Public Notice

The Boston Redevelopment Authority ("BRA"), pursuant to Article 80 of the Boston Zoning Code, hereby gives notice that a Draft Environmental Impact Report/Project Impact Report (EIR/PIR) was received by the BRA on October 15, 2009 from Brigham and Women's Hospital, Inc. (BWH or the Hospital) and Partners HealthCare System Inc., in association with the Roxbury Tenants of Harvard Association, Inc. (RTH) (the "Proponent") for the Massachusetts Mental Health Center (MMHC) Redevelopment (the "Project").

The redevelopment proposal is the result of a request for proposals and subsequent selection process conducted by the Massachusetts Division of Capital Asset Management (DCAM) on behalf of the Massachusetts Department of Mental Health (DMH).

In the first phase of the Project, the Proponent proposes the abatement and demolition of existing buildings followed by the construction of two buildings to serve the Commonwealth of Massachusetts Department of Mental Health (DMH) clientele. The Partial Hospital/Fenwood Inn Building, which will be developed by BWH on behalf of DMH, will include 13 single residential units and 17 double residential units, a 8,260 square feet (sf) outpatient clinic and a partial hospital component (a link between crisis stabilization/transitional housing and outpatient mental health treatment) for a total of 21,000 sf with 47 beds. The Binney Street Building, which will be developed by BWH on BWH-owned land adjacent to the existing Servicenter Complex, will comprise 56,540 sf of clinical and office space which will be used by BWH for outpatient uses. DMH will occupy the Binney Street Building for similar purposes, on an interim basis, until the DMH-designated space within the proposed Brigham and Women's Building (described below) is available.

Latter phases of the Project will include RTH's development of a residential building and BWH's development of a building for medical-related uses. The Residential Building, which will be developed, operated, and controlled by RTH, will provide approximately 136 units, including approximately 66 affordable rental units and approximately 70 condominiums (subject to refinement during the design process). It is expected that all of the rental apartments will be affordable units, and that the majority of the condominiums will be affordable housing. The 197,750-square-foot building may also include approximately 10,000 sf of community space. If the planned community space is constructed at RTH's Mission Park development instead of within the Residential Building, and if further refinement of design and engineering allows, the number of units may increase, the unit mix may change, the residential/non-residential square footages may change, and the Project may include residential units on the first floor. The Brigham and Women's Building, which will be developed, managed, and controlled by BWH, will contain approximately 358,670 sf of space for research and development, clinical, and office uses by BWH. DMH's clinical and office uses will be relocated from the Binney Street Building into the Brigham and Women's Building once it is complete. At that time, BWH will use the Binney Street Building for office and clinical space.

The Project will contain 406 parking spaces located beneath the Brigham and Women's Building, 50 of which will be reserved for DMH use.

The Proponent is seeking the issuance of an Adequacy Determination and a Certificate of Compliance by the Director of the BRA pursuant to Section 80B-5. The BRA, in the Preliminary Adequacy Determination regarding the Draft EIR/PIR, may waive further review requirements pursuant to Section 80B-5.4(c)(iv) of the Code, if after reviewing public comments, the BRA finds that such DEIR/PIR adequately described the project's impacts. The Draft EIR/PIR may be viewed at the following locations: Office of the Secretary of the BRA, Boston City Hall, One City Hall Square, Boston, MA 02201 (Monday through Friday, 9am to 5pm); Boston Public Library, Copley Branch, 700 Boylston Street, Boston, MA 02116, Government Documents Department (Monday through Thursday, 9am to 9pm; Friday and Saturday, 9am to 5pm); and, Boston Public Library, Parker Hill Branch, 1497 Tremont Street, Boston, MA 02120 (Monday through Wednesday 10am to 6pm, Thursday 12pm to 8pm, Friday 9am to 5pm) except legal holidays. Public comments on the DEIR/PIR should be transmitted to Ms. Sonal Gandhi, BRA, at the address stated above or at sonal.gandhi.bra@cityofboston.gov within 75 days of the date of this notice.

Boston Redevelopment Authority
Theresa Donovan, Assistant Secretary

Draft Environmental Impact Report/
Draft Project Impact Report
EEA # 14440

Massachusetts Mental Health Center Redevelopment

Submitted to:
Executive Office of Energy and Environmental Affairs
MEPA Office
100 Cambridge Street
Boston, MA 02114
and
Boston Redevelopment Authority
One City Hall Square
Boston, MA 02201

Submitted by:
The Brigham and Women's Hospital, Inc.
Partners HealthCare System, Inc.
Roxbury Tenants of Harvard Association, Inc.

Prepared by:
Epsilon Associates, Inc.
3 Clock Tower Place, Suite 250
Maynard, MA 01754

In Association with:
The Architectural Team
Copley-Wolff Design Group
Edwards Angell Palmer & Dodge LLP
Fitzemeyer & Tocci Associates, Inc.
Linea 5
John Moriarty & Associates Inc.
Ropes & Gray LLP
VHB, Inc.
Wozny/Barbar & Associates, Inc

October 15, 2009

Epsilon ASSOCIATES INC.

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Section 1.0

Introduction

1.0 INTRODUCTION

1.1 Project Summary

The Brigham and Women's Hospital, Inc. (BWH or the Hospital) and Partners HealthCare System Inc. (PHS), in association with the Roxbury Tenants of Harvard Association, Inc. (RTH), are proposing to redevelop three parcels in Boston with mixed uses in four buildings; 1) a new Department of Mental Health- (DMH) operated Partial Hospital/Fenwood Inn, 2) a clinical and administrative building (BWH-owned Binney Street Building), 3) housing (RTH-owned Residential Building), and 4) clinical and research uses (Brigham and Women's Building).

The site includes three parcels as shown on the existing conditions survey in Appendix A and Figures 1-1 and 1-2. The first parcel totaling 2.61 acres is the Main Massachusetts Mental Health Center (MMHC) Site. The second parcel, Partial Hospital/Fenwood Inn Site, totals 0.25 acres. Together the Main MMHC Site and Partial Hospital/Fenwood Inn Site constitute the MMHC Site and comprise 2.86 acres. The third parcel, the 0.29-acre Binney Street Site is owned by BWH. Together, these parcels collectively comprise the 3.15-acre Project Site.

The redevelopment proposal is the result of a request for proposals and subsequent selection process conducted by the Massachusetts Division of Capital Asset Management (DCAM) on behalf of the Massachusetts Department of Mental Health (DMH). For the purposes of this report, the Proponent refers to the joint development effort by BWH and RTH for all four buildings proposed, as the MMHC Redevelopment Project or the Project.

The MMHC Site is located in the Mission Hill neighborhood and is adjacent to the Longwood Medical and Academic Area (LMA). The MMHC Site contains five buildings formerly occupied by the MMHC, run by the Massachusetts Department of Mental Health (Figure 1-3). These buildings containing approximately 190,000 gross square feet are currently vacant, as MMHC temporarily relocated in 2003. The 2.86-acre MMHC Site is owned by the Commonwealth of Massachusetts acting through the Massachusetts Division of Capital Asset Management (DCAM) on behalf of DMH. The Binney Street Site is owned and used by BWH and is currently occupied by construction trailers. DCAM will execute three 95-year ground leases for the Non-Residential, Residential and Partial Hospital/Fenwood Inn Premises with BWH when all approvals have been received. BWH in turn will have the right to enter into a sublease with RTH at the time the Residential Building is ready to start construction. DMH will sublease from BWH the Partial Hospital/Fenwood Inn for 95 years and will lease from BWH the building at Binney Street for ten years, when the DMH space in the Brigham and Women's Building is to be completed.

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Massachusetts Mental Health Center Redevelopment Project Boston, Massachusetts

Epsilon ASSOCIATES INC

Figure 1-1
USGS Locus Map

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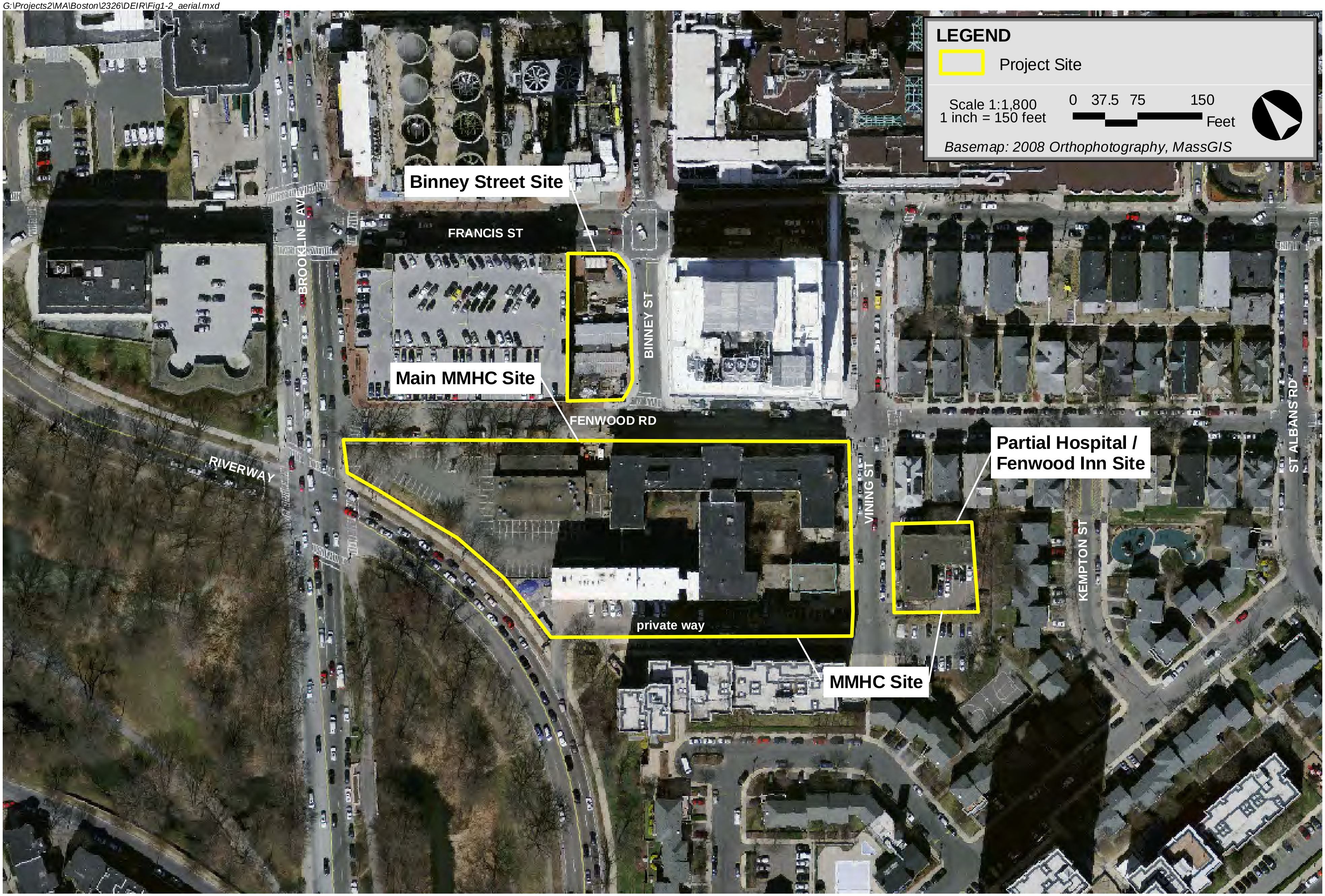
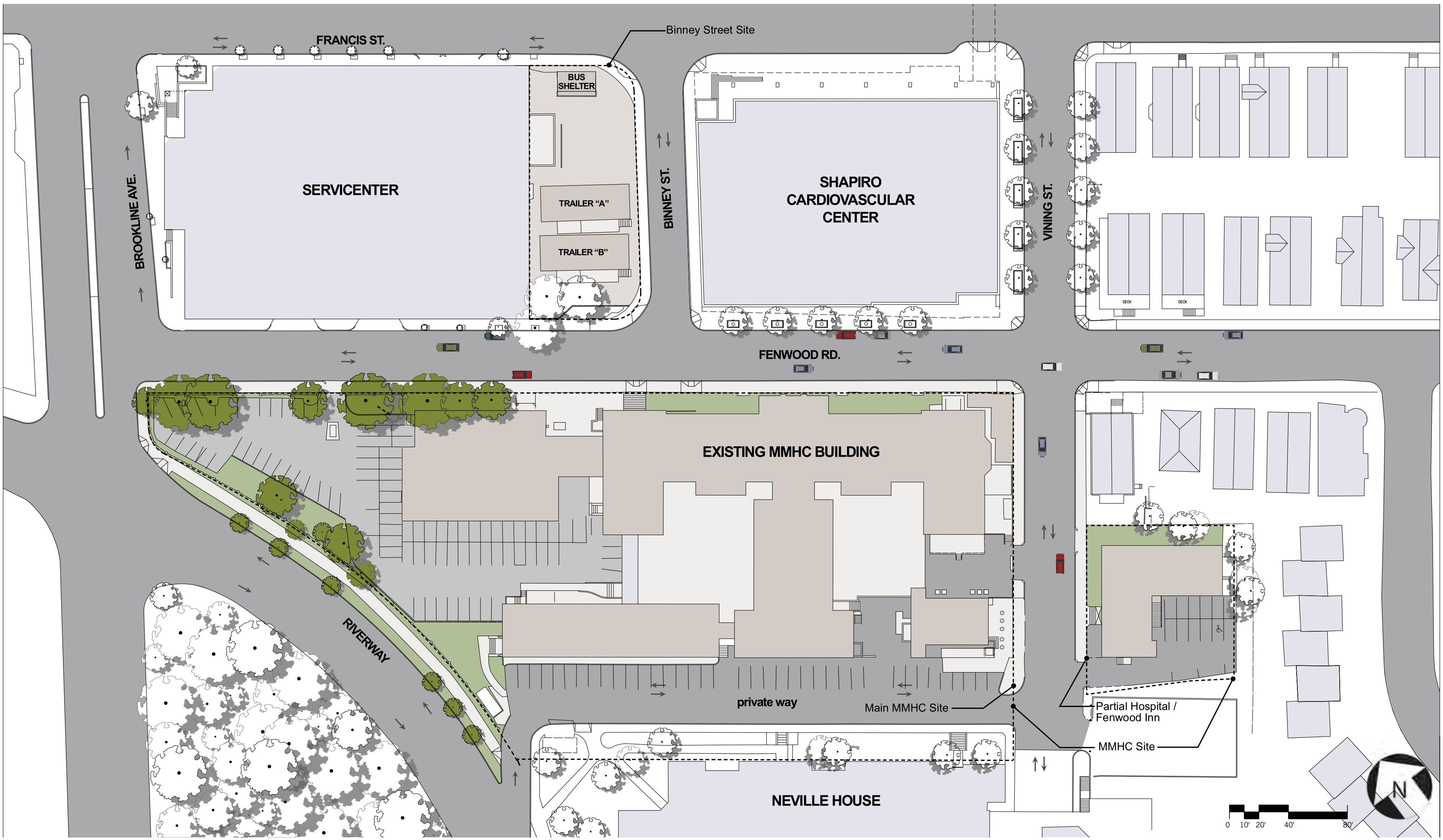


Massachusetts Mental Health Center Redevelopment Project   Boston, Massachusetts

Epsilon Associates Inc.

Figure 1-2

Existing Aerial Photo



Massachusetts Mental Health Center Redevelopment Project Boston, MA

Figure 1 - 3

LINEA 5, inc. Boston, MA • Miami Beach, FL tat the architectural team

Existing Site Plan

Scale: 1" = 60' - 0"

The Proponent proposes and the Project is predicated upon the demolition of the existing buildings located on the MMHC Site and removal of the construction trailers on the Binney Street Site in order to construct approximately 633,960 square feet[1] (sf) in four buildings (the Project). The Project will include residential, clinical, transitional housing and crisis stabilization space, research, and office uses, including replacement space for the MMHC, parking and loading facilities. The Project may also include community space in the Residential Building.

The four distinct Project buildings are shown in Figure 1-4:

1. The Binney Street Building, which will be developed by BWH, comprises 56,540 sf of clinical and office space which will be used by BWH for outpatient uses. DMH will occupy the Binney Street Building for similar purposes, on an interim basis until the DMH-designated space within the proposed Brigham and Women's Building is available.
2. The Partial Hospital/Fenwood Inn Building, which will be developed by BWH on behalf of DMH, will include a 42 bed transitional shelter program for homeless, mentally ill men and women, a five bed crisis stabilization unit and 8,260 square feet of partial hospital and outpatient treatment space.
3. The Residential Building, which will be developed, operated, and controlled by RTH, will provide approximately 136 units, including approximately 66 affordable rental units and approximately 70 condominiums (subject to refinement during the design process). It is expected that all of the rental apartments will be affordable units, and that the majority of the condominiums will be affordable housing. The 197,750-square-foot building may also include approximately 10,000 sf of community space. If the planned community space is constructed at RTH's Mission Park development instead of within the Residential Building, and if further refinement of design and engineering allows, the number of units may increase, the unit mix will change, the residential/non-residential square footages may change, and the Project may include residential units on the first floor.[2]

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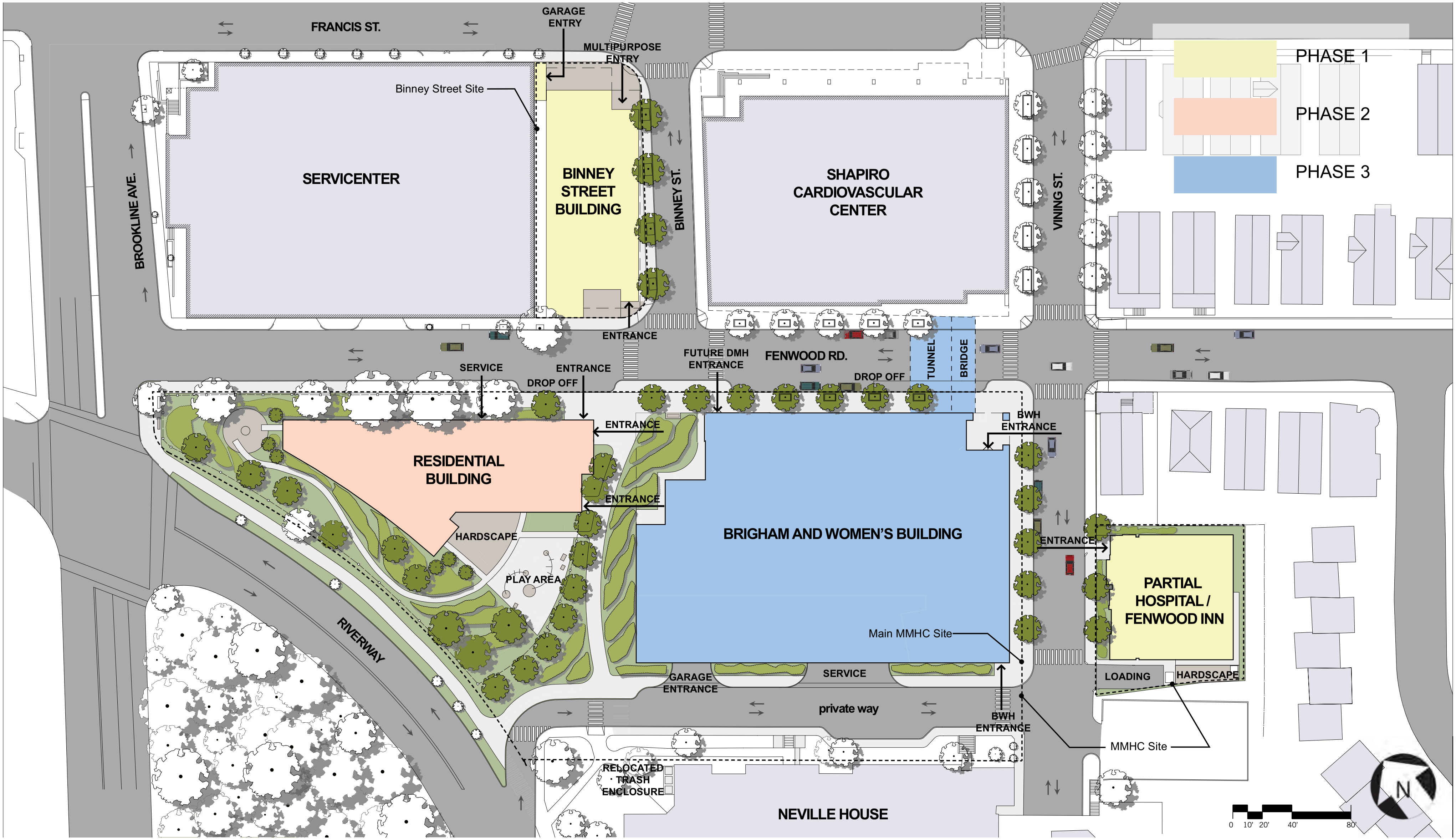
1 Under the Boston Zoning Code, zoning square footage excludes certain areas such as mechanical space and the below grade parking garage. The Draft EIR/PIR uses zoning square footage.

2 The design of the Residential Building is at an early stage (e.g. flloor plans are at an early conceptual stage) and the community space may be built at the nearby Mission Park development. Thus, the Project has the potential to create more than 136 units, which would make the Project an even more key housing resource in the Mission Hill community. For purposes of describing potential environmental impacts, this Draft EIR/PIR evaluates up to 165 residential units to disclose the maximum possible impact in the event the number of residential units increases from the proposed 136 units.



Massachusetts Mental Health Center Redevelopment Project **Boston, MA**

Figure 1 - 4

LINEA 5, inc. Boston, MA • Miami Beach, FL tat the architectural team

Proposed Site Plan

Scale: 1" = 60' - 0"

4. The Brigham and Women's Building, which will be developed, managed, and controlled by BWH, will contain approximately 358,670 sf of space for research and development, clinical, and office uses by BWH. DMH's clinical and office uses will be relocated from the Binney Street Building into the Brigham and Women's Building once it is complete. At that time, BWH will use the Binney Street Building for office and clinical space[3].

The Project will contain 406 parking spaces located beneath the Brigham and Women's Building, 50 of which will be reserved for DMH use. No parking will be located on the portion of the Main MMHC Site slated for development of the Residential Building.

The Project will significantly improve both the quantity and quality of open space with a 30 foot to 40 foot setback from the Riverway resulting in over a half acre of open space on the site of the Residential Building. A landscape plan has been developed to visually link the distinct Project buildings. The plan reflects a strong streetscape language of hardscape and plantings punctuated by plazas at major entrances as well as terraces and sheltered outdoor space.

Connections between the Brigham and Women's Building and the new Shapiro Cardiovascular Center at 70 Francis Street are proposed via an underground tunnel and a pedestrian bridge across Fenwood Road. The bridge will tie the Brigham and Women's Building to the rest of the campus as opposed to creating a stand alone outpost, and will be a continuation of the Pike, the primary circulation element within the hospital connecting all of the buildings on the hospital campus. Tunnel connections will ensure a secure and appropriate environment for inpatients moving between imaging at the Shapiro Building and clinical services in the proposed Brigham and Women's Building. In addition, the tunnel will allow uninhibited transfer of materials to the centralized linen and disposal services at the Servicenter Complex that handles bio-medical waste, trash and linen services.

Perspectives and elevations of the proposed Project are provided in Chapter 2.0, Project Description. Floor plans and additional graphics are provided as Appendix B.

Development of the first phase of the Project will commence immediately upon the completion of the permitting of the Project by the relevant City and State agencies and authorities and execution of the ground leases of land with DCAM. The abatement and demolition of the MMHC buildings will be an integral part of the first phase of work, as the cleared site is necessary to ensure public safety and to allow for safe and clear access to

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3 Upon completion of the Brigham and Women's Building, BWH will have a total of 362,460 combined sf in the Binney Street Building and the Brigham and Women's Building and DMH will have 52,750 sf at the Brigham and Women's Building.

construct the first two buildings.[4] The vacant buildings have suffered serious deterioration, including structural damage, and they present a potential public safety hazard. The Article 85 demolition delay expires on November 10, 2009.

The first phase of the Project will include the development of the DMH's Partial Hospital/Fenwood Inn and the Binney Street Building which will be occupied by DMH for ten years. The other elements of the Project, specifically the Brigham and Women's Building and the Residential Building, will be constructed in subsequent phases. The timing of the construction of the Residential Building and the Brigham and Women's Building will depend on the availability of capital for these two elements of the Project. Pursuant to the Proponent's Development Agreement with DCAM, the Brigham and Women's Building must be completed within 10 years of the occupancy of the Binney Street Building.

1.2 Project Team

1.2.1 Project Team

Brigham and Women's Hospital

BWH is a Harvard-affiliated, non-profit, teaching hospital located in the Longwood Medical and Academic Area. The hospital is a founding member of Partners HealthCare System Inc. and has an international reputation for the quality of its medical care and innovative research. BWH has performed pioneering work in several areas, including transplantation technology, the evaluation of methods to reduce the effect of heart attack, high-risk obstetrics, diagnostic imaging and joint replacement. In addition, its varied educational programs provide the highest quality training for medical, nursing and other health professions.

Partners HealthCare System

Partners HealthCare System Inc. was founded in 1994 by Brigham and Women's Hospital and Massachusetts General Hospital. In addition to its two original academic medical centers, the system also includes community hospitals, specialty hospitals, community health centers, a physician network, home health and long-term care services, and other health-related entities.

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4 The demolition of these buildings was contemplated under the MOA between DCAM and the Massachusetts Historical Commission.

Roxbury Tenants of Harvard

Roxbury Tenants of Harvard Association, Inc. is a non-profit, resident organization founded in Mission Hill in 1969. Its mission is to own and operate high-quality low- and moderate-income housing, to provide education, employment and other opportunities for residents of Mission Hill, and to ensure community participation in the City's design and review process for projects that affect the Mission Hill neighborhood. RTH also runs a children's center and after-school program, as well as classes for youths and adults. RTH operates a wide array of social, educational, and economic opportunity programs.

Department of Mental Health

The Massachusetts Department of Mental Health is the State agency which sets the standards for the operation of mental health facilities and community residential programs. The agency provides clinical, rehabilitative and supportive services for adults with serious mental illness, and children and adolescents with serious mental illness or serious emotional disturbance. DMH integrates public and private services and resources to provide optimal community-based care and opportunities.

The operation of the Massachusetts Mental Health Center is a collaboration between the DMH and Harvard Medical School (HMS). It is both a state mental health facility and a center of excellence in academic psychiatry, combining public service with outstanding clinical and research programs. The MMHC provides access to a network of effective, efficient and culturally sensitive clinical and rehabilitative services for Boston Metro area DMH clients with mental illness.

Proponent:	The Brigham and Women's Hospital, Inc. 75 Francis Street Boston, MA 02115 617) 732-6843 Arthur Mombourquette, Vice President
	Partners HealthCare System Inc. 101 Merrimac Street, 8th Floor Boston, MA 02114-4719 (617) 724-5234 Timothy J. Pattison, Director of Real Estate
	Roxbury Tenants of Harvard Association, Inc. 11 New Winter Street Boston, MA 02115 (617) 232-4306 Girma Belay, Executive Director Peter Munkenbeck, Development Consultant

Architects:	Brigham and Women's Building, Binney Street Building and Partial Hospital/Fenwood Inn: Linea 5 195 State Street Boston, MA 02109 (617) 723-8808 Michael Slezak Richard Radville
	Residential Building & Master Planners: The Architectural Team 50 Commandant's Way at Admiral's Hill Chelsea, MA 02150 (617) 889-4402 Michael Liu Tom Schultz
Landscape Architect:	Copley-Wolff Design Group 160 Boylston Street 4th Floor Boston, MA (617) 889-4402 John Copley
Permitting Consultants:	Epsilon Associates, Inc. 3 Clock Tower Place, Suite 250 Maynard, MA 01754 (978) 897-7100 Cindy Schlessinger Katherine Fuller Doug Kelleher Ron Morad
Transportation/Parking/Civil Engineering Consultants:	Vanasse Hangen Brustlin, Inc. 99 High Street Boston, MA 02110 (617) 728-7777 David Bohn Howard Moshier Sean Manning Ellen Donohoe

Legal Counsel for BWH:	Ropes & Gray LLP One International Place Boston, MA 02110-2624 (617) 951-7177 Mary T. Marshall, Esq.
Legal Counsel for Roxbury Tenants of Harvard:	Edwards Angell Palmer & Dodge LLP 111 Huntington Avenue Boston, MA 02199-7613 (617) 239-0225 Rebecca A. Lee, Esq.
Construction Manager	John Moriarty & Associates Inc. 3 Church Street Winchester, MA 01890 (781) 729-3900 John Moriarty David Leathers
Structural Engineer:	McNamara/Salvia, Inc. 160 Federal Street Boston, MA 02110 (617) 737-0040 Joseph Salvia
MEP Designer for BWH	Fitzemeyer & Tocci Associates, Inc. 92 Montvale Avenue Suite 4100 Stoneham, MA 02180 (978) 481-0210 Ted Fitzemeyer James M. Conway, PE
MEP Designer for RTH	Wozny/Barbar & Associates, Inc. 1090 Washington Street Hanover, MA 02339 (781) 826-4144 Zbigniew M. Wozny

1.3 Project Benefits

The Project will provide a number of public benefits and has been carefully designed to meet DMH program objectives while being sensitive to the residential and institutional neighborhood surrounding the Project Site. Specific benefits are described below.

Mental Health Services

The Project provides replacement space for the MMHC in the Binney Street Building in the short term and then in the Brigham and Women's Building in the long term as well as a stand alone Partial Hospital/Fenwood Inn. The proposed 56,540 sf of outpatient and office space, which will first be located in the Binney Street Building and then relocated upon completion of the Brigham and Women's Building, and the proposed Partial Hospital/Fenwood Inn Building will replace the existing obsolete buildings at the MMHC Site. This will enable the return of patient care and DMH services to the MMHC Site in modern, state of the art buildings where care can be delivered in an efficient and dignified setting. The move back from the Shattuck Hospital, where the services have been located in the interim, will also provide much greater public transportation access for MMHC clients.

Increased Housing

The Project is consistent with the City of Boston's Leading the Way III housing strategy and will provide approximately 136 residential units to the neighborhood with a mix of rental and home ownership opportunities. It is expected that all rental apartments will be affordable units, and that the majority of the condominiums will be affordable housing.

Affordable Housing

As previously described, the Project team includes RTH, a non-profit housing and human services organization. The Residential Building will result in the creation of approximately 66 affordable rental units and 70 condominiums, a substantial number of which will be affordable units.

To ensure that affordable housing is a viable Project component, BWH will not assign a land value to the Residential Building parcel and is contributing $3 million in straight subsidy for pre-construction and construction costs, as well as agreeing to extend a letter of credit up to $2 million to support the financing of the Residential Building, which will include Federal, State and City housing subsidies.

All affordable units will be marketed in accordance with the City's fair housing regulations and widely marketed, including to neighborhood residents. To date, there have been approximately 2,000 people inquiring about potential housing opportunities in the area. RTH will provide homeownership training for potential first time home buyers after construction of the Residential Building commences.

Community Space and Community Programs

The Project will provide approximately 10,000 sf of community space either in the Residential Building or at the nearby RTH-owned Mission Park development, which will provide an area for social and educational programs including job-training, education and wellness programs. BWH is contributing $2.5 million toward construction of this community center.

BWH will provide $1.7 million to help RTH to construct a gymnasium and recreational and large meeting space for the community to be constructed on land adjacent to the Project and owned by RTH.

Preservation

While the Project requires the demolition of the MMHC Buildings, the continued presence of the MMHC DMH program on the Project Site in a new state-of-the-art facility will allow for the continuation of the MMHC Site's historic function. The Proponent has developed an architectural salvage and reuse plan that will ensure the preservation of discrete architectural elements of the existing MMHC buildings to the extent practical. In addition, the original 1912 cast iron and brick fence will be replicated and healthy, mature trees will be protected to the extent feasible. A display of historic photos at the Binney Street Building is also being explored. The Proponent will continue to work with the Boston Landmarks Commission (BLC) on the architectural salvage plan as the design of the Project progresses.

The Project includes setbacks from the property line along Fenwood Road and the Riverway to preserve view lines and enhance the feeling of openness. The setbacks also allow for the mature perimeter trees to be protected to the greatest extent feasible and incorporated into the landscape plan as well as the extension of the continuous green border at the RTH-owned Mission Park development along the eastern edge of the Riverway roadway.

Redevelopment

The Project will replace functionally obsolescent and dilapidated vacant buildings with new residential, community, DMH, research and clinical uses.

Increased Employment

The Project will create both temporary construction jobs and permanent jobs. The Brigham and Women's Building will create approximately 500 new jobs in both research and clinical areas. The Residential Building will create the need for 13 new permanent jobs for the residential space and community programming.

Construction Employment

The construction of the four buildings will contribute directly to the local economy by providing numerous construction employment opportunities. Approximately 600 full-time construction jobs are anticipated as a result of these construction projects.

Sustainable Design

The Proponent is committed to a sustainable Project and will incorporate sustainable design initiatives as part of the design, construction and operation of the Project. The Project will advance sustainable and environmentally conscious design and construction practices. All buildings will include environmentally protective technologies and practices such as energy-efficient equipment and fixtures, and water conservation features for mechanical, electrical, and architectural systems, where feasible.

The Proponent's commitment to sustainability is reflected in its commitment to meeting various LEED levels. The Partial Hospital/Fenwood Inn will be LEED Certified. The Proponent aims to exceed requirements of Article 37 of the Boston Zoning Code for the Binney Street Building and Brigham and Women's Building and proposes these buildings to be LEED Silver Certified. The Residential Building is proposed to be LEED Certifiable with the possibility of being LEED Silver Certifiable.

Tax Revenue

BWH is a tax-exempt not for profit institution and currently has several Payment in Lieu of Taxes (PILOT) agreements in place with the City of Boston. BWH will meet with the City of Boston Assessing Department and anticipates entering into a PILOT agreement in connection with certain elements of this Project.

Following the transfer of the land from the State at the start of construction, RTH will apply to the assessor for redevelopment status during construction. During building occupancy, the Residential Building will be taxable, consistent with its affordable status, and is expected to pay annual real estate taxes in excess of $100,000 per year.

DMH is exempt from taxation and thus, the Partial Hospital/Fenwood Inn Building will continue to be tax-exempt.

Linkage

Under Section 80B-7 of the Boston Zoning Code, projects that require zoning relief and that will devote more than 100,000 sf of space to "development impact uses," must make contributions to the City of Boston's Neighborhood Housing Trust and Neighborhood Jobs Trust.

The Residential Building is not considered a development impact use. DMH space is exempt from local regulations because it is an "essential governmental function."

For those portions of the Project that are classified as Development Impact Project uses, the Proponent will make a housing contribution grant and a jobs contribution grant to the Neighborhood Housing Trust and the Neighborhood Jobs Trust, respectively. BWH will pursue a Housing Creation Option Application to allow the housing linkage funds to be targeted to the Residential Building, if practicable. The Project will generate approximately $2.4 million in housing and jobs linkage funds to the City of Boston.

1.4 Review Process and Anticipated Permits

1.4.1 MEPA and BRA Review

The Project is subject to review under the City of Boston's Zoning Code Article 80B Large Project Review and Article 80D Institutional Master Plan Review. The Proponent submitted a joint Project Notification Form and Institutional Master Plan Notification Form (PNF/IMPNF) for the proposed Project to the Boston Redevelopment Authority (BRA) on June 16, 2009 to initiate Large Project Review pursuant to Article 80B and to amend and to authorize the adoption of the BWH 2010 Institutional Master Plan (IMP) pursuant to Article 80D. The BRA issued a Scoping Determination dated August 11, 2009 outlining information to be included in a Draft Project Impact Report (PIR) and an IMP. A copy of the BRA's Scoping Determination is included in Chapter 9.0, Response to Comments.

With the filing of this Draft EIR/PIR and the filing of the RTH Planned Development Area (PDA) Plan, the BWH 2010 IMP, and the Development Impact Project Plan (DIPP) for public review and approval, the Proponent is seeking the following BRA approvals:

1. Large Project Review approval of the Project pursuant to the provisions of Article 80B of the Boston Zoning Code which include approval of a Development Impact Project, subject to further design review by the BRA and further review by the Boston Civic Design Commission for architecture (schematic design for the Residential Building and the Brigham and Women's Building);

2. RTH PDA Plan approval pursuant to the provisions of Article 80C of the Boston Zoning Code, as well as an amendment to Article 59 of the Boston Zoning Code to allow a PDA at the site of the Residential Building; and

3. IMP approval pursuant to the provisions of Article 80D of the Boston Zoning Code.

The Project also requires review under the Massachusetts Environmental Policy Act (MEPA). The Proponent submitted an Environmental Notification Form (ENF) to the MEPA office on June 30, 2009. On August 7, 2009, MEPA issued a Certificate determining that the Project requires the preparation of a Draft Environmental Impact Report (EIR). A copy of the MEPA Certificate is included in Chapter 9.0, Response to Comments.

In accordance with the MEPA Certificate and Article 80B of the Boston Zoning Code, the two impact reviews are being coordinated and this Draft EIR/PIR responds to both the MEPA Certificate and the BRA's Scoping Determination. A separate BWH 2010 IMP will be submitted to the BRA pursuant to Article 80D of the Boston Zoning Code as will be the RTH PDA Plan pursuant to Article 80C of the Boston Zoning Code.

1.4.2 Anticipated Permits

Table 1-1 lists the anticipated permits and approvals required from federal, state, and local agencies. Public financing will be needed for the Residential Building. RTH expects to seek Federal HOME, Low Income Housing Tax Credits (LIHTC), Section 8, and State bond-financed housing subsidies and City Linkage, Affordable Housing Trust, HOME, Community Development Block Grant (CDBG), and other housing subsidies. BWH may use HEFA financing. Although some permits will be sought concurrently with the Article 80 and MEPA processes, most required permits, reviews, and approvals will be sought following completion of these City and State reviews.

Table 1-1 Anticipated Permits and Approvals

Agency Name	Permit / Approval
Federal	
Environmental Protection Agency	National Pollutant Discharge Elimination System Stormwater Discharge Construction Dewatering
Federal Aviation Administration	Notice of Construction and Crane Approvals
State	
Division of Capital Asset Management	Three 95-year Ground Leases (Nonresidential premises, Residential premises, and Partial Hospital/Fenwood Inn Premises) of MMHC Site to BWH and Long Term Leases/subleases on behalf of DMH
Department of Environmental Protection, Division of Water Pollution Control	Sewer Connection and Extension Permit

Table 1-1 Anticipated Permits and Approvals (Continued)

Agency Name	Permit / Approval
State	
Department of Environmental Protection, Division of Air Quality Control	Environmental Results Program Review under Title V (if necessary) Abatement of hazardous materials permits (if required)
Executive Office of Environmental Affairs (MEPA Unit)	Secretary's Certificate
Massachusetts Water Resources Authority	Sewer Use Discharge Permit Construction Dewatering Permit Industrial Discharge Permit for Brigham and Women's Building (if required)
Massachusetts Historic Commission[5]	State Register Review/Chapter 254 Review Review for consistency with 2003 MOA
Massachusetts Aeronautics Commission	Notice of Pre-Construction
Department of Conservation and Recreation	Approval of sidewalk/pedestrian improvements (Riverway/private way intersection)
Department of Public Safety	Permits and other approvals, as necessary (Partial Hospital/Fenwood Inn)
Local	
Boston Civic Design Commission	Review pursuant to Article 28
Boston Redevelopment Authority	Article 80B Large Project Review Article 80D Institutional Master Plan Review (Binney Street Building and Brigham and Women's Hospital Building Article 80C Planned Development Area Review (Residential Building) Other approvals as required
Boston Water and Sewer Commission	Sewer Use Discharge Permits Site Plan Approvals Sewer Extension/ Connection Permits Stormwater Connections
City of Boston Inspectional Services Department	Building and Occupancy Permits
City of Boston Public Improvement Commission	Streetscape Improvements and discontinuances
Boston Zoning Commission	Approval of the Institutional Master Plan, Planned Development Area Plan (Residential Building), and Amendment to Article 59 (for PDA designation)
Boston Department of Public Works	Street Occupancy Permit (construction period) Curb Cut Approval

5 The MHC submitted a letter to MEPA commenting on the ENF indicating that the stipulations and documentation required by the 2003 MOA have been fulfilled. MHC may comment on the new construction. A copy of the letter is provided in Chapter 9.0.

Table 1-1 Anticipated Permits and Approvals (Continued)

Agency Name	Permit / Approval
Local	
Boston Transportation Department	Transportation Access Plan Agreement Construction Management Plan
Boston Landmarks Commission[6]	Article 85 Demolition Delay Consistency with 2003 MOA
Boston Parks and Recreation Commission	Approval of Construction within 100 feet of park or parkway and 20 foot setback requirement (Residential Building)
City of Boston Committee on Licenses	Permit to erect and maintain parking garage (BWH Building) Flammable storage license (BWH Building)
Boston Fire Department	Permits and review as necessary

1.5 Community Participation

The Proponent is committed to effective community outreach and will continue to engage the community to ensure public input on the Project. As part of this effort, the Proponent has met extensively with a large number of community groups and elected officials as well as presented the Project at several area community meetings.

As part of its commitment to community participation, the Proponent established a Community Construction Mitigation Group in response to area residents' concerns regarding construction impacts. This group of residents and stakeholders including all segments of the residential neighborhood and the construction manager, BWH, RTH and all relevant professionals including engineers and scientists, are working with the Proponent to address potential construction impacts including phasing, truck routes and coordination of deliveries, construction worker parking, demolition, and other construction activities. The group meets twice monthly to review in detail each element of the process.

The following is a list of additional outreach efforts:

- Presenting the MMHC Project to the LMA Forum and participation in regular LMA Forum meetings;
- Presenting the Project at a BRA-sponsored public meeting;

6 The Proponent filed an Article 85 application in July 2009. At the August 11, 2009 BLC hearing, the Commission voted to impose demolition delay for the MMHC Buildings. The Proponent committed to continuing to work with BLC staff as the design for the MMHC Redevelopment Project advances. The demolition delay period terminates on November 10, 2009.

- Coordinating with DCAM;
- Meeting with the Emerald Necklace Conservancy;
- Presenting the Project at a RTH community meeting and meetings with the Roxbury Tenants of Harvard Board of Directors;
- Meeting with elected officials including City Councilor Michael Ross, State Representative Jeffrey Sanchez, State Representative Gloria Fox, and State Senator Sonia Chang-Diaz;
- Meeting with Mission Hill Neighborhood Housing Services with and the Back of the Hill Community Development Corporation;
- Meeting with Medical Area Total Energy Plant;
- Meeting with Medical Academic and Scientific Community Organization;
- Coordinating with DMH;
- Meeting with representatives of neighboring institutions including Children's Hospital Boston, Harvard Medical School, Dana Farber Cancer Institute, and Beth Israel Deaconess; and
- Hosting an ongoing collaboration with the Community Construction Mitigation Group.

In these meetings, the Proponent has presented a comprehensive illustrated description of the Project and has responded to detailed questions and comments of interest to each constituency. Similar to the comprehensive written responses provided in Chapter 9.0 of this Draft EIR/PIR, there has been extensive face-to-face discussion of these topics.

A partial list of the subjects presented and questions addressed in these meetings include:

- description of the agreement with DCAM;
- a graphic presentation of the current plans, program, and timetable for the phased development;
- demolition;
- abatement;
- noise;
- potential BWH program and uses;

- shadows;
- design;
- parking;
- landscaping;
- traffic;
- temporary site conditions;
- preservation;
- construction logistics;
- view corridors;
- sustainability;
- financing; and
- affordable housing.

Following this initial phase of the Project, the Proponent will participate in community outreach when subsequent phases are ready to move forward.

Section 2.0

Project Description

2.0 PROJECT DESCRIPTION

2.1 Site History and Existing Uses

2.1.1 Site Location

The MMHC Site is located in the Mission Hill neighborhood and the Binney Street Site is located within the LMA in Boston. The Project Site includes three parcels totaling 3.15 acres as shown on the existing conditions survey in Appendix A. The first parcel totaling 2.61 acres, the Main MMHC Site, is bounded by Fenwood Road to the north, Vining Street to the east, the Neville House to the south, and Riverway to the west. The second parcel, Partial Hospital/Fenwood Inn Site with 0.25 acres, is bounded by Vining Street to the west, an RTH-owned surface parking lot to the south and RTH-owned residences to the north and east. This parcel also abuts a DMH-operated halfway house at the corner of Vining Street and Fenwood Road. Together the Main MMHC Site and Partial Hospital/Fenwood Inn Site constitute the MMHC Site and comprise 2.86 acres. The third parcel, the 0.29-acre Binney Street Site which is owned by BWH, is located on Binney Street between Francis Street and Fenwood Street to the east of BWH's Servicenter Complex. The Project Site is immediately adjacent to hospital, research, DMH and residential uses, and has access to mass transit and vehicular transportation systems.

2.1.2 Previous Site Uses

The MMHC Site is the former location of the MMHC, a community mental health center administered by the DMH. Opened as the Psychopathic Department of Boston State Hospital, the MMHC Site is historically significant for the pioneering role MMHC played both in psychiatric research and in the development of new patient treatment strategies. The MMHC represented a shift from the asylum setting found at institutions such as Danvers and Northampton state hospitals to a more clinical and research-based rehabilitation program with a strong emphasis on furthering scientific knowledge. In 1956, the facility officially became known as the MMHC. The MMHC continues to provide outpatient psychiatry services, mental health research, inpatient care, and intensive day hospitalizations.

BWH acquired the Binney Street Site along with the Servicenter Complex in 2005 when it was a combination of brick hardscape and landscaping.

2.1.3 Planning for MMHC Site Redevelopment

During the 1990s, the Commonwealth conducted several studies to assess DMH's program needs in relation to the existing buildings. Studies concluded that the existing buildings provided far more space than required by DMH and recommended that DMH remain on-site, however in a much smaller facility. Since the Commonwealth determined that the rehabilitation of the property for DMH use was infeasible, redeploying the property through long-term leases has the potential to generate economic benefits for the Commonwealth, as well as provide the DMH with a modern space to continue its clinical services on the MMHC Site, without the need for funds from the Commonwealth for construction.

2.1.4 Current Site Uses

The existing MMHC Site contains five buildings with approximately 190,000 gross square feet. The buildings are currently vacant following the interim relocation of MMHC to Shattuck Hospital in 2003. The vacant buildings have suffered serious deterioration, including structural damage and they present a potential public safety hazard. In addition, there are approximately 163 surface parking spaces around the buildings which are currently licensed by DCAM to BWH.

The Binney Street Site, owned and used by BWH, is currently occupied by construction trailers which are no longer in use, the transformer for the Servicenter Complex and the former bus stop for the Partners HealthCare and LMA shuttles – the bus stop function has been relocated to the front of the Shapiro Center.

2.2 Proposed Development Program

2.2.1 Building Program

The Proponent proposes to construct four new buildings that will collectively provide approximately 633,960 sf of space as outlined in Table 2-1 and described below. Figure 2-1 through Figure 2-18 at the end of this Chapter are perspectives and elevations of the proposed Project. Floor plans and additional graphics are provided as Appendix B. The scale and general massing of the Project as shown and analyzed in this Draft EIR/PIR has been presented to the BRA staff and Boston Civic Design Commission (BCDC). Schematic Design approval of the Partial Hospital/Fenwood Inn and Binney Street Building is being sought from the BCDC at this time. In addition, the BCDC is reviewing the height and massing of the Residential Building and the Brigham and Women's Building. When construction of the latter two buildings is scheduled to commence, the BCDC will be asked to review those buildings' schematic design.

Table 2-1 Full Build Program

Use	Zoning Square Footage
DMH - Partial Hospital/Fenwood Inn	
Outpatient Clinic	8,260
Fenwood Inn (crisis stabilization/transitional housing)	12,740
Partial Hospital/Fenwood Inn Subtotal	*21,000*
Binney Street Building	
Outpatient Clinics	16,040
Administrative	40,500
Binney Street Building Subtotal	*56,540*

Table 2-1 Full Build Program (Continued)

Use	Zoning Square Footage
Residential Building	
Residential Units	187,750
Community Space	10,000
Residential Building Subtotal	*197,750*
Brigham and Women's Building	
BWH Research (clinical, wet, dry)	152,960
BWH Clinical	152,960
BWH Subtotal	*305,920*
DMH Outpatient Clinics	16,730
DMH Office	36,020
DMH Subtotal	*52,750*
Brigham and Women's Building Total	358,670*
PROJECT TOTAL	**633,960**

* Upon completion of the Brigham and Women's Building, BWH will have a total of 362,460 combined sf in the Binney Building and the Brigham and Women's Building and DMH will have 52,750 sf at the Brigham and Women's Building. The difference in sf for the DMH space is due to more efficient use of space which is possible given the design and configuration of the Brigham and Women's Building.

2.2.1.1 Binney Street Building

The Binney Street Building, which will be developed by BWH, comprises 56,540 of clinical and office space which will be used by BWH for outpatient uses. In the short-term, DMH will occupy the Binney Street Building until the DMH designated space within the Brigham and Women's Building is available.

2.2.1.2 Partial Hospital/Fenwood Inn

The Partial Hospital/Fenwood Inn Building, which will be developed by BWH for utilization by DMH, will include a 42 bed transitional shelter program for homeless, mentally ill men and women, a 5 bed crisis stabilization unit and 8,260 square feet of partial hospital and outpatient treatment space.

The Fenwood Inn is a transitional residence for DMH clients with severe and persistent mental illness. All residents are referred to community housing and are discharged when appropriate housing is available. The Fenwood Inn provides rehabilitation services to assess and assist with medication compliance, sobriety support, personal hygiene, room care and other skills needed for successful community living. The Fenwood Inn works in collaboration with the Partial Hospital Program (PHP), a link between crisis stabilization/transitional housing and outpatient mental health treatment, to provide a 24-hour, acute, step-down and diversion service for clients who require this intensity of treatment. PHP serves clients from the Fenwood Inn and the general community by providing a highly structured four-week intensive therapeutic intervention. In addition to treating acute symptoms, the PHP staff also provides diagnostic, cognitive, and functional consultation to outpatient clinicians.

The first floor of the building includes office space and exam rooms associated with the Partial Hospital. The second and third floors provide space for both the Partial Hospital and the Fenwood Inn. The second floor offers a group kitchen, common room, laundry and five single rooms. The top floor includes eight singles and 17 doubles for a total of 47 beds in 30 rooms. Loading facilities for the Partial Hospital/Fenwood Inn building will be located on the south side of the building.

2.2.1.3 Residential Building

The Residential Building (which will be developed, operated and controlled by RTH) will include approximately 66 affordable rental units and approximately 70 condominiums for a total of approximately 136 units. The building may also include approximately 10,000 sf of community space, for a total of approximately 197,750 sf. It is expected that all rental apartments will be affordable units, and that the majority of the condominiums will be affordable housing. If the community space is located at the nearby Mission Park development, there may be additional residential. Also, as the building design evolves, the unit count may increase as a result, to as many as 165 units.

2.2.1.4 Brigham and Women's Building

The Brigham and Women's Building, which will be developed, managed, and controlled by BWH, will contain approximately 358,670 sf of space for research and development, clinical, and offices uses by BWH and DMH. In response to community concerns raised during the community meetings, it is noted that the research uses will not include a Level 4 biolab.

2.2.1.5 Parking, Access and Circulation

Parking

Today there are 163 parking spaces on the MMHC Site. The Project will include a 406-space below-grade parking garage in the Brigham and Women's Building. The garage includes 50 spaces for DMH and the balance will serve BWH. The garage will be accessed via the driveway on the southern edge of the MMHC Site.

When the Brigham and Women's Garage is opened, 106 of the BWH-designated spaces in the Mission Park Garage will be used instead for residents of the Residential Building. Specifically, a total of 106 parking passes (90 new and 16 replacement spaces) will be provided for residents by BWH as lessee for the next 20+ years and thereafter by RTH as the garage owner.

Access

A small loading area off Vining Street is proposed for the Partial Hospital/Fenwood Inn. A loading zone for the Binney Street Building is proposed on Fenwood Road. The proposed driveway on the private way at the southern edge of the Main MMHC Site will provide access and egress to the parking garage and service area at the Brigham and Women's Building pursuant to the terms of a declaration of easements or other similar instrument as described below. A service entrance for the Residential Building will be located along Fenwood Road opposite the existing service entrances of the Servicenter Complex. Residents of the Residential Building will park in the Mission Park Garage which will be accessed via Vining Street or the private way.

Private Way

There is a private way that runs from the Riverway to the entrance of the Mission Park Garage between the Neville House building of Mission Park and the back of the Main MMHC Site. It is slated to be redeveloped as a private roadway to serve a variety of access and service purposes for DMH, RTH and BWH and their respective interests. It will be maintained, cleaned and plowed by the BWH for the benefit of all of the users. Contemporaneously with the execution of the ground leases for the MMHC Site between the Commonwealth (acting through DCAM) and BWH, the Commonwealth and the Proponent will record in the Suffolk County Registry of Deeds, a "Declaration of Easements" or similar instruments to confirm that the private way may be used by both residents of the Residential Building and users of the Brigham and Women's Building, including, without limitation, employees, invitees and patients of BWH and DMH, and their respective successors and assigns as the case may be.

The private way will be improved with sidewalk, curbing and some planting along the northeast edge, the pavement will be renewed and the entrance from the Riverway will include new traffic calming features and clearly marked pedestrian crossings perpendicular to the traffic flow both before and after the 90 degree turn (subject to DCR approval). The initial 200 feet of this roadway will be one-way from the Riverway to the first curb cut at the Brigham and Women's Building. From there to the end at the mouth of the Mission Park Garage, it will be two way.

The main traffic patterns will be:

- the one way flow of passenger cars from the Riverway to the new garage to be built under the Brigham and Women's Building;
- the two way traffic of cars, trucks and vans to the Brigham and Women's Building, all arriving and leaving via Vining Street which connects to the private way at the southern edge of the Main MMHC Site, where two-way traffic will end at the entrance to the Mission Park Garage; and

- pedestrian and some bicycle travel for people coming and going from the eastern sidewalk adjacent to the Riverway, the main Mission Park campus, the offices in Neville House, the new Brigham and Women's Building's Vining Street entrance, the Partial Hospital/Fenwood Inn and the new Residential Building that is a part of this development.

The primary sidewalk for most pedestrian travel will be the existing sidewalk on the southwest side of the private way as it is not interrupted by curb cuts and has a green buffer from the adjacent Neville House.

Area Future Improvements by Others

The Proponent recognizes that a dedicated right-turn lane on the northbound approach to Brookline Avenue has been identified by the LMA, MASCO, and the City of Boston as having area wide benefits that will improve traffic flow both to the LMA as well as regionally. This right-turn lane is not proposed as part of the Project and the Project does not trigger the need for the right-turn lane. However, the Project has been designed so that future implementation of the right-turn lane improvement by others will not be precluded.

2.2.2 Approximate Project Height

Table 2-2 summarizes the approximate physical dimensions of the proposed Project elements.

Table 2-2 Physical Project Dimensions

Project Site Area	3.15 acres
Zoning Height	
Residential Building	182 feet
Brigham and Women's Building	222 feet*
Partial Hospital/Fenwood Inn	40 feet
Binney Street Building	75 feet
Parking	406 spaces

* Includes mechanical levels 13 and 14 but excludes rooftop mechanical equipment. As noted above, the Brigham and Women's Building will have a maximum height of 222 feet measured from the average grade around the building to the top of the roof of the mechanical penthouses: The zoning height as calculated in accordance with Article 2A of the Code may in fact be less than the 222 feet maximum described herein. The number of floors within the Brigham and Women's Building will depend on the final program mix between clinical and research uses. The square footage may be configured as 12 above-grade and one occupied level below grade.

2.3 Schedule and Phasing

2.3.1 Initial Phase

The initial phase of the Project will be the development of the Partial Hospital/Fenwood Inn and the Binney Street Building. This phase is estimated to commence immediately upon the receipt of all required permits and approvals from applicable City and State agencies and authorities. Construction is anticipated to begin in Spring 2010 with approximately five months of phased abatement and demolition of the existing MMHC buildings. Construction of the two buildings will be concurrent with duration of construction anticipated to last approximately 15 months for the Partial Hospital/Fenwood Inn and approximately 18 months for the Binney Street Building. Section 4.10.2 describes the logistics of the first phase of construction.

2.3.2 First Interim Phase

Following construction of the Partial Hospital/Fenwood Inn and the Binney Street Building and prior to construction of the Residential Building, the Main MMHC Site will not be used for active construction activity. The Proponent has developed, in consultation with a Community Construction Mitigation Group, an interim plan outlining proposed uses of the Main MMHC Site during this phase. Interim uses include landscaping on the area of the proposed Residential Building and temporary parking of 82 spaces on the area of the proposed Brigham and Women's Building. The Proponent will work with the Community Construction Mitigation Group on details of the proposed landscaping. The parking includes replacement spaces for the Main MMHC Site spaces currently used by RTH residents, and 50 spaces for use by DMH as required under the terms of the Development Agreement described below in Section 2.7. To accommodate the construction needs of the Residential Building, a staging area between the landscaped area and temporary parking will be established. Please see Figure 4.10-6 in Section 4.10.2 for an illustration of interim uses.

2.3.3 Residential Building Phase

Specific timing of the construction of the Residential Building will depend on market conditions and the availability of capital. Construction of the 197,750-sf Residential Building is expected to last for approximately 24 months.

2.3.4 Second Interim Phase

A second interim phase is anticipated when the Residential Building and associated streetscape improvements and open space will be completed prior to the Brigham and Women's Building start of construction. During this interim phase, the use of temporary parking with 82 spaces on the eastern side of the Main MMHC Site will remain.

2.3.5 Brigham and Women's Building

As with the Residential Building, the timing for construction of the Brigham and Women's Building is contingent upon the financial market. The Brigham and Women's Building will likely take approximately 30 months to construct. The agreement with the Commonwealth requires that the Brigham and Women's Building must be completed within 10 years of the occupancy of the Binney Street Building.

2.4 Project Cost

The total Project cost, including soft costs, is estimated at approximately $383 million. The cost of the Partial Hospital/Fenwood Inn will be approximately $13 million; the cost of the Binney Street Building will be approximately $20 million; the cost of the Brigham and Women's Building will be approximately $ 300 million, and the cost of the Residential Building will be approximately $50 million. These costs are based on current estimates of construction and related costs which have decreased due to the current economy, and on assumed construction commencement dates. Any changes in the economy or Project schedule could change these estimates, as will design refinements as construction documents are developed.

2.5 Zoning

2.5.1 Existing Zoning

The Main MMHC Site (i.e., the parcel bounded by the Riverway to the west, Fenwood Road to the north, Vining Street to the east, and a private way to the south and comprising approximately 113,769 sf as shown on the survey included in Appendix A) is located within the Massachusetts Mental Health Institutional Subdistrict established by Article 59 (Article 59) of the Boston Zoning Code (Zoning Code), as well as the Restricted Parking Overlay District established pursuant to Section 3-1A.c of the Zoning Code. A westerly portion of the Main MMHC Site (i.e., a portion of the proposed Residential Building site), as shown on the survey in Appendix A, is located within the Greenbelt Protection Overlay District as established by Article 29 and Section 59-28 of the Zoning Code, and as shown on Map 6D of the Boston Zoning Maps.

The existing dimensional regulations within the Massachusetts Mental Health Institutional Subdistrict call for a maximum height of 55 feet, a minimum front yard of 20 feet, and a maximum floor area ratio of 2.0. There are no other dimensional requirements within this institutional subdistrict (see Section 59-25 of the Zoning Code and Table I to Article 59). The uses permitted as of right within this institutional subdistrict are as set forth on Table D to Article 59, and include the multi-family residential, community, clinical, laboratory, office and research uses planned for the Project.

The Partial Hospital/Fenwood Inn Site is not located within the Massachusetts Mental Health Center Institutional Subdistrict; rather, it is also located within the 3F-2000/Three-Family Residential District and the Restricted Parking Overlay District of the Mission Hill Zoning District. The development of this site will be exempt from local zoning and other regulations, as the site will be developed to serve an "essential governmental function" of DMH which, as an agency of the Commonwealth, is exempt from local zoning and other regulations. The Partial Hospital/Fenwood Inn Site will be developed by BWH on behalf of

DMH pursuant to the terms of the DCAM/DMH Master Plan, BWH's Development Agreement with DCAM (acting on behalf of DMH), and the future ground leases of the MMHC Site between DCAM (acting on behalf of DMH) and BWH.

The underlying zoning for the Binney Street Site is the H-1 Zoning District, and this site is also within the Restricted Parking Overlay District as shown on Map 1 and Map 6. By virtue of Map Amendment No. 444, adopted by the Boston Zoning Commission in February, 2005, the Binney Street Site is now located within the BWH Institutional Master Plan Overlay District (the BWH IMP Overlay District), and the governing zoning for this site is BWH's existing IMP approved in 2005. The construction of the Binney Street Building will be approved as part of the BWH 2010 IMP being submitted in October 2009.

Neither the MMHC Site nor the Binney Street Site is located within the Groundwater Protection Overlay District established by Article 32 of the Zoning Code.

2.5.2 Partial Hospital/Fenwood Inn

The development and use of the Partial Hospital/Fenwood Inn will be exempt from local zoning and other local regulations, and will be authorized as an "essential government function" of DMH which, as an agency of the Commonwealth, will use the replacement Partial Hospital/Fenwood Inn (formerly located in the MMHC at 74 Fenwood Road) for the care and treatment, with crisis stabilization, transitional housing and outpatient services, of the patient community which it serves. The redevelopment of the Partial Hospital/Fenwood Inn will be undertaken by BWH on behalf of DCAM/DMH pursuant to the terms of the Master Plan, Development Agreement, and ground leases with DCAM, acting by and on behalf of DMH, which will set forth the terms of the redevelopment.

2.5.3 Binney Street Building and Brigham and Women's Building

The BWH 2010 IMP to be submitted to the BRA in October 2009 includes detailed zoning information for the Binney Street Building and Brigham and Women's Building. The BWH 2010 IMP proposes to supercede the 2005 BWH IMP and to amend the BWH IMP Overlay District boundaries. Once approved by the BRA and adopted by the Boston Zoning Commission, the BWH 2010 IMP will authorize the additional BWH specific components of the MMHC Project, specifically the Brigham and Women's Building and the Binney Street Building, with respect to the uses therein and such structures and other improvements.

2.5.4 Residential Building

The site of the proposed Residential Building will comprise the westerly portion of the Main MMHC Site and will contain approximately 48,640 sf of land and approximately 197,750 sf of building area (the RTH Site). As noted in Section 2.4.1, the Main MMHC Site is located within the Massachusetts Mental Health Center Institutional Subdistrict established pursuant to Article 59 of the Zoning Code and the Restricted Parking Overlay District established pursuant to Article 3-1.A.c of the Zoning Code. A portion of the RTH Site lies within the Greenbelt Protection Overlay District established pursuant to Articles 29 and 59 of the Zoning Code.

The Residential Building will require zoning relief because it does not comply with the existing dimensional requirements for the MMHC Institutional Subdistrict. Article 59 provides for the creation of Planned Development Areas (PDA's) for a number of reasons, such as to create a more flexible zoning law and to provide public benefits for the Mission Hill community. The Residential Building, with its many units of affordable housing, community space (potentially on-site) and expansive open space, will provide such public benefits. After consultation with the BRA, discussions with community residents and public officials, and community meetings with respect to the Project, RTH is proposing that the RTH Site be re-zoned as a PDA. RTH is submitting a draft PDA Plan for the Residential Building (RTH PDA Plan) in October 2009 for public review and comment pursuant to the provisions of Article 80C of the Zoning Code.

As required by Section 3-1A.a of the Zoning Code, the RTH PDA Plan sets forth the proposed location, appearance and dimensions of the Residential Building, the open space surrounding it, the proposed uses within the building, the density of development at the RTH Site, proposed traffic circulation around the RTH Site, the loading facilities at the building, and access to public transportation. The RTH PDA Plan also discusses the many public benefits to be afforded by development of the Residential Building.

At present, Article 59 does not contemplate the creation of a PDA at the RTH Site. Therefore, the rezoning of the RTH Site and the creation of a PDA covering the RTH Site will be accomplished in two steps: (1) an amendment to Article 59 of the Zoning Code and an amendment to the Mission Hill zoning map (Map 6D of the Boston Zoning Maps) to authorize the creation of a PDA at the RTH Site, and (2) approval of the RTH PDA Plan. Both of these actions will need to be approved by both the BRA and the Boston Zoning Commission.

2.6 Legal Information

2.6.1 Legal Judgments Adverse to the Proposed Project

The Proponent is not aware of any legal judgments which are adverse to the proposed Project.

2.6.2 History of Tax Arrears on Property

The MMHC Site has been owned by the Commonwealth and dedicated for use by DMH, thus it is in tax exempt ownership. The Binney Street Site is owned by BWH and was formerly exempt from real estate taxation given its status as a MGL c121A approved project.

It continues to be exempt from taxation as it is owned by BWH. BWH has entered into a PILOT Agreement with respect to the Servicenter Complex, which currently includes the Binney Street Site.

2.6.3 Evidence of Site Control/Nature of Public Easements

The MMHC Site is owned by the Commonwealth of Massachusetts. The Commonwealth, acting by and through its Division of Capital Asset Management and Maintenance, has designated BWH as the developer of the MMHC Redevelopment Project pursuant to a Development Agreement dated as of November 21, 2005, as amended (the Development Agreement). Upon the closing of the transactions contemplated under the Development Agreement, BWH will, *inter alia*, enter into long term ground leases providing for the redevelopment of the MMHC Site. The Binney Street Site is owned by BWH.

Other than any easements as may relate to public streets and sidewalks surrounding the Project Site, there are no public easements into, through or surrounding the Project Site.

2.7 Development Agreement

2.7.1 Terms of Development Agreement

DCAM and BWH have entered into a Development Agreement for redevelopment of the MMHC Site. The major terms of the agreement include the proposed Project consisting of four buildings as generally described in Section 2.2. The terms of the agreement include:

- ♦ Providing 70,000 sf (approximately 20,000 sf at Partial Hospital/Fenwood Inn Building and approximately 50,000 sf first at the Binney Street Building and then at the Brigham and Women's Building) to the Commonwealth for 95 years at no capital cost and $1 a year lease cost;
- ♦ Providing 50 designated parking spaces at no charge for 95 years;
- ♦ Paying $950,000 in non-refundable deposits for Commonwealth expenses;
- ♦ Making a $2.1 million payment to seed an expendable trust for DMH operating costs of its new facilities, with an additional payment into the trust of $1 per square foot per year for hospital use space not less than $300,000 per year adjusted by 75% of Consumer Price Index every five years for the Brigham and Women's Building beginning in the 11th year from the occupancy of the Binney Street Building; and
- ♦ Making a one-time $9 million payment to the Commonwealth at the time of the execution of ground leases.

2.7.2 Ground Lease Agreements

Upon receipt of all necessary approvals, BWH will enter into 95-year ground lease agreements with DCAM for the Main MMHC Site and the Partial Hospital/Fenwood Inn Site. The ground lease agreements and associated lease agreements include the following provisions:

- The Commonwealth will be the sublessee of the new Partial Hospital/Fenwood Inn building for 95 years for a rent of $1 a year and with the State responsible for associated operating costs;
- The Commonwealth will be lessee under a separate 10-year lease for a rent of $1 per year for the Binney Street Building, including 50 parking spaces;
- The Commonwealth will be a sublessee of a portion of the Brigham and Women's Building for at least 85 years for a rent of $1 a year and with the State responsible for associated operating costs. This lease will commence after the separate 10-year lease for the Binney Street Building expires and will include the 50 parking spaces in the Brigham and Women's Building Garage provided for in that lease for the remaining 85 years;
- BWH will have 10 years to enter into a residential ground sublease with RTH or an affiliate thereof when financing is in place and construction is ready to move forward; and
- The Brigham and Women's Building must be completed within 10 years of DMH's occupancy of the Binney Building.

2.7.3 Schedule Agreements

By virtue of the execution of the Development Agreement, BWH is required to move expeditiously in gaining all necessary approvals for the Project. The Development Agreement includes milestones and deadlines for the purpose of obtaining approvals, signing ground leases, and completing construction on the first two buildings.

2.8 Consistency with Local, Regional and State Land Use Planning

2.8.1 Compliance with Executive Order 385

Executive Order 385, "Planning for Growth" ("EO 385"), explicitly seeks to promote sustainable economic development in the Commonwealth of Massachusetts. This Project is designed to promote economic activity while satisfying the two-dimensional edict of EO 385 to ensure such economic development is supported by adequate infrastructure and does not result in avoidable loss of environmental quality and resources. The Project will redevelop the Project Site by replacing dilapidated and structurally deficient buildings with new state-of-the-art facilities that will benefit the surrounding community without having an adverse impact on endangered or threatened natural resources. The Project is proximate to public transportation, and the dense urban development in the area is expected to promote walking and bicycle transport modes. The Proponent is committed to incorporating sustainable design elements into the Project such as building energy management systems, efficient lighting, recycling practices, conservation measures, and locally-sourced building materials. The Partial Hospital/Fenwood Inn is planned to be LEED Certified. The Proponent aims to exceed requirements of Article 37 for the Binney Street Building and Brigham and Women's Building and proposes these buildings to be LEED Silver Certified. The Residential Building is proposed to be LEED Certifiable with the possibility of being LEED Silver Certifiable.

The Project reflects "Smart Growth" principles in a number of ways:

- *Redevelopment* – The Project will transform an underutilized, previously-developed parcel into a vibrant development with a mix of uses.

- *Reuse and rehabilitate existing infrastructure* – By locating near and using existing infrastructure and transportation systems (both roadway and public transit), the Project's environmental impacts will be minimal relative to a similar project constructed on an undeveloped site without these services and infrastructure in place.

- *Concentrate Development* – The Project density concentrates a mix of uses in a single location to promote efficient use of the Project Site and foster a sense of place.

- *Conserve Natural Resources* – The Project will advance sustainable and environmentally conscious design and construction practices.

- *Expand Housing Opportunities* – The Residential Building will provide high-quality affordable and market rate housing to residents who will have convenient access to local public transportation and job opportunities in the LMA.

2.8.2 MAPC MetroFuture

The MetroFuture plan is the regional plan prepared by the Metropolitan Area Planning Council to establish a vision for regional land use and development. The plan identifies 65 goals in six categories: Sustainable Growth Patterns, Housing Choices, Community Vitality, Prosperity, Getting Around, and Energy, Air, Water and Wildlife. By redeveloping a parcel of existing developed land in Boston, enhancing the pedestrian environment, and utilizing existing transportation infrastructure, the Project is consistent with many of the goals set forth in the plan. In addition, the proposed transportation demand management program will reduce the Project's dependency on single occupancy vehicles.

2.8.3 Consistency with Local Land Use Planning

The Project is subject to the jurisdiction of two City of Boston Ordinances under the purview of the City of Boston Parks and Recreation Commission, as follows:

- **Permission for Construction Near Parks or Parkways** – Ordinance 7-4.11 requires written permission from the Parks and Recreation Commission for the construction of structures or buildings located within 100 feet of a "parkway" or "park." The Riverway (a parkway) and a portion of the Emerald Necklace (a park) are located to the west of the Project Site. As shown on Figure 2-19, a portion of the Residential Building will be located within 100 feet of the Riverway and thus, that building will require approval from the Parks and Recreation Commission after a public meeting of the Commission. The other three Project buildings (the Binney Street Building, the Brigham and Women's Building, and the Partial Hospital/Fenwood Inn), will be located more than 100 feet from the Riverway and therefore this Ordinance will not be applicable to those buildings. Furthermore, the Partial Hospital/Fenwood Inn is exempt from local regulations altogether because it is an "essential governmental function" of DMH.

- **Setback Requirements** – Ordinance 7-4.12 requires that new buildings constructed along the Riverway adjacent to the Project Site have at least a 20 foot setback from the Riverway. The Residential Building will be located more than 30 feet from the Riverway and therefore, will comply with the requirements of this Ordinance.

There is a third City Ordinance (City of Boston Ordinance 7-4.10) which regulates land uses and sets a 70-foot height limit on new structures constructed on land abutting designated portions of the Riverway. This Ordinance applies to the portion of the Riverway from Brookline Avenue to Beacon Street and therefore, is not applicable to the Project Site or any portion of the Project.

The City of Boston's Parks and Recreation Department's Open Space Plan 2008-2012 looks at public open space, including non-traditional open spaces such as urban wilds, community gardens, cemeteries, greenways, trails, thoroughfares, and harbor islands, as well as traditional parks, playgrounds, squares and malls. It also examines open lands under private ownership, such as non-profit institutions, so as to understand their role in the citywide open space system. The Plan's goals include: sustain and improve the existing open space system; realize the potential of a dynamic, integrated open space system within the urban framework; protect, restore, and improve the environmental base of the open space system; coordinate open space provision for maximum community benefit; and develop a network of resources to support a fiscally stable open space system. Although many of these goals look for actions from the City and its agencies, the private sector is able to further many of these goals as well. The Project will provide new landscaped open spaces on the MMHC Site, and the planned setbacks from the property line along Fenwood Road, the private way along the southern portion of the Main MMHC Site and the Riverway will preserve view lines and enhance a sense of openness. The proposed open spaces shown in Figure 2-19 will integrate with the Emerald Necklace and Riverway (shown in Figure 2-20), complement and enhance these open spaces, improve the environmental base of the open space system, and be coordinated with the surrounding open spaces.

Open space on the MMHC Site will also complement the Riverway. Although owned by separate entities, the landscape and pedestrian circulation master plan between and around the RTH Residential Building and Brigham and Women's Building has been developed as a unified design concept as opposed to two separate but coordinated parcels. The setback from the Riverway and proposed green space continues the green border to the south of the Main MMHC Site. In addition, the space between the two buildings is conceived as a visual extension of the Riverway green space to the northeast toward Binney Street. The proposed pedestrian way will create a new connection between the LMA and the residential neighborhood to the south. BWH will take responsibility for the maintenance of this new open space with the participation of RTH.

Setbacks will protect the mature perimeter of trees to the greatest extent feasible, and incorporate them into the landscape plan, if possible. A certified arborist has been retained to examine the condition of trees on the Main MMHC Site. The arborist is charged with developing a site visit report, evaluation of the health of the mature trees and remedial recommendations.

Please see Section 2.5 for a description of the Project's consistency with City of Boston zoning regulations.

2.9 Project Alternatives

The Project's massing and siting are based not only on urban design considerations to ensure that the Project is respectful of the site and adjacent institutional, residential and recreational/park uses, but are also the result of the history of the disposition process by DCAM, the Proponent's financial outlay pursuant to the terms of its Development Agreement with DCAM, and the required development program to ensure that the Project meets the needs of BWH, DMH and RTH and is financially feasible.

The proposed massing is driven by the program required to make the Project financially viable for BWH and RTH given BWH's commitment to provide 70,000 sf of space and 50 parking spaces to DMH at no cost and to contribute $950,000 for Commonwealth expenses, $2.1 million for an expendable trust for DMH building operations, a payment to an expendable trust for ongoing DMH operations ($1 per square foot per year for hospital use space not less than $300,000 per year adjusted by 75% of Consumer Price Index every five years for the Brigham and Women's Building beginning in the 11th year from the occupancy of the Binney Street Building), and $9 million to the Commonwealth at the closing for the ground leases. In order for the Residential Building (100 percent of rental apartments and majority of condominiums are anticipated to be affordable) to be included in the Project, BWH has committed to provide the following resources:

- Contributing $2.5 million toward construction of a 10,000 square foot community center;

- Providing $3 million straight subsidy for pre-construction and construction costs;

- Agreeing to extend up to $2 million in a letter of credit to support financing of the Residential Building; and

- has not applied a land value to the residential parcel.

In addition to these financial contributions and subsidies, the Proponent will assume all development costs including the extensive cost of demolition and abatement of the existing MMHC buildings. The Project also provides numerous public benefits including a $1.7 million contribution by BWH to help RTH construct a gymnasium, recreational and meeting space at the Mission Park development, and approximately $2 million for housing linkage and approximately $412,000 for jobs linkage. In return for the development of MMHC space, financial contributions and public benefits, the Proponent is proposing 362,460 square feet of clinical and research space within a massing scheme that reflects the character of the area and aims to reduce environmental impacts.

The following sections describe the evolution of the Project, various alternatives that have been considered, and design changes intended to minimize potential environmental impacts.

2.9.1 Initial Site Studies

Because funding did not allow for ongoing necessary maintenance, by the 1990s, physical conditions at the MMHC had deteriorated to the point that the buildings required complete renovation or replacement. Archaic wiring, ancient mechanical systems, and degraded structural conditions indicated a deteriorating public asset. Moreover, the mission of the MMHC had shifted over time from its original use as a comprehensive mental health facility with a large inpatient component to exclusively ambulatory use. The existing buildings and campus configuration, having been developed for inpatient use, were inefficient for this new, outpatient service model and resulted in high maintenance and operational costs. DMH did not have sufficient funding to upgrade the buildings, including improvements necessary to ensure compliance with the National Fire Protection Association's Life Safety Code, the accessibility requirements of the Americans with Disabilities Act, and accreditation standards of the Joint Commission on Accreditation of Healthcare Organizations.

Unable to address these deficiencies, in 1994, DMH announced its intention to close the MMHC. The resulting public outcry prompted DMH to reexamine its options, including whether the prime location adjacent to the LMA could be used to generate economic benefits. One of DMH's goals was to evaluate whether it could continue to provide clinical services at the current MMHC Site but in a modern replacement space with no capital outlay by the Commonwealth for the construction. DCAM assisted DMH by examining alternatives, including analyzing the costs of both renovation and new construction alternatives and assessing the value of the development rights of the residual land area. DMH formed a task force of its clients and staff, academics, and others to identify MMHC's optimal future space needs and developed a plan with DCAM which included a total of 70,000 sf of MMHC program space (a 50,000 sf MMHC facility and a 20,000 sf Partial Hospital/Fenwood Inn) as well as 50 parking spaces.

In 2001, a study was issued noting that costs to renovate the MMHC facility would be approximately $13 million more than demolishing and building anew. That additional cost has grown to $16.4 million in 2009 construction dollars. These costs do not include the costs required to mitigate the significant structural and environmental damage that has occurred since the buildings were vacated in 2003. As noted above, even if buildings were renovated, the layout of existing buildings did not meet the needs of MMHC's new mode of focusing on outpatient services. In addition, existing buildings provided far more space than required by DMH.

Financial feasibility studies performed by real estate advisors determined that the MMHC Site could generate enough private redevelopment value to finance the construction of 70,000 square feet and 50 parking spaces for DMH. DMH and DCAM submitted a proposal to the Commonwealth's Asset Management Board (AMB) for the redevelopment of the MMHC Site. Public hearings were held in December 2001 and October 2002 to gather public comment on the redevelopment proposal. Preliminary, Draft Final and Final Project Proposals were prepared by DMH and DCAM and submitted to the AMB which approved the project proposal in December 2002.

In early planning discussions of development potential for the MMHC Site and as a result of numerous public meetings, residential use appeared to be the preferred use for the MMHC Site. After consideration of costs associated with redevelopment and requirements for 70,000 sf and 50 parking spaces for DMH, however, it was clear that a housing development alone, particularly affordable housing, would not support the financial demands of redevelopment.

2.9.2 Request for Proposals for Redevelopment

In 2004, DCAM, on behalf of DMH, issued an RFP for the MMHC redevelopment, and two proposals were submitted to DCAM and DMH in response. One of the two proposals was for a student housing complex. It proposed to retain a portion of the main building and integrate it into a new, multi-story building. DCAM and DMH, in consultation with the City of Boston, determined that the student housing proposal had little chance of being permitted and was, therefore, infeasible.

The other proposal presented by a team that included the Proponent included construction of requisite space and parking for DMH along with research, office and residential uses. It was selected, and BWH is seeking to implement this proposal, as modified in consultation with DCAM and DMH. The Master Plan for the redevelopment of the MMHC Site, dated February 2007, contained approximately 590,000 sf, including 70,000 sf and 50 parking spaces for DMH along with space for BWH and RTH. The proposal included three buildings – the three-story Partial Hospital / Fenwood Inn (20,000 sf), the 12-story Office/Research Building in the center of the Main MMHC Site (including 50,000 sf and 50 parking spaces for DMH and approximately 360,000 sf for BWH), and a 15-story residential building at the northwestern end of the Main MMHC Site.

2.9.3 Existing Zoning / As-of-right Alternative

Section 2.4.1 above outlines the existing zoning for the Project Site. The massing allowed for the Main MMHC Site would result in a building with a maximum height of 55 feet, a minimum front yard of 20 feet, and a maximum floor area ratio of 2.0. Table 1 of Article 59 expressly recognizes that within the MMHC Institutional Subdistrict an institutional master plan may modify the underlying dimensional requirements as applied to institutional uses. An FAR of 2.0 would allow construction of only approximately 230,000 sf. With approximately 50,000 sf required for the DMH space on the Main MMHC Site, only 180,000 sf would remain to support the financial outlay for the site (outlined in Section 2.5) and the costs associated with developing the 50,000 sf of DMH space. These zoning restrictions would not allow the Proponent to develop the square footage needed to make the Project financially feasible.

The development of the Partial Hospital/Fenwood Inn Site will be exempt from local zoning and other regulations as described in Section 2.5.1. The proposed massing for the Partial Hospital / Fenwood Inn meets DMH's program requirements and is similar to the massing of the existing building to be demolished.

The underlying zoning for the Binney Street Site does not include a height limit but sets an FAR maximum of 1.0. An FAR of 1.0 would allow construction of 12,484 sf. Although the proposed Binney Street Building exceeds this square footage, by virtue of the Binney Street Site's inclusion in the BWH IMP area, the BRA's Article 80 process allows for overriding underlying zoning of this site. The proposed square footage of 56,540 sf is required to meet the program needs of the temporary DMH space at this location.

In summary, a program that meets the underlying zoning for the Project Site would render the Project infeasible, thereby eliminating the opportunity for DMH to return to the MMHC Site, the provision of approximately 136 (or more) mostly affordable residential units, and the development of new open space.

2.9.4 Alternative Site Layout and Massing

Since DCAM's initial selection of the Proposer, the redevelopment of the MMHC Site has undergone a number of alternative site planning and massing modifications while retaining the general overall program to ensure viability of the Project. The original siting and the massing of the buildings were designed to meet the criteria of the Commonwealth's RFP. This proposal and other early versions envisioned both buildings on the Main MMHC Site as blockier forms with the Brigham and Women's Building as a cube on a podium and the Residential Building with a more intensive footprint and squatter form. Earlier proposals also incorporated a parking court located between the two buildings. As design progressed, the Brigham and Women's Building's formerly cube-like form was fractured into three layers oriented to the geometry of Fenwood Road and was streamlined with more slender northwest and southeast facades. In addition, the Brigham and Women's Building width was reduced by 15 feet and it was moved northeastward to increase its separation from the residential Neville House on the other side of the private way. This shift of Brigham and Women's Building footprint allowed the Residential Building to be relocated from the extreme northwest of the Main MMHC Site more to the east. The resulting layout and elimination of the parking court creates more open space immediately adjacent to the Riverway by continuing the 30 to 40 foot wide Mission Park landscaped buffer located to the south of the existing Neville House.

Addition of Binney Street Building

Due to changes in the economy and capital market upheavals, concerns arose about the ability to finance the Brigham and Women's Building in the near term. In an effort not to delay the construction of the DMH space, BWH introduced the concept of building interim space for DMH adjacent to the existing MMHC complex. The Fenwood Inn/Partial Hospital Site at 20 Vining Street was studied for this interim use. This study proved that a building of the size and scale required to house the Fenwood Inn/Partial Hospital together with the DMH clinical and administrative space would not be achievable given the small floor plate available on the Partial Hospital/Fenwood Inn Site. At that point, BWH proposed a building on Binney Street to accommodate the DMH space until the Brigham and Women's Building could be built. BWH, DCAM and DMH agreed that the proposed building on the Binney Street Site would meet DMH's immediate space requirements. In exchange for providing the additional land area and given the exigencies of the financing market, BWH requested additional time to construct the Brigham and Women's Building, and additional time for RTH to build the Residential Building as RTH identified capital sources for the residential project.

2.9.5 Environmental Impacts

As described above, Project viability is contingent upon the proposed program. While retaining a program that ensures viability of the Project, the evolution of the massing resulted in a general reduction in environmental impacts. Specific massing-related impacts are described below. Impacts on water and wastewater, air quality, greenhouse gas emissions, and hazardous waste, as well as construction and solid waste impacts are based primarily on the program needed for the Project. These potential impacts and proposed mitigation measures are described in this Draft EIR/PIR.

Wind and Riverway Parkland Impacts

Overall, wind tunnel testing demonstrated that the pedestrian level wind comfort conditions at the Project Site were similar in the No Build and Build conditions. The wind conditions improved or stayed the same with the Proposed Project in more locations than they worsened. Along the parkland side of the Riverway roadway, wind conditions are anticipated to improve. The Binney Street Building Site is currently vacant, therefore, the construction of a building at this location will result in some sheltering from wind and predicted improvements in wind conditions along Binney Street and Francis Street. At the Partial Hospital/ Fenwood Inn Site, the current low rise building will be demolished and replaced with a building similar in scale. Therefore the proposed building at this location is not anticipated to cause degradation of wind conditions.

The Main MMHC Site is currently occupied by low rise buildings to be replaced by the Residential Building and Brigham and Women's Building. The siting and massing of these two buildings are predicated upon program needs to ensure viability of the project and the desire to set back the buildings from the Riverway and the private way allowing for a visual buffer between open space and residential neighbors. Given wind conditions in Boston and the development program required to ensure viability of the Project, it is anticipated that wind impacts of alternative massing configurations that meet program requirements would result in impacts similar to those of the Project. It is anticipated that a project with a similar program would result in similar net wind impacts, although the locations of impact may differ. In either an alternative case or the proposed case, the Project could require mitigation to ensure that pedestrian level impacts are minimized. The Proponent is exploring appropriate mitigation to reduce potential impacts on pedestrian level winds including the possible use of wind screens and landscaping.

Shadow and Riverway Parkland Impacts

The relocation of the Residential Building from the western-most edge of the Main MMHC Site and the reduction of the length of the northwest façade have reduced the early morning shadows cast on the Riverway. With the shift of the building footprints, the massing of the BWH Building was made more slender, further reducing shadow impacts. The BWH building footprint was decreased by 15 feet along the northeast axis to allow the Residential Building to be located further from the Riverway. This shift mitigates potential shadow impacts of the BWH Building on the Riverway.

Transportation

The layout and access plan for the proposed Project maximizes efficiency of traffic and pedestrian flows to protect pedestrian safety and minimize vehicle circulation around the Project Site. The proposed driveway from the Brigham and Women's Building garage on the private way at the southern edge of the Main MMHC Site will provide access and egress along the most underutilized road adjacent to the Main MMHC Site from a transportation perspective. By locating this driveway along the private way, clear sight distances can be obtained for vehicles exiting the driveway. In addition, vehicle/pedestrian conflicts will be minimized, since the Brigham and Women's Building's main pedestrian access will be along Fenwood Road.

The location of the driveway along the private way also takes advantage of the slope of the Main MMHC Site – allowing the Fenwood Road face of the Brigham and Women's Building to have a complete floorplate – with windows and pedestrian entry points, which were important considerations for both the BRA and the neighborhood.

The Project will include comprehensive Transportation Demand Management programs for both the Brigham and Women's Building and the Residential Building, as well as storage areas for bicycles and improvements to pedestrian connections that will mitigate traffic impacts.

Air Quality and Greenhouse Gas Emissions

The Project will comply with the National Ambient Air Quality Standards, and the Proponent has identified an extensive list of specific measures to reduce greenhouse gas emissions. This Draft EIR/PIR includes air quality and greenhouse gas analyses and describes measures to mitigate impacts.

Drainage

By shifting the Brigham and Women's Building and the Residential Building to the east and reducing building footprints, the Project proposes over an acre of open space on the Main MMHC Site. The Brigham and Women's Building proposed garage eliminates all surface parking from the Project Site. This open space and reduced impervious surface will not only reduce the volume of runoff, but will also enhance the quality of runoff entering the BWSC drainage system. In addition, the open space area offers opportunity for some roof runoff from the Brigham and Women's Building to be conveyed to the site of the Residential Building for infiltration below-grade. Due to the increase in impervious area at the Binney Street Building, the Proponent is evaluating the use of either a green roof or a cistern (or both) to reduce peak discharge rates. Overall, it is anticipated that the Project will reduce stormwater discharge rates by approximately 1.77 cubic feet per second (cfs), or approximately 19% in the two-year storm event.

Historic Resources

As described above, the costs of rehabilitation of the buildings by DCAM were prohibitive for the Commonwealth. To mitigate impacts to historic resources, the Proponent has developed a draft architectural salvage and reuse plan that includes salvaging and incorporating selective architectural features into the design of the Project.

2.9.6 Alternatives Conclusion

DCAM issued an RFP that would allow the Commonwealth to leverage the development opportunity of the MMHC Site and the return of MMHC to its original location without State funding. As described above, the proposed massing is contingent upon the program required to make the Project financially viable for BWH and RTH given the provision of space for MMHC and the monetary contributions to the Commonwealth for deposits and MMHC operating costs outlined above. In addition, the Proponent requires sufficient program space to offset extensive costs of abatement and demolition of buildings with hazardous materials. The Project also includes numerous public benefits including contributions toward community space, and linkage payments. A summary table of BWH's commitments and subsidies is provided in Table 2-3.

Table 2-3 BWH's Commitments and Subsidies

Item	Cost
BWH Contributions to Commonwealth / DCAM / DMH	
Provide 70,000 sf of space for DMH for 95 years at no capital cost	BWH responsible for all construction and soft costs related to this use
Designate 50 parking spaces for DMH for 95 years at no cost	BWH responsible for all construction and soft costs related to this use
Contribute to Commonwealth expenses	$950,000
Establish an expendable trust for DMH facilities maintenance cost	$2.1 million
Contribute to an expendable trust for ongoing DMH operations annually ($1 per square foot per year for hospital use space for the Brigham and Women's Building)	Not less than $300,000 per year adjusted by CPI every five years beginning in the 11th year from the occupancy of the Binney Street Building (or for 85 years)
Payment to the Commonwealth at closing of the ground leases	$9 million

Table 2-3 BWH's Commitments and Subsidies (Continued)

Item	Cost
BWH Subsidies for Residential Building	
Contribute toward construction of 10,000 sf community space	$2.5 million
Provide subsidy for pre-construction and construction costs	$3 million
Agree to extend a letter of credit to support Residential Building financing	Up to $2 million
BWH's additional costs and benefits	
Abate and demolish existing MMHC buildings	Part of Project cost
Help RTH construct a gymnasium, recreational and meeting space (at Mission Park)	$1.7 million
Contribute housing and jobs linkage funds to City of Boston	$2.4 million

In return for the in-kind development of MMHC space, financial contributions and public benefits, BWH is proposing 362,460 sf of clinical and research space. This program is essential to the viability of the Project and has been incorporated into a massing scheme that respects the character of the Project Site and area. As the Project has evolved, the Proponent and design team have worked to mitigate potential environmental impacts by moving the building footprints to reduce shadow impacts on the Emerald Necklace and by exploring landscaping and wind screens to further reduce wind impacts.

Massachusetts Mental Health Center Redevelopment Project Boston, MA

Figure 2 - 1

Linea 5, inc. Boston, MA • Miami Beach, FL tat the architectural team

Perspective View from the West

Perspective View from the North

Perspective View from the East

Perspective View from the South

Ground Level Perspective View from the Riverway
(from the Southwest)

Massachusetts Mental Health Center Redevelopment Project Boston, MA

Figure 2 - 6

Linea 5, inc. Boston, MA • Miami Beach, FL tat the architectural team

Ground Level Perspective View from the Northwest

Ground Level Perspective View from the Northeast

Massachusetts Mental Health Center Redevelopment Project Boston, MA

Figure 2 - 8

LINEA 5, inc. Boston, MA • Miami Beach, FL tat the architectural team

Ground Level Perspective View from the Northeast

Massachusetts Mental Health Center Redevelopment Project **Boston, MA**

Figure 2 - 9

LINEA 5, inc. Boston, MA • Miami Beach, FL tat | the architectural team

Binney Street Building from Fenwood Road

Massachusetts Mental Health Center Redevelopment Project Boston, MA

Figure 2 - 10

LINEA 5, inc. Boston, MA • Miami Beach, FL   tat the architectural team

Binney Street Building from Francis Street

Binney Street Building from Francis Street

Massachusetts Mental Health Center Redevelopment Project Boston, MA

Figure 2 - 12

LINEA 5, inc. Boston, MA • Miami Beach, FL tat the architectural team

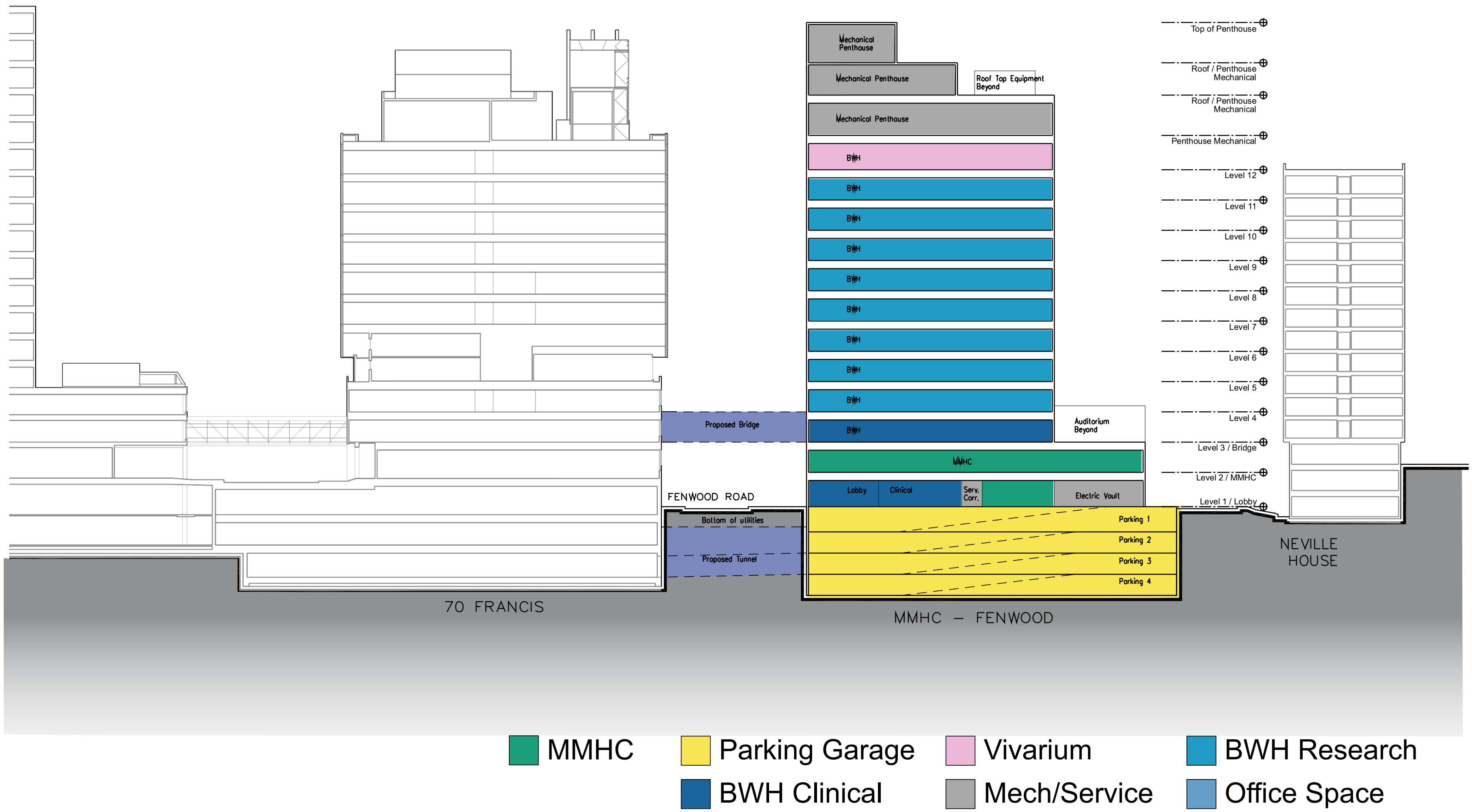
Partial Hospital / Fenwood Inn from Vining Street

Massachusetts Mental Health Center Redevelopment Project **Boston, MA**

Figure 2 - 13

Linea 5, inc. Boston, MA • Miami Beach, FL tat | the architectural team

Partial Hospital / Fenwood Inn from Vining Street

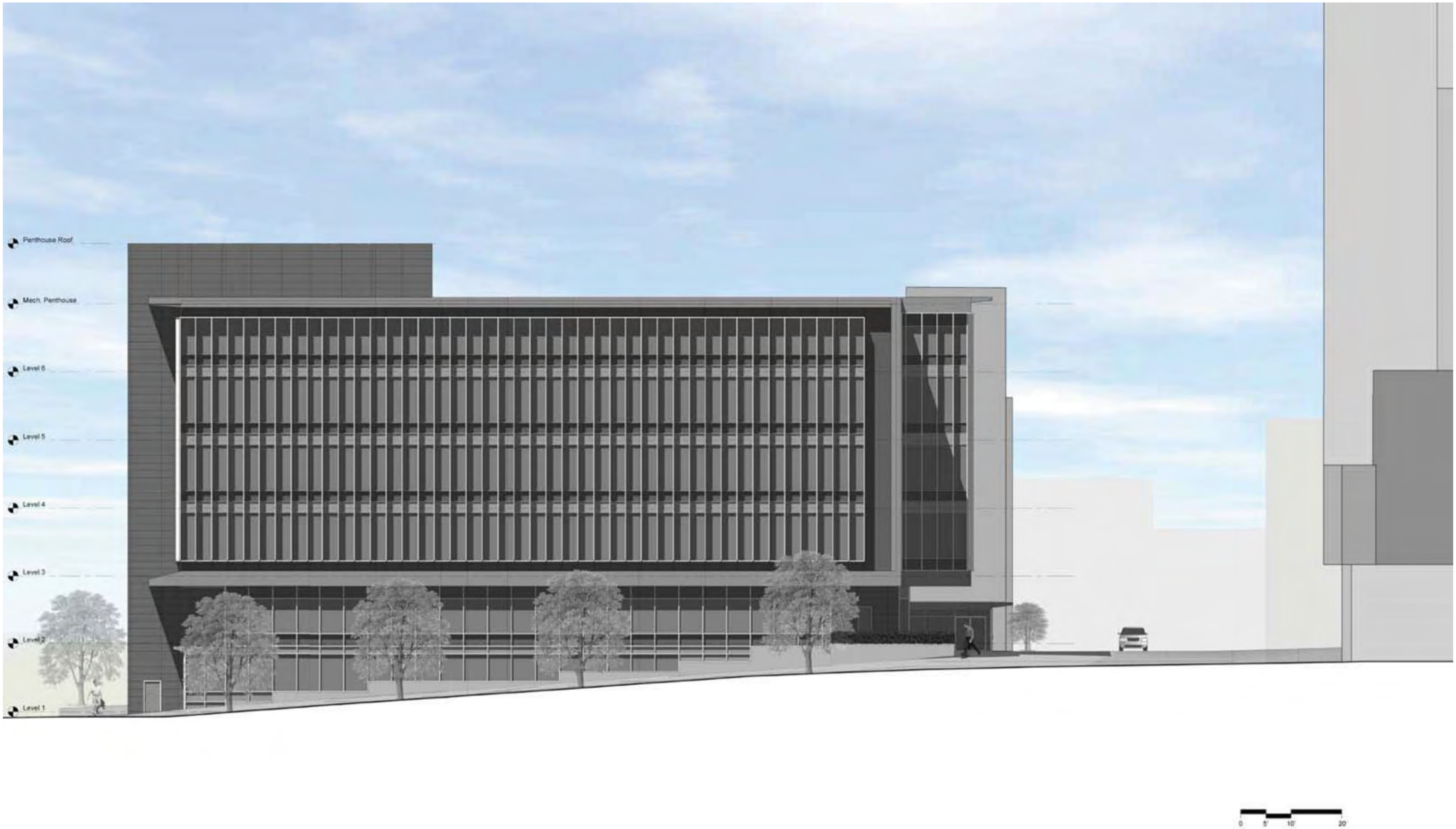


The Brigham and Women's Building will have a maximum height of 222 feet measured from the average grade around the building to the top of the roof of the mechanical penthouses: The zoning height as calculated in accordance with Article 2A of the Code may in fact be less than the 222 feet maximum . The number of floors within the Brigham and Women's Building will depend on the final program mix between clinical and research uses.

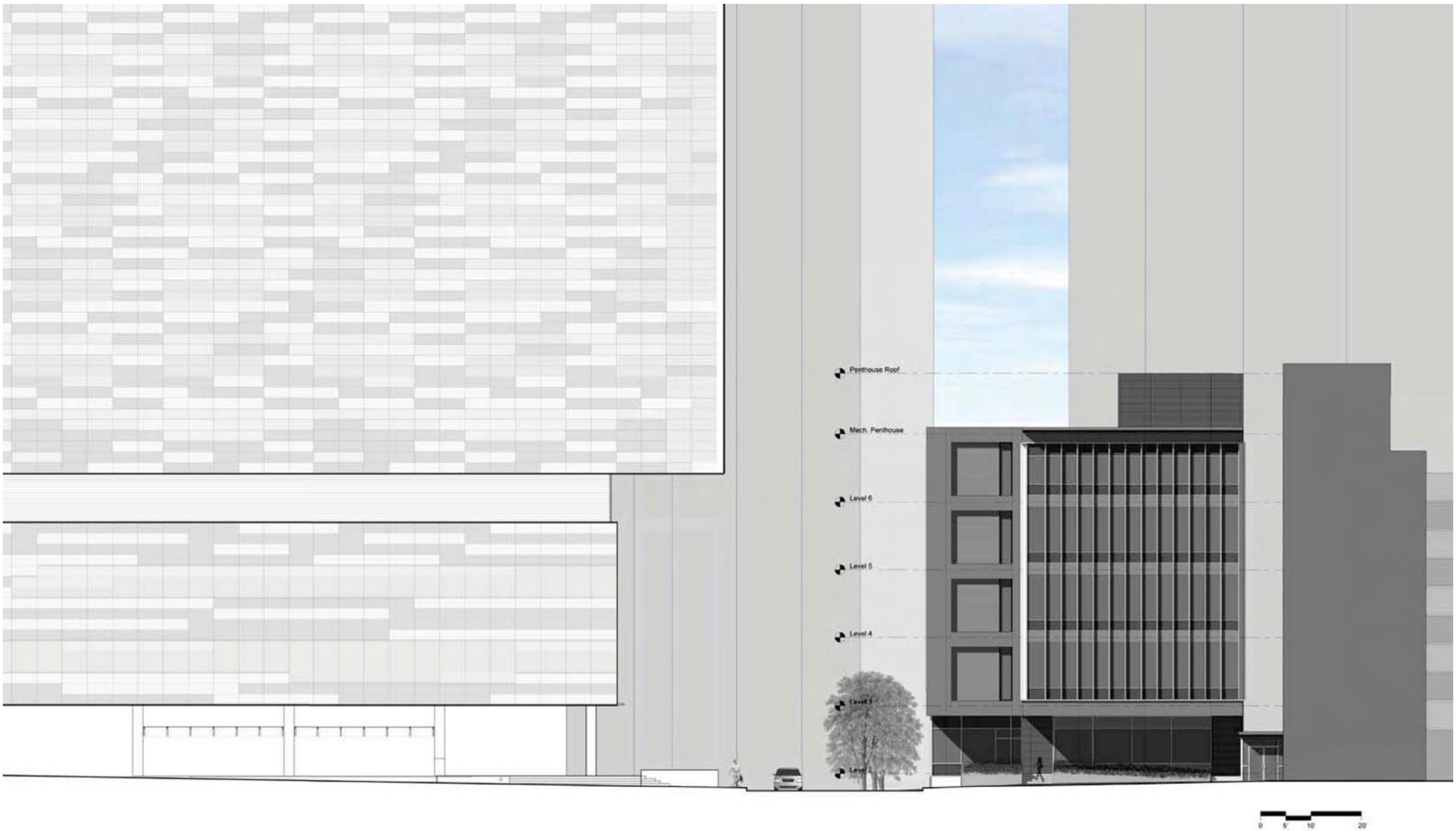
LINEA 5, inc. Boston, MA • Miami Beach, FL | tat the architectural team

Brigham and Women's Building Proposed Site Section

Scale: 1" = 50' - 0"



East Elevation of Binney Street Building



Massachusetts Mental Health Center Redevelopment Project Boston, MA

Figure 2 - 16

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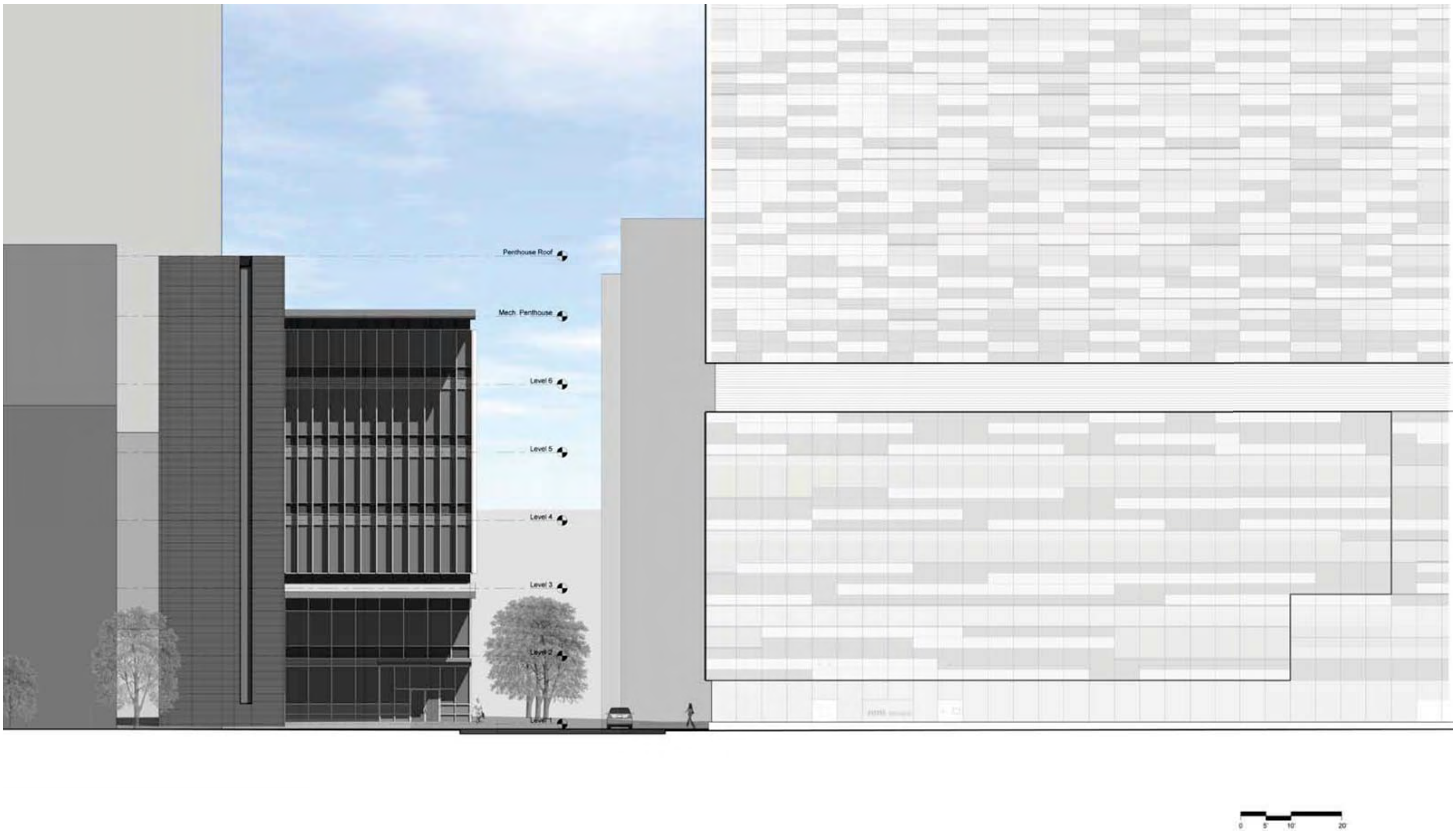
North Elevation of Binney Street Building



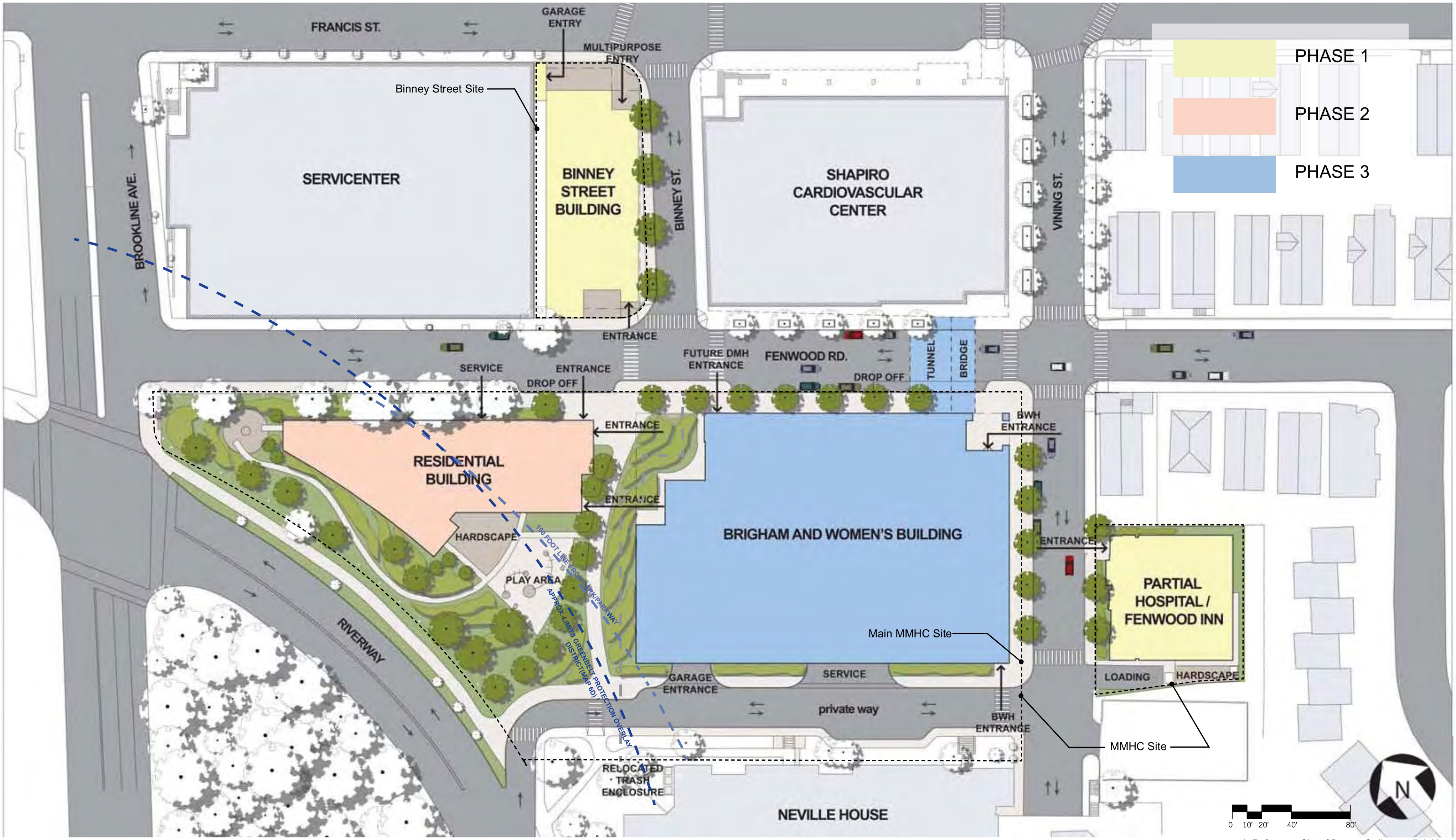
South Elevation of Binney Street Building

Massachusetts Mental Health Center Redevelopment Project Boston, MA

Figure 2 - 18

LINEA 5, inc. Boston, MA • Miami Beach, FL tat the architectural team

West Elevation of Partial Hospital / Fenwood Inn



1. Reference City of Boston Ordinance 7-4.11

Massachusetts Mental Health Center Redevelopment Project **Boston, MA**

Figure 2 - 19

LINEA 5, inc. Boston, MA • Miami Beach, FL tat the architectural team

Proposed Open Space

Scale: 1" = 60' - 0"

Source from Emerald Necklace Parks Map and Guide

Existing Riverway Parkland

Section 3.0

Transportation Access Plan Component

3.0 TRANSPORTATION ACCESS PLAN COMPONENT

3.1 Introduction

The transportation analysis presented in this chapter conforms to the BTD "Transportation Access Plans Guidelines" and is responsive to the Scoping Determination issued by the BRA and the comment letter issued by BTD[1] for the Massachusetts Mental Health Center Redevelopment Project (MMHC Project). It is also responsive to MEPA's Certificate[2] on the ENF which has required the transportation study for the Draft EIR. This study also is intended to identify transportation impacts that are expected over the term of the BWH 2010 IMP, and to codify mitigation and improvement actions aimed at supporting access to BWH's campus in the Longwood Medical and Academic Area (LMA) by its patients, visitors, and staff,. In addition, the study also supports those portions of the Project that are proposed by Roxbury Tenants of Harvard Association, Inc. (RTH), most notably, the residential component of the Project. As such, the Project study area includes portions of the LMA as well as the neighboring Mission Hill neighborhood.

This chapter presents an evaluation and summary of existing and future transportation infrastructure and operations. This transportation study has been developed in order to understand and mitigate the transportation impacts of the MMHC Project and to develop appropriate transportation infrastructure improvements. As mentioned previously, the study also incorporates all transportation-related actions that are expected to occur during the term of the IMP.

The transportation study was conducted in three distinct stages. The first stage (Existing Conditions) involved a survey and compilation of existing transportation conditions within the study area (defined below) including:

- An inventory of the transportation infrastructure within the defined Project study area;
- Transportation characteristics of the BWH campus, including parking for patients, visitors, and employees, as well as loading, shuttle bus, and ambulance activities;
- Geometric and operational characteristics of study area roadways and intersections;
- Existing traffic control at study area intersections (i.e., traffic signalization, stop signs, one-way streets, etc.);

---

1 Scoping Determination issued by BRA, August 11, 2009; comment letter issued by BTD, August 12, 2009

2 MEPA Certificate issued August 7, 2009

- Area off-street and on-street parking supply, parking utilization, availability, and rates;
- Pedestrian activity on the BWH campus, along study area roadways, and at study area intersections;
- Bicycle activity and accommodations;
- Public transportation options within the study area, including bus, subway, commuter rail, and private shuttle bus options.

In the second and third stage of the study (Evaluation of Long-Term Transportation Impacts), future transportation conditions were projected within the study area for the years 2016 and 2021 since the development will be phased. The future No Build Condition includes an assessment of future transportation impacts, as well as background growth on area roadways and transit services, planned transportation infrastructure improvements, and growth related to other proposed projects within the study area. The future 2016 Phase 1 Build and 2021 Full Build conditions assess the No Build Condition plus the MMHC Project and supporting transportation infrastructure. This section also quantifies the proposed mitigation and improvement actions to address Project-related pedestrian, parking, traffic, and public transportation impacts that have been identified. The proposed improvement actions serve as the basis for the forthcoming preparation of a Transportation Access Plan Agreement (TAPA) to be developed and executed by both the Proponent and the BTD.

This study includes detailed roadway, pedestrian, and transit capacity analysis for the morning and evening peak commuter periods for the following conditions:

- 2009 Existing Condition
- 2016 No Build Condition
- 2016 Phase 1 Build Condition
- 2021 No Build Condition
- 2021 Full Build Condition

3.1.1 Project Summary

The BWH Campus is located predominately in the Longwood Medical and Academic Area (LMA) and abuts and includes some properties within the Mission Hill residential neighborhood as shown in Figure 3-1. The existing BWH Campus is generally bounded by Francis Street, Shattuck Street, Brookline Avenue, and Huntington Avenue. BWH also owns the newly constructed Shapiro Cardiovascular Center at 70 Francis Street, the Servicenter

Massachusetts Mental Health Center Project Boston, Massachusetts

Vanasse Hangen Brustlin, Inc.

Figure 3-1

Site Location Map

Complex at 80 Francis Street and several buildings located at 221 Longwood Avenue. All of these properties are described in BWH's existing BWH 2005 IMP and located within the IMP Overlay District.

The MMHC Site is located on a parcel south of Fenwood Road and east of the Riverway. Vining Street splits the Site with the Partial Hospital/Fenwood Inn located to the east of Vining Street and the balance of the MMHC site (Main MMHC Site) located between Vining Street and the Riverway. A 50-foot wide private way bounds the Site to the south. The Partial Hospital/Fenwood Inn is a small 11,000-sf parcel on the east side of Vining Street.

The Binney Street Site is currently a vacant parcel of land bounded by Binney Street, Francis Street, and Fenwood Road adjacent to the Servicenter Complex. This parcel is currently occupied by temporary construction trailers.

The Proponent, Brigham and Women's Hospital (BWH), Partners HealthCare System, Inc., and Roxbury Tenants of Harvard Association, Inc. (RTH), are proposing to develop a mixed-use development Project on the Site of the former MMHC located between the Riverway and Fenwood Road in the Mission Hill neighborhood immediately adjacent to the LMA and a portion of BWH-owned vacant land located at the corner of Binney Street and Francis Street within the LMA. The Main MMHC Site includes vacant buildings totaling 190,000 sf and 163 surface parking spaces. As currently contemplated, the Project includes four new buildings. These building are described below:

The Residential Building, located at the northwestern end of the Main MMHC Site, will include approximately 136 units but potentially up to 165 units[3]. A substantial number of the condominiums will be designated as affordable. The building may also include approximately 10,000 sf of community space for a total of approximately 197,750 sf. This component of the Project is intended to foster RTH's goal to continue to meet the large and growing need for housing close to transit and jobs that can be accessed by households of limited income. This building will not provide parking. Ninety parking passes will be provided for the new residents at the Mission Park Garage, and in turn, 90 BWH employees will be moved from the Mission Park Garage to the Brigham and Women's Building (discussed below).

Brigham and Women's Building, located at the eastern end of the Main MMHC Site, will house a new research and clinical facility (305,920 sf) for BWH. The building will also accommodate DMH outpatient clinical and office space, providing approximately 52,750 sf

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3 For the purposes of describing potential environmental impacts, this Draft EIR/PIR evaluates up to 165 residential units to disclose the maximum possible impact in the event the number of residential units increases from the proposed 136 units.

of space for that use. In total, this building will be approximately 358,670 sf and will provide 406 parking spaces below grade that will support the entire Project. This is the only proposed parking within the Project.

Binney Street Building, located adjacent to the Servicenter Complex on Binney Street, will provide 16,000 sf of outpatient clinic space and 40,540 sf of administrative space (56,540 sf in total). Ultimately this building will be occupied by BWH however; in the interim DMH will occupy the building until the DMH-dedicated space in the Brigham and Women's Building is constructed. The parking associated with the building will be provided in the Brigham and Women's Building.[4]

The Partial Hospital/Fenwood Inn, at the eastern end of the Project Site across Vining Street from the Main MMHC Site, will be developed by BWH for utilization by DMH, will include a 42 bed transitional shelter program for homeless, mentally ill men and women, a 5 bed crisis stabilization unit and 8,260 square feet of partial hospital and outpatient treatment space. The parking associated with the building will be provided in the Brigham and Women's Building.

Upon completion of the Brigham and Women's Building, BWH will have a total of 305,920 sf and DMH will have 52,750 sf at the Brigham and Women's Building. The Brigham and Women's Building garage will provide 406 parking spaces to support the new building space. New parking to support the Project is planned to be provided at a rate of 0.65 parking spaces per thousand sf of net new development.

Table 3-1 presents the proposed program for the four buildings.

Table 3-1 Project Building Program Summary

	Size (sf)	Parking
Residential Building	197,750	
Brigham and Women's Building		
DMH	52,750	
BWH	305,920	
Total Brigham and Women's Building	358,670	406
Binney Street Building	56,540	
Partial Hospital/Fenwood Inn	21,000	
Total	633,960	406

4 Until the Brigham and Women's Building is completed, 50 parking spaces will be provided for DMH on the Main MMHC Site as surface parking.

3.1.2 Summary Of Findings

The additional traffic generated by the MMHC Project is expected to have only limited impacts on the area's transportation infrastructure. However, to offset these new trips, BWH and RTH are committed to providing transportation improvements and mitigation actions to improve transportation conditions for residents, patients, visitors, and employees traveling in the area.

3.1.2.1 Parking Summary

The Project will provide a limited amount of new parking. The Project includes 406 new spaces to be constructed to provide necessary additional parking supply in the area for the Residential Building, DMH, and BWH. New residents will park in the Mission Park Garage (90 keycards). In addition, 16 existing residential spaces on the Main MMHC Site will be relocated to the Mission Park Garage. To accommodate additional residential parking in the Mission Park Garage, a total of 106 BWH employees who park in the Mission Park Garage today will need to be relocated to the new Brigham and Women's Building Garage.

The commitment to minimize the construction of new parking spaces as part of the BWH 2010 IMP is a key to reducing traffic impacts in the area. New parking that is proposed within the IMP is below the LMA interim guidelines ratio of 0.75 spaces per thousand square feet[5]. BWH plans to be proactive about managing parking and encouraging employees to use alternative modes of transportation. In addition, BWH will rely on off-site parking outside of the LMA to meet a portion of its employee parking needs associated with the Project. This measure will discourage employee traffic in the LMA. As shown below in Table 3-2, when the MMHC Project is completed, BWH's campus parking ratio will decline from 1.17 to 1.11 (spaces per ksf).

Table 3-2 BWH Parking Ratios in the LMA (Includes Owned and Leased Space)

	Brigham and Women's Building Floor Area (sf)	BWH-Controlled Parking Spaces in the LMA	Parking Ratio (spaces/1,000 sf)
Existing Conditions	2,794,761	3,277 *	1.17
Future Conditions**	3,229,971	3,577	1.11

* Includes approved (but not yet constructed) 249 net-new permitted spaces at Brigham Green Parking and Enhancement Project.
** Does not include Residential Building and associated parking.
Source: Brigham and Women's Hospital Facilities and Parking/Security Departments.

Note: Parking ratios are based on both owned and leased building space and parking within the LMA.

5 As noted earlier in this Draft EIR/PIR, the MMHC Site is outside the boundaries of the BRA's LMA Interim Guidelines. However, the Project complies with those Guidelines as they relate to the construction of on-site parking spaces.

In addition to constraining the proposed parking supply, BWH will move valet operations from the Mission Park Garage to the ASB-II Garage to reduce traffic impacts to the residential neighborhood. The planned Brigham Green Project, which includes 400 parking spaces (249 net-new) will accommodate the valet operations currently on the Main MMHC Site which were temporarily relocated there to complete the 70 Francis Street/Shapiro Building Project. With the changes to valet parking operations at BWH, modifications to the signal timings at the intersection of Vining Street/Francis Street are proposed to better process traffic flows on the Francis Street corridor.

3.1.2.2 Pedestrian Access

It is expected that the additional pedestrian traffic will help activate the streets abutting the Project Site. These new pedestrians will be accommodated by the widened sidewalks adjacent to the Project Site. The Project will also provide significant open space at the terminus of Binney Street. The open space will then extend into a pedestrian path between the LMA and the nearby Emerald Necklace through the Project Site.

3.1.2.3 Loading and Service

To accommodate additional demands, there will be a dedicated loading dock at the Brigham and Women's Building. This dock will provide four bays and will be shared with DMH.

The Residential Building is proposing a dedicated drop-off and loading zone on Fenwood Road. As proposed, this drop-off area will be approximately 60 feet long and therefore accommodate passenger cars and single-unit trucks. Moving activities and typically deliveries will be accommodated at this curb.

The Partial Hospital/Fenwood Inn will have a driveway to accommodate loading and service for the building. This driveway will be located off Vining Street. The driveway will be approximately 40-feet in length and will accommodate one single unit truck or two tandem vans or passenger vehicles.

The Binney Street Building will be served from a dedicated on-street loading zone adjacent to the site. This loading zone will be permitted with the Boston Transportation Department. It is anticipated that trash and recycling for the building will be consolidated at the existing loading facilities at the Servicenter Complex.

3.1.2.4 Traffic Impacts

The effects of the MMHC Project, including a detailed analysis of intersection level of service (LOS), were examined at 17 intersections specified by the City and MEPA. This analysis was conducted for existing conditions and for future conditions. The future conditions analysis assumes the years 2016 for Phase 1 completion and 2021 for the entire Full Build condition. These analyses consider background growth, growth attributable to other identified projects, and traffic estimates associated with the MMHC Project.

With the 2016 Phase 1 Build Condition, traffic impacts associated with the Project will be reduced from the current condition due to the removal of BWH valet services from the Site. Overall there is a decrease in the parking supply Existing Conditions to the Phase 1 Build Condition.

The 2021 Full Build Condition creates additional traffic demands on the streets immediately surrounding the Project Site. Most affected are Vining Street and the private way adjacent to the Site. However, since there are currently low traffic demands on these streets today there is adequate capacity in the future to accommodate the Project generated traffic.

The results of the analysis indicate that there will be no substantial changes in LOS in the study area as a result of the Project. Several key intersections in the LMA and the Mission Hill neighborhood will continue to operate at poor LOS during the peak hours. The Longwood Avenue, Brookline Avenue and Huntington Avenue corridors will continue to operate with heavy vehicle delays. To reduce the Project's peak hour impacts, BWH will utilize remote parking facilities for a significant portion of the new employee population and shuttle these employees into the LMA. In addition, improvements at the intersection of Brigham Circle and Francis Street at Vining Street are proposed to improve operations.

3.1.2.5 Transportation Demand Management

BWH is committed to continuing to offer a wide array of Transportation Demand Management (TDM) incentives as a means to reduce single occupant driving and increase use of alternative forms of transportation to access the workplace. BWH actively supports efforts to reduce auto use for employees traveling to the hospital. Many actions to support this goal are currently actively employed by BWH, including the following:

- Employee Transportation Advisor.
- Membership in MASCO's CommuteWorks TMA.
- Full support of MASCO's other ongoing transportation initiatives.
- 50 percent transit pass subsidy for employees.
- Carpool assistance and incentives.
- Vanpool coordination and subsidies.
- Bicycling/walking incentives and amenities.

- Location-priced parking (i.e.; offering competitive-rate parking on-campus and subsidized parking off-campus).

- Telecommuting and compressed workweeks, where reasonably feasible.

- Promotional efforts.

BWH will continue to promote and improve its TDM program to benefit its employees and reduce traffic impacts to roadways and parking facilities within the LMA and nearby neighborhoods. In addition, both DMH and RTH are also committed to proactively supporting TDM actions as a means to discourage single-occupant travel to the Project Site.

3.1.2.6 Public Transportation

The Project is projected to have only a modest incremental impact on transit operations in the area by 2021. The analysis assumed that future BWH and DMH employees, patients, and visitors and RTH residents will have access to the many public transportation services offered by the MBTA, as well as the array of private shuttle and transportation demand management services that are offered in the LMA through MASCO.

Because there are so many public transportation options that provide service to and from the LMA, no single service appears to be unduly affected by anticipated increases in activities because of the Project under future conditions. Consequently, transit trips are expected to affect the transit system only minimally under future conditions.

3.1.2.7 Proposed Mitigation

The proposed transportation mitigation plan includes several elements that will be codified in the forthcoming Transportation Access Plan Agreement (TAPA) with the Boston Transportation Department. Mitigation measures currently being considered include the following:

- Provide significant open space at the terminus of Binney Street – providing a clear visual connection between the LMA and the nearby Emerald Necklace through the Project Site;

- Provide street trees and other hardscape amenities along Fenwood Road, Binney Street, Vining Street, and the private way;

- Modify existing traffic signal operations to accommodate improved vehicle access and pedestrian safety at Brigham Circle;

- Modify existing traffic signal timings at the intersection of Vining Street/Francis Street to better facilitate the change in valet operations at BWH that will remove valet parking from the Main MMHC Site and the Mission Park Garage;

- Improve pedestrian amenities by reconstructing and widening sidewalks along portions of Fenwood Road, Binney Street, Vining Street, and the private way on the southern portion of the Main MMHC Site;

- Reconstruct the private way on the southern portion of the Main MMHC Site and portions of Vining Street and Fenwood Road abutting the MMHC Site to create a friendlier pedestrian environment;

- Provide a patient drop-off area along Fenwood Road in front of the Brigham and Women's Building;

- Provide convenient vehicle drop-off location for residents/visitors to the Residential Building;

- Include four new loading bays at the Brigham and Women's Building;

- Provide loading/service areas for the Partial Hospital/Fenwood Inn and the Binney Street Building;

- Provide secure bicycle storage and shower facilities for employees in the Brigham and Women's Building;

- Preparation of a detailed Construction Management Plan (CMP) for each proposed construction phase; and

- Continued participation in and funding support for system-wide transportation improvement studies for the LMA and impacted portions of the Mission Hill neighborhood.

3.2 Existing Conditions

Existing transportation conditions in the study area, including roadway geometry, traffic controls, peak hour traffic and pedestrian flows, transit availability, parking supply and utilization, loading and service activities are all described within this section of the Transportation Access Plan Component.

Initial sections specifically describe existing access characteristics of the Roxbury Tenants of Harvard (RTH) and the BWH campus, including the current use of the Project Site. Subsequent sections describe and quantify transportation characteristics of the entire study area as required by MEPA in their Certificate and the BRA within their Scoping Determination for the Draft PIR/EIR.

3.2.1 Summary of Existing BWH Transportation Infrastructure and Services

The BWH Campus is located predominately in the LMA and abuts the Mission Hill residential neighborhood. The existing BWH Campus includes the block bounded by Francis Street, Shattuck Street, Brookline Avenue, and Huntington Avenue. BWH also owns the newly constructed Shapiro Cardiovascular Center at 70 Francis Street, the Servicenter Complex at 80 Francis Street, a residential facility at 48 Francis Street, and several buildings located at 221 Longwood Avenue. All of these properties are described in BWH's IMP and are located within the IMP Overlay District.

The MMHC Site is located in the Mission Hill neighborhood and is adjacent to the Longwood Medical and Academic Area (LMA). The MMHC Site contains five buildings formerly occupied by the MMHC, run by the Massachusetts Department of Mental Health (DMH). These buildings containing approximately 190,000 gross square feet are currently vacant, as MMHC temporarily relocated in 2003. The 2.86-acre MMHC Site is owned by the Commonwealth of Massachusetts acting through the Massachusetts Division of Capital Asset Management (DCAM) on behalf of DMH. The Binney Street Site is owned and used by BWH and is currently occupied by construction trailers.

Figure 3-2 summarizes the existing street network and campus transportation infrastructure.

3.2.1.1 BWH Parking System

Since the filing of the PNF on June 16, 2009 and ENF on June 30, 2009, the existing MASCO lease at BWH's Servicenter Complex has expired. With BWH's use of the garage the following changes have occurred on the BWH campus:

- ♦ BWH has moved patient self-parking operations (246 spaces) from the ASB-II Garage at 45 Francis Street to the Servicenter Complex where BWH now controls the entire garage (650 spaces). The remaining 404 spaces in the Servicenter Complex remain available as public transient spaces as they were previously used.

- ♦ Valet storage (204 spaces) previously occurring in the Mission Park Garage has been relocated to the ASB-II garage. This change has resulted in fewer trips on Fenwood Road and Vining Street.

- ♦ Employee parking was moved from the MASCO garage at 375 Longwood Avenue (98 spaces) and the Servicenter Complex (70 spaces) and have been backfilled at the Mission Park Garage. BWH now uses 36 fewer spaces in this garage. Parking data (discussed later) suggests that even with this change the Mission Park Garage remains fully occupied.

With these recent changes, BWH controls approximately 5,457 total off-street parking spaces. The majority of the spaces that BWH relies on are leased from others. A summary of the existing BWH parking supply is shown in Table 3-4.

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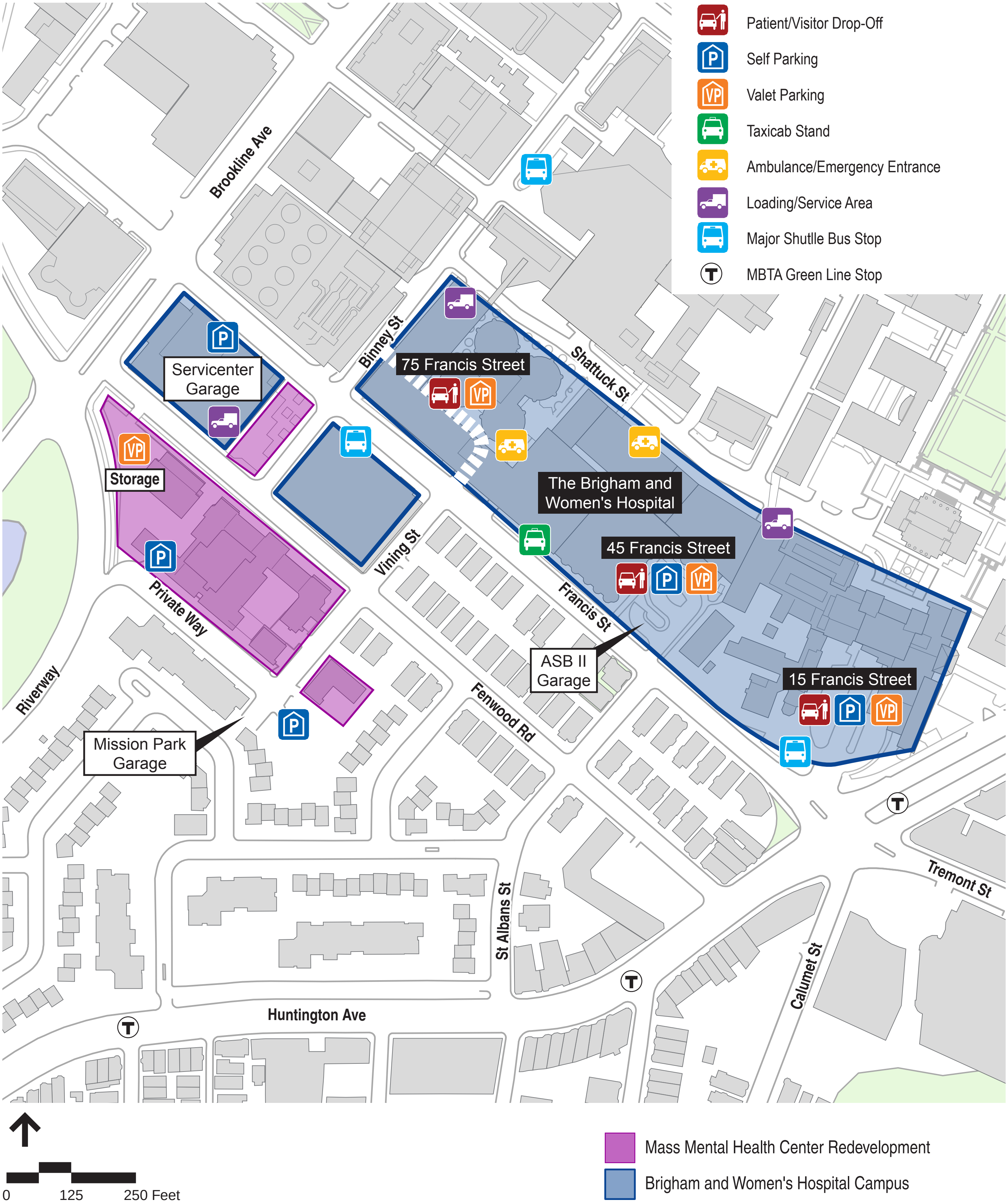

Massachusetts Mental Health Center Project Boston, Massachusetts

VHB *Vanasse Hangen Brustlin, Inc.*

Figure 3-2

BWH Campus Transportation Infrastructure

Table 3-3 BWH Existing Parking Space Inventory (October 2009)

Parking Facility	Owned/ Leased	Number of BWH Spaces			Connecting Mode
On-Campus/LMA		Total	Patient/Visitor	Employee	
Mission Park Garage	Leased	1,269	0	1,269	Walk/
Servicenter Complex	Owned	650*	650	0	Walk
ASB-II Garage (45 Francis)	Owned	247	246	1	Valet
221 Longwood	Owned	15	15	0	Walk/Valet
Harvard Garage	Leased	5	0	5	Walk
15 Francis Street	Owned	57	47	10	Walk/Valet
One Brigham Circle	Leased	248	0	248	Walk
Harvard NRB Garage	Leased	297	0	297	Walk
Mass College of Pharmacy	Leased	40	0	40	Walk
Mass Mental Health Ctr Site	Leased	147**	104	43	Valet
Smith Building (Dana Farber)	Leased	33	0	33	Walk
Children's Hospital Garage	Leased	20	0	20	Walk
Total On-Campus/LMA		**3,028**	**1,062**	**1,966**	
Off-Campus					
20 Kent Street Lot ***	Leased	24	0	24	Walk
850 Boylston Street ***	Leased	681	407	274	Shuttle
Wentworth Lot	Leased	267	0	267	Shuttle
Lansdowne Garage	Leased	200	0	200	Shuttle
Red Sox Garage	Leased	63	0	63	Shuttle
116 Huntington Avenue	Leased	5	0	5	Walk
Colonnade Garage	Leased	15	0	15	Walk
Chestnut Hill Lot	Leased	146	0	146	Shuttle
Ipswich Garage	Leased	62	0	62	Shuttle
Atrium Mall	Leased	200	0	200	Shuttle
One Brookline Place	Leased	12	0	12	Shuttle
1249 Boylston Street Lot	Leased	40	0	40	Shuttle
St. Lawrence Church	Leased	40	0	40	Walk
Crosstown Garage	Leased	552	0	552	Shuttle/Walk
65 Lansdowne Garage	Leased	122	0	122	Shuttle
Total Off-Campus		**2,429**	**407**	**2,022**	
Total BWH Parking Spaces		**5,457**	**1,469**	**3,988**	

**BWH controls 650 spaces; however most of the spaces are transient spaces and are used by other institutions.*

*** Includes spaces at MMH and Fenwood Inn spaces used by BWH.*

****Spaces provided do not support space in the LMA.*

Over the past several years, BWH has had the opportunity to make only modest incremental increases to its on-campus parking supply in the LMA. With the opening of 70 Francis Street no new parking was provided however, the Brigham Green Enhancement and Parking Project was permitted to provide 400 (249 net-new) parking spaces for this building in the future.

Table 3-4 provides a summary of parking spaces that will come online as owned or leased spaces from other approved projects, independent of this Project. Accounting for these other projects, BWH will control 3,028 spaces in the LMA independent of parking modifications that are proposed during the term of BWH's IMP (2010-2020).

Table 3-4 Approved Parking Space Inventory

	Number of Parking Spaces
Existing LMA Parking Supply	3,028
Brigham Green Enhancement and Parking Project	249*
Total Approved Parking Spaces	**3,277**

* A total of 400 spaces are permitted for the Brigham Green Site of which 249 spaces are net-new.

Current planning calls for the completion of the previously-approved Brigham Green Enhancement and Parking project prior to the start of construction of the Brigham and Women's Building. This Project, located at 15 Francis Street includes the construction of 400 below grade spaces of which 249 are net-new.

Existing Weekday Peak Parking Accumulation and Parking Turnover

To determine a baseline from which future parking demand can be projected, a study of existing parking utilization was performed. Electronic data was collected for each facility. Generally, peak parking accumulation at BWH occurs around midday (between 11:00 AM and 2:00 PM) on Tuesdays, Wednesdays, and Thursdays.

Table 3-5 shows existing peak parking accumulation for the entire BWH on-campus (and nearby) parking system.

Table 3-5 2009 Existing BWH Campus Peak Parking Accumulation

Location	BWH Parking Supply	Demand	Percent Occupied
Mission Park Garage	1,269	1,438	110%
Servicenter Complex	650	650	100%
ASB-II Garage	247	247	100%
221 Longwood	15	30	200%
Harvard Garage	5	5	100%
15 Francis Street	57	16	28%
One Brigham Circle	248	240	97%
Harvard NRB Garage	297	285	96%
Mass College of Pharmacy	40	40	100%
Mass Mental Health Site	147	99	67%
Smith Building (Dana Farber)	33	33	100%
Children's Hospital Garage	20	20	100%
Total LMA Parking Spaces	**3,028**	**3,103**	**102%**

Source: BWH Parking and Security and 2009 observations.

The table shows that under existing conditions, the BWH's parking system has just enough capacity to meet typical weekday parking demands under current conditions. Nearly all of the facilities are operating at capacity, with the exception of the Main MMHC Site surface lot. The primary on-campus parking garages are operating at or near capacity and readily available parking in other nearby public parking facilities is difficult to find.

Parking turnover rates, the number of cars which use each space over the course of a day, were extracted from data provided for the Mission Park Garage which provides patient valet and employee parking. A summary of the turnover rates are shown in Table 3-6.

Table 3-6 Existing BWH Parking Turnover Rates

Location	Parking Turnover Rate*
Employees	1.6
Patients	3.3

Source: BWH Parking and Security.
*Number of vehicles parked per day.

Employee spaces turnover 1.6 times per day on average while patient spaces have a much higher turnover of 3.3 turnovers per day.

Patient and Visitor Parking Management

BWH provides a range of options to patients and visitors driving to its main LMA campus, including pick-up/drop-off areas, self-parking, and valet parking. The primary pick-up/drop-off loop is located at its main hospital entrance and Emergency Department, which is at 75 Francis Street, near the intersection of Francis and Binney streets. A second dedicated pick-up/drop-off loop is located at the H. Richard Nessen Ambulatory Center (ASB-II) at 45

Francis Street. Additionally, ancillary pick-up/drop-off activities are provided from the 15 Francis Street entrance, which is located in front of the Peter Bent Brigham building near the intersection of Francis Street and Huntington Avenue.

Ambulatory care patients are encouraged to self-park at the Servicenter Complex. Visitors may, of course, also use any of the other area garages open to the public. Rates for the BWH garages are provided in the Transportation Appendix.

Valet services are provided at four locations on the campus: 75 Francis Street, 15 Francis Street, 45 Francis Street, and 221 Longwood Avenue. Vehicles arriving at 75 Francis Street, which were previously stored in the Mission Park Garage, are now stored at the ASB-II Garage and to a lesser extent the Main MMHC Site surface parking lot. The other valet areas are self contained and do not require vehicles to be stored at another location.

Approximately 1,000 patients are valet parked each day from the three BWH Francis Street entrances. A summary of valet operations are provided in Table 3-7. Nearly three-quarters of the BWH valet parking operation occurs at the 75 Francis Street entrance. Patient arrivals are generally constant between 9:00 AM and 3:00 PM.

Table 3-7 Daily Curbside Valet Operations (Number of Vehicles Parked per Hour)

Hour Beginning	75 Francis Street	15 Francis Street	45 Francis Street	221 Longwood Avenue	Total
Midnight	2	0	0	0	2
1:00 AM	0	0	0	0	0
2:00 AM	2	0	0	0	2
3:00 AM	2	0	0	0	2
4:00 AM	0	0	0	0	0
5:00 AM	19	0	0	0	19
6:00 AM	23	1	4	0	28
7:00 AM	42	5	17	5	69
8:00 AM	45	6	15	21	87
9:00 AM	76	7	33	19	135
10:00 AM	76	5	24	11	116
11:00 AM	66	6	25	14	111
Noon	69	3	19	20	111
1:00 PM	73	3	24	15	115
2:00 PM	60	4	18	16	98
3:00 PM	34	2	14	18	68
4:00 PM	22	0	5	4	31
5:00 PM	24	0	0	0	24
6:00 PM	16	0	0	0	16
7:00 PM	16	0	0	0	16
8:00 PM	3	0	0	0	3
9:00 PM	2	0	0	0	2
10:00 PM	0	0	0	0	0
11:00 PM	1	0	0	0	1
Daily Total	**673**	**42**	**198**	**143**	**1,056**

Source: BWH Parking and Security.

Employee Parking Management

Employees who work at least 20 hours per week are eligible for reserved parking through BWH, allocated on a first-come, first-served basis. Shuttle buses operated by MASCO or Partners connect the remote parking locations to the main BWH campus. All on-site and nearby employee parking spaces are priced competitively at $318 per month. Remote employee parking spaces cost $84 per month. BWH offers a 50 percent discount for vanpool members. BWH charges competitive rates to its employees for the use of on-site parking to reduce the number of employee vehicles entering the LMA each day and make more nearby spaces available to patients and visitors.

BWH strongly encourages employees to use alternative modes of transportation. BWH's Massachusetts Department of Environmental Protection (DEP) Rideshare Program Update Report for 2008 indicates that 39 percent of the BWH employees drive to work. This is less than the area's average vehicle share of 47 percent as reported by the 2000 Census data.

3.2.1.2 BWH Employee Transportation Demand Management Program

BWH actively supports efforts to reduce auto use for employees traveling to the hospital campus. Many actions to support this goal are actively employed by BWH, including the following:

- Employee Transportation Advisor – Provides alternative transportation information for employees. BWH promotes alternative transportation through a variety of newsletters, information kiosks, websites, e-mail, and special events. Bicycle racks are provided throughout the campus.
- 50 percent transit pass subsidy for employees - Provides a 50 percent subsidy in the cost of MBTA transit passes for employees. The cost of passes is deducted on a pre-tax basis, resulting in an additional cost savings to employees.
- Location-priced parking - Discouraging on-campus parking by offering market rate parking for employees on-campus and while offering parking at a significantly lower rate in off-campus parking locations. Vanpool members are offered a 50 percent parking discount.
- Member of the CommuteWorks Transportation Management Association, which is operated by MASCO. CommuteWorks offers an array of ongoing programs (discussed further below) designed to encourage employees to choose alternative options for commuting.
- Emergency Ride Home - With CommuteWorks' Emergency Ride Home program, registered BWH employees can receive a guaranteed ride home in the event of a personal emergency during the work day. Up to five times a year, CommuteWorks will pay for a taxi cab or rental car to get employees home quickly. All employees

who participate in their employers' transit subsidy program are eligible for the Emergency Ride Home Program. Employees who carpool, vanpool, or walk/bike to work through the CommuteFit Program (see below) are also eligible to register for Emergency Ride Home.

- ♦ The Longwood T Party Program - Under this CommuteWorks program, BWH employees who currently drive to work alone can try using public transit risk free, and have CommuteWorks help pay for it. The Longwood T Party Program allows drive-alone commuters to put their parking spaces on hold for three months to try public transportation and receive up to $333 in incentives. Eligible employees will receive $65 per month in commuter checks to use towards the purchase of transit passes and reimbursement for up to $46 per month for parking costs at transit stations. While employees' parking spaces are on hold, they do not pay for or lose the space and can opt out of the program at any time if they decide to go back to parking. This program is also available for commuters who recently moved to a new home location resulting in an increased cost of their monthly MBTA pass.
- ♦ CommuteFit Program - Employees who incorporate biking, walking, or jogging into their daily commute are eligible to participate in the CommuteFit Program. By signing up for the CommuteFit program, employees can keep track of the miles commuted by foot and earn points for free prizes. Rewards include water bottles, coffee mugs, lunch totes, pedometers, first aid kits, and many others. All participants who log 500 miles in the CommuteFit program will receive a $30 gift certificate to REI.
- ♦ Ridesharing: Carpools and Vanpools - CommuteWorks partners with MassRides, the Massachusetts statewide travel options program, to help match BWH employees into carpools and vanpools from their home town. By completing CommuteWorks' online Ridematching Registration Form, CommuteWorks will work with the State using their 13,000+ member database to help find BWH employees potential carpool partners who share their commutes and working hour and/or vanpool options from their home areas. MassRides currently manages a fleet of aver 40 vanpools including two (Rockland and Sagamore/Kingston) that come directly into the LMA. BWH offers a 50 percent discount for vanpool members.
- ♦ MASCO Shuttle Services - MASCO operates several shuttles to and from the LMA providing connecting service to commuter rail and rapid transit and off-site parking facilities. With the exception of the M2 Shuttle, these shuttles are free of charge to BWH employees.
- ♦ Zip Car Discounts - BWH Employees are eligible to join CommuteWorks' Zipcar program at a reduced membership fee of only $25 per year and no application fee. Ordinarily, people joining Zipcar pay $75 in initial set up fees and $50 per year in membership fees. Through the MASCO discount, Zipcar members also receive reduced hourly rates when using Zipcars during regular business hours.

- Personalized Commuting Assistance - CommuteWorks answers any general commuting questions employees have and provides them with various travel options to help maximize the efficiency of their commute. CommuteWorks' personalized itineraries identify employees complete travel options with information on commuter rail, subway, bus, shuttles, ridesharing, biking and walking.
- MBTA Service Feedback Options - MASCO continually advocates for improved MBTA services to the LMA, and rider feedback regarding MBTA experiences helps us work with the MBTA for such improvements. BWH employees who use MBTA services such as bus, boat, subway, or commuter rail and want to offer feedback on their experiences or share ideas for new or improved MBTA services can do so by completing the online MBTA Service Feedback Form. This information is relayed by MASCO at regularly scheduled meetings with MBTA staff to discuss LMA service improvement needs.
- Discounted regional bus services – BWH provides a 50 percent discount to employees who commute by non-MBTA bus services. This program includes private bus services to Cape Cod and New Hampshire.
- Secure bicycle storage – BWH offers bicycle storage throughout the campus (discussed later in more detail).
- Telecommuting and compressed workweeks – BWH has an informal policy of encouraging telecommuting and compressed workweeks for employees where reasonably feasible.

3.2.1.3 BWH/Partners Shuttle Bus System

The Partners Passenger Transportation Service is a free shuttle bus service for employees, patients and visitors to BWH. There are six distinct shuttle routes that serve the main BWH campus. These routes connect BWH to surrounding Partners health care facilities, local transit hubs, and parking garages.

- **MGH, Prudential Center, BWH**: Operating Mondays through Fridays, except holidays, this route stops at MGH, Prudential Center and BWH. The shuttles arrive at the Prudential Center approximately five minutes after leaving BWH and 10 minutes after leaving MGH. The shuttles run between 6:00 AM and 8:30 PM with 15 minutes headways during peak hours.
- **BWH to 850 Boylston Street**: Four shuttles run a continuous loop between 5:45 AM and 8:30 PM. The loop picks up at BWH, Brookline Village T Stop, 850 Boylston Street, Atrium, Chestnut Hill Parking Lot (mid-day only). During peak hours, the headway is 15 minutes.
- **BWH to 10 Brookline and 111 Cypress Street**: Monday thru Friday this shuttle operates between 5:15 AM and 7:40 PM. The shuttles travels from BWH to 10 Brookline Place, to 111 Cypress Street to the Brookline Village T Station.

- **BWH to Faulkner Hospital**: Two shuttles travel between BWH and Faulkner Hospital with five trips including stops at Trinity Lot and West Roxbury VA Medical Center. The stops are at BWH Francis Street Shelter, Main Entrance to Faulkner Hospital (Center Street-Side), Trinity Parking Lot and West Roxbury VA Medical Center's MBTA bust stop near the Main Entrance. The shuttles operate Monday through Friday, except holidays, between 6:00 AM and 7:30 PM.
- **BWH/MIT Shuttle**: Operating Monday through Friday, except holidays, this shuttle travels between BWH and MIT. The shuttle stops at BWH at the corner of Binney and Francis Street, 65 Lansdowne Street main entrance, and 84 Massachusetts Avenue – Julie Adams Stratton Building. With a 30 minute headway, the shuttle operates between 7:00 AM and 7:00 PM.
- **BWH to Wellesley Gateway (HPHC)**: The shuttle stops at BWH and at the Harvard Pilgrim Health Care Facility located at 93 Worcester Street in Wellesley. The shuttle runs between the hours of 7:30 AM and 6:30 PM with an hour headway.
- **BWH to Crosstown**: The shuttle operates Monday through Friday, except on holidays, between the hours of 6:15 AM and 6:15 PM. The stops include BWH, 221 Longwood Avenue, and 801 Massachusetts Avenue. The 221 Longwood stop is a "rolling stop" which occurs 5 minutes after departing BWH and 7 minutes after departing 801 Massachusetts Avenue.

Table 3-8 provides a summary of the daily ridership by shuttle route. In May 2009, approximately 1,294 riders used the BWH shuttle services on a daily basis.

Table 3-8 BWH Shuttle Ridership Summary (May 2009)

	Average Daily Ridership
BWH/Faulkner (via Trinity Lot)	94
BWH/Faulkner (Express)	102
BWH/Lansdowne St/MIT	97
BWH/Cypress St	153
BWH/HPHC	35
BWH/MGH/Prudential	381*
850 Boylston St/Atrium	342
BWH/221 Longwood/Crosstown	90
Daily Total	**1,294**

* Ridership shown is to/from BWH Main Campus only.
Source: BWH Parking and Security.

3.2.1.4 BWH Ambulance Operations

Ambulances use an entrance on Shattuck Street to access BWH, except in very rare occasions when using the Francis Street entrance to the Emergency Department saves critical time. The Shattuck Street ambulance area is covered and has seven bays and a pedestrian entrance.

Emergency trips are largely local, although some originate from the suburbs along the Route I-95/128 corridor. The majority of these trips arrive to the hospital via Francis Street. Non-emergency/transport trips may be made to or from other states, and are synchronized with scheduled midday surgeries. During the day, approximately one third of all ambulance trips to BWH are emergency-related. The remaining trips consist of patient transfers to or from other hospitals or their homes, when the patients are unable to travel comfortably by car. In the past year, BWH received 13,375 annual ambulance visits, or about 40 per day.

3.2.1.5 BWH Loading and Service Activities

The main BWH loading and service area is located in the Servicenter Loading Dock at 89 Fenwood Road underneath the Servicenter Parking Garage. These docks are connected to the BWH Main Campus via an underground tunnel across Francis Street to the BWH Amory Building. Ordinarily open from 6:00 AM to 4:00 PM, this location handles about 35 trucks per day. The majority of activities at the Servicenter Loading Dock occur in the morning prior to 10:00 AM. Medical and surgical supplies, food, mail/courier, cleaners, dumpsters, and waste removal (including used linen) comprise the bulk of activity here.

Additional loading and service areas are located on Shattuck Street. One is at 50 Shattuck Street (the West Plaza Loading Dock) and the other is a smaller dock at the Thorn Building (20 Shattuck Street). The West Plaza dock has four large loading bays. This dock was built in the mid-1990s to accommodate larger food service and linen trucks (WB-50s) that require more space and longer loading/unloading periods. The Thorn Building has two loading bays for small trucks (box type or vans): one bay is active, the other contains a trash compactor.

A breakdown of trucks per size per day for a typical week can be seen in Table 3-9.

Table 3-9 Service Activity (Number of Trucks) *

Time of Day	Servicenter Loading Docks Van/Single Unit Truck	Servicenter Loading Docks Tractor Trailer	Shattuck Street Loading Docks* Van/Single Unit Truck	Shattuck Street Loading Docks* Tractor Trailer	Total
Midnight – 4:00 AM		2	2		4
5:00 – 6:00 AM			10		10
6:00 – 7: 00 AM		2	5		7
7:00 – 8:00 AM	5	3	5	1	14
8:00 – 9:00 AM	5		8		13
9:00 – 10:00 AM	7		5		12
10:00 – 11:00 AM	1	1	8		10
11:00 AM – 12:00 PM			7		7
12:00 PM – 1:00 PM			6	1	7
1:00 – 2:00 PM		1	5	1	7
2:00 – 3:00 PM	1	1	5	1	8
3:00 – 4:00 PM	1	1	5		7
4:00 – 5:00 PM		1	5		6
5:00 – 6:00 PM		1	5		6
6:00 PM - Midnight		1		2	3
Total	**20**	**14**	**81**	**6**	**121**

Source: BWH Facilities.
*Includes West Plaza loading docks and Thorn Building.

BWH currently generates approximately 0.05 trucks per thousand square feet per day. Approximately 83 percent of these trips are made by a single unit truck or van.

3.2.1.6 BWH Bicycle Amenities

BWH encourages employees to commute by bicycle. Currently there are bicycle storage racks located throughout the campus. As shown in Table 3-10, BWH currently maintains 26 bicycle racks throughout the campus.

Table 3-10 BWH Bicycle Storage Locations (Number of Racks)

	Number of Bicycle Racks
Mission Park Garage	7
45 Francis Street – ASB II Garage	3
One Brigham Circle	3
Servicenter Complex	5
Francis Street (Former Bus Shelter at Binney Street)	2
221 Longwood Avenue	6
Total	**26**

Source: BWH Parking and Security.

3.2.2 Summary of Existing RTH Transportation Infrastructure and Services

The Roxbury Tenants of Harvard Association, Inc. is a non-profit housing and human service organization that was founded by residents of the neighborhood in 1969. Their mission is to ensure community participation in decision-making, to foster the improvement of housing, recreation and related facilities for the residents of the Mission Hill area of Boston and to improve the social and economic condition of the community.

3.2.2.1 RTH Parking Summary

Currently RTH manages all of the residential properties in the area bounded by between Francis Street, the Riverway, and the western side of Huntington Avenue. RTH properties and the respective off-street parking supply are summarized in Table 3-11. Overall, there is a relatively low parking demand for RTH residents. The existing parking ratio for residents, who generally use designed off-street parking, is 0.43 spaces per residential unit. Data from the Mission Park Garage suggest that approximately 87 percent of the residential vehicles remained parked at noon on a typical weekday. This data suggests that most residents are not using their cars to commute to work on a daily basis.

As part of the 70 Francis Street Project, due to the removal of some on-street residential parking, BWH agreed to provide 32 nearby spaces for residents since the same number of on-street residential parking spaces were removed as a result of the Project. To honor this commitment, BWH provides 16 surface parking spaces for RTH at the Main MMHC Site today. An additional 20 spaces are leased by BWH for residential use in the Mission Park Garage. These 36 spaces provided by BWH to residents exceed BWH's commitment to provide 32 nearby spaces for residents as part of the 70 Francis Street Project.

Table 3-11 RTH Residential Parking Summary

Property	Address	Number of Units	Residential Parking Spaces
	Apartment Buildings		
Levinson Building	835 Huntington Ave	260	-
Duggan Building	25 Mission Park Dr	129	-
Flynn Building	805 Huntington Ave	85	-
Neville Building	11 New Whitney St	154	-
Subtotal Apartment Buildings		***628***	***164****
	Townhouses		
Mission Park Townhouses	New Whitney St, Mission Park Dr., Kempton St, St. Albans Rd	147	146
	Original Neighborhood Housing		
Neighborhood Housing	Francis Street, Fenwood Road, St. Albans St., Huntington Ave.	200	-
	Parking Facilities		
Mission Park Garage	Vining Street	-	62**
20/20 Lot		-	10
Vining Street Lot	10 Vining Street	-	20
Main MMHC Site	Vining Street	-	16
Total		975	418

Source: RTH
*Unassigned surface parking on private lots and private ways.
**Remaining spaces are used by BWH.

3.2.2.2 RTH Loading

Currently RTH does not have any formal loading operations or scheduled deliveries. Trash pickup is by a private contractor for the Mission Park development. Designated commercial vehicle spaces are provided at several of the Mission Park buildings to serve the buildings.

3.2.2.3 RTH Transportation Demand Management

Existing programs that decrease auto dependency for RTH residents include the following:

- After school programs for children that will eliminate the need for parents to travel to pick up their children after school and allow parents to have flexible work hours;
- Daycare programs that allow parents to walk their children to daycare services;

- Van service that allow residents to run errands without the need for a personal automobile. RTH operates one vehicle with a capacity of 14 persons. This vehicle is used to transport residents to various weekly programs and intermittent events; and

- Assistance in accessing job opportunities at BWH so that residents may live and work in the Mission Hill neighborhood to reduce commuter traffic in the area.

3.2.3 Transportation Study Area

The Project study area as required by the MEPA and BRA/BTD scopes includes the analysis of 17 intersections. These intersections are described below and illustrated in Figure 3-3. The descriptions of the intersections include physical characteristics, geometric conditions, pedestrian facilities, and traffic control measures.

1. Brookline Avenue/Francis Street

The intersection of Francis Street and Brookline Avenue is a four-legged intersection that operates under four-phase traffic signal control, including a southbound lead phase and an exclusive pedestrian phase. The Francis Street northbound approach provides two lanes, one for left turns, and one for through movements and right turns. The Francis Street southbound approach provides a single general purpose travel lane. The Brookline Avenue eastbound approach provides three general lanes during the peak hours due to a peak hour parking restriction. As a result, eastbound Brookline Avenue operates with a shared left/thru lane, a thru lane, and the parking lane operates as a defacto right turn lane onto Francis Street. The Brookline Avenue westbound approach provides an exclusive left-turn lane, an exclusive through lane, and a shared through/right-turn lane. MBTA bus stops are located on Brookline Avenue on both eastbound and westbound departures from the intersection. The traffic signal's actuated pedestrian phase provides for exclusive pedestrian movement at the intersection. Sidewalks and crosswalks are provided at all four intersection approaches.

2. Brookline Avenue/Fenwood Road

The intersection of Fenwood Road and Brookline Avenue eastbound is a three-legged unsignalized intersection adjacent to the signalized intersection of Brookline Avenue and the Riverway. The Brookline Avenue westbound approach is physically separated from the intersection by a concrete median. The Fenwood Road northbound approach provides a single lane exclusively for right turns. The Brookline Avenue eastbound approach provides an exclusive through lane and a shared through/right-turn lane. On-street metered parking is permitted along only the west side of Fenwood Road, but does not affect this intersection as it begins south of the Servicenter loading dock entrance. A loading dock is located on the east side of Fenwood Road near the intersection. Sidewalks are provided along all intersection approaches and a crosswalk is provided across Fenwood Road.

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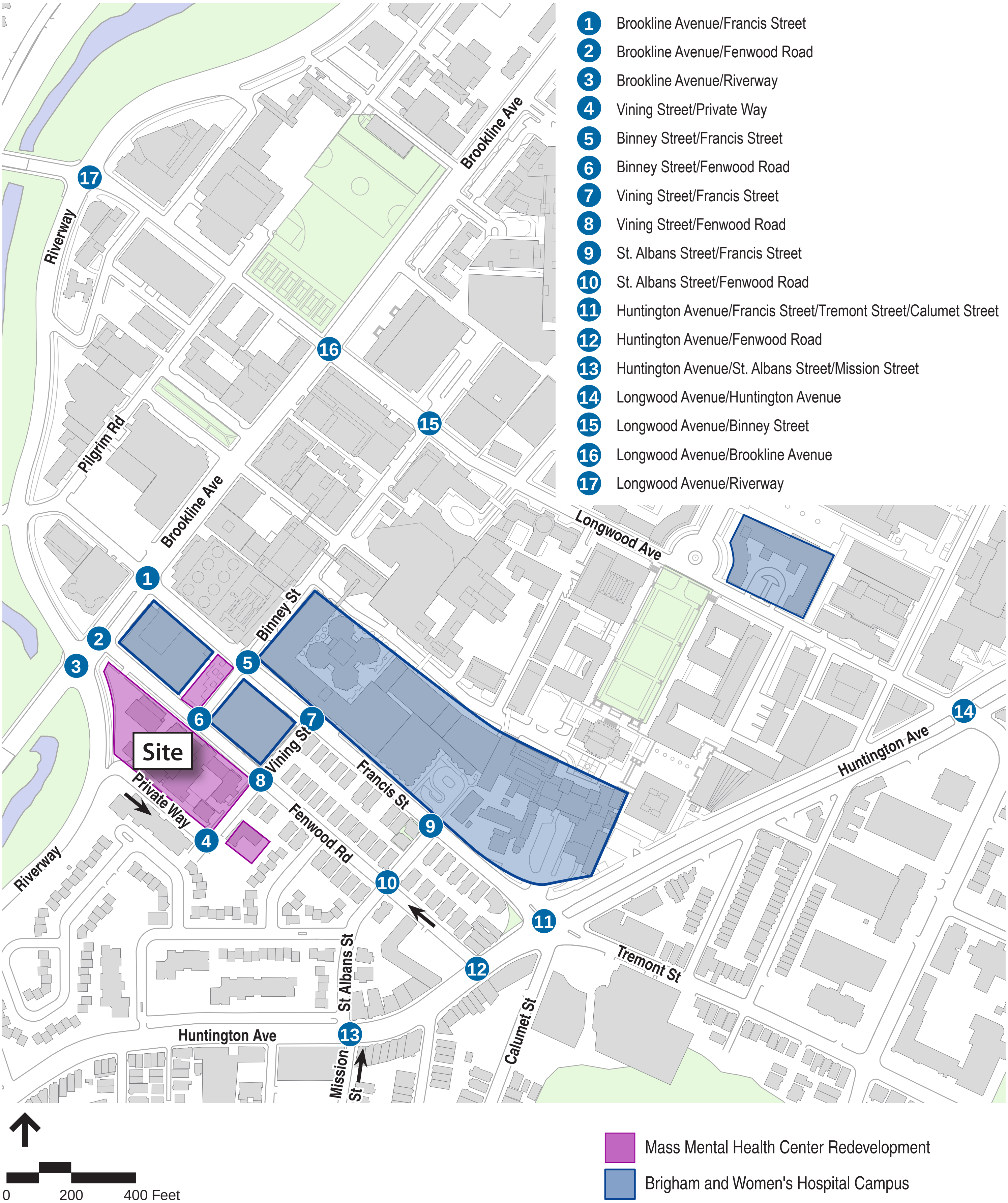

Massachusetts Mental Health Center Project Boston, Massachusetts

VHB *Vanasse Hangen Brustlin, Inc.*

Figure 3-3

Study Area Intersections

3. Brookline Avenue/Riverway

The intersection of Brookline Avenue and the Riverway is a four-legged intersection that operates under four-phase traffic signal control, including a westbound lead phase and an exclusive pedestrian phase. The Riverway provides two lanes on each approach. In the southbound direction, there is a combined right/thru lane and a thru only lane with no left permitted. In the northbound direction, a left/thru and thru/right are provided. Brookline Avenue provides three lanes on each approach, one exclusive left-turn lane, one exclusive through lane, and one shared through/right-turn lane. There is no on-street parking permitted along any of the approaches. The traffic signal's pedestrian phase provides for exclusive pedestrian movement at the intersection. Sidewalks are provided along both sides of Brookline Avenue and along the north side of the Riverway. Unpaved paths follow the Riverway on its south side. Crosswalks are provided across all four intersection approaches.

4. Vining Street/Private Way

The private way at the southern portion of the Main MMHC Site intersects Vining Street to the east of the Project Site at the Mission Park Garage and the 10 Vining Street surface parking lot. This intersection provides four legs, each with one general travel lane. The private way approach is stop-controlled. Sidewalks and a crosswalk across the private way approach are provided.

5. Binney Street/Francis Street

The intersection of Francis Street and Binney Street is a four-legged intersection controlled by stop signs on both Binney Street approaches. Each of the four approaches provides a single general purpose travel lane. No parking is allowed on any approach and a shuttle bus/MBTA bus stop is provided on the departure lane for the southbound direction. A loading dock that serves the adjacent MATEP facility is located on the north side of Francis Street just west of the intersection. Sidewalks and crosswalks are provided at all four intersection approaches.

6. Binney Street/Fenwood Road

The intersection of Fenwood Road and Binney Street is a three-legged intersection controlled by a stop sign on the Binney Street approach. Each of the three intersection approaches provides a single general purpose travel lane. On-street parking is permitted along the west side of Fenwood Road on both sides of the intersection and along the east side of Fenwood Road south of the intersection. Sidewalks are provided along all intersection approaches and a crosswalk is provided across the Binney Street approach.

7. Vining Street/Francis Street

The main BWH entrance is aligned with Vining Street at its intersection with Francis Street. Including the BWH driveway, it is a four-legged intersection that operates under two-phase traffic signal control with concurrent pedestrian movements. The Francis Street northbound approach provides one general purpose travel lane. The Francis Street southbound approach provides two lanes, one for left turns into the BWH main entrance at 75 Francis Street, and one for through movements and right turns. The Vining Street northbound approach provides a single general purpose travel lane. The BWH driveway entrance (the southbound approach) is one-way into this drop-off pick-up area. There is on-street resident permit parking along the west side of Francis Street on the south side of the intersection, and along both sides of Vining Street. A taxi stand serving BWH is located on the east side of the Francis Street northbound approach. Sidewalks are provided along all intersection approaches and crosswalks are provided across Vining Street and both Francis Street approaches.

8. Vining Street/Fenwood Road

The intersection of Fenwood Road and Vining Street is a four-legged intersection under all-way stop sign control. Each of the four approaches provides a single general purpose travel lane. On-street parking is permitted along all intersection approaches. Sidewalks and crosswalks are provided at all four intersection approaches.

9. St. Albans Street/Francis Street

The exit from the 45 Francis Street driveway aligns with St. Albans Road at its intersection with Francis Street. Including the driveway, it is a four-legged unsignalized intersection with stop sign control on the driveway and the St. Albans Street approach. During peak hospital activity periods, a police officer often directs traffic here and at the adjacent driveway entrance (located just 72 feet south of the driveway exit). Each Francis Street approach provides a single general purpose travel lane. St. Albans Street also provides a single eastbound approach lane. On-street parking is permitted along all intersection approaches except the east side of Francis Street north of the intersection. Sidewalks are provided along both sides of Francis Street, both sides of St. Albans Road, and the east side of the exit driveway. Crosswalks are provided across St. Albans Road and across Francis Street on the south side of the exit driveway.

10. St. Albans Street/Fenwood Road

The intersection of Fenwood Road and St. Albans Road is a four-legged intersection controlled by stop signs on both St. Albans Road approaches. Each of the four intersection approaches provides a single general purpose travel lane. The Fenwood Road northbound approach is one-way into the intersection. On-street parking is permitted along all intersection approaches. Sidewalks and crosswalks are provided at all four intersection approaches.

11. Francis Street/Huntington Avenue/Tremont Street/Calumet Street (Brigham Circle)

The intersection of Francis Street, Huntington Avenue, Tremont Street and Calumet Street, also known as Brigham Circle, is a five-legged intersection that operates under four-phase traffic signal control with concurrent pedestrian movements. A fifth signal phase, exclusive pedestrian movements, may be actuated using a push button. The Tremont Street northbound approach provides two lanes, one for left turns and through movements and one for through movements and right turns. The Francis Street southbound approach provides one general approach lane however, right turning vehicles often operate with their own lane after the on-street parking lane due to the wide lane width. Huntington Avenue in both eastbound and westbound directions provides two lanes, one shared left-turn/through lane and one shared through/right-turn lane. Calumet Street is a one-way departure from the intersection. On-street parking is permitted on all intersection approaches except along the east side of Francis Street north of the intersection. The traffic signal's actuated pedestrian phase provides for exclusive pedestrian movement at the intersection. Sidewalks and crosswalks are provided at all five intersection approaches.

12. Huntington Avenue/Fenwood Road

Fenwood Road intersects Huntington Avenue opposite Mission Street, forming a three-way unsignalized intersection. Fenwood Road runs one-way northbound (away from Huntington Avenue) with a single general purpose travel lane. On Huntington Avenue, there are two general purpose travel lanes in each direction. On-street parking is permitted along all intersection approaches. Sidewalks and crosswalks are provided at all intersection approaches.

13. Huntington Avenue/St. Albans Street

St. Albans Road intersects Huntington Avenue opposite Mission Street, forming a four-way unsignalized intersection. Mission Street runs one-way northbound (toward Huntington Avenue) with a single general purpose travel lane. One general purpose travel lane in each direction is provided on St. Albans Road. On Huntington Avenue, there are two general purpose travel lanes in each direction. On-street parking is permitted along all intersection approaches. Sidewalks and crosswalks are provided at all intersection approaches.

14. Huntington Avenue/Longwood Avenue

The intersection of Longwood Avenue and Huntington Avenue is a four-legged intersection that operates under three-phase traffic signal control, which includes a lead phase for Huntington Avenue east and westbound left-turns. The Huntington Avenue eastbound and westbound approaches provide an exclusive left-turn lane, a through lane, and a shared through/right-turn lane. Pedestrian movements are concurrent with traffic movements. Pedestrians can cross Longwood Avenue during the Huntington Avenue through movement, while pedestrians crossing Huntington Avenue must do so in two phases. They can cross the departure lanes during the Huntington left-turn movement and the approaches during the Longwood through movement. The MBTA's Green Line (E Line) also operates within the median of Huntington Avenue. Longwood Avenue provides one general purpose lane northbound. Southbound typically provides two general travel lanes however, due to construction this approach is operating with only one lane. Unregulated parking is provided on the east side of the Longwood Avenue northbound approach. A bus stop is located on the westbound approach of Huntington Avenue, just east of Longwood Avenue which services MBTA bus routes 39 and CT2. Sidewalks and crosswalks are provided along all four intersection approaches.

15. Longwood Avenue/Binney Street

The intersection of Longwood Avenue and Binney Street is a four-legged, signalized intersection that operates under four-phase traffic signal control, including a southbound lead phase and an exclusive pedestrian phase. The Longwood Avenue northbound and southbound approaches provide two general-purpose travel lanes. The Binney Street eastbound approach has a single general-purpose lane while the westbound approach provides a shared left-turn/through lane and exclusive right-turn lane. Sidewalks and crosswalks are provided at all four intersection approaches. On-street parking is not permitted at any of the approaches; however, there is an MBTA bus stop located at the northbound approach in front of 333 Longwood Avenue which services bus routes 8, 47, CT2, CT3, and 10.

16. Brookline Avenue/Longwood Avenue

The intersection of Longwood Avenue and Brookline Avenue is a four-legged signalized intersection with an exclusive pedestrian phase. The Longwood Avenue northbound approach accommodates an exclusive left-turn lane, a through lane, and an exclusive right-turn lane. The Longwood Avenue southbound approach provides an exclusive left-turn lane, and a shared through/right-turn lane. The Brookline Avenue eastbound and westbound approaches each provide an exclusive left-turn lane, a through lane and a shared through/right-turn lane. There is no on-street parking or loading permitted along any of the approaches, however, loading and delivery vehicles occasionally stop along both sides of Brookline Avenue south of Longwood Avenue. Sidewalks and crosswalks are provided at all four intersection approaches.

17. Longwood Avenue/Riverway

The intersection of Longwood Avenue and the Riverway is a four-legged intersection that operates under three-phase traffic signal control. In addition to phases for all Riverway traffic and for all Longwood Avenue traffic, a phase allows for protected left turns from Riverway eastbound and right turns from Longwood Avenue southbound. Pedestrian movements across Longwood Avenue are concurrent with the Riverway traffic phase. Pedestrian movements across the Riverway are concurrent with the eastbound Riverway protected left turn phase and are made via a diagonal crosswalk. The Longwood Avenue northbound approach provides an exclusive left-turn lane and a shared through/right-turn lane. The Longwood Avenue southbound approach provides a shared left-turn/through lane and an exclusive right-turn lane. The Riverway eastbound approach provides an exclusive left-turn lane, a through lane, and a shared through/right-turn lane. The Riverway westbound approach provides two through lanes (left turns from this approach are prohibited) and an exclusive right-turn lane. There is no on-street parking permitted along any of the intersection approaches. Sidewalks are provided along all intersection approaches except along the north side of the Riverway. Crosswalks run across the north, east, south legs of the intersection. A fourth crosswalk runs diagonally from the northeast corner to the southwest corner of the intersection.

3.2.4 Study Area Intersection Conditions

An extensive transportation data collection program was undertaken as directed by the Scoping Determination. This effort included conducting turning movement counts (TMCs) from 7:00 AM to 9:00 AM and 4:00 to 6:00 PM at all identified study area intersections. Counts were conducted in May 2009 with the exception of the intersections on the Longwood Avenue corridor and Vining Street at the private way which were counted in August 2009. The August Longwood Avenue counts were not adjusted to account for seasonal variations since the Massachusetts Highway Department (MHD) seasonal factors suggest that traffic volumes on urban streets are higher in August and would therefore recommend a traffic volume reduction. However, counts along Brookline Avenue and Longwood Avenue were increased slightly to balance with adjacent intersections and to reflect historical volumes in the area. All TMC's included passenger vehicles, heavy vehicles, and pedestrian volumes.

Automatic traffic recorders (ATRs) were installed to collect daily traffic volumes on Francis Street on Tuesday, May 4, 2009. The traffic data are included in the Transportation Appendix and are summarized below.

3.2.4.1 Average Daily Traffic Counts

Francis Street

ATR counts were conducted on Francis Street between Binney Street and Vining Street adjacent to 70 Francis Street. At this location, Francis Street carries approximately 9,300 vehicles on an average weekday. Over the course of an entire day, flows in both directions are nearly balanced. Daily volumes have dropped from approximately 15,000 vehicles in 2002 as part of the 70 Francis Street DPIR/DEIR to 9,260 vehicles in 2009. Hourly traffic volumes have also decreased since 2002 from over 800 vehicles per hour to approximately 600 vehicles per hour during the peak hours. At the time of the counts in 2002, Huntington Avenue was undergoing reconstruction and regional traffic may have shifted into the LMA. This reduction in traffic may also be attributed to reduction of surface parking lots in the area. Hourly volumes for 2009 are summarized in Table 3-12.

Table 3-12 Average Weekday Daily Traffic Summary Francis Street east of Brookline Avenue (at 70 Francis Street)

Hour Beginning	Westbound Volume	Eastbound Volume	Total for Both Directions
Midnight	39	61	100
1:00 AM	31	36	67
2:00 AM	24	29	53
3:00 AM	14	22	36
4:00 AM	21	18	39
5:00 AM	53	114	167
6:00 AM	160	217	377
7:00 AM	306	285	591
8:00 AM	286	296	528
9:00 AM	254	323	577
10:00 AM	288	320	608
11:00 AM	269	311	580
Noon	219	334	553
1:00 PM	258	344	602
2:00 PM	251	282	533
3:00 PM	263	254	517
4:00 PM	246	296	542
5:00 PM	259	294	553
6:00 PM	267	300	567

Table 3-12 Average Weekday Daily Traffic Summary Francis Street east of Brookline Avenue (at 70 Francis Street) (Continued)

Hour Beginning	Westbound Volume	Eastbound Volume	Total for Both Directions
7:00 PM	199	245	444
8:00 PM	166	197	363
9:00 PM	115	165	280
10:00 PM	106	146	252
11:00 PM	133	147	280
Daily Total	**4,227**	**5,036**	**9,263**

Source: ATR counts conducted May 4, 2009.

3.2.4.2 Peak Hour Volumes

The intersection turning movement counts were used to establish traffic networks for the 2009 Existing Condition for the morning and evening peak hours. The study area's overall morning peak hour was determined to occur between 7:15 AM and 8:15 AM and the study area's overall evening peak hour was determined to occur between 4:45 PM and 5:45 PM. These peak hours are predominately governed by traffic volumes on Brookline Avenue and Huntington Avenue when commuter volumes are the heaviest. Existing Condition (2009) morning and evening peak hour traffic volumes are shown in Figures 3-4 and 3-5.

3.2.5 Crash Analysis

Accident data was investigated for the study area. Data was obtained from the Massachusetts Highway Department (MassHighway) for the most recent three-year period available (2005 thru 2007) for the intersections within the study area. Crash results are summarized in Table 3-13.

Of the reported accidents, most (57 percent) occurred during a weekday outside of the traditional peak travel periods of 7:00-9:00 AM and 4:00-6:00 PM. The majority of the reported incidents occurred during dry pavement conditions. The severity ranged from personal injury to property-damage. No fatalities were indicated by the data.

The City of Boston falls into the MassHighway District 4 which includes the northeast region of the state. The 2008 average intersection crash rate for District 4 signalized intersections is 0.78 crashes per million entering vehicles (MEV). The average for unsignalized intersection in District 4 is 0.58 crashes per MEV. District 4 has a slightly lower average than the Statewide Average of 0.80 crashes per MEV for signalized intersections and 0.60 crashes per MEV for unsignalized intersections. Over the three year period, three intersections had on average a higher crash rate than the district and statewide averages:

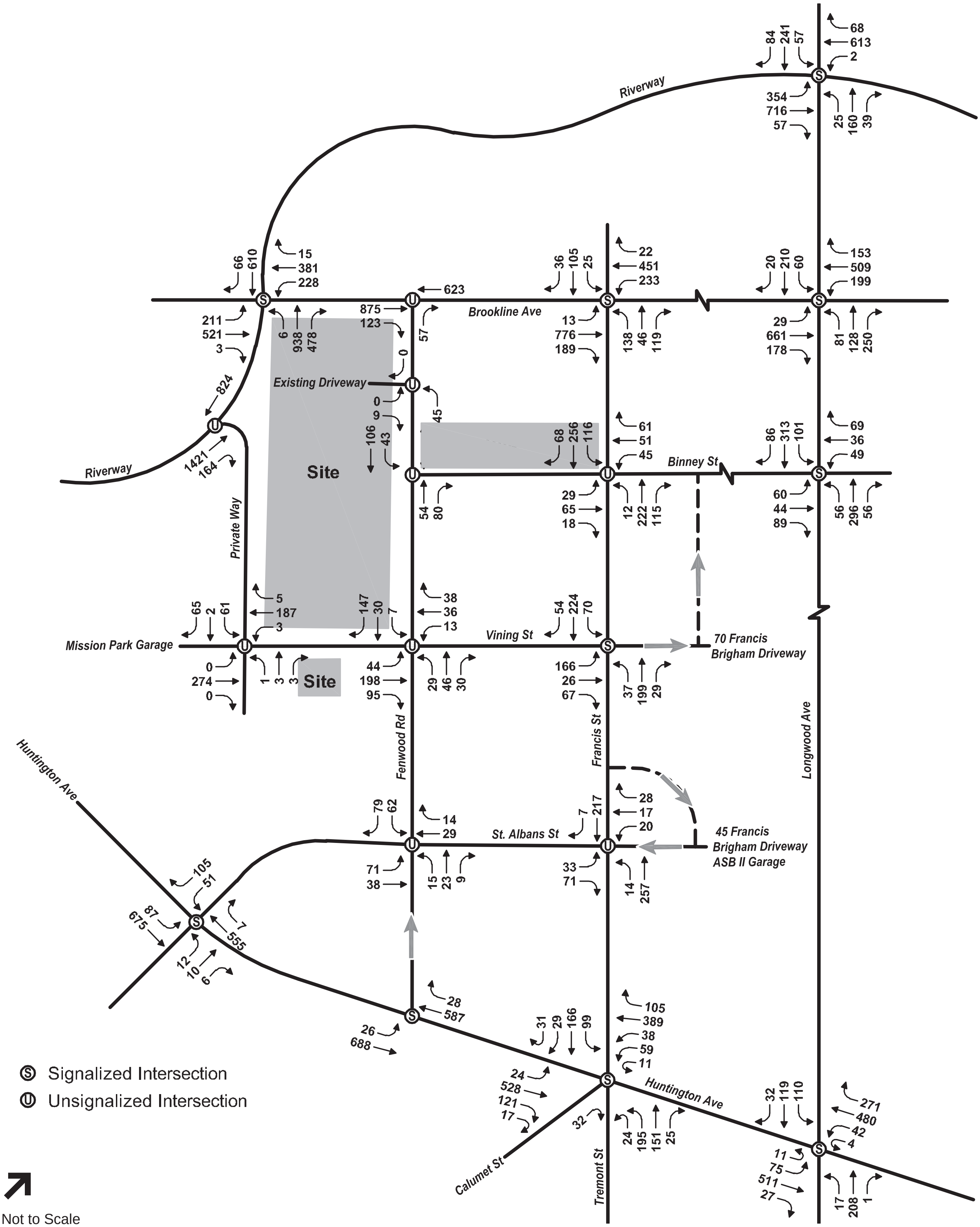

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Figure 3-4

2009 Existing Traffic Volumes AM Peak Hour (7:15 AM - 8:15 AM)

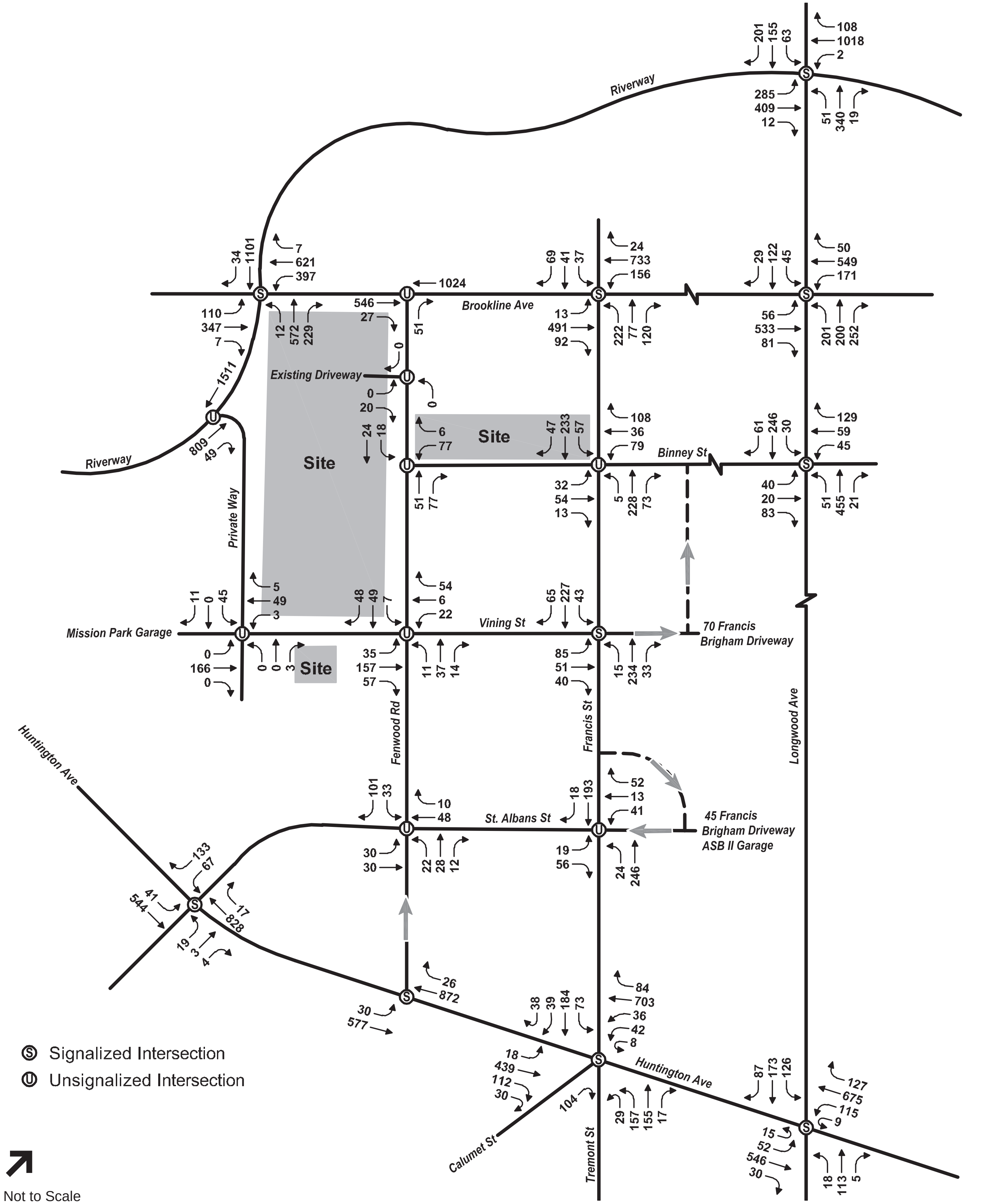

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Figure 3-5

2009 Existing Traffic Volumes PM Peak Hour (4:45 PM - 5:45 PM)

- Brookline Avenue at Riverway crashes were primarily reported as angle or sideswipe incidents. As reported, 18 of the 46 crashes involved personal injury. The majority of these crashes were reported as occurring outside of the peak hours and during dry conditions.

- Francis Street at Huntington Avenue crashes were reported in several categories: sideswipe, angle, and rear-end. Twelve of the 35 crashes resulted in injury. Like the other locations, the majority of reported crashes were outside of the peak hours with dry conditions.

- Brookline Avenue at Longwood Avenue crashes were primarily angle and rear-end type accidents. The majority of the incidents occurred outside of the peak hour on weekdays. Nine of the 28 accidents resulted in personal injury, while 15 reported property damage.

The Fenwood corridor located adjacent to the Site had very few crashes reported. Over the three year period, the three study area intersections on Fenwood Avenue next to the Project Site (intersections with Brookline Avenue, Binney Street, and Vining Street) had a total of two crashes. The intersection of Vining Street at the private way has no reported crashes during the last three year period.

The Francis Street corridor also had a low volume of reported crashes except at its signalized intersections with Brookline Avenue and Huntington Avenue. Francis Street at St. Albans Street and Francis Street at Binney Street both averaged less than one crash per year while Francis Street at Vining had only a single crash over the three year period. Overall, intersections directly surrounding the Site have low crash rates.

Table 3-13 Vehicular Crash Summary (2005 - 2007)

	Brookline/ Longwood	Riverway/ Longwood	Binney/ Longwood	Huntington/ Longwood	Francis/ Brookline	Fenwood/ Brookline	Riverway/ Brookline	Francis/ Vining	Francis/ Binney	Francis/ St. Albans	Francis/ Huntingto n	Vining/ Fenwood	Fenwood/ Huntington	St. Albans/ Huntington
Year														
2005	11	11	2	7	4	0	14	1	1	0	11	1	0	2
2006	9	4	4	6	7	0	13	0	1	2	11	0	1	5
2007	8	3	2	4	6	1	19	0	0	0	13	0	0	3
Total	28	18	8	17	17	1	46	1	2	2	35	1	1	10
Average	9.3	6.0	2.7	5.7	5.7	0.3	15.3	0.3	0.7	0.7	11.7	0.3	0.3	3.3
Crash Rate (crashes per million entering vehicles)	1.01	0.56	0.53	0.67	0.64	0.05	1.10	0.10	0.17	0.25	1.27	0.17	0.05	0.50
Collision Type														
Angle	11	6	4	2	3	1	18	0	1	1	10	0	0	2
Head-on	1	1	0	0	0	0	3	0	0	0	0	0	0	0
Rear-end	7	6	1	2	5	0	6	0	1	0	9	0	0	2
Rear-to-Rear	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Sideswipe	5	3	3	8	5	0	13	0	0	1	7	1	0	2
Single Vehicle Crash	0	2	0	3	0	0	1	0	0	0	2	0	0	1
Unknown	4	0	0	2	3	0	5	1	0	0	7	0	1	3
Severity														
Injury	9	4	2	3	3	0	18	1	1	0	12	0	0	3
Property-related	15	10	5	10	11	1	23	0	1	1	17	0	1	3
Unknown	4	4	1	4	3	0	5	0	0	1	6	1	0	4
Time of Day														
Weekday, 7:00 AM – 9:00 AM	1	2	0	0	1	0	4	0	0	0	5	0	1	1
Weekday, 4:00 PM – 6:00 PM	5	0	2	1	5	0	5	0	1	0	3	0	0	1
Saturday, 11:00 AM – 2:00 PM	1	1	0	0	0	0	1	0	0	0	0	0	0	0
Weekday, other time	17	11	5	13	9	1	29	1	1	2	19	1	0	6
Weekend, other time	4	4	1	3	2	0	7	0	0	0	8	0	0	2
Pavement Conditions														
Dry	24	11	6	8	13	1	39	1	1	2	28	1	1	8
Wet	3	4	2	5	3	0	5	0	1	0	4	0	0	1
Snow	0	1	0	3	0	0	1	0	0	0	1	0	0	0
Ice/Slush	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Unknown	1	1	0	1	1	0	1	0	0	0	2	0	0	0

Source: Massachusetts Highway Department.

3.2.6 Pedestrians and Bicycles

In accordance with the Scoping Determination, pedestrian and bicycle activity was observed and recorded in the study area during the peak hours. The following section discusses pedestrian and bicycle accommodations and details peak hour pedestrian flows in the Project study area.

3.2.6.1 Existing Pedestrian Conditions

MASCO and its member institutions, including BWH, recognize the importance of providing safe and efficient pedestrian facilities, and continue to study and re-evaluate pedestrian needs in the area. The high level of pedestrian activity in the area has prompted changes in traffic signal design and operation in recent years to include exclusive pedestrian phasing, and area signalized intersections now are equipped with pedestrian push-buttons.

2009 Existing Condition morning and evening peak hour pedestrian counts conducted at each of the study area intersections are graphically represented in Figures 3-6 and 3-7, respectively. Overall pedestrian volumes are heavy during the peak hour along the major corridors.

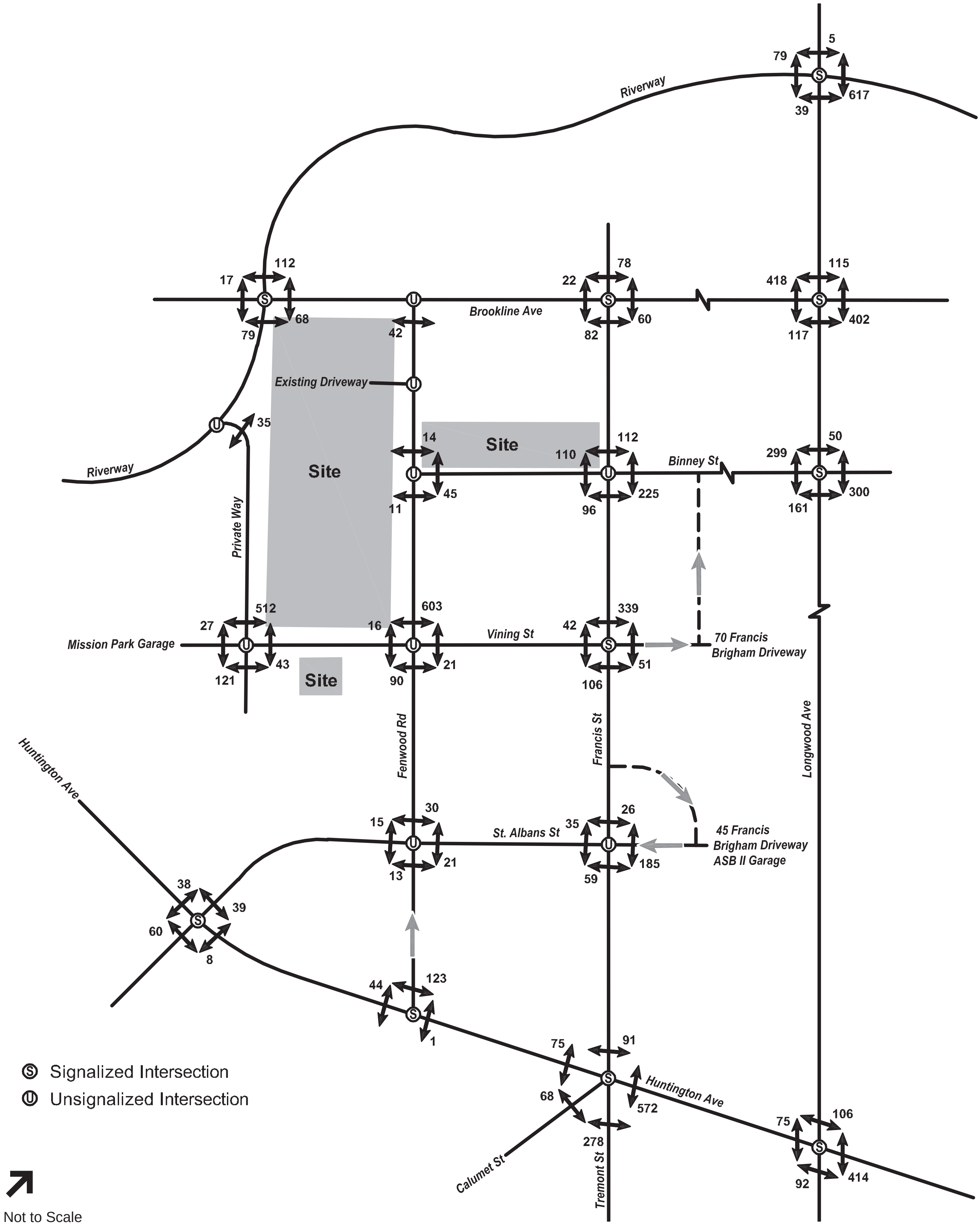
At the study area intersections, the crossing volumes are most concentrated between the Mission Park Garage and BWH's Main Campus on Francis Street during the morning peak hour with approximately 600 pedestrians per hour on the north side of Vining Street. During the evening, peak hour volumes on Vining Street are lower with approximately 300 crossing pedestrians per hour.

Pedestrian volumes adjacent to the MMHC Site on Fenwood Road and the private way are the lowest in the study due to the limited activity at this location. Pedestrian activity on each of these streets totals approximately 30-50 pedestrians per hour during the morning and evening peak hours.

3.2.6.2 Bicycle Volumes and Accommodations

Bicycling is becoming an increasingly popular travel mode in the LMA. Historic bicycle counts and field observations revealed many commuters bicycling even in midwinter. Paths through the Emerald Necklace accommodate bicyclists who prefer not to ride on streets, and bicycle parking is plentiful. Bicycle parking is abundant in the LMA with public storage located at each institution for employees and visitors. The closest bicycle storage to the Site is currently located at the Servicenter Garage and the Mission Park Garage.

Through the LMA, bicyclists travel most heavily along Longwood Avenue and Huntington Avenue. These corridors serve as major arterials for bicyclists traveling to and from the City. Volumes on these main roadways tend to range between 20 and 90 bicycles during the peak hour, as seen in Figure 3-8 and 3-9. A small number of bicycles use the private way on the southern portion of the Main MMHC Site in order to access parts of the LMA.



Massachusetts Mental Health Center Project Boston, Massachusetts

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Figure 3-6

2009 Existing Pedestrian Volumes AM Peak Hour (7:15 AM - 8:15 AM)

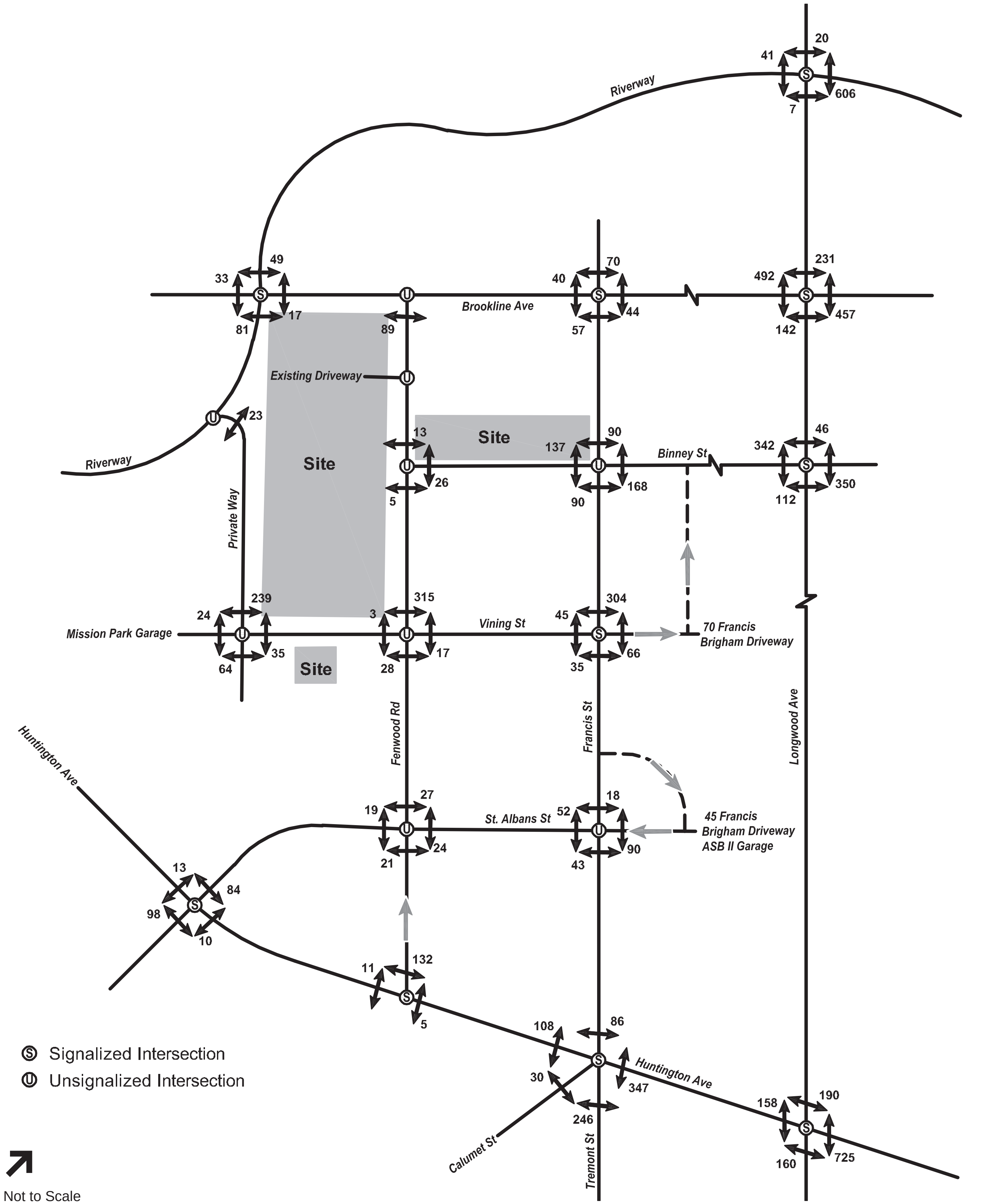

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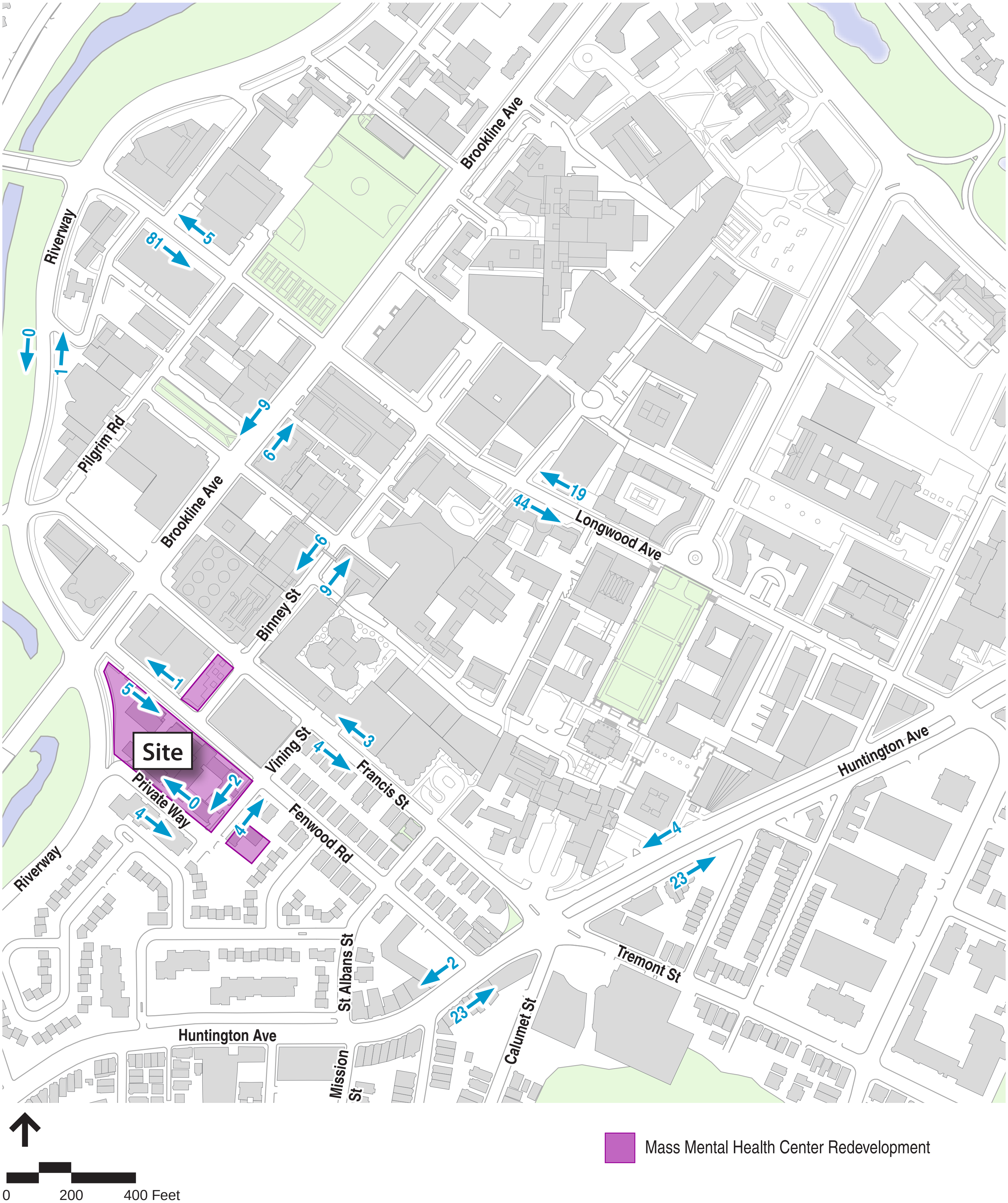
Figure 3-7

2009 Existing Pedestrian Volumes PM Peak Hour (4:45 PM - 5:45 PM)



Massachusetts Mental Health Center Project Boston, Massachusetts

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Figure 3-8

2009 Existing Bicycle Volumes AM Peak Hour (7:15 AM - 8:15 AM)

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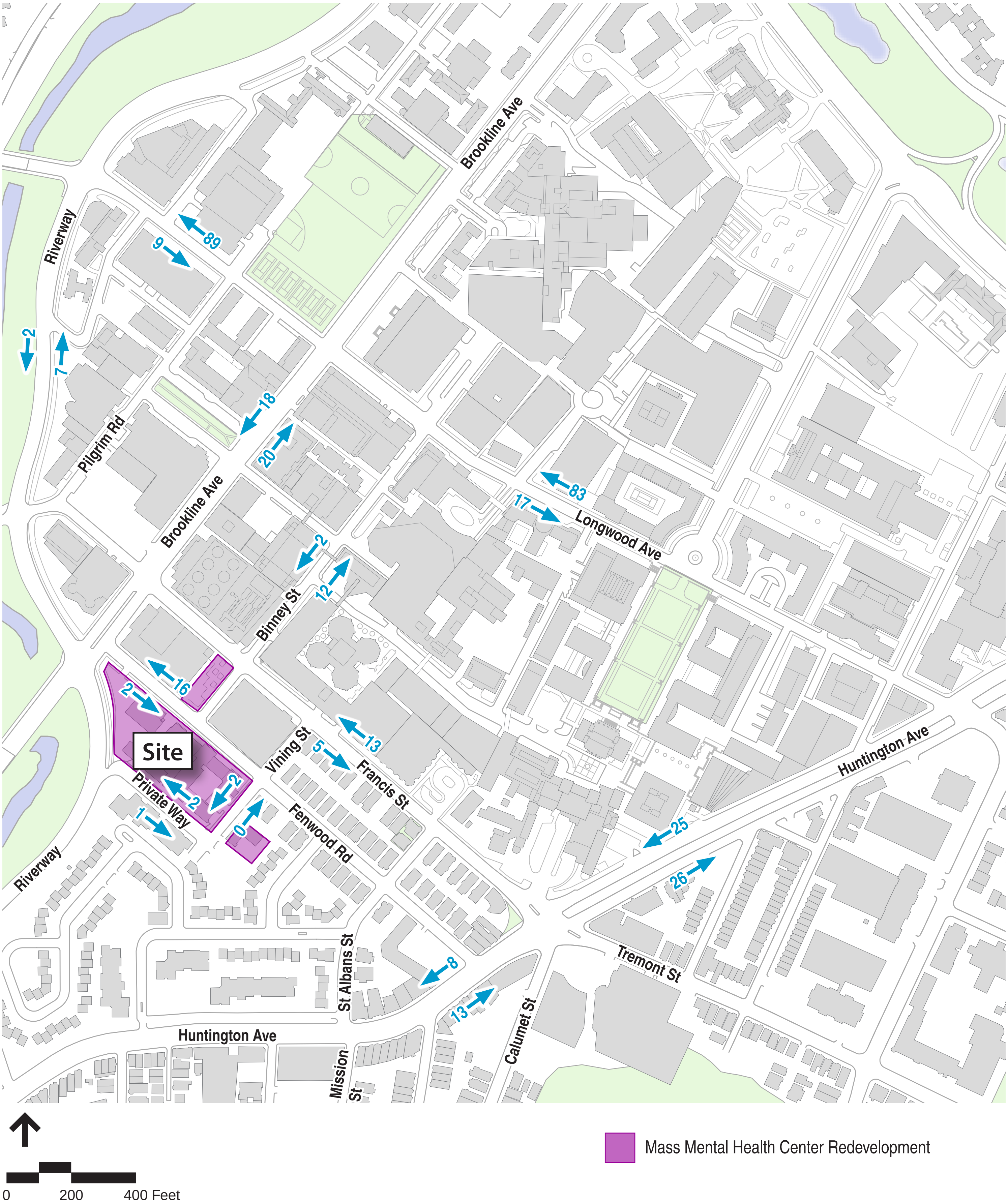

Massachusetts Mental Health Center Project Boston, Massachusetts

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Figure 3-9

2009 Existing Bicycle Volumes PM Peak Hour (4:45 PM - 5:45 PM)

Binney Street is also utilized as a connection between Francis Street and Longwood Avenue. Very few bicycles were counted along Fenwood Road and Francis Street adjacent to the Site.

3.2.7 Area-wide Parking

This section identifies the parking supply and demand relationships for the study area, including off-street and on-street parking. Several off-street public parking facilities and a relatively small number of on-street parking spaces are located in close proximity of the Site.

3.2.7.1 Public Parking Facilities

As shown in Figure 3-10 there are eight publicly available off-street parking areas in close proximity to BWH. These garages and their respective parking rates are summarized in Table 3-14. As shown, parking rates are structured to discourage all-day employee parking.

Table 3-14 Public Off-Street Parking Facilities and Rates (Summer 2009)

Facility/Location Name	Total Spaces	1 Hour	6 Hours	24 Hours
Longwood Galleria Garage	103	$8	$24	$29
BIDMC/Lowery Garage	294	$7	$16	$30
Servicenter Complex	650	$5	$25	$31
BWH/ASB II Garage	247	$6	$13	$21
MASCO/375 Longwood Avenue Garage	750	$6	$23	$29
BIDMC/Carl J. Shapiro Clinical Center Garage	737	$7	$16	$30
333 Longwood Avenue Garage	495	$9	$32	$35
Children's Hospital Patient and Family Garage	643	$5*	-	$35

*Parking rate is for first half hour.

At midday there is relatively little available parking in any of these facilities. The apparent supply is further reduced by the number of spaces reserved for specific institutions or specific users within those institutions. Most of the hospital-controlled spaces are primarily for each institution's patients and visitors. Many LMA institutions maintain long waiting lists of employees seeking reserved off-street parking.

On-street parking located in the area around the Project Site is illustrated in Figure 3-11. Although no counts were taken, informal observations of on-street parking revealed that non-resident spaces were generally fully utilized during the day, and typically one or two resident permit spaces were available on each block.

	Facility	Total Spaces
1	Longwood Galleria Garage	103
2	BIDMC/Lowry Garage	294
3	Servicenter Garage	643
4	BWH/ASB II Garage	247
5	MASCO/375 Longwood Avenue Garage	750
6	BIDMC/Carl J. Shapiro Clinical Center Garage	737
7	333 Longwood Avenue Garage	495
8	Children's Hospital Boston Patient & Family Garage	643

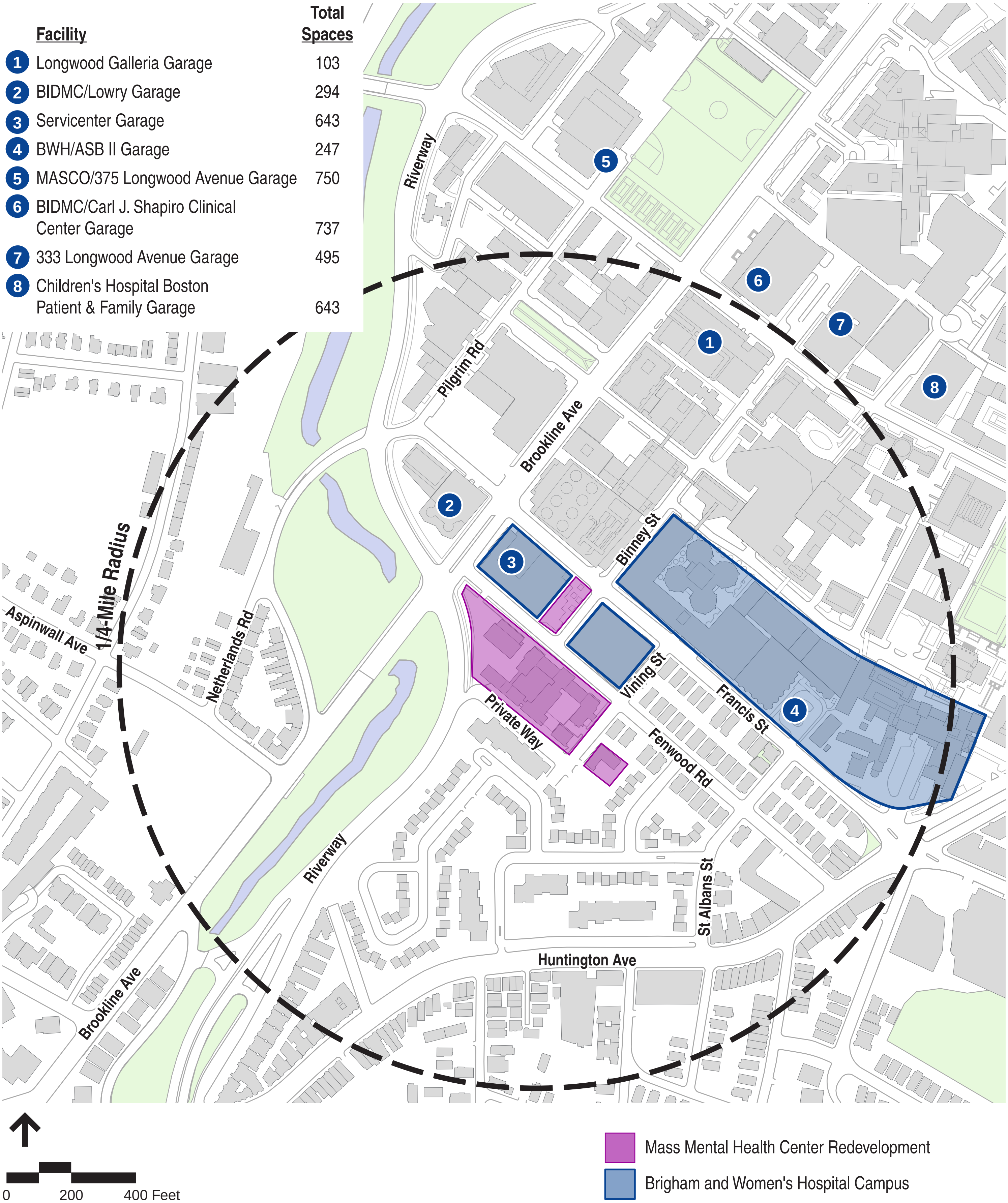

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Figure 3-10

Summary of Nearby Off-Street Major Parking Facilities

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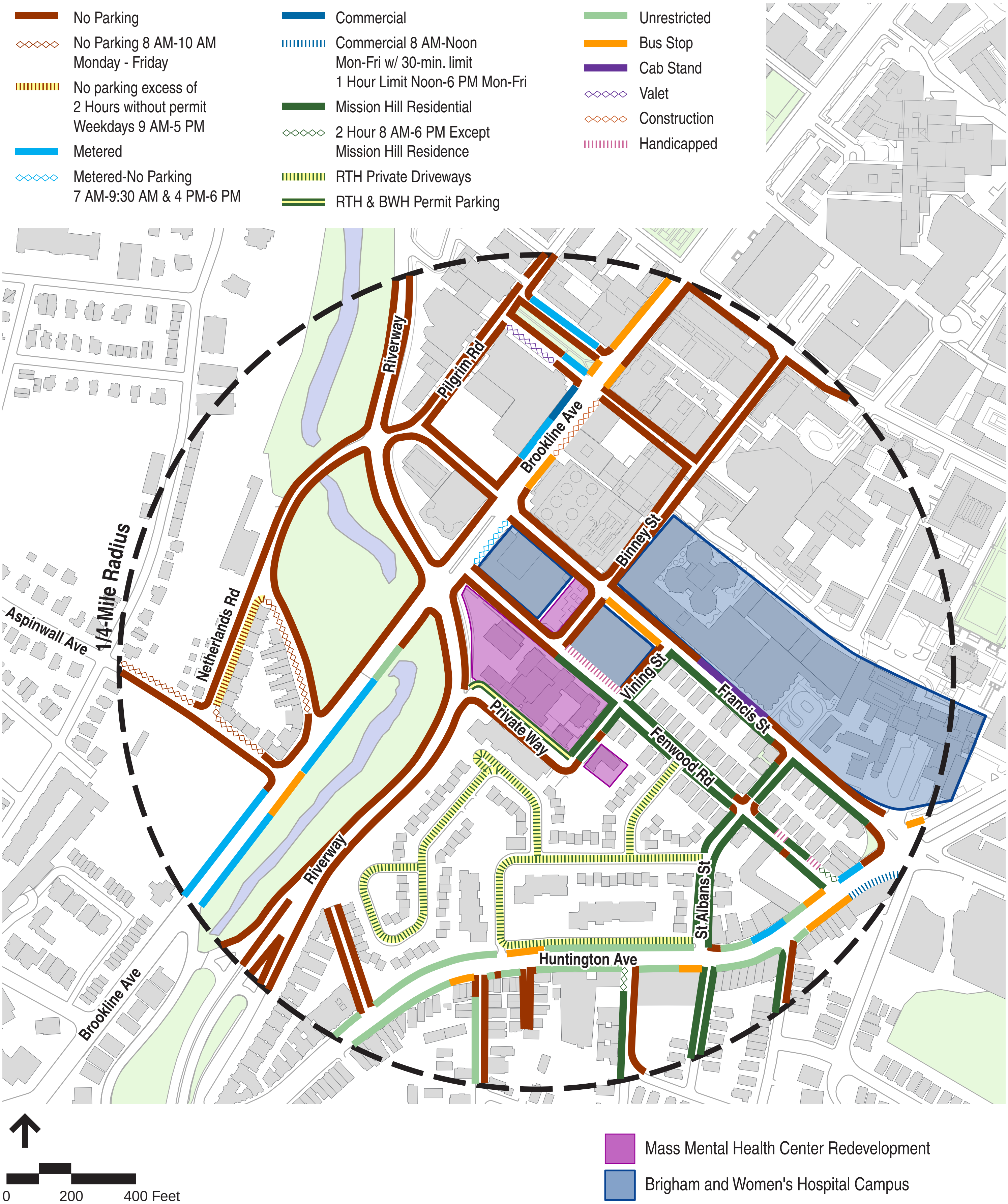


Massachusetts Mental Health Center Project Boston, Massachusetts

VHB *Vanasse Hangen Brustlin, Inc.*

Figure 3-11

Summary of On-Street Parking in the Study Area

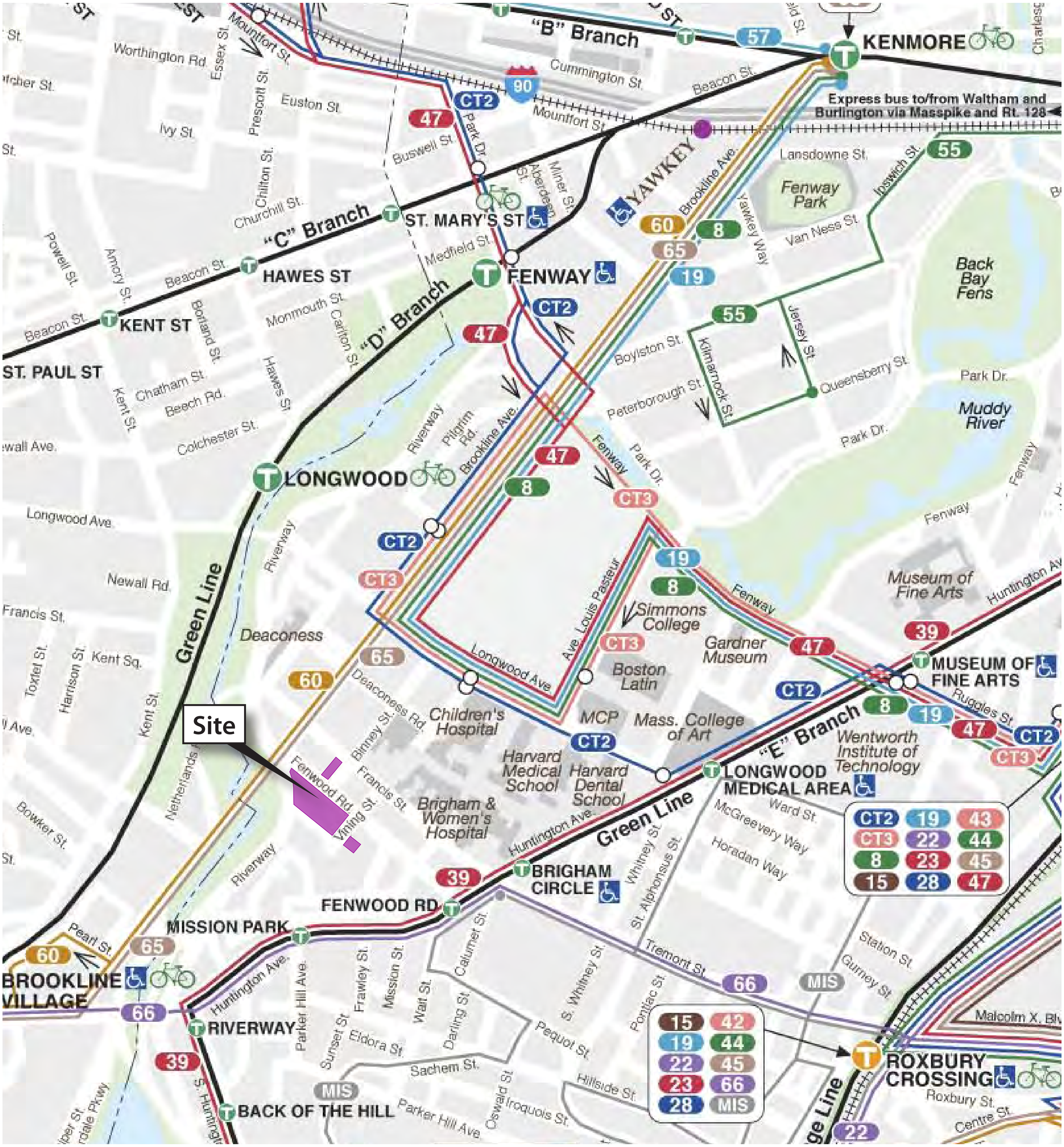
3.2.8 Public Transportation

The Project Site, situated at the crossroads of the LMA and the Mission Hill neighborhood, is well served by public transportation as shown in Figure 3-12. The Site is located between the Arborway (E Line) Branch and the Riverside Branch (D Line) of the MBTA Green Line. The Green Line connects to the North Station Commuter Rail Station. The Project Site is also close to the Orange Line which provides connections to Back Bay's Commuter Rail Station. MBTA services are described below:

- **Green Line D Branch** – The D (or Riverside) Branch of the Green Line light rail subway line runs on 5-minute headways during peak hours. The line runs above ground on a dedicated right-of-way from Riverside Station in Newton through multiple stations in Newton, Brookline, and Boston before turning north along the Riverway and joining the main below-grade Green Line east of Fenway Station. The main line continues through the Back Bay, Government Center, and North Station to its terminus at Lechmere Station. The D line stops closest to the Site are the Longwood and Brookline Village stops, both located west of the Muddy River. Passengers traveling to the Project Site would either walk half a mile from the Longwood stop, or transfer to MBTA bus routes 60 or 65 at Brookline Village.

- **Green Line E Branch** – The E (or Heath Street) Branch of the Green Line light rail subway line runs on 9-minute headways during peak hours. The line originates at Heath Street Station and runs east at grade within the median of Huntington Avenue. Southwest of Massachusetts Avenue, the line descends below grade to serve Symphony and Prudential stations before joining the main Green Line (described previously in the D Branch section) at Copley. The Project Site is served by the line's Brigham Circle and Fenwood Street stops which are located approximately ¼-mile from the Project Site.

- **Orange Line** – The Orange Line heavy rail subway line runs on 5-minute headways during peak hours, using 6-car trains. From north to south, the line runs from Oak Grove Station in Malden through Medford, Charlestown, downtown Boston, the South End, and Roxbury, before reaching Forest Hills Station in Jamaica Plain. The Orange Line connects with the Green Line and with all northern commuter rail lines at North Station, with the Green Line at Haymarket, with the Blue Line at State Street, and with the Red Line at Downtown Crossing. It connects with all northern commuter rail lines at North Station. Orange Line passengers traveling to the Project Site would either walk approximately one mile from Roxbury Crossing Station or take the MASCO Ruggles Express shuttle service from Ruggles Station to the LMA.



Source: MBTA.com (2009)

0 300 600 Feet

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Figure 3-12
Public Transportation

The MBTA also operates eight bus routes that provide service within one-half mile of the Project Site:

- **Crosstown 2 (CT2)** bus route operates between Sullivan Square Station on the Orange Line and Ruggles Station on the Orange Line.
- **Crosstown 3 (CT3)** bus route operates between Brookline Avenue at BIDMC East Campus and Andrew Square Station on the Red Line Station in Dorchester.
- **Route 8** operates between Kenmore Square and UMass Boston, with high-frequency service between Kenmore Square and the Ruggles Street MBTA Orange Line/Commuter Rail Station during peak commuter periods.
- **Route 39** provides service between the Forest Hills Station on the Orange Line and Back Bay Station on the Orange Line.
- **Route 47** provides service between Central Square Station on the Red Line and Broadway Station on the Red Line via Ruggles Street Station on the Orange Line.
- **Route 60** provides service between Chestnut Hill in Newton and Kenmore Square via Brookline Village Station on the Green Line D Branch.
- **Route 65** provides service between Brighton Center and Kenmore Square via Washington Street Station on the Green Line B Branch, Washington Square Station on the Green Line C Branch, and Brookline Village Station on the Green Line D Branch.
- **Route 66** provides service between Harvard Square in Cambridge and Dudley Station.

The headways provided by the MBTA's Ridership and Service Statistics, Eleventh Edition 2007 Revised are shown in Table 3-15.

Table 3-15 MBTA Bus Service

Route	Origin	Destination	AM Peak Hour Headways	PM Peak Hour Headways
D Line	Riverside	Government Center	5	5
E Line	Heath Street	Lechmere Station	5	5
CT2	Sullivan Station	Ruggles Station	20	20
CT3	Beth Israel Deaconess	Andrew Station	15	20
8	UMass/Harbor Point	Kenmore Station	13	20

Table 3-15 MBTA Bus Service (Continued)

Route	Origin	Destination	AM Peak Hour Headways	PM Peak Hour Headways
19	Fields Corner Station	Kenmore Station or Ruggles Station	12	20
39	Forest Hills	Back Bay Station	6	6
47	Central Square	Broadway Station	22	20
60	Chestnut Hill	Kenmore Station	24	27
65	Brighton Center	Kenmore Station	14	24
66	Harvard Square	Dudley Square Station	9	10

Source: Ridership and Service Statistics, Eleventh Edition 2007 Revised

3.2.8.1 MASCO Transit Services

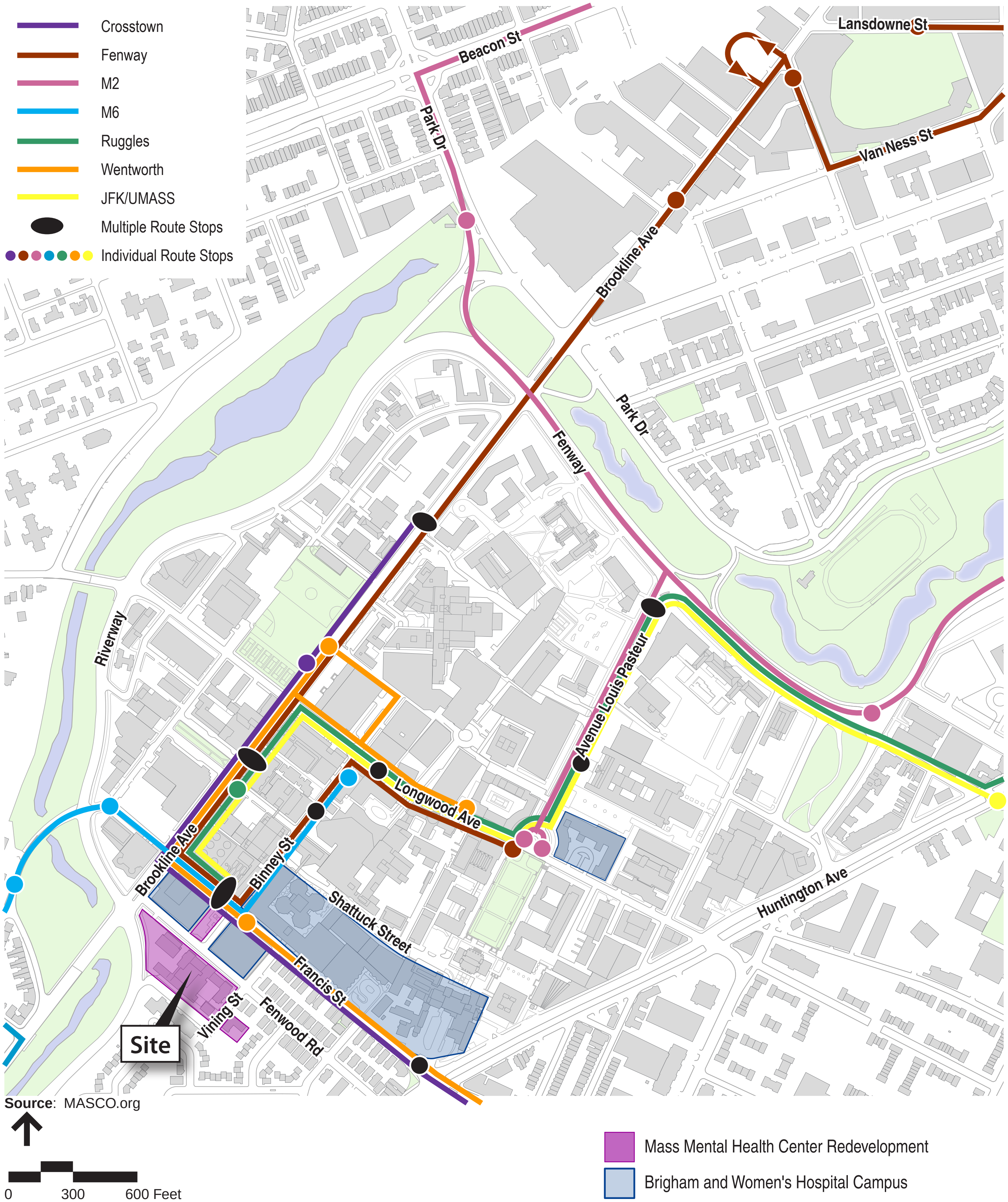
In addition to MBTA bus routes, MASCO operates ten shuttle routes that provide service within one-half mile of the Project Site as shown in Figure 3-13 and 3-14. The MASCO shuttles are intended for the use of employees of MASCO member institutions and are not generally available to residents to visitors. These services include:

- **Fenway Park and Ride Shuttle** connecting the LMA with the Boylston Street Lot and the Kenmore Lot. The shuttle runs Monday thru Friday without any Weekend or Holiday service. The morning service runs from Landsdowne Street to the LMA between the hours of 5:30 AM and 10:00 AM. The Midday service operates between the hours of 10:15 AM and 2:00 PM from D'Angelo's to the LMA. The evening service operates between Deaconess Road and the Fenway lots from 2:30 PM to 9:30 PM.

- **M2 Cambridge Shuttle** connects the LMA to Harvard Square, with interim stops along Mass Ave at Putnam Street, Bay Street, Central Square, MIT, and Beacon Street, the Fenway and Kenmore MBTA station as well as Simmons and Vanderbilt Hall.

- **M6 Chestnut Hill Shuttle** connects the LMA with the Mishkan Tefila Parking Lot in Chestnut Hill (Newton), making interim stops at 850 Boylston, Lowry, Brigham & Women's Hospital, Dana-Faber Cancer Institute, Children's Hospital Boston, and the BIDMC Shapiro Building. BWH is served by a stop at the intersection of Francis and Binney streets. The shuttle runs Monday to Friday from 5:40 AM to 9:00 AM (to the LMA) and from 2:30 PM to 8:30 PM (to Chestnut Hill).

- **Ruggles Express -** MASCO's Ruggles Express provides continuous service between the MBTA's Ruggles Station and the LMA throughout the day, on 8-minute headways during peak hours and 30-minute headways midday. At Ruggles Station,



Source: MASCO.org

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Figure 3-13

MASCO AM Shuttle Bus Services

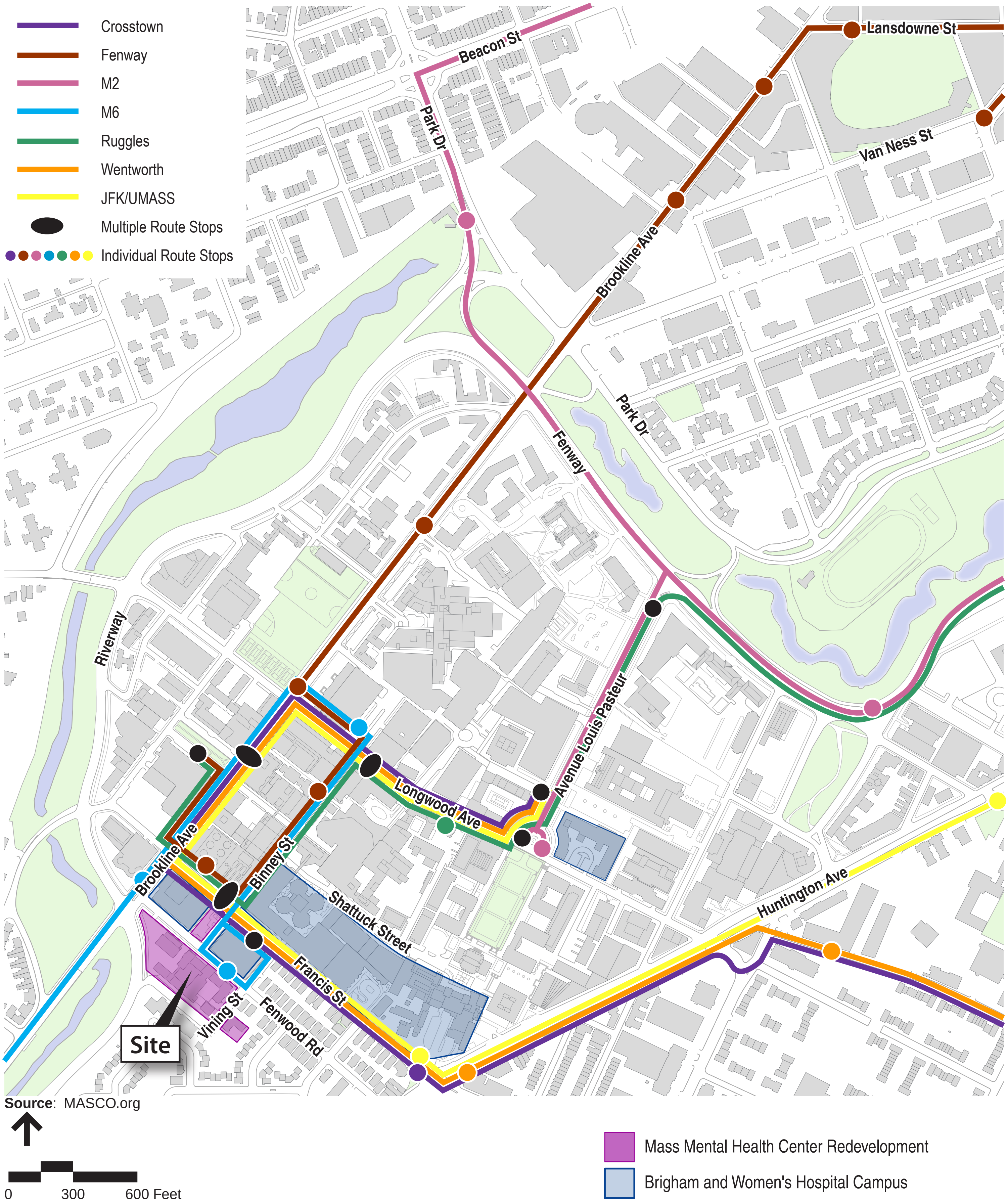

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Figure 3-14

MASCO PM Shuttle Bus Services

- passengers can connect to the Orange Line subway and the Needham, Franklin, Attleboro/Providence and Stoughton commuter rail lines in addition to other buses. BWH is served by a stop at the intersection of Francis and Binney Streets. The shuttle runs Monday to Friday from 5:30 AM to 9:00 PM.

- **JFK/UMass Shuttle -** MASCO initiated the JFK/UMass Shuttle service on February 19, 2002. The service connects the LMA and the JFK/UMass Station on the MBTA's Red Line. The stops serving BWH are at 75 Francis Street and at Brigham Circle. The JFK/UMass Shuttle runs Monday to Friday from 5:55 AM to 9:30 AM and from 3:15 PM to 8:10 PM.

- **Centre Street/Wentworth Park and Ride Shuttle** connects the LMA and the Centre Street and Wentworth lot.

- **Crosstown Shuttle** connects the LMA and the Crosstown Center Parking Facility. The morning service operates between the hours of 5:30 AM and 10:20 AM, while the evening service operates between the hours of 2:25 PM and 8:55 PM. The stops include Vanderbilt Hall, COOP MBTA Stop, Joslin Park, 70 Francis, the corner of Huntington Street and Tremont Street, and the Crosstown Garage.

- **Midday Shuttle -** MASCO operates a mid-day shuttle on 40-minute headways, connecting the LMA to all of its satellite parking facilities between 10:12 AM and 2:43 PM, when most other MASCO shuttle services are not running. Stops on Francis Street at Binney Street and at Brigham Circle serve BWH.

3.3 Evaluation Of Long-Term Transportation Impacts

This section describes the future transportation infrastructure in the LMA and Mission Hill including the impacts of the Project. Included in this section are a summary of area transportation infrastructure improvements that are currently planned, are under design, or are under construction by area institutions/developers, the City of Boston, the Commonwealth of Massachusetts, the Massachusetts Bay Transportation Authority (MBTA), or by MASCO.

This section also includes a detailed summary of the development of both 2016 and 2021 future traffic conditions with and without the Project. The development and evaluation of the 2016 and 2021 No Build and Build Conditions has been conducted to help identify additional roadway, pedestrian, and transit improvements that may be appropriate to mitigate identified transportation impacts generated by the Project and the BWH 2010 IMP and help to improve the transportation infrastructure that serves the LMA.

3.3.1 Area Transportation Improvements

The LMA and Mission Hill are areas of the City with a concentration of both pedestrian and vehicular traffic, as well as a multitude of reconstruction projects. There are many transportation infrastructure initiatives that are currently being put in place in connection with other nearby development projects by the City of Boston, Commonwealth of Massachusetts, the MBTA, MASCO, and others. These are described in detail below.

3.3.1.1 Area Development Projects

There are currently seven approved or planned development projects that are expected to have an influence on future year peak hour traffic volumes on study area roadways and intersections. Their anticipated transportation impacts have been included within the analyses of the 2016 and 2021 No Build Condition. A description of each planned project and/or master plan is provided below.

- Children's Hospital Boston's Main Building Expansion includes an addition to the CHB Main Building along Binney Street. This building will include 112,000 square feet of hospital space (105,000 net new square feet) in a 14-story tower. The existing 7,000 sf temporary building on Binney Street will be demolished to accommodate construction logistics and lay-down space, allowing for the implementation of the expansion to the Main Building. No new parking will be provided in connection with this Project.

- Dana-Farber Cancer Institute is currently constructing a 13-story, 275,000 SF clinical and research facility – which will be named the Yawkey Center for Cancer Care. When complete, this state-of-the-art facility will include much needed clinical programs and support space, a new main lobby, retail space, patient and family services, and a below grade 460 space parking garage (with 217 "net new" parking spaces). This Project is expected to be complete in 2011.

- Wentworth Institute of Technology Institutional Master Plan. The Wentworth Institute of Technology plans a 600-bed residential dormitory on its existing Boston campus. The purpose of the Project is to provide quality on-campus housing for some of its existing students who currently must secure their own off-campus housing. With completion of this Project, Wentworth would possess 1,500 on-campus beds for its daytime student population of approximately 3,000 (or half of its total daytime students). No new parking will be constructed as part of this Project. It is anticipated that this Project will not have a noticeable impact on future peak hour traffic activity within the LMA and is therefore not included in the No Build networks.

- **Northeastern University** currently proposes the construction of two residential buildings on the existing campus. The first Project, Residence Hall I, will consist of 1,200 residential units, office space, retail space and a full service dining facility totaling 495,000 SF. The second development, Residence Hall K, will contain 600 residential units and approximately 200,000 SF of space. The development is shifting 1,800 students from off-campus to on-campus. As a result, fewer vehicles will be traveling in the study area as a result of these two residential buildings. Reductions for Northeastern University trips were not applied to the future No Build networks.

- **Longwood Center,** previously called the Joslin Diabetes Center, includes a reduction of gross floor area from the approximately 1 million gsf originally proposed to approximately 518,000 gsf. In addition, the Project contemplates a parking supply of 357 parking spaces. The transportation analysis for the Project, filed in 2002, analyzed a larger building program than the currently proposed plan. However, the original analysis was added to the transportation network as a conservative estimate of the anticipated traffic associated with this Project. This Project is currently on hold, but has been assumed to be complete and fully occupied under both 2016 and 2021 future transportation conditions in this study.

- **Longwood Research Institute** is a 440,000 SF state-of-the-art research and laboratory facility that is planned to include 330 underground parking spaces. Construction of the LRI by Children's Hospital Boston is expected to commence in the forthcoming few years – although a specific date of commencement is not known. For this study, we have assumed that this Project would be open and fully occupied by 2016. (Note: this Project was formerly known as the Longwood North Research Center when it was originally approved.)

- **Massachusetts College of Pharmacy and Health Sciences** officially opened the Richard E. Griffin Academic Center, a new six-story academic building at 670 Huntington Avenue in April 2009. This Project includes 49,700 of academic space including a 250-seat theater. It is unclear if the building was fully-occupied at the time of the traffic data collection so this Project's traffic estimates were added to the No Build Condition to be conservative.

- **Brigham Green Parking and Enhancement Project** includes the construction of a 400-space underground garage (249 net new parking spaces) in front of the existing Peter Bent Building at 15 Francis Street. This parking garage will be connected internally to the BWH campus at the existing patient drop-off area located at 45 Francis Street to reduce traffic on Francis Street. This construction will allow for landscaped open space above the parking facility at grade. Current planning calls for the completion of the previously-approved Brigham Green Enhancement and

Parking project prior to the start of construction of the Brigham and Women's Building; therefore, traffic associated with the Project was added to the 2021 No Build and Build Condition analysis only.

3.3.1.2 Development-Related Infrastructure Improvements

Over the next several years, many important transportation improvement and mitigation actions are planned to be put in place to support transportation access to and from the LMA. This section lists those improvements that are expected to be constructed and fully operational in connection with other area development projects under the 2016 and 2021 No Build and Build Conditions.

- **BIDMC East Campus Main Entrance/Brookline Avenue Intersection** will be improved in connection with Children's Hospital's Longwood Research Institute (LRI) Project. This improvement includes the modification of Brookline Avenue to a 5-lane cross-section to allow for the creation of an exclusive left-turn lane at the signalized entrance into the BIDMC East Campus.

- **BIDMC Binney Connector and South Service Road Improvements** include the creation of a two-way access open to public travel between the BIDMC East Campus Main entrance on Brookline Avenue and Binney Street and an additional one-way connection to Blackfan Street. These improvements will be put in place in connection with the BIDMC Institutional Master Plan and Children's Hospital's LRI Project.

- **Pilgrim Road Corridor Improvements** include modifying of Pilgrim Road into a two-way street between Longwood Avenue and Joslin Place in connection with the implementation of the development projects proposed as part of the Longwood Center development. This improvement will help to reduce traffic volumes at the Brookline Avenue/Deaconess Road intersection.

- **Longwood Avenue/Brookline Avenue Improvements** include the modification of existing corner radii at selected corners of this intersection to help provide for more efficient turning movements by trucks. This improvement is planned as part of the Longwood Center Project.

3.3.1.3 MASCO Initiatives

BWH is a proactive member of MASCO, the area's leader in developing and promoting transportation and pedestrian improvements for the LMA. The following section summarizes major MASCO initiatives in the LMA.

- **Area Traffic Signal Improvements**. Over the past three years, MASCO has undertaken an extensive evaluation and repair plan for many of the LMA's signalized intersections. The program has focused on identifying and delineating operational deficiencies and making modifications to signal timings and phasing, loop detectors, pedestrian push buttons, optical programming, and interconnect/communications issues. In 2005, MASCO improved signal conditions at several locations, including Longwood Avenue intersections with Blackfan Circle, Binney Street, Chapel Street, and Kent Street. MASCO also repaired a master controller at Brookline Avenue and Francis Street, which controls operations at several important LMA locations when the BTD's main Universal Traffic Control System (UTCS) controller occasionally goes off-line. In 2007, MASCO completed similar repairs along the Ruggles Street and Melnea Cass Boulevard corridors as a means to improve traffic flow and pedestrian movements into and out of the LMA. In 2008, MASCO led an initiative to identify and correct deficiencies along Boylston Street in the Fenway.

- Ultra-Low Sulfur Diesel Fuel (ULSD) Bus Program, MASCO has taken a first-in-the-country stand to reduce pollution from the bus fleet servicing the LMA. MASCO's fleet of shuttle buses carry over two million passengers annually, eliminating pollution from individual car trips by staff and visitors. MASCO fitted all its buses with emissions technology that reduces particulate pollution by 90 percent.

- Thermoplastic Pavement Marking Program at key pedestrian crossings and travel lanes. Thermoplastic marking have a longer life cycle than normal painted markings, and are more clearly visible during the evening and during inclement weather conditions. MASCO proactively maintains all LMA crosswalks in close coordination with the City of Boston.

- LMA Sign Program, which updates signs to clearly highlight institutional destinations and construction routes. This program is targeted at improving circulation in and around the LMA for patients, students and visitors, and reinforces the use of primary area roadways over local (often residential) streets.

- Patient/Visitor Access Program, which provides MBTA Charlie Cards free or at a discount to patients who are able to use MBTA services.

- Targeted Ticket and Towing Program, under which a Boston Police officer is dispatched to ticket and arrange for towing of illegally parked vehicles during peak traffic hours.

- Pedestrian/Biking Incentive Program, under which MASCO provides bike racks at strategic locations throughout the LMA.

- MASCO Bus Shelters are maintained throughout the LMA to better serve area employees. MASCO recently installed a shelter on Longwood Avenue in front of Children's Hospital Boston in connection with intersection improvements at Blackfan Circle.

3.3.1.4 Riverway Right-Turn Lane

For over 20 years, key LMA stakeholders have identified the northbound movement on the Riverway at its intersection with Brookline Avenue as a location providing inadequate capacity to support typical traffic demand on that specific approach. Under its current configuration, the approach operates with two travel lanes: a shared left-turn/through lane and a shared through/right-turn lane. The right-lane is signed in advance as a right-turn only lane; however, it operates as a shared through/right turn lane since the left/thru lane is often blocked by left-turning vehicles.

The issue at this location is that there is a substantial demand of motorists that want to turn right at this location, and this movement impacts the ability to manage traffic that wants to continue inbound on the Riverway (through traffic). The installation of a dedicated right-turn lane on the Riverway's northbound approach to Brookline Avenue was first envisioned during planning efforts by MASCO in the mid-1980's. This possible improvement was highlighted again recently in the BRA's 2003 LMA Interim Guidelines as a potential public benefit to the area to reduce auto congestion, vehicle emissions, and reduce the vehicle queuing along the Riverway. Long-term planning efforts have discussed the potential benefits of adding an additional lane to process the heavy right-turn demands into the LMA – particularly during the weekday morning peak hours. Benefits of such an improvement include:

- Reducing traffic congestion on the Riverway - particularly during the morning peak commuter period;
- Providing storage for the right-turn traffic to allow through traffic to be processed more efficiently at this intersection;
- Reduce overall vehicle delay at the Brookline Avenue/Riverway intersection; and
- Provides an opportunity to upgrade the entire intersection and make it comply with ADA-accessibility requirements.

With the benefits of providing an additional turn lane there are some challenges to implementation. These primarily include:

- Loss of a limited amount of green space along the Riverway;
- Challenges of permitting an additional travel lane along a state-owned parkway that is located in an historic protection area ; and
- Necessary funding.

Since the timing, permitting, and funding for this Project have not been established, this Project is not included in the No Build traffic model of this study. The Project has been designed so as not to preclude the future implementation of this traffic improvement by others. However, this improvement is not part of the MMHC Project, nor is this traffic improvement needed as a result of project-generated traffic demands.

A detailed analysis of this vision, as requested in the BRA Scoping Determination, is included later in this chapter.

3.3.1.5 MBTA Urban Ring Project

The Urban Ring Project is a phased set of regional transit improvements that are proposed within a defined corridor around Metropolitan Boston. The Project corridor forms a circumferential loop that passes through Boston, Brookline, Cambridge, Chelsea, Everett, Medford and Somerville. Phase 1 has already been implemented and includes the circumferential transit services in the area via its existing Crosstown bus routes (CT1, CT2 and CT3).

The Massachusetts Executive Office of Transportation filed a Notice of Project Change for Phase 2 of the Urban Ring Project on June 30, 2009. Proposals for surface routing options in the Fenway/LMA area in the previously filed RDEIR/DEIS process were strongly opposed by area stakeholders; therefore a lesser proposal which was not part of the NPC filing is currently being analyzed.

As previously proposed, early action items would include Albany Street bus lanes in Cambridge, Mountfort Street corridor improvements in Brookline and Boston, Ruggles Station improvements, Melnea Cass Boulevard center median busway, bus lanes on Albany Street, Massachusetts Avenue, and potentially on Columbia Point in Boston, and interim surface improvements in the Fenway/LMA section of the corridor.

Transit service improvements in the area could possibly be included in the early action items. These transit improvements would include upgraded traffic signals capable of transit signal priority, transit signal priority in major bus corridors, and amenities such as upgraded bus shelters and the provision of real-time traveler information. In addition, EOT will continue to develop surface routing options in order to accommodate the major transit demand in the area.

The Urban Ring Phase 2 alignment through the Fenway/LMA area proposed in the RDEIR/DEIS also entails a new bus tunnel between the vicinity of Landmark Center and Ruggles Station. The tunnel faces major environmental, engineering, design, construction, and abutter impact issues as well as financial obstacles that have prevented EOT from committing to it at this point.

3.3.2 2016 and 2021 No Build Condition

The 2016 and 2021 No Build Condition were developed and analyzed to evaluate future transportation conditions in the study area, such as background traffic growth and site-specific traffic growth, without taking into consideration the Project construction. These conditions also include planned parking management changes at BWH and the Brigham Green Project which will occur independently of the Project.

A four-step process has been utilized to estimate the increases in traffic activity in the Project study area under the No Build Condition as discussed below.

3.3.2.1 Step 1 - Background Growth

An annual growth rate of 0.5 percent per year was applied to the 2009 Existing Condition traffic volumes to increase background traffic to the 2016 and 2021 forecast years. The 0.5 percent is consistent with the rate used for several other recently approved LMA development projects.

Traffic counts in the area show that traffic volumes in the LMA have actually been generally stable or decreasing during the peak hours in recent years. A summary of historic traffic volumes in the area are shown in Table 3-16. However, to be conservative, 0.5 percent per year was applied to the baseline traffic volumes.

Table 3-16 Peak Hour Intersection Volume Comparison (Entering Vehicles)

	AM Peak			PM Peak		
Intersection	2002	2006/ 2007	2009	2002	2006/ 2007	2009
Brookline Ave/Francis St	2,550	2,310	2,153	2,820	2,273	2,075
Francis Street/Vining St	805	892	827	980	836	793
Brigham Circle	2,280	1,785	2,044	2,800	2,278	2,268

3.3.2.2 Step 2 - Site-Specific Growth

The following projects have been included in the 2016 and 2021 No Build Condition due to anticipated site-specific background traffic growth:

- Children's Hospital Boston Main Building Expansion
- Dana-Farber Cancer Institute Yawkey Center for Cancer Care
- Wentworth Institute of Technology Institutional Master Plan
- Northeastern University

- Longwood Center
- Longwood Research Institute
- Massachusetts College of Pharmacy
- Brigham Green Parking and Enhancement Project (2021 Only)

3.3.2.3 Step 3 – 2016 Parking Management Changes

In October 2009 MASCO's existing lease at the Servicenter Complex expired. BWH now uses the Servicenter Complex for patient self-parking as discussed previously. This change has allowed several parking management changes on the BWH campus including the following:

- BWH patients are directed to park at the Servicenter Complex instead of the ASB II garage located at 45 Francis Street.
- BWH is in the process of relocating its valet parking from the Mission Park Garage to the ASB II garage located at 45 Francis Street.
- 98 employees who previously parked at the MASCO Garage on Longwood Avenue and 70 employees who used the Servicenter Complex were relocated to the Mission Park Garage.

Trips generated by these users were redistributed within the traffic networks to reflect the future operations at the BWH. The primary purpose of this action was to substantially reduce the amount of BWH patient valet traffic that travels on Fenwood Road (to access the Mission Park Garage). This action helps to reduce hospital-generated traffic in the adjacent residential neighborhood.

Figures 3-15 thru 3-16 illustrate the morning and evening peak hour traffic volume networks for the 2016 No Build Condition.

3.3.2.4 Step 4 – 2021 Brigham Green Project

Current planning calls for the completion of the previously-approved Brigham Green Enhancement and Parking project prior to the start of construction of the Brigham and Women's Building. This previously approved project, located at 15 Francis Street, includes the construction of 400 (249 net-new) below-grade parking spaces. This space count includes the valet parking which was relocated to the MMHC Site from the 70 Francis Street Site during the construction of the Shapiro Building. With the completion of the Brigham Green Project, the valet spaces at the MMHC Site will move to the Brigham Green garage. All spaces will be dedicated for BWH patients and visitors only.

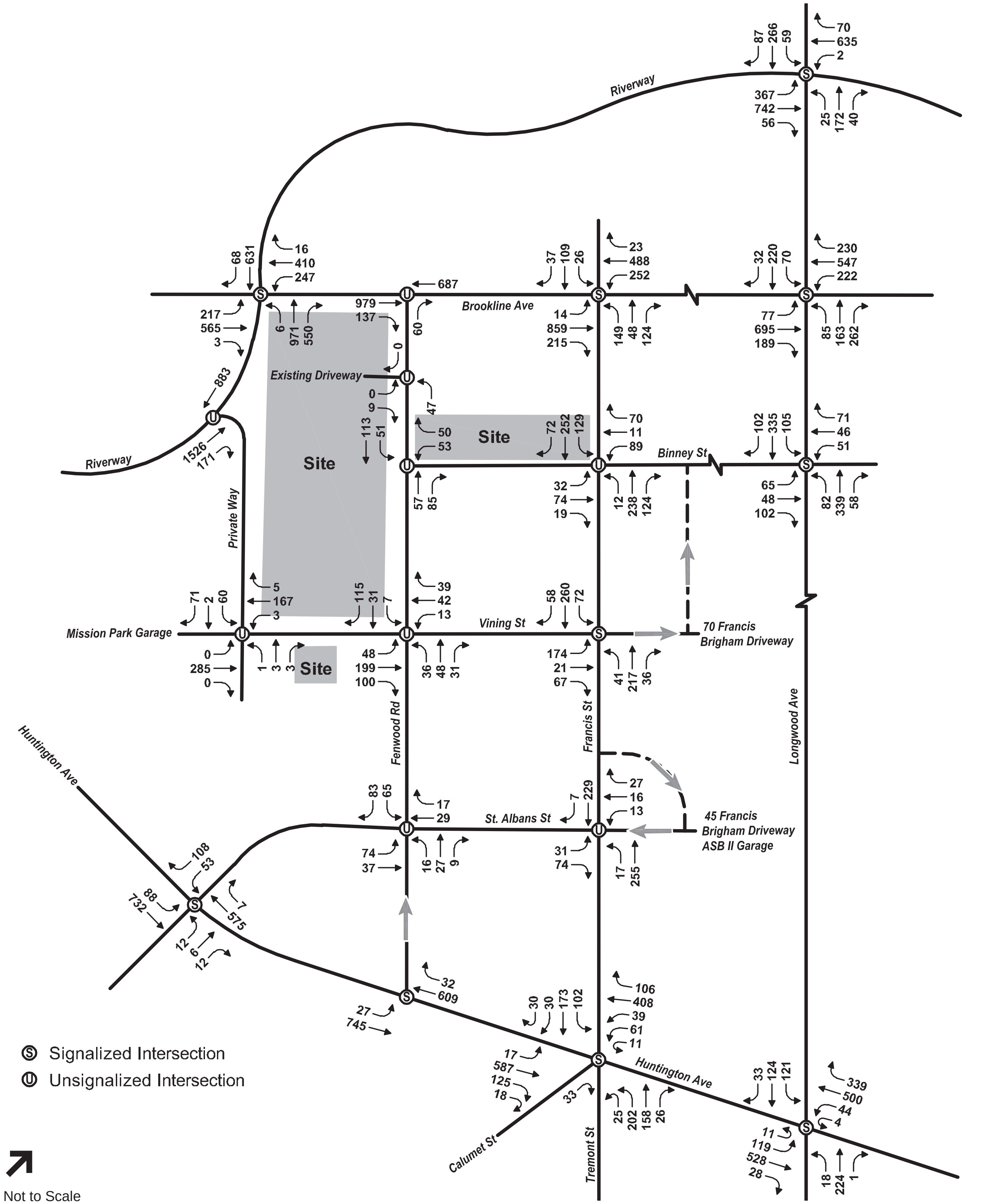

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Figure 3-15

2016 No-Build Traffic Volumes AM Peak Hour (7:15 AM - 8:15 AM)

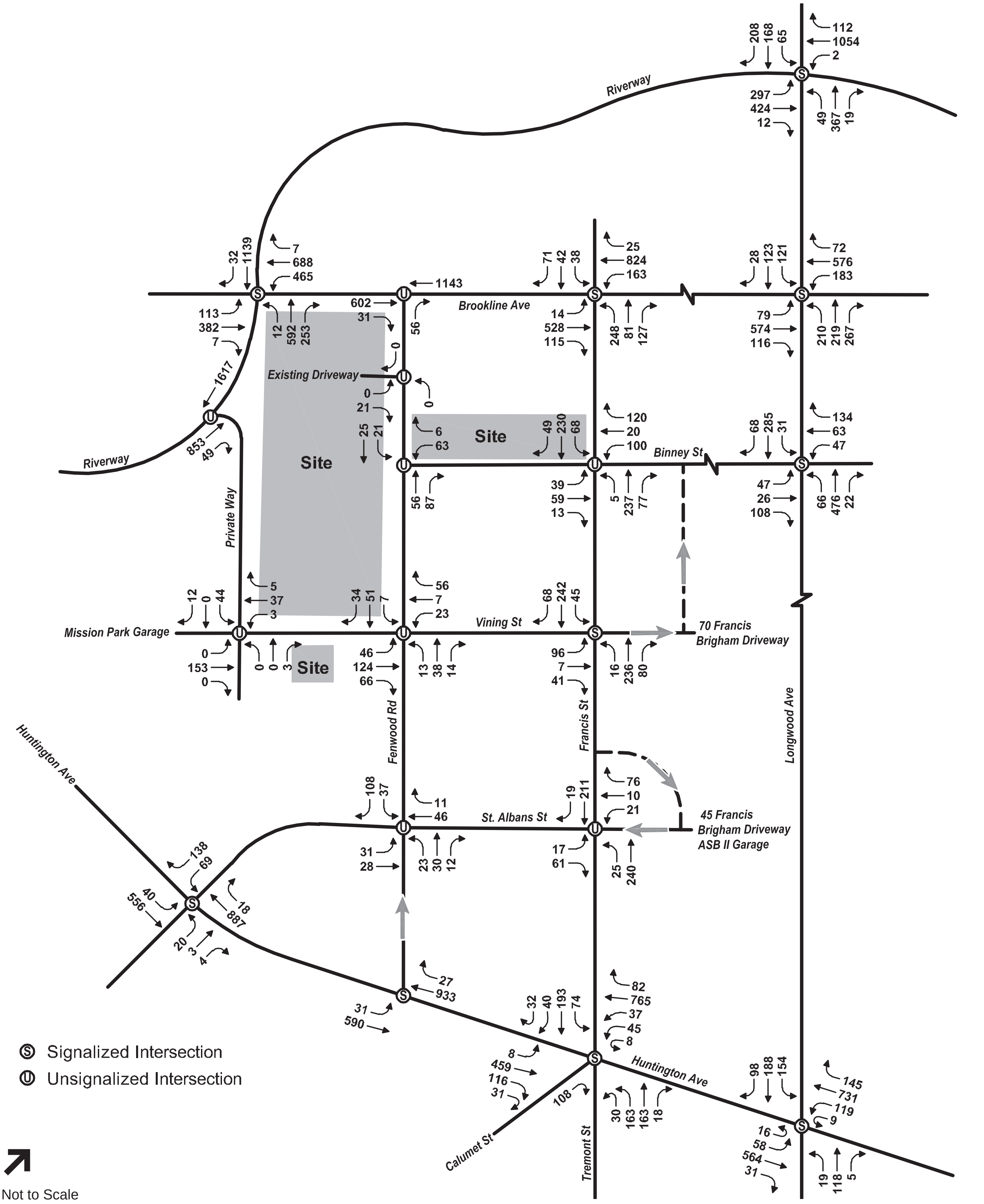

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Figure 3-16

2016 No-Build Traffic Volumes PM Peak Hour (4:45 PM - 5:45 PM)

Project generated trips for the Brigham Green Project were included in the 2021 No Build Condition analysis in addition to the projects and background growth previously discussed. These trips were taken from the 70 Francis Street/Brigham Green Enhancement and Parking DPIR/DEIR filed in August 2004. Figures 3-17 thru 3-18 illustrate the morning and evening peak hour traffic volume networks for the 2021 No Build Condition.

3.3.3 2016 Phase 1 Build and 2021 Full Build Conditions

As contemplated, the Project will be built in phases. For purposes of the transportation study, the first phase, Phase 1, will include the construction of the Binney Street Building and the Partial Hospital/Fenwood Inn which will both be occupied by DMH. Parking will be provided at the Main MMHC Site for 82 vehicles – a reduction from the 163 spaces that are currently provided on-site today. The second phase, Full Build, includes the Brigham and Women's Building and the Residential Building.

Under the Full Build Condition, DMH will move from the Binney Street Building to a portion of the Brigham and Women's Building and BWH will backfill the space in the Binney Street Building. The Brigham and Women's Building will include 406 parking spaces below grade to meet the new demands created by DMH, BWH, and the new residents (who will actually park in Mission Park Garage – requiring some BWH employees to be relocated to the new Garage). The Phase 1 Build and Full Build program is summarized in Table 3-17 below.

Table 3-17 Project Building Program Summary

	2016 Phase 1 Build	2021 Full Build
Residential Building	-	197,750 sf
Brigham and Women's Building	-	
DMH	-	52,750 sf
BWH	-	305,920 sf
Total Brigham and Women's Building	-	358,670 sf
Binney Street Building	56,540 sf	56,540 sf
Partial Hospital/Fenwood Inn	21,000 sf	21,000 sf
Total	**77,540 sf**	**633,960 sf**
Parking	**76 spaces**	**406 spaces**

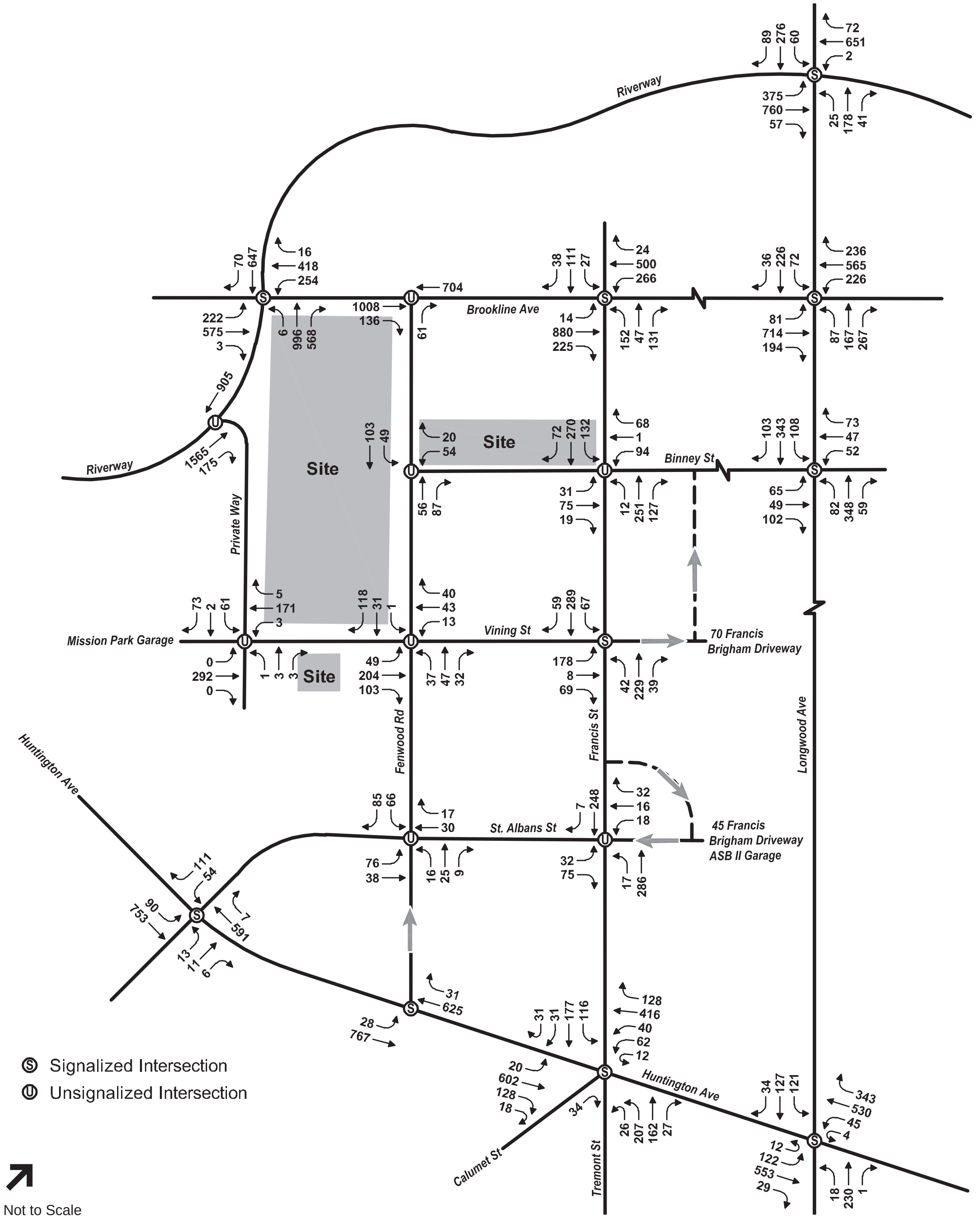

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Figure 3-17

2021 No-Build Traffic Volumes AM Peak Hour (7:15 AM - 8:15 AM)

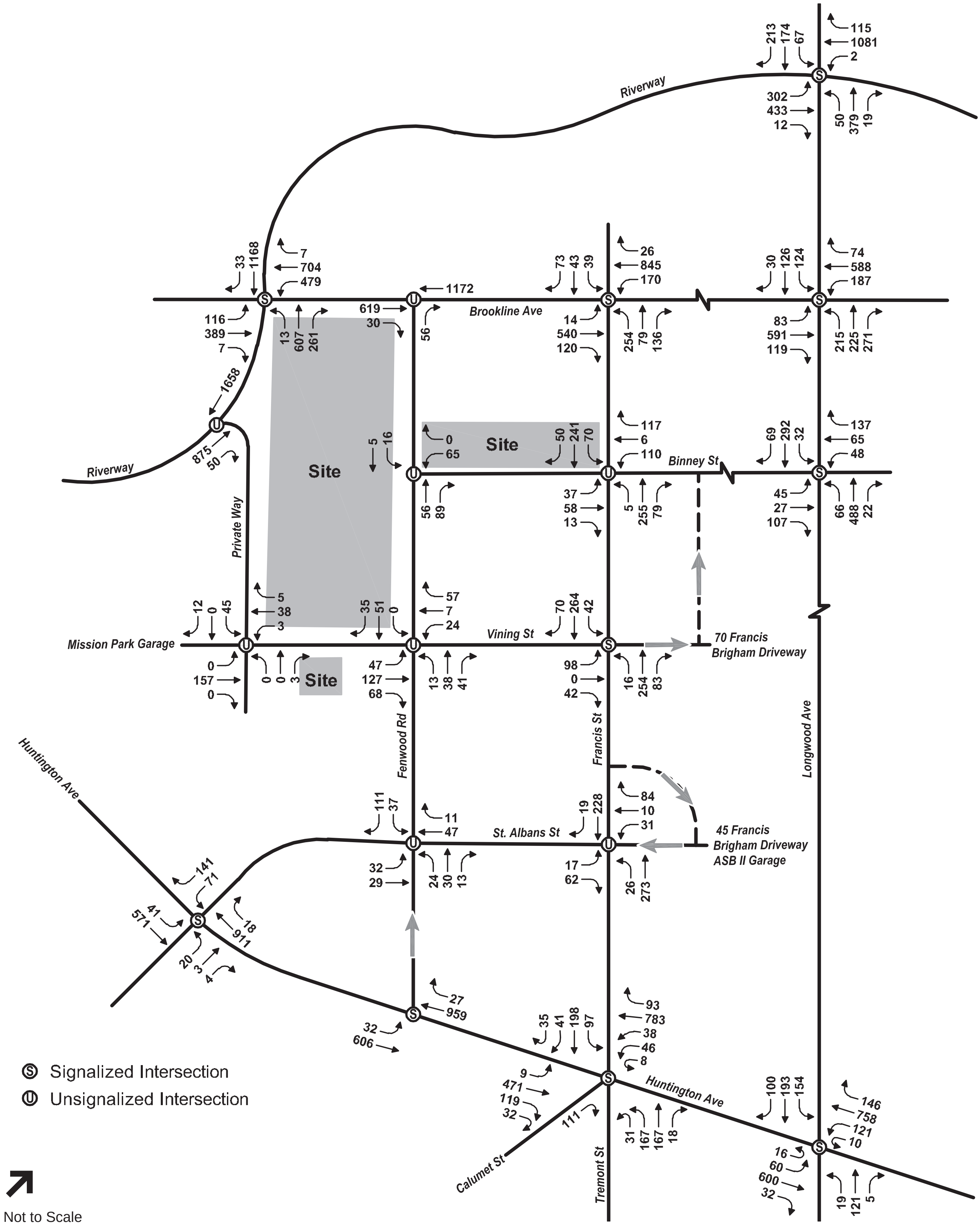

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Figure 3-18

2021 No-Build Traffic Volumes PM Peak Hour (4:45 PM - 5:45 PM)

2016 Phase 1 Build Condition

The 2016 Phase 1 Build Condition was developed in order to evaluate future transportation conditions in the study area with the proposed Phase 1 construction. This condition includes construction of the following:

- The Binney Street Building with 56,540 sf to be used by DMH for the Phase 1 interim condition only. As planned, 39,810 sf will be used as office space and the remaining 16,730 sf will be used as clinical space. To support these new uses, 50 surface spaces will be provided on the Main MMHC Site for DMH. These spaces will be accessed via the private way.

- The Partial Hospital/Fenwood Inn which will provide 21,000 sf to be used by DMH. The building will include a 42 bed transitional shelter program for homeless, mentally ill men and women, a five bed crisis stabilization unit and 8,260 sf of partial hospital and outpatient treatment space. Parking will be accommodated within the 50 surface spaces provided on the Main MMHC Site.

- The Main MMHC Site will be used for surface parking for DMH (50 spaces) and residents (16 spaces) that park on Site today. In addition, BWH will reserve 10 spaces for contractors to reduce parking impacts in the neighborhood and 6 spaces for oversize patient vehicles[6]. Overall BWH's parking will be reduced from 147 spaces to 16 parking spaces during this condition, in which BWH will also discontinue valet operations on the Site. Patients currently parking on the Main MMHC Site were relocated to the Servicenter Complex during Phase 1 of this analysis. It anticipated that these vehicles will use the Servicenter Garage until the completion of the Brigham Green Project at which time they will be relocated to that Site.

The Phase 1 Build Condition takes into account the changes and growth established as part of the 2016 No Build Condition presented previously and also accounts for the changes that will occur with the Project, physically and in terms of transportation demand and operations. Valet trips currently on the Site were redistributed as self-park trips to the Servicenter Complex.

2021 Full Build Condition

The 2021 Full Build Condition includes the following changes from the Phase 1 Build Condition:

---

6 This contractor parking is for contractors serving the BWH campus not construction workers for the Project.

- Construction of the 358,670 sf Brigham and Women's Building on the Main MMHC Site. This building will provide 52,750 sf of space for DMH (36,020 sf office and 16,730 sf clinical). The remaining space will be used by BWH (152,960 sf office and 152,960 sf clinical). The building will provide 406 below grade parking spaces that will be accessed via the private way. DMH will vacate and be relocated to the new Brigham and Women's Building as described above. BWH will occupy the Binney Street Building and use 40,500 sf as office space and the remaining 16,040 sf as clinical space.

- The Residential Building will be constructed at the Main MMHC Site. The building will total 197,750 sf and provide up to 165 residential units.

In total, the Project will employ approximately 889 employees and treat an estimated 1,116 patients over the course of a typical day (of which 47 will use beds in the Partial Hospital/Fenwood Inn). The Project will also provide up to 165 residential units, most of which will be offered as affordable housing opportunities. Table 3-18 provides a summary of the estimated population for the BWH and DMH buildings.

Table 3-18 Estimated Daily BWH and DMH Population

	Employees	Visiting Patients	Total Population
Partial Hospital/Fenwood Inn	35	47*	82
Binney Street Building	169	109	278
Brigham and Women's Building	685	960	1,645
Total	**889**	**1,116**	**2,005**

Source: BWH
*47 Partial Hospital/Fenwood Inn patients are temporary residents.

3.3.3.1 Trip Generation

Table 3-19 summarizes existing vehicle activity on the Main MMHC Site on Fenwood Road during weekday peak periods. BWH uses will be discontinued under the Phase 1 Build and Full Build Conditions with the exception of 10 contractor spaces that will remain to reduce parking impacts in the neighborhood in Phase 1. The 16 residential spaces are located on the private way and will remain at the Main MMHC Site during the Phase 1 Build Condition.

Table 3-19 2009 Existing Condition Main MMHC Site Vehicle Trips

Time Period	Valet (104 spaces)	Contractor/ Employee (43 Spaces)	Residents (16 spaces)	Total
Morning Peak Hour				
Enter	27	16	2	45
Exit	12	12	1	25
Total	39	28	3	70
Evening Peak Hour				
Enter	13	8	2	23
Exit	19	11	2	32
Total	32	19	4	55
Daily	324	136	48	508

Source: Vehicle counts conducted by VHB, June 2007 and August 2009.

The residential trips associated with the 16 resident spaces provided on the Main MMHC Site today will remain during the Phase 1 Build Condition. Under the Full Build Condition these trips are relocated to the Mission Park Garage as discussed later in more detail.

3.3.3.1.1 Unadjusted Vehicle Trip Generation

Consistent with BTD guidelines, trips were estimated using the Institute of Transportation Engineers (ITE) Trip Generation Manual. The ITE manual yields 'unadjusted' vehicle trips meaning that these trips do not reflect alternative modes of transportation such as walking and public transportation. The most appropriate ITE land codes were used:

- LUC 220 (Apartments) – was used to estimate residential trips. The Project currently contemplates a mix of condominiums and apartments however, as a conservative estimate the apartment land use code was used since this category has a higher trip generation rate than condominiums.

- LUC 620 (Nursing Home) – was used to estimate trips to the Partial Hospital/Fenwood Inn. This land use code most closely reflects trips being made primarily by staff and employees providing full-time care.

- LUC 710 (Office) – was used to estimate trips to the Brigham and Women's Building and Binney Street Building where some office space will be provided.

- LUC 760 (Research and Development Center) – was used to estimate the BWH research and development space at the new Brigham and Women's Building.

- **LUC 610 (Hospital)** - was used to estimate trips associated with the new clinical space in the Brigham and Women's Building and the Binney Street Building. This land use code is the most closely related ITE data set.

Table 3-20 summarizes net new unadjusted ITE trips once existing trips are accounted for.

Table 3-20 Unadjusted Trip Generation*

	ITE Unadjusted Vehicle Trip Generation						
		AM Peak Hour			PM Peak Hour		
	Daily	Enter	Exit	Total	Enter	Exit	Total
Phase 1 Build Condition	988	80	20	100	23	76	99
Full Build Condition	6,518	437	161	618	178	425	603

**Trips are not adjusted for local mode share and do not take into account loss of existing parking on-site.*

3.3.3.1.2 Adjusted Vehicle Trip Generation

To account for alternative modes of transportation, mode splits were applied to the trip results presented in Table 3-20. The auto mode split includes all vehicle based trips including taxis. Mode splits for the area are based on BTD Guidelines and the BWH Rideshare Report is shown in Table 3-21.

Table 3-21 Peak Hour Mode Splits

Mode	BWH Employees	Zone 5 Work Trips	Zone 5 Residential Trips	Zone 5 All Purpose
Public Transit	50 %	33 %	17 %	42 %
Walk/Bike/Other	11 %	20 %	46 %	26 %
Automobile	39 %	47 %	37 %	42 %

Source: BTD Guidelines, Zone 5 and 2008 BWH DEP Rideshare Report

As shown, actual BWH employee vehicle mode shares are considerably less than the BTD Guidelines which were based on 2000 Census journey-to-work data. Of the 39 percent of employees that arrive to BWH via automobile, 6 percent carpool, and 1 percent vanpool. Only 32 percent of BWH employees drive alone. These mode shares were applied to the unadjusted office and R&D trip generation.

According to BWH, the majority of BWH patients travel to BWH via automobile due to illness/medical needs. Conversely, the majority of DMH patients are expected to be regular visitors and travel by public transportation.

BWH Campus Changes with Phase 1 Build and Full Build Conditions

As mentioned previously, the following changes will occur on the Main MMHC Site to accommodate the Phase 1 Build and Full Build Conditions. These changes, which affect traffic volumes, include:

- BWH's use of the Main MMHC Site for valet storage will be discontinued with the Phase 1 and Full Build construction. During the Phase 1 Condition, these vehicles will be temporarily relocated to the Servicenter Complex until completion of the Brigham Green Project.

- BWH will reduce the number of contractor parking spaces from 43 spaces at the Main MMHC Site to 10 spaces under the Phase 1 Build Condition. Upon Project completion these spaces are eliminated and visitors will be encouraged to park in the public parking supply in the Servicenter Complex.

- The 16 resident spaces currently provided on the Main MMHC Site at the private way will be maintained in the Phase 1 Build surface parking lot. Under the Full Build Condition, these residents will be relocated to the Mission Park Garage and will result in 16 existing BWH employee spaces in the Mission Park Garage to be relocated to the Brigham and Women's Building Garage.

Table 3-22 provides a summary of net-new vehicle trips adjusted for the local mode share.

Table 3-22 Phase 1 Build Condition Project Trip Generation

Time Period/Direction	Walk/Bike/Other	Transit	Total Vehicle Trips	Less Existing Valet Trips	Less Existing 33 Employee/Contactor Spaces	Net-New Vehicle Trips
Daily						
In	152	235	210	-162	-57	-9
Out	152	235	210	-162	-57	-9
Daily Total	304	470	420	-324	-114	-18
AM Peak Hour						
In	16	46	32	-27	-12	-7
Out	5	11	8	-12	-9	-13
AM Total	21	57	40	-39	-21	-20
PM Peak Hour						
In	6	13	9	-13	-6	-10
Out	16	43	30	-19	-8	3
PM Total	21	56	39	-32	-14	-7

As shown in Table 3-22, during the Phase 1 Build Condition, traffic to the Site will be less than what is today. BWH's commitment to remove valet parking from the Site under the Phase 1 Build and elimination of 33 of the 43 employee/contractor spaces will reduce the amount of traffic at the Main MMHC Site. In total, 81 surface spaces will be taken out of service after completion of the Phase 1 Build Condition.

2021 Full Build Condition adjusted trip generation is summarized in Table 3-23 below. With the Full Build Condition, the existing valet operations and existing BWH employees/contractors parking on-site are discontinued.

Table 3-23 Full Build Condition Project Trip Generation

Time Period/Direction	Walk/Bike/Other	Transit	Total Vehicle Trips	Less Existing Valet Trips	Less Existing 43 Employee/Contactor Spaces	Net-New Vehicle Trips
Daily						
In	1,259	1,286	1,439	-162	-68	1,209
Out	1,259	1,286	1,439	-162	-68	1,209
Daily Total	**2,518**	**2,572**	**2,878**	**-324**	**-136**	**2,418**
AM Peak Hour						
In	108	241	176	-27	-16	133
Out	69	79	73	-12	-12	49
AM Total	**177**	**320**	**249**	**-39**	**-28**	**182**
PM Peak Hour						
In	68	77	71	-13	-8	50
Out	112	227	171	-19	-11	141
PM Total	**180**	**304**	**242**	**-32**	**-19**	**191**

As shown, the Project will generate 182 (133 entering and 49 exiting) net-new trips during the morning peak hour. During the evening peak hour the Project will generate 191 (50 entering and 141 exiting) net-new trips in the study area.

3.3.3.2 Trip Distribution

2016 and 2021 Build Condition peak hour traffic volumes for the study area roadways were based on patient, employee and resident vehicle-trip generation estimates summarized previously in Table 3-21. Having estimated the vehicle trips, the next step is to determine the trip distribution for the different users. The anticipated trip distribution patterns were based on BTD distributions to/from Area 5 (LMA/Mission Hill). Employees/Patients were distributed according to 'trips ending' in Area 5 while residents were distributed according to 'trips beginning' in Area 5.

The majority of the patient and employee trips by auto travel on Storrow Drive, Route 9, and Melnea Cass Boulevard to reach the Site. Residents also heavily use those roadway corridors. Four percent of the residential trips live and work in the BTD Area 5. These local trips were assigned to the south of the LMA in Area 5 since it is likely that residents working and living in the LMA would walk to work and not generate a vehicle trip. Table 3-24 and Figures 3-19 and 3-20 indicate the percentage of vehicle trips using each route.

Table 3-24 Peak Hour Auto Trip Distribution

Origin/Destination	Patients/ Employees	Residents
Storrow Drive	30%	27%
Boylston Street	5%	7%
Huntington Ave Eastbound	-	6%
Melnea Cass Boulevard	21%	19%
Longwood Avenue from the North	3%	3%
The Riverway from the South	11%	5%
Park Drive from the North	1%	2%
Route 9/Huntington Avenue from the West	29%	21%
Local/LMA and Mission Hill	-	10%
Total	**100%**	**100%**

Source: BTD Guidelines Area 5

Of the peak hour trips to be generated by the Project Site, approximately 30 percent will be patient trips. These patient trips were assigned to the Servicenter Complex and the remainder were assigned to the Project's new Brigham and Women's Building Garage with the exception of residents who are assigned to the Mission Park Garage.

3.3.3.3 Build Condition Peak Hour Traffic Volumes

The 2016 Phase 1 Condition and 2021 Full Build Condition weekday morning and evening peak hour traffic volumes were developed by adding the project-generated trips and BWH redistributed trips to the 2016 and 2021 No Build Condition traffic networks. Figures 3-21 thru 3-30 present the resulting 2016 and 2021 Build Condition traffic volume networks for the morning and evening peak hours.

3.3.4 Public Transportation

The Project will generate approximately 320 and 304 new transit trips during the morning and evening peak hours respectively. These trips will be distributed amongst the transit and bus lines in the area. Transit trip distribution, as provided by BTD, is summarized in Table 3-25.

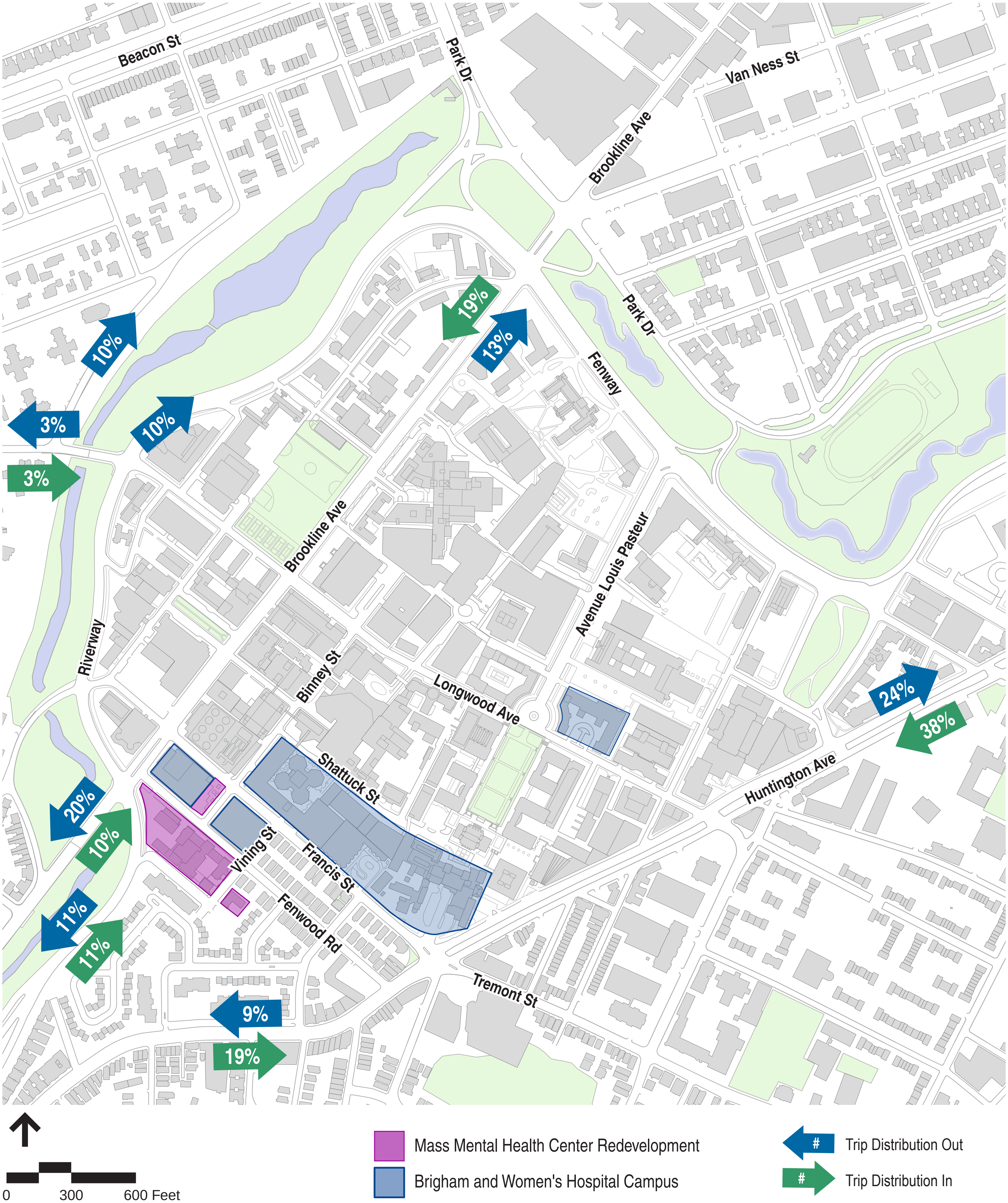

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Figure 3-19

BWH/DMH Trip Distribution

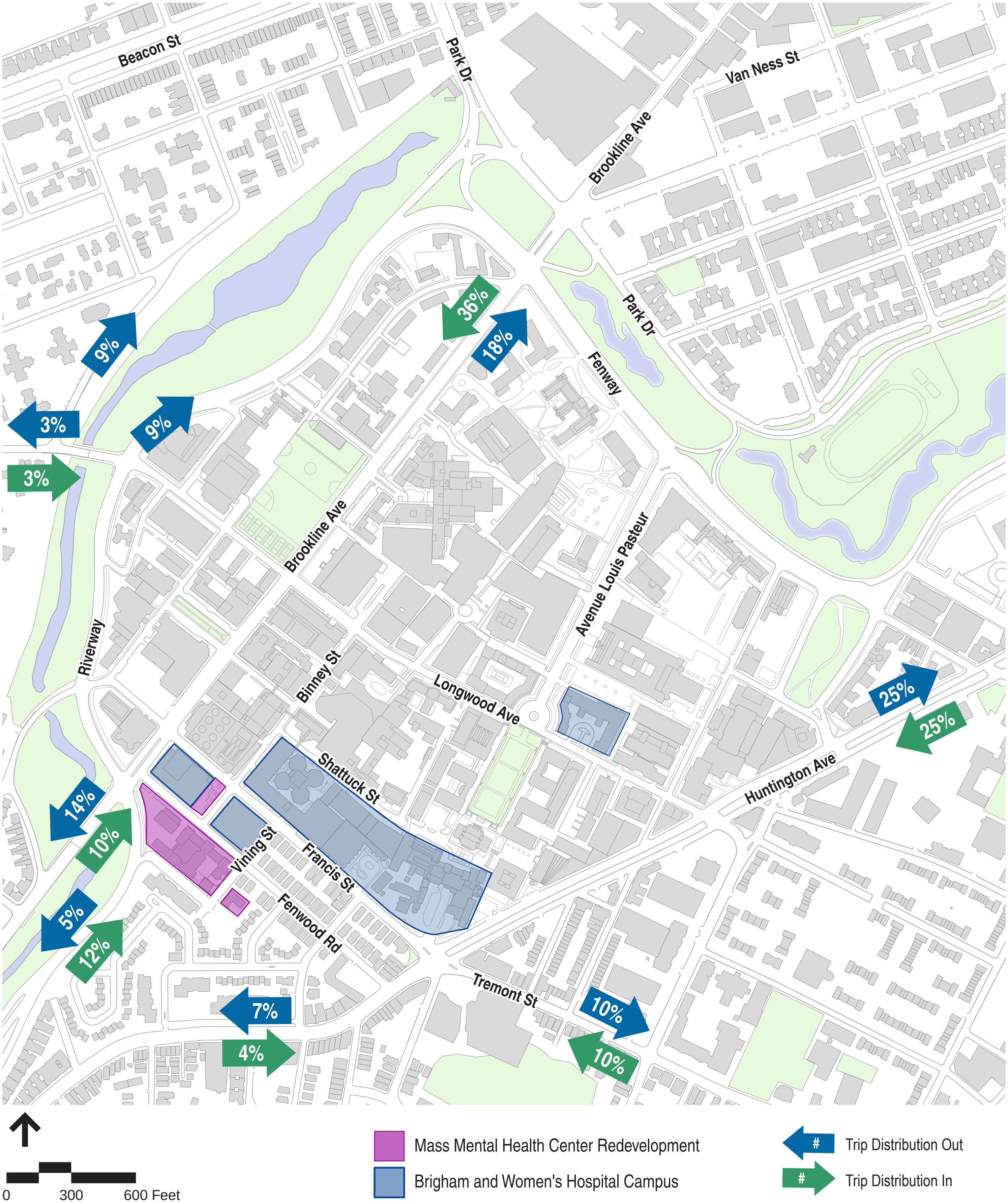

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Figure 3-20

Residential Trip Distribution

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Phase 1 Build

Brigham Parking Changes

	Arrive	Depart
Main Valet	27	12
Surface Valet	27	12
Surface Contractor	11	5
Servicenter Transient	27	12

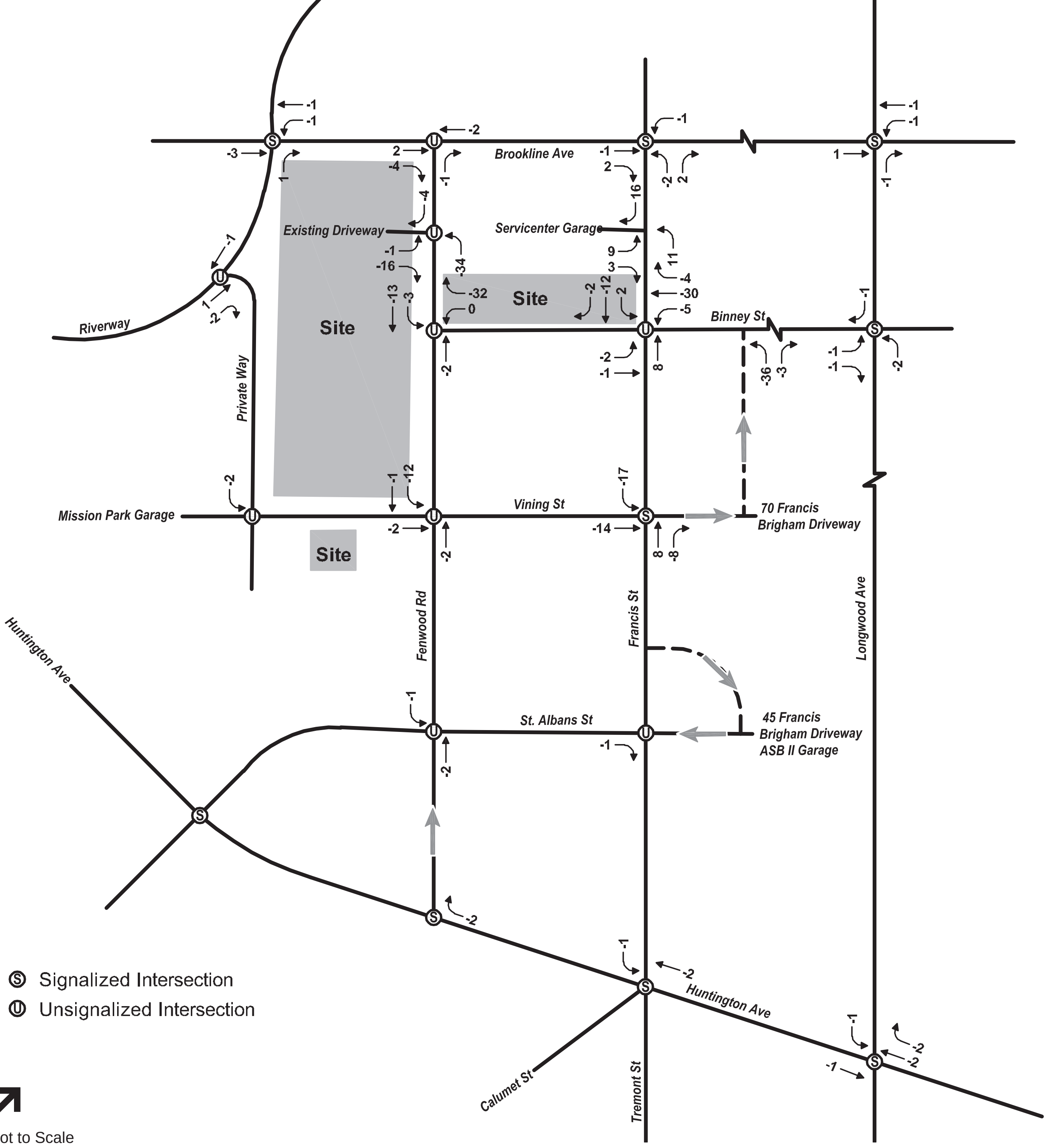

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Figure 3-21

2016 BWH Parking Changes AM Peak Hour (7:15 AM - 8:15 AM)

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Phase 1 Build
Project Trips

	IN	OUT
Project	32	8
Contractor	9	4
Residents*	2	1

*Residents already exist in street network therfore only shown at driveway

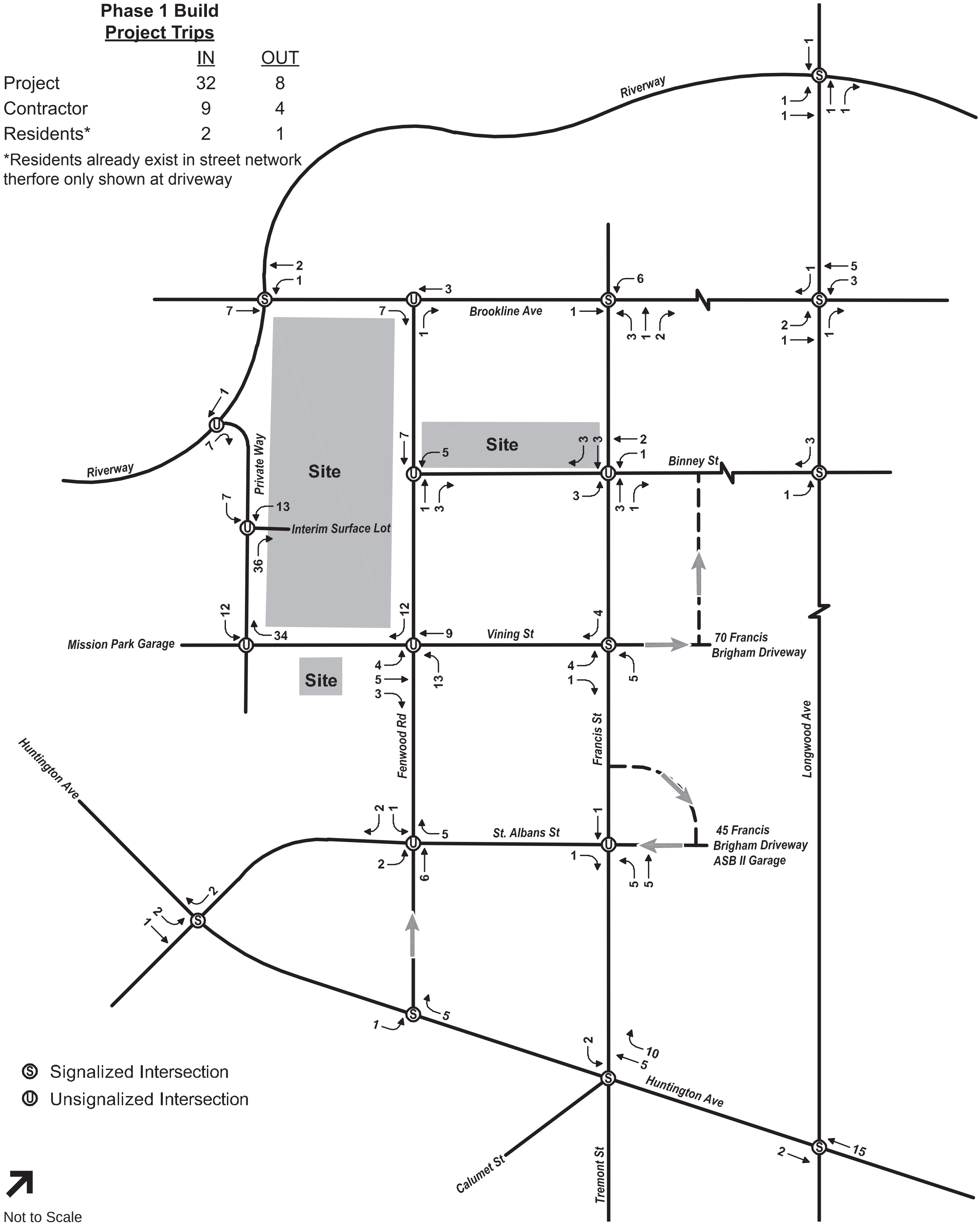

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Figure 3-22

2016 Phase 1 Build Trips AM Peak Hour (7:15 AM - 8:15 AM)

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Phase 1 Build

Brigham Parking Changes

	Arrive	Depart
Main Valet	13	19
Surface Valet	13	19
Surface Contractor	5	8
Servicenter Transient	13	19

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Figure 3-23

2016 BWH Parking Changes PM Peak Hour (4:45 PM - 5:45 PM)

Phase 1 Build
Project Trips

	IN	OUT
Project	9	30
Contractor	4	7
Residents*	2	2

*Residents already exist in street network therfore only shown at driveway

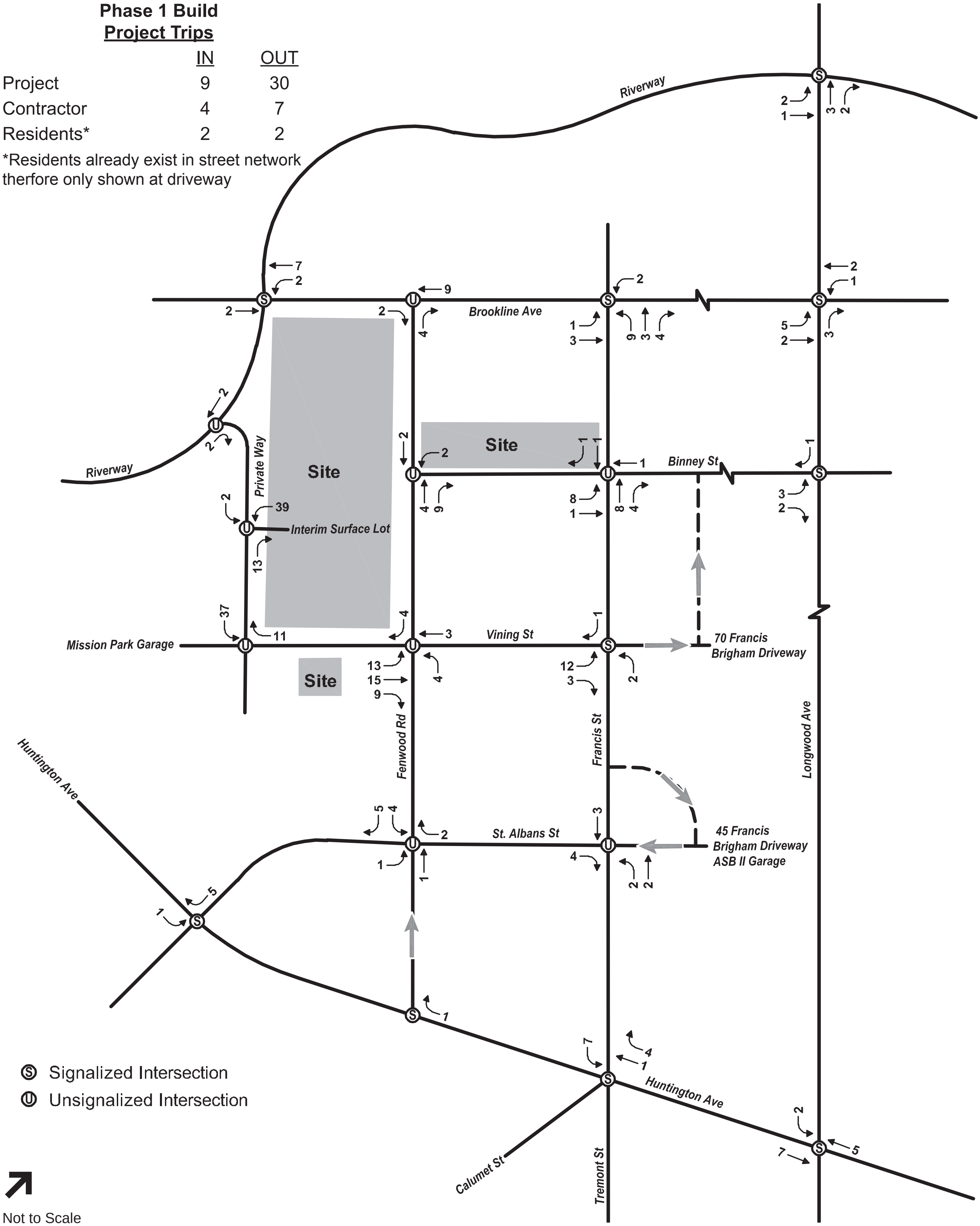

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Figure 3-24

2016 Phase 1 Build Trips PM Peak Hour (4:45 PM - 5:45 PM)

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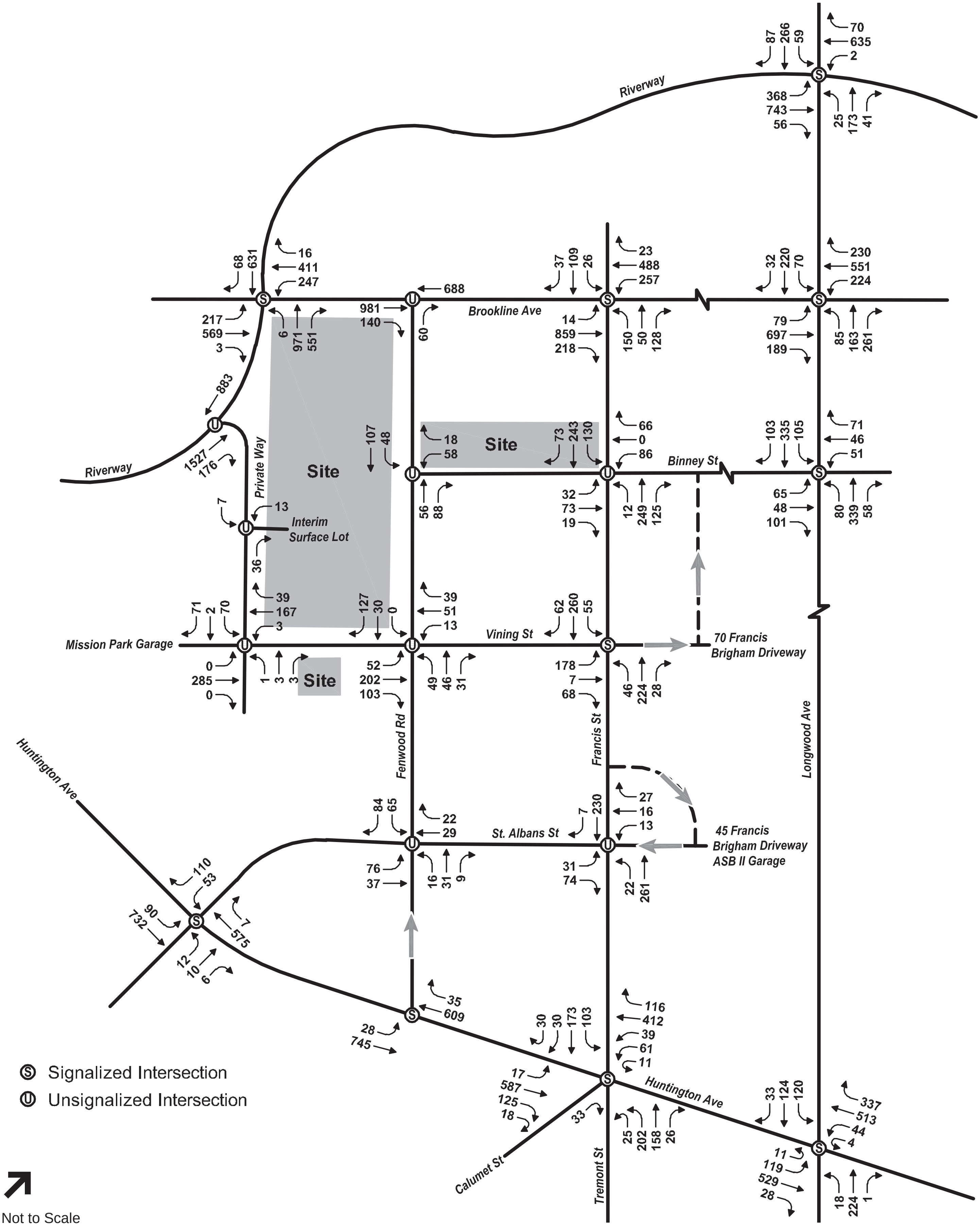

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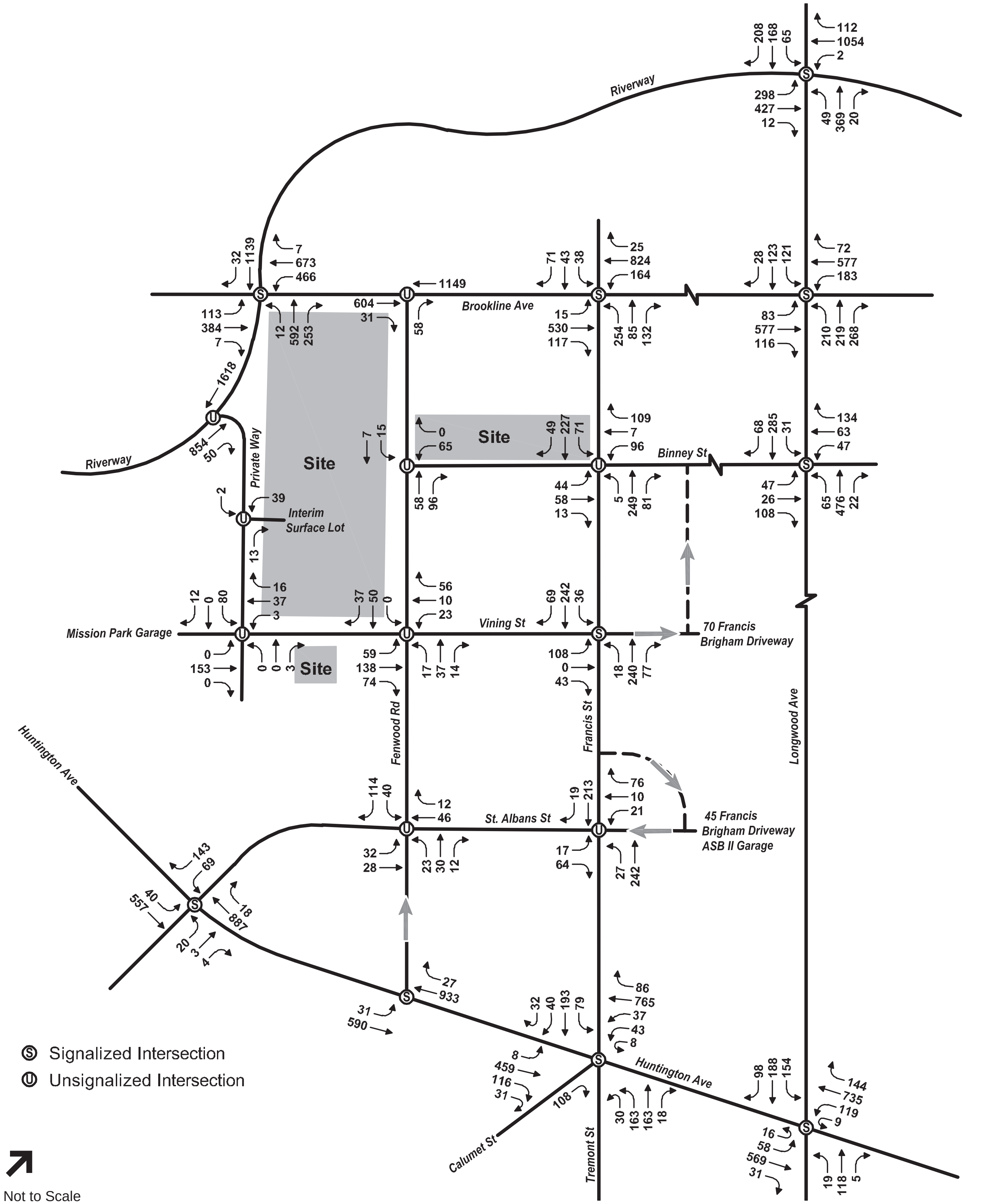
Figure 3-25

2016 Phase 1 Build Condition Traffic Volumes AM Peak Hour (7:15 AM - 8:15 AM)



Massachusetts Mental Health Center Project Boston, Massachusetts

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Figure 3-26

2016 Phase 1 Build Condition Traffic Volumes PM Peak Hour (4:45 PM - 5:45 PM)

New Garage Trips

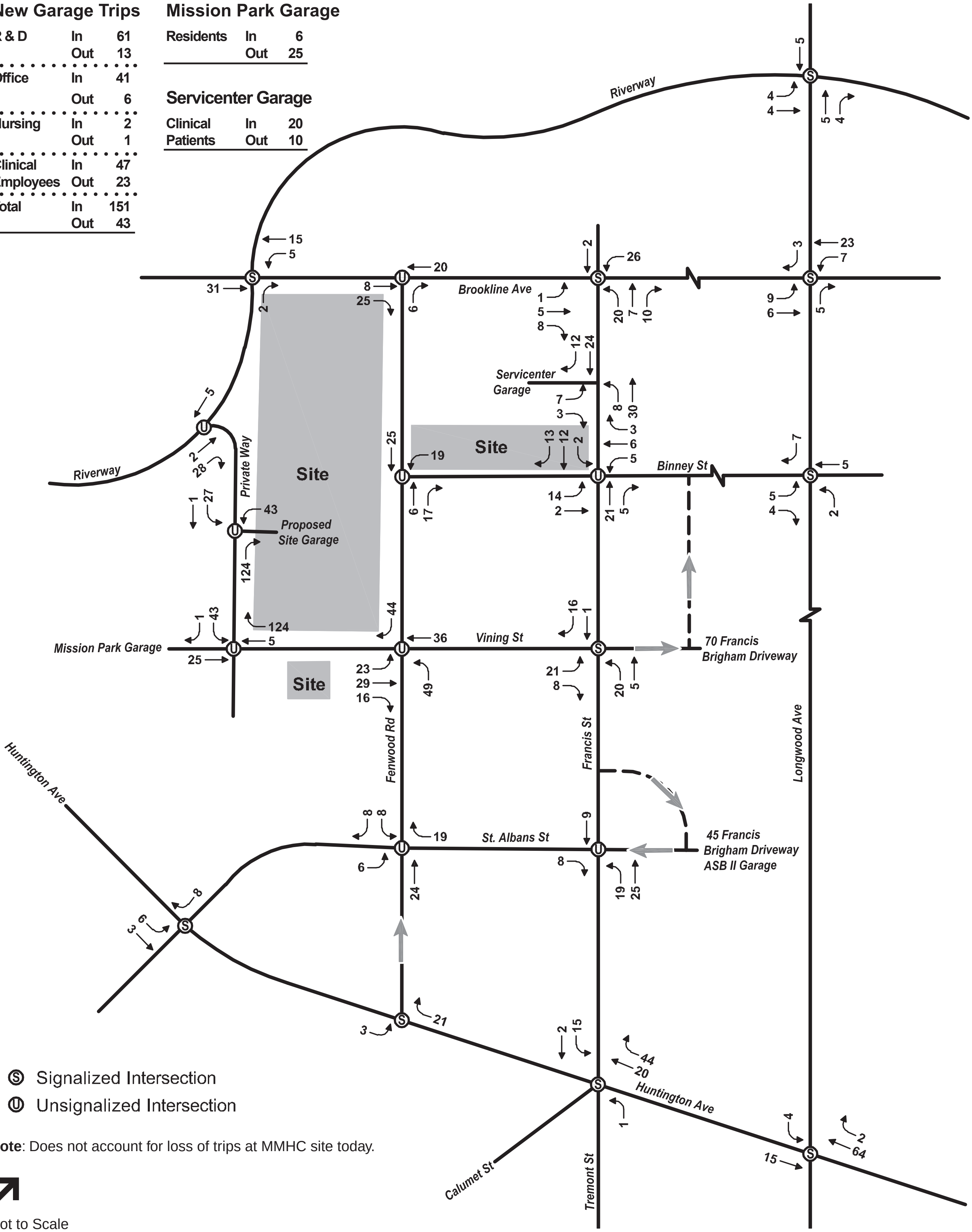
R & D	In	61
	Out	13
Office	In	41
	Out	6
Nursing	In	2
	Out	1
Clinical Employees	In	47
	Out	23
Total	In	151
	Out	43

Mission Park Garage

Residents	In	6
	Out	25

Servicenter Garage

Clinical Patients	In	20
	Out	10



Ⓢ Signalized Intersection
Ⓤ Unsignalized Intersection

Note: Does not account for loss of trips at MMHC site today.

Not to Scale

Massachusetts Mental Health Center Project Boston, Massachusetts

Vanasse Hangen Brustlin, Inc.

Figure 3-27

2021 Full Build Project Trips AM Peak Hour (7:15 AM - 8:15 AM)

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New Garage Trips

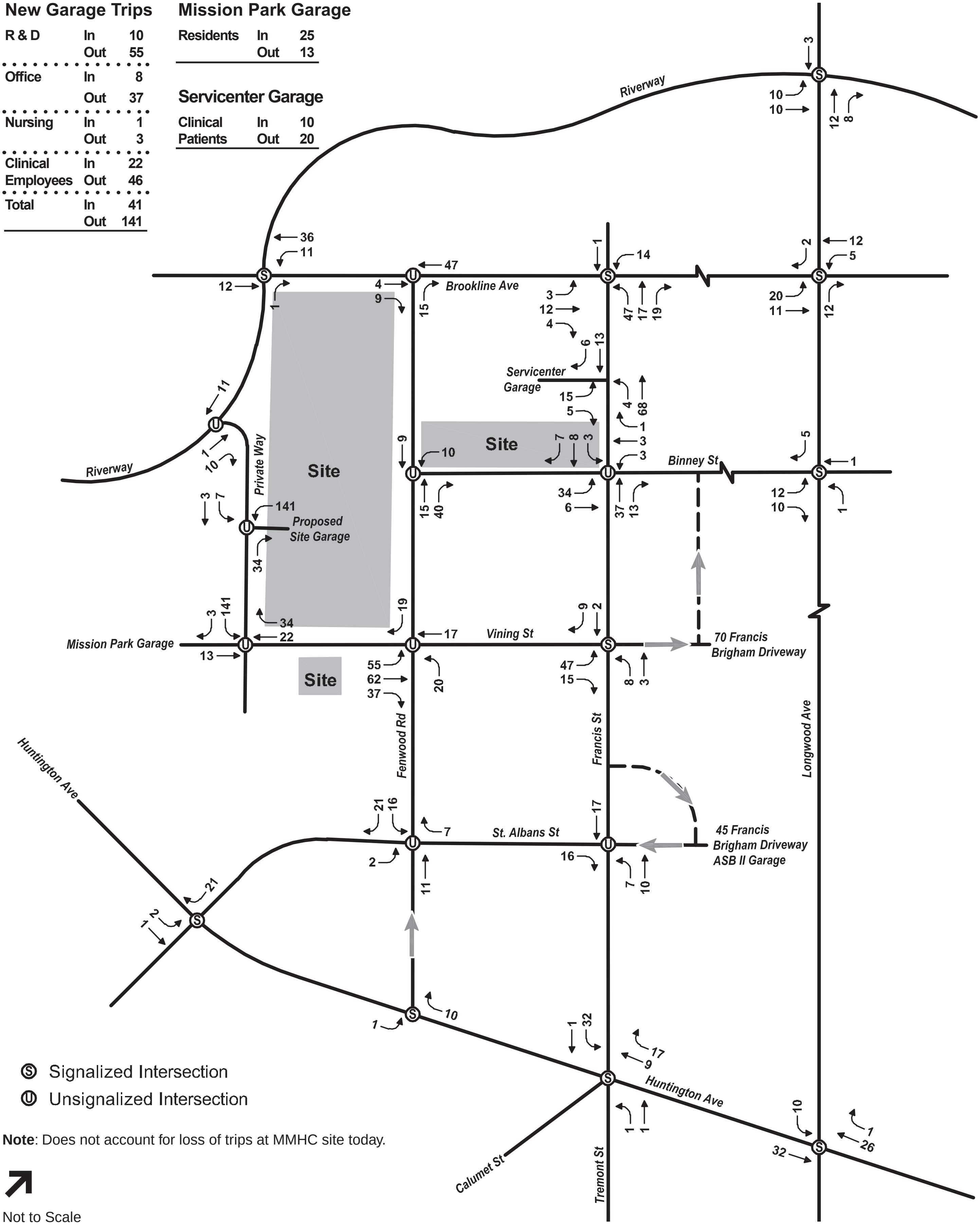
R & D	In	10
	Out	55
Office	In	8
	Out	37
Nursing	In	1
	Out	3
Clinical Employees	In	22
	Out	46
Total	In	41
	Out	141

Mission Park Garage

Residents	In	25
	Out	13

Servicenter Garage

Clinical Patients	In	10
	Out	20



Ⓢ Signalized Intersection

Ⓤ Unsignalized Intersection

Note: Does not account for loss of trips at MMHC site today.

Not to Scale

Massachusetts Mental Health Center Project Boston, Massachusetts

Vanasse Hangen Brustlin, Inc.

Figure 3-28

2021 Full Build Project Trips PM Peak Hour (4:45 PM - 5:45 PM)

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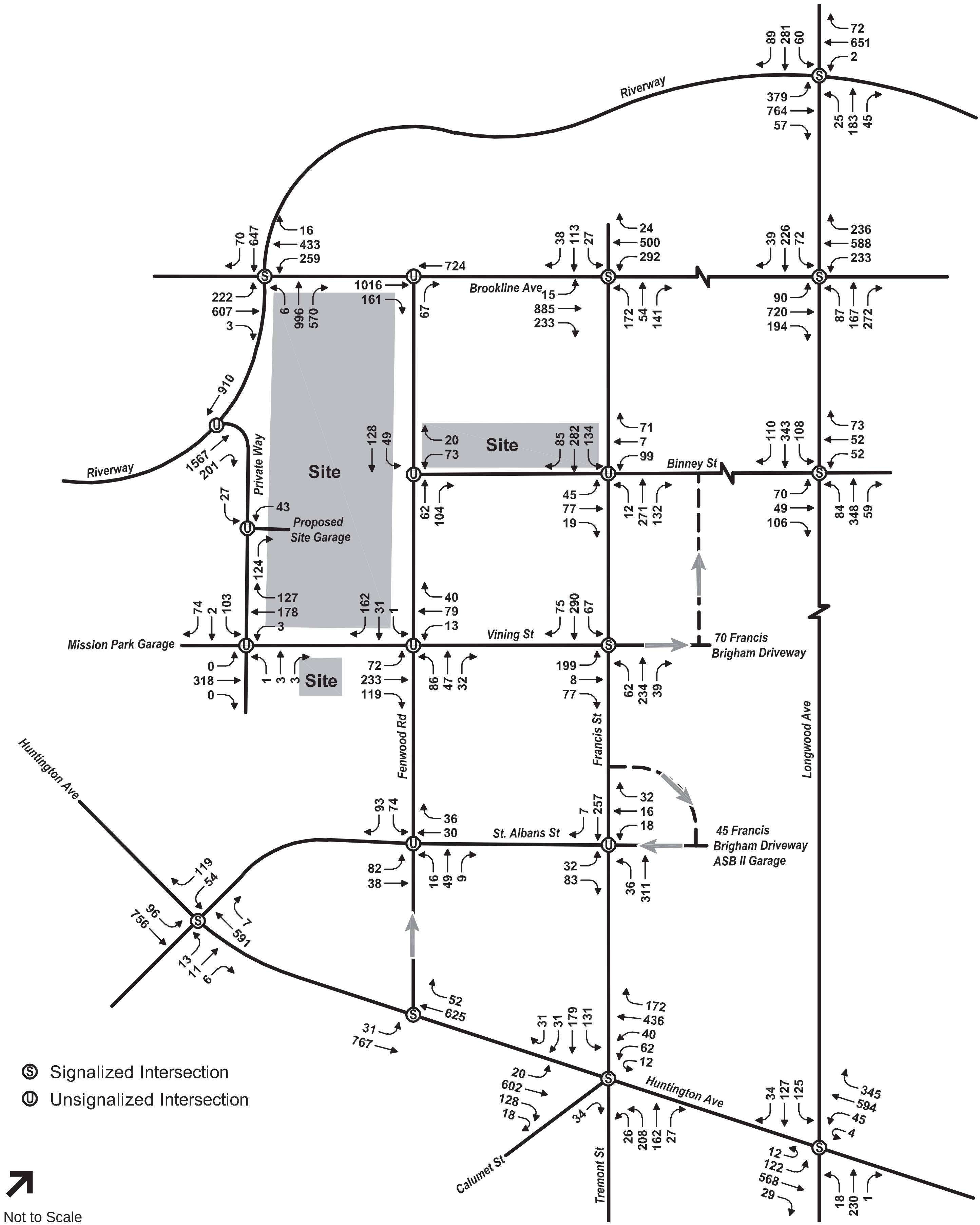
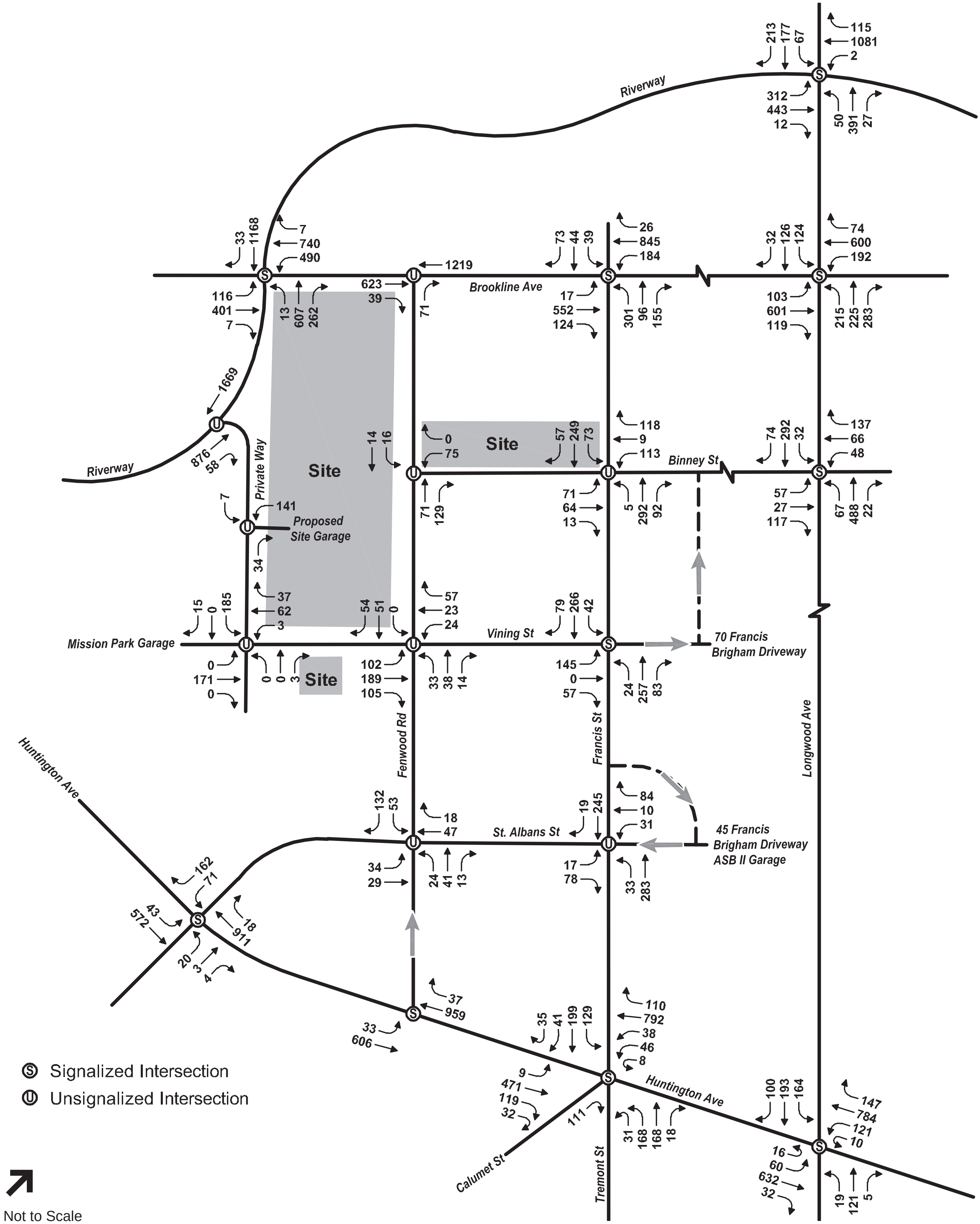


Massachusetts Mental Health Center Project Boston, Massachusetts

Vanasse Hangen Brustlin, Inc.

Figure 3-29

2021 Full Build Condition Traffic Volumes AM Peak Hour (7:15 AM - 8:15 AM)



Massachusetts Mental Health Center Project Boston, Massachusetts

Vanasse Hangen Brustlin, Inc.

Figure 3-30

2021 Full Build Condition Traffic Volumes PM Peak Hour (4:45 PM - 5:45 PM)

Table 3-25 Peak Hour Transit Trip Distribution

Origin/Destination	Patients/ Employees	Residents
Green – D Line		
East of Longwood Station	8%	14%
West of Longwood Station	18%	2%
Green – E Line		
East of Brigham Circle	23%	36%
West of Brigham Circle	1%	0%
Orange Line	7%	6%
Route CT2	3%	3%
Route CT3	5%	1%
Route 8	7%	4%
Route 39	12%	22%
Route 47	6%	4%
Route 60	1%	1%
Route 65	7%	2%
Route 66	2%	5%
Total	100%	100%

Source: BTD Guidelines Area 5

As shown, the majority of new transit trips will be along the Green Line and the Route 39 bus route. Primarily the trips utilizing the Green Line's D Line will be coming from and going to the western end of the line towards Newton. Trips beginning and ending in Boston were distributed between the two Green Lines. Seventy percent of the trips were assumed to utilize the E Line and thirty percent on the D Line. The Brigham Circle Station is approximately half the distance from the Project Site vs. the Longwood Station, therefore more trips were assumed to utilize that station. The MBTA Bus Route 39 will be highly utilized by trips originating in and departing to the southeast side of the city, including the Mattapan, Hyde Park, and Roslindale neighborhoods.

Transit operations are discussed later in Section 3.5.

3.3.5 Pedestrians & Bicycles

A new pedestrian path will be constructed between the private way and Binney Street between the Brigham and Women's Building and the Residential Building. This pathway will create a new connection through the Main MMHC Site that does not exist today between the Riverway and the LMA. In addition, the Brigham and Women's Building will be connected to the Shapiro Cardiovascular Center at 70 Francis Street via an underground tunnel and a pedestrian bridge across Fenwood Road.

To further encourage walking and bicycling, the Proponent will reconstruct sidewalks around the Project Site and provide secure bicycle storage at each project building. In addition, shower facilities and lockers will be installed for employees at the Brigham and Women's Building.

The Project will generate approximately 177 walk and bike trips during the morning peak hour and 180 trips during the evening peak hour. These trips will be accommodated within the existing transportation infrastructure.

3.3.6 Parking

Parking will be phased with the building programs. During the Phase 1 Build Condition, a surface parking lot will remain on the Main MMHC Site. With the Full Build Condition, a new below grade garage will be constructed beneath the Brigham and Women's Building accommodating 406 vehicles. A more detailed discussion of the proposed phased parking plan is provided below.

3.3.6.1 Phase 1 Parking Supply

Under the Phase 1 Build Condition, the Project will be supported by 82 surface parking spaces on the Main MMHC Site. This supply is an 81 space reduction from what currently exists on-site today since BWH plans to eliminate valet parking on-site and temporarily relocate these spaces to the Servicenter Complex until the Brigham Green parking garage is constructed. Once the Brigham Green Garage is opened, these vehicles will move to the new facility.

The planned 82 spaces on the MMHC during Phase 1 will be accessed via the private way. This supply will provide 50 spaces for DMH to support the uses at the Binney Street Building and the Partial Hospital/Fenwood Inn, 16 replacement resident spaces to replace those previously lost on-street as part of the 70 Francis Street Project, 10 BWH contractor spaces to discourage contractors from parking on the neighboring residential streets, and 6 spaces for oversized patient vehicles. The proposed parking supply is summarized in Table 3-26.

Table 3-26 Phase 1 Surface Parking Supply

	Main MMHC Site
BWH Contractor Spaces	10
BWH Oversized Valet Spaces	6
DMH	50
Existing RTH Spaces*	16
Total	82
Less Existing Spaces	-163
Net-New Parking	-81

*16 residential spaces are currently on-site.

3.3.6.2 Full Build Parking Supply

Upon Full Build Project completion, the Project will include 406 parking spaces located beneath the Brigham and Women's Building. Access to and egress from these spaces will be provided from the private way.

Of the 406 parking spaces, 50 spaces will be allocated to DMH. Approximately 90 parking passes will be provided to the new Residential Building residents in the nearby Mission Park Garage. In addition, the 16 residential spaces on the Main MMHC Site will be moved to the Mission Park Garage for a total of 106 residential spaces. To allow for these new spaces, 106 BWH employees currently parking in the Mission Park Garage will be relocated to the new Brigham and Women's Building garage. The remaining 250 spaces will also be used by BWH to meet the demands associated with the new Binney Street Building and Brigham and Women's Building.

As planned, BWH will use the new Brigham and Women's Building Garage for employee parking to reduce impacts to the neighborhood that could be otherwise created if visitors were sent to the garage at the edge of the BWH Main Campus area. New clinical patients will be encouraged to self-park at the Servicenter Garage. It is estimated that there will a demand of approximately 90 additional patient spaces at the Service Center associated with the new clinical space. This new demand will lessen the availability of otherwise publicly available spaces.

Planned parking changes are summarized in Table 3-27.

Table 3-27 Full Build Parking Supply

	Servicenter Complex	Mission Park Garage	Brigham and Women's Garage
New BWH Employee	90		250
New Residential		90	-
New DMH			50
Relocated BWH		(-106)	106
Relocated Residential		16	-
Public Spaces	(-90)		
Total	0	0	406

Table 3-28 summarizes the net-new parking changes with the Project. The proposed parking supply is well under BTD's guidelines for the Mission Hill and LMA neighborhoods.

Table 3-28 Parking Supply

	Program Size	Parking Rate	Parking Supply
BWH	362,460 sf	0.69 spaces/ksf	250
DMH	73,750 sf	0.68 spaces/ksf	50
Residential	197,750 sf (165 units)	0.55 spaces/unit	90
Total	633,960 sf	0.62 spaces/ksf	390*

*Does not include 16 replacement residential spaces.

On a square footage basis the Project as a whole has a parking ratio of 0.62 parking spaces per 1,000 sf. BTD guidelines applicable to parking ratios for new construction would allow for 0.75 spaces per residential unit and 1,000 sf per non-residential land uses within the LMA and 0.75-1.0 spaces per 1,000 sf of non-residential use and 0.5-1.0 spaces per residential unit within the Mission Hill neighborhood. Under the existing guidelines, up to 584 parking spaces could be built to support the Project.

3.3.6.3 Project Parking Demand

Parking demand for the Project was estimated using ITE's Parking Generation Handbook, 3rd Edition for the non-residential components of the Project. The new non-residential parking demands were estimated for a non-urban environment and then adjusted for alternative mode shares using the rates presented previously. Residential parking demands were provided by RTH and reflect the current residential market for mixed income housing.

Table 3-29 summarizes the Project's estimated parking demand. As shown, the parking demand of 769 to be generated by the Project exceeds the proposed 406 space parking supply. It is anticipated that patient parking will be accommodated in the Servicenter Complex and that any excess demand for employee parking will be accommodated in remote locations outside of the LMA and employees will need to use existing shuttle services to the Site. This traffic analysis presented herein assumes a conservative approach in which all new BWH vehicle trips are assigned to the new garage.

Table 3-29 Parking Demand

	Size	Parking Demand Rate	Mode Share Adjustment	Total Demand (spaces)
Office	76,560 sf	2.84 spaces/ksf	43% **	93
Research & Development	152,960 sf	1.42 spaces/ksf*	43% **	217
Clinical	193,990 sf	4.43 spaces/ksf	42%	361
Partial Hospital/Fenwood Inn	47 Beds	0.39 spaces/bed	42%	8
Residential	165 units	0.55 spaces/unit		90
Total				769

Source: Parking Generation, 3rd Edition, Institute of Transportation Engineers; Residential demand provided by RTH.
*R&D population density is assumed to be half of office density.
**Blended vehicle mode share rate for BWH and DMH employees.

3.3.7 Loading & Service

The Brigham and Women's Building will provide a dedicated off-street loading facility accessed from the south side of the Main MMHC Site. Currently, four loading docks are planned, one of which will contain a trash compactor. These docks will accommodate single unit trucks. The spaces will be accessed by backing in from the private way. All trucks will arrive and depart from Brookline Avenue via Fenwood Road and Vining Street. Larger tractor trailer trucks for the Brigham and Women's Building will use the existing docks at the Servicenter Complex on Fenwood Road.

The Residential Building is proposing a dedicated drop-off and loading zone on Fenwood Road. As proposed, this drop-off area will be approximately 60 feet long and therefore accommodate passenger cars and single-unit trucks. Moving activities and typically deliveries will be accommodated at this curb. In addition, residents with groceries and other short-term loading needs may use this area. Trash will be collected internally within the building and be picked up curbside.

The Partial Hospital/Fenwood Inn will have a driveway to accommodate loading and service for the building. This driveway will be located off Vining Street. The driveway will be approximately 40-feet in length and will accommodate one single unit truck or two tandem vans or passenger vehicles.

The Binney Street Building will be served from a dedicated on-street loading zone adjacent to the site. This loading zone will need to be permitted with the Boston Transportation Department. It is anticipated that trash and recycling for the building will be consolidated at the existing loading facilities at the Servicenter Complex.

Phase 1 will generate approximately four (4) new daily truck trips. The Full Build will generate 37 truck trips (32 for office and clinical spaces and 5 for the residential building). These trips will be over the course of the day. Based on existing trends at BWH, DMH, and RTH, it is expected that approximately 83 percent of the trucks will be single unit trucks or smaller.

3.3.8 Construction

Construction vehicles will be necessary to move construction materials to and from the Project Site. Every reasonable effort will be made to reduce the noise, control dust, and minimize other disturbances associated with construction traffic. Brookline Avenue will serve as the principal construction traffic route to the Project Site. Each phase of the Project will have a separate CMP. As with the CMP for the Shapiro Cardiovascular Center Project, each CMP will attempt to minimize the disruptions to BWH's neighbors on Francis Street and Fenwood Road to the east of Vining Street by restricting construction traffic there. All construction traffic routes are subject to BTD approval. The primary lay-down area is expected to be located on the Project Site, reducing the impacts to adjacent properties.

3.3.8.1 Construction Parking Issues

Contractors will be required to develop access plans for their personnel that de-emphasize auto use (such as seeking off-site parking, provide transit subsidies, on-site lockers, etc.) Construction workers will also be encouraged to use public transportation to access the Project Site because no new parking will be provided for them. The Proponent will work with the BTD, MASCO, and the Boston Police Department to ensure that parking regulations in the area and in designated residential parking areas are enforced.

3.3.8.2 Pedestrian Access during Construction

During the construction period, pedestrian circulation around the MMHC Project Site may need to be re-routed. A variety of measures will be considered and implemented to protect the safety of pedestrians around the Site that are affected by construction. Temporary walkways, appropriate lighting, and new directional and informational signage to direct pedestrians around the construction sites will be provided. After construction is complete, finished pedestrian sidewalks will be reconstructed around the new buildings as discussed later in Section 4.10.

3.4 Transportation Operations

This section presents the transportation operations analyses for peak hour operations at study area intersections and transit lines. This operations analysis provides a summary of transportation capacities and overall operations as they relate to delay and congestion.

3.4.1 Intersection Level of Service (LOS) Operations

Vehicle Level of Service (LOS) is a qualitative measure of control delay at an intersection providing an index to the operational qualities of a roadway or intersection. LOS designations range from A to F, with LOS A representing the best operating conditions and LOS F representing the worst operating conditions. LOS A through D are considered acceptable, while LOS E indicates vehicles endure significant delay and LOS F suggests a level of delay that exceeds the intended capacity of that respective intersection. LOS thresholds differ for signalized and unsignalized intersections with longer delays at signalized intersections perceived as being acceptable.

Table 3-30 below presents the level of service delay threshold criteria as defined in the 2000 Highway Capacity Manual (HCM).

Table 3-30 Level of Service Criteria

Level of Service (LOS)	Unsignalized Intersection Control Delay (sec/veh)	Signalized Intersection Control Delay (sec/veh)
A	≤ 10	≤10
B	> 10 - ≤ 15	> 10 - ≤20
C	> 15 - ≤25	> 20 - ≤35
D	> 25 - ≤35	> 35 - ≤55
E	> 35 - ≤50	> 55- ≤ 80
F	> 50	> 80

Source: 2000 HCM

Consistent with BTD's guidelines, Synchro 6 software was used to model LOS operations at the study area intersections. Adjustments were made to the Synchro model to include characteristics of the study area such as heavy vehicles, bus operations, parking activity, and pedestrian crossings. "Defacto turns" were coded into the Synchro model when the traffic model recognized that a shared-lane had a high enough turning volume that the lane is used for turns only even though there may not be striping or signs posted at the intersection to designate such operations. Often this condition only occurs during one peak hour.

A summary of the results for each analysis scenario that was studied is presented in Tables 3-31 thru 3-50. A comparison of the results is presented in Table 3-51 and 3-52. Overall intersection LOS and delay are only provided for signalized intersections by Synchro. In addition, 50th percentile queues are not reported by Synchro for unsignalized intersections. Synchro calculation sheets are presented in the Transportation Appendix.

Table 3-31 Existing Condition (2009) Intersection LOS Summary – AM Peak Hour

Intersection	LOS	Delay (sec.)	V/C Ratio	Average Queue	95th % Queue (feet)
Signalized Intersections					
1. Brookline Avenue at Francis Street	E	55.4	>1.0	-	-
EB Brookline Thru/Left	D	51.5	>1.0	303	m#366
EB Brookline Right	B	15.4	0.40	69	m80
WB Brookline Left	F	>80	>1.0	~117	m#233
WB Brookline Thru/Right	A	4.7	0.35	36	m46
NB Francis Left	D	35.1	0.57	111	#237
NB Francis Thru/Right	C	31.3	0.28	62	97
SB Francis Left/Thru/Right	C	24.7	0.32	76	#225
3. Brookline Avenue at Riverway	F	>80	>1.0	-	-
EB Brookline Left	F	>80	>1.0	~253	#371
EB Brookline Thru/Right	E	63.3	0.94	179	#272
WB Brookline Left	F	>80	>1.0	~215	m#364
WB Brookline Thru/Right	C	21.2	0.52	67	m97
NB Riverway Left/Thru/Right	D	51.1	>1.0	~584	#723
SB Riverway Left/Thru/Right	B	18.4	0.53	203	247
7. Vining Street at Francis Street	C	33.7	0.66	-	-
EB Vining Left/Thru/Right	B	12.8	0.58	109	178
NB Francis Left/Thru/Right	D	38.9	0.82	195	m162
SB Francis Left	D	47.8	0.54	49	m57
SB Francis Thru/Right	D	47.3	0.70	190	m174
11. Francis Street at Huntington Avenue	F	>80	>1.0	-	-
EB Huntington Hard Left/Left/Thru/Right	F	>80	>1.0	~422	#544
WB Huntington Hard Left/Left	D	45.6	0.77	62	m#74
WB Huntington Left/Thru/Right	E	71.4	>1.0	~202	m#319
NB Tremont Hard Left/Left/Thru/Right	F	>80	>1.0	~399	#592
SB Francis Left/Thru/Right	F	>80	>1.0	~281	#421
SB Francis Hard Right	C	21.9	0.13	17	m23
NEB Calumet Hard Right	D	45.1	0.28	26	49

Table 3-31 Existing Condition (2009) Intersection LOS Summary – AM Peak Hour (Continued)

Intersection	LOS	Delay (sec.)	V/C Ratio	Average Queue	95th % Queue (feet)
Signalized Intersections					
12. Fenwood Road at Huntington Avenue	A	0.1	0.30	-	-
EB Huntington Thru/Left	A	0.3	0.30	0	0
WB Huntington Thru/Right	A	0.0	0.25	0	m0
13. St. Albans Street at Huntington Avenue	B	10.7	0.50	-	-
SE Huntington Left/Thru	A	5.3	0.50	77	161
NW Huntington Thru/Right	A	8.0	0.30	136	123
NE St. Alban's Left/Thru/Right	D	37.5	0.16	18	33
SW St. Alban's Left/Thru/Right	D	40.3	0.50	50	111
14. Huntington Avenue at Longwood Avenue	E	55.2	0.94	-	-
EB Huntington Left	E	71.9	0.67	70	m0
EB Huntington Thru/Right	B	11.5	0.44	224	m21
WB Huntington Left	D	43.0	0.35	30	65
WB Huntington Thru	C	26.8	0.73	269	#467
WB Huntington Right	C	32.1	0.74	153	#318
NB Longwood Left/Thru/Right	D	35.2	0.67	167	209
SB Longwood Left/Thru/Right	F	>80	>1.0	~261	m#389
15. Binney Street at Longwood Avenue	C	31.1	0.67	-	-
EB Binney Left/Thru/Right	D	53.2	0.80	106	m132
WB Binney Left/Thru	D	37.5	0.49	55	96
WB Binney Right	C	32.5	0.06	0	34
NB Longwood Left/Thru/Right	C	29.8	0.61	132	192
SB Longwood Left/Thru/Right	C	21.8	0.61	120	m96
16. Brookline Avenue at Longwood Avenue	F	>80	>1.0	-	-
EB Brookline Left	E	72.6	0.63	21	m27
EB Brookline Thru/Right	F	>80	>1.0	~397	m#441
WB Brookline Left	F	>80	>1.0	~184	#329
WB Brookline Thru/Right	C	21.9	0.66	179	246
NB Longwood Left	F	>80	>1.0	~73	m#145
NB Longwood Thru	D	36.7	0.54	60	m110
NB Longwood Right	B	12.2	0.25	0	m16
SB Longwood Left	D	36.0	0.47	45	75
SB Longwood Thru/Right	F	>80	>1.0	~222	#293

Table 3-31 Existing Condition (2009) Intersection LOS Summary – AM Peak Hour (Continued)

Intersection	LOS	Delay (sec.)	V/C Ratio	Average Queue	95th % Queue (feet)
Signalized Intersections					
17. Riverway at Longwood Avenue	D	38.5	0.89	-	-
EB Riverway Left	B	17.7	0.73	98	204
EB Riverway Thru/Right	D	38.7	0.88	225	#330
WB Riverway Left/Thru	C	29.7	0.70	161	223
WB Riverway Right	C	21.6	0.05	0	29
NB Longwood Left	C	26.2	0.19	12	35
NB Longwood Thru/Right	C	29.6	0.48	100	166
SB Longwood Thru/Left	F	>80	>1.0	~229	#364
SB Longwood Right	A	8.2	0.13	23	43

~ Volume exceeds capacity, queue is theoretically infinite.
# 95th percentile volume exceeds capacity, queue may be longer.
m Volume for 95th percentile queue is metered by upstream signal.

Table 3-32 Existing Condition (2009) Intersection LOS Summary – AM Peak Hour

Intersection	LOS	Delay (sec.)	V/C Ratio	95th % Queue (feet)
Unsignalized Intersections				
2. Fenwood Road at Brookline Avenue				
EB Brookline Thru/Right	A	0.0	0.36	0
WB Brookline Thru	A	0.0	0.20	0
NB Fenwood Right	B	13.1	0.17	15
4. Vining Street at Private Way				
EB Mission Park Garage Left/Thru/Right	B	12.2	0.50	n/a
WB Vining Left/Thru/Right	B	10.1	0.33	n/a
NB Driveway Left/Thru/Right	A	8.6	0.02	n/a
SB Vining St Ext. Left/Thru/Right	A	9.5	0.20	n/a
5. Binney Street at Francis Street				
EB Binney Left/Thru/Right	F	>50	>1.0	n/a
WB Binney Left/Thru/Right	F	>50	>1.0	n/a
NB Francis Left/Thru/Right	A	0.5	0.02	1
SB Francis Left	B	12.7	0.22	21
SB Francis Thru/Right	A	0.0	0.22	0
6. Binney Street at Fenwood Road				
WB Binney Left/Right	B	14.0	0.29	29
NB Fenwood Thru/Right	A	0.0	0.09	0
SB Fenwood Left/Thru	A	2.5	0.04	3
8. Fenwood Road at Vining Street				
EB Vining Left/Thru/Right	C	15.6	0.62	n/a
WB Vining Left/Thru/Right	A	9.7	0.18	n/a
NB Fenwood Left/Thru/Right	B	10.4	0.24	n/a
SB Fenwood Left/Thru/Right	B	10.3	0.29	n/a

Table 3-32 Existing Condition (2009) Intersection LOS Summary – AM Peak Hour (Continued)

Intersection	LOS	Delay (sec.)	V/C Ratio	95^{th} % Queue (feet)
Unsignalized Intersections				
9. St. Albans Street at Francis Street				
EB St. Alban's Left	F	>50	0.49	56
EB St. Alban's Right	C	18.0	0.16	14
WB St. Alban's Left/Thru/Right	F	>50	0.95	146
NB Francis Left/Thru	A	0.60	0.02	1
SB Francis Thru/Right	A	0.0	0.19	0
10. St. Albans Street at Fenwood Road				
EB St. Alban's Thru/Left	C	19.0	0.39	45
WB St. Alban's Thru/Right	B	12.9	0.10	8
NB Fenwood Left/Thru/Right	A	2.5	0.02	1
SB Fenwood Left/Thru/Right	A	3.7	0.06	5

~ Volume exceeds capacity, queue is theoretically infinite.
# 95th percentile volume exceeds capacity, queue may be longer.
m Volume for 95th percentile queue is metered by upstream signal.

Table 3-33 Existing Condition (2009) Intersection LOS Summary – PM Peak Hour

Intersection	LOS	Delay (sec.)	V/C Ratio	Average Queue	95^{th} % Queue (feet)
Signalized Intersections					
1. Brookline Avenue at Francis Street	F	>80	0.87	-	-
EB Brookline Thru/Left	F	>80	>1.0	~280	m#365
EB Brookline Right	E	56.8	0.43	67	m106
WB Brookline Left	C	26.2	0.30	84	m#143
WB Brookline Thru/Right	C	25.1	0.46	240	m354
NB Francis Left	E	67.7	0.88	191	m237
NB Francis Thru/Right	D	38.9	0.36	104	m141
SB Francis Left/Thru/Right	C	32.8	0.29	69	104
3. Brookline Avenue at Riverway	F	>80	>1.0	-	-
EB Brookline Left	F	>80	>1.0	~140	#260
EB Brookline Thru/Right	D	46.0	0.59	133	184
WB Brookline Left	F	>80	>1.0	~376	m#441
WB Brookline Thru/Right	C	29.8	0.57	240	m170
NB Riverway Left/Thru/Right	D	42.4	0.86	~377	#508
SB Riverway Left/Thru/Right	F	>80	>1.0	~632	#730
7. Vining Street at Francis Street	B	19.6	0.43	-	-
EB Vining Left/Thru/Right	E	65.7	0.83	149	190
NB Francis Left/Thru/Right	A	7.3	0.31	73	163
SB Francis Left	A	3.9	0.09	6	20
SB Francis Thru/Right	A	4.6	0.31	65	86

Table 3-33 Existing Condition (2009) Intersection LOS Summary – PM Peak Hour (Continued)

Intersection	LOS	Delay (sec.)	V/C Ratio	Average Queue	95th % Queue (feet)
Signalized Intersections					
11. Francis Street at Huntington Avenue	F	>80	>1.0	-	-
EB Huntington Hard Left/Left/Thru/Right	F	>80	>1.0	~297	#421
WB Huntington Hard Left/Left	C	20.5	0.60	45	m45
WB Huntington Left/Thru/Right	C	28.5	0.85	301	m280
NB Tremont Hard Left/Left/Thru/Right	F	>80	>1.0	~351	#535
SB Francis Left/Thru/Right	F	>80	>1.0	~246	#412
SB Francis Hard Right	D	36.7	0.18	21	52
NEB Calumet Hard Right	F	>80	>1.0	~99	#172
12. Fenwood Road at Huntington Avenue	A	0.1	0.32	-	-
EB Huntington Thru/Left	A	0.2	0.27	0	0
WB Huntington Thru/Right	A	0.0	0.32	0	m0
13. St. Albans Street at Huntington Avenue	B	11.2	0.48	-	-
SE Huntington Left/Thru	A	5.5	0.37	62	136
NW Huntington Thru/Right	A	4.7	0.43	55	365
NE St. Alban's Left/Thru/Right	C	34.5	0.17	19	29
SW St. Alban's Left/Thru/Right	D	45.8	0.69	100	137
14. Huntington Avenue at Longwood Avenue	E	69.3	>1.0	-	-
EB Huntington Left	D	54.1	0.37	43	m40
EB Huntington Thru/Right	A	5.6	0.45	49	m37
WB Huntington Left	D	54.4	0.73	86	#156
WB Huntington Thru	F	>80	>1.0	~563	#761
WB Huntington Right	C	25.6	0.51	65	128
NB Longwood Left/Thru/Right	C	28.6	0.36	79	131
SB Longwood Left/Thru/Right	F	>80	>1.0	~323	#511
15. Binney Street at Longwood Avenue	C	34.5	0.59	-	-
EB Binney Left/Thru/Right	E	78.6	0.85	90	m134
WB Binney Left/Thru	E	74.0	0.80	90	131
WB Binney Right	D	45.0	0.11	0	47
NB Longwood Left/Thru/Right	C	23.8	0.58	186	#316
SB Longwood Left/Thru/Right	B	14.2	0.31	99	m126
16. Brookline Avenue at Longwood Avenue	D	43.0	>1.0	-	-
EB Brookline Left	F	>80	>1.0	~49	m#49
EB Brookline Thru/Right	D	50.0	>1.0	~310	m237
WB Brookline Left	E	63.3	0.90	105	#254
WB Brookline Thru/Right	C	29.9	0.67	226	295
NB Longwood Left	E	68.5	0.95	105	m#297
NB Longwood Thru	C	23.9	0.53	50	m112
NB Longwood Right	B	13.8	0.24	0	m4
SB Longwood Left	C	30.6	0.24	29	60
SB Longwood Thru/Right	C	32.8	0.43	104	162

Table 3-33 Existing Condition (2009) Intersection LOS Summary – PM Peak Hour (Continued)

Intersection	LOS	Delay (sec.)	V/C Ratio	Average Queue	95th % Queue (feet)
Signalized Intersections					
17. Riverway at Longwood Avenue	F	>80	>1.0	-	-
EB Riverway Left	C	22.4	0.66	104	196
EB Riverway Thru/Right	C	21.4	0.40	96	137
WB Riverway Left/Thru	E	75.8	>1.0	~374	#501
WB Riverway Right	B	18.8	0.09	0	34
NB Longwood Left	C	33.7	0.35	29	61
NB Longwood Thru/Right	F	>80	>1.0	~274	#404
SB Longwood Thru/Left	F	>80	>1.0	~227	#371
SB Longwood Right	B	11.7	0.26	63	105

~ Volume exceeds capacity, queue is theoretically infinite.
# 95th percentile volume exceeds capacity, queue may be longer.
m Volume for 95th percentile queue is metered by upstream signal.

Table 3-34 Existing Condition (2009) Intersection LOS Summary – PM Peak Hour

Intersection	LOS	Delay (sec.)	V/C Ratio	95th % Queue (feet)
Unsignalized Intersections				
2. Fenwood Road at Brookline Avenue				
EB Brookline Thru/Right	A	0.0	0.24	0
WB Brookline Thru	A	0.0	0.31	0
NB Fenwood Right	B	13.3	0.13	11
4. Vining Street at Private Way				
EB Mission Park Garage Left/Thru/Right	A	8.4	0.22	n/a
WB Vining Left/Thru/Right	A	7.7	0.10	n/a
NB Driveway Left/Thru/Right	A	7.0	0.00	n/a
SB Vining St Ext. Left/Thru/Right	A	8.1	0.09	n/a
5. Binney Street at Francis Street				
EB Binney Left/Thru/Right	F	>50	>1.0	n/a
WB Binney Left/Thru/Right	F	>50	>1.0	n/a
NB Francis Left/Thru/Right	A	0.2	0.01	1
SB Francis Left	B	10.4	0.09	7
SB Francis Thru/Right	A	0.0	0.19	0
6. Binney Street at Fenwood Road				
WB Binney Left/Right	B	11.6	0.15	14
NB Fenwood Thru/Right	A	0.0	0.14	0
SB Fenwood Left/Thru	A	3.6	0.02	1

Table 3-34 Existing Condition (2009) Intersection LOS Summary – PM Peak Hour (Continued)

Intersection	LOS	Delay (sec.)	V/C Ratio	95th % Queue (feet)
Unsignalized Intersections				
8. Fenwood Road at Vining Street				
EB Vining Left/Thru/Right	B	10.2	0.37	n/a
WB Vining Left/Thru/Right	A	8.8	0.16	n/a
NB Fenwood Left/Thru/Right	A	8.7	0.12	n/a
SB Fenwood Left/Thru/Right	A	9.0	0.20	n/a
9. St. Albans Street at Francis Street				
EB St. Alban's Left	C	21.1	0.19	17
EB St. Alban's Right	B	12.5	0.10	8
WB St. Alban's Left/Thru/Right	D	28.6	0.46	57
NB Francis Left/Thru	A	1.0	0.02	2
SB Francis Thru/Right	A	0.0	0.15	0
10. St. Albans Street at Fenwood Road				
EB St. Alban's Thru/Left	B	14.8	0.18	16
WB St. Alban's Thru/Right	B	13.6	0.15	13
NB Fenwood Left/Thru/Right	A	2.8	0.02	2
SB Fenwood Left/Thru/Right	A	2.1	0.03	3

~ Volume exceeds capacity, queue is theoretically infinite.
# 95th percentile volume exceeds capacity, queue may be longer.
m Volume for 95th percentile queue is metered by upstream signal.

3.4.1.1 Existing (2009) AM Peak Hour LOS Summary

The three study area intersections located along Brookline Avenue experience either LOS E or F during the morning peak period. Lengthy vehicle queuing has been observed on this roadway during the morning peak period and modeled similarly within Synchro. The queues tend to create increased delays for the turning movements at these major intersections, resulting in these calculated LOS results. Huntington Avenue also experiences similar LOS results at its intersections with Francis Street and Longwood Avenue. The general purpose lanes on Huntington Avenue, Francis Street and Tremont Street all have measureable delays. It has been observed in the field that pedestrians crossing at these intersections tend to walk without waiting for the exclusive pedestrian phase, causing conflicting movements with turning vehicles.

Longwood Avenue at Huntington Avenue was modeled in Synchro to match existing conditions. At the time that counts were conducted to support this transportation study (Summer 2009), the southbound direction on Longwood Avenue had been temporarily altered for construction and only provided a single eastbound general purpose lane verses the typical one left and one thru/right lane at the approach. The approach is modeled with two lanes in both the no-build and build conditions.

The unsignalized intersections surrounding the Project Site were determined to operate at acceptable LOS B or C for the minor movements. Fenwood Road at Brookline Avenue, for which the minor movement is a right-turn only onto Brookline Avenue, operates at LOS B during the morning peak hour. The Vining Street at the private way intersection also operates at LOS B. Fenwood Road at Vining Street was determined to operate at LOS C in the eastbound direction on Vining Street. The unsignalized intersections that were studied that are located slightly further from the Project Site were calculated to have generally lower LOS. St. Albans Street at Francis Street operates at LOS F in the east and westbound directions. This delay is mostly due to queues extending from Huntington Avenue at Francis Street. BWH provides a police detail during high volume periods in order to alleviate delays and manage traffic flow at this location. Binney Street at Francis Street experiences similar vehicle queuing from Brookline Avenue. The eastbound and westbound movements are at LOS F at this intersection.

3.4.1.2 Existing (2009) Intersection LOS Summary PM Peak Hour

During the evening peak period, the intersections of Brookline Avenue at both Riverway and Francis Street operate at LOS F. The heavy through volumes and congestion on Brookline Avenue are the primary cause of the delays at these locations. The Riverway is also highly utilized by vehicles traveling into Brookline. These volumes also affect the intersection of Riverway at Longwood Avenue, which tends to back-up due to congestion at Harvard Street in Brookline. The eastbound lefts from Riverway onto Longwood Avenue and the northbound movements on Longwood Avenue both have LOS that reaches or exceeds capacity. Unlike the morning peak, the intersection of Brookline Avenue at Longwood Avenue operates at a more acceptable LOS D. The left movements at this intersection are still heavy; however the through movements are less congested with less delay.

Most of the unsignalized intersections during the evening peak function at improved LOS compared to the morning peak. The intersection of Binney Street at Francis Street still operates at LOS F due to the congestion on Francis approaching Brookline Avenue.

Table 3-35 No Build Condition (2016) Intersection LOS Summary – AM Peak Hour

Intersection	LOS	Delay (sec.)	V/C Ratio	Average Queue	95th % Queue (feet)
Signalized Intersections					
1. Brookline Avenue at Francis Street	F	>80	>1.0	-	-
EB Brookline Thru/Left	F	>80	>1.0	~381	m#398
EB Brookline Right	B	16.0	0.45	82	m88
WB Brookline Left	F	>80	>1.0	~178	m#219
WB Brookline Thru/Right	A	4.7	0.38	42	m50
NB Francis Left	D	35.9	0.63	124	m#249
NB Francis Thru/Right	C	30.0	0.30	68	m100
SB Francis Left/Thru/Right	C	24.9	0.33	82	#249

Table 3-35 No Build Condition (2016) Intersection LOS Summary – AM Peak Hour (Continued)

Intersection	LOS	Delay (sec.)	V/C Ratio	Average Queue	95th % Queue (feet)
Signalized Intersections					
3. Brookline Avenue at Riverway	F	>80	>1.0	-	-
EB Brookline Left	F	>80	>1.0	~261	#380
EB Brookline Thru/Right	F	>80	>1.0	198	#307
WB Brookline Left	F	>80	>1.0	~265	m#395
WB Brookline Thru/Right	C	24.0	0.56	78	m118
NB Riverway Left/Thru/Right	E	74.7	>1.0	~655	#795
SB Riverway Left/Thru/Right	B	18.7	0.55	213	257
7. Vining Street at Francis Street	E	69.2	0.78	-	-
EB Vining Left/Thru/Right	B	11.9	0.59	102	205
NB Francis Left/Thru/Right	F	>80	>1.0	220	m167
SB Francis Left	E	56.3	0.65	47	m50
SB Francis Thru/Right	E	56.4	0.85	205	m175
11. Francis Street at Huntington Avenue	F	>80	>1.0	-	-
EB Huntington Hard Left/Left/Thru/Right	F	>80	>1.0	~461	#583
WB Huntington Hard Left/Left	D	46.2	0.80	56	m#74
WB Huntington Left/Thru/Right	E	76.5	>1.0	~216	m#332
NB Tremont Hard Left/Left/Thru/Right	F	>80	>1.0	~434	#630
SB Francis Left/Thru/Right	F	>80	>1.0	~304	m#408
SB Francis Hard Right	C	20.1	0.13	12	m20
NEB Calumet Hard Right	D	45.3	0.28	27	50
12. Fenwood Road at Huntington Avenue	A	0.2	0.33	-	-
EB Huntington Thru/Left	A	0.3	0.33	0	0
WB Huntington Thru/Right	A	0.0	0.26	0	m0
13. St. Albans Street at Huntington Avenue	B	10.8	0.54	-	-
SE Huntington Left/Thru	A	5.8	0.54	87	190
NW Huntington Thru/Right	A	7.9	0.31	103	130
NE St. Alban's Left/Thru/Right	D	37.2	0.16	18	33
SW St. Alban's Left/Thru/Right	D	40.6	0.53	55	115
14. Huntington Avenue at Longwood Avenue	D	41.6	0.97	-	-
EB Huntington Left	E	71.6	0.77	105	m0
EB Huntington Thru/Right	B	13.3	0.49	232	m20
WB Huntington Left	D	39.5	0.28	30	68
WB Huntington Thru	C	33.8	0.81	302	#498
WB Huntington Right	E	71.6	0.99	~244	#434
NB Longwood Left/Thru/Right	D	37.3	0.72	183	226
SB Longwood Left	F	>80	>1.0	~100	m#165
SB Longwood Thru/Right	C	32.2	0.43	87	m125

Table 3-35 No Build Condition (2016) Intersection LOS Summary – AM Peak Hour (Continued)

Intersection	LOS	Delay (sec.)	V/C Ratio	Average Queue	95th % Queue (feet)
Signalized Intersections					
15. Binney Street at Longwood Avenue	C	34.5	0.82	-	-
EB Binney Left/Thru/Right	D	53.7	0.84	106	m141
WB Binney Left/Thru	D	36.3	0.51	59	108
WB Binney Right	C	31.2	0.07	0	35
NB Longwood Left/Thru/Right	D	36.5	0.84	167	m#233
SB Longwood Left/Thru/Right	C	25.0	0.72	131	m95
16. Brookline Avenue at Longwood Avenue	F	>80	>1.0	-	-
EB Brookline Left	F	>80	>1.0	~80	m#89
EB Brookline Thru/Right	F	>80	>1.0	~433	m#408
WB Brookline Left	F	>80	>1.0	~217	#369
WB Brookline Thru/Right	C	26.2	0.79	230	315
NB Longwood Left	F	>80	>1.0	~87	m#125
NB Longwood Thru	D	43.5	0.68	87	m111
NB Longwood Right	B	10.3	0.26	0	m0
SB Longwood Left	D	43.9	0.63	54	90
SB Longwood Thru/Right	F	>80	>1.0	~263	#333
17. Riverway at Longwood Avenue	D	47.8	0.96	-	-
EB Riverway Left	B	18.9	0.76	110	#250
EB Riverway Thru/Right	D	39.7	0.89	236	#348
WB Riverway Left/Thru	C	29.7	0.71	169	232
WB Riverway Right	C	21.3	0.05	0	29
NB Longwood Left	C	28.3	0.23	12	36
NB Longwood Thru/Right	C	31.0	0.52	108	178
SB Longwood Thru/Left	F	>80	>1.0	~272	#409
SB Longwood Right	A	8.5	0.13	24	44

~ Volume exceeds capacity, queue is theoretically infinite.
# 95th percentile volume exceeds capacity, queue may be longer.
m Volume for 95th percentile queue is metered by upstream signal.

Table 3-36 No Build Condition (2016) Intersection LOS Summary – AM Peak Hour

Intersection	LOS	Delay (sec.)	V/C Ratio	95th % Queue (feet)
Unsignalized Intersections				
2. Fenwood Road at Brookline Avenue				
EB Brookline Thru/Right	A	0.0	0.40	0
WB Brookline Thru	A	0.0	0.22	0
NB Fenwood Right	B	14.1	0.19	17
4. Vining Street at Private Way				
EB Mission Park Garage Left/Thru/Right	B	12.5	0.52	n/a
WB Vining Left/Thru/Right	A	9.9	0.30	n/a
NB Driveway Left/Thru/Right	A	8.5	0.02	n/a
SB Vining St Ext. Left/Thru/Right	A	9.5	0.21	n/a

Table 3-36 No Build Condition (2016) Intersection LOS Summary – AM Peak Hour (Continued)

Intersection	LOS	Delay (sec.)	V/C Ratio	95th % Queue (feet)
Unsignalized Intersections				
5. Binney Street at Francis Street				
EB Binney Left/Thru/Right	F	>50	>1.0	n/a
WB Binney Left/Thru/Right	F	>50	>1.0	n/a
NB Francis Left/Thru/Right	A	0.5	0.02	1
SB Francis Left	B	13.2	0.25	25
SB Francis Thru/Right	A	0.0	0.22	0
6. Binney Street at Fenwood Road				
WB Binney Left/Right	B	13.0	0.21	20
NB Fenwood Thru/Right	A	0.0	0.10	0
SB Fenwood Left/Thru	A	2.7	0.04	3
8. Fenwood Road at Vining Street				
EB Vining Left/Thru/Right	C	16.0	0.63	n/a
WB Vining Left/Thru/Right	A	9.8	0.20	n/a
NB Fenwood Left/Thru/Right	B	10.6	0.26	n/a
SB Fenwood Left/Thru/Right	B	10.1	0.25	n/a
9. St. Albans Street at Francis Street				
EB St. Alban's Left	F	>50	0.48	55
EB St. Alban's Right	C	18.5	0.17	15
WB St. Alban's Left/Thru/Right	F	>50	0.76	106
NB Francis Left/Thru	A	0.8	0.02	2
SB Francis Thru/Right	A	0.0	0.20	0
10. St. Albans Street at Fenwood Road				
EB St. Alban's Thru/Left	C	20.2	0.41	49
WB St. Alban's Thru/Right	B	13.0	0.11	9
NB Fenwood Left/Thru/Right	A	2.5	0.02	1
SB Fenwood Left/Thru/Right	A	3.7	0.07	5

~ Volume exceeds capacity, queue is theoretically infinite.
# 95th percentile volume exceeds capacity, queue may be longer.
m Volume for 95th percentile queue is metered by upstream signal.

Table 3-37 No Build Condition (2016) Intersection LOS Summary – PM Peak Hour

Intersection	LOS	Delay (sec.)	V/C Ratio	Average Queue	95th % Queue (feet)
Signalized Intersections					
1. Brookline Avenue at Francis Street	F	>80	0.95	-	-
EB Brookline Thru/Left	F	>80	>1.0	~319	m#396
EB Brookline Right	E	60.6	0.54	85	m125
WB Brookline Left	C	29.4	0.35	93	m#140
WB Brookline Thru/Right	C	29.3	0.55	273	m404
NB Francis Left	E	60.1	0.86	208	m274
NB Francis Thru/Right	D	35.3	0.35	106	m152
SB Francis Left/Thru/Right	C	29.7	0.27	66	108

Table 3-37 No Build Condition (2016) Intersection LOS Summary – PM Peak Hour (Continued)

Intersection	LOS	Delay (sec.)	V/C Ratio	Average Queue	95th % Queue (feet)
Signalized Intersections					
3. Brookline Avenue at Riverway	F	>80	>1.0	-	-
EB Brookline Left	F	>80	>1.0	~144	#267
EB Brookline Thru/Right	D	47.7	0.64	148	203
WB Brookline Left	F	>80	>1.0	~414	m#587
WB Brookline Thru/Right	C	28.0	0.61	264	m177
NB Riverway Left/Thru/Right	D	50.7	0.93	~414	#547
SB Riverway Left/Thru/Right	F	>80	>1.0	~668	#765
7. Vining Street at Francis Street	B	17.7	0.48	-	-
EB Vining Left/Thru/Right	E	70.0	0.83	118	157
NB Francis Left/Thru/Right	A	7.9	0.37	86	205
SB Francis Left	A	3.6	0.10	6	18
SB Francis Thru/Right	A	4.6	0.33	42	134
11. Francis Street at Huntington Avenue	F	>80	>1.0	-	-
EB Huntington Hard Left/Left/Thru/Right	F	>80	>1.0	~300	#425
WB Huntington Hard Left/Left	C	20.1	0.62	46	m48
WB Huntington Left/Thru/Right	C	29.8	0.92	325	m310
NB Tremont Hard Left/Left/Thru/Right	F	>80	>1.0	~385	#572
SB Francis Left/Thru/Right	F	>80	>1.0	~262	#431
SB Francis Hard Right	D	36.1	0.16	18	46
NEB Calumet Hard Right	F	>80	>1.0	~106	#180
12. Fenwood Road at Huntington Avenue	A	0.1	0.34	-	-
EB Huntington Thru/Left	A	0.3	0.28	0	0
WB Huntington Thru/Right	A	0.0	0.34	0	m0
13. St. Albans Street at Huntington Avenue	B	11.6	0.51	-	-
SE Huntington Left/Thru	A	5.8	0.38	67	145
NW Huntington Thru/Right	A	5.4	0.47	61	402
NE St. Alban's Left/Thru/Right	C	34.0	0.18	20	30
SW St. Alban's Left/Thru/Right	D	45.4	0.69	104	141
14. Huntington Avenue at Longwood Avenue	D	50.6	0.99	-	-
EB Huntington Left	D	54.1	0.40	47	m43
EB Huntington Thru/Right	A	4.9	0.45	50	m39
WB Huntington Left	E	55.3	0.74	88	#162
WB Huntington Thru	F	89.1	>1.0	~649	#850
WB Huntington Right	C	25.5	0.55	78	153
NB Longwood Left/Thru/Right	C	31.3	0.42	83	136
SB Longwood Left	F	84.3	0.93	96	#214
SB Longwood Thru/Right	D	41.4	0.74	155	254
15. Binney Street at Longwood Avenue	D	35.2	0.68	-	-
EB Binney Left/Thru/Right	E	69.6	0.85	124	m169
WB Binney Left/Thru	D	53.0	0.65	91	129
WB Binney Right	D	41.1	0.12	0	44

Table 3-37 No Build Condition (2016) Intersection LOS Summary – PM Peak Hour (Continued)

Intersection	LOS	Delay (sec.)	V/C Ratio	Average Queue	95th % Queue (feet)
Signalized Intersections					
NB Longwood Left/Thru/Right	C	30.2	0.70	239	#375
SB Longwood Left/Thru/Right	B	17.7	0.38	137	m135
16. Brookline Avenue at Longwood Avenue	E	77.8	>1.0	-	-
EB Brookline Left	F	>80	>1.0	~89	m#85
EB Brookline Thru/Right	F	>80	>1.0	~380	m#262
WB Brookline Left	F	>80	>1.0	~150	#301
WB Brookline Thru/Right	C	33.0	0.75	254	328
NB Longwood Left	E	70.9	0.97	75	m#301
NB Longwood Thru	C	26.2	0.57	74	m#120
NB Longwood Right	B	12.0	0.26	0	m3
SB Longwood Left	D	42.9	0.67	91	161
SB Longwood Thru/Right	C	32.1	0.42	104	162
17. Riverway at Longwood Avenue	F	>80	>1.0	-	-
EB Riverway Left	C	24.0	0.69	112	208
EB Riverway Thru/Right	C	21.6	0.42	100	143
WB Riverway Left/Thru	F	>80	>1.0	~399	#527
WB Riverway Right	B	18.8	0.09	0	35
NB Longwood Left	C	34.5	0.37	28	60
NB Longwood Thru/Right	F	>80	>1.0	~313	#444
SB Longwood Thru/Left	F	>80	>1.0	~265	#387
SB Longwood Right	B	11.8	0.27	65	109

~ Volume exceeds capacity, queue is theoretically infinite.
# 95th percentile volume exceeds capacity, queue may be longer.
m Volume for 95th percentile queue is metered by upstream signal.

Table 3-38 No Build Condition (2016) Intersection LOS Summary – PM Peak Hour

Intersection	LOS	Delay (sec.)	V/C Ratio	95th % Queue (feet)
Unsignalized Intersections				
2. Fenwood Road at Brookline Avenue				
EB Brookline Thru/Right	A	0.0	0.26	0
WB Brookline Thru	A	0.0	0.35	0
NB Fenwood Right	B	13.8	0.15	13
4. Vining Street at Private Way				
EB Mission Park Garage Left/Thru/Right	A	8.2	0.20	n/a
WB Vining Left/Thru/Right	A	7.6	0.07	n/a
NB Driveway Left/Thru/Right	A	6.9	0.0	n/a
SB Vining St Ext. Left/Thru/Right	A	8.0	0.09	n/a

Table 3-38 No Build Condition (2016) Intersection LOS Summary – PM Peak Hour (Continued)

Intersection	LOS	Delay (sec.)	V/C Ratio	95th % Queue (feet)
Unsignalized Intersections				
5. Binney Street at Francis Street				
EB Binney Left/Thru/Right	F	>50	>1.0	n/a
WB Binney Left/Thru/Right	F	>50	>1.0	n/a
NB Francis Left/Thru/Right	A	0.2	0.01	1
SB Francis Left	B	10.4	0.10	9
SB Francis Thru/Right	A	0.0	0.19	0
6. Binney Street at Fenwood Road				
WB Binney Left/Right	B	11.6	0.13	11
NB Fenwood Thru/Right	A	0.0	0.15	0
SB Fenwood Left/Thru	A	3.9	0.02	2
8. Fenwood Road at Vining Street				
EB Vining Left/Thru/Right	A	9.9	0.35	n/a
WB Vining Left/Thru/Right	A	8.7	0.17	n/a
NB Fenwood Left/Thru/Right	A	8.7	0.12	n/a
SB Fenwood Left/Thru/Right	A	8.8	0.18	n/a
9. St. Albans Street at Francis Street				
EB St. Alban's Left	C	22.2	0.20	18
EB St. Alban's Right	B	12.8	0.11	9
WB St. Alban's Left/Thru/Right	C	21.7	0.38	42
NB Francis Left/Thru	A	1.0	0.03	2
SB Francis Thru/Right	A	0.0	0.16	0
10. St. Albans Street at Fenwood Road				
EB St. Alban's Thru/Left	C	15.3	0.18	17
WB St. Alban's Thru/Right	B	13.8	0.15	13
NB Fenwood Left/Thru/Right	A	2.9	0.02	2
SB Fenwood Left/Thru/Right	A	2.2	0.04	3

~ Volume exceeds capacity, queue is theoretically infinite.
# 95th percentile volume exceeds capacity, queue may be longer.
m Volume for 95th percentile queue is metered by upstream signal.

3.4.1.3 No Build Condition (2016) AM Peak Hour LOS Summary

During the No Build Condition morning peak period, operations at the intersection of Francis Street at Brookline Avenue decrease from LOS E under Existing Conditions to an LOS F. The increase in delay is seen mostly in the eastbound through/left-turn movement. Vining Street at Francis Street decreases from LOS C to an LOS E. The intersection of Longwood Avenue at Huntington Avenue operates LOS D. This change in LOS can be associated with the change in lane configuration in the southbound direction. The unsignalized intersections were determined to have the same LOS as the 2009 Existing Condition.

3.4.1.4 No Build Condition (2016) Intersection LOS Summary PM Peak Hour

During the evening peak period, the intersections of Binney Street and Brookline Avenue at Longwood Avenue decrease in LOS. Binney Street at Longwood Avenue decreases from LOS C to LOS D; while Brookline Avenue at Longwood Avenue decreases from an LOS D to LOS E. The eastbound through/right-turn movement changes from LOS D to LOS F. The westbound left-turn movement also decreases from LOS E to LOS F. These delays can be attributed mostly to higher through volumes, which make it increasingly difficult for motorists making left turns.

Two of the unsignalized intersections will see improved LOS during the evening peak period. Fenwood Road at Vining Street improved to LOS A while St. Albans Street at Francis Street improved to LOS C. The increase in LOS at Fenwood Road and Vining Street is directly associated with the change in valet services – the relocation of patient valet parking from Mission Park Garage to the ASB II Garage.

Table 3-39 No Build Condition (2021) Intersection LOS Summary – AM Peak Hour

Intersection	LOS	Delay (sec.)	V/C Ratio	Average Queue	95th % Queue (feet)
Signalized Intersections					
1. Brookline Avenue at Francis Street	F	>80	>1.0	-	-
EB Brookline Thru/Left	F	>80	>1.0	~397	m#402
EB Brookline Right	B	16.2	0.47	86	M91
WB Brookline Left	F	>80	>1.0	~184	m#234
WB Brookline Thru/Right	A	4.8	0.39	44	m50
NB Francis Left	D	36.5	0.65	137	m#255
NB Francis Thru/Right	C	29.9	0.30	67	m98
SB Francis Left/Thru/Right	C	25.0	0.34	86	#268
3. Brookline Avenue at Riverway	F	>80	>1.0	-	-
EB Brookline Left	F	>80	>1.0	~269	#391
EB Brookline Thru/Right	F	>80	>1.0	202	#314
WB Brookline Left	F	>80	>1.0	~280	m#401
WB Brookline Thru/Right	C	24.4	0.57	81	m120
NB Riverway Left/Thru/Right	F	>80	>1.0	~687	#827
SB Riverway Left/Thru/Right	B	19.0	0.57	220	266
7. Vining Street at Francis Street	F	80.0	0.83	-	-
EB Vining Left/Thru/Right	B	13.0	0.60	104	214
NB Francis Left/Thru/Right	F	>80	>1.0	232	m179
SB Francis Left	D	48.4	0.67	42	m43
SB Francis Thru/Right	E	59.0	0.87	221	m178

Table 3-39 No Build Condition (2021) Intersection LOS Summary – AM Peak Hour (Continued)

Intersection	LOS	Delay (sec.)	V/C Ratio	Average Queue	95th % Queue (feet)
Signalized Intersections					
11. Francis Street at Huntington Avenue	F	>80	>1.0	-	-
EB Huntington Hard Left/Left/Thru/Right	F	>80	>1.0	~482	#607
WB Huntington Hard Left/Left	E	57.4	0.88	60	m#82
WB Huntington Left/Thru/Right	C	28.3	0.84	~210	M254
NB Tremont Hard Left/Left/Thru/Right	F	>80	>1.0	~468	#666
SB Francis Left/Thru/Right	F	>80	>1.0	~338	m#424
SB Francis Hard Right	C	20.1	0.13	12	m20
NEB Calumet Hard Right	D	45.6	0.30	28	51
12. Fenwood Road at Huntington Avenue	A	0.2	0.34	-	-
EB Huntington Thru/Left	A	0.3	0.34	0	0
WB Huntington Thru/Right	A	0.0	0.27	0	m0
13. St. Albans Street at Huntington Avenue	B	11.7	0.56	-	-
SE Huntington Left/Thru	A	6.1	0.56	93	208
NW Huntington Thru/Right	A	9.7	0.32	109	146
NE St. Alban's Left/Thru/Right	D	37.2	0.18	20	35
SW St. Alban's Left/Thru/Right	D	40.3	0.54	57	118
14. Huntington Avenue at Longwood Avenue	D	44.2	>1.0	-	-
EB Huntington Left	E	70.7	0.78	108	m0
EB Huntington Thru/Right	B	14.4	0.52	243	m21
WB Huntington Left	D	39.3	0.28	31	68
WB Huntington Thru	D	3835	0.86	331	#546
WB Huntington Right	E	75.3	>1.0	~269	#439
NB Longwood Left/Thru/Right	D	38.3	0.74	188	232
SB Longwood Left	F	>80	>1.0	~102	m#160
SB Longwood Thru/Right	C	32.1	0.44	90	m124
15. Binney Street at Longwood Avenue	C	34.9	0.84	-	-
EB Binney Left/Thru/Right	D	50.1	0.82	106	m139
WB Binney Left/Thru	C	33.5	0.50	59	109
WB Binney Right	C	30.7	0.07	0	35
NB Longwood Left/Thru/Right	D	38.8	0.87	~174	m#240
SB Longwood Left/Thru/Right	C	25.9	0.75	134	m95
16. Brookline Avenue at Longwood Avenue	F	>80	>1.0	-	-
EB Brookline Left	F	>80	>1.0	~84	m#92
EB Brookline Thru/Right	F	>80	>1.0	~451	m#413
WB Brookline Left	F	>80	>1.0	~224	#377
WB Brookline Thru/Right	C	27.4	0.81	241	331
NB Longwood Left	F	>80	>1.0	~93	m#126
NB Longwood Thru	D	44.3	0.70	90	m113
NB Longwood Right	B	10.5	0.26	0	m0
SB Longwood Left	D	46.4	0.66	56	#99
SB Longwood Thru/Right	F	>80	>1.0	~281	#349

Table 3-39 No Build Condition (2021) Intersection LOS Summary – AM Peak Hour (Continued)

Intersection	LOS	Delay (sec.)	V/C Ratio	Average Queue	95th % Queue (feet)
Signalized Intersections					
17. Riverway at Longwood Avenue	D	54.3	1.0	-	-
EB Riverway Left	C	20.6	0.78	121	#268
EB Riverway Thru/Right	D	41.3	0.91	244	#363
WB Riverway Left/Thru	C	29.9	0.72	174	239
WB Riverway Right	C	21.2	0.05	0	30
NB Longwood Left	C	29.6	0.25	12	36
NB Longwood Thru/Right	C	31.9	0.55	113	185
SB Longwood Thru/Left	F	>80	>1.0	~293	#433
SB Longwood Right	A	8.6	0.14	25	45

~ Volume exceeds capacity, queue is theoretically infinite.
# 95th percentile volume exceeds capacity, queue may be longer.
m Volume for 95th percentile queue is metered by upstream signal.

Table 3-40 No Build Condition (2021) Intersection LOS Summary – AM Peak Hour

Intersection	LOS	Delay (sec.)	V/C Ratio	95th % Queue (feet)
Unsignalized Intersections				
2. Fenwood Road at Brookline Avenue				
EB Brookline Thru/Right	A	0.0	0.42	0
WB Brookline Thru	A	0.0	0.29	0
NB Fenwood Right	B	14.5	0.20	18
4. Vining Street at Private Way				
EB Mission Park Garage Left/Thru/Right	B	12.9	0.54	n/a
WB Vining Left/Thru/Right	B	10.0	0.31	n/a
NB Driveway Left/Thru/Right	A	8.6	0.02	n/a
SB Vining St Ext. Left/Thru/Right	A	9.7	0.22	n/a
5. Binney Street at Francis Street				
EB Binney Left/Thru/Right	F	>50	>1.0	n/a
WB Binney Left/Thru/Right	F	>50	>1.0	n/a
NB Francis Left/Thru/Right	A	0.5	0.02	1
SB Francis Left	B	13.4	0.26	26
SB Francis Thru/Right	A	0.0	0.23	0
6. Binney Street at Fenwood Road				
WB Binney Left/Right	B	13.1	0.16	14
NB Fenwood Thru/Right	A	0.0	0.10	0
SB Fenwood Left/Thru	A	2.8	0.04	3

Table 3-40 No Build Condition (2021) Intersection LOS Summary – AM Peak Hour (Continued)

Intersection	LOS	Delay (sec.)	V/C Ratio	95th % Queue (feet)
Unsignalized Intersections				
8. Fenwood Road at Vining Street				
EB Vining Left/Thru/Right	C	16.6	0.65	n/a
WB Vining Left/Thru/Right	A	10.7	0.20	n/a
NB Fenwood Left/Thru/Right	B	10.7	0.27	n/a
SB Fenwood Left/Thru/Right	B	10.1	0.24	n/a
9. St. Albans Street at Francis Street				
EB St. Alban's Left	F	>50	0.62	75
EB St. Alban's Right	C	19.6	0.18	17
WB St. Alban's Left/Thru/Right	F	>50	>1.0	177
NB Francis Left/Thru	A	0.7	0.02	2
SB Francis Thru/Right	A	0.0	0.21	0
10. St. Albans Street at Fenwood Road				
EB St. Alban's Thru/Left	C	20.5	0.42	51
WB St. Alban's Thru/Right	B	13.0	0.11	9
NB Fenwood Left/Thru/Right	A	2.6	0.02	1
SB Fenwood Left/Thru/Right	A	3.7	0.07	5

~ Volume exceeds capacity, queue is theoretically infinite.
# 95th percentile volume exceeds capacity, queue may be longer.
m Volume for 95th percentile queue is metered by upstream signal.

Table 3-41 No Build Condition (2021) Intersection LOS Summary – PM Peak Hour

Intersection	LOS	Delay (sec.)	V/C Ratio	Average Queue	95th % Queue (feet)
Signalized Intersections					
1. Brookline Avenue at Francis Street	F	F	>80	0.97	-
EB Brookline Thru/Left	F	F	>80	>1.0	~330
EB Brookline Right	E	E	61.2	0.56	90
WB Brookline Left	C	C	30.6	0.37	101
WB Brookline Thru/Right	C	C	30.4	0.58	281
NB Francis Left	E	E	57.8	0.85	209
NB Francis Thru/Right	C	C	34.0	0.35	104
SB Francis Left/Thru/Right	C	C	28.8	0.27	66
3. Brookline Avenue at Riverway	F	>80	>1.0	-	-
EB Brookline Left	F	>80	>1.0	~151	#275
EB Brookline Thru/Right	D	48.1	0.65	151	207
WB Brookline Left	F	>80	>1.0	~444	m#620
WB Brookline Thru/Right	C	28.0	0.64	279	m202
NB Riverway Left/Thru/Right	E	63.3	0.99	~440	#574
SB Riverway Left/Thru/Right	F	>80	>1.0	~698	#795

Table 3-41 No Build Condition (2021) Intersection LOS Summary – PM Peak Hour (Continued)

Intersection	LOS	Delay (sec.)	V/C Ratio	Average Queue	95th % Queue (feet)
Signalized Intersections					
7. Vining Street at Francis Street	**B**	**17.2**	**0.50**	**-**	**-**
EB Vining Left/Thru/Right	E	69.8	0.83	114	152
NB Francis Left/Thru/Right	A	8.2	0.40	94	226
SB Francis Left	A	3.6	0.10	6	21
SB Francis Thru/Right	A	5.0	0.35	42	182
11. Francis Street at Huntington Avenue	**F**	**>80**	**>1.0**	**-**	**-**
EB Huntington Hard Left/Left/Thru/Right	F	>80	>1.0	~310	#442
WB Huntington Hard Left/Left	C	20.4	0.64	47	m48
WB Huntington Left/Thru/Right	C	31.2	0.95	339	m311
NB Tremont Hard Left/Left/Thru/Right	F	>80	1.0	~400	#587
SB Francis Left/Thru/Right	F	>80	>1.0	~307	#481
SB Francis Hard Right	D	36.4	0.17	20	49
NEB Calumet Hard Right	F	>80	>1.0	~111	#184
12. Fenwood Road at Huntington Avenue	**A**	**0.1**	**0.35**	**-**	**-**
EB Huntington Thru/Left	A	0.3	0.28	0	0
WB Huntington Thru/Right	A	0.0	0.35	0	m0
13. St. Albans Street at Huntington Avenue	**B**	**12.0**	**0.53**	**-**	**-**
SE Huntington Left/Thru	A	6.2	0.40	74	157
NW Huntington Thru/Right	A	6.2	0.48	65	411
NE St. Alban's Left/Thru/Right	C	33.4	0.17	19	30
SW St. Alban's Left/Thru/Right	D	45.1	0.70	109	144
14. Huntington Avenue at Longwood Avenue	**E**	**56.3**	**>1.0**	**-**	**-**
EB Huntington Left	D	52.7	0.41	48	m41
EB Huntington Thru/Right	A	5.5	0.47	59	m43
WB Huntington Left	E	56.9	0.76	91	#169
WB Huntington Thru	F	>80	>1.0	~689	#892
WB Huntington Right	C	25.8	0.56	79	154
NB Longwood Left/Thru/Right	C	31.3	0.44	85	139
SB Longwood Left	F	>80	0.93	96	#214
SB Longwood Thru/Right	D	42.2	0.76	161	261
15. Binney Street at Longwood Avenue	**D**	**35.7**	**0.69**	**-**	**-**
EB Binney Left/Thru/Right	E	71.3	0.86	121	m160
WB Binney Left/Thru	E	56.4	0.69	95	133
WB Binney Right	D	41.5	0.12	0	45
NB Longwood Left/Thru/Right	C	30.8	0.72	247	#388
SB Longwood Left/Thru/Right	B	17.3	0.39	141	m132

Table 3-41 No Build Condition (2021) Intersection LOS Summary – PM Peak Hour (Continued)

Intersection	LOS	Delay (sec.)	V/C Ratio	Average Queue	95th % Queue (feet)
Signalized Intersections					
16. Brookline Avenue at Longwood Avenue	F	>80	>1.0	-	-
EB Brookline Left	F	>80	>1.0	~95	m#93
EB Brookline Thru/Right	F	>80	>1.0	~400	m#273
WB Brookline Left	F	>80	>1.0	~157	#309
WB Brookline Thru/Right	D	36.0	0.79	262	338
NB Longwood Left	E	65.3	0.95	92	m#307
NB Longwood Thru	C	25.2	0.56	79	m121
NB Longwood Right	B	12.0	0.26	0	m3
SB Longwood Left	D	40.5	0.66	95	#169
SB Longwood Thru/Right	C	31.0	0.42	108	167
17. Riverway at Longwood Avenue	F	>80	>1.0	-	-
EB Riverway Left	C	24.9	0.70	115	#214
EB Riverway Thru/Right	C	21.7	0.43	102	146
WB Riverway Left/Thru	F	>80	>1.0	~418	#546
WB Riverway Right	B	18.8	0.10	0	36
NB Longwood Left	D	35.7	0.39	29	62
NB Longwood Thru/Right	F	>80	>1.0	~331	#463
SB Longwood Thru/Left	F	>80	>1.0	~266	#420
SB Longwood Right	B	11.9	0.28	67	112

~ Volume exceeds capacity, queue is theoretically infinite.
# 95th percentile volume exceeds capacity, queue may be longer.
m Volume for 95th percentile queue is metered by upstream signal.

Table 3-42 No Build Condition (2021) Intersection LOS Summary – PM Peak Hour

Intersection	LOS	Delay (sec.)	V/C Ratio	95th % Queue (feet)
Unsignalized Intersections				
2. Fenwood Road at Brookline Avenue				
EB Brookline Thru/Right	A	0.0	0.27	0
WB Brookline Thru	A	0.0	0.36	0
NB Fenwood Right	B	13.9	0.15	13
4. Vining Street at Private Way				
EB Mission Park Garage Left/Thru/Right	A	8.3	0.21	n/a
WB Vining Left/Thru/Right	A	7.6	0.08	n/a
NB Driveway Left/Thru/Right	A	6.9	0.00	n/a
SB Vining St Ext. Left/Thru/Right	A	8.0	0.09	n/a
5. Binney Street at Francis Street				
EB Binney Left/Thru/Right	F	>50	>1.0	0
WB Binney Left/Thru/Right	F	>50	>1.0	0

Table 3-42 No Build Condition (2021) Intersection LOS Summary – PM Peak Hour (Continued)

Intersection	LOS	Delay (sec.)	V/C Ratio	95th % Queue (feet)
Unsignalized Intersections				
NB Francis Left/Thru/Right	A	0.2	0.01	1
SB Francis Left	B	10.5	0.11	9
SB Francis Thru/Right	A	0.0	0.20	0
6. Binney Street at Fenwood Road				
WB Binney Left/Right	B	11.3	0.12	10
NB Fenwood Thru/Right	A	0.0	0.16	0
SB Fenwood Left/Thru	A	6.4	0.02	1
8. Fenwood Road at Vining Street				
EB Vining Left/Thru/Right	A	9.9	0.35	n/a
WB Vining Left/Thru/Right	A	8.7	0.17	n/a
NB Fenwood Left/Thru/Right	A	8.7	0.13	n/a
SB Fenwood Left/Thru/Right	A	8.7	0.17	n/a
9. St. Albans Street at Francis Street				
EB St. Alban's Left	C	24.8	0.22	21
EB St. Alban's Right	B	13.0	0.11	10
WB St. Alban's Left/Thru/Right	D	28.8	0.51	67
NB Francis Left/Thru	A	1.0	0.03	2
SB Francis Thru/Right	A	0.0	0.18	0
10. St. Albans Street at Fenwood Road				
EB St. Alban's Thru/Left	C	15.5	0.19	n/a
WB St. Alban's Thru/Right	B	13.9	0.15	n/a
NB Fenwood Left/Thru/Right	A	2.9	0.02	n/a
SB Fenwood Left/Thru/Right	A	2.1	0.04	n/a

~ Volume exceeds capacity, queue is theoretically infinite.
# 95th percentile volume exceeds capacity, queue may be longer.
m Volume for 95th percentile queue is metered by upstream signal.

3.4.1.5 No Build Condition (2021) AM Peak Hour LOS Summary

The 2021 No Build Condition has similar results to the 2016 No Build Condition. During the morning peak hour, the Vining Street/Francis Street intersection is expected to operate at LOS F with the changes in valet operations that move all valet parking from the Mission Park Garage to the ASB-II Garage. In addition, the construction of the Brigham Green Parking and Enhancement Project will add additional traffic demands on Francis Street. With signal timing adjustments this intersection can be improved to satisfactory conditions within the existing roadway geometry.

3.4.1.6 No Build Condition (2021) Intersection LOS Summary PM Peak Hour

The evening peak period has two signalized intersections with a decrease in LOS and one unsignalized intersection with a decrease. Huntington Avenue at Longwood Avenue went from LOS D to LOS E. The westbound approach was the largest change in delay between 2016 and 2021. The intersection of Brookline Avenue at Longwood Avenue decreased from LOS E to LOS F. The westbound approach and the northbound left-turn movement had the highest increase in delay under this condition.

Table 3-43 2016 Phase I Build Intersection LOS Summary – AM Peak Hour

Intersection	LOS	Delay (sec.)	V/C Ratio	Average Queue	95th % Queue (feet)
Signalized Intersections					
1. Brookline Avenue at Francis Street	F	>80	>1.0	-	-
EB Brookline Thru/Left	F	>80	>1.0	~380	m#396
EB Brookline Right	B	16.0	0.46	83	m88
WB Brookline Left	F	>80	>1.0	~183	m#223
WB Brookline Thru/Right	A	4.7	0.38	42	m49
NB Francis Left	D	36.2	0.63	126	m#249
NB Francis Thru/Right	C	30.0	0.31	74	m106
SB Francis Left/Thru/Right	C	24.9	0.33	83	#258
3. Brookline Avenue at Riverway	F	>80	>1.0	-	-
EB Brookline Left	F	>80	>1.0	~261	#380
EB Brookline Thru/Right	F	>80	>1.0	200	#310
WB Brookline Left	F	>80	>1.0	~265	m#393
WB Brookline Thru/Right	C	24.1	0.57	78	m119
NB Riverway Left/Thru/Right	E	74.8	>1.0	~655	#795
SB Riverway Left/Thru/Right	B	18.7	0.55	213	257
7. Vining Street at Francis Street	F	>80	0.81	-	-
EB Vining Left/Thru/Right	B	12.1	0.59	100	204
NB Francis Left/Thru/Right	F	>80	>1.0	225	m171
SB Francis Left	D	46.4	0.50	34	m38
SB Francis Thru/Right	E	58.7	0.87	205	m175
11. Francis Street at Huntington Avenue	F	>80	>1.0	-	-
EB Huntington Hard Left/Left/Thru/Right	F	>80	>1.0	~463	#586
WB Huntington Hard Left/Left	D	47.7	0.82	56	m#75
WB Huntington Left/Thru/Right	E	72.3	>1.0	~221	m#326
NB Tremont Hard Left/Left/Thru/Right	F	>80	>1.0	~434	#630
SB Francis Left/Thru/Right	F	>80	>1.0	~307	m#402
SB Francis Hard Right	C	20.3	0.13	12	m20
NEB Calumet Hard Right	D	45.3	0.28	27	50

Table 3-43 2016 Phase I Build Intersection LOS Summary – AM Peak Hour (Continued)

Intersection	LOS	Delay (sec.)	V/C Ratio	Average Queue	95th % Queue (feet)
Signalized Intersections					
12. Fenwood Road at Huntington Avenue	**A**	**0.2**	**0.33**	**-**	**-**
EB Huntington Thru/Left	A	0.3	0.33	0	0
WB Huntington Thru/Right	A	0.0	0.26	0	m0
13. St. Albans Street at Huntington Avenue	**B**	**11.0**	**0.54**	**-**	**-**
SE Huntington Left/Thru	A	5.9	0.54	88	194
NW Huntington Thru/Right	A	8.1	0.31	104	131
NE St. Alban's Left/Thru/Right	D	37.1	0.15	18	33
SW St. Alban's Left/Thru/Right	D	40.8	0.53	55	116
14. Huntington Avenue at Longwood Avenue	**D**	**41.5**	**0.97**	**-**	**-**
EB Huntington Left	E	71.4	0.77	105	m0
EB Huntington Thru/Right	B	13.4	0.49	232	m20
WB Huntington Left	D	39.5	0.28	30	68
WB Huntington Thru	D	35.5	0.83	315	#519
WB Huntington Right	E	69.6	0.98	~237	#429
NB Longwood Left/Thru/Right	D	37.3	0.72	183	226
SB Longwood Left	F	>80	>1.0	~98	m#162
SB Longwood Thru/Right	C	32.1	0.43	87	m125
15. Binney Street at Longwood Avenue	**C**	**34.0**	**0.81**	**-**	**-**
EB Binney Left/Thru/Right	D	50.8	0.82	106	m139
WB Binney Left/Thru	D	35.7	0.49	59	108
WB Binney Right	C	30.8	0.07	0	35
NB Longwood Left/Thru/Right	D	36.1	0.83	165	m#232
SB Longwood Left/Thru/Right	C	25.5	0.73	132	m96
16. Brookline Avenue at Longwood Avenue	**F**	**>80**	**>1.0**	**-**	**-**
EB Brookline Left	F	>80	>1.0	~82	m#90
EB Brookline Thru/Right	F	>80	>1.0	~435	m#411
WB Brookline Left	F	>80	>1.0	~220	#372
WB Brookline Thru/Right	C	26.4	0.79	232	317
NB Longwood Left	F	>80	>1.0	~87	m#129
NB Longwood Thru	D	43.5	0.68	86	m112
NB Longwood Right	B	10.2	0.26	0	m0
SB Longwood Left	D	43.9	0.63	54	90
SB Longwood Thru/Right	F	>80	>1.0	~263	#333

Table 3-43 2016 Phase I Build Intersection LOS Summary – AM Peak Hour (Continued)

Intersection	LOS	Delay (sec.)	V/C Ratio	Average Queue	95th % Queue (feet)
Signalized Intersections					
17. Riverway at Longwood Avenue	D	48.5	0.97	-	-
EB Riverway Left	B	19.1	0.76	110	#251
EB Riverway Thru/Right	D	39.8	0.89	236	#349
WB Riverway Left/Thru	C	29.7	0.71	169	232
WB Riverway Right	C	21.3	0.05	0	29
NB Longwood Left	C	28.3	0.23	12	36
NB Longwood Thru/Right	C	31.3	0.53	111	182
SB Longwood Thru/Left	F	>80	>1.0	~273	#411
SB Longwood Right	A	8.5	0.13	24	44

~ Volume exceeds capacity, queue is theoretically infinite.
# 95th percentile volume exceeds capacity, queue may be longer.
m Volume for 95th percentile queue is metered by upstream signal.

Table 3-44 2016 Phase I Build Intersection LOS Summary – AM Peak Hour

Intersection	LOS	Delay (sec.)	V/C Ratio	95th % Queue (feet)
Unsignalized Intersections				
2. Fenwood Road at Brookline Avenue				
EB Brookline Thru/Right	A	0.0	0.40	0
WB Brookline Thru	A	0.0	0.22	0
NB Fenwood Right	B	14.2	0.19	17
4. Vining Street at Private Way				
EB Mission Park Garage Left/Thru/Right	B	13.0	0.53	n/a
WB Vining Left/Thru/Right	B	10.4	0.35	n/a
NB Driveway Left/Thru/Right	A	8.7	0.02	n/a
SB Vining St Ext. Left/Thru/Right	A	9.9	0.23	n/a
5. Binney Street at Francis Street				
EB Binney Left/Thru/Right	F	>50	>1.0	n/a
WB Binney Left/Thru/Right	F	>50	>1.0	n/a
NB Francis Left/Thru/Right	A	0.5	0.02	1
SB Francis Left	B	13.6	0.26	26
SB Francis Thru/Right	A	0.0	0.21	0
6. Binney Street at Fenwood Road				
WB Binney Left/Right	B	13.3	0.17	15
NB Fenwood Thru/Right	A	0.0	0.10	0
SB Fenwood Left/Thru	A	2.7	0.04	3
8. Fenwood Road at Vining Street				
EB Vining Left/Thru/Right	C	17.4	0.67	n/a
WB Vining Left/Thru/Right	B	10.2	0.22	n/a
NB Fenwood Left/Thru/Right	B	11.2	0.29	n/a
SB Fenwood Left/Thru/Right	B	10.3	0.26	n/a

Table 3-44 2016 Phase I Build Intersection LOS Summary – AM Peak Hour (Continued)

Intersection	LOS	Delay (sec.)	V/C Ratio	95th % Queue (feet)
Unsignalized Intersections				
9. St. Albans Street at Francis Street				
EB St. Alban's Left	F	>50	0.49	56
EB St. Alban's Right	C	18.3	0.17	15
WB St. Alban's Left/Thru/Right	F	>50	0.76	106
NB Francis Left/Thru	A	1.0	0.03	2
SB Francis Thru/Right	A	0.0	0.20	0
10. St. Albans Street at Fenwood Road				
EB St. Alban's Thru/Left	C	21.0	0.43	52
WB St. Alban's Thru/Right	B	12.8	0.12	10
NB Fenwood Left/Thru/Right	A	2.3	0.02	1
SB Fenwood Left/Thru/Right	A	3.7	0.07	5

~ Volume exceeds capacity, queue is theoretically infinite.
# 95th percentile volume exceeds capacity, queue may be longer.
m Volume for 95th percentile queue is metered by upstream signal.

Table 3-45 2016 Phase I Build Intersection LOS Summary – PM Peak Hour

Intersection	LOS	Delay (sec.)	V/C Ratio	Average Queue	95th % Queue (feet)
Signalized Intersections					
1. Brookline Avenue at Francis Street	F	>80	>1.0	-	-
EB Brookline Thru/Left	F	>80	>1.0	~323	m#402
EB Brookline Right	E	60.9	0.55	88	m128
WB Brookline Left	C	30.5	0.36	97	m#139
WB Brookline Thru/Right	C	30.4	0.56	274	m403
NB Francis Left	E	58.4	0.86	210	m285
NB Francis Thru/Right	C	34.5	0.36	112	m163
SB Francis Left/Thru/Right	C	28.9	0.27	64	108
3. Brookline Avenue at Riverway	F	>80	>1.0	-	-
EB Brookline Left	F	>80	>1.0	~144	#267
EB Brookline Thru/Right	D	47.8	0.65	148	205
WB Brookline Left	F	>80	>1.0	~417	m#590
WB Brookline Thru/Right	C	27.7	0.61	266	m182
NB Riverway Left/Thru/Right	D	50.7	0.93	~414	#547
SB Riverway Left/Thru/Right	F	>80	>1.0	~668	#765
7. Vining Street at Francis Street	B	18.4	0.51	-	-
EB Vining Left/Thru/Right	E	65.0	0.82	124	158
NB Francis Left/Thru/Right	A	9.4	0.39	98	234
SB Francis Left	A	4.3	0.09	5	24
SB Francis Thru/Right	A	5.9	0.34	62	179

Table 3-45 2016 Phase I Build Intersection LOS Summary – PM Peak Hour (Continued)

Intersection	LOS	Delay (sec.)	V/C Ratio	Average Queue	95th % Queue (feet)
Signalized Intersections					
11. Francis Street at Huntington Avenue	F	>80	>1.0	-	-
EB Huntington Hard Left/Left/Thru/Right	F	>80	>1.0	~301	#425
WB Huntington Hard Left/Left	C	20.0	0.62	46	m48
WB Huntington Left/Thru/Right	C	29.9	0.92	328	m310
NB Tremont Hard Left/Left/Thru/Right	F	>80	>1.0	~388	#575
SB Francis Left/Thru/Right	F	>80	>1.0	~271	#440
SB Francis Hard Right	D	36.1	0.16	18	46
NEB Calumet Hard Right	F	>80	>1.0	~106	#180
12. Fenwood Road at Huntington Avenue	A	0.1	0.34	-	-
EB Huntington Thru/Left	A	0.3	0.28	0	0
WB Huntington Thru/Right	A	0.0	0.34	0	m0
13. St. Albans Street at Huntington Avenue	B	11.8	0.52	-	-
SE Huntington Left/Thru	A	6.0	0.38	68	148
NW Huntington Thru/Right	A	5.6	0.47	61	402
NE St. Alban's Left/Thru/Right	C	33.8	0.17	20	30
SW St. Alban's Left/Thru/Right	D	45.3	0.70	106	142
14. Huntington Avenue at Longwood Avenue	D	51.2	1.0	-	-
EB Huntington Left	D	53.7	0.40	47	m42
EB Huntington Thru/Right	A	5.1	0.45	52	m40
WB Huntington Left	E	55.3	0.74	88	#162
WB Huntington Thru	F	>80	>1.0	~654	#856
WB Huntington Right	C	25.3	0.55	78	151
NB Longwood Left/Thru/Right	C	31.3	0.42	83	136
SB Longwood Left	F	>80	0.93	96	#214
SB Longwood Thru/Right	D	41.4	0.74	155	254
15. Binney Street at Longwood Avenue	C	35.0	0.68	-	-
EB Binney Left/Thru/Right	E	68.3	0.85	124	m158
WB Binney Left/Thru	D	53.0	0.65	91	129
WB Binney Right	D	41.1	0.12	0	44
NB Longwood Left/Thru/Right	C	30.1	0.70	238	#374
SB Longwood Left/Thru/Right	B	17.8	0.38	137	m135
16. Brookline Avenue at Longwood Avenue	F	>80	>1.0	-	-
EB Brookline Left	F	>80	>1.0	~95	m#93
EB Brookline Thru/Right	F	>80	>1.0	~382	m#261
WB Brookline Left	F	>80	>1.0	~150	#301
WB Brookline Thru/Right	C	33.0	0.75	254	329
NB Longwood Left	E	70.9	0.97	74	m#305
NB Longwood Thru	C	26.2	0.57	74	m120
NB Longwood Right	B	12.2	0.26	0	m3
SB Longwood Left	D	42.9	0.67	91	161
SB Longwood Thru/Right	C	32.1	0.42	104	162

Table 3-45 2016 Phase I Build Intersection LOS Summary – PM Peak Hour (Continued)

Intersection	LOS	Delay (sec.)	V/C Ratio	Average Queue	95th % Queue (feet)
Signalized Intersections					
17. Riverway at Longwood Avenue	F	>80	>1.0	-	-
EB Riverway Left	C	24.2	0.69	113	208
EB Riverway Thru/Right	C	21.6	0.42	101	144
WB Riverway Left/Thru	F	>80	>1.0	~399	#527
WB Riverway Right	B	18.8	0.09	0	35
NB Longwood Left	C	34.5	0.37	28	60
NB Longwood Thru/Right	F	>80	>1.0	~219	#449
SB Longwood Thru/Left	F	>80	>1.0	~268	#391
SB Longwood Right	B	11.8	0.27	65	109

~ Volume exceeds capacity, queue is theoretically infinite.
# 95th percentile volume exceeds capacity, queue may be longer.
m Volume for 95th percentile queue is metered by upstream signal.

Table 3-46 2016 Phase I Build Intersection LOS Summary – PM Peak Hour

Intersection	LOS	Delay (sec.)	V/C Ratio	95th % Queue (feet)
Unsignalized Intersections				
2. Fenwood Road at Brookline Avenue				
EB Brookline Thru/Right	A	0.0	0.26	0
WB Brookline Thru	A	0.0	0.35	0
NB Fenwood Right	B	13.8	0.15	13
4. Vining Street at Private Way				
EB Mission Park Garage Left/Thru/Right	A	8.4	0.21	n/a
WB Vining Left/Thru/Right	A	7.7	0.09	n/a
NB Driveway Left/Thru/Right	A	7.0	0.00	n/a
SB Vining St Ext. Left/Thru/Right	A	8.5	0.15	n/a
5. Binney Street at Francis Street				
EB Binney Left/Thru/Right	F	>50	>1.0	n/a
WB Binney Left/Thru/Right	F	>50	>1.0	n/a
NB Francis Left/Thru/Right	A	0.2	0.01	1
SB Francis Left	B	10.5	0.11	9
SB Francis Thru/Right	A	0.0	0.19	0
6. Binney Street at Fenwood Road				
WB Binney Left/Right	B	11.4	0.12	10
NB Fenwood Thru/Right	A	0.0	0.16	0
SB Fenwood Left/Thru	A	5.8	0.02	1
8. Fenwood Road at Vining Street				
EB Vining Left/Thru/Right	B	10.5	0.40	n/a
WB Vining Left/Thru/Right	A	8.9	0.18	n/a
NB Fenwood Left/Thru/Right	A	8.9	0.13	n/a
SB Fenwood Left/Thru/Right	A	8.9	0.18	n/a

Table 3-46 2016 Phase I Build Intersection LOS Summary – PM Peak Hour (Continued)

Intersection	LOS	Delay (sec.)	V/C Ratio	95th % Queue (feet)
Unsignalized Intersections				
9. St. Albans Street at Francis Street				
EB St. Alban's Left	C	22.3	0.20	19
EB St. Alban's Right	B	12.8	0.11	10
WB St. Alban's Left/Thru/Right	C	22.1	0.38	43
NB Francis Left/Thru	A	1.1	0.03	2
SB Francis Thru/Right	A	0.0	0.16	0
10. St. Albans Street at Fenwood Road				
EB St. Alban's Thru/Left	C	15.6	0.19	17
WB St. Alban's Thru/Right	B	14.0	0.15	13
NB Fenwood Left/Thru/Right	A	2.9	0.02	2
SB Fenwood Left/Thru/Right	A	2.2	0.04	3

~ Volume exceeds capacity, queue is theoretically infinite.
# 95th percentile volume exceeds capacity, queue may be longer.
m Volume for 95th percentile queue is metered by upstream signal.

3.4.1.7 2016 Phase I Build AM Peak Hour LOS Summary

During the morning peak period, the intersections LOS remain nearly equivalent to the 2016 No Build Condition. The only change that was identified was at the intersection of Vining Street at Francis Street. The LOS decreases from an LOS E to LOS F. The northbound general purpose lane sees a 40 second delay increase from the 2016 No Build Condition at this location.

3.4.1.8 2016 Phase I Build Intersection LOS Summary PM Peak Hour

The intersection of Binney Street at Longwood Avenue has a change in LOS from LOS E to LOS D. The modest improvement in LOS comes from a slight decrease in delay in the eastbound approach. The signalized intersection of Brookline Avenue at Longwood Avenue decreased from LOS E to LOS F during the evening peak period. The eastbound left-turn movement had an increase in delay of approximately 40 seconds thus contributing to the LOS F.

The unsignalized intersection of Fenwood Road at Vining Street decreased from LOS A to LOS B during the 2016 Phase 1 Build Condition. The eastbound approach on Vining Street sees the increase in delay due to the new surface parking lot driveway being located to the south of the west of the intersection.

Table 3-47 2021 Full Build Intersection LOS Summary – AM Peak Hour

Intersection	LOS	Delay (sec.)	V/C Ratio	Average Queue	95th % Queue (feet)
Signalized Intersections					
1. Brookline Avenue at Francis Street	F	>80	>1.0	-	-
EB Brookline Thru/Left	F	>80	>1.0	~405	m#393
EB Brookline Right	B	15.9	0.49	88	M90
WB Brookline Left	F	>80	>1.0	~225	m#271
WB Brookline Thru/Right	A	4.7	0.39	43	m48
NB Francis Left	D	39.8	0.74	~164	m#293
NB Francis Thru/Right	C	27.3	0.35	72	m113
SB Francis Left/Thru/Right	C	25.0	0.34	95	#298
3. Brookline Avenue at Riverway	F	>80	>1.0	-	-
EB Brookline Left	F	>80	>1.0	~269	#391
EB Brookline Thru/Right	F	>80	>1.0	~220	#341
WB Brookline Left	F	>80	>1.0	~293	m#389
WB Brookline Thru/Right	C	24.9	0.62	88	m122
NB Riverway Left/Thru/Right	F	>80	>1.0	~688	#827
SB Riverway Left/Thru/Right	B	19.0	0.57	220	266
7. Vining Street at Francis Street	F	>80	0.95	-	-
EB Vining Left/Thru/Right	B	19.7	0.72	146	#313
NB Francis Left/Thru/Right	F	>80	>1.0	251	m158
SB Francis Left	D	35.0	0.47	40	m33
SB Francis Thru/Right	D	44.7	0.85	219	m143
11. Francis Street at Huntington Avenue	F	>80	>1.0	-	-
EB Huntington Hard Left/Left/Thru/Right	F	>80	>1.0	~494	#617
WB Huntington Hard Left/Left	D	49.7	0.88	52	M62
WB Huntington Left/Thru/Right	C	34.7	0.94	229	m#263
NB Tremont Hard Left/Left/Thru/Right	F	>80	>1.0	~487	#685
SB Francis Left/Thru/Right	F	>80	>1.0	~368	m#484
SB Francis Hard Right	C	22.8	0.13	12	m22
NEB Calumet Hard Right	D	45.6	0.30	28	51
12. Fenwood Road at Huntington Avenue	A	0.2	0.34	-	-
EB Huntington Thru/Left	A	0.3	0.34	0	0
WB Huntington Thru/Right	A	0.0	0.28	0	m0
13. St. Albans Street at Huntington Avenue	B	11.9	0.57	-	-
SE Huntington Left/Thru	A	6.4	0.57	96	223
NW Huntington Thru/Right	A	9.5	0.32	115	148
NE St. Alban's Left/Thru/Right	D	37.0	0.18	20	35
SW St. Alban's Left/Thru/Right	D	40.8	0.55	59	119
14. Huntington Avenue at Longwood Avenue	D	48.5	>1.0	-	-
EB Huntington Left	E	69.9	0.78	108	m0
EB Huntington Thru/Right	B	15.2	0.53	249	m21
WB Huntington Left	D	39.3	0.28	31	68

Table 3-47 2021 Full Build Intersection LOS Summary – AM Peak Hour (Continued)

Intersection	LOS	Delay (sec.)	V/C Ratio	Average Queue	95th % Queue (feet)
Signalized Intersections					
WB Huntington Thru	E	55.6	0.97	407	#653
WB Huntington Right	E	76.6	>1.0	~262	#442
NB Longwood Left/Thru/Right	D	38.3	0.74	188	232
SB Longwood Left	F	>80	>1.0	~108	m#163
SB Longwood Thru/Right	C	32.0	0.44	89	m122
15. Binney Street at Longwood Avenue	D	37.0	0.87	-	-
EB Binney Left/Thru/Right	E	57.0	0.88	114	m145
WB Binney Left/Thru	D	36.1	0.52	63	115
WB Binney Right	C	30.7	0.07	0	35
NB Longwood Left/Thru/Right	D	40.8	0.89	~178	m#243
SB Longwood Left/Thru/Right	C	26.4	0.76	136	m94
16. Brookline Avenue at Longwood Avenue	F	>80	>1.0	-	-
EB Brookline Left	F	>80	>1.0	~98	m#103
EB Brookline Thru/Right	F	>80	>1.0	~455	m#411
WB Brookline Left	F	>80	>1.0	~233	#388
WB Brookline Thru/Right	C	28.7	0.83	253	346
NB Longwood Left	F	>80	>1.0	~93	m#123
NB Longwood Thru	D	43.8	0.70	90	m110
NB Longwood Right	B	10.6	0.27	0	m0
SB Longwood Left	D	46.4	0.66	56	#99
SB Longwood Thru/Right	F	>80	>1.0	~287	#355
17. Riverway at Longwood Avenue	E	57.9	>1.0	-	-
EB Riverway Left	C	20.9	0.79	124	#274
EB Riverway Thru/Right	D	41.3	0.91	246	#365
WB Riverway Left/Thru	C	29.8	0.72	174	239
WB Riverway Right	C	21.1	0.05	0	30
NB Longwood Left	C	30.3	0.26	12	37
NB Longwood Thru/Right	C	32.8	0.58	119	193
SB Longwood Thru/Left	F	>80	>1.0	~304	#444
SB Longwood Right	A	8.7	0.14	25	45

~ Volume exceeds capacity, queue is theoretically infinite.
# 95th percentile volume exceeds capacity, queue may be longer.
m Volume for 95th percentile queue is metered by upstream signal.

Table 3-48 2021 Full Build Intersection LOS Summary – AM Peak Hour

Intersection	LOS	Delay (sec.)	V/C Ratio	95th % Queue (feet)
Unsignalized Intersections				
2. Fenwood Road at Brookline Avenue				
EB Brookline Thru/Right	A	0.0	0.42	0
WB Brookline Thru	A	0.0	0.31	0
NB Fenwood Right	C	15.1	0.23	21
4. Vining Street at Private Way				
EB Mission Park Garage Left/Thru/Right	C	16.8	0.64	n/a
WB Vining Left/Thru/Right	B	13.6	0.54	n/a
NB Driveway Left/Thru/Right	A	9.4	0.03	n/a
SB Vining St Ext. Left/Thru/Right	B	11.6	0.32	n/a
5. Binney Street at Francis Street				
EB Binney Left/Thru/Right	F	>50	>1.0	n/a
WB Binney Left/Thru/Right	F	>50	>1.0	n/a
NB Francis Left/Thru/Right	A	0.5	0.02	1
SB Francis Left	B	13.7	0.27	28
SB Francis Thru/Right	A	0.0	0.25	0
6. Binney Street at Fenwood Road				
WB Binney Left/Right	B	14.3	0.22	21
NB Fenwood Thru/Right	A	0.0	0.12	0
SB Fenwood Left/Thru	A	2.5	0.04	3
8. Fenwood Road at Vining Street				
EB Vining Left/Thru/Right	E	37.6	0.89	n/a
WB Vining Left/Thru/Right	B	12.7	0.33	n/a
NB Fenwood Left/Thru/Right	B	14.8	0.44	n/a
SB Fenwood Left/Thru/Right	B	12.9	0.37	n/a
9. St. Albans Street at Francis Street				
EB St. Alban's Left	F	>50	0.62	77
EB St. Alban's Right	C	18.9	0.19	17
WB St. Alban's Left/Thru/Right	F	>50	>1.0	175
NB Francis Left/Thru	A	1.4	0.05	4
SB Francis Thru/Right	A	0.0	0.22	0
10. St. Albans Street at Fenwood Road				
EB St. Alban's Thru/Left	D	26.6	0.52	71
WB St. Alban's Thru/Right	B	13.1	0.15	13
NB Fenwood Left/Thru/Right	A	1.8	0.02	1
SB Fenwood Left/Thru/Right	A	3.8	0.08	6

~ Volume exceeds capacity, queue is theoretically infinite.
# 95th percentile volume exceeds capacity, queue may be longer.
m Volume for 95th percentile queue is metered by upstream signal.

Table 3-49 2021 Full Build Intersection LOS Summary – PM Peak Hour

Intersection	LOS	Delay (sec.)	V/C Ratio	Average Queue	95th % Queue (feet)
Signalized Intersections					
1. Brookline Avenue at Francis Street	F	>80	>1.0	-	-
EB Brookline Thru/Left	F	>80	>1.0	~354	m#427
EB Brookline Right	E	62.1	0.58	94	m132
WB Brookline Left	D	44.0	0.56	114	m#164
WB Brookline Thru/Right	D	42.0	0.71	301	m417
NB Francis Left	D	37.5	0.77	220	#396
NB Francis Thru/Right	C	23.2	0.34	113	162
SB Francis Left/Thru/Right	C	21.5	0.22	52	111
3. Brookline Avenue at Riverway	F	>80	>1.0	-	-
EB Brookline Left	F	>80	>1.0	~151	#275
EB Brookline Thru/Right	D	48.7	0.67	156	214
WB Brookline Left	F	>80	>1.0	~446	m#659
WB Brookline Thru/Right	C	24.8	0.67	298	244
NB Riverway Left/Thru/Right	E	63.6	0.99	~441	#575
SB Riverway Left/Thru/Right	F	>80	>1.0	~698	#795
7. Vining Street at Francis Street	C	22.1	0.62	-	-
EB Vining Left/Thru/Right	D	39.1	0.73	148	182
NB Francis Left/Thru/Right	C	20.5	0.54	177	347
SB Francis Left	B	10.7	0.14	15	m54
SB Francis Thru/Right	B	14.9	0.47	154	348
11. Francis Street at Huntington Avenue	F	>80	>1.0	-	-
EB Huntington Hard Left/Left/Thru/Right	F	>80	>1.0	~299	#442
WB Huntington Hard Left/Left	C	20.1	0.64	48	m46
WB Huntington Left/Thru/Right	C	33.8	0.98	352	m305
NB Tremont Hard Left/Left/Thru/Right	F	>80	>1.0	~403	#591
SB Francis Left/Thru/Right	F	>80	>1.0	~359	#539
SB Francis Hard Right	D	36.4	0.17	20	49
NEB Calumet Hard Right	F	>80	>1.0	~111	#184
12. Fenwood Road at Huntington Avenue	A	0.1	0.36	-	-
EB Huntington Thru/Left	A	0.3	0.29	0	0
WB Huntington Thru/Right	A	0.0	0.36	0	m0
13. St. Albans Street at Huntington Avenue	B	12.9	0.54	-	-
SE Huntington Left/Thru	A	6.9	0.41	80	171
NW Huntington Thru/Right	A	7.0	0.49	66	411
NE St. Alban's Left/Thru/Right	C	32.2	0.16	19	29
SW St. Alban's Left/Thru/Right	D	44.1	0.71	116	150
14. Huntington Avenue at Longwood Avenue	E	65.4	>1.0	-	-
EB Huntington Left	D	50.9	0.41	47	m39
EB Huntington Thru/Right	A	6.7	0.51	71	m51
WB Huntington Left	E	56.9	0.76	91	#169

Table 3-49 2021 Full Build Intersection LOS Summary – PM Peak Hour (Continued)

Intersection	LOS	Delay (sec.)	V/C Ratio	Average Queue	95th % Queue (feet)
Signalized Intersections					
WB Huntington Thru	F	>80	>1.0	~729	#933
WB Huntington Right	C	27.3	0.58	80	156
NB Longwood Left/Thru/Right	C	30.3	0.41	85	139
SB Longwood Left	F	>80	0.95	105	#233
SB Longwood Thru/Right	D	39.7	0.73	161	261
15. Binney Street at Longwood Avenue	D	36.4	0.73	-	-
EB Binney Left/Thru/Right	E	68.8	0.89	147	180
WB Binney Left/Thru	D	45.8	0.57	92	128
WB Binney Right	D	38.8	0.12	0	43
NB Longwood Left/Thru/Right	C	33.3	0.74	~271	#391
SB Longwood Left/Thru/Right	B	19.9	0.42	143	m132
16. Brookline Avenue at Longwood Avenue	F	>80	>1.0	-	-
EB Brookline Left	F	>80	>1.0	~131	m#119
EB Brookline Thru/Right	F	>80	>1.0	~407	m#263
WB Brookline Left	F	>80	>1.0	~167	#347
WB Brookline Thru/Right	D	36.7	0.80	268	348
NB Longwood Left	E	65.7	0.95	91	m#293
NB Longwood Thru	C	25.2	0.56	84	m119
NB Longwood Right	B	11.3	0.28	0	m2
SB Longwood Left	D	40.5	0.66	95	#169
SB Longwood Thru/Right	C	31.1	0.42	109	168
17. Riverway at Longwood Avenue	F	>80	>1.0	-	-
EB Riverway Left	C	26.1	0.72	122	#231
EB Riverway Thru/Right	C	21.8	0.44	105	150
WB Riverway Left/Thru	F	>80	>1.0	~418	#546
WB Riverway Right	B	18.8	0.10	0	36
NB Longwood Left	D	35.9	0.39	29	62
NB Longwood Thru/Right	F	>80	>1.0	~362	#495
SB Longwood Thru/Left	F	>80	>1.0	~277	#432
SB Longwood Right	B	11.9	0.28	67	112

~ Volume exceeds capacity, queue is theoretically infinite.
# 95th percentile volume exceeds capacity, queue may be longer.
m Volume for 95th percentile queue is metered by upstream signal.

Table 3-50 2021 Full Build Intersection LOS Summary – PM Peak Hour

Intersection	LOS	Delay (sec.)	V/C Ratio	95th % Queue (feet)
Unsignalized Intersections				
2. Fenwood Road at Brookline Avenue				
EB Brookline Thru/Right	A	0.0	0.27	0
WB Brookline Thru	A	0.0	0.37	0
NB Fenwood Right	B	14.3	0.19	17
4. Vining Street at Private Way				
EB Mission Park Garage Left/Thru/Right	A	9.5	0.26	n/a
WB Vining Left/Thru/Right	A	8.7	0.19	n/a
NB Driveway Left/Thru/Right	A	7.5	0.00	n/a
SB Vining St Ext. Left/Thru/Right	B	10.6	0.35	n/a
5. Binney Street at Francis Street				
EB Binney Left/Thru/Right	F	>50	>1.0	n/a
WB Binney Left/Thru/Right	F	>50	>1.0	n/a
NB Francis Left/Thru/Right	A	0.2	0.01	1
SB Francis Left	B	10.9	0.12	10
SB Francis Thru/Right	A	0.0	0.21	0
6. Binney Street at Fenwood Road				
WB Binney Left/Right	B	12.2	0.15	14
NB Fenwood Thru/Right	A	0.0	0.21	0
SB Fenwood Left/Thru	A	4.7	0.02	1
8. Fenwood Road at Vining Street				
EB Vining Left/Thru/Right	C	15.4	0.62	n/a
WB Vining Left/Thru/Right	A	9.9	0.23	n/a
NB Fenwood Left/Thru/Right	B	10.1	0.19	n/a
SB Fenwood Left/Thru/Right	A	10.0	0.23	n/a
9. St. Albans Street at Francis Street				
EB St. Alban's Left	D	25.6	0.26	25
EB St. Alban's Right	B	13.6	0.15	13
WB St. Alban's Left/Thru/Right	D	34.3	0.56	79
NB Francis Left/Thru	A	1.2	0.04	3
SB Francis Thru/Right	A	0.0	0.19	0
10. St. Albans Street at Fenwood Road				
EB St. Alban's Thru/Left	C	17.7	0.23	22
WB St. Alban's Thru/Right	B	14.9	0.18	16
NB Fenwood Left/Thru/Right	A	2.5	0.02	2
SB Fenwood Left/Thru/Right	A	2.5	0.05	4

~ Volume exceeds capacity, queue is theoretically infinite.
# 95th percentile volume exceeds capacity, queue may be longer.
m Volume for 95th percentile queue is metered by upstream signal.

3.4.1.9 2021 Full Build AM Peak Hour LOS Summary

Two of the ten signalized intersections were determined to decrease in overall LOS during the morning peak period under the 2021 Full Build Condition. The intersection of Vining Street at Francis Street decreases from an LOS E during the 2021 No Build Condition to LOS F. The intersection had a similar change under the 2016 Build Condition. Longwood Avenue at Riverway also had an overall LOS decrease from LOS D during the previous conditions to an LOS E during the 2021 Full Build. This decrease in LOS was due to a small (less than 4 second), increase in the overall intersection delay. While the LOS designation actually changes at this location – overall delay change is very modest.

The unsignalized intersections decrease in overall LOS at four of the seven intersections. The four intersections are all relatively close to the Site and tend to see a larger increase in trips than the other unsignalized intersections. Fenwood Road at Vining Street and St. Albans Street at Fenwood Road are expected to experience a decrease in LOS. Fenwood Road at Vining Street has the majority of the Project generated trips traveling through the intersection, resulting in decreasing LOS from LOS C to LOS E. The intersection of St. Albans Street at Fenwood Road has a slight decrease from LOS C to LOS D in the eastbound direction.

3.4.1.10 2021 Full Build Intersection LOS Summary PM Peak Hour

The intersection of Vining Street at Francis Street is the only street that decreases in overall LOS during the evening peak hour under the 2021 Full Build Condition. The overall LOS decrease was determined to be from LOS B to LOS C. The northbound movement on Francis Street decreases from LOS A to LOS C and the southbound movements decrease from LOS A to LOS B. The overall intersection experienced only 4 additional seconds in delay between the 2021 No Build Condition and the 2021 Full Build Condition.

Two of the seven unsignalized intersections had a decrease in LOS during the Full Build Condition. Vining Street at the private way decreased to LOS B due to volume increases on the southbound approach of the private way. Fenwood Road at Vining Street also saw a decrease changing from LOS B to LOS C in the eastbound direction on Vining Street. These two intersections are the only routes available to vehicles exiting both the proposed garage and the Mission Park Garage.

3.4.1.11 Intersection LOS Summary

Tables 3-51 and 3-52 provide a summary of the overall LOS results for signalized intersections in the study area.

Table 3-51 Signalized Intersection LOS Comparison AM Peak Hour

	Existing	2016 No Build	2016 Build	2021 No Build	2021 Build
1. Brookline Avenue at Francis Street	E	F	F	F	F
3. Brookline Avenue at Riverway	F	F	F	F	F
7. Vining Street at Francis Street	C	E	F	F	F
11. Francis Street at Huntington Avenue	F	F	F	F	F
12. Fenwood Road at Huntington Avenue	A	A	A	A	A
13. St. Albans Street at Huntington Avenue	B	B	B	B	B
14. Huntington Avenue at Longwood Avenue	E	D	D	D	D
15. Binney Street at Longwood Avenue	C	C	C	C	D
16. Brookline Avenue at Longwood Avenue	F	F	F	F	F
17. Riverway at Longwood Avenue	D	D	D	D	E

Table 3-52 Signalized Intersection LOS Comparison PM Peak Hour

	Existing	**2016 No Build**	**2016 Build**	**2021 No Build**	**2021 Build**
1. Brookline Avenue at Francis Street	F	F	F	F	F
3. Brookline Avenue at Riverway	F	F	F	F	F
7. Vining Street at Francis Street	B	B	B	B	C
11. Francis Street at Huntington Avenue	F	F	F	F	F
12. Fenwood Road at Huntington Avenue	A	A	A	A	A
13. St. Albans Street at Huntington Avenue	B	B	B	B	B
14. Huntington Avenue at Longwood Avenue	E	D	D	E	E
15. Binney Street at Longwood Avenue	C	D	C	D	D
16. Brookline Avenue at Longwood Avenue	D	E	F	F	F
17. Riverway at Longwood Avenue	F	F	F	F	F

The results of the analysis indicate that there will be no substantial changes in LOS in the study area as a result of the MMHC Project. Several key intersections in the LMA will continue to operate at poor LOS during the peak hours. The Longwood Avenue, Brookline Avenue, and Huntington Avenue corridors will continue to operate with heavy vehicle delays. To reduce the Project's peak hour impacts, BWH will utilize remote parking facilities for a significant portion of the new employee population and shuttle these employees into the LMA.

To offset the impacts of the Project, the Proponent proposes to work with the BTD to improve traffic operations at the Brigham Circle intersection (Francis Street/Huntington Avenue/Calument Street/Tremont Street) by changing the exclusive pedestrian phase to a concurrent pedestrian phase. This change will reduce delays for pedestrians and vehicles at this location.

In conjunction with the shift in valet operations from the Mission Park Garage to the ASB-II garage, BWH proposes to collaborate with the BTD to modify the signal timings at the intersection of Francis Street/Vining Street to reduce vehicle delays. This change will improve operations by reducing vehicle delay on Francis Street with the change in valet management at BWH.

All mitigation measures will be formalized with the Boston Transportation Department in the forthcoming Transportation Access Plan Agreement (TAPA) for the Project.

3.4.2 2021 Riverway Right-Turn Lane Analysis

As requested in the BRA Scoping Determination, an analysis with the provision of a dedicated right-turn lane from the Riverway to Brookline Avenue on the northbound approach to the intersection is included. This right-turn lane is not proposed as part of the Project and the Project does not trigger the need for the right-turn lane. However, the Project has been designed so that future implementation of the right-turn lane improvement by others will not be precluded.

Under its current configuration, the northbound Riverway approach to Brookline Avenue provides two travel lanes. The right-lane is signed in advance as a right-turn only lane; however, it operates as a shared through/right turn lane since the left/thru lane is often blocked by left-turning vehicles. The issue at this location is that there is a substantial demand of motorists that want to turn right at this location, and this movement impacts the ability to manage traffic that wants to continue northbound on the Riverway (through traffic). For the purposes of this analysis, the Synchro traffic model was modified with an additional 300-foot right-turn storage lane on the approach. This storage lane would start just after the existing private way on the southern edge of the Main MMHC Site and continue to Brookline Avenue. The results of this analysis are shown in Tables 3-53 and 3-54 for the morning and evening peak hours.

Table 3-53 2021 Full Build Intersection LOS Summary With Right Turn Lane - AM Peak Hour

Intersection	LOS	Delay (sec.)	V/C Ratio	Average Queue	95th % Queue (feet)
2021 Full Build Condition					
Brookline Avenue at Riverway	F	>80	>1.0	-	-
EB Brookline Left	F	>80	>1.0	~269	#391
EB Brookline Thru/Right	F	>80	>1.0	~220	#341
WB Brookline Left	F	>80	>1.0	~293	m#389
WB Brookline Thru/Right	C	24.9	0.62	88	m122
NB Riverway Left/Thru/Right	F	>80	>1.0	~688	#827
SB Riverway Left/Thru/Right	B	19.0	0.57	220	266
2021 Full Build Condition With Right Turn Lane					
Brookline Avenue at Riverway	F	>80	>1.0	-	-
EB Brookline Left	F	>80	>1.0	~269	#391
EB Brookline Thru/Right	F	>80	>1.0	~220	#341
WB Brookline Left	F	>80	>1.0	~291	m#387
WB Brookline Thru/Right	C	20.4	0.70	88	m123
NB Riverway Left/Thru	C	22.0	0.70	305	396
NB Riverway Right	B	17.7	0.42	0	70
SB Riverway Left/Thru/Right	B	19.0	0.57	220	266

~ Volume exceeds capacity, queue is theoretically infinite.
# 95th percentile volume exceeds capacity, queue may be longer.
m Volume for 95th percentile queue is metered by upstream signal.

Table 3-54 2021 Full Build Intersection LOS Summary With Right Turn Lane - PM Peak Hour

Intersection	LOS	Delay (sec.)	V/C Ratio	Average Queue	95th % Queue (feet)
2021 Full Build Condition					
Brookline Avenue at Riverway	F	>80	>1.0	-	-
EB Brookline Left	F	>80	>1.0	~151	#275
EB Brookline Thru/Right	D	48.7	0.67	156	214
WB Brookline Left	F	>80	>1.0	~446	m#659
WB Brookline Thru/Right	C	24.8	0.67	298	244
NB Riverway Left/Thru/Right	E	63.6	0.99	~441	#575
SB Riverway Left/Thru/Right	F	>80	>1.0	~698	#795
2021 Full Build Condition With Right Turn Lane					
Brookline Avenue at Riverway	F	>80	>1.0	-	-
EB Brookline Left	F	>80	>1.0	~151	#275
EB Brookline Thru/Right	D	48.7	0.67	156	214
WB Brookline Left	F	>80	>1.0	~447	m#655
WB Brookline Thru/Right	C	25.3	0.67	298	244
NB Riverway Left/Thru	C	33.5	0.69	240	322
NB Riverway Right	C	23.6	0.20	0	56
SB Riverway Left/Thru/Right	F	>80	>1.0	~698	#795

~ Volume exceeds capacity, queue is theoretically infinite.
# 95th percentile volume exceeds capacity, queue may be longer.
m Volume for 95th percentile queue is metered by upstream signal.

As shown, with the provision of a dedicated right-turn lane on the Riverway operations will improve and queuing will decrease. In the morning, when the congestion is highest on this portion of the Riverway, operations will improve from a LOS F on the approach to a LOS C for thru/left-turning traffic and a LOS B for right-turns onto Brookline Avenue.

As noted above, the Proponent is not proposing this transportation improvement as part of the Project and the Project will not contribute to the northbound right-turn lane traffic volume since vehicles can use the private way to access the Project from the Riverway.

3.4.3 Transit System Capacity Analysis

The first step in analyzing the public transit system availability near the LMA is to quantify the capacity of existing transit services. The following section presents the capacities of the various MBTA transit services in the area.

3.4.3.1 Existing Bus System Capacity

Bus route capacity is a function of vehicle size and frequency of service. The peak hour capacities estimated in this table are based on a bus capacity of 55 passengers for a standard MBTA bus. The service rush-hour frequencies presented in Table 3-55 are based on the most current schedules.

The MBTA Ridership and Service Statistics, Eleventh Edition 2007 provides daily bus boardings. Hourly or stop-based ridership information in not available in recent MBTA publications, the most recent data provided in various MBTA bus ridership counts and CTPS subway counts was used to obtain peak hour bus loads as shown in Table 3-55. This table also presents ridership and utilization (percent occupancy) data for the areas subway system.

Table 3-55 MBTA Bus Route Peak Hour Utilization (2009 Existing Condition)

Route and Direction		Morning Peak Frequency (buses/hour)	Evening Peak Frequency (buses/hour)	Morning Hourly Capacity (passengers)	Evening Hourly Capacity (passengers)	Hourly Ridership*		V/C Ratio (Utilization)	
						AM Peak	PM Peak	AM Peak	PM Peak
CT2	Inbound	5	6	275	330	81	86	0.29	0.26
	Outbound	5.3	6	292	330	108	149	0.37	0.45
CT3	Inbound	4	3	220	165	29	86	0.13	0.52
	Outbound	4	3	220	165	148	41	0.67	0.25
8	Inbound	5	3	275	165	155	71	0.56	0.43
	Outbound	5	3	275	165	104	87	0.38	0.53
39	Inbound	14	12	770	660	672	240	0.87	0.36
	Outbound	12	14	660	770	292	872	0.44	1.13

Table 3-55 MBTA Bus Route Peak Hour Utilization (2009 Existing Condition) (Continued)

Route and Direction		Morning Peak Frequency (buses/hour)	Evening Peak Frequency (buses/hour)	Morning Hourly Capacity (passengers)	Evening Hourly Capacity (passengers)	Hourly Ridership*		V/C Ratio (Utilization)	
						AM Peak	PM Peak	AM Peak	PM Peak
47	Inbound	3	3	165	165	129	51	0.78	0.31
	Outbound	3	3	165	165	123	107	0.75	0.65
60	Inbound	2	2.2	110	121	74	40	0.67	0.33
	Outbound	2.5	2.1	138	116	35	44	0.25	0.38
65	Inbound	5.5	2.4	303	132	268	28	0.88	0.21
	Outbound	3.5	2.5	193	138	25	99	0.13	0.72
6	Inbound	6.7	6.7	369	369	253	302	0.69	0.82
	Outbound	6.7	6.7	369	369	355	320	0.96	0.87

As shown in Table 3-55, the existing bus service passenger loads exceed comfortable passenger riding capacity during the evening peak hour on Route 39 in the outbound direction. With the installation of the Charlie Card machines on local buses, the MBTA has the ability to monitor passenger loads and adjust schedules as needed to meet customer demands. It is anticipated that with expected growth in the LMA, the MBTA will continue to adjust its bus operations to provide more frequent service as demand warrants.

3.4.3.2 Existing Green Line Capacity

Subway route capacity is a function of vehicle size and the frequency of service. The Green Line peak hour capacities for the D Line and E Line are based on a vehicle capacity of 99 passengers per car or 198 passengers per a two-car trainset. This assumes a conservative analysis since the D Line often provides three-car trainsets during the peak hours. The Orange Line provides six cars per trainset giving a capacity of 786 passengers per trainset.

The peak hour loads are presented in Table 3-56. This table also presents the volume-to-capacity, or availability, of passenger loads for three closest subway lines. Ridership on the Green Line is highest downtown, however the majority of transit trips to/from of the Project Site will not pass through this peak point. Many of the trips will be coming from western points and exiting the Green Line at the Longwood D-Line Station. Therefore, the ridership to the west of the Site is presented in addition to the highest ridership downtown. The Green D-Line was assumed carry 38 percent of all the Green Line passengers while the E-Line was assumed to transport 23 percent of all Green Line passengers.

Table 3-56 MBTA Bus Route Peak Hour Utilization (2009 Existing Condition)

Route and Direction	Frequency (trains/hour)	Capacity (passengers/hr)	Ridership*		V/C Ratio (Utilization)	
			AM Peak	PM Peak	AM Peak	PM Peak
Green - D Line						
Inbound – Arriving at Longwood	10	1,980	2166	996	1.09	0.50
Inbound – Leaving Longwood	10	1,980	2,525	1,947	1.28	0.98
Outbound – Arriving at Longwood	10	1,980	2,020	2,301	1.02	1.16
Outbound – Leaving Longwood	10	1,980	533	1804	0.27	0.91
Green - E Line						
Inbound – Arriving at Brigham Circle	10	1,980	296	363	0.15	0.18
Inbound – Leaving Brigham Circle	10	1,980	1,525	1,176	0.77	0.59
Outbound – Arriving at Brigham Circle	10	1,980	1,220	1,390	0.62	0.70
Outbound – Leaving Brigham Circle	10	1,980	89	253	0.04	0.13
Orange Line						
Inbound	10	7,860	5,874	6,730	0.75	0.86
Outbound	10	7,860	7,732	5,174	0.98	0.66

1. Assumes two-car trainsets of Type 8 Breda cars (198 passengers per trainset). Older Type 7 two-car trainsets have capacities of 220 persons.

As shown in Table 3-56, there is adequate capacity on the E Line and Orange Line to accommodate the peak hour crunch loads. With conservative ridership volumes and capacity of only two car trainsets verses the typical three car trainsets, the D Line utilization is above or at its capacity during peak hours. This analysis assumes that all trains arrive on schedule and that passengers are evenly distributed throughout the hour. In reality, passenger loads can vary and some trains become more congested than others. However, over the course of the hour, there is an adequate train capacity to meet the demand.

With the new Charlie Card tickets, the MBTA has the ability to monitor passenger loads and adjust schedules as needed to meet the customer demands. It is anticipated that with expected growth in and through the LMA, the MBTA will provide more frequent service and increase the frequency of three-car trainsets on the D Line as needed. With construction of the proposed Urban Ring Project discussed previously in this chapter, new connections are being discussed within the MBTA system which would help to alleviate existing demands on major components of the public transportation system.

3.4.3.3 Future Bus System Capacity

As previously discussed, bus route capacity is a function of vehicle size and frequency of service. In order to evaluate the impact of the Project on the surrounding transit, the transit trips were distributed to specific bus routes and subway lines to determine the increase in utilization. This distribution was presently previously in Section 3.3.4. Table 3-57 presents the future ridership and utilization (percent occupancy) data for the areas bus and subway system.

Table 3-57 MBTA Bus Route Peak Hour Utilization (2021 Full Build Condition)

Route and Direction		Existing Hourly Ridership		Project Transit Trips		Future Hourly Ridership		Future V/C Ratio (Utilization)	
		AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
CT2	Inbound	81	86	7	3	88	89	0.32	0.27
	Outbound	108	149	2	7	110	156	0.38	0.47
CT3	Inbound	29	86	11	3	40	89	0.18	0.54
	Outbound	148	41	3	11	151	52	0.69	0.32
8	Inbound	155	71	17	5	172	76	0.62	0.46
	Outbound	104	87	6	17	110	104	0.40	0.63
39	Inbound	672	240	30	10	702	250	0.91	0.38
	Outbound	292	872	10	29	302	901	0.46	1.17
47	Inbound	129	51	13	4	142	55	0.86	0.33
	Outbound	123	107	4	12	127	119	0.77	0.72
60	Inbound	74	40	3	1	77	41	0.70	0.34
	Outbound	35	44	1	3	36	47	0.26	0.41
65	Inbound	268	28	18	5	286	33	0.94	0.25
	Outbound	25	99	5	17	30	116	0.16	0.88
66	Inbound	253	302	4	2	257	304	0.69	0.82
	Outbound	355	320	2	3	357	322	0.97	0.97

Bus Route 39 continues to operate above capacity during the evening outbound condition. The outbound Route 66 shows a utilization ratio over 1.0 for the evening peak hour, which indicates that this route should be evaluated to determine whether increase in service is necessary.

3.4.3.3.1 Future Green Line Capacity

Subway capacity is a function of vehicle size and the frequency of service. The Green Line peak hour capacities for the D Line and E Line are based on a vehicle capacity of 99 passengers per car or 198 passengers per a two-car trainset. This assumes a conservative analysis since the D Line often provides three-car trains during the peak hours. The Orange Line provides 6 cars per trainset giving a capacity of 786 passengers per trainset.

The future projected peak hour loads for the surrounding Green Line and Orange Line subway routes are presented in Table 3-58.

As shown in Table 3-58, the utilization has very little increase due to project trips on each individual line. The Orange Line has no change in v/c from existing conditions. The E Line and D Line both have very minor increases from existing to future conditions. The E Line maintains an adequate capacity, while the D Line continues to operate above capacity. The operations that continue to pose an issue on the D Line are the morning peak for the inbound trainsets and the evening peak both the outbound arriving at Longwood Station and the inbound leaving Longwood Station. As discussed in the existing condition, these capacity analysis are conservative in that the D Line tends to operate with three-car trainsets verses the two-car trainsets used to calculate capacity.

Table 3-58 MBTA Bus Route Peak Hour Utilization (2021 Full Build Condition)

Route and Direction	Existing Ridership		Project Transit Trips		Future Ridership		V/C Ratio (Utilization)	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Green - D Line								
Inbound – Arriving at Longwood	2166	996	44	12	2210	1008	1.12	0.51
Inbound – Leaving Longwood	2,525	1,947	7	19	2532	1966	1.28	0.99
Outbound – Arriving at Longwood	2,020	2,301	20	7	2040	2308	1.03	1.17
Outbound – Leaving Longwood	533	1804	12	41	545	1845	0.28	0.93
Green - E Line								
Inbound – Arriving at Brigham Circle	296	363	1	0	297	363	0.15	0.18
Inbound – Leaving Brigham Circle	1,525	1,176	19	52	1544	1228	0.78	0.62
Outbound – Arriving at Brigham Circle	1,220	1,390	54	19	1274	1409	0.64	0.71
Outbound – Leaving Brigham Circle	89	253	0	1	89	254	0.05	0.13
Orange Line								
Inbound	5,874	6,730	18	6	5892	6736	0.75	0.86
Outbound	7,732	5,174	6	15	7738	5189	0.98	0.66

1. Assumes two-car trainsets of Type 8 Breda cars (198 passengers per trainset). Older Type 7 two-car trainsets have capacities of 220 persons.

3.5 Mitigation And Improvement Actions

This section delineates the transportation improvements and mitigation plan developed by BWH and RTH. The purpose of this transportation mitigation plan is to:

- Help alleviate transportation impacts generated by the Project;
- Provide transportation infrastructure enhancements to the LMA, including improved pedestrian corridors, and public space amenities; and
- Exceed the requirements of the BRA's Interim Guidelines for the LMA relative to transportation improvements and mitigation.

BWH has also made important mitigation commitments in the form of policies and management actions. Key commitments are to continue to establish and maintain a proactive TDM program, parking management strategies to limit the construction of new parking spaces to no more than the 0.75 parking spaces per 1,000 square feet (SF) of development guideline established by the LMA Interim Guidelines and carefully coordinate construction management actions related to the forthcoming Project. BWH believes that these transportation mitigation actions will lessen the impacts of their proposed development plans and, when complete, will help improve the LMA's existing transportation infrastructure.

This transportation mitigation plan includes several elements:

- Roadway and traffic operations improvements.
- Parking consolidation and management strategies.
- Transportation demand management enhancements.
- Sustainability.
- Pedestrian access and open space improvements.
- Construction management.
- Participation in identifying system-wide transportation improvements for the LMA.

In addition to the existing TDM measures offered by RTH, additional measures that will be promoted for the Residential Building include:

- Providing a packet of TDM information in each resident's move-in documents that highlight non-automobile transportation options and on-line transportation services including the MBTA on-line transit pass purchase option.

- The Building's Property Manager will create a transportation information area at the development for residents and for visitors. Information to be provided includes area and transportation maps, bicycle maps, public transit contact information, a list of local transit services and schedules, etc. The property management company will be responsible for updating the information on a regular basis.

- The property management company will serve as the Transportation Coordinator and will coordinate TDM measures for the Residential Building with those already in place at Mission Park. These responsibilities will include:

    - Updating the transportation information described above; and

    - Coordinating van services, vehicular operations, service and loading, and parking enforcement related to the Residential Building.

- To take advantage of the variety of public transportation facilities available in LMA, the Project's public transportation TDM measures include:

    - Providing information in each resident's move-in documents on public transportation benefits to residents and

- Bicycle/Pedestrian TDM measures will include:

    - Providing landscaped sidewalks adjacent to and around the site; and

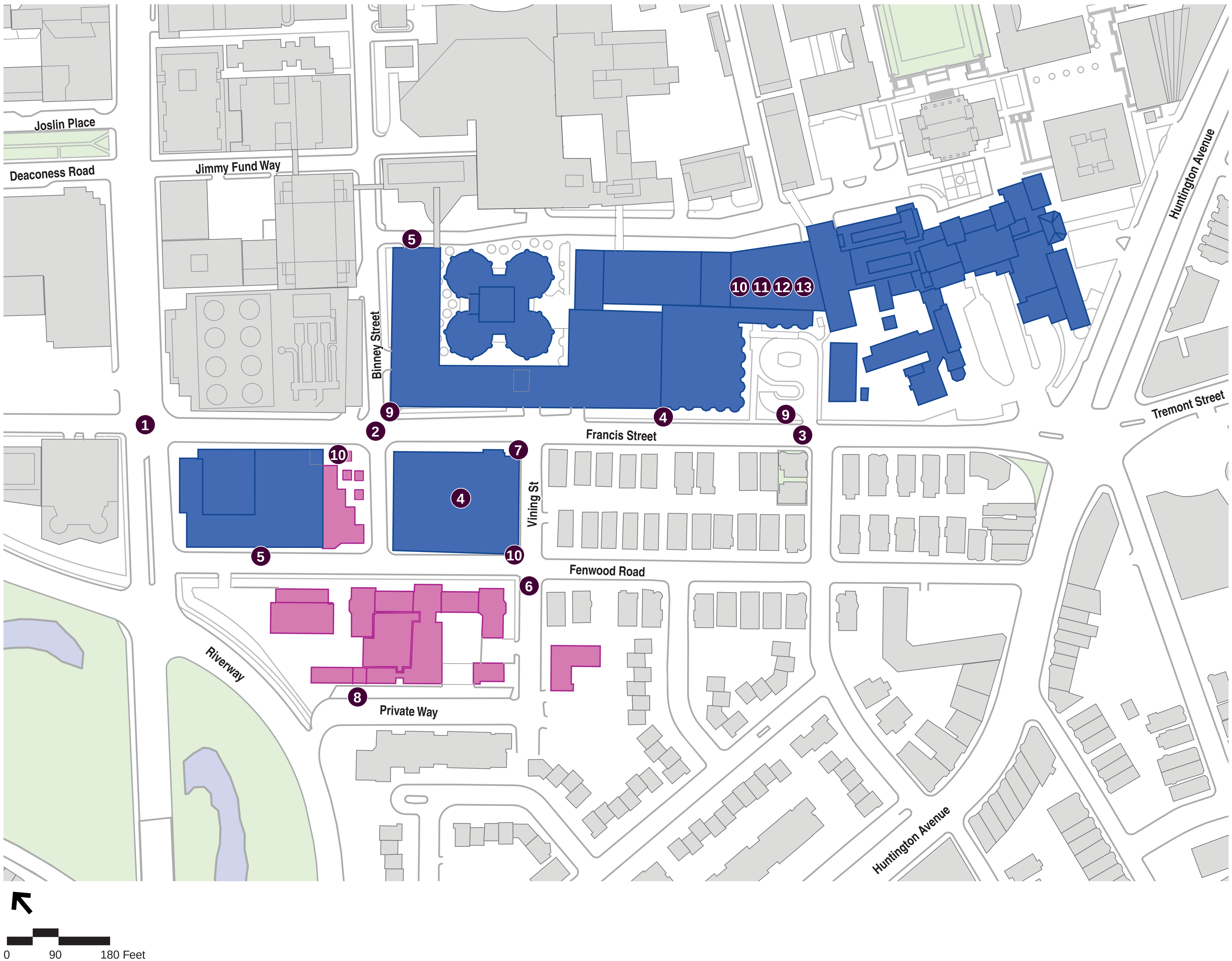
    - Providing on-site bike racks for residents and visitors.

DMH is a state agency which will offer the same TDM incentives offered to other state employees. On-site transportation amenities, such as bicycle storage and shower facilities will be provided to encourage alternative modes of transportation.

Many of these mitigation elements will improve the LMA transportation infrastructure in addition to addressing potential impacts of the Project. Table 3-59 lists each transportation mitigation element that is proposed by the Proponent and provides a summary of the following:

- Description of the proposed action.
- Interim Guideline criterion that is met by that action.
- Summary of the purpose and benefit of that action.
- Implementation responsibility.

Additionally, Figures 3-31 and 3-32 illustrate the physical location of the various transportation improvements that have been implemented in recent years as well as new mitigation and improvement elements that are proposed.



Recently Implemented Brigham and Women's Hospital Transportation Mitigation and Improvement Actions

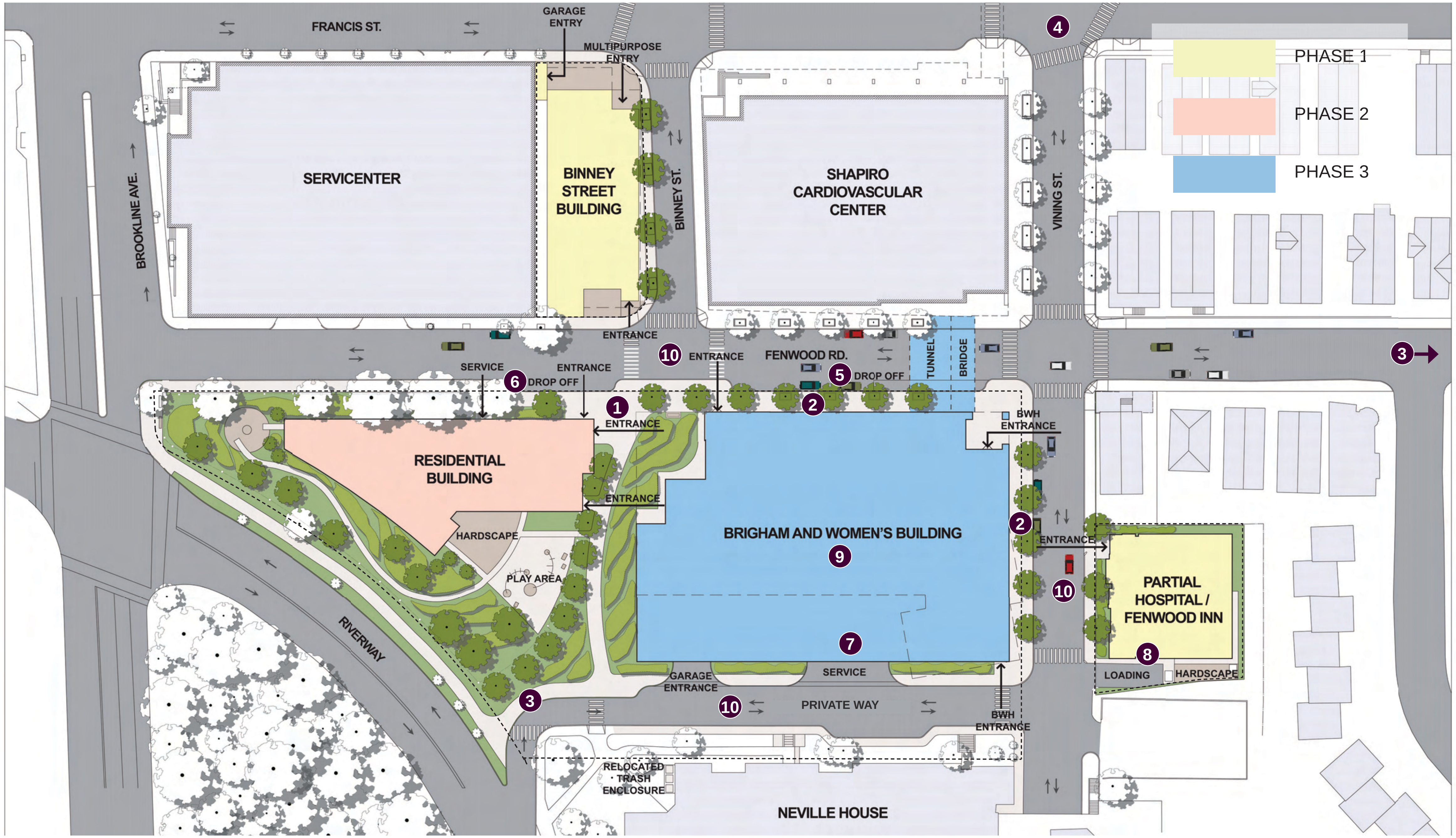
1. Brookline Avenue/Francis Street intersection-including new traffic signal system.
2. Francis Street/Vining Street intersection-including new traffic signal system.
3. New dedicated Francis Street left-turn lane into Brigham and Women's Hospital 45 Francis Entrance.
4. New sidewalks, accessible ramps and crosswalks in street print and thermoplastic (Francis Street, Binney Street, Vining Street, Fenwood Road).
5. Proactive loading and materials management operations.
6. Residential truck restrictions.
7. Convenient, off-street shuttle bus area-with covered waiting area.
8. Replacement residential parking spaces.
9. Privately-funded police details to manage peak hour traffic flows.
10. Covered, secured bicycle parking with supporting shower facilities.
11. Limited parking provided for Brigham and Women's Hospital employees.
12. Proactive TDM program via MASCO's Commute Works.
13. 50% Employee transit pass subsidy.

Mass Mental Health Center Redevelopment

Brigham and Women's Hospital Campus

Figure 3-31

Recently Implemented Brigham and Women's Hospital Transportation Mitigation Actions



Proposed MMHC Mitigation Summary

1. Provide significant open space at the terminus of Binney Street
2. Provide street trees and other hardscape amenities along Fenwood Road, Binney Street, and Vining Street
3. Modify the existing traffic signal operations to improve operations at Brigham Circle
4. Modify the existing traffic signal timings at the intersection of Vining Street/Francis Street to better facilitate the change in valet operations
5. Provide a patient drop-off along Fenwood Road for Brigham & Women's Building
6. Provide drop-off/loading location for residents/visitors to the Residential Building
7. Include four additional loading bays to serve the new Brigham and Women's Building
8. Provide loading/service area for the Partial Hospital/Fenwood Inn
9. Provide bicycle storage and shower facilities for employees
10. Upgrade streets around project perimeter

0 40 80 Feet

Massachusetts Mental Health Center Project **Boston, Massachusetts**

Vanasse Hangen Brustlin, Inc.

Figure 3-32

Proposed MMHC Mitigation Plan

Table 3-59 Mitigation Action Plan

	Mitigation Element	Description	Purpose/Benefit	Implementation Timing
Traffic Management Plan				
1	Patient Drop-off on Fenwood Road	Provide a patient drop-off along Fenwood Road in front of the Brigham and Women's Building – which will be made available for patients.	Provide convenient/efficient patient access to the new facility.	Certificate of Occupancy Brigham and Women's Building
2	Residential Building Drop-off	Provide convenient vehicle drop-off location for residents/visitors to the Residential Building	Provide convenient and safe drop-off location along Fenwood Road.	Certificate of Occupancy Residential Building
3	Loading and Service Improvements	Include four additional loading bays to serve the new Brigham and Women's Building.	Improve off-street loading conditions, eliminate potential illegal loading along Fenwood Road.	Certificate of Occupancy Brigham and Women's Building
4	Materials Management Operations Plan	Continue to employ a proactive materials management plan at BWH Servicenter and West Plaza Loading docks.	Allows for "just in time" delivery techniques, which will reduce trucks trip frequency and dock utilization times at these locations.	Ongoing
Local Street Network / System-wide Transportation Improvements				
5	Brigham Circle Signal Improvements	Modify the existing traffic signal operations at Brigham Circle.	Will improve traffic access, and wayfinding and safety in the area.	Ongoing
6	Riverway Right-Turn Lane at Brookline Avenue Improvements	Support the provision of a dedicated right-turn lane from Riverway NB to Brookline Avenue. Project will be designed so that it does not preclude future implementation of this possible improvement.	Future traffic flow improvement at this intersection (to be permitted, designed and implemented by others).	Not Applicable
7	Area Sidewalk Improvements	Reconstruct widened sidewalks along portions of Fenwood Road, Binney Street, and Vining Street adjacent to the Project Site.	Improve pedestrian access, safety, and urban design of the area.	Certificate of Occupancy Binney Building/Partial Hospital Building
8	Area Street Improvements	Reconstruct roadways surrounding Site. New pavement markings will be installed	Improve operations and safety.	Certificate of Occupancy Brigham and Women's Building
Urban Design				
8	Main MMHC Site Pedestrian Plaza	Provide significant open space at the terminus of Binney Street – providing a clear pedestrian connection between the LMA and the nearby Emerald Necklace through the Project Site.	Provide open space enhancement that complements open space in the area	Certificate of Occupancy Binney Building
9	Urban Design Improvements	Provide street trees and other hardscape amenities along Fenwood Road, Binney Street, and Vining Street.	Provide open space enhancement to the BWH campus and the adjacent neighborhood.	Ongoing through multiple phases of the Project

Table 3-59 Mitigation Action Plan (Continued)

	Mitigation Element	Description	Purpose/Benefit	Implementation Timing
Parking				
10	Limit new parking to be constructed	Project will include construction of 406 spaces for 633,960 sf of development.	Resultant parking ratio will be 0.62 spaces per 1,000 sf that complies with the ratio that has been established by the BTD within the LMA Interim Guidelines.	Certificate of Occupancy Brigham and Women's Building
11	Improve patient valet parking operations	Eliminate self parking in the ASB II Garage and covert that facility into a dedicated patient valet parking area. Modify signal timings at Vining Street/Francis Street to accommodate change.	Reduce patient traffic in the adjacent neighborhood by eliminating patient valet parking in the Mission Park Garage.	2010
12	Employee Parking Pricing	Evaluate and charge market rates for monthly employee parking.	Encourage shifting employee mode share from auto to transit. Will help to reduce parking demands.	Ongoing
BWHTransportation Demand Management Plan				
13	Maintain proactive in MASCO's TMA	Maintain access to wide array of TDM programs and amenities that seek to encourage the use of transit as a regular means of commuting.	Encourage shift in employee mode share from auto to transit.	Ongoing
14	Maintain high percentage employee transit subsidy	Maintain employee/tenant transit subsidy at 50 percent.	Encourage shift in employee mode share from auto to transit.	Ongoing
15	Zip Car Provision	Coordinate with ZipCar representatives to investigate provision of this shared-car service at the Brigham and Women's Building.	Encourage shift in employee mode share from auto to transit.	Certificate of Occupancy Brigham and Women's Building
16	Loading Dock Manager	Oversee loading operations.	Oversee delivery scheduling to maintain dock efficiency and reduce truck queuing at Brigham and Women's Building and other BWH materials management locations in the LMA.	Ongoing
Construction Management Plan				
17	Prepare Construction Management Plan	Prepare and submit a detailed Construction Management Plan (CMP) for the MMHC Project	Minimize construction impacts.	Ongoing through multiple phases of construction for this Project

3.6 Conclusion

The primary finding of this transportation analysis is that the transportation improvement and mitigation plan proposed by the Proponent will mitigate adverse environmental impacts associated with the MMHC redevelopment. Roadway improvements and changes to valet parking operations have been devised to help manage peak hour traffic flow in the area, and will substantially reduce the amount of traffic at the Mission Park Garage.

The proposed parking complies with the LMA Interim Guidelines. BWH will need to rely on remote off-site parking to accommodate its growth since the proposed parking supply will not meet all of its demands. This step will discourage employee traffic in the LMA.

The results of the traffic analysis indicate that there will be no substantial changes in LOS in the study area as a result of the Project. Several key intersections in the LMA will continue to operate at poor LOS during the peak hours. However, to reduce the Project's peak hour impacts, BWH will use remote parking facilities for a significant portion of the new employee population and shuttle these employees into the LMA. Also, BWH will continue and expand its transportation demand management measures (TDM) to its employees to encourage the use of transit and other alternative forms of transportation.

The purpose of this transportation mitigation plan is to:

- Help alleviate transportation impacts generated by the Project;
- Provide transportation infrastructure enhancements to the LMA, including intersection improvements and open space amenities and streetscape improvements; and
- Exceed the requirements of the BRA's Interim Guidelines for the LMA relative to transportation improvements and mitigation.

The Proponent believes that the transportation mitigation actions will lessen the impacts of the proposed development plans and, when complete, will help improve the LMA's existing transportation infrastructure.

Section 4.0

Environmental Protection Component

4.0 ENVIRONMENTAL PROTECTION COMPONENT

4.1 Wind

4.1.1 Introduction

A pedestrian wind study was conducted for the proposed Project. The objective of the study was to assess the effect of the Project on local wind conditions in pedestrian areas around the study site and provide recommendations for minimizing adverse wind effects, where necessary.

The study involved wind simulations on a 1:300 (1″:25′) scale model of the proposed buildings with existing surroundings. These simulations were conducted in a boundary-layer wind tunnel, for the purpose of quantifying local wind speed conditions and comparing to appropriate criteria for gauging wind comfort and safety in pedestrian areas. The criteria recommended by the Boston Redevelopment Authority (BRA) were used in this study. This section describes the methods and presents the results of the wind tunnel simulations.

Overall, wind tunnel testing demonstrated that the pedestrian level wind comfort conditions at the Project Site were similar in the No Build and Build conditions. The wind conditions improved or stayed the same with the Proposed Project in more locations than they worsened. The number of locations with dangerous wind conditions on an annual basis was reduced from four for the No Build Configuration to one for the Build Configuration. Along the open space side of the Riverway roadway, wind conditions are anticipated to improve. The Binney Street Building Site is currently vacant, therefore, the construction of a building at this location will result in some sheltering from wind and predicted improvements in wind conditions along Binney Street and Francis Street. At the Partial Hospital/Fenwood Inn Site, the current low rise building will be demolished and replaced with a building similar in scale. Therefore the proposed building at this location is not anticipated to cause overall degradation of wind conditions. The Residential Building and Brigham and Women's Building are proposed on the site of existing low-rise buildings. In some cases, these buildings will shelter areas, thereby reducing wind impacts. In other areas, these buildings are predicted to increase winds.

In general, wind conditions were comfortable for their intended usage in most areas. Potential mitigation measures to improve pedestrian wind comfort conditions will be identified during the design review process. These measures may consist of canopies, wind screens and landscaping.

4.1.2. Overview

Major buildings, especially those that protrude above their surroundings, often cause increased local wind speeds at the pedestrian level. Typically, wind speeds increase with elevation above the ground surface, and taller buildings intercept these faster winds and deflect them down to the pedestrian level. The funneling of wind through gaps between buildings and the acceleration of wind around corners of buildings may also cause increases in wind speed. Conversely, if a building is surrounded by others of equivalent height, it may be protected from the prevailing upper-level winds, resulting in no significant changes to the local pedestrian-level wind environment. The most effective way to assess potential pedestrian-level wind impacts around a proposed new building is to conduct scale model tests in a wind tunnel.

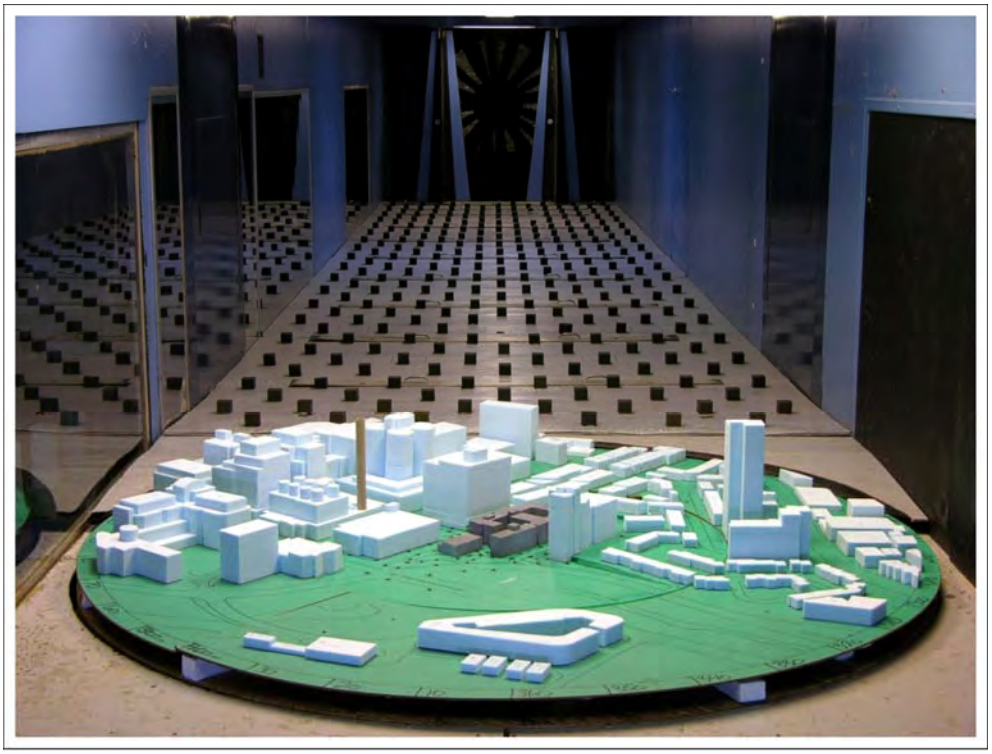
The consideration of wind in planning outdoor activity areas is important since high winds in an area tend to deter pedestrian use. For example, winds should be light or relatively light in areas where people would be sitting, such as outdoor cafes or playgrounds. For bus stops and other locations where people would be standing, somewhat higher winds can be tolerated. For frequently used sidewalks, where people are primarily walking, stronger winds are acceptable. For infrequently used areas, the wind comfort criteria can be somewhat relaxed. The actual effects of wind can range from pedestrian inconvenience, due to the blowing of dust and other loose material in a moderate breeze, to severe difficulty with walking due to the wind forces on the pedestrian.

4.1.3 Methodology

Information concerning the site and surroundings was derived from: site photographs; information on surrounding buildings and terrain; a site plan and 3-D model of the Project. The following configurations were simulated:

> **(A) No Build Configuration:** includes all existing buildings and surroundings (Figure 4.1-1); and
>
> **(B) Build Configuration:** includes the four proposed buildings (Binney Street Building, Partial Hospital/Fenwood Inn, the Residential Building, and the Brigham and Women's Building) to be constructed in phases, and existing surroundings (Figure 4.1-2).

The wind simulations were conducted in an eight foot wide by six foot high boundary-layer wind tunnel. Unwanted fan turbulence was removed by means of screens and honeycombs, and a realistic simulation of atmospheric turbulence was provided in the long working section by means of spires at the upwind end of the tunnel and roughness blocks on the floor. The spires and roughness are selected to represent either an open, suburban or urban terrain, depending on the site and the wind direction being tested. The working section is followed by the test section, where the scale model sits on a motorized turntable, embedded in the wind tunnel floor.



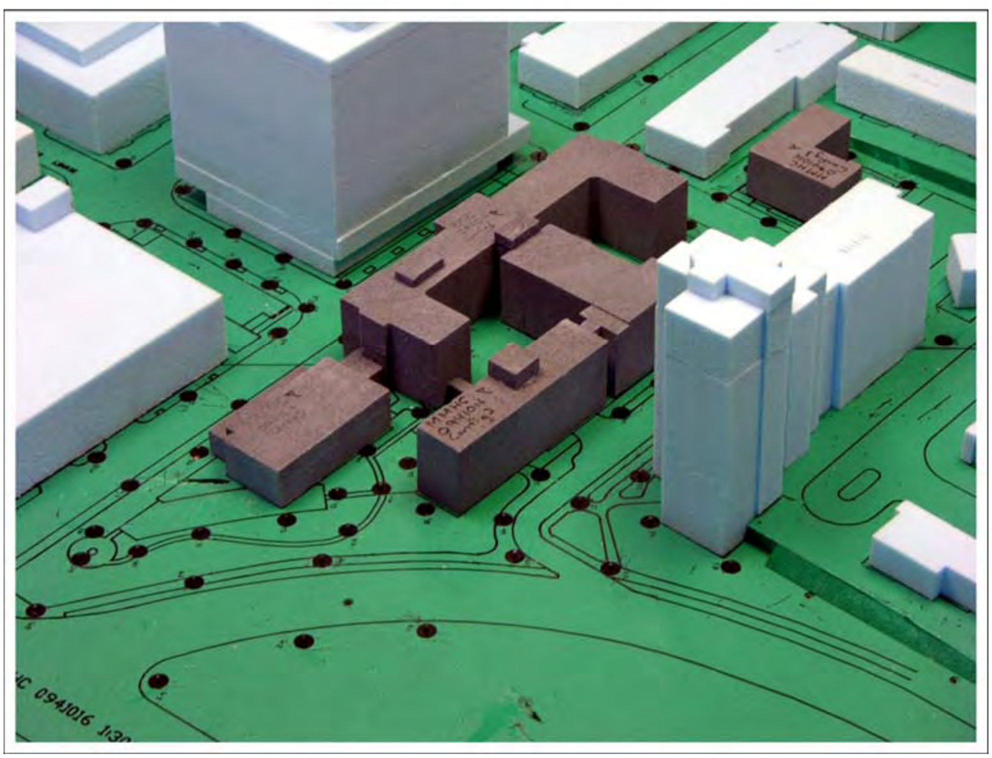


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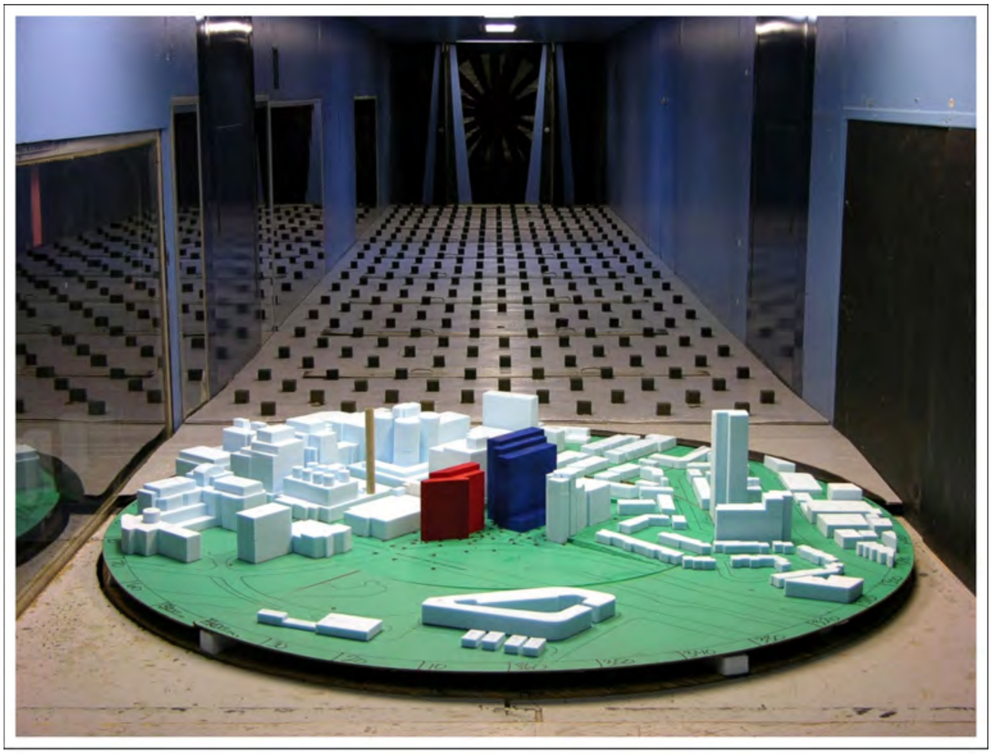
Figure 4.1-1

Wind Tunnel Study Model, No Build



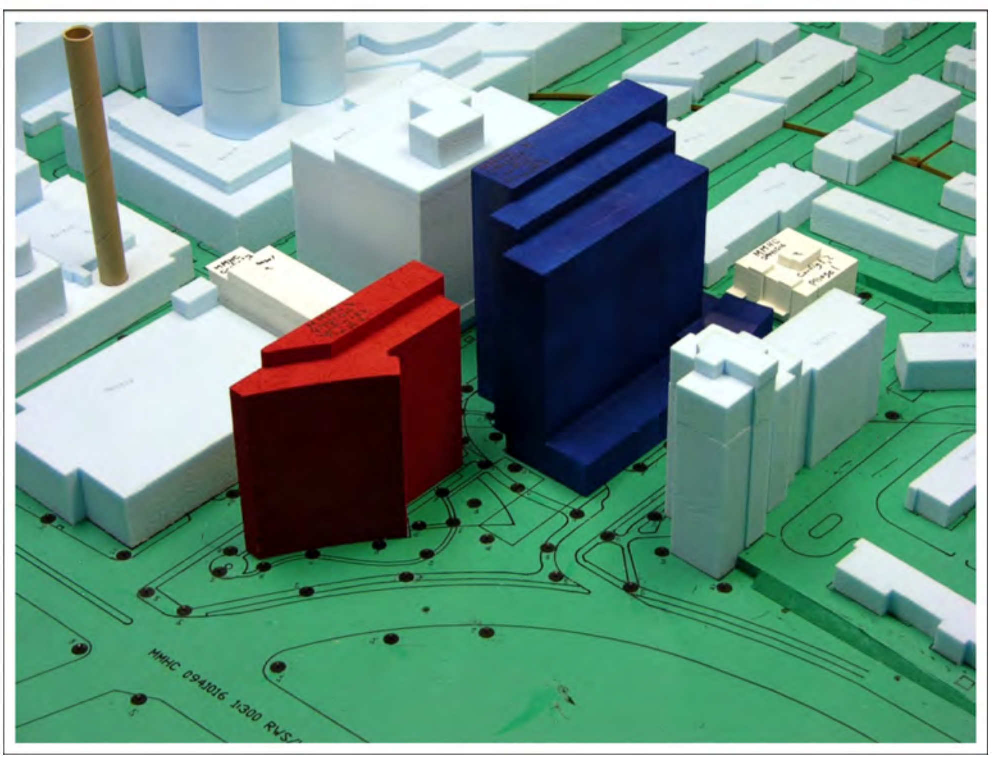


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Figure 4.1-2

Wind Tunnel Study Model, Full Build

The scale model was equipped with 109 specially designed wind speed sensors that were connected to the wind tunnel's data acquisition system to record the mean and fluctuating components of wind speed at a full-scale height of five feet above grade in pedestrian areas throughout the study site. Wind speeds were measured for 36 wind directions, in 10 degree increments, starting from true north. The measurements at each sensor location were recorded in the form of ratios of local mean and gust speeds to the reference wind speed in the free stream above the model. The results were then combined with long-term meteorological data, recorded during the years 1945 to 1998 at Boston-Logan International Airport, in order to predict full scale wind conditions. The analysis was performed separately for each of the four seasons and for the entire year.

Wind roses summarizing the annual and seasonal wind climates in the Boston area, based on the data from Boston-Logan International Airport are provided in Appendix D. The left-hand wind roses, in Figures 2a and 2b, are based on all observed wind readings for the given season, and the right-hand wind roses are based on strong winds for one percent of the time. The upper wind roses in Figure 2a, for example summarize the spring (March, April, and May) wind data. In general, the prevailing winds at this time of year are from the west-northwest, northwest, west, southwest and east. In the case of strong winds, however, the most common wind direction is northeast and west.

On an annual basis (Figure 2c in Appendix D) the most common wind directions are those from southwest, through west, to northwest. Winds from the east and east-southeast are also relatively common. In the case of strong winds, northeast and west-northwest are the dominant wind directions.

This study involved state-of-the-art measurement and analysis techniques to predict wind conditions at the study site. Some uncertainty remains in predicting wind comfort as the sensation of comfort among individuals can be quite variable. Variations in age, individual health, clothing, and other human factors can change a particular response of an individual. The comfort limits used in this report represent an average for the total population. Also, unforeseen changes in the project area, such as the construction or removal of buildings, can affect the conditions experienced at the site. Finally, the prediction of wind speeds is necessarily a statistical procedure. The wind speeds reported are for the frequency of occurrence stated (one percent of the time). Higher wind speeds will occur but on a less frequent basis.

4.1.4 Pedestrian Wind Comfort Criteria

The BRA has adopted two standards for assessing the relative wind comfort of pedestrians. First, the BRA wind design guidance criterion states that an effective gust velocity (hourly mean wind speed + 1.5 times the root-mean-square wind speed) of 31 mph should not be exceeded more than one percent of the time. The second set of criteria used by the BRA to determine the acceptability of specific locations is based on the work of Melbourne[1]. This set of criteria is used to determine the relative level of pedestrian wind comfort for activities such as sitting, standing, or walking.

The criteria are expressed in terms of benchmarks for the 1-hour mean wind speed exceeded 1% of the time (i.e., the 99-percentile mean wind speed). They are as follows:

Table 4.1-1 BRA Mean Wind Criteria*

Dangerous Conditions > 27 mph
Uncomfortable for Walking > 19 and _ 27 mph
Comfortable for Walking > 15 and _ 19 mph
Comfortable for Standing > 12 and _ 15 mph
Comfortable for Sitting _ 12 mph

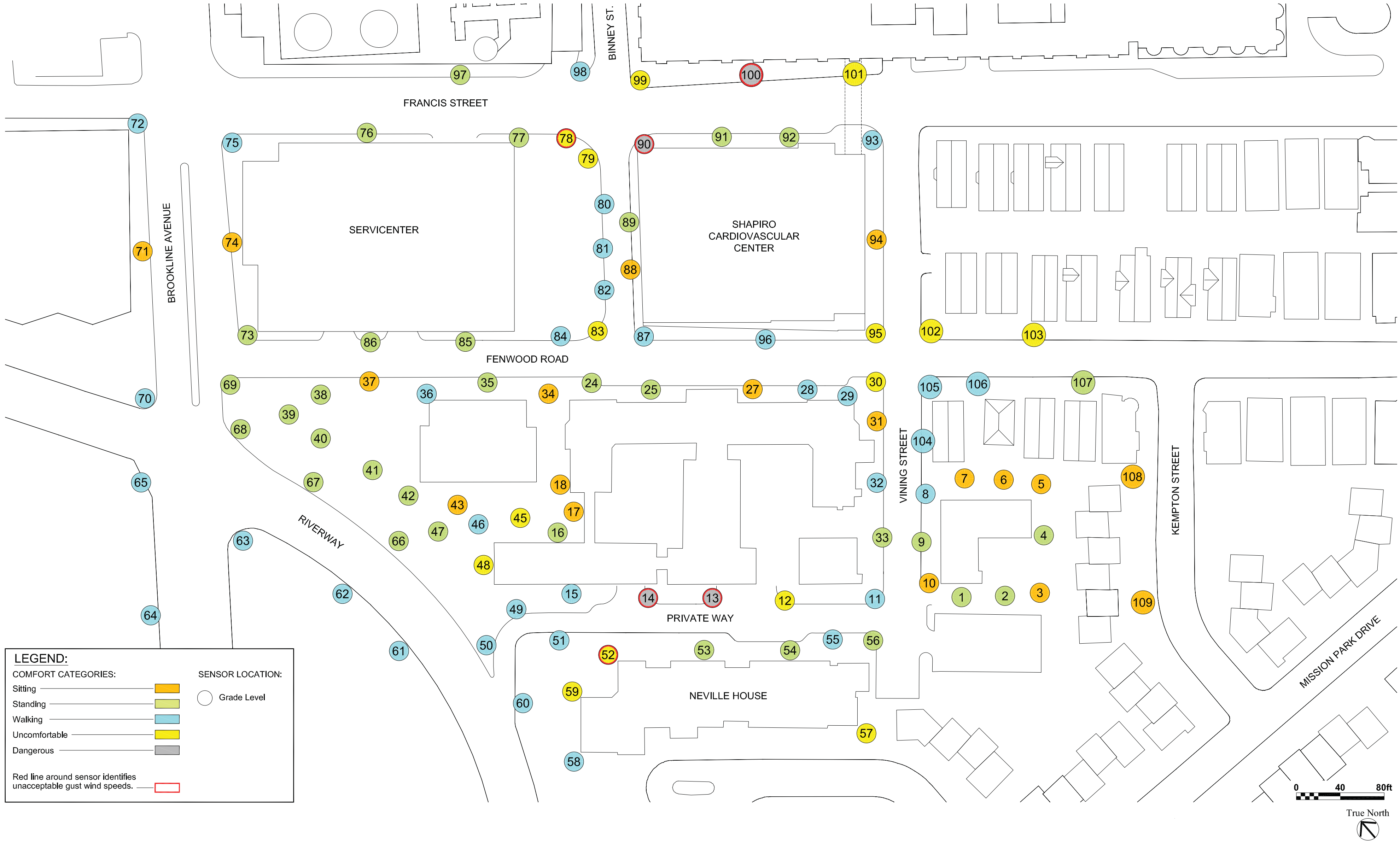
* Applicable to the hourly mean wind speed exceeded one percent of the time.

The wind climate found in a typical downtown location in Boston is generally comfortable for the pedestrian use of sidewalks and thoroughfares and meets the BRA effective gust velocity criterion of 31 mph. However, without any mitigation measures, Boston existing wind climate is likely to be frequently uncomfortable for more passive activities such as sitting.

4.1.5 Test Results

The wind summary table provided in Appendix D presents the mean and effective gust wind speeds for each season as well as annually. Figures 4.1-3 and Figure 4.1-4 graphically depict the wind comfort conditions at each wind measurement location based on the annual winds. Typically the summer and fall winds tend to be more comfortable than the annual winds while the winter and spring winds are less comfortable than the annual winds. The following summary of pedestrian wind comfort is based on the annual winds for each configuration tested, except where noted below in the text.

1 Melbourne, W.H., 1978, "Criteria for Environmental Wind Conditions", Journal of Industrial Aerodynamics, 3 (1978) 241 - 249.



LEGEND:

COMFORT CATEGORIES:
- Sitting
- Standing
- Walking
- Uncomfortable
- Dangerous

Red line around sensor identifies unacceptable gust wind speeds.

SENSOR LOCATION:
- Grade Level

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Figure 4.1-3

Pedestrian Wind Conditions - No Build, Annual

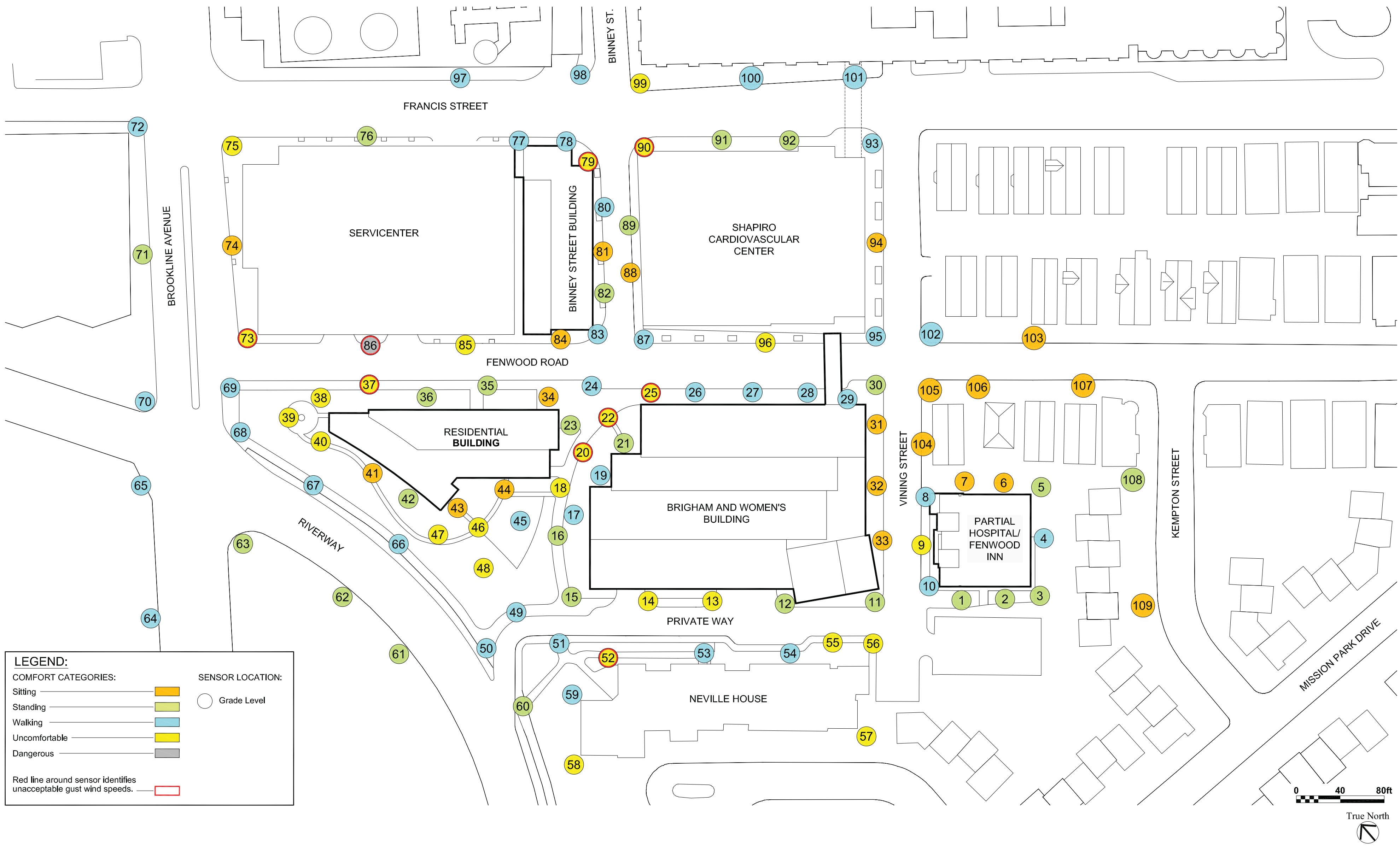

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Figure 4.1-4

Pedestrian Wind Conditions - Build, Annual

4.1.5.1 Partial Hospital/Fenwood Inn And Surroundings (Locations 1 To 10 And 104 To 109)

Under the No Build condition, mean wind speeds were comfortable for walking or better on an annual basis. No dangerous mean wind speeds or unacceptable gusts occur in any of the four seasons.

Under the Build condition, the proposed Brigham and Women's Building and Residential Building to the west were found to shelter the area from the prevailing westerly winds, resulting in reduced wind speeds at sidewalk Locations 104 to 107. Wind conditions at only one location (location 9) were found to be uncomfortable on an annual basis, and no dangerous conditions or unacceptable gusts were detected for any season.

In addition, the wind conditions at the main entrance (Location 8) remain unchanged from the No Build condition and were comfortable for walking on an annual basis. During the winter, PLWs at Location 8 worsened to uncomfortable, but with a 1 mph improvement could be comfortable. Potential mitigation measures such as canopies or landscaping will be explored during the design stage to further reduce wind impacts.

4.1.5.2 Brigham And Women's Building And Residential Building (Locations 11 To 48)

The existing buildings on site are relatively low and, as a result, suitable wind conditions were found in most areas. However, in the No Build configuration, the existing Neville House to the south deflected the predominant westerly winds to sidewalks along private way, causing dangerous wind conditions at Locations 13 and 14 and uncomfortable conditions at Location 12 on an annual basis. Other uncomfortable locations included 30, 45 and 48. Under the No Build configuration, the effective gust speeds at Locations 13 and 14 were unacceptable.

With the proposed Project in place, the dangerous wind conditions at Locations 13 and 14 were eliminated due to the design of a large, low podium on the south side the Brigham and Women's Building. Under the Build Configuration, suitable wind conditions were found at main entrance areas (Locations 11 and 34) and as previously mentioned the dangerous wind locations at Locations 13 and 14 were eliminated.

Uncomfortable wind speeds were measured between the two proposed buildings (Location 18) and around the wind-exposed corners of the Residential Building (Locations 38 to 40 and 46) on an annual basis. Location 48 remains unchanged from the No Build configuration with uncomfortable annual wind speeds. Unacceptable annual wind speeds were measured between the two proposed buildings at Locations 20, 22 and 25 as well as around the wind-exposed corners of the Residential Building at one Location (37). Potential mitigation measures will be explored during the design stage to reduce wind impacts in these two areas.

Annual wind speeds on the open space (Location 45) improved from the uncomfortable condition in the No Build configuration to comfortable for walking (and improved to standing in the summer, Table 2). Again, potential mitigation measures such as dense landscaping, canopies, or trellises will be explored during the design stage to reduce wind impacts.

4.1.5.3 Surrounding Areas (Locations 49 To 72)

The proposed Project is generally located downwind of these areas and therefore, wind conditions in these areas were similar for the No Build and Build configurations. Slightly improved wind conditions were noticed on the west side of the Riverway for the Build configuration (Locations 61, 62 and 63). Increased wind speeds were detected along the private way due to the channeling of the prevailing westerly winds between the existing Neville House and the proposed Brigham and Women's Building, resulting in uncomfortable wind conditions at Locations 55 and 56. .

Additionally, annual wind conditions improved from uncomfortable in the No Build to comfortable for walking in the Build on the northern corner of Neville House (Location 59).

The annual gust wind speeds were generally acceptable and the same for both the No Build and Build conditions with some minor differences during the seasons. There was only one annual gust wind speed which was considered unacceptable and it occurred in both the No Build and Build condition (Location 52).

4.1.5.4 Service Center, Binney Street Building And Shapiro Cardiovascular Center (Locations 73 To 103)

Under the No Build Configuration, on an annual basis, dangerous wind speeds were found at Locations 90 and 100, uncomfortable wind speeds were noted at Locations 78, 79, 83, 95, 99 and 101 to 103, and unacceptable gusts were recorded at Locations 78, 90 and 100.

Overall wind conditions in this area improved. Of the 30 locations studied, more improved or stayed generally the same than worsened. Under Build Conditions, the proposed Binney Street Building will be located on the east side of the Servicenter Complex and will be similar in height. With the potential sheltering effect provided by the proposed Residential Building and Brigham and Women's Building, the existing windy conditions at the intersection of Binney Street and Francis Street are expected to improve substantially. For instance, the dangerous wind speeds at Locations 90 and 100 were eliminated under the Build Also eliminated were uncomfortable wind conditions at Locations 78, 83, 95, 101 102 and 103.

Although six locations with uncomfortable wind conditions in this general area in the No Build condition were improved, only four locations (73, 75, 85, 96) had increased annual winds that worsened to uncomfortable in the Build condition. Similarly, two locations in the No Build condition with dangerous conditions were improved and only one condition in the Build worsened to a dangerous condition (Location 86).

Of the 30 locations studied, annual gust wind speeds were similar for both No Build and Build conditions. Three locations (86, 79, 73) had gust wind speeds which worsened in the Build condition and two locations (78, 100) had gust wind speeds which improved from unacceptable to acceptable in the Build condition. Annual gust wind speeds in other locations were either acceptable or unacceptable in both the No Build and Build conditions. Potential mitigation measures will be explored during the design stage to reduce wind impacts. Wind control measures may include installing canopies and planting coniferous trees.

4.1.6. Summary

Based on the test results and the intended usage at pedestrian areas around the proposed development, wind conditions were comfortable for their intended usage in most areas. The number of locations with dangerous wind conditions on an annual basis was reduced from four for the No Build Configuration to one for the Build Configuration. Potential mitigation measures to improve pedestrian wind comfort conditions will be identified during the design review process. These measures may consist of canopies, wind screens and landscaping.

4.2 Shadow

4.2.1 Introduction

An analysis of existing and new shadow conditions was conducted in accordance with the BRA Scoping Determination. The shadow study included an analysis of impacts to the area surrounding the Project, including the Riverway open space. Results of the analysis indicate that the Project will not cause substantial impacts to the surrounding area. In general, impacts will be primarily limited to the public ways and pedestrian sidewalks immediately surrounding the Project buildings. Shadows will be cast on some surrounding rooftops, many of which are already in partial shadow during these periods. There are no new shadows on the Riverway open space as a result of the proposed Project during the late morning, midday, afternoon and evening hours studied. During the time periods studied, shadows on the Riverway open space will be limited to the early to mid-morning hours only. Please see Section 5.4.2.1 for a discussion of the Project's consistency with shadow criteria of the LMA Interim Guidelines.

Results of the shadow impact study are discussed in the following sections, and are supported by Figures 4.2-1 through 4.2-14.

4.2.2 Methodology

A shadow impact analysis was conducted to investigate shadow impacts from the Project during three time periods (9:00 am, 12:00 noon, and 3:00 pm) during the summer solstice (June 21), autumnal equinox (September 21), and the winter solstice (December 21). Due to the change in legislation regarding Eastern Daylight Time (Daylight Saving Time), the shadow impacts from the vernal equinox (March 21) and the autumnal equinox would be virtually the same. For this study, the vernal equinox shadow impacts are studied as if March 21 were still in Standard Time, meaning they are studied during the time periods of 10:00 am, 1:00 pm, and 4:00 pm. Impacts at 6:00 pm during the summer and autumn were also examined.

As requested in the BRA's Scoping Determination, the analysis focuses in particular on public open spaces and major pedestrian areas, as well as the sidewalks and plazas adjacent to and in the vicinity of the Project Site, including the Riverway portion of the Olmsted Park System and nearby residential properties.

The shadow analysis presents existing shadow as well as net new shadow from the Project buildings to illustrate the incremental impact of the Project. For the purposes of clarity, new shadow is shown in a blue tone while existing shadow is shown in dark gray.

As requested by the BRA's Scoping Determination, shadows have been determined using the applicable Altitude and Azimuth data for Boston, shown in Table 4.2-1.

Table 4.2-1 Azimuth and Altitude Data

Date	Local Time	Solar Position	
		Altitude	Azimuth
March 21	10:00 am (DST)	33.2	125.6
	1:00 pm (DST)	48.1	-176.8
	4:00 pm (DST)	30.6	-121.6
June 21	9:00 am (DST)	39.9	93.5
	12 noon (DST)	68.8	149.4
	3:00 pm (DST)	56.5	-113.7
	6:00 pm (DST)	23.9	-79.3
September 21	9:00 am (DST)	25.9	115.3
	12:00 pm (DST)	47.4	166.0
	3:00 pm (DST)	37.4	-132.9
	6:00 pm (DST)	7.3	-96.0
December 21	9:00 am (EST)	14.2	141.9
	12 noon (EST)	24.1	-175.6
	3:00 pm (EST)	10.0	-135.1

4.2.3 Vernal Equinox (March 21)

Net new shadows during the vernal equinox fall to the west, north, and east of the Project Site. Overall, there will be limited impacts to the adjacent streets and sidewalks in the Project vicinity. Figures 4.2-1 through 4.2-3 illustrate shadow impacts from the Project on the surrounding area.

At 10:00 am, new shadows from the proposed Partial Hospital/Fenwood Inn will be cast onto a minor portion of Vining Street, slightly extending shadows cast by the existing building currently at the Project Site. Shadow from the proposed Brigham and Women's Building and the Residential Building will be cast within the Project Site and across small portions of the roadway and sidewalks along Fenwood Road, the Riverway, and Brookline Avenue. The proposed open space in the center of the Main MMHC Site will have a mix of sunny and shaded areas. Some minor shadow will be cast on Fenwood Road by the proposed bridge connecting the Brigham and Women's Building and the Shapiro Cardiovascular Center. There will also be some minimal net new shadow on the southeast corner of the Riverway open space.

By 1:00 pm, shadows will be cast to the north. Shadow from the Partial Hospital/ Fenwood Inn will fall immediately adjacent to the building, including minimal portions of new shadow on the adjacent sidewalk on Vining Street. Shadow from the Brigham and Women's Building and the Residential Building will fall onto Fenwood Road adjacent to the Project Site. Shadow from the Residential Building will also fall on a portion of the

Servicenter Complex. Shadow from the Binney Street Building will be cast onto a minor portion of the roadway and sidewalks of Francis Street. The western portion of the proposed open space on the Project Site will have sunny areas, while shady areas will be closer to the Brigham and Women's Building. At this time period, there will be no new shadow on the Riverway open space.

At 4:00 pm during the vernal equinox, new shadow from the proposed buildings will fall to the northeast. Shadow from the proposed Partial Hospital/Fenwood Inn will slightly extend the existing shadow cast by the existing building at the Partial Hospital/Fenwood Inn Site, primarily falling within the property boundary but also extending slightly onto portions of adjacent properties at Fenwood Road and Vining Street. Shadow cast by the Brigham and Women's Building will extend the existing shadows onto portions of Fenwood Road and Francis Street on the property at the southern corner of Francis and Vining Streets. Shadow from the Residential Building will extend the existing shadow on Fenwood Road, Francis Street, and Binney Street, including the rooftop parking area of the Servicenter Complex. The proposed open space will be primarily in sun. Shadow from the Binney Street Building will fall on Binney Street and Francis Street. At this time period, there will be no new shadow on the Riverway open space.

4.2.4 Summer Solstice (June 21)

As with the Vernal Equinox, net new shadows during the summer are cast to the west, north, and east of the Project buildings. New shadows cast during the summer solstice are illustrated on Figures 4.2-4 through 4.2-7.

Net new shadows cast at 9:00 am during the summer solstice will be cast to the west. New shadow cast by the proposed Partial Hospital/Fenwood Inn will largely fall within the property boundary, with minor patches of shadow cast onto the adjacent sidewalk and roadway on Vining Street. Shadow cast by the Brigham and Women's Building and the Residential Building will largely fall within the Main MMHC Site, although some new shadow will fall onto a relatively small area of the adjacent Riverway open space at the intersection of the Riverway and Brookline Avenue. The Brigham and Women's Building will also cast shadow on portions of the adjacent private way. The proposed open space will mostly be shaded from both existing and net new shadow. The proposed Binney Street Building will cast shadow on minimal portions of the Servicenter Complex and Fenwood Road.

As the day progresses, the shadows become shorter and fall to the north. At noon, shadow from the Partial Hospital/Fenwood Inn will be limited to the property boundary and a minimal portion of the sidewalk on Vining Street. Shadow from the Brigham and Women's Building and the Residential Building will be cast on portions of the Fenwood Road sidewalk immediately adjacent to the Project, and shadow from the Binney Street Building will fall on a very minor portion of Francis Street. The proposed open space will be mostly sunny, with the only shadow cast onto an area close to the Brigham and Women's Building that is already covered by existing shadow. At this time period, there will be no new shadow on the Riverway open space.

In the afternoon (3:00 pm), new shadow from the Project will extend northeast of the Project. New shadow cast by the Partial Hospital / Fenwood Inn will largely be contained within the property boundary. Shadow from the Brigham and Women's Building will be cast across portions of Fenwood Road and Vining Street. The proposed Residential Building will cast shadow across Fenwood Road, including the intersection of Fenwood Road and Binney Street and onto a minimal portion the roof of the Servicenter Complex. The proposed open space will be primarily sunny with some minor areas of shade to the east of the Residential Building. Shadow from the Binney Street Building will fall on a portion of Binney Street and the intersection of Francis and Binney Streets. At this time period, there will be no new shadow on the Riverway open space.

By 6:00 pm, much of the area is in existing shadow. Shadows cast by the Partial Hospital/Fenwood Inn will largely be contained within the property boundary. New shadow from the Brigham and Women's Building will be cast on portions of the roadway, sidewalks and on the roofs of adjacent properties along Fenwood Road and Francis Street. A sliver of new shadow from the Residential Building will be cast diagonally across small portions of Fenwood Road and Binney Street, including a small portion of the roof of the Binney Street Building. New shadow from the Binney Street Building will be cast on a minor portion of Francis Street. At this time period, there will be no new shadow on the Riverway open space.

4.2.5 Autumnal Equinox (September 21)

Net new shadows during the vernal equinox fall to the west, north, and east of the Project Site. Figures 4.2-8 through 4.2-11 illustrate shadow impacts from the Project and surrounding area.

At 9:00 am, new shadows from the proposed Partial Hospital/Fenwood Inn will be cast within the property boundary and across Vining Street, slightly extending shadows cast by the existing building. Shadow from the proposed Brigham and Women's Building and the Residential Building will be cast within the Main MMHC Site and across portions of the roadway and sidewalks along Brookline Avenue, the Riverway, and the private way. Some shadow cast by the Brigham and Women's Building and the Residential Building will fall onto minor portions of the Riverway open space. This new shadow will be limited to the area near the intersection of Riverway and Brookline Avenue. The proposed open space on the Main MMHC Site will be shaded due to both existing and net new shadow.

By noon, shadows will be cast to the north. Shadow from the Partial Hospital/ Fenwood Inn will mostly fall within the property boundary. Shadow from the Brigham and Women's Building will fall within the Main MMHC Site and across adjacent portions of Fenwood

Road. Shadow from the Residential Building will fall across portions of Fenwood Road and a minimal portion of Brookline Avenue, and shadow from the Binney Street Building will be cast onto a minor portion of Francis Street. The proposed open space will have a mix of sunny and shaded areas. At this time period, there will be no new shadow on the Riverway open space.

At 3:00 pm during the autumnal equinox, new shadow from the Project will fall to the northeast. Shadow from the proposed Partial Hospital/Fenwood Inn will slightly extend the existing shadow cast by the existing building, falling within the property boundary and onto portions of adjacent residential properties. New shadow cast by the Brigham and Women's Building will extend existing shadows in the area from the existing MMHC Buildings across onto portions of Binney Street, Fenwood Road, Francis Street, and Vining Street. New shadow from the Residential Building will fall on Fenwood Road and Binney Street, including portions of the rooftops of the Servicenter Complex and the proposed Binney Street Building. The proposed open space will be mostly sunny. Shadow from the Binney Street Building will fall on Binney Street and Francis Street adjacent to the Binney Street Site. At this time period, there will be no new shadow on the Riverway open space.

By 6:00 pm, the sun will be low in the sky and much of the area will be in existing shadow. Shadows cast by the Partial Hospital/Fenwood Inn will slightly extend the existing shadows in the area onto some adjacent residential properties. New shadow from the Brigham and Women's Building will be cast on the rooftops the Shapiro Cardiovascular Center and some nearby residential properties along Fenwood Road and Francis Street, reaching to the BWH Main Campus. New shadow from the Residential Building will be cast diagonally across small portions of Fenwood Road, and onto portions of the Servicenter Complex, the Shapiro Cardiovascular Center and the BWH Main Campus. No new shadow is anticipated from the Binney Street Building. At this time period, there will be no new shadow on the Riverway open space.

4.2.6 Winter Solstice (December 21)

The winter solstice creates the least favorable conditions for sunlight in New England. The sun angle during the winter is lower than in any other season causing the shadows to elongate and creating considerable shadow in the area. Figures 4.2-12 through 4.2-14 illustrate impacts from the Project.

At 9:00 am, the morning sun casts new shadows to the northwest. A sliver of new shadow from the Partial Hospital/Fenwood Inn will be cast across Vining Street adjacent to the Project. Shadow cast by the Brigham and Women's Building will largely fall within the Main MMHC Site, although some new shadow from the building will fall across portions of Fenwood Road and onto a portion of the Servicenter Complex. Shadow from the Residential Building will be cast to the northwest, across portions of Fenwood Road, the Riverway, and Pilgrim Road, including a portion of the rooftop of the BIDMC 110 Francis Street Garage. From Brookline Avenue to Pilgrim Road, new shadows will be cast onto a small area of the Riverway open space and portions of the adjacent roadway. The proposed open space will be in shadow cast from existing structures. Shadow from the Binney Street Building will be cast onto a small portion of the Servicenter Complex.

By noon, the sun has moved higher in the sky, casting shadows to the north that are significantly shorter than during the morning hours. Net new shadow from the Partial Hospital/Fenwood Inn will extend northward across minor portions of Vining Street and onto the residential buildings on the corner of Vining Street and Fenwood Road. Shadow from the Brigham and Women's Building will be cast across a minor portion of Fenwood Road and portions of the rooftops of the Shapiro Cardiovascular Center, the Binney Street Building, the Servicenter Complex, and the Medical Area Total Energy Plant (MATEP). Shadows from the Residential Building will fall onto portions of Fenwood Road and Brookline Avenue and onto a portion of the rooftop of the Servicenter Complex. At this time period, there will be no new shadow on the Riverway open space.

As the sun sinks lower in the sky, shadows once again become elongated and by 3:00 pm fall northeast. New shadows will extend the long existing shadows in the Project area. The Partial Hospital/Fenwood Inn will cast patches of new shadow on the rooftop of some adjacent properties along Fenwood Road. Shadow from the Brigham and Women's Building will fall on portions of the rooftop of the Shapiro Cardiovascular Center and the BWH Tower Building. Shadow from the Residential Building will fall across a portion of Fenwood Road and onto the rooftops of the Servicenter Complex and MATEP. Slivers of new shadow from the Binney Street Building will be cast northwards along Binney Street. At this time period, there will be no new shadow on the Riverway open space.

4.2.7 Conclusions

The shadow study analysis evaluates potential impacts to the streets, sidewalks, and open spaces on the Project Site and surrounding area. Results indicate that the Project will not cause substantial impacts. In general, new shadow from the Project will largely be limited to the immediate surrounding public ways and sidewalks of Fenwood Road, the Riverway, Binney, Francis and Vining Streets. No new shadow from the Project is anticipated to fall on any of the existing open spaces in the area except for some shadow on the Riverway portion of the Emerald Necklace during the early to mid-morning hours during limited periods of the year. During most time periods, the proposed open space on the Main MMHC Site will have a mix of sunny and shaded areas available to users of the space. Additional minor new shadow will be cast on adjacent residential properties from the Partial Hospital/Fenwood Inn.

Massachusetts Mental Health Center Redevelopment Project **Boston, MA**

Figure 4.2-1

March 21 - 10:00 AM

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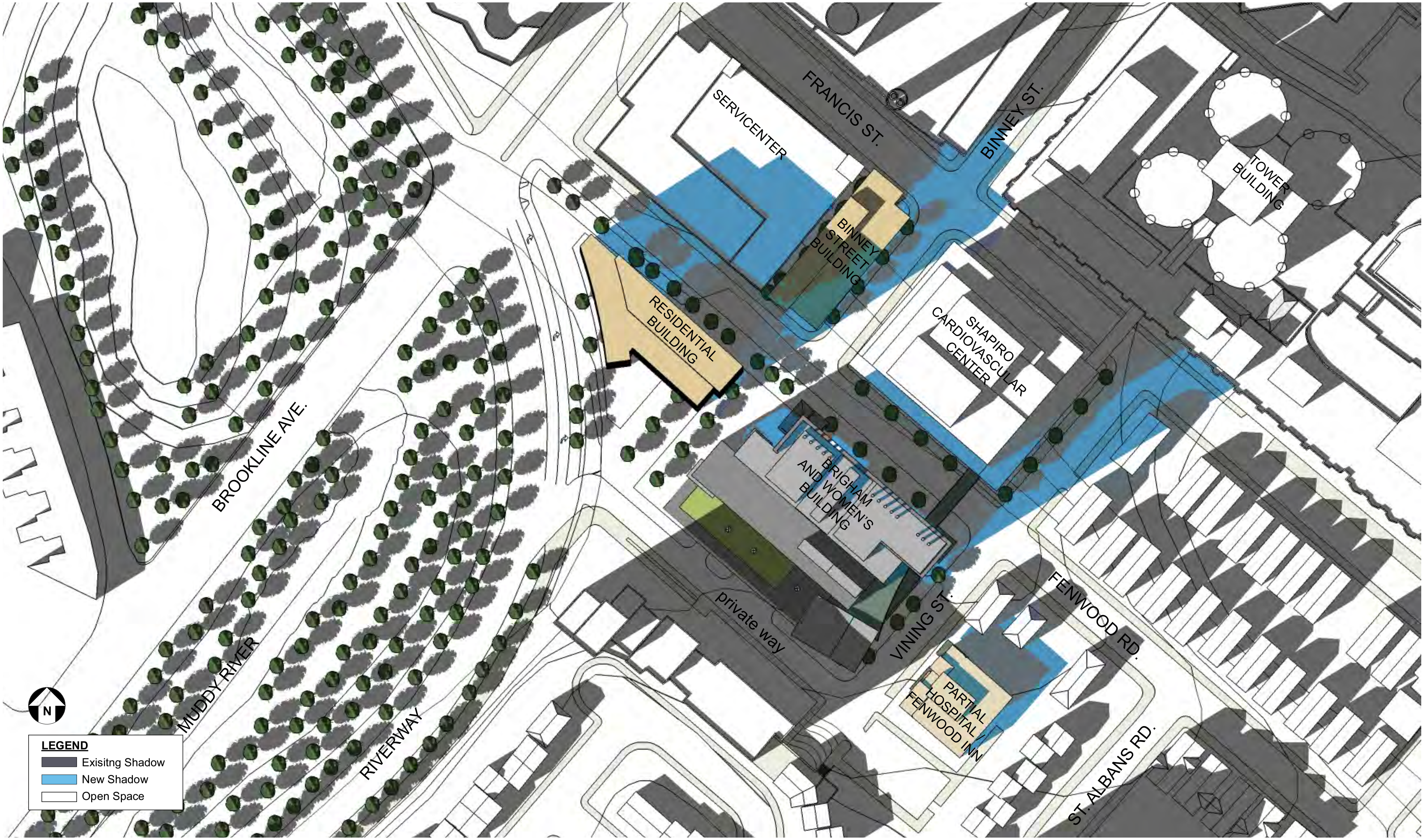
Massachusetts Mental Health Center Redevelopment Project **Boston, MA**

Figure 4.2-2

LINEA 5, inc.
Boston, MA • Miami Beach, FL

tat | the architectural team

March 21 - 01:00 PM



Massachusetts Mental Health Center Redevelopment Project Boston, MA

Figure 4.2-3

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March 21 - 04:00 PM

Massachusetts Mental Health Center Redevelopment Project Boston, MA

Figure 4.2-4

June 21 - 09:00 AM

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Massachusetts Mental Health Center Redevelopment Project Boston, MA

Figure 4.2-5

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June 21 - 12:00 PM

Massachusetts Mental Health Center Redevelopment Project **Boston, MA**

Figure 4.2-6

LINEA 5, inc.
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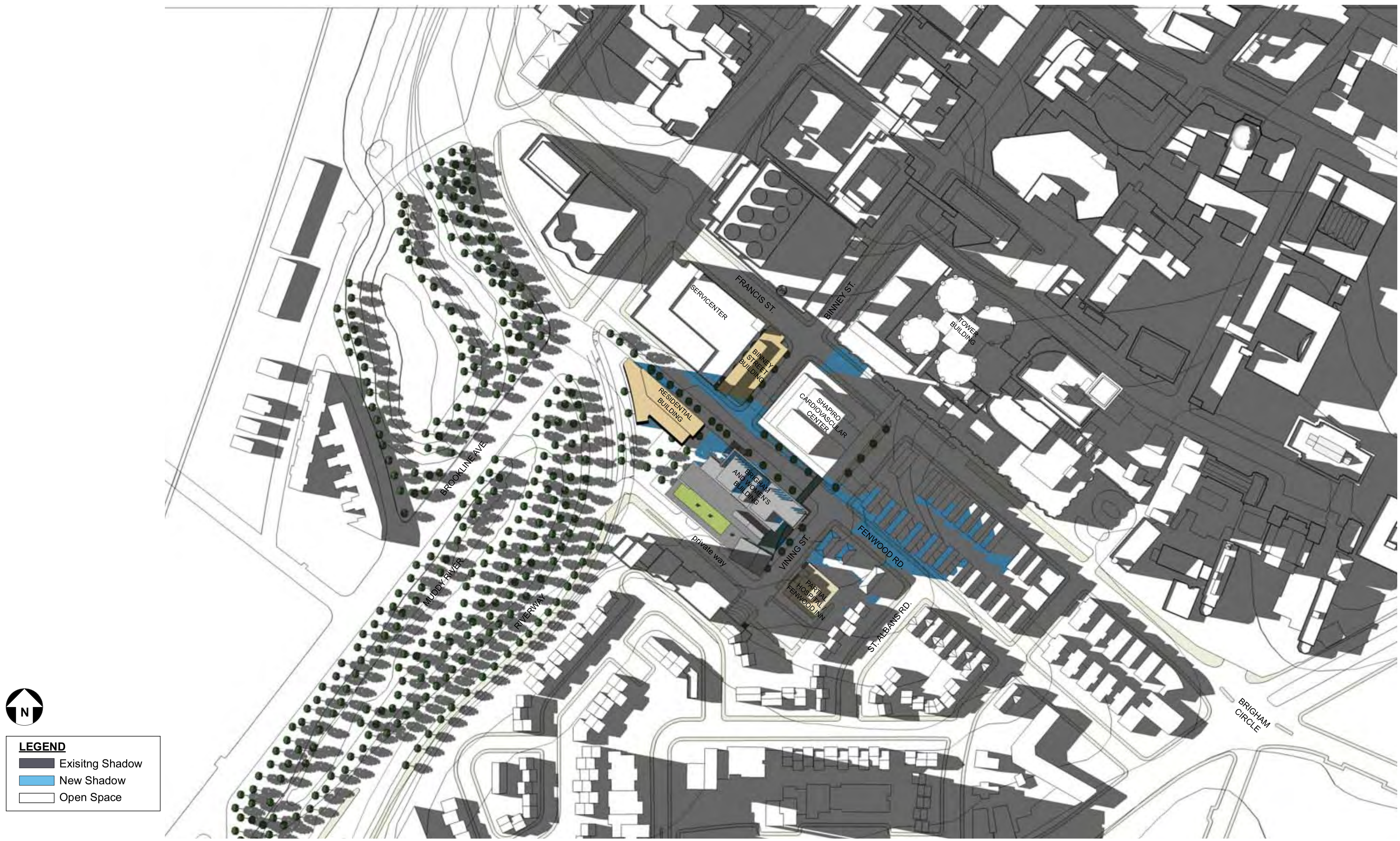
June 21 - 03:00 PM



Massachusetts Mental Health Center Redevelopment Project **Boston, MA**

Figure 4.2-7

June 21 - 06:00 PM

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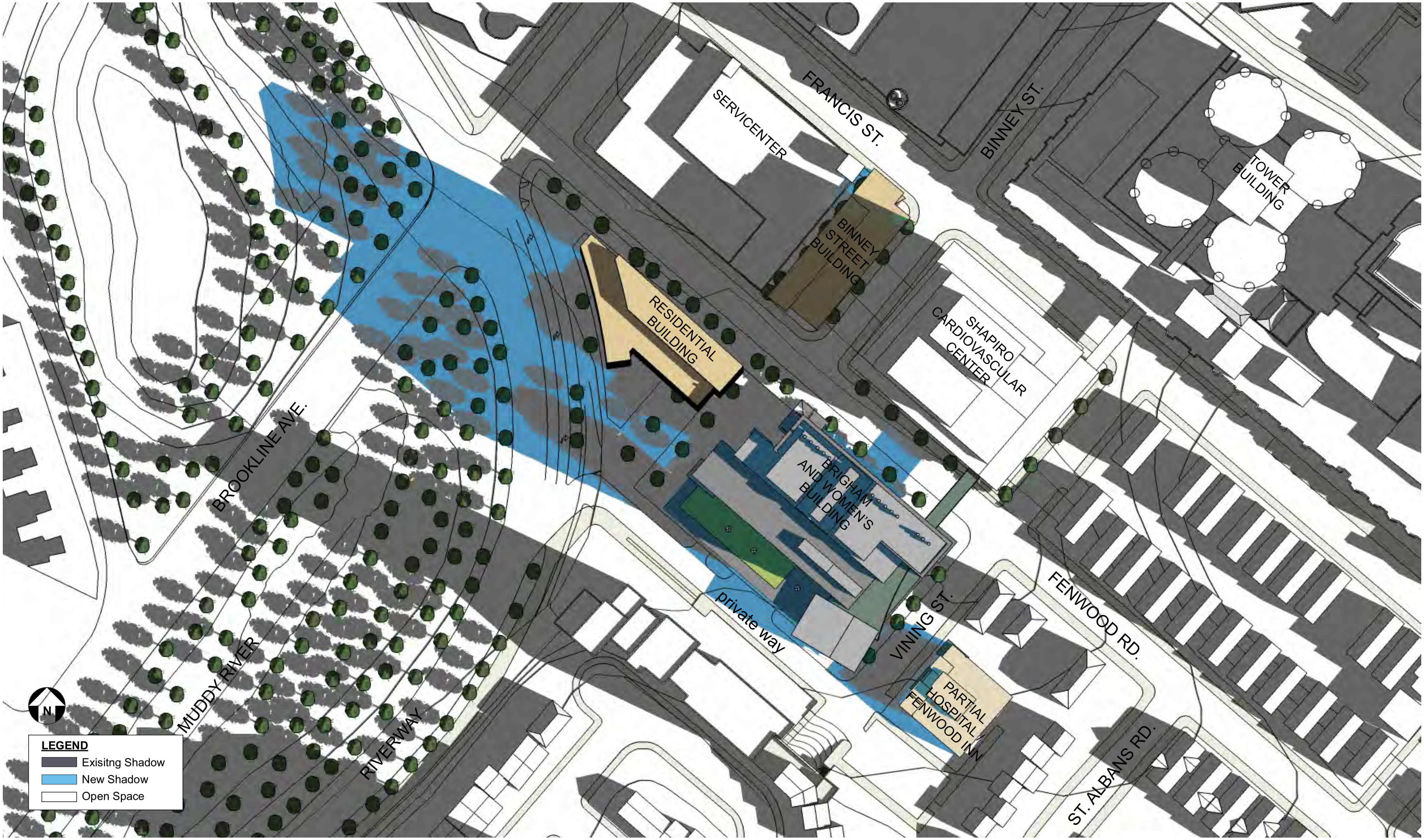

Massachusetts Mental Health Center Redevelopment Project Boston, MA

Figure 4.2-8

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September 21 - 09:00 AM

Massachusetts Mental Health Center Redevelopment Project Boston, MA

Figure 4.2-9

LINEA 5, inc. Boston, MA • Miami Beach, FL

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September 21 - 12:00 PM

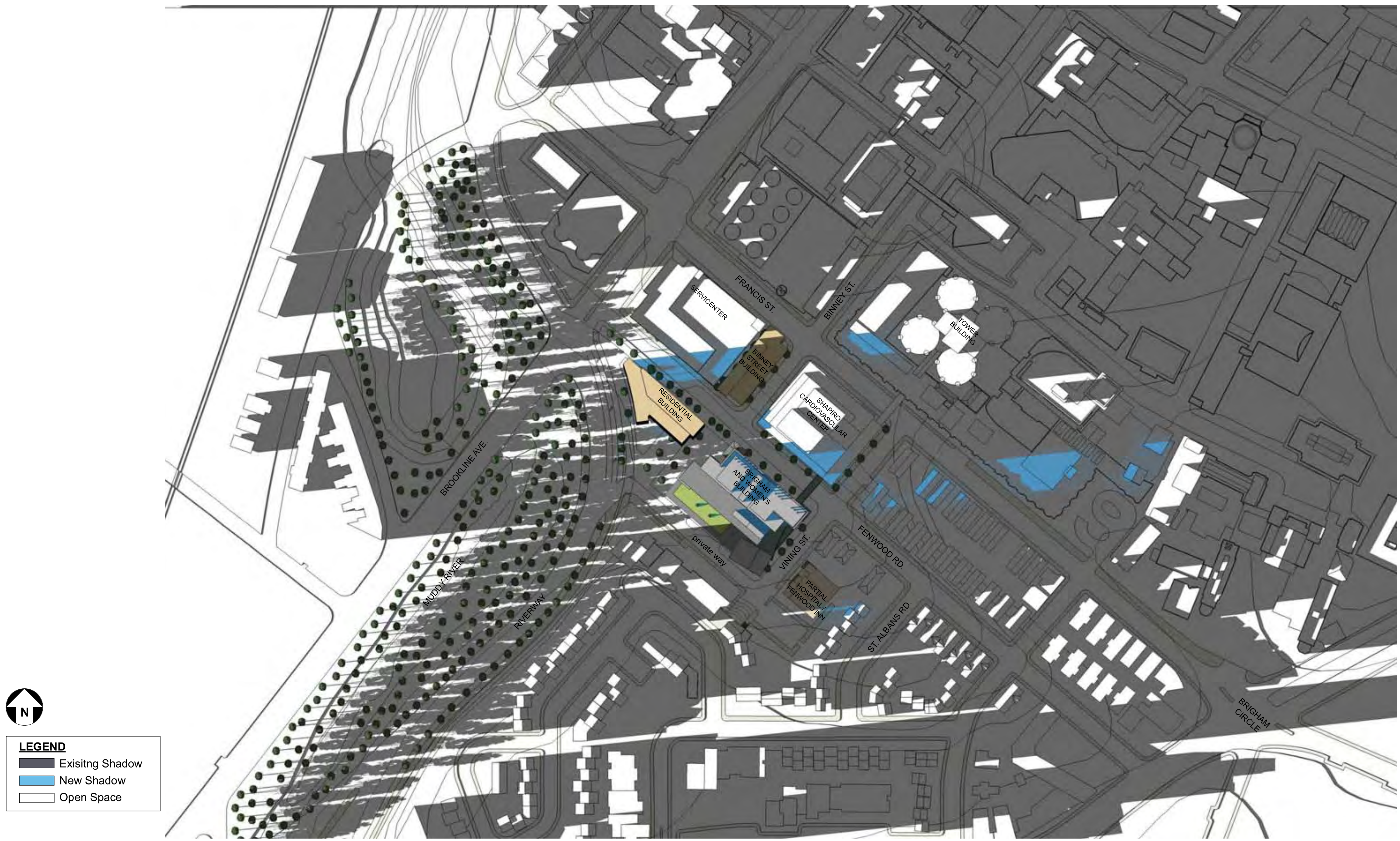
Massachusetts Mental Health Center Redevelopment Project Boston, MA

Figure 4.2-10

LINEA 5, inc. Boston, MA • Miami Beach, FL

tat | the architectural team

September 21 - 03:00 PM



Massachusetts Mental Health Center Redevelopment Project Boston, MA

Figure 4.2-11

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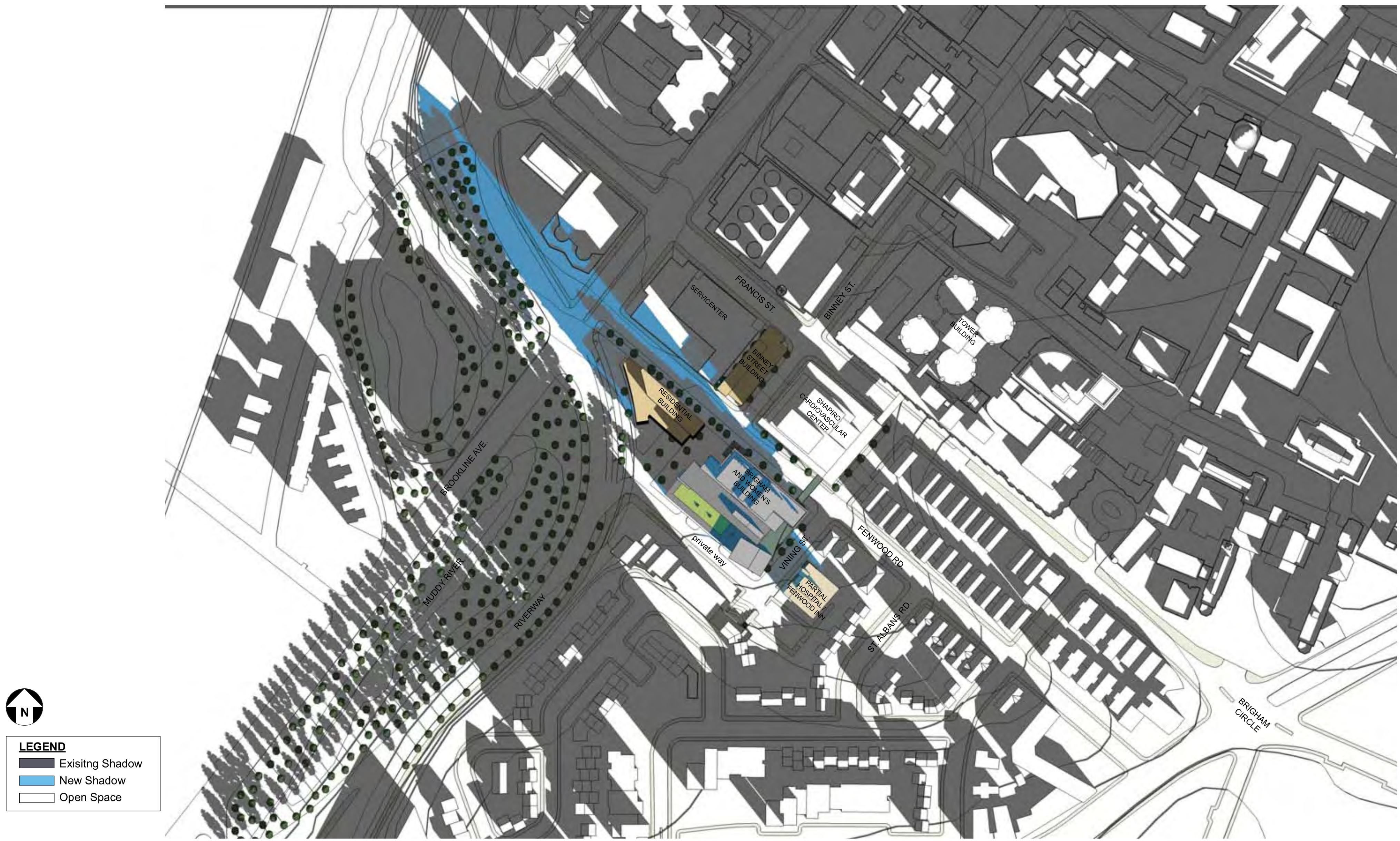
September 21 - 06:00 PM



Massachusetts Mental Health Center Redevelopment Project Boston, MA

Figure 4.2-12

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December 21 - 09:00 AM

Massachusetts Mental Health Center Redevelopment Project Boston, MA

Figure 4.2-13

LINEA 5, inc. Boston, MA • Miami Beach, FL

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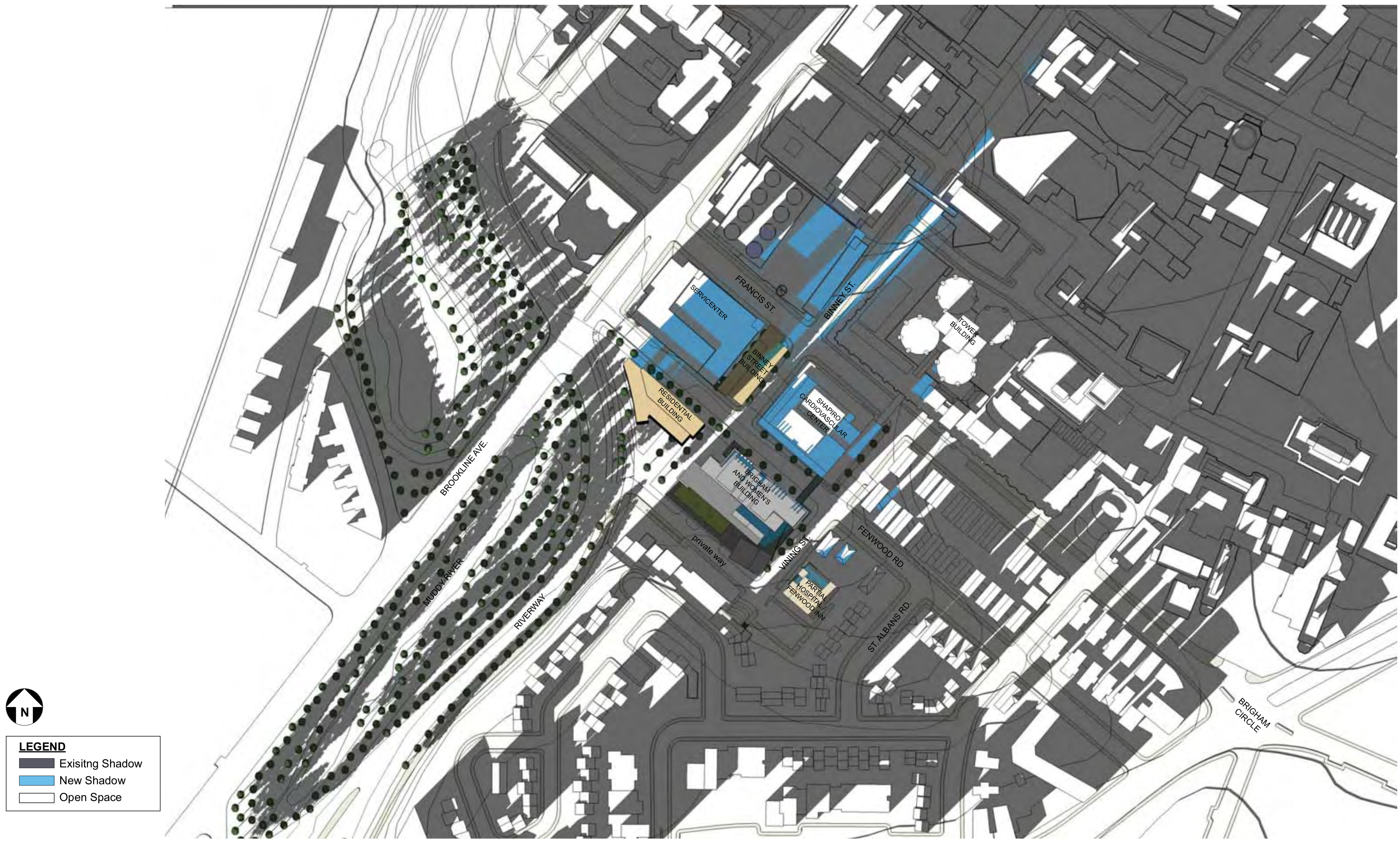
December 21 - 12:00 PM



Massachusetts Mental Health Center Redevelopment Project **Boston, MA**

Figure 4.2-14

LINEA 5, inc. Boston, MA • Miami Beach, FL

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December 21 - 03:00 PM

4.3 Daylight

4.3.1 Introduction and Summary of Analysis

The purpose of the daylight analysis is to estimate the extent to which a proposed project will affect the amount of daylight reaching the streets and the sidewalks in the immediate vicinity of the Project Site. In accordance with the BRA Scoping Determination, the daylight analysis for the Project considers the existing, as-of-right and proposed conditions, and daylight obstruction values of the surrounding area.

The results of the daylight analysis presented in this Draft EIR/PIR indicate that while the development of the Project will result in increased daylight obstruction at the Project Site over existing conditions, the resulting conditions will be within the range of existing daylight obstruction values in the Project vicinity, and therefore, consistent with daylight conditions of the nearby area.

4.3.2 Methodology

The daylight analysis was performed utilizing the Boston Redevelopment Authority Daylight Analysis ("BRADA") computer program[2]. This program measures the percentage of sky-dome that is obstructed by a project and is a useful tool in evaluating the net change in obstruction from existing to build conditions at a specific site.

Using BRADA, a silhouette view of the building is taken at ground level from the middle of the adjacent city streets or pedestrian ways centered on the proposed building. The façade of the building facing the viewpoint, including heights, setbacks, corners and other features, is plotted onto a base map using lateral and elevation angles. The two-dimensional base map generated by BRADA represents a figure of the building in the "sky-dome" from the viewpoint chosen. The BRADA program calculates the percentage of daylight that will be obstructed on a scale of 0% to 100% based on the width of the view, the distance between the viewpoint and the building, and the massing and setbacks incorporated into the design of the building; the lower the number, the lower the percentage of obstruction of daylight from any given viewpoint.

As mentioned, for purposes of data comparison the BRA typically requests that the analysis treat the following elements as controls:

- Existing Conditions;
- Proposed Conditions;

2 Method developed by Harvey Bryan and Susan Stuebing, computer program developed by Ronald Fergle, Massachusetts Institute of Technology, Cambridge, MA, September 1984.

- The as-of-right zoning envelope; and
- The context of the area.

Viewpoints were chosen along Binney Street (Viewpoint 1), Fenwood Road (Viewpoints 2 and 3), Vining Street (Viewpoints 4 and 6), and the Riverway (Viewpoint 5). The analysis examined daylight obstruction from the six locations for the existing and proposed conditions.

The Main MMHC Site, where the Brigham and Women's and Residential Buildings are proposed, is outside of the area covered by the LMA Interim Guidelines. The as-of-right scenario for the Brigham and Women's and the Residential Buildings was assumed to be a 55 feet height with a 20-foot front yard setback per the requirements set by Article 59 of the Zoning Code. The Partial Hospital/Fenwood Inn is exempt from zoning. However, the dimensions set forth below are consistent for development within the 3F-2000/Three-Family Residential District in the absence of an IMP. Therefore, the as-of-right scenario for the Partial Hospital/Fenwood Inn Site was assumed to be of 35 feet height with five-foot side yards and a five-foot front yard setback. The underlying zoning for the Binney Street Site is the H-1 Zoning District. Accordingly, the as-of-right scenario for the Binney Street Site was assumed to be of a two-story, 30-foot tall height with a 25-foot setback from the property line fronting Binney Street.

Additionally, this study considered area context points to provide a basis of comparison to existing conditions in the surrounding area. These viewpoints were taken along Fenwood Road (AC1 and AC2); Francis Street (AC3 and AC4), Binney Street (AC5); and the private way (AC6). These viewpoints are all illustrated on Figure 4.3-1.

4.3.3 Daylight Analysis Results

The results for each viewpoint under each alternative condition are described in Table 4.3-1. Figures 4.3-2 through 4.3-8 illustrate the BRADA results for each analysis and are located at the end of this section.

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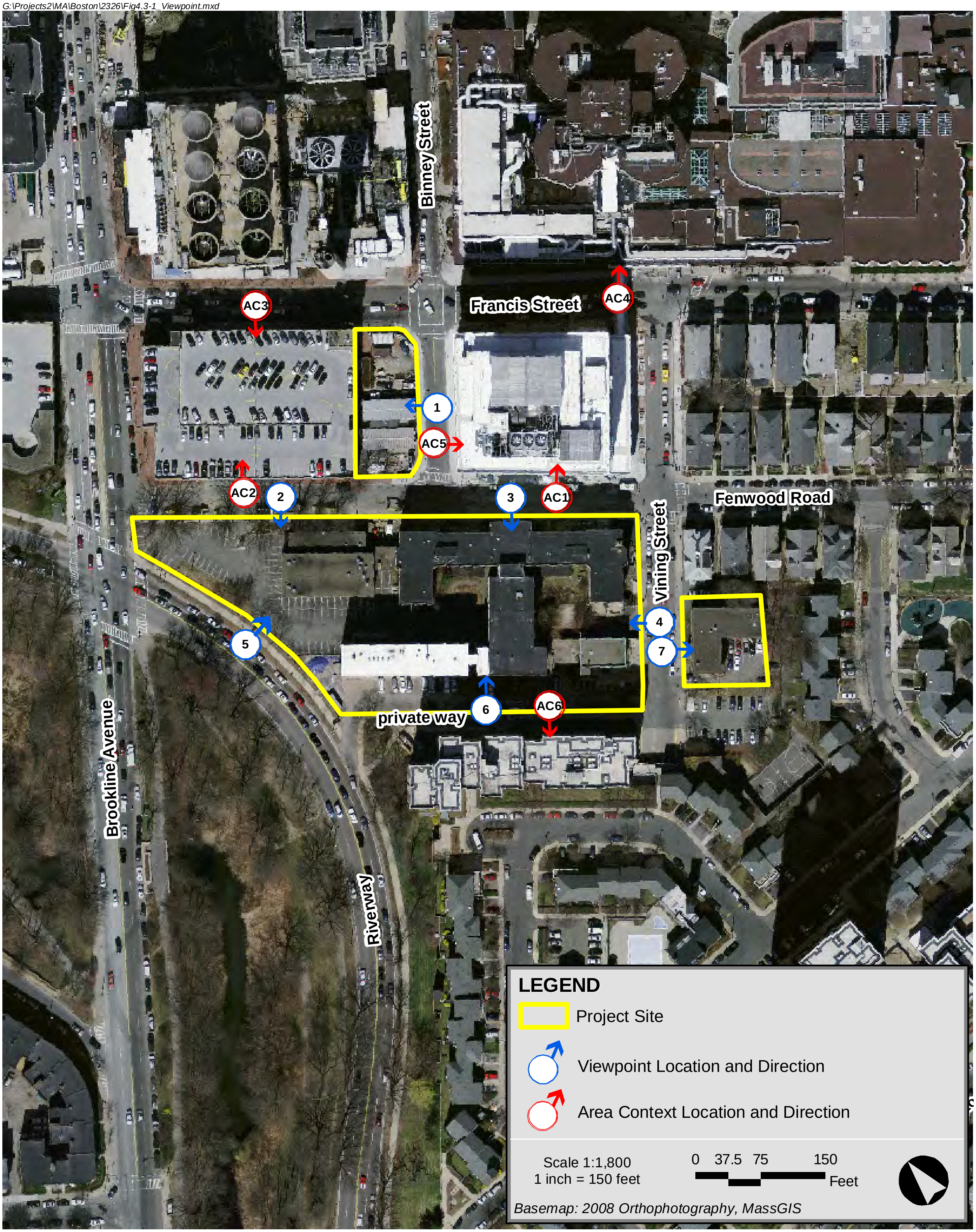


Massachusetts Mental Health Center Redevelopment **Boston, Massachusetts**

Epsilon ASSOCIATES INC.

Figure 4.3-1

Viewpoint Locations

Table 4.3-1 Daylight Obstruction Values

Viewpoint Locations		Existing Conditions	As-of-Right	Proposed
Viewpoint 1	Binney Street looking Northwest at the Binney Street Building	23.0%	32.5%	83.2%
Viewpoint 2	Fenwood Road looking Southwest at the Residential Building	13.4%	52.2%	68.9%
Viewpoint 3	Fenwood Road looking Southwest at the Brigham and Women's Building	69.7%	55.1%	84.4%
Viewpoint 4	Vining Street looking Northwest at the Brigham and Women's Building	27.1%	73.1%	67.7%
Viewpoint 5	Riverway looking Northeast at the Residential Building	3.4%	41.9%	34.4%
Viewpoint 6	The private way looking Northeast at the Brigham and Women's Building	64.9%	62.5%	61.8%
Viewpoint 7	Vining Street looking Southeast at the Fenwood Inn / Partial Hospital	43.7%	50.2%	46.0%
Area Context Points				
AC1*	Fenwood Road looking north at 70 Francis Street (Shapiro Cardiovascular Center)	87.6%		
AC2*	Binney Street looking northwest at 474 Brookline Avenue (MATEP Building)	69.6%		
AC3*	Francis Street looking southwest at Servicenter	60.0%		
AC4*	Francis Street looking northeast at the Brigham and Women's campus at 75 Francis Street	70.2%		
AC5*	Binney Street looking southeast at 70 Francis Street (Shapiro Cardiovascular Center)	91.3%		
AC6	Neville House	72.5%		

* AC1 through AC5 are based on a daylight analysis prepared by Epsilon Associates for the 70 Francis Street / Brigham Green Enhancement and Parking Draft EIR/DPIR from August, 2004.

Binney Street – Viewpoint 1

Binney Street runs along the eastern edge of the Binney Street Building Site. Viewpoint 1 was taken from the center of Binney Street, looking northwest. The Binney Street Site is currently occupied by construction trailers which were utilized in connection with the development of the Shapiro Cardiovascular Center and are now vacant. The abutting Servicenter Complex while currently one parcel as both are owned by BWH is not proposed to be included within the Binney Street Site but currently affects the amount of daylight currently reaching Binney Street because of the shape of the Binney Street Site. Therefore, calculations for the existing conditions were assumed to include both the Binney Street Site and the abutting Servicenter Complex. The construction of the Binney Street Building will increase the daylight obstruction value to 83.2 percent. While this is an increase over existing conditions (23 percent), the daylight obstruction value for the Project is consistent with the daylight obstruction values of existing buildings in the vicinity of the Project Site, as shown above in Table 4.3-1.

Fenwood Road (West) – Viewpoint 2

Fenwood Road runs along the northern edge of the Main MMHC Site. Viewpoint 2 was taken from the center of Fenwood Road, looking southwest at the western section of the Main MMHC Site. This area is currently occupied by the existing two-story brick building (formerly known as the Therapeutic Building) and a surface parking lot, and therefore has a low daylight obstruction value. The development of the Residential Building on the Main MMHC Site will increase daylight obstruction values to 68.9 percent. While this is an increase in daylight obstruction, the value is typical of densely built urban environment such as the Project area. Daylight values are also higher along Fenwood Road due to the substantial setback from the private way which was created in response to community comments.

Fenwood Road (East) – Viewpoint 3

Viewpoint 3 was taken from the center of Fenwood Road, looking southwest at the eastern section of the Main MMHC Site. This area is currently occupied by the existing four-story building, formerly known as the MMHC Main Building, with an obstruction value of 69.7 percent. The development of the Brigham and Women's Building will increase daylight obstruction values to 84.4 percent, which will exceed the as-of-right massing value of 55.1 percent, but will be within the range of daylight obstruction values from existing buildings in the Project vicinity. As noted above, the increased setback from the private way results in increased obstruction values along Fenwood Road but lower obstruction values from the private way.

Vining Street – Viewpoint 4

Vining Street runs along the eastern edge of the Main MMHC Site. Viewpoint 4 was taken from the center of Vining Street looking northwest at the Main MMHC Site. The Site is currently occupied by the two-story former power plant building and the four-story former Main Building. The development of the Brigham and Women's Building will increase the daylight obstruction value to 67.7 percent, which will be consistent with the as-of-right massing value of 73.1 percent.

Riverway – Viewpoint 5

The Riverway runs along the western edge of the Main MMHC Site. Viewpoint 5 was taken from the center of the street, looking northeast at the Residential Building. The Main MMHC Site is currently occupied by the two-story, former Therapeutic Building, and a surface parking lot. Construction of the Residential Building will increase the daylight obstruction value to 34.4 percent, which will also be consistent with the as-of-right scenario of 41.9 percent.

Private Way – Viewpoint 6

The private way runs along the southwestern edge of the Main MMHC Site. Viewpoint 6 was taken from the center of the street, looking northeast at the Brigham and Women's Building. The site is currently occupied by the five-story, formerly Research brick building, a section of the four-story, formerly Main Building, the two-story, formerly Power House, and a surface parking lot. Construction of the proposed Brigham and Women's Building will reduce obstruction levels to 61.8 percent, which is consistent with the as-of-right alternative with obstruction value of 62.5 percent, and below the existing obstruction value of 64.9 percent. This is largely due to the proposed design for the Brigham and Women's Building, which incorporates significant setbacks from the private way to maintain the existing daylight conditions for nearby residents at the adjacent Neville House.

Vining Street – Viewpoint 7

Vining Street runs along the western edge of the Partial Hospital/Fenwood Inn Site. Viewpoint 7 was taken from the center of Vining Street, looking southeast. Existing conditions at the Partial Hospital/Fenwood Inn Site, which is occupied by the existing four-story building, have a daylight obstruction value of 43.7 percent. Construction of the new Partial Hospital/Fenwood Inn Building will slightly increase the daylight obstruction value to 46.0 percent, which will be consistent with the as-of-right massing value of 50.2 percent.

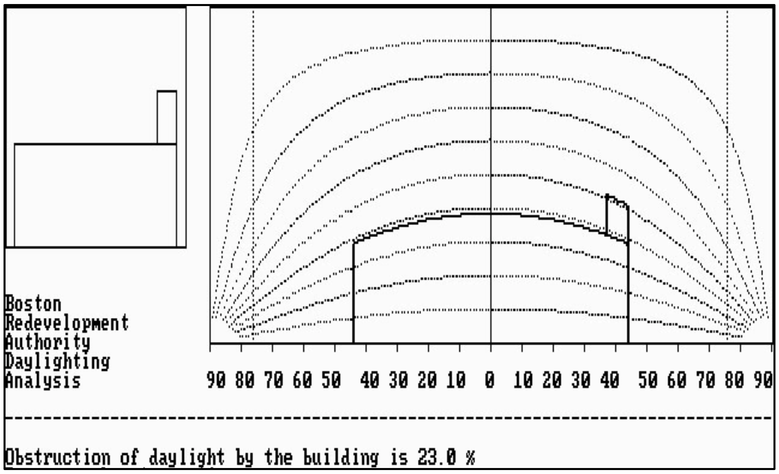
Area Context Views

The proposed Project will be located in a dense urban neighborhood that is characterized by a mix of institutional, commercial and residential uses, as well as surface parking lots and recreational open space. Buildings in the Project area range between two and 27 stories (Levinson House). The Project's daylight obstruction values are consistent with the daylight obstruction values in the area.

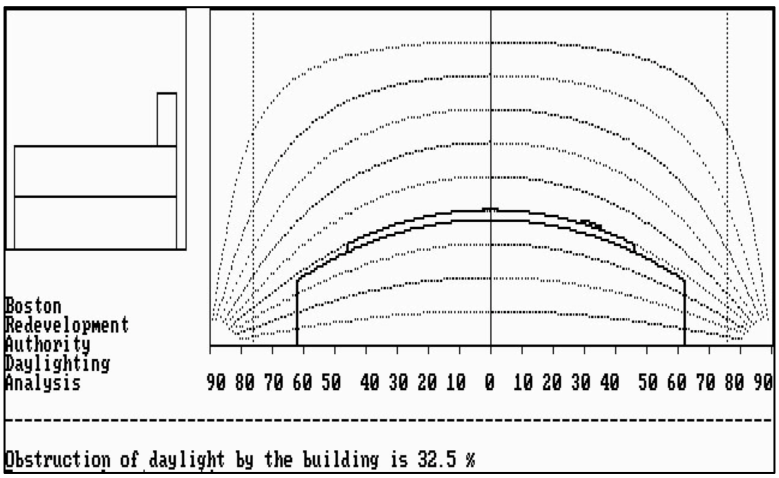
To provide a larger context for a specific comparison of daylight conditions, obstruction values were calculated from six viewpoints. The daylight conditions adjacent to the Project Site ranged from 60.0 percent (AC3) on Francis Street to 91.3 percent on Binney Street (AC5).

4.3.4 Conclusions

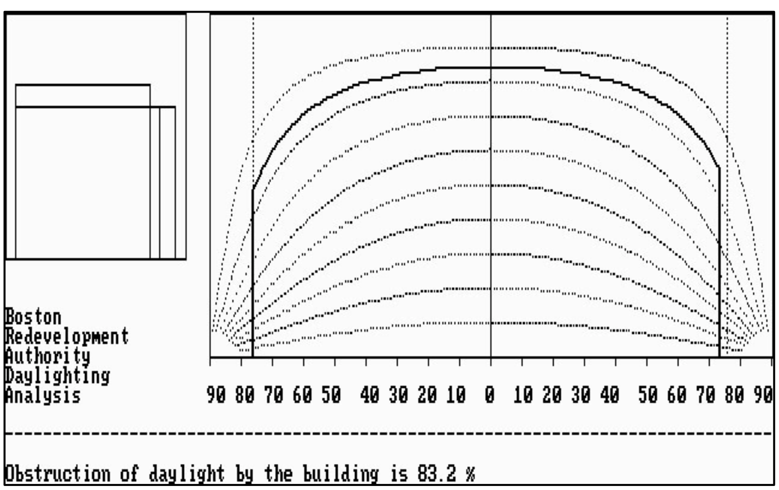
The Project's design is intended to reflect the transition from a residential neighborhood at the east of the Project Site to the institutional and high-rise uses on the western side of the Project Site. The low-scale proposed Partial Hospital/Fenwood Inn is located closest to the lower scale residential buildings along Vining Street and Fenwood Road. Taller Project buildings are proposed adjacent to the 26-story Neville House and institutional uses along Binney Street and Fenwood Road. Therefore, the daylight values of each of the Project structures are consistent with its adjacent land uses. The daylight analysis conducted for the Project describes existing, as-of-right and proposed daylight obstruction conditions at the Project Site and in the surrounding area. The results of the BRADA analysis indicate that while the development of the Project will result in increased daylight obstruction over existing conditions, the resulting conditions will often be similar to both daylight obstruction values within the surrounding area and typical of densely built urban areas.



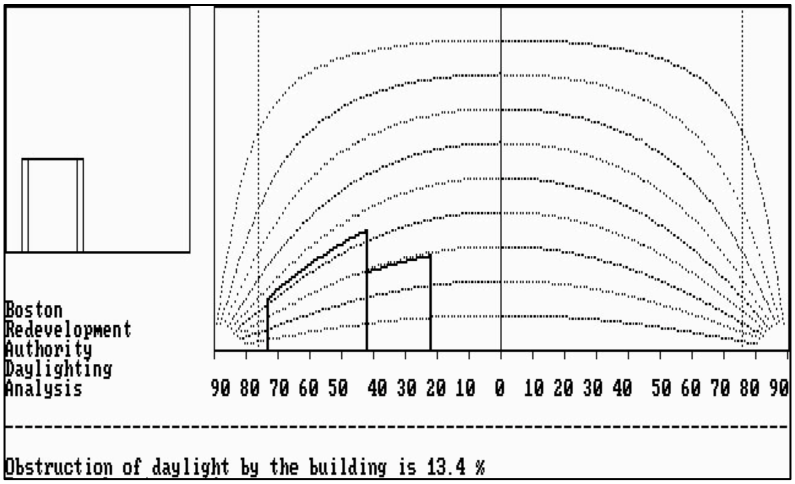
Viewpoint 1 –
Existing Conditions: Binney Street looking Northwest at the Binney Street Building



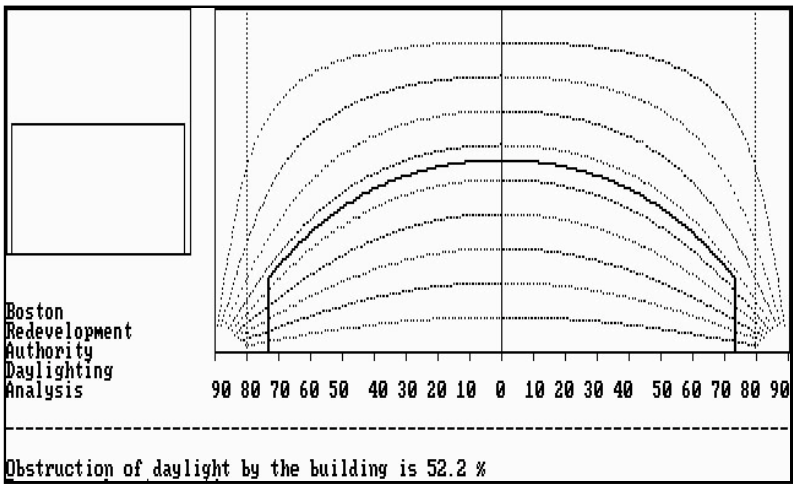
Viewpoint 1 –
As-of-Right Conditions: Binney Street looking Northwest at the Binney Street Building



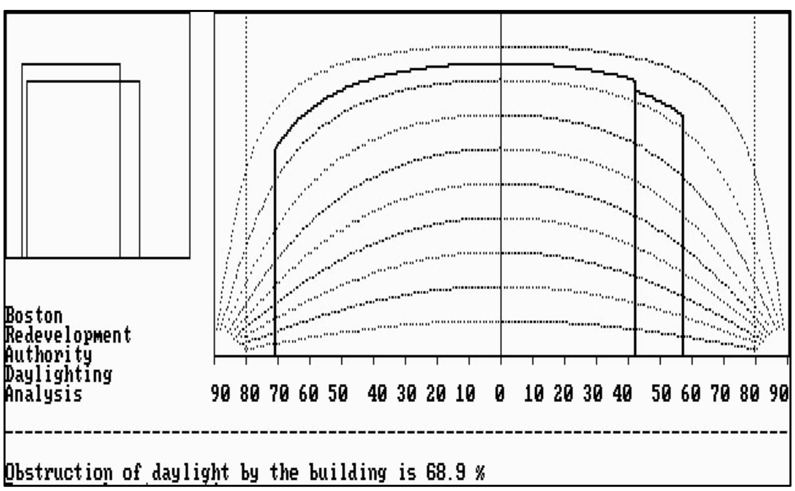
Viewpoint 1 –
Proposed Conditions: Binney Street looking Northwest at the Binney Street Building



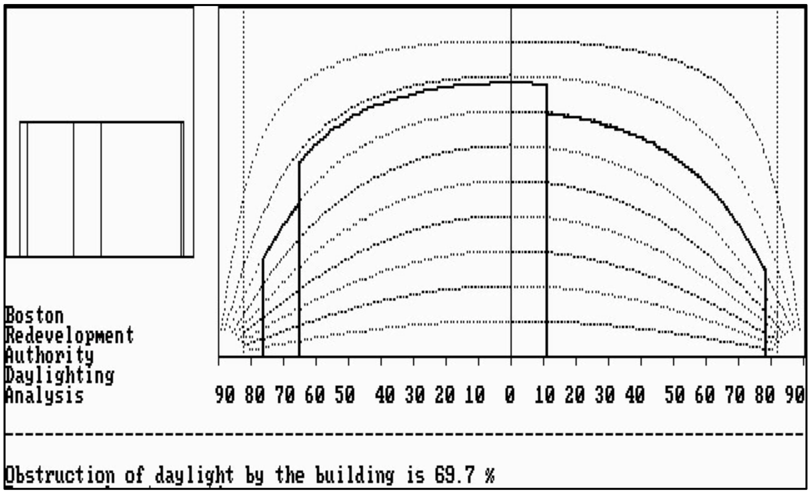
Viewpoint 2 –
Existing Conditions: Fenwood Road looking Southwest at the Residential Building



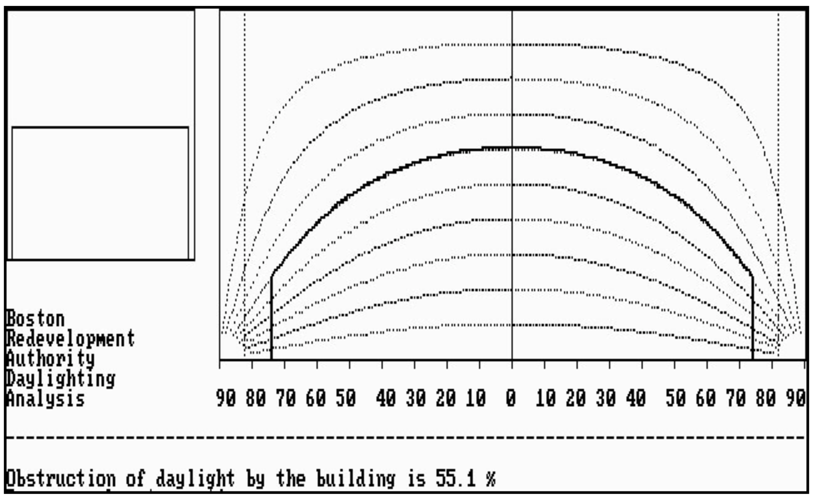
Viewpoint 2 –
As-of-Right Conditions: Fenwood Road looking Southwest at the Residential Building



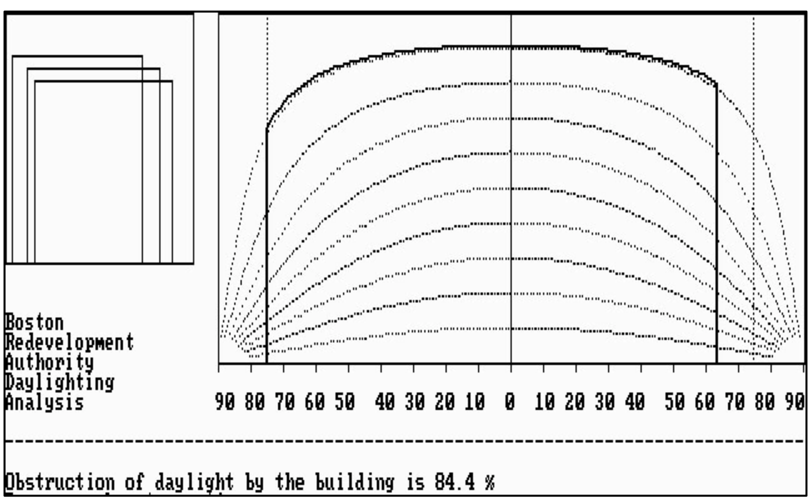
Viewpoint 2 –
Proposed Conditions: Fenwood Road looking Southwest at the Residential Building



Viewpoint 3 –
Existing Conditions: Fenwood Road looking Southwest at the Brigham and Women's Building

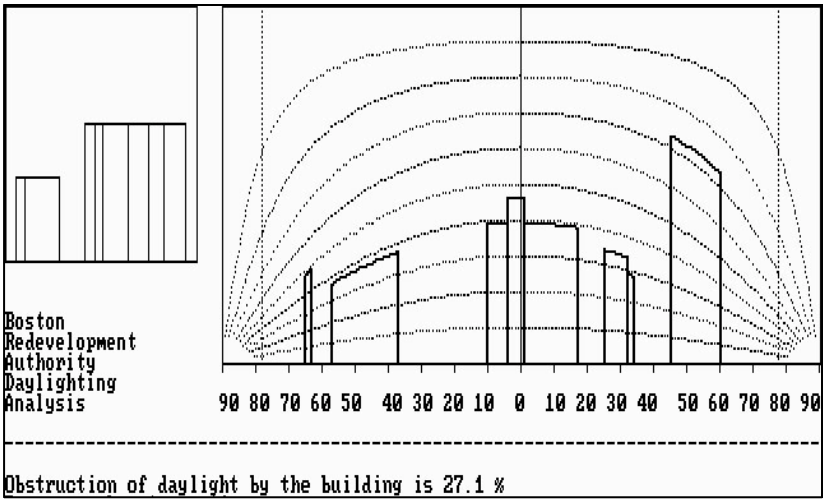


Viewpoint 3 –
As-of-Right Conditions: Fenwood Road looking Southwest at the Brigham and Women's Building

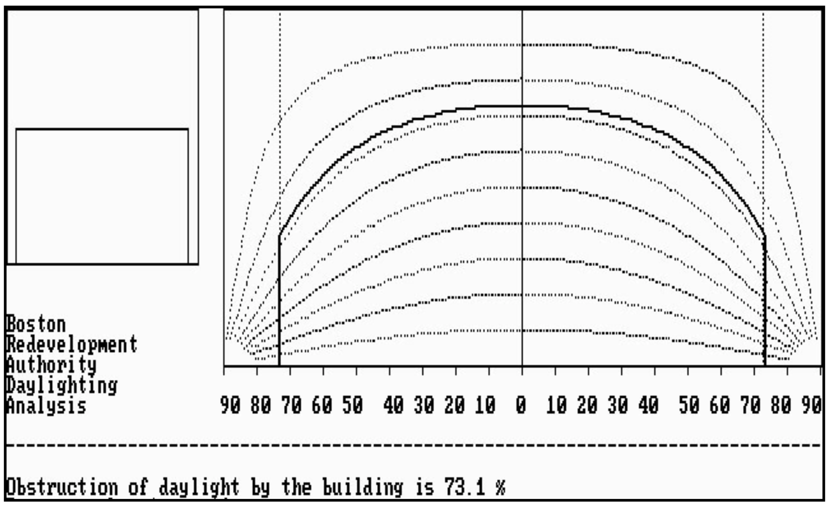


Viewpoint 3 –
Proposed Conditions: Fenwood Road looking Southwest at the Brigham and Women's Building

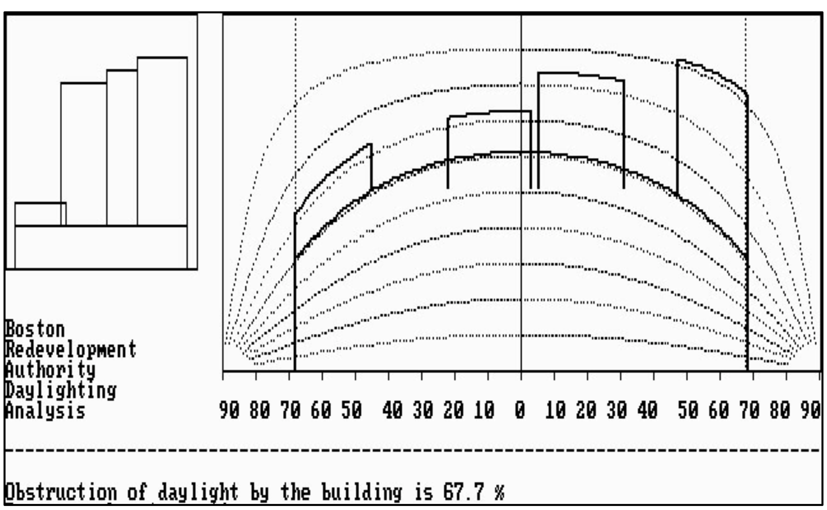
Figure 4.3-4



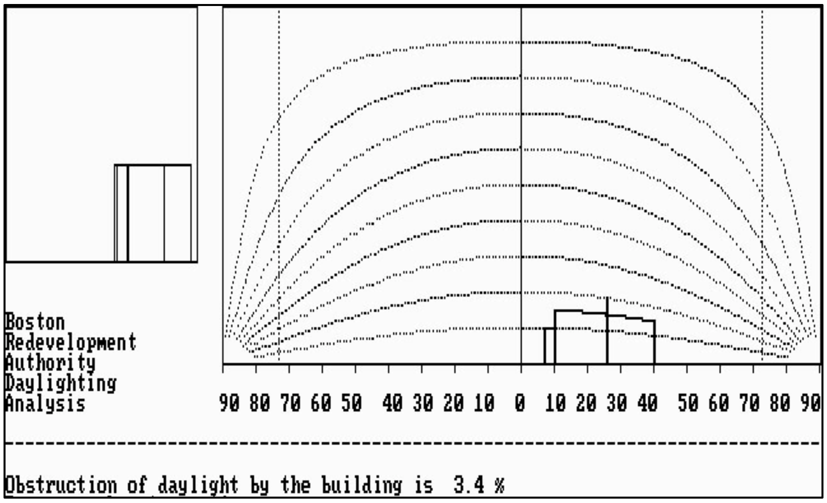
Viewpoint 4 –
Existing Conditions: Vining Street looking Northwest at the Brigham and Women's Building



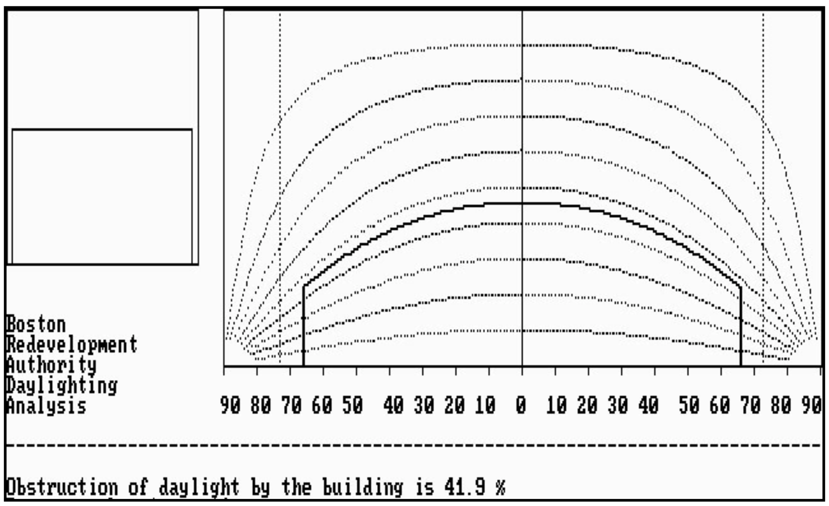
Viewpoint 4 –
As-of-Right Conditions: Vining Street looking Northwest at the Brigham and Women's Building



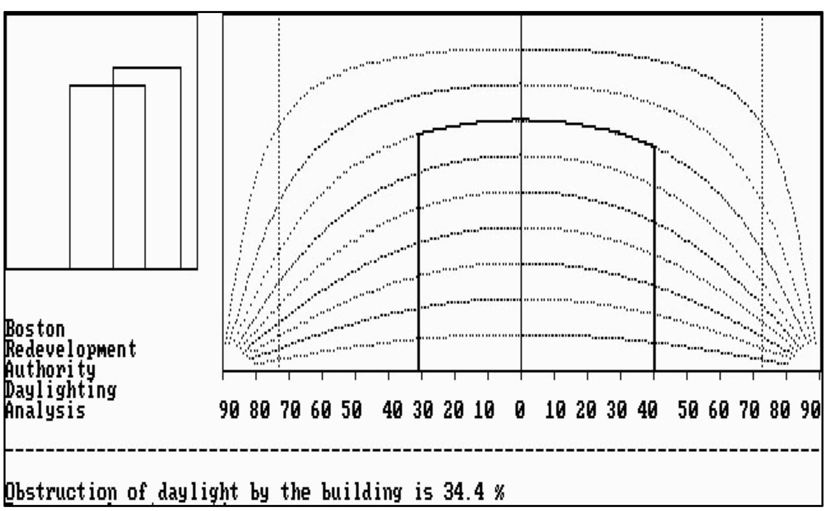
Viewpoint 4 –
Proposed Conditions: Vining Street looking Northwest at the Brigham and Women's Building



Viewpoint 5 –
Existing Conditions: Riverway looking Northeast at the Residential Building

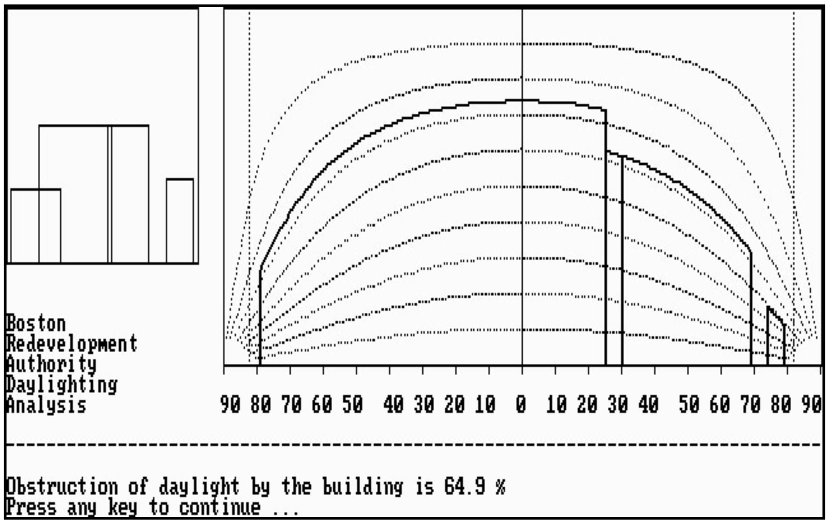


Viewpoint 5 –
As-of-Right Conditions: Riverway looking Northeast at the Residential Building

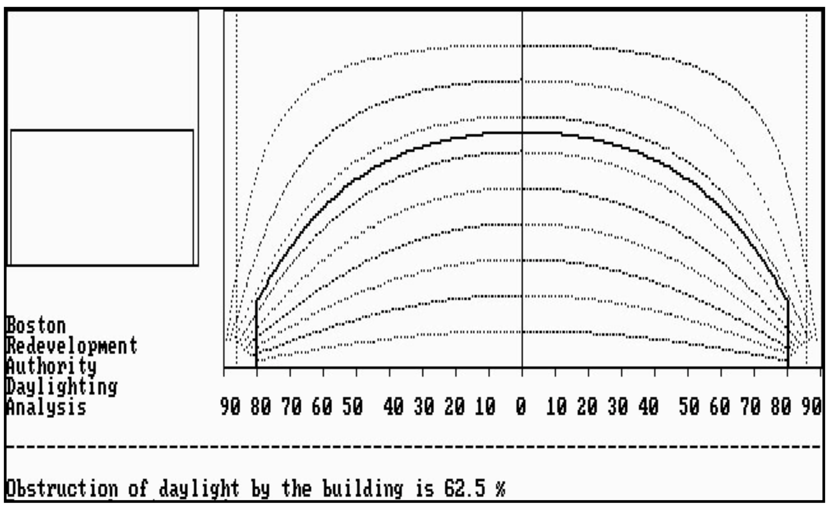


Viewpoint 5 –
Proposed Conditions: Riverway looking Northeast at the Residential Building

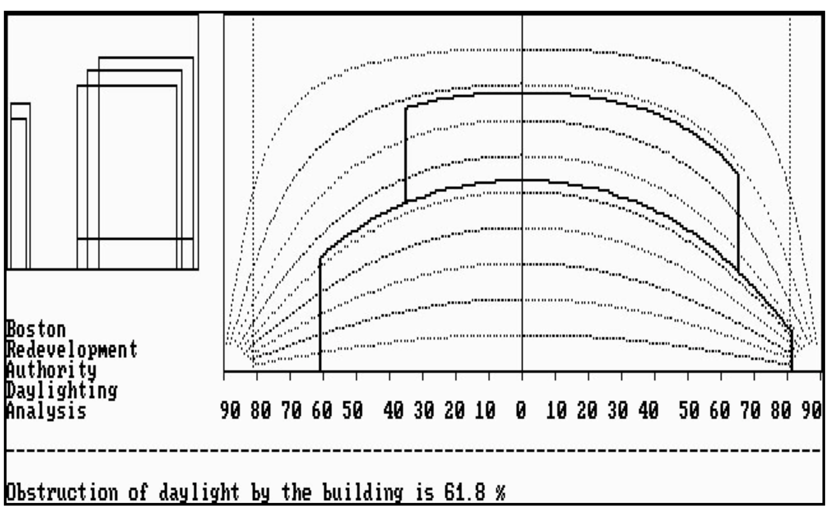
Figure 4.3-6



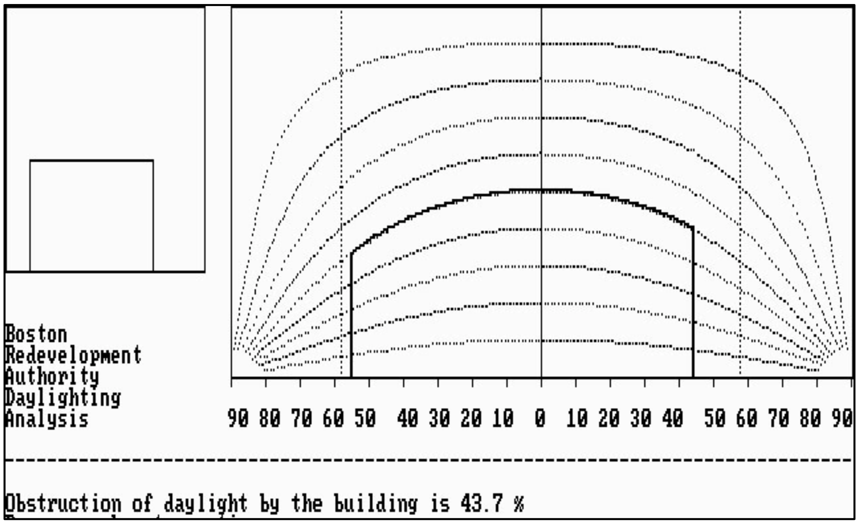
Viewpoint 6 –
Existing Conditions: Private Way looking Northeast at the Brigham and Women's Building



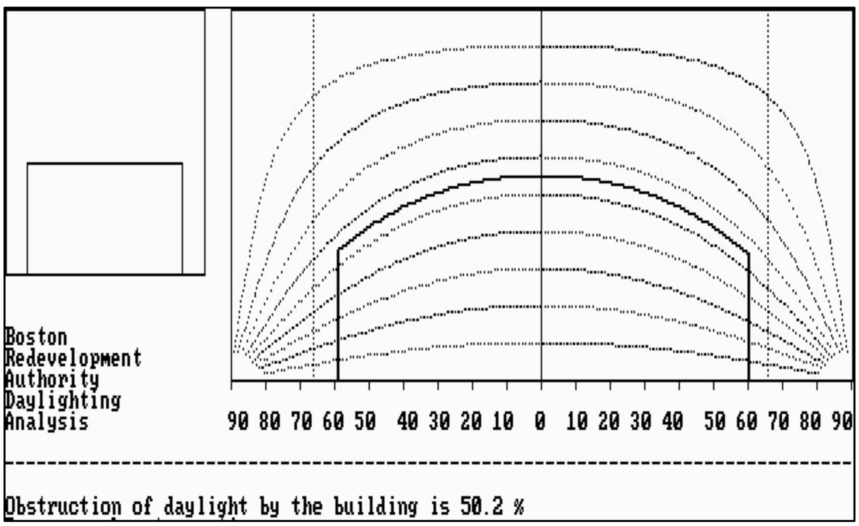
Viewpoint 6 –
As-of-Right Conditions:
Private Way looking Northeast at the Brigham and Women's Building



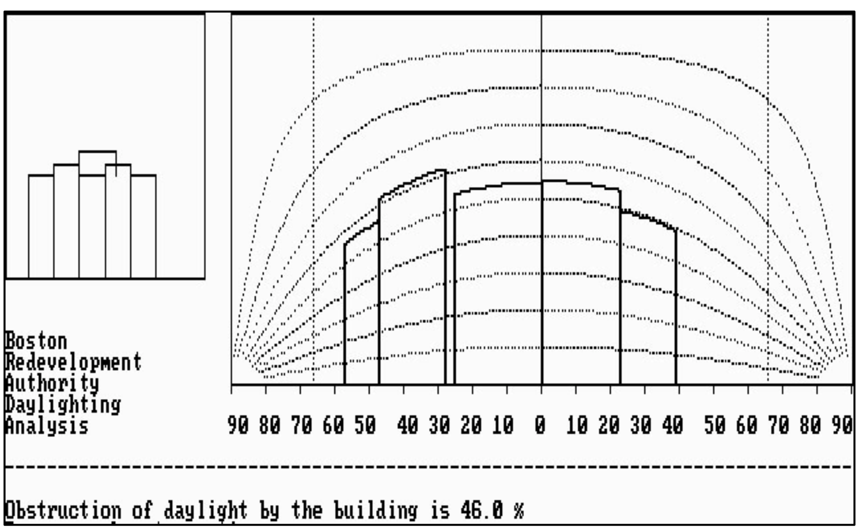
Viewpoint 6 –
Proposed Conditions:
Private Way looking Northeast at the Brigham and Women's Building



Viewpoint 7 –
Existing Conditions: Vining Street looking Southeast at the Partial Hospital / Fenwood Inn



Viewpoint 7 –
As-of-Right Conditions: Vining Street looking Southeast at the Partial Hospital / Fenwood Inn



Viewpoint 7 –
Proposed Conditions: Vining Street looking Southeast at the Partial Hospital / Fenwood Inn

Figure 4.3-8

4.4 Solar Glare

Brick and metal panels are proposed as surface materials for the Partial Hospital/Fenwood Inn. The Binney Street Building is anticipated to include metal panels at the cornice, masonry units at solid areas and curtain wall.

As the design progresses, exterior cladding materials (metal, glass, etc.) used in the building envelope will be evaluated for their reflectivity characteristics. However, since the Proponent does not anticipate that the proposed buildings will be constructed using mirrored finishes, glazes, or reflective glass, the Project is not expected to have any significant solar glare impacts on surrounding buildings, pedestrian areas, or roadways. Tinted and/or coated low-e glazing will be used to achieve energy savings. Building details and design elements will be presented to the BRA and the Boston Civic Design Commission as the design schedule progresses.

4.5 Air Quality

4.5.1 Introduction

An air quality analysis was conducted to determine the impact of pollutant emissions from combustion and mobile source emissions generated by the Project. A mesoscale analysis is performed to determine whether and to what extent the Project will increase the amount of ozone precursors in the area, as well as to determine if the Project is consistent with the Massachusetts State Implementation Plan (SIP). A microscale analysis is typically performed to evaluate the potential air quality impacts of carbon monoxide (CO) due to traffic flow around the Project area. In addition, for stationary sources (i.e. combustion stacks, and garage vents), United States Environmental Protection Agency (EPA) approved air dispersion models were used to estimate ambient concentrations of nitrogen oxides (NOx), particulate matter (PM-10 and PM-2.5), and sulfur dioxide (SO_2), in addition to CO.

The impacts were added to monitored background values and compared to the Federal National Ambient Air Quality Standards (NAAQS). The standards were developed by EPA to protect the human health against adverse health effects with a margin of safety.

The modeling methodology was developed in accordance with the latest Massachusetts Department of Environmental Protection (MassDEP) modeling policies and Federal modeling guidelines.[3] The air quality analysis results show that CO, NOx, PM-10, PM-2.5, and SO_2 concentrations at all receptors studied are well under NAAQS thresholds.

Modeling assumptions and backup data for results presented in this section are provided in Appendix E.

[3] 40 CFR 51 Appendix W, Guideline on Air Quality Models, 70 FR 68228, Nov. 9, 2005

4.5.2 Methodology

4.5.2.1 Mesoscale Analysis

A mesoscale analysis predicts the change in regional ozone precursor emissions due to the Project. The total vehicle pollutant burden was estimated for the existing conditions, and the no-build, build, and build with mitigation conditions for the future year 2021 based on the traffic analysis. The traffic conditions are described in more detail in Chapter 3.0.

The EPA's MOBILE6.2 computer program was used to estimate motor vehicle emission factors of VOC and NOx on the roadway network. Conservatively, emission factors derived from MOBILE6.2 for VOC and NOx are based on the worst case of either wintertime or summertime conditions. Using the vehicle count data, the mileage between intersections, modeled signalized intersection delay times, and the emission factors, per day and per year emission estimates were calculated. MOBILE6.2 outputs are provided in Appendix E.

The traffic volumes provided in Chapter 3.0 form the basis of the mesoscale study. Seventeen roadway links were included in the mesoscale analysis. Peak hour traffic volumes were provided by the transportation consultant. Estimates of average daily traffic (ADT) were made from the peak hour volumes assuming a 10% K-Factor. An average speed of 30 mph was used for all links. Distances for the links were estimated with mapping software.

Average per vehicle idle times were based on SYNCHRO output reports provided by the transportation consultant. Idling vehicle emissions, at signalized intersections only, were calculated. Peak delay times at signalized intersections with LOS of "F" were capped at 80 seconds and assumed to persist all day. The cap of 80 seconds was implemented to remove any bias from extremely poor LOS intersections.

4.5.2.2 Microscale Analysis

The microscale analysis typically examines ground-level CO impacts due to traffic queues in the immediate vicinity of a project. CO is used in microscale studies to indicate roadway pollutant levels since it is the most abundant pollutant emitted by motor vehicles and can result in so-called "hot spot" (high concentration) locations around congested intersections. NAAQS have been established by the EPA for CO to protect the public health (known as primary standards). These standards do not allow ambient CO concentrations to exceed 35 parts per million (ppm) for a one-hour averaging period and 9 ppm for an eight-hour averaging period, more than once per year at any location. The widespread use of CO catalysts on late-model vehicles has reduced the occurrences of CO hotspots. Air quality modeling techniques (computer simulation programs) are typically used to predict CO levels for both existing and future conditions to evaluate compliance of the roadways with the standards. The analyses followed the procedure outlined in U.S. EPA's intersection modeling guidance.[4]

The microscale analysis has been conducted using the latest versions of EPA MOBILE6.2, CAL3QHC, and AERMOD to estimate CO concentrations at sidewalk receptor locations.

Future year (2021) emissions data calculated from the MOBILE6.2 model, along with traffic data, were input into the CAL3QHC program to determine CO concentrations due to traffic flowing through the selected intersections. AERMOD was used to estimate potential ground- level impacts due to emissions from the parking garage and combustion sources.

CAL3QHC and AERMOD results were then added to background CO values of 3.0 ppm (1-hour) and 1.7 ppm (8-hour), as provided by the U.S. EPA, to determine total air quality impacts due to the Project. This value was compared to the NAAQS for CO of 35 ppm (1-hour) and 9 ppm (8-hour).

Intersection Selection

Intersection selection criteria for a microscale analysis is typically based on a Level of Service (LOS) D where the project increases traffic volumes by ten percent or greater, or if the signalized intersection operates at LOS E or F and the project degrades conditions at the location. An analysis of the seventeen intersections from the traffic study for the Build Condition was conducted (See Chapter 3.0, Transportation). Although there were six signalized intersections that met the microscale selection criteria, microscale modeling was limited to what were determined to be the four worst intersections:

1. Brookline Avenue at the Riverway
2. Francis Street at Huntington Avenue
3. Brookline Avenue at Francis Street
4. Longwood Avenue at Brookline Avenue

The traffic volumes and LOS calculations provided in Chapter 3.0 form the basis of evaluating the traffic data versus the microscale thresholds.

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4 U.S. EPA, Guideline for Modeling Carbon Monoxide from Roadway Intersections; EPA-454/R-92-005, November 1992.

Emissions Calculations (MOBILE6.2)

The EPA MOBILE6.2 computer program was used to estimate motor vehicle emission factors on the roadway network. Emission factors calculated by the MOBILE6.2 model are based on motor vehicle operations typical of daily periods. The Commonwealth's statewide annual Inspection and Maintenance (I&M) program was included, as well as the state specific vehicle age registration distribution. The input files for MOBILE6.2 for the existing (2009) and build year (2021) are provided by MassDEP[5]. As is typical, minor edits to the files were necessary to allow the program to output emission factors for the various speeds used in the analyses.

The current version of MOBILE6.2 does not explicitly calculate idle emissions. However, idle emissions can be obtained from a vehicle speed of 2.5 mph (the lowest speed MOBILE6 will model). The resulting emission rate given in (grams/mile) is then multiplied by 2.5 mph to estimate idle emissions (given in grams/hour). Moving emissions are calculated based on actual speeds at which free-flowing vehicles travel through the intersections. A speed of 30 mph is used for all free-flow traffic. Speeds of 10 and 15 mph were used for right (and U-turns) and left turns, respectively, as specified by the transportation consultant.

Winter CO emission factors are typically higher than summer for CO. Therefore winter vehicular emission factors were conservatively used in the microscale analyses.

Receptors & Meteorology Inputs

Sets of up to 60 receptors were placed in the vicinity of each of the modeled intersections. Receptors extended approximately 150 to 200 feet on the sidewalks along the roadways approaching the intersection. The roadway links and receptor locations of each modeled intersection are presented in Figure 4.5-1 through Figure 4.5-4.

For the CAL3QHC model, limited meteorological inputs are required. Following EPA guidance[6], a wind speed of 1 m/s, stability class D (4), and a mixing height of 1000 meters was used. To account for the intersection geometry, wind directions from 0° to 350°, every 10° were selected. A surface roughness length of 175 cm corresponding to "City Land Use - Office" was selected.[7]

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5 Latest input files for MOBILE6.2 were provided by Marc Bennett of MADEP, May 4, 2009.

6 U.S. EPA, Guideline for Modeling Carbon Monoxide from Roadway Intersections. EPA-454/R-92-005, November 1992.

7 U.S. EPA, *User's Guide for CAL3QHC Version 2: A Modeling Methodology for Predicting Pollutant Concentrations Near Roadway Intersections*. EPA –454/R-92-006 (Revised), September 1995

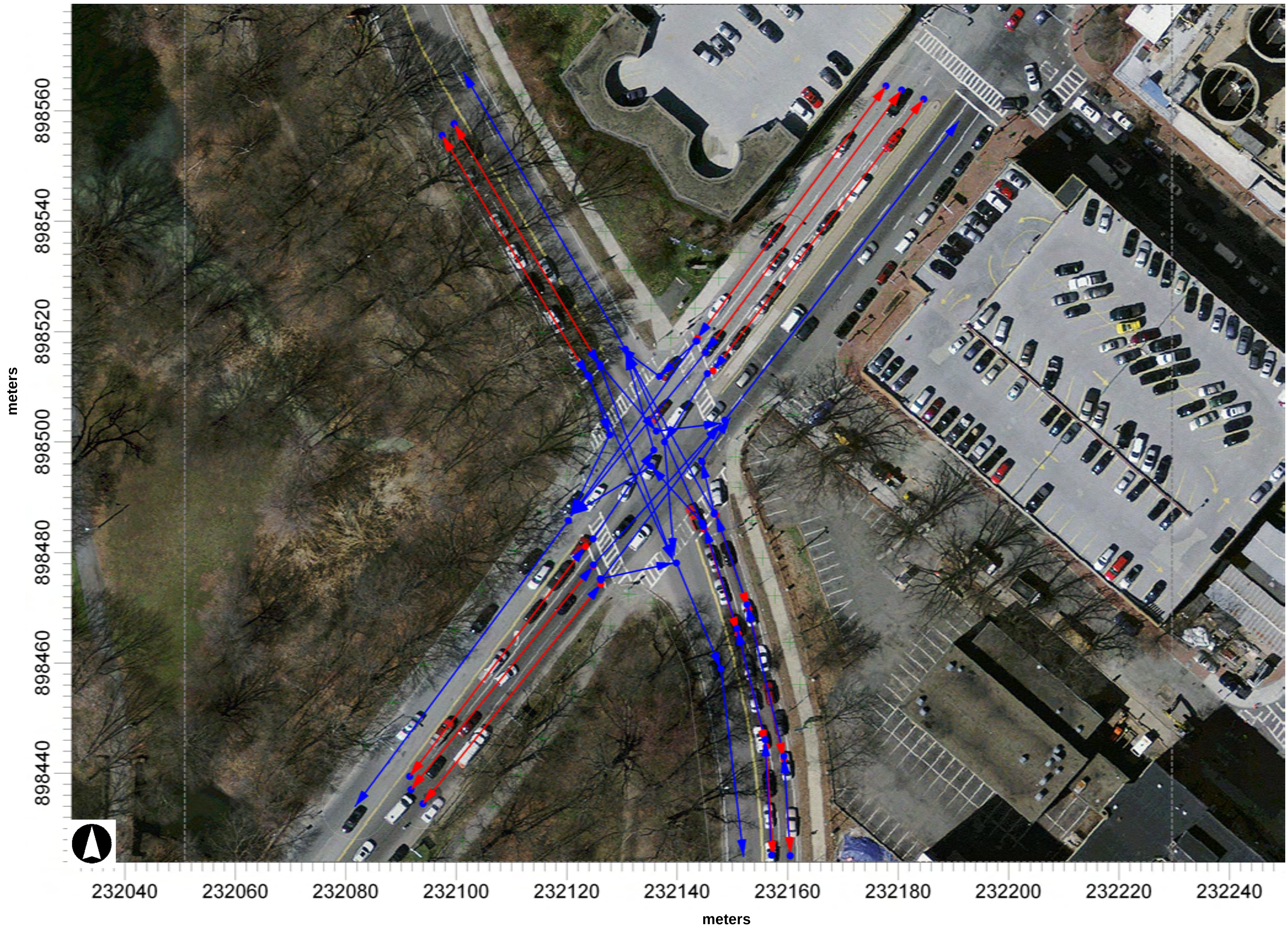

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Figure 4.5-1

Receptor Locations for CAL3QHC modeling of Intersection 1, Brookline Avenue at the Riverway

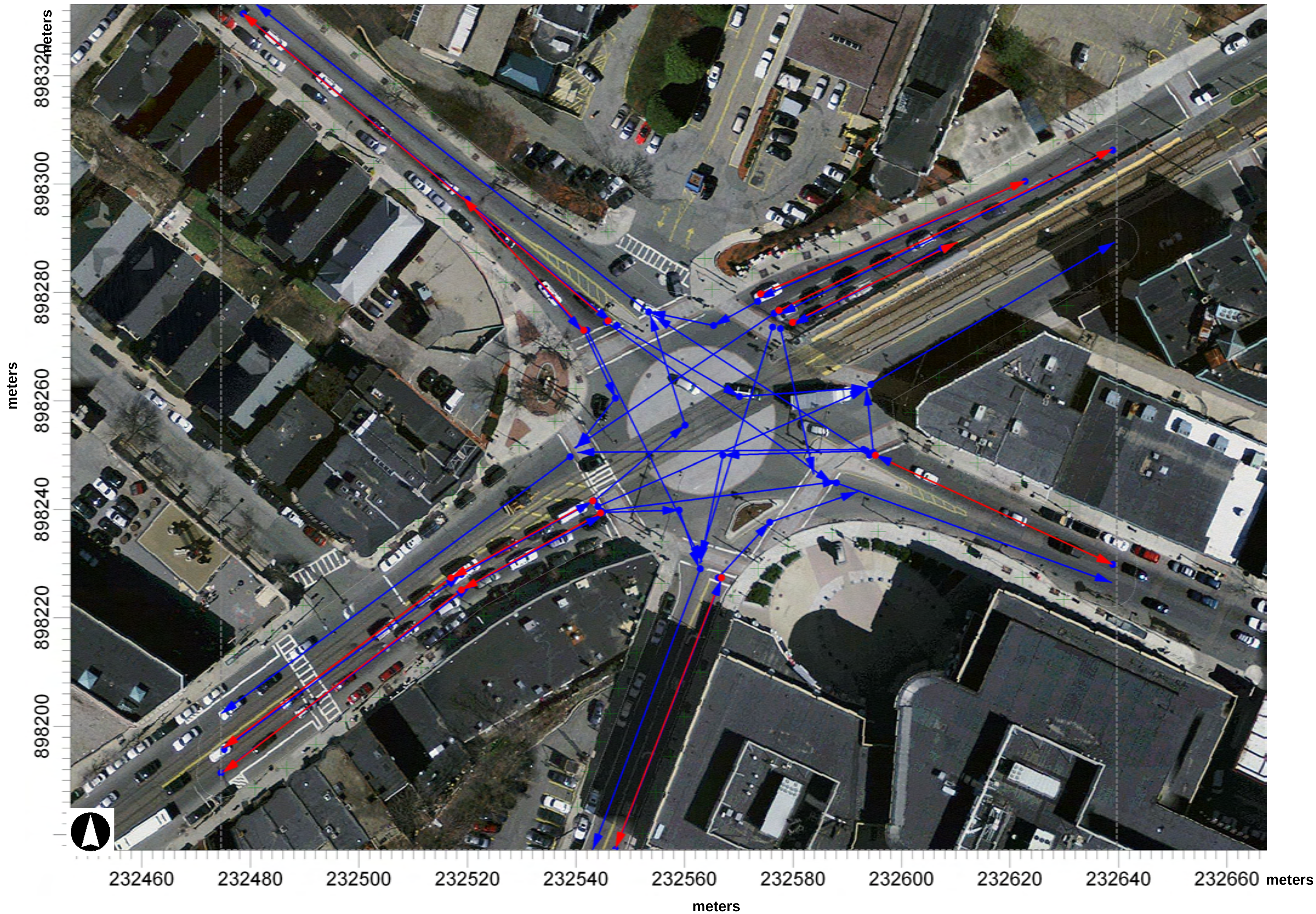

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Figure 4.5-2

Receptor Locations for CAL3QHC modeling of Intersection 2, Francis Street at Huntington Avenue

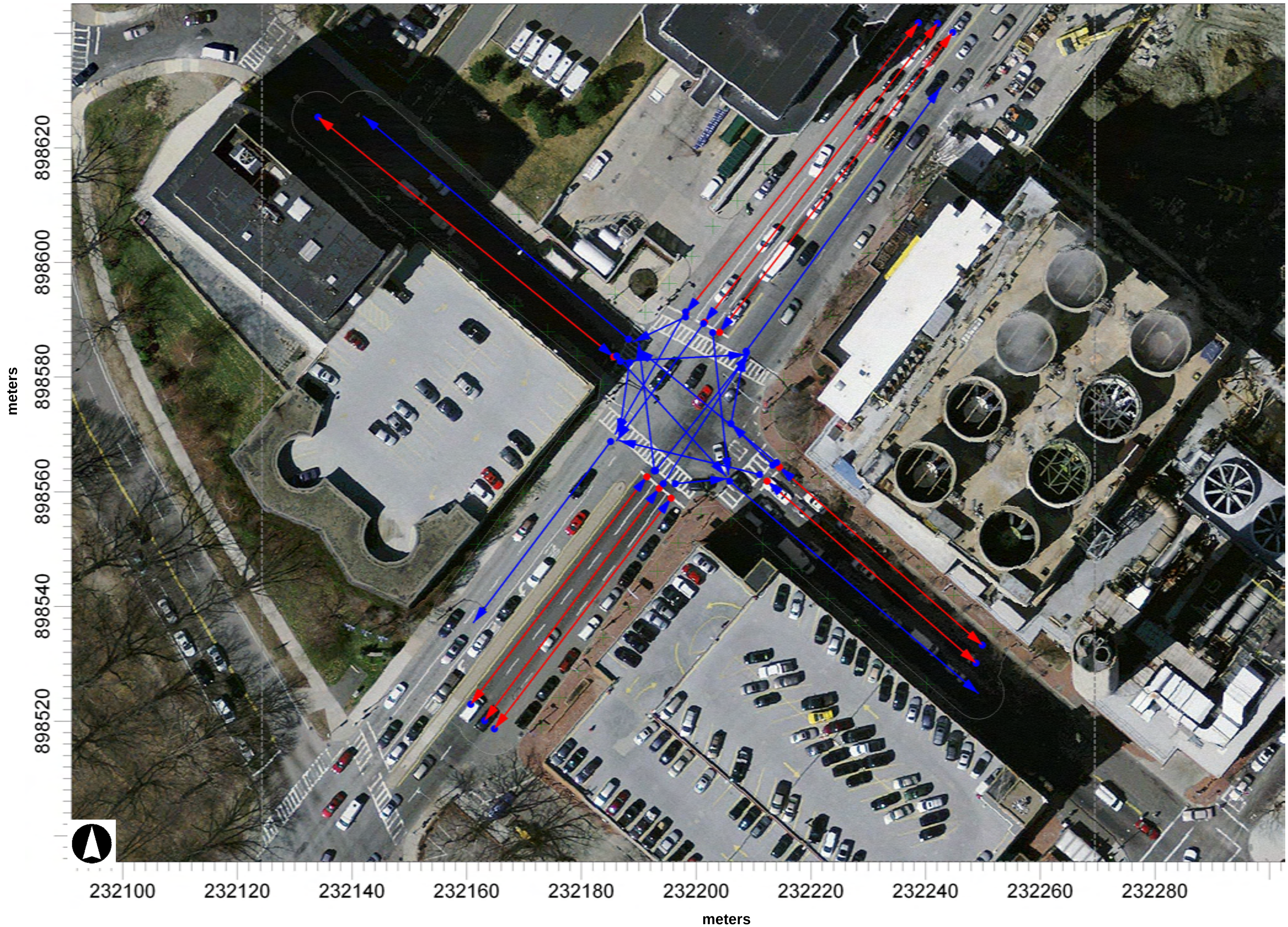

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Figure 4.5-3

Receptor Locations for CAL3QHC modeling of Intersection 3, Brookline Avenue at Francis Street

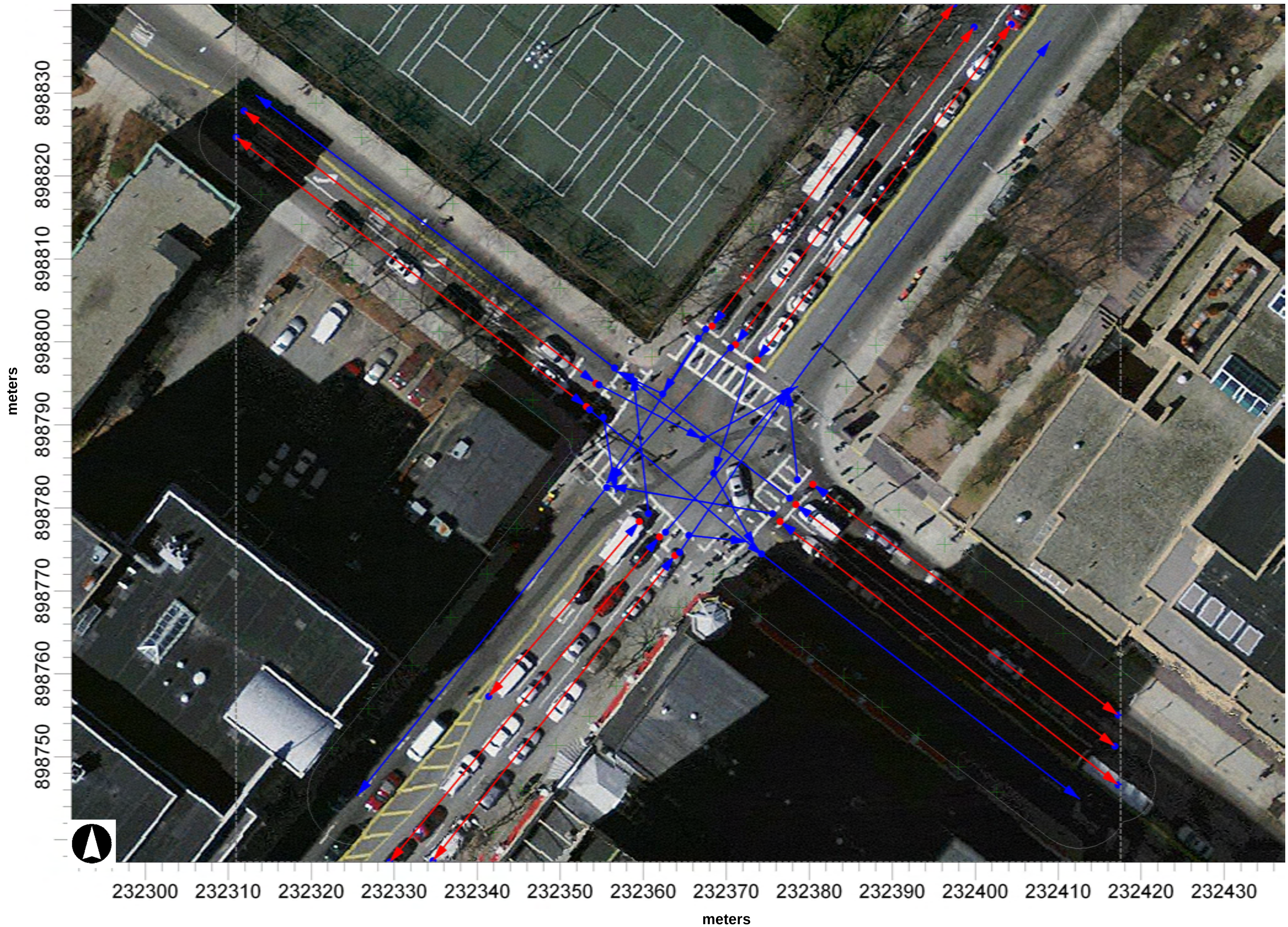

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Figure 4.5-4

Receptor Locations for CAL3QHC modeling of Intersection 4, Longwood Avenue at Brookline Avenue

Impact Calculations (CAL3QHC)

The CAL3QHC model predicts one-hour concentrations using queue-links at intersections based on worst-case meteorological conditions and traffic input data. The one-hour concentrations were scaled by a factor of 0.7 to estimate 8-hour concentrations.[8] The CAL3QHC methodology was based on EPA CO modeling guidance. Signal timings were provided directly from the traffic modeling runs. Travel speeds were estimated based on field observations, traffic data, and queue links at the intersections. The CAL3QHC input parameters are listed in Appendix E.

4.5.2.3 Stationary Source Analysis

AERMOD Modeling Methodology

The most recent version of the U.S. EPA AERMOD refined dispersion model (Version 07026) was selected to predict concentrations from the stationary sources related to the project. AERMOD is the U.S. EPA's preferred model for regulatory applications. The use of AERMOD provides the benefits of using the most current algorithms available for steady state dispersion modeling.

The ISC-AERMOD View graphical user interface (GUI) Version 6.2, created by Lakes Environmental, was used to facilitate model setup and post-processing of data. The AERMOD model was selected for this analysis because it:

- is the required U.S. EPA model for all refined regulatory analyses for receptors within 50 km of a source;
- is a refined model for facilities with multiple sources, source types, and building-induced downwash;
- uses actual representative hourly meteorological data;
- incorporates direction-specific building parameters which can be used to predict impacts within the wake region of nearby structures;
- allows the modeling of multiple sources together to predict cumulative downwind impacts;
- provides for variable emission rates;

[8] U.S. EPA, Screening Procedures for Estimating the Air Quality Impact of Stationary Sources; EPA-454/R-92-019, October 1992

- provides options to select multiple averaging periods between one-hour and one year (scaling factors can be applied to adjust the one-hour impact to a peak impact less than one-hour); and,

- allows the use of large Cartesian and polar receptor grids, as well as discrete receptor locations.

Regulatory default options adopted for the model include:

- *Use stack-tip downwash (except for building downwash).* Stack-tip downwash is an adjustment of the actual stack release height for conditions when the gas exit velocity is less than 1.5 times the wind speed. For these conditions, the effective release height is reduced a bit, based on the diameter of the stack and the wind and gas exit velocity. This option applies to point sources only, such as emergency generators, cooling towers, boiler units and garage vents.

- *Use the missing data and calms processing routines.* The model treats missing meteorological data in the same way as the calms processing routine, i.e., it sets the concentration values to zero for that hour, and calculates the short term averages according to U.S. EPA's calms policy, as set forth in the Guideline. Since only 1-hour averages are being used, concentrations predicted with calm or missing data would not affect model results.

The AERMOD model is able to assign sources to a rural or urban category to allow specified urban sources to use the effects of increased surface heating under stable atmospheric conditions. The urban dispersion classification was selected based on a visual inspection of the area within a three kilometer radius of the Project Site. A population estimate of 600,000 was obtained from the U.S. Census website (www.census.gov) and is used in the AERMOD model to estimate the urban boundary layer height.

The regional meteorology in Boston is best approximated with meteorological data collected by the nearby Boston Logan International Airport in East Boston, MA. The station is located approximately five miles (8.0 km) to the east-northeast of the Project Site at an elevation of 15 feet (4.6 m) above mean sea level. This station is the closest site for which extensive meteorological data are available which are representative of similar topographic influences that affect the proposed Project Site. Five years (2001-2005) of hourly surface data collected at the station include wind speed and direction, temperature, cloud cover and ceiling height. Upper air data from Gray, Maine was processed along with the surface data. The processed meteorological files for use in AERMOD were provided by the MassDEP. These files have been used on other AERMOD applications in the area for review by MassDEP and are presumed to be of sufficient quality for regulatory applications.

A network of 1,877 receptors was used for the refined AERMOD modeling analysis. A nested grid of Cartesian receptors centered on the Project was used. The Project area bounded by an area 100 meters by 160 meters was laden with receptors spaced every 20 meters. From this area to 200 meters beyond, receptors were spaced every 20 meters; every 50 meters, from 100 meters to 1 kilometer; and every 200 meters from 1 kilometer to two kilometers.

Terrain data were obtained from the U.S.G.S National Map Seamless Server (www.seamless.usgs.gov) according to guidance set forth by EPA.[9] Source, building, and receptor elevations were processed using the AERMAP processor by way of the Lakes AERMOD View interface. Figure 4.5-5 presents the source and receptor locations, as well as the buildings used in the GEP stack height/downwash analysis described below.

Stationary Sources

Parking Garage Exhaust Vents

A four-level underground parking garage beneath the Brigham and Women's building totaling 406 spaces is part of the Project. Carbon monoxide monitors will be installed within the garages to insure that levels of CO do not exceed health standards and will be used to control abatement ventilation when necessary.

Emissions from the parking garage were calculated using MOBILE6.2 and an estimate of the total miles traveled within the garages during the AM and PM peak hours. Estimates of vehicle turnover by usage were provided by the transportation consultant. The total vehicle miles traveled (VMT) are calculated by multiplying the average distance a car would travel in the garage by the number of cars entering and leaving the garage.

To provide a conservative assumption for emissions from the garages, an emission rate from MOBILE6.2 of 10 miles per hour was assumed for the 2021 conditions. The higher of the summer or winter factors were used, depending on pollutant. Additionally, emission factors were weighted such that only factors for light duty gasoline and diesel vehicle classes (MOBILE6.2 designations LDGV, LDGT, LDDV, and MCY) were used for garage emissions.

Therefore, the emission rates from the garage vents can be calculated as follows:

Mobile 6.2 emission factor in grams/mile
x garage VMT/hour
x 1 hour/3600 seconds
= grams/second

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9 U.S. EPA, AERMOD Implementation Guide, March 19, 2009.

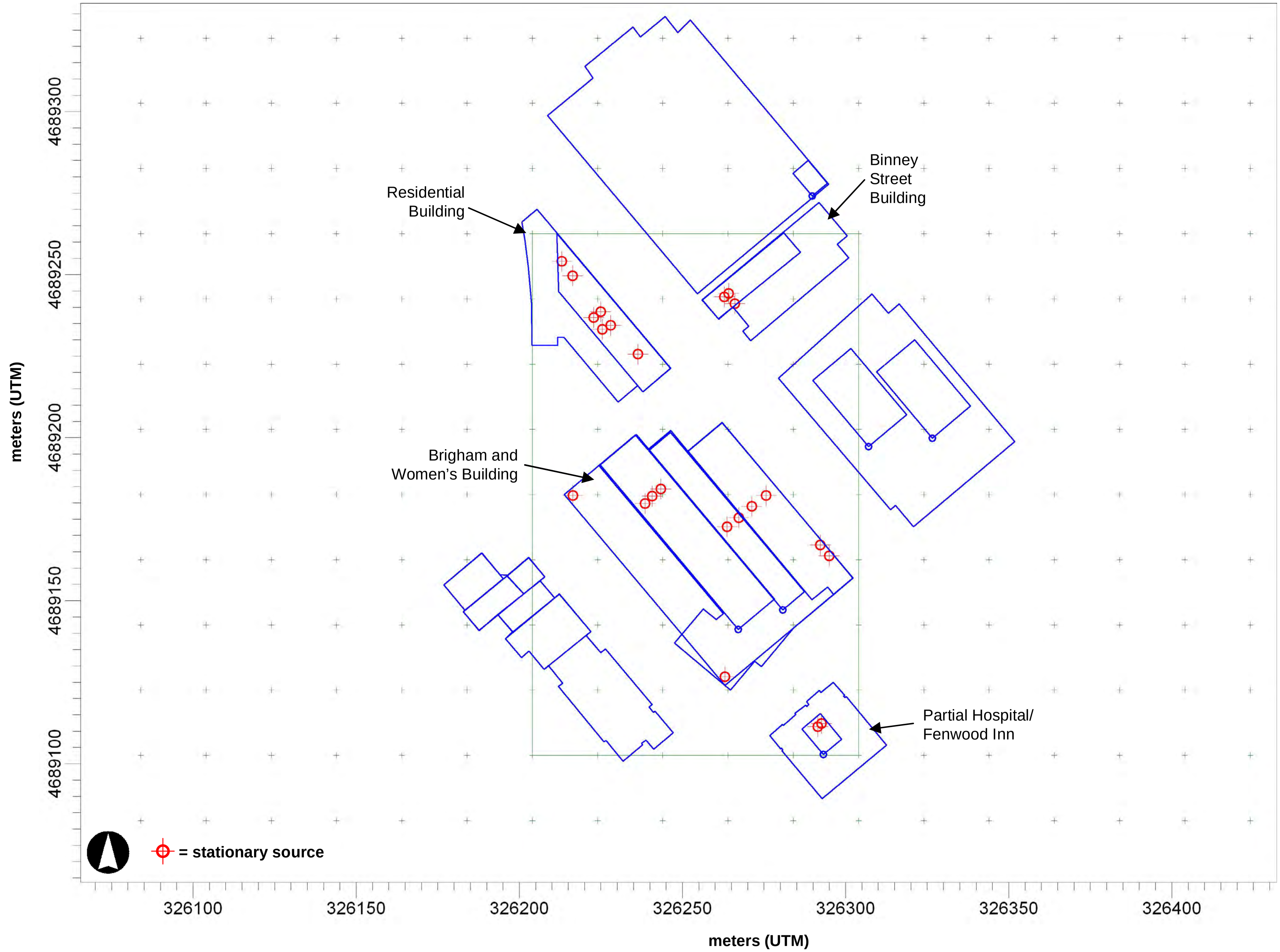

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Figure 4.5-5

Stationary Sources, Buildings and Local Receptors

High velocity air intake louvers and the main garage entry will supply make-up air for the garage's ventilation systems. A total ventilation air requirement of 280,000 cubic feet and two exhaust vents were used. The vents are expected to be louvered penthouse gravity ventilators which are assumed to be the largest available size of the model provided by the architect, approximately 60″ x 120″ rectangular (50 sf).

Although the garage exhaust vents would be controlled using CO monitors, the garage vents are assumed to emit at 100% for the AM and PM rush hours (6AM-8AM and 6PM-7PM), 50% for the daytime hours (9AM-5PM), and 25% overnight (8PM-5AM). Detailed calculations, assumptions, and exhaust parameters are presented in Appendix E.

Heating Equipment

Current design plans are for three small 500 boiler-horsepower (BoHP) condensing boiler units to be installed on the Brigham and Women's Building. These units will provide heat to the buildings. All units will be natural gas-fired and located in a mechanical area on the roof of the building.

The Residential Building is planned to have four small (0.6 mmBtu/hr heat input) boilers and two small (1.0 mmBtu/hr) boilers to provide heating to the building. All units will be natural gas-fired and exhaust to the roof of the building.

The Binney Street building is expected to have two small (1.5 mmBtu/hr) natural gas-fired boilers, while the Partial Hospital/Fenwood Inn Building is expected to have two small (0.757 mmBtu/hr) natural gas-fired boilers. All boilers will exhaust to the roof of the buildings.

The boilers will be either within or well below the requirements of the MassDEP's Environmental Results Program (ERP) since individual estimated heat inputs are within or below the 10 to 40 mmBtu/hour ERP range. However, emissions were conservatively estimated for each boiler based on the MassDEP Boiler ERP program emission limits. Dispersion modeled impacts from the heating units were estimated from exhaust stacks ten feet above the individual building roof heights above ground level, or as determined by the architect. For short term impacts, the heating equipment is assumed to be in operation 24 hours per day. For annual impacts, a 15% capacity factor is assumed. Detailed calculations and stack parameters are presented in Appendix E.

The Brigham and Women's Building boilers are expected to be between the the ERP limits of 10 and 40 mmBtu/hour. Therefore, registration with MassDEP would be required. Since the other boilers' rating capacities are below the 10 mmBtu/hr limit, no registration is expected to be required.

Emergency Generators

Current design plans are two emergency generators (500 and 2500 kilowatts) to be installed on the Brigham and Women's Building to be constructed. These units will provide life safety and standby emergency power to the buildings. All units will be diesel-fired and located either in a mechanical area on the roofs of the buildings, or in a mechanical room on a lower level. The generators are assumed to be designed such that their exhaust stacks extend 10 feet above the individual building roof heights above ground level.

The Residential Building is planned to have one 300 kilowatt natural gas emergency generator while the Binney Building is planned to have one 300 kilowatt diesel emergency generator.

Typically, the generators will operate for approximately one hour each month for testing and general maintenance. The ERP regulation applies to new emergency generators greater than 37 kW. The regulation is similar to the boiler ERP in that new engines are subject to emission standards, recordkeeping, certification, and compliance with the MassDEP noise policy. Since the generator maximum rating capacity is greater than the ERP limit of 37 kW, it will be subject to the new ERP program. Per the ERP, the generator owner will limit operation of the generator to less than 300 hours per year and submit a certification form to MassDEP within 60 days of installation.

Emissions were estimated for the emergency generators based on vendor supplied data. Comparable equipment was assumed where not provided by the architects. The generators are assumed to operate 300 of 8,760 hours per year in the modeling for annual averaging times. Detailed calculations and stack parameters are presented in Appendix E.

Cooling Towers

Current design plans are for four 700-ton cooling towers to be installed in connection with the construction of the Brigham and Women's Building. The Residential Building is planned to have two smaller 90-ton cooling towers. These units will remove the excess heat generated by the building's mechanical equipment. All units will be located on the roof of the building.

Only emissions of particulate matter are assumed to be produced by the cooling tower cells and are described below in Section 4.5.4.3. As noted, particulate matter levels are below the NAAQS. The cooling towers are assumed to operate at 100% capacity for 8,760 hours per year. Emissions of all other pollutants from the cooling towers are expected to be negligible.

Emissions and exhaust parameters were based on vendor supplied data and/or engineering judgment. Detailed calculations are presented in Appendix E.

GEP Stack Height Analysis

The Good Engineering Practice (GEP) stack height evaluation of the facility has been conducted in accordance with the EPA revised Guidelines for Determination of Good Engineering Practice Stack Height (EPA, 1985). A GEP stack is sufficiently high to avoid aerodynamic downwash effects from nearby buildings or structures. As defined by the EPA guidelines, the formula for computing GEP stack height is:

$$H_{GEP} = H_b + 1.5L$$

where H_{GEP} = GEP stack height,

H_b = Height of adjacent or nearby structures,

L = Lesser of height or maximum projected width of adjacent or nearby building (*i.e.*, the critical dimension), and nearby is within 5L of the stack from downwind (trailing edge) of the building.

The GEP formula was applied to each Project building. Facility grade is approximately at mean sea level. The EPA's Building Profile Input Program Prime Version (BPIP-Prime) was run to confirm the GEP height and to calculate building dimensions for use in AERMOD.

The point sources subject to building influences are the boiler stacks, garage vents, the cooling towers, and the emergency generator stacks.

The proposed boiler stacks, the cooling towers, garage vents, and emergency generator stacks are all below GEP height; therefore, building downwash effects were considered in the air quality modeling. The AERMOD model determines when and if to include downwash in its calculations. In addition, if downwash applies, the AERMOD downwash algorithm will be used to estimate concentrations in the building cavity areas.

4.5.3 Background Concentrations

To estimate background pollutant levels representative of the area, the most recent air quality monitor data reported on the U.S. EPA's AIRData website (http://www.epa.gov/air/data) was obtained for 2006 to 2008. MassDEP guidance specifies the use of the latest three years of available monitoring data from within 10 km of the Project Site.

The Clean Air Act allows for one exceedance per year of the CO and SO_2 short-term NAAQS per year. The highest second-high accounts for the one exceedance. Annual NAAQS are never to be exceeded. The 24-hour PM-10 standard is not to be exceeded more than once per year on average over three years. To attain the 24-hour PM-2.5

standard, the three-year average of the 98th percentile of 24-hour concentrations must not exceed 35 μg/m^3. For annual PM2.5 averages, the average of the highest yearly observations was used as the background concentration.

Background concentrations were determined from the closest available monitoring stations to the proposed development. The closest monitor, 1.1 miles away at Kenmore Square, samples only for all pollutants. A summary of the background air quality concentrations are presented in Table 4.5-1.

For use in the microscale analysis, background concentrations of CO in ppm were required. The corresponding maximum background concentrations in ppm were 2.3 ppm for 1-hour and 1.7 ppm for 8-hour CO.

Table 4.5-1 Observed Ambient Air Quality Concentrations and Selected Background Levels

Pollutant	Averaging Period	Station[6]	2006	2007	2008	Background	NAAQS
SO_2[1] (μg/m^3)	3-Hour	KMSQ	80.6	88.4	62.4	88.4	1,300
	24-Hour	KMSQ	52.0	52.0	46.8	52.0	365
	Annual	KMSQ	10.4	10.4	10.4	10.4	80
CO [2] (μg/m^3)	1-Hour	KMSQ	2622	1824	1938	2622	40,000
	8-Hour	KMSQ	1938	1482	1482	1938	10,000
NO_2 [3] (μg/m^3)	Annual	KMSQ	43.24	39.48	41.36	43.24	100
PM-10 (μg/m^3)	24-Hour	KMSQ	52	40	53	53	150
	Annual	KMSQ	22	22	23	23	50
PM-2.5 (μg/m^3)	24-Hour [4]	KMSQ	28.5	31.7	26.3	28.83	35
	Annual [5]	KMSQ	10.8	11.43	11.31	11.18	15

Notes: [1] SO_2 reported in PPM. Converted to μg/m^3 using factor of 1 ppm = 2600 μg/m^3.
[2] CO reported in PPM. Converted to μg/m^3 using factor of 1 ppm = 1140 μg/m^3.
[3] NO_2 reported in PPM. Converted to μg/m^3 using factor of 1 ppm = 1880 μg/m^3.
[4] Background level for 24-hour PM-2.5 is the average concentration of the 98th percentile for three years.
[5] Background level for annual PM-2.5 is the average for three years.
[6] KMSQ = Kenmore Square, Boston

4.5.4 Air Quality Results

4.5.4.1 Mesoscale Analysis

Results of the mesoscale analysis are presented in Table 4.5-2. The 2016 interim year Build Condition results in less than a 1% increase in NOx and VOC emissions compared to the 2016 No-Build condition. The 2021 full Build Condition results in just over a 3.5%

increase in VOC and just over a 3% increase in NOx compared to the 2021 No-Build condition. All increases are far less than 1 ton per year of pollutant, and on the order of 0.1-0.2 tpy, within the accuracy of the calculations and assumptions used in the analysis.

The 2021 Build condition when compared to the Existing conditions shows a reduction of about 78% of NOx and 54% of VOC emissions. This is primarily due to improved vehicle technology, which translates to improved future vehicular emission rates.

Mitigation Measures and Conclusions

The Proponent has identified and reviewed reasonable and feasible reduction and mitigation measures to address traffic congestion and the resulting slight increase in emissions associated with the 2021 Build scenario over the No-Build. Chapter 3.0 provides a description of the Transportation Demand Management (TDM) program that will be implemented to reduce Project-related vehicle trips. The Proponent is committed to implementing infrastructure and management improvements to minimize impact on the transportation system. These measures include alternative means of travel, rideshare programs and telecommuting and are already included in the 2021 Build scenario.

In addition, any future mitigation not yet determined or discussed in Chapter 3 may be implemented resulting in further reductions in emissions. It is anticipated that further mitigation measures will be implemented on as as-needed basis to alleviate traffic congestion in the area and further reduce emissions.

Further reductions in delay can be achieved by optimizing signal phasing and/or lane configurations as needed in the future. Reductions in delay correlate to reductions in vehicle idle time. Since VOC emissions are highest at low engine RPM, further reductions in idle time would result in further reductions of VOC emissions. Slight decreases in NOx emissions would also be realized.

The reduction in delay times would also result in a general increase in traffic speed along roadway links. In general, emission rates of NOx decrease from idle to 30 miles per hour. Therefore any increase in speeds to approach the speed limit would result in decreases of NOx emissions. Since future changes in traffic speeds are speculative, exact reductions in emissions are not quantified.

Calculation details for the mesoscale analysis are presented in Appendix E.

Table 4.5-2 Mesoscale Analysis Summary

Pollutant	VOC (lbs/day)	VOC (tons/yr)	NOx (lbs/day)	NOx (tons/yr)
2009 Existing	79.6	10.3	155.4	20.2
2016 No-Build	41.4	5.4	53.5	6.9
2016 Build	41.6	5.4	53.6	7.0
Difference	0.2	0.0	0.2	0.0
Difference (%)	0.38%	0.38%	0.28%	0.28%
2021 No-Build	35.0	4.6	32.9	4.3
2021 Build	36.3	4.7	34.0	4.4
Difference	1.3	0.2	1.0	0.1
Difference (%)	3.62%	3.62%	3.17%	3.17%

4.5.4.2 Microscale Analysis

The results of the maximum one-hour predicted CO concentrations from CAL3QHC at each intersection are provided in Tables 4.5-3, 4.5-4, and 4.5-5 for the Existing, midterm No-Build, and Build scenarios. Eight-hour average concentrations are calculated by multiplying the maximum one-hour concentrations by a factor of 0.7.[10]

The results of the one-hour and eight-hour maximum modeled CO ground-level concentrations from CAL3QHC were added to EPA supplied background levels for comparison to the NAAQS. These values represent the highest potential concentrations at each intersection as they are predicted during the simultaneous occurrence of "defined" worst case meteorology. The highest one-hour traffic-related concentrations predicted in the area of the Project for the modeled conditions (2.4 ppm) plus background (2.3 ppm) is 4.7 ppm for the future Build case (at Francis and Huntington). The highest eight-hour traffic-related concentration predicted in the area of the Project for the modeled conditions (1.7 ppm) plus background (1.7 ppm) is 3.4 ppm for the future Build case. Both concentrations are well below the one-hour NAAQS of 35 ppm and the eight-hour NAAQS of 9 ppm.

When adding the high-second highest AERMOD-predicted one-hour CO concentrations from the stationary sources for the future build case (200.2 $\mu g/m^3$, 0.2 ppm), the one-hour modeled concentration (2.4 ppm) plus background (2.3 ppm) is 2.9 ppm. The total future build concentration includes the highest second-high predicted concentrations from AERMOD for the parking exhaust vents, the heating boilers, and the emergency generators. This combined value is also well below the one-hour NAAQS standard of 35 ppm.

10 U.S. EPA, Screening Procedures for Estimating the Air Quality Impact of Stationary Sources; EPA-454/R-92-019, October 1992

Similarly, when adding the high-second highest AERMOD-predicted eight-hour CO concentrations from the stationary sources for the future build case (113.8 $\mu g/m^3$, 0.1 ppm), the eight-hour modeled concentration (1.7 ppm) plus background (1.7 ppm) is 3.5 ppm. These values are also below the eight-hour NAAQS standard of 9.0 ppm.

This is a highly conservative estimate, since the added values are irrespective of time and space (i.e., the modeled and background concentrations occur at different times and at different locations).

It would be expected that any mitigation measures implemented to improve traffic flow at any of the modeled intersections would result in improved air quality impacts. Since there are no modeled exceedances of the NAAQS for the Build conditions, it is inferred that there would be no exceedances of the NAAQS for the Build with Mitigation conditions.

4.5.4.3 Stationary Source Analysis

In addition to the microscale analysis, a cumulative impact analysis was also conducted for comparison to the NAAQS for SO_2, NOx, PM-10, and PM-2.5. This analysis addresses emissions from the Project's heating boilers, emergency generators, cooling towers, and the garage vents.

Worst case maximum predicted impacts from these sources were added to monitored background values obtained from the EPA AIRData website for 2006 to 2008 and compared to the NAAQS.

Table 4.5-6 presents the cumulative modeling results for the stationary sources plus monitored background values. The total impacts when combined with background are below the NAAQS for all pollutants and averaging periods.

4.5.5 Conclusions

Using conservative estimates, the CO concentrations at the nearest receptors for impacts from the intersection, the heating boilers, and emergency generator units, plus monitored background values, are well under the CO NAAQS thresholds. In addition, maximum cumulative impacts from the heating boilers, garage vents, cooling towers, and emergency generators plus monitored background values are also below the NAAQS thresholds for SO_2, NOx, PM-10, and PM-2.5.

Table 4.5-3 Summary of Microscale Modeling Analysis (Existing 2009)

Intersection	Peak	CAL3QHC Modeled CO Impacts (ppm)	Monitored Background Concentration (ppm)	Total CO Impacts (ppm)	NAAQS (ppm)
1-Hour					
Brookline at Riverway	AM	3.4	2.3	5.7	35
	PM	3.2	2.3	5.5	35
Brookline at Longwood	AM	2.3	2.3	4.6	35
	PM	2.4	2.3	4.7	35
Brookline at Francis	AM	2.2	2.3	4.5	35
	PM	1.9	2.3	4.2	35
Francis at Huntington	AM	4.1	2.3	6.4	35
	PM	2.8	2.3	5.1	35
8-Hour					
Brookline at Riverway	AM	2.4	1.7	4.1	9
	PM	2.2	1.7	3.9	9
Brookline at Longwood	AM	1.6	1.7	3.3	9
	PM	1.7	1.7	3.4	9
Brookline at Francis	AM	1.5	1.7	3.2	9
	PM	1.3	1.7	3.0	9
Francis at Huntington	AM	2.9	1.7	4.6	9
	PM	2.0	1.7	3.7	9

Notes:
CAL3QHC 8-hour impacts were conservatively obtained by multiplying 1-hour impacts by a screening factor of 0.7.

Table 4.5-4 Summary of Microscale Modeling Analysis (Phase I Build 2016)

Intersection	Peak	CAL3QHC Modeled CO Impacts (ppm)	Monitored Background Concentration (ppm)	Total CO Impacts (ppm)	NAAQS (ppm)
1-Hour					
Brookline at Riverway	AM	2.0	2.3	4.3	35
	PM	1.7	2.3	4.0	35
Brookline at Longwood	AM	1.4	2.3	3.7	35
	PM	1.9	2.3	4.2	35
Brookline at Francis	AM	1.2	2.3	3.5	35
	PM	1.3	2.3	3.6	35
Francis at Huntington	AM	2.3	2.3	4.6	35
	PM	1.5	2.3	3.8	35
8-Hour					
Brookline at Riverway	AM	1.4	1.7	3.1	9
	PM	1.2	1.7	2.9	9
Brookline at Longwood	AM	1.0	1.7	2.7	9
	PM	1.3	1.7	3.0	9
Brookline at Francis	AM	0.8	1.7	2.5	9
	PM	0.9	1.7	2.6	9
Francis at Huntington	AM	1.6	1.7	3.3	9
	PM	1.1	1.7	2.8	9

Notes:

CAL3QHC 8-hour impacts were conservatively obtained by multiplying 1-hour impacts by a screening factor of 0.7.

Table 4.5-5 Summary of Microscale Modeling Analysis (Full Build 2021)

Intersection	Peak	CAL3QHC Modeled CO Impacts (ppm)	Monitored Background Concentration (ppm)	Total CO Impacts (ppm)	NAAQS (ppm)
1-Hour					
Brookline at Riverway	AM	2.2	2.3	4.5	35
	PM	1.8	2.3	4.1	35
Brookline at Longwood	AM	1.6	2.3	3.9	35
	PM	1.4	2.3	3.7	35
Brookline at Francis	AM	1.4	2.3	3.7	35
	PM	1.2	2.3	3.5	35
Francis at Huntington	AM	2.4	2.3	4.7	35
	PM	2.4	2.3	4.7	35
8-Hour					
Brookline at Riverway	AM	1.5	1.7	3.2	9
	PM	1.3	1.7	3.0	9
Brookline at Longwood	AM	1.1	1.7	2.8	9
	PM	1.0	1.7	2.7	9
Brookline at Francis	AM	1.0	1.7	2.7	9
	PM	0.8	1.7	2.5	9
Francis at Huntington	AM	1.7	1.7	3.4	9
	PM	1.7	1.7	3.4	9

Notes:

CAL3QHC 8-hour impacts were conservatively obtained by multiplying 1-hour impacts by a screening factor of 0.7.

Table 4.5-6 Summary of NAAQS Stationary Source Modeling Analysis

Pollutant	Period	Stationary Source Total Modeled Concentration (μg/m³)	Monitored Background Concentration (μg/m³)	Total Concentration (μg/m³)	NAAQS (μg/m³)
NOx	Annual High	3.45	43.2	46.7	100
SO_2	3-Hour H2H	21.48	88.4	109.9	1300
	24-Hour H2H	9.95	52.0	62.0	365
	Annual High	0.0	10.4	10.5	80
PM-10	24-Hour H2H	6.88	53	59.9	150
	Annual High	0.30	23	23.3	50
PM-2.5	24-Hour H8H	5.86	28.83	34.7	35
	Annual High	0.30	11.18	11.5	15
CO	1-Hour H2H	200.1	2622	2822.1	40000
	8-Hour H2H	113.6	1938	2052.6	10000
Hours of Operation Emergency Generator: 300 hrs per year, 24 hrs per day for short term.					
Hours of Boiler Operation Heating: 15% for annual, 24 hrs per day for short-term.					

4.6 Water Quality / Stormwater

Please see Section 7.3 for a detailed description of potential water quality and stormwater impacts.

4.7 Solid and Hazardous Waste

4.7.1 Hazardous Waste Site Conditions

4.7.1.1 Previous Environment Studies

Preliminary environmental studies undertaken on behalf of the Proponent indicated that total petroleum hydrocarbons (TPH), polynuclear aromatic hydrocarbons (PAHs), and lead were detected in Project Site soils at concentrations below currently applicable Massachusetts Contingency Plan (MCP) Reportable Concentrations. These constituents are typical of urban fill material that is ubiquitous throughout the Project area. Groundwater testing has not been conducted at the Project Site to-date; however, additional characterization of soil and groundwater may be required to further evaluate site environmental conditions and soil management requirements for each building. Management of soil and groundwater will be conducted in accordance with applicable local, state, and federal laws and regulations..

4.7.1.2 Proposed Future Environmental Studies

Additional analyses of soil and groundwater will be conducted in advance of construction and demolition activities. Results will be used to characterize site materials proposed for excavation and will inform plans for off-site disposal and management of construction dewatering effluent in accordance with applicable environmental regulatory requirements.

4.7.1.3 Proposed Soil and Groundwater Management Plans for Construction

Excavation will be conducted in accordance with a Soil Management Plan that will be included as part of the Construction Documents. The Soil Management Plan will describe procedures for management and off-site transport of any contaminated soils, if encountered.

Construction dewatering will be conducted in accordance with a Groundwater Management Plan that will be included as part of the construction documents. The Groundwater Management Plan will describe the procedures for maintenance of groundwater levels and for the treatment (if necessary) and discharge of effluent from dewatering activities.

4.7.2 Construction Period Hazardous Waste Generation, Disposal, and Recycling

The Project will involve demolition of existing buildings. Demolition debris will be recycled to the extent practicable and handled in accordance with Massachusetts Department of Environmental Protection (DEP) regulations for construction debris. Asbestos-containing materials or other hazardous materials will be managed in accordance with applicable local, state, and federal laws and regulations. Management of soil and groundwater during excavation and construction will be conducted in accordance with applicable local, state, and federal laws and regulations.

Please see Section 4.10.5 for additional discussion of construction and building demolition waste.

4.7.3 Operational Waste and Recycling

The proposed Brigham and Women's Building, Binney Street Building, and Partial Hospital/Fenwood Inn are expected to produce a total of approximately 510 tons of solid waste per year based on existing waste generation rates across the BWH campus. All waste will be segregated at the point of origin into separate streams. The proposed Residential Building is expected to produce approximately 200 tons of solid waste per year.

Building-specific solid waste, recycling and hazardous waste considerations are addressed below.

Partial Hospital/Fenwood Inn

Solid waste is expected to include wastepaper, styrofoam, cardboard, glass bottles, food and other similar items. Solid waste management and recycling will be consistent with applicable regulations and policies of the Commonwealth of Massachusetts for State buildings. Solid waste will be segregated at the point of origin into separate streams. Labeled site collection containers for solid waste will be located at designated collection points throughout the building. Trash collection, recycling, and loading will occur on-site. Trash will be collected daily and stored in a small enclosed dumpster facility at the back of the on-site loading areas until it is picked up by a licensed contractor.

Recycling materials will include but may not be limited to glass, cardboard, paper, metal, and newspaper, and these will be separated on-site and stored in an indoor recycling area until they are picked up by a state-authorized contractor.

Operation of the Partial Hospital/Fenwood Inn will result in generation of some biomedical wastes as well as hazardous materials typical of household and office use hazardous wastes such as cleaning fluids, paint, and fuel for emergency generators. The biomedical waste will be handled in accordance with applicable regulations. Sharps waste will be segregated from other wastes immediately at the point of use and placed in rigid, puncture-resistant, leak-proof and shatter-proof biohazard sharps containers. Sharps containers will be handled in accordance with applicable regulations. Hazardous materials associated with office uses and Fenwood Inn uses will be treated and disposed of in compliance with applicable regulations.

Binney Street Building

Solid waste generated by DMH or BWH in the Binney Street Building will be similar to the waste stream described above for the Partial Hospital/Fenwood Inn. The Binney Street Building will include labeled site collection containers located at designated collection points throughout the building. Trash will be collected daily and stored on-site until it is transferred to the BWH Servicenter Complex for processing. When BWH occupies the Binney Street Building in the Full Build Condition, the solid waste will be collected daily and transported by BWH's Environmental Services Department to the Servicenter Complex for processing and disposal.

Recycled materials will include cardboard, paper, metal, and newspaper, and will be separated at a designated location and stored indoors until they are picked up by a state-authorized contractor. BWH or DMH recycled materials will be transported to the Servicenter Complex for processing

Some hazardous waste associated with DMH's office space is anticipated. These are similar to "household hazardous wastes" such as cleaning fluids and paint. As a mental health facility, the clinical use will not involve extensive generation of biomedical waste. Only a very minimal level of biomedical waste is anticipated from activities such as from blood draws or injections. Waste associated with these activities which will be handled, stored and disposed in accordance with applicable regulations. Sharps waste will be handled as described above for the Partial Hospital/Fenwood Inn Building. Other than these materials, during occupancy of the building by DMH, the Project will not involve the generation, use, transportation, storage, release or disposal of potentially hazardous materials.

When BWH occupies the building, some biomedical waste and sharps waste associated with clinical uses and typical hazardous wastes of office use are anticipated. These wastes will be handled as described below for the Brigham and Women's Building.

Residential Building

All recycling, trash collection, and loading activities for the Residential Building will occur on-site. Loading areas will be provided on the ground floor. Trash will be collected at a dedicated ground-floor location.

The building's recycling program will provide residents with the use of on-site receptacles for mixed paper, newspaper, cardboard, magazines, milk cartons, plastics numbered 1 through 5 and 7, juice containers, glass, aluminum and other scrap metal, and additional materials as appropriate and consistent with City of Boston requirements. RTH will also seek to maximize waste prevention through maintenance and cleaning practices such as the purchase of eco-friendly products, the use of refillable containers, and the recycling of used mercury light fixtures. A private trash collector will pick up trash and recycling as needed.

With the exception of "household hazardous waste" typical of residential developments, the Project will not involve the generation, use, transportation, storage, release, or disposal of potentially hazardous materials.

Brigham and Women's Building

Solid Waste and Recycling

Solid waste generated by the Brigham and Women's Building is expected to include wastepaper, styrofoam, cardboard, and food. Labeled site collection containers for solid waste will be located at designated collection points throughout the Brigham and Women's Building, and waste will be collected daily and transported by BWH's Environmental Services Department.

BWH has long been a leader in healthcare recycling efforts. BWH's aggressive recycling program includes paper, cardboard, styrofoam, fluorescent bulbs, batteries, monitors and televisions, toner cartridges, cans, cafeteria cooking oils, and old furniture and medical equipment. BWH will extend its existing policy to the proposed Brigham and Women's Building and will recycle as much solid waste as is feasible from this Project.

The Brigham and Women's Building will include easily-accessible areas designated for recycling collection. Prior to final programmatic design, BWH will perform an evaluation to identify the most effective locations and space requirements for recycling areas. An area for storage and pick-up will be available prior to transport of recycled materials to the Servicenter Complex waste facility for processing.

The Brigham and Women's Building is expected to generate minimal cardboard since case quantity receiving and case breakdown will occur at BWH's central receiving. The minimal quantities generated within the building will be collected and transported with the solid waste to the Servicenter Complex waste facility, where it will be baled and stored for pickup by the recycling vendor.

Paper will be collected in secure confidential data bins and subsequently removed by a vendor who will shred the paper before recycling the pulp. Labeled paper recycling collection containers will be located throughout the building at collection points. On a nightly basis, these containers will be emptied into larger totes and then transported to the Servicenter Complex collection dumpster for pickup by the recycling vendor.

Most food will be prepared off-site and delivered, so there will be minimal food preparation waste from the Brigham and Women's Building. Metal containers will be rinsed by food service staff and placed into collection totes which, when full, will be transported to the Servicenter Complex waste processing facility for pickup by the recycling vendor.

Hazardous Waste Generation and Disposal

Regulated Medical Waste Generation and Disposal

Based on BWH's current generation rates, the Project is expected to generate approximately 40 tons of regulated medical waste per year. Regulated medical waste (excluding pathological/antineoplastic) will be segregated in leak-proof labeled waste carts staged in designated waste rooms. These carts will be transported to the Servicenter Complex waste processing area. Medical waste is rendered non-infectious in BWH's on-site autoclave, shredded, and disposed of as solid waste. BWH performs twice-weekly Biological Monitoring to ensure that hazardous infectious waste is decontaminated through autoclaving. Any pathological/antineoplastic-contaminated waste will be contained in cartons labeled "Regulated Medical Waste." These cartons will be lined, sealed, marked for incineration and staged in the Servicenter Complex pending removal by a licensed vendor for off-site incineration.

Sharp waste is segregated from other wastes immediately at the point of use and placed in rigid, puncture-resistant, leak-proof and shatter-proof biohazard sharps containers. Sharps containers are sealed and transported by the BWH Environmental Services Department staff to the Servicenter Complex waste treatment area to be rendered non-infectious by steam sterilization. Treated waste is shredded on-site prior to disposal as solid waste. During DMH occupation of the Binney Street Building, DMH will be responsible for disposal of any biomedical waste in accordance with applicable regulations.

All waste will be handled, transported, and disposed of in accordance with local, state, and federal regulations.

Chemical Waste

BWH has an active program to reduce and eliminate toxic materials (e.g., mercury, dioxins, lead, and cadmium) from products such as thermometers that are used within the facility. BWH had a leadership role in reconstituting a Longwood Medical and Academic Area working group to evaluate best practices to ensure hospital compliance with EPA/MWRA mercury guidelines. This program proved to be extremely successful and has aided many of the surrounding hospitals in their efforts to achieve compliance.

All chemical waste will be characterized for chemical composition, packaged, transported and disposed of in accordance with Federal and Commonwealth requirements, utilizing a Massachusetts Licensed Hazardous Waste Contractor.

Low-level Radioactive Waste

Low-level radioactive waste material could potentially be generated from biomedical laboratory research or clinical uses. Waste materials will be handled in accordance with Federal and State waste regulations, which will include personnel training, monitoring and disposal by trained radiation safety personnel. Any waste that requires off-site management will be serviced through a licensed contractor in accordance with applicable local, state and federal regulations.

Spill Control Measures

BWH has a detailed Spill Prevention Control and Countermeasure (SPCC) Plan that includes the following measures:

- detailed written procedures for handling and storage of chemicals on-site;
- 24-hour on-call staff;
- detailed responder training in control procedures;
- on-site storage of supplies and equipment to handle small to moderate spills; and
- an on-call contingency plan with a licensed contractor to respond to larger spills if they occurred.

4.8 Noise

4.8.1 Introduction

This section includes a noise analysis for the Project, including a noise-monitoring program to determine existing noise levels and an estimate of future noise levels when the Project is in operation. The scope of the analysis is consistent with BRA requirements for noise studies.

The analysis indicates that predicted noise levels from Project mechanical equipment with appropriate noise mitigation will be below the most stringent City of Boston Noise Zoning requirements for nighttime and daytime residential zones, and below existing measured baseline noise levels in the area.

4.8.2 Noise Terminology

There are several ways in which sound (noise) levels are measured and quantified. All of them use the logarithmic decibel (dB) scale. The following information defines the noise measurement terminology used in this analysis.

The decibel scale is logarithmic to accommodate the wide range of sound intensities found in the environment. A property of the decibel scale is that the sound pressure levels of two separate sounds are not directly additive. For example, if a sound of 50 dB is added to another sound of 50 dB, the total is only a three-decibel increase (to 53 dB), not a doubling to 100 dB. Thus, every three dB change in sound levels represents a doubling or halving of sound energy. Related to this is the fact that a change in sound levels of less than three dB is imperceptible to the human ear.

Another property of decibels is that if one source of noise is 10 dB (or more) louder than another source, then the total sound level is simply the sound level of the higher source. For example, a source of sound at 60 dB plus another source of sound at 47 dB is 60 dB.

The sound level meter used to measure noise is a standardized instrument. It contains "weighting networks" to adjust the frequency response of the instrument to approximate that of the human ear under various circumstances. One network is the A-weighting network (there are also B- and C-weighting networks). The A-weighted scale (dBA) most closely approximates how the human ear responds to sound at various frequencies. Sounds are frequently reported as detected with the A-weighting network of the sound level meter. A-weighted sound levels emphasize the middle frequency (*i.e.,* middle pitched – around 1,000 Hertz sounds), and de-emphasize lower and higher frequency sounds. A-weighted sound levels are reported in decibels designated as "dBA."

Because the sounds in our environment vary with time they cannot simply be described with a single number. Two methods are used for describing variable sounds. These are exceedance levels and the equivalent level, both of which are derived from a large number of moment-to-moment A-weighted sound level measurements. Exceedance levels are values from the cumulative amplitude distribution of all of the sound levels observed during a measurement period. Exceedance levels are designated L_n, where n can have a value of 0 to 100 percent.

For example:

- L_{90} is the sound level in dBA exceeded 90 percent of the time during the measurement period. The L_{90} is close to the lowest sound level observed. It is essentially the same as the residual sound level, which is the sound level observed when there are no obvious nearby intermittent noise sources.
- L_{50} is the median sound level: the sound level in dBA exceeded 50 percent of the time during the measurement period.
- L_{10} is the sound level in dBA exceeded only 10 percent of the time. It is close to the maximum level observed during the measurement period. The L_{10} is sometimes called the intrusive sound level because it is caused by occasional louder noises like those from passing motor vehicles.
- L_{eq}, the equivalent level, is the level of a hypothetical steady sound that would have the same energy (*i.e.,* the same time-averaged mean square sound pressure) as the actual fluctuating sound observed. The equivalent level is designated L_{eq} and is also A-weighted. The equivalent level represents the time average of the fluctuating sound pressure, but because sound is represented on a logarithmic scale and the averaging is done with linear mean square sound pressure values, the L_{eq} is mostly determined by occasional loud, intrusive noises. Day-night average sound level, abbreviated as DNL and symbolized as L_{dn}, is the 24-hour average sound level, in decibels, obtained after addition of 10 decibels to sound levels in the night from 10:00 PM to 7:00 AM. The hourly L_{eq} sound level metric is used to calculate the L_{dn}

By using various noise metrics it is possible to separate prevailing, steady sounds (the L_{90}) from occasional, louder sounds (L_{10}) in the noise environment or combined average levels (L_{eq}). This analysis of sounds expected from the Project treats all noises as though they will be steady and continuous and hence the L_{90} exceedance level was used. In the design of noise control treatments it is essential to know something about the frequency spectrum of the noise of interest. Noise control treatments do not function like the human ear, so simple A-weighted levels are not useful for noise-control design. The spectra of noises are usually stated in terms of octave band sound pressure levels, in dB, with the octave frequency bands being those established by standard. To facilitate the noise-control design process, the estimates of noise levels in this analysis are also presented in terms of octave band sound pressure levels.

Baseline noise levels were measured in the vicinity of the proposed buildings and were compared to predicted noise levels that were derived based on information provided by the manufacturers of representative mechanical equipment. The predicted noise levels were compared to the City of Boston Zoning District Noise Standards.

4.8.3 Noise Regulations and Criteria

The primary set of regulations relating to the potential increase in noise levels is the City of Boston Noise Standards (City of Boston Code – Ordinances: Section 16–26 Unreasonable Noise and City of Boston Air Pollution Control Commission Regulations for the Control of Noise in the City of Boston). Results of the baseline ambient noise level survey and the modeled noise levels were compared to the City of Boston Noise Standards. Separate regulations within the Standard provide criteria to control different types of noise. Regulation 2 is applicable to the effects of the completed proposed buildings and was considered in this noise study. Table 4.8-1 includes the Zoning District Standards.

The Massachusetts DEP regulates community noise by its Noise Policy: DAQC policy 90-001. The DEP policy limits source sound levels to a 10-dBA increase in the ambient measured noise level (L_{90}) at the Project property line and at the nearest residences. The policy further prohibits pure tone conditions – when any octave band center frequency sound pressure level exceeds the two adjacent center frequency sound pressure levels by three decibels or more.

Table 4.8-1 City of Boston Noise Standards, Maximum Allowable Sound Pressure Levels

Octave Band Center Frequency (Hz)	Residential Zoning District Daytime (dB)	Residential Zoning District All Other Times (dB)	Residential-Industrial Zoning District Daytime (dB)	Residential-Industrial Zoning District All Other Times (dB)	Business Zoning District Anytime (dB)	Industrial Zoning District Anytime (dB)
31.5	76	68	79	72	79	83
63	75	67	78	71	78	82
125	69	61	73	65	73	77
250	62	52	68	57	68	73
500	56	46	62	51	62	67
1000	50	40	56	45	56	61
2000	45	33	51	39	51	57
4000	40	28	47	34	47	53
8000	38	26	44	32	44	50
A-Weighted (dBA)	60	50	65	55	65	70

Notes: Noise standards are extracted from Regulation 2.5, City of Boston Air Pollution Control Commission, "Regulations for the Control of Noise in the City of Boston", adopted December 17, 1976.

- ♦ All standards apply at the property line of the receiving property.
- ♦ dB and dBA based on a reference pressure of 20 micropascals.
- ♦ Daytime refers to the period between 7:00 a.m. and 6:00 p.m. daily except Sunday.

4.8.4 Existing Conditions

4.8.4.1 Baseline Noise Environment

An ambient noise level survey was conducted to characterize the existing "baseline" acoustical environment in the vicinity of the Project. Existing noise sources in the vicinity of the Project include vehicular traffic (including trucks) on the local roadways, pedestrian traffic, and mechanical equipment located on the surrounding buildings.

4.8.4.2 Noise Measurement Locations

The selection of the sound monitoring receptor locations was based upon a review of the current land use in the area of the Project Site. Five noise-monitoring locations were selected in representative locations to obtain a sampling of the ambient baseline noise environment. This area encompasses the closest residences on Vining Street and Fenwood Road. The BRA has reviewed and approved baseline ambient noise monitoring locations. The measurement locations are depicted on Figure 4.8-1 and are described below.

- Location 1 is at the intersection of Brookline Avenue and Riverway
- Location 2 is on Vining Street in front of the Neville House
- Location 3 is at a parking lot of Vining Street, adjacent to the Mission Park development
- Location 4 is at the intersection of Vining Street and Fenwood Road
- Location 5 is on Binney Street in front of the Shapiro Cardiovascular Center

4.8.4.3 Noise Measurement Methodology

Sound level measurements were taken for 20 minutes per location during daytime (2:00 P.M. to 4:30 P.M.) on July 28, 2009, and nighttime hours (12:00 A.M. to 2:00 A.M.) on July 29, 2009. Since noise impacts are greatest at night when existing noise levels are lowest, the study was designed to measure community noise levels under conditions typical of a "quiet period" for the area. Daytime measurements were scheduled to exclude peak traffic conditions.

The sound levels were measured at publicly accessible locations at a height of five feet above the ground and at locations where there were no large reflective surfaces to affect the measured levels. The measurements were made under low wind conditions and with dry roadway surfaces. Wind speed measurements were made with a Davis Instruments TurboMeter electronic wind speed indicator, and temperature and humidity measurements were made using a psychrometer. Unofficial observations about meteorology or land use in the community were made solely to characterize the existing sound levels in the area and to estimate the noise sensitivity at properties near the proposed Project.

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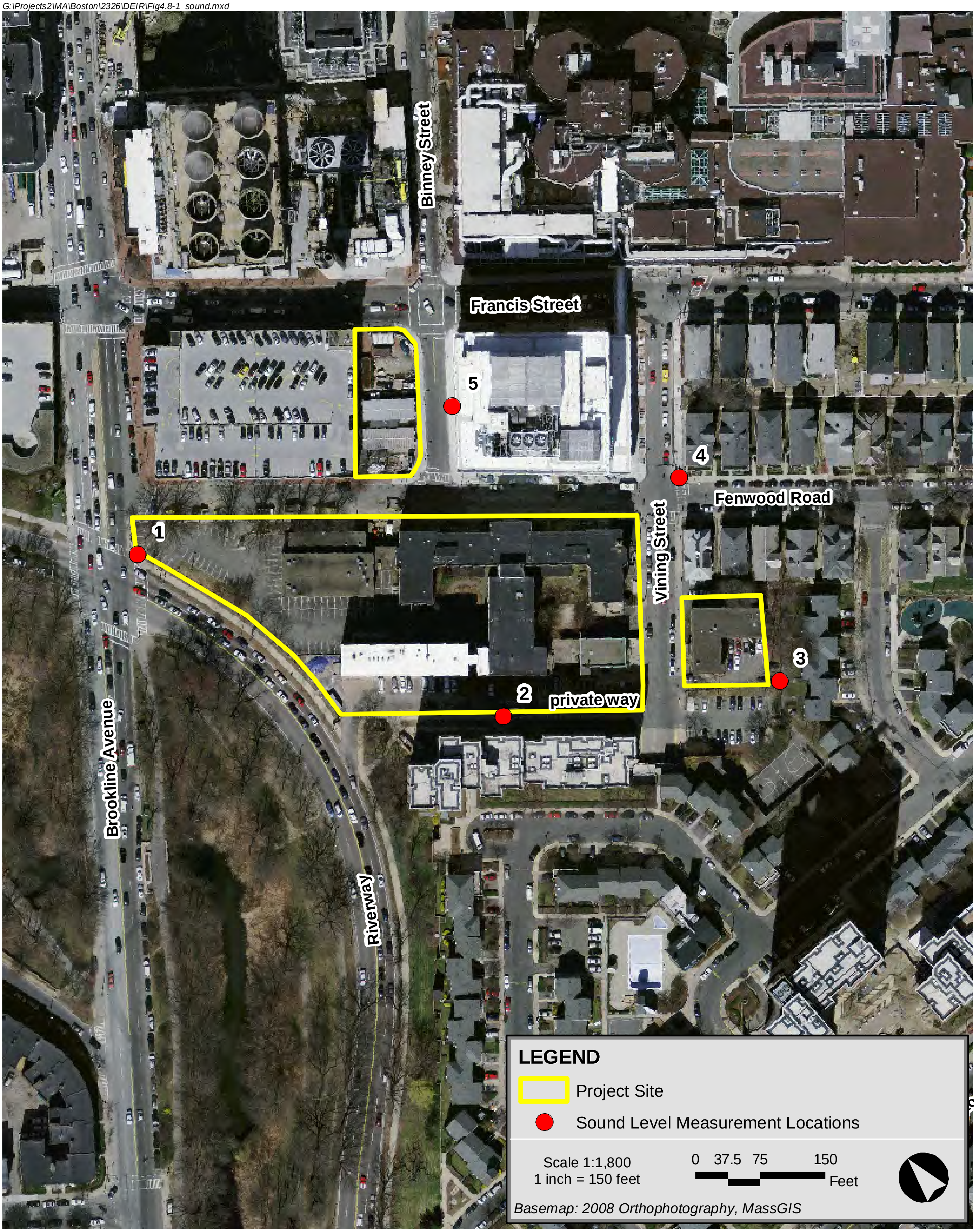

Massachusetts Mental Health Center Redevelopment Project **Boston, Massachusetts**

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Figure 4.8-1

Sound Level Measurement Locations

4.8.4.4 Measurement Equipment

A Norsonic Model Nor 140 sound level meter was used to collect ambient sound pressure level data. The instrumentation meets the "Type 1 - Precision" requirements set forth in American National Standards Institute (ANSI) S1.4 for acoustical measuring devices. The microphone was tripod-mounted at a height of five feet above ground and statistical descriptors (L_{eq}, L_{90}, etc.) were calculated for each 20-minute sampling period. Octave band levels for this study correspond to the same data set processed for the broadband levels. The measurement equipment was calibrated in the field before and after the surveys with an acoustical calibrator which meets the standards of IEC 942 Class 1L and ANSI S1.40-1984.

4.8.4.5 Baseline Ambient Noise Levels

The existing ambient noise environment is impacted primarily by vehicular traffic on nearby roadways, building exhaust systems, and pedestrian activity. Baseline noise monitoring results are presented in Table 4.8-2.

For this analysis, each of the measurement locations was considered to be residential under the City of Boston Noise Standards. Therefore, the maximum allowable daytime level is 60 dBA, and the maximum allowable nighttime level is 50 dBA. The L_{10} sound level is an appropriate metric for describing maximum sound levels within a community.

During the day, the measured L_{10} sound level exceeded the city's 60-dBA maximum allowable daytime level for a residential area at Locations 1 (69 dBA), 2 (61 dBA), 4 (70 dBA), and 5 (73 dBA). Location 3 (59 dBA) was below the limit. At night, the L_{10} sound levels measured at all of the locations (1 (68 dBA), 2 (57 dBA), 3 (56 dBA), 4 (59 dBA), and 5 (66 dBA)) exceeded the city's 50-dBA maximum allowable nighttime level for a residential area.

Table 4.8-2 Baseline Ambient Noise Measurements – Massachusetts Mental Health Center Redevelopment Site

							Octave Band Center Frequency (Hz)								
Location and Period	Start	L_{10}	L_{50}	L_{90}	L_{eq}	L_{max}	31.5	63	125	250	500	1000	2000	4000	8000
	Time	(dBA)	(dBA)	(dBA)	(dBA)	(dBA)	L_{90} (dB)	L_{90} (dB)	L_{90} (dB)	L_{90} (dB)	L_{90} (dB)	L_{90} (dB)	L_{90} (dB)	L_{90} (dB)	L_{90} (dB)
Loc 1 Day	2:15 PM	69	65	59	72	96	69	67	63	58	55	54	49	44	37
Loc 2 Day	2:41 PM	61	57	55	59	68	62	62	58	55	53	49	46	41	30
Loc 3 Day	3:09 PM	59	57	56	58	71	59	58	56	56	54	48	43	35	27
Loc 4 Day	3:33 PM	70	62	59	69	86	66	64	60	58	58	54	49	43	34
Loc 5 Day	3:58 PM	73	67	65	70	85	70	69	68	64	63	59	53	52	42
Loc 1 Night	11:38 AM	68	64	58	66	78	66	64	61	56	54	53	48	41	33
Loc 2 Night	12:00 AM	57	55	54	56	66	59	59	56	56	52	48	43	37	27
Loc 3 Night	12:22 AM	56	54	54	55	61	55	56	55	54	53	47	41	33	24
Loc 4 Night	12:44 AM	59	58	57	58	67	61	58	57	57	56	52	46	38	28
Loc 5 Night	1:06 AM	66	64	64	65	72	68	66	71	63	61	55	50	50	44

Notes:

1. Daytime weather: Temperature = 87 ^{0}F, skies sunny, winds light and variable
   Nighttime weather: Temperature = 78^{0} F, clear skies, winds calm.
2. Road Surfaces were dry during all periods.
3. All sampling periods were approximately 20 minutes duration.

4.8.5 *Overview of Potential Project Noise Sources*

The primary source of sound exterior to the new buildings will be cooling towers, ventilation fans located on the roofs and at ground level, and condensing units (chillers). The analysis considered the four proposed buildings. A summary of the major mechanical equipment proposed for the Project is presented below in Table 4.8-3. Noise emissions from the primary sources, as estimated from the equipment's capacity or from manufacturer-provided specifications, are also presented in Table 4.8-4, which includes broadband (dBA) sound power levels, as well as octave band sound levels when available.

The Brigham and Women's Building will have four cooling towers (Marley) and eight general exhaust fans on the roof (elevation approximately 205 feet above street level). Most of the mechanical equipment for the Brigham and Women's Building will be housed within a mechanical penthouse. There will also be two exhaust areas for the garage ventilation, located on the roof of Level 2 (elevation approximately 33 feet above street level). Although the garage intake and exhaust fans will not be constant sources of noise, they were included in the modeling. They will operate intermittently using variable air volume fans inside the garage, which will be triggered by carbon monoxide sensors. It was assumed that the exhaust for those fans would be ducted, terminating in a louvered rooftop penthouse.

The primary noise sources for the Partial Hospital/Fenwood Inn will be two air-cooled condensing units (chillers) located on the roof. Similarly, the primary sources of noise from the Binney Street Building will also be two air-cooled condensing units (ACCUs). Sound levels for other rooftop mechanical equipment at either the Partial Hospital/ Fenwood Inn or Binney Street Building are expected to be at least 10 decibels lower than the condenser units. Sound level data for the ACC units was taken from the manufacturer (York).

The Residential Building will have two (2) 90-Ton cooling towers, two (2) air-cooled chillers, and two (2) rooftop ventilation units. There will be smaller fans for stairwell pressurization and vestibule smoke exhaust, but those are expected to have much lower sound levels (10 dBA or more) than the other, larger pieces of equipment.

Table 4.8-3 Expected Primary Noise Sources

Noise Source	Quantity	Location	Size/Capacity
Cooling Tower – Marley	4	Roof of Brigham and Women's Building – 220' Elevation	700 Tons per unit
General Exhaust Fan	8	Roof of Brigham and Women's Building – 220' Elevation	55,000 CFM per unit
Garage Exhaust Fan (Tubular Centrifugal)	2	Roof of Brigham and Women's Building – 32' Elevation	67,144 CFM per unit
Garage Intake Fan (Tubular Centrifugal)	1	Adjacent to Brigham and Women's Building – Ground Level	138,450 CFM per unit
Air-Cooled Scroll Condensing Unit (Chiller)	2	Roof of Binney Street Building – 106' Elevation	77 Tons per unit

Table 4.8-3 Expected Primary Noise Sources (Continued)

Noise Source	Quantity	Location	Size/Capacity
Air-Cooled Scroll Condensing Unit (Chiller)	2	Roof of Fenwood Building – 40′ Elevation	51 Tons per unit
Cooling Towers	2	Roof of Residential Building – 182′ Elevation	90 Tons per unit
Air-Cooled Chiller	2	Roof of Residential Building – 182′ Elevation	90 Tons per unit
Rooftop Ventilation Units for Corridors	2	Roof of Residential Building – 167′ Elevation	250 MBTU per hour (per unit)

Table 4.8-4 Reference Equipment Noise Levels

Noise Source	Form of Data	Ref. Distance (feet)	Level (dBA)	Octave Band Center Frequency (Hz)							
				63	125	250	500	1k	2k	4k	8k
Cooling Tower – B&W – Marley NC8409U-1	Sound Pressure	5 Feet	81	-	-	-	-	-	-	-	-
General Exhaust Fan – B&W – Stobic TS4L6000C12	Sound Power	NA	103	98	101	101	100	98	95	94	82
Garage Exhaust Fan – B&W – Twin City 490TSL	Sound Power	NA	85	89	92	88	83	79	72	68	66
Garage Intake Fan – B&W – Twin City 730TSL	Sound Power	NA	85	88	91	87	82	78	71	67	65
Air-Cooled Scroll Condensing Unit (Chiller) – Binney Street - York	Sound Power	NA	95	99	94	93	94	87	86	82	81
Air-Cooled Scroll Condensing Unit (Chiller) – Fenwood Inn - York	Sound Power	NA	93	96	92	94	92	86	84	79	76
Cooling Towers - Residential - Marley	Sound Power	NA	76	93	90	84	79	77	72	67	71
Air-Cooled Chiller - Residential	Sound Power	NA	95	-	-	-	-	-	-	-	-
Rooftop Ventilation Units for Corridors - Residential	Sound Power	NA	95	-	-	-	-	-	-	-	-

NA = Not Applicable to sound power data.

Mitigation will be applied to multiple sources as needed, to ensure compliance with the noise regulations. Product-specific noise mitigation proposed for the Project is presented below in Table 4.8-5. In addition, it was assumed that the cooling towers on the Brigham and Women's Building would be partially-surrounded by a barrier, particularly in the direction of the Neville House and the Fenwood Road/Vining Street intersection. It was also assumed that the chillers on the roof of the Partial Hospital/Fenwood Inn would be completely surrounded by barriers, due to the close proximity of houses within the Mission Park complex.

Table 4.8-5 Attenuation Values Used for Sound Level Modeling (dB)

Source	Form of Mitigation	Octave Band Center Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Fume/General Exhaust for Brigham and Womens Building	Silencer Nozzles for General Exhaust (Brigham and Womens Building) [1]	5	8	9	11	12	12	10	6
Garage Exhaust for Brigham and Womens Building	Louvers [2]	6	6	8	10	14	18	16	15

1. Strobic Air TS-4 – Model R
2. IAC Slimshield Quiet-Vent Louvers – 6 in. Deep

Two diesel-powered emergency generators, one with a capacity of 500 kW and one 2,500 kW unit, are expected to be located on the roof of the Brigham and Women's Building. The Residential Building will have a 300-kW emergency generator, and the Binney Street Building will also have a 300-kW emergency generator. All generators will be controlled using critical-grade exhaust silencers and sound-attenuating enclosures. To further limit impacts, the required periodic routine testing of the generators will be during daytime hours when background sound levels are highest. Given that periodic routine generator testing will be during daytime hours (when background sound levels are highest), noise impacts are not expected to be an issue.

4.8.6 Modeling Methodology

Anticipated noise impacts associated with the Project were predicted at the nearest residences around the Project Site using the Cadna/A noise-calculation software. This software uses the ISO 9613-2 industrial noise calculation methodology. Cadna/A allows for octave band calculation of noise from multiple noise sources, as well as for computation of diffraction around building edges and multiple reflections off parallel buildings and solid ground areas. In this manner, all significant noise sources and geometric propagation effects are accounted for in the noise modeling.

4.8.7 *Future Sound Levels from Project*

Predicted mechanical equipment noise levels from the Project at each receptor location, taking into account attenuation due to distance, structures, and the modeled noise control measures, are all below the MA DEP criteria of 10 dBA over the quietest nighttime sound levels (the L_{90} level). The predicted exterior sound levels measures are expected to range from 47 dBA to 48 dBA at nearby receptors. The predicted sound levels from Project-related equipment are within the most stringent broadband nighttime residential zoning limits for the City of Boston (50 dBA or less) at closest residential receptors. Although this broadband limit is met, the modeling does indicate that for particular octave bands (2000 Hz and 4000 Hz) the Project sound levels are predicted to exceed the corresponding octave band limits. It should be noted that the existing ambient background levels already exceed the 50 dBA broadband limit and the corresponding octave band limits. At this time, the mechanical equipment and noise controls are conceptual in nature. During the design phase of the Project, mechanical equipment and noise controls will be specified and designed to meet not only the 50 dBA limit but also the corresponding octave band limits. The Project's mechanical equipment is not expected to create any additional pure tone conditions when combined with existing middle of the night background sound levels. At one location, there was already an existing pure tone at night. The results of the modeling, including mitigation, are shown in Table 4.8-6 (DEP criteria) and Table 4.8-7 (Boston criteria).

Table 4.8-6 Comparison of Future Predicted Nighttime Sound Levels with Existing Background – MA DEP Criteria

Location	Lowest Existing L_{90} – Nighttime (dBA)	Project-Generated Sound Levels (dBA)[1]	Future L_{90} – Nighttime Total (dBA)	Increase (dBA)
Location 1 – Riverway	58	47	58	0
Location 2 - Neville House on Vining (Residential)	54	47	55	1
Location 3 – Parking Lot on Vining – Adjacent Mission Park (Residential)	54	47	55	1
Location 4 – Vining and Fenwood (Residential)	57	47	57	0
Location 5 – Binney Street	64	48	64	0

1. Assumes equipment operates continuously.

Table4.8-7 Comparison of Future Predicted Nighttime Sound Levels Incorporating Appropriate Mitigation to City of Boston Criteria

Location	Project-Generated Sound Level (dBA)[1]	Boston Nighttime Limit (dBA)
Location 1 – Riverway (Business Zoning)	47	50
Location 2 - Neville House on Vining (Residential)	47	50
Location 3 – Parking Lot on Vining – Adjacent Mission Park (Residential)	47	50
Location 4 – Vining and Fenwood (Residential)	47	50
Location 5 – Binney Street (Business Zoning)	48	50

1. Assumes equipment operates continuously.

4.8.8 Interior Sound Levels

The HUD Environmental Criteria and Standards (24 CFR Part 51), Subpart B – "Noise Abatement and Control" specifies noise criteria for HUD-funded housing developments. The Residential Building may use HUD funds; therefore, the HUD noise criteria do apply. The HUD interior noise goal for residential construction is a day-night average sound level (L_{dn}) of 45 dBA or less. The Residential Building proposed as part of this Project will be constructed to meet this interior level.

4.8.9 Conclusions

This Project will not introduce significant outdoor mechanical equipment noise into the surrounding community. The above results indicate that noise levels due to the Project at the various receptor locations are below the 50 dBA City of Boston Noise Zoning requirement for a nighttime residential zone, and also comply with MA DEP noise level increase requirements.

4.9 Geotechnical Impacts / Groundwater

4.9.1 Existing Site and Subsurface Conditions

4.9.1.1 Existing Site

The MMHC Site was previously developed as the Massachusetts Mental Health Center (former Boston Psychopathic Hospital) in 1912; several additions to the hospital building and construction of Fenwood Inn followed. The buildings have been vacant since 2003. Also included in the Project is a vacant parcel located at the corner of Fenwood Road and

Binney Street (across the street from the Main MMHC Site). The Binney Street Site was formerly occupied by residential structures in the early to mid-1900s, but has been vacant since the 1980s.

Available geologic and other subsurface information was collected and reviewed to develop an understanding of subsurface soil, bedrock, and groundwater conditions. The research consisted of information from various sources including historic and recent test boring data and data compiled for nearby developments.

4.9.1.2 Groundwater Conditions

Although the Project Site is not located with the Groundwater Conservation Overlay District (GCOD) as shown in Figure 4.9-1, the Project will incorporate measures to ensure that area groundwater levels are maintained.

Groundwater level measurements obtained from monitoring wells installed on and in the vicinity of the Project Site have been reviewed to develop an understanding of groundwater conditions and considerations for below-grade construction design and planning.

Groundwater was measured at depths of approximately 10 to 20 feet below existing grades, at existing monitoring wells, corresponding to approximately El. 9 to El. 19 (Boston City Base Datum). Shallower groundwater levels are anticipated in the Project area proximate to the Muddy River. Groundwater levels are expected to fluctuate naturally due to seasonal variation in such factors as precipitation and temperature.

In general, it is anticipated that groundwater flows from northeast to southwest in the Project area, towards the Muddy River. A groundwater flow survey will be conducted to measure the flow direction and gradient across the Project site.

4.9.1.3 Subsurface Conditions

Subsurface conditions are generally characterized as noted in Table 4.9-1

Table 4.9-1 Subsurface Characteristics

Generalized Description	Depth to Top of Layer (ft)	Thickness of Layer (ft)
Fill	–	4 to 14.5
Organic Soil	14.5	0 to 4.5
Marine Clay	4 to 8	3 to 22
Glaciofluvial Deposits	9 to 30	44 to 50
Glacial Till	55 to 58	–

Remains of previous structures from former development at the property and other historic uses may remain buried in place within the surficial fill soils. Several utilities (steam, sewer, drainage) are aligned through or adjacent to the Project Site.

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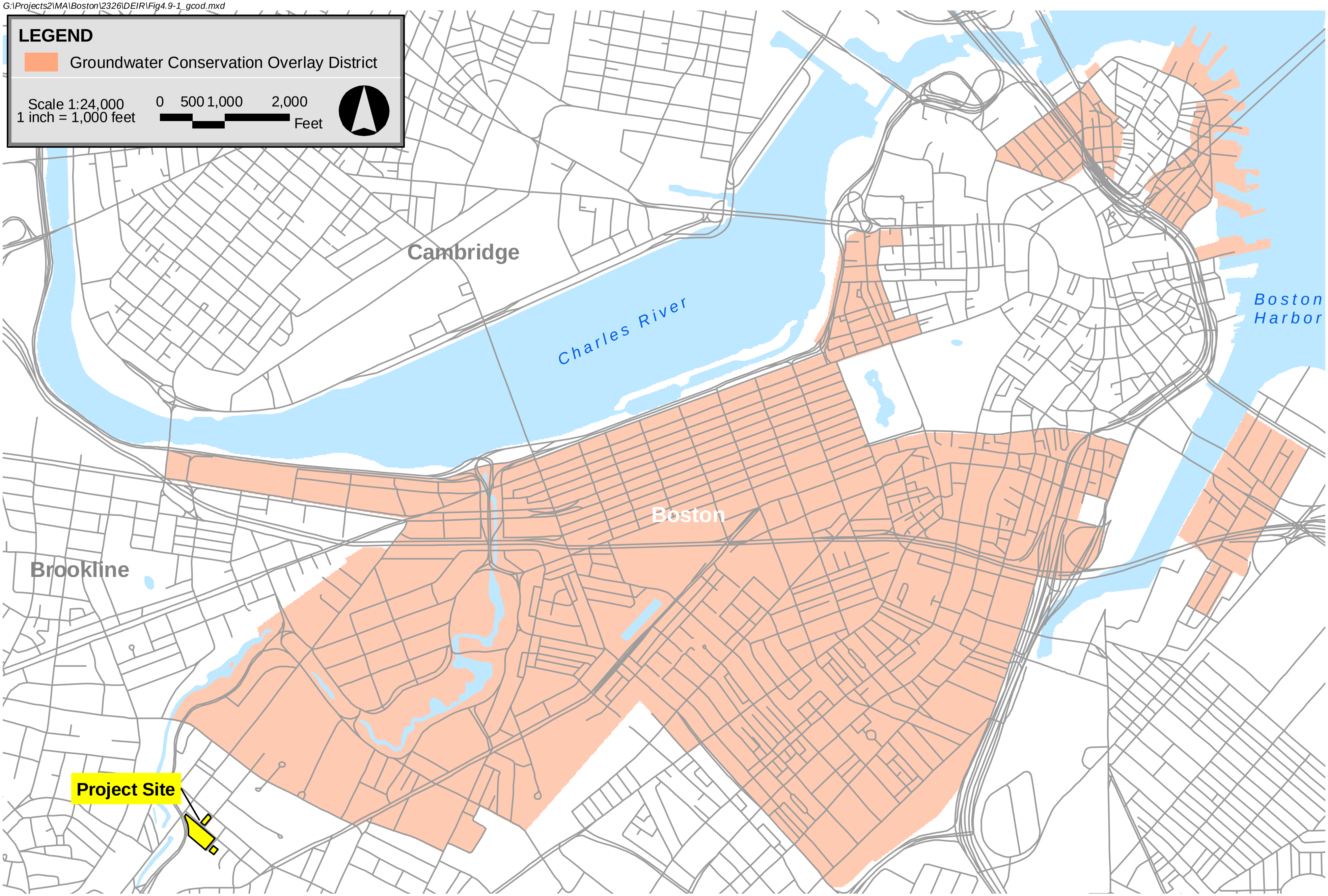

Massachusetts Mental Health Center Redevelopment Project   Boston, Massachusetts

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Figure 4.9-1

Groundwater Conservation Overlay District

4.9.2 Geotechnical Design

Considering the range of building geometries and basement configurations proposed for the Project, geotechnical design studies will focus on developing appropriate solutions for each potential situation. A variety of foundation systems and solutions will be necessary based on structural requirements, Project Site constraints and subsurface conditions.

The surficial fill and organic soils are not considered suitable for foundation support. A summary of planned foundation types for each building is as follows:

- For the Binney Street Building with one basement level, it is anticipated that the foundation will consist of spread footings bearing in the marine clay or glaciofluvial deposits.

- For the Partial Hospital/Fenwood Inn, it is anticipated that the foundation will consist of spread footings bearing in the marine clay or glaciofluvial deposits.

- For the Residential Building, if no below-grade space is planned, pile foundations extending to below the unsuitable soils will be required. If below-grade space is planned, a spread footing foundation may be feasible depending on the configuration and depth of planned excavation.

- For the Brigham and Women's Building, excavation for below-grade space is anticipated to extend up to 40 to 50 feet in depth. Foundations for this structure will consist of a concrete foundation mat or spread footings bearing in the glaciofluvial deposits or glacial till.

4.9.3 Below-Grade Construction Activities

For construction of the buildings with below-grade space, temporary excavation support systems that are compatible with subsurface conditions will be designed to provide adequate support and protection of the adjacent streets and utilities and to maintain groundwater levels outside the excavation at or near pre-construction levels.

It is anticipated that, in general, the excavation support systems will consist of soldier piles and lagging or interlocking steel sheets. Due to the depth of excavation currently planned for the Brigham and Women's Building, it is anticipated that the excavation support system will consist of a concrete diaphragm (slurry) wall.

Please see Section 4.10.10 for a description of construction measures to protect adjacent buildings and utilities during construction.

4.10 Construction Impacts

4.10.1 Introduction

The Proponent will submit a Construction Management Plan (CMP) in compliance with the City's Construction Management Program to the Boston Transportation Department (BTD). Each phase of the Project will have a separate CMP.

The CMP is an agreement between the Proponent and the City, and will include detailed information on construction activities, specific construction mitigation measures and construction materials, access, and staging area plans to minimize impacts to the abutters and the local community.

Proper planning with the City will be essential to the successful construction of the Project. Construction methodologies that ensure public safety will be employed. Techniques such as barricades, walkways, and signage will be used. Each CMP will include plans for construction worker commuting and parking, routing plans for trucking and deliveries, protection of existing utilities, and control of noise and dust.

The Proponent and its construction teams intend to follow the guidelines of the City of Boston and the Massachusetts Department of Environmental Protection which direct the evaluation and mitigation of construction impacts. As part of this process, the Proponent and its construction team will evaluate the mitigation methods identified by the Commonwealth's Clean Air Construction Initiative.

The Proponent has established a Community Construction Mitigation Group to address potential construction impacts including phasing, truck routes and coordination of deliveries, construction worker parking, demolition, and other construction activities.

4.10.2 Construction Activity Schedule

The Proponent will retain the services of a construction manager who will be responsible for coordinating construction activities during all phases of construction. During active construction phases, typical construction hours will be from 7:00 am to 6:00 pm, Monday through Friday and occasionally on weekend days. If periodic work is required on weekends, applicable approvals from the City of Boston will be obtained.

The construction manager will coordinate with the City of Boston agencies and with the Community Construction Mitigation Group in order to make sure that the concerns of the residential and institutional neighbors are addressed.

Construction Schedule and Phasing

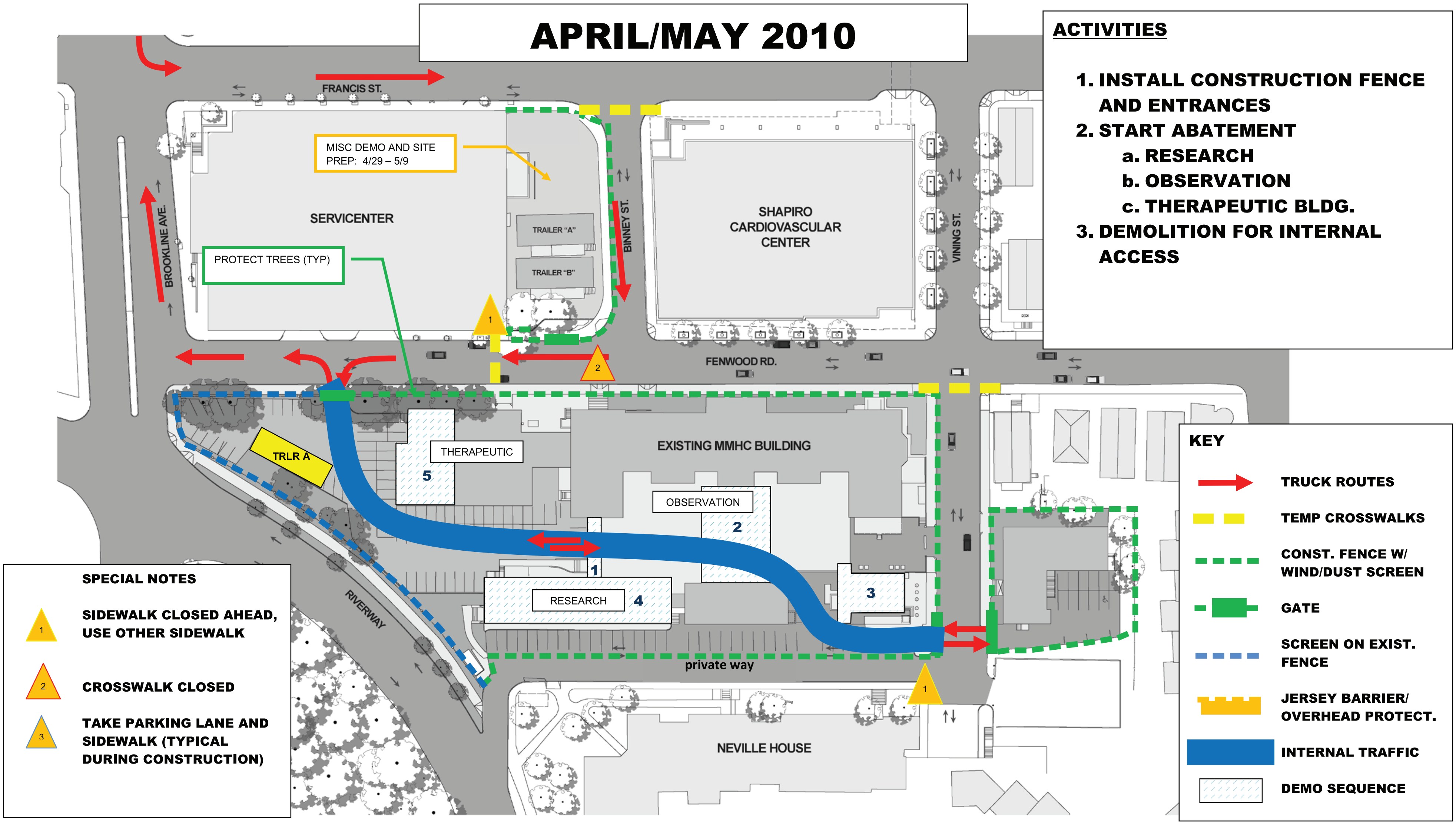
Following the execution of ground leases with DCAM, the Project will be constructed in phases over the course of approximately 12 years. For the years between active construction phases at the Project Site, the Proponent has developed interim use plans to reduce impacts to the adjacent residential and institutional community, maximize open space opportunities, and ensure active use of the Project Site. The Proponent has met with the Community Construction Mitigation Group to review the construction logistics and phasing of the Project, including the interim use of the Project Site.

The following sections and Figures 4.10-1 through 4.10-8 describe the planned construction schedule, Project phasing and interim uses between active construction phases. Table 4.10-1 provides a summary of the Project construction schedule. The projected construction schedule is approximate and subject to change. The description of interim uses represents the Proponent's current plans for the Project Site based on available information at this time and is subject to change as more detailed plans are developed and new information comes to light.

A certified arborist has been retained to examine the condition of trees on the Main MMHC Site. The arborist is charged with developing a site visit report, evaluation of the health of the mature trees and remedial recommendations. Streetscape improvements will be completed for each phase as the building associated with those improvements are completed.

Table 4.10-1 Construction Schedule

Activity	Date
First Phase – Binney Street Building and Partial Hospital/Fenwood Inn	
Initiate abatement and demolition	April - May 2010
Continued abatement and demolition	June 2010
Complete demolition (with exception of Observation Building) Start site work activity Initiate concrete operations	July 2010
Complete abatement and demolition of Observation Building Continue concrete operations	August 2010
Structural operations	September 2010 – December 2011
First Interim Phase	
Landscaping, temporary parking and laydown area for Residential Building	December 2011 – TBD
Residential Building Construction	24 month duration
Second Interim Phase	
Residential Building constructed and temporary parking	TBD
Brigham and Women's Building Construction	To be opened within 10 years of occupancy of Binney Street Building 30 month construction duration



Massachusetts Mental Health Center Redevelopment Project   Boston, Massachusetts

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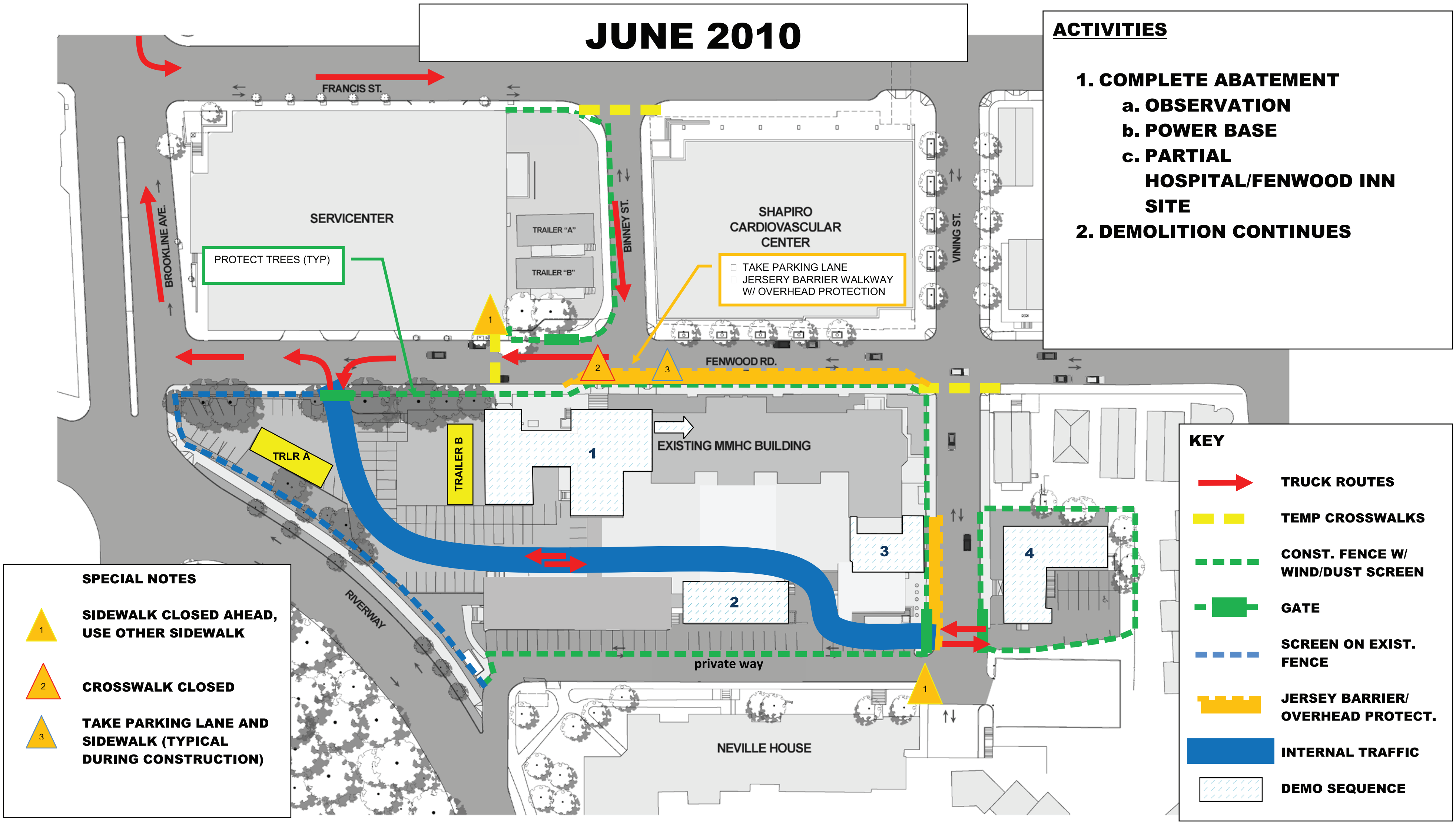
Figure 4.10-1
Construction Plan, April/May 2010

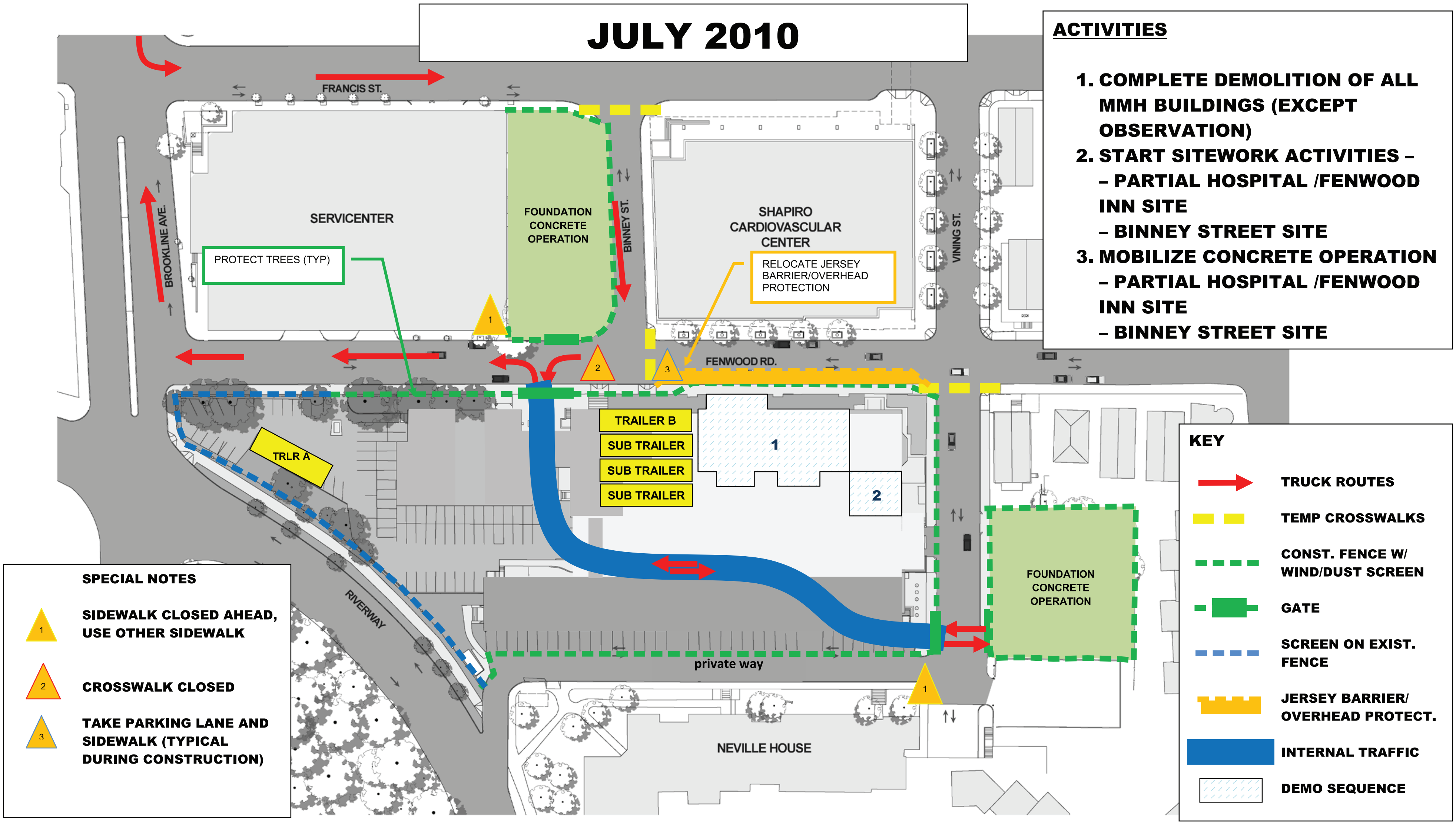


Massachusetts Mental Health Center Redevelopment Project Boston, Massachusetts

MORIARTY

Figure 4.10-2

Construction Plan, June 2010

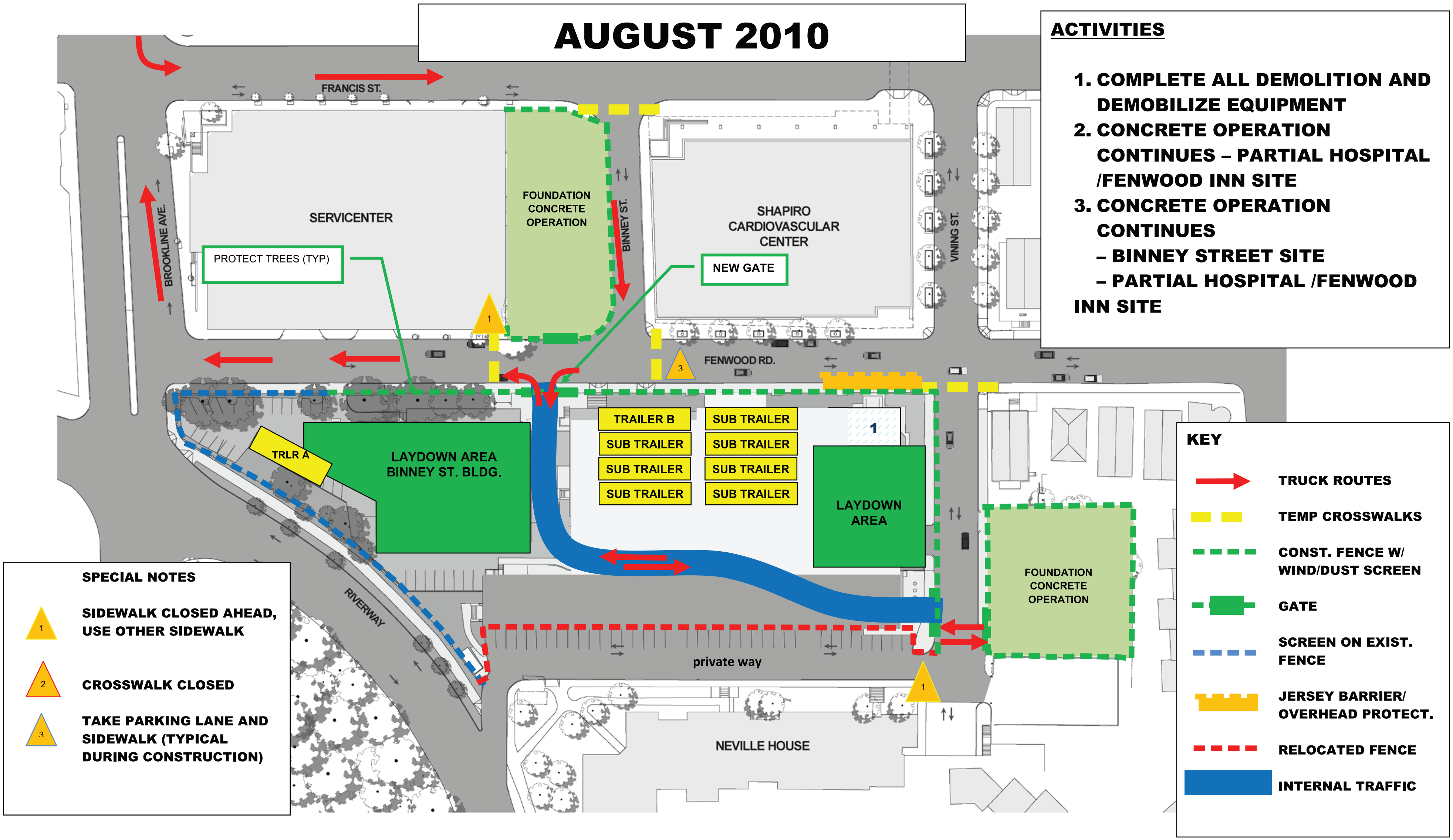


Massachusetts Mental Health Center Redevelopment Project   Boston, Massachusetts

MORIARTY

Figure 4.10-3

Construction Plan, July 2010



ACTIVITIES

1. COMPLETE ALL DEMOLITION AND DEMOBILIZE EQUIPMENT
2. CONCRETE OPERATION CONTINUES – PARTIAL HOSPITAL /FENWOOD INN SITE
3. CONCRETE OPERATION CONTINUES
   – BINNEY STREET SITE
   – PARTIAL HOSPITAL /FENWOOD INN SITE

Massachusetts Mental Health Center Redevelopment Project   Boston, Massachusetts

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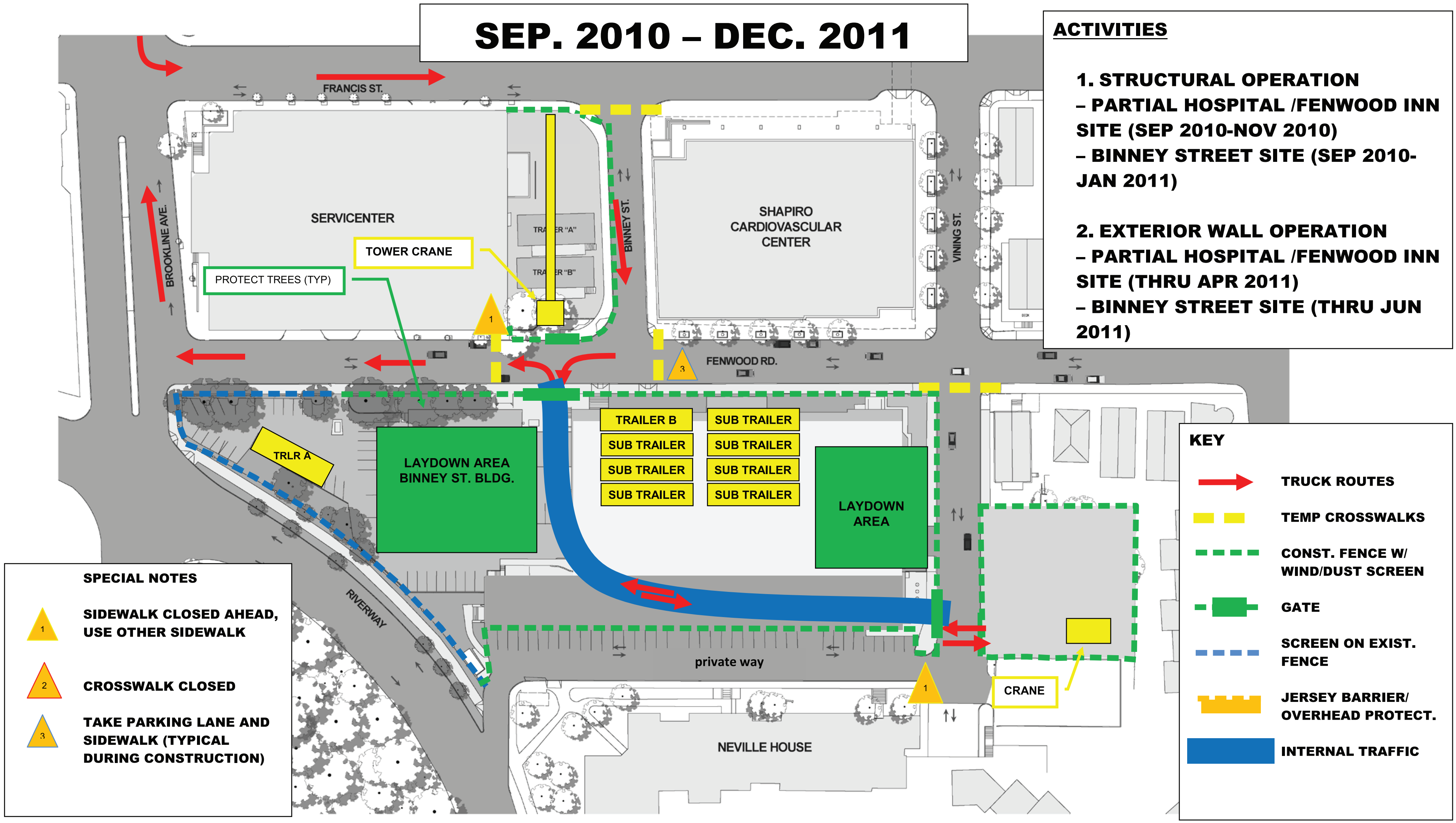
Figure 4.10-4
Construction Plan, August 2010



Massachusetts Mental Health Center Redevelopment Project Boston, Massachusetts

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Figure 4.10-5

Construction Plan, September 2010 - December 2011

INTERIM PARKING & LANDSCAPING
PRE-RESIDENTIAL CONSTRUCTION

THIS GRAPHIC REPRESENTS THE TEMPORARY PARKING AND LANDSCAPING AT THE COMPLETION OF THE BINNEY STREET BUILDING AND PARTIAL HOSPITAL/FENWOOD INN, AND PRIOR TO THE START OF RESIDENTIAL BUILDING.
WORK TO CONSTRUCT THIS INTERIM PARKING/STAGING AND GREEN SPACE TO TAKE PLACE MAY 2011-NOV 2011.

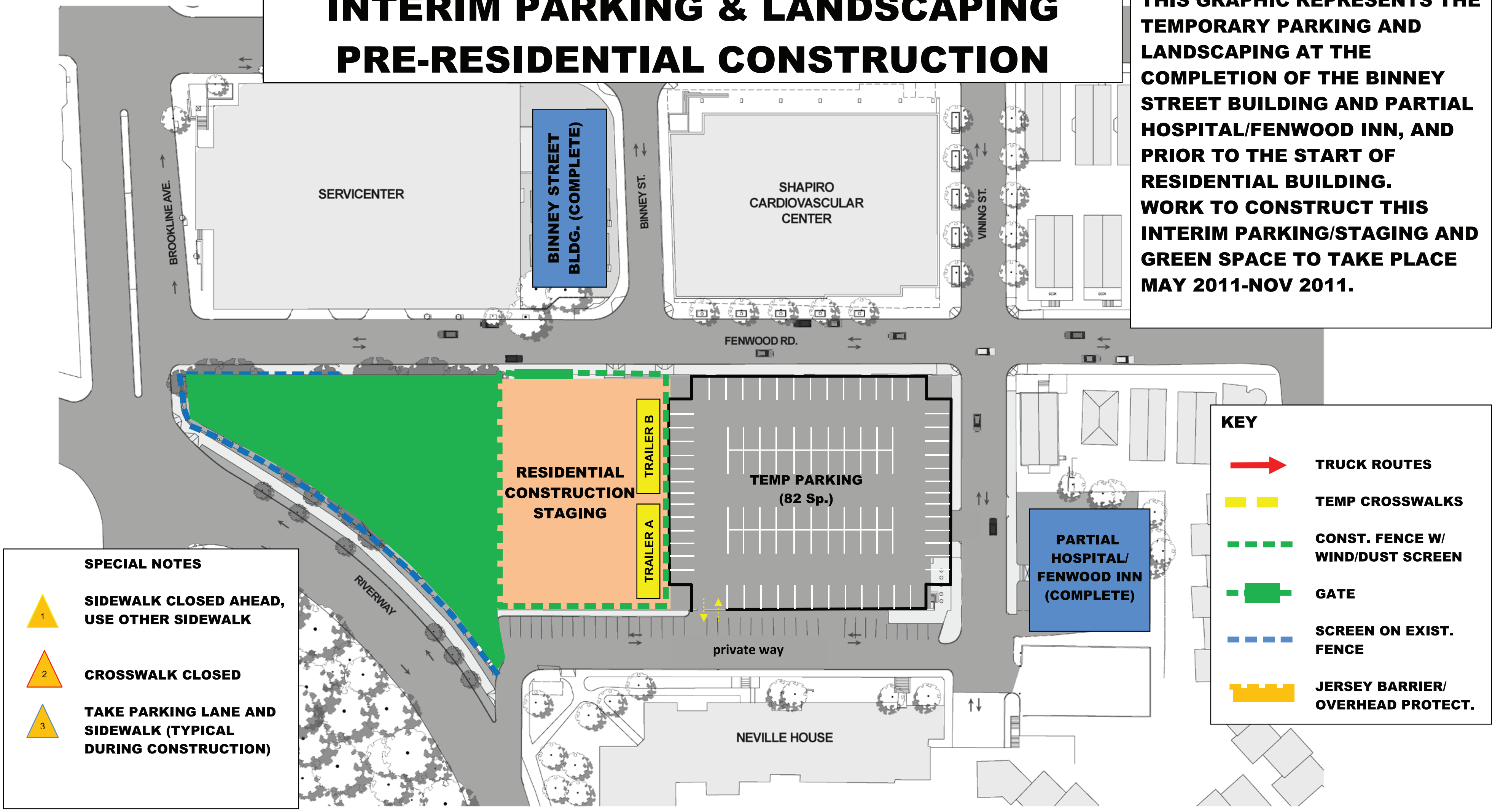


Figure 4.10-6
First Interim Phase

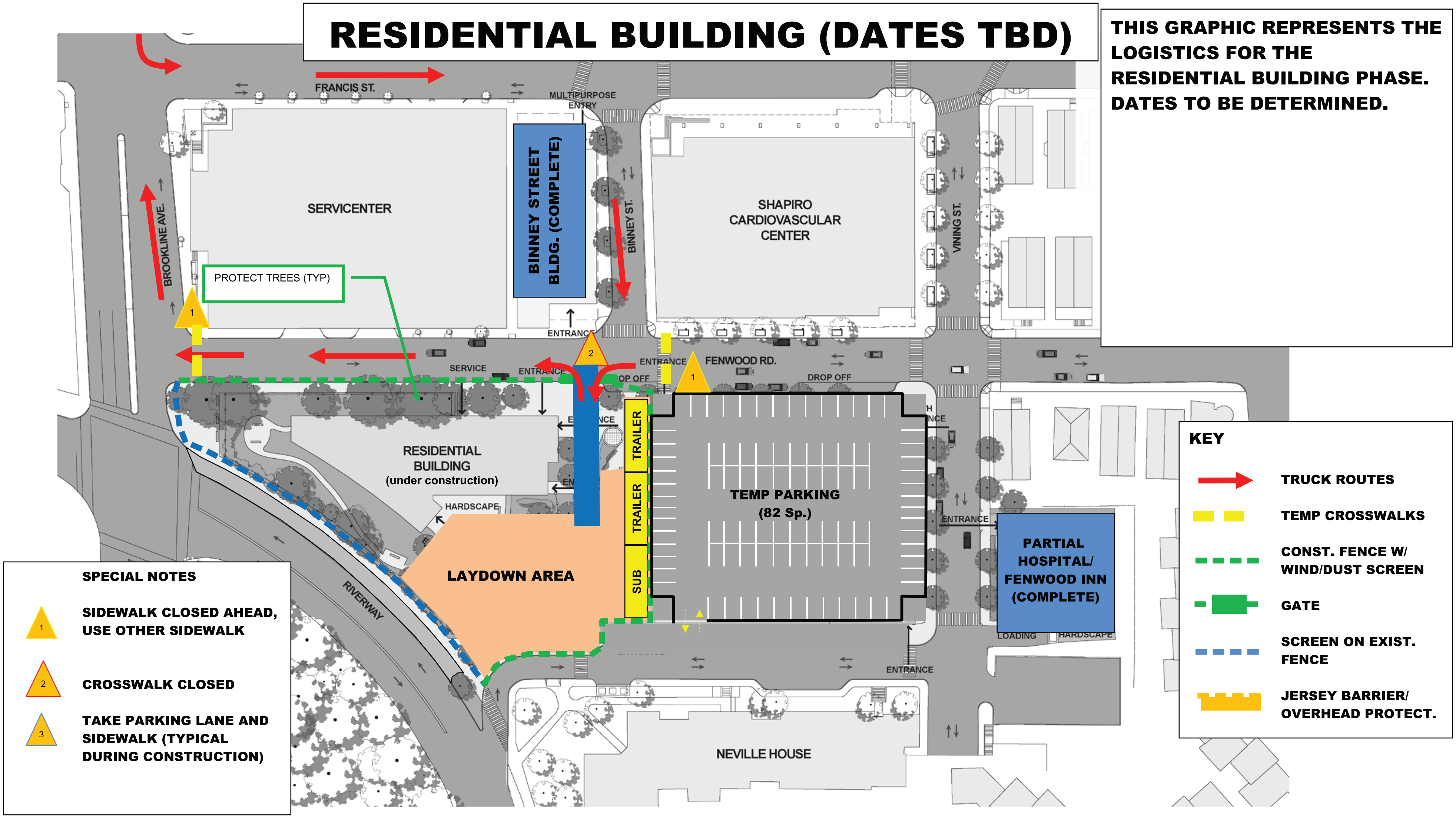


Figure 4.10-7

Construction Plan Residential Building

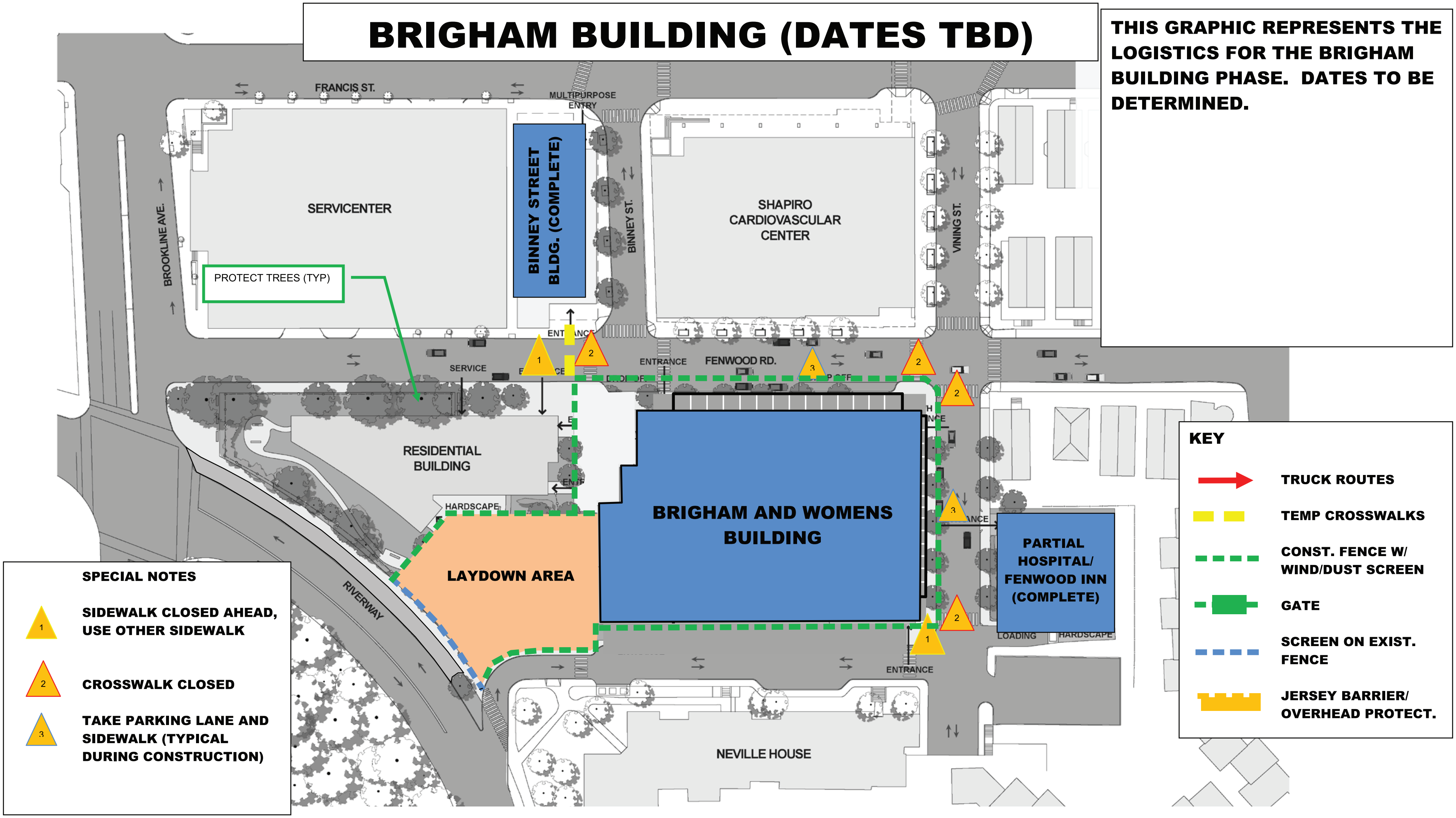


Figure 4.10-8

Construction Plan Brigham Building

First Phase – Binney Street Building and Partial Hospital/Fenwood Inn

The first phase of the Project will begin after the Proponent executes ground leases for the MMHC Site with DCAM and the Proponent secures relevant permits from City and State agencies and authorities. The first phase is anticipated to last approximately 18 months. This phase includes abatement, demolition and construction of the Partial Hospital/Fenwood Inn and the Binney Street Building. This first phase of construction is anticipated to begin in the Spring of 2010.

As shown in Figure 4.10-1, initial activity involves installation of construction fences and gated entrances to the Project Site. One of the construction trailers from the Binney Street Site will be relocated to the Main MMHC Site. The Proponent will secure the perimeter of the Project Site to ensure pedestrian safety by closing some crosswalks, creating temporary safe crosswalks, and marking pedestrian detours. After ensuring the Project Site is secure, the Proponent will start abatement and demolition of the existing Research, Observation and Therapeutic buildings to allow for internal circulation of construction vehicles on the Main MMHC Site. This internal haul road will reduce construction traffic impacts to the residential community. Demolition is also necessary due to the structural deterioration of the existing buildings. Although they are boarded up, there is concern that they present a potential public safety hazard. Please see Section 4.10.4 below for additional information on demolition methodology.

Installation of further construction fencing, overhead protection and pedestrian detours is anticipated for June 2010 as shown in Figure 4.10-2. During this month, there will be continued abatement and demolition of the Observation Building. The Power Plant on the Main MMHC Site and the existing Nurses Home at 20 Vining Street will be entirely abated and demolished at this time. Construction Trailer "B" will be relocated from the Binney Street Site to the Main MMHC Site.

By July 2010, as shown in Figure 4.10-3, all MMHC Buildings will be abated and demolished with the exception of the Observation Building which will be completed in August 2010. Additional facilities will be established on the Main MMHC Site to support construction of the Binney Street Building and Partial Hospital / Fenwood Inn. Site work for these buildings will begin and foundation operations will be mobilized.

As shown in Figure 4.10-4, all abatement and demolition activity will be completed by August 2010. The Main MMHC Site will include laydown areas for the Binney Street Building and Partial Hospital / Fenwood Inn and foundation work for each of these building will continue.

Figure 4.10-5 depicts the anticipated construction logistics for September 2010 to December 2011. During this time frame, construction of both the Binney Street Building and Partial Hospital / Fenwood Inn will continue. Binney Street Building structural operations are anticipated from September 2010 to January 2011 with exterior wall operations through June 2011. For the Partial Hospital / Fenwood Inn, structural operations are planned for September 2010 to November 2010 and exterior wall operations through April 2011. Streetscape improvements associated with each of these buildings will be constructed.

First Interim Phase

Following the completion of the Binney Street Building and Partial Hospital/Fenwood Inn, the Proponent proposes interim uses for the Main MMHC Site. All construction fencing and pedestrian detours will be removed. These interim uses include temporary parking with 82 spaces and landscaping as shown in Figure 4.10-6. The Proponent will work with the Community Construction Mitigation Group on details of the proposed landscaping. The 82 surface parking spaces are for DMH (50 spaces as required under the terms of the development agreement) and RTH residents (16 spaces) that park on Main MMHC Site today. Interim parking also includes six spaces for oversize patient vehicles and 10 spaces for contractors serving the BWH campus not construction workers for the Project.

A staging area for the Residential Building including two construction trailers will also be provided. Construction of this parking and installation of landscaping is anticipated to occur between May 2011 and November 2011.

Residential Building Phase

The timing of construction of the Residential Building will depend on market conditions and availability of capital for the Project. It is anticipated that the construction duration of the Residential Building will be 24 months.

During the construction of the Residential Building, a laydown area will be established in the center of the Main MMHC Site which will include two construction trailers and a subtrailer as shown in Figure 4.10-7. Appropriate construction fencing and pedestrian detours/protection will be installed. During this phase, landscaped areas not impacted by required lay down area for the Brigham and Women's Building will be constructed. The temporary parking provided in the first interim phase will not change.

Second Interim Phase

During this interim phase, the Residential Building and associated streetscape improvements and open space will be completed. The use of temporary parking with 82 spaces on the eastern side of the Main MMHC Site will continue.

Brigham and Women's Building Phase

As with the Residential Building, the timing for construction of the Brigham and Women's Building is contingent upon the financial market. It is anticipated that the Brigham and Women's Building will likely take 30 months to construct. Commencement of construction will include installation of appropriate fencing and pedestrian protection measures. The laydown area for the Brigham and Women's Building will be south of the Residential Building as shown in Figure 4.10-8. Current planning calls for the completion of the previously-approved Brigham Green Enhancement and Parking project (EOEA#12644) prior to the start of construction of the Brigham and Women's Building.

4.10.3 Construction Staging Areas/Public Safety

As shown in Figures 4.10-1 through 4.10-8, the proposed staging plan for the Project will be designed to isolate construction while providing safe access for pedestrians and automobiles during normal day-to-day activities.

During construction, it will be necessary to prepare materials offsite and sequence the delivery of these materials to the Project Site from a remote location due to their size or complexity. When off-site staging is required, the Construction Manager will secure the location. Typically larger materials are prepared for delivery to the Project Site in the riggers' yard. The Construction Manager, or in many cases a Project subcontractor, will arrange for large material handling with a qualified rigging company. Rigging companies have the appropriate yard space and specialized equipment to handle large, heavy materials. Electrical gear, chillers, air handlers and generators are examples of materials prepared off-site.

Additional materials such as steel and curtain wall assemblies are frequently too large to stage and handle on-site in an urban environment. In these cases, the material is shipped to the Project Site in installation sequenced deliveries. The delivery equipment is utilized as the staging platform (e.g. flatbed trailers). Several units are staged at a local site, if the vendor is not a local firm. In such a case the Construction Manager either rents a vacant lot temporarily or utilizes the riggers lot with whom the Construction Manager typically does business.

During the construction period, pedestrian access may need to be re-routed around the construction site. A variety of measures will be considered and implemented to protect the safety of pedestrians traversing those portions of the neighborhood affected by construction. Where necessary, the Construction Manager will provide protective barriers around the construction site, replacement of walkways, appropriate lighting, and new directional and informational signage to direct pedestrians around the construction sites. Police details will be provided as needed.

4.10.4 Demolition

The Project will require the demolition of existing MMHC buildings. Demolition of the existing structures will utilize controlled demolition techniques similar to those used on other projects within the City. A demolition sequence for these buildings will be developed which uses the exterior walls of the structures to isolate the demolition activity to the greatest extent possible. As mentioned previously, the Proponent has established a Community Construction Mitigation Group which meets bi-weekly to address potential construction impacts including potential impacts associated with demolition.

Prior to demolition activities, a survey will be performed to ascertain the existence of any hazardous materials such as asbestos. Given the age of the buildings, it is anticipated that the structures contain hazardous materials. Any hazardous materials will be treated as a special waste in accordance with Massachusetts DEP guidelines and addressed, transported, and disposed of accordingly. In addition, with respect to the demolition of the buildings, the demolition debris will be disposed of at a properly licensed solid waste disposal facility. Concrete, brick, and asphalt will be separated for crushing and possible re-use on site. During demolition, provisions will be made for the use of water spray to control the generation of dust.

Prior to the start of demolition, utilities to the existing buildings will be cut and capped and any hazardous materials within the buildings will be remediated. Stairwells and elevator shafts will then be used as internal debris chutes and all interior, non-structural demolition will occur within the buildings. Floor slabs will then be removed. At this point, all non-load bearing elements will have been removed using the exterior walls to contain the demolition operation. Finally, the remaining walls will be dismantled using large excavators to pull portions of the structures down in a controlled manner and internal to the MMHC Site.

4.10.5 Disposal and Recycling of Construction Debris

The Proponent will take an active role with regard to the reprocessing and recycling of construction and building demolition waste. During the demolition phase, concrete, brick and asphalt will be separated for off-site crushing and re-use. The demolition subcontract will include specific provisions for the segregation, reprocessing, reuse and recycling of materials. For those demolition materials that cannot be recycled, solid waste will be transported in covered trucks to an approved solid waste facility, per DEP's Regulation for Solid Waste Facilities, 310 CMR 16.00.

During the construction phase, the disposal contract will include specific requirements that will ensure that construction procedures allow for the necessary segregation, reprocessing, reuse and recycling of materials. For those materials that cannot be recycled, solid waste will be transported in covered trucks to an approved solid waste facility, per DEP's Regulations for Solid Waste Facilities, 310 CMR 16.00. Construction will be conducted so that materials that may be recycled are segregated from those materials not recyclable to enable disposal at an approved solid waste facility.

Some appropriate excess materials may be donated to the Building Materials Resource Center (BMRC) in Roxbury. For the recycling of any construction debris not appropriate for donation to the BMRC (with the exception of materials classified as hazardous) the proponent will contact Mark Lennon of the Institution Recycling Network (IRN).

4.10.6 Transportation

Construction Trip Generation and Construction Worker Parking

The number of workers required for construction of the proposed buildings will vary by phase during the construction period. However, the construction workers will generally arrive and depart prior to peak traffic periods and the construction trips are not expected to impact traffic conditions. To reduce vehicle trips to and from the construction site, no construction worker parking will be permitted on-site and all workers will be strongly encouraged to use public transportation[11]. A comprehensive TDM plan for construction workers will be established.

The Proponent and the construction manager will work aggressively to ensure the construction workers are well-informed of the public transportation options serving each construction site. On-site space during each construction phase will be made available for workers' supplies and tools so they do not have to be brought to the construction site each day. Contractors will be encouraged to devise access plans for their personnel that de-emphasize auto use (such as seeking off-site parking, providing transit subsidies, etc.).

The Proponent will work with the BTD and the Boston Police Department to ensure that parking regulations in the area and in designated residential parking areas are enforced. As has been the case with other construction projects, it is expected that this will be a considerable disincentive to park in residential areas.

Truck Routes and Volumes

Trucks will be needed to deliver construction materials and truck traffic will vary throughout the construction phases, depending on the activity. The volumes described in Table 4.10-2 are estimates and will be refined as the construction schedule becomes finalized. The number of truck trips will likely be higher during the periods of demolition and excavation as more trucks will be needed to remove excavated soil and demolition debris.

[11] Interim use of the Main MMHC Site includes 82 parking spaces, including 10 for contractor parking. This contractor parking is for contractors serving the BWH campus not construction workers for the Project.

Table 4.10-2 Estimated Construction Truck Trips

	Avg. Volume per Day	Avg. Volume per Hour
Binney Street Building &Partial Hospital/Fenwood Inn	12	1.5
Residential Building	16	2
Brigham & Women's Building	24	3

Truck access routes will be developed to avoid trips on adjacent residential streets. Trucks will access the construction site and staging areas via Brookline Avenue. Specific truck routes will be established with the BTD through each CMP required for each of the proposed buildings. Construction contracts will include clauses restricting truck travel from the Riverway and residential streets such as Fenwood Road (east of Vining Street). The Proponent is not seeking to modify truck restrictions on the DCR-controlled Riverway. Enforcement of truck routes will be accomplished through clauses in the contractors' and subcontractors' agreements. Material deliveries will be scheduled to avoid peak traffic periods in order to limit any traffic impacts. Deliveries will be driven directly to the staging platform.

Traffic Maintenance and Parking

During the construction period, traffic may need to be re-routed for temporary periods. At this time, there are no plans to close the private way at the southern end of the Main MMHC Site during the first construction phase. The Proponent will provide appropriate signage and a police detail to ensure public safety in the event of temporary lane closures on streets adjacent to the Project Site. The goal of the CMP will be to reduce the number and duration of potential lane closures and to minimize any interruptions to on-street parking in the area. The Proponent will coordinate with BTD and MASCO to coordinate construction efforts with other area projects to minimize cumulative traffic impacts.

4.10.7 Construction Air Quality and Dust Control

Impacts associated with construction activities may generate fugitive dust, which will result in localized increases in airborne particulate levels. Fugitive dust emissions from construction activities will depend on such factors as the properties of the emitting surfaces (e.g., moisture content, and volume of spoils), meteorological variables, and construction practices employed.

To reduce emissions of fugitive dust and minimize impacts on the local environment, the construction work will adhere to a number of strictly enforced mitigation measures. These measures may include the following:

- Using wetting agents regularly to control and suppress dust that may come from the construction materials;
- Fully covering all trucks used for transportation of construction debris;
- Retrofitted equipment and ultra low-sulfur diesel (ULSD) fuel (15 ppm) will be used, in off-road construction equipment;
- Removing construction debris from each site regularly as needed;
- Monitoring construction practices to ensure that unnecessary transfers and mechanical disturbances of loose materials are minimized and to ensure that any emissions of dust are negligible;
- Providing a wheel wash at all exits from the construction areas; and
- Regular vacuum cleaning of streets and sidewalks in the Project area will be employed to ensure that they remain free of dust and debris from the Project.

4.10.8 Construction Noise

The Proponent is committed to mitigating noise impacts from Project construction. Construction work will comply with the requirements of the City of Boston Code -- Ordinances and the Regulations for Control of Noise in Boston administered by the Boston Environment Department. Every reasonable effort will be made to minimize the noise impact of construction activities.

Construction period noise mitigation measures are expected to include the following:

- Instituting a proactive program to ensure compliance with the City of Boston ordinances and regulations;
- Using appropriate mufflers on all equipment and ongoing maintenance of intake and exhaust mufflers;
- Muffling enclosures on continuously running equipment, such as air compressors and welding generators;
- Replacing specific construction operations and techniques by less noisy ones where feasible;

- Scheduling equipment operations to keep average noise levels low, to synchronize noisiest operations with times of highest ambient levels, and to maintain relatively uniform noise levels;

- Turning off idling equipment; and

- Locating noisy equipment at locations that protect sensitive locations by shielding or distance.

4.10.9 Measures to Protect Water Quality

There are no wetland resources on-site or adjacent to the Project Site. The Project is located proximate to the Muddy River and compliance with the State's Stormwater Management Standards through the use of Best Management Practices (BMPs), such as erosion and sediment controls, during the construction period will reduce potential impacts on water quality. If required, these may include siltation fences or staked hay bales placed around the perimeter of the work areas.

Section 7.3, Water Quality/Stormwater, includes a complete discussion of the proposed Project's impacts to water quality and compliance with DEP's Stormwater Management Standards. As described in Section 7.3, the Project is expected to result in beneficial changes in both drainage patterns and water quality. Construction dewatering discharges will be appropriately controlled and discharged in accordance with National Pollutant Discharge Elimination System (NPDES) and State dewatering standards.

Please see Section 4.7.1.3 for information on measures to protect proposed soil and groundwater during construction.

4.10.10 Vibration Control

Based on current subsoil investigations, blasting is not anticipated. The Proponent will implement a vibration control program to ensure that demolition of existing buildings, garage excavation for the Brigham and Women's Building and foundation construction for all four Project buildings will not negatively impact structures and utilities surrounding the Project Site. All means and methods for performing work at the Project Site will be evaluated for potential vibration impacts on nearby buildings and utilities.

Before construction, the proponent will conduct studies, prepare designs and specifications, and review contractor's submittals for conformance to the Project contract documents with specific attention to protection of nearby structures and facilities, including protection from vibrations. The Project specifications will contain specific criteria for allowable threshold and limiting values for vibrations. A preconstruction measurement of survey points in the Project area will be obtained prior to the start of construction.

During the construction period, a geotechnical field instrumentation program will be implemented that includes documentation of ground vibrations. To mitigate potential impacts, vibration levels during foundation construction activities will be measured and monitored at appropriate structures. Construction activities will be modified according to contingency plans for remedial measures in the event that vibration levels at adjacent buildings and streets exceed threshold response levels contained in the contract technical specifications.

4.10.11 Rodent Control

The City of Boston has declared that the infestation of rodents in the City is a serious problem. In order to control rodents, the City enforces the requirements established under the Massachusetts State Sanitary Code, Chapter II, 105 CMR 410.550 and the State Building Code, Section 108.6. Policy Number 87-4 of the City's Inspectional Services Department establishes that extermination of rodents shall be required for issuance of permits for demolition, excavation, foundation, and basement rehabilitation.

Rodent extermination certificates will be filed with building permit applications to the City. Rodent inspection monitoring and treatment will be carried out before, during and at the completion of all construction work for the proposed projects, in compliance with the City's requirements. Rodent extermination prior to work start-up will consist of treatment of areas throughout the Project Site. During the construction process, regular service visits will be made.

4.11 Sustainable Design

The Proponent is committed to a sustainable Project and will incorporate sustainable design measures into the Project. These will include measures related to building energy management systems, lighting, recycling, conservation measures, and local building materials.

The Project reflects "Smart Growth" principles in a number of ways:

- ♦ *Redevelopment* – The Project will transform an underutilized, previously-developed site into a vibrant development with a mix of uses.
- ♦ *Reuse and rehabilitate existing infrastructure* – By locating near and utilizing existing infrastructure and transportation systems (both roadway and public transit), the Project's environmental impacts will be minimal relative to a similar project constructed on an undeveloped site without these services and infrastructure in place.
- ♦ *Concentrate Development* – The Project density concentrates a mix of uses in a single location to promote efficient use of the Project Site and foster a sense of place.

- *Conserve Natural Resources* – The Project will advance sustainable and environmentally conscious design and construction practices. Consistent with Article 37, the Project buildings will be LEED certifiable at a minimum.

- *Expand Housing Opportunities* – The proposed Residential Building will provide high-quality affordable and market rate housing to residents who will have convenient access to local public transportation and job opportunities in the LMA.

In addition to Smart Growth, the Project will incorporate the following additional sustainable design features:

- The Proponent will aim to reduce greenhouse gas emissions as described below in Section 4.12;

- The Proponent will ensure measures to maximize energy efficiency as described in Section 7.4.1;

- The Proponent will maximize recycling efforts during construction and operation as described in Section 4.7.2, 4.10.5 and 4.7.3; and

- The Project buildings will be LEED Certifiable at a minimum as described below in Section 4.11.1 and outlined in Appendix F.

4.11.1 LEED Certification and Executive Order 484

The purpose of the City of Boston's Article 37 of the Zoning Code is "to ensure that major building projects are planned, designed, constructed, and managed to minimize adverse environmental impacts; to conserve natural resources; to promote sustainable development; and to enhance the quality of life in Boston." Due to the requirements of Article 37, buildings in this Project (with the exception of the Partial Hospital/Fenwood Inn, which is exempt from local zoning control) must attain a level of "LEED Certifiable" based on the USGBC's building-rating system LEED for New Construction Version 2.2. In order to achieve LEED Certifiable, 26 points are required. In addition to all prerequisites, the LEED building-rating system provides 69 possible points, and Article 37 provides four additional points, called Boston Green Building Credits (BGBC), with certain prerequisites in order to attain any of the four BGBC points.

The Proponent is committed to a sustainable Project and will incorporate sustainable design measures into the Project. The Proponent's commitment to sustainability is reflected in plans for LEED levels. The Partial Hospital/Fenwood Inn will be LEED Certified. The Proponent aims to exceed requirements of Article 37 of the Zoning Code for the Binney Street Building and Brigham and Women's Building and proposes these buildings to be LEED Silver Certified. The Residential Building is proposed to be LEED Certifiable with the possibility of being LEED Silver Certifiable. Updated LEED checklists and a narrative description of each credit proposed in this preliminary stage for each building are provided in Appendix F. These checklists will continue to be updated and revised as the design progresses.

Executive Order 484, Leading by Example – Clean Energy and Efficient Buildings, requires that "state agencies prioritize practices and programs that address resource use at state facilities, including a reduction in energy consumption derived from fossil fuels and emissions associated with such consumption." Specifically, "all new construction at state agencies and significant renovation projects over 20,000 sf meet a Mass. LEED Plus building standard," which includes the following requirements:

- Certification by the U.S. Green Building Council (USGBC); energy performance 20% better than the Massachusetts Energy Code;
- independent 3rd party commissioning;
- reduction of outdoor water consumption by 50% and indoor water consumption by 20% relative to standard baseline projections; and
- conformance with at least 1 of 4 identified smart growth criteria per LEED Sustainable Sites Credits 1-4.

The Proponent has considered the recommendations and measures of Executive Order 484. Accordingly, the Binney Street Building, Brigham and Women's Building and Partial Hospital/Fenwood Inn will meet the Mass. LEED Plus standard. The Proponent proposes the Binney Street and Brigham and Women's Buildings to be LEED Silver Certified, and the Partial Hospital/Fenwood Inn to be LEED Certified. These buildings aim to maximize energy performance to the extent practical and incorporate measures to conserve energy and water resources. Additional information on specific sustainable energy measures are described below in Section 12 and provided in Appendix F.

4.12 Greenhouse Gas Analysis

This section addresses greenhouse gas (GHG) emissions generated by the Project and options that may reduce those emissions, in accordance with the MEPA Greenhouse Gas Emissions Policy and Protocol (Policy). The Policy requires that certain projects undergoing review by the MEPA Office quantify the project's GHG emissions and identify measures to avoid, minimize, or mitigate such emissions. In addition to quantifying project-related GHG emissions, the GHG Policy also requires proponents to quantify the impact of proposed mitigation in terms of energy savings and GHG emissions.

The analysis provided herein focuses on emissions of carbon dioxide (CO_2). As noted in the GHG Policy, there are other GHGs, but CO_2 is the predominant contributor to global warming. Furthermore, CO_2 is by far the predominant GHG emitted from the types of sources related to this Project (with one small exception, refrigerant management, which is addressed later herein), and CO_2 emissions can be calculated for these source types with readily available data.

Organization of this Section

The Project is comprised of four buildings, two small buildings, (Binney Street Building and Partial Hospital/Fenwood Inn) to be constructed in the near future and two larger buildings (Brigham and Women's Building and Residential Building) that are not expected to be constructed for five to ten years. Furthermore, the Binney Street Building and Partial Hospital/Fenwood Inn buildings are independent and located more than a city block apart. The Brigham and Women's Building and Residential Building are functionally independent and will have separate ownership. Therefore, this analysis is conducted to address four independent buildings; essentially four GHG analyses.

The Proponent will utilize the nationally recognized Leadership in Energy and Environmental Design program as administered by the US Green Building Council. LEED New Construction will all be utilized to quantify the Project's various metrics relating to sustainability and "green" design. The Binney Street Building and Brigham and Women's Building will be designed to meet LEED Silver Certified requirements, the Partial Hospital/Fenwood Inn will be designed to be LEED Certified, and the Residential Building will be LEED Certifiable with the possibility of being LEED Silver Certifiable.

GHG emissions can be categorized into two groups: emissions related to activities that are stationary on the site and emissions related to transportation. Activities on the site can be further broken down into direct sources and indirect sources: direct sources include GHG emissions from fuel combustion and indirect sources include GHG emissions associated with electricity and other forms of energy that are used on the site and are imported from off-site power plants via the regional electrical grid or local steam distribution system.

Emissions from stationary sources are discussed in Sections 4.12.2 through 4.12.5, while emissions and mitigation measures related to transportation are discussed in Section 4.12.6. The two are combined into a summary GHG analysis in Section 4.12.7 together with a summary of GHG emissions mitigation commitments. Supporting technical analyses and information are presented in Appendix G.

The GHG Policy requires the Proponent to calculate and compare the GHG emissions in three cases, each of which incorporates both stationary source and transportation components:

Case 1 is the baseline from which progress in energy use and GHG emissions reductions are measured. The base case is a building that is designed to meet the 7th edition of the Massachusetts Building Code (Code). The Code incorporates the building energy provisions both ASHRAE 90.1-2007 and IECC 2006 and gives the applicant the option of which to use. In this analysis, the ASHRAE option is utilized.

The Code is a dynamic regulation and is revised periodically. In particular, whenever a revision to either ASHRAE 90.1 or the IECC is published, the Code automatically incorporates it one year later. IECC 2009 was recently published and will be incorporated into the Code in 2010. ASHRAE 90.1 is scheduled to be revised in 2010 and will be incorporated into the Code in 2011. The Code in effect at the time the Proponent submits a building permit application for a specific building is the Code to which that building must conform. Therefore, it is likely that the buildings of this Project, particularly the Residential Building and the Brigham and Women's Building, will be subject to later, more stringent versions of the Code. At this time, however, the exact nature of any future editions of the Code is unknown. Therefore, in accordance with MEPA Office guidance, these baseline analyses are based on the current, 7^{th} edition of the Code, and this version of the Code will remain the baseline for all future energy modeling of the Project.

Offsite transportation-related emissions would be modeled for the "build condition", without improvements or mitigation measures proposed by the Project, developed using the standard methodology outlined in the EEA/EOT Guidelines for EIR/EIS Traffic Impact Assessment. However, because the TDM program is, in part, prescriptive by City requirements, and in part negotiated, it is not practical to determine a build-without-mitigation case. Therefore, Case 1 includes all of the Project's proposed TDM measures. The transportation analysis and details of the mitigation measures are described in detail in Chapter 3.

Case 2 represents the proposed Project, including measures incorporated into the building shell, its mechanical, electrical and plumbing (MEP) systems, lighting design, and other factors that go above and beyond those required for code compliance.

Transportation analysis for Case 2 is the same as for Case 1 and includes the effects all of the TDM measures proposed as part of the Project.

Case 3 represents a project alternative configuration with greater GHG emissions-related mitigation than the proposed Project. In the analysis presented herein, this case includes additional mitigation measures that are under study and may be applied as further design development occurs, but cannot be committed to at this time.

The Proponent has evaluated numerous stationary source GHG mitigation techniques comprised of design parameters and technologies, and construction and operating parameters, which are generally referred to herein as "technologies" for convenience. Some have been adopted, some designated for later evaluation for possible incorporation into the Project as design progresses, particularly for the longer-term buildings, and some have been eliminated from further consideration for some or all of the Project's buildings. These mitigation technologies are summarized in Section 4.12.1 and explained in more detail on a building-by-building basis in Sections 4.12.2 through 4.12.5.

4.12.1 Mitigation Technologies

GHG mitigation techniques are a mix of design techniques, applied technologies and operating methodologies. For convenience, they are generally referred to herein as "technologies."

The Proponent has examined approximately 40 mitigation technologies for application to each of the Project's four buildings. Each technology has been placed in one of four categories:

- "P" - Proposed as part of the Project (Case 2);
- "3" - Under study for possible inclusion, but not committed to at this time (included in Case 3);
- "S" - To be studied at some time in the future;
- "X" - Rejected or not applicable.

A matrix of the technologies and buildings, and which category a technology falls into, is presented in Table 4.12-1. This matrix is indicative of the extensive and detailed efforts the Proponent is using to consider, early in the design phase of each building, various methods to maximize energy efficiency and mitigate GHG emissions.

Technologies in the matrix under the Energy Efficiency and Energy Generation headings are the heart of the stationary source GHG analysis. These technologies are described on a building-by-building basis in Sections 4.12.2 through 4.12.5.

Table 4.12-1 GHG Mitigation Technologies Matrix

KEY: P = Proposed (Case 2) S = to be studied at later design phase, if appropriate
3 = Examined in Case 3 X = Rejected, not applicable or not feasible

Technology	Binney St	PH/FI	B&W Bldg	Residential
Energy Use Reduction				
Building Orientation	X	X	X	X
High performance building envelope	P	P	P	P
Green roof/podium areas	P	X	S	X
High-albedo / reflective roofs	P	P	P	P
Exterior shading devices	X	X	S	S
Low resistance circuiting	X	X	S	S
Radiant heat - lobbies	X	X	S	X
Under-floor air distribution	X	X	X	X
Heat recovery	X	X	P	P
Reduced air changes	X	X	3	X
Natural (hybrid) ventilation	X	X	X	P
Variable exhaust	X	X	X	P bathrooms, S kitchens
Room occupancy sensor	P	P	P (non-lab areas)	P common areas
Individual space HVAC controls	S	S	X	P
Natural lighting	S	S	S	P
Daylight harvesting	X	S	X	X
High performance lighting	P	P	P	S
Low flow fixtures	P	P	P	P
Energy-Star appliances	P	P	X	P
Advanced energy efficient elevators	S	X	P	S
Energy Generation				
High efficiency mechanical equipt.	P	P	P	P
Cogeneration, CHP	X	X	3	3
Fuel cell	X	X	X	X
Solar hot water generation	X	X	X	S
PV - roof	X	X	X	X
Building-integrated PV	X	X	X	X
PV ready	X	X	P	P
Ground source heat pumps	X	X	X	X
Wind turbines	X	X	X	X
Purchased Green Energy	3	3	3	3
Other Related				
Rainwater harvest, groundwater recharge	P (recharge) S (harvest)	P (recharge)	P	P (recharge)
Recycling collection areas	P	P	P	P
Enhanced refrigerant management	S	X	P	X
Energy management system	P	P	P	P
Enhanced building commissioning (LEED)	P	P	P	S
Construction waste recycling	P	P	P	P
Recycled content materials	P	P	P	S
Regional materials	S	X	S	S

Other Related Technologies

Additional measures will add indirectly to GHG mitigation, though their primary purpose is to accomplish other goals. Listed in the matrix of Table 4.12-1 under the Other Related heading and discussed briefly below, the GHG emissions reduction potentials are difficult to quantify with any reasonable accuracy and are numerically expected to be a small part of the overall mitigation and are therefore not included in the building energy modeling results reported in Sections 4.12.2 through 4.12.5.

Other Related technologies are divided into those that are associated with the operation of the buildings and those that are associated with the construction phases of the buildings.

Operations

Rainwater Harvest – Groundwater Recharge, Irrigation

Rainwater harvest from the Brigham and Women's Building is being studied for potential collection and storage for various uses, including groundwater recharge and irrigation. Using rainwater for cooling tower make-up water was evaluated, but the amount of available rainwater is not sufficient to significantly reduce the cooling tower water consumption.

The Binney Street Building, because of site limitations, will utilize a green roof to the extent possible. The Partial Hospital/Fenwood Inn will direct rainwater to groundwater recharge. The Residential Building will direct runoff to an adjacent undeveloped portion of the site for groundwater recharge.

Tenant Manuals

The Proponent will develop tenant manuals for the Binney Street Building and Partial Hospital/Fenwood Inn to provide instruction and guidance in the proper use of supplied equipment and systems. This will encourage the occupant of these buildings, the Department of Mental Health (DMH), to maximize the efficient use of the capabilities of the building and its components. A representative sample outline (Table of Contents) of the Tenant Operations Manual is contained in Appendix G.1.

Recycling Areas

Each building in the Project will incorporate recycling collection staging areas. The initial metric used to meet this requirement will be the LEED rating system, which requires the provision of collection facilities for paper, cardboard, metal, and plastic. Detailed discussions of recycling are provided in Section 4.7.3.

Refrigerant Management

Refrigerants, typically various compounds classified as hydrofluorocarbons (HFCs), are greenhouse gases of stronger effect than CO_2. Releases of HFC, however, are due to leaks or equipment failure and are not routine emissions. Nevertheless, use of low-CO_2-equivalent HFCs is beneficial, providing that the functionality of the refrigeration equipment is maintained.

LEED certification requires adopting a refrigeration management system that allows no chloro-fluorocarbon (CFC) use. All buildings will be able to achieve this LEED refrigerant management credit through the appropriate selection of refrigerants and efficient refrigeration systems.

The Binney Street Building and Brigham and Women's Building will target adoption of LEED Enhanced Refrigerant Management systems to select refrigerants with the least ozone depletion potential. The Proponent will evaluate which refrigerants are designed into each building's HVAC and refrigeration components, as well as fire suppression systems. Inclusion of the most appropriate refrigerants with a reduced contribution to ozone depletion and reduced GHG-equivalent concentrations will be evaluated during detailed design based on the specific mechanical systems selected for inclusion in each individual building.

Energy Management System (EMS)

An EMS does not reduce the design energy utilization, but rather insures that actual operation comes as close to design optimum as practical. An EMS allows the building manager to monitor building energy performance, which aids in identifying maintenance needs to maintain optimum performance. An EMS should, therefore, be viewed as an insurance mechanism to aid the building manager in attaining the optimum efficiency inherent in the building design.

Each building will be provided with Energy Management Systems which will continuously monitor building mechanical equipment control points (air handlers, fans, cooling towers, chillers, boilers, etc.), including airflows, water flows, energy consumption, etc. This will allow building operators to optimize building energy usage and will notify operators when equipment is not functioning as desired (and thereby wasting energy). The EMS in the Brigham and Women's Building and Residential Building will be capable of remote monitoring as well as monitoring from a central operator's station.

Construction

Regional Content Materials

The Proponent will encourage the specification of regionally-sourced materials wherever possible. Concrete aggregate/cement, wood, glass/glazing products, metals, masonry, and drywall will be evaluated for comparing the cost effectiveness of locally-sourced alternatives. As part of the LEED effort on the Project, the Brigham and Women's Building will target 10% regional materials content by overall construction materials cost per LEED definitions.

Recycled Content Materials

Individual buildings will encourage the specification of recycled-content materials wherever practical. Specifications will be written into Project documents requiring contractors and subcontractors to evaluate materials not only by cost, but also report recycled-materials content in relevant submittals provided to the owners or construction managers (CM). Concrete aggregate/cement, wood, glass/glazing products, metals, masonry, and drywall will be evaluated for cost effectiveness of recycled-content alternatives. As part of the LEED effort on the Project, individual buildings will target 10% recycled-content materials as a fraction of overall construction materials cost per LEED definitions.

Construction Waste Management

The Proponent will work with its Construction Manager for each building to outline, develop, and implement a comprehensive construction staging and phasing plan. Part of this plan will involve the creation of a comprehensive construction waste management plan. The Project is currently anticipating at least a 75% reduction in construction debris diverted to landfill (by weight) for the Binney Street Building, Partial Hospital/Fenwood Inn and Brigham and Women's Building and 50% for the Residential Building.

Building Commissioning

All buildings within the Project will be LEED certifiable, at a minimum, on an individual building basis under the LEED rating system. The Brigham and Women's Building, Binney Street Building and Partial Hospital/Fenwood Inn will utilize Enhanced Building Commissioning. This option begins the commissioning process earlier in the design stage, and also includes a post-occupancy follow-up visit to ensure that building systems have been operating properly in both the heating and cooling season.

Rejected

Some technologies are deemed to be not applicable, primarily for technical reasons, to any of the buildings.

Under-Floor Air Distribution (UFAD)

UFAD reduces energy consumption by extending the amount of time that the HVAC system can run in economizer cycle (i.e. using outside air to cool a space rather than mechanically cooled air) and by reducing the amount of air and the fan horsepower (and thus electrical energy) required to deliver the air. Implementation of UFAD requires a different architectural structure with raised floors and a different configuration and layout of air handling units compared to spaces served by conventional means. For these reasons, it is an applicable technology almost exclusively for large office and certain types of commercial buildings and is not applicable to any of the Project buildings.

Ground-Source Heat Pumps (GSHP)

GSHPs take advantage of the relatively constant temperature and infinite mass of the ground to seasonally either extract or discharge heat in an efficient thermodynamic cycle. GSHP systems are of two types. An open loop system draws in and returns groundwater from one or more open wells. A closed loop system keeps the working fluid in a closed circuit of pipes, relying on heat transfer through the pipe walls to or from the ground.

GSHP systems have been evaluated and have been rejected for use in this Project. GSHP systems are not deemed to be feasible for various reasons.

The Binney Street Building, Partial Hospital/Fenwood Inn and Brigham and Women's Building will occupy essentially all of the available property at those locations; thus there is no room on these urban sites for the well field required for GSHP systems. The Residential Building site has an open space to buffer the adjacent Emerald Necklace , but has determined that the economics of GSHP are not favorable for this 15 story building. The wells would need to be 1,500 feet deep, based on the Copley Church installation. The efficiency is non-optimum over the course of the season. A system deigned for the coldest February day and the warmest August day is over-designed and underutilized the remainder of the time, and therefore very expensive. In addition, the Proponent does not have enough confidence in the reliability of the system to build a building with no back-up conventional system, and redundant equipment adds to the cost.

Wind Turbines

Large Turbines: Turbines greater than 100 kW are often sited in low-development density areas where a consistent wind resource, unaffected by the built environment, maximizes the payback rate for the installed equipment. Siting facilities in low density areas minimizes wind turbulence, a major contributor to reduced performance and longevity of large-scale wind turbines. The City of Boston and surrounding areas have several cases of urban/suburban installation of larger turbines. Among those cases are the IBEW turbine adjacent to the Southeast Expressway in Dorchester, MA, the Forbes Park complex in Chelsea, MA, and the multiple utility-scale wind turbines in Hull, MA. These projects are sited in relatively open areas without tall buildings in close proximity. There is no space available on the Project site for a large wind turbine.

The area in the immediate vicinity of the Project includes numerous high-rise buildings and structures which tend to redirect wind flow and create turbulence. This is an unacceptable condition for siting a large turbine as it leads to unpredictable loads on the turbine blades. Furthermore, there is no available land on the Project site for installation of a large wind turbine.

Small Turbines: This class of turbines, less than 100 kW, includes small pole-mounted units as well as modest tower-mounted units up to about 250 feet tall. Due to the dense urban nature of the Project and its proximity to numerous tall buildings, the wind regime will be highly variable and turbulent, making it unsuitable for small turbines. Also, there is no available land on the Project site for installation of a small wind turbine.

Building-integrated Turbines: This class of wind turbines includes small turbines, generally less than 1 kW to about 5 kW, mounted on building roofs, parapets, or otherwise attached to a building. Some examples of such installations include Boston City Hall, Massport Logan Office Center, and the Museum of Science wind turbine lab.

The Partial Hospital/Fenwood Inn is a low building with inadequate wind resource to utilize wind power. The Binney Street Building is surrounded by high-rise buildings and also would have inadequate wind resource.

For the Brigham and Women's Building and Residential Building, initial cost investigations indicate that these machines are still prohibitively expensive, and annual output of the machines is very dependent on the surrounding built environment. A recent article (Environmental Building News, May 2009) indicated that building integrated turbines are not performing as predicted, have noise and vibration issues, and are a safety/insurance issue.

Due to the site's constraints, the proximity to high-rise buildings and other factors, it is expected that wind turbines will not be effective at this site., The decision was made, therefore, to not pursue building-integrated wind systems.

Fuel Cells

Fuel cells use methane (natural gas) in an electro-chemical process operating at low temperature to generate electricity. High-grade and/or low-grade waste heat recovery makes these units into a combined heat and power (CHP) technology.

Although fuel cells have been utilized in very limited applications for continuous power generation, they are very expensive, reportedly on the order of $12,000/kW. Even with a federal tax rebate of 30%, the capital cost still exceeds $9,000/kW, which is far in excess of other generation options. In spite of other subsidy programs and/or Alternative Energy Credits that might be available, the current costs of fuel cells are too high to be considered for application to this Project.

Utilization of the waste heat during summer months presents an additional system design challenge. The CHP aspect of the fuel cell requires a consistent need for either heating, domestic hot water production or cooling. Fuel cells have been implemented in grocery store and hotel properties due to their consistent demand for electricity and their ability to effectively use the low-grade waste heat generated. For economic considerations of this technology, the demand profile of a building (based on use type and tenant requirements) must be known to a much greater detail than is currently known.

Although the Proponent may re-examine fuel cells in the future if either substantial improvements in capital cost or large subsidy programs develop, it is not expected to be a candidate for use in these buildings.

4.12.2 Binney Street Building

The Binney Street Building is a six-story office building that will be operated and occupied by the DMH for ten years. It is being designed to be LEED Silver Certified under LEED 2.2.

4.12.2.1 Overview of Cases 1, 2 and 3

Case 1 - Baseline

When modeled, Case 1 demonstrates the energy utilization and GHG emissions of buildings that meet, but do not exceed, the requirements of the Code. This is not the project that the Proponent proposes to build. It is merely a baseline for energy use analysis that serves as a reference point from which to demonstrate the improvements in energy use and GHG emissions of the proposed design and of other additional measures that may or may not be implemented.

As will be demonstrated, the Binney Street Building is designed to exceed the current Code by a substantial margin in many areas. Thus, even if the Code becomes more restrictive in the future, it is not expected that the Project will have to change in any significant way.

The primary elements of the building core and shell and HVAC component efficiencies are presented in Table 4.12.2-1 for both the Code building and the Proposed building for comparison.

Case 2 - Proposed Project

Case 2 represents the proposed building, including measures incorporated into the building and MEP systems above and beyond those required for code compliance. The proposed Project includes the energy efficiency measures indicated in the matrix of options presented in Table 4.12-1 and described in Section 4.12.1. The basic systems of Case 2 are described in HVAC Concept Descriptions in Appendix G.2.

The Binney Street Building is in an early stage of design; nevertheless these measures, or equivalent, have been committed to by the Proponent. Features included in the Binney Street Building design include:

- Building core that complies with the Advanced Buildings Core Performance Guide, New Buildings Institute, July 2007
- High albedo roof
- Room occupancy sensors
- High performance lighting meeting current BWH efficiency standards
- Low flow plumbing fixtures
- Energy Star appliances
- High efficiency mechanical equipment

Case 3 – Alternatives with Greater GHG Mitigation

The Binney Street Building is a relatively small building that will be occupied by the Department of Mental Health for 10 years. The Proponent is responsible for the design of the building, and will supply the utilities during DMH's occupancy.

Given the size of the building and the technologies employed in the proposed design, Case 3 examines one additional measure, purchase of Green Electricity, i.e., electricity generated by off-site renewable resources such as solar, wind and biomass.

4.12.2.2 Technologies

The following describes the various technologies that may be applicable to the Binney Street Building and the rationale for their use or non-use. They are organized, similar to Table 4.12-1, into Energy Use Reduction and Energy Generation.

Energy Use Reduction

Orientation

Building footprint is largely constrained by the existing street grid and adjacent buildings. In order to optimize floor plates for maximum construction efficiency, building façades will remain generally parallel to the existing street grid. The existing orientation of the lot boundaries constrains buildings to have the southernmost façade actually be oriented along a line that is approximately NorthWest-SouthEast. The design of the exterior envelope will be evaluated on a façade-by-façade basis (each side of the building) for optimal configuration of glazing areas, opaque wall area, shading devices, overhangs, screens, balconies, operable windows, etc. Such details will not be developed until the detailed design phase of each building, however.

As only the basic characteristics of the envelope performance can be accounted for in this early evaluation stage, no credit has been taken in the building energy modeling for overhangs, balconies, screens, or exterior shading devices.

High Performance Building Envelope

Minimizing the energy intensity of the buildings is an important component of the design process for each building in the MMHC Project. The Proponent is committed to developing an energy-efficient project consistent with economics and the end uses of the space. Two prominent factors in controlling energy use are a building shell that minimizes the energy required to maintain the desired interior conditions and an HVAC system comprised of high efficiency components to maximize the efficiency with which the necessary energy is delivered. The HVAC systems are discussed later in this section.

The Advanced Building Core includes, among other components, greater insulation in the roof and glazing design that combines functionality and high insulating properties. Key building design elements that relate to the energy efficiency of the building envelopes are compared in Table 4.12.2-1. Code values for various parameters are included, where applicable, for comparison.

As indicated, proposed roof, floors, glazing, doors and skylights all exceed Code requirements and comply with the Advanced Buildings Core Performance Guide, New Buildings Institute, July 2007.

High-albedo/Reflective Roof

High albedo roofing materials will be utilized. Building energy modeling assumed that 75% of the roof will have white reflective surface, though that value may change if a green roof is adopted. Mechanical equipment is expected to occupy at least 25% of the roof surface. The high albedo roof aids in minimizing summer urban heat island effects.

Exterior Shading Devices

This building is largely in the shadow of nearby taller buildings. Exterior shading devices would serve little purpose.

Table 4.12.2-1 Key Building Elements, Binney Street Building

		Case 1- Code		Case 2 - Proposed		
Item	**Item Component**	**ASHRAE 90.1-2007**		**Advance Bldg - Core Performance**		**Comments**
		Assembly Max	**Insul. Min R-Value**	**U-Value**	**Insul Min R-Value**	
Roof	Roof Insulation entirely above deck	U-0.048	R-20 ci	**U-0.039**	R-25 ci	
	Metal building	U-0.055	r-13+r-13	U-0.047	R-19+R-13	
	Attic and other	u-0.027	R-38	U-0.027	R-38	
Walls	Mass (HC> 7 Btu/ft2)	u-0.090	R-11.4 ci	U-0.085	R-13	
	Metal building	u-0.069	R-13+R-5.6 ci	U-0.061	R-10+R-13	
	Steel framed	U-0.064	R-13+R-7.5 ci	**U-0.064**	R-13+R-7.5 ci	
	Wood framed and other -	U-0.064	R-13+R-3.8 ci	U-0.064	R-13+R-3.8	
	Below-grade walls	C-0.119	R-7.5 cl	c-0.119	R-7.5 ci	
Floors	Mass	U-0.420	R-1.8 ci	u-0.076	R-10 ci	
	Steel-Joist	U-0.214	R-5.3	**u-0.038**	R-30	
	Wood framed and other	U-0.188	R-5.3	u-0.33	R-30	
Slabs	Unheated	F-1.264	NR	**F-0.54**	R-10	
	Heated	F-1.489	R-2.6 for 600 mn	F-0.58	R-15+R-5	
Doors-Opaque	Swinging	U-3.975		**U-0.37**	u-0.37	
	Non-Swinging	U-2.839		U-0.53	R-4.75	
Vertical glazing including doors	Area (percent of gross wall)	0 - 40%	32%	0-40%	**32%**	
	Non-metal framing	U-0.35		U-0.35		
	Metal framing (curtain wall/storefront)	U-0.45		U-0.45		
	Metal framing (entrance door)	U-0.80		U-0.45		
	Metal Framing (all others)	U-0.55		**U-0.45**		
	Solar Heat Gain Coeffficient (SHGC)	0.40	SC=0.46	**0.3**	**SC=0.34**	Model Uses SC. SC= SGHC/0.87
	Exterior sun control (s,e,w only)	Not Required		Not Required if SHGC>0.3		For higher SHGC exterior sun control
Skylights (all)	Area (percent of gross roof)	0-2%	2.1%-5%	0-5%	**0**	
	Thermal transmittance	U-3.92	3.92	**u-0.45**		
	Solar Heat Gain Coeffficient (SHGC)	0.49 (SC=.56)	0.39 (SC=.45)	**0.4**	**SC=0.45**	
Interior lighting (Building Area	Interior Lighting power density (LPD)	office	1.0	**office**	**0.9**	
		clinic	1.0	clinic	1.0	
		Lab	1.4	Lab	NA	
Misc. Elec	Plugs and Recepticals	Not Specified		Not Specified		
		office	0.75	**office**	**0.70**	Case 2 assumes energy star equipment and appliances
		clinic	0.75	clinic	0.75	
		Lab	5	Lab	5	
	Elevator Horsepower					
Exterior	Façade and externally illuminated signage	NS				
Occupancy	Occupancy SF/Person	NS	144	NS	144	
HVAC	Package/Split - AC (0-65 kBtuh)	13 - SEER		15.0 SEER / 12.0 EER		
	(>65-135 kBtuh)	10.8 - EER		11.5 EER/11.9 IPLV		
	(>135-240 kBtuh)	10.4 - EER		11.5 EER/11.9 IPLV		
	(>24 0 kBtuh)	9.3 - EER		10.5 EER/ **11,1 - YORK**		
	Gas Boiler <300 MBH	80% AFUE		90% Et		
	300-2500 MBH	80% Et		89% Et		
	>2500 MBH	82% Ec		**89% Et**		
	Gas Steam Boiler >2500 MBH	79% Et		89% Et		
	Air Cooled Chiller<150 Tons	2.80 COP/ 3.05 NPLV		1.2 KW/ton	1.0 - IPLV	
	Centrifugal Chiller<150 Tons	4.45 COP/ 5.20 NPLV		0.610 KW/ton	0.620 - IPLV	
	150-300 Tons	5.55 COP 5.90 NPLV		0.59 KW/ton	0.560 - IPLV	
	>300 tons	6.10 COP 6.40 NPLV		0.57 KW/ton	0.510 - IPLV	
	> 600 tons	NS		0.55 KW/ton	0.510 - IPLV	
	Enthalpy Energy Recovery	> 70% outside air		NS		
Economizer	Air conditioners & heat pumps- SP	required		**required**		
Ventilation	Outdoor air damper	>300 cfm				
	Demand control	NS				
Ducts	Friction rate	NS -0.10w wc/100ft				
	Sealing	Seal Class C				
Service Water Heating	Gas storage (>75 kbtuh)	80% Et				
	Instananeous	?				
	Electric storage (S 12 kW and >20 gal)	EF >0.93 - 0.000132xVol				
	Pipe insulation (d < 1 1/2 in./ d >= 1 1/2".)	?				

BOLD indicates the actual values used.
NS - Not Specified

Low Resistance Circuiting

Low resistance circuiting (LRC) uses lower wire gauges (i.e. thicker wires) than those required by the electrical code to conduct electricity. This has the effect of reducing the power lost, in the form of heat, due to the internal resistance of the wire, and decreasing air conditioning load.

LRC will not be utilized in the Binney Street Building where the limited electrical runs (lengths of wiring) and loads minimize the losses so that heat contribution to building HVAC is negligible; i.e., there is very little benefit to using LRC in this small building.

Radiant Heat – Lobbies

The characteristic application of radiant heat consists of hot water pumped through tubes imbedded in the floor slab. Because water has a higher thermal capacitance than air, it requires less energy to heat a space hydronically (with water) than with air (i.e. instead of a 30 horsepower (hp) fan forcing hot air into the space, an approximately 5 hp pump will do the same). Energy savings can accrue as this heating system will be active throughout the heating season.

The ground floor lobby of the Binney Street Building is considered to be too small to be a suitable candidate for radiant heat application.

Heat Recovery

The Binney Street Building is considered to be too small to gain significant benefit from heat recovery.

Hybrid Ventilation

Hybrid ventilation (combination of natural and mechanically induced ventilation that may be used separately or in concert, depending on ambient conditions) is not functionally appropriate to the Binney Street Building.

Room Occupancy Sensor

Sensors adjust the heating/cooling set point when rooms are unoccupied, thereby reducing the energy spent on heating/cooling unoccupied or vacant rooms. Sensors also turn off the artificial lights when a space is unoccupied. Occupancy sensors are proposed for the Binney Street Building.

Daylighting and Daylight Harvesting

Daylight harvesting is the design of the interior in a manner that allows natural light to penetrate deeply into the building interior; this strategy compliments natural lighting. Space layout maximizes regularly occupied spaces along exterior wall to provide views and daylight to these spaces first. Perimeter offices are currently designed with 10' ceilings, use of clerestory glass to corridor, so that interior spaces will receive daylight.

High Performance Lighting

High-performance lighting (lower wattage per square foot than the Code minimum requirement) is proposed. This would consist of a lighting design which would result in 90% of the Code-allowed installed lighting power density, reducing the amount of electricity consumed by the lighting system and the corresponding energy used by the HVAC system to remove the heat generated by the lights. Lower lighting power levels will be achieved by use of fluorescent and/or LED lighting fixtures and bulbs.

Low Flow Fixtures

Several features of the Binney Street Building will reduce water consumption, in turn reducing wastewater generation. Such reductions reduce indirect GHG emissions by reducing the MWRA's water pumping and wastewater treatment energy requirements. Only credit for low-flow fixtures has been included in the energy modeling.

The Binney Street Building will meet the LEED prerequisite of an overall 20% reduction compared to the baseline EPAct case. Reductions will be realized through the selection and installation of advanced low-flow toilets, dual-flush toilets, high-efficiency urinals, and low-flow faucets and lavatories.

Energy-Star Appliances

Energy Star appliances utilize less energy than other models of the same appliances. Tenants in the Binney Street Building will be encouraged to utilize Energy Star appliances. Building Energy modeling in Case 2 assumes that the state agency tenant will utilize Energy Star appliances, computers, etc and is reflected in a reduced plug and receptacle load (Table 4.12.2-1).

Advanced Energy Efficient Elevators

The energy consumption of the elevator systems is a component of the base building electrical load, but does not necessarily constitute a significant proportion of overall building energy consumption. Manufacturers of advanced belt-drive elevators with regenerative braking technologies claim savings of up to 75% compared to traditional geared elevator systems. This technology is most cost-effective in high-rise elevators, typically greater than 100 feet in height. The applicability and economics of this technology to the Binney Street Building will be examined during detailed design.

Energy Generation

High Efficiency Mechanical Equipment

High efficiency HVAC systems are a combination of energy use reduction and energy generation technologies and include use of high efficiency boilers and chillers, premium electric motors, and incorporating variable frequency drive (VFD) motors, above and beyond the requirements of the Code, where practical. Table 4.11.2-1 indicates proposed AC equipment with Energy Efficiency Ratings, and boilers with high thermal efficiencies, better than Code and state-of-the-art for equipment of that size and type.

Cogeneration

To be economical, cogeneration requires a sustained (i.e., nearly 24/7) electrical demand and a substantial and sustained hot water demand. The Binney Street Building, as a small office and clinical building, has neither characteristic and is not a candidate for a cogeneration or micro-CHP installation.

The Proponent is examining the possibility of taking steam generated at the nearby MATEP cogeneration plant via a tap in the adjacent parking garage for use to generate the small hot water demands of the building. This is not included in the building energy modeling as the quantity is too small to make a significant GHG emissions difference.

Solar Energy

The Binney Street Building is nestled amongst high rise buildings that shadow its roof most of the time. Therefore, neither photovoltaic electricity generation nor solar hot water generation are applicable technologies.

Green Energy

Massachusetts utilities offer options that allow the customer to purchase a portion of its electricity requirements from renewable energy sources. The Binney Street Building, will obtain its electricity via the BWH system which will be metered and billed by BWH. Thus, the electricity provided to the Binney Street Building will come from the same supplier as the remainder of the BWH system.

Should DCAM, on behalf of DMH, elect to obtain Green Energy for the Binney Street Building, an arrangement with BWH would be necessary to obtain such Green Energy from its supplier. The Proponent cannot dictate that Green Energy be utilized.

Should DCAM choose to purchase Green Energy and such a pass-through arrangement can be made, the impact on GHG emissions from purchase of a nominal 10% of the building's electricity needs as Green Energy has been examined in Case 3.

4.12.2.3 Building Energy Modeling

Three cases were analyzed, in accordance with the Policy, as described in Section 4.12.2.1. Building energy modeling for the Binney Street Building was conducted by Fitzemeyer-Tocci, an engineering firm that offers building HVAC, plumbing, fire protection, fire safety and electrical engineering services. Fitzmeyer-Tocci utilizes the Trane Trace 700 model, version 6.1, in its daily business and, therefore, used the same model for these analyses.

Results of Case 2 modeling of the Binney Street Building are summarized, and compared to the Case 1 baseline, in Table 4.12.2-2.

Stationary sources of the Binney Street Building have the calculated GHG emissions of slightly more tan 1,000 tons/year, reflecting the small size and low energy intensity of its uses.

The energy efficiency technologies employed in the proposed design will result in a 22% decrease in natural gas use and 23% decrease in electricity use, resulting in approximately a 230 ton/year, 23% decrease in GHG emissions compared to a Code-compliant building. This excludes the technologies identified in Section 4.11.1 that have not been quantified for this analysis.

Should DMH choose to purchase 10% of the building's electricity use from Green Energy sources, as discussed in Section 4.12.2.2, it could reduce GHG emissions approximately 73 tons/eayr, or an additional 9% from the proposed case.

Table 4.12.2-2 Modeling Results - Binney Street Building

			Case 1 Baseline	Case 2 Proposed	Case 1-->2 Differential	Case 3 10% Green Energy	Case 2-->3 Differential
DIRECT (NATURAL GAS)			MMBtu/yr	MMBtu/yr			
	Space Heating		1,092	848		848	
	Domestic Hot Water	incl. above					
	Cogen Plant Heating Credit						
	Cogen Plant Fuel Input						
		Total	1,092	848	-22.3%	848	0.0%
INDIRECT (ELECTRICITY)			kWh/yr	kWh/yr		kWh/yr	
	Space heating		9,877	9,027		9,027	
	Space Cooling		159,906	61,899		61,899	
	Cooling Tower (Heat Rejection)		8,822	9,203		9,203	
	Ventilation and Fans		145,487	70,223		70,223	
	Pumps & Auxilary		9,789	8,558		8,558	
	Misc. Equipment (plug-in)		137,309	128,165		128,165	
	Area Lighting		144,402	129,982		129,982	
	Water/wastewater trtmt		1,737	1,390		1,390	
	Green energy credit		0	0		-41,845	
	CHP Credit		0	0		0	
		Total	617,329	418,447	-32.2%	376,602	-10.0%
GHG EMISSIONS			tons/yr	tons/yr			
	Direct	Gas-burning	64	49		49	
	Indirect	Grid electricity	249	169		152	
		Total	313	218	**-30.2%**	201	**-7.7%**

CO_2 Emission Factors:

Electricity [1]	808	lb/MWh
Gas [2]	116.4	lb/MMBtu

4.12.2.4 Executive Order 484

EO484 includes a requirement for energy efficiency of 20% below the Massachusetts Building Code. As indicated in Table 4.12.2-2, the Binney Street Building will achieve that requirement when compared to the current, 7th Edition of the Code.

4.12.3 Partial Hospital/Fenwood Inn

The Partial Hospital/Fenwood Inn is a three story building that will be constructed by the Proponent and turned over to the DCAM for occupancy and operation by the DMH. It is being designed to achieve LEED Certified under LEED V2.2

4.12.3.1 Overview of Partial Hospital/Fenwood Inn Cases 1, 2 and 3

Case 1 - Baseline

As with all buildings in the Project, the Base Case is analyzed, in accordance with MEPA Office guidance, based on the current, 7th edition of the Code, and this version of the Code will remain the baseline for all future energy modeling of the Project.

As will be demonstrated, the Partial Hospital/Fenwood Inn is designed to exceed the current Code by a substantial margin in many areas. Thus, even if the Code becomes more restrictive in the future, it is not expected that the Project will to have to change in any significant way.

The primary elements of the building core and shell and HVAC component efficiencies are presented in Table 4.12.3-1 for both the Code building and the proposed building for comparison.

Case 2 - Proposed Project

Case 2 represents the proposed building, including measures incorporated into the building and MEP systems above and beyond those required for code compliance. The proposed Partial Hospital/Fenwood Inn includes the energy efficiency measures indicated in the matrix of options presented in Table 4.12-1 and described in Section 4.12.1. The basic systems of Case 2 are described in HVAC Concept Descriptions in Appendix G.2.

The Partial Hospital/Fenwood Inn is in an early stage of design; nevertheless these measures have been committed to by the Proponent.

Features included in the Partial Hospital/Fenwood Inn design include:

- Building core that complies with the Advanced Buildings Core Performance Guide, New Buildings Institute, July 2007
- High albedo roof
- Room occupancy sensors
- High performance lighting
- Low flow plumbing fixtures
- Energy Star appliances
- High efficiency mechanical equipment

Case 3 – Alternatives with Greater GHG Mitigation

Partial Hospital/Fenwood Inn is a 21,000 sf building that will be occupied by DMH. The Proponent is responsible for the design of the building and the state agency for its operation.

Given the size of the building and the technologies employed in the proposed design, Case 3 examines two additional measures, heat recovery from building ventilation, and purchase of Green Energy, i.e., electricity generated by off-site renewable resources such as solar, wind and biomass.

4.12.3.2 Technologies

The following describes the various technologies that may be applicable to the Partial Hospital/Fenwood Inn and the rationale for their use or non-use. They are organized, similar to Table 4.12-1, into Energy Use Reduction and Energy Generation.

Energy Use Reduction

<u>Orientation</u>

Building footprint is largely constrained by the existing street grid and adjacent buildings. In order to optimize floor plates for maximum construction efficiency, building façades will remain generally parallel to the existing street grid. The existing orientation of the lot boundaries constrains buildings to have the southernmost façade actually be oriented along a line that is approximately NW-SE. The design of the exterior envelope will be evaluated on a façade-by-façade basis (each side of the building) for optimal configuration of glazing areas, opaque wall area, shading devices, overhangs, screens, balconies, operable windows, etc. Such details will not be developed until the detailed design phase of each building, however.

As only the basic characteristics of the envelope performance can be accounted for in this early evaluation stage, no credit has been taken in the building energy modeling for overhangs, balconies, screens, or exterior shading devices.

High Performance Building Envelope

Minimizing the energy intensity of the buildings is an important component of the design process for each building in the MMHC Project. The Proponent is committed to developing an energy-efficient project consistent with economics and the end uses of the space. Two prominent factors in controlling energy use are a building shell that minimizes the energy required to maintain the desired interior conditions and an HVAC system comprised of high efficiency components to maximize the efficiency with which the necessary energy is delivered. The HVAC systems are discussed later in this section.

A high efficiency building shell includes, among other components, greater insulation in the walls and roof and glazing design that combines functionality and high insulating properties. Key building design elements that relate to the energy efficiency of the building envelopes are compared in Table 4.12.3-1. Code values for various parameters are included, where applicable, for comparison.

As indicated, proposed roof, floors, glazing, doors and skylights all exceed Code requirements and comply with the Advanced Buildings Core Performance Guide, New Buildings Institute, July 2007.

High-albedo / Reflective Roofs

High albedo roofing materials will be utilized. Building energy modeling assumed that 80% of the roof will have white reflective surface. Mechanical equipment and equipment access ways are expected to occupy at least 20% of the roof surface. The high albedo roof aids in minimizing summer urban heat island effects.

Table 4.12.3-1 Key Building Parameters, Partial Hospital/Fenwood Inn

		Case 1- Code		Case 2 - Proposed		
Item	**Item Component**	**ASHRAE 90.1-2007**		**Advance Bldg - Core Performance**		**Comments**
		Assembly Max	**Insul. Min R-Value**	**U-Value**	**Insul Min R-Value**	
Roof	Roof Insulation entirely above deck	U-0.048	R-20 ci	**U-0.039**	R-25 ci	
	Metal building	U-0.055	r-13+r-13	U-0.047	R-19+R-13	
	Attic and other	u-0.027	R-38	U-0.027	R-38	
Walls	Mass (HC> 7 Btu/ft2)	u-0.090	R-11.4 ci	U-0.085	R-13	
	Metal building	u-0.069	R-13+R-5.6 ci	U-0.061	R-10+R-13	
	Steel framed	U-0.064	R-13+R-7.5 ci	**U-0.064**	R-13+R-7.5 ci	
	Wood framed and other -	U-0.064	R-13+R-3.8 ci	U-0.064	R-13+R-3.8	
	Below-grade walls	C-0.119	R-7.5 cI	c-0.119	R-7.5 ci	
Floors	Mass	U-0.420	R-1.8 ci	u-0.076	R-10 ci	
	Steel-Joist	U-0.214	R-5.3	**u-0.038**	R-30	
	Wood framed and other	U-0.188	R-5.3	u-0.33	R-30	
Slabs	Unheated	F-1.264	NR	**F-0.54**	R-10	
	Heated	F-1.489	R-2.6 for 600 mm	F-0.58	R-15+R-5	
Doors- Opaque	Swinging	U-3.975		**U-0.37**	u-0.37	
	Non-Swinging	U-2.839		U-0.53	R-4.75	
Vertical glazing including doors	Area (percent of gross wall)	0 - 40%	32%	0-40%	**32%**	
	Non-metal framing	U-0.35		U-0.35		
	Metal framing (curtain wall/storefront)	U-0.45		U-0.45		
	Metal framing (entrance door)	U-0.80		U-0.45		
	Metal Framing (all others)	U-0.55		**U-0.45**		
	Solar Heat Gain Coeffficient (SHGC)	0.40	SC=0.46	0.3	**SC=0.34**	Model Uses SC. SC= SGHC/0.87
	Exterior sun control (s,e,w only)	Not Required		Not Required if SHGC>0.3		For higher SHGC exterior sun control
Skylights (all)	Area (percent of gross roof)	0-2%	2.1%-5%	0-5%	**5**	
	Thermal transmittance	U-3.92	3.92	**u-0.45**		
	Solar Heat Gain Coeffficient (SHGC)	0.49 (SC=.56)	0.39 (SC=.45)	**0.4**	**SC=0.45**	
Interior lighting (Building Area Method)	Interior Lighting power density (LPD)	office	1.0	**office**	**0.9**	
		clinic	1.0	clinic	1.0	
		Lab	1.4	Lab	NA	
Misc. Elec	Plugs and Recepticals	Not Specified		Not Specified		Case 2 assumes energy star equipment and appliances
		office	0.75	**office**	**0.7**	
		clinic	0.75	clinic	0.75	
		Lab	5	Lab	5	
	Elevator Horsepower					
Exterior	Façade and externally illuminated signage	NS				
Occupancy	Occupancy SF/Person	NS	144	NS	144	
HVAC	Package/Split - AC (0-65 kBtuh)	13 - SEER		15.0 SEER / 12.0 EER		
	(>65-135 kBtuh)	10.8 - EER		11.5 EER/11.9 IPLV		
	(>135-240 kBtuh)	10.4 - EER		11.5 EER/11.9 IPLV		
	(>24 0 kBtuh)	9.3 - EER		10.5 EER/ **11.1 - YORK**		
	Gas Boiler <300 MBH	80% AFUE		90% Et		
	300-2500 MBH	80% Et		89% Et		
	>2500 MBH	82% Ec		**89% Et**		
	Gas Steam Boiler >2500 MBH	79% Et		89% Et		
	Air Cooled Chiller<150 Tons	2.80 COP/ 3.05 NPLV		1.2 KW/ton	1.0 - IPLV	
	Centrifugal Chiller<150 Tons	4.45 COP/ 5.20 NPLV		0.610 KW/ton	0.620 - IPLV	
	150-300 Tons	5.55 COP 5.90 NPLV		0.59 KW/ton	0.560 - IPLV	
	>300 tons	6.10 COP 6.40 NPLV		0.57 KW/ton	0.510 - IPLV	
	> 600 tons	NS		0.55 KW/ton	0.510 - IPLV	
	Enthalpy Energy Recovery	> 70% outside air		NS		
Economizer	Air conditioners & heat pumps- SP	required		**required**		
Ventilation	Outdoor air damper	>300 cfm				
	Demand control	NS				
Ducts	Friction rate	NS -0.10w wc/100ft				
	Sealing	Seal Class C				
Service Water Heating	Gas storage (>75 kbtuh)	80% Et				
	Instananeous	?				
	Electric storage (S 12 kW and >20 gal)	EF >0.93 - 0.000132xVol				
	Pipe insulation (d < 1 1/2 in./ d >= 1 1/2".)	?				

BOLD - indicates the actual values used.
NS - Not Specified

Exterior Shading Devices

No exterior shading devices are planned for this building.

Low Resistance Circuiting

Low resistance circuiting uses lower wire gauges (i.e. thicker wires) than those required by the electrical code to conduct electricity. This has the effect of reducing the power lost, in the form of heat, due to the internal resistance of the wire, and decreasing air conditioning load.

LRC will not be utilized in the Partial Hospital/Fenwood Inn where the limited electrical runs (lengths of wiring) and loads minimize the losses so that heat contribution to building HVAC is negligible; therefore, there is very little benefit to using LRC in this small building.

Radiant Heat – Lobbies

As with the Binney Street Building, the ground floor lobby of the Partial Hospital/Fenwood Inn building is considered to be too small to be a suitable candidate for economical radiant heat application.

Heat Recovery

The heat recovery system for the Partial Hospital/Fenwood Inn is evaluated in Case 3.

Hybrid Ventilation

Hybrid ventilation (combination of natural and mechanically induced ventilation that may be used separately or in concert, depending on ambient conditions) is not functionally appropriate to the Partial Hospital/Fenwood Inn.

Room Occupancy Sensor

Sensors adjust the heating/cooling set point when rooms are unoccupied, thereby reducing the energy spent on heating/cooling unoccupied or vacant rooms.

These sensors are not appropriate technology for office (clinical) spaces, which tend to be continuously occupied during working hours. Sensors also turn off the artificial lights when a space is unoccupied.

Occupancy sensors are proposed for the Fenwood Inn areas of the Partial Hospital/Fenwood Inn.

Daylighting and Daylight Harvesting

Daylight harvesting is the design of the interior in a manner that allows natural light to penetrate deeply into the building interior; this strategy complements natural lighting. Space layout maximizes regularly occupied spaces along exterior walls to provide views and daylight to these spaces first. Perimeter offices are currently designed with 10' ceilings, use of clerestory glass to corridor, interior spaces will receive daylight.

High Performance Lighting

High-performance lighting (lower wattage per square foot than the Code minimum requirement) is proposed in all buildings. This would consist of a lighting design which would result in approximately 90% of the Code-allowed installed lighting power density, reducing the amount of electricity consumed by the lighting system and the corresponding energy used by the HVAC system to remove the heat generated by the lights. Lower lighting power levels will be achieved by use of fluorescent and/or LED lighting fixtures and bulbs.

Low Flow Fixtures

Several features of the Partial Hospital/Fenwood Inn will reduce water consumption, in turn reducing wastewater generation. Such reductions reduce indirect GHG emissions by reducing the MWRA's water pumping and wastewater treatment energy requirements. Only credit for low-flow fixtures has been included in the energy modeling.

The Partial Hospital/Fenwood Inn will achieve the LEED prerequisite of an overall 20% reduction compared to the baseline EPAct case. Reductions will be realized through the selection and installation of advanced low-flow toilets, dual-flush toilets, high-efficiency urinals, and low-flow faucets and lavatories.

Energy-Star Appliances

Energy Star appliances utilize less energy than other models of the same appliances. Building energy modeling in Case 2 assumes that the state agency tenant will utilize Energy Star appliances, computers, etc and is reflected in a reduced plug and receptacle load (Table 4.12.3-1).

Advanced Energy Efficient Elevators

This technology is most cost-effective in high-rise elevators, typically greater than 100 feet in height, and has not been considered for the Partial Hospital/Fenwood Inn.

Energy Generation

High Efficiency Mechanical Equipment

High efficiency HVAC systems are a combination of energy use reduction and energy generation technologies and include use of high efficiency boilers and air-cooled condensing units, premium electric motors, and incorporating variable frequency drive motors on hot water pumping systems and air handling fans, above and beyond the requirements of the Code, where practical. Table 4.12.3-1 indicates proposed AC equipment with Energy Efficiency Ratings, and boilers with high thermal efficiencies, much better than Code and state-of-the-art for equipment of that size and type.

Cogeneration & Micro-CHP

To be economical, cogeneration requires a sustained (i.e., nearly 24/7) electrical demand and a sustained and substantial hot water demand. The Partial Hospital/Fenwood Inn, as a combination office (clinical) and transitional housing building, does not have these characteristics.

Solar Energy

The Partial Hospital/Fenwood Inn has some high rise buildings that shadow its roof part of the time. Therefore, neither photovoltaic electricity generation nor solar hot water generation would be efficient technologies. Furthermore, the available roof area is limited due to skylights and mechanical equipment. There may not be a large enough continuous area to install a cost-effective system at scale.

Green Energy

Massachusetts utilities offer options that allow the customer to purchase all or part of its electricity requirements from renewable energy sources. As the Partial Hospital/Fenwood Inn will be operated by DMH, the Proponent cannot control how electricity will be purchased. However, the impact on GHG emissions from purchase of a nominal 10% of the building's electricity needs as Green Energy has been examined as a Case 3 alternative.

4.12.3.3 Building Energy Modeling

Three cases were analyzed, in accordance with the Policy, as described in Section 4.12.3.1. As for the Binney Street Building, building energy modeling for the Partial Hospital/Fenwood Inn was conducted by Fitzemeyer-Tocci, using the Trane Trace 700 model.

Results of Cases 1 and 2 modeling of the Partial Hospital/Fenwood Inn are summarized in Table 4.12.3-2.

The energy efficiency technologies employed in the proposed design will result in a 28% decrease in natural gas use and 22% decrease in electricity use, resulting in a 23% decrease in GHG emissions compared to a Code-compliant building. This excludes the technologies identified in Section 4.12.1 that have not been quantified for this analysis.

Heat recovery yields a 24% decrease in natural gas use, but a 1% increase in electricity use, resulting in only a 3 ton/year decrease in GHG emissions over the proposed case. The estimated capital payback for the energy recovery system is approximately five years. However, before committing to this technology, the Proponent will need to consider factors such as equipment location on the roof, maintenance costs, and system life expectancy. This will be done during the detailed design phase.

Purchase of 10% of the building's electricity use from Green Energy sources, should DMH elect to do so, could reduce GHG emissions approximately five tons/year, or an additional 7% from the proposed case.

Each of the above Case 3 analyses are independent of the others; i.e., they show the impact of each technologies as if the others were absent. The potential benefits are not directly additive if more than one technology were considered.

4.12.3.4 Executive Order 484

EO484 includes a requirement for energy efficiency of 20% below the Massachusetts Building Code. As indicated in Table 4.12.3-2, the Partial Hospital/Fenwood Inn will exceed that requirement when compared to the current, 7th Edition of the Code.

Table 4.12.3-2 Modeling Results – Partial Hospital/Fenwood Inn

	Case 1 Baseline	Case 2 Proposed	1-->2 Change	Case 3A Energy Recovery	2-->3A Change	Case 3B 10% Green Energy	2-->3B Change
DIRECT (NATURAL GAS)	MMBtu/yr	MMBtu/yr		MMBtu/yr		MMBtu/yr	
Space Heating	518	371		280		371	
Domestic Hot Water	incl in space heating aboveabove						
Cogen Plant Heating Credit							
Cogen Plant Fuel Input							
Total	518	371	-28%	280	-24%	371	0%
INDIRECT (ELECTRICITY)	kWh/yr	kWh/yr		kWh/yr		kWh/yr	
Space heating	5,598	3,986		3,341		3,986	
Space Cooling	50,615	19,549		20,311		19,549	
Cooling Tower (Heat Rejection)	2,814	2,902		3,019		2,902	
Ventilation and Fans	46,688	11,723		14,801		11,723	
Pumps & Auxilary	0	0		0		0	
Misc. Equipment (plug-in)	58,558	54,631		58,148		54,631	
Area Lighting	37,866	34,086		34,086		34,086	
Water/wastewater trtmt	1,306	1,045		1,045		1,045	
Green electricity credit	0	0		0		-12,792	
Cogen Credit							
Total	203,445	127,921	-37%	134,749	5%	115,128	-10%
GHG EMISSIONS	tons/yr	tons/yr		tons/yr		tons/yr	
Direct - Gas-burning	30	22		16		22	
Indirect - Imported Electricity	82	52		54		47	
Total	112	73	**-35%**	71	**-3%**	68	**-7%**

CO_2 Emission Factors:

Electricity [1]	808	lb/MWh
Gas [2]	116.4	lb/MMBtu

4.12.4 Brigham and Women's Building

The Brigham and Women's Building is a 15-story building that will be approximately half clinical space and half laboratory space. It will be constructed, owned and operated by the Brigham and Women's Hospital. It is being designed targeting LEED Silver Certification.

The design/construction schedule for this building is considerably in the future, with commissioning estimated to occur about 2021. Building design is in the earliest conceptual stage.

4.12.4.1 Overview of Brigham and Women's Building Cases 1, 2 and 3

Case 1 - Baseline

As with all buildings in the Project, the Base Case is analyzed, in accordance with MEPA Office guidance, based on the current, 7th edition of the Code, and this version of the Code will remain the baseline for all future energy modeling of the Project.

As will be demonstrated, the Brigham and Women's Building is designed to exceed the current Code by a substantial margin in many areas. Thus, even if the Code becomes more restrictive in the future, it is not expected that the Project will to have to change in any significant way.

The primary elements of the building core and shell and HVAC component efficiencies are presented in Table 4.12.4-1 for both the Code building and the proposed building for comparison.

Case 2 - Proposed Project

The Brigham and Women's Building, for which construction is not anticipated for almost a decade, is in the earliest stage of conceptual design. Nevertheless, certain technologies have been incorporated in that concept and are committed to by the Proponent. Case 2 represents the proposed building, including measures incorporated into the building and MEP systems above and beyond those required for code compliance. The Brigham and Women's Building includes the energy efficiency measures indicated in the matrix of options presented in Table 4.12-1 and described in Section 4.12.1. The basic systems of Case 2 are described in HVAC Concept Descriptions in Appendix G.2.

Features included in the Brigham and Women's Building design include:

- Advanced building core
- High albedo roof
- Heat recovery from ventilation exhaust

- Room occupancy sensors in non-laboratory areas
- High performance lighting
- Low flow plumbing fixtures
- High efficiency mechanical equipment
- Advanced energy-efficient elevators

Case 3 – Alternatives with Greater GHG Mitigation

Case 3 examines four additional measures, a higher degree of building insulation, reduced air changes in laboratory spaces, cogeneration and purchase of Green Energy.

4.12.4.2 Technologies

The following describes the various technologies that may be applicable to the Brigham and Women's Building and the rational for their feasibility. They are organized, similar to Table 4.12-1, into Energy Use Reduction and Energy Generation.

Energy Use Reduction

<u>Orientation</u>

Building footprint is largely constrained by the existing street grid and adjacent buildings. In order to optimize floor plates for maximum construction efficiency, building façades will remain generally parallel to the existing street grid. The existing orientation of the lot boundaries constrains the building to have the southernmost façade actually be oriented along a line that is approximately Northwest-Southeast. The design of the exterior envelope will be evaluated on a façade-by-façade basis (each side of the building) for optimal configuration of glazing areas, opaque wall area, shading devices, overhangs, screens, balconies, operable windows, etc. However, such details will not be developed until the detailed design phase of the building.

As only the basic characteristics of the envelope performance can be accounted for in this early evaluation stage, no credit has been taken in the building energy modeling for overhangs, balconies, screens, or exterior shading devices.

<u>High Performance Building Envelope</u>

Minimizing the energy intensity of the buildings is an important component of the design process for each building in the MMHC Project. The Proponent is committed to developing an energy-efficient project consistent with economics and the end uses of the space. Two prominent factors in controlling energy use are a building shell that minimizes the energy required to maintain the desired interior conditions and an HVAC system comprised of high efficiency components to maximize the efficiency with which the necessary energy is delivered. The HVAC systems are discussed later in this section.

A high efficiency building shell includes, among other components, greater insulation and glazing design that combines functionality and high insulating properties. Key building design elements that relate to the energy efficiency of the building envelopes are compared in Table 4.12.4-1. Code values for various parameters are included, where applicable, for comparison.

As indicated, proposed roof, floors, glazing, doors and skylights all exceed Code requirements. Although the Advanced Building Core Performance Guide is specifically for buildings less than 70,000 sf, it can be used for larger buildings and has been applied to the Brigham and Women's Building.

Green Roof

A green roof, wherein soil and vegetation add to insulating values, is under consideration for the podium portion of the Brigham and Women's Building because it is visible from the adjacent existing and proposed residential mid-rises and because it will significantly reduce the peak flow storm drain load and the air conditioning load.

High-albedo / Reflective Roofs

High albedo roofing materials will be utilized. Building energy modeling assumed that 85% of the roof will have white reflective surface. Mechanical equipment and equipment access ways are expected to occupy at least 60% of the roof surface. The high albedo roof aids in minimizing summer urban heat island effects.

Exterior Shading Devices

Exterior shading devices will be considered during the detailed design phase of the building.

Table 4.12.4-1 Key Building Factors, Brigham and Women's Building

Zone 5		Case 1- Code		Case 2 - Proposed		
Item	**Item Component**	**ASHRAE 90.1-2007**		**Adv Bldg - Core Performance**		**Comments**
		Assembly Max	**Insul. Min R-Value**	**U-Value**	**Insul Min R-Value**	
Roof	Roof Insulation entirely above deck	U-0.048	R-20 ci	**U-0.039**	R-25 ci	
	Metal building	U-0.055	r-13+r-13	U-0.047	R-19+R-13	
	Attic and other	u-0.027	R-38	U-0.027	R-38	
Walls	Mass (HC> 7 Btu/ft2)	u-0.090	R-11.4 ci	U-0.085	R-13	
	Metal building	u-0.069	R-13+R-5.6 ci	U-0.061	R-10+R-13	
	Steel framed	U-0.064	R-13+R-7.5 ci	**U-0.064**	R-13+R-7.5 ci	
	Wood framed and other -	U-0.064	R-13+R-3.8 ci	U-0.064	R-13+R-3.8	
	Below-grade walls	C-0.119	R-7.5 cl	c-0.119	R-7.5 ci	
Floors	Mass	U-0.420	R-1.8 ci	u-0.076	R-10 ci	
	Steel-Joist	U-0.214	R-5.3	**u-0.038**	R-30	
	Wood framed and other	U-0.188	R-5.3	u-0.33	R-30	
Slabs	Unheated	F-1.264	NR	**F-0.54**	R-10	
	Heated	F-1.489	R-2.6 for 600 mm	F-0.58	R-15+R-5	
Doors- Opaque	Swinging	U-3.975		**U-0.37**	u-0.37	
	Non-Swinging	U-2.839		U-0.53	R-4.75	
Vertical glazing including doors	Area (percent of gross wall)	0 - 40%	27%	0-40%	**27%**	
	Non-metal framing	U-0.35		U-0.35		
	Metal framing (curtain wall/storefront)	U-0.45		U-0.45		
	Metal framing (entrance door)	U-0.80		U-0.45		
	Metal Framing (all others)	U-0.55		**U-0.45**		
	Solar Heat Gain Coeffficient (SHGC)	0.40	SC=0.46	0,3	**SC=0.34**	Model Uses SC. SC= SGHC/0.87
	Exterior sun control (s,e,w only)	Not Required		Not Required if SHGC>0.3		For higher SHGC exterior sun control
Skylights (all)	Area (percent of gross roof)	0-2%	2.1%-5%	0-5%	**0**	
	Thermal transmittance	U-3.92	3.92	**u-0.45**		
	Solar Heat Gain Coeffficient (SHGC)	0.49 (SC=.56)	0.39 (SC=.45)	**0.4**	**SC=0.45**	
Interior lighting (Building Area Method)	Interior Lighting power density (LPD)	office	1.0	office	0.9	
		clinic	1.0	clinic	1.0	
		Lab	1.4	**Lab**	**1.3**	
Misc. Elec	Plugs and Recepticals	Not Specified		Not Specified		
		office	0.75	office	0.75	
		clinic	0.75	clinic	**0.75**	
		Lab	5	Lab	**5**	
	Elevator Horsepower					
Exterior	Façade and externally illuminated signage	NS				
Occupancy	Occupancy SF/Person	NS	144	NS	144	
HVAC	Package/Split - AC (0-65 kBtuh)	13 - SEER		15.0 SEER / 12.0 EER		
	(>65-135 kBtuh)	10.8 - EER		11.5 EER/11.9 IPLV		
	(>135-240 kBtuh)	10.4 - EER		11.5 EER/11.9 IPLV		
	(>24 0 kBtuh)	9.3 - EER		10.5 EER/ 11,1 - YORK		
	Gas Boiler <300 MBH	80% AFUE		90% Et		
	300-2500 MBH	80% Et		89% Et		
	>2500 MBH	82% Ec		**89% Et**		
	Gas Steam Boiler >2500 MBH	79% Et		89% Et		
	Air Cooled Chiller<150 Tons	2.80 COP/ 3.05 NPLV		1.2 KW/ton	1.0 - IPLV	
	Centrifugal Chiller<150 Tons	4.45 COP/ 5.20 NPLV		0.610 KW/ton	0.620 - IPLV	
	150-300 Tons	5.55 COP 5.90 NPLV		0.59 KW/ton	0.560 - IPLV	
	>300 tons	6.10 COP 6.40 NPLV		0.57 KW/ton	0.510 - IPLV	
	> 600 tons	NS		**0.525 KW/ton**	**0.510 - IPLV**	**York Chiller 0.525 kW/ton used in model**
	Enthalpy Energy Recovery	> 70% outside air		NS		
Economizer	Air conditioners & heat pumps- SP	required		required		
Ventilation	Outdoor air damper	>300 cfm				
	Demand control	NS				
Ducts	Friction rate	NS -0.10w wc/100ft				
	Sealing	Seal Class C				
Service Water Heating	Gas storage (>75 kbtuh)	80% Et				
	Instananeous	?				
	Electric storage (S 12 kW and >20 gal)	EF >0.93 - 0.000132xVol				
	Pipe insulation (d < 1 1/2 in./ d >= 1 1/2".)	?				

BOLD - indicates the actual values used.
NS - Not Specified

Low Resistance Circuiting

Low resistance circuiting uses lower wire gauges (i.e. thicker wires) than those required by the electrical code to conduct electricity. This has the effect of reducing the power lost, in the form of heat, due to the internal resistance of the wire, and decreasing air conditioning load.

LRC will be studied for the Brigham and Women's Building during detailed design. A large part of the cost-effectiveness of LRC is dependent upon materials prices, particularly copper, which can, and has, fluctuated considerably over the years. Therefore, pricing at the time of construction must be taken into account.

Radiant Heat – Lobbies

Radiant heat may have some potential application in the Brigham and Women's Building area depending upon the size and layout of lobby areas. It will be examined during later design phases.

Heat Recovery

Heat recovery from the building ventilation exhaust is incorporated into the Brigham and Women's Building design. The large fraction of building that will be devoted to laboratory use, and the attendant laboratory ventilation hoods, results in a high ventilation rate, thus justifying the additional equipment required for heat recovery.

Reduced Air Changes

As noted above, laboratory spaces typically have much greater ventilation rates than clinical spaces. A large fraction of the building's energy use, as indicated in the modeling presented in Table 4.12.4-2, is due to ventilation requirements. Water use for humidification is also significantly affected by this high ventilation rate.

The premise is that most laboratory spaces have their variable air volume minimums set at six air changes per hour (ACPH) with a peak ACPH driven by thermal demand. By reducing air changes in such spaces to the minimum necessary to safely operate lab hoods, fan power for moving air to/from those spaces is reduced, saving energy.

Studies are ongoing in Boston area hospitals that may lead to optimization of ventilation in such spaces. Typically fume hood air flow tracking systems have been reported to achieve a 20% flow reduction. Pilot programs using the technology developed by Aircuity™ of Newton, MA have successfully reduced occupied air change rates from six to four air changes per hour in occupied space and in unoccupied space to two. Actual savings, however, have not been fully defined because of measurement and verification issues on the first installations. BWH is participating in those studies and will carefully examine the results, as they become available, and apply those results to the detailed design of the ventilation system.

The potential energy and GHG emissions savings are estimated in Case 3 for a nominal 15% reduction in lab hood air flow. Approval for use, and system optimization, must await both further testing and the detailed design phase for the building.

Hybrid Ventilation

Hybrid ventilation (combination of natural and mechanically induced ventilation that may be used separately or in concert, depending on ambient conditions) is not functionally appropriate to the Brigham and Women's Building.

Room Occupancy Sensor

Room occupancy sensors adjust the heating/cooling set point when rooms are unoccupied, thereby reducing the energy spent on heating/cooling unoccupied or vacant rooms. Sensors also turn off the artificial lights when a space is unoccupied. Occupancy sensors are proposed for the non-laboratory spaces of the Brigham and Women's Building.

Daylighting and Daylight Harvesting

Daylight harvesting is the design of the interior in a manner that allows natural light to penetrate deeply into the building interior; this strategy compliments natural lighting. Building layout will be designed to maximize regularly occupied spaces along the exterior to provide views and daylighting. High ceilings at exterior spaces and clerestory glass at walls allows daylight to reach interior spaces.

High Performance Lighting

High-performance lighting (lower wattage per square foot than the Code minimum requirement) is proposed in all buildings. This would consist of a lighting design which would result in approximately 90% of the Code-allowed installed lighting power density, reducing the amount of electricity consumed by the lighting system and the corresponding energy used by the HVAC system to remove the heat generated by the lights. Lower lighting power levels will be achieved by use of fluorescent and/or LED lighting fixtures and bulbs.

Low Flow Fixtures

Several features of the Brigham and Women's Building will reduce water consumption, in turn reducing wastewater generation. Such reductions reduce indirect GHG emissions by reducing the MWRA's water pumping and wastewater treatment energy requirements. Only credit for low-flow fixtures has been included in the energy modeling.

The building is anticipated to be registered under the LEED 2009 rating system, or a later version, from the US Green Building Council. One of the pre-requisites in the LEED 2009 rating system is a mandatory 20% reduction of potable water consumption in plumbing fixtures compared to a modified EPAct baseline.

The Brigham and Women's Building will meet the LEED prerequisite of an overall 20% reduction compared to the baseline EPAct case. Reductions will be realized through the selection and installation of advanced low-flow toilets, dual-flush toilets, high-efficiency urinals, and low-flow faucets and lavatories.

During detailed design, the Proponent will target a 30% reduction, though only 20% can be committed to at this time.

Energy-Star Appliances

Energy Star appliances utilize less energy than other models of the same appliances. However, the types of equipment utilized in a clinical/laboratory building are not part of the Energy-Star rating system. The commercial and special-purpose appliances utilized in the Brigham and Women's Building are high efficiency equipment. Where smaller, residential- or office-type equipment are utilized, such as refrigerators in employee lounges, Energy-Star equipment will be selected.

Variable Speed Parking Garage Ventilation Fans

The fans for the parking garage will be controlled by CO detectors placed strategically within the garage. This control is expected to reduce fan energy requirements by approximately 40%.

Advanced Energy Efficient Elevators

The energy consumption of the elevator systems is a component of the base building electrical load, but does not necessarily constitute a significant proportion of overall building energy consumption. However, given the comprehensive approach to energy savings being implemented in the Project, a preliminary analysis was done to evaluate the potential for electricity savings through the use of advanced belt-drive elevators with regenerative braking technologies. Manufacturer websites claim savings of up to 80% compared to traditional geared elevator systems. If traditional elevators are duty-rated at 75-100kW, and are in use the equivalent of several hours per day, the potential for electricity savings when aggregated can be significant.

This technology is most cost-effective in high-rise elevators, typically greater than 100 feet in height.

The Brigham and Women's Building will likely have more than six elevators over 100 feet tall that are expected to utilize this advanced technology. Assuming an aggregated use of 12 hours per day at 80 kW, operating load could lead to electrical consumption of 2.1 million kWh/yr for conventional elevators. Advanced elevators might reduce electricity consumption due to elevator use by approximately 80%, then indirect GHG emissions could be reduced by approximately 700 tons/year.

Energy Generation

High Efficiency Mechanical Equipment

High efficiency HVAC systems are a combination of energy use reduction and energy generation technologies and include use of high efficiency boilers and chillers, premium electric motors, and incorporating variable frequency drive motors, variable flow hot water, chilled water, supply air, and exhaust systems will be utilized above and beyond the requirements of the Code, where practical. Table 4.12.3-1 indicates proposed AC equipment with Energy Efficiency Ratings, and boilers with high thermal efficiencies, much better than Code and state-of-the-art for equipment of that size and type.

Cogeneration

Cogeneration could satisfy some of the site's power and heat needs while reducing the associated carbon-dioxide emissions. Standard grid-connected power plants operate at approximately 30 to 55% efficiency. Because cogeneration can use waste heat to provide steam and/or hot water for building heating, equipment sterilization, domestic hot water, and other uses, it can generate power and heat at 70% or greater efficiency. The Proponent does not consider the efficiency and reliability of absorption chillers to be adequate for utilization in the hospital environment, and so chilled water production from waste heat has not been examined.

Cogeneration, or combined heat and power, could take various forms at the Brigham and Women's Building involving off-site and/or on-site resources.

Currently, Brigham and Women's Hospital obtains steam and chilled water from the nearby Medical Area Total Energy Plant. Although MATEP is a cogeneration plant, Brigham and Women's Hospital does not buy electricity from MATEP; its electricity is supplied by a separate bulk power supplier and is delivered via a nearby NStar substation. The Proponent understands that MATEP does not currently have the additional capacity to provide the new Brigham and Women's Building with chilled water, and its excess steam capacity is not certain. Given that detailed design and construction of the Brigham and Women's Building is several years in the future, it cannot be predicted what the future status of MATEP will be. The Proponent will monitor this energy source and if, in the future, it becomes technically feasible and economically attractive to utilize MATEP for some or all of the energy for this new building, BWH may choose to do so. At the current time, however, the conceptual design (as reflected in Case 2) is for steam and chilled water to be produced onsite with high-efficiency equipment and for electricity to be purchased via the grid.

With a moderate base loads for electricity, steam and hot water, the Brigham and Women's Building may be a candidate for its own CHP plant. Although it is too early in design to predict diurnal and weekly cycle demands for these energy sources in order to properly size and evaluate a CHP plant, a nominal CHP plant sized to meet the approximate base load electrical requirements of the building is examined in Case 3.

Small quantities of steam needed for sterilization and humidification are expected to be imported from the steam supplied by MATEP via the existing BWH Shapiro Building. This quantity is small and has not been included in the building energy modeling.

Photovoltaics (PV)

PV systems are developing in two general types, roof-top and façade.

Roof-top

The traditional PV installation on a building is an array of collectors mounted on a flat or sloped roof, angled to face south and with appropriate slope. Given the design of the Brigham and Women's Building, the cooling towers, MEP equipment, emergency generators and elevator penthouses and ventilation exhausts will occupy the majority of the tower rooftop area. Additional area will be required for access ways to these equipment, and some of the remaining rooftop area will be at least partially shadowed by this equipment. The area remaining that might be available for a PV array is expected to be very small. Any PV installation would be expected to only be able to offset a very small fraction of yearly electrical demand.

The actual degree to which rooftop equipment might be located so as to provide unshaded space for PV panels requires considerable design development and cannot be determined at this stage of design. Hence, the capability to utilize rooftop PV must be left to later stages of design.

Façade

Façade PV, where the PV collectors are an integral portion of the upper levels of the building's vertical surfaces, is a technology that is in its earliest stages of commercial deployment. A few showcase installations with ideal orientation and exposure have been planned or implemented, but the costs of the technology today have been reported to be considerably higher than conventional PV installations. Furthermore, as described earlier, the orientation of the building follows the street grid, so an ideal south-facing façade does not exist. While this technology cannot be excluded from consideration, it is premature to be evaluated at this time.

PV Economics

The cost of PV panels, the major component of a PV system, is very high in comparison to other common generating technologies. Although prices have fallen recently, some financial analysts believe that this may be a temporary condition caused by the recessionary impact on demand at a time when PV suppliers had built manufacturing capacity in expectation of a boom in PV utilization. Nevertheless, PV remains an expensive capital component even at currently depressed prices.

The economics of PV, both roof-top and façade, are greatly influenced by available state and federal incentive programs. It is not possible to project what incentives will be available when the Brigham and Women's Building goes into detailed design phase several years into the future. For example, the current Commonwealth Solar program, which provides both capital and operating subsidies for PV systems, is expected to be replaced by a market-driven PV set-aside program within the MA Renewable Portfolio Standard. Regulations for such a program are in their early development stage at this time. Therefore, no relevant economic analysis is feasible at this time.

The Proponent is aware that the technology may advance in the coming decade and the cost structure may change radically. Although it cannot evaluate the technical and economic feasibility of its application at this time, the Brigham and Women's Building will be designed and constructed PV-ready so as not to preclude PV from future application. PV-ready means that the available roof area will be structurally capable of accepting the additional loads imposed by a PV array, inverter space is reserved, conduit space is reserved for future interconnection of the array to the building's electrical system and sufficient excess interconnection points within the building's distribution system are provided.

Third party PV installations have recently become commercially available and may be more commonplace in the future. In such an arrangement, a PV company may build, own and operate a PV array and system at a host facility, such as the Brigham and Women's Building, and sell the electricity produced to the host under a long term power purchase agreement. If this business arrangement continues to develop during the next decade, the Proponent would consider, amongst its other alternatives, hosting such a third party PV system, providing appropriate terms and commercial arrangements could be negotiated.

Green Energy

Massachusetts utilities offer options that allow the customer to purchase all or part of its electricity requirements from renewable energy sources. The Proponent cannot predict energy prices well into the future, but will include future examination of Green Energy as a potential option. The impact on GHG emissions from purchase of a nominal 10% of the building's electricity needs as Green Energy has been examined as a Case 3 alternative. This impact could vary considerably with other energy choices; e.g., if CHP were included in the final design.

4.12.4.3 Building Energy Modeling

Three cases, including three parts in Case 3, were analyzed, in accordance with the Policy, as described in Section 4.12.4.1. As for the Binney Street Building and Partial Hospital/Fenwood Inn, building energy modeling for the Brigham and Women's Building was conducted by Fitzemeyer-Tocci, using the Trane Trace 700 model.

Proposed

Results of Cases 1 and 2 modeling of the Brigham and Women's Building are summarized in Table 4.12.4-2. The energy efficiency technologies employed in the proposed design will result in a 5% decrease in natural gas use and 11% decrease in electricity use, resulting in approximately a 2,000 ton/year, 9% decrease in GHG emissions compared to a Code-compliant building. This excludes the technologies identified in Section 4.12.1 that have not been quantified for this analysis. It is expected that the building as finally designed will improve on these values substantially by the adoption of one or more additional mitigation technologies. However, specific additional technologies cannot be committed to at this early stage.

Case 3A – Low Flow Lab Hoods

Due to the large volume of laboratory space and its attendant ventilation requirements, low flow lab hoods have can have a substantial impact on energy use. Low flow laboratory vent hoods with an assumed 15% reduction in flow yields a 37% decrease in natural gas use compared to the proposed design, offset partially by an 11% increase in electricity use, for a nearly 17% (3,300 ton/yr) decrease in GHG emissions over the proposed case.

Table 4.12.4-2 Modeling Results – Brigham and Women's Building

	Case 1	Case 2	1-->2	Case 3A	2-->3A	Case 3B	2-->3B	Case 3C	2-->3C
	Baseline	Proposed	Change	Reduced ventilation, Low-flow lab hoods	Change	CHP	Change	10% Green Energy	Change
DIRECT (NATURAL GAS)	MMBtu/yr	MMBtu/yr		MMBtu/yr		MMBtu/yr		MMBtu/yr	
Space Heating & domestic HW	80,066	75,809		47,473		75,809		75,809	
Space Cooling	0	0		0		0		0	
CHP heating credit	na	na		na		-42,457		na	
CHP plant fuel Input	na	na		na		88,206		na	
Total	80,066	75,809	-5%	47,473	-37%	121,559	60%	75,809	0%
INDIRECT (ELECTRICITY)	kWh/yr	kWh/yr		kWh/yr				kWh/yr	
Space heating	425,234	414,947		344,988		414,947		414,947	
Space Cooling	3,813,072	2,324,560		1,914,566		2,324,560		2,324,560	
Cooling Tower (Heat Rejection)	1,380,627	1,203,664		1,004,426		1,203,664		1,203,664	
Ventilation and Fans	11,680,305	12,387,192		9,220,487		12,387,192		12,387,192	
Pumps & Auxilary	2,328,722	1,378,869		1,149,297		1,378,869		1,378,869	
Misc. Equipment (plug-in)	13,595,164	13,595,164		13,595,164		13,595,164		13,595,164	
Area Lighting	4,379,631	4,066,794		4,066,794		4,066,794		4,066,794	
Water/wastewater	8,546	7,684		6,663		7,374		7,684	
Pkg garage fans	930,601	558,360		558,360		558,360		558,360	
Elevators	2,102,400	394,200		394,200		394,200		394,200	
Green electricity credit	0	0		0		0		-3,632,375	
CHP Credit	na	na		na		-7,861,531		na	
Total	40,644,302	36,331,434	-11%	32,254,944	-11%	28,469,593	-22%	32,699,059	-10%
GHG EMISSIONS	tons/yr	tons/yr		tons/yr		tons/yr		tons/yr	
Direct - Gas-burning	4,660	4,412		2,763		7,075		4,412	
Indirect - Grid Electricity	16,420	14,678		13,031		11,502		13,210	
Total	21,080	19,090	**-9%**	15,794	**-17%**	18,576	**-3%**	17,623	**-8%**

CO_2 Emission Factors:

Electricity[1]	808	lb/MWh
Gas[2]	116.4	lb/MMBtu

[1] ISO-NE 2006 Marginal Emissions Rate Analysis, Table 5.12, 2006 value

[2] Conversions, Emissions Factors, and Other Reference Data, U. S. EPA, Novenbver 2004

[3] Conversion factors for water/wastewater to MWRA energy use, from DOER

0.2	kWh/kgal water
1.3	kWh/kgal wastewater

Case 3B – Combined Heat & Power

The CHP unit evaluated assumed a Wakesha 925 kW gas-fired engine-generator with waste heat recovery, which is representative of the type of equipment commercially available with the performance needed for the Brigham and Women's Building. The CHP unit was sized to meet the base-load electrical needs of the building so that it would be expected to operate essentially 24/7 at full load. The CHP unit's performance was calculated outside of the building energy model and taken as credits and debits in Table 4.12.4-2. The calculation is included in Appendix G.3. Overall thermal efficiency is expected to be approximately 79%.

The CHP examined would increase natural gas utilization approximately 60% but decrease electricity import by almost 8 million kWh/yr, or 22%, resulting in a modest approximately 3%, or 500 ton/yr, reduction in GHG emissions.

This is a very preliminary analysis; optimization of a CHP unit can only be done when the building's design and use plans are further along. Nevertheless, it indicates that, while there is potential for GHG emissions mitigation, evaluating the potential for a small CHP is complex and the benefits are dependent on a number of variables. Small CHP units, while having the advantage of recovering thermal energy, are quite inefficient in the generation of electricity. The unit examined, for instance, has a net heat rate of more than 11,000 Btu/kWh, compared to approximately 7,700 Btu/hr for grid-generated electricity. This differential decays the advantage gained by of thermal capture. With only a small impact on GHG emissions, the potential for CHP must rely on detailed technical and economic analysis later in the building's development.

Case 3C – Green Energy

Purchase of 10% of the building's electricity use from Green Energy sources could reduce GHG emissions almost 1,500 tons/yr, or an additional 8%, from the proposed case. The feasibility of this option will depend on the relative price of Green Energy a decade in the future, and upon what other mitigation technologies are adopted in the final design.

Each of the above Case 3 analyses are independent of the others; i.e., they show the impact of each technology as if the others were absent. The potential benefits of these technologies are not directly additive if more than one technology were applied.

4.12.4.4 Executive Order 484

See Section 4.11.

4.12.4.5 U.S. DOE EnergySmart Hospitals Program

The Brigham and Women's Building includes laboratory and clinical space. The DOE Energy Smart Hospital Program is generally not suitable for the variety and intensity of BWH uses or the interplay between these uses needed for a teaching hospital.

4.12.5 Residential Building

The Residential Building is 15-stories that will be approximately half affordable apartments and half condominiums. It will be constructed, owned and operated by the Proponent and be subsidized from City, Commonwealth and Federal sources. It will be designed to be LEED Certifiable with the possibility of being LEED Silver Certifiable.

The design/construction schedule for this building is several years in the future, depending upon the economy and availability of funds from subsidies from the Commonwealth and federal governments. Building design is in the conceptual stage.

Because construction and operation of this building will be substantially subsidized by government agencies, the Proponent is, in many cases, unable to commit to capital-intensive GHG mitigation strategies without the concurrence of those agencies. This process is normally worked out in the latter design stages for the building. In addition, the future and uncertain schedule for building design and construction add economic uncertainty to any technology evaluation. Therefore, some technologies are designated as "future study" or are preliminarily examined in Case 3.

4.12.5.1 Overview of Residential Building Cases 1, 2 and 3

Case 1 - Baseline

As with all buildings in the Project, the Base Case is analyzed, in accordance with MEPA Office guidance, based on the current, 7th edition of the Code, and this version of the Code will remain the baseline for all future energy modeling of the Project.

As will be demonstrated, the Residential Building is designed to exceed the current Code by a substantial margin in many areas. Thus, even if the Code becomes more restrictive in the future, it is not expected that the Project will to have to change in any significant way.

The primary elements of the building core and shell and HVAC component efficiencies are presented in Table 4.12.5-1 for both the Code building and the proposed building for comparison.

Case 2 - Proposed Project

The Residential Building is in the earliest stage of conceptual design. Nevertheless, certain technologies have been incorporated into that concept and are committed to by the Proponent. Case 2 represents the proposed building, including measures incorporated into the building and MEP systems above and beyond those required for code compliance. The proposed Project includes the energy efficiency measures indicated in the matrix of options presented in Table 4.12-1 and described in Section 4.12.1. The basic systems of Case 2 are described in HVAC Concept Descriptions in Appendix G.2.

Features incorporated into the Residential Building design include:

- ♦ Extra wall insulation
- ♦ High albedo roof
- ♦ High efficiency mechanical equipment
- ♦ Heat recovery from ventilation exhaust
- ♦ Room occupancy sensors in common areas
- ♦ Individual unit HVAC controls
- ♦ Natural (hybrid) ventilation
- ♦ Two-stage ventilation exhaust
- ♦ Low flow plumbing fixtures
- ♦ Energy-Star appliances and lighting fixtures

Case 3 – Alternatives with Greater GHG Mitigation

Case 3 examines two additional measures, cogeneration and purchase of Green Energy.

4.12.5.2 Technologies

The following describes the various technologies that may be applicable to the Residential Building and the rationale for their use or non-use. They are organized, similar to Table 4.12-1, into Energy Use Reduction and Energy Generation.

Energy Use Reduction

<u>Orientation</u>

Building footprint is largely constrained by the existing street grid and adjacent buildings and parklands. In order to optimize floor plates for maximum construction efficiency, and to reduce impact on the adjacent parklands, building façades will remain generally parallel to the existing street grid. The southernmost façade will be oriented along a line that is approximately NW-SE. The design of the exterior envelope will be evaluated on a façade-by-façade basis (each side of the building) for optimal configuration of glazing areas, opaque wall area, shading devices, overhangs, screens, balconies, operable windows, etc. However, such details will not be developed until the detailed design phase of the building.

As only the basic characteristics of the envelope performance can be accounted for in this early evaluation stage, no credit has been taken in the building energy modeling for overhangs, balconies, screens, or exterior shading devices.

Building Envelope

Key building design elements that relate to the energy efficiency of the building envelopes are compared in Table 4.12.5-1. Code values for various parameters are included, where applicable, for comparison.

As indicated, proposed roof, floors, glazing, doors and skylights all meet Code requirements. Some parameters meet or exceed the guidelines of the New Building Institute's Advanced Building Core Performance Guide, Version 1.02. This Guide is intended for smaller buildings (<70,000 sf), although some of it may be expanded to use in larger buildings. The Guide also indicates, however, that "Only some elements of the Core Performance are directly applicable to Lodging."

Green Roof

A green roof is not being considered for the Residential Building because the relatively small footprint of the roof is largely taken up with mechanical equipment and access ways needed to service them.

High-albedo / Reflective Roofs

High albedo roofing materials will be utilized. Building energy modeling assumed that 60% of the roof will have white reflective surface, including access ways and the areas under and around free-standing mechanical equipment. Mechanical equipment and equipment access ways are expected to occupy at least 75% of the roof surface. The high albedo roof aids in minimizing summer urban heat island effects.

Exterior Shading Devices

The Proponent will study the feasibility of using various forms of external shading during the detailed design phase of the building.

Table 4.12.5-1 Key Building Parameters – Residential Building

Item	Item Component	Alternative 1- Base: ASHRAE 90.1-2007 Assembly Max	Alternative 1- Base: ASHRAE 90.1-2007 Insul. Min R-Value	Alternative 2: Used in Model Assembly Max	Alternative 2: Used in Model Insul. Min R-Value
Roof	Roof Insulation entirely above deck	U-0.048	R-20 ci	**U-0.048**	R-20 ci
	Metal building	U-0.065	R-19.0	U-0.065	R-19.0
	Attic and other	U-0.027	R-38.0	U-0.027	R-38.0
	Single rafter				
	Solar reflectance index (SRI)				
Walls	Mass (HC> 7 Btu/ft2)	U-0.080	R-13.3 ci	U-0.080	R-13.3 ci
	Metal building	U-0.057	R-13.0 + R-13.0	U-0.057	R-13.0 + R-13.0
	Steel framed	U-0.064	R-13.0+R-7.5 ci	**U-0.055**	R-13.0+R-10 ci
	Wood framed and other -	U-0.051	R-13.0+R-7.5 ci	U-0.051	R-13.0+R-7.5 ci
	Below-grade walls	C-0,119	NR	C-0,119	NR
Floors	Mass	U-0.064	R-12.5 ci	U-0.064	R-12.5 ci
	2 Steel framed	U-0.038	R-30.0	U-0.038	R-30.0
	Wood framed and other	U-0.033	R-30.0	U-0.033	R-30.0
Slabs	Unheated	F-0.540	R-10 for 24"	**F-0.540**	R-10 for 24"
	Heated	F-0.860	R-15 for 24"	F-0.860	R-15 for 24"
Doors- Opaque	Swinging	U-0.5		U-0.5	
	Non-Swinging	U-0.5		U-0.5	
Vertical glazing including doors	Area (percent of gross wall)	20.65%		20.65%	
	Thermal transmittance	0.55		**0.51**	
	Solar Heat Gain Coeffficient (SHGC)	0.4	SC = 0.46	0.4	**SC = 0.46**
	Exterior sun control (s,e,w only)	Not Required		Not Required	
Skylights	Area (percent of gross roof)				
	Thermal transmittance				
	Solar Heat Gain Coeffficient (SHGC)				
Interior lighting	Interior Lighting power density (LPD)	0.7 W/ft2		**0.7 W/ft2**	
	Linear fluorescent with high-performance electronic ballast	32W T-8 LF with High Performance Ballast with a BEF of 0.88		32W T-8 LF with High Performance Ballast with a BEF of 0.88	
	All other sources	CFL/LED		CFL/LED	
	Dimming controls for daylight harvesting under skylights	N.A.		N.A.	
	Occupancy controls	A scheduled basis using time-of-day operated control device that turns lighting off at specific programmed times		An occupant sensor that turns lighting off within 30 minutes of an occupant leaving a space	
	Interior room surface reflectances in locations with daylighting	Not Specified		Not Specified	
Additional interior lighting for sales floor	Additional LPD for adjustable lighting equipment that is specifically designed and directed to highhght merchandise and is automatically controlled separately from the general lighting	N.A.		N.A.	
		N.A.		N.A.	
		N.A.		N.A.	
		N.A.		N.A.	
Misc. Elec	Plugs and Recepticals	0.75w/sf		**0.68w/sf**	
	Elevator Horsepower				
Exterior	Façade and externally illuminated signage	0.2 W/ft2 for each illuminated wall or surface or 5.0 W/linear foot for each illuminated wall or surface length		0.2 W/ft2 for each illuminated wall or surface or 5.0 W/linear foot for each illuminated wall or surface length	
Occupancy	Occupancy SF/Person	144			
HVAC	HP Units 0-17KBtu/Hr; 86 deg F wtr/68 deg F	12 EER/4,2 COP		15.3 EER/4.9 COP	
	HP Units up to 5 Tons; wtr 86 deg F/68 deg F	12 EER/ 4.2 COP		15.3 EER/4.9 COP	
	Boiler	80% AFUE		92.5% AFUE	
	Cooling tower	20 GPM/HP		25 GPM/HP	
	Roof-Mounted Air Handler (gas-fired, DX system)	9.1 EER		10.6 EER	
	Fan-coils	PCM		ECM	
	Air-cooled chiller	2.8 COP		4.0 COP	
	Pumps	Standard		High efficiency	
Economizer	Not required (Corridor system 100% OA)				
Ventilation	Outdoor air damper	>300 cfm			
	Demand control	Not Required			
Ducts	Friction rate	0.08 inches of WC			
	Sealing (supply and return ducts)	Seal Class C			
	Location	Not Specified			
	Insulation level	See remarks			
Service Water Heating	Gas storage (>75 kbtuh)	80% Et		92.5% AFUE	
	Gas Instantaneous	80% Et		92.5% AFUE	
	Electric storage (S 12 kW and >20 gal)	EF >0.93 - 0.000132xVol			
	Pipe insulation (d < 1 1/2 in./ d >= 1 1/2".)	?			

BOLD - indicates the actual values used.
NS - Not Specified

Low Resistance Circuiting

Low resistance circuiting uses lower wire gauges (i.e. thicker wires) than those required by the electrical code to conduct electricity. This has the effect of reducing the power lost, in the form of heat, due to the internal resistance of the wire, and decreasing air conditioning load.

LRC will be studied for the Residential Building during detailed design. A large part of the cost-effectiveness of LRC is dependent upon projected cost of electricity and materials prices, particularly copper, which can, and has, fluctuated considerably over the years. Therefore, pricing at the time of construction must be taken into account. Life cycle cost will be computed based on copper prices and electrical cost projections at the time the job goes to bid.

Radiant Heat – Lobbies

Lobby area of the Residential Building is believed to be too small to benefit from radiant heating.

Heat Recovery

Heat recovery transfers the heat in exhaust ventilation to the incoming fresh air, thus reducing the demand for heating boilers. Heat recovery from the building ventilation exhaust is incorporated into the Residential Building design.

Two-stage Ventilation Exhaust

By utilizing two-stage bathroom exhaust fans in conjunction with occupancy sensors in the condominiums and apartments, ventilation losses are significantly reduced. These fans operate at low speed continuously, providing the necessary air changes healthy indoor air quality, and then step up to a higher flow when the bathroom is occupied. This reduces the amount of air requiring heating or cooling.

Hybrid Ventilation

Hybrid ventilation (combination of natural and mechanically induced ventilation that may be used separately or in concert, depending on ambient conditions) is incorporated into the building design. All residential units have operable windows.

Room Occupancy Sensor

Room occupancy sensors that turn off the artificial lights when a space is unoccupied are proposed for the common spaces of the Residential Building.

Daylighting and Daylight Harvesting

Daylight harvesting is the design of the interior in a manner that allows natural light to penetrate deeply into the building interior; this strategy complements natural lighting. Functional requirements and the design of the Residential Building limit opportunities for daylight harvesting. Although it will be considered during detailed design for uses where possible, it has not been considered in the building energy modeling presented herein.

High Performance Lighting

Lower lighting power levels are achieved by use of fluorescent or LED lighting fixtures and bulbs. LED fixtures and bulbs are currently expensive compared to fluorescent light fixtures and bulbs; however, their costs are coming down as more efficient manufacturing and higher volumes of production emerge. By the time the Residential Building enters detailed design, LED lighting may become affordable, resulting in higher installed efficiency than the modeling herein utilizes. However, the Proponent cannot commit to higher efficiencies than are currently proposed.

Low Flow Fixtures

Reductions in water use reduce indirect GHG emissions by reducing the MWRA's water pumping and wastewater treatment energy requirements. Only credit for low-flow fixtures has been included in the energy modeling.

The building is anticipated to be registered under the LEED 2009 rating system from the US Green Building Council. The Residential Building will achieve the LEED prerequisite of an overall 20% reduction compared to the baseline EPAct case, and may achieve a higher reduction but cannot commit to achieving it at this time. Reductions will be realized through the selection and installation of advanced low-flow toilets, dual-flush toilets and low-flow faucets and lavatories.

Energy-Star Appliances and Light Fixtures

Energy Star appliances and light fixtures utilize less energy than other models of the same appliances. Energy Star appliances and light fixtures utilize less energy than other models of the same appliances. Apartments and condominiums in the Residential Building will be fitted with Energy Star appliances and light fixtures.

Advanced Energy Efficient Elevators

Advanced elevators incorporate belt-drive systems with regenerative braking technologies. This technology is most cost-effective in high-rise elevators, typically greater than 100 ft in height. The economics of this technology will be examined during the detailed design phase of the Residential Building.

Energy Generation

High Efficiency Mechanical Equipment

High efficiency HVAC systems are a combination of energy use reduction and energy generation technologies and include use of high efficiency boilers and chillers, premium electric motors, and incorporating VFD motors, above and beyond the requirements of the Code, where practical. Table 4.12.5-1 indicates proposed AC equipment with high Energy Efficiency Ratings, and boilers with high thermal efficiencies, much better than Code and state-of-the-art for equipment of that size and type.

Cogeneration

Small combined heat and power systems (micro-CHP) are small integrated cogeneration systems installed on a building-by-building basis. Micro-CHP systems generate electricity, hot water or steam, and chilled water in an integrated package. They are available in a variety of modular sizes and configurations. A micro-CHP may utilize a small combustion turbine or a gas-fired internal combustion engine as the prime mover, integrated with electrical generation, emissions controls, heat recovery systems and, perhaps, absorption or hybrid absorption/electric chillers. They are complex, expensive systems that must be custom-fit to an individual building's needs to maximize efficiency. Furthermore, they are significant sources of noise and vibration, requiring an additional layer of engineering of the building spaces to mitigate unwanted consequences.

Micro-CHP requires more detailed building design information than is currently available. Its GHG emissions reduction potential has been preliminarily examined for the Residential Building in Case 3 although, like any cogeneration application, the technical and economic feasibility of cogeneration must await the detailed design phase to be sufficiently accurate for judgments to be made.

Photovoltaics (PV)

PV systems are developing in two general types, roof-top and façade.

Roof-top

The traditional PV installation on a building is an array of collectors mounted on a flat or sloped roof, angled to face south and with appropriate slope above horizontal. Given the tower structure of the Residential Building, MEP equipment, emergency generators and elevator penthouses and ventilation exhausts will occupy the majority of the tower rooftop area. Additional area will be required for access ways to this equipment, and some of the remaining rooftop area will be at least partially shadowed by the equipment. The area remaining that might be available for a PV array is expected to be very small. Any PV installation would be expected to only be able to offset a very small fraction of yearly electrical demand.

The actual degree to which rooftop equipment might be located so as to provide unshaded space for PV panels requires considerable design development and cannot be determined at this stage of design. Hence, the capability to utilize rooftop PV must be left to later stages of design.

Façade

Façade PV, where the PV collectors are an integral portion of the upper levels of the building's vertical surfaces, is a technology that is in its earliest stages of commercial deployment. A few showcase installations with ideal orientation and exposure have been planned or implemented, but the costs of the technology today have been reported to be considerably higher than conventional PV installations. Furthermore, as described earlier, the orientation of the building follows the street grid, so an ideal south-facing façade does not exist. While this technology cannot be excluded from consideration for a building that will be designed approximately five years in the future, it is premature to be evaluated at this time.

PV Economics

The cost of PV panels, the major component of a PV system, is very high in comparison to other common generating technologies. Although prices have fallen recently, some financial analysts believe that this may be a temporary condition caused by the recessionary impact on demand at a time when PV suppliers had built manufacturing capacity in expectation of a boom in PV utilization. Nevertheless, PV remains an expensive capital component even at current prices.

The economics of PV, both roof-top and façade, are greatly influenced by available state and federal incentive programs. It is not possible to project what such incentives may look like when the Residential Building goes into detailed design phase a few years into the future. For example, the current Commonwealth Solar program, which provides both capital and operating subsidies for PV systems, is expected to be replaced by a market-driven PV set-aside program within the MA Renewable Portfolio Standard. Regulations for such a program are in their early development stage at this time. Therefore, no relevant economic analysis is feasible at this time.

The Proponent is aware that the technology may advance in the coming decade and the cost structure may change radically. Although it cannot evaluate the technical and economic feasibility of its application at this time, the Residential Building will be designed and constructed PV-ready so as not to preclude PV from future application. PV-ready means that the available roof area will be structurally capable of accepting the additional loads imposed by a PV array, inverter space will be reserved, conduit space will be reserved for future interconnection of the array to the building's electrical system and sufficient excess interconnection points within the building's distribution system will be provided.

Furthermore, third party PV installations have recently become commercially available and may be more commonplace in the future. In such an arrangement, a PV company may build, own and operate a PV array and system at a host facility such as the Residential Building, and sell the electricity produced to the host under a long term power purchase agreement. If this business arrangement continues to develop during the next few years, the Proponent would consider, amongst its other alternatives, hosting such a third party PV system, providing appropriate terms and commercial arrangements could be negotiated.

Solar Hot Water

Solar hot water systems use solar energy to provide heating for domestic hot water. SHW systems may be applicable where there is a significant year-around hot water demand such as in the Residential Building.

As described for PV, there will be a very limited footprint where panels could capture solar radiation to create hot water. Study during later design phases is required to determine if enough south-facing rooftop area can be set-aside to install a panel array that could significantly contribute to the heat energy required to generate domestic hot water.

Just as more advanced building design is needed to determine technical feasibility, future economic analysis is also required. Currently, solar hot water systems can be partially financed through state and federal subsidy programs and tax policy; the status and framework of which cannot be forecast several years into the future.

No specific commitments to solar hot water systems can be made at this time. This technology will be studied as the building design progresses. If the Residential Building can apply a feasible cogeneration option, then domestic hot water would likely be generated from waste heat, displacing the potential for solar hot water.

Green Energy

Massachusetts utilities offer options that allow the customer to purchase all or part of its electricity requirements from renewable energy sources.

The individual occupants of the Residential Building will purchase ¾ of the building's electricity with the balance purchased by two or three separate entities (condominium association, apartment landlord, community space) within the building. A portion of both the tenant and common space electricity costs will be subsidized by state and federal agencies. Therefore, the additional cost associated with Green Energy must be a decision made by each electrical customer. The Proponent cannot predict energy prices well into the future, but will include future examination of Green Energy as a potential option.

Targeting the LEED credit for Green Energy, the impact on GHG emissions from purchase of 35% of the building's house load electricity needs (i.e., less tenant-occupied spaces, which will be separately metered) as Green Energy has been examined as a Case 3 alternative. This impact could vary considerably with other energy choices; e.g., if CHP were included in the final design.

4.12.5.3 Building Energy Modeling

Three cases, including two parts in Case 3, were analyzed, in accordance with the Policy, as described in Section 4.12.5.1. Building energy modeling for the Modeling of the Residential Building was conducted by Wozny/Barbar & Associates, Inc., a full service consulting firm specializing in the engineering and design of heating, ventilation, air conditioning, electrical, plumbing, fire protection, fire alarm and energy management systems. Wozny/Barber utilized the EQUEST model for its analyses.

Results of modeling off all three cases for the Residential Building are summarized in Table 4.12.5-2.

Table 4.12.5-2 Modeling Results – Residential Building

			Case 1 Baseline	Case 2 Proposed	1-->2 Change	Case 3A Micro-CHP	2-->3A Change	Case 3B Green Energy	2-->3B Change
DIRECT (NATURAL GAS)			MMBtu/yr	MMBtu/yr		MMBtu/yr		MMBtu/yr	
Space Heating			1,666	747		747		747	
Domestic Hot Water			1,815	1,568		1,568		1,568	
Space Cooling									
Cooling Tower (Heat Rejection)									
Ventilation and Fans									
Pumps & Auxilary									
Misc. Equipment (plug-in)									
Area Lighting									
Cogen Plant Heating Credit			na	na		-1,398		na	
Cogen Plant Fuel Input			na	na		2,560		na	
	Total		3,481	2,315	-33%	3,477	50%	2,315	0%
INDIRECT (ELECTRICITY)			kWh/yr	kWh/yr				kWh/yr	
Space heating			139,900	69,900		69,900		69,900	
Space Cooling			146,600	112,300		112,300		112,300	
Cooling Tower (Heat Rejection)			2,600	2,300		2,300		2,300	
Ventilation and Fans			170,500	169,000		169,000		169,000	
Pumps & Auxilary			319,800	302,900		302,900		302,900	
Misc. Equipment (plug-in)			413,200	371,900		371,900		371,900	
Area Lighting			159,400	142,900		142,900		142,900	
Water/wastewater trtmt[3]			16,357	13,701		13,701		13,701	
Green electricity credit		9%	0	0		0		-102,480	
CHP Credit			0	0		-193,158		0	
	Total		1,368,357	1,184,901	-13%	991,743	-16%	1,082,421	-9%
GHG EMISSIONS			tons/yr	tons/yr				tons/yr	
Direct	Gas-burning		203	135		202		135	
Indirect	Grid Electricity		553	479		401		437	
	Total		755	613	**-19%**	603	**-2%**	572	**-7%**

CO_2 Emission Factors:

Electricity[1] 808 lb/MWh

Gas[2] 116.4 lb/MMBtu

[1] ISO-NE 2006 Marginal Emissions Rate Analysis, Table 5.12, 2006 value

[2] Conversions, Emissions Factors, and Other Reference Data, U. S. EPA, Novenbver 2004

[3] Conversion factors for water/wastewater to MWRA energy use, from DOER

0.2 kWh/kgal water

1.3 kWh/kgal wastewater

Proposed

The energy efficiency technologies employed in the proposed design will result in a 33% decrease in natural gas use and 13% decrease in electricity use, resulting in a 142 ton/year, 19% decrease in GHG emissions compared to a Code-compliant building. This excludes the technologies identified in Section 4.12.1 that have not been quantified for this analysis.

Case 3A- Micro-CHP

Optimum economic sizing of a CHP unit would allow continuous operation at or near full load. Sizing and selection of a micro-CHP must be carefully matched to the operating parameters for the building. Thus optimization of a micro-CHP unit can only be done when the building's design and use plans are further along and the economic parameters for operation are better known (i.e., a one or two year forecast of fuel prices is likely to be much more accurate than a six or seven year forecast)

For this preliminary analysis, micro-CHP was evaluated based on a 30 kW EcoGen system, which is a gas-fired internal combustion engine-generator with integrated waste heat recovery. This is representative of the type of equipment commercially available with the performance that approximately meets the requirements of the Residential Building to meet the majority of the hot water heating requirements and a portion of the electrical requirements for the common spaces. The CHP unit's performance was calculated outside of EQUEST and taken as credits and debits in Table 4.12.5-2. The calculation is included in Appendix G.3.

Even this small unit will not be operated 24/7 because the building's hot water demand is expected to be insufficient during the troughs of the diurnal, weekly and seasonal cycles. Small CHP units, while having the advantage of recovering thermal energy, are quite inefficient in the generation of electricity. The unit examined, for instance, has a net heat rate of more than 13,000 Btu/kWh, compared to approximately 7,700 Btu/hour for grid-generated electricity. This differential decays the advantage gained by thermal capture.

A CHP of this size and configuration operated at about 75% annual capacity factor would increase natural gas use 50% as fuel use in the CHP unit greatly offsets the decrease in gas use for domestic hot water. However, a CHP unit also decreases importation of electricity by 16%. The net result is a mere 10 ton/year decrease in GHG emissions, or less than 2%, compared to the proposed project.

The technical and economic feasibility of tCHP in this application is dependent on further design to refine the operating loads of the building vs. time-of-day and season as well as capital and operating costs. These cannot be determined with any accuracy at this stage of design. The Proponent will examine this technology further, along with other competing GHG mitigation technologies, as the building moves into the detailed design phase. The Proponent has operating CHP units in other residential complexes that it manages.

Case 3B - Green Energy

The Proponent will evaluate the purchase of Green Energy to supply approximately 35% of the house load. House load is the building load minus the loads for the apartment and condominium units, which are metered separately. House load is estimated to comprise 25% of the total building load, so Green Energy would account for approximately 9% of the total electricity.

Purchase of 35% of the building's electricity use from Green Energy sources could reduce GHG emissions approximately 41 tons/year, or an additional 7% from the proposed design. At an estimated $0.015/kWh premium for Green Energy, the cost of mitigating a ton of GHG is approximately $37, or 10-15 times what utilities have been paying for CO_2 allowances at RGGI auctions. The feasibility of this option will depend upon: the relative price of Green Energy several years in the future, what other mitigation technologies are adopted in the final design, and the will of the agencies that subsidize building operations.

Each of the above Case 3 analyses is independent of the others; i.e., they show the impact of each technology as if the others were absent. The potential benefits are not directly additive if more than one technology were considered.

4.12.6 Mobile Source Emissions

In accordance with the MEPA GHG Policy, GHG emissions within the mesoscale study area were estimated (see Section 4.5 for a discussion of the mesoscale analysis). For this study, the EPA's MOBILE6.2 computer program was used to estimate motor vehicle emission factors of GHG on the roadway network. Conservatively, emission factors derived from MOBILE6.2 for GHG are based on the worst case of either wintertime or summertime conditions. Using vehicle count data, the mileage between intersections, and the emission factors, per day and per year emission estimates for moving vehicles along roadway links were calculated. In addition, intersection delay data were used to estimate emissions from idling vehicles. MOBILE6.2 output and the mobile source GHG calculations are provided in Appendix E. Peak hour traffic volumes were provided by the transportation consultant and extrapolated to average daily traffic (ADT) volumes using a 10% K-factor. Factors were also used to adjust to annual timescales. Refer to Section 4.5 and Appendix E for details on the MOBILE6.2 program, and the mesoscale methodology also used in this GHG emissions analysis.

Cases 1, 2 and 3

Offsite transportation-related emissions would typically be modeled for the "build condition", developed using the standard methodology outlined in the EEA/EOT Guidelines for EIR/EIS Traffic Impact Assessment, and. without improvements or mitigation measures proposed by the Project. However, because the TDM program is, in part, prescriptive by City requirements, and in part negotiated, it is not practical to determine a build-without-mitigation case. Thus, although the Proponent will be implementing a host of TDM measures which will mitigate mobile source GHG emissions, a baseline without those measures has not been calculated.

These mitigation features are defined in the Transportation Demand Management program described in Section 3.1, and include the following measures:

BWH-occupied Project components

BWH is committed to continuing to offer a wide array of Transportation Demand Management (TDM) incentives as a means to reduce single occupant driving and increase use of alternative forms of transportation to access the workplace. BWH actively supports efforts to reduce auto use for employees traveling to the hospital. Many actions to support this goal are currently actively employed by BWH, including the following:

- Employee Transportation Advisor – Provides alternative transportation information for employees. BWH promotes alternative transportation through a variety of newsletters, information kiosks, websites, e-mail, and special events.

- 50 percent transit pass subsidy for employees - Provides a 50 percent subsidy in the cost of MBTA transit passes for employees. The cost of passes is deducted on a pre-tax basis, resulting in an additional cost savings to employees.

- Location-priced parking - Discouraging on-campus parking by offering only market rate parking for employees on-campus and while offering parking at a significantly lower rate in off-campus parking locations.

- Full support of MASCO's other ongoing transportation initiatives.

- Member of the CommuteWorks Transportation Management Association, which is operated by MASCO. CommuteWorks offers an array of ongoing programs (discussed further below) designed to encourage employees to choose alternative options for commuting.

- Emergency Ride Home - With CommuteWorks' Emergency Ride Home program, registered BWH employees can receive a guaranteed ride home in the event of a personal emergency during the work day. Up to five times a year, CommuteWorks will pay for a taxi cab or rental car to get employees home quickly. All employees who participate in their employers' transit subsidy program are eligible for the Emergency Ride Home Program. Employees who carpool, vanpool, or walk/bike to work through the CommuteFit Program (see below) are also eligible to register for Emergency Ride Home.

- The Longwood T Party Program - Under this CommuteWorks program, BWH employees who currently drive to work alone can try using public transit risk free, and have CommuteWorks help pay for it. The Longwood T Party Program allows drive-alone commuters to put their parking spaces on hold for three months to try public transportation and receive up to $333 in incentives. Eligible employees will receive $65 per month in commuter checks to use towards the purchase of transit passes and reimbursement for up to $46 per month for parking costs at transit stations. While employees' parking spaces are on hold, they do not pay for or lose the space and can opt out of the program at any time if they decide to go back to parking. This program is also available for commuters who recently moved to a new home location resulting in an increased cost of their monthly MBTA pass.

- CommuteFit Program - Employees who incorporate biking, walking, or jogging into their daily commutes are eligible to participate in the CommuteFit Program. By signing up for the CommuteFit program, employees can keep track of the miles commuted by foot and earn points for free prizes. Rewards include water bottles, coffee mugs, lunch totes, pedometers, first aid kits, and many others. All participants who log 500 miles in the CommuteFit program will receive a $30 gift certificate to REI.

- Ridesharing: Carpools and Vanpools - CommuteWorks partners with MassRides, the Massachusetts statewide travel options program, to help match BWH employees into carpools and vanpools from their home town. By completing CommuteWorks' online Ridematching Registration Form, CommuteWorks will work with the State using their 13,000+ member database to help find BWH employees potential carpool partners who share their commutes and working hour and/or vanpool options from their home areas. MassRides currently manages a fleet of aver 40 vanpools including two (Rockland and Sagamore/Kingston) that come directly into the LMA. BWH offers a 50 percent discount for vanpool members.

- MASCO Shuttle Services - MASCO operates several shuttles to and from the LMA providing connecting service to commuter rail and rapid transit and off-site parking facilities. With the exception of the M2 Shuttle, these shuttles are free of charge to BWH employees.

- Zip Car Discounts - BWH Employees are eligible to join CommuteWorks' Zipcar program at a reduced membership fee of only $25 per year and no application fee. Ordinarily, people joining Zipcar pay $75 in initial set up fees and $50 per year in membership fees. Through the MASCO discount, Zipcar members also receive reduced hourly rates when using Zipcars during regular business hours.

- Personalized Commuting Assistance - CommuteWorks answers any general commuting questions employees have and provides them with various travel options to help maximize the efficiency of their commute. CommuteWorks' personalized itineraries identify employees complete travel options with information on commuter rail, subway, bus, shuttles, ridesharing, biking and walking.

- MBTA Service Feedback Options - MASCO continually advocates for improved MBTA services to the LMA, and rider feedback regarding MBTA experiences helps us work with the MBTA for such improvements. BWH employees who use MBTA services such as bus, boat, subway, or commuter rail and want to offer feedback on their experiences or share ideas for new or improved MBTA services can do so by completing the online MBTA Service Feedback Form. This information is relayed by MASCO at regularly scheduled meetings with MBTA staff to discuss LMA service improvement needs.

- Discounted regional bus services - BWH provides a 50 percent discount to employees who commute by non-MBTA bus services. This program includes private bus services to Cape Cod and New Hampshire.

- Secure bicycle storage – BWH offers bicycle storage throughout the campus.

- Telecommuting and compressed workweeks – BWH has an informal policy of encouraging telecommuting and compressed workweeks for employees where reasonably feasible.

Residential Building Transportation Demand Management

New residents will be provided access to the same services as existing RTH residents including:

- After school programs for children that will eliminate the need for parents to travel to pick up their children after school and allow parents to have flexible work hours;

- Van service that allow residents to run errands without the need for a personal automobile. RTH operates one vehicle with a capacity of 14 persons. This vehicle is used to transport residents to various weekly programs and intermittent events; and

- Assistance in accessing job opportunities at BWH so that residents may live and work in the Mission Hill neighborhood to reduce commuter traffic in the area.

Additional measures that will be promoted for the Residential Building include:

- Providing a packet of TDM information in each resident's move-in documents that highlight non-automobile transportation options and on-line transportation services including the MBTA on-line transit pass purchase option.

- The building's Property Manager will create a transportation information area at the development for residents and for visitors. Information to be provided includes area and transportation maps, bicycle maps, public transit contact information, a list of local transit services and schedules, etc. The property management company will be responsible for updating the information on a regular basis.

- The property management company will serve as the Transportation Coordinator and will coordinate TDM measures for the Residential Building with those already in place at Mission Park. These responsibilities will include:

  - Updating the transportation information described above; and

  - Coordinating van services, vehicular operations, service and loading, and parking enforcement related to the Residential Building.

- To take advantage of the variety of public transportation facilities available in LMA, the Project's public transportation TDM measures include:

  - Providing information in each resident's move-in documents on public transportation benefits to residents and

- Bicycle/Pedestrian TDM measures will include:

  - Providing landscaped sidewalks adjacent to and around the site; and

  - Providing on-site bike racks for residents and visitors;

DMH-occupied Project Components Transportation Demand Management

DMH is a state agency which will offer the same TDM incentives offered to other state employees. On-site transportation amenities, such as bicycle storage will be provided to encourage alternative modes of transportation.

Case 3 would represent a project alternative configuration with greater GHG emissions-related mitigation than the proposed Project. However, the proposed Project, is including all of the feasible transportation mitigation options available. Further mitigation measures would be purely speculative. Therefore, no Case 3 is provided.

Table 4.12.6-1 presents the results of the transportation GHG analysis. Total transportation-related GHG emissions are a very small fraction (on the order of 1%) of the stationary source emissions described in earlier sections.

Table 4.12.6-1 Transportation-Related GHG Emissions

	Cases 1 and 2 2021Build (base) - No Build
Net VMT, miles/day	1,637
Roadway GHG, tons/yr	267
Net Delay, hrs/day	68
Intersection GHG, tons/yr	28
Net GHG Emissions, tons/yr	295

4.12.7 Summary and Mitigation Commitments

Table 4.12.7-1 presents the combined stationary source and transportation GHG emissions profiles of the baseline and proposed cases. Case 3 GHG emissions would be dependent upon which options for each building were selected.

Table 4.12.7-1 Project GHG Emissions Summary

	Case 1 - Baseline	Case 2 - Proposed	1-->2 Reduction
	tons/yr	tons/yr	
Binney St. Building	313	218	-30%
Partial Hospital/Fenwood Inn	112	73	-35%
Brigham and Women's Building	21,080	19,090	-9%
Residential Building	755	613	-19%
Transportation @ full build-out	295	295	0%

The Proponent's commitments to mitigate Project GHG emissions from the stationary sources are extensive, as indicated in the preceding sections and in Table 4.12.7-1. Numerous additional mitigation measures have not been quantified, primarily because the degree of accuracy or the reliability of the quantification method is uncertain, and, as indicated in Section 4.12.6, all transportation mitigation is included in the baseline, so that no credit is taken for transportation GHG mitigation.

The two smaller buildings, the Binney Street Buiding and Partial Hospital/Fenwood Inn, which are to be constructed in the near future, are not large GHG emissions-producers. nevertheless, they are expected to achieve 30% or more reductions in GHG emissions compared to Code-compliant buildings, primarily through use of high efficiency building shell design and mechanical systems. Additional mitigation is achieved through a variety of other technologies.

The Brigham and Women's Building is in very preliminary design and, as such, has made commitments to mitigating technologies commensurate with that state of design. The tons/year of GHG emissions reduction indicated above is more than the total emissions of the other three buildings combined. It is expected that, as design develops further during the next several years, that additional technologies, as described earlier or possibly new technologies developed in the interim period, will be adopted that will further decrease GHG emissions, but these are not ripe for selection this far in advance of detailed design. The Proponent will continue to evaluate further energy efficiency measures as the design develops.

The Residential Building, also several years from detailed design, is expected to achieve significant GHG emissions reductions, primarily through use of improved building shell and high efficiency mechanical systems. Additional mitigation is achieved through a variety of other technologies, with almost 20% improvement over a Code-compliant building indicated.

The Proponent is committed to the following design elements for the Project, or for individual buildings, as indicated:

- High performance building envelopes; i.e., better than required by the Code, 7th edition, for all buildings;
- High efficiency mechanical equipment for all buildings;
- High albedo (reflective) roofs on all buildings;
- Heat recovery in Brigham and Women's Building and Residential Building ventilation exhausts;
- Natural ventilation in combination with forced ventilation in the Residential Building;
- Multi-speed exhaust fans in the Residential Building;
- Room occupancy sensors in the appropriate spaces of all buildings;
- Energy management systems in each building;

- Energy-Star appliances in the Binney Street Building, the Partial Hospital/Fenwood Inn and Residential Building. Typical equipment in the Brigham and Women's Building is generally not of a type that is in the Energy Star rating program, but is high efficiency equipment;

- High performance lighting in appropriate spaces of the Binney Street., Partial Hospital/Fenwood Inn and Brigham and Women's Buildings;

- Brigham and Women's and Residential Buildings will be constructed to be PV-ready;

- Low-flow and water-efficient plumbing fixtures in all buildings;

- Two-stage ventilation fans in the Residential Building;

- Advanced energy-efficient elevators in the Brigham and Women's Building;

- Enhanced building commissioning for the Binney Street Building, Partial Hospital/Fenwood Inn and Brigham and Women's Building.;

- Advanced refrigeration management for the Brigham and Women's Building;

- Recycling collection areas in all buildings;

- Construction waste recycling 50-75% for all buildings;

- Greater than 10% recycled content of construction materials forfor the Binney Street Building, Partial Hospital/Fenwood Inn and Brigham and Women's Builidng;

- Traffic demand management measures as described in Section 3.1

The Proponent remains committed to the level of GHG emissions reduction and energy savings presented in the above analysis, but must retain an amount of design flexibility to allow for changes that will inevitably occur as design progresses. Case 2 provides a comprehensive look at anticipated GHG performance based on estimates of system performance. If, during the course of design on an individual building, a specific combination of design strategies proves more advantageous from an engineering, economic, or constrained space perspective, the design of that building may vary from what is shown in Case 2. Energy performance minima (and associated GHG emissions) by building, as shown in Tables 4.12.2-2, 4.12.3-2, 4.121.4-2 and 4.12.5-2, will be adhered to in individual building designs to the extent possible, and are expected to be improved upon as design progresses.

Section 5.0

Urban Design Component

5.0 URBAN DESIGN COMPONENT

5.1 Introduction

The Project's four buildings are intended to stand as individual buildings with architectural vocabularies appropriate to their respective uses, but work together as an ensemble in a mutually reinforcing and coordinated manner. The ensemble of buildings consists of four distinct masses: the Partial Hospital/Fenwood Inn, the Binney Street Building, the Brigham and Women's Building and the Residential Building. The Partial Hospital/Fenwood Inn Building is at the southeastern end of the Project Site, separated from the other buildings by Vining Street. The Brigham and Women's Building, located between the Partial Hospital/Fenwood Inn and the Residential Building on Fenwood Road, will be separated from the Residential Building by a new landscaped pedestrian way. This new landscaped pedestrian way will permit a view corridor looking southwestward from the intersection of Binney Street and Fenwood Road to the Riverway and the landscape beyond. The Binney Street Building will be located between Francis and Binney Streets and Fenwood Road, adjacent to the Servicenter Complex.

Figure 2-1 through Figure 2-18 in Chapter 2.0 are perspectives and elevations. Floor plans and additional graphics are provided as Appendix B. The scale and general massing of the Project as shown and analyzed in this Draft EIR/PIR has been presented to the BRA staff and Boston Civic Design Commission (BCDC). Schematic Design approval of the Partial Hospital/Fenwood Inn and Binney Street Building is being sought from the BCDC at this time. In addition, the BCDC is reviewing the height and massing of the Residential Building and the Brigham and Women's Building. When construction of the latter two buildings is scheduled to commence, the BCDC will be asked to review those buildings' schematic design. Due to the early stage of design, elevations of the Brigham and Women's Building and Residential Building are not available. As design progresses, the Proponent and design team will ensure appropriate articulation at ends of vistas of the Project Site.

This Chapter outlines the design intent of the Project and responds to the BRA's Scoping Determination. Section 5.2 describes broad design concepts including Project orientation and connectivity to area uses and consideration of the Binney Street Corridor. Section 5.3 describes the design approach to Project edges including streetscape, wayfinding and vehicular access and egress. Section 5.4 addresses Project Site-specific issues including the extensive Project Site open space planning, the rationale for the proposed massing and height and the design concept for each Project building. The final section addresses BWH campus networks.

5.2 Broad Design Considerations

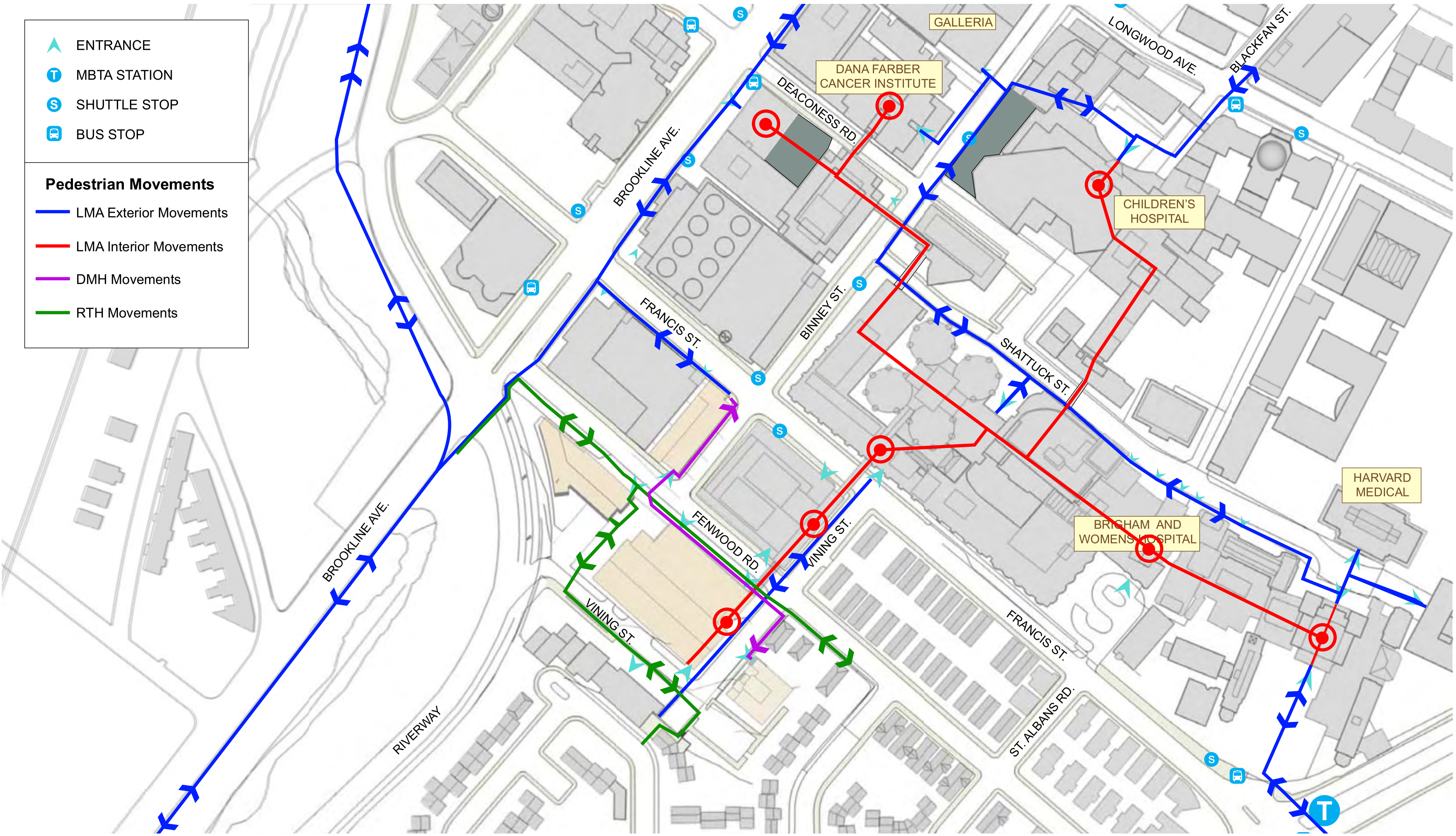
5.2.1 Project Orientation and Connectivity to BWH Campus and Residential Neighborhood

The proposed development can be understood as the logical completion and extension of the neighboring RTH Mission Park community to the south and southeast, and the BWH campus to the north and east. Figure 5-1 and Figure 5-2 depict pedestrian connections and the pedestrian realm.

The proposed Residential Building completes the RTH presence along the block fronting on the Riverway from Huntington to Brookline Avenues. The historic fence which marks the edge of the Main MMHC Site along the Riverway and defines the limits of pedestrian access will be reconstructed in its present, thereby preserving the existing pedestrian promenade along the site of the Residential Building. The fence will turn northeastward at the space between the Residential Building and the Brigham and Women's Building to define a landscaped route through the block to Binney Street. Pedestrian paths within the new landscaped green space between the Residential Building and the Brigham and Women's Building are configured to turn toward the Neville House and the broad landscaped walkway on the southwest side of the private way, connecting this last addition to the RTH community back towards Mission Park.

The Brigham and Women's Building will extend the widened sidewalks and new street tree pattern established by the Shapiro Cardiovascular Center on the northwest side of Vining Street, completing the connection between the Mission Park Garage and the main Brigham and Women's Hospital entrance at 75 Francis Street. Likewise, the sidewalk bordering the Brigham and Women's Building along Fenwood Road will be broadened and developed with street trees, completing the pattern established at the Shapiro Cardiovascular Building side opposite the Project Site. This establishes a suitable pedestrian connection between DMH's Partial Hospital/Fenwood Inn and the entrance for DMH located on Fenwood Road to the Binney Street Building. Internal pedestrian connections of the Brigham and Women's Building to the BWH campus are described below in Section 5.6.

The Binney Street block will be completed with the addition of the Binney Street Building with its primary entrance at the corner of Fenwood Road and Binney Street and a secondary entrance at the corner of Francis and Binney Streets. Each of these entrances will have a new small entrance plaza associated with them and connected by sidewalk starting at 8 feet and widening to 12 feet as it continues alongside the northwest side of Binney Street. This streetscape will be improved with a column of street trees set in flush sidewalk grates. Section 5.2.2 below describes through-block visual and pedestrian connections from Binney Street to the Emerald Necklace.



Massachusetts Mental Health Center Redevelopment Project Boston, MA

Figure 5 - 1

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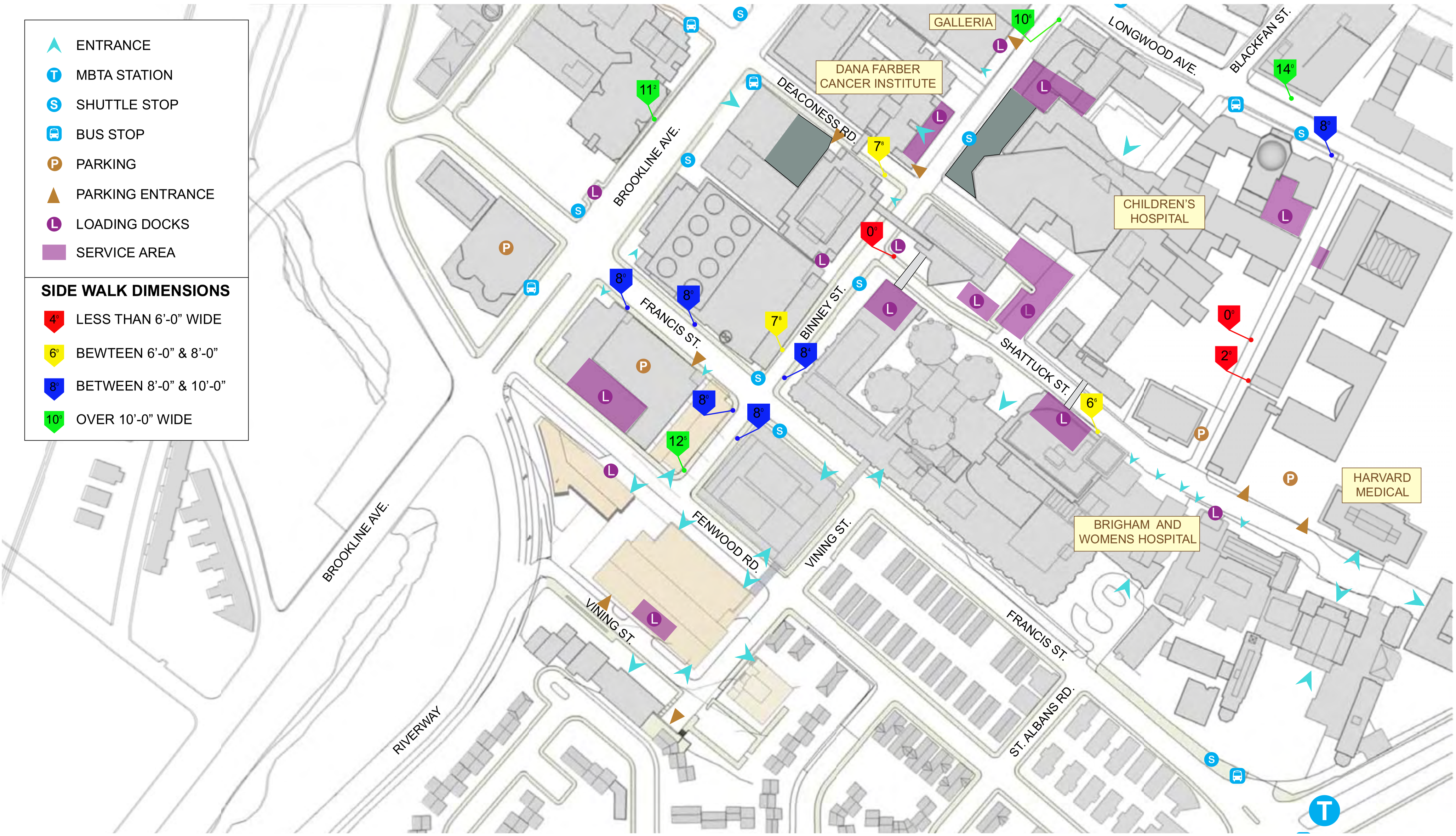
Pedestrian Movements



Massachusetts Mental Health Center Redevelopment Project Boston, MA

Figure 5 - 2

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Pedestrian Realm

Pedestrian paths and street crossings will be clearly marked and oriented to maximize pedestrian and cyclist safety. In pursuit of this goal, the Proponent will seek permission to construct a fence between the southeast side of the roadway which leads from the Riverway to the private way and the adjacent sidewalk to a point where pedestrians can make a perpendicular crossing of the roadway. This will be a significant pedestrian safety enhancement.

In keeping with the high volume of bicycle use in the area and to reinforce bicycle connections from areas beyond the Project Site, bicycle storage areas will be provided for each of the four Project buildings. Interior bicycle storage facilities will be provided at the Brigham and Women's Building. Exterior bicycle storage facilities will be provided at the Binney Street Building and the Partial Hospital / Fenwood Inn. Residential bicycle storage will be provided in the Mission Park Garage and outside the building.

Connections to MBTA bus service are located along Brookline Avenue one block north of the Project Site at the intersection of Francis Street and Brookline Avenue while bus connections on the Longwood Avenue corridor can be made by following Binney Street two blocks northeast. Light rail service on the Arborway line is accessible at a stop two blocks southeast at Brigham Circle. In addition to MBTA service, numerous MASCO shuttle stops are distributed throughout the area including one located in the Shapiro Cardiovascular Center at the corner of Binney and Francis Streets.

5.2.2 Binney Street Corridor

Binney Street, which extends from Longwood Avenue to Fenwood Road, vastly changes character over its length. From Longwood Avenue to Francis Street, it is essentially a service road with eight loading docks and garage entrances but only one primary building address. The street wall within this zone is irregular, dictated by the immediate logistical requirements of each individual building frontage. In addition, it is a street with a considerable change in topography, the crown occurring at the intersection with Jimmy Fund Way (elevation 43.0 Boston City Base), midway between Longwood Avenue and Francis Street. This elevation is approximately 21 feet above Longwood Avenue (elevation 22.5 BCB) and 20 feet above Fenwood Road (23.5 BCB).

Between Shattuck Street and Francis Street, Binney Street begins to change as it passes the BWH campus on the southeast side of the block. On the BWH campus, the sidewalk widens to accommodate planters and street trees. The northwest side of the street along the MATEP facility is somewhat narrower; however the sidewalk here is also relieved with street trees. The transition anticipates the intersection with Francis Street which develops a much more coherent streetscape to the southeast.

Because of its topography, the view from Binney Street southward toward the Project Site is obstructed until Jimmy Fund Way. The narrowness of the street, signs, trees and the overhead bridge just beyond the Jimmy Fund Way intersection are further impediments to long views toward the Project Site. Above and beyond the existing MMHC buildings, the Neville House provides a somewhat undistinguished termination to this vista.

The Binney Street Building proposed on the block between Francis Street and Fenwood Road continues and improves the streetscape coherence that begins on the block between Shattuck and Francis Streets. The Binney Street Building picks up the sidewalk and street alignment of the MATEP facility but then gradually widens the sidewalk from eight feet to twelve feet moving toward Fenwood Road, as well as continuing the Shattuck/Francis block colonnade of street trees.

View angles from the intersection of Francis and Binney Streets have been studied and the building footprint of the proposed Brigham and Women's Building adjusted so that the proposed Brigham and Women's Building masks Neville House, but does not impinge upon the southeastern edge of the view corridor to the Riverway established by Neville House. Proceeding southwest on Binney Street this view corridor widens and opens further to the Riverway, reorienting the vista westward.

The geometry and massing of the Brigham and Women's Building have been set up to provide an appropriate visual termination of the long view down Binney Street which presently terminates at the Neville House. Views to the Riverway, which are currently obscured by the existing MMHC buildings, and which would not, in any case be possible due to topography beyond the Jimmy Fund Way intersection, have been managed to orchestrate a dynamic view which changes and opens to the Riverway when moving southwest along Binney Street.

The Binney Street Building is intended for use by the DMH for the first ten years. However, with entrances at both the Francis Street and Binney Street intersections, each catty-corner to the main BWH entrance at 75 Francis Street and the proposed Brigham and Women's Building, and opposite the Shapiro Cardiovascular Center, it is ideally situated as a future addition to the BWH campus. Wayfinding and signage efforts described in Section 5.3.3 will ensure this building is clearly marked as a BWH building in the future.

5.3 Project Edges

5.3.1 Sidewalk Improvements

The Project includes plans to improve sidewalks adjacent to the Project Site. These improvements further the pedestrian connectivity efforts described above by enlivening the pedestrian experience for those moving through and adjacent to the Project Site from and to the residential neighborhood, the BWH campus and the Emerald Necklace. As described in Section 4.10.2, the construction of the various streetscape improvements will occur during the construction phase of the building adjacent to the applicable sidewalk.

The facade of the existing MMHC buildings are presently set back 2'-0" to 12'-3" from the Fenwood Road property line and 10'-0" to 20'-0" to the curb with two smaller setbacks essentially on the property line. The proposed Residential Building and Brigham and Women's Building will increase these setbacks and therefore improve the pedestrian experience. The Residential Building is set back approximately 18'-6" from the Fenwood Road property line and approximately 18'-8" to 26'-6"to the curb, while the Brigham and Women's Building is set back approximately 13'-9" from the Fenwood Road property line and approximately 14'-4" to 22'-4" to the curb.

An 8 foot sidewalk is proposed at the Residential Building, but with a widened landscaped green space between the sidewalk and building. Setbacks will protect the mature perimeter of trees to the greatest extent feasible, and incorporate them into the landscape plan if possible. A certified arborist has been retained to examine the condition of trees on the Main MMHC Site. The arborist is charged with developing a site visit report, evaluation of the health of the mature trees and remedial recommendations. The setback also provides a buffer from Fenwood Road for the residents of the Residential Building. Traditional landscape materials will be used which are sympathetic to Olmsted's Emerald Necklace. The reconstructed historic fence of decorative masonry piers and steel fencing will edge this area of the Main MMHC Site and provide security to residents. Exterior features include a small play area, a formal lawn area, and outdoor terraces in two locations.

The treatment changes at the Brigham and Women's Building, where increased pedestrian traffic along Fenwood Road is anticipated between the Vining Street and Binney Street intersections. This increased width permits a broad sidewalk of 14 feet enlivened with street trees in landscaped, curbed planters, in a rhythm and spacing to match the tree pattern on the northeast side of the street. Building entrances are marked by with widened sidewalks and an entry plaza at the southeast end of this facade.

The Brigham and Women's Building sidewalk along Vining Street is similarly widened with the sidewalk extending from curb to building and matching the alignment of the Shapiro Cardiovascular Building on the next block. Street trees in a similar pattern to those along Vining Street at the Shapiro Building block are proposed; however, these will be set in flush sidewalk grates as opposed to the raised planter treatment on the Shapiro block.

On the opposite side of Vining Street, the Partial Hospital / Fenwood Inn will be set 6 feet to 10 feet from the property line and 14 feet to 18 feet from the curb. This is an increased setback beyond that of its immediate neighbor to the northeast which permits the introduction of landscaping in front of the building (described in Section 5.3.2 below).

Traditional materials of flowering trees, perennials and evergreen shrubs will be planted behind a decorative steel fence with masonry piers modeled from the proposed building materials.

The private way edge will be improved with sidewalks, new curbing and some planting along the northeast edge.

5.3.2 Plazas and Entry Improvements

The Binney Street Building is set back to create entry plazas at both its primary entrance on Fenwood Road and secondary entrance on Francis Street. The secondary entrance plaza on Francis Street is also the point of entry to the adjacent Servicenter Complex. Plaza development on Francis Street includes stairs beneath a cantilevered overhang to allow for some rain shelter. The sidewalk along Binney Street between these two plazas will increase from eight feet at Francis Street to twelve feet at Fenwood Road and be planted with a colonnade of street trees in flush tree grates.

At the Partial Hospital/Fenwood Inn traditional materials of flowering trees, perennials and evergreen shrubs will be planted behind a decorative steel fence with masonry piers modeled from the proposed building materials.

The pedestrian way between the Residential Building and the Brigham and Women's Building, will be a landscaped path across the Main MMHC Site to and from the Riverway to the LMA and will include a path edge with perennial plantings and specimen trees. Historical, cultural, and environmental content will be incorporated into the various Project elements to illustrate the importance of the Emerald Necklace and the LMA to passersby. Special rain gardens will also be included to reduce stormwater flows into the stormwater network. Additional information on this open space is provided below in Section 5.3.2.

In general, the proposed landscape design improves the existing LMA streetscape character. Concrete sidewalks will be enhanced with tree pits and major entrances to the street at each building. Where dimensions allow, street trees will be placed in special planting areas with landscape curbs, a better environmental condition for each tree. Existing narrower sidewalks will have traditional tree grates for each tree. The sidewalks will include areas for street lights, bike racks, trash receptacles and all project signage.

The exterior lighting approach will be to maintain a minimum light intensity of approximately 1 foot candle to allow for safe passage. Pole mounted lights will be down-cast to prevent excess light pollution and all other lights will be arranged or shielded to prevent direct glare for the light source onto adjacent properties

5.3.3 Wayfinding

The Project includes four distinct buildings to be occupied by three separate entities, DMH, BWH and RTH residents, therefore a clear plan for wayfinding is essential to help visitors traveling by car or foot to easily identify their destination. One wayfinding and signage goal for the Project is to ensure that area signage clearly marks each building and uses. Another goal for wayfinding is to ensure that signage is appropriately sized and designed to reflect both the design of the Project but also the aesthetic of the surrounding area. Potential measures to assist with wayfinding are providing directional signage along major access routes to the Project Site, using appropriate logos on buildings (DMH or BWH), including building names on the façade and marking clearly building entrances. To ensure the plan for each building meets these goals, the Proponent will meet with BRA design staff to discuss appropriate wayfinding and signage for each Project building.

Signage for the Brigham and Women's Building and the Binney Street Building (when vacated by DMH) will be consistent with the goals set forth in the BWH 2010 IMP, to be submitted in October 2009, to reinforce BWH's institutional identity. As described above, Project buildings with BWH uses will incorporate the BWH logo and entrances will be clearly marked. To promote integration of the proposed BWH buildings into the existing BWH campus, the signage and wayfinding design will be consistent with the March 2006 Comprehensive Sign Design for the Shapiro Cardiovascular Center, subject to approval by the BRA.

5.3.4 Vehicular Access and Egress

The layout and access plan for the Project maximizes efficiency of traffic and pedestrian flows to protect pedestrian safety and minimize vehicle circulation around the Project Site. Figure 1-4, Proposed Site Plan, in Chapter 1.0 identifies access and egress locations and service and loading areas.

The proposed driveway on the private way will provide access and egress to the Brigham and Women's Building parking garage and service area along the most underutilized road adjacent to the Main MMHC Site from a transportation perspective. By locating the driveway along the private way, clear sight distances can be obtained for vehicles exiting the driveway. In addition, vehicle/pedestrian conflicts will be minimized, since the Residential Building's and Brigham and Women's Building's main pedestrian access points will be along Fenwood Road. The primary sidewalk for most pedestrian travel will be the existing one on the southwest side of the private way as it is not interrupted by curb cuts and has a green buffer from the adjacent Neville House. The location of the driveway along the private way also takes advantage of the slope of the Main MMHC Site – allowing the Fenwood Road face of the building to have a complete floorplate – with windows and pedestrian entry points, which were important considerations for both the BRA and the neighborhood.

A service entrance for the Residential Building will be located along the Fenwood Road facade opposite the existing service entrances of the Servicenter Complex.

A small loading area off Vining Street is proposed for the Partial Hospital/Fenwood Inn.

A loading zone for the Binney Street Building is proposed on Fenwood Road. Solid waste and recycling for the Binney Street Building will occur in the Serivcenter Complex.

5.4 Project Specific Design

5.4.1 Open Space

The Project will significantly improve both the quantity and quality of open space. At present, 47,901 sf of the Project Site is occupied by building while of the remaining 89,098 sf only 17,949 sf is landscaped open space/pervious area. Impervious cover in the existing condition is 71,149 sf. Approximately 13 percent of the existing condition is greenspace[1] but it is predominately space left over at the margins of parking lots and buildings as shown in Figure 1-3, Existing Site Plan.

By comparison, the proposed redevelopment of the Project Site will reduce the amount of impervious cover from 71,149 sf to 43,320 sf (a 39 percent reduction) and provide 26,231 sf of landscaped, pervious open space (a 46 percent increase). The proposed open space will be organized in a coherent form that extends the existing pattern of open space at the Riverway while reinforcing patterns along Fenwood Road, Binney Street and Vining Street. Figure 1-4, Proposed Site Plan, provided in Chapter 1.0 underscores the quality of green space proposed both along Project edges but also on the Main MMHC Site buffering the Emerald Necklace to the west.

This existing open space includes trees that the Proponent will make an effort to preserve. Setbacks will protect the mature perimeter of trees to the greatest extent feasible, and incorporate them into the landscape plan if possible. A certified arborist has been retained to examine the condition of trees on the Main MMHC Site. The arborist is charged with developing a site visit report, evaluation of the health of the mature trees and remedial recommendations.

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1 Although the Binney Street Site was previously a combination of brick hardscape and green landscaping, calculations of impervious, pervious and green spaces assume the current Binney Street Site use of construction trailers, bus stop for shuttles, and transformer for the Servicenter Complex. Calculations of pervious area and green space in the proposed condition do not include the proposed green roof on the Binney Street Building. In general, the provision of a green roof on the Binney Street Building will reintroduce green and pervious surface to the Binney Street Site consistent with its historical use. Overall, there will be a significant increase in pervious and green spaces as a result of the Project, as noted in greater detail herein.

The block bounded by the Riverway, Fenwood Road, Vining Street and the private way will be occupied by the Residential Building to the northwest and the Brigham and Women's Building to the southeast. Although owned by separate entities, the landscape and pedestrian circulation master plan between and around these buildings has been developed as a unified design concept as opposed to two separate but coordinated parcels. The space between the two buildings is conceived as an extension of the Riverway green space extending northeast toward Binney Street. Brigham and Women's Hospital will take responsibility for the maintenance of this new open space with the participation of RTH.

From a pedestrian's point of view looking southwest along the Binney Street corridor, the Brigham and Women's Building provides an opportunity to appropriately screen the blank wall of the neighboring Neville House which would otherwise represent the termination of the view down Binney Street. The footprints and massing of the Residential Building and the Brigham and Women's Building are stepped and coordinated to redirect this vista and define a landscaped pedestrian and visual connector from the intersection of Francis Street and Binney Street to the Riverway. This vista to the Riverway widens as the point of view moves southwest to the intersection of Fenwood Road and Binney Street. The main Residential Building entrance is envisioned at the mouth of this new opening to the Riverway where the Brigham and Women's Building steps back to form an entry plaza. This new landscaped open space between the two buildings will provide a landscaped connection amenity to the Riverway that does not presently exist. It has been designed as more organic in form and more soft-scaped than hardscaped, bringing a sense of the Riverway northeastward onto the Project Site.

Following the curve of the Riverway, a landscaped buffer on the inside of the reconstructed historic fence is activated with walking paths and sitting areas for residents and provides a visual amenity to pedestrians walking on the east side of the Riverway. The historic fence will be reconstructed in its present location along the Riverway preserving the existing pedestrian promenade. On a macro level, this landscaped buffer represents the continuation of the 30 foot to 40 foot landscaped Mission Park buffer to the south of Neville House. The landscaped buffer widens toward the intersection of the Riverway and the private way where the Residential Building will step back to define an outdoor space that will serve the residents of the Residential Building. A direct entrance to these spaces is envisioned at this outdoor space linking to the pedestrian way between the Residential Building and the Brigham and Women's Building and the wider RTH community to the south.

5.4.2 Massing and Height

The Residential Building and the Brigham and Women's Building will match the scale and massing established by Neville House and the Shapiro Cardiovascular Center. From a macro level (which can be appreciated when viewing a massing model of the area) the two new additions represent a coherent extension of the massing established by the BWH campus generally. Within that context, a number of massing strategies and alternatives have been studied. In each case, the massing of the Residential Building and the Brigham and Women's Building have been studied together to ensure a cohesive design for the site. The massing is based on both design considerations and program needs to ensure viability of the Project as described in Section 2.9. Earlier versions envisioned both buildings as blockier forms. The Brigham and Women's Building was originally conceived as a cube on a podium. This related to a squatter, more footprint intensive Residential Building which took the form of an extruded triangle, with one of its broad façades facing and approximately matching an opposite facade of the Brigham and Women's Building.

The massing of these two larger buildings evolved in an effort to move toward more elegantly proportioned forms. In the case of the Brigham and Women's Building, the formerly cube-like form was fractured into three layers oriented to the geometry of Fenwood Road. Sliding these layers past one another permitted the manipulation of the form to present apparently slender northwest and southeast facades as well as to respond to ground plane objectives, particularly on the northwest in order to open and reorient a vista to the Riverway. As this massing strategy evolved, the Brigham and Women's Building footprint was also moved northeastward to increase its separation from the residential Neville House on the other side of the private way.

The Residential Building evolved in tandem, responding to the strengthening northwest/southeast geometry of the Brigham and Women's Building. From an extruded triangle it became, in essence, a modified layer on axis with the layered tower of the Brigham and Women's Building. The modification occurs at the northwest end where it retained the triangular form generated by site geometry and presenting a dramatic, slender gateway to the intersection of Riverway and Brookline Avenue. The footprint of the Residential Building was shifted eastward to maintain a landscaped 30 foot to 40 foot setback along the Riverway which resumes the typical landscaped setback of Mission Park to the south on the Riverway. Moving from the earlier 12 story triangular form to the proposed 15 story, slender form permitted a smaller building footprint. This allowed a 30 foot to 40 foot setback from the Riverway creating a substantial open space programmed for a variety of uses. It also furthered the conceptual extension of the Riverway through the Main MMHC Site.

The space between the two larger buildings was originally designed as a parking court located approximately 45' feet to the northwest. The evolution of the buildings massing and consequent shift of the open space between the buildings southeastward provided the opportunity to open a view corridor to the Riverway from Binney Street.

The rationale for the massing and height of the smaller Binney Building and Fenwood Inn are quite straightforward. The Binney Building masks the adjacent Servicenter Complex and continues, in a general sense, its massing. The Partial Hospital/Fenwood Inn approximates the massing of the existing former nurses' quarters building and provides a transitional function to the scale of the surrounding residential neighborhood to the southeast.

5.4.2.1 Compliance with the LMA Interim Guidelines

The Interim Guidelines establish a principle of protecting the physical assets of the LMA, and include restrictions on new shadows on City of Boston parks. The Interim Guidelines state:

> "…no project will be approved if it casts any new shadow for more than one hour on March 21st on the Emerald Necklace, Joslin Park or Evans Way Park. This standard is consistent with the most recent shadow restrictions adopted in the City's Municipal Harbor Plan."

The shadow analysis conducted for the Project presents the cumulative impacts for all four buildings proposed as part of the Project, although only the Binney Street Site is subject to the LMA Interim Guidelines. As demonstrated in Figures 5-1 through 5-5, no shadows from the Binney Street Building are anticipated on the Riverway section of the Emerald Necklace on March 21st. Therefore, the Project complies with the BRA's LMA Interim Guidelines shadow criteria as stated below.

Shadow studies of all four proposed buildings have been conducted for March 21st, the Vernal Equinox, and include analyses of shadow impacts for every hour beginning at 7:00 am through 6:00 pm. As stated above, the only building subject to the Interim Guidelines is the Binney Street Building and it does not cast any shadow on the Riverway on March 21. As demonstrated in Figures 5-3 to 5-7, the proposed Brigham and Women's and Residential Buildings will cast shadow onto the Riverway section of the Emerald Necklace on March 21st. The evolution of the Project's massing described in Section 5.4.2 resulted in the shift of the footprints of the Brigham and Women's Building and the Residential Building to the east in tandem with a presentation of more slender profile of the Residential Building. These changes reduced shadow impacts on the Riverway parkland of the Emerald Necklace. At 8:00 am, the sun is lower in the sky casting longer shadows, but over the course of the morning shadows shorten and move across the northern end of the Riverway. By 10:00 am, shadows fall on a small area at the edge of the Riverway parkland near the intersection of Brookline Avenue and Riverway. Shortly after 10:00 am, there are no new shadows on the Riverway on March 21 as a result of the proposed Project.

As demonstrated, the Binney Street Building will comply with the BRA's LMA Interim Guidelines shadow restrictions.

5.4.3 Individual Building Design Concepts

5.4.3.1 Partial Hospital/Fenwood Inn

At three stories, the height of the Partial Hospital/Fenwood Inn extends the residential scale of Vining Street, Kempton Street and St. Albans Street. While the somewhat larger footprint of the building provides transition to the other new buildings in the development, the

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Figure 5-3

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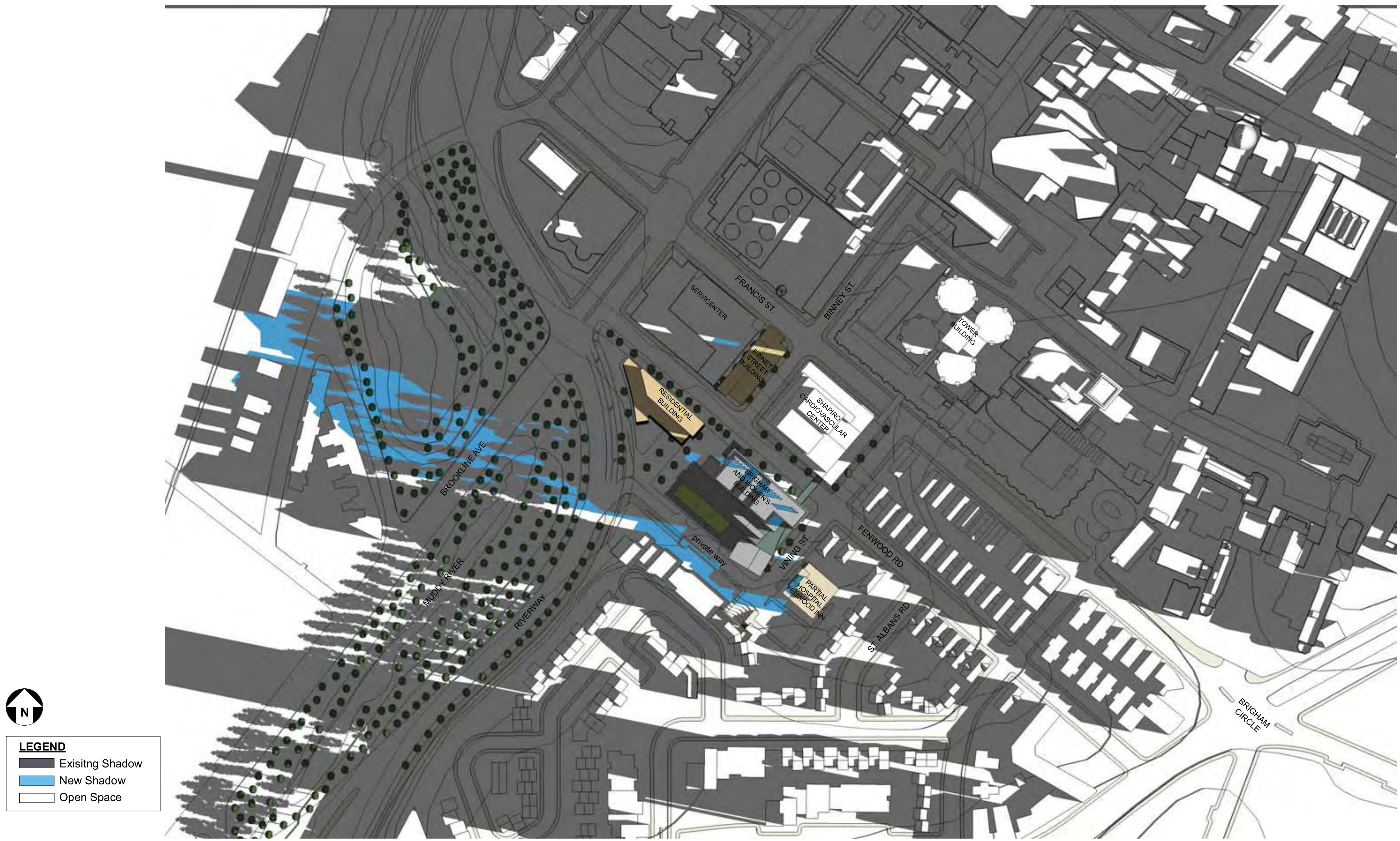
March 21 - 07:00 AM



Massachusetts Mental Health Center Redevelopment Project Boston, MA

Figure 5-4

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March 21 - 08:00 AM

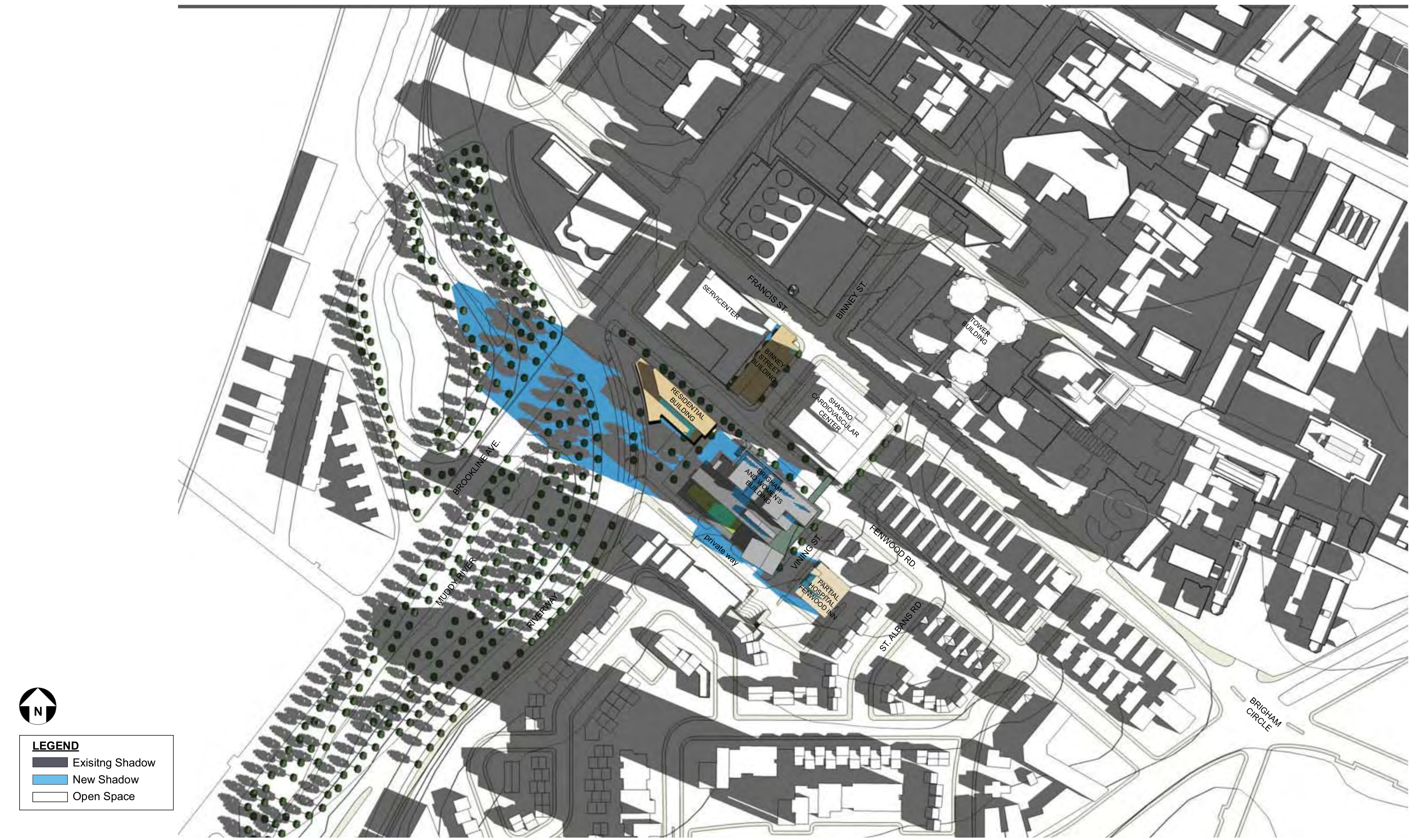

Figure 5-5

Massachusetts Mental Health Center Redevelopment Project Boston, MA

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March 21 - 09:00 AM

Massachusetts Mental Health Center Redevelopment Project Boston, MA

Figure 5-6

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March 21 - 10:00 AM

Massachusetts Mental Health Center Redevelopment Project Boston, MA

Figure 5-7

March 21 - 11:00 AM

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massing along Vining Street is divided into five vertical sections, each set back at slightly different planes from the street. This division of the Vining Street façade recalls the familiar vertical proportion and scale of the neighborhood. Punched residentially scaled windows are proposed throughout, slightly larger at the Vining Street façade to reflect common spaces within the building. Brick and composite panels are proposed as surface materials.

5.4.3.2 Binney Street Building

The Binney Street Building is proposed as a six-level structure between Binney Street, Francis Street and Fenwood Road, adjacent to the Servicenter Complex. The building presents a uniform roof line, but is five floors at Francis Street and six floors at Fenwood Road due to the change in grade across the Binney Street Site. The underlying massing is layered, with a solid, anchoring mass containing core elements along the garage and a lighter, glassy element which wraps the solid element along Binney and Francis Streets. The upper four floors of this lighter, glassy element are visually enclosed within in a metal cornice which at the southwestern end extends toward Fenwood Road and on the northeastern side turns to become a vertical element on the Francis Street facade. The floors below this distinct massing element are set back to widen the sidewalks and further articulate the mass above. This widening of sidewalk extends the Binney Street sidewalk and creates entry plazas at both Binney Street intersections.

These two entry plazas mark the two points of entry to the building. The primary address is on Fenwood Road in a space defined by the entry plaza and the extended cornice canopy described above. The secondary entrance located at the corner of Francis and Binney Streets accesses the meeting space and certain other first floor public areas, which need to be separate from other programmatic uses within the building.

Materials contemplated are chosen to reinforce the massing organization and include metal panels at the cornice, masonry units at solid areas and curtain wall.

5.4.3.3 Brigham and Women's Building

The Brigham and Women's Building is located at the eastern side of the Main MMHC Site. Its massing is organized as three vertically-oriented layers over a two-story podium. These three vertically-oriented layers slide past each other along their northwest-southeast axis, which at both northwest and southeast facades permit a slender, vertically-oriented organization. In addition, they create a staggered footprint at the northwestern end of the Brigham and Women's Building which helps define and zone the ground plane of the pedestrian way. The two-story podium facing the RTH community to the southwest serves to set the taller, layered volume back from Neville House, the RTH residential high-rise located on the opposite side of the private way. An additional third level of massing is added to the podium at its southern corner and along its southeastern edge with the addition of an articulated conference center volume and the termination of the "Pike," a visual extension of the bridge crossing Fenwood Road from the Shapiro Cardiovascular Center at 70 Francis Street.

Major entrances to the Brigham and Women's Building are located at the north and east corners. The main BWH entry is located at the corner of Fenwood Road and Vining Street and accesses a lobby with security functions, entrance to the parking garage, and some small miscellaneous outpatient clinical functions are proposed on the ground floor at the east entry. Another BWH entry is proposed along private way at the southern edge of the Main MMHC Site which will allow access to the internal circulation system of the Brigham and Women's Building as well as the BWH campus "Pike." The building also includes a main entry for DMH's MMHC psychiatric clinical space and administrative uses in the building.

Service and garage entrances are located on the southwest façade along the private way as shown on Figure 1-3.

5.4.3.4 Residential Building

The proposed massing of the Residential Building to the northwest is oriented along Fenwood Road, set back from the street to accommodate the mature trees and to provide light and air for the lower residential floors. At its northwesterly end, the mass of the Residential Building is set back 30 feet to 40 feet from the Riverway property line and follows its curved geometry to the approximate midpoint of the Riverway frontage before stepping back first perpendicular to the Riverway for about 30 feet and then to the orthogonal geometry established by a plane parallel with Fenwood Road. The resulting notched geometry of the footprint establishes several distinct zones around the Main MMHC Site. The ground floor will include an entrance lobby and possibly 10,000 sf of community space. The rooftop mechanical penthouse will be set away from the Riverway and incorporated into the northwestern corner of the building facing Binney Street.

5.5 BWH Campus Networks

The BWH 2010 IMP to be submitted to the BRA in October 2009 outlines the Project's relationship to BWH campus networks, including campus internal and external connections and open space networks.

Section 6.0

Historic Resources

6.0 HISTORIC RESOURCES

6.1 Historic Resources

6.1.1 Buildings on the Project Site

Massachusetts Mental Health Center (74 Fenwood Road)

Opened in 1912 as the Psychopathic Department of Boston State Hospital, MMHC is historically significant for its pioneering role it played both in psychiatric research and in the development of new patient treatment strategies, both of which revolutionized mental health care in the early twentieth century. Designed by the Boston architectural firm of Kendall, Taylor & Company, MMHC is also architecturally significant as a representative example of the major shift in psychiatric philosophies at the turn of the century, from physical rather than environmental causes to mental illness. MMHC reflects a shift from the creation of the asylum setting, as seen at Danvers and Northampton state hospitals, to a more clinical and research based rehabilitation program with strong emphasis on furthering scientific knowledge. Chapter 537 of the Acts of 1920 removed the Psychopathic Department from the direct control of Boston State Hospital and renamed it the Boston Psychopathic Hospital. Chapter 63 of the Acts of 1956 renamed the facility the Massachusetts Mental Health Center.

The Massachusetts Historical Commission (MHC) included MMHC, along with 14 other state hospitals and state reformatory schools in a Multiple Property Thematic nomination to the National Register of Historic Places. As a result, in 1994, MMHC was listed in the National Register of Historic Places and is de facto included within the State Register of Historic Places. The National Register nomination for MMHC includes five resources at the Main MMHC Site: the 1912, four-story, red brick, E-shaped Main Building; the 1912 freestanding, red brick Power Plant; the 1954 five-story, red brick Research Building; the 1957, two-story, red brick Therapeutic Building; and the original 1912 cast iron and brick fence. The nomination did not include the building at 20 Vining Street on the Partial Hospital/Fenwood Inn Site. Of the five resources included in the National Register nomination, only those dating from the hospital's original 1912 construction are considered "contributing" to the historical and architectural significance of MMHC; these include the Main Building, the Power Plant and fence.

While the Project includes the demolition of the MMHC Buildings, the continued presence of MMHC on the MMHC Site in a new state-of-the-art facility will allow for the continuation of the site's historic function.

6.1.2 Historic Resources in the Project vicinity

Olmsted Park System, Sections of the Back Bay Fens and the Emerald Necklace Parks

The Back Bay Fens and the Emerald Necklace Parks were designed by Frederick Law Olmsted as part of the Boston Park System. Landscaped as a park, the Muddy River runs through the Fens, and a conduit was created to carry the overflow of Stony Brook to the Charles River. To accommodate the various city streets in the area, several bridges were also constructed through the Fens and Emerald Necklace Parks. Simple in design, the Fens consists of a passive park of walkways and a bridle path. When the Charles River dam was completed in 1910, the salt water marshes began to die and three of the large marshes on the southern half of the Fens were filled, and the Victory Garden, part of Olmsted's original design, was reconfigured in the early 20th century for playing fields. Despite the changes to the Fens in the 20th century, it remains an important and noteworthy resource in the Olmsted Park System Historic District. The Emerald Necklace Parks are similar in design to the Fens. The portion of the Emerald Necklace Parks adjacent to the LMA consists of low lying areas surrounding the Muddy River with meandering pathways on both sides of the waterway and bounded on the southwest by the landscaped Riverway. The Riverway itself is located within a Boston Landmarks Commission designated Protection Area.

Mission Hill Triangle Architectural Conservation District

The Mission Hill Triangle District comprises 71 buildings in a triangular area bordered by Huntington Avenue, Tremont and Worthington Streets. In 1871, developer George D. Cox began building single-family row houses resembling those in the Back Bay. By the early 1880s, Huntington Avenue was extended, bringing with it electric car service that influenced new housing types. The Helvetica, a distinctive apartment hotel, was constructed at 706-708 Huntington Avenue in 1884-1885; three-family houses were built in 1890 on Wigglesworth and Worthington Streets; and the Georgian Revival apartment building known as the Esther (682 Huntington Avenue/142-148 Smith Street) was constructed in 1912. The District, which is designated a Boston Architectural Conservation District, exemplifies the development of this urban neighborhood from the 1870s to the 1910s. The buildings of brick, brownstone, sandstone and marble trace the changes from single-family housing to more modest three-family buildings and apartment buildings.

Table 6-1 identifies State and National Register listed properties within the vicinity.

Table 6-1 State and National Register-listed properties

No.	Name	Address
A	Massachusetts Mental Health Center	74 Fenwood Road
B	Mission Hill Triangle District	Huntington Avenue, Smith, Worthington, Wigglesworth and Tremont streets
C	Olmsted Park System (including the Riverway)	Sections of the Back Bay Fens*, Emerald Necklace Parks* (including the Riverway, which is in a Protection Area)

* Property listed as a Boston City Landmark

6.1.2.1 Properties included in the Inventory of Historic and Archaeological Resources of the Commonwealth

Francis Street and Fenwood Road District (Francis Street and Fenwood Road)

The Francis Street and Fenwood Road District consists of a group of approximately forty residential pitched roof two to six-family houses and a few brick multi-family residential buildings along Francis Street and Fenwood Road from the early 20th century. The vast majority of these are owned by RTH. Most of the houses in the neighborhood have retained original porches and trim, and many maintain natural siding. Edges of the district along Huntington Avenue include brick multi-family properties dating from the turn of the 20th century.

Former New England Deaconess Hospital Building (175 Pilgrim Road)

New England Deaconess Home and Training School was founded in 1889 by eight Methodist Deaconesses. The New England Deaconess Hospital was constructed in 1903-1907. The Georgian Revival style, three-story hospital is nine bays long with a central pediment and pilasters. Light colored stone details accentuate the façade. Deaconess was the first hospital to perform insulin treatment for patients in New England.

Harvard Medical School (210, 220, 240, 260 Longwood Avenue/25 Shattuck Street)

The Harvard Medical School was built between 1906 and 1908 in the Classical Revival style. It consists of five white marble buildings in a U-shaped plan around a monumentally-scaled, landscaped quadrangle. The buildings were designed by Shepley, Rutan and Coolidge who designed many of the buildings in the surrounding LMA. They are connected to one another by a raised marble terrace and marble banister further encloses the group along Longwood Avenue.

Former Palmer Hospital Building (195 Pilgrim Road)

Originally known as the Palmer Memorial Hospital, the imposing Georgian Revival building originally housed patients from the Cullis Consumptive Home in Roxbury and ministered to acutely ill patients requiring radium, deep X-ray therapy and surgery. The five-story brick building features a central three-bay pavilion with three-story pilasters. The nine-bay-wide and five-bay-deep building is accentuated with dentil courses and quioning.

Thomas Morgan Rotch, Jr. Memorial Hospital for Infants (55 Shattuck Street)

The Thomas Morgan Rotch, Jr. Memorial Hospital for Infants was designed by Shepley, Rutan and Coolidge and built in 1910. The building is a fine example of Classical Revival architecture by one of Boston's most prominent architectural firms who were responsible for several buildings in the LMA. The building is a white marble clad structure with a monumental Ionic portico and was designed to coordinate with the adjacent Harvard Medical School buildings.

Peter Bent Brigham Hospital (721 Huntington Avenue/15 Francis Street)

The will of Peter Bent Brigham provided the funds for the establishment of a hospital for the care of the poor in Suffolk County in 1877. In 1902 a hospital corporation was organized and a competition for the design of the new hospital was instituted. The architectural firm of Codman & Despradelle was chosen from the six competing firms. The hospital was opened in 1913 for the admission of patients.

Not long after its dedication, the design of the new hospital was cited for its role in the development of hospital architecture in America. Designed in the pavilion style, the Administration Building with its central Doric style pedimented portico is flanked on both sides with two projecting wings. Four pavilion style wards ran parallel down Francis Street. Each ward was connected to the other, and in turn to the Administration Building, and each terminated with an octagonal pavilion. The pavilion style wards have been removed and replaced with modern hospital buildings, but the Administration Building and projecting wings, though with some alterations, maintains its historic integrity and presence at Brigham Circle as does the "Pike" which continues to connect the main hospital buildings.

Farragut School (10 Fenwood Road)

The Farragut School was constructed in 1903 and opened in January 1904 as a 12-classroom primary school. Designed by the renowned architecture firm of Wheelwright and Haven, the Farragut School was considered experimental with its attempts to exclude sunlight from the classrooms to benefit the eyes. Despite the fact that this was the most expensive school erected at the time, the school board determined as early as 1905 that the lack of sunlight was a detriment.

The red brick Georgian Revival school building is complemented with light sandstone trim, quoins, stringcourses, keystones and classical surrounds at the entries. Nine-over-nine sash with flat arches, stone sills, keystones and roundels enclose a central playground. A low brick and cast iron fence parallel to the street complete the courtyard.

Properties within the Project's vicinity that are included in the Inventory are identified in Table 6-2. Figure 6-1 depicts the locations of the State and National Register listed properties, and properties included in the Inventory, within one-quarter mile of the Project Site.

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Massachusetts Mental Health Center Redevelopment Project **Boston, Massachusetts**

Epsilon ASSOCIATES INC.

Figure 6-1

Historic Resources

Table 6-2 Properties included in the Inventory of Historic and Archaeological Resources of the Commonwealth

No.	Name	Address
1	Francis Street and Fenwood Road District	Francis Street and Fenwood Road
2	Harvard Medical School District	210, 220, 230, 240, 260 Longwood Ave. and 25 Shattuck Street
3	Former New England Deaconess Hospital Building	175 Pilgrim Road
4	Former Palmer Hospital Building	195 Pilgrim Road
5	Thomas M. Rotch Jr. Memorial Hospital For Infants	55 Shattuck Street
6	Peter Bent Brigham Hospital	721 Huntington Avenue / 15 Francis Street
7	Farragut School	10 Fenwood Road

6.2 Impacts to Historic Resources

Prior to the Commonwealth's disposition of the property, it was anticipated that demolition of the MMHC buildings would likely be part of the redevelopment of the site. In June 2003, DCAM, DMH, MHC and the Boston Landmarks Commission (BLC) entered into a Memorandum of Agreement (MOA) for the disposition and redevelopment of MMHC. A copy of the MOA is attached as Appendix H.

The MOA states that if preservation of all character-defining features is not feasible, preservation of portions of contributing resources, as identified in the National Register nomination, is encouraged. The Project includes an architectural salvage and reuse plan that ensures the preservation of portions of the contributing buildings' character-defining features. As discussed below, the Proponent has developed a draft architectural salvage and reuse plan. The Proponent is working with BLC staff to finalize and implement the salvage and reuse plan after the Proponent acquires leasehold site control.

The MOA further stated that prior to any major changes on the MMHC Site, photographic recordation and documentation must be prepared and submitted for review by MHC, with final copies of the resulting documentation made available to MHC and BLC. In December 2005, archival black and white photographs documenting the character-defining features of MMHC were submitted to the MHC and BLC. In letters dated January 3, 2006 and January 25, 2006, BLC and MHC stated that the documentation submitted fulfilled the photographic recordation stipulation of the MOA.

6.2.1 *Design and Visual Impacts*

As discussed in greater detail in Section 5.0 Urban Design, the designs of the Partial Hospital/Fenwood Inn, Binney Street Building, Brigham and Women's Building and the Residential Building will include a mix of building heights, materials and massing. The three story height of the Partial Hospital/Fenwood Inn will extend the residential scale found in the nearby Francis Street and Fenwood Road Historic Area. The new three story building will provide a transition to the taller new buildings in the development. The massing along Vining Street is divided into five vertical sections, each set back at slightly different planes from the street. This division of the Vining Street façade recalls the familiar vertical proportion and scale of the neighborhood.

The Binney Street Building is proposed as a six-level structure between Binney Street, Francis Street and Fenwood Road, adjacent to the Servicenter Complex. The building presents a uniform roof line, but is five floors at Francis Street and six floors at Fenwood Road due to the change in grade across the site. The Binney Street Building will be consistent in height with the adjacent Servicecenter Complex, and will be separated from the Francis Street and Fenwood Road Historic Area by the existing adjacent ten story Shapiro Cardiovascular Center.

As noted above, the three story Partial Hospital/Fenwood Inn will provide a transition between the Francis Street and Fenwood Road Historic Area to the east and the new Brigham and Women's Building and Residential Building to the west. The massing of the Residential Building will be set back from the street to accommodate the mature trees. At its northwesterly end, the mass of the Residential Building is set back 30 feet to 40 feet from the Riverway property line and follows its curved geometry to the approximate midpoint of the Riverway frontage before stepping back first perpendicular to the Riverway for about 30 feet and then to the orthogonal geometry established by a plane parallel with Fenwood Road. The resulting notched geometry of the footprint establishes several distinct zones around the site.

6.2.2 *Shadow Impacts*

As discussed in greater detail in Section 4.2, the Project will result in some new shadow. However, new shadow will generally be cast to the northwest, north and northeast on paved streets or on predominately late 20th century institutional buildings in the area.

The shadow study results indicate that the Project will not cause substantial impacts. In general, new shadow from the Project will largely be limited to the immediate surrounding public ways and sidewalks of Fenwood Road, the Riverway, Binney, Francis and Vining Streets. Some shadows will be cast on the Riverway portion of the Emerald Necklace, however, impacts will be limited to the morning hours. As the sun moves across the sky during these impacted times the shadows will also be moving, therefore no one particular area of the Riverway will be in shadow during the entire impacted period. There will be no new shadows on the Riverway open space during the midday, afternoon and evening hours studied.

Impacts to other historic resources in the Project's vicinity will also be minimal. The Francis Street and Fenwood Road Historic Area will experience a limited amount of new shadow during the late afternoon.

6.3 Status of Project Review with Historical Agencies

In addition to consulting with the Boston Civic Design Commission and neighborhood and community groups, the Project Proponent has met with the Boston Landmarks Commission. Specifically, the Proponent filed an Article 85 application for the demolition of the existing buildings on the site. At an August 11, 2009 BLC hearing on the Article 85 application the Proponent committed to continuing to work with BLC staff as the design for the project advances. As outlined to the BLC, the Proponent has developed a draft architectural salvage and reuse plan that would include salvaging and incorporating selective architectural features into the design of the project. Such features from the 1912 Main MMHC building include:

- **Commonwealth of Massachusetts seal** centered on the parapet above the main entrance;
- **Fireplace mantels** from the lobby, library and various offices;
- **Bookcases** with leaded glass doors from the library; and
- **Original light fixtures** from throughout the building

In addition, the Proponent continues to explore the possibility of salvaging components of the marble inlay flooring and baseboard in the main lobby area for reuse or recreating the floor with new material if reuse is not a feasible option. At this time, it is anticipated that the Commonwealth of Massachusetts seal will be relocated to the Binney Street Building entrance; the fireplace mantels will be placed in the Partial Hospital/Fenwood Inn large group room and possibly the conference room in the Binney Street Building, the bookcases will be located in the large conference room in the Binney Street Building, and light fixtures will be in the large conference room in the Binney Street Building and in the Partial Hospital/Fenwood Inn lobby.

While the existing wrought iron and brick post fence at the northwest limits of the project site is deteriorated and beyond repair, the Proponent has committed to replicating the fence in its present location. Components of the original fence will be salvaged and used as a guide in the manufacturing of the new fence.

Efforts will be made to ensure the continued presence of the mature trees at the northwest limits of the MMHC site, along the Fenwood Road sidewalk. Setbacks will protect the mature perimeter of trees to the greatest extent feasible, and incorporate them into the landscape plan if possible. A certified arborist has been retained to examine the condition of trees on the Main MMHC Site. The arborist is charged with developing a site visit report, evaluation of the health of the mature trees and remedial recommendations.

The Proponent is also committed to incorporating a photographic exhibit documenting the development of the MMHC Site. The exhibit will also highlight the pioneering role MMHC played in both psychiatric research and in the development of new patient treatment strategies, both of which revolutionized mental health care in the early twentieth century. As envisioned, the exhibit will be displayed in a light box in the Binney Street Building facing the Francis Street sidewalk. This location is highly visible given the active pedestrian activity along Francis Street from Brookline Avenue and Servicenter Complex to the Shapiro Cardiovascular Center and beyond.

In their comment letter on the ENF, the Massachusetts Historical Commission requested that the potential shadow impacts on the Riverway from new construction be included in the Draft EIR. As noted above, and in more detail in Section 4.2, shadow impacts on the Riverway will be limited to the morning hours.

Section 7.0

Infrastructure Systems Component

7.0 INFRASTRUCTURE SYSTEMS COMPONENT

This chapter evaluates the infrastructure systems that will support the Project. Based on initial investigations and consultations with the appropriate agencies and utility companies, existing infrastructure systems are adequately sized to accept the incremental increase in demand associated with the development and operation of the proposed Project. The following utilities are evaluated: wastewater, water, stormwater management, steam, natural gas, electricity, and telecommunications.

The final design process for the Project will adhere to applicable protocols and design standards, ensuring that the proposed building are properly supported by, and in turn properly use, the City's infrastructure. Detailed design of the Project's utility systems will proceed in conjunction with the design of the building and interior mechanical systems.

The systems discussed below include those owned or managed by the Boston Water and Sewer Commission (BWSC), private utility companies, and on-site infrastructure systems. There will be close coordination among these entities and with the Project engineers and architects during subsequent reviews and design process.

7.1 Wastewater Generation

Sewage generated by the Project will discharge to the BWSC system via the 12-inch sewer in Fenwood Road and the 12-inch sewer in Vining Street. The locations and sizes of these connections have not been determined. From there these sewers flow to the Brookline Sewer and ultimately flow to the MWRA Deer Island Waste Water Treatment Plant for treatment and disposal.

The Project will generate an average daily sewer flow of approximately 111,608 gpd, inclusive of mechanical equipment as shown in Table 7-1. For future clinical space, a wastewater generation rate of 200 gallons per day per 1,000 sf has been assumed. Wastewater generation rates for bedrooms and offices are per Department of Environmental Protection guidelines.

Table 7-1 Net New Wastewater Generation – Full Project Build Out

Proposed Project	Size (sf) or # of Bedrooms	Flow Rate (gpd)	Sewage Generation (gpd)
Partial Hospital/Fenwood Inn			
Outpatient clinic offices	8,260	200/1,000 sf	1,652
Bedrooms	47	110/bdrm	5,170
Brigham and Women's Building			
BWH - Wet Research	107,072	200/1,000 sf	21,414
BWH - Dry Research/Offices	45,888	75/1,000 sf	3,442
BWH - Clinics	152,960	200/1,000 sf	30,952
DMH – Office	36,020	75/1,000 sf	2,702
DMH - Clinical	16,730	200/1,000 sf	3,346
Residential Building			
Bedrooms	330	110/bdrm	36,300
Community Room	10,000	75/1,000 sf	750
Binney Street Building – BWH			
Outpatient Clinic	16,000	200/1,000 sf	3,200
Administrative/Offices	40,540	75/1,000 sf	3,040
Total New Wastewater Generation			111,608

7.2 Water Supply System

The BWSC will provide potable water to the Project Site. Existing water service for domestic use and fire protection is supplied from water systems owned and operated by BWSC. Water service will be provided to the Project via an 8-inch line in Vining Street, 12- and 8-inch lines in Fenwood Road and a 12-inch line in Binney Street.

Water generation is based upon estimated sewage generation with an added factor of 10 percent for consumption, system losses, and other usage. The average daily water demands for the proposed Project are expected to be approximately 122,770 gpd, inclusive of mechanical equipment demand.

7.3 Water Quality and Stormwater Management

The purpose of this section is to discuss the Project impacts on water quality, stormwater quality and surrounding wetlands.

7.3.1 Stormwater

The Project is expected to result in beneficial changes in both drainage patterns and water quality. The Project is not expected to result in the introduction of pollutants, including sediments, into surface waters or local groundwater. Upon full-build out of the Project, surface parking will be eliminated from the Project Sites. Site-by-site descriptions of stormwater management strategies are included in the following sections of this report.

For the Residential Building, Brigham and Women's Building and the Partial Hospital/Fenwood Inn, the existing sites are approximately 83 percent impervious and currently covered mostly by roof area and pavement. The current design for the proposed Site will reduce the impervious area through increased landscaped areas and landscaped buffers. This additional landscaped space will not only reduce the volume of runoff, but will also enhance the quality of runoff entering the BWSC drainage system.

The Binney Street Building Site is currently covered by construction trailers and construction support space and has been in this condition for several years. In the proposed condition, the Site is expected to be nearly completely impervious.[1]

In addition to the added green space, the Proponent is exploring permeable pavement materials, vegetated stormwater management areas and/or subsurface infiltration/detention systems. The Proponent intends to further refine the stormwater management strategy in conjunction with the progress of the Project's design and overall sustainability objectives development.

Stormwater management controls will be established in compliance with BWSC standards and the Project will not introduce peak flows, pollutants, or sediments that would potentially impact the receiving waters of the local BWSC stormwater drainage system. Among the stormwater management controls considered for implementation will be deep sumped and hooded catch basins, sump cleaning, and oil/gas separators. Stormwater from the Sites will be collected and discharged via several new connections to either the existing 36-inch drain in Fenwood Road or the 15-inch drain in Vining Street.

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[1] Although the Binney Street Site was previously a combination of brick hardscape and green landscaping, stormwater calculations of impervious, pervious and green spaces assume the current Binney Street Site use of construction trailers, bus stop for shuttles, and transformer for the Servicenter Complex. Calculations of pervious area and green space in the proposed condition do not include the proposed green roof on the Binney Street Building. In general, the provision of a green roof on the Binney Street Building will reintroduce green and pervious surface to the Binney Street Site consistent with its historical use. Overall, there will be a significant increase in pervious and green spaces as a result of the Project, as noted in greater detail herein.

As part of the permitting process, the Project will submit stormwater management plans for each phase of the Project to the BWSC. Surface drain structures required by the Project will be developed to meet the latest city and state codes and standards. Compliance with the standards for the final Site design will be reviewed as part of BWSC's Site Plan Review Process.

It is noted that the Boston Parks Department has expressed concerns regarding the capacity of the existing stormwater system in the Riverway. Later in this Chapter an analysis of pre-development and post-development stormwater flows to the existing Riverway system is presented. As noted above, the Proponent is working towards site planning and stormwater system improvements that will reduce the contributory flows to the DCR system, as described herein. The Project is expected to result in beneficial changes in both drainage patterns and water quality.

The Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) indicates the FEMA Flood Zone Designations for the site area (Map Number 25025C0078G, September 25, 2009). The map for the proposed Project Sites show the site as located in either Zone X (area determined to be outside the 0.2% annual chance floodplain) or Zone D (area in which flood hazards are undetermined, but possible).

As a commitment to both the goal of improving the water quality of local bodies of water and public education, the Proponents will install plaques that bear the warning "Don't Dump – Drains to Charles River" at all new and adjacent catch basins. Oil traps will also be provided for all parking areas below grade, with any discharge from these traps directed into the sanitary sewer and not the storm sewer.

7.3.2 Construction Stormwater Management

Construction of the proposed Project is not expected to produce significant changes in either the pattern of, or rate of, stormwater runoff from the sites. Stormwater management controls will be established in compliance with BWSC standards, and the Project is not expected to result in the introduction of any peak flows, pollutants, or sediments that would potentially impact the receiving waters of the local BWSC stormwater drainage system. Potential runoff during construction will be controlled by measures developed in accordance with the policies and approvals of the BWSC and other appropriate oversight agencies.

7.3.3 Compliance with DEP Stormwater Management Policy

This section discusses the Project's compliance with each of the Department of Environmental Protection (DEP) Stormwater Management Policy Standards.

7.3.3.1 Standard #1: Untreated Stormwater

For sidewalk, street and driveway runoff, catch basins with hoods and sumps will collect runoff and sediments and help control floatables.

For the Partial Hospital/Fenwood Inn, it is expected that roof runoff will be diverted through infiltration galleys below the proposed driveway. An overflow to the BWSC storm drainage system will be provided for the infiltration system. The Partial Hospital/Fenwood Inn will replace a significant amount of existing parking surface with a combination of new roof and landscaped areas.

For the Binney Street Building, roof runoff is currently expected to be captured and reused within the building via a holding tank and/or treated through green roofs.

For the parcel containing the Residential Building and the Brigham and Women's Building, the current design calls for a combination of small-scale green roofs, bio-swales, rain gardens and subsurface recharge systems. It is likely that some roof runoff from the Brigham and Women's Building will be conveyed to the residential site for infiltration below-grade while the residential site runoff is captured and controlled via a mix of Low Impact Design and traditional strategies such as bio-swales, rain gardens and subsurface infiltration devices.

The final configuration of all stormwater systems will be reviewed by the Boston Water and Sewer Commission (BWSC) under the BWSC Site Plan Approval process. The location, sizing and configuration of these system is contingent upon the approval of the individual building configurations and massing by the Boston Redevelopment Authority and the Commonwealth of Massachusetts under the Article 80 and MEPA processes, respectively. In Section 7.3.3.2, existing and post-development discharge rates are presented.

7.3.3.2 Standard #2: Post-Development Peak Discharge Rates

Due to the increase in impervious area at the Binney Street Building, the Project is evaluating the use of either a green roof or a cistern (or both) as discussed in Section 7.3.3.1 to reduce peak discharge rates.

Both the Partial Hospital/Fenwood Inn parcel and Residential Building and Brigham and Women's Building sites propose an increase in pervious area, thus reducing the post-development peak discharge rates; however both parcels intend to further reduce rates by the use of infiltration techniques discussed in Section 7.3.3.3.

The following table presents a summary of the pre-development and post-development stormwater discharges rates. The discharge rates presented herein assume the following:

- The Binney Street Building's roof is covered for 30% by a green roof (or an equivalent retention tank is provided).

- The Partial Hospital/Fenwood Inn rates do not reflect the benefit of infiltration galleys as the Project is currently evaluating the geotechnical aspects of the sites. By excluding this potential benefit, the stormwater runoff rates presented herein are a conservative estimate. Upon receipt of the geotechnical data and prior to BWSC Site Plan approval, the Partial Hospital/Fenwood Inn discharge rates can be recalculated.

- The runoff rates presented for the Residential Building and the Brigham and Women's Building do not reflect the benefit of the expected low-impact design features (pending final site design including grading). However, the benefits of surface infiltration systems have been estimated herein.

Given these conservative assumptions, the expected discharge rates from the Project should be lower than the rates presented below. As shown in the following table, the Project is expected to reduce stormwater discharge rates by approximately 1.77 cubic feet per second (cfs), or approximately 19%in the two-year storm event.

Table 7-2 Stormwater Discharge Rates

Site	Event (yr)	Pre-development Discharge Rate (cfs)	Post-development Discharge Rate (cfs)
Binney Street Building	2	0.83	0.67
	10	1.29	1.11
	25	1.56	1.37
	100	1.90	1.69
Partial Hospital/Fenwood Inn	2	0.77	0.75
	10	1.15	1.14
	25	1.39	1.38
	100	1.67	1.66
Residential Building & Brigham and Women's Building	2	7.76	6.17
	10	11.85	10.01
	25	14.29	12.74
	100	17.25	15.35
Total	**2**	**9.36**	**7.59**
	10	**14.29**	**12.26**
	25	**17.24**	**15.49**
	100	**20.82**	**18.7**

Regarding the Boston Parks Department's expressed concern regarding stormwater runoff to the existing Riverway system, the Proponent has estimated the pre- and post-development discharge rates to the existing Riverway system. Under pre-development conditions, the 2-year storm event discharge rate is 1.72 cfs. Through a reduction in tributary area and an increase in the relative proportion of pervious area, the post-development 2-year storm event discharge rate is reduced to 0.81 cfs. Reductions are similarly projected for the 10-year, 25-year and 100-year storm events.

7.3.3.3 Standard #3: Recharge to Groundwater

The Partial Hospital/Fenwood Inn parcel proposes an underground concrete galley system under the driveway for infiltration of roof runoff. The Residential Building and Brigham and Women's Building parcel proposes the use of underground recharge systems within both landscaped and paved areas for infiltration of roof runoff. Both methods are traditionally accepted as effective means for recharging clean roof runoff within the ground. In addition, the Residential Building site is being evaluated for the siting of low-impact design features such as bio-swales and rain gardens.

Recharge at the Binney Street Building site is not practicable because the proposed building, coupled with an existing tunnel, takes up the entire parcel.

7.3.3.4 Standard #4: 80 Percent Total Suspended Solids Removal

The overall Project is targeting the removal 80% of TSS through the use of a long term pollution prevention plan, as well as the use of BMPs (Best Management Practices) and Low Impact Design (LID) design features including street sweeping, deep sump hooded catch basins, bioretention areas, grass channels, dry wells, infiltration basins, and green roofs. Much of the removal of pollutants will be achieved via the replacement of surface parking areas with roof and landscaped areas.

7.3.3.5 Standard #5: Higher Potential Pollutant Loads

The Project site does not contain land uses with higher potential pollutant loads.

7.3.3.6 Standard #6: Protection of Critical Areas

The Project site does not contain any critical areas.

7.3.3.7 Standard #7: Redevelopment Projects

The Project is a redevelopment and intends to meet the Stormwater Management Standards to the maximum extent practicable.

7.3.3.8 Standard #8: Erosion/Sediment Controls

The Project's construction documents will include measures and specifications regarding erosion and sediment controls and barriers (e.g., silt fence, catch basin sacks). Construction dewatering discharges will be appropriately controlled and discharged in accordance with National Pollutant Discharge Elimination System (NPDES) and State dewatering standards.

7.3.3.9 Standard #9: Operation/Maintenance Plan

An Operation and Maintenance plan will be developed for both construction and post-development, which will include system ownership information, parties responsible for operation and maintenance, and inspection and maintenance schedules. Routine maintenance includes catch basin cleaning, stormwater control cleaning, and removal of debris from outlets. It is also expected that pedestrian and vehicular access ways will be swept appropriately to control sand applied during winter months.

Measures aimed at minimizing the disposition of site soils to off-site areas, primarily the surrounding streets and existing drainage collection systems, will be a part of the City's required Construction Management Plan. In addition, the proponents will be applying for all appropriate permits for construction activity and dewatering. All efforts will be made to contain sediment, pollutants, and any other construction-related materials within the site. Stabilized construction exits will be installed at each access point of the work areas to minimize off-site transport of soil by construction vehicles. These exits will remain in place until site areas have been stabilized. The Proponent's will use BMPs during construction, including installing silt sacks on catch basins.

7.3.3.10 Standard #10: Illicit Discharges

The Project site is not known to contain any illicit discharges.

7.3.4 Lab Waste

This Project includes proposed wet laboratory space. As the wet research functions are identified during final design, the Proponent will coordinate with the MWRA TRAC program to identify the required treatment program. All lab wastes shall be treated and discharged separately into a sanitary sewer.

7.4 Energy Systems

7.4.1 Energy Efficiency

Each building will be designed to provide for its own heating and cooling needs. The Proponent is committed to promoting energy efficiency measures throughout the Project. Since research and clinical facilities are by nature 24-hour operations and intense equipment users, the Proponent will take seriously its leadership role in helping control use of excess energy. The Proponent will commission mechanical systems to ensure systems are operating as efficiently as possible from the day of their installation.

The Proponent will have a program in place to ensure chlorofluorocarbon reduction in all heating, ventilation, air-conditioning, and refrigeration equipment purchased. The Proponent will incorporate efficient light fixtures to increase energy efficiency and improve illumination. The energy requirements for all major pieces of equipment will be in accordance with energy code requirements and with requirements for LEED Certifiability.

Additionally the Proponents are pursuing numerous sustainable design initiatives including the optimization of energy performance and building commissioning. More detailed discussion of these opportunities is discussed in Section 4.11, Sustainable Design and Section 4.12, Greenhouse Gas Analysis.

7.4.2 Energy Needs

Electricity is provided in the LMA by NSTAR and the MATEP. NSTAR has recently completed upgrades in the Project area, including Fenwood Road. The Proponents are currently coordinating the estimated demands with NSTAR. Electrical demands are estimated to be as follows:

- Binney Street Building – 1,200 kVA
- Partial Hospital/Fenwood Inn – 360 kVA
- Residential Building – 1.3 MW
- Brigham and Women's Building – 4.8 MW

National Grid provides natural gas to the Project site. A 6-inch gas line is in Fenwood Road. Natural gas demands are estimated to be as follows:

- Binney Street Building – 3,370 CFH
- Partial Hospital/Fenwood Inn – 1,166 CFH
- Residential Building – 1,720 CFH
- Brigham and Women's Building – 57,000 CFH

Currently, there are no estimated demands for either steam or chilled water.

Section 8.0

Mitigation / Section 61 Findings

8.0 MITIGATION / SECTION 61 FINDINGS

8.1 Introduction

The Proponent has committed to mitigate impacts of the Project. This chapter outlines proposed mitigation and provides draft Section 61 Findings for each state action. The Proponent is responsible for implementation of these mitigation measures.

8.2 Section 61 Findings

The Secretary's Certificate on the ENF directed that the Draft EIR include a proposed Section 61 Finding for use by state agencies that issue permits. M.G.L. c. 30, s. 61 requires that "[a]ll authorities of the commonwealth ... review, evaluate, and determine the impact on the natural environment of all works, projects or activities conducted by them and ... use all practicable means and measures to minimize [their] damage to the environment. ... Any determination made by an agency of the commonwealth shall include a finding describing the environmental impact, if any, of the project and a finding that all feasible measures have been taken to avoid or minimize said impact." Since the project requires a number of state permits, the Section 61 Finding should extend to cover all potential impacts of the project. Each state agency that issues a permit for the project shall issue a Section 61 Finding in connection with permit issuance, identifying mitigation that is relied upon to satisfy the Section 61 requirement. The following state actions/permits are required for the proposed Project.

Table 8-1 Anticipated State Permits

State Agency	*Permit/Action*
Division of Capital Asset Management	Three 95-year Ground Leases (Nonresidential premises, Residential premises, and Partial Hospital/Fenwood Inn Premises) of MMHC Site to BWH and Long Term Leases/Subleases on behalf of DMH
Department of Environmental Protection, Division of Water Pollution Control	Sewer Connection and Extension Permit
Department of Environmental Protection, Division of Air Quality Control	Environmental Results Program Review under Title V (if necessary) Abatement of hazardous materials permits (if required)
Massachusetts Water Resources Authority	Sewer Use Discharge Permit Construction Dewatering Permit Industrial Discharge Permit for Brigham and Women's Building (if required)
Massachusetts Historic Commission	State Register Review/Chapter 254 Review Review for Consistency with 2003 MOA
Massachusetts Aeronautics Commission	Notice of Pre-Construction
Department of Conservation and Recreation	Approval of sidewalk/pedestrian improvements (Riverway/private way intersection)
Department of Public Safety	Permits and other approvals, as necessary (Partial Hospital/Fenwood Inn)

The Proponent will be responsible for implementing all of the mitigation measures. Individual costs have not yet been determined because most are considered simply to be a part of the overall Project design.

Proposed Section 61 findings for use by state agencies issuing permits for the Project are provided below to assist the agencies in meeting their obligations. The proposed Section 61 Findings incorporate the proposed mitigation measures described above.

8.2.1 Division of Capital Asset Management Proposed Section 61 Findings

DIVISION OF CAPITAL ASSET MANAGEMENT
MASSACHUSETTS MENTAL HEALTH CENTER REDEVELOPMENT (EEA #14440)

These findings for the Massachusetts Mental Health Center (MMHC) Redevelopment Project (EEA #14440) have been prepared in accordance with the provisions of M.G.L. c. 30, Section 61 and 301 CMR 11.00. On *[insert date]* the Secretary of Environmental Affairs issued a Certificate stating that the Project's Draft Environmental Impact Report (EIR) dated *[insert date]* adequately and properly complied with the MEPA statute and regulations.

The Proponent proposes and the Project is predicated upon the demolition of the existing buildings located on the MMHC Site and removal of the construction trailers on the Binney Street Site in order to construct approximately 633,960 square feet[1] (sf) in four buildings (the Project). The Project will include residential, clinical, transitional housing and crisis stabilization space, research, and office uses, including replacement space for the MMHC, and parking. The Project may also include community space in the Residential Building.

Proposed mitigation measures related to the long-term ground leases from DCAM are described in the attached table.

DCAM has reviewed and commented on the Draft EIR, EEA #14440, prepared for the Project. Pursuant to G.L. Ch. 30, Section 61, DCAM finds that the environmental impacts of the Project are as set forth in the Draft EIR, and that, as documented in the Draft EIR, all feasible means and measures have been utilized to minimize impacts on the environment.

DIVISION OF CAPITAL ASSET MANAGEMENT

____________________________________ ____________________

BY DATE

1 Under the Boston Zoning Code, zoning square footage excludes certain areas such as mechanical space and the below grade parking garage. The Draft EIR/PIR uses zoning square footage.

Table 8-2 Summary of Impacts and Mitigation Measures

Mitigation	*Responsibility*	*Timing*	*Cost*
Transportation			
The Project includes a transportation mitigation plan (see Table 3-59 of the Draft EIR/PIR) that will address transportation impacts and improve LMA transportation infrastructure.	BWH/RTH/DMH as applicable	During design, construction and operation as applicable	Included in overall Project cost
BWH is committed to continuing its comprehensive TDM program which includes providing an Employee Transportation Advisor; promoting alternative transportation information; including bicycle racks throughout the campus; offering a 50 percent transit pass subsidy; offering a 50 percent discount for commuters using non-MBTA bus lines; providing location-priced parking; supporting MASCO and other ongoing transportation initiatives; being a member CommuteWorks Transportation Management Association; participating in the Emergency Ride Home Program; participating in the Longwood T Party Program; participating in the CommuteFit Program; partnering with MassRides for ridesharing and vanpools through CommuteWorks, including a 50 percent discount for vanpool members; partnering with MASCO Shuttle Services to allow BWH employees to use shuttles free of charge; making employees eligible to join the CommuteWorks Zipcar program; offering personalized commuting assistance through CommuteWorks; and encouraging telecommuting and compressed workweeks for employees where reasonably feasible.	BWH	During operation	Part of operating costs
RTH offers after school programs for children that will eliminate the need for parents to travel to pick up their children after school and allow parents to have flexible work hours; provides a van service that allows residents to run errands without the need for a personal automobile; operates one vehicle with a capacity of 14 persons that is used to transport residents to various weekly programs and intermittent events; and offers assistance in accessing job opportunities at BWH so that residents may live and work in the Mission Hill neighborhood to reduce commuter traffic in the area.	RTH	During operation	Part of operating costs

Table 8-2 Summary of Impacts and Mitigation Measures (Continued)

Mitigation	*Responsibility*	*Timing*	*Cost*
Transportation			
TDM measures associated with the Residential Building include providing packets of TDM information in move-in documents; creating a transportation information area in the building for residents and visitors; and assigning the property management company to serve as transportation coordinator (organizes van services, vehicle operations, service and loading, and parking enforcement). The Project will also provide landscaped sidewalks adjacent to and around the Project Site and will include on-site bike racks for residents and visitors.	RTH	During operation	Part of operating costs
DMH is a state agency which will offer the same TDM incentives offered to other state employees. On-site transportation amenities, such as bicycle storage will be provided to encourage alternative modes of transportation.	DMH	During operation	Part of operating costs
Wind			
The Proponent is exploring appropriate mitigation to reduce potential impacts on pedestrian level winds. Possible mitigation options include the use of canopies, wind screens and landscaping.	BWH for its three buildings and RTH for its building	During design	Included in overall Project cost
Shadow			
The shift of the Brigham and Women's Building to the east allowed the footprint of the Residential Building to be relocated from the western-most edge of the Main MMHC Site reducing the morning shadows cast on the Riverway. With the shift of the building footprints, the massing of the BWH Building was made more slender, further reducing shadow impacts.	BWH for its building and RTH for its building	During design	Included in overall Project cost
Shadow impacts on the Riverway are mitigated by the Project's approximately half acre for open space and setback increase beyond the 20-foot requirement.	BWH for its three buildings and RTH for its building	During design	Included in overall Project cost

Table 8-2 Summary of Impacts and Mitigation Measures (Continued)

Mitigation	*Responsibility*	*Timing*	*Cost*
Daylight			
The Project's design is intended to reflect the transition from a residential neighborhood at the east of the site to the institutional and high-rise uses on the western side of the site. The low-scale proposed Partial Hospital/Fenwood Inn is located closest to the lower-scale residential buildings along Vining Street and Fenwood Road. Taller Project buildings are proposed adjacent to the 13-story Neville House and institutional uses along Binney Street and Fenwood Road. Building setbacks from the Riverway reduce daylight obstruction values. The daylight values of each of the Project structures are consistent with its adjacent land uses.	BWH for its three buildings and RTH for its building	During design	Included in overall Project cost
Solar Glare			
Non-reflective glass will be used to avoid solar glare impacts.	BWH for its three buildings and RTH for its building	During design.	Included in overall Project cost
Air Quality			
CO concentrations are well under the NAAQS thresholds. In addition, maximum cumulative impacts from the heating boilers, garage vents, cooling towers, and emergency generators plus monitored background values are also below the NAAQS thresholds for SO_2, NOx, PM-10, and PM-2.5.	BWH for its three buildings and RTH for its building	During operation	Included in overall Project cost
Sources of pollutants (e.g. boilers, emergency diesel generator) will be properly equipped and maintained.	BWH for its 3three buildings and RTH for its building	During operations	Included in overall Project cost

Table 8-2 Summary of Impacts and Mitigation Measures (Continued)

Mitigation	*Responsibility*	*Timing*	*Cost*
The Proponent will implement a TDM program to reduce traffic trips.	BWH for BWH-occupied components and RTH for its building	During operation	Included in overall Project cost
Solid/Hazardous Waste			
An extensive recycling program will minimize waste by segregating mixed paper, newspaper, cardboard, magazines, plastics, aluminum and scrap metal, and some additional materials. BWH's aggressive recycling program includes paper, cardboard, Styrofoam, fluorescent bulbs, batteries, monitors and televisions, toner cartridges, cans, cafeteria cooking oils, and old furniture and medical equipment. BWH will extend its existing policy to the proposed Brigham and Women's Building and will recycle as much solid waste as is feasible from this Project. The recycling programs for the Binney Street Building and the Partial Hospital/Fenwood Inn include, cardboard, paper, metal and newspaper. RTH's recycling program for the Residential Building will include mixed paper, newspaper, cardboard, magazines, milk cartons, plastics numbered 1 through 5 and 7, juice containers, glass, aluminum and other scrap metal, and additional materials as appropriate and consistent with City of Boston requirements. Waste prevention will be maximized through maintenance and cleaning practices such as the purchase of eco-friendly products, the use of refillable containers, and the recycling of used mercury light fixtures.	BWH for BWH-occupied components and DMH for DMH-occupied components; RTH for its building	During construction and operation	Included in overall Project cost.
BWH has a detailed Spill Prevention Control and Countermeasure (SPCC) Plan.	BWH	During construction and operation	Included in overall Project cost.
During the demolition phase, concrete, brick and asphalt will be separated for off-site crushing and re-use. The demolition subcontract will include specific provisions for the segregation, reprocessing, reuse and recycling of materials.	BWH	During demolition and construction	Included in overall Project cost

Table 8-2 Summary of Impacts and Mitigation Measures (Continued)

Mitigation	*Responsibility*	*Timing*	*Cost*
Noise			
Construction period noise mitigation measures are expected to include the mufflers on equipment, scheduling operations to keep average noise levels low, turning off idling equipment, and locating noisy equipment to protect sensitive locations.	BWH for its three buildings and RTH for its building	During construction	Included in overall Project cost
Mitigating noise during operations including careful selection of mechanical equipment and implementation of noise attenuation.	BWH for its 3 buildings and RTH for its building	During design and operation	Included in overall Project cost
Geotechnical/Groundwater			
Temporary excavation support systems will be designed to provide adequate support and protection of the adjacent streets and utilities and to maintain groundwater levels outside the excavation at or near pre-construction levels.	BWH for its 3 buildings and RTH for its building	During construction	Included in overall Project cost
Measures to protect area groundwater levels include underground concrete galley system under the driveway for infiltration of roof runoff (Partial Hospital/Fenwood Inn), underground recharge systems for infiltration of roof runoff (Main MMHC Site). The Residential Building site is being evaluated for the siting of low-impact design features such as bio-swales and rain gardens.	BWH for its 3 buildings and RTH for its building	During operation	Included in overall Project cost
Construction Impacts			
The Proponent has established a Community Construction Mitigation Group that meets regularly to address potential construction impacts including phasing, truck routes and coordination of deliveries, construction worker parking, demolition, and other construction activities.	BWH for its three buildings and RTH for its building	Prior to and during construction	Included in overall Project cost
The Proponent has developed interim use plans to reduce impacts to the adjacent residential community, maximize open space opportunities, and ensure active use of the Project Site between construction phases.	BWH for its three buildings and RTH for its building	During interim phase	Included in overall Project cost

Table 8-2 Summary of Impacts and Mitigation Measures (Continued)

Mitigation	*Responsibility*	*Timing*	*Cost*
A variety of measures will be considered and implemented to protect the safety of pedestrians traversing those portions of the neighborhood affected by construction. Where necessary, the Construction Manager will provide protective barriers around the construction site, replacement of walkways, appropriate lighting, and new directional and informational signage to direct pedestrians around the construction sites. Police details will be provided as needed.	BWH for its three buildings and RTH for its building	During construction period	Included in overall Project cost
A demolition sequence will be developed which uses the exterior walls of the structures to isolate the demolition activity to the greatest extent possible.	BWH	During construction period	Included in overall Project cost
During demolition, provisions will be made for the use of water spray to control the generation of dust.	BWH	During construction period	Included in overall Project cost
The demolition subcontract will include specific provisions for the segregation, reprocessing, reuse and recycling of materials.	BWH	During construction period	Included in overall Project cost
Some appropriate excess materials may be donated to the Building Materials Resource Center (BMRC) in Roxbury.	BWH for its three buildings and RTH for its building	During construction period	Included in overall Project cost
To reduce vehicle trips to and from the construction site, no construction worker parking will be permitted on-site and all workers will be strongly encouraged to use public transportation. A comprehensive TDM plan for construction workers will be established. On-site space during each construction phase will be made available for workers' supplies and tools so they do not have to be brought to the construction site each day. Truck access routes will be developed to avoid trips on adjacent residential streets.	BWH for its three buildings and RTH for its building	During construction period	Included in overall Project cost
To reduce emissions of fugitive dust and minimize impacts on the local environment, mitigation includes use of wetting agents, covering trucks, using ultra low-sulfur diesel, removing construction debris from the site, providing wheel washes and vacuum cleaning streets.	BWH for its three buildings and RTH for its building	During construction period	Included in overall Project cost

Table 8-2 Summary of Impacts and Mitigation Measures (Continued)

Mitigation	*Responsibility*	*Timing*	*Cost*
The construction documents will include measures and specifications regarding erosion and sediment controls. For the construction of these buildings, use of sediment barriers (silt fence, hay bales, catch basin sacks) is expected during earthwork operations.	BWH for its three buildings and RTH for its building	During construction	Included in overall Project cost
The Proponent will implement a vibration control program to ensure that demolition of existing buildings, garage excavation for the Brigham and Women's Building and foundation construction for all four Project buildings will not negatively impact structures and utilities surrounding the Project Site.	BWH for its three buildings and RTH for its building	During construction period	Included in overall Project cost
Sustainable Development			
The Project will aim to reduce greenhouse gases, maximize energy efficiency, maximize recycling during construction and operations, and meet stated LEED goals for each building.	BWH for its three buildings and RTH for its building	During construction and operations	Included in overall Project cost.
Greenhouse Gas Emissions			
The Binney Street Building will include the following mitigation measures: ♦ Building core that complies with the Advanced Buildings Core Performance Guide, New Buildings Institute, July 2007 ♦ High albedo roof ♦ Room occupancy sensors ♦ High performance lighting meeting current BWH efficiency standards ♦ Low flow plumbing fixtures ♦ Energy Star appliances ♦ High efficiency mechanical equipment	BWH	During design and construction	Included in overall Project cost

Table 8-2 Summary of Impacts and Mitigation Measures (Continued)

Mitigation	*Responsibility*	*Timing*	*Cost*
The Partial Hospital/Fenwood Inn will include the following mitigation measures: ♦ Building core that complies with the Advanced Buildings Core Performance Guide, New Buildings Institute, July 2007 ♦ High albedo roof ♦ Room occupancy sensors ♦ High performance lighting ♦ Low flow plumbing fixtures ♦ Energy Star appliances ♦ High efficiency mechanical equipment	BWH	During design and construction	Included in overall Project cost
The Brigham and Women's building will include the following mitigation measures: ♦ Advanced building core ♦ High albedo roof ♦ Heat recovery from ventilation exhaust ♦ Room occupancy sensors in non-laboratory areas ♦ High performance lighting ♦ Low flow plumbing fixtures ♦ High efficiency mechanical equipment ♦ Advanced energy-efficient elevators	BWH	During design and construction	Included in overall Project cost

Table 8-2 Summary of Impacts and Mitigation Measures (Continued)

Mitigation	*Responsibility*	*Timing*	*Cost*
The Residential Building will include the following mitigation measures: ♦ High efficiency building core ♦ High albedo roof ♦ High efficiency mechanical equipment ♦ Heat recovery from ventilation exhaust ♦ Room occupancy sensors in common areas ♦ Individual unit HVAC controls ♦ Natural (hybrid) ventilation ♦ Two-stage ventilation exhaust ♦ Low flow plumbing fixtures ♦ Energy-Star appliances and lighting fixtures	RTH	During design and construction	Included in overall Project cost
Implement TDM measures	BWH for BWH-occupied components and RTH for its building	During operation	Included in overall Project cost
Urban Design			
The Project includes plans to improve sidewalks adjacent to the Project Site.	BWH for its three buildings and RTH for its building	During design	Included in overall Project cost
The Brigham and Women's Building will extend the widened sidewalks and new street tree pattern established by the Shapiro Cardiovascular Center on the northwest side of Vining Street.	BWH	During construction	Included in overall Project cost
The sidewalk bordering the Brigham and Women's Building along Fenwood Road will be broadened and developed with street trees.	BWH	During construction	Included in overall Project cost

Table 8-2 Summary of Impacts and Mitigation Measures (Continued)

Mitigation	*Responsibility*	*Timing*	*Cost*
Binney Street will be improved with new street trees and a widened sidewalk.	BWH	During construction	Included in overall Project cost
Pedestrian paths and street crossings will be clearly marked and oriented to maximize pedestrian and cyclist safety.	BWH	During operation	Included in overall Project cost
The Proponent will seek permission to construct a fence between the southeast side of the roadway which leads from the Riverway to the private way and the adjacent sidewalk to a point where pedestrians can make a perpendicular crossing of the exit ramp.	RTH	During construction	Included in overall Project cost
Bicycle storage areas will be provided for each of the four Project buildings. Interior bicycle storage facilities will be provided at the Brigham and Women's Building. Exterior bicycle storage facilities will be provided at the Binney Street Building and the Partial Hospital / Fenwood Inn. Residential bicycle storage will be provided in the Mission Park Garage and outside the building.	BWH at its three buildings and RTH at its building	During design	Included in overall Project cost
View angles from the intersection of Francis and Binney Streets have been studied and the building footprint of the proposed Brigham and Women's Building adjusted so that the proposed Brigham and Women's Building masks Neville House, but does not impinge upon the southeastern edge of the view corridor to the Riverway established by Neville House.	BWH	During design	Included in overall Project cost
The geometry and massing of the Brigham and Women's Building have been set up to provide an appropriate visual termination of the long view down Binney Street which presently terminates at the Neville House.	BWH	During design	Included in overall Project cost
The proposed Residential Building and Brigham and Women's Building will increase the setbacks along Fenwood Road and will therefore improve the pedestrian experience.	BWH for its building and RTH for its building	During design	Included in overall Project cost

Table 8-2 Summary of Impacts and Mitigation Measures (Continued)

Mitigation	*Responsibility*	*Timing*	*Cost*
An 8-foot sidewalk is proposed at the Residential Building, but with a widened landscaped green space between the sidewalk and building. Setbacks will also protect the mature perimeter of trees to the greatest extent feasible, and incorporate them into the landscape plan if possible. A certified arborist has been retained to examine the condition of trees on the Main MMHC Site. The arborist is charged with developing a site visit report, evaluation of the health of the mature trees and remedial recommendations.	RTH	During design	Included in overall Project cost
Small play area, a formal lawn area, and outdoor terraces in two locations are proposed around the Residential Building.	RTH	During operation	Included in overall Project cost
A broad sidewalk of 14 feet adjacent to the Brigham and Women's Building enlivened with street trees in landscaped, curbed planters, in a rhythm and spacing to match the tree pattern on the northeast side of Fenwood Road.	BWH	During design	Included in overall Project cost
The Brigham and Women's Building sidewalk along Vining Street is proposed to be widened with the sidewalk extending from curb to building and matching the alignment of the Shapiro Cardiovascular Building on the next block. Street trees in a similar pattern to those along Vining Street at the Shapiro Building block are proposed; however, these will be set in flush sidewalk grates as opposed to the raised planter treatment on the Shapiro block.	BWH	During design	Included in overall Project cost
On the opposite side of Vining Street, the Partial Hospital / Fenwood Inn will be set 6 to 10 feet from the property line and 14 to 18 feet from the curb. This is an increased setback beyond that of its immediate neighbor to the northeast which permits the introduction of landscaping in front of the building.	BWH	During design	Included in overall Project cost
The private way edge will be improved with sidewalks, new curbing and some planting along the northeast edge.	BWH	During design	Included in overall Project cost
The Binney Street Building is set back to create entry plazas at both its primary entrance on Fenwood Road and secondary entrance on Francis Street.	BWH	During design	Included in overall Project cost

Table 8-2 Summary of Impacts and Mitigation Measures (Continued)

Mitigation	*Responsibility*	*Timing*	*Cost*
The sidewalk along Binney Street between the two entry plazas two plazas will increase from 8 feet at the Francis Street to twelve feet at Fenwood Road and be planted with a colonnade of street trees in flush tree grates.	BWH	During design	Included in overall Project cost
The pedestrian way between the Residential Building and the Brigham and Women's Building, will be a landscaped path across the Main MMHC Site to and from the Riverway to the LMA and will include a path edge with perennial plantings and specimen trees. Historical, cultural, and environmental content will be incorporated into the various Project elements to illustrate the importance of the Emerald Necklace and the LMA to passersby. Special rain gardens will also be included to reduce stormwater flows into the stormwater network.	BWH	During design	Included in overall Project cost
The proposed redevelopment of the Project Site will reduce the amount of impervious cover to 43,210 sf (a 31 percent reduction) and create 26,231 sf of landscaped open space (a 27 percent increase).	BWH for its three buildings and RTH for its building	During design	Included in overall Project cost
The footprints and massing of the Residential Building and the Brigham and Women's Building are stepped and coordinated to redirect this vista and define a landscaped pedestrian and visual connector from the intersection of Francis Street and Binney Street to the Riverway.	BWH for its three buildings and RTH for its building	During design	Included in overall Project cost
The formerly cube-like form of the Brigham and Women's Building was fractured into three layers oriented to the geometry of Fenwood Road. Sliding these layers past one another permitted the manipulation of the form to present apparently slender northwest and southeast facades as well as to respond to ground plane objectives, particularly on the northwest in order to open and reorient a vista to the Riverway. As this massing strategy evolved, the Brigham and Women's Building footprint was also moved northeastward to increase its separation from the residential Neville House on the other side of the private way.	BWH	During design	Included in overall Project cost

Table 8-2 Summary of Impacts and Mitigation Measures (Continued)

Mitigation	*Responsibility*	*Timing*	*Cost*
The footprint of the Residential Building was shifted eastward to maintain a landscaped 30 foot to 40 foot setback along the Riverway which resumes the typical landscaped setback of Mission Park to the south on the Riverway.	RTH	During design	Included in overall Project cost
Building massing and footprints have been adjusted to maximize open space, create view corridors, and complement existing buildings.	BWH for its three buildings and RTH for its building	During design	Included in overall Project cost
The layout and access plan for the Project maximizes efficiency of traffic and pedestrian flows to protect pedestrian safety and minimize vehicle circulation around the Project Site.	BWH for its three buildings and RTH for its building	During design	Included in overall Project cost
The Project creates approximately a half acre of open space.	BWH for its three buildings and RTH for its building	During design	Included in overall Project cost
Building footprints were adjusted to minimize shadow impacts.	BWH for its 3three buildings and RTH for its building	During design	Included in overall Project cost
Historic Resources			
Developed a draft architectural salvage and reuse plan that includes salvaging and incorporating selective architectural features into the design of the Project.	BWH	During design	Included in overall Project cost
Replicating the wrought iron and brick post fence at the northwest limits of the Project site.	RTH	During construction	Included in overall Project cost

Table 8-2 Summary of Impacts and Mitigation Measures (Continued)

Mitigation	*Responsibility*	*Timing*	*Cost*
Efforts will be made to ensure the continued presence of the mature trees at the northwest limits of the MMHC site, along the Fenwood Road sidewalk.	BWH during demolition and construction; RTH during construction of Residential Building and during operation	During Construction and operation	Included in overall Project cost
Water and Wastewater Generation			
Complete mitigation measures to be determined through compliance with BWSC Site Plan Review Process. The Project will use water efficient plumbing fixtures. The Proponent has a goal to eliminate or reduce potable water use for water efficient landscaping.	BWH for its three buildings and RTH for its building	During design and operation.	Part of overall Project cost
The Proponent has initiated coordination with the Boston Water and Sewer Commission regarding the removal of Infiltration/Inflow. A formal understanding is required prior to BWSC site plan approval.	BWH for its three buildings and RTH for its building	During design	Part of overall Project cost
Water Quality and Stormwater			
The current design for the proposed Site will reduce the impervious area through increased landscaped areas and landscaped buffers. This additional landscaped space will not only reduce the volume of runoff, but will also enhance the quality of runoff entering the BWSC drainage system.	BWH for its three buildings and RTH for its building	During design	Included in overall Project cost
The Proponent is exploring permeable pavement materials, vegetated stormwater management areas and/or subsurface infiltration/detention systems.	BWH for its three buildings and RTH for its building	During design	Included in overall Project cost

Table 8-2 Summary of Impacts and Mitigation Measures (Continued)

Mitigation	*Responsibility*	*Timing*	*Cost*
The Proponents will install plaques that bear the warning "Don't Dump – Drains to Charles River" at all new and adjacent catch basins.	BWH for its three buildings and RTH for its building	During construction	Included in overall Project cost
Oil traps will also be provided for all parking areas below grade, with any discharge from these traps directed into the sanitary sewer and not the storm sewer.	BWH for its three buildings and RTH for its building	During construction	Included in overall Project cost
Potential runoff during construction will be controlled by measures developed in accordance with the policies and approvals of the BWSC and other appropriate oversight agencies.	BWH for its three buildings and RTH for its building	During construction	Included in overall Project cost
Energy			
The Proponent will have a program in place to ensure chlorofluorocarbon reduction in all heating, ventilation, air-conditioning, and refrigeration equipment purchased.	BWH for its three buildings and RTH for its building	During operation	Included in overall Project cost
The Proponent will incorporate efficient light fixtures to increase energy efficiency and improve illumination.	BWH for its three buildings and RTH for its building	During operation	Included in overall Project cost
The energy requirements for all major pieces of equipment will be in accordance with energy code requirements and with requirements for LEED certifiability at a minimum.	BWH for its three buildings and RTH for its building	During design	Included in overall Project cost
Proponent's commitment to reduce greenhouse gases includes technologies that reduces energy demands	BWH for its three buildings and RTH for its building	During design and operation	Included in overall Project cost

8.2.2 Department of Environmental Protection Proposed Section 61 Findings

DEPARTMENT OF ENVIRONMENTAL PROTECTION
MASSACHUSETTS MENTAL HEALTH CENTER REDEVELOPMENT (EEA #14440)

These findings for the Massachusetts Mental Health Center (MMHC) Redevelopment Project (EEA #14440) have been prepared in accordance with the provisions of M.G.L. c. 30, Section 61 and 301 CMR 11.00. On *[insert date]* the Secretary of Environmental Affairs issued a Certificate stating that the Project's Draft Environmental Impact Report (EIR) dated *[insert date]* adequately and properly complied with the MEPA statute and regulations.

The Proponent proposes and the Project is predicated upon the demolition of the existing buildings located on the MMHC Site and removal of the construction trailers on the Binney Street Site in order to construct approximately 633,960 square feet[2] (sf) in four buildings (the Project). The Project will include residential, clinical, transitional housing and crisis stabilization space, research, and office uses, including replacement space for the MMHC, and parking. The Project may also include community space in the Residential Building.

As the Project is currently described, it requires a Sewer Connection and Extension Permit from the Division of Water Pollution Control reporting under the Environmental Results Program and may require review under Title V from the Division of Air Quality Control.

Proposed mitigation measures related to the permits and reviews from the Department are described in the attached table.

The Department has reviewed and commented on the Draft EIR, EEA #14440, prepared for the Project. Pursuant to G.L. Ch. 30, Section 61, the Department finds that the environmental impacts of the Project are as set forth in the Draft EIR, and that, as documented in the Draft EIR, all feasible means and measures have been utilized to minimize impacts on the environment.

DEPARTMENT OF ENVIRONMENTAL PROTECTION

______________________________________ ____________________

BY DATE

2 Under the Boston Zoning Code, zoning square footage excludes certain areas such as mechanical space and the below grade parking garage. The Draft EIR/PIR uses zoning square footage.

Table 8-3 Summary of Impacts and Mitigation Measures

Mitigation	Responsibility	Schedule	Cost
See Table of Impacts and Mitigation Measures attached to the DCAM Section 61 Finding for mitigating impacts to water, wastewater, greenhouse gas emission, air quality, and hazardous waste.	BWH / RTH as applicable	See Table above	See Table above

8.2.3 Massachusetts Water Resources Authority Proposed Section 61 Findings

MASSACHUSETTS WATER RESOURCES AUTHORITY
MASSACHUSETTS MENTAL HEALTH CENTER REDEVELOPMENT (EEA #14440)

These findings for the Massachusetts Mental Health Center (MMHC) Redevelopment Project (EEA #14440) have been prepared in accordance with the provisions of M.G.L. c. 30, Section 61 and 301 CMR 11.00. On *[insert date]* the Secretary of Environmental Affairs issued a Certificate stating that the Project's Draft Environmental Impact Report (EIR) dated *[insert date]* adequately and properly complied with the MEPA statute and regulations.

The Proponent proposes and the Project is predicated upon the demolition of the existing buildings located on the MMHC Site and removal of the construction trailers on the Binney Street Site in order to construct approximately 633,960 square feet[3] (sf) in four buildings (the Project). The Project will include residential, clinical, transitional housing and crisis stabilization space, research, and office uses, including replacement space for the MMHC, and parking. The Project may also include community space in the Residential Building.

As the Project is currently described, it requires a Sewer Use Discharge Permit, Construction Dewatering Permit, and possibly an Industrial Discharge Permit.

Proposed mitigation measures related to the permits and reviews from the Authority are described in the attached table.

The Authority has reviewed and commented on the Draft EIR, EEA #14440, prepared for the Project. Pursuant to G.L. Ch. 30, Section 61, the Authority finds that the environmental impacts of the Project are as set forth in the Draft EIR, and that, as documented in the Draft EIR, all feasible means and measures have been utilized to minimize impacts on the environment.

MASSACHUSETTS WATER RESOURCES AUTHORITY

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BY DATE

[3] Under the Boston Zoning Code, zoning square footage excludes certain areas such as mechanical space and the below grade parking garage. The Draft EIR/PIR uses zoning square footage.

Table 8-4 Summary of Impacts and Mitigation Measures

Mitigation	Responsibility	Timing	Cost
The construction documents will include measures and specifications regarding erosion and sediment controls. For the construction of these buildings, use of sediment barriers (silt fence, hay bales, catch basin sacks) is expected during earthwork operations.	BWH for its three buildings and RTH for its building	During construction	Included in overall Project cost
Construction dewatering discharges will be appropriately controlled and discharged in accordance with the National Pollutant Discharge Elimination System (NPDES) and State dewatering standards.	BWH for its three buildings and RTH for its building	During construction	Included in overall Project cost
The temporary construction dewatering effluent will be sampled on a weekly basis, and chemically analyzed for the parameters described in the NPDES dewatering approval document. Should concentrations of contaminants which exceed the NPDES standards be detected, construction dewatering will be immediately terminated, and mitigating measures such as use of granular activated carbon treatment, and/or other treatment systems as determined to be necessary implemented.	BWH for its three buildings and RTH for its building	During construction	Included in overall Project cost
Complete mitigation measures to be determined through compliance with BWSC Site Plan Review Process. The Project will use water efficient plumbing fixtures. The Proponent has a goal to eliminate or reduce potable water use for water efficient landscaping.	BWH for its three buildings and RTH for its building	During design and operation.	Part of overall Project cost
The Proponent has initiated coordination with the Boston Water and Sewer Commission regarding the removal of Infiltration/Inflow. A formal understanding is required prior to BWSC site plan approval.	BWH for its three buildings and RTH for its building	During design	Part of overall Project cost

8.2.4 *Massachusetts Historical Commission Proposed Section 61 Findings*

MASSACHUSETTS HISTORICAL COMMISSION
MASSACHUSETTS MENTAL HEALTH CENTER REDEVELOPMENT (EEA #14440)

These findings for the Massachusetts Mental Health Center (MMHC) Redevelopment Project (EEA #14440) have been prepared in accordance with the provisions of M.G.L. c. 30, Section 61 and 301 CMR 11.00. On *[insert date]* the Secretary of Environmental Affairs issued a Certificate stating that the Project's Draft Environmental Impact Report (EIR) dated *[insert date]* adequately and properly complied with the MEPA statute and regulations.

The Proponent proposes and the Project is predicated upon the demolition of the existing buildings located on the MMHC Site and removal of the construction trailers on the Binney Street Site in order to construct approximately 633,960 square feet[4] (sf) in four buildings (the Project). The Project will include residential, clinical, transitional housing and crisis stabilization space, research, and office uses, including replacement space for the MMHC, and parking. The Project may also include community space in the Residential Building.

As the Project is currently described, it requires a review by MHC.

Proposed mitigation measures related to the MHC review are described in the attached table.

MHC has reviewed and commented on the Draft EIR, EEA #14440, prepared for the Project. Pursuant to G.L. Ch. 30, Section 61, MHC finds that the environmental impacts of the Project are as set forth in the Draft EIR, and that, as documented in the Draft EIR, all feasible means and measures have been utilized to minimize impacts on the environment.

MASSACHUSETTS HISTORICAL COMMISSION

____________________________________ ____________________

BY DATE

4 Under the Boston Zoning Code, zoning square footage excludes certain areas such as mechanical space and the below grade parking garage. The Draft EIR/PIR uses zoning square footage.

Table 8-5 Summary of Impacts and Mitigation Measures

Mitigation	Responsibility	Timing	Cost
Developed a draft architectural salvage and reuse plan that includes salvaging and incorporating selective architectural features into the design of the Project.	BWH	During design	Included in overall Project cost
Replicating the wrought iron and brick post fence at the northwest limits of the Project site.	BWH / RTH	During construction	Included in overall Project cost
Efforts will be made to ensure the continued presence of the mature trees at the northwest limits of the MMHC site, along the Fenwood Road sidewalk.	BWH during demolition and construction; RTH during construction of Residential Building and during operation	During design	Included in overall Project cost

8.2.5 *Massachusetts Aeronautics Commission Proposed Section 61 Findings*

MASSACHUSETTS AERONAUTICS COMMISSION
MASSACHUSETTS MENTAL HEALTH CENTER REDEVELOPMENT (EEA #14440)

These findings for the Massachusetts Mental Health Center (MMHC) Redevelopment Project (EEA #14440) have been prepared in accordance with the provisions of M.G.L. c. 30, Section 61 and 301 CMR 11.00. On *[insert date]* the Secretary of Environmental Affairs issued a Certificate stating that the Project's Draft Environmental Impact Report (EIR) dated *[insert date]* adequately and properly complied with the MEPA statute and regulations.

The Proponent proposes and the Project is predicated upon the demolition of the existing buildings located on the MMHC Site and removal of the construction trailers on the Binney Street Site in order to construct approximately 633,960 square feet[5] (sf) in four buildings (the Project). The Project will include residential, clinical, transitional housing and crisis stabilization space, research, and office uses, including replacement space for the MMHC, and parking. The Project may also include community space in the Residential Building.

As the Project is currently described, it requires the submission of a Notice of Pre-Construction to the Commission.

Proposed mitigation measures related to the Notice are described in the attached table.

The Commission has reviewed and commented on the Draft EIR, EEA #14440, prepared for the Project. Pursuant to G.L. Ch. 30, Section 61, the Commission finds that the environmental impacts of the Project are as set forth in the Draft EIR, and that, as documented in the Draft EIR, all feasible means and measures have been utilized to minimize impacts on the environment.

MASSACHUSETTS AERONAUTICS COMMISSION

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BY DATE

5 Under the Boston Zoning Code, zoning square footage excludes certain areas such as mechanical space and the below grade parking garage. The Draft EIR/PIR uses zoning square footage.

Table 8-6 Summary of Impacts and Mitigation Measures

Mitigation	Responsibility	Timing	Cost
The maximum Project height is approximately 222 feet with an additional mechanical penthouse. During construction, a crane reaching beyond the maximum building height will be used for each of the Project buildings. All building heights, including total height for construction equipment will be described in the Notices of Construction to the FAA.	BWH for its 3 buildings and RTH for its building	Prior to construction	Included in overall Project cost

8.2.6 Massachusetts Department of Conservation and Recreation

MASSACHUSETTS DEPARTMENT OF CONSERVATION AND RECREATION
MASSACHUSETTS MENTAL HEALTH CENTER REDEVELOPMENT (EEA #14440)

These findings for the Massachusetts Mental Health Center (MMHC) Redevelopment Project (EEA #14440) have been prepared in accordance with the provisions of M.G.L. c. 30, Section 61 and 301 CMR 11.00. On *[insert date]* the Secretary of Environmental Affairs issued a Certificate stating that the Project's Draft Environmental Impact Report (EIR) dated *[insert date]* adequately and properly complied with the MEPA statute and regulations.

The Proponent proposes and the Project is predicated upon the demolition of the existing buildings located on the MMHC Site and removal of the construction trailers on the Binney Street Site in order to construct approximately 633,960 square feet[6] (sf) in four buildings (the Project). The Project will include residential, clinical, transitional housing and crisis stabilization space, research, and office uses, including replacement space for the MMHC, and parking. The Project may also include community space in the Residential Building.

As the Project is currently described, it requires approval of sidewalk and pedestrian improvements at the Riverway and private way intersection.

Proposed mitigation measures related to the DCR approval are described in the attached table.

The Commission has reviewed and commented on the Draft EIR, EEA #14440, prepared for the Project. Pursuant to G.L. Ch. 30, Section 61, the Commission finds that the environmental impacts of the Project are as set forth in the Draft EIR, and that, as documented in the Draft EIR, all feasible means and measures have been utilized to minimize impacts on the environment.

MASSACHUSETTS DEPARTMENT OF CONSERVATION AND RECREATION

____________________________________ ____________________

BY DATE

6 Under the Boston Zoning Code, zoning square footage excludes certain areas such as mechanical space and the below grade parking garage. The Draft EIR/PIR uses zoning square footage.

Table 8-7 Summary of Impacts and Mitigation Measures

Mitigation	Responsibility	Schedule	Cost
See Table of Impacts and Mitigation Measures attached to the DCAM Section 61 Finding for urban design mitigation measures to enhance the pedestrian environment.	RTH	See Table above	See Table above

8.2.7 Massachusetts Department of Public Safety

MASSACHUSETTS DEPARTMENT OF PUBLIC SAFETY
MASSACHUSETTS MENTAL HEALTH CENTER REDEVELOPMENT (EEA #14440)

These findings for the Massachusetts Mental Health Center (MMHC) Redevelopment Project (EEA #14440) have been prepared in accordance with the provisions of M.G.L. c. 30, Section 61 and 301 CMR 11.00. On [insert date] the Secretary of Environmental Affairs issued a Certificate stating that the Project's Draft Environmental Impact Report (EIR) dated [insert date] adequately and properly complied with the MEPA statute and regulations.

The Proponent proposes and the Project is predicated upon the demolition of the existing buildings located on the MMHC Site and removal of the construction trailers on the Binney Street Site in order to construct approximately 633,960 square feet[7] (sf) in four buildings (the Project). The Project will include residential, clinical, transitional housing and crisis stabilization space, research, and office uses, including replacement space for the MMHC, and parking. The Project may also include community space in the Residential Building.

As the Project is currently described, it may require permits and other approvals from the Department of Public Safety for the Partial Hospital/Fenwood Inn.

Proposed mitigation measures related to the Department of Public Safety permits and approvals (as necessary) are described in the attached table.

The Commission has reviewed and commented on the Draft EIR, EEA #14440, prepared for the Project. Pursuant to G.L. Ch. 30, Section 61, the Commission finds that the environmental impacts of the Project are as set forth in the Draft EIR, and that, as documented in the Draft EIR, all feasible means and measures have been utilized to minimize impacts on the environment.

MASSACHUSETTS DEPARTMENT OF PUBLIC SAFETY

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BY DATE

[7] Under the Boston Zoning Code, zoning square footage excludes certain areas such as mechanical space and the below grade parking garage. The Draft EIR/PIR uses zoning square footage.

Table 8-8 Summary of Impacts and Mitigation Measures

Mitigation	Responsibility	Schedule	Cost
See Table of Impacts and Mitigation Measures attached to the DCAM Section 61 Finding for mitigating impacts of the Partial Hospital/Fenwood Inn.	BWH	See Table above	See Table above

Section 9.0

Response to Comments

9.0 RESPONSE TO COMMENTS

9.1 Introduction

This section specifically addresses individual comments within the Certificate on the ENF and the Scoping Determination on the PNF/IMPNF. Individual comments raised in each comment letter received during the MEPA and BRA comment periods for the Project are also addressed. Each comment is numbered and summarized to correspond with the comment letters. A copy of the complete comment can be found within the designated comment letter, followed by the responses to the specific letter. Table 9-1 is a list of comment letters on the ENF and PNF/IMPNF.

Table 9-1 Comment Letters on the ENF and PNF/IMPNF

Commenters	Abbreviation
State Agencies	
Massachusetts Environmental Policy Act Office	MEPA
Massachusetts Department of Conservation and Recreation	DCR
Massachusetts Department of Energy Resources	DOER
Massachusetts Department of Environmental Protection	DEP
Massachusetts Historical Commission	MHC
Massachusetts Water Resources Authority	MWRA
City Agencies	
Boston Redevelopment Authority Scoping Determination	BRA
Boston Redevelopment Authority, David Carlson	BRADC
Boston Redevelopment Authority, Katie Pederson	BRAKP
Boston Transportation Department	BTD
Boston Assessing Department	BAD
Boston Water and Sewer Commission	BWSC
Boston Groundwater Trust	BGWT
Public Comments	
Charles River Watershed Association	CRWA
Children's Hospital Boston	CHB
Fenway Community Development Corporation	FCDC
Friends of Historic Mission Hill	FHMH
Friends of the Muddy River	FMR
Medical Academic and Scientific Community Organization, Inc.	MASCO
Mission Hill Health Movement	MHHM
Mission Hill Neighborhood Housing Services	MHNHS
VHB, Inc.	-
Epsilon Associates	-

The Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, MA 02114

Deval L. Patrick
GOVERNOR

Timothy P. Murray
LIEUTENANT
GOVERNOR

Ian A. Bowles
SECRETARY

Tel: (617) 626-1000
Fax: (617) 626-1181
http://www.mass.gov/envir

August 7, 2009

CERTIFICATE OF THE SECRETARY OF ENERGY AND ENVIRONMENTAL AFFAIRS
ON THE
ENVIRONMENTAL NOTIFICATION FORM

PROJECT NAME	: Massachusetts Mental Health Center Redevelopment
PROJECT MUNICIPALITY	: Fenwood Road – Boston
PROJECT WATERSHED	: Boston Harbor
EOEA NUMBER	: 14440
PROJECT PROPONENT	: Brigham and Women's Hospital/Partners HealthCare/Roxbury Tenants of Harvard
DATE NOTICED IN MONITOR	: July 8, 2009

Pursuant to the Massachusetts Environmental Policy Act (G. L., c. 30, ss. 61-62I) and Section 11.06 of the MEPA regulations (301 CMR 11.00), I hereby determine that this **project requires** the preparation of an Environmental Impact Report (EIR).

Project Overview

According to the Environmental Notification Form (ENF), the proposed project consists of the construction of a 633,960 square feet (sf) mixed-use development and an underground parking garage. The project is proposed to be constructed in three phases. Phase 1 includes the demolition of the 190,000 sf Massachusetts Mental Health Center and the construction of a 56,000 sf replacement clinical and office building on the Binney Street parcel and a 21,000 sf mental health hospital housing 47 beds and providing 50 initial surface parking spaces for the return of the Department of Mental Health (DMH) to the project site. Phase 2 would include the construction of an approximately 182 foot tall, 15 floors, 197,750 sf residential building with 136 units and a 10,000 sf community meeting area by the Roxbury Tenants of Harvard (RTH). The residential building would contain approximately 66 affordable rental units and 70 condominiums. Phase 3 would include the construction of an approximately 220-foot tall, 14 floors (two mechanical floors), 358,670 sf medical office and research building with 406 underground parking spaces to be owned by Partners HealthCare.

The project site is comprised of three parcels that total approximately 3.15 acres. The Binney Street site is currently owned by Partners HealthCare and is vacant of buildings. The two other sites are owned by the Commonwealth. The DMH is planning on relocating their service to within the new Brigham and Women's Hospital (BWH) Building and returning the Binney Street Building to BWH for its use as clinical space.

Access to the proposed parking garage, to be constructed in Phase III, will be from the Vining Street Extension on the back side of the building. Using the Institute of Traffic Engineers Trip Generation land use codes 220 for apartments, 610 for hospital, 620 for nursing home, 710 for office and 760 for research & development space, the proponent has estimated 6,516 unadjusted new average daily vehicle trips. However, after adjusting for Boston Transportation Department (BTD) mode splits for the Longwood Medical Area (LMA), the proponent estimated that the project would generate approximately 3,252 new vehicle trips.

The proposed project will be connected to existing municipal water and sewer service. It will consume approximately 109,100 gallons per day (gpd) of water and will generate approximately 99,180 gpd of wastewater flow.

State Permits and Jurisdiction

This project is subject to a mandatory EIR pursuant to Section 11.03(6)(a)(6) of the MEPA regulations because it involves a land transfer from the Commonwealth, may receive Commonwealth financing, requires state permits, and generates 3,000 or more new vehicle trips. It will require a long-term lease of the land (95 years) from the Division of Capital Asset Management (DCAM). The proponent may require a Massachusetts Department of Conservation and Recreation (DCR) modified Access Permit if the proponent modifies the Riverway by the addition of a right turning lane at the Riverway/ Brookline Avenue intersection. The project will require a Sewer Connection/Extension Permit and an Environmental Results Program Certification for emergency generators and commercial boilers from the Department of Environmental Protection (MassDEP). It is subject to the EEA/MEPA Greenhouse Gas (GHG) Emissions Policy and Protocol. The proponent may need to obtain an Industrial Discharge Permit, a Sewer Use Discharge Permit, and a Construction Dewatering Permit from the Massachusetts Water Resources Authority (MWRA). The project must comply with the National Pollutant Discharge Elimination System (NPDES) General Permit for stormwater discharges from a construction site. It should submit a Notice of Preconstruction to the Massachusetts Aeronautics Commission and a Notice of Construction and Crane Approvals to the Federal Aviation Administration.

Because the proponents may be receiving funding from the Commonwealth (Massachusetts Health and Educational Facilities Authority (MHEFA) and housing grants) and the site is the subject to a land transfer of Commonwealth property, MEPA jurisdiction is broad and extends to all aspects of the project that may cause Damage to the Environment, as defined in the MEPA regulations.

The project is also subject to review by the Boston Redevelopment Authority (BRA) under the Article 80 Large Project Review process of the Boston Zoning Code. Accordingly, the proponent will prepare a Project Impact Report (PIR). It is my view that the planning for this project would be best served by a coordinated review and the submission of a single set of documents to satisfy the requirements of both MEPA (Section 11.09(4)(c) and the BRA (Section 80-6). The proponent should coordinate this joint review process with both agencies to establish the necessary review periods.

SCOPE

As modified by this scope, the Draft EIR should conform to Section 11.07 of the MEPA regulations for outline and content. The Draft EIR should also address the issues outlined below in detail. It should include a copy of this Certificate and all comment letters received on the ENF.

Project Description

The EIR should provide a detailed project description with a summary/history of the project. It should include existing and proposed site plans. The EIR should identify and describe the project phasing and the timing of the phases. It must identify the long-term lease arrangements between the proponents and the Commonwealth. The EIR should discuss the aesthetics of the project, and should include a conceptual-level landscaping plan and building elevations from all sides. It should identify any proposed lighting impacts on adjacent residential structures. The EIR should discuss how this project is compatible with local, regional, and state land use planning.

MEPA.1
MEPA.2
MEPA.3
MEPA.4
MEPA.5
MEPA.6
MEPA.7

Alternatives Analysis

The EIR should discuss and compare the Preferred Alternative, an alternative showing the buildable bulk and density under the existing zoning provisions without zoning relief, and the No-Build Alternative. It should summarize any alternatives that have previously been explored for the project site by the proponent. The analysis should clearly present the alternative driveway/garage configurations at the site and identify the advantages and disadvantages of the Preferred Alternative. The EIR should discuss alternative building configurations on the site that might result in fewer impacts, particularly on traffic, parking, and wind and shadows. It should provide a comparative analysis that clearly shows the differences between the environmental impacts associated with each of the alternatives for each of the areas that are scoped.

MEPA.8
MEPA.9
MEPA.10
MEPA.11
MEPA.12

<u>Traffic</u>

The traffic analysis presented in the EIR should be prepared in conformance with the EEA/EOT Guidelines for EIR/EIS Traffic Impact Assessment. It should identify appropriate mitigation measures for areas where the project will produce impacts on local and regional traffic operations, especially where delay increases at intersections. The unadjusted and adjusted trip generation rates must be fully explained in the EIR. Since this project contains a specialized hospital with outpatient services, the EIR should identify the number and type of outpatient services for the Massachusetts Mental Health Center (MMHC) and BWH. The EIR should provide information regarding how these outpatient visits will reach MMHC and BWH. It should include a breakdown by transportation mode and the reasoning behind these estimated trip generation numbers. It should fully describe all of the proposed components at MMHC and BWH to provide accurate trip generation estimations. MEPA.13 MEPA.14 MEPA.15 MEPA.16 MEPA.17 MEPA.18

The EIR should include a Level-of-Service (LOS) analysis for the following intersections: MEPA.19

- Brookline Avenue/Fenwood Road;
- Brookline Avenue/Francis Street;
- Francis Street/Huntington Avenue;
- Francis Street/Binney Street;
- Fenwood Road/Binney Street;
- Fenwood Road/Vining Street;
- Fenwood Road/Huntington Avenue;
- Francis Street/Vining Street;
- Francis Street/St. Albans Road;
- Fenwood Road/St. Albans Road;
- St. Albans Road/Huntington Avenue;
- Longwood Avenue/Brookline Avenue; and
- Brookline Avenue/Riverway.

If the scope for the DPIR requires the study of other intersections, the analysis for those intersections should also be presented in the DEIR. The EIR's LOS tables should include the weekday morning and evening peak hours for each movement at these above intersections. It should verify the proposed morning and evening peak hour. The EIR should provide a traffic distribution map and background growth from other proposed projects in the area. Future conditions should cover a five-year (2014) and a ten-year (2019) time horizon to account for the phasing of the project. The EIR should examine present (2009) and future (2014 and 2019) build and no-build traffic volumes for impacted roadways and intersections. The Volume/Capacity ratio should also be provided for signalized intersections. The EIR should include a summary of average and 95th percentile vehicle queues for each intersection within the study area. The DEIR should include a LOS analysis for the Riverway/Brookline Avenue intersection evaluating a no-build scenario, a build scenario without a proposed right-turn lane on the Riverway northbound at the Brookline Avenue intersection, a build scenario with the proposed improvement, and MEPA.20 MEPA.21 MEPA.22

additional proposed alternatives to a proposed right-turn only lane.

Traffic accident history for the three most recent years for which data are available should be reviewed and presented for the study area. In the DEIR, traffic accident problem areas should be identified, and solutions should be proposed. MEPA.23

The EIR should discuss the proponent's coordination efforts with DCR, MassHighway and BTD officials as they address regional and local traffic concerns within this area. It should provide the most current information on the proposed construction dates for any roadway improvements in the area. MEPA.24 MEPA.25

The EIR should discuss the suitability of any proposed signalization changes and any roadway widening. It should discuss right-of-way (ROW) implications of possible widening and describe how such ROW's would be acquired. The EIR should include plans showing the configuration of each roadway intersection proposed for modification. MEPA.26

The proponent should consider participating in proposals by DCR, MassHighway, and the BTD to provide additional traffic mitigation measures to reduce the impacts on estimated delay at adjacent intersections along the Brookline Avenue corridor. MEPA.27

Parking

According to the ENF, parking at the site will include approximately 406 parking spaces in an underground garage under the BWH building. The EIR should identify how parking demand and the number of proposed parking spaces was determined. The proponent is also proposing to supply MMHC with 50 parking spaces when MMHC returns to the site. This may be initially done as a surface parking area and later as part of the proponent's 406-space garage. Residential units will be supplied by BWH's existing lease of approximately 90 parking spaces in the adjacent RTH garage. The EIR should identify the number of parking spaces required by zoning, and recommended by the BTD in its citywide standards. It should describe any proposed valet parking. The EIR should describe any proposed off-site parking and for whom this parking is available. MEPA.28 MEPA.29 MEPA.30 MEPA.31

The EIR should include a comprehensive parking needs assessment. The parking needs assessment should take into account the turnover rates for employees, patients, visitors, and residences. It should describe the parking supply and demand in the Longwood Medical Area (LMA) generally. The EIR should inventory both off- and on-street parking and proposed parking fees. It should present vehicle occupancies/modal splits for the trips generated in order to estimate parking demand. Parking demand management should be a key component of the overall mitigation analysis. MEPA.32 MEPA.33

Transportation Demand Management

The EIR should outline the proponent's Transportation Demand Management (TDM) Program. TDM measures to consider include: providing a greater transit subsidy to employees using public transportation and providing transit passes to each residential unit as part of the rent or management fee; employing an on-site vehicle trip reduction coordinator; implementing a rideshare matching program; a guaranteed ride home program; additional bicycle incentives; and parking management. The proponents should commit to participating in the Longwood Medical Area (LMA) Transportation Management Agency (TMA). MEPA.34

Public Transit

The EIR should identify the nearby Huntington Avenue/Brigham Circle Stop on the Heath Street Branch and Longwood Station on the Riverside Branch of the Green Line and MBTA bus routes and bus stops in the neighborhood. The Medical Area (MASCO) shuttle bus routes and stops in the area also should be identified. The EIR should identify what transit services have limited capacity available during peak hours. It should also identify how MBTA improvements, like the Urban Ring project may provide service to the LMA in the future. The DEIR should analyze any needed improvements to existing transit service and evaluate potential contributions that can be made by this project to improving transit service in the area. MEPA.35 MEPA.36 MEPA.37 MEPA.38 MEPA.39

Pedestrian and Bicycle Facilities

The EIR should show where sidewalks currently exist on a map of the area and where the proponent proposes sidewalks. It should identify the proposed bicycle facility improvements included with this project. Bicycle parking/storage areas should be identified on a plan. MEPA.40 MEPA.41

Air Quality

Air Quality microscale modeling for carbon monoxide will be needed for intersections deteriorating to LOS D or worse where the project contributes ten percent or more to the existing traffic volumes. MassDEP must be consulted as to the intersections, sensitive receptors, and model input parameters to be included in these analyses. MEPA.42

An air quality mesoscale analysis for ozone will be needed for this project to assess the total volatile organic compound (VOC) and nitrogen oxide (NOx) emissions associated with all project-related vehicle trips and to demonstrate that VOC/NOx emissions associated with the Preferred Alternative are less than those from the no-build case in the short- and long-term. If VOC/NOx emissions from the Preferred Alternative are greater than the no-build case, reasonable and feasible VOC/NOx reduction/ mitigation measures should be included. The proponent should consult MassDEP's "Guidelines for Performing Mesoscale Analysis of Indirect Sources" to determine the appropriate study area. This section of the DEIR should discuss opportunities to enhance pedestrian, bicycle, and transit modes as required above to reduce the MEPA.43 MEPA.44

air quality impacts of the proposed project. The EIR should discuss the project's compliance with MassDEP's Ridesharing Regulations, 310 CMR 7.16. The mesoscale analysis should also be used to estimate indirect carbon dioxide (CO_2) emissions from transportation sources in conjunction with the GHG Policy and Protocol, as outlined further below. MEPA.45

The proponent should evaluate the feasibility of compliance with the Massachusetts Idling regulation (310 CMR 7.11) and the Rideshare Regulation (310 CMR 7.16) and should make commitments to such compliance wherever feasible. It should also evaluate participating in the MassDEP Diesel Retrofit Program and utilize ultra low sulfur diesel fuel in the off-road engines of construction vehicles. MEPA.46 MEPA.47

Greenhouse Gas Emissions (GHG)

The DEIR should include an analysis of GHG emissions and mitigation measures in accordance with the standard requirements of the MEPA GHG Policy and Protocol ("the Policy"). The DEIR should quantify the direct and indirect GHG emissions associated with the project's energy use and transportation-related emissions. Direct emissions include on-site stationary sources, which typically emit GHGs by burning fossil fuel for heat, hot water, steam and other processes. Indirect emissions result from the consumption of energy, such as electricity, that is generated off-site by the burning of fossil fuels, and from emissions associated with vehicle use by employees, vendors, customers and others. The DEIR should outline and commit to mitigation measures to reduce GHG emissions. I refer the proponent to the Policy for additional guidance on the analysis and I strongly encourage the proponent to meet with representatives from MEPA, MassDEP and the Department of Energy Resources (DOER) prior to preparation of the DEIR. MEPA.48

The DEIR should include GHG emissions analysis that calculates and compares GHG emissions associated with three scenarios: 1) a Massachusetts Building Code-compliant baseline; 2) a Preferred Alternative; and 3) a project alternative with greater GHG emissions-related mitigation than the Preferred Alternative. Please note that the code currently in effect for the design and construction of this project and for the establishment of the Base Code Compliant Case is 780 CMR 13.00 7th Edition of the MA State Building Code. This edition is the 2006 with 2007 supplement to the International Energy Conservation Code (IECC) or the ASHRAE Standard 90.1 2006, with the 2007 Supplement (including Massachusetts specific supplements).

The GHG analysis should clearly demonstrate consistency with the objectives of MEPA review, one of which is to document the means by which the Proponent plans to avoid, minimize, or mitigate damage to the environment to the maximum extent feasible. The policy allows the proponent to select a model but, DEP and DOER recommend using EQUEST for stationary source modeling for buildings and building systems. The DEIR should include the modeling printout for each of the three scenarios. It should include emission tables that compare the base case (in tons of Carbon Dioxide (CO_2)) with the mitigation alternatives and show the projected reduction (in tons and percentages) by emissions source. The DEIR should clearly state modeling assumptions and explicitly note which GHG reduction measures have been modeled and provide supporting data demonstrating GHG reductions. The DEIR should identify whether certain building design or operations GHG reduction measures will be mandated by the proponent to future occupants or merely encouraged for adoption and implementation. I refer the proponent to the MassDEP comment letter (that includes contributions from DOER) for additional recommendations on the analysis of GHG emissions, data to be incorporated into the DEIR, and potential mitigation measures.

Given the phased nature of this project, the proponent should consider design options that will allow them to cost effectively integrate efficiency or renewable energy measures in the future when it is more financially or technically feasible. The proponent should not discount mitigation measures even if it is not currently feasible to quantify the GHG reduction impact including recycling of construction, office and residential materials as well as water conserving approaches such as low flow plumbing fixtures, gray water reuse, and low impact landscaping and irrigation designs. These measures will be considered when evaluating whether the project mitigated its GHG emissions to the greatest extent practicable.

The proponent should evaluate stationary source GHG mitigation alternatives as MEPA.49 suggested by MassDEP and DOER in their comments. In support of these evaluations, the DEIR should clearly describe each building including the type, usage, and orientation. It should also describe the building envelope elements, along with the proposed design performance criteria (such as R or U-value) for each element. The DEIR should describe the building electrical and HVAC systems, including the design loads and levels, equipment selected, and the relevant performance. The DEIR should consider quantifying the GHG reductions associated with water conservation measures in its plans.

The DEIR should respond to the comments by MassDEP/DOER with respect to: MEPA.50

- Pursuit of Leadership in Energy and Environmental Design (LEED) and/or Energy Star certifiable project status;
- Availability of potential rebates from energy providers associated with the installation of highly efficient equipment;
- Explanation of building orientation and discussion of expected impacts on energy usage;
- Energy efficient lighting (both interior and exterior);
- Interior day-lighting of buildings;
- Duct insulation;
- Use of peak shaving or load shifting strategies;
- Super insulation;
- Window glazing;
- High-efficiency HVAC systems;
- High-albedo roofing materials;
- Incorporation of third-party building commissioning;

- Implementation of lighting motion sensors, climate control and building energy management systems. I strongly encourage the implementation of separate metering of utilities within the residential units and between separate office/institutional uses to incentivize energy conservation;
- On-site renewable energy sources. The DEIR should evaluate the use of photovoltaic (PV) systems in accordance with the recommendations of DOER.
- Combined heat and power (CHP) technologies;
- Energy performance tracking capabilities; and
- Energy Star-rated appliances.

The DEIR should also evaluate the following sustainable design elements: water conservation and the reuse of wastewater and/or stormwater; the use of non-toxic and/or recycled building materials; recycling systems or plans; solid waste reduction plans; and an annual audit program for energy consumption, waste streams and the use of renewable resources. MEPA.51

The DEIR should reflect a commitment to pursue additional GHG mitigation measures in response to the modeling. If the proponent chooses not to model a specific mitigation measure recommended by MassDEP because it determines the measure to be infeasible for this particular project, the DEIR should thoughtfully explain why and demonstrate that the alternative selected has avoided, minimized, and mitigated CO_2 emissions adequately. MEPA.52

Because the project buildings will be leased from DCAM, the proponent must consider the recommendations and energy-related measures included in Executive Order No.484, Leading by Example. The DEIR should identify measures committed to, and justify any measures which will not be adopted. In addition, the proponent should consider the guidance provided in the USDOE Office of Energy Efficiency EnergySmart Hospital Program. MEPA.53 MEPA.53b

The mesoscale analysis described previously should be used to estimate the indirect emissions from mobile source GHG emissions associated with the additional project related vehicle trips. The calculation should compare GHG emissions for existing and future year (full) Build and No-Build conditions and future year (full) Build with Mitigation conditions. The proponent should follow the procedures for the GHG analysis as described in the Policy. The ENF indicates that the Proponent will implement a Transportation Demand Management (TDM) program to reduce vehicle miles travelled (VMT) and related GHG emissions. The DEIR should identify TDM measures proposed for each of the alternatives and the corresponding emission reductions expected. MEPA.54

Wind and Shadow

The EIR should consider specific building design alternatives as a means of reducing adverse wind and shadow impacts on the ground level pedestrian environment. It should be guided by the wind tunnel testing of the LMA massing. This wind tunnel testing is essential to determine the potential impacts of wind at the pedestrian level. For purposes of the EIR, a wind analysis that evaluates pedestrian level impacts will be sufficient. Mitigation for wind impacts should be identified in the EIR. MEPA.55

The EIR should identify shadow impacts during the different times of the year as required by the BRA. I encourage the proponent to explore mitigation measures that could be implemented to lessen the shadow impacts of the proposed project and improve the quality of the pedestrian experience in that location. MEPA.56

Drainage

The EIR should evaluate potential drainage impacts on water resources, such as the Muddy River. It should present drainage calculations and plans for the management of stormwater from the proposed project. It should include a detailed description of the proposed drainage system design, including a discussion of the alternatives considered along with their impacts. The EIR should identify the quantity and quality of flows. The rates of stormwater runoff should be analyzed for the 10, 25 and 100-year storm events. The proposed drainage system should control storm flows at existing levels. The proponent should recharge roof runoff and other treated stormwater runoff from paved areas and driveways in order to retain as much as possible of the existing groundwater flows and drainage patterns. If the proponent ties into the existing City of Boston stormwater system or the Riverway's drainage system, the EIR should clarify the permits required from the City and DCR. The EIR should clarify if there will be a recharge deficit on-site. It should indicate and discuss where the Riverway, Fenwood Road, Vining Street, and the Vining Street Extension drainage systems discharge in this area. MEPA.57 MEPA.58 MEPA.59

The EIR's stormwater management should aim to maximize infiltration, slow runoff from the site, maximize the use of vegetation, capture rooftop runoff for irrigation, and minimize sediment and nutrient loading downstream. It should address the performance standards of DEP's Stormwater Management Guidelines. It should demonstrate that the design of the drainage system is consistent with these guidelines, or in the alternative, why the proponent is proposing a drainage system design not recommended by MassDEP. The EIR's stormwater analysis should evaluate the use of Low Impact Development (LID) techniques. As recommended by the Charles River Watershed Association (CRWA), the project should be developed to meet the phosphorous reduction requirements of the Total Maximum Daily Load for Nutrients in the Lower Charles River Basin. The stormwater system should reduce the sediment load to the Muddy River and reduce the peak flow. The EIR should also determine groundwater flow directions on the project site as recommended by the CRWA. MEPA.60 MEPA.61 MEPA.62

The EIR should discuss consistency of the project with the provisions of the National Pollutant Discharge Elimination System (NPDES) General Permit from the U.S. Environmental Protection Agency for stormwater discharges from construction sites. The EIR should include a discussion of best management practices employed to meet the NPDES requirements, and should include a draft Pollution Prevention Plan. MEPA.63

In addition, a maintenance program for the drainage system should be included in the EIR to ensure its effectiveness. This maintenance program should outline the actual maintenance operations, responsible parties, and back-up systems. MEPA.64

The project site is located within a Groundwater Conservation Overlay District, which is intended to promote the restoration of groundwater levels and reduce the impact of surface water runoff. The proponent will be required to construct a structure capable of retaining a specific amount of stormwater accumulated on the site. It should seek guidance for the design of this structure from the Boston Water and Sewer Commission. MEPA.65

Water and Wastewater

The EIR should identify any Boston Water and Sewer Commission (BWSC) water or wastewater system improvements that will be required in order to connect to the municipal water and wastewater system. It should describe the proponent's proposed water and wastewater infrastructure improvements. The EIR should provide a detailed breakdown of the estimated water demand and wastewater generation for the project. This breakdown should include the proposed outdoor watering demand for landscaping and the projected water source. MEPA.66
The EIR should outline the proponent's efforts to reduce water consumption and thereby reduce wastewater generation. It should show the breakdown of its water consumption and wastewater generation for each component proposed on the project site. It should provide an analysis of the required Infiltration/Inflow (I/I) removal as identified in the MassDEP and BWSC comments. MEPA.67
The DEIR should also respond to the detailed comments in the BWSC letter. MEPA.68

Historical/Archaeological Issues

The Massachusetts Mental Health Center (MMHC) is listed in the State and National Registers of Historic Place. The MMHC listing includes five resources at the site: the 1912, four-story, red brick, E-shaped Main Building; the 1912 freestanding, red brick Power Plant; the 1954 five-story, red brick Research Building; the 1957, two-story, red brick Therapeutic Building; and the original 1912 cast iron and brick fence. However, only those dating from 1912 are considered "contributing" to the historical and architectural significance of MMHC. The project includes the demolition of the MMHC Buildings. The proponent is exploring the feasibility of incorporating several of the key architectural features into the new construction. Because the Commonwealth has determined that the rehabilitation of the MMHC for DMH use was infeasible, DCAM has proposed the redevelopment of the site.

The EIR should provide a comprehensive examination of the MMHC site to determine the items for potential inclusion into the replacement buildings. MEPA.69 The Massachusetts Historical Commission (MHC) has also requested that the EIR identify potential shadows from new construction on the Riverway, which is listed on the State and National Registers. MEPA.70 The EIR should address shadow impacts on these historic resources, or on any other historic resources within the area of the project.

Riverway Parkland Impacts

The EIR should identify not only wind and shadow impacts on the Riverway parkland, but any groundwater, drainage, or other impacts. The Riverway is part of the Emerald Necklace, and it includes the Muddy River, the Riverway and the Riverway Park. The EIR should include a figure that shows parkland trails, sidewalks, roadways, and other recreational facilities within the adjacent park. The proponent should propose mitigation to reduce any environmental impacts from traffic. MEPA.71

Hazardous Wastes

The EIR should present a summary of the results of any hazardous waste studies and remediation efforts undertaken at the site by the proponent. It should identify potential groundwater contamination. The BWSC reported that a draft Remediation General Permit for groundwater contamination, contaminated construction dewatering and miscellaneous surface water discharges from the project site was issued by the U.S. Environmental Protection Agency. MEPA.72
The EIR should address this contamination on the site and identify any future remediation efforts. MEPA.73

Construction

The EIR should present a discussion of construction period impacts (including but not limited to noise, dust, blasting, wetlands, and traffic maintenance) and analyze feasible measures that can avoid or eliminate these impacts. MEPA.74
It should also present a construction sequencing plan, and a traffic mitigation plan to be used during construction periods. MEPA.75

Recycling Issues

In its comment letter, MasssDEP encourages the proponent to evaluate construction and demolition recycling activities in the EIR. The EIR should consider future waste reduction and recycling and integrating recycled materials into the project to minimize or mitigate long-term solid waste impacts from the project. MEPA.76

Mitigation

The EIR should include a separate chapter on mitigation measures. This chapter on mitigation should include proposed Section 61 Findings for all state permits. The proposed Section 61 Findings should contain a clear commitment to mitigation, an estimate of the individual costs of the proposed mitigation and the identification of the parties responsible for implementing the mitigation. A schedule for the implementation of mitigation should also be included. MEPA.77

Response to Comments

In order to ensure that the issues raised by commenters are addressed, the EIR should include a detailed response to comments. This directive is not intended to and shall not be construed to enlarge the scope of the EIR beyond what has been expressly identified in this Certificate. MEPA.78

Circulation

The EIR should be circulated in compliance with Section 11.16 of the MEPA regulations and copies should also be sent to the list of "comments received" below and to Boston and Brookline officials. A copy of the EIR should be made available for public review at the Boston Public Library (Mission Hill Branch) and the Brookline Public Library. MEPA.79

August 7, 2009
Date

Ian A. Bowles

Cc: Ms. Sonal Gandhi, Boston Redevelopment Authority

Comments received:

Epsilon Associates, 7/10/09
Vanasse Hangen Brustlin, 7/23/09
Boston Water and Sewer Commission, 7/24/09
Massachusetts Department of Energy Resources, 7/27/09
The Mission Hill Health Movement, 7/27/09
Friends of the Muddy River, 7/27/09
Massachusetts Department of Conservation and Recreation, 7/28/09
Massachusetts Department of Environmental Protection/Northeast Regional Office, 7/28/09
Massachusetts Water Resources Authority, 7/27/09
Massachusetts Historical Commission, 7/28/09
Charles River Watershed Association, 7/28/09
Friends of Historic Mission Hill, 7/28/09

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9.2 MEPA

MEPA.1 History of the Project

The MMHC Site is the former location of the MMHC, a community mental health center administered by the DMH. Following an evaluation of existing buildings, it was determined that the rehabilitation of the property for DMH use was infeasible, and DCAM issued an RFP that would allow a private developer to redevelop the MMHC Site including the construction of 70,000 square feet of space and 50 parking spaces for DMH. The Project is in response to that RFP and a subsequent Development Agreement between the Proponent and DCAM.

BWH acquired the Binney Street Site along with the Servicenter Complex in 2005 when it was a combination of brick hardscape and landscaping. Later, the Binney Street Site served as the construction staging area for the Shapiro Cardiovascular Center.

Please see Section 2.1 for additional information on the Project Site and Section 2.9 for the history of plans for redevelopment.

MEPA.2 Existing and Proposed Site Plans

Please see Figures 1-3 and 1-4 for existing and proposed site plans, respectively.

MEPA.3 Project Phasing and Timing

The Project will be constructed in phases. The first phase, to commence immediately upon the receipt of all required permits and approvals from applicable City and State agencies and authorities will be the abatement and demolition of existing buildings and construction of the Partial Hospital/Fenwood Inn and the Binney Street Building interim MMHC offices. The Residential Building and Brigham and Women's Building will be constructed in subsequent phases and will start when market conditions allow and financial capital is available. The Proponent has carefully planned use of the Main MMHC Site during interim phases. Please see Section 2.3 for additional information.

MEPA.4 Leases

DCAM and BWH have entered into a development agreement for redevelopment of the MMHC Site and execution of long-term leases and subleases. Please see Section 2.7 for additional information.

MEPA.5 Aesthetics of the Project

Please see Chapter 5.0, Urban Design for a description of the aesthetics of the Project. Concept-level landscaping is shown on Figure 1-4, Proposed Site Plan. Building elevations are provided in Appendix B.

MEPA.6 Lighting impacts on adjacent residential structures

Exterior lighting will maintain a minimum light intensity of approximately one foot candle to allow for safe passage. Pole mounted lights will be down-cast to prevent excess light pollution and all other lights will be arranged or shielded to prevent direct glare for the light source onto adjacent properties.

MEPA.7 Consistency with Local, Regional and State land use planning

The Project is generally consistent with local, regional and state land use planning. Please see Section 2.8 for more information.

MEPA.8 Existing zoning alternative

An existing zoning alternative is discussed in Section 2.9.

MEPA.9 Alternatives previously explored

The proposed massing is driven by the program required to make the Project financially viable for BWH and RTH given the Proponent's financial commitments and contributions to the Commonwealth as well as other public benefits. Evolution of the Project's massing and alternatives previously explored are discussed in Section 2.9.

MEPA.10 Alternative driveway / garage configurations

As described in more detail in the alternatives discussion provided Section 2.9, the Proponent designed the layout and access plan to maximizes efficiency of traffic and pedestrian flows to protect pedestrian safety and minimize vehicle circulation around the Project Site.

MEPA.11 Alternative Building Configurations

Project viability is contingent upon the proposed program. While retaining a program that ensures viability of the Project, the evolution of the massing resulted in a general reduction in environmental impacts. Please see Section 2.9, Alternatives for a discussion of evolution of the massing and resultant environmental impacts.

MEPA.12 **Comparative analysis of alternatives**

Section 2.9 describes alternatives and impacts on areas scoped by MEPA.

MEPA.13 **EEA/EOT Guidelines.**

The MMHC transportation analysis conforms with the EEA/EOT Guidelines for EIR/EIS Traffic Impact Assessment and is responsive to the Certificate issued for the ENF as well as to the scope issued in response to the IMPNF/PNF.

MEPA.14 **Mitigation measures for impacts on local and regional traffic operations**

Section 3.5 of the Draft EIR/PIR identifies proposed mitigation and improvement actions associated with the Project.

MEPA.15 **Trip generation rates**

Trip generation assumptions are discussed in Section 3.3.3.1 of the Draft EIR/PIR.

MEPA.16 **Outpatient services**

Table 3-18 in the DRAFT EIR/PIR provides daily patient estimates for the Project.

MEPA.17 **Transportation mode split**

Section 3.3.3.1.2 provides a detailed discussion regarding mode splits employed to support the transportation analysis.

MEPA.18 **Proposed components of MMHC and BWH**

Section 3.3.3 of the Draft EIR/PIR provide a detailed discussion of the proposed building program used to estimate Project trip generation.

MEPA.19 **Level-of-Service Analysis**

Intersection level of service analyses are provided in Chapter 3 of the Draft EIR/PIR for the required study area intersections referenced in the MEPA Certificate.

MEPA.20 **Traffic distribution and background growth**

Figures 3-19 and 3-20 of the Draft EIR/PIR illustrate the trip distribution used for the transportation analysis. Background growth is discussed in Section 3.3.2 of the document.

MEPA.21 **Existing, No Build and Build analysis**

The transportation analysis considers a 2009 Existing Condition, 2016 Phase 1 Build, and a 2021 Full Build Condition. It is expected that these milestones most accurately reflect the phased building competition dates contemplated by BWH, DMH and RTH. The V/C ratio is provided for signalized intersections in each of the conditions.

MEPA.22 **Riverway/Brookline Avenue**

The Draft EIR/PIR provides a detailed analysis of the Riverway/Brookline Avenue intersection in Section 3.4.

MEPA.23 **Traffic accident data**

Section 3.2.5 provides detailed crash information for the study area intersections.

MEPA.24 **Coordination with DCR, MassHighway and BTD**

BWH will work with DCR, MassHighway and the BTD relative to the implementation of transportation infrastructure improvements that are proposed to support the Project, as well as area–wide mitigation and improvement actions that may be required. Any improvements that are currently being proposed are discussed in detail in Chapter 3.0 of the Draft EIR/PIR.

MEPA.25 **Construction schedule for roadway improvements**

The construction schedule for any proposed improvement actions are provided in Table 3-59 (Mitigation Action Plan) in the Draft EIR/PIR.

MEPA.26 **Signalization changes and roadway widening**

The Project does not propose any roadway widening or changes to existing intersection geometry. Proposed signal timing changes are discussed in Section 3.5 of the Draft EIR/PIR.

MEPA.27 **Additional traffic mitigation**

BWH is involved in area-wide transportation improvement planning through its affiliation with the Medical Academic and Scientific Community Organization, Inc (MASCO).

MEPA.28 **Parking demand and proposed parking spaces**

Section 3.3.6 of the Draft EIR/PIR provides a comprehensive study of the proposed parking supply and the parking demand associated with the Project.

MEPA.29 Parking requirements

Section 3.3.6.2 compares the Project's proposed parking supply to the Boston Transportation Department's parking guidelines. The proposed parking supply conforms to these guidelines.

MEPA.30 Valet parking

The Project does not propose any valet parking.

MEPA.31 Off-site parking

Section 3.3.6 of the Draft EIR/PIR discusses the Project's need to provide off-site parking outside of the Longwood Medical and Academic Area to meet the parking demand.

MEPA.32 Parking needs assessment

A detailed parking demand analysis is provided in Section 3.3.6.3 of the Draft EIR/PIR.

MEPA.33 Inventory of parking and proposed parking fees

A detailed inventory of the existing parking supply and parking management is provided in Section 3.2.7 of the Draft EIR/PIR. Proposed parking fees will be market-rate.

MEPA.34 Transportation Demand Management

BWH's TDM program is provided in Section 3.2.1.2. RTH's TDM program is provided in Section 3.2.2.3. In addition, RTH proposes several new TDM measures for the Residential Building which are discussed in Section 3.5.

MEPA.35 Identify nearby transit

Section 3.2.8 provides a detailed inventory of existing transit services.

MEPA.36 MASCO shuttle bus routes and stops

MASCO shuttle services are provided in Section 3.2.8.1.

MEPA.37 Transit capacity

A detailed transit capacity analysis is provided in Section 3.4.3.

MEPA.38 **Future transit projects**

Planned transit improvements, including the Urban Ring project, are discussed in Section 3.3.1.5.

MEPA.39 **Improvements to existing transit service**

The transit capacity analysis (Section 3.4.3) discusses services that are over capacity.

MEPA.40 **Sidewalks**

Sidewalks around the Project Site will be reconstructed with the Project. A discussion of the proposed mitigation is included in Section 3.5.

MEPA.41 **Bicycle facilities**

The Project will provide on-site bicycle facilities within the proposed garage. Bicycle storage is discussed in Section 3.5.

MEPA.42 **Microscale analysis**

The results of the microscale analysis show that CO ground-level concentrations are expected to be well below the one-hour NAAQS of 35 ppm and the eight-hour NAAQS of 9 ppm. Please see Section 4.5.4.2 for a detailed discussion of the results of the microscale analysis.

MEPA.43 **Mesoscale analysis**

The results of the mesoscale analysis show that NOx and VOC emissions for the Build condition will be less than for the Existing condition (primarily due to improved vehicle technology), but slightly more than the No Build condition. The Proponent has identified and reviewed reasonable and feasible reduction and mitigation measures to address traffic congestion and the resulting slight increase in emissions associated with the 2021 Build scenario over the No-Build. Please see Section 4.5.4.1 for results of the mesoscale analysis.

MEPA.44 **Enhancement of alternative transportation**

Please see Section 4.5.4.1 and Chapter 3.0 for information on alternative transportation and how the Project will encourage these modes of transportation.

MEPA.45 **Compliance with Ridesharing regulations**

The Project will comply with MassDEP's Ridesharing regulations. The mesoscale analysis was also used to estimate indirect CO2 emissions from transportation sources for the GH analysis included in Section 4.12.

MEPA.46 Idling regulations

The Project will comply with MassDEP's Idling regulations.

MEPA.47 Ultra low sulfur diesel

Retrofitted equipment and ultra low-sulfur diesel (ULSD) fuel (15 ppm) will be used in off-road construction equipment.

MEPA.48 GHG emissions analysis

Section 4.12 addresses greenhouse gas emissions generated by the Project and options that may reduce those emissions, in accordance with the MEPA Greenhouse Gas Emissions Policy and Protocol.

MEPA.49 Stationary source emissions

Stationary sources are includes in the GHG emissions analysis. Please see Section 4.12.

MEPA.50 Response to MassDEP/DOER comments

Responses to MassDEP and DOER comments are provided in Section 9.4 and Section 9.5 below.

MEPA.51 Sustainable design elements

Please see Section 4.12.

MEPA.52 Commitment to additional GHG mitigation measures

Please see Section 4.12

MEPA.53 Executive Order No. 484 and Energy Smart Hospital Program

The Proponent has considered the recommendations and measures of Executive Order 484. Accordingly, the Binney Street Building, Brigham and Women's Building and Partial Hospital/Fenwood Inn will meet the Mass. LEED Plus standard. The Binney Street Building and Brigham and Women's Building are proposed to be LEED Silver Certified, and the Partial Hospital/Fenwood Inn will be LEED Certified. These buildings aim to maximize energy performance to the extent practical and incorporate measures to conserve energy and water resources. Additional information on specific sustainable energy measures are described in Section 4.11 and provided in Appendix F.

This Brigham and Women's Building includes laboratory and clinical space. The DOE Energy Smart Hospital Program is generally not suitable for the variety and intensity of BWH uses or the interplay between these uses needed for a teaching hospital.

MEPA.54 Mobile source emissions and mitigation measures

Please see Section 4.12 for mobile source emissions and mitigation measures. The mesoscale analysis was used to estimate indirect emissions from mobile sources.

MEPA.55 Wind analysis

Overall, wind tunnel testing demonstrated that the pedestrian level wind comfort conditions at the Project Site were similar in the No Build and Build conditions. The wind conditions improved or stayed the same with the Proposed Project in more locations than they worsened. The number of locations with dangerous wind conditions on an annual basis was reduced from four for the No Build Configuration to one for the Full Build Configuration. In general, wind conditions were comfortable for their intended usage in most areas. Potential mitigation measures to improve pedestrian wind comfort conditions will be identified during the design review process. These measures consist of canopies, wind screens and landscaping. A wind analysis is provided in Section 4.1.

MEPA.56 Shadow impacts

In general, shadow impacts will be primarily limited to the public ways and pedestrian sidewalks immediately surrounding the Project buildings. Shadows will be cast on some surrounding rooftops, many of which are already in partial shadow during these periods. There will be some new shadows in the morning on the Riverway section of the Emerald Necklace. During the course of design, the siting and massing of the Residential Building evolved to reduce shadow impacts on the Emerald Necklace. Please see Section 4.2 for the shadow analysis.

MEPA.57 Drainage impacts

The Draft EIR/PIR contains an analysis of the stormwater characteristics of the Project under both pre- and post-development conditions, including estimates of expected stormwater discharges under the specified storm events.

MEPA.58 Recharge deficit

The Draft EIR/PIR describes, site by site, measures proposed to recharge roof runoff.

MEPA.59 Discharge locations

The Draft EIR/PIR describes the stormwater discharge patterns under existing and proposed conditions.

MEPA.60 Stormwater management

A description of the Project's consistency with the Stormwater Management Guidelines is included in the Draft EIR/PIR.

MEPA.61 Low impact design

The Draft EIR/PIR includes a narrative outlining the stormwater control measures being considered, including Low Impact Design features.

MEPA.62 Groundwater flow

In general, groundwater flows from northeast to southwest in the Project area, towards the Muddy River. A groundwater level survey will be conducted to measure the flow direction and gradient across the Project Site.

The Project will include measures to avoid impacts on groundwater. The Partial Hospital/Fenwood Inn parcel proposes an underground concrete galley system under the driveway for infiltration of roof runoff. The Residential Building and Brigham and Women's Building propose the use of underground recharge systems within both landscaped and paved areas for infiltration of roof runoff. Both methods are traditionally accepted as effective means for recharging clean roof runoff within the ground. In addition, the Residential Building site is being evaluated for the siting of low-impact design features such as bio-swales and rain gardens. Recharge at the Binney Street Building Site is not practicable because the proposed building, coupled with an existing tunnel, takes up the entire parcel.

MEPA.63 Consistency with NPDES

Based on the currently anticipated phasing, demolition of existing buildings and construction of the Residential Building and the Brigham and Women's Building will require the filing of a Notice of Intent under the NPDES regulations. As part of that Notice of Intent, the Contractor(s) will be required to prepare a detailed stormwater pollution prevention plan. The pollution prevention plan will be prepared by the Contractor as required under the NPDES general permit."

MEPA.64 Drainage system maintenance

The Proponents will be maintaining all on-site stormwater controls and devices. The frequency and type of maintenance will be specified upon final approval of the site plans.

MEPA.65 Groundwater

The Project is not located within the Groundwater Conservation Overlay District. However, the Proponent is currently planning the use of infiltration devices throughout the Project.

MEPA.66 Water and wastewater

Estimates of expected water demand and wastewater generation inclusive of irrigation demands (using Title 5 guidance) are presented in the Draft EIR/PIR. Please refer to Section 4.11 and Appendix F for discussions on irrigation water management as well as overall water conservation.

MEPA.67 Infiltration/Inflow

The Proponent has initiated coordination with the Boston Water and Sewer Commission regarding the removal of Infiltration/Inflow. A formal understanding will be reached in connection with BWSC site plan approval.

MEPA.68 Response to BWSC comments

Please refer to the responses to BWSC comments below.

MEPA.69 Examination of items for inclusion into new buildings

The Proponent has developed a draft architectural salvage and reuse plan that would include salvaging and incorporating selective architectural features into the design of the Project. Please see Section 6.5 for information on potential features to be included in the salvage plan.

MEPA.70 Shadow impacts on historic resources

Some shadows will be cast on the Riverway portion of the Emerald Necklace, however, impacts will be limited to the morning hours. As the sun moves across the sky during these impacted times the shadows will also be moving, therefore no one particular area of the Riverway will be in shadow during the entire impacted period. There will be no new shadows on the Riverway open space during the midday, afternoon and evening hours studied. Please see Section 6.3.2 for a discussion of shadow impacts in historic resources.

MEPA.71 Impacts on Riverway parkland

Impacts on the Riverway are included in the appropriate analyses in Chapter 4. Section 2.8.3 describes the Project's proposed open spaces shown in Figure 2-19 and its context with the Emerald Necklace and Riverway (shown in Figure 2-20).

MEPA.72 Hazardous wastes

Preliminary environmental studies detected concentrations of TPH, PAHs, and lead in the fill soils at the Project Site which are typical of urban fill material. Additional analyses of soil and groundwater are planned in advance of construction and demolition activities. Results will be used to characterize and address the site materials proposed for excavation and will inform plans for off-site disposal and management of construction dewatering effluent in accordance with any applicable environmental regulatory requirements.

The Project will comply with applicable local, state, and federal regulations (including NPDES) should temporary discharge of dewatering effluent be necessary based on the proposed construction.

MEPA.73 Contamination and remediation on-site

Please see Response to Comment MEPA.72.

MEPA.74 Construction period impacts

Section 4.10 outlines potential construction impacts.

MEPA.75 Construction sequencing and traffic mitigation

The Project will be constructed in phases. The first phase, to commence immediately upon the receipt of all required permits and approvals from applicable City and State agencies and authorities will be the abatement and demolition of existing buildings and construction of the Partial Hospital/Fenwood Inn. The Residential Building and Brigham and Women's Building will be constructed in subsequent phases and will start when market conditions allow and financial capital is available. Please see Section 4.10.2 for a detailed discussion of construction logistics and Section 4.10.6 for a description of transportation mitigation during construction.

MEPA.76 **Waste reduction and recycling**

The Proponent will take an active role with regard to the reprocessing and recycling of construction and building demolition waste. Demolition debris will be removed from the construction site or re-used on the site, as appropriate. Please see Section 4.7.3 for more information on construction related waste reduction and recycling.

MEPA.77 **Mitigation measures and Section 61 findings**

Mitigation measures and Section 61 Findings are provided in Chapter 8.0.

MEPA.78 **Response to comments**

This chapter provides responses to comments submitted to MEPA and the BRA.

MEPA.79 **Circulation**

This Draft EIR/PIR will be circulated in accordance with Section 11.6 of the MEPA regulations. A copy of the circulation list is provided in Appendix I.

dcr
Massachusetts

July 28, 2009

Secretary Ian A. Bowles
Executive Office of Energy and Environmental Affairs
Attn: William Gage, MEPA Office
100 Cambridge Street, Suite 900
Boston, Massachusetts 02114

Re: Massachusetts Mental Health Center Redevelopment – EOEEA No. 14440

Dear Secretary Bowles:

The Department of Conservation and Recreation ("DCR" or the "Department") submits the following comments in response to the Environmental Notification Form ("ENF") for the Massachusetts Mental Health Center Redevelopment (the "Project") submitted by the Brigham and Women's Hospital Inc, Partners Healthcare System Inc., and Roxbury Tenants of Harvard Association, Inc. (the "Proponent"). As proposed, the Project will redevelop the 2.39 acre Massachusetts Mental Health Center ("MMHC") complex on Fenwood Road and Vining Street ("MMHC Site") that presently contains five vacant buildings, and a 0.29 acre parcel at the corner of Binney and Francis Streets ("Binney Street Site"). Upon completion, the Project would contain approximately 358,670 square feet of research and development, clinical, and office uses by Brigham and Women's Hospital; 136 residential units (70 market-rate condominium units and 66 affordable units); 400 parking spaces; and a 8,260 square foot outpatient clinic and partial hospital with 30 residential units. The Project requires a mandatory Environmental Impact Report ("EIR") review as the new traffic generated by the Project exceeds the EIR threshold of 3,000 or more Average Daily Traffic ("ADT") on roadways providing access to a single location. The ENF states the Project would generate approximately 6,036 new ADT (unadjusted), and would generate 2,772 adjusted ADT using the Boston Transportation Department's ("BTD") mode share guidelines.

As described in the ENF, the Project does not require any transportation improvements in the area. However, the Proponent states a willingness to explore modifications to the adjacent Riverway; specifically construction of a right-turn only lane on the northbound section of the Riverway, near its intersection with Brookline Avenue[1]. The improvement has been sought in the past by the Medical Academic and Scientific Community Organization ("MASCO") which represents many of the institutions in the Longwood Medical Area. Figure 1-3 of the ENF shows a new turning lane that will coincide with the construction of the Brigham and Women's Building in the last phase of the Project. DCR owns and operates the Riverway and accordingly submits the following suggestions for the EIR scope in relation to transportation impacts.

The Riverway is part of a historic parkway system designed by Fredrick Law Olmsted in the 1890s. Heading north to south, the Riverway begins west of the Landmark Center and generally follows the

[1] The ENF identifies the traffic improvement as occurring on the southbound approach to Brookline Avenue off the Riverway (see page 16). DCR notes the improvement as shown on Figure 1-3 occurs on the northbound approach to Brookline Avenue off the Riverway.

course of the Muddy River adjacent to parkland until its conclusion at the Huntington Avenue Overpass. The Riverway is part of the historic Emerald Necklace, designed by Olmsted to connect parkland stretching from the Charles River south to Franklin Park. The historic importance and value of the parkways are evidenced by its designation as a Boston Historic Landmark and its listing on the National Register of Historic Places.

In the EIR process for the Project, DCR recommends that the Proponent identify and evaluate alternatives DCR.1
that would avoid the Riverway right-turn only lane on to Brookline Avenue, and include a Level of Service DCR.2
analysis for the Riverway/Brookline Avenue intersection evaluating a no-build scenario; a build scenario DCR.3
without the proposed traffic improvement; a build scenario with the proposed improvement, and additional DCR.4
proposed alternatives to the proposed right-turn only lane. In the analysis, the Proponent should also identify future development projects in the area and adjust future traffic counts accordingly.

The Proponent should be aware that the traffic signal at the intersection of Riverway and Brookline Avenue (currently operated and maintained by DCR) is interconnected to the BTD traffic signal
system. In preparing background assumptions for the DEIR traffic study, the Proponent should contact DCR.5
BTD and determine which nearby traffic signals also belong to the same subsystem in the computerized traffic signal system. DCR notes that any proposed changes at Riverway and Brookline Avenue which would affect system parameters (for example, cycle length) would require modifications to all traffic signals in this subsystem. These issues should be considered in establishing the Traffic Study Area for the Project which will help determine appropriate mitigation measures for project generated traffic impacts.

Page 17 of the ENF references various agencies that the Proponent is committed to working with "to identify and implement reasonable transportation improvements to help mitigate transportation impacts generated by the Project and improve traffic flow, transit access options, and pedestrian access and safety in the area." DCR should be added to the list of agencies.

Thank you for the opportunity to comment on the ENF. Please contact Ken Kirwin at (617) 626-1498 with any questions or to request additional coordination with DCR.

Sincerely,

Richard K. Sullivan, Jr.
Commissioner

cc: Laura Dietz, Ken Kirwin, Joe Orfant, Julia O'Brien, Nathaniel Tipton (DCR)
Katherine Fuller, Corrine Snowden (Epsilon Associates)
Arthur Mombourquette, The Brigham and Women's Hospital
Girma Belay, Roxbury Tenants of Harvard Association Inc.

9.3 Department of Conservation and Recreation

DCR.1 Riverway Right-turn only

The Proponent recognizes that a dedicated right-turn lane on the northbound approach to Brookline Avenue has been identified by the LMA, MASCO, and the City of Boston as having area wide benefits that will improve traffic flow both to the LMA as well as regionally. This right-turn lane is not proposed as part of the Project and the Project does not trigger the need for the right-turn lane. However, the Project has been designed so that future implementation of the right-turn lane improvement by others will not be precluded.

DCR.2 Level of Service for Riverway/Brookline Avenue

The Draft EIR/PIR provides a detailed analysis of the Riverway/Brookline Avenue intersection in Section 3.4.

DCR.3 Alternatives to Right-turn only

Please see Response to Comment DCR.1.

DCR.4 Traffic signal system

The transportation analysis includes development projects planned for the area. These projects are discussed in Section 3.3.1.1.

DCR.5 Coordination with DCR on traffic issues

The signal timing for the Riverway/Brookline is on BTD's system. If needed, the Proponent will coordinate with BTD and DCR on any potential changes to this signal.

July 27, 2009
Mass. Mental Health Center Redevelopment ENF (14440)
Green House Gas (GHG) Protocol Review for Stationary Sources
DOER Comments
J J Ballam

The intent of these comments is to provide guidance in preparing the DEIR with respect to meeting the requirements of the MEPA GHG Protocol and Policy with regard to emissions from stationary sources. Where appropriate, these comments focus on topics most applicable to the type of project as proposed.

In general terms, The DEIR should include a description for each building including the type, usage, and orientation. It should also include a description of the building envelope element (such as walls, roofs, window, etc.) along with the proposed design performance criteria (such as R or U-value) for each element. In addition the DEIR should include a description of the building electrical and HVAC systems including design loads and levels (e.g. Lighting Power Density, design heating and cooling loads), equipment selected and relevant performance (e.g. the Coefficient of Performance or Energy Efficiency Rating for air conditioners) DOER.1

The policy requires the proponent to use energy modeling software to quantify projected energy consumption and the related GHG emissions from direct and indirect stationary sources. The policy allows the proponent to select a model but, DEP and DOER recommend using EQUEST for stationary source modeling. The EIR should include the modeling printout, including input values, for each of the three scenarios: base case, preferred alternative case, and preferred alternative with greater GHG mitigation case. In addition, the EIR should include emission tables that compare base case emissions in tons with the mitigation alternatives showing the reduction in tons and percentage by emissions source, direct, indirect and transportation. Other tables or graphs that show the tonnage and percentage reduction of major mitigation elements are also very useful in comparing the value added of different measures. The EIR should explain, in reasonable detail, any measure not selected- either because it is not applicable to the project or is considered technically or financially infeasible- that would result in a significant reduction of GHG. DOER.2 DOER.3 DOER.4

As explained in the MEPA Greenhouse Gas Emissions Policy and Protocol, the proponent's base case energy model must comply with Chapter 780 CMR 13.00 7th ed. of the MA State Building Code, 780 CMR 13.00 7th ed. is the 2006 with 2007 supplement of the International Energy Conservation Code (IECC) **or** the ASHRAE Standard 90.1 2006 with 2007 Supplement (with some Mass.-specific supplements). DOER.5

The Appendix of the MEPA Greenhouse Gas Emissions Policy and Control document has a list of suggested mitigation measures to provide guidance in identifying DOER.6

items that should be considered for as the conservation of energy and the control of GHG emissions. Specifically the following measures would apply directly to the control of GHG emissions:

- Minimize energy use through building orientation.
  The subsequent filing needs to note clearly how the buildings will be oriented, why, and the expected impacts on energy usage
- Use high-albedo roofing materials
  The subsequent filing should fully consider these roofing materials, which are highly reflective and reduce cooling requirements for buildings.
- Install high-efficiency HVAC systems
  The subsequent filing needs to provide information regarding the HVAC system, including the heating system. Although there is a potential for additional first costs with highly efficient systems, more efficient units provide definite economic benefits over the life of the system
- Reduce energy demand using peak shaving or load shifting strategies
  Reduce the summer grid peak load will reduce operations of "peaker" generating plants that generate power at lower than average heat rates (higher than average CO2 emission rates). Some examples for achieving this goal are: The incorporation of thermal mass in the building design, ice storage for air conditioning, combined heat and power systems for load shedding capacity.
- Maximize interior day-lighting through floor plates, increased building perimeter and use of skylights, clerestories and light wells
- Incorporate window glazing to balance and optimize daylighting, heat loss and solar heat gain performance
  The subsequent filing should include the U-value of the windows to be used, which should be greater than code for the particular application
- Incorporate super insulation to minimize heat loss
  The project proponent should evaluate using the highest R-value insulation available. In general, providing the best building envelope possible provides the greatest gains in energy savings for building operations and insulation is generally very cost effective.
- Incorporate motion sensors and lighting and climate control
- Use efficient, directed exterior lighting
- Incorporate on-site renewable energy sources into project including solar, wind Geothermal, low-impact hydro, biomass and bio-gas strategies
  At a minimum, buildings should be oriented and roofs should be constructed to support the added weight of a solar photovoltaic (PV) system for potential installation during project construction or at a future date. It should be noted that a rooftop PV system operates even more efficiently, due to added reflectivity, when installed on a high-albedo roof. Considering the support of subsidies through the Commonwealth Solar and RPS programs, a life-cycle cost analysis should be done to evaluate the installation of a PV system during project construction under two scenarios: 1) construction, ownership and operation of a PV system by the building owner; or 2) construction, ownership, and operation of

a PV system by a third party that will then enter into a long-term power purchase agreement with the building owner for the electricity produced by the system. (At this time, due to the current economic conditions, this option may not be readily available. However, future conditions may allow selection of this option during the period when the project is making these decisions). If neither of these scenarios is economically feasible at this time, the project should continue to consider the opportunity for installing PV at a future date and state thDDEIR willingness to host a third-party owned PV array under a favorable power purchase agreement. The following website provides information on the Commonwealth Solar program and tools for performing basic life cycle cost analyses:
http://www.masstech.org/renewableenergy/commonwealth_solar/index.html#
Even if on-site power generation is not feasible, many projects now routinely commit to orienting and designing buildings for energy efficiency, and this project is commended for incorporating energy efficient lighting, Energy Star rated appliances with the lowest energy rating, and high-albedo roofing materials. Additional information and other energy efficient measures, as explained below, also need further consideration. Additional information on building design energy reduction measures and standards is available on many websites, including the following: http://www.eere.energy.gov/,
http://www.nahb.org,www.sbicouncil.org, http://www.aceee.org,
http://www.ashrae.org/, http://www.coolroofs.org/ and http://www.ornl.gov.

- Incorporate combined heat and power (CHP) technologies
  In addition to adding the capability for load shedding (see above), CHP systems reduce the annual fuel consumption (and related CO2 emissions) when compared with what would be required by supplying natural gas and grid supplied power as would be required to operate the central plant with grid power as proposed
- Use water conserving fixtures that exceed building code requirements
  The factors for energy savings related to potable and waste water reductions are: Waste water treatment @ 1.3 kWh per gallon; Potable water supply @ 0.2 kWh per gallon.
- Conduct 3rd party building commissioning to ensure energy performance
  The subsequent filing should fully consider building commissioning, and for it to be conducted by a third party to ensure the commissioning process is thorough and energy performance of the building is maximized. In accordance with the Green Communities Act, building code revisions will be issued that will make building commissioning required for all non-residential buildings greater than 10,000 square feet
- Track energy performance of building and develop strategy to maintain efficiency
- Purchase Energy Star-rated appliances that are the lowest energy rating.

In addition to the measures above, The Department of Energy Resources (DOER) has identified several measures worthy of consideration in the subsequent filing, and adoption into the project, where feasible, as detailed below DOER.7

- Energy Efficient Lighting – The subsequent filing should provide information on the exterior and interior lighting. For interior spaces, enhanced or "Super T8" lighting, T5 or metal halide lighting should be installed, and for exit signs, LED lighting.

- Duct Insulation – Insulation of supply air ducts is the baseline required by code. Since duct leakage can be a major contributor to inefficiency, after all duct joints are sealed with mastic, they should be pressure tested and then insulated.

- Lighting Motion Sensors, Climate Control and Building Energy Management Systems - To ensure that the energy systems function as designed long term, a strategy should be developed for monitoring energy performance of all buildings where the energy systems are centrally controlled, possible through a building management system. A building energy management system can incorporate basic energy saving measures such as lighting and climate control. Climate and lighting control should definitely be included for the building. Lighting control can provide savings for spaces that are occupied infrequently, such as storage areas. A system or strategy for monitoring energy performance would be expected to pay for itself through eliminating potential inefficient building energy operations, such as heating and cooling operating simultaneously in January.

Although it is unnecessary to provide a complete technological and financial analysis of all these, or other GHG reduction mitigation measures, it will benefit the proponent to use functional and quantitative analyses and approved models to assess feasible greenhouse gas reduction measures for the project type, starting with measures that offer the greatest energy reductions, and then considering opportunities to improve ongoing operations. These assessments should either lead to commitments to adopt the or the DEIR should do a credible job in explaining why a particular efficiency or green power generation component is impracticable. The reasons that energy efficient techniques were DOER.8
considered but not selected should be thoughtfully explained to demonstrate that the alternative selected has avoided, minimized, and mitigated CO_2 emissions adequately.

As the project buildings will be leased from DCAM, the proponents must also consider for incorporation the recommendations and energy related measures included in Executive Order, Leading by Example. The EIR should include any measures committed DOER.9
to, as well as justification for any which will not be incorporated. The Leading by Example order can be found at :
http://www.mass.gov/?pageID=gov3terminal&L=3&L0=Home&L1=Legislation+%26+Executive+Orders&L2=Executive+Orders&sid=Agov3&b=terminalcontent&f=Executive+Orders_executive_order_484&csid=Agov3

Also, the proponent should be aware of and utilize US DOE Office of Energy DOER.10
Efficiency EnergySmart Hospital program which targets strategies and measures specific to hospital design and operations. The web site is :
http://www1.eere.energy.gov/buildings/energysmarthospitals/

As soon as is practical, it is recommended that the project proponent contact the New Construction division of the electric and/or gas utility which will be serving the project in order to take advantage of any rebate programs available for the facility design and/ or installation of energy efficient equipment. DOER.11

Gage, Bill (EEA)

From: Ballam, John (ENE)
Sent: Monday, July 27, 2009 12:56 PM
To: Gage, Bill (EEA); Weinberg, Philip (DEP)
Subject: FW: Massachusetts Mental Health Center (MMHC) GHG comment - DOER Comments attached

Importance: High

John Ballam*Energy Engineer*
Massachusetts Department of Energy Resources
100 Cambridge Street, Suite 1020, Boston, MA 02114
Ph: 617.626.1070 Fax: 617.727.0030
http://www.mass.gov/doer/
DOER
Massachusetts Department of Energy Resources
Creating a Greener Energy Future for the Commonwealth

From: Ballam, John (ENE)
Sent: Monday, July 27, 2009 12:52 PM
To: Baker, Nancy (DEP)
Subject: RE: Massachusetts Mental Health Center (MMHC) GHG comment - DOER Comments attached
Importance: High

Hi Nancy,

DOER comments attached,

Thanks

Mass Mental Health DOER GHG Co...

John Ballam*Energy Engineer*
Massachusetts Department of Energy Resources
100 Cambridge Street, Suite 1020, Boston, MA 02114
Ph: 617.626.1070 Fax: 617.727.0030
http://www.mass.gov/doer/
DOER
Massachusetts Department of Energy Resources
Creating a Greener Energy Future for the Commonwealth

From: Baker, Nancy (DEP)
Sent: Thursday, July 23, 2009 8:09 AM
To: Weinberg, Philip (DEP); Ballam, John (ENE)
Subject: Massachusetts Mental Health Center (MMHC) GHG comment
Importance: High

For InterAgency Policy Deliberations
~~~~~~~~~~~~~~~~~~~~~~~~~~~

Hi Phil and John,

Another deadline looms on Tuesday 7/28 for the Massachusetts Mental Health Center (MMHC) project. Below is a basic draft comment on GHG. Please send any additions and changes no later than Monday morning. Thanks for your help.

Regards,
Nancy

Greenhouse Gas Emissions

This project is categorically included for the preparation of an environmental impact report and therefore, the project is subject to the MEPA Greenhouse Gas Emissions Policy and Protocol. Since the ENF did not provide a GHG analysis, MassDEP will review the GHG analysis in the EIR for consistency with the policy, and in particular will be looking for an understanding of the approach and objectives to reducing greenhouse gas emissions for this project which may have more energy efficiency and renewable energy options available in the future as the project is phased in. In any event, sufficient information should be presented to demonstrate that the project alternative selected has avoided, minimized, and mitigated CO_2 emissions in conformance with the MEPA regulatory and policy standards.

The policy requires the proponent to use energy modeling software to quantify projected energy consumption and the related GHG emissions from direct and indirect stationary sources. The policy allows the proponent to select a model but, DEP and DOER recommend using EQUEST for stationary source modeling. The EIR should include the modeling printout for each of the three scenarios: base case, preferred alternative case, and preferred alternative with greater GHG mitigation case. In addition, the EIR should include emission tables that compare base case emissions in tons with the mitigation alternatives showing the reduction in tons and percentage by emissions source, direct, indirect and transportation. Other tables or graphs that show the tonnage and percentage reduction of major mitigation elements are also very useful in comparing the value added of different measures. The EIR should explain, in reasonable detail, any measure not selected- either because it is not applicable to the project or is considered technically or financially infeasible- that would result in a significant reduction of GHG.

The mesoscale analysis described below also is used to estimate the indirect emissions from transportation CO_2 emissions associated with the additional project related vehicle trips. The calculation should compare CO_2 emissions for existing and future year (full) Build and No Build conditions and future year (full) Build with Mitigation conditions. The proponent should follow the procedures for the CO_2 analysis as described in the Policy.

The Department encourages developers to consider design options that will allow them to cost effectively integrate efficiency or renewable energy measures in the future when it is more financially or technically feasible. The proponent should not discount mitigation measures even if it not currently feasible to
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quantify the GHG reduction impact including recycling of construction, office and residential materials as well as water conserving approaches such as low flow plumbing fixtures, gray water reuse, and low impact landscaping and irrigation designs. All these measures will be considered when evaluating whether the project mitigated its GHG emissions to the greatest practicable extent.

Stationary Sources of GHG Emissions

According the U.S. Green Building Council (USGBC), "In the United States alone, buildings account for 72 percent of electricity consumption, 39 percent of energy use, 38 percent of all carbon dioxide (CO_2) emissions, 40 percent of raw materials use, 30 percent of waste output (136 million tons annually), and 14 percent of potable water consumption."

Building industry organizations, corporations, universities, government agencies, such as the Boston Redevelopment Authority, and other nonprofit organizations are advancing the evolution of high performance buildings, and carbon footprints of new and redeveloped facilities are shrinking. The City of Boston's building code Article 37 Green Buildings requires that this project achieve of a level of LEED certification, which incorporates building designs and operational measures to reduce greenhouse gas emissions. Because the EIR needs to show that the preferred alternative would be designed and operated to reduce GHG emissions with building designs, selection of building materials, and water use efficiencies that reduce and/or offset the fossil fuel energy demand of the project, the proponent is encouraged to pursue integrated building designs to attain the highest LEED rating practicable. Additional information on energy efficiency and renewable building systems is available at numerous websites, (e.g., http://www.buildinggreen.com/, http://energystar.gov/, www.architecture2030.org/, and www.wbdg.org. For new construction, core and shell, and commercial interiors relating to LEED certified buildings, information is available on the following website: http://www.usgbc.org/DisplayPage.aspx?CMSPageID=222. In addition, for a Massachusetts perspective, consultation with green building experts can be obtained through the Green Building Roundtable: http://www.greenroundtable.org, located in Boston.

The Department of Energy Resources (DOER) has identified several measures worthy of consideration in the subsequent filing for the new building, and adoption into the project, where feasible, detailed below. In the event that the proponent is not able to adopt one of these measures, the subsequent filing must provide technical and cost information to document the rationale for not making a commitment to a mitigation recommendation.

- Building Orientation- The subsequent filing needs to note clearly how the buildings will be oriented, why, and the expected impacts on energy usage including solar gain, day-lighting and effect on proposed and future solar energy collection systems.

- Duct Insulation- Duct insulation is the baseline required by code. To enhance efficiency, the subsequent filing should note, and construction should reflect, that all ducts will be sealed with mastic, tested and then insulated, since duct leakage can be a major factor in energy losses.

- Roof and Wall Insulation- The proponent should evaluate using the highest R-value insulation possible. In general, providing the best building envelope possible provides the greatest gains in energy savings for building operations and insulation is generally very cost effective.

- High-Albedo Roofing Materials – The subsequent filing should fully consider these roofing materials, which are highly reflective and reduce cooling requirements for buildings. For roofing, USGBC provides LEED credit for low-slope roofs with a minimum SRI of 78 and for steep-slope roofs with a minimum SRI of 29.
  To qualify for an Energy Star label:
  – Low Slope roofs must have an initial solar reflectance of >= 0.65. After 3 years, the solar reflectance

must be >= 0.50.
– Steep Slope roofs must have an initial solar reflectance of >= 0.25. After 3 years, the solar reflectance must be >= 0.15.
In addition, the performance of solar PV systems is improved when mounted on high albedo roofs.

- On-site renewable energy – At a minimum, buildings should be oriented and roofs should be constructed to support the added weight of a solar photovoltaic (PV) system for potential installation during project construction or at a future date. It should be noted that a rooftop PV system operates even more efficiently, due to added reflectivity, when installed on a high-albedo roof. Considering the support of subsidies through the Commonwealth Solar and RPS programs, a life-cycle cost analysis should be done to evaluate the installation of a PV system during project construction under two scenarios: 1) construction, ownership and operation of a PV system by the building owner; or 2) construction, ownership, and operation of a PV system by a third party that will then enter into a long-term power purchase agreement with the building owner for the electricity produced by the system. If neither of these scenarios is economically feasible at this time, the project should continue to consider the opportunity for installing PV at a future date and state their willingness to host a third-party owned PV array under a favorable power purchase agreement. The following website provides information on the Commonwealth Solar program and tools for performing basic life cycle cost analyses: http://www.masstech.org/renewableenergy/commonwealth_solar/index.html#.

Although the main sources of GHG associated with this proposed project include building heating and cooling, lighting, and vehicle travel to and from the proposed development, the energy required to provide potable water and treat wastewater also will be a source of GHG. The ENF estimates that the proposed development will consume 109,100 gallons of potable water per day, or 39,821,500 gallons per year and generate approximately 99,180 gallons of wastewater per day or approximately 36,200,700 gallons per year. It is not clear if that generation rate incorporates the water conservation measures the proponent commits implement to be LEED certified. Based on utility data and project specific reviews of water and wastewater treatment plants, the Department estimates an energy consumption rate of 1.1 kWh/kg for water and 1.7 kWh/kg for wastewater, yielding 43,803 kWh and 61,541 kWh of power consumed, respectively, for these services. Applying the Electric CO_2 Emission Factors from ISO-NE Marginal Rate Analysis for 2006 (993 lb/MWh) to water consumption generates approximately 47,468 lbs of CO_2 and 61,110 lbs of CO_2 for wastewater management. Using this framework, the proponent should consider quantifying the GHG reductions associated with the water conservation measures in plans to incorporate into the project design. Mitigation measures for water and wastewater beyond the infiltration and inflow (I/I) removal from sewer mains for wastewater permitting also may be considered, in addition to water use reductions that are rated in LEED for compliance with Boston's Article 37 Green Building program.

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MassDEP- Northeast Region
205B Lowell Street
Wilmington, MA 01887

Nancy Baker
Phone: 978/694-3338
Fax: 978/694-3499
Email: nancy.baker@state.ma.us
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9.4 Department of Energy and Resources

DOER.1 Description for Each Building

Please see Section 4.12 for a discussion of each building.

DOER.2 Energy Modeling Software

As identified in Section 4.12, the Proponents' MEP engineers have modeled the Residential Building using EQUEST and the remaining three buildings using Trane Trace 700.

DOER.3 Modeling Scenarios and Emission Tables

Please see Section 4.12 for the modeling scenarios and emissions tables.

DOER.4 Measures not Selected

Please see Section 4.12 for a discussion of measures not selected.

DOER.5 Compliance with Chapter 780 CMR 13.00 7th ed. Of the MA State Building Code or ASHRAE Standard 90.1 2006 with 2007 Supplement

Please see Section 4.12.

DOER.6 Suggested Mitigation Measures List

The Proponent has evaluated feasible measures to reduce greenhouse gases including many of those identified by DOER. Please see Section 4.12 for a discussion of specific mitigation measures evaluated in the greenhouse gas analysis.

DOER.7 Additional Measures

Please see Section 4.12 for a discussion of additional measures.

DOER.8 Measures not Selected

Please see Section 4.12 for a discussion of measures not selected and the reasoning behind the decision.

DOER.9 Executive Order: Leading by Example

Please see response to comment MEPA.53.

DOER.10 DOE Office of Energy Efficiency Energy Smart Hospital Program

Please see response to comment MEPA.53.

DOER.11 New Construction Division of Electric and/or Gas Utility

The Proponent is working with NSTAR and National Grid's New Construction divisions to discuss any rebate programs available. The Binney Street Building is part of the advanced building's program and the Partial Hospital/Fenwood Inn is being reviewed for each system available.

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENERGY & ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL PROTECTION
NORTHEAST REGIONAL OFFICE
205B Lowell Street, Wilmington, MA 01887 • (978) 694-3200

DEVAL L. PATRICK
Governor

TIMOTHY P. MURRAY
Lieutenant Governor

IAN A. BOWLES
Secretary

LAURIE BURT
Commissioner

July 28, 2009

Ian A. Bowles
Executive Office of
Energy & Environmental Affairs
100 Cambridge Street,
Boston MA, 02108

Attn: MEPA Unit

RE: Boston
Massachusetts Mental Health Center
Redevelopment
Fenwood Road, Vining Street,
Binney Street
EEA # 14440

Dear Secretary Bowles:

The Department of Environmental Protection in collaboration with the Division of Energy Resources in the Executive Office of Energy and Environmental Affairs (EEA/DOER) have reviewed the Environmental Notification Form (ENF) submitted by Brigham and Women's Hospital, Inc/Partners HealthCare/Roxbury Tenants of Harvard to demolish the existing 190,000 square feet of space that was formerly occupied by the Massachusetts Mental Health Center (MMHC) in order to construct four buildings totaling 633,960 square feet on a 2.39 acre site in Boston (EEA #14440). The project will be phased; in Phase 1, demolition of five buildings and construction of two buildings to serve the Massachusetts Department of Mental Health clientele is proposed, and in later phases, construction of a residential building with 136 units and a medical facilities building for research and development, and clinical and office use is planned. This project is categorically included for the preparation of an environmental impact report and the Department provides the following comments.

Wastewater

The ENF states that there is sufficient capacity in the existing collection system to accommodate the estimated 99,180 gpd of wastewater flow from the MMCH redevelopment project. Wastewater generated by the project will discharge into the Boston Water and Sewer Commission (BWSC) sewer system, which flows into the MWRA system and ultimately to the Deer Island Wastewater Treatment Facility, where MassDEP, in cooperation with MWRA and its member communities (including Boston), are implementing a flow control program in the MWRA regional wastewater system, to remove extraneous clean water, (i.e., infiltration/ inflow (I/I)) from the system.) Routinely, MassDEP is requiring proponents that are adding significant new wastewater flow, (including the MMCH redevelopment project), to assist in the I/I reduction effort, to ensure that the additional wastewater flows are offset by the removal of I/I.

A minimum 4:1 ratio for I/I removal to new wastewater flow added is typically used. However, this ratio may be increased if specific flow constrictions/overflows already exist in the sewershed to which the new flow is added. The proponent is encouraged to contact and consult with the BWSC, and MassDEP in order to present in the EIR as complete understanding of the I/I removal work as possible to demonstrate that wastewater impacts would be mitigated as the project is phased in. Assuming that a 4:1 ratio is utilized, the proponent will need to remove, or cause to be removed, 396,720 gpd of I/I. The requirements for I/I mitigation are specifically DEP.1 noted in DEP Policy No. BRP 09-01, which can be found on the MassDEP website at: http://www.mass.gov/dep/water/laws/mwraii09.pdf.

Air Quality, Mesoscale Analysis

The proposed project comprised of four new or redeveloped buildings totaling approximately 600,000 sf of mixed use space is estimated to generate 6,036 new vehicle trips. The projected new daily vehicle trips triggers MassDEP's review threshold of 6,000 daily trips for mixed-use projects that requires the project proponent to conduct an air quality mesoscale analysis. The EIR should contain a mesoscale analysis comparing the indirect emissions from DEP.2 transportation sources under No Build, Build, and Build with Mitigation conditions. The EIR should include a demonstration that the proposed project's mobile source emission impacts will not exceed or contribute to an exceedance of National/State Ambient Air Quality Standards. The mesoscale analysis should also determine to what extent the proposed project will increase the amount of volatile organic compounds (VOCs) and nitrogen oxides (NOx) emissions in the project study area as compared to the No Build condition. In addition, the analysis will help identify the efficacy of traffic mitigation measures and as well as the proposed Transportation Demand Management (TDM) program as necessary to reduce project generated emissions and project related trips.

Greenhouse Gas Emissions

This project is categorically included for the preparation of an environmental impact report and therefore, the project is subject to the MEPA Greenhouse Gas Emissions Policy and DEP.3 Protocol. Since the ENF did not provide a GHG analysis, MassDEP will review the GHG analysis in the EIR for consistency with the Policy, and in particular will be looking for an understanding of the approach and objectives to reducing greenhouse gas emissions for this project which may have more energy efficiency and renewable energy options available in the future as the project is phased in. In any event, sufficient information should be presented to demonstrate that the project alternative selected has avoided, minimized, and mitigated CO_2 emissions in conformance with the MEPA regulatory and policy standards.

The mesoscale analysis described above also is used to estimate the indirect emissions from transportation CO_2 emissions associated with the additional project related vehicle trips. The calculation should compare CO_2 emissions for existing and future year (full) Build and No Build conditions and future year (full) Build with Mitigation conditions. The proponent should follow the procedures for the CO_2 analysis as described in the Policy. DEP.4

The Department encourages developers to consider design options that will allow them to cost effectively integrate efficiency or renewable energy measures in the future when it is DEP.5 more financially or technically feasible. The proponent should not discount mitigation measures DEP.6 even if it not currently feasible to quantify the GHG reduction impact including recycling of construction, office and residential materials as well as water conserving approaches such as low flow plumbing fixtures, gray water reuse, and low impact landscaping and irrigation designs. All these measures will be considered when evaluating whether the project mitigated its GHG emissions to the greatest practicable extent.

Stationary Sources of GHG Emissions

According the U.S. Green Building Council (USGBC), "In the United States alone, buildings account for 72 percent of electricity consumption, 39 percent of energy use, 38 percent of all carbon dioxide (CO_2) emissions, 40 percent of raw materials use, 30 percent of waste output (136 million tons annually), and 14 percent of potable water consumption."

Building industry organizations, corporations, universities, government agencies, such as the Boston Redevelopment Authority, and other nonprofit organizations are advancing the evolution of high performance buildings, and carbon footprints of new and redeveloped facilities are shrinking. The City of Boston's building code Article 37 Green Buildings requires that this project achieve of a level of LEED certification, which incorporates building designs and operational measures to reduce greenhouse gas emissions. Because the EIR needs to show that the preferred alternative would be designed and operated to reduce GHG emissions with building designs, selection of building materials, and water use efficiencies that reduce and/or offset the fossil fuel energy demand of the project, the proponent is encouraged to pursue integrated building designs to attain the highest LEED rating practicable. Additional information on energy DEP.7 efficiency and renewable building systems is available at numerous websites, (e.g., http://www.buildinggreen.com/, http://energystar.gov/, www.architecture2030.org/, and www.wbdg.org. For new construction, core and shell, and commercial interiors relating to LEED certified buildings, information is available on the following website: http://www.usgbc.org/DisplayPage.aspx?CMSPageID=222. In addition, for a Massachusetts perspective, consultation with green building experts can be obtained through the Green Building Roundtable: http://www.greenroundtable.org, located in Boston.

The following comments offer guidance in preparing the DEIR to meet the requirements of the Policy with regard to emissions from stationary sources. Where appropriate, these comments focus on topics most applicable to the type of project proposed.

The DEIR should include a description for each building including the type, usage, and DEP.8 orientation. It also should include a description of the building envelope element, (such as walls, roofs, and windows), along with the proposed design performance criteria, (such as R or U-value), for each element. A description should be provided for the building electrical and HVAC systems, including design loads and levels, (e.g., lighting power density, and design heating and cooling loads), equipment selected, and relevant performance, (e.g., the coefficient of performance or energy efficiency rating for air conditioners).

The Policy requires the proponent to use energy modeling software to quantify projected DEP.9 energy consumption and the related GHG emissions from direct and indirect stationary sources. Although the proponent has discretion in the selection of a model for the analysis, MassDEP and DOER recommend using EQUEST for stationary source modeling. The EIR should include the DEP.10 modeling printout, including input values, for each of the three scenarios: base case, preferred alternative case, and preferred alternative with greater GHG mitigation case. In addition, the EIR should include emission tables that compare base case emissions, in tons, with the mitigation alternatives showing the reduction in tons and percentage by emissions source, (i.e., direct and indirect). Other tables or graphs that show the tonnage and percentage reduction of major mitigation elements also are very useful in comparing the value added of different measures. The EIR should explain, in reasonable detail, any measure that would result in a significant reduction of GHG, which is not selected – either because it is not applicable to the project or is considered technically or financially infeasible. DEP.11

As explained in the Policy, the proponent's base case energy model must comply with Chapter 780 CMR 13.00 7th edition of the MA State Building Code. This edition is the 2006 with 2007 supplement to the International Energy Conservation Code (IECC) or the ASHRAE Standard 90.1 2006, with the 2007 Supplement (including Massachusetts specific supplements). DEP.12

The Appendix to the Policy has a list of suggested mitigation measures to provide guidance in identifying measures to be considered in the EIR for conservation of energy and the control of GHG emissions. Specifically, the following measures would apply to the control of GHG emissions. DEP.13

- Minimize energy use through building orientation- Explain clearly how the buildings will be oriented, the reasons for the proposed positioning, and the impacts on energy usage.
- Use high-albedo roofing materials – Give full consideration to[1] high-albedo roofing materials, which are highly reflective and reduce cooling requirements for buildings.
- Install high-efficiency HVAC systems - Provide information about the HVAC system, including the heating system. Although there is a potential for additional first-costs with highly efficient systems, over the life of the system, more efficient units provide definite economic benefits.
- Reduce energy demand using peak shaving or load shifting strategies - Reduce the summer grid peak load will reduce operations of "peaker" generating plants that generate power at lower than average heat rates, (higher than average CO_2 emission rates). Some examples for achieving this goal are the incorporation of thermal mass in the building design, ice storage for air conditioning, and combined heat and power systems for load shedding capacity.
- Maximize interior day-lighting through floor plates, increased building perimeter and use of skylights, clerestories and light wells
- Incorporate window glazing to balance and optimize daylighting, heat loss and solar heat gain performance. The U-value of the windows to be used should be greater than Code for the particular applications.
- Incorporate super insulation to minimize heat loss. The project proponent should evaluate using the highest R-value insulation available. In general, providing the best building envelope possible yields the largest gains in energy savings for building operations, and insulation is generally very cost-effective.
- Incorporate motion sensors for lighting and climate control.
- Use efficient, directed exterior lighting.

[1] At this time, due to the current economic conditions, this option may not be readily available. However, future conditions may allow selection of this option during the period when the project is making these decisions.

- Incorporate on-site renewable energy sources into project including solar, wind, geothermal, low-impact hydro, biomass, and bio-gas strategies. At a minimum, buildings should be oriented and roofs should be constructed to support the added weight of a solar photovoltaic (PV) system for potential installation during project construction or at a future date. It is noted that a rooftop PV system operates even more efficiently, due to added reflectivity, when installed on a high-albedo roof. Considering the support of subsidies through the Commonwealth Solar and RPS programs, a life-cycle cost analysis should be done to evaluate the installation of a PV system during project construction under two scenarios: 1) construction, ownership, and operation of a PV system by the building owner; or 2) construction, ownership, and operation of a PV system by a third party that will then enter into a long-term power purchase agreement with the building owner for the electricity produced by the system. If neither of these scenarios is economically feasible at this time, the project should continue to consider the opportunity for installing PV at a future date and discuss the proponent's willingness to host a third-party owned PV array under a favorable power purchase agreement. Information on the Commonwealth Solar program and tools for basic life cycle cost analyses is available at: http://www.masstech.org/renewableenergy/commonwealth_solar/index.html#. Even if on-site power generation is not feasible, many projects now routinely commit to orienting and designing buildings for energy efficiency. Additional information on building design energy reduction measures and standards is available on many websites, including the following: http://www.eere.energy.gov/, http://www.nahb.org,www.sbicouncil.org, http://www.aceee.org, http://www.ashrae.org/, http://www.coolroofs.org/ and http://www.ornl.gov.
- Incorporate combined heat and power (CHP) technologies - In addition to adding the capability for load shedding (see above), CHP systems reduce the annual fuel consumption, and related CO_2 emissions, when compared with what would be required by supplying natural gas and grid supplied power as would be required to operate the central plant with grid power as proposed.
- Use water conserving fixtures that exceed Code requirements.
- Conduct third party building commissioning to ensure energy performance. The subsequent filing should fully consider building commissioning, and for it to be conducted by a third party to ensure the commissioning process is thorough and energy performance of the building is maximized. In accordance with the Green Communities Act, building code revisions will be issued that will make building commissioning required for all non-residential buildings greater than 10,000 square feet
- Track energy performance of building and develop strategy to maintain efficiency.
- Select EnergyStar-rated appliances that are the lowest energy rating.

In addition to the measures above, The Department of Energy Resources (DOER) has identified several measures worthy of consideration in the EIR and adoption into the project, where feasible, as detailed below. DEP.14

- Energy Efficient Lighting - Provide information on the exterior and interior lighting. For interior spaces, enhanced or "Super T8" lighting, T5 or metal halide lighting should be installed, and for exit signs, LED lighting.

- Duct Insulation - Insulation of supply air ducts is the baseline required by code. Since duct leakage can be a major contributor to inefficiency, after all duct joints are sealed with mastic, they should be pressure tested and then insulated.
- Building Energy Management System - To ensure that the energy systems function as designed long term, a strategy should be developed for monitoring energy performance of all buildings where the energy systems are centrally controlled, possible through a building management system. A building energy management system can incorporate basic energy saving measures such as lighting and climate control. Lighting control can provide savings for spaces that are occupied infrequently, such as storage areas. A system or strategy for monitoring energy performance would be expected to pay for itself through eliminating potential inefficient building energy operations, such as heating and cooling operating simultaneously in January.

Although it is unnecessary to provide a complete technological and financial analysis of all of the measures identified or other GHG reduction mitigation measures that the proponent may propose, it will be beneficial to use functional and quantitative analyses and approved models to assess feasible greenhouse gas reduction measures for the project type, starting with measures that offer the greatest energy reductions, and then considering opportunities to improve ongoing operations. These assessments should either lead to commitments to adopt the measures or the DEIR should do a credible job in explaining why a particular efficiency or green power generation component is impracticable. The reasons that energy efficient techniques were considered but not selected should be thoughtfully explained to demonstrate that the alternative DEP.15 selected has avoided, minimized, and mitigated CO_2 emissions adequately.

Since the project buildings will be leased from DCAM, the proponents also must consider the recommendations and energy related measures included in Executive Order, Leading by DEP.16 Example. The EIR should identify measures committed to, and justify any measures which will not be adopted. The Leading by Example Order is accessible at the following website : http://www.mass.gov/?pageID=gov3terminal&L=3&L0=Home&L1=Legislation+%26+Executive+Orders&L2=Executive+Orders&sid=Agov3&b=terminalcontent&f=Executive+Orders_executive_order_484&csid=Agov3. In addition, the proponent should consider the guidance provided in the USDOE Office of Energy Efficiency EnergySmart Hospital program, which targets DEP.17 strategies and measures specific to hospital design and operations. Information is available on the USDOE website: http://www1.eere.energy.gov/buildings/energysmarthospitals/.

As soon as is practical, it is recommended that the project proponent contact the New Construction division of the electric and/or gas utility which will be serving the project in order DEP.18 to take advantage of any rebate programs available for the facility design and/ or installation of energy efficient equipment.

Mobile Sources of GHG Emissions

Recommended Transportation Demand Management (TDM) Measures

The ENF indicates that a TDM program will be designed for the different project elements. The EIR should describe the specific TDM measures being proposed and commit to an appropriate set of TDM Measures that will further reduce vehicle trips within the project DEP.19 study area. MassDEP recommends the following measures.

- On-Site Vehicle Trip Reduction Coordinator - MassDEP recommends that the proponent designate an on-site vehicle trip reduction coordinator to implement, promote and follow up on the use of the mitigation trip reduction measures.
- Commuter Tax Benefit Program - MassDEP recommends that the proponent explore implementing a transportation tax benefit program to encourage employees to take transit or vanpools to work, given that transit and bus services are available within a mile of the project site. This program provides the added benefit of decreasing taxes for employers and employees.
- Rideshare-Matching Program - MassDEP recommends that the proponent establish a rideshare-matching program to match employees in carpools and/or vanpools. MassRides, the Executive Office of Transportation's statewide travel options program providing free assistance to commuters, employers, and students, can help to establish such a program (http://www.commute.com/). The project proponent could also enlist the services of a third-party provider to carry out this program.
- Join the CommuteWork/MASCO Transportation Management Association (TMA)- TMAs are organizations that help several employers in a local area develop and implement incentives that reduce traffic and trips to the worksite. Employers pay a fee for this service to a centralized coordinator to market and implement these incentives on their behalf. Additional information on the CommuteWorks TMA can be found at MassCommute website (http://www.masscommute.com/).
- Guaranteed Ride Home Program - MassDEP recommends that the proponent establish an emergency ride home program for all project employees who travel by carpools/vanpools.
- Additional Bicycle Incentives - MassDEP recommends that the proponent install adequate locker and shower facilities for employees in addition to provisions for secure bicycle storage.
- Parking Management - MassDEP recommends that the proponent develop a parking management program to minimize parking requirements such as parking cash-out, parking charges, establishing limited parking availability to employees, providing preferential carpool and vanpool parking.

Required Measures

In addition to the recommendations listed above, the proponent must also meet the following required measures. DEP.20

Compliance with the Massachusetts Idling Regulation

MassDEP recommends the project commit to comply with the Massachusetts Idling regulation (310 CMR 7.11). The regulation prohibits motor vehicles from idling their engines more than five minutes unless the idling is necessary to service the vehicle or to operate engine-assisted power equipment (such as refrigeration units) or other associated power. The proponent should post idling restriction signs in all loading and drop-off areas within the site to remind all drivers, patrons, and delivery personnel of the state's idling regulation. Questions regarding this regulation should be directed to Julie Ross of MassDEP at 617-292-5958.

Compliance with the Massachusetts Rideshare Regulation

MassDEP recommends the project commit to comply with the Rideshare Regulation (310 CMR 7.16) if applicable. The regulation applies to employers with 250 or more daily employees. Employers subject to the Rideshare Program must implement a series of incentives that are designed to reduce the number of trips made by employees who drive alone to work. To date, employers with 1,000 or more employees and employers with 250 or more employees that are also subject to the Air Operating Permit Program (as detailed in MassDEP regulation, 310 CMR 7.00, Appendix C) must comply with the Rideshare regulation. Questions regarding this regulation should be directed to MassDEP's Rideshare Helpline at 617-292-5663 for assistance in complying with this air quality program.

Water/Wastewater and GHG Emissions

Although the main sources of GHG associated with this proposed project include building heating and cooling, lighting, and vehicle travel to and from the proposed development, the energy required to provide potable water and treat wastewater also will be a source of GHG. The ENF estimates that the proposed development will consume 109,100 gallons of potable water per day, or 39,821,500 gallons per year and generate approximately 99,180 gallons of wastewater per day or approximately 36,200,700 gallons per year. It is not clear if that generation rate incorporates the water conservation measures the proponent commits implement to be LEED certified. Based on utility data and project specific reviews of water and wastewater treatment plants, the Department estimates an energy consumption rate of 1.1 kWh/kg for water and 1.7 kWh/kg for wastewater, yielding 43,803 kWh and 61,541 kWh of power consumed, respectively, for these services. Applying the Electric CO_2 Emission Factors from ISO-NE Marginal Rate Analysis for 2006 (993 lb/MWh) to water consumption generates approximately 47,468 lbs of CO_2 and 61,110 lbs of CO_2 for wastewater management. Using this framework, the proponent should consider quantifying the DEP.21 GHG reductions associated with the water conservation measures in plans to incorporate into the project design. Mitigation measures for water and wastewater beyond the infiltration and inflow (I/I) removal from sewer mains for wastewater permitting also may be considered, in addition to water use reductions that are rated in LEED for compliance with Boston's Article 37 Green Building program.

Construction Period Air Quality Mitigation Measures

MassDEP recommends that the project proponent participate in the MassDEP Diesel Retrofit Program. Diesel emissions contain fine particulate matter 2.5 microns or less in diameter DEP.22 ($PM_{2.5}$), which has been found to exacerbate a number of heath conditions, including asthma and other respiratory ailments. $PM_{2.5}$ has also been identified as a likely carcinogen by the US EPA.

MassDEP recommends that the project proponent work with its staff to implement DEP.23 construction-period diesel emission mitigation, which could include the installation of after-engine emission controls, such as diesel oxidation catalysts (DOCs) or diesel particulate filters (DPFs). For more information on these technologies, see: http://www.epa.gov/otaq/retrofit/verif-list.htm and MassDEP's guidance document, *Diesel Engine Retrofits in the Construction Industry – A How to Guide*. This document is available on MassDEP's website at http://www.mass.gov/dep/air/diesel/conretro.pdf. Additional questions or help can be directed to Gary Rennie of MassDEP at 617-292-5869.

In addition, MassDEP recommends that the project proponent use ultra low sulfur diesel (ULSD) fuel in the off-road engines. ULSD fuel has a sulfur content of approximately 15 parts per million (ppm) in contrast to the 500 ppm sulfur level of current off-road low sulfur diesel (LSD) fuel. The use of ULSD fuel, in conjunction with after-engine emission controls, can significantly reduce $PM_{2.5}$ emissions. DEP.24

Air Quality

The project proponent is advised that pre-installation approval from the MassDEP Division of Air Quality Control is needed if the project will include the installation of any Fuel Utilization DEP.25 Facility that emits air contaminants (e.g., furnaces, fuel burning equipment, boiler(s)) sized above the de minimus threshold levels in 310 CMR 7.02. In addition, if the building is to be equipped with emergency generators, additional review by the Department may be required depending on the DEP.26 size of the generator units. An emergency generator with an energy input capacity of less than 3 million BTU per hour is exempt from the requirements of 310 CMR 7.02. An emergency generator with an energy input capacity of more than 10 million BTU per hour requires pre-installation approval from the Department. A generator with a capacity between 3 million and 10 million BTU per hour must either follow the work practices in 310 CMR 7.03 or receive pre-installation approval under 310 CMR 7.02.

Recycling Issues

The project includes demolition and reconstruction, which will generate a significant amount of construction and demolition (C&D) waste. Although the ENF has not made specific DEP.27 commitments to recycling construction debris, MassDEP encourages the project proponent to incorporate C&D recycling activities as a sustainable measure for the project. In addition, the proponent is advised that demolition activities must comply with both Solid Waste and Air DEP.28 Pollution Control regulations, pursuant to M.G.L. Chapter 40, Section 54, which provides:

> "Every city or town shall require, as a condition of issuing a building permit or license for the demolition, renovation, rehabilitation or other alteration of a building or structure, that the debris resulting from such demolition, renovation, rehabilitation or alteration be disposed of in a properly licensed solid waste disposal facility, as defined by Section one hundred and fifty A of Chapter one hundred and eleven. Any such permit or license shall indicate the location of the facility at which the debris is to be disposed. If for any reason, the debris will not be disposed as indicated, the permittee or licensee shall notify the issuing authority as to the location where the debris will be disposed. The issuing authority shall amend the permit or license to so indicate."

For the purposes of implementing the requirements of M.G.L. Chapter 40, Section 54, MassDEP considers an asphalt, brick, and concrete (ABC) rubble processing or recycling facility, (pursuant to the provisions of Section (3) under 310 CMR 16.05, the Site Assignment regulations for solid waste management facilities), to be conditionally exempt from the site assignment requirements, if the ABC rubble at such facilities is separated from other solid waste materials at the point of generation. In accordance with 310 CMR 16.05(3), ABC can be crushed on-site with a 30-day notification to MassDEP. However, the asphalt is limited to weathered bituminous concrete, (no roofing asphalt), and the brick and concrete must be uncoated or not impregnated with materials such as roofing epoxy. If the brick and concrete are not clean, the material is defined as construction and demolition (C&D) waste and requires either a Beneficial Use Determination (BUD) or a Site Assignment and permit before it can be crushed.

Pursuant to the requirements of 310 CMR 7.02 of the Air Pollution Control regulations, if the ABC crushing activities are projected to result in the emission of one ton or more of particulate matter to the ambient air per year, and/or if the crushing equipment employs a diesel oil fired engine with an energy input capacity of three million or more British thermal units per hour for either mechanical or electrical power which will remain on-site for twelve or more months, then a plan application must be submitted to MassDEP for written approval prior to installation and operation of the crushing equipment. DEP.29

In addition, if significant portions of the demolition project contain asbestos, the project proponent is advised that asbestos and asbestos-containing waste material are a special waste as defined in the Solid Waste Management regulations, (310 CMR 19.061). Asbestos removal notification on permit form ANF 001 and building demolition notification on permit form AQ06 must be submitted to MassDEP at least 10 working days prior to initiating work. Except for vinyl asbestos tile (VAT) and asphaltic-asbestos felt and shingles, the disposal of asbestos containing materials within the Commonwealth must be at a facility specifically approved by MassDEP, (310 CMR 19.061). No asbestos containing material including VAT, and/or asphaltic-asbestos felts or shingles may be disposed at a facility operating as a recycling facility, (310 CMR 16.05). The disposal of the asbestos containing materials outside the jurisdictional boundaries of the Commonwealth must comply with all the applicable laws and regulations of the state receiving the material. DEP.30 DEP.31

The demolition activity also must conform to current Massachusetts Air Pollution Control regulations governing nuisance conditions at 310 CMR 7.01, 7.09 and 7.10. As such, the proponent should propose measures to alleviate dust, noise, and odor nuisance conditions, which may occur during the demolition. Again, MassDEP must be notified in writing, at least 10 days in advance of removing any asbestos, and at least 10 days prior to any demolition work. The removal of asbestos from the buildings must adhere to the special safeguards defined in the Air Pollution Control regulations, (310 CMR 7.15 (2)). DEP.32

Facilitating future waste reduction and recycling and integrating recycled materials into the project are necessary to minimize or mitigate the long-term solid waste impacts of this type of development. The Commonwealth's waste diversion strategy is part of an integrated solid waste management plan, contained in The Solid Waste Master Plan that places a priority on source reduction and recycling. Efforts to reduce waste generation and promote recycling have yielded significant environmental and economic benefits to Massachusetts' residents, businesses and municipal governments over the last ten years. Waste diversion will become even more important in the future as the key means to conserve the state's declining supply of disposal capacity and stabilize waste disposal costs.

As the lead state agencies responsible for helping the Commonwealth achieve its waste diversion goals, MassDEP and EEA have strongly supported voluntary initiatives by the private sector to institutionalize source reduction and recycling into their operations. Adapting the design, infrastructure, and contractual requirements necessary to incorporate reduction, recycling and recycled products into existing large-scale developments has presented significant challenges to recycling proponents. Integrating those components into developments such as the Massachusetts Mental Health Center Redevelopment project at the planning and design stage enable the project's management and occupants to establish and maintain effective waste diversion programs. For example, facilities with minimal obstructions to trash receptacles and easy access to main recycling areas and trash chutes allow for implementation of recycling programs and have been proven to reduce cleaning costs by 20 percent to 50 percent. Other designs that provide sufficient space and electrical services will support consolidating and compacting recyclable material and truck access for recycling material collection.

By incorporating recycling and source reduction into the design, the proponent has the DEP.33
opportunity to join a national movement toward sustainable design. Sustainable design was endorsed in 1993 by the American Institute of Architects with the signing of its *Declaration of Interdependence for a Sustainable Future.* The project proponent should be aware there are several organizations that provide additional information and technical assistance, including WasteCap, the Chelsea Center for Recycling and Economic Development, and MassRecycle.

The MassDEP and DOER appreciate the opportunity to comment on this proposed project. Please contact Philip.Weinberg@state.ma.us at (617) 292-5972 for additional information on greenhouse gas emissions analysis, and John.Zajac@state.ma.us, at (978) 694-3240 for further information on the sewer issues. If you have any general questions regarding these comments, please contact Nancy.Baker@state.ma.us, MEPA Review Coordinator at (978) 694-3338.

Sincerely,

John D. Viola
Deputy Regional Director

cc: Brona Simon, Massachusetts Historical Commission
Phil Weinberg, Jerome Grafe, MassDEP-Boston
John Ballam, EEA, DOER
Kevin Brander, Jack Zajac, MassDEP-NERO, BRP
Marianne Connolly, MWRA
Joseph P. Sullivan P.E., Boston Water and Sewer Commission

9.5 Department of Environmental Protection

9.5.1 Department of Environmental Protection – Nancy Baker

Included in the comment documents received was an interoffice e-mail from Ms. Baker (MassDEP) to Messrs. Weinberg (MassDEP) and Ballam (DOER) dated July 23, 2009. All of the comments therein were included in a July 28, 2009, letter from MassDEP to the Secretary, which are responded to below.

9.5.2 Department of Environmental Protection – Northeast Regional Office

DEP.1 I/I Removal

The Proponent has initiated coordination with the Boston Water and Sewer Commission regarding the removal of Infiltration/Inflow. A formal understanding will be reached in connection with BWSC site plan approval.

DEP.2 Mesoscale Analysis

Please see Section 4.5.4.1 for results of the mesoscale analysis.

DEP.3 GHG Analysis

Please see Section 4.12 for the GHG emissions analysis.

DEP.4 CO_2 Analysis

Please see Section 4.12 for the CO_2 analysis provided in accordance with the MEPA Greenhouse Gas Emissions Policy.

DEP.5 Integration of Efficiency or Renewable Energy Measures

Please see Section 4.12 for a discussion of efficiency and renewable energy measures and their feasibility now and in the future.

DEP.6 Mitigation Measures

Please see Section 4.12 for a discussion of mitigation measures analyzed related to GHG emissions.

DEP.7 LEED Rating

The Proponent's commitment to sustainability is reflected in plans for LEED levels. The Partial Hospital/Fenwood Inn will be LEED Certified. The Proponent aims to exceed requirements of Article 37 of the Boston Zoning Code for the Binney Street Building and Brigham and Women's Building and proposes these buildings to be

LEED Silver Certified. The Residential Building is proposed to be LEED Certifiable with the possibility for LEED Silver Certifiable. Please refer to Section 4.11 and Appendix F for further details.

DEP.8 Description for Each Building

Please see Section 4.12 for more information on each building.

DEP.9 Energy Modeling Software

Please see response to comment DOER.4.

DEP.10 Modeling Scenarios

Please see response to comment DOER.5

DEP.11 Measures not Selected

Please see response to comment DOER.7

DEP.12 Compliance with Chapter 780 CMR 13.00 7th ed. Of the MA State Building Code or ASHRAE Standard 90.1 2006 with 2007 Supplement

Please see Section 4.12.

DEP.13 Suggested Mitigation Measures List

Please see response to comment DOER.9.

DEP.14 Additional Measures

Please see response to comment DOER.10.

DEP.15 Measures not Selected

Please see response to comment DOER.11.

DEP.16 Recommendations and Measures included in Executive Order, Leading by Example

Please see response to comment MEPA.53.

DEP.17 DOE Office of Energy Efficiency Energy Smart Hospital Program

Please see response to comment MEPA.53.

DEP.18 Contact the New Construction Division of Electric and/or Gas Utility

Please see Response to Comment DOER.11.

DEP.19 Recommended TDM Measures

Please see Section 4.12.6

DEP.20 Required TDM Measures

The Project will comply with the Massachusetts Idling regulation and the Massachusetts Rideshare regulations, as applicable.

DEP.21 Quantification of GHG Reductions Associated with Project Water Conservation Measures

Some energy equivalency for water conservation and wastewater reduction has been included in the analysis in Section 4.12. However, we note a discrepancy between the energy factors estimated by DEP and factors provided by DOER. Furthermore, the DOER-provided factors appear to vary from similar factors provided by DOER in comments on other projects. DOER factors from previous projects have been utilized herein.

DEP.22 MassDEP Diesel Retrofit Program

The Proponent will participate in the MassDEP Diesel Retrofit Program.

DEP.23 Construction-period Diesel Emission Mitigation

Construction activity will comply with DEP's recommended processes.

DEP.24 ULSD Fuel in Off-Road Engines

Retrofitted equipment and ultra low-sulfur diesel (ULSD) fuel (15 ppm) will be used in off-road construction equipment.

DEP.25 Pre-Installation Approval from MassDEP Division of Air Quality Control

The Proponent will seek pre-installation approval from MassDEP Division of Air Quality Control if the Project includes any Fuel Utilization Facility if such pre-approval is required. Most of the anticipated fuel burning equipment will be either below permit requirement thresholds or will be subject to the Environmental Results Program and will not require pre-approval.

DEP.26 DEP Review of Emergency Generators

The Proponent will contact MassDEP if review of emergency generators is required.

DEP.27 Construction and Demolition Recycling Activities

The Proponent will take an active role with regard to the reprocessing and recycling of construction and building demolition waste. Demolition debris will be removed from the construction site or re-used on the site, as appropriate. Please see Section 4.10 for more information.

DEP.28 Compliance with Solid Waste and Air Pollution Control Regulations

The Proponent will comply with Solid Waste and Air Pollution Control Regulations.

DEP.29 Installation and Operation of ABC Crushing Equipment

The Proponent will comply with 310 CMR 7.02 of the Air Pollution Control regulations.

DEP.30 Asbestos Removal and Building Demolition Notifications

The Proponent will apply for required permits and will comply with applicable regulations regarding asbestos removal.

DEP.31 Disposal of Asbestos Containing Materials Outside the Boundaries of the Commonwealth

Disposal of asbestos containing materials will comply with applicable laws and regulations.

DEP.32 Conform to Current Mass. Air Pollution Control Regulations during Demolition

Demolition activities will comply with Air Pollution Control regulations governing nuisance conditions.

DEP.33 Recycling and Source Reduction

The Proponent will encourage the specification of regionally-sourced materials wherever possible. Construction recycling is described in Section 4.10.5.

The Commonwealth of Massachusetts

William Francis Galvin, Secretary of the Commonwealth
Massachusetts Historical Commission

July 28, 2009

Secretary Ian A. Bowles
Executive Office of Energy & Environmental Affairs
100 Cambridge Street, Suite 900
Boston, MA 02202

ATTN: William Gage, MEPA Office

RE: Mass Mental Health Center Redevelopment, Fenwood Road, Vining Street, Binney Street, Boston (Fenway), MA, MHC# 46627; EEA# 14440

Dear Secretary Bowles:

Staff of the Massachusetts Historical Commission have received the Environmental Notification Form (ENF) submitted for the above referenced project. After a review of the information submitted, MHC staff have the following comments.

MHC has previously reviewed the disposition of the Massachusetts Mental Health property out of state ownership in accordance with Massachusetts General Laws, Chapter 9, Section 26-27C (950 CMR 71.00). A Memorandum of Agreement was executed in 2003 regarding the disposition of the Massachusetts Mental Health Center by the Massachusetts Division of Capital Assets Management (DCAM) and the Massachusetts Department of Mental Health (DMH). The stipulations and documentation required by the MOA have been fulfilled. MHC regrets the loss of this historic property and that DCAM did not select a development option that would have preserved more historic material.

MHC would like to comment on the proposed new construction and note that it is adjacent to the Riverway, which is part of the State and National Register listed Emerald Necklace Park System (BOS.JE). MHC requests the effect of potential shadows from new construction be included in the Draft Environmental Impact Report (DEIR). MHC.1 MHC.2

These comments are offered to assist in compliance with M.G.L. Chapter 9, Section 26-27C, (950 CMR 71.00) and MEPA. Please do not hesitate to contact Brandee Loughlin of my staff if you have any questions.

Sincerely,

Brona Simon

Brona Simon
State Historic Preservation Officer
Executive Director
Massachusetts Historical Commission

xc: Carol Meeker, DCAM
BLC

9.6 Massachusetts Historical Commission

MHC.1 New Construction

Information on the Project for MHC review is provided in this Draft EIR/PIR.

MHC.2 Shadows on Riverway

Please see Section 6.2.2 for a discussion of shadow impacts on the Riverway.

MASSACHUSETTS WATER RESOURCES AUTHORITY
Charlestown Navy Yard
100 First Avenue, Building 39
Boston, MA 02129

BG

Frederick A. Laskey
Executive Director

Telephone: (617) 242-6000
Fax: (617) 788-4899
TTY: (617) 788-4971

July 27, 2009

RECEIVED
JUL 28 2009
MEPA

Mr. Ian A. Bowles, Secretary
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Attn.: MEPA Office – William Gage
Boston, MA 02114

Subject: Environmental Notification Form #14440
Massachusetts Mental Health Center, Boston, MA

Dear Secretary Bowles:

The Massachusetts Water Resources Authority (MWRA) appreciates the opportunity to comment on the Environmental Notification Form (ENF) for the proposed Massachusetts Mental Health Center (MMHC) Redevelopment project. The Brigham and Women's Hospital, Inc. (BWH) and the Partners Health Care System, Inc., in association with the Roxbury Tenants of Harvard Association, Inc., (RTH), are proposing to redevelop the 2.39-acre site located in Mission Hill adjacent to the Longwood Medical Area. Currently, the site contains five buildings formerly occupied by the MMHC and the buildings have suffered serious deterioration, and present a public safety hazard.

The first phase of the involves the demolition of four existing buildings on site and the construction of two buildings to serve the Department of Mental Health (DMH) clientele. The Partial Hospital/Fenwood Inn Building, which will be developed by BWH on behalf of DMH will include residential units, outpatient clinic, and partial hospital. The Binney Street Building to be developed by BWH will contain space for research and development, clinical, and office space to be used initially by DMH.

The latter phases of the project will include the development of both a residential (rental and condominiums) building and a building for medical-related uses. The medical-use building will be developed, managed, and controlled by BWH and contain space for research and development, office and clinical uses as well as parking spaces located beneath the building.

MWRA's comments focus on issues related to wastewater/stormwater and groundwater and other discharge permitting.

Wastewater/Stormwater

According to the ENF, the Proponent proposes to discharge wastewater flows from the project site(s) to a Boston Water and Sewer Commission (BWSC) 12-inch sanitary sewer in Fenwood Road and a BWSC 12-inch sanitary sewer in Vining Street. Stormwater from the project site is separately collected by a BWSC storm drain system that discharges to the Muddy River at BWSC stormwater outfall SDO161.

The Vining Street sewer is tributary to the Fenwood Road sewer, which will convey all of the project's wastewater flows to a BWSC 18-inch, then 24-inch, sanitary sewer along The Riverway that eventually ties into a Town of Brookline main line combined (sanitary and stormwater) sewer that carries Brookline and the BWSC flows to the MWRA's Charles River Valley Sewer (CRVS). The CRVS conveys flows to MWRA's Ward Street Headworks for transport to the Deer Island Wastewater Treatment Plant.

The ENF reports that the MMHC redevelopment project will increase wastewater flows to these systems by 99,180 gallons per day, triggering the need for a Sewer Connection and Extension Permit from the Massachusetts Department of Environmental Protection for the new flows. During dry weather, the BWSC sanitary sewers, the Brookline combined sewer and the MWRA interceptor and headworks have sufficient capacity to carry the project flows. However, large areas draining to the Brookline combined sewer and the MWRA's CRVS are served by combined sewer systems that during wet weather can carry large quantities of stormwater runoff along with the sanitary flows. In larger storms, the combined flows contribute to surcharging of the MWRA's CRVS, which can cause combined sewer overflows (CSOs) to the Charles River Basin at MWRA CSO outfall MWR010 and at MWRA's Cottage Farm CSO Treatment Facility in Cambridge. MWRA.1

MWRA is implementing an $878 million program of wastewater system improvements to control CSO discharges to Boston Harbor, the Charles River and other area waters, including a $24 million project to separate combined sewers in parts of Brookline tributary to the CRVS. With the overall CSO plan complete by 2015, MWRA and communities with CSOs will be subject to strict numerical discharge limits in the federal permits for their CSO outfalls. To avoid increasing CSOs and compromising MWRA's compliance with its discharge permit limits, new flows to the CRVS should be offset with I/I removal or sewer separation to help ensure that the benefits of the CSO control investments will be realized and will provide the necessary water quality improvements for the Charles River for the long-term. The Proponent should offset the project's increase in wastewater flow in accordance with DEP's Policy for Managing Infiltration and Inflow in MWRA Community Sewer Systems (No. BRP 09-01, April 2, 2009) and with related BWSC sewer use requirements. MWRA.2 MWRA.3

Groundwater and Other Discharge Issues

As mentioned above, the project site is served by separate sewer and storm drain systems owned and operated by BWSC. Pursuant to 360 C.M.R. 10.023(1), the MWRA prohibits the discharge of groundwater to the sanitary sewer system, except in a combined sewer area when permitted by the Authority and the municipality. The project Proponent has access to a storm drain and the site is not located in a combined sewer area; therefore, the discharge of MWRA.4
groundwater to the sanitary sewer system associated with this project is prohibited. The Project MWRA.5
Proponent will need to obtain a US EPA National Pollutants Discharge Elimination System (NPDES) Construction General Permit for Storm Water Discharges from Construction Activities for this project.

BWH must also comply with 360 C.M.R. 10.016, if it intends to install oil/gas MWRA.6
separator(s) in the proposed 406 parking space underground parking garage to be located beneath the BWH Building. In addition to complying with 360 C.M.R. 10.000, BWH must also conform MWRA.7
to the regulations of the Board of State Examiners of Plumbers and Gas Fitters, 248 C.M.R. 2.00 (State Plumbing Code), and all other applicable laws. MWRA will require approval for the installation of any oil/gas separator(s) and approval by the local Plumbing Inspector prior to MWRA.8
backfilling. The Proponent should contact Mr. Peter Yarossi, MWRA, Regional Manager at (617) 305-5671 to obtain an application and further information on this process.

In addition, BWH currently holds an existing MWRA Sewer Use Discharge Permit MWRA.9
#45005731 for the hospital, research and development, and clinical laboratory operations conducted at 75 Francis Street, Boston, Massachusetts. If BWH intends to change its current operation(s) and/or discharge(s) in any way, it must provide at least 30 days advance written notification to Walter Schultz, MWRA Industrial Coordinator, 2 Griffin Way, Chelsea, MA 02150 and/or phone him at (671) 305- 5665 for guidance.

Should you have any questions or require further information on these comments, please contact me at 671 788-1165.

Marianne Connolly,

Marianne Connolly

Program Manager, Regulatory Compliance

cc: David Kubiak, MWRA, E&C
Kattia Thomas, MWRA, TRAC

C:MEPA:14440MassMentalHealthBos.doc

9.7 Massachusetts Water Resources Authority

MWRA.1 Sewer Connection and Extension Permit

The Proponent will be preparing sewer connection and extension permits as necessary on a building by building basis.

MWRA.2 CSO Control and Compliance with Discharge Permit Limits

The Proponent has initiated coordination with the Boston Water and Sewer Commission regarding the removal of Infiltration/Inflow. A formal understanding will be reached in connection with BWSC site plan approval.

MWRA.3 Offset Increase in Wastewater Flow in accordance with DEP's Policy for Managing Infiltration and Inflow and with BWSC requirements

The Proponent has initiated coordination with the Boston Water and Sewer Commission regarding the removal of Infiltration/Inflow. A formal understanding will be reached in connection with BWSC site plan approval.

MWRA.4 Groundwater Discharge

The Proponent is not proposing the discharge of groundwater into the sanitary sewer system.

MWRA.5 NPDES Construction General Permit

Based on the currently anticipated phasing, demolition of existing buildings and construction of the Residential Building and the Brigham and Women's Building will require the filing of a Notice of Intent under the NPDES regulations. As part of that Notice of Intent, the Contractor(s) will be required to prepare a detailed stormwater pollution prevention plan.

MWRA.6 Compliance with 360 C.M.R 10.016

Comment noted.

MWRA.7 Conform to State Plumbing Code and other Applicable Laws

Comment noted.

MWRA.8 Approval for the Installation of Oil/Gas Separators and Approval by the Local Plumbing Inspector Prior to Backfilling

Comment noted.

MWRA.9 MWRA Sewer Use Discharge Permit

Comment noted. As the detailed program information develops, BWH will work with MWRA's staff to appropriately amend its existing industrial sewer use discharge permit.

BOSTON REDEVELOPMENT AUTHORITY

SCOPING DETERMINATION
FOR
MASSACHUSETTS MENTAL HEALTH CENTER REDEVELOPMENT
INSTITUTIONAL MASTER PLAN NOTIFICATION FORM/PROJECT NOTIFICATION FORM

PREAMBLE

The Brigham and Women's Hospital Inc. ("BWH") and the Partners HealthCare System Inc. in association with the Roxbury Tenants of Harvard Inc. ("RTH") (the "Proponent") is proposing to redevelop the 2.39 acre Massachusetts Mental Health Center complex on Fenwood Road and Vining Street and the 0.29 acre Binney Street site at the corner of Binney Street and Francis Street (the "Site"). The Proponent proposes the demolition of the existing buildings located on the Site to allow for the construction of four buildings totaling approximately 633,960 square feet to house residential, parking, clinical, inpatient, research and office uses (the "MMHC Redevelopment Project".)

The Site is located in the Longwood Medical and Academic Area ("LMA") and Mission Hill residential neighborhood of Boston, situated three miles from downtown. The LMA is one of the country's preeminent areas of medical and academic institutions, encompassing approximately 210 acres and over 14 million square feet of building floor area. Over 53,000 people either work or study in the LMA (approximately 37,000 employees and approximately 15,000 students) on a typical weekday, and employment figures are projected to grow by 25% within the next decade. The Mission Hill neighborhood is one of Boston's most unique neighborhoods, where residents co-exist with the LMA. This distinctive cohabitation brings opportunity to the area but is also the basis for conflicts in terms of traffic and parking. The opportunity it affords the neighborhood is the diverse residents drawn to the area, including families, students and medical center staff. This mix makes Mission Hill one the most racially and economically diverse in the city. Once filled with farms and breweries, Mission Hill today is a architecturally rich district with a combination of homes built by early landowners, blocks of traditional brick row house, large three family homes and active small and large businesses.

As stated in Section 80D-1 of the Boston Zoning Code (the "Code"), "the purpose of Institutional Master Plan Review is to provide for the well-planned development of Institutional Uses in order to enhance their public service and economic development role in the surrounding neighborhoods." Under the Code, an Institutional Master Plan ("IMP") has a dual purpose of meeting the needs of the institution and relating the campus to its context in a positive way. As stated in Section 80B-1 of the Code, "Large Project Review provides for the comprehensive review of large development projects before the during the schematic design stage and affords the public the opportunity for review and comment. The purpose of this review is to assess a project's impacts on its surroundings and on City resources and to identify necessary mitigation measures."

In preparing its IMP Amendment and Renewal and Draft Project Impact Report ("IMPA/DPIR"), the Proponent will need not only to demonstrate an understanding of its future facilities needs but also the context of its Site, land uses, physical characteristics, planned changes, resident desires, and applicable public policy. The BRA also seeks to enhance the Proponent's presence in the City of Boston as an important economic development entity, employer and housing provider.

SUBMISSION REQUIREMENTS

FOR

MASSACHUSETTS MENTAL HEALTH CENTER REDEVELOPMENT PROJECT INSTITUTIONAL MASTER PLAN NOTIFICATION FORM/PROJECT NOTIFICATION FORM

The Boston Redevelopment Authority ("BRA") is issuing this Scoping Determination in response to an Institutional Master Plan Notification Form/Project Notification Form ("IMPNF/PNF") submitted by the Brigham and Women's Hospital, Inc. ("BWH") and Partners Healthcare System, Inc. in association with the Roxbury Tenants of Harvard, Inc. ("RTH") (the "Proponent") for the Massachusetts Mental Health Center Redevelopment Project (the "MMHC Redevelopment Project") on June 16, 2009. Notice of the receipt by the BRA of the IMPNF/PNF was published in the Boston Herald on June 19, 2009 initiating a public comment period ending on July 19, 2009. At the request of the Proponent, the comment period was extended to July 27, 2009. The IMPNF submission seeks to amend and renew the current Brigham and Women's Institutional Master Plan which was approved by the BRA on January 20, 2005 and by the Boston Zoning Commission on February 9, 2005, with an effective date of February 10, 2005 (the "2005 BWH IMP") pursuant to Article 80D of the Boston Zoning Code ("Code"). In conjunction with the submission of the IMPNF, the Proponent also submitted a Project Notification Form ("PNF") which seeks Large Project Review, under Section 80B of the Code, for 4 distinct buildings: 1) The Residential Building – which will be developed, managed and controlled by RTH – will include 66 affordable rental units and approximately 70 condominiums for a total of approximately 136 units. The building may also include approximately 10,000 SF of community space for a total of approximately 197,750 SF; 2) The Brigham and Women's Building - which will be developed, managed, and controlled by BWH – will include approximately 358,670 SF of space for research and development, clinical and office uses by BWH and the Department of Mental Health ("DMH"); 3) The Binney Street Building – which will be developed by BWH – will include 56,540 SF of clinical and office space which will be initially occupied by DMH and eventually utilized by BWH for outpatient uses; and 4) the Partial Hospital/Fenwood Inn Building – which will be developed by BWH on behalf of DMH – will include 13 single residential units and 17 double residential units and 8260 SF outpatient clinic and partial hospital. The MMHC Redevelopment Project, when completed, will include approximately 633,960 square feet of residential, parking, clinical, inpatient, research and office uses and 406 parking spaces located beneath the Brigham and Women's Building.

Pursuant to Section 80B-5.3c and Section 80D-5.3c of the Code, a scoping session was held on June 30, 2009 with the City's public agencies to which members of the Task Force were invited and attended. A Task Force meeting, where the IMPNF/PNF was reviewed and discussed, was held on June 30, 2009. The Proponent presented the IMPNF/PNF at the LMA Forum on June 22, 2009 and at a public meeting in the Mission Hill neighborhood on July 14, 2009. Following the scoping session and based on the BRA's review of public comments and comments from the City's public agencies, the BRA hereby issues this Scoping Determination pursuant to Section 80B-5.3 and Section 80D-5.3 of the Code.

Section 80D: IMPNF Requirements:

Consistent with the requirements of Article 80D of the Zoning Code, the 2005 BWH IMP described the existing uses, structures, and activities on the BHW campus, along with future needs, master planning objectives, and proposed construction projects over the five-year term of the 2005 BWH IMP.

This Scoping Determination sets forth those elements specified in Section 80D-3 of the Code that are required to be included in the BWH Institutional Master Plan Amendment and renewal ("BWH IMPA"). This Scoping Determination requests information required by the BRA for its review of the proposed BWH IMPA in connection with the following:

1. Approval of the BWH IMPA pursuant to Article 80 and other applicable sections of the Code;
2. Recommendation to the Zoning Commission for approval of the BWH IMPA.

The BWH IMPA should be documented in a report of appropriate dimensions and in presentation materials which support the full review of the IMP. Forty copies of the full BWH IMPA should be submitted to the BRA. An additional fifty copies should be available for distribution to the Task Force members, LMA Forum participants, community groups and other interested parties in support of the public review process. The BWH IMPA should be made available in an electronic format on a server so that it may be viewed on the internet. The BWH IMPA should be submitted 1) as a stand-alone document, and 2) electronically in the form of CD's. The BWH IMPA should reference and/or include information from the Draft Project Impact Report ("DPIR") that is also submitted to the BRA to meet the requirements of Large Project Review for the Proposed Project. The BWH IMPA document should include this Scoping Determination and text, maps, plans, and other graphic materials sufficient to clearly communicate the various elements of the BWH IMPA.

The BWH IMPA should include a complete update of the 2005 BWH IMP: existing uses, structures, and activities on the BHW campus, along with future needs, master planning objectives, and status of proposed construction projects over the five-year term of the 2005 BWH IMP. The BWH IMPA should also include an update on the following:

I. Brigham and Women's Mission and Goals

The mission of BWH as it relates to the MMHC Redevelopment Project should be described. The description should articulate the larger as well as local aspects of the mission. Services to the community are of particular interest. The population to be served by the MMHC Redevelopment Project should be described in detail. Changes expected in the type or size of the mission components, particularly as they relate to the MMHC Redevelopment Project, should be highlighted. The longer term goals and the expected growth in the number of employees, patients and research needs, at least ten (10) years into the future, should be described. A statement of how the MMHC Redevelopment Project will advance the mission and goals of the BWH should be included.

II. Program Needs and Objectives

Specific program needs and objectives for the BWH campus to be addressed in the BWH IMPA should be defined in sufficient detail. Included in the description should be current and future trends that are impacting BWH and shaping program objectives. Projection of changes in the patient population, employee population, new or expanded programs, research including National Institute of Health ("NIH") grants, parking, BWH enterprises and spin-off companies and other activities that require space in the LMA and in and outside of the City of Boston in the next 5 to 10 years should be included.

A. <u>Compliance with the Longwood Medical and Academic Area Interim Guidelines:</u> The BRA has formulated a set of Interim Guidelines to govern proposed projects in the LMA. These Guidelines have been established to ensure that projects apply good planning principles in the areas of transportation, urban design, and workforce development. They describe the physical character of the LMA and outline mutually beneficial public benefits that can be provided by project proponents to achieve project heights that are greater than those specified in the Guidelines. Development projects within the LMA must demonstrate compliance with guidelines for building height and setbacks, street networks, building character, environmental impacts, and transportation and workforce development. Included in this section should be an outline of how the BWH IMPA components, if applicable, comply with the Interim Guidelines.

III. Physical Needs and Objectives

A. Campus

A summary analysis of the BWH campus should be provided using sufficient text and visual materials.

B. Facilities

An inventory and description of the buildings, facilities, and other structures occupied on the BWH campus and beyond should be provided. An updated illustrative campus plan should be prepared showing the location of each facility. For each building the following information should be provided: total gross floor area, occupancy or use by gross floor area, height in stories and in feet, FAR (for each lot), year built and ownership. Information on parking facilities should include the total number of parking spaces and a breakdown of the number of spaces allocated by used category. Appropriate description of other types of facilities and their use such as infrastructure systems, recreational fields, and places of assembly should be provided.
An analysis of the existing facilities in light of the identified program needs and objectives should be undertaken and documented.

IV. Campus Context

The immediate area around BWH should be inventoried, analyzed and summarized in the BWH IMPA. The analysis should include land use, building height and FARs, historic resources, open space, student and employee population, public facilities and a ten-year projection of future growth. The capacity and condition of the infrastructure system that serves the BWH should be documented. Area residents and businesses should be consulted and their views regarding the BWH IMPA should be described. From this analysis, guidelines should be defined that will shape the BWH IMPA so that BWH will relate positively to the area around it.

V. Master Plan

A. Development Program

A description of all the significant physical changes proposed for the BWH IMPA time period should be provided. Included here should be information on the renovation of existing facilities, leased space both on and off the BWH campus, urban design improvements, and any potential future projects identified in the IMPNF. For those locations which are to gain zoning rights through the BWH IMPA, the information required is defined in Section 80D-3.4 of the Code. The impacts of each proposal on the campus should be discussed at a level of definition appropriate to the BWH IMPA and mindful that large projects shall undergo Article 80 Large Project Review when they are implemented. The demolition of any building over 50 years old is subject to the provision of Article 85 of the Zoning Code (Demolition Delay). A full explanation description of the Article 85 process should be provided.

B. Transportation Plan

The scope of the transportation component of the BWH IMPA is included in Appendix 1 and must be responded to in full by the Proponent.

C. Community Benefits Plan

1. Training and Employment Initiatives

A detailed description of BWH's current workforce and project future employment needs concerning the BWH IMPA and the MMHC Redevelopment Project should be provided. Of particular interest is learning about that part of the workforce that is drawn from the adjacent neighborhoods and about programs to recruit, train and promote this population.

2. Taxes

In the context of the IMPA process, the Proponent should meet with the City's Assessing Department to address the concerns expressed in the Assessing Department memo found in Appendix 1.

3. Other benefits

BWH should identify current and future proposed community benefits as well as any other benefits that minimize or mitigate detrimental and adverse impacts on the local community from the BWH IMPA.

D. Urban Design Scope

The BWH IMPA shall include a narrative of the MMHC Redevelopment Project's design concept and its relationship to the existing buildings and surrounding environment. In preparing the BWH IMPA, BWH's shall also address the following issues, providing thorough documentation in text and images.

(a)Description of site history and a discussion of the MMHC Redevelopment Project's design;

(b) Consistency with the LMA Interim Guidelines, as applicable, should be described and documented;
(c) Description of short term plans for open spaces created by the demolition of existing buildings on the Site;
(d) Improved wayfinding should be described as it relates to the MMHC Redevelopment Project and any future projects; and
(e) The urban design component should include plans, and elevations to illustrate the MMHC Redevelopment Project.

The scope of the urban design component of the BWH IMPA is included in Appendix 1 and must be responded to in full by the Proponent.

VI. Comments

Comments from the City's public agencies, the Task Force and the public, found in Appendix A and B respectively, are incorporated as a part of this Scoping Determination. Comments from the City's public agencies and the Task Force must be responded to in full. Comments from the public must be responded to reasonably.

VII. Public Notice

The Proponent will be responsible for preparing and publishing in one or more newspapers of general circulation in the City of Boston a Public Notice of the submission of the BWH IMPA to the BRA as required by Section 80A-2. This Notice shall be published within five (5) days after the receipt of the BWH IMPA by the BRA. Public comments shall be transmitted to the BRA within sixty (60) days of the publication of this Notice, unless a time extension has been granted by the BRA in accordance with the provisions of Article 80 or to coordinate the BWH IMPA review with any required Large Project Review. Following publication of the Notice, the Proponent shall submit to the BRA a copy of the published Notice together with the date of publication.

Section 80B: PNF Requirements:

The Proponent is required to prepare and submit to the BRA a Draft Project Impact Report ("DPIR") that meets the requirements of this Scoping Determination by detailing the MMHC Redevelopment Project's expected impacts and proposing measures to mitigate, limit, or minimize such impacts. The DPIR shall contain the information necessary to meet the specifications of Section 80B-3 (Scope of Review; Content of Reports) and Section 80B-A (Standards for Large Project Review Approval) as required by this Scoping Determination.

The DPIR should be documented in a report of appropriate dimensions and in presentation materials which support the full review of the IMP. Forty copies of the full DPIR should be submitted to the BRA. An additional fifty copies should be available for distribution to the Task Force members, LMA Forum participants, community groups and other interested parties in support of the public review process. The DPIR should be made available in an electronic format on a server so that it may be viewed on the internet. The DPIR should be submitted 1) as a stand-alone document, and 2) electronically in the form of CD's. The DPIR should reference and/or include information from the BWH IMPA that is also submitted to the BRA to meet the requirements of Institutional Master Plan review. The DPIR document should include this Scoping Determination and text, maps, plans, and other graphic materials sufficient to clearly communicate the various elements of the DPIR.

Subsequent to the end of the forty-five (45) day public comment period for the DPIR, the BRA will issue a Preliminary Adequacy Determination ("PAD") that indicates the additional steps necessary for the Proponent to complete in order to satisfy the requirements of this Scoping Determination and all applicable sections of Article 80 of the Code. If the BRA finds that the DPIR adequately describes the MMHC Redevelopment Project's impacts and, if appropriate, proposes satisfactory measures to mitigate, limit or minimize such impacts, the PAD will announce such a determination and that the requirements for the filing and review of a Final Project Impact Report ("FPIR") are waived pursuant to Section 80B-5.4(c)(iv) of the Code. Before reaching said findings, the BRA shall hold a public hearing pursuant to Article 80 of the Code. Sections 80B-6 and 80D-10 require the Director of the BRA to issue a Certification of Compliance and a Certification of Consistency, respectively, before the Commissioner of Inspectional Services can issue any building permit for the MMHC Redevelopment Project.

Submission Requirements

I. General Information

BRA.1

1. Application Information

a. Development Team

(1) Names

(a) Proponent (including description of development entity and type of corporation)

(b) Attorney
(c) Project consultants and architect
(2) Business address, telephone number and email for each
(3) Designated contact for each

b. Legal Information
(1) Legal judgements or actions pending concerning the MMHC Redevelopment Project
(2) History of tax arrears on property owned in Boston by the Proponent
(3) Evidence of site control over the Project Site, including current ownership and purchase options of all parcels in the MMHC Redevelopment Project, all restrictive covenants and contractual restrictions affecting the Proponent's right or ability to accomplish the MMHC Redevelopment Project, and the nature of the agreements for securing parcels not owned by the Proponent.
(4) Nature and extent of any and all public easements into, through or surrounding the Project Site.

c. Disclosure of Beneficial Interests
Disclosure of Beneficial Interests in the MMHC Redevelopment Project must be provided pursuant to Section 80B-8 of the Code.

2. <u>Project Area</u>
a. An area map identifying the location of the MMHC Redevelopment Project
b. Description of metes and bounds of the Site or certified survey of the Site

3. <u>Public Benefits</u>
a. Development Impact Project Contribution and Jobs Contribution specifying amount of housing linkage and jobs linkage contributions.

b. Estimated annual property taxes for each parcel, and estimated total property taxes during all construction and phased development years and after full occupancy.

c. Anticipated employment levels including the following:
(1) Estimated number of construction jobs
(2) Estimated number of permanent jobs

d. Current activities and programs which benefit adjacent neighborhoods and the city at large, such as: child care programs, scholarships, internships, elderly services, education and job training programs, etc.

e. Other public benefits, if any, to be provided.

4. Regulatory Controls and Permits

a. Existing zoning requirements, zoning computation forms, and any anticipated requests for zoning relief should be explained and submitted in full.

b. Anticipated permits required from other local, state, and federal entities with a proposed application schedule should be noted.

c. A statement on the applicability of the Massachusetts Environmental Policy Act ('MEPA") should be provided. If the MMHC Redevelopment Project is subject to MEPA, all required documentation should be provided to the BRA, including but not limited to, copies of the Environmental Notification Form, decisions of the Secretary of Environmental Affairs, and the proposed schedule for coordination with BRA procedure.

5. Community Groups

a. Names and addresses of the Site area owners, abutters, and any community of business groups which, in the opinion of the Proponent, may be substantially interested in or affected by the MMHC Redevelopment Project and the steps the Proponent is undertaking to address any concerns thereof.

b. A list of meetings held and proposed with interested parties, including public agencies, abutters, and community and business groups.

II. Project Description and Alternatives

BRA.2

1. Project Description

The DPIR shall contain a full description of the MMHC Redevelopment Project and its components, including their size, physical characteristics, development schedule, costs, and proposed uses. This section of the DPIR also shall present analysis of the development context of the MMHC Redevelopment Project. Appropriate site and building plans to illustrate the MMHC Redevelopment Project clearly shall be required.

2. Project Alternatives

A description of any alternatives to the MMHC Redevelopment Project, including the No-Build alternative (not carrying out the MMHC Redevelopment Project) shall be presented and the primary differences among the alternatives, particularly as they may affect environmental conditions, shall be discussed. The No-Build alternative shall establish the future baseline conditions to which the effects of the MMHC Redevelopment Project are to be compared.

3. Housing

The MMHC Redevelopment Project is expected to comply with the Mayor's Executive Order relative to the Inclusionary Development Policy. There are currently three (3) options offered under the Inclusionary Development Policy: (1) the construction of affordable units on-site; (2) the construction/provision of affordable units off-site; and/or (3) a payment in lieu of providing on-site affordable units. If the Proponent is proposing to locate some or all of the affordable units off-site, this location should be identified. Furthermore, any units provided off-site must be ready for occupancy on or before the date that the units within the MMHC Redevelopment Project are ready for occupancy.

III. Transportation Component

BRA.3

The scope of the transportation component of the MMHC Redevelopment Project is included in Appendix 1 and must be responded to in full by the Proponent.

IV. Environmental Protection Component

The DPIR shall contain an Environmental Protection Component as outlined.

Wind

In general, the BRA has adopted two standards for assessing the relative wind comfort of pedestrians. First, the BRA wind design criterion states that an effective gust velocity of 31 mph should not be exceeded more than one percent of the time. The second set of criteria used by the BRA to determine the acceptability of specific locations is based on the work of Melbourne. The placement of wind measurement locations shall be based on an understanding of the pedestrian use of the MMHC Redevelopment Project and the surrounding area. All wind tunnel test point points shall be approved by the BRA staff before conduction of testing. This set of criteria is used to determine the BRA.4

relative level of pedestrian wind comfort for activities such as sitting, standing or walking.

Measurement points for this PLW analysis should be placed at all building entrances, entrances to public transportation stations, crosswalks and public sidewalks, public plazas and gathering areas, parks and green spaces

Analysis of results and effective mitigation should be presented in the Draft Project Impact Report (DPIR) using diagram methodology so that the delta or changes manifested by the MMHC Redevelopment Project relative to existing or as-of-right conditions (whichever provides the higher base impacts) are clearly understood.

<u>Shadow</u>

The shadow impact analysis must include net new shadow from the MMHC Redevelopment Project well as existing shadow and clearly illustrate the incremental impact of the MMHC Redevelopment Project. For purposes of clarity, the Proponent shall be directed to consider the use of color as an alternative to dark tonality to indicate new shadows. The shadow impact study area shall include, at a minimum, the entire area to be encompassed by the maximum shadow expected to be produced by the MMHC Redevelopment Project. The build condition(s) shall include all buildings under construction and any proposed buildings anticipated to be completed prior to the completion of the MMHC Redevelopment Project. Shadows from all existing buildings within the shadow impact study area shall be shown. A North Arrow shall be provided on all figures. Shadows shall be determined by using the applicable Boston Azimuth and Altitude data. BRA.5

Particular attention shall be given to existing or proposed public open spaces and pedestrian areas, including, but not limited to, the existing sidewalks and pedestrian walkways within, adjacent to, and in the vicinity of the MMHC Redevelopment Project and the existing and proposed plazas, historic resources, in particular the Olmsted Park system and other open space areas within the vicinity of the MMHC Redevelopment Project.

<u>Daylight</u>

The Proponent shall conduct a daylight analysis for both build and no-build conditions. The analysis shall measure the percentage of skydome obstructed by the MMHC Redevelopment Project and evaluate the net change in obstruction. Since project alternative massing studies are requested as part of the Article 80 Development Review BRA.6

Process, daylight analysis of such alternatives shall also be conducted for comparison. The study shall treat the following elements as controls for data comparison: existing conditions, the context examples, and the as-of right conditions. Particular attention shall be given to existing or proposed public open spaces and pedestrian areas, including, but not limited to, the existing sidewalks and pedestrian walkways within, adjacent to, and in the vicinity of the MMHC Redevelopment Project and the existing and proposed plazas, historic resources, in particular the Olmsted Park system and other open space areas within the vicinity of the MMHC Redevelopment Project.

Daylight analyses should be taken for each major building façade within the limits of the Boston Redevelopment Authority Daylight Analysis (BRADA) program, fronting these public and quasi-public ways. The midpoint of each public accessway or roadway should be taken as a study point.

Solar Glare

The Proponent has stated that the MMHC Redevelopment Project is not expected to incorporate the use of reflective building material. Consequently, the Proponent does not anticipate the creation of either an adverse solar glare impact or a solar heat buildup in nearby buildings. The Proponent shall demonstrate that the glass selected will avoid the creation of a visual nuisance and/or a hazard, as it interferes with vision and concentration. However, should the design change and incorporate substantial glass-facades, a solar glare analysis shall be required. The analysis shall measure potential reflective glare from the buildings onto potentially affected streets and public open spaces and sidewalk areas in order to determine the likelihood of visual impairment or discomfort due to reflective spot glare. Mitigation measures to eliminate any adverse reflective glare shall be identified. BRA.7

Air Quality BRA.8

The Proponent shall provide a description of the existing and projected future air quality in the MMHC Redevelopment Project vicinity and shall evaluate ambient levels to determine conformance with the National Ambient Air Quality Standards (NAAQS). Careful consideration shall be given to mitigation measures to ensure compliance with air quality standards.

A future air quality (carbon monoxide) analysis shall be required for any intersection (including garage entrance/exits) where the level of service (LOS) is expected to deteriorate to D and the MMHC Redevelopment Project causes a 10 percent increase in traffic or where the level of service is E or F and the MMHC Redevelopment Project contributes to a reduction in LOS.

The study shall analyze the existing conditions, future No-Build and future Build conditions, for all Project Alternatives. The methodology and parameters of the air quality analysis shall be approved in advance by the Boston Redevelopment Authority (BRA) and the Massachusetts Department of Environmental Protection (DEP). Mitigation measures to eliminate or avoid any violation of air quality standards shall be described.

A description of the MMHC Redevelopment Project's heating and mechanical systems including location of buildings/garage intake and exhaust vents and specifications, and an analysis of the impact on pedestrian level air quality and on any sensitive receptors from operation of the heating, mechanical and exhaust systems, including the building's emergency generator as well as the parking garage, shall be required. Measures to avoid any violation of air quality standards shall be described.

Noise

The Proponent shall establish the existing noise levels at the MMHC Redevelopment BRA.0
Project site and vicinity and shall calculate future noise levels after project completion, thus demonstrating compliance with the Interior Design Noise Levels (not to exceed day-night average sound level of 45 decibels) established by U.S. Department of Housing and Urban Development, as well as applicable City, State and Federal noise criteria.

The Proponent has stated that mechanical equipment such as chillers, garage exhaust fans, and emergency generators have the potential to cause nuisance levels of noise. Due to the MMHC Redevelopment Project's proximity to an adjacent residential neighbors appropriate low-noise mechanical equipment and noise control measures will be required in accord with the Regulations for Control of Noise in the City of Boston and the Commonwealth of Massachusetts. The Proponent shall also describe any other measures necessary to minimize and/or eliminate adverse noise impacts from the MMHC Redevelopment Project.

Solid and Hazardous Waste

The Proponent shall provide a list of any known or potential contaminants on the MMHC BRA.10
Redevelopment Project site, and if applicable, a description of remediation measures to

ensure their safe removal and disposal, pursuant to the M.G.L., Chapter 21E and the Massachusetts Contingency Plan.

Any potential hazardous wastes to be generated by the MMHC Redevelopment Project site must be identified. In addition, potential waste generation must be estimated and plans for disposal indicated and measures to promote reduction of waste generation and to promote recycling in compliance with the City's recycling program described.

Geotechnical Impacts

A description and analysis of the existing sub-soil conditions, including the potential for ground movement and settlement during excavation and potential impact on adjacent buildings and utility lines shall be required. This analysis shall also include a description of the foundation construction methodology, the amount and method of excavation, and the need for any blasting and/or pile driving and the impact on adjacent buildings and infrastructure. A Vibration Monitoring Plan shall be developed prior to commencing construction activities to ensure that impacts from the project construction on adjacent buildings and infrastructure are avoided. Mitigation measures to minimize and avoid damage to adjacent buildings and infrastructure must be described. BRA.11

Sustainable Design/Green Buildings BRA.12

The purpose of Article 37 of the Boston Zoning Code is to ensure that major buildings projects are planned, designed, constructed and managed to minimize adverse environmental impacts; to conserve natural resources; to promote sustainable development; and to enhance the quality of life in Boston. Any proposed project subject to the provisions of Article 37 shall be LEED Certifiable (U.S. Green Buildings Council) under the most appropriate LEED rating system. Proponents are encouraged to integrate sustainable building practices at the pre-design phase. Proposed Projects which are subject to comply with Section 80B of the Boston Zoning Code, Large Project Review, shall be subject to the requirements of Article 37.

The MMHC Redevelopment Project consists of multiple buildings and accordingly the Proponent shall be required to submit separate LEED checklists, together with explanatory narratives demonstrating compliance with specific points. The Proponent shall also demonstrate that the Proposed Project will meet the requirements of Article 37 with appropriate supporting documentation and by certification from a LEED Accredited Professional. A LEED checklist or information on the Green Guidelines for Health Care will also be included.

Construction Impacts

A construction impact analysis shall include a description and evaluation of air quality impacts, noise generation and mitigation, construction staging, schedule, access routes demolition, construction waste and recycling, measures to protect public safety, and rodent control. BRA.13

Infrastructure Systems Component

An infrastructure impact analysis should be performed. The discussion of the MMHC Redevelopment Project on infrastructure systems should be organized system-by-system as suggested below. The applicant's submission must include an evaluation of the MMHC Redevelopment Project's impact on the capacity and adequacy of existing water, sewerage, energy (including gas and steam), and electrical communications (including telephone, fire alarm, computer, cable, etc.) utility systems, and the need reasonably attributable to the MMHC Redevelopment Project for additional systems facilities. BRA.14

Any system upgrading or connection requiring a significant public or utility investment, creating a significant disruption in vehicular or pedestrian circulation, or affecting any public or neighborhood park or streetscape improvements, comprises an impact which must be mitigated. The DPIR must describe anticipated impacts in this regard, including specific mitigation measures, and must include nearby MMHC Redevelopment Project build-out figures in the analysis. The standard scope for infrastructure analysis is given below:

Utility Systems and Water Quality

a. Estimated water consumption and sewage generation from the Proposed Project and the basis for each estimate. Include separate calculations for air conditioning system make-up water

b. Description of the capacity and adequacy of water and sewer systems and an evaluation of the impacts of the MMHC Redevelopment Project on those systems

c. Identification of measures to conserve resources, including any provisions for recycling or 'green' strategies

d. Description of the MMHC Redevelopment Project 's impacts on the water quality of Boston Harbor or other water bodies (Muddy River, Charles River) that could be affected by the MMHC Redevelopment Project, if applicable

e. Description of mitigation measures to reduce or eliminate impacts on water quality

f. Description of impact of on-site storm drainage on water quality

g. Information on how the MMHC Redevelopment Project will conform to requirements of the Ground Water Trust under Article 32 by providing additional recharge opportunities

h. Detail methods of protection proposed for infrastructure conduits and other artifacts, including BSWC sewer lines and water mains, during construction

i. Detail the energy source of the interior space heating; how obtained, and, if applicable, plans for reuse of condensate.

   Thorough consultation with the planners and engineers of the utilities will be required, and should be referenced in the Infrastructure Component section.

Energy Systems

a. Description of energy requirements of the project and evaluation of project impacts on resources and supply

b. Description of measures to conserve energy usage and consideration of the feasibility of including solar energy provisions or other on-site energy provisions.

Additional constraints or information required are described below. Any other system (emergency systems, gas, steam, optic fiber, cable, etc.) impacted by this development should also be described in brief. The relationship with MATEP and/or sustainable energy strategies should be defined.

Information is requested to clarify sewage tributary flows and constraints as well as energy choices. The location of transformer and other vaults required for electrical distribution or ventilation must be chosen to minimize disruption to pedestrian paths and public improvements both when operating normally and when being serviced, and must be described. Storm drain and sewage systems should be separated or separations provided for in the design of connections.

V. Urban Design Component

Submission Requirements: BRA.15

1. Written description of program elements and space allocation (in square feet) for each element, as well as Project totals.
2. Neighborhood plan, elevations and sections at an appropriate scale (1"=100' or larger as determined by the BRA) showing relationships of the proposed project to the neighborhood context:
   a. massing
   b. building height
   c. scaling elements
   d. open space
   e major topographic features
   f. pedestrian and vehicular circulation
   g. land use
3. Color, or black and white photographs of the site and neighborhood.
4. Sketches and diagrams to clarify design issues and massing options.
5. Eye-level perspective (reproducible line or other approved drawings) showing the proposals (including main entries and public passages/areas) in the context of the surrounding area. Views should display a particular emphasis on important viewing areas such as key intersections, accessways, or public parks/attractions. Long-ranged (distanced) views of the proposed project must also be studied to assess the impact on the skyline or other view lines. At least one bird's-eye perspective should also be included. All perspectives should show (in separate comparative sketches) both the build and no-build conditions. The BRA should approve the view locations before analysis is begun. View studies should be cognizant of light and shadow, massing and bulk.
6. Additional aerial or skyline views of the project, if and as requested.
7. Site sections at 1"=20' or larger (or other scale approved by the BRA) showing relationships to adjacent buildings and spaces.
8. Site plan(s) at an appropriate scale (1"=20' or larger, or as approved by the BRA) showing:
   a. general relationships of proposed and existing adjacent buildings and open spaces
   b. open spaces defined by buildings on adjacent parcels and across streets
   c. general location of pedestrian ways, driveways, parking, service areas, streets, and major landscape features

d. pedestrian, handicapped, vehicular and service access and flow through the parcel and to adjacent areas
e. survey information, such as existing elevations, benchmarks, and utilities
f. phasing possibilities
g. construction limits

9. Massing model at 1":40'0" or equivalent reasonable scale for use in public presentations and review. In any case, a model of the updated MMHC site at 1":100'0" must be provided to the BRA for insertion in its Longwood Medical Area model.
10. Study models at 1" = 16' or 1" = 20' showing preliminary concept of setbacks, cornice lines, fenestration, facade composition, etc. if and as required
11. Drawings at an appropriate scale (e.g., 1":16'0", or as determined by BRA) describing architectural massing, facade design and proposed materials including:
    a. building and site improvement plans
    b. neighborhood elevations, sections, and/or plans showing the development in the context of the surrounding area
    c. sections showing organization of functions and spaces, and relationships to adjacent spaces and structures
    d. preliminary building plans showing ground floor and typical upper floor(s).
    e. phasing, if any, of the Proposed Projects
12. A written and/or graphic description of the building materials and its texture, color, and general fenestration patterns is required for the proposed development.
13. Electronic files describing the site and Proposed Project at Representation Levels one and two ("Streetscape" and "Massing") as described in the document *Boston "Smart Model": CAD & 3D Model Standard Guidelines.*
14. Full responses, which may be in the formats listed above, to any urban design-related issues raised in preliminary reviews or specifically included in the BRA scoping determination, preliminary adequacy determination, or other document requesting additional information leading up to BRA Board action, inclusive of material required for Boston Civic Design Commission review, and including information on the logistics of construction phasing.
15. Proposed schedule for submission of all design or development-related materials.
16. Diagrammatic sections through the neighborhood (to the extent not covered in item #2 above) cutting north-south and east-west at the scale and distance indicated above.

17. True-scale three-dimensional graphic representations of the area indicated above either as aerial perspective or isometric views showing all buildings, streets, parks, and natural features.

VI. Comments

Comments from the City's public agencies, the Task Force and the public, found in Appendix A and B respectively, are incorporated as a part of this Scoping Determination. Comments from the City's public agencies and the Task Force must be responded to in full. Comments from the public must be responded to reasonably. BRA.16

VII. Public Notice

The Proponent will be responsible for preparing and publishing in one or more newspapers of general circulation in the City of Boston a Public Notice of the submission of the DPIR to the BRA as required by Section 80A-2. This Notice shall be published within five (5) days after the receipt of the DPIR. Public comments shall be transmitted to the BRA within forty-five (45) days of the publication of this Notice. Following publication of the Notice, the Proponent shall submit to the BRA a copy of the published Notice together with the date of publication. BRA.17

9.8 Boston Redevelopment Authority – Scoping Determination

This Draft EIR/PIR provides responses to comments relative to Article 80B, Large Project Review. The BWH 2010 IMP to be submitted to the BRA in October 2009 will provide information required by the Scoping Determination that is specific to Article 80D, Institutional Master Plan Review.

BRA.1 General Information

Please see Chapter 1.0 for information on the Project team. Legal information is provided in Chapter 2.0. Disclosure of beneficial interests will be provided by the Proponent under separate cover. Figure 1-1a and Figure 1-1b identify the MMHC Project Site. An existing conditions survey is provided in Appendix A. Public benefits are described in Section 1.3. A list of proposed permits is provided in Section 1.4. Section 1.5 outlines the Proponent's community outreach efforts.

BRA.2 Project Description and Alternatives

Chapter 2 includes the Project Description. The proposed massing is driven by the program required to make the Project financially viable for BWH and RTH given the Proponent's financial commitments and contributions to the Commonwealth as well as other public benefits. Evolution of the Project's massing and alternatives previously explored are discussed in Section 2.9.

BRA.3 Transportation Component

The transportation component is including in Chapter 3.

BRA.4 Wind Impact Analysis

Please see Section 4.1 for the wind analysis.

BRA.5 Shadow Impact Analysis

Please see Section 4.2 for the shadow analysis.

BRA.6 Daylight Analysis

Please see Section 4.3 for the daylight analysis.

BRA.7 Solar Glare

Please see Section 4.4 for a discussion of solar glare.

BRA.8 Air Quality Analysis

Please see Section 4.5 for the air quality analysis.

BRA.9 Noise Impacts

Please see Section 4.8 for the noise analysis.

BRA.10 Solid and Hazardous Waste

Please see Section 4.7 for a discussion of solid and hazardous wastes.

BRA.11 Geotechnical Impacts

Please see Section 4.9 for a discussion of geotechnical impacts.

BRA.12 Sustainable Design/Green Buildings

Please see Section 4.11 for a discussion of sustainable design.

BRA.13 Construction Impacts

Please see Section 4.10 for a discussion of construction impacts.

BRA.14 Infrastructure Systems Component

Please see Chapter 7 for the Infrastructure section.

BRA.15 Urban Design Component – Submission Requirements

Comment noted.

BRA.16 Comments

This chapter provides responses to comments.

BRA.17 Public Notice

The Proponent will ensure this Draft EIR/PIR is noticed in the Boston Herald.

MEMORANDUM

TO: Sonal Gandhi
FROM: David Carlson
DATE: August 7, 2009 and as amended
SUBJECT: Massachusetts Mental Health Center Redevelopment Project
Scoping Comments

The Brigham and Women's Hospital with Partners Healthcare (BWH) in association with the Roxbury Tenants of Harvard (RTH) propose to redevelop the Massachusetts Mental Health Care (MMHC) site and a site on Binney Street into a mixed-use complex providing for the needs of MMHC as well as allowing for BWH research needs, residential uses with a high affordability ratio, and parking. A total of about 630,000 SF is proposed on about 2.68 acres in four buildings on what will be four parcels (Binney site, Fenwood Inn, BWH building, RTH building). The deal is complex, however, since all development will be accomplished in the first ten years under a 95-year lease for the MMHC site. Proposed zoning relief is proposed to be accomplished via a PDA for the RTH portion of the site and via an amended IMP for the BWH and Binney sites. This latter results in IMP implications for the BWH Campus.

URBAN DESIGN COMPONENT

The BCDC has voted to review and seen a presentation of the Massachusetts Mental Health Center Redevelopment proposal in their meeting on August 4, 2009. Comments as reflected in the draft minutes for that date are attached. Completion of the BCDC process must be completed as soon as possible given the reported schedule of the primary Projects and entitlements contemplated under the PNF. BRADC.1

The information presented in the PNF suggests a number of studies, many of which engage the nature and treatment of the area's streetscape and massing relationships, as well as the Proposed Project's relationship to the Emerald Necklace system along the Riverway. More information on the following topics is requested in the DPIR/IMP/PDA submission.

Pedestrian and streetscape strategies. The MMHC Redevelopment Project will need to study strategies of connection and orientation that provide not only for comprehension of this extension of the BWH Campus, but also for the residential area encompassed by RTH. BWH Campus connections must be reinforced by strong streetscape improvements and pedestrian crossings along Vining and Binney that extend to and embrace the MMHC site. Wayfinding and directional signage is encouraged. The streetscape improvements should extend along both sides of Fenwood as well. And how will the proposed reconfiguration at Brookline Avenue strengthen pedestrian as well as vehicular traffic? The logic of the BWH 'Pike' is proposed to be extended via a single primary bridge across Fenwood, connecting the new BWH building to the Shapiro Center at 70 Francis Street. This proposal's urban logic must be defended in terms of necessity of use, as the bridge across Francis was defended and ultimately approved for the Shapiro Center. Finally, the pedestrian connections that help knit the community of RTH and other residential neighbors together should be diagramed and strengthened where possible. Vining Street Extension should be treated to accommodate and resolve many forces...and to diminish the impacts of the Riverway ramp and the loading and parking entries. BRADC.2

Connections to the neighborhood. Develop diagrams and concepts, translatable into reinforcing action, that are clearly intended to animate and connect the edges of the MMHC Redevelopment Project with the surrounding institutions and neighborhoods (see above), and to create and enhance through-block pedestrian path connections such as the connection along the Binney corridor continuation to the green BRADC.3

space of the Emerald Necklace along the Riverway. Safe physical connections to walking or bicycling trails should be created or strengthened. Connections to MBTA services (Green lines, buses) should also be clear, and space must be provided within the Project for bicycles - improvements that will replace the *ad hoc* bicycle forest on Francis at the corner of Binney must be included in the programming of the new buildings.

A Campus Signage Plan for BWH should be developed, if such does not already exist, or extended to include the new BWH buildings. BRADC.4

An IMP for the BWH buildings implies Campus-wide thinking. This should extend to ideas of transportation as well as energy and communication/data systems. The percentage of employees and visitors who bicycle may be limited by the amount of bicycle racks and reasonable storage facilities provided; this idea should be expanded as a strategy, and possibly extended into ideas of patient therapy if applicable. Regarding energy, consider consolidating systems in development as well as the use of alternative energy sources (solar, wind, geothermal), or maximizing the use of local resources such as MATEP. An infrastructure analysis/update should be included in the IMP (see standard Article 80 infrastructure analysis requirements). BRADC.5

Campus (BWH networks) and Open Spaces. Develop a diagram and plan that shows BWH Campus connections and other key connections inside and outside of buildings. Develop a plan for the open space networks which both act along edges and along the major pathways, and play a role in defining the nature of the BWH Campus. Show how open spaces, including the spaces which serve now as *ad hoc* places of relaxation and refuge, may be defined further in the future, even if not currently a part of the intended IMP entitlement. Develop the open space on the MMHC parcel in particular not only as a 'collector' of the view corridor of Binney Street and plaza/forecourt to two building entries, as a connector, and as a 'buffer' for the Riverway traffic and green space, but also as a resource for the residents of the RTH building and an amenity of green respite for the public, and as a conceptual reflection of the green space of the Riverway. Demonstrate how the phasing and parcelization of the two buildings on the primary MMHC lot will be worked out to allow the efficient accomplishment of what is planned for open space. Determine whether the trees noted in the conversation that took place at the BCDC can reasonably be saved and, if not, design the open space and streetscape so that the shading and green effects that exist now will be an asset in the future. BRADC.6

The nature of Binney Street should be considered along its length. Also consider the future role of the Binney building as part of the BWH Campus and the location of its primary entry. Aside from the streetscape improvements referenced earlier, consider the responses possible to the ending (or continuation) of its view corridor, which now terminates in part on both the MMHC building complex and the Neville House. Currently the scheme attempts to accomplish several goals: ending the view corridor in a vertical building component expression, gathering the force of the Binney corridor and its pedestrians into a forecourt/proscenium, and redirecting the axis of the view corridor to suggest a connection to the open space of the Riverway which is translated into open space on the parcel as well. The scheme is a design work in progress and will be stronger if simplified. BRADC.7

Massing and Height. Discuss the degree and means of conformance with the LMA Interim Guidelines. Shadow investigations should be a part of this in particular as they impact the Riverway. The massings of the two primary buildings on the MMHC site as shown are serving several ideas and responding to a number of constraints. It may be helpful, particularly in addressing the BCDC comments, to show the process by which the proposed massing was conceived, and to investigate possible adjustments by taking a *macro* look at the larger massings in the immediate area, as well as considering sectional relationships across streets (Vining and Vining Extension, Fenwood, and the Riverway. BRADC.8

For the Proposed Project, we suggest submitting the following urban design materials for its schematic design. These are for the most part standard requirements for the equivalent of a DPIR stage. Certain of these requirements will also be appropriate more slightly more broadly to the IMP. Children's should develop a physical model of their campus if this has not already been done. The studies requested above for the IMP should be developed at a scale appropriate to the element study and purpose (i.e. diagrams, concept plan, plan or section detail needed to define a concept, etc.) BRADC.9

1. Written description of program elements and space allocation (in square feet) for each element, as well as Project totals.
2. Neighborhood plan, elevations and sections at an appropriate scale (1"=100' or larger as determined by the BRA) showing relationships of the proposed project to the neighborhood context:
   a. massing
   b. building height
   c. scaling elements
   d. open space
   e major topographic features
   f. pedestrian and vehicular circulation
   g. land use
3. Color, or black and white photographs of the site and neighborhood.
4. Sketches and diagrams to clarify design issues and massing options.
5. Eye-level perspective (reproducible line or other approved drawings) showing the proposals (including main entries and public passages/areas) in the context of the surrounding area. Views should display a particular emphasis on important viewing areas such as key intersections, accessways, or public parks/attractions. Long-ranged (distanced) views of the proposed project must also be studied to assess the impact on the skyline or other view lines. At least one bird's-eye perspective should also be included. All perspectives should show (in separate comparative sketches) both the build and no-build conditions. The BRA should approve the view locations before analysis is begun. View studies should be cognizant of light and shadow, massing and bulk.
6. Additional aerial or skyline views of the project, if and as requested.
7. Site sections at 1"=20' or larger (or other scale approved by the BRA) showing relationships to adjacent buildings and spaces.
8. Site plan(s) at an appropriate scale (1"=20' or larger, or as approved by the BRA) showing:
   a. general relationships of proposed and existing adjacent buildings and open spaces
   b. open spaces defined by buildings on adjacent parcels and across streets
   c. general location of pedestrian ways, driveways, parking, service areas, streets, and major landscape features
   d. pedestrian, handicapped, vehicular and service access and flow through the parcel and to adjacent areas
   e. survey information, such as existing elevations, benchmarks, and utilities
   f. phasing possibilities
   g. construction limits
9. Massing model at 1":40'0" or equivalent reasonable scale for use in public presentations and review. In any case, a model of the updated MMHC site at 1":100'0" must be provided to the BRA for insertion in its Longwood Medical Area model.
10. Study models at 1" = 16' or 1" = 20' showing preliminary concept of setbacks, cornice lines, fenestration, facade composition, etc. if and as required
11. Drawings at an appropriate scale (e.g., 1":16'0", or as determined by BRA) describing architectural massing, facade design and proposed materials including:

a. building and site improvement plans
b. neighborhood elevations, sections, and/or plans showing the development in the context of the surrounding area
c. sections showing organization of functions and spaces, and relationships to adjacent spaces and structures
d. preliminary building plans showing ground floor and typical upper floor(s).
e. phasing, if any, of the Proposed Projects

12. A written and/or graphic description of the building materials and its texture, color, and general fenestration patterns is required for the proposed development.
13. Electronic files describing the site and Proposed Project at Representation Levels one and two ("Streetscape" and "Massing") as described in the document *Boston "Smart Model": CAD & 3D Model Standard Guidelines*.
14. Full responses, which may be in the formats listed above, to any urban design-related issues raised in preliminary reviews or specifically included in the BRA scoping determination, preliminary adequacy determination, or other document requesting additional information leading up to BRA Board action, inclusive of material required for Boston Civic Design Commission review, and including information on the logistics of construction phasing.
15. Proposed schedule for submission of all design or development-related materials.
16. Diagrammatic sections through the neighborhood (to the extent not covered in item #2 above) cutting north-south and east-west at the scale and distance indicated above.
17. True-scale three-dimensional graphic representations of the area indicated above either as aerial perspective or isometric views showing all buildings, streets, parks, and natural features.

DAYLIGHT AND SHADOWS BRADC.10

These investigations have likely been scoped by another BRA reviewer. For the required BRADA analysis, all ol the streets bordering the primary MMHC site are of interest. For the shadow analysis, focus on the duration and scope of any impacts on the Emerald Necklace park area.

INFRASTRUCTURE SYSTEMS COMPONENT (referenced above) BRADC.11

An infrastructure impact analysis should be performed.

The discussion of Proposed Project impacts on infrastructure systems should be organized system-by-system as suggested below. The applicant's submission must include an evaluation of the Proposed Project's impact on the capacity and adequacy of existing water, sewerage, energy (including gas and steam), and electrical communications (including telephone, fire alarm, computer, cable, etc.) utility systems, and the need reasonably attributable to the proposed project for additional systems facilities.

Any system upgrading or connection requiring a significant public or utility investment, creating a significant disruption in vehicular or pedestrian circulation, or affecting any public or neighborhood park or streetscape improvements, comprises an impact which must be mitigated. The DPIR must describe anticipated impacts in this regard, including specific mitigation measures, and must include nearby Proposed Project build-out figures in the analysis. The standard scope for infrastructure analysis is given below:

1. Utility Systems and Water Quality

a. Estimated water consumption and sewage generation from the Proposed Project and the basis for each estimate. Include separate calculations for air conditioning system make-up water

b. Description of the capacity and adequacy of water and sewer systems and an evaluation of the impacts of the Proposed Project on those systems

c. Identification of measures to conserve resources, including any provisions for recycling or 'green' strategies

d. Description of the Proposed Project's impacts on the water quality of Boston Harbor or other water bodies (Muddy River, Charles River) that could be affected by the Project, if applicable

e. Description of mitigation measures to reduce or eliminate impacts on water quality

f. Description of impact of on-site storm drainage on water quality

g. Information on how the Proposed Project will conform to requirements of the Ground Water Trust under Article 32 by providing additional recharge opportunities

h. Detail methods of protection proposed for infrastructure conduits and other artifacts, including BSWC sewer lines and water mains, during construction

i. Detail the energy source of the interior space heating; how obtained, and, if applicable, plans for reuse of condensate.

Thorough consultation with the planners and engineers of the utilities will be required, and should be referenced in the Infrastructure Component section.

2. Energy Systems

a. Description of energy requirements of the project and evaluation of project impacts on resources and supply

b. Description of measures to conserve energy usage and consideration of the feasibility of including solar energy provisions or other on-site energy provisions.

Additional constraints or information required are described below. Any other system (emergency systems, gas, steam, optic fiber, cable, etc.) impacted by this development should also be described in brief. The relationship with MATEP and/or sustainable energy strategies should be defined.

Information is requested to clarify sewage tributary flows and constraints as well as energy choices. The location of transformer and other vaults required for electrical distribution or ventilation must be chosen to minimize disruption to pedestrian paths and public improvements both when operating normally and when being serviced, and must be described. Storm drain and sewage systems should be separated or separations provided for in the design of connections.

Excerpted from the draft BCDC Minutes of August 4, 2009:

The next item was a presentation of the **Massachusetts Mental Health Center ('MMHC') Redevelopment Project**. Jonathan Katz (JK) of Brigham and Women's/Partners HealthCare introduced Michael Liu (ML) of The Architectural Team and the rest of the MMHC team. The proponents are Brigham and Women's Hospital ('BWH'), The Roxbury Tenants of Harvard ('RTH'), DCAM, and the State DMH. The conversation about redeveloping the site began 11 years ago, in 1998, when it became clear that the existing buildings could no longer adequately serve their functions. The MMHC actually moved out in 2003; in 2005, an RFP for the site was issued, with respondents required to build first and at no cost to the State DMH 70,000 SF of space and 50 parking spaces. For that, DCAM would grant a 95-year lease. We (BWH) had worked with RTH on the Shapiro (70 Francis Street) Building and so, when the site became available, we decided to go in together. The key objective of the State is to get their clients back to the site ASAP. JK then showed an aerial photo, an existing site plan, the proposed site plan, and describes the basic program. He noted the phasing, and the eventual move of DMH to the second floor of the BWH building.

Peter Munckenbeck of RTH then gave the background of their organization...Harvard bought land, built towers, and started a war, resulting in a demarcation line and in the approval of MATEP. With Shapiro, they moved the line of demarcation up to Vining Street. That was the genesis of this partnership, and allowed for the continuation of residential and a defined limit for medical uses.

ML then presented the conceptual design, noting key features such as the topography and The Riverway. Vining Street leads to a 1372-car garage under the RTH complex and Neville House. He noted also the existing bridge across Francis to the Shapiro Building, and the proposed continuation of that path across Fenwood to the new BWH building. ML: There are four buildings; we are presenting only two, and the other two only as they are components of a future Master Plan. Along the Riverway, there is a continuation of a 35-foot-wide swath of open space setback; at the RTH building, this would screen the parking garage. The footprints of the buildings are integrated with the massings, which we have altered to create a space and a diagonal opening/path at the end of Binney. The corner entries reinforce the space. (Goes to perspective drawings. PM leaves, and DH takes the gavel as Acting Chair.)

ML: The Neville House residential use starts above its base, and the BWH building sets back to maximize the distance between the towers where units exist. The profile is as thin as possible in the RTH residential building, to minimize shadows, to respond to the geometry of the Riverway and the BWH tower. It is a continuation of layers, of elements. The bridge connection continues the 'Pike,' which ends at the corner closest to the RTH garage. There will be a minor entry there, because half of all BWH parking is in that garage. (Shows views.) The Binney Building has its core layer against the existing Service Garage; its glassy form is a platonic shape along Binney. On Francis, the building continues the sense of the garage entry and bus stop, echoing across the street. This is the second level of the building; its main entry is on Fenwood. At the Partial Hospital, we have tried a more residential scale, recalling the scale of the triple-deckers on Francis and Fenwood. (Shows street elevations and drawings of the Partial Hospital/Fenwood Inn.)

AL: The two yellow (DMH) parcels - on the original site, were the programs together? Peter: Yes, they were in the same building complex. AL: Do they want that? Peter: No, there are separate programs. AL: If then it's still the same organization, then should the architecture be more the same? DS: Why not build the Binney Building higher? ML points out the drawing is deceptive; the height is really the same as the large adjacent Service Center building. DS: Then I withdraw the question. JK: The program space is adaptable to each user (DMH then BWH); this was worked out carefully. LE: So no connection is needed (across Vining) when it moves? JK: No. DC: Why are you demolishing the buildings in the first phase? You can't use them? Joe: The buildings have all the issues you would expect. So we can't use them; we intend to have 50 surface parking spaces, and temporary green space. Peter: We expect to build the residential building in about three years. DC: The piece that concerns me is the sidewalk along Fenwood. Peter: That's why the building is set back from Fenwood; we want to save the trees, that's a demand from the community. DC: They are not likely able to be saved; you should look at that closely. Peter: We will take a look; we have an arborist. JK: There is a lot of phasing, a lot of things going on. Peter: There is an intense interest in the interim period being acceptable. DC: Present information on the sidewalks and plantings in Committee.

DS: Keep the BWH building massing in line with 70 Francis; it's important to step to the scale of the community. AL: I agree. DS: I'm not sure what the aesthetic is with the Fenwood Inn - it's like an institutional Deco. Maybe it should be even more residential. ML: We considered that, but were concerned about durability. DS: It feels like an old relic that doesn't fit well...a contextual building...that doesn't fit. Peter: Let us show you photos of brick buildings in the area. DM: This is a complex program. You impact an enormous amount of streetscape. The view corridors are incredibly important. On the corridors: some should go through, some should terminate. The relationship between the three largest buildings, the Shapiro Building being one - the latter is so deliberate across Vining. I don't see (the connection). And then for the residential vs. the research - I'm not convinced there either. The pieces are where they are, I'm not arguing that. It really feels like the site plan are these three (plus) large buildings. The Binney Building fits, in many ways. I'm looking for more connections on the others.

DH: A model is needed before you come to Committee. I'm not sure that's the norm, but it is needed. AL: A broader context is needed. The massing strategy for the BWH building, the 3 slabs coming to an edge, is respectful of the Neville House, but nothing else. There are many other ways to do it; it needs more looking at. Adjusting the footprint might also open up view corridor possibilities. There are ways to arrange the SF and plan you need. DH: The issue of the bridge should be resolved. DAC: Yes - The BCDC approved the bridge at 70 Francis, but they presented clear arguments for the need for the bridge as part of the resolution. LE: The desire lines are unclear. And during the phasing...I want to protect the pedestrian and view corridors through the site.

DH asked about the process. DAC explained that it was complex, but that the BCDC and BRA would be asked to approve the two smaller buildings, while the two larger buildings would eventually return with more detail as an IMP (the BWH building) and PDA (the RTH building), but the site plan holding it all together and the massing would have to be resolved as well. DH: Comments?

Julie of the Friends of the Emerald Necklace noted that morning shadows would be significant at 15 stories. Is there any way to reduce them? Peter: We need the program shown. Julie: You can look at other massings. DH: Maybe that can be an agenda item in Committee. Julie: The smaller buildings are not so much a concern. Allison Pultinas of the Friends of Historic Mission Hill noted that the intersection (at Brookline) should get attention; a widening was proposed. The trees are suffering now, and have to be cared for if they are to be saved. Vining Street Extension now is a driveway; it should have sidewalks. Neville House doesn't face the Riverway; these buildings shouldn't turn their back. DH: Thanks. There should be more attention to the landscape architecture. With that, the MMHC Redevelopment Project was sent to Design Committee.

9.9 Boston Redevelopment Authority – David Carlson

BRADC.1 BCDC Process

The Proponent initially presented the Project to the BCDC on August 4, 2009 when the Project was sent to BCDC Design Committee for review. The Proponent has and will continue to meet with BCDC.

BRADC.2 Pedestrian and Streetscape Strategies

The Project includes plans to improve sidewalks adjacent to the Project Site. These improvements further the pedestrian connectivity efforts described above by enlivening pedestrian experience for those moving through and adjacent to the Project Site from and to the residential neighborhood, the BWH campus and the Emerald Necklace. Please see Section 5.3 for a discussion of streetscape strategies. Wayfinding is addressed in Section 5.3.3.

The Proponent recognizes that a dedicated right-turn lane on the northbound approach to Brookline Avenue has been identified by the LMA, MASCO, and the City of Boston as having area wide benefits that will improve traffic flow both to the LMA as well as regionally. This right-turn lane is not proposed as part of the Project and the Project does not trigger the need for the right-turn lane. However, the Project has been designed so that future implementation of the right-turn lane improvement by others will not be precluded.

BRADC.3 Connection to the Neighborhood

The proposed development can be understood as the logical completion and extension of the neighboring RTH Mission Park community to the south and southeast, and the BWH campus to the north and east. Please see Section 5.2.1 for a description of the Project's connections to the adjacent land uses.

BRADC.4 Campus Signage Plan

Section 5.3.3 addresses wayfinding for the Project and discusses the Project's relationship with BWH's campus signage goals.

BRADC.5 Campus-wide Transportation and Infrastructure Systems

Chapter 3.0 addresses BWH campus-wide transportation. BWH campus-wide infrastructure systems are addressed in the 2010 BWH IMP to be submitted to the BRA in October 2009.

BRADC.6 Campus Connections and Open Space

Project open space is described in Section 5.4.1. BWH campus connections are described in the BWH 2010 IMP to be submitted to the BRA in October 2009.

BRADC.7 Binney Street Corridor

Section 5.2.2 describes the Binney Street Corridor.

BRADC.8 Conformance with the LMA Interim Guidelines

Please see Section 5.4.2.1 for a discussion of the LMA Guidelines.

BRADC.9 Urban Design Materials

Urban design materials and graphics are provided in this Draft EIR/PIR. Additional urban design material will be presented to the BRA Design Staff and BCDC.

BRADC.10 Daylight and Shadow Analyses

Please see Sections 4.2 and 4.3 for the shadow and daylight analyses, respectively.

BRADC.11 Infrastructure Systems Component

Please see Chapter 7 for the Infrastructure section.

BRA MEMORANDUM

TO: Sonal Gandhi

FROM: Katie Pedersen

DATE: July 22, 2009

RE: Massachusetts Mental Health Center Redevelopment
Boston, Massachusetts
Comments on Project Notification Form/Institutional Master Plan Notification Form

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I have reviewed the Plan Notification Form (PNF)/ Institutional Master Plan Notification Form dated June 16, 2009 and submit the following comments for the Environmental Protection Component. The Brigham and Women's Hospital, Inc. (the "Proponent") and Partners HealthCare System, Inc., in association with the Roxbury Tenants of Harvard Association, Inc. are proposing to redevelop the 2.39 acre Massachusetts Mental Health Center complex on Fenwood Road and Vining Street and the .29 acre Binney Street site at the corner of Binney Street and Francis Street (the "Site"). The Proponent proposes the demolition of the existing buildings located the Site and the construction of four buildings (totaling 633,960 square feet) to house residential, parking, clinical, inpatient, research and office uses (the "Proposed Project").

<u>Wind</u>

In general, the Boston Redevelopment Authority (BRA) has adopted two standards for assessing the relative wind comfort of pedestrians. First, the BRA wind design criterion states that an effective gust velocity of 31 mph should not be exceeded more than one percent of the time. The second set of criteria used by the BRA to determine the acceptability of specific locations is based on the work of Melbourne. The placement of wind measurement locations shall be based on an understanding of the pedestrian use of the Proposed Project and the surrounding area. All wind tunnel test point points shall be approved by the BRA staff before conduction of testing. This set of criteria is used to determine the relative level of pedestrian wind comfort for activities such as sitting, standing or walking. BRAKP.1

Measurement points for this PLW analysis should be placed at all building entrances, entrances to public transportation stations, crosswalks and public sidewalks, public plazas and gathering areas, parks and green spaces

Analysis of results and effective mitigation should be presented in the Draft Project Impact Report (DPIR) using diagram methodology so that the delta or changes manifested by the Proposed Project relative to existing or as-of-right conditions (whichever provides the higher base impacts) are clearly understood.

Shadow

The shadow impact analysis must include net new shadow from the Proposed Project as well as existing shadow and clearly illustrate the incremental impact of the Proposed Project. For purposes of clarity, the Proponent shall be directed to consider the use of color as an alternative to dark tonality to indicate new shadows. The shadow impact study area shall include, at a minimum, the entire area to be encompassed by the maximum shadow expected to be produced by the Proposed Project. The build condition(s) shall include all buildings under construction and any proposed buildings anticipated to be completed prior to the completion of the Proposed Project. Shadows from all existing buildings within the shadow impact study area shall be shown. A North Arrow shall be provided on all figures. Shadows shall be determined by using the applicable Boston Azimuth and Altitude data. BRAKP.2

Particular attention shall be given to existing or proposed public open spaces and pedestrian areas, including, but not limited to, the existing sidewalks and pedestrian walkways within, adjacent to, and in the vicinity of the Proposed Project and the existing and proposed plazas, historic resources, in particular the Olmsted Park system and other open space areas within the vicinity of the Proposed Project.

Daylight

The Proponent shall conduct a daylight analysis for both build and no-build conditions. The analysis shall measure the percentage of skydome obstructed by the Proposed Project and evaluate the net change in obstruction. Since project alternative massing studies are requested as part of the Article 80 Development Review Process, daylight analysis of such alternatives shall also be conducted for comparison. The study shall treat the following elements as controls for data comparison: existing conditions, the context examples, and the as-of right conditions. Particular attention shall be given to existing or proposed public open spaces and pedestrian areas, including, but not limited to, the existing sidewalks and pedestrian walkways within, adjacent to, and in the vicinity of the Proposed Project and the existing and proposed plazas, historic resources, in particular the Olmsted Park system and other open space areas within the vicinity of the Proposed Project. BRAKP.3

Daylight analyses should be taken for each major building façade within the limits of the Boston Redevelopment Authority Daylight Analysis (BRADA) program, fronting these public and quasi-public ways. The midpoint of each public accessway or roadway should be taken as a study point.

Solar Glare

The Proponent has stated that the Proposed Project is not expected to incorporate the use of reflective building material. Consequently, the Proponent does not anticipate the creation of either an adverse solar glare impact or a solar heat buildup in nearby buildings. The Proponent shall demonstrate that the glass selected will avoid the creation of a visual nuisance and/or a hazard, as it interferes with vision and concentration. BRAKP.4

However, should the design change and incorporate substantial glass-facades, a solar glare analysis shall be required. The analysis shall measure potential reflective glare from the buildings onto potentially affected streets and public open spaces and sidewalk areas in order to determine the likelihood of visual impairment or discomfort due to reflective spot glare. Mitigation measures to eliminate any adverse reflective glare shall be identified.

Air Quality

The Proponent shall provide a description of the existing and projected future air quality in the Proposed Project vicinity and shall evaluate ambient levels to determine conformance with the National Ambient Air Quality Standards (NAAQS). Careful consideration shall be given to mitigation measures to ensure compliance with air quality standards. BRAKP.5

A future air quality (carbon monoxide) analysis shall be required for any intersection (including garage entrance/exits) where the level of service (LOS) is expected to deteriorate to D and the Proposed Project causes a 10 percent increase in traffic or where the level of service is E or F and the Proposed Project contributes to a reduction in LOS.

The study shall analyze the existing conditions, future No-Build and future Build conditions, for all Project Alternatives. The methodology and parameters of the air quality analysis shall be approved in advance by the Boston Redevelopment Authority (BRA) and the Massachusetts Department of Environmental Protection (DEP). Mitigation measures to eliminate or avoid any violation of air quality standards shall be described.

A description of the Proposed Project's heating and mechanical systems including location of buildings/garage intake and exhaust vents and specifications, and an analysis of the impact on pedestrian level air quality and on any sensitive receptors from operation of the heating, mechanical and exhaust systems, including the building's emergency generator as well as the parking garage, shall be required. Measures to avoid any violation of air quality standards shall be described.

Noise

The Proponent shall establish the existing noise levels at the Proposed Project site and vicinity and shall calculate future noise levels after project completion, thus demonstrating compliance with the Interior Design Noise Levels (not to exceed day-night average sound level of 45 decibels) established by U.S. Department of Housing and Urban Development, as well as applicable City, State and Federal noise criteria. BRAKP.6

The Proponent has stated that mechanical equipment such as chillers, garage exhaust fans, and emergency generators have the potential to cause nuisance levels of noise. Due to the Proposed Project's proximity to an adjacent residential neighbors appropriate low-noise mechanical equipment and noise control measures will be required in accord with the Regulations for Control of Noise in the City of Boston and the Commonwealth of Massachusetts. The Proponent shall also describe any other measures necessary to minimize and/or eliminate adverse noise impacts from the Proposed Project.

Solid and Hazardous Waste

The Proponent shall provide a list of any known or potential contaminants on the Proposed Project site, and if applicable, a description of remediation measures to ensure their safe removal and disposal, pursuant to the M.G.L., Chapter 21E and the Massachusetts Contingency Plan. BRAKP.7

Any potential hazardous wastes to be generated by the Proposed Project site must be identified. In addition, potential waste generation must be estimated and plans for disposal indicated and measures to promote reduction of waste generation and to promote recycling in compliance with the City's recycling program described.

Geotechnical Impacts

A description and analysis of the existing sub-soil conditions, including the potential for ground movement and settlement during excavation and potential impact on adjacent buildings and utility lines shall be required. This analysis shall also include a description of the foundation construction methodology, the amount and method of excavation, and the need for any blasting and/or pile driving and the impact on adjacent buildings and infrastructure. A Vibration Monitoring Plan shall be developed prior to commencing construction activities to ensure that impacts from the project construction on adjacent buildings and infrastructure are avoided. Mitigation measures to minimize and avoid damage to adjacent buildings and infrastructure must be described. BRAKP.8

Sustainable Design/Green Buildings

The purpose of Article 37 of the Boston Zoning Code is to ensure that major buildings projects are planned, designed, constructed and managed to minimize adverse environmental impacts; to conserve natural resources; to promote sustainable development; and to enhance the quality of life in Boston. Any proposed project subject to the provisions of Article 37 shall be LEED Certifiable (U.S. Green Buildings Council) under the most appropriate LEED rating system. Proponents are encouraged to integrate sustainable building practices at the pre-design phase. Proposed Projects which are subject to comply with Section 80B of the Boston Zoning Code, Large Project Review, shall be subject to the requirements of Article 37. BRAKP.9

The Proposed Project consists of multiple buildings and accordingly the Proponent shall be required to submit separate LEED checklists, together with explanatory narratives demonstrating compliance with specific points. The Proponent shall also demonstrate that the Proposed Project will meet the requirements of Article 37 with appropriate supporting documentation and by certification from a LEED Accredited Professional.

9.10 Boston Redevelopment Authority – Katie Pedersen

BRAKP.1 Wind Impact Analysis

Please see Section 4.1 for the wind analysis.

BRAKP.2 Shadow Impact Analysis

Please see Section 4.2 for the shadow analysis.

BRAKP.3 Daylight Obstruction Analysis

Please see Section 4.3 for the daylight analysis.

BRAKP.4 Solar Glare

Please see Section 4.4 for a discussion of solar glare.

BRAKP.5 Air Quality

Please see Section 4.5 for the air quality analysis.

BRAKP.6 Noise

Please see Section 4.8 for the noise analysis.

BRAKP.7 Solid and Hazardous Waste

Please see Section 4.7 for a discussion of solid and hazardous wastes.

BRAKP.8 Geotechnical Impacts

Please see Section 4.9 for a discussion of geotechnical impacts.

BRAKP.9 Sustainable Design/Green Buildings

Please see Section 4.11 and Appendix F for a discussion of compliance with Article 37 and the LEED certification standards.

August 11, 2009

Sonal Gandhi
Boston Redevelopment Authority
One City Hall Square, 9^{th} Floor
Boston, MA 02201

RE: Massachusetts Mental Health Center Redevelopment – Project Notification Form/Institutional Master Plan Notification Form

Dear Ms. Gandhi,

Thank you for the opportunity to comment on the Project Notification Form/Institutional Master Plan Notification Form (PNF/IMPNF) for the Massachusetts Mental Health Center Redevelopment. The proposal includes four buildings on three sites: a Residential Building with approximately 136 units of mostly affordable housing, to be developed by the Roxbury Tenants of Harvard; a Brigham and Women's Building with 358,670 square feet of space for research and development, clinical and office uses; a building on Binney Street with 56,540 square feet of clinical and office space; and a Partial Hospital/Fenwood Inn Building with 30 residential units, an 8,260 square foot outpatient clinic, and a "partial hospital" (a link between inpatient and outpatient mental health treatment).

The proposal also includes a 406-space parking garage to be located below the Brigham and Women's Building. Under the current plan, 90 parking passes would be provided by Brigham and Women's for the new residential units in the nearby Mission Park Garage.

The Residential Building and the Brigham and Women's Building would be constructed on the site of the former Massachusetts Mental Health Center, which contains five vacant buildings and approximately 163 surface parking spaces that are currently leased by the Department of Capital Asset Management (DCAM) to Brigham and Women's Hospital.

The project would be built in phases, with the Binney Street Building and the Partial Hospital/Fenwood Inn building to be constructed upon completion of permitting, and the Residential Building and the Brigham and Women's Building to be constructed in a subsequent phase when capital is available. The Brigham and Women's Building must be completed within 10 years of the completion of the Binney Building under the terms of the development agreement with DCAM.

As a next step, the proponent will be required to develop an Institutional Master Plan (IMP) and a Draft Project Impact Report (DPIR) that responds to the scope of work outlined by the Boston Transportation Department (BTD). Analysis performed by the proponent will lead to a Transportation Access Plan Agreement (TAPA), which will codify the project's transportation-related elements, including mitigation items. To further the discussion that will lead to the TAPA, the following comments identify issues needing clarification, additional submissions, and proposed mitigation items.

Parking

Parking in the Longwood Medical Area is a challenge for the City, the neighborhood, and the medical institutions that are so critical to the region's economy. Too much parking encourages driving and exacerbates traffic congestion. Too little parking puts pressure on parking in adjacent neighborhoods and could hinder job recruitment. BTD intends to work closely with the proponent to determine the minimum amount of parking needed to support this development, taking into account capacity in existing lots and garages, and assuming implementation of aggressive and effective parking demand management strategies, as described below.

Number of Spaces

The proponent is proposing to construct a 406-space underground parking garage in conjunction with the Brigham and Women's Building in the second phase of the project. This represents a rate of 0.65 parking spaces per thousand square feet of development. Parking for the Residential Building would be provided in the existing Mission Park Garage. The spaces displaced by the residential parking would be relocated in the new parking garage.

In the interim phase before the Brigham and Women's Building is completed, the proposal is to provide 50 parking spaces for the Department of Mental Health on the project site as surface parking or in the adjacent Servicenter Garage. The existing site has 163 surface parking spaces.

The IMPNF notes that starting in October, 2009 Brigham and Women's Hospital will control 650 spaces in the Servecenter Garage, an increase of 580 spaces from the 70 spaces it currently leases from MASCO.

To clarify future parking needs, the proponent should analyze the existing parking supply and BTD.1
utilization, and predicted supply and demand at four stages: 1) During construction of the first phase; 2) After the first phase is completed; 2) During the interim between the first phase and construction of the Brigham and Women's Building; and 3) After construction of the Brigham and Women's Building. The potential for accommodating parking demand in appropriately remote facilities should be included in the analysis.

The parking analysis should also include a description of proposed parking policies and pricing in the proposed underground garage, including allowable users, allocation of spaces among users, permits and leases, public parking, reserved and dedicated spaces, shared parking strategies, fee structures/rates, discounts, and cash-out (see below) policies.

Parking Demand Management

BTD commends Brigham and Women's Hospital for providing remote parking facilities for its employees and offering a parking rate structure that makes it advantageous for employees to park outside of the LMA. Future submittals should provide more details on the parking rate structure, BTD.2
and efforts to make use of additional appropriately remote parking facilities.

BTD encourages the proponent to take parking demand management a step further by BTD.3
implementing a "cash-out" program for employees that receive parking as part of their compensation packages. Employees that accept the parking cash-out would agree to commute by methods that don't require parking and would receive a cash allowance equal to the employer paid parking subsidy. This would reduce the demand on existing parking and would also reduce congestion on City streets.

Spaces for Car Share and Low Emission Vehicles

The IMPNF notes that Brigham and Women's will explore the opportunity to provide for a car-sharing service such as Zipcar in the Servicenter Garage. To encourage a reduction in personal BTD.4
automobile use, the proponent should provide spaces provided for car-share services and for carpool, vanpool, and shuttle service parking.

Current trends indicate that electric hybrids will soon be a significant percentage of all vehicles on the road. BTD is aggressively promoting the installation of a supporting infrastructure for these vehicles. We request a commitment to dedicate 5% of the total vehicle parking capacity for BTD.5
low-emitting and fuel efficient vehicles, and a commitment to provide dedicated electric vehicle charging stations.

Service and Loading

As noted in the IMPNF, Brigham and Women's Hospital is proposing to use existing loading and service areas located in the Servicenter Loading Dock at 89 Fenwood Road, at the West Plaza Loading Dock at 20 Shattuck Street, and at the Thorn Building (50 Shattuck Street). The site plan also shows a loading area for the Partial Hospital/Fenwood Inn off of Vining Street, a service entrance for the Brigham and Women's Building off the Vining Street extension, and a service entrance for the Residential Building off Fenwood Road. More information is needed to BTD.6
evaluate the service area for the Residential Building, such as the need for a curb cut, and confirmation that sufficient space is provided to ensure that service vehicles do not block the sidewalks.

Public Transportation

The project site is well served by public transportation, with ready access to buses along Brookline, Longwood and Huntington avenues and Greenline D and E Line trolleys. To promote the use of public transportation, Brigham and Women's provides a 50 percent subsidy to the cost of MBTA and commuter rail passes for employees.

In addition, as a member of MASCO, Brigham and Women's Hospital supports ten bus routes that provide service within one-half mile of the project site.

BTD comments the efforts of Brigham and Women's Hospital to promote the use of mass transit and public transportation. As a further incentive to encourage mode shift, we encourage the BTD.7 proponent to institute a program used by other area hospitals in which free transit passes are provided to employees who give up their parking spots for three months under a "Three for Free" program.

Traffic

A detailed, empirically-based estimate of future trip generation based on resident, employment and patient projections and a comprehensive review of existing conditions will be required for each phase of this project. At a minimum, the evaluation should include analysis of the BTD.8 following intersections:

- Longwood Avenue and Riverway
- Longwood Avenue and Brookline Avenue
- Longwood Avenue and Binney Street
- Longwood Avenue and Huntington Avenue
- Francis Street and Brookline Avenue
- Francis Street and Binney Street
- Francis Street and Vining Street
- Francis Street and Huntington Avenue
- Riverway and Brookline Avenue
- Fenwood Road and Brookline Avenue
- Fenwood Road and Binney Street
- Fenwood Road and Vining Street
- Fenwood Road and Huntington Avenue
- Vining Street Extension and Vining Street

Counts at these intersections shall include bicycle and pedestrian counts as well as vehicular counts.

Pedestrian Access

Given the number of people who walk to destinations in this area or combine transit with walking, it is important to provide a safe and inviting pedestrian environment along any sidewalks impacted by this project. BTD is most interested in streetscape improvements (including generous sidewalks and street trees), wayfinding and signage, and enhancements to pedestrian access and connectivity to the campus. Future submittals should describe these and provide pedestrian counts and projections along major pedestrian routes to the buildings. BTD.9

Bicycle Access

The project site is located between two major links in the City's off-road bicycle network – the Southwest Corridor and Riverway portion of the Emerald Necklace. As the City expands its network of on-street facilities and makes connections to these off-road paths, bicycle ridership is expected to increase. In addition, the City is working with MAPC and neighboring cities to launch a bike share program in the spring of 2010, with an expected 1,500 to 3,000 bicycles to be located in the metropolitan area. These efforts are expected to dramatically increase bicycle ridership in the City over time.

Future submittals should describe the existing accommodations for bicycles (including the location and number of bike racks and bike cages) and any proposed improvements to the accommodations. The site plans must include secure covered bike parking spaces for residents and employees, and covered or open outdoor bike parking spaces for patrons and visitors. The IMP should also consider provision of spaces for bike share facilities, and potential bike share locations. All spaces must be conveniently located near building entrances. BTD is in the process of updating its Bicycle Facilities Policy that addresses the minimum number of spaces required – the draft new policy is attached. BTD.10

To encourage commuting by bicycle, the project must also include shower facilities that are available for use by all building employees.

Transportation Demand Management

The PNF/IMPNF briefly describes TDM measures currently implemented by Brigham and Women's Hospital. BTD looks forward to reviewing a more detailed description of the program and new measures proposed to improve the effectiveness and comprehensiveness of the program. Using the existing program as a foundation, BTD will work with the proponent to determine the specifics to be codified in the TAPA.

Site Plan

The proponent needs to submit an engineered site plan within the context of the surrounding roadways at 1:20 scale depicting: BTD.11

- Vehicular Access and Circulation
- Parking Layout and Circulation
- Pedestrian Access and Circulation
- Bicycle Access and Circulation
- Shuttle/Van Pool Pickup and Dropoff
- Parking Spaces for Car Sharing services
- Service and Loading*
- Roadways and Sidewalks
- Building Layout
- Bicycle Parking Locations and Types (covered, indoor, bike share, etc)
- Transit Stops and Connections
- Electric Vehicle Charging Stations

* *Trash compactors/dumpsters need to be depicted as well.*

Construction Management Plan

As the project advances, the proponent will be required to develop and submit a detailed Construction Management Plan (CMP) to BTD for review and approval. The CMP will address TDM measures for construction workers, proposed street occupancies, equipment stating, sidewalk relocations and hours of construction work. BTD will work with the proponent to execute the CMP. BTD.12

Sincerely,

Charlotte Fleetwood
Transportation Planner
Boston Transportation Department
Policy and Planning Division

Cc: Vineet Gupta, Director of Policy and Planning
John DeBenedictis, Director of Engineering

9.11 Boston Transportation Department

BTD.1 Analyze parking

A detailed parking analysis is provided in Section 3.3.6 of the Draft EIR/PIR.

BTD.2 Remote parking facilities

BWH will need to use remote parking facilities to meet all of its anticipated parking demand at the Project. This is discussed in more detail in Section 3.3.6 of the Draft EIR/PIR.

BTD.3 "Cash out" program

Through MASCO, BWH offers a parking program similar to a "cash-out" program which allows BWH employees who currently drive to work alone to try using public transit risk free, and have CommuteWorks help pay for it. The Longwood T Party Program allows drive-alone commuters to put their parking spaces on hold for three months to try public transportation and receive up to $333 in incentives. Eligible employees will receive $65 per month in commuter checks to use towards the purchase of transit passes and reimbursement for up to $46 per month for parking costs at transit stations.

BTD.4 Car-sharing parking

BWH is committed to exploring the feasibility of including additional car sharing opportunities within its parking system in connection with the proposed Project. BWH looks forward to continuing these discussions with the BTD as part of the preparation, review and execution of a Transportation Access Plan Agreement (TAPA) in connection with the Project.

BTD.5 Electric hybrid parking and electric vehicle charging stations

BWH is committed to exploring the feasibility of including preferential parking and electric charge stations in connection with the implementation of the proposed Project. BWH looks forward to continuing these discussions with the BTD as part of the preparation, review and execution of a Transportation Access Plan Agreement (TAPA) in connection with the Project.

BTD.6 Residential building service area

Loading for the Residential Building is provided in Section 3.3.7 of the Draft EIR/PIR.

BTD.7 "Three for Free" program

The Longwood T Party Program, offered through MASCO, allows BWH drive-alone commuters to put their parking spaces on hold for three months to try public transportation and receive up to $333 in incentives. Eligible employees will receive $65 per month in commuter checks to use towards the purchase of transit passes and reimbursement for up to $46 per month for parking costs at transit stations.

BTD.8 Intersections

Intersection level of service analysis is provided in Chapter 3 of the Draft EIR/PIR for the intersections included in the BTD Scoping Letter.

BTD.9 Pedestrian environment

Existing pedestrian counts are provided in Figures 3-6 and 3-7 in the Draft EIR/PIR. Proposed pedestrian improvements are discussed in Section 3.5.

BTD.10 Bicycle environment and facilities

An inventory of existing bicycle facilities is included in Section 3.2.1.6. Section 3.5 discussed planned bicycle storage as part of the Project.

BTD.11 Engineered site plan

BTD will be provided with a 20-scale site plan under separate cover.

BTD.12 Construction management plan

BWH and RTH will prepare a Construction Management Plan as required by the Boston Transportation Department.

Boston Water and Sewer Commission

980 Harrison Avenue
Boston, MA 02119-2540
617-989-7000

July 23, 2009

Secretary Ian Bowles
Executive Office of Environmental Affairs
MEPA Office
Attn: William Gage
100 Cambridge Street
Suite 900
Boston, MA 02114

and

Ms. Sonal Gandhi
Senior Project Manager
Boston Redevelopment Authority
One City Hall Square
Boston, MA 02201

Re: Massachusetts Mental Health Center Redevelopment
Project Notification Form/Institutional Master Plan Notification Form,
Environmental Notification Form

Dear Secretary Bowles and Ms. Gandhi:

The Boston Water and Sewer Commission (Commission) has reviewed the Project Notification Form (PNF) and the Institutional Master Plan Notification Form (IMPNF), and the Environmental Notification Form (ENF) for the proposed Massachusetts Mental Health Center Redevelopment Project in the Roxbury District of Boston. This letter provides the Commission's comments on the PNF, IMPNF, and ENF.

The proposed project is located on two sites which together comprise 2.68 acres. The first site, Massachusetts Mental Health Center (MMHC) site, consists of 2.39-acres formerly occupied by the MMHC Complex on Fenwood Road and Vining Street. The MMHC site currently contains five vacant buildings containing 190,000 gross square feet and is currently run by the Massachusetts Department of Mental Health. The site is bounded to the northwest by Brookline Avenue, to the west by The Riverway, to the northeast by Francis Street, and to the southeast by Vining Street. The second site, the Binney Street site, is a 0.29-acre area bounded to the northeast by Francis Street and southwest by Fenwood Road and is currently occupied by vacant construction trailers used by the Brigham and Women's Hospital (BWH).

The proposed project consists of the demolition of five existing buildings located on the MMHC site and the relocation of the construction trailers currently located at the Binney Street site in order to construct four buildings of approximately 633,960 square feet (sf), ranging in height from approximately 40 to 220 feet. The proposed project will include residential, clinical, inpatient, research, and office uses, including replacement space for the MMHC, possible community space, and the removal of 163 surface parking spaces. The proposed development will contain 406 underground parking spaces located beneath the proposed BWH building which will be constructed during this project. This will result in a net gain of 243 parking spaces.

According to the PNF, IMPNF and ENF, the proposed sanitary sewer discharge is 99,180 gallons per day (gpd) and the project is expected to generate approximately 109,100 gpd of water demand. For water service, the site is served by an 8-inch low service water main in Vining Street, a 8-inch low service and 12-inch low service main in Fenwood Road, and a 12-inch low service water main in Binney Street. There is a 30-inch low service transmission main in Vining Street and a 30-inch transmission main in Fenwood Road. The Commission will not permit the proponent to connect to the 30-inch main for fire protection or domestic water services. BWSC.1

According to the PNF, ENF and IMPNF, there is a 12-inch sewer in Fenwood Road and a 12-inch sewer in Vining Street. These discharge to the Brookline Sewer and ultimately to the MWRA Deer Island Waste Water Treatment Plant. The Commission recently replaced a portion of the 12-inch sewer on Fenwood Road with a new 15-inch sewer.

For storm drain service, there is a 36-inch storm drain in Fenwood Road and a 15-inch storm drain in Vining Street.

The Commission has the following comments regarding the PNF, IMPNF and ENF:

General

1. Prior to demolition of the buildings, all water, sewer and storm drain connections to the buildings must be cut and capped at the main pipe in accordance with the Commission's requirements. The Developers, the Brigham and Women's Hospital, Inc, Partner's HealthCare System, Inc., and the Roxbury Tenants of Harvard Association, Inc., must then complete a Termination Verification Approval Form for a Demolition Permit, available from the Commission and submit the completed form to the City of Boston's Inspectional Services Department before a demolition permit will be issued. BWSC.2

2. All new or relocated water mains, sewers and storm drains must be designed and constructed at the Brigham and Women's Hospital, Inc, Partner's HealthCare System, Inc., and the Roxbury Tenants of Harvard Association, Inc. expense. They must be designed and constructed in conformance with the Commission's design standards, Water Distribution System and Sewer Use Regulations, and Requirements for Site Plans. To assure compliance with the Commission's requirements, the Brigham and Women's BWSC.3

Hospital, Inc, Partner's HealthCare System, Inc., and the Roxbury Tenants of Harvard Association, Inc. must submit a site plan and a General Service Application to the Commission's Engineering Customer Service Department for review and approval when the design of the new water and wastewater systems and the proposed service connections to those systems are 50 percent complete. The site plan should include the locations of new, relocated and existing water mains, sewers and drains which serve the site, proposed service connections as well as water meter locations.

3. The Department of Environmental Protection, in cooperation with the Massachusetts Water Resources Authority and its member communities, are implementing a coordinated approach to flow control in the MWRA regional wastewater system, particularly the removal of extraneous clean water (e.g., infiltration/ inflow (I/I)) in the system. In this regard, DEP has been routinely requiring proponents proposing to add significant new wastewater flow to assist in the I/I reduction effort to ensure that the additional wastewater flows are offset by the removal of I/I. Currently, DEP is typically using a minimum 4:1 ratio for I/I removal to new wastewater flow added. The Commission supports the DEP/MWRA policy, and will require the Brigham and Women's Hospital, Inc, Partner's HealthCare System, Inc., and the Roxbury Tenants of Harvard Association, Inc. to develop a consistent inflow reduction plan. BWSC.4

The 4:1 reduction must be addressed at least 90 days prior to activation of water service and will be based on the estimated sewage generation provided with the project site plan.

4. The Brigham and Women's Hospital, Inc, Partner's HealthCare System, Inc., and the Roxbury Tenants of Harvard Association, Inc. should be aware that the US Environmental Protection Agency issued a draft Remediation General Permit (RGP) for Groundwater Remediation, Contaminated Construction Dewatering, and Miscellaneous Surface Water Discharges. If groundwater contaminated with petroleum products, for example, is encountered, will be required to apply for a RGP to cover these discharges. BWSC.5

5. A Groundwater Conservation Overlay District has been developed and this project is located within it. This district is intended to promote the restoration of groundwater levels and reduce the impact of surface water runoff. The applicant for a building permit will be required to construct a structure capable of retaining a specific amount of stormwater accumulated on the site. This retention structure would be designed to direct the stormwater towards the groundwater table for recharge. The Brigham and Women's Hospital, Inc, Partner's HealthCare System, Inc., and the Roxbury Tenants of Harvard Association, Inc. should contact the Inspectional Services Department for further information. BWSC.6

Water

1. The Brigham and Women's Hospital, Inc, Partner's HealthCare System, Inc., and the Roxbury Tenants of Harvard Association, Inc. should provide separate estimates of peak and continuous maximum water demand for residential, commercial, industrial, irrigation of landscaped areas, and air-conditioning make-up water for the project with the site plan. Estimates should be based on full-site build-out of the proposed project. The Brigham and Women's Hospital, Inc, Partner's HealthCare System, Inc., and the Roxbury Tenants of Harvard Association, Inc. should also provide the methodology used to estimate water demand for the proposed project. BWSC.7

2. In addition to the water conservation measures required by the Massachusetts Plumbing Code and listed in the Brigham and Women's Hospital, Inc, Partner's HealthCare System, Inc., and the Roxbury Tenants of Harvard Association, Inc. should also consider implementing other water saving measures where appropriate. Public restrooms should be equipped with sensor-operated faucets and toilets. BWSC.8

3. The Brigham and Women's Hospital, Inc, Partner's HealthCare System, Inc., and the Roxbury Tenants of Harvard Association, Inc. are required to obtain a Hydrant Permit for use of any hydrant during the construction phase of this project. The water used from the hydrant must be metered. The Brigham and Women's Hospital, Inc, Partner's HealthCare System, Inc., and the Roxbury Tenants of Harvard Association, Inc. should contact the Commission's Operations Division for information on and to obtain a Hydrant Permit. BWSC.9

4. If potable water is to be used for irrigation of the landscaped areas, the amount should be quantified. If the Brigham and Women's Hospital, Inc, Partner's HealthCare System, Inc., and the Roxbury Tenants of Harvard Association, Inc. plan to install a sprinkler system, the Commission suggests that timers, tension meters (soil moisture indicators) and rainfall sensors also be installed. The Commission strongly encourages the creation of landscape that requires minimal use of potable water. BWSC.10

5. The Commission is utilizing a Fixed Radio Meter Reading System to obtain water meter readings. For new water meters, the Commission will provide a Meter Transmitter Unit (MTU) and connect the device to the meter. For information regarding the installation of MTUs, the Brigham and Women's Hospital, Inc, Partner's HealthCare System, Inc., and the Roxbury Tenants of Harvard Association, Inc. should contact the Commission's Meter installation Department. BWSC.11

Sewage / Drainage

1. The Brigham and Women's Hospital, Inc, Partner's HealthCare System, Inc., and the Roxbury Tenants of Harvard Association, Inc. must submit to the Commission's Engineering Customer Service Department a detailed stormwater management plan which: BWSC.12

   - Identifies best management practices for controlling erosion and for preventing the discharge of sediment and contaminated groundwater or stormwater runoff to the Commission's drainage system when the construction is underway.

   - Includes a site map which shows, at a minimum, existing drainage patterns and areas used for storage or treatment of contaminated soils, groundwater or stormwater, and the location of major control or treatment structures to be utilized during the construction.

   - Provides a stormwater management plan in compliance with the DEP's standards mentioned above. The plan should include a description of the measures to control pollutants in stormwater after construction is completed.

2. Developers of projects involving disturbances of land of one acre or more will be required to obtain an NPDES General Permit for Construction from the Environmental Protection Agency and the Massachusetts Department of Environmental Protection. The Brigham and Women's Hospital, Inc, Partner's HealthCare System, Inc., and the Roxbury Tenants of Harvard Association, Inc. are responsible for determining if such a permit is required and for obtaining the permit. If such a permit is required, it is requested that a copy of the permit and any pollution prevention plan prepared pursuant to the permit be provided to the Commission's Engineering Customer Services Department, prior to the commencement of construction. The pollution prevention plan submitted pursuant to a NPDES Permit may be submitted in place of the pollution prevention plan required by the Commission provided the Plan addresses the same components identified in item 1 above. BWSC.13

3. The Commission encourages the Brigham and Women's Hospital, Inc, Partner's HealthCare System, Inc., and the Roxbury Tenants of Harvard Association, Inc. to explore additional opportunities for protecting stormwater quality on site by minimizing sanding and the use of deicing chemicals, pesticides, and fertilizers. BWSC.14

4. If the Brigham and Women's Hospital, Inc, Partner's HealthCare System, Inc., and the Roxbury Tenants of Harvard Association, Inc. seek to discharge dewatering drainage to the Commission's sewer system, they will be required to obtain a Drainage Discharge Permit from the Commission's Engineering Customer Service Department prior to discharge. BWSC.15

5. The Brigham and Women's Hospital, Inc, Partner's HealthCare System, Inc., and the Roxbury Tenants of Harvard Association, Inc. must fully investigate methods for retaining stormwater on-site before the Commission will consider a request to discharge stormwater BWSC.16

to the Commission's system. The site plan should indicate how storm drainage from roof drains will be handled and the feasibility of retaining their stormwater discharge on-site. Under no circumstances will stormwater be allowed to discharge to a sanitary sewer. The Commission encourages the proponent to explore utilization of green roof technologies.

6. Sanitary sewage must be kept separate from stormwater and separate sanitary sewer and storm drain service connections must be provided. BWSC.17

7. The Commission requests that the Brigham and Women's Hospital, Inc, Partner's HealthCare System, Inc., and the Roxbury Tenants of Harvard Association, Inc. install a permanent casting stating "Don't Dump: Drains to Charles River" next to any catch basin created or modified as part of this project. The Brigham and Women's Hospital, Inc, Partner's HealthCare System, Inc., and the Roxbury Tenants of Harvard Association, Inc. should contact the Commission's Operations Division for information regarding the purchase of the castings. BWSC.18

8. If a cafeteria or food service facility is built as part of this project, grease traps will be required in accordance with the Commission's Sewer Use Regulations. The Brigham and Women's Hospital, Inc, Partner's HealthCare System, Inc., and the Roxbury Tenants of Harvard Association, Inc. are advised to consult with Mr. Mark Medico, Deputy Superintendent of Special Projects, with regards to grease traps. BWSC.19

9. The enclosed floors of the parking garage must drain through oil separators into the sewer system in accordance with the Commission's Sewer Use Regulations. The Commission's Requirements for Site Plans, available by contacting the Engineering Customer Services Department, include requirements for separators. BWSC.20

10. Existing sewer and drain services not reused by the proponent shall be capped at the existing sewer main in conformance with the Commission's standards. BWSC.21

11. Though it is not anticipated for this project, the Commission requires that existing stormwater and sanitary sewer service connections, which are to be re-used by the proposed project, be dye tested to confirm they are connected to the appropriate system. BWSC.22

Thank you for the opportunity to comment on this project.

Yours truly,

John P. Sullivan, P.E.
Chief Engineer

JPS/ah

C: Arthur Mombourquette, The Brigham and Women's Hospital, Inc.
Timothy J. Pattison, Partners HealthCare System, Inc.
Girma Belay, Roxbury Tenents of Harvard Association, Inc.
~~Peter Munkenbeck, Roxbury Tenants of Harvard Association, Inc.~~
Michael Slezak, Linea 5
Michael Liu, The Architectural Team
Cindy Schlessinger, Epsilon Associates, Inc.
Kathleen Pedersen, BRA
M. Zlody, BED
P. Larocque, BWSC

9.12 Boston Water and Sewer Commission

BWSC.1 Connection for fire protection and domestic water services

No connection to the existing 30-inch main is proposed.

BWSC.2 Termination Verification Approval Form for Demolition Permit

The Proponent has initiated this process with Boston Water and Sewer Commission.

BWSC.3 New or relocated water mains, sewers and storm drains and General Service Application

The Proponent will be filing Site Plans as required by Boston Water and Sewer Commission prior to any site activities involving BWSC systems.

BWSC.4 Infiltration / Inflow

The Proponent has initiated coordination with the Boston Water and Sewer Commission regarding the removal of Infiltration/Inflow. A formal understanding will be reached in connection with BWSC site plan approval.

BWSC.5 Remediation General Permit

Comment noted.

BWSC.6 Groundwater

Although the Project Site is not located with the Groundwater Conservation Overlay District (GCOD) as shown in Figure 4.9-1, the Proponent will incorporate measures to ensure that area groundwater levels are maintained.

BWSC.7 Water Demand

An estimate of the expected water demand, inclusive of mechanical equipment, is provided in the Draft EIR/PIR. Irrigation demands can be provided at the time of the Site Plan approval, as the overall landscape plan is still undergoing development. Also provided in the Sustainability section is a description of water conservation measures.

BWSC.8 Water conservation

Please see Appendix F for water conservation targets. Low flow fixtures will be used.

BWSC.9 Hydrant Permit

Comment noted.

BWSC.10 Irrigation and sprinkler water.

Comment noted. Details concerning irrigation will be developed during design and presented to BWSC during the Site Plan approval process.

BWSC.11 Fixed Radio Meter System

Comment noted.

BWSC.12 Stormwater Management Plan

Please refer to the Draft EIR/PIR for a description of stormwater management strategies.

BWSC.13 NPDES General Permit

Based on the currently anticipated phasing, demolition of existing buildings and construction of the Residential Building and the Brigham and Women's Building will require the filing of a Notice of Intent under the NPDES regulations. As part of that Notice of Intent, the Contractor(s) will be required to prepare a detailed stormwater pollution prevention plan.

BWSC.14 Sanding, deicing chemicals, pesticides and fertilizers

The Proponent will evaluate these goals as part of on-going operations and maintenance as well as the selection of surface materials.

BWSC.15 Drainage Discharge Permit

Comment noted.

BWSC.16 Stormwater retention / green roof technologies

As discussed in the Draft EIR/PIR the Proponent is exploring numerous structural and Low Impact Design strategies to retain stormwater on-site.

BWSC.17 Separate stormwater and sanitary sewer

Comment noted. Stormwater and sanitary sewer systems will be kept separated.

BWSC.18 Don't dump castings

Don't dump castings will be provided at any new and/or modified catch basins for this Project.

BWSC.19 Grease traps

Comment noted.

BWSC.20 Oil separators

Comment noted.

BWSC.21 Cap old sewer and drain connections

The Proponent has initiated this process with Boston Water and Sewer Commission including the cutting and capping of existing connections.

BWSC.22 Dye test existing connections

Comment noted. The potential re-use of existing connections will be evaluated during final design and BWSC Site Plan approvals.

Boston Groundwater Trust

234 Clarendon St., Third Floor, Boston, MA 02116
617.859.8439 voice • 617.266.8750 fax
bostongroundwater.org

July 2, 2009

Ms. Sonal Gandhi, Senior Project Manager
Boston Redevelopment Authority
One City Hall Square
Boston, MA 02201-1007

Subject: Massachusetts Mental Health Center Redevelopment Project

Dear Ms. Gandhi:

Thank you for the opportunity to comment on the Project Notification Form for the MMHC Redevelopment Project. The Boston Groundwater Trust was established by the Boston City Council to monitor groundwater levels in sections of the City where the integrity of building foundations is threatened by low groundwater levels and to make recommendations for solving the problem. Therefore, my comments are limited to groundwater related issues.

As noted in the PNF, the project is not located in the Groundwater Conservation Overlay District. I appreciate the commitment, as stated in the document, that the project will be designed to ensure that area groundwater levels are maintained and to work with the Trust toward the achievement of this goal. In this case, that will require particular attention to the design of the multi-level underground garage planned for the Brigham and Women's building. I appreciate, as well, the response from the proponents at the scoping session that, to their knowledge, buildings in the vicinity are not supported on wood pilings. BGWT.1

I look forward to working with the Authority and the proponents to assure that their commitment to maintain groundwater levels is achieved.

Very truly yours,

Elliott Laffer
Executive Director

Cc: Kathleen Pedersen, BRA
Maura Zlody, BED

9.13 Boston Groundwater Trust

BGWT.1 Maintain groundwater levels

For construction of the buildings with below-grade space, temporary excavation support systems that are compatible with subsurface conditions will be designed in order to provide adequate support and protection of the adjacent streets and utilities and to maintain groundwater levels outside the excavation at or near pre-construction levels.

Although the Project Site is not located with the Groundwater Conservation Overlay District as shown in Figure 4.9-1, the Proponent will incorporate measures to ensure that area groundwater levels are maintained.

ASSESSING DEPARTMENT
Boston City Hall, Room 301, Boston, MA 02201

TO: Sonal Gandhi, Senior Project Manager
FROM: Matt Englander, Director of Tax Policy
DATE: August 19, 2009
RE: Mass Mental Health Center - Comments for IMP Scoping Determination

Boston residents are very fortunate to have some of the best hospitals, colleges & universities, museums, and other cultural attractions in their backyard. Partners HealthCare ("Partners"), who purchased the property from the state, will be funding the development phase, and managing a portion of the property upon completion, is one such world-class institution that adds to Boston's unparalleled medical landscape. However, when institutions like Partners expand or redevelop their property they increase their reliance on and demand for essential City services (police, fire, snow removal, etc). And while Partners attracts patients/residents from all over the word, it is the Boston taxpayers who must subsidize the cost of these services.

As Partners seeks to enhance their campus, I ask that they consider the impact on taxpayers by increasing their Payment-in-Lieu-of-Tax (PILOT) commitment. BAD.1

Should you or representatives from Partners have any questions related to this consideration please contact me at (617) 635-4797.

9.14 Boston Assessing Department

BAD.1 Payment-in-Lieu-of-Tax (PILOT) Commitment

BWH will meet with the Boston Assessing Department. Please see Section 1.3 for a discussion of taxes.

Charles River Watershed Association

Sonal Gandhi
Boston Redevelopment Authority
One City Hall Square
Boston, MA 02201

June 27, 2009

RE: Mass Mental Health Center Redevelopment

Dear Ms. Gandhi:

Charles River Watershed Association (CRWA) has reviewed the Project Notification Form/ Institutional Master Plan Notification Form (PNF/IMPNF) for the above referenced project. There are several project elements that we believe need further analysis and discussion in the Draft Project Impact Report (DPIR) and should be included in the BRA's Scoping Determination for the IMP in order to ensure that not only are all environmental impacts minimized and mitigated, but the development will in fact enhance the environment. The expanded development in the LMA is leading to numerous cumulative environmental strains that are addressed only in a limited way by site-specific planning and design review process. Assessing cumulative impacts and identifying appropriate mitigation is an important function of the Article 80 review process.

We provide comments specifically focused on hydrologic sustainability, and hope that they will assist the BRA and the project proponents as the planning and design evolves.

Stormwater Management

It is our understanding that the stormwater from this site drains, via the Boston Water and Sewer Commission's municipal storm drain system, into the Muddy River and out to the Charles River. Both of these waters are listed as Category 5 waters on the Massachusetts Integrated List of Waters, meaning they fail to meet state water quality standards. In addition, the Muddy River suffers from significant hydrologic impairments, having both major flooding problems and severe low flow problems. Construction on the Muddy River Restoration Project, which will include bank to bank dredging of the entire river as well as stream daylighting and wetlands restoration, is due to begin later this year, and reducing sediment loads is essential to protecting the value of this investment in flood protection and environmental restoration.

Most of the above problems are a direct result of stormwater discharges into the Muddy River. Any redevelopment that is proposed in areas that drain directly into the Muddy River system, therefore, needs to focus carefully on stormwater management issues, and should maximize opportunities to reduce peak storm flows, minimize imperviousness, maximize infiltration and capture sediments. The significant expenditure that is being made by the federal and state government, as well as by the City of Boston, to dredge and restore the Muddy River must be protected to the maximum extent possible. CRWA.1

The PNF / IMPNF document mentions that the DPIR will evaluate the project impact on the Muddy River but does not make any reference to putting together a stormwater management program to ensure that every effort will be made to protect the River from flooding and water quality impairments. Thus, it is our hope that the DPIR will study various alternatives to enhance stormwater management on the site so as to demonstrate how improvements will be made over the existing conditions. Stormwater management should aim to maximize infiltration, slow runoff from the site, maximize the use of vegetation, capture rooftop runoff for irrigation, and minimize sediment and nutrient loading. Project planning should also identify opportunities for recharge, and design buildings, open space and infrastructure to take advantage of these areas. Also the project design should attempt to maximize the tree canopy and vegetated areas, including green roofs, to reduce the heat island effect, improve air quality and increase evapo-transpiration. CRWA.2

While the infrastructure section of the PNF gives some details on the stormwater management controls that will be established, much more detail needs to be included in the DPIR since water related issues play a direct role in the project planning and design. Not only should the project be developed to meet the phosphorus reduction requirements of the Total Maximum Daily Load for Nutrients in the Lower Charles River Basin (TMDL) and the requirements of Boston Water and Sewer Commission, stormwater infrastructure design should focus on water quality improvements, especially reducing the sediment load to the river, and on reducing peak flows. A comprehensive approach to stormwater management should aim to restore the natural water cycle (i.e. ~10% of annual rainfall discharged from site as runoff; ~40% lost through evapotranspiration; ~50% recharged to shallow or deep storage). The project should examine opportunities to achieve specific standards such as the following: CRWA.3 CRWA.4

- Infiltrate flows from impervious cover for up to a 2 year storm,
- Reduce total annual runoff volume from the site by 50% over existing conditions
- Design site to maximize evapotranspiration (minimum of 20% vegetation cover overall)

We feel that the Article 80 Project Impact Review is the appropriate process for a full analysis of the stormwater management program. The IMP and DPIR should include specific, detailed information and alternatives analyses of stormwater management on the site. We urge the BRA to include the following in the scoping for the IMP and DPIR:

1. Assess the cumulative impact assessment of the overall project, including considerations such as overall changes in impervious cover, tree canopy, groundwater recharge, stormwater runoff, open space and water use; CRWA.5 CRWA.6
2. Provide soils and groundwater information, to the extent it is available, to determine opportunities for recharge; CRWA.7
3. Propose stormwater management goals, and designs to achieve these goals;

4. Detailed information about any surface stormwater management features such as swales, vegetative filter strips, rain gardens, permeable pavement or vegetated storage areas; CRWA.8
5. Expand the Urban Design and Sustainable Design sections to include goals to begin to restore the area's natural hydrology, to reduce stormwater flows into the Muddy River, and to increase the total urban tree canopy through street "greening"[1]. CRWA.9
6. An assessment of the opportunities to reduce even further the peak flows and volume of stormwater runoff, including estimates of the impacts in a one-year storm; CRWA.10
7. An assessment of how the site could meet DEP's stormwater management policy in its entirety, not just "to the maximum extent practicable;" CRWA.11
8. A plan to minimize the primary pollutants of concern for the Muddy River, sediments and nutrients; CRWA.12
9. A maintenance plan for the stormwater BMPs and an operations plan to minimize stormwater pollution. CRWA.13

Groundwater

The location of this project in an area of historic fill, and the ongoing problems throughout many areas of the City with groundwater levels, make it important that this aspect of the project be designed with the utmost care and in anticipation of any potential impacts. Although the project is not within the Groundwater Conservation Overlay District, the project needs to be designed to minimize groundwater impacts. Investigations should also include the potential seasonal changes in groundwater levels, CRWA.14 as well as potential effects on groundwater flow. In some areas of Boston, construction of sub-surface projects such as tunnels, underpasses and even building foundations have altered groundwater flow patterns, resulting over time in changes to ambient groundwater levels. Groundwater flows are extremely slow so alterations may occur over years.

The DPIR and the Scoping Determination for the IMP should include an assessment of groundwater flow directions, as well as a determination of whether those directional CRWA.15 flows change seasonally. If the project shows any potential for altering flows, either slowing or reducing flows into the Muddy River, or conversely reducing flows back into the ground during periods of high groundwater, or causing any groundwater "mounding," CRWA.16 the DPIR should document a mitigation plan for any such alterations. In addition, the DPIR should specify what source of water would be used should groundwater recharging CRWA.17 be necessary during or after construction. Finally, a detailed plan for the treatment and disposal of water from dewatering activities should be included in the DPIR. CRWA.18

[1] According to the "Green Streets" manual published by Metro OR, a "green" street is designed to incorporate a system of stormwater treatment within its right of way so as to minimize the quantity of water that is piped directly to streams or rivers.

Impacts to the Emerald Necklace

The project will increase not only the vehicular traffic in the area, but also the number of pedestrians, and will likely increase the use of the Emerald Necklace Parks, including the Fenway. This park system is already heavily used, and is in need of significant capital and operations improvements. Therefore the DPIR needs to ensure that the aesthetic and environmental opportunities to improve the Fenway are maximized to the extent possible. CRWA.19
It is advisable that the proponents coordinate their design efforts with the Department of Conservation and Recreation (DCR) especially with regard to its interface with the Fenway. CRWA.20

We also suggest that project proponents work with the BRA, the Boston Parks and Recreation Department, the Medical Academic and Scientific Community Organization (MASCO), the Fenway Alliance, and the Emerald Necklace Conservancy to develop a program to support the improvement of maintenance and management of the park system CRWA.21
to mitigate this increased use and to provide support for the community-wide effort that is underway to bring this park system up to an acceptable community standard. This contribution could be made as a linkage payment (as a part of the public benefits package) or through the implementation of a specific capital improvement project for improving access to and maintenance of the park or for environmental restoration CRWA.22
projects in the LMA as a whole. The mitigation package to be included in the DPIR should therefore provide details on both parkland improvements and well as street greening projects.

Sustainable Design

While there is significant commitment to sustainable design for the various buildings in the PNF document, there are no specifics provided on what kinds of best management CRWA.23
practices and technologies will be incorporated at the site level. The Scoping Determination for the IMP and the DPIR need to explicitly define what the project aims to achieve in terms of standards for environmental sustainability on the overall site level as well as how the project will determine indicators for sustainability. Also, while the LEED system provides one metrics for incorporating green building standards and requirements, there are only limited credits available for stormwater management in the LEED. Given that the adjacent Muddy River is a valuable ecological and community resource for the neighborhood, CRWA encourages the proponents to consider ecological CRWA.24
designs beyond the checklists of the LEED rating system when considering "greening" strategies for the site, landscape and the neighborhood more broadly.

We encourage the project proponents to expand the Environmental Protection and Urban Design section, and especially the Sustainable Design section, to include a broader discussion of and planning for water, especially stormwater management, and open CRWA.25
space. The proposed landscaped pedestrian way between the Brigham and Women's building and the Residential Building, offers the opportunity to integrate open space design with a variety of stormwater landscape features. Also, in addition to planting new street trees along Fenwood Road, Binney Street (with sidewalks being widened), Vining

Street and Vining Street Extension, the proponents should explore the opportunity of transforming all the above into Green Streets. We would be happy to work with the project proponents to explore site and neighborhood scale Low Impact Development (LID) opportunities including Green Streets, Greenways, porous parking lots, as well as building-scale designs such as green roofs and walls, water reuse, and irrigation alternatives. Many of these techniques can actually reduce costs, as well as improve the local environment. CRWA.26

Instead of following the prevalent practice of discharging all the wastewater from the various buildings through the BWSC sewer into the MWRA system to be treated at Deer Island, a strategy needs to be developed to recycle and reuse wastewater. Specific standards should be adopted for wastewater reuse for flushing toilets etc. (through double plumbing the building) as well as capturing, filtering and storing roof run-off. CRWA.27 CRWA would encourage the proponents to consider a green roof for the various buildings but also as a retrofit for all other buildings on its campus. Given that there is such a dearth of green / open space in the LMA as a whole, green roofs would not only provide cleaner roof runoff and reduce the urban heat island effect in the LMA but also provide an aesthetically pleasing amenity for the building occupants as well as habitat for birds and insects. CRWA.28

By evaluating the environmental conditions of the entire site, the proponents can find numerous opportunities for modifications and improvements, small and large, and can accomplish far more than simply developing a collection of individual green buildings. Many LID designs are simple and relatively inexpensive, while being highly visible and providing excellent educational opportunities. This project offers a huge potential to expand the purview of green practices from individual building scale to looking a "greening of infrastructure" at an overall neighborhood level. Through retrofitting the entire site area with LID best management practices, the proponent can achieve a much larger impact than the cumulative impact of a collection of individual green buildings.

We appreciate the opportunity to provide comment on this project through the Article 80 review process. Please feel free to contact me should you have any questions.

Sincerely,

Pallavi Kalia Mande

Pallavi Kalia Mande
Urban Restoration Specialist

cc: The Brigham and Women's Hospital
Medical Academic and Scientific Community Organization
Boston Water and Sewer Commission
Boston Parks and Recreation Department
Boston Environment Department
Muddy River Maintenance and Management Oversight Committee

9.15 Charles River Watershed Association

CRWA.1 Stormwater

Please refer to the Draft EIR/PIR for a discussion of these strategies.

CRWA.2 Various stormwater management alternatives

Please refer to the Draft EIR/PIR for a discussion of these strategies.

CRWA.3 Phosphorus reduction, water quality improvements, sediment load and reducing peak flows

The amount of phosphorus reduction has not yet been calculated. Prior to detailed stormwater system design, the Project will require approvals from the City of Boston and the Commonwealth of Massachusetts that could potentially alter the building massings and locations as well as overall Project Site designs. Upon receipt of these approvals and during final design, the expected benefits of the final stormwater management system can be calculated.

However, given the anticipated Project Site characteristics, it has been shown that the stormwater management strategies will produce a significant reduction in stormwater runoff rates in all calculated storm events. Stormwater quality benefits are also expected through the re-orientation of uses from parking to buildings and open space as well as the inclusion of the infiltration of roof runoff and low impact design features such as bio-swales.

As the Project advances into final design, BWH would be receptive to a review with CRWA of the proposed stormwater management strategies.

CRWA.4 Specific stormwater standards

The Project is not required by regulation to meet the stormwater standards proposed in this comment. However, the Project is expected to produce stormwater benefits beyond those required by existing regulations, as described in the Draft EIR/PIR.

CRWA.5 Cumulative impacts

The Proponent is actively considering all of the strategies described by CRWA in this comment. However, at this stage of the Project's design, investigations and approvals and a comprehensive calculation encompassing these strategies would be potentially inaccurate. Please note that the Project will be reducing impervious, non-roof area; will be providing more groundwater recharge facilities than currently exist; and will improve both stormwater quality and quantity.

CRWA.6 Soils and groundwater information/recharge

The Proponent is gathering geotechnical information as the Project Site becomes accessible to testing equipment. The Proponent is considering groundwater recharge in several locations. The amount of infiltration accomplished with these systems may not be quantified until detailed soil data is available.

CRWA.7 Stormwater management goals

Please refer to the Draft EIR/PIR for a description of these goals and features.

CRWA.8 Specific stormwater management features

Please refer to the Draft EIR/PIR for a description of these goals and features.

CRWA.9 Urban Design / Sustainable Design

One of the Project's goals is the reduction of stormwater flows to the Muddy River. As currently proposed, the Project will reduce stormwater flows through mechanisms such as green roofs, retention tanks, infiltration chambers, Low Impact Design features such as vegetated swales, etc. The Project includes proposed landscaping and trees within public ways, all of which are subject to the approval of the City of Boston through its Public Improvement Commission.

CRWA.10 Reducing peak flows and volume of runoff

Please refer to the Draft EIR/PIR for discussions related to this comment.

CRWA.11 Assessment of compliance with DEP stormwater management policy

Please refer to the Draft EIR/PIR for discussions related to this comment.

CRWA.12 Plan to minimize pollutants of concern for Muddy River

Please refer to the Draft EIR/PIR for discussions related to this comment.

CRWA.13 Maintenance and operations plans for stormwater BMPs

Please refer to the Draft EIR/PIR for discussions related to this comment.

CRWA.14 Minimize groundwater impacts (seasonal changes and flow)

For construction of the buildings with below-grade space, temporary excavation support systems that are compatible with subsurface conditions will be designed in order to provide adequate support and protection of the adjacent streets and utilities and to maintain groundwater levels outside the excavation at or near pre-construction levels.

CRWA.15 Directional groundwater flows

In general, it is anticipated that groundwater flows from northeast to southwest in the Project area, towards the Muddy River. A groundwater flow survey will be conducted to measure the flow direction and gradient across the Project Site. The Proponent will take measures to ensure protection of groundwater during construction and operations. For construction of the buildings with below-grade space, temporary excavation support systems that are compatible with subsurface conditions will be designed in order to provide adequate support and protection of the adjacent streets and utilities and to maintain groundwater levels outside the excavation at or near pre-construction levels.

CRWA.16 Mitigation of groundwater impacts

For construction of the buildings with below-grade space, temporary excavation support systems that are compatible with subsurface conditions will be designed in order to provide adequate support and protection of the adjacent streets and utilities and to maintain groundwater levels outside the excavation at or near pre-construction levels.

CRWA.17 Source of water for groundwater recharge

Roof runoff is the expected source of water for groundwater recharge.

CRWA.18 Plan for treatment and disposal of water from dewatering activities

Construction dewatering will be conducted in accordance with a Groundwater Management Plan that will be included as part of the Construction Documents. The Groundwater Management Plan will describe the procedures for maintenance of groundwater levels and for the treatment (if necessary) and discharge of effluent from dewatering activities.

CRWA.19 Impacts on Emerald Necklace

As a direct abutter to the Riverway south of the MMHC Site, RTH created at Mission Park in the late 1970's a 30-foot wide extensively landscaped green buffer zone for over 600 feet along that development's entire frontage. The landscape design was sloped to hide the Mission Park parking garage and complemented the public park across the Riverway. As part of this MMHC Redevelopment Project, RTH proposes to continue the theme of visually extending the greenbelt, this time with an approximately 30 foot to 40-foot wide level landscaped zone that replaces the current asphalt and existing buildings with uninterrupted green space.

Environmental factors have been taken into consideration in designing the Project. The layout of the Main MMHC Site has evolved to reduce shadow impacts as described in Section 2.9. Stormwater management is described in Section 7.3.

CRWA.20 **Coordinate with DCR on interface with Fenway**

Both RTH and BWH will continue to cooperate with larger community efforts to maintain and improve the parklands. Setting aside approximately half an acre (more than the amount of required set back) of the Main MMHC Site as green space directly adjacent to the Riverway is the Proponent's proposed in-kind contribution to this goal.

CRWA.21 **Coordinate with BRA, Boston Parks and Recreation, MASCO, Fenway Alliance, and Emerald Necklace Conservancy**

The Proponent will coordinate with the BRA, Boston Parks and Recreation Department, MASCO, the Fenway Alliance and the Emerald Necklace Conservancy as the Project progresses. To ensure the Project complements the existing park system, the Proponent has set aside approximately half an acre of land fronting the Riverway as green space.

CRWA.22 **Mitigate impact on park system**

As described above in CRWA.20, the Proponent has designed a half acre of green space by increasing the required setback along the Riverway.

CRWA.23 **Site level sustainable design BMPs and technologies**

Section 7.3 outlines some of the best management practices (BMPs) under consideration. The site design for the Main MMHC Site (location of the Residential Building and the Brigham and Women's Building) which has the largest potential for stormwater BMPs is still in the formative stages. The Proponent will be considering the use of both structural and non-structural BMPs for the Main MMHC Site. To the extent practicable given existing Project Site constraints, the urban nature of the Project Site as well as programmatic requirements, the Proponent is looking to maximize stormwater benefits.

CRWA.24 **Green strategies for site, landscape and neighborhood**

To the extent practicable given existing Project Site constraints, the urban nature of the Project Site as well as programmatic requirements, the Proponent is looking to maximize stormwater benefits.

CRWA.25 **Sustainable design for stormwater management and open space**

The Proponent agrees that the landscaped pedestrian way between the Brigham and Women's Building and the Residential Building offers the opportunity to integrate stormwater controls. Working with the Proponent, architects, landscape architects, engineers and the Boston Fire Department (to maintain fire fighting abilities), the Proponent will seek to maximize the stormwater benefits obtained from this open space. Please see Section 7.3.

CRWA.26 **Green Streets and Low Impact Development**

The Proponent is considering Low Impact Design features within the Project Site. As the Project Site design evolves, the Proponent will work with the design and construction team to further investigate the inclusion of features such as green roofs and walls.

CRWA.27 **Recycle and reuse wastewater**

Reuse of wastewater poses infection control issues. Therefore, due to the clinical uses and tight site conditions for the Binney Street Building, Partial Hospital/Fenwood Inn and Brigham and Women's Building, reuse of wastewater is not an option.

CRWA.28 **Green roofs**

The Proponent is planning to incorporate a green roof for part of the roof space of the Binney Street Building.

A green roof is not proposed for the Partial Hospital/Fenwood Inn due to limited rooftop area that will be occupied by mechanical equipment and equipment access space.

A green roof is being considered for the podium portion of the Brigham and Women's Building because it is visible from the adjacent existing and proposed residential mid-rises and because it will significantly reduce the peak flow storm drain load and the air conditioning load.

The Residential Building will have a 12,000-sf roof only at the 15th story and it will be mostly occupied with mechanical equipment that services the building and open lanes between equipment to allow access and replacement. The opportunities for green roof applications on this building are too limited to be practical. Please note that over 70% of the area of the Residential Building will be preserved as predominantly green open space.

Children's Hospital Boston
A teaching affiliate of Harvard Medical School
Vice President for
Real Estate Planning and Development

Charles Weinstein
300 Longwood Avenue
Boston, Massachusetts 02115
phone 617-355-2338 | *fax* 617-730-0019
charles.weinstein@childrens.harvard.edu

July 1, 2009

Ms. Sonal Gandhi
Senior Project Manager
Boston Redevelopment Authority
One City Hall Square
Boston, MA 02201-1007

Re: Massachusetts Mental Health Center Redevelopment

Dear Sonal;

Children's Hospital Boston is pleased to have the opportunity to provide this letter in support of the proposed phased development of the Massachusetts Mental Health site by Brigham and Women's Hospital, Partners HealthCare System, and the Roxbury Tenants of Harvard.

This project is a model effort in collaboration by multiple partners to meet multiple, and mutually reinforcing, goals. For the Commonwealth, replacement of obsolete facilities with new residential and outpatient space to accommodate Department of Mental Health (DMH) programs. For the nearby community, working through the Roxbury Tenants of Harvard, 136 new residential units (including 66 affordable rental units and approximately 70 condominiums) and community space, and for the Brigham and Women's Hospital, the site for a new building to accommodate research, clinical and office uses for both the Brigham and DMH.

Their spirit of collaboration will apply to the construction period, when construction phasing and traffic will challenge both the nearby community and institutional neighbors. They have already begun coordination efforts with Children's, Dana Farber and other area representatives on the impacts to Binney St in particular, a vital corridor for patient and family traffic, as well as emergency vehicles and materials deliveries.

The Longwood Medical Area, with its health care and educational institutions, is a critical resource to the City and Commonwealth. It needs to constantly evolve, replacing outdated programs and facilities with new, while maintaining, respecting and enhancing the Mission Hill community, with its vibrant residential life. The proposal before the City can achieve these objectives, and Children's Hospital Boston is pleased to offer our enthusiastic support.

Sincerely,

Charles Weinstein, Esq.

CW/jp
Cc: A. Mombourquette
K. West
J. Messervey
M. Papola

9.16 Children's Hospital Boston

Letter of Support

FENWAY CDC

July 10, 2009
Fenway Community Development Corporation
73 Hemenway Street, Boston, MA 02115
www.fenwaycdc.org, 617.267.4637

Ms. Sonal Gandhi
Project Manager
Boston Redevelopment Authority
One City Hall Square
Boston, MA 02201-1007
617.918.4314
Sonal.Gandhi.BRA@cityofboston.gov

"Project Notification Form, Institutional Master Plan Notification Form, Massachusetts Mental Health Center Redevelopment, June 16, 2009"

Sonal,

Thank you for the opportunity to review the Project Notification Form (PNF).

Fenway CDC builds and preserves affordable housing and champions local projects that engage the entire Fenway community in protecting the neighborhood's economic and racial diversity as well as its long-term vibrancy.

Fenway CDC has **no objections** to moving to the next phase of review the proposal for a four-building, 633,960-sf complex, submitted by The Brigham and Women's Hospital, Inc. (BWH), Partners HealthCare Systems, Inc., and Roxbury Tenants of Harvard Association, Inc. (RTH). In the next phase, after the BRA issues a scoping determination, the proponent will file a Draft Project Impact Report (DPIR) for further public review.

We are confident that the issues we raise here, though significant, will be thoughtfully addressed. Our most pressing concern is that insufficient assurance has been offered that the residential building will ever be built. This is the single most important community benefit from this proposal. Without this significant investment in the affordable housing stock of the neighborhood and the addition of community facilities, this would be an unattractive proposal. FCDC.1

Fenway CDC first reviewed the PNF against our **Urban Village Plan**. The Urban Village Plan is Fenway CDC's vision for the Fenway's growth into the 21st century. The core of that vision is a smart-growth residential neighborhood in the heart of Boston that is welcoming to the broadest spectrum of residents.

The plan sets goals in five key areas: 1) a sufficient and varied housing supply, 2) access to public transportation and reducing vehicular traffic, 3) community-building facilities such as a community center, 4) a healthy business community serving local residents and visitors while providing employment opportunities, and 5) open space and a responsible level of impact upon the environment. The first section of our comments on the proposal reflects our assessment of how the project would advance those goals.

1. **Housing**: The greatest threat to the future of the Fenway is maintaining economic diversity among its residents. This proposal will help meet that need:

a. The residential building (to be developed, managed and controlled by RTH) will include approximately 66 affordable rental units and approximately 70 condominiums—a substantial number of which will also be affordable—for a total of 136 new housing units.

b. What will trigger the start of construction for this building? FCDC.2

c. How will this building be financed? There is at least one measure of the value of this building to the community: If this were off-site, inclusionary rental housing, the developer's expected contribution to the City's housing trust fund would be $13.2 million. Can we assume that this same amount will be internally funded by this proposal? FCDC.3

d. Will new units—affordable and market-rate, on-site and off-site—be affirmatively marketed? FCDC.4

2. **Transportation**: This proposal suggests no particular benefit to the transportation goals of the Urban Village Plan:

a. While this is an example of transit-oriented development, the proposal will generate additional vehicular traffic in an already congested area (217 net new PM peak-hour trips). Adjustments must be made to make sure that this project is incrementally beneficial to the overall vehicular traffic patterns in the neighborhood and not incrementally burdensome. FCDC.5

b. No new non-accessory vehicle parking spaces are proposed. The 406 proposed new parking spaces can all be considered accessory to the other uses being built. FCDC.6

c. BWH maintains a massive inventory of 5,027 vehicular parking spaces; 2,598 of these are on-campus, and many of the others are in our neighborhood. Even the addition of a modest number of accessory parking spaces needs to be balanced against the burden this existing inventory places on the neighborhood's transportation infrastructure. FCDC.7

d. We appreciate that the proponent will implement a TDM program.

e. No improvements to the area transportation infrastructure are being proposed. FCDC.8

3. **Community-Building Facilities**: This proposal makes positive steps to meet the community's needs for public facilities:

a. The 10,000-sf community space holds great potential. We look forward to seeing more detail about this aspect of the proposal. Who will manage the space? What rates will be charged for its use? Since this could be a significant piece of the public benefit from this proposal, we would like to see much more detail on the space and solicitation of community feedback on its function and architectural program. The space's inclusion in the residential building brings us back to our earlier concern that the plan offers little assurance that it will eventually be built. FCDC.9

b. The $1.7-million set aside to build a gymnasium, recreation and large meeting space for the community on land owned by RTH represents another significant and appreciated benefit to the community. When will this investment be made—when the project is approved or at some future, uncertain date when capital is available? FCDC.10

4. **Businesses**: This project will have a healthy influence on the economic vitality of the city and the neighborhood. The proponents expect the project to create 600 full-time construction jobs and 513 new permanent jobs. We applaud BWH's pledge to focus on recruiting walk-to-work employees from Mission Hill but encourage the hospital to broaden its focus to include the recruitment of Fenway residents, as well. FCDC.11

5. **Open Space and the Environment**: This project does little to meet the environmental goals of the Urban Village Plan:

a. We appreciate inclusion of the LEED checklists as part of the PNF document. Except for the residential building, however, this project aims for barely minimal compliance with the sustainable design requirements of current zoning. We urge the proponent to explore ways to achieve higher levels of sustainability. FCDC.12

b. We would seek several clarifications. How many LEED credit points will the designs actually achieve? Can higher ratings be achieved? Will the project actually be certified as an energy-efficient building or just certifiable? FCDC.13

c. Additional LEED credit point(s) can be earned by providing at least 2.5% of the energy for a building from renewable sources. Rooftop photovoltaic panels may provide enough energy to meet this benchmark. We would like to see the proponents actively explore this idea, noting with disappointment that only the residential building lists this as a possibility, and then only as a "maybe." (Third-party certification assures that LEED-eligible features are correctly installed and operating and provides a reliable measurement of energy savings. Taking this extra step would add significant value to the project and the neighborhood.) FCDC.14

We hope the following additional comments will facilitate the Article 80 development review and approval process:

1. ***Consistency with Zoning (PNF page 2-20, paragraph 2.5)***: Considerable variances are being requested from the current zoning. The four-building site is approximately127,000sf (3 acres), with an average allowable maximum floor area ratio of approximately 2.0. Therefore the maximum "as-of-right" build-out would be 254,000sf. The proponents propose 633,960sf—almost 380,000sf extra or 250% of the allowed zoning—for an overall FAR of nearly 5.0. FCDC.15

Aside from the environmental impacts (height, shadow, sky view, wind) and transportation burden this extra development places on the neighborhood, these extra development rights represent a windfall of value being requested by the proponent. Additional development rights can be considered a gift from the public realm. The value of such rights is at least equal to the price of a vacant parcel in the vicinity that could support this building program as-of-right. Estimating that developable land in the area sells for $50 per developable as-of-right square foot, these additional rights are worth $19 million to the proponents.

The proponent gains significant value from the award of these development rights. In return for this windfall, we believe that the community should receive a guarantee that the portions of the project that most greatly benefit the neighborhood will get built and become usable in a reasonable amount of time.

2. ***Transfer of development rights:*** Who owns development rights granted through a process like this IMP? Can they be sold, transferred, or banked? FCDC.16
   - *Selling*: Should these development rights be sold by the institution that receives the zoning relief?
   - *Moving:* Are these rights, once granted, transferable from one institutionally controlled parcel to another or are they associated with the parcels for which they are granted?
   - *Banking:* Are the rights retained in the event the institution decides not to build?

3. ***Energy Systems (PNF page 3-36, paragraph 3.5.4):*** Can the sustainable design and carbon footprint data be combined in a new "energy" section in PNF, DPIR and FPIR submissions? BWH may be familiar with American College and University Presidents Climate Commitment. Has BWH published a report along those lines? We request that such a report be inserted as an appendix to the PNF. FCDC.17

4. ***BWH-Owned Facilities (PNF pages 4-7 and 4-8, Table 4-1):*** The list of BWH-owned properties does not include important information that should be gathered from other sources and presented as a whole. Members of the Fenway CDC's Urban Village Committee have been asking the BRA to require institutions to provide this type of information in a unified format since 2005. FCDC.18

   We suggest presenting a spreadsheet listing all parcels owned by the institution. The Parcel ID should be the list sort field. This fields should include; 1) Parcel ID numbers and the City of Boston assessor's listed address and description, 2) Parcel owner, 3) Lot size, 4) Parcel real estate tax-rate category and exception status, 5) City of Boston assessed land and building values, 6) Computed annual real estate tax that assessed values imply, 7) Underlying zoning and IMP status, 8) Gross square footage of the building, number of dwellings, dwelling units, dormitory beds and number of parking spaces for each buildings on each parcel, 9) Totals and subtotals for each field.

   The total of 2,110,923 square feet of facility space reported on this table compares well with the 2,004,986-square feet of exempt property space reported by the City of Boston's Assessors office.

5. ***Payment in Lieu of Taxes/PILOT (PNF page 4-24, paragraph 4.7.1.6):*** PILOT payments are generally tied to particular parcels for set lengths of time through agreements with the City of Boston assessing department. Can BWH provide details of these agreements? If not, BWH should at least list the PILOT obligations that it has already agreed to throughout the lifetime of this IMP—that is, for each of the next ten years and including anticipated adjustments from this PNF. FCDC.19

   BWH has not listed its current PILOT payment in the PNF. The City of Boston Assessing Department has, however, recently compiled a report that includes this information. For FY09, BWH owns $815,886,700 of assessed value in its tax-exempt properties. If not exempt, BWH would owe $22,118,688 a year in property tax. The hospital currently pays just $1,315,822 in PILOT, or just 6% of the property tax burden of a comparable for-profit entity.

6. ***Project Benefits, "Linkage" (PNF page 1-13, paragraph 1.3) Linkage Payments (page 4-24, paragraph 4.7.1.8)*:** This project should generate housing and job linkage payments. BWH has neglected to calculate these payments in the PNF. Our understanding is that housing linkage payment would be $3,432,973. Job linkage would be $684,850. We ask that the proponent report in the next review phase whether or not housing linkage will be internally directed to the residential building or delivered to the City's housing fund. FCDC.20

7. ***Financing:*** How will BWH finance this project? FCDC.21

Sincerely,

Lisa Soli
Interim Executive Director,
Fenway CDC

Marc Laderman
Member, Fenway CDC
Urban Village Committee
87 Gainsborough Street

Copy:

Via e-mail

David Holtzman, Fenway CDC Development and Sustainability Planner
Manuel Delgado, Board Member, Fenway CDC, Chair of Urban Village Committee, Fenway CDC
Romin Koebel, Urban Village Committee Member, Fenway CDC

Senator Steven Tolman, Second Suffolk and Middlesex
Representative Byron Rushing, Ninth Suffolk
City Councilor Michael Ross, District 8
City Councilor Stephen Murphy, At-Large

9.17 Fenway Community Development Corporation

FCDC.1 Residential Building Construction

It is anticipated that the BRA approval will include an affirmative obligation to complete the Residential Building with a substantial affordable component.

FCDC.2 Residential Building schedule

The trigger for construction of the Residential Building will be obtaining the resource commitments. The current estimate is that the Residential Building will close on its financing and begin construction in about three years. Substantial commitments of City, State and Federal resources are required to reach the planned affordability parameters and the market conditions must be adequate for the market rate residential units that provide economic support to the overall Project feasibility.

FCDC.3 Residential Building financing

The Residential Building is expected to be financed with a construction loan from MassHousing in participation with two or three private banks. The permanent loan for the rental portion of the Project would also be a MassHousing loan. The affordable and market rate condominiums will be sold to buyers who obtain individual mortgages. Low Income Housing Tax Credits would pay almost half the cost of the affordable rental component and State and City homeownership subsidy is needed for the affordable condos. RTH expects to obtain a modest number of Project-based Section 8 operating subsidies and soft loans from City and State programs for the rental portion of the Project.

FCDC.4 Affirmative marketing

Marketing for all units will be consistent with the City of Boston's detailed and comprehensive fair housing requirements, and all applicable fair housing laws.

FCDC.5 Traffic impacts

The Project proposes to limit the available parking supply to further encourage alternative modes of transportation and reduce traffic impacts. Further, adjustments will be made to the location of patient valet parking, which will result in reduced hospital vehicle trips on adjacent neighborhood streets – particularly Fenwood Road and St. Albans Street.

FCDC.6 Non-accessory vehicle parking

The proposed parking supply and management is discussed in Section 3.3.6 of the Draft EIR/PIR.

FCDC.7 **Neighborhood parking**

The Project's planned parking supply balances the need to discourage additional vehicle trips without impacting parking in the residential neighborhood. BWH will need to utilize parking outside of the LMA and shuttle employees to its new buildings. Further, nearly all new parking that is proposed is intended to serve patients.

FCDC.8 **Area transportation improvements**

Section 3.5 of the Draft EIR/PIR includes an overview of the proposed transportation mitigation and improvement actions associated with the Project.

FCDC.9 **Detail on community space**

RTH will manage the community space. Use charges for community events and activities will be related to a share of the operating and maintenance cost, not the initial capital cost.

The design of the space will occur closer to the time the building is built and will be a participatory process involving the community. This space may be built on the lower floor of the Residential Building or perhaps on an adjacent site in conjunction with a new gymnasium, recreation and large meeting space envisioned on the Mission Park campus. The potential off-site alternative, though on Mission Park land, is right at the end of Vining Street and is fully accessible to the wider community. This community facility, whether built in conjunction with the Residential Building or the new gym, does depend on RTH assembling the remainder of the necessary financial resources, but in either case, the majority of the resources are either in hand, or are in amounts and types that are readily available in the public and civic domain for such projects.

FCDC.10 **Contribution for gymnasium, recreation and meeting space**

The $1.7 million BWH contribution will be available in part for pre-development costs and then at a construction loan closing when the remaining funds will be available as well.

FCDC.11 **Recruitment of Fenway residents for employment**

BWH will continue to support walk to work recruitment but will also commit to announcing to the greater community the types of new jobs and skill levels required for the Brigham and Women's Building three years prior to opening.

FCDC.12 **Level of sustainability**

The Proponent is committed to attaining the following levels of LEED Certification:

- Partial Hospital/Fenwood Inn: LEED Certified;
- Binney Street Building: LEED Silver Certified;
- Brigham and Women's Clinical/Research Building: LEED Silver Certified; and
- Residential Building: LEED Certifiable with possibility of being LEED Silver Certifiable.

Please see Section 4.11 and Appendix F for additional information on levels of sustainability.

FCDC.13 **LEED credits**

Please see Section 4.11.

FCDC.14 **Rooftop photovoltaic panels**

The Binney Street Building is largely in the shadow of adjacent high-rise buildings. The Partial Hospital/Fenwood Inn will have equipment and ventilation shafts that will occupy a substantial portion of the small roof area. Availability of sufficient contiguous area for a PV array is not likely. The Brigham and Women's Building will have open-air equipment, a penthouse for other equipment, ventilation exhausts and elevator penthouses that will themselves partially shadow the roof and, combined with access ways to these equipment, will occupy much of the roof area. Nevertheless, BWH will explore the use of this technology when the design for the Brigham and Women's Building is advanced sufficiently to determine if this could be accommodated from design and financial standpoints.

Please see Section 4.12. The Residential Building is still in its conceptual design stage but there will be a 12,000-sf roof only at the 15th story and it will be mostly occupied with mechanical equipment and open lanes between equipment to allow for equipment servicing. As a result, opportunities for PV applications on this building may be too limited to be practical, using current technology. The building will provide, however, for the conduit and structure needed to support a PV array in the event that the economic, technological and practical considerations can be overcome.

FCDC.15 **Zoning and community benefits**

The existing zoning for the Main MMHC Site (as set forth in Article 59 of the Boston Zoning Code) was put in place in 1996 and was designed to accommodate the existing MMHC campus. The proposed program for the Project will serve a broad array of local and broader community needs, including approximately 136 units of housing, the majority of which will be affordable rental and for-sale housing; 70,000 sf of space exclusively dedicated to DMH's provision of mental health services; community uses; and medical research and clinical services. Affordable for-sale housing is a particularly rare resource in this part of the Mission Hill neighborhood.

The new MMHC/DMH facilities are being constructed by BWH at no capital cost to the Commonwealth, and BWH is required under its Development Agreement with DCAM to fund an expendable trust that will assist DMH in maintaining its new facilities. In addition, BWH will assist RTH in funding both a portion of the costs of its new Residential Building and enhanced recreational facilities at the Mission Park development, so that RTH can more fully serve youth in the broader Mission Hill community. Please see Section 2.9.6 for a summary of BWH's commitments and subsidies for the Project.

Both BWH and RTH are committed to the commencement of the Residential Building construction as soon as economically feasible.

FCDC.16 Transfer of development rights

The development rights granted through the BRA and Boston Zoning Commission approvals of the BWH 2010 Institutional Master Plan and the Planned Development Area Plan for the Residential Building are applicable only to the properties and projects described in the BWH 2010 IMP and the PDA Plan to be submitted to the BRA in October 2009. These development rights are not transferable to other properties or projects. Both the BWH 2010 IMP and the PDA Plan set forth the anticipated time frame for the completion of the buildings described therein (i.e., the Residential Building and the Brigham and Women's Building and Binney Street Building).

FCDC.17 Energy Systems

Section 4.12 contains a greenhouse gas emissions analysis, in accordance with MEPA's Greenhouse Gas Emissions policy and Protocol, which addresses many sustainability issues and carbon emissions related to energy use.

FCDC.18 BWH-owned facilities

The BWH 2010 IMP to be submitted to the BRA in October 2009 includes information on BWH-owned facilities required by the BRA's Scoping Determination.

FCDC.19 PILOT payments

BWH is currently making a Payment in Lieu of Tax (PILOT) contribution for the Nesson Ambulatory Services Building and Garage, the Thorn Building, the Shapiro Cardiovascular Center and the Servicenter Garage. BWH will meet with the Boston Assessing Department. Please see Section 1.3 for a discussion of taxes.

FCDC.20 Linkage Payment

Please see Section 1.2 for an estimation of linkage payments.

BWH will propose to the City that the housing linkage funds be directed to support the affordable housing component of the Project to the extent that the sequencing of projects allows.

BWH would also like to explore with the City the use of job linkage funds to directly support the training of individuals for specific entry level job opportunities that will be created by this Project.

FCDC.21 BWH financing

It is anticipated that the Residential Building will be financed with a combination of Low Income Housing Tax Credits and State and City loan financing, as is typical of affordable housing developments throughout the City. It is anticipated that the Brigham and Women's Building will be financed in part through the Massachusetts Health and Educational Facilities Authority.

Friends of Historic Mission Hill

81 Lawn Street, Roxbury, MA. 02120

Secretary Ian A. Bowles
EOEA, Attn: MEPA Office
William Gage, EOEA No. 14440
100 Cambridge Street, Suite 900
Boston MA 02114

Director John Palmieri
Attn: Sonal Gandhi, LMA project manager
Boston Redevelopment Authority
Boston City Hall
Boston, MA 02201

Re: MMHC Redevelopment, 74 Fenwood Road, Boston
EOEA # 14440

Dear Secretary Bowles and Director Palmieri,

The Friends of Historic Mission Hill are submitting comments on the above referenced ENF and IMPPNF for the same project. We think the DEIR should address the transportation and historic impacts of the project, both interim and future uses. We note that the proposed project is significantly greater than the as-of-right development. The Friends urge MEPA and the BRA to conduct a phased review of the redevelopment. The Friends believe the immediate review should focus on transportation and the historic impacts of the currently proposed uses. The Friends are concerned about signing off on the environmental review of the final project when the construction timeline is so uncertain.

FHMH.1
FHMH.2
FHMH.3
FHMH.4

The Friends of Historic Mission Hill are a resident based group involved with issues affecting the preservation of the local community; both its historic buildings and streetscapes and the quality of life experienced in our urban neighborhood. We actively participated in the public review for the state's Request for Proposal (RFP) process. Our 2002 comments are attached.

The stakeholders in the current proposal are many and the transactions complex. Brigham and Women's Hospital (BWH) will sign (after project approvals are received) a 95 yr ground lease with the Commonwealth for the Massachusetts Mental Health Center site, essentially, a permanent disposition.

The clients of the state's Dept. of Mental Health (DMH) will return to the Longwood Medical Area (LMA) but their original home at the former Boston Psychiatric Hospital will be demolished. In exchange for BWH building a 5-6-story structure on the Binney Street block next to the Chapter121A, 1978 era Servicenter Garage/ Material Handling facility and on Vining Street, a 21,000 SF replacement inpatient bed facility (Fenwood Inn), the state will transfer the MMHC 2.39 acres to BWH. The filings describe two proposed projects on the 74 Fenwood Rd.

site, a lab/office bldg., 222 ft high/ 358,670 SF and a residential development approx.198, 000 SF /15-16 stories to be built by Roxbury Tenants of Harvard (RTH). The current review will essentially give approvals for these future plans through BWH's institutional master plan process.

Allowing demolition of the National Register property for new construction that by the proponents' own admission is years away is not responsible public policy and can become a negative precedent. At the July 20 2009, MEPA site meeting, John Messervey, Director of Capital and Facility Planning for Partners, stated that a ground breaking for the contemplated BWH wet lab research space is 10 years in the future. The second proposed project for the site, the residential towers, has no financing in place; the expected timeline for a construction start is optimistically 3-5 years according to RTH's development consultant, Peter Munkenbeck at the BRA sponsored public meeting in July 2009.

The interim plan, after razing of all structures, is apparently for the site to continue as a surface parking lot AND a construction lay down area while the 2 facilities being constructed for DMH are built on Binney and Vining Streets. According to BWH's 2004 filings for the 70 Francis Street facility, the surface parking lot at the 74 Fenwood Rd site holds 212 vehicles, in the current submission the lot is described as 163 spaces. The DEIR needs to clarify the amount of parking proposed as an interim use. FHMH.5

The Binney Street parcel, approx. 12,000 SF served as the staging area for BWH's 350,000 SF Shapiro Cardiovascular Center at 70 Francis Street. Two trailers and construction related material remain on the lot a year after the facility opened. The MMHC property is 113,769 SF. Holding more than 2 acres of land adjacent to the landmarked Olmsted Park System for construction equipment and surface parking for a period of at least 4 –10 years is not appropriate stewardship for this historic property. FHMH.6

The 2003 Memorandum of Agreement negotiated with the Mass. Historical Commission focused on the RFP process. However, in *Stipulation IV, Exempted Activities,* MHC apparently signed off on their mandated role to review new construction "in any environmental review process" if that construction was determined to be compatible with the character defining attributes of the existing structures. The DEIR should clarify whether or not MHC has decided that the proposed project meets these criteria. FHMH.7

The Friends of Historic Mission Hill's concerns include the interim uses, as well as, the future plans. MHC and the Boston Landmark Commission (BLC) function to protect historically significant property from negative impacts and encroachment. The Riverway, part of Olmsted's Park System, a Boston City Landmark immediately adjacent to the MMHC site, will be affected by the proposed tall buildings. Traffic, views, shadows, storm water runoff are factors that environmental permitting agencies should be considering. Will there be follow up on zoning requirements for screening and buffering of parking lots, runoff from impervious surfaces, care and protection for the 100 yr. oak trees that are supposed to be preserved? FHMH.8 FHMH.9 FHMH.10 FHMH.11

The Riverway is protected through the Greenbelt Protection Overlay District and by the city's own Municipal Code 7-4.10-12. However, interestingly enough, Neville House at 10 Vining Street, 13 stories (uses shared between BWH and RTH), stands as an obvious exception. The 1970s urban redevelopment in this area (MATEP, Servicenter etc) was not favorable for quality of life improvements for local residents. Decades later, we are struggling for improved air quality, pedestrian friendly sidewalks & streets, and safe access to historic parks. The potential addition of an exclusive right hand turn lane to the Riverway and the state's acquiescence is alarming. Improvements to the Vining Street driveway/ private way should be a relief valve for congestion; however, improved crosswalks are also required. Trucks and buses are forbidden on the Riverway like the other parkways in the Emerald Necklace, even though enforcing this has been hit or miss in the LMA/Fenway area. The state's Department of Conservation and Recreation will need to be vigilant to protect Olmsted's visionary creation from incompatible development, as well as, wayward trucks and buses. The impacts and remedies for these concerns should be analyzed in the DEIR FHMH.12 FHMH.13 FHMH.14 FHMH.15

The states' RFP process did not prioritize historic preservation. The Friends wonder if wholesale demolition is necessary when development is years away and the economic under pinning of the project is not in place? There are 4 structures on site, could the 1912 main building, at least, be mothballed until a later time? FHMH.16

Our concern is fueled not only by the extended and vague schedule for the proposed projects, but also, the obvious slow down in the economy and the delayed starts to other previously approved BWH projects. And, of course, the residential development is dependent on public financing for which we note there is extensive competition, even within the Mission Hill community. FHMH.17
Curiously, previous statements from BWH call in question the hospital's own intentions. Specifically, there was an assertion that BWH is not interested in this site for clinical or research space [See DMH's 2002 *Final Project Proposal to the Asset Management Board*, Arthur Mombourquette letter]. The environmental review filings for the 70 Francis Street project also stated a commitment to no new employee parking. The building described in the ENF and IMPPNF will have a new 406-car garage. Increasing the parking supply in the LMA inevitably increases the amount of traffic. In 2002 the city's own Environment Department wrote of their concern that the LMA roadways and adjacent neighborhoods cannot absorb additional congestion. Currently, there is a lease arrangement with DCAM for the surface lot at 74 Fenwood, primarily for valet parking. It would not be surprising in fact to see a notice of project change substituting a major parking garage for one or more of the future Fenwood Road projects. FHMH.18

Sincerely,

Alison Pultinas   Mary Ann Nelson
For Friends of Historic Mission Hill

cc: Ellen Lipsey, BLC
State Rep. Jeffrey Sanchez
State Senator Sonia Chang Diaz
CC President Michael Ross
Carol Meeker, DCAM
Brona Simon, MHC
Don Eunson, Emerald Necklace Conservancy

9.18 Friends of Historic Mission Hill

FHMH.1 Transportation impacts for interim and future uses

Chapter 3 of the Draft EIR/PIR provides a detailed transportation analysis of the Full Build and the interim Phase 1 Condition building program. FHMH.2 Historic impacts for interim and future uses

The existing buildings on the MMHC Site will need to be demolished to remove the potential public safety hazards; to provide staging areas for the safe construction for the first phase of the Project; and to provide the parking for the DMH employees as required.

Historic impacts of the Project are discussed in Chapter 6.

FHMH.2 Historic impacts for interim and future uses

The existing buildings on the MMHC Site will need to be demolished to remove the potential public safety hazards; to provide staging areas for the safe construction for the first phase of the Project; and to provide the parking for the DMH employees as required. Historic impacts of the Project are discussed in Chapter 6.

FHMH.3 As of right development

Please see Section 2.5.1 for a discussion of the existing zoning for the Project Site.

FHMH.4 Phased review

Because the sequencing of the Project requires BWH to expend a substantial majority of costs of the public benefits before the construction Brigham and Women's Building and Residential Building commences, it is essential that this approval process result in the grant of development rights that are sufficiently certain so as to support this initial investment. Phased approvals are inconsistent with this requirement.

FHMH.5 Interim parking count

Please see Section 2.3.2 and Section 4.10.2 for a discussion of interim site use. A discussion of the interim parking count is also provided in Section 3.3.6.

FHMH.6 **Interim site use**

Please see Section 2.3.2 and Section 4.10.2 for a discussion of interim site use.

FHMH.7 **MHC review**

The comment letter sent by MHC on the Project states "The stipulations and documentation required by the MOA have been fulfilled." Chapter 6.0 describes MHC review.

FHMH.8 **Traffic, view, shadow, and stormwater runoff impacts on Riverway**

Analysis of traffic, shadow, views (urban design) and stormwater runoff are provided in the Draft EIR/PIR. The Proponent has taken careful measures so that the Project will protect, minimize and mitigate potential impacts to the Riverway.

FHMH.9 **Screening and buffering parking lots**

All proposed parking is to be located in a below-grade garage under the Brigham and Women's Building. Interim parking for that period after the Binney Street Building and Fenwood Inn/Partial Hospital are completed but before the Residential Building Brigham and Women's Building has begun construction is proposed to be located on the southeastern end of the block between Fenwood Road, Vining Street and the private way. The northwestern end of this block toward the Riverway will be green space until such time as the Residential Building is constructed. This green space will provide screening of the surface parking until the Residential Building is constructed after which the RTH Building itself will screen the temporary parking. Please see Section 2.3 and Section 4.10.2 for additional information.

FHMH.10 **Runoff from impervious surfaces**

Please refer to Chapter 7 of the Draft EIR/PIR for a description of stormwater management strategies.

FHMH.11 **Protection of mature trees**

Setbacks will protect the mature perimeter of trees to the greatest extent feasible, and incorporate them into the landscape plan, if possible. A certified arborist has been retained to examine the condition of trees on the Main MMHC Site. The arborist is charged with developing a site visit report, evaluation of the health of the mature trees and remedial recommendations.

FHMH.12 GPOD and Municipal Code 7-4. 10-12

The Proponent shares Friends of Historic Mission Hill's concern that important elements of the Mission Hill neighborhood be preserved and protected. However, while City of Boston Ordinances 7-4.11 and 7-4.12 are applicable to the Residential Building and will be adhered to (i.e., the Parks and Recreation Commission will review this building at a public meeting since the building will be located within 100 feet of the Riverway, and the building itself is set back at least 20 feet from the Riverway as required by Ordinance 7-4.12), City of Boston Ordinance 7-4.10 is not applicable to the portion of the Riverway adjacent to the Main MMHC Site and therefore, is not applicable to the Project. The PDA Plan for the Residential Building will address all of the issues implicated by the building's location within the Greenbelt Overlay Protection District.

FHMH.13 Right hand turn to Riverway

The Proponent recognizes that a dedicated right-turn lane on the northbound approach to Brookline Avenue has been identified by the LMA, MASCO, and the City of Boston as having area wide benefits that will improve traffic flow both to the LMA as well as regionally. This right-turn lane is not proposed as part of the Project and the Project does not trigger the need for the right-turn lane. However, the Project has been designed so that future implementation of the right-turn lane improvement by others will not be precluded.

FHMH.14 Improvements to Vining Street driveway/private way and crosswalks

The private way will be reconstructed as part of the Project. Reconstruction will include new pavement striping, crosswalks, and sidewalks.

FHMH.15 No trucks and buses on Riverway

BWH employs a proactive Loading and Materials Management Plan that includes provisions to limit unnecessary truck traffic on neighborhood streets and DCR parkways. The Project's Loading Dock Manager directs most truck traffic to the Project Site via Binney Street, Vining Street, and Brookline Avenue.

FHMH.16 Historic preservation and demolition

Section 2.9 and Chapter 6.0 address the history of planning for the MMHC Site, including evaluation of reuse of buildings and preservation of selected architectural elements of existing buildings.

FHMH.17 Project schedule and financing

In terms of the BWH's intentions on this Project, there was support from the neighborhood in 2002, prior to the issuance of an RFP by DCAM, for all residential use on the MMHC Site. BWH supported efforts by RTH to shape an RFP that would promote this type of use.

In 2004, with the release of the RFP, RTH concluded that a purely housing scenario could not support the economic demands required by the Commonwealth in the RFP. The height and scale and market price of housing necessary to pay for 70,000 square feet of DMH space (at no cost to DMH) would be too great an imposition on the Riverway and parklands and on the mixed income character of the neighborhood. Therefore, RTH requested BWH to reconsider its 2002 position and to consider the option of a mixed use development that would be consistent with the character and scale of the neighborhood. The current plan is the result of that request.

The Binney Street Building and Partial Hospital/Fenwood Inn will start construction as soon as practicable after completion of permitting and the signing of the ground leases and enabling abatement and demolition. The construction of the Residential Building will follow as soon as the financing can be put together, with the current objective of a start date within two to three years of the completion of the Binney Street and Partial Hospital/Fenwood Inn Buildings.

The Brigham and Women's Building will start construction as soon as the capital markets allow for a project of this scale. The current economic downturn has had an impact on the Hospital's ability to move forward with their building over the short term. The agreement with the Commonwealth requires that the Brigham and Women's Building be completed and occupied within ten years of the opening of the Binney Street Building.

It is anticipated that the Residential Building will be financed with a combination of Low Income Housing Tax Credits and State and City loan financing, as is typical of affordable housing developments throughout the City. It is anticipated that the Brigham and Women's Building will be financed in part through the Massachusetts Health and Educational Facilities Authority.

FHMH.18 Parking

The Project Site currently has parking for 163 vehicles and proposes the construction of 406 spaces. The agreement with the Commonwealth requires that the Project provide 50 parking spaces for the returning MMHC employees. The additional 356 spaces is required to support the development of approximately 362,460 sf of clinical/research space in the Binney Street Building and Brigham and

Women's Building (less DMH space) and the provision of up to165 primarily affordable housing units in 197,750 sf at the Residential Building. Parking to be provided is lower than the parking that could otherwise be provided under the BTD guidelines.

#14440 BG

10 Bowker Street,
Brookline, MA 02445

107Queensberry Street #2
Boston, MA 02215

RECEIVED
JUL 27 2009
MEPA

July 27, 2009

Secretary Ian A. Bowles
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, MA 02114
Attention: MEPA

Re: Massachusetts Mental Health Center Redevelopment

Dear Secretary Bowles:

We are glad that this project will allow the Massachusetts Mental Center to relocate back to new facilities, will include affordable housing units and will be LEED certified. However, The Friends of the Muddy River are concerned about the environmental impact of the 2 major tall buildings on the Muddy River and Riverway Park across from the Massachusetts Mental Health site.

The Friends appreciate that Brigham and Women's Hospital is mindful of the significance of the Emerald Necklace Riverway Park. In the planning of any future buildings, we hope that the Brigham and the Roxbury Tenants of Harvard will observe the 70 foot height limit along The Riverway under the Boston Park Recreation Department zoning height restriction within a hundred feet of the park. This height limit should include rooftop mechanical penthouses. A particular concern is on page 3-17 3.2.2 of the PNF that "it is anticipated that the Project may result in some new shadow on surrounding public open spaces in the morning although efforts have been undertaken to minimize shadow impacts". There should be **no** new shadows. The new buildings should not exceed the tree line and cast shadows on the river and Riverway Park. Just as the Boston Common and Public Gardens are protected from new shadows so also should this part of the Emerald Necklace. The views from within the park should not be disrupted by tall buildings looming overhead. FMR.1 FMR.2 FMR.3

Since The Riverway is a historic parkway, the Historic Parkway Preservation Treatment Guidelines of the Massachusetts Department of Conservation and Recreation need to be considered with any future plans. FMR.4

Sincerely yours,
FRIENDS OF THE MUDDY RIVER, INC.

Brenda Lew
Co-President, Boston
107 Queensberry Street #2
Boston, MA 02215

9.19 Friends of the Muddy River

FMR.1 70 foot height limit

City of Boston Ordinance 7-4.10 is not applicable to the portion of the Riverway adjacent to the Main MMHC Site and therefore, is not applicable to the Project.

FMR.2 Shadows on riverway

The only existing guidelines regarding shadows on the Riverway and Emerald Necklace are the LMA Interim Guidelines. The Interim Guidelines state:

> "…no project will be approved if it casts any new shadow for more than one hour on March 21st on the Emerald Necklace, Joslin Park or Evans Way Park. This standard is consistent with the most recent shadow restrictions adopted in the City's Municipal Harbor Plan."

The shadow analysis conducted for the Project presents the cumulative impacts for all four buildings proposed as part of the Project, although only the Binney Street Site is subject to the LMA Interim Guidelines. No shadows from the Binney Street Building are anticipated on the Riverway section of the Emerald Necklace on March 21st. Therefore, the Project complies with the BRA's LMA Interim Guidelines shadow criteria.

FMR.3 Views from within Emerald Necklace Riverway Park

Of the four proposed new buildings, the Residential Building is closest to the Riverway. Approximately 30 feet to 40 feet from the Riverway, the setback continues the green space setback maintained along the RTH properties to the southeast of the Neville House. The geometry of the Residential Building and its orientation is such that it presents a narrow façade when approached along the Riverway from the north, and, as the massing follows the triangular shape of the northern end of the Main MMHC Site, taking on an attractive "Flatiron" form when viewed from the intersection of Brookline Avenue and the Riverway.

Approached from the south, the configuration of the Residential Building emphasizes the large adjacent green space which, coordinated with that of the adjacent Brigham and Women's Building, opens a landscaped view corridor between the two buildings toward the Binney Street/Fenwood Road intersection.

FMR.4 DCR Historic Parkway Preservation Treatment Guidelines

The State's Department of Conservation and Recreation has promulgated "Historic Parkway Preservation Treatment Guidelines" (November 2006) which are applicable to the DCR-controlled Riverway. The Proponent does not propose any changes to the Riverway roadway. However, changes to the eastern sidewalk of the Riverway at its intersection with the private way along the southern edge of the Main MMHC Site may be necessary to create a safer pedestrian crossing where currently, pedestrian sight lines to see passenger vehicles entering the private way from the Riverway are less than optimal. The Proponent will work with DCR staff with respect to any such changes, and such changes will be implemented in conformance with DCR's Historic Parkway Preservation Treatment Guidelines.

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July 27, 2009

Ms. Sonal Gandhi
Boston Redevelopment Authority
One City Hall Square
Boston, MA 02201

RE: Comments on Project Notification Form (PNF)/Institutional Master Plan Notification Form (IMPNF) for Massachusetts Mental Health Center Redevelopment

Dear Ms. Gandhi,

The Massachusetts Mental Health Center (MMHC) site redevelopment has been long awaited and much anticipated, to return MMHC to its proper home in the Longwood Medical and Academic Area (LMA) of Boston, in modern facilities that will support its programs to provide the highest level of mental health research and patient care to its constituents. The proposed collaboration of Roxbury Tenants of Harvard, Brigham and Women's Hospital, and Partners HealthCare System is uniquely positioned to help MMHC realize its plans, while at the same time implementing their respective longer term visions for additional affordable housing opportunities on the one hand and additional space for medical research, medical office and support space on the other hand.
We look forward to assisting with and participating in the review process, as co-facilitators of the LMA Forum with the BRA and as a member of the BWH's Task Force.

The proposed plan contains two small early action projects (the Binney Street Building and the Partial Hospital/Fenwood Inn Building) that need to be developed in the short-term (18+ months), using the site of the closed Mass Mental Health facility as a staging area; and two large, longer term (7-10 years) buildings, the Brigham and Women's Hospital Building and the RTH Housing Building. To a large extent, the comments below relate more to the longer term components of the plan than the short-term components because the buildings are larger, more complex, and their uses and dimensions potentially have greater impacts on the public realm. As the proposed project and master plan filings proceed into the Draft Project Impact (DPIR) stage, I suggest the following areas be clarified or further detailed.

375 Longwood Avenue / Boston, MA 02215-5328 / Tel:617.632.2310 Fax: 617.632.2759

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Architecture/Open Space/Site Design/Density/Shadows

This large site is prominently located at an important gateway to the City of Boston from the west of Boston, via Rt. 9 and Brookline Village, and from the southwest via Rt. 1/Jamaicaway. It also is a gateway to the heart of the Commonwealth's Life Sciences community – the LMA. For these reasons and due to its adjacency to the historic Emerald Necklace park system and parkways, as the proponents know, the plans require thoughtful and sensitive architectural and site plan development. In addition to the overall relationship to the gateway and the park, each individual building in the plan also has its own special challenges and relationships that will drive good design decisions.

We support the concepts proposed in the filings to convert an existing surface parking lot at the corner of Brookline Avenue and the Riverway into pedestrian and open space uses. As design proceeds it would be helpful to have the design further acknowledge the 'gateway ' aspects of the site, and reinforce its visual and physical connections with the Emerald Necklace, while balancing "softscape" and "hardscape" particularly near the juncture of Fenwood Road/Brookline Avenue/Riverway and the site driveway with the Riverway. I recognize that site planning has to serve the needs of the contiguous buildings' occupants; because of this site's prominence, it has the opportunity to become, through design, a more beautiful and imageable gateway with a stronger relationship to the Emerald Necklace parks. Also see below, Transportation/Access. MASCO.1 MASCO.2

The DPIR should also cover in greater detail how the buildings' architectural designs will relate within their specific community sub-blocks or contexts. For example, the Binney Street Building and site plan needs to both relate architecturally to the LMA community and BWH's campus including the Shapiro Center and Tower Building, while the Partial Hospital/Fenwood Inn Building and site plan needs to relate more specifically to the residential community in the Fenwood Road area. MASCO.3

We look forward to seeing the full shadow and wind studies (and proposed mitigation, where warranted) that the proponents plan to include in the DPIR to illustrate the extent of impacts, if any, to the parklands, the residential community, the BWH's Shapiro Center area including Binney/Francis, and pedestrians who will be patrons of these adjacent uses as well as of the new complex of buildings. MASCO.4

It also would be useful to know the extent to which both program and financial requirements for MMHC, BWH and RTH are driving the proposed scale, heights and densities of the complex. MASCO.5

375 Longwood Avenue / Boston, MA 02215-5328 / Tel:617.632.2310 Fax: 617.632.2759

Transportation/Access

We are pleased that the draft filings have referenced adding a short right-turn lane on the Riverway for vehicles turning north onto Brookline Avenue. MASCO studied and proposed this improvement over 15 years ago to be part of a future MMHC site redevelopment as a significant measure to improve public safety (pedestrian, cyclist, ambulance, auto accidents) and reduce air pollution related to the then over half-mile delays there. The State, in its developer selection process, asked developers to consider this improvement in their proposals; the City adopted this improvement in the Interim Guidelines for access improvements, which the BRA and BTD follow in the LMA. Due to delays in site redevelopment, years later in 2009, this pernicious situation remains. We recognize the special significance of the parks and parkways and respectfully suggest that the redevelopment of the MMHC site represents a unique opportunity to create both a significant open space that both visually relates to the Emerald Necklace, creates a gateway to the city, and at the same time enhances the currently degraded environment at this location by reducing air emissions related to congestion, improving pedestrian and bicycle access, and public safety. (See above comments re: architecture, open space, etc.). MASCO.6

We recognize that a plan of this significance would require some of the best designers and a community participation process involving many stakeholders. Such processes take time, which is at odds with the proponents' timelines for approvals for phase I short term plans, which we have no interest in delaying. It would be useful for the DPIR to address how planning for a Gateway and access improvements at the Riverway Gateway (Riverway/Brookline/site driveway) could occur in relation to design, site and mitigation measure planning for the 7-10 year projects in a way that does not delay the Binney Street Building and Partial Hospital/Inn projects and demolition of existing structures. MASCO reserved $133,000 in 1996 to defray capital costs of improvements at this location. We remain willing to contribute this to the implementation of a significant Gateway Open Space and Traffic Improvement at this location. MASCO.7

Environment/Energy/Sustainability

We congratulate the proponents on their continued leadership in proposing projects that will seek LEED certification. As a repository of area-wide data MASCO can help provide data to support your certification process particularly in the areas of Sustainable Sites: SS1 (Site Selection), SS2 (Development Density and Community Connectivity), SS4.1 (Alternative Transportation-Public Transportation Access), SS4.2 (Alternative Transportation-Bicycle Storage); and may potentially be helpful regarding an LMA database for Materials Resource:

4.1/4.1 (Recycled Content), 5.1/5.2 (Regional Materials), 6 (Rapidly Renewables), and 7 (Certified Wood).

It would also be useful for the DPIR to contain additional information on alternative energy, energy conservation and supply options that will be considered for the buildings. Finally, the documents note that the new designs will comply with the City of Boston's sustainability requirements for storm water; to the extent that these may be further modified by pending State DEP regulations these changes might also be addressed in the DPIR. MASCO.8 MASCO.9

Demand Management/Alternative Transportation

We are pleased to see BWH's continued leadership and commitment to TDM measures including the full range of CommuteWorks services. For example, we note BWH's 2009 Bike to Work Week participation increased by 100%, representing the highest number of registrants at any institution; and their T-pass programs and participation in off-site parking and shuttle services to reduce overall parking demand. We are pleased that RTH will further promote TDM through their management company at the new residential building and request the MMHC pursue, at this site, similar strategies to those adopted by the proponents. MASCO will provide additional information to the proponents about Commuter Rail and shuttle options currently available to the site from JFK/UMass, Ruggles and Yawkey Stations as well as ridesharing, zip car and carpool and vanpool incentives, for inclusion in the DPIR, under separate cover. We stand ready to assist the proponents in planning for these services as well as others, such as on-site bicycle parking. MASCO.10

Parking/Drop-Off/Loading

It would be helpful for the DPIR to review the relationship between the Brigham Green Project parking garage and the proposed new buildings. The Brigham Green was approved in the last BWH master plan; the PNF/IMPNF states it will be implemented prior to construction of the longer term projects contained in the MMHC Development Plan. The public could better understand the Brigham Green garage's role in absorbing parking demands generated by existing hospital operations, the proposed future uses in the MMHC PNF/IMPNF--particularly in the Binney Street Building during its occupancy by MMHC and later by the hospital, and the Brigham and Women's Building; and its expected beneficial outcomes in reducing existing traffic congestion on Francis Street, related to both general traffic and valet activities that currently cross through to and from the LMA and the residential neighborhood. MASCO.11

A more detailed breakdown would be helpful, by use and including valet, on space demands for MMHC in the short-term at the new Binney Street Building at ServiceCenter and in the proposed long-term BWH Building; spaces for the MASCO.12

hospital's and MMHC's uses when the BWH Building is operational; and spaces for the residential uses in the proposed RTH Building, which we understand are contemplated to be accommodated by the existing Mission Park Garage. This would provide a clearer overall picture of current, phase one and full build parking demand. On the supply side, an overall picture would be helpful of how existing parking on the hospital's campus and at Mission Park are used by the hospital and by RTH, how the future supply adequately meets demand so as to not exacerbate impacts on residential parking areas or elsewhere in the LMA, and what other parking siting options were considered in the planning for the proposed future uses. The demand and supply information will provide a better understanding to the public of the plan's traffic impacts and proposed mitigation strategies. MASCO.13 MASCO.14 MASCO.15

Curb-side drop-off needs should be identified for each of the proposed buildings, particularly those where parking supply is proposed to be in a different building, such as that proposed for the RTH Building. Appropriately planned drop-off areas serve to reduce traffic congestion and ameliorate parking and traffic enforcement needs. MASCO.16

Loading needs are intended to be accommodated at the Residential Building, the BWH Building and the Partial Hospital/Fenwood Inn. We have found it helpful when proponents include more detail in their DPIRs on the design of loading docks; anticipated truck activities by type of truck and time of day; and turning templates that illustrate how truck movements can be accommodated off-street, either partially or fully. These help identify whether design or mitigation strategies need to be pursued so as to lessen impacts on neighboring streets. We are supportive of relocating MMHC to the LMA at the earliest possible time, through the realization of the proponents' phased plans to create new space that benefits MMHC, housing for the community, and medical and research space for the hospital. Thank you for this opportunity to comment. MASCO.17

Sincerely,

Sarah J. Hamilton

Sarah J. Hamilton
Vice President, Area Planning and Development

9.20 MASCO

MASCO.1 "Gateway" design features

Of the four proposed new buildings, the Residential Building is located adjacent to the intersection of Brookline Avenue and the Riverway. Its massing follows the triangular shape of the northern end of the Main MMHC Site at the intersection and presents a dramatic and attractive "Flatiron" form at this important corner. This massing anticipates its further development as an appropriately memorable piece of gateway architecture.

The footprint of this form integrates the needs of the residents with broader planning motivations vis a vis the Riverway. From the Brookline Avenue/Riverway intersection southward the building maintains a 30 foot to 40 foot setback from the Riverway, a resumption of the landscaped green space setback maintained along the RTH-owned Mission Park development. Mid block along the Riverway frontage, the building footprint steps further back to provide both recreational hardscape associated with the Residential Building and additional greenscape.

Approached on the Riverway from the south, this area of enlarged hardscape and softscape associated with the Residential Building is contiguous with that of the space between it and the adjacent Brigham and Women's Building and opens a landscaped view corridor between the two buildings toward the Binney Street/Fenwood Road intersection. The effect is to create a sense of the Riverway green space splitting off and flowing eastward between the two buildings toward Binney Street.

MASCO.2 Balance softscape and hardscape

Please see MASCO.1. In addition, Section 5.4.1 addresses open space planning and Figure 1-4 depicts proposed open space for the Project.

MASCO.3 Individual buildings' relationship to specific contexts

The design integrates the massing, the open space that the massing defines, and integration of all four buildings into a design. At the same time, each of the four buildings responds to a specific local sub-context. Except for the Partial Hospital/Fenwood Inn, which is itself located mid-block, the Binney Street Building, the Residential Building and the Brigham and Women's Building have street frontage on at least three sides. Public and service entrances at these buildings are organized according to the prevailing pattern in the area with public entrances and addresses located at intersections and service entrances located mid-block.

The Binney Street Building occupies a narrow parcel bordered by Francis Street, Fenwood Road and Binney Street, and serves to screen the Servicenter Complex with which it shares its only internal lot line and the massing of which, when compared to its larger neighbors, it extends. In accordance with the prevailing pattern in the area, its entrances are located at either intersection with the formal address and main entrance on Fenwood Road and a secondary entrance at Francis Street. Sidewalks are enlarged at each of these corner entrances to create entry plazas. The building is also cantilevered at both locations creating a covered protected area associated with the entrances. Architectural treatment is meant to convey an explicitly institutional use.

The massing and architectural expression of the Partial Hospital/Fenwood Inn is, by contrast, explicitly residential and meant to provide a transition from the larger proposed Brigham and Women's Building to the north and the existing Neville House to the west to the low two and a half and three-story neighborhood to the southeast. The massing is broken up into five vertical blocks, each of which imitate the scale and proportion of the residential three-family houses found throughout the neighborhood whose narrow facades typically face the street.

The Residential Building and Brigham and Women's Building are best understood together. The massing of both buildings is oriented along Fenwood Road along a northwest/southeast axis. While providing a generous setback from the Fenwood Road curb, this still represents a sliding of the taller mass of each building to the northeast on their respective sites. In the case of the Residential Building, this provides a significant green open space to the Riverway, while in the case of the Brigham and Women's Building it moves the building mass away from the residential Neville House community on the other side of the private way to the southwest.

The space between the two building masses and their edges have been crafted to manage the view to the Project Site down the Binney Street corridor, a view that would otherwise terminate in a 13-story blank wall of the Neville House and the Neville House dumpsters at grade. Instead, the massing at the northwestern end of the Brigham and Women's Building is divided into three layers and stepped so that the middle layer can present a strong vertical façade element which can be articulated as an appropriate terminus to the Binney Street vista.

Opposite this layered and stepped façade, the Residential Building steps back in sync so that that the space between the two buildings takes on a new diagonal geometry towards the Riverway. The effect is to provide a view to the Riverway from as far away as the Francis Street/Binney Street intersection while masking the blank wall of the existing Neville House and replacing it with a more appropriate architectural focal point to the Binney Street vista. Approaching the Project Site from the Francis Street/Binney Street intersection, the vista widens to the Riverway providing a new visual focal point.

MASCO.4 Shadow and wind studies

Please see Section 4.1 and 4.2 for wind and shadow analyses, respectively.

MASCO.5 Program and financial requirements

The cost to meet the minimum requirements of the Commonwealth to create a replacement facility for DMH was published in the RFP and was not negotiable. The minimum size of institutional facility that would justify this cost is a result of that requirement. The community's need for affordable housing, reflected in the BRA's Interim Guidelines for the LMA, as well as the broader expectations of the community and the City, all contribute to the scale of the residential component which also has implications for the level of subsidy for affordability in the budget. The height is a factor of the balance of program square feet and the desire to preserve open space adjacent to the Riverway.

MASCO.6 Right turn lane at Riverway

The Proponent recognizes that a dedicated right-turn lane on the northbound approach to Brookline Avenue has been identified by the LMA, MASCO, and the City of Boston as having area wide benefits that will improve traffic flow both to the LMA as well as regionally. This right-turn lane is not proposed as part of the Project and the Project does not trigger the need for the right-turn lane. However, the Project has been designed so that future implementation of the right-turn lane improvement by others will not be precluded.

MASCO.7 Planning for gateway and access improvements

This is an area-wide improvement that is beyond the scope of this Project. Every attempt will be made to ensure the Project does not preclude the development of the Riverway Gateway.

MASCO.8 Alternative energy, energy conservation and supply options

Please see Section 4.12 for a discussion of energy for the Project.

MASCO.9 Sustainability for stormwater

Please refer to the Draft EIR/PIR for stormwater management strategies.

MASCO.10 MMHC TDM program

MMHC's TDM will be in accordance with the existing TDM programs in place for Commonwealth of Massachusetts employees.

MASCO.11 Status of Brigham Green

Current planning calls for the completion of the previously-approved Brigham Green Enhancement and Parking project prior to the start of construction of the Brigham and Women's Building. A discussion of parking is provided in Chapter 3.

MASCO.12 Breakdown of parking spaces

Section 3.3.6 of the Draft EIR/PIR provides a detailed breakdown of the proposed parking supply, demand, and management.

MASCO.13 Existing parking

Existing parking operations for BWH and RTH are provided in Sections 3.2.1.1 and 3.2.2.1. Currently BWH leases 1,269 parking spaces from RTH at the Mission Park Garage. RTH residents use 62 spaces there.

MASCO.14 Parking supply and demand

Section 3.2.1.1 provides a summary of the existing BWH parking supply in the LMA and the utilization of these spaces.

MASCO.15 Parking siting options

Section 3.2.1.1 provides a summary of the existing BWH parking supply in the LMA and the utilization of these spaces.

MASCO.16 Curb side drop off

Drop-off areas are proposed on Fenwood Road for the Residential Building and the Brigham and Women's Building. These planned drop-off areas are illustrated in Figure 3-32.

MASCO.17 Loading

Proposed loading operations are discussed in Section 3.3.7 of the Draft EIR/PIR.

Sullivan, Katelyn

From: Gandhi, Sonal
Sent: Tuesday, July 28, 2009 10:43 AM
To: Sullivan, Katelyn
Subject: FW: Massachusetts Mental Health Center Redevelopment
Attachments: Gulliver's Travels (1).docx

From: Betty Commerford [mailto:ecommerford@joimail.com]
Sent: Monday, July 27, 2009 10:31 PM
To: Gandhi, Sonal
Cc: Ross, Michael (City Council); JeffreySanchez@hou.state.ma.us; bill.gage@state.ma.us; Lipsey, Ellen; ecommerford@joimail.com
Subject: Massachusetts Mental Health Center Redevelopment

Ms. Sonal Gandhi, Project Manager
Boston Redevelopment Authority

Subject: BWH IMP Notification Form, PNF: Massachusetts Mental Health Center Redevelopment 6-16-09

The Mission Hill Health Movement, Inc. (MHHM) board members unanimously voted this evening to formally submit the following comments and information regarding the title subject.

MHHM, incorporated as a 501c3 in 1969, has continuously sought to improve the health status, services and quality of life available to residents of Mission Hill. In recent years we have prioritized programs addressing air quality, capacity building of community organizations, and issues of health disparities, particularly asthma and diabetes. In the nineteen sixties and seventies institutional expansion was the greatest threat to the survival of Mission Hill as a vigorous residential neighborhood. It was an era of civil rights as well as town/gown fights, ultimately it benefited us all.

In April of 1977 MHHM, Roxbury Tenants of Harvard (RTH) and the Brigham and Woman's Hospital (BWH) (then AHC), after protracted discussions initiated by the Commissioner of the MA Department of Public Health and his General Counsel, signed an Agreement (The '77 Agreement) which dealt with many concerns and practical considerations raised then as now by the hospital's building and land use plans. The provisions of Article III Section B "Land Use" in the 77 Agreement were guaranteed by the hospital through January 1, 2010. Central to the entire Agreement was the principle of clear boundaries between the 'Institutional Area' west of Francis Street and northwest of Huntington Ave., and the rest of Mission Hill - the 'Residential Area'. Two lines on page two, paragraph eight, of the hospital's three page April 27 press release: AGREEMENT REACHED BETWEEN COMMUNITY GROUPS AND AFFILIATED HOSPITALS CENTER state:

"The agreement generally confines future construction of new facilities by AHC to the institutional area and prohibits AHC from acquiring property within the residential area, either by lease or purchase." * MHHM.1

While "Land Use" was central to the practicalities and may prove to be so again, of equal concern to us then as now were the hospital's good faith assurances and the understanding, expressed in the last line of the Agreement, on page seventeen just above our signatures, that

"the residents and the institutions can cooperate together to build
a stronger community in which each can live and work."

We all understood that situations might arise where amending or waiving certain terms or provisions of the Agreement might be mutually beneficial. Provision and procedure for doing so was made. ** We have received no notice(s) from BWH, nor has there been any agreement to amend or waive any term or provision of the

Agreement.*** Rather than assume ignorance on the part of BWH we regret that we have historical precedent to assume otherwise.

Then as now, the hospital spoke of its hope and commitment to meaningful interaction with us in the future, in fact choosing to quote from the Agreement: "It is hoped that the terms of this agreement and, more importantly, the process which led to its execution, will foster a new ongoing relationship between the residents of Mission Hill and its institutions whereby the residents and the institutions can cooperate to build a stronger community in which each can live and work." (Hospital Press Release, April 1977)

That was then, this is now:
"The proponent (hospital) is committed to effective community outreach and will engage the community to ensure public input on the Project. See Section 2-1 for further discussion of community involvement with BWH and RTH projects." (5.7Community Outreach p. 5-1)

Section 2-1 referred to above is a nicely written account from the hospital viewpoint which we find factually amiss. While we greatly appreciate and value the responsiveness to Mission Hill residents and community organizations by individual staff and clinicians, the BWH planners cite only their history of interactions resulting in extending the hospital's encroachment into the residential area.

As to the submission before you:

The scheme is intriguing, some say ingenious. It presents the community and the DMH some exciting possibilities. However, only BWH presently appears to have a sure thing. The DCAM MOA might assure that Mass Mental Health Center could return, but what if BWH is not able to build on the old MMHC site in ten years ...or twenty ...or ever? Is Mass Mental assured of a home in the Binney Building beyond ten years? Is there a similar MOA to even partially protect RTH? What if RTH cannot build the residential building? Does the ninety five year Ground lease then become wholly the property of BWH? MHHM.2

It appears that the Department of Mental Health (DMH), RTH and the greater Mission Hill neighborhood are exposed to all the risks of environmental degradation, permitting, obtaining zoning variances, financing, and so on. Could we end up with no residential building, no return of MMHC but with BWH spreading further and higher into the community as it has with the two other RTH residential blocks lost to hospital encroachment since the 77 Agreement? There were 25 houses and 59 families lost to the Materials handling building alone, promoted at the time as 'a good architectural fit'. The leftover trailers from the Shapiro Building construction sit as empty eyesores in a sandy wasteland on Binney Street.

Where are **current** air studies for the traffic congestion (moving and idling) and exhaust from commercial vehicles, particularly diesels? MHHM.3
Ultimately, the traffic, the noise, the parking and air pollution impact fall on the residents of RTH and the broader community, hospital staff, patients and visitors - not planners. MHHM.4

Where are any demonstrations of financial feasibility? Where are reasonable development plans firmly based on need? MHHM.5
Is there a clear and pressing need for another, highest yet, hospital building?
Lacking so much data the submission seems based on opportunity for more land rather than need.

We dread a rush to demolition of the 1912 buildings. Careful, thoughtful study and dialogue would avoid any demolition based primarily on the understandable institutional urge to seize any opportunity to obtain a prime site. How much easier the review path if a design for a site can be presented which also speaks to neighborhood goals of affordable housing and accessible mental health services. MHHM.6

We fear that this submission, given the pattern of changes to the BWH IMP to date, may be mostly driven by the need and/or the opportunity to landbank the MMHC site for some future expansion that could bear little or no resemblance to the current outline.

Given the plan to "bifurcate the Ground lease from DCAM ... at the time the Residential Building **is**

constructed." Who will be the owner/builder of the building, RTH or BWH? Whose money will be used and where will it come from? The lease of the building at Binney Street to DMH is for ten years. If the music stops (i.e. construction is not undertaken) could not both RTH and DMH be left standing while the 95 year lease allows BWH to sit and mothball the old MMHC site with the 1912 building long gone, and simply use it for surface parking while awaiting better times? See attachment re: cucumbers MHHM.7

The questions and concerns above regarding what is in, and what is lacking, in the submission could conceivably become relevant in some future discussion but to us **they are now moot**. In our view nothing can go forward while BWH is in violation of the 77 Agreement.
Current BRA and DCAM staff may not realize that BWH cannot execute a Ground lease with DCAM without continuing violation of the letter, spirit and intent of the 77 Agreement.

Thank you for your attention and thoroughness. We look forward to any dialogue opportunity.

Ceredo L. Dean, President
James J. Farrow, Vice President and
Elizabeth Commerford for Mission Hill Health Movement
617-694-9096

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relevant passages from the 77 Agreement

* LAND USE p.3 Article B. #2 "In furtherance of the above principle of clear boundaries bordering the residential Area ... (the Hospital) will not acquire property within the Residential Area, either by purchase, lease, or otherwise, nor utilize property within the Residential Area for institutional purposes."

** AMENDMENTS p.14 Article F. #1 "Any proposed amendment or waiver of any portion of this Agreement must be executed by AHC and MHHM."

*** NOTICES p.15 Article G. #1 "For any notice to be effective hereunder it must be given in writing and mailed to the party for whom intended, postage prepaid, registered or certified mail, return receipt requested, and addressed:... if intended for MHHM, as follows: Mission Hill Health Movement, Inc., 1534 Tremont Street, Roxbury, Massachusetts 02120" (please note: address unchanged then to now)

Attachment: is from community 1973 testimony. Relevant then as now.

cc/ City Councilor Michael Ross
State Representative Jeffrey Sanchez
Bill Gage/ MEPA
Ellen Lipsey/ BLC
Simon Brona Sec. of State's Office

9.21 Mission Hill Health Movement

MHHM.1 '77 Agreement

The existing agreement is due to expire on 1/1/2010 however BWH recognizes the importance of maintaining the city's affordable housing stock and has agreed to enter into discussions to create a new mutually acceptable agreement.

MHHM.2 Development of DMH space and RTH Building

BWH is committed to meeting its obligations to DCAM/DMH with respect to the provision of facilities which would bring MMHC back to the neighborhood. The ability to build the mixed income residential building remains even if RTH is unable to build it.

MHHM.3 Air Quality

Please see Section 4.5 for the air quality analysis.

MHHM.4 Traffic and noise.

This Draft EIR/PIR includes analysis of transportation, noise and air quality impacts.

MHHM.5 Financial feasibility

Please see Response to Comment MASCO.5.

MHHM.6 Demolition

Section 2.9.1 describes initial studies of the condition of MMHC buildings and consideration of rehabilitation. Please see Chapter 6.0 for a discussion of the historic resources.

MHHM.7 Ownership

The MMHC Site is now and will continue to be, owned by the Commonwealth of Massachusetts, acting through DCAM. DCAM will execute three 95-year ground leases for the Non-Residential, Residential and Partial Hospital/Fenwood Inn Premises with BWH when all approvals have been received. Each of the BWH and RTH buildings will be separately financed, constructed, maintained and operated. The Residential Building will be owned by RTH and individual condominium owners and the Brigham and Women's Building will be owned by BWH. It is anticipated that the Residential Building will be financed with a combination of Low Income Housing Tax Credits and State and City loan financing, as is typical of affordable housing developments throughout the City. It is anticipated that the

Brigham and Women's Building will be financed in part through the Massachusetts Health and Educational Facilities Authority. Upon completion of construction of the Brigham and Women's Building, DMH will occupy under a sublease approximately 50,000 sf.

The Binney Street Site is owned by BWH and the Binney Street Building will be owned by BWH and leased to the Commonwealth acting by and through DCAM, for the benefit of DMH for ten years. After DMH vacates this structure and moves its Binney Street operations to the Brigham and Women's Building, BWH will continue to own and use the Binney Street Building for other BWH core functions.

The Partial Hospital/Fenwood Inn Site is owned by the Commonwealth, acting through DCAM and will be ground leased to BWH under the terms of a 95-year ground lease. Upon completion of construction by BWH of the new Partial Hospital/Fenwood Inn building, the building will be owned by BWH and sublet to DMH.

MISSION HILL
NEIGHBORHOOD HOUSING SERVICES

TEL 617-566-6565
FAX 617-566-1440

July 24, 2009

Sonal Gandhi
Project Manager
Boston Redevelopment Authority
One City Hall Square
Boston, MA 02201

Re: Brigham & Women's Hospital / Massachusetts Mental Health Center Redevelopment / Institutional Master Plan Notification / Project Notification Form

Dear Ms. Gandhi:

Mission Hill Neighborhood Housing Services through its Neighborhood Planning and Review Committee has reviewed and discussed the proposed MMHC project presented by Brigham and Women's Hospital. At its July meeting, the committee voted to make the following comments and requests the following community benefits related to the BWH MMHC project:

- MHNHS understands the need to build the facilities for the DMH as soon as possible in order for BWH to meet its obligations under the RFP. MHNHS supports the benefits the BWH MMHC project will provide to the DMH, including the construction of 70,000 sf of new space at no cost to the State, the provision of 50 free parking spaces, and the BWH-funded operating trust. MHNHS supports the return of the Massachusetts Mental Health Center to the Mission Hill neighborhood.

- MHNHS also supports the multi-million dollar benefits package the project will bring to RTH including the free land for the 136 unit RTH-developed rental housing and condominium project at the site, the free land for the 10,000 sf RTH community space at the site, parking for the residential component, operating money for the RTH community center and other RTH community recreational space off site, provision of guarantee to underwrite the RTH affordable housing, and the extension of program and service funding at RTH for an additional 8 years.

- MHNHS supports the development of 136 units of affordable worker housing for renters and homeowners at the site.

- MHNHS would like to see the many mature trees on the site preserved. We understand that the current schematic design of the residential building accommodates this preservation by pulling that construction back from the lot line 40 feet and protecting the root balls of the existing trees. We support this design effort. MHNHS.1

- MHNHS would like to see the many artifacts related to the historic buildings and grounds identified, preserved, and reused as part of the redevelopment of the site. MHNHS.2

- While the use of the 306,000 sf BWH building has not been established, we understand that through this approval process the assumptions and review of traffic and parking and other impacts is based upon 50% of the space being clinical and 50% of the space being Biomedical Research Institute (BRI) lab space. Mission Hill NHS further understands that this approval process sets the parameters of the project moving forward in terms of massing, height, and use. While the use has not been fully established, and we recognize needs will change in the 7 to 10 years anticipated before this component of the project commences, Mission Hill NHS has significant concerns about certain lab space being proposed adjacent to residential space and requires further information about the biolab level being proposed, the research that would be allowed in the facility, and the specific construction containment and HVAC mitigations to be included. MHNHS.3

- MHNHS is concerned that the necessary phasing of the project will increase the construction period and the construction period impacts on the direct abutters, Brigham Circle and the surrounding neighborhood. BWH has committed to forming a Community Construction Mitigation group to address the impacts of the construction, deliveries, trucks, and construction workers on the community and to prepare the CMP for the various phases of the redevelopment of the MMHC site. While direct abutters must be represented on this group, Mission Hill NHS would also like representation on this group to address potential impacts and mitigations for the Brigham Circle area and wider Mission Hill community. MHNHS.4

- An important mitigation for BWH construction worker vehicles and BWH employee, visitor and patient cars is the MBTA E line. To ensure that this important automobile alternative remains available to both LMA institutions and the residential community, we ask that representatives of BWH join Mission Hill neighbors in our efforts, including but not limited to participation in community meetings with the MBTA, to ensure that the E Line continues to run evenings and weekends and continues to provide trolley transportation down Huntington and South Huntington to Heath Street. MHNHS.5

- MHNHS shares the concern of neighbors regarding the interim use of the MMHC site. While we recognize the need to use this site for construction staging, given the potential 10 years time period before the completion of the BWH portion of the redevelopment plan, MHNHS would like to be involved in the proposed charrette and the interim planning for the site and would like to see the amount of the site dedicated to "temporary" surface parking kept to a minimum. MHNHS.6

- BWH should continue to provide data and outreach and hiring strategies to increase the number of Mission Hill residents employed at the institution. As part of the 70 Francis/Brigham Green project we suggested opening HR office in Brigham Circle and setting hiring goals for Mission Hill residents. BWH reports in this document that of their 2007 new hires, 10% were from Mission Hill and of their 2008 new hires, 6% were Mission Hill residents. Despite these advances more work needs to be done to ensure the impacted residential neighbors benefit from the economic engine of the City of Boston. We still hear numerous personal accounts of Mission Hill neighbors not being hired for entry level positions, Mission Hill youth not being employed for jobs they are qualified for due to competition with out of neighborhood candidates, and still many others who lack skills for the positions open. The dialogue and information flow between community groups and HR needs to continue and needs to expand. BWH should identify the various skill levels of the 550 -700 permanent jobs created by this project and the number of Mission Hill residents to be hired at the various skill levels. BWH should periodically report the results of their employee training program though their Workforce Development Plan to the Mission Hill community. Additionally, BWH should expand the number of summer jobs and internships for Mission Hill youth. MHNHS.7 MHNHS.8 MHNHS.9

- To assist with meeting the need for more affordable family housing in the Mission Hill community, 50% of the housing linkage payments for this project should be allocated to the impacted neighborhood of Mission Hill. MHNHS.10

Housing funds should be disbursed as housing creation agreements to designated projects, both in RTH and in Mission Hill.

- Mission Hill NHS acknowledges the critical partnership with BWH in support of the Kevin W. Fitzgerald Park at One Brigham Circle. MHNHS.11

We thank you in advance for consideration of our concerns and requests.

Sincerely,

Jim Hoffman
Executive Director

Patricia Flaherty
Senior Project Manager

Cc: State Representative Jeffrey Sanchez
Boston City Councilor Michael Ross
Nikko Mendoza, Mayor's Office of Neighborhood Services
John Palmieri, Director, Boston Redevelopment Authority

9.22 Mission Hill Neighborhood Housing Services

MHNHS.1 Preservation of mature trees

Setbacks will protect the mature perimeter of trees to the greatest extent feasible, and incorporate them into the landscape plan if possible. A certified arborist has been retained to examine the condition of trees on the Main MMHC Site. The arborist is charged with developing a site visit report, evaluation of the health of the mature trees and remedial recommendations.

MHNHS.2 Identify, preserve and reuse artifacts of historic buildings

At an August 11, 2009 BLC hearing on the Article 85 application the Proponent committed to continuing to work with BLC staff as the design for the Project advances. As outlined to the BLC, the Proponent has developed a draft architectural salvage and reuse plan that would include salvaging and incorporating selective architectural features into the design of the Project. Such features include: the Commonwealth of Massachusetts seal centered on the parapet above the main entrance of the 1912 building; as many as five fireplace mantels from the 1912 building; bookcases with leaded glass doors from the library; and a limited number of original light fixtures. In addition, the Proponent continues to explore the possibility of salvaging components of the marble inlay flooring and baseboard in the main lobby area for reuse or recreating the floor with new material if reuse is not a feasible option.

While the existing wrought iron and brick post fence is too far deteriorated for reuse, the Proponent has committed to replicating the fence in its present location. Components of the original fence will be salvaged and used as a guide in the manufacturing of the new fence.

MHNHS.3 Type of lab space

The Brigham and Women's Building will not contain a Level 4 biolab. The construction containment methods will be developed to ensure public safety. The HVAC mitigations will be in accordance with best engineering practices and all governing codes and regulations.

MHNHS.4 Participation in the Community Construction Mitigation group

MHNHS is participating in the construction mitigation group discussions.

MHNHS.5 Support for E Line

BWH is committed to support MHNHS in its efforts to convince the MBTA to maintain the E Line service to support community needs.

MHNHS.6 Interim site use and planning

Please see Section 4.10.2 for information on the interim use of the Main MMHC Site.

MHNHS.7 Employment information

BWH has made a commitment to increase access to employment at the Hospital for residents of Mission Hill and bordering Boston communities. BWH's Community Career Liaison works with Mission Hill applicants or potential applicants for employment at BWH. The Hospital's Human Resources Department helps residents become competitive candidates for open positions at the hospital by providing, through Project Hope, case management services to assist residents in addressing problems such as limited literacy, lack of key job skills, lack of English fluency, childcare and transportation difficulties, and limited work experience.

Community Residents can receive the following services when enrolled in the Case Management Project:

- Assessment – Hold initial intake sessions with prospective clients and explain the services to them. Review each client's work history and family support system to identify needs and challenges as well as strengths. Assess job fit for the positions that the client wants to pursue. Utilize the Test of Adult Basic Education (TABE) to determine the client's literacy level.

- Workplace Protocols -- Familiarize each client with workplace expectations and protocols.

- Customized Action Plan – In full collaboration with the client, establish an action plan that outlines issues to be addressed through case management and that will enhance client's employability at BWH. Determine what the client and the case manager will each do to accomplish the goals of the plan. Establish a timeline for reaching the goals.

- Collaborate with BWH HR specialists – Accept referrals of Mission Hill residents who apply to BWH positions and who may be appropriate candidates for case management. Maintain contact with HR specialists as appropriate to facilitate re-application. BWH Community Liaison, HR specialists, will collaborate to ensure this program results in the successful employment of Mission Hill residents.

- Supportive Referrals – Make appropriate referrals to the BWH Human Resources Department for open positions within the hospital. Make referrals to ESL, GED, and adult basic education classes; childcare services; transportation services; social service organizations; and job training programs such as Partners in Career and Workforce Development (PCWD). Follow up to determine both whether the client has acted on the referral and whether the client has received the help that he/she requested.

- Ongoing Support – Engage in problem solving with clients as needed and provide advocacy on issues such as CORI check results. Maintain regular contact with clients to monitor progress on action plans. Strategize with clients to address challenges.

- Follow-Up – Maintain contact with clients at regular intervals for up to one year after active case management has ceased. Ensure that clients are able to sustain the progress that has been made. Address any setbacks that occur.

MHNHS.8 Skill level of jobs

The skill levels of the permanent jobs will be provided to MHNHS, and other civic groups, three years in advance of opening the Brigham and Women's Building to provide time for surrounding residents to prepare themselves to compete effectively for those positions.

MHNHS.9 Summer jobs and internships

BWH hired 94 high school students and 18 college students from the Mission Hill and bordering Boston zip codes. There were 57 departments that sponsored students. BWH works closely with the Boston Private Industry Council and ABCD to ensure that summer youth referrals are from Mission Hill and surrounding neighborhoods. BWH hopes to be able to continue to fund the hourly wages at the same level next year. This year BWH is planning to offer a series of workshops for the youth at RTH who are interested in summer employment opportunities at BWH. The youth who successfully complete the program and meet the BWH employment criteria will be accepted into the program.

MHNHS.10 Linkage

BWH will pursue a Housing Creation Option Application to allow the housing linkage funds to be targeted to the Residential Building, if practicable.

MHNHS.11 Partnership in support of Kevin W. Fitzgerald Park

BWH is committed to ensuring the Kevin W. Fitzgerald Park is adequately supported.

9.23 VHB, Inc.

No response required.

9.24 Epsilon Associates

No response required.

From: Fuller, Katherine
Sent: Tuesday, August 11, 2009 12:06 PM
To: Fuller, Katherine
Subject: RE: MMHC - Area Map

From: Donohoe, Ellen
Sent: Thursday, July 23, 2009 10:03 AM
To: 'bill.gage@state.ma.us'
Cc: 'O'Farrell, Joseph'; Katz, Jonathan; Manning, Sean; Cindy Schlessinger (cschlessinger@EpsilonAssociates.com)
Subject: MMHC - Area Map

Bill:

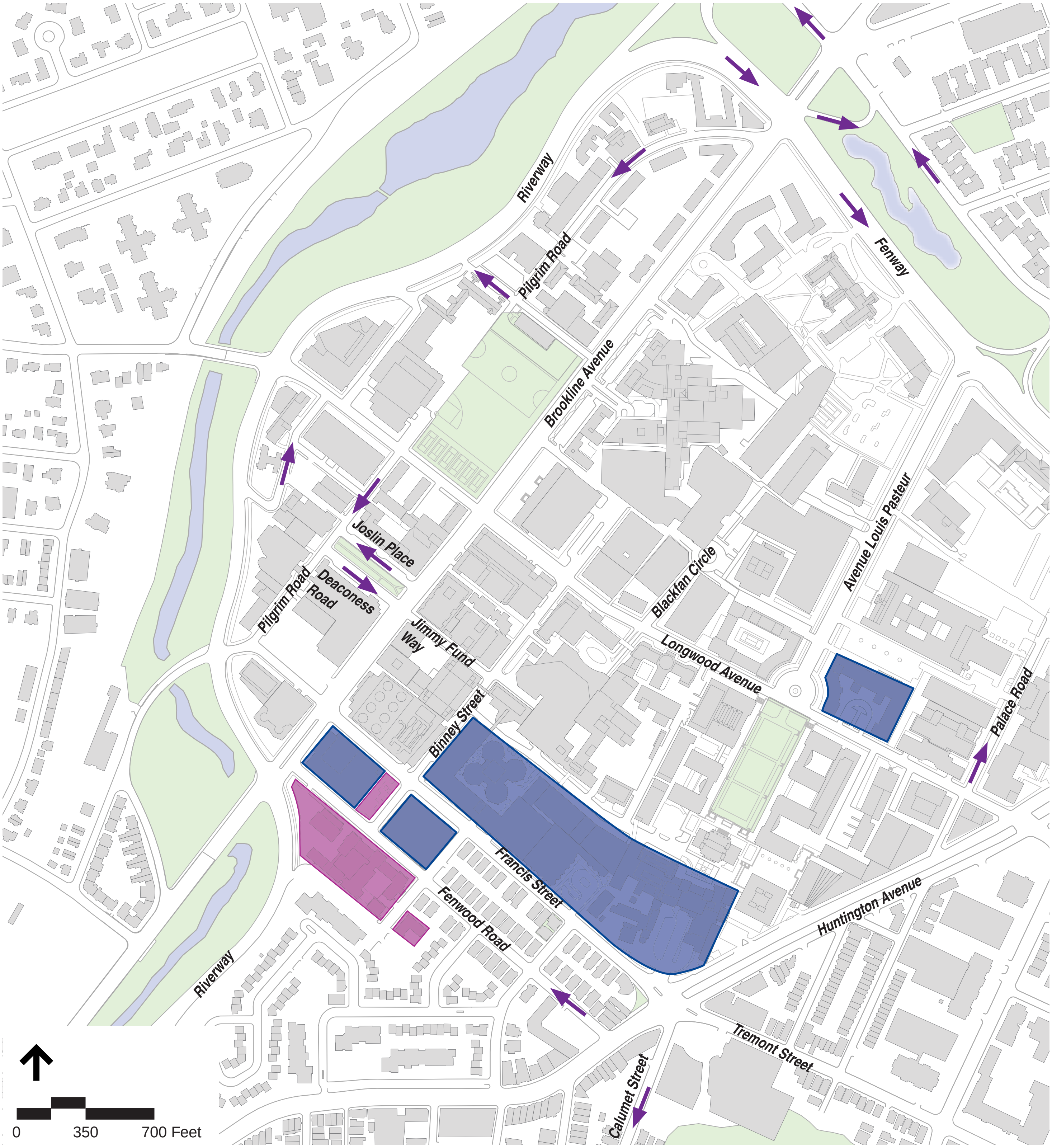
As requested, we have prepared a map of LMA to help you with your scoping letter. Please let me know if there is anything else you need. My contact information is provided below.

Thanks,
Ellen

Ellen Donohoe
Project Manager
VHB/Vanasse Hangen Brustlin, Inc.
99 High Street, 10th Floor
Boston, MA 02110
p. 617.728.7777
f. 617.728.7782

Mass Mental Health Center Redevelopment

Brigham and Womens Hospital Campus



TRANSMITTAL

3 Clock Tower Place, Suite 250 Maynard, MA 01754-0700 Phone: 978/897-7100 Fax: 978/897-0099	Epsilon ASSOCIATES INC.

Date:	July 9 2009
To:	Bill Gage
	Massachusetts Environmental Policy Act Office
	Executive Office of Energy and Environmental Affairs
	100 Cambridge Street
	Boston, MA 02114
From:	Katherine Fuller
	978-461-6264
RE:	Massachusetts Mental Health Center IMPNF/PNF

☐ Urgent ☐ For Review ☐ Please Comment ☐ Please Reply ☐ For Your Use

- **Comments:**

Enclosed is a copy of the Massachusetts Mental Health Center Redevelopment Institutional Master Plan Notification Form / Project Notification Form (IMPNF/PNF) for your use. The IMPNF/PNF was submitted to the Boston Redevelopment Authority pursuant to Article 80 of the Boston Zoning Code on June 16, 2009. Please contact me with any questions or concerns.

Regards,

Katherine

Appendix A

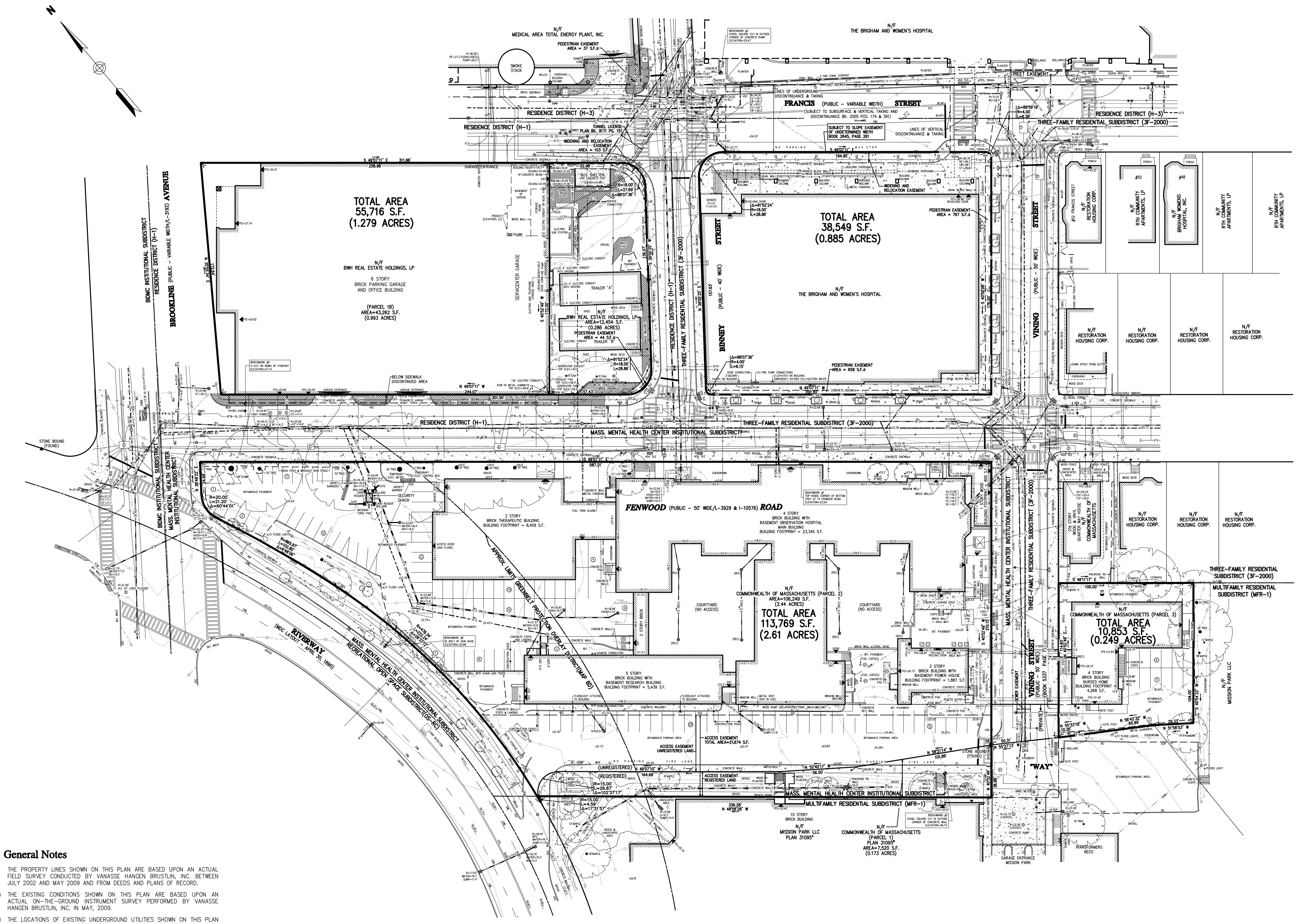
Site Plans

VHB

Vanasse Hangen Brustlin, Inc.

Transportation
Land Development
Environmental Services

101 Walnut Street, P.O. Box 9151
Watertown, Massachusetts 02471-9151
617 924 1770 • FAX 617 924 2286



30 0 30 60
SCALE IN FEET

Legend

- DRAIN MANHOLE
- CATCH BASIN
- SEWER MANHOLE
- ELECTRIC MANHOLE
- TELEPHONE MANHOLE
- MANHOLE
- HANDHOLE
- WATER GATE
- FIRE HYDRANT
- GAS GATE
- STREET SIGN
- LIGHT POLE
- UTILITY POLE
- GUY WIRE
- GUY POLE
- FIRST FLOOR ELEVATION
- MONITORING WELL
- EDGE OF PAVEMENT
- CONCRETE CURB
- VERTICAL GRANITE CURB
- SLOPED GRANITE EDGE
- BITUMINOUS BERM
- GUARD RAIL
- CHAIN LINK FENCE
- DRAINAGE LINE
- SEWER LINE
- OHW — OVERHEAD WIRE
- E — UNDERGROUND ELECTRIC
- T — TELEPHONE LINE
- G — GAS LINE
- W — WATER LINE
- STONEWALL
- TREELINE

General Notes

1) THE PROPERTY LINES SHOWN ON THIS PLAN ARE BASED UPON AN ACTUAL FIELD SURVEY CONDUCTED BY VANASSE HANGEN BRUSTLIN, INC. BETWEEN JULY 2002 AND MAY 2009 AND FROM DEEDS AND PLANS OF RECORD.
2) THE EXISTING CONDITIONS SHOWN ON THIS PLAN ARE BASED UPON AN ACTUAL ON-THE-GROUND INSTRUMENT SURVEY PERFORMED BY VANASSE HANGEN BRUSTLIN, INC. IN MAY, 2009.
3) THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES SHOWN ON THIS PLAN ARE ABASED ON FIELD OBSERVATIONS AND INFORMATION OF RECORD. THEY ARE NOT WARRANTED TO BE EXACTLY LOCATED NOR IS IT WARRANTED THAT ALL UNDERGROUND UTILITIES OR OTHER STRUCTURES ARE SHOWN ON THIS PLAN.
4) ELEVATIONS SHOWN ON THIS PLAN REFER TO BOSTON CITY BASE.
5) THE SITE LIES ENTIRELY WITHIN ZONE C (AREA OF MINIMAL FLOODING) AS SHOWN ON THE FLOOD INSURANCE RATE MAP FOR THE CITY OF BOSTON, MASSACHUSETTS COMMUNITY PANEL NUMBER 250286 0009C, EFFECTIVE DATE APRIL 1, 1982.
6) THE UTILITY INVERT ELEVATIONS ARE LISTED IN A CLOCKWISE DIRECTION WITH THE OUTLET ELEVATION LAST.
7) SITES SHOWN ON THIS PLAN LIE WITHIN SEVERAL DISTRICTS ON TWO ZONING MAPS. ON THE CITY OF BOSTON ZONING MAP 6D (MISSION HILL NEIGHBORHOOD DISTRICT) DISTRICTS INCLUDE; i) MASS. MENTAL HEALTH CENTER INSTITUTIONAL SUBDISTRICT; ii) THE GREENBELT OVERLAY PROTECTION DISTRICT; iii) MULTIFAMILY RESIDENTIAL SUBDISTRICT (MFR-1); iv) THREE-FAMILY RESIDENTIAL SUBDISTRICT (3F-2000); v) INSTITUTIONAL MASTER PLAN AREA. ON THE CITY OF BOSTON ZONING MAP 1 (BOSTON PROPER) DISTRICTS INCLUDE: i) APARTMENT RESIDENCE DISTRICTS (H-1 & H-3); ii) INSTITUTIONAL MASTER PLAN AREA; iii) INSTITUTIONAL OVERLAY DISTRICT

No.	Revision	Date	Appvd.
2	PLAN UPDATES	10/5/09	RJB
1	PLAN UPDATES	8/21/09	RJB

Designed by | Drawn by | Checked by

CAD checked by | Approved by

Scale 1"=30' | Date May 27, 2009

Project Title

Brigham & Women's Massachusetts Mental Hospital

Boston, Massachusetts

Issued for

Drawing Title

Existing Conditions Plan of Land

Drawing Number

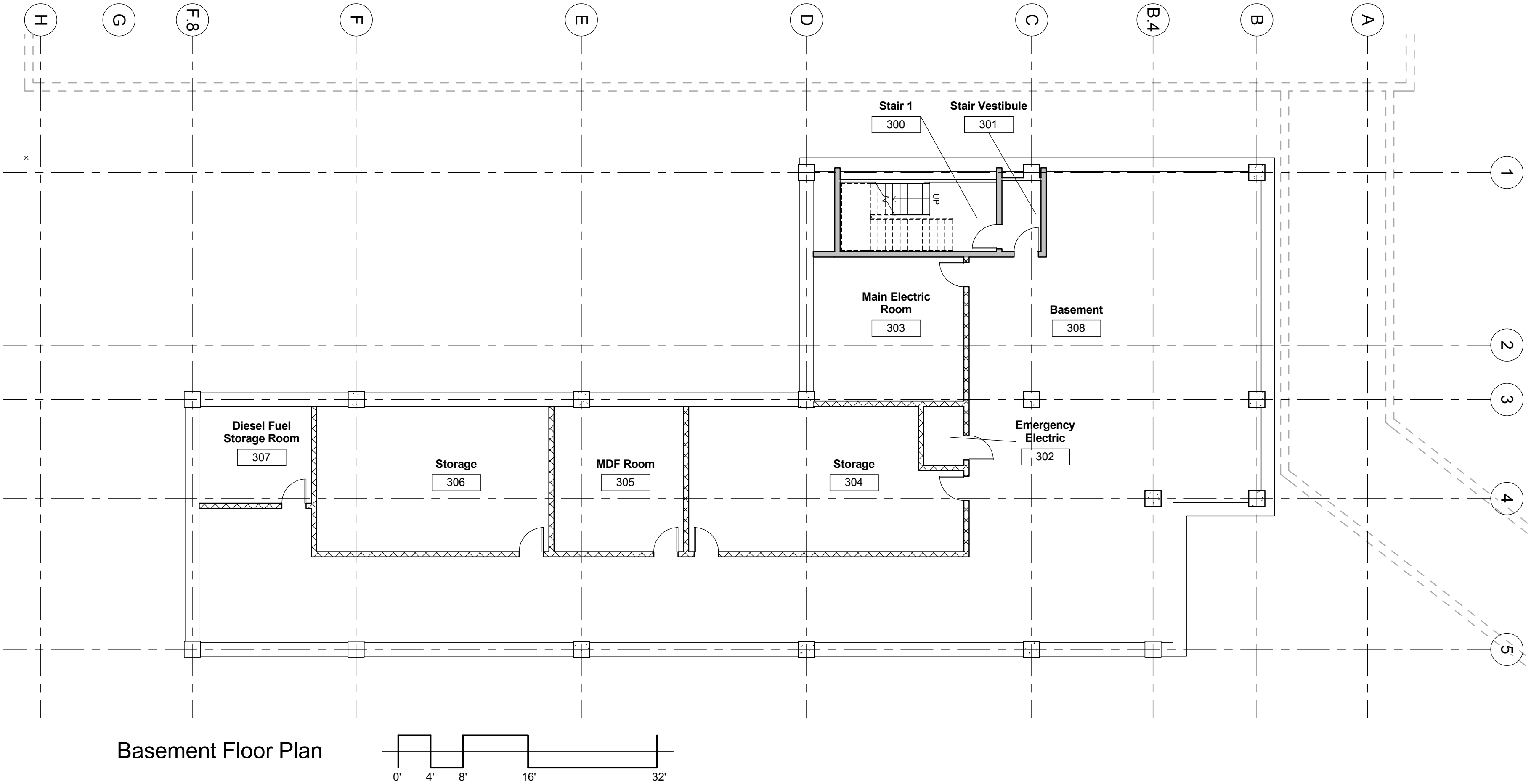
Sv-1

Sheet 1 of 1

Project Number
10568.00

Appendix B

Urban Design



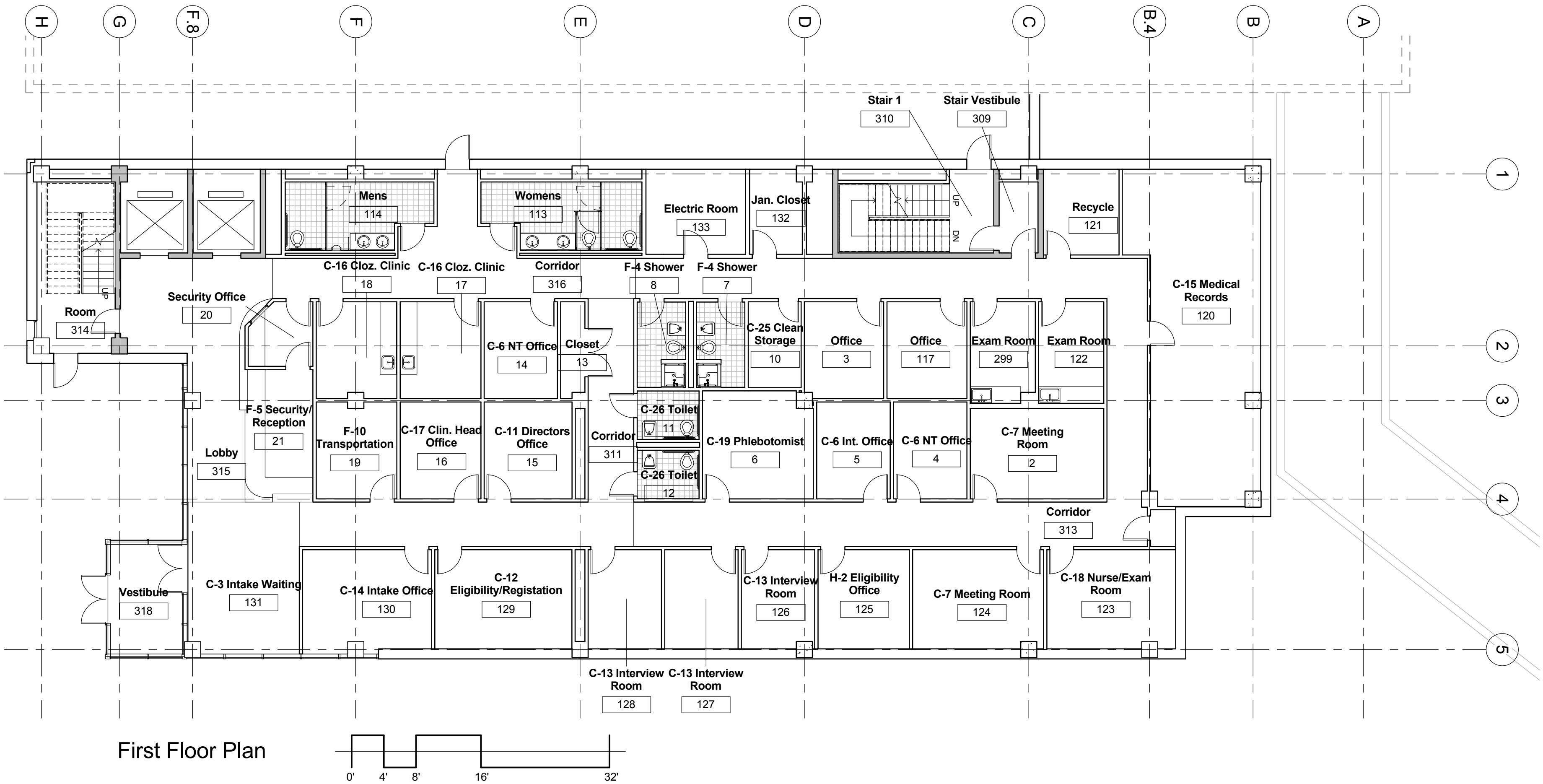
Basement Floor Plan

Massachusetts Mental Health Center Boston, Massachusetts

LINEA 5, inc. Boston, MA • Miami Beach, FL
tat | the architectural team

Floor Plans

Binney Street Building, Basement Floor Plan



First Floor Plan

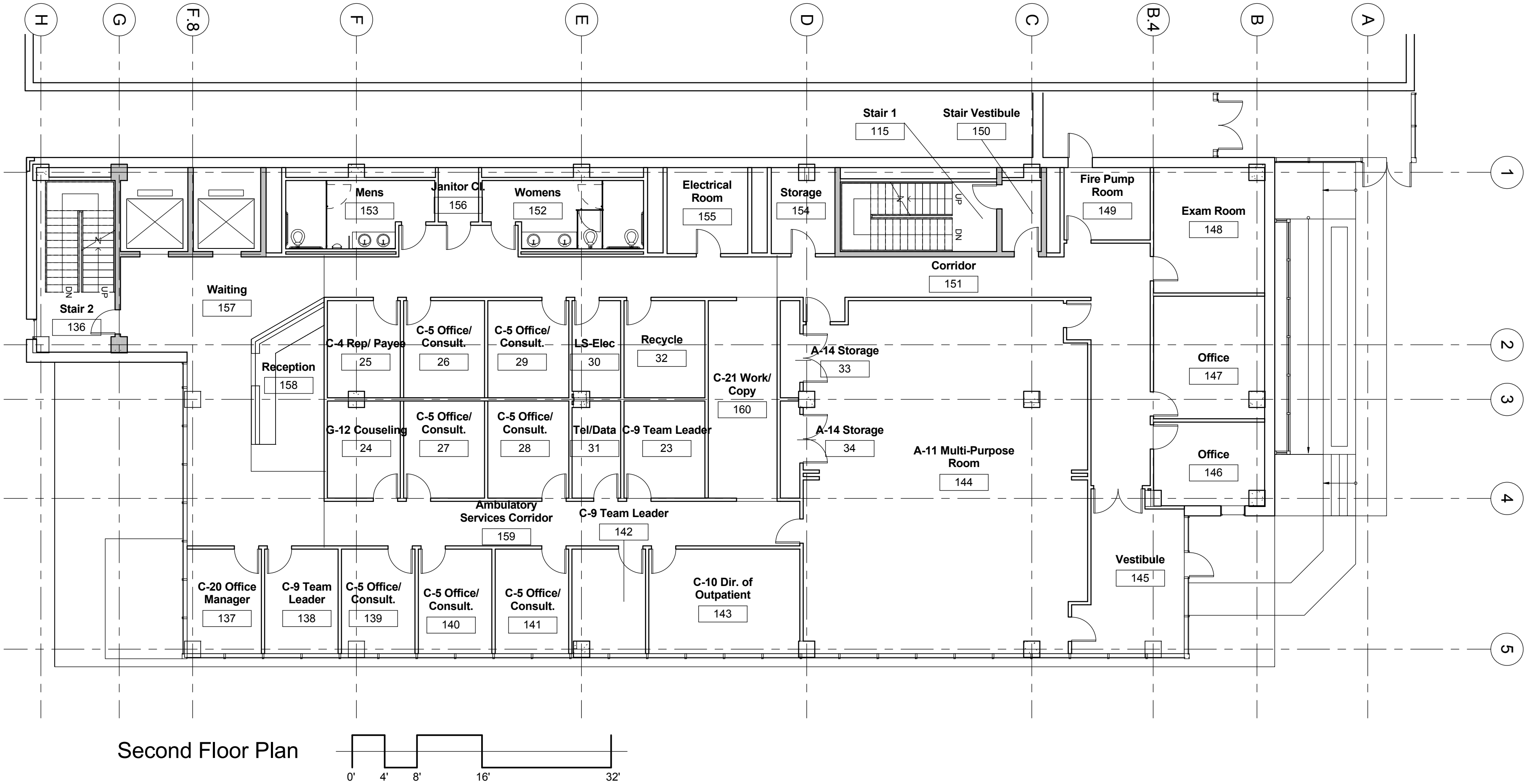
Massachusetts Mental Health Center Boston, Massachusetts

LINEA 5, inc.
Boston, MA • Miami Beach, FL

tat | the architectural team

Floor Plans

Binney Street Building, First Floor Plan



Second Floor Plan

Massachusetts Mental Health Center Boston, Massachusetts

LINEA 5, inc. Boston, MA • Miami Beach, FL

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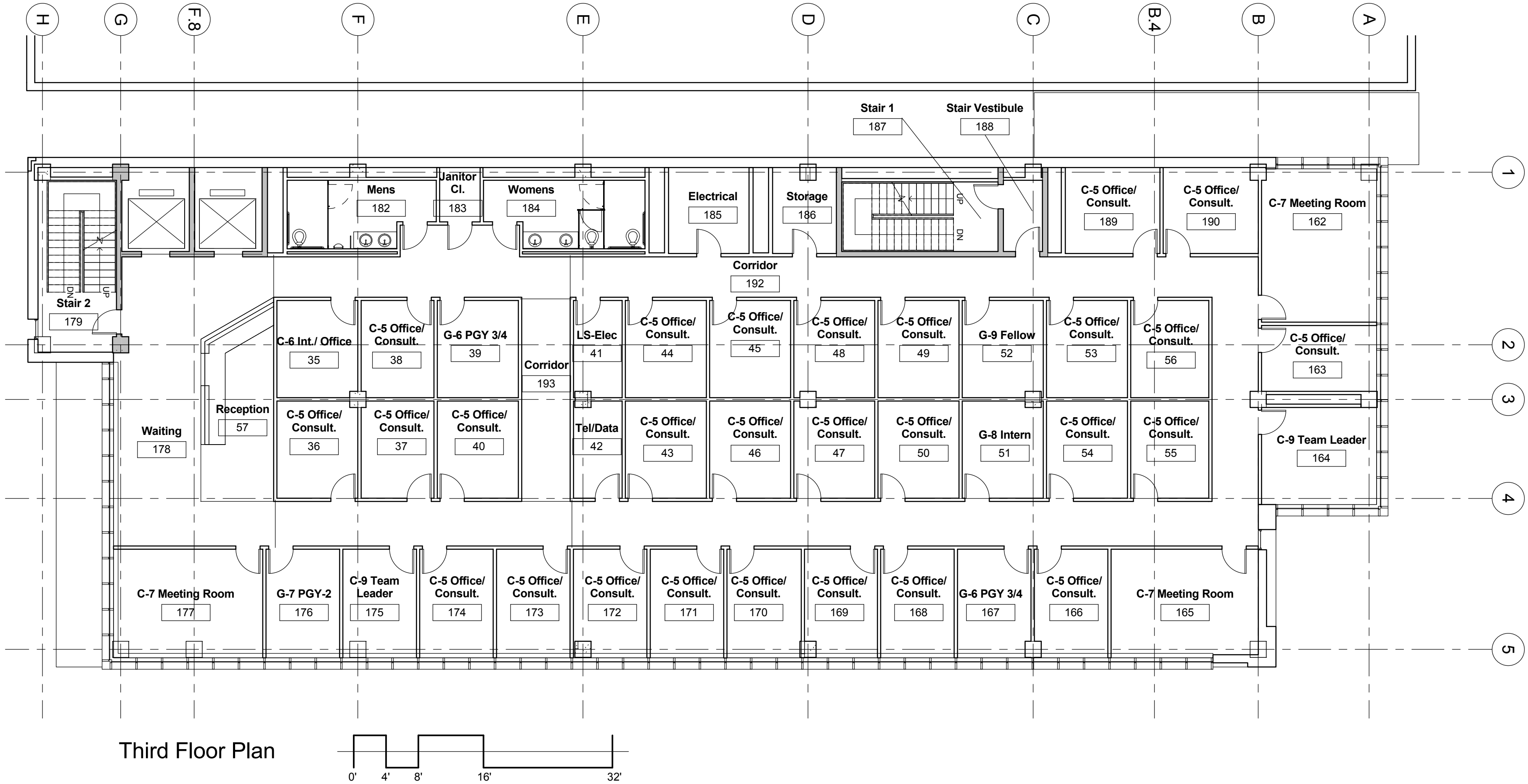
Floor Plans

Binney Street Building, Second Floor Plan



Third Floor Plan

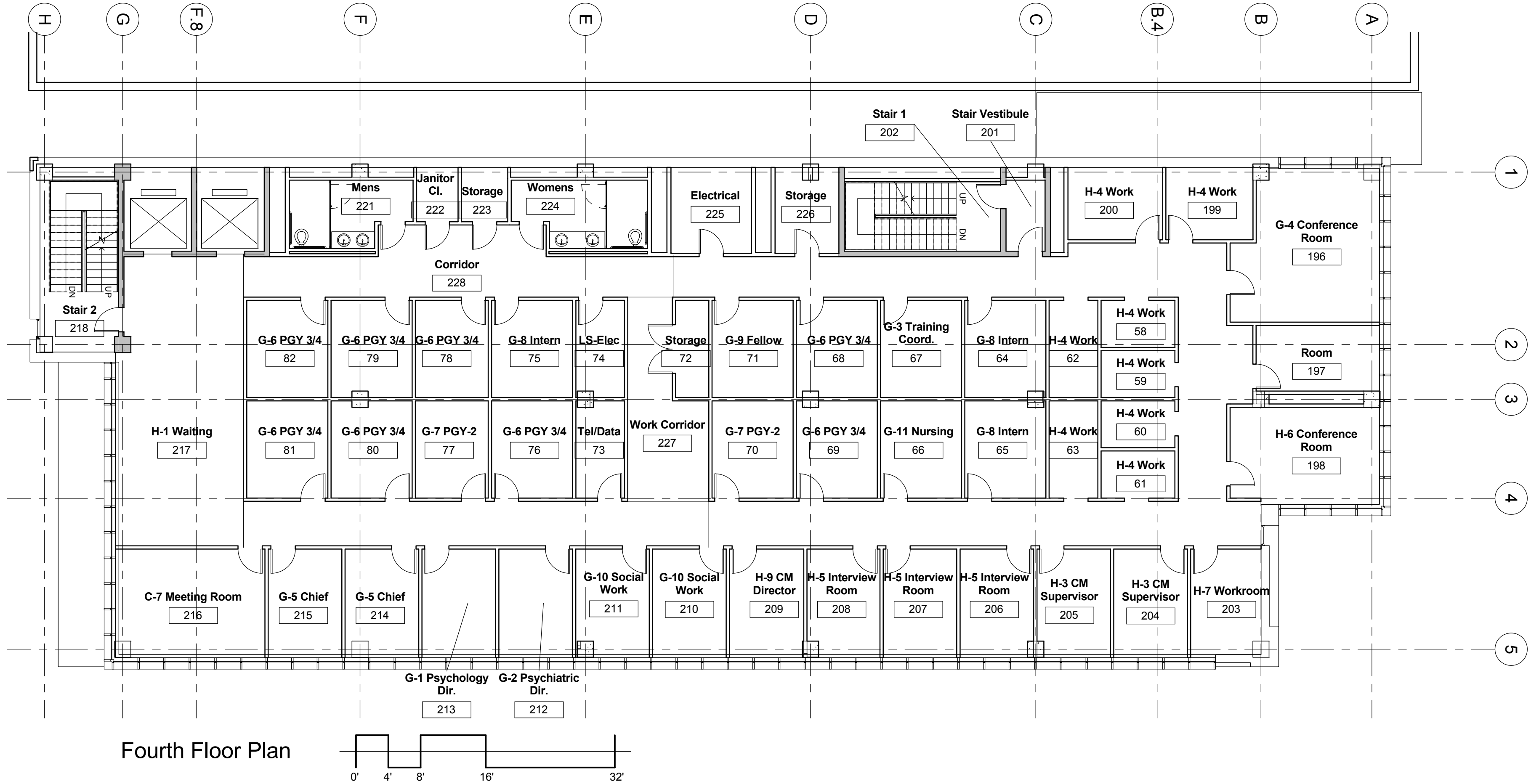
Massachusetts Mental Health Center   Boston, Massachusetts

LINEA 5, inc. Boston, MA • Miami Beach, FL

tat | the architectural team

Floor Plans

Binney Street Building, Third Floor Plan



Massachusetts Mental Health Center Boston, Massachusetts

LINEA 5, inc.
Boston, MA • Miami Beach, FL

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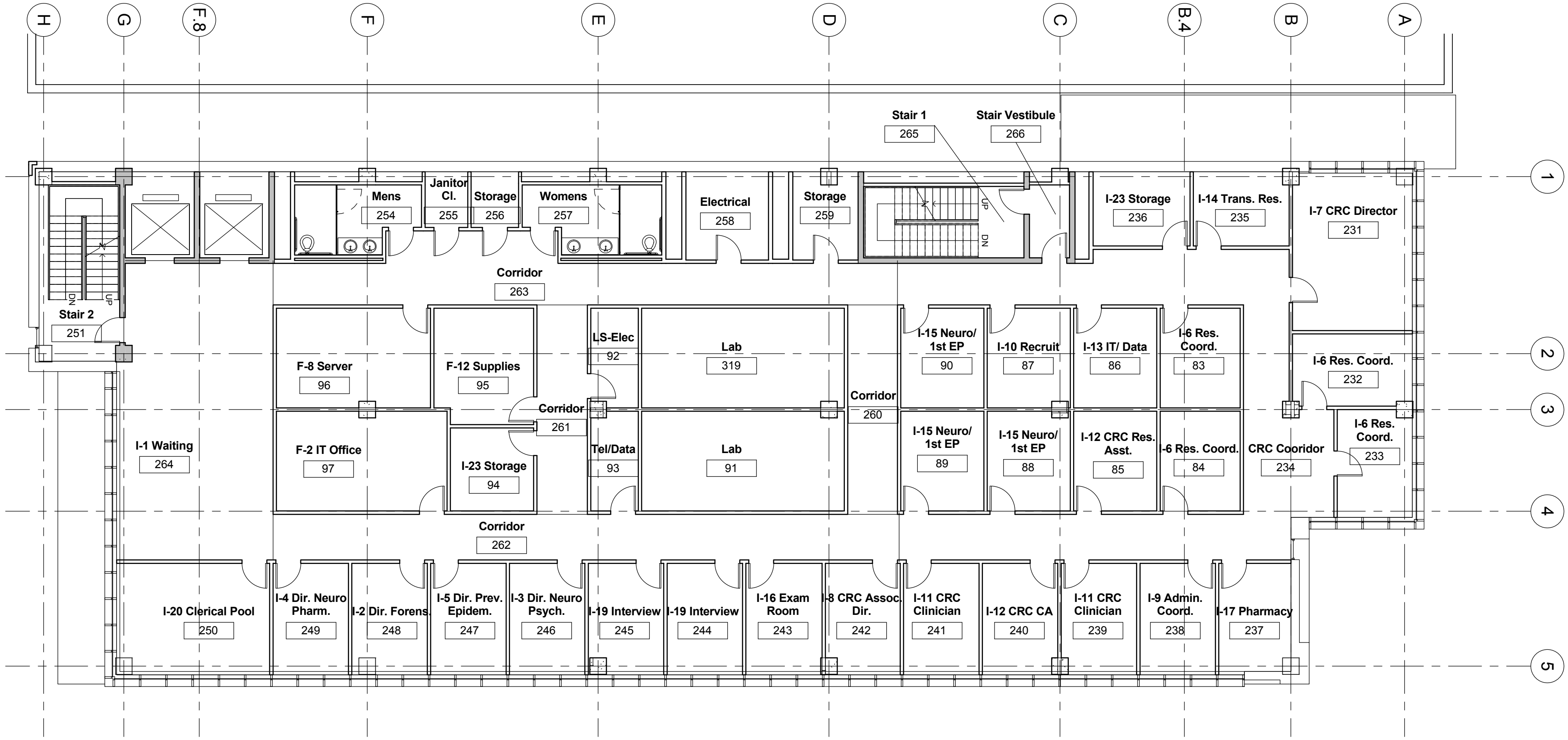
Floor Plans

Binney Street Building, Fourth Floor Plan



Fifth Floor Plan

0' 4' 8' 16' 32'

Massachusetts Mental Health Center Boston, Massachusetts

LINEA 5, inc. Boston, MA • Miami Beach, FL

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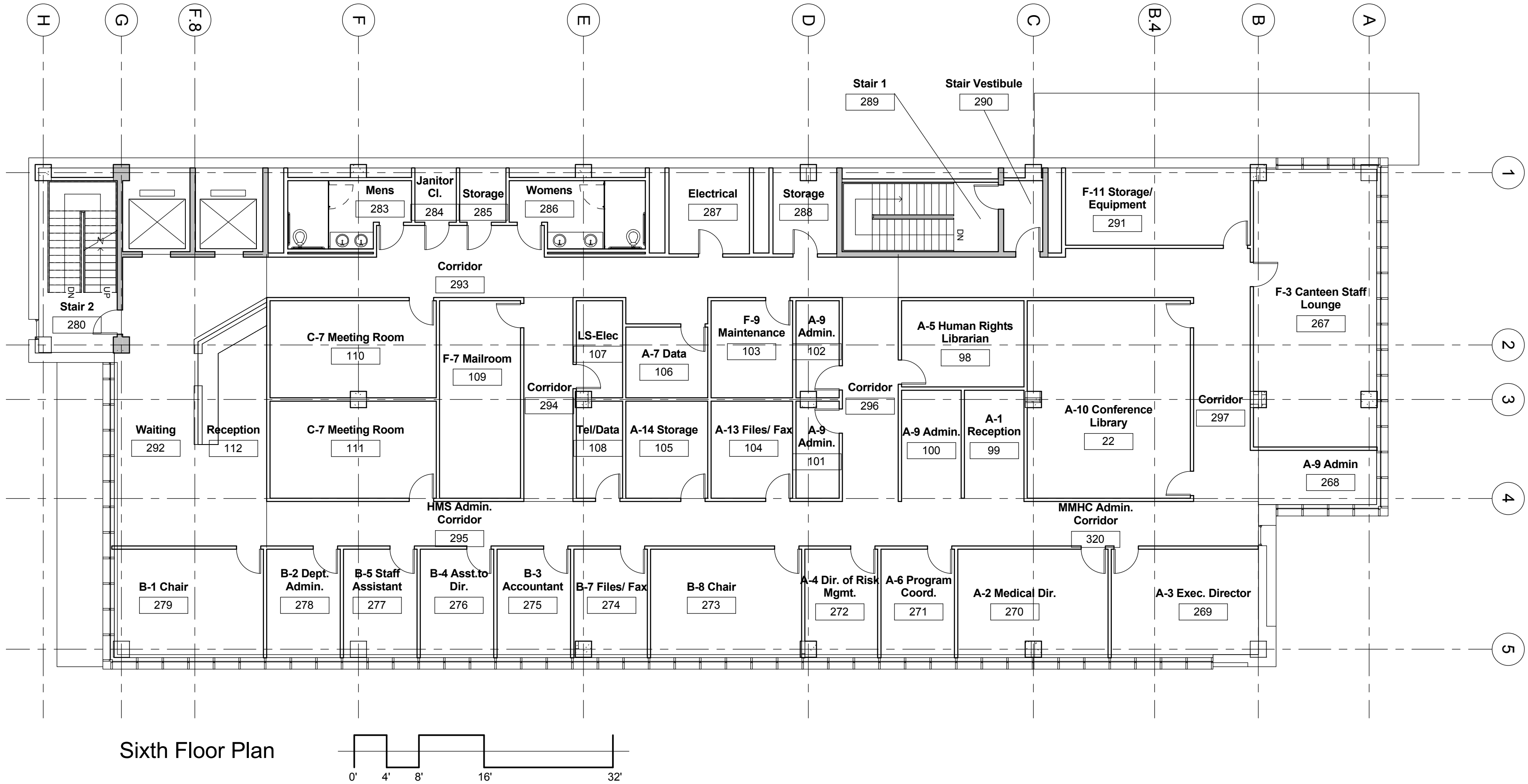
Floor Plans

Binney Street Building, Fifth Floor Plan



Sixth Floor Plan

Massachusetts Mental Health Center   Boston, Massachusetts

LINEA 5, inc.
Boston, MA • Miami Beach, FL

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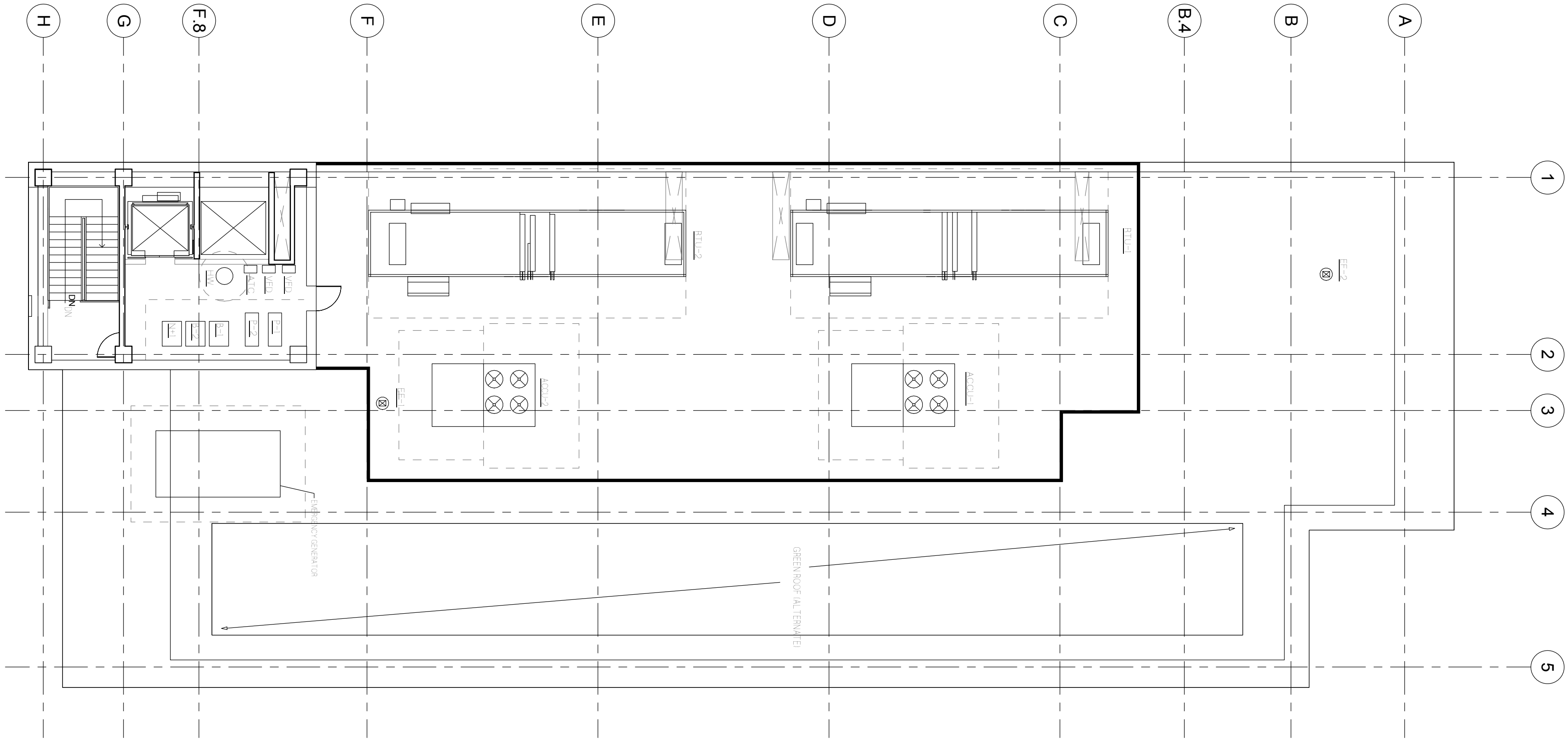
Floor Plans

Binney Street Building, Sixth Floor Plan



Roof Plan

0' 4' 8' 16' 32'

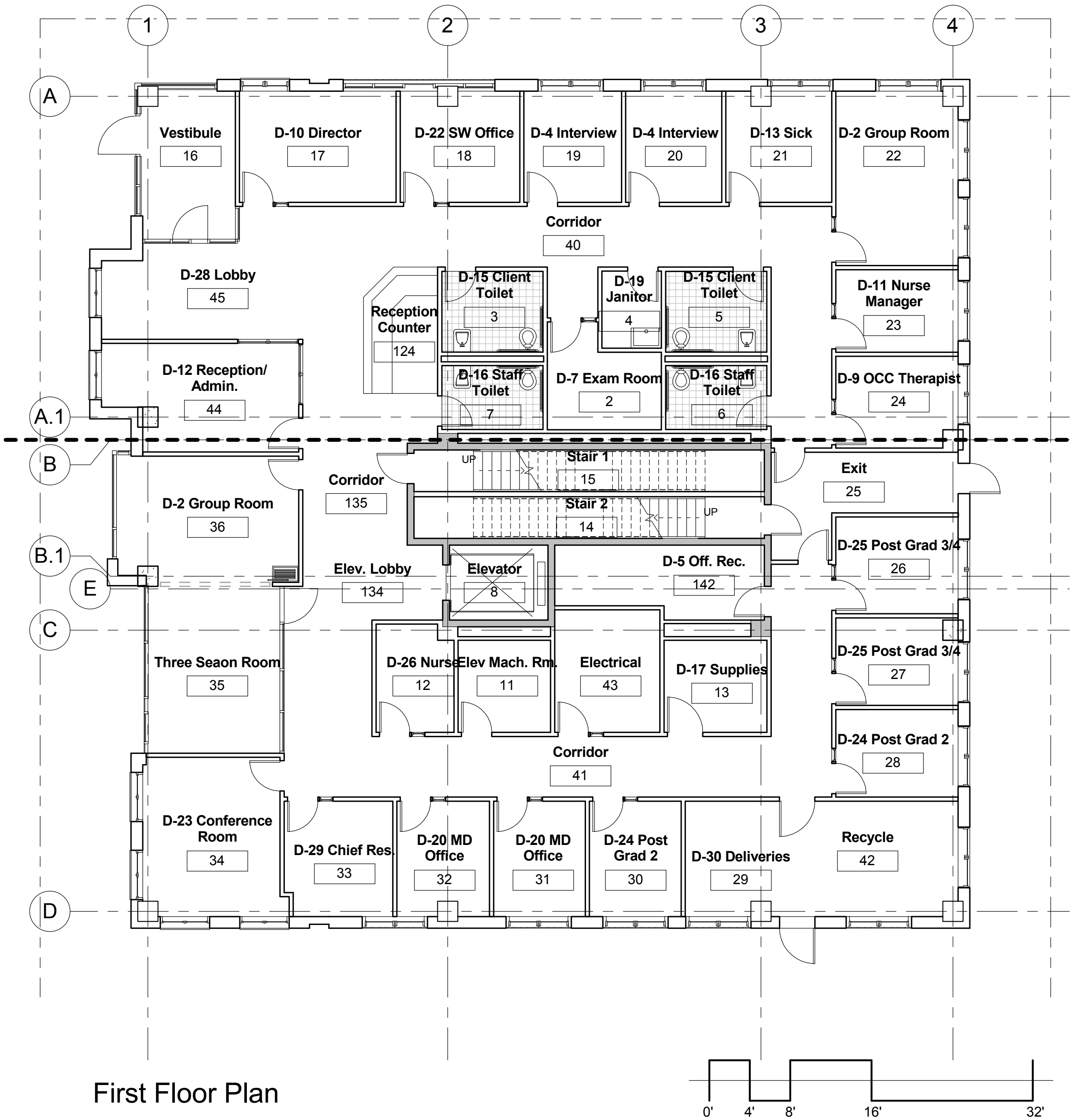
Massachusetts Mental Health Center **Boston, Massachusetts**

LINEA 5, inc. Boston, MA • Miami Beach, FL

tat | the architectural team

Floor Plans

Binney Street Building, Roof Plan



First Floor Plan

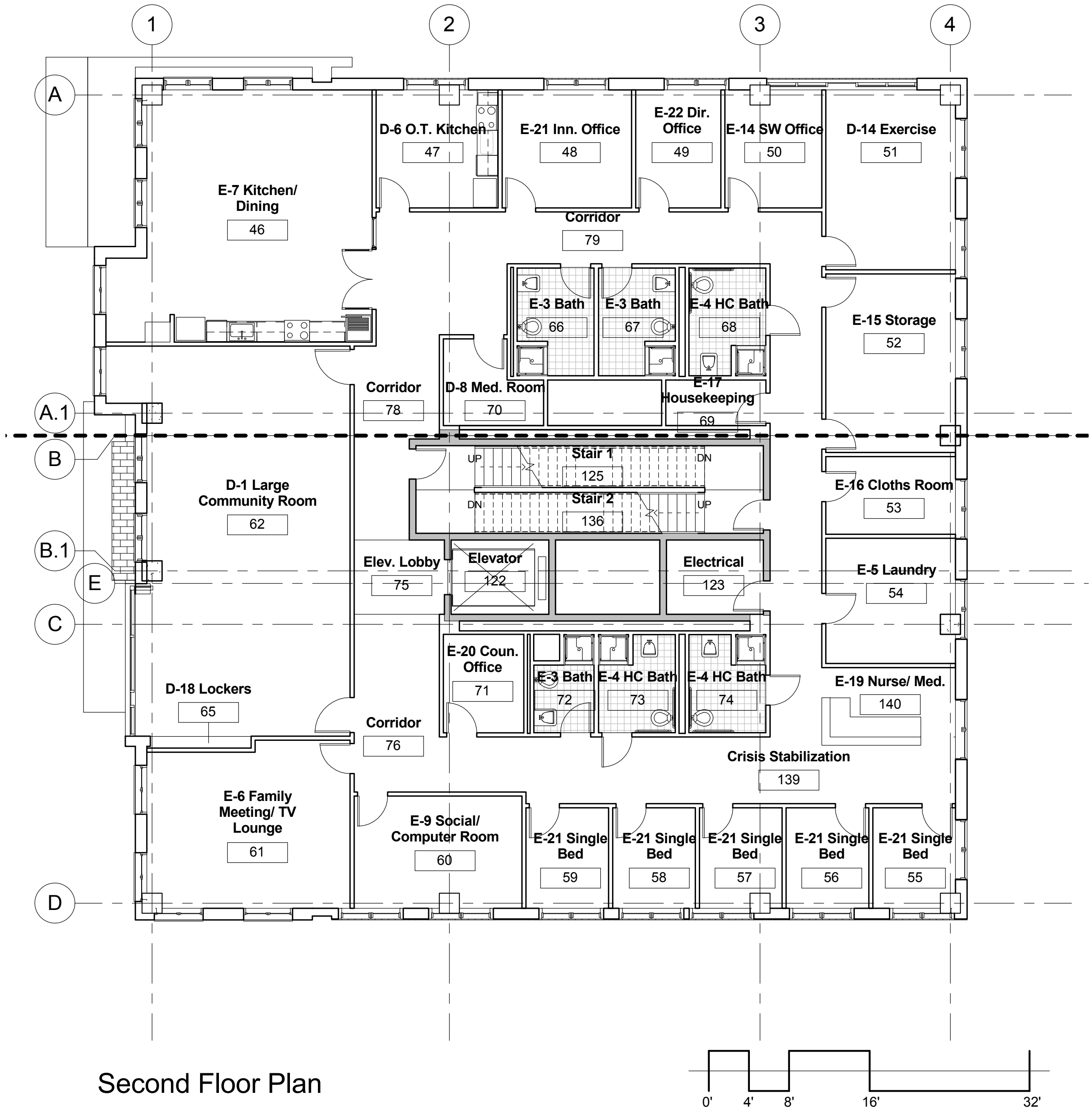
Massachusetts Mental Health Center   Boston, Massachusetts

LINEA 5, inc. Boston, MA • Miami Beach, FL

tat | the architectural team

Floor Plans

Partial Hospital/ Fenwood Inn, First Floor Plan



Second Floor Plan

Massachusetts Mental Health Center   Boston, Massachusetts

LINEA 5, inc.
Boston, MA • Miami Beach, FL

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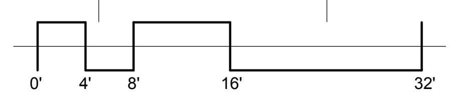
Floor Plans

Partial Hospital/ Fenwood Inn, Second Floor Plan

Third Floor Plan



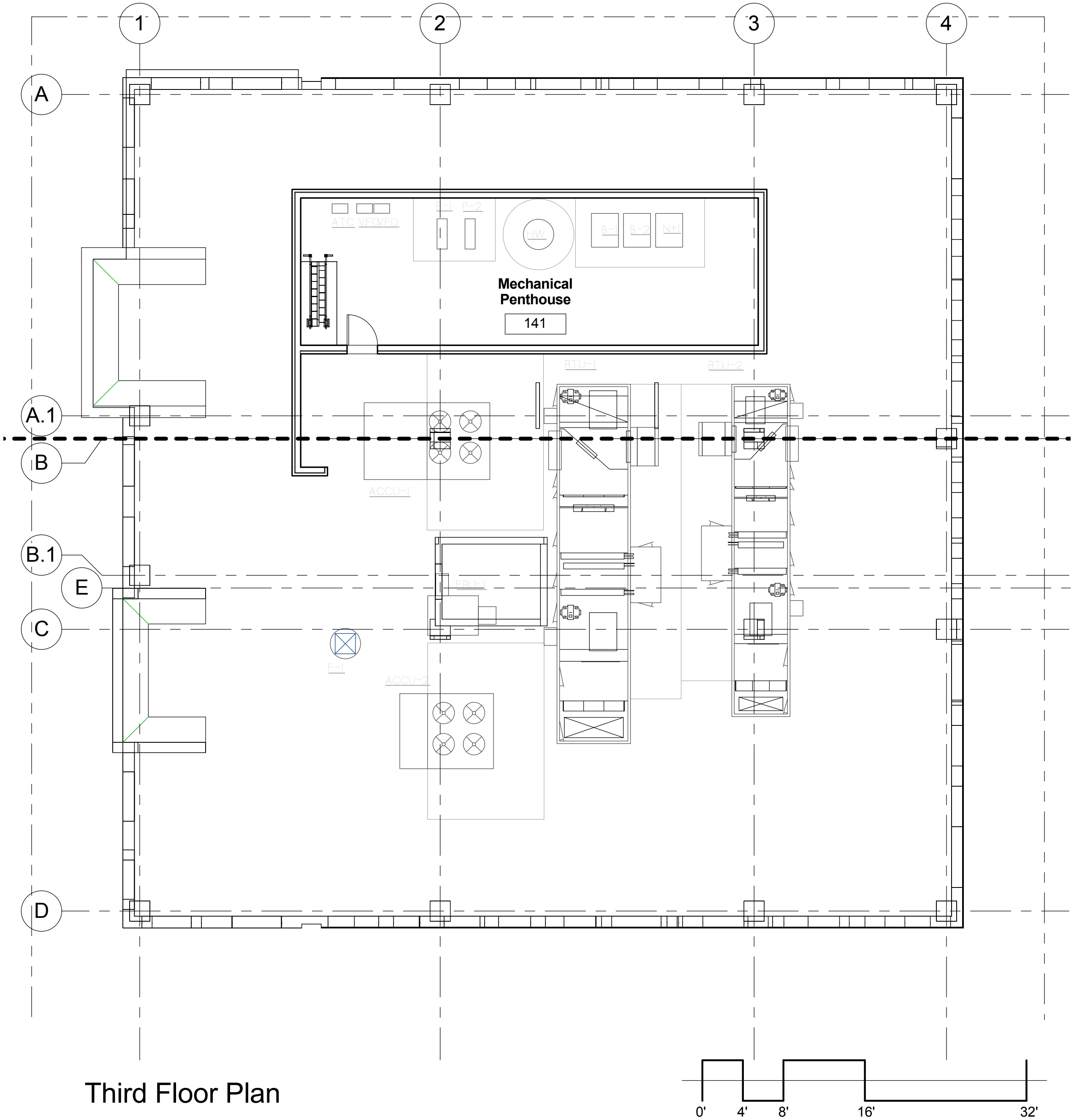
Massachusetts Mental Health Center Boston, Massachusetts

LINEA 5, inc.
Boston, MA • Miami Beach, FL

tat | the architectural team

Floor Plans

Partial Hospital/ Fenwood Inn, Third Floor Plan



Third Floor Plan

Massachusetts Mental Health Center   Boston, Massachusetts

Appendix C

Transportation

Scoping Document

Boston Transportation Department

BOSTON
TRANSPORTATION
DEPARTMENT

ONE CITY HALL PLAZA/ROOM 721
BOSTON, MASSACHUSETTS 02201
(617) 635-4680/FAX (617) 635-4295

August 12, 2009

Sonal Gandhi
Boston Redevelopment Authority
One City Hall Square, 9th Floor
Boston, MA 02201

RE: Massachusetts Mental Health Center Redevelopment – Project Notification Form/Institutional Master Plan Notification Form

Dear Ms. Gandhi,

Thank you for the opportunity to comment on the Project Notification Form/Institutional Master Plan Notification Form (PNF/IMPNF) for the Massachusetts Mental Health Center Redevelopment. The proposal includes four buildings on three sites: a Residential Building with approximately 136 units of mostly affordable housing, to be developed by the Roxbury Tenants of Harvard; a Brigham and Women's Building with 358,670 square feet of space for research and development, clinical and office uses; a building on Binney Street with 56,540 square feet of clinical and office space; and a Partial Hospital/Fenwood Inn Building with 30 residential units, an 8,260 square foot outpatient clinic, and a "partial hospital" (a link between inpatient and outpatient mental health treatment).

The proposal also includes a 406-space parking garage to be located below the Brigham and Women's Building. Under the current plan, 90 parking passes would be provided by Brigham and Women's for the new residential units in the nearby Mission Park Garage.

The Residential Building and the Brigham and Women's Building would be constructed on the site of the former Massachusetts Mental Health Center, which contains five vacant buildings and approximately 163 surface parking spaces that are currently leased by the Department of Capital Asset Management (DCAM) to Brigham and Women's Hospital.

The project would be built in phases, with the Binney Street Building and the Partial Hospital/Fenwood Inn building to be constructed upon completion of permitting, and the Residential Building and the Brigham and Women's Building to be constructed in a subsequent phase when capital is available. The Brigham and Women's Building must be completed within 10 years of the completion of the Binney Building under the terms of the development agreement with DCAM.

As a next step, the proponent will be required to develop an Institutional Master Plan (IMP) and a Draft Project Impact Report (DPIR) that responds to the scope of work outlined by the Boston Transportation Department (BTD). Analysis performed by the proponent will lead to a Transportation Access Plan Agreement (TAPA), which will codify the project's transportation-related elements, including mitigation items. To further the discussion that will lead to the TAPA, the following comments identify issues needing clarification, additional submissions, and proposed mitigation items.

Parking

Parking in the Longwood Medical Area is a challenge for the City, the neighborhood, and the medical institutions that are so critical to the region's economy. Too much parking encourages driving and exacerbates traffic congestion. Too little parking puts pressure on parking in adjacent neighborhoods and could hinder job recruitment. BTD intends to work closely with the proponent to determine the minimum amount of parking needed to support this development, taking into account capacity in existing lots and garages, and assuming implementation of aggressive and effective parking demand management strategies, as described below.

Number of Spaces

The proponent is proposing to construct a 406-space underground parking garage in conjunction with the Brigham and Women's Building in the second phase of the project. This represents a rate of 0.65 parking spaces per thousand square feet of development. Parking for the Residential Building would be provided in the existing Mission Park Garage. The spaces displaced by the residential parking would be relocated in the new parking garage.

In the interim phase before the Brigham and Women's Building is completed, the proposal is to provide 50 parking spaces for the Department of Mental Health on the project site as surface parking or in the adjacent Servicenter Garage. The existing site has 163 surface parking spaces.

The IMPNF notes that starting in October, 2009 Brigham and Women's Hospital will control 650 spaces in the Servecenter Garage, an increase of 580 spaces from the 70 spaces it currently leases from MASCO.

To clarify future parking needs, the proponent should analyze the existing parking supply and utilization, and predicted supply and demand at four stages: 1) During construction of the first phase; 2) After the first phase is completed; 2) During the interim between the first phase and construction of the Brigham and Women's Building; and 3) After construction of the Brigham and Women's Building. The potential for accommodating parking demand in appropriately remote facilities should be included in the analysis.

The parking analysis should also include a description of proposed parking policies and pricing in the proposed underground garage, including allowable users, allocation of spaces among users, permits and leases, public parking, reserved and dedicated spaces, shared parking strategies, fee structures/rates, discounts, and cash-out (see below) policies.

Parking Demand Management

BTD commends Brigham and Women's Hospital for providing remote parking facilities for its employees and offering a parking rate structure that makes it advantageous for employees to park outside of the LMA. Future submittals should provide more details on the parking rate structure, and efforts to make use of additional appropriately remote parking facilities.

BTD encourages the proponent to take parking demand management a step further by implementing a "cash-out" program for employees that receive parking as part of their compensation packages. Employees that accept the parking cash-out would agree to commute by methods that don't require parking and would receive a cash allowance equal to the employer paid parking subsidy. This would reduce the demand on existing parking and would also reduce congestion on City streets.

Spaces for Car Share and Low Emission Vehicles

The IMPNF notes that Brigham and Women's will explore the opportunity to provide for a car-sharing service such as Zipcar in the Servicenter Garage. To encourage a reduction in personal automobile use, the proponent should provide spaces provided for car-share services and for carpool, vanpool, and shuttle service parking.

Current trends indicate that electric hybrids will soon be a significant percentage of all vehicles on the road. BTD is aggressively promoting the installation of a supporting infrastructure for these vehicles. We request a commitment to dedicate 5% of the total vehicle parking capacity for low-emitting and fuel efficient vehicles, and a commitment to provide dedicated electric vehicle charging stations.

Service and Loading

As noted in the IMPNF, Brigham and Women's Hospital is proposing to use existing loading and service areas located in the Servicenter Loading Dock at 89 Fenwood Road, at the West Plaza Loading Dock at 20 Shattuck Street, and at the Thorn Building (50 Shattuck Street). The site plan also shows a loading area for the Partial Hospital/Fenwood Inn off of Vining Street, a service entrance for the Brigham and Women's Building off the Vining Street extension, and a service entrance for the Residential Building off Fenwood Road. More information is needed to evaluate the service area for the Residential Building, such as the need for a curb cut, and confirmation that sufficient space is provided to ensure that service vehicles do not block the sidewalks.

Public Transportation

The project site is well served by public transportation, with ready access to buses along Brookline, Longwood and Huntington avenues and Greenline D and E Line trolleys. To promote the use of public transportation, Brigham and Women's provides a 50 percent subsidy to the cost of MBTA and commuter rail passes for employees.

In addition, as a member of MASCO, Brigham and Women's Hospital supports ten bus routes that provide service within one-half mile of the project site.

BTD comments the efforts of Brigham and Women's Hospital to promote the use of mass transit and public transportation. As a further incentive to encourage mode shift, we encourage the proponent to institute a program used by other area hospitals in which free transit passes are provided to employees who give up their parking spots for three months under a "Three for Free" program.

Traffic

A detailed, empirically-based estimate of future trip generation based on resident, employment and patient projections and a comprehensive review of existing conditions will be required for each phase of this project. At a minimum, the evaluation should include analysis of the following intersections:

- Longwood Avenue and Riverway
- Longwood Avenue and Brookline Avenue
- Longwood Avenue and Binney Street
- Longwood Avenue and Huntington Avenue
- Francis Street and Brookline Avenue
- Francis Street and Binney Street
- Francis Street and Vining Street
- Francis Street and Huntington Avenue
- Riverway and Brookline Avenue
- Fenwood Road and Brookline Avenue
- Fenwood Road and Binney Street
- Fenwood Road and Vining Street
- Fenwood Road and Huntington Avenue
- Vining Street Extension and Vining Street

Counts at these intersections shall include bicycle and pedestrian counts as well as vehicular counts.

Pedestrian Access

Given the number of people who walk to destinations in this area or combine transit with walking, it is important to provide a safe and inviting pedestrian environment along any sidewalks impacted by this project. BTD is most interested in streetscape improvements (including generous sidewalks and street trees), wayfinding and signage, and enhancements to pedestrian access and connectivity to the campus. Future submittals should describe these and provide pedestrian counts and projections along major pedestrian routes to the buildings.

Bicycle Access

The project site is located between two major links in the City's off-road bicycle network – the Southwest Corridor and Riverway portion of the Emerald Necklace. As the City expands its network of on-street facilities and makes connections to these off-road paths, bicycle ridership is expected to increase. In addition, the City is working with MAPC and neighboring cities to launch a bike share program in the spring of 2010, with an expected 1,500 to 3,000 bicycles to be located in the metropolitan area. These efforts are expected to dramatically increase bicycle ridership in the City over time.

Future submittals should describe the existing accommodations for bicycles (including the location and number of bike racks and bike cages) and any proposed improvements to the accommodations. The site plans must include secure covered bike parking spaces for residents and employees, and covered or open outdoor bike parking spaces for patrons and visitors. The IMP should also consider provision of spaces for bike share facilities, and potential bike share locations. All spaces must be conveniently located near building entrances. BTD is in the process of updating its Bicycle Facilities Policy that addresses the minimum number of spaces required – the draft new policy is attached.

To encourage commuting by bicycle, the project must also include shower facilities that are available for use by all building employees.

Transportation Demand Management

The PNF/IMPNF briefly describes TDM measures currently implemented by Brigham and Women's Hospital. BTD looks forward to reviewing a more detailed description of the program and new measures proposed to improve the effectiveness and comprehensiveness of the program. Using the existing program as a foundation, BTD will work with the proponent to determine the specifics to be codified in the TAPA.

Site Plan

The proponent needs to submit an engineered site plan within the context of the surrounding roadways at 1:20 scale depicting:

- Vehicular Access and Circulation
- Parking Layout and Circulation
- Pedestrian Access and Circulation
- Bicycle Access and Circulation
- Shuttle/Van Pool Pickup and Dropoff
- Parking Spaces for Car Sharing services
- Service and Loading*
- Roadways and Sidewalks
- Building Layout
- Bicycle Parking Locations and Types (covered, indoor, bike share, etc)
- Transit Stops and Connections
- Electric Vehicle Charging Stations

* *Trash compactors/dumpsters need to be depicted as well.*

Construction Management Plan

As the project advances, the proponent will be required to develop and submit a detailed Construction Management Plan (CMP) to BTD for review and approval. The CMP will address TDM measures for construction workers, proposed street occupancies, equipment stating, sidewalk relocations and hours of construction work. BTD will work with the proponent to execute the CMP.

Sincerely,

Charlotte Fleetwood

Charlotte Fleetwood
Transportation Planner
Boston Transportation Department
Policy and Planning Division

Cc: Vineet Gupta, Director of Policy and Planning
John DeBenedictis, Director of Engineering

Secretary of Energy and Environmental Affairs

The Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, MA 02114

Deval L. Patrick
GOVERNOR

Timothy P. Murray
LIEUTENANT
GOVERNOR

Ian A. Bowles
SECRETARY

Tel: (617) 626-1000
Fax: (617) 626-1181
http://www.mass.gov/envir

August 7, 2009

CERTIFICATE OF THE SECRETARY OF ENERGY AND ENVIRONMENTAL AFFAIRS
ON THE
ENVIRONMENTAL NOTIFICATION FORM

PROJECT NAME	: Massachusetts Mental Health Center Redevelopment
PROJECT MUNICIPALITY	: Fenwood Road – Boston
PROJECT WATERSHED	: Boston Harbor
EOEA NUMBER	: 14440
PROJECT PROPONENT	: Brigham and Women's Hospital/Partners HealthCare/Roxbury Tenants of Harvard
DATE NOTICED IN MONITOR	: July 8, 2009

Pursuant to the Massachusetts Environmental Policy Act (G. L., c. 30, ss. 61-62I) and Section 11.06 of the MEPA regulations (301 CMR 11.00), I hereby determine that this **project requires** the preparation of an Environmental Impact Report (EIR).

Project Overview

According to the Environmental Notification Form (ENF), the proposed project consists of the construction of a 633,960 square feet (sf) mixed-use development and an underground parking garage. The project is proposed to be constructed in three phases. Phase 1 includes the demolition of the 190,000 sf Massachusetts Mental Health Center and the construction of a 56,000 sf replacement clinical and office building on the Binney Street parcel and a 21,000 sf mental health hospital housing 47 beds and providing 50 initial surface parking spaces for the return of the Department of Mental Health (DMH) to the project site. Phase 2 would include the construction of an approximately 182 foot tall, 15 floors, 197,750 sf residential building with 136 units and a 10,000 sf community meeting area by the Roxbury Tenants of Harvard (RTH). The residential building would contain approximately 66 affordable rental units and 70 condominiums. Phase 3 would include the construction of an approximately 220-foot tall, 14 floors (two mechanical floors), 358,670 sf medical office and research building with 406 underground parking spaces to be owned by Partners HealthCare.

The project site is comprised of three parcels that total approximately 3.15 acres. The Binney Street site is currently owned by Partners HealthCare and is vacant of buildings. The two other sites are owned by the Commonwealth. The DMH is planning on relocating their service to within the new Brigham and Women's Hospital (BWH) Building and returning the Binney Street Building to BWH for its use as clinical space.

Access to the proposed parking garage, to be constructed in Phase III, will be from the Vining Street Extension on the back side of the building. Using the Institute of Traffic Engineers Trip Generation land use codes 220 for apartments, 610 for hospital, 620 for nursing home, 710 for office and 760 for research & development space, the proponent has estimated 6,516 unadjusted new average daily vehicle trips. However, after adjusting for Boston Transportation Department (BTD) mode splits for the Longwood Medical Area (LMA), the proponent estimated that the project would generate approximately 3,252 new vehicle trips.

The proposed project will be connected to existing municipal water and sewer service. It will consume approximately 109,100 gallons per day (gpd) of water and will generate approximately 99,180 gpd of wastewater flow.

State Permits and Jurisdiction

This project is subject to a mandatory EIR pursuant to Section 11.03(6)(a)(6) of the MEPA regulations because it involves a land transfer from the Commonwealth, may receive Commonwealth financing, requires state permits, and generates 3,000 or more new vehicle trips. It will require a long-term lease of the land (95 years) from the Division of Capital Asset Management (DCAM). The proponent may require a Massachusetts Department of Conservation and Recreation (DCR) modified Access Permit if the proponent modifies the Riverway by the addition of a right turning lane at the Riverway/ Brookline Avenue intersection. The project will require a Sewer Connection/Extension Permit and an Environmental Results Program Certification for emergency generators and commercial boilers from the Department of Environmental Protection (MassDEP). It is subject to the EEA/MEPA Greenhouse Gas (GHG) Emissions Policy and Protocol. The proponent may need to obtain an Industrial Discharge Permit, a Sewer Use Discharge Permit, and a Construction Dewatering Permit from the Massachusetts Water Resources Authority (MWRA). The project must comply with the National Pollutant Discharge Elimination System (NPDES) General Permit for stormwater discharges from a construction site. It should submit a Notice of Preconstruction to the Massachusetts Aeronautics Commission and a Notice of Construction and Crane Approvals to the Federal Aviation Administration.

Because the proponents may be receiving funding from the Commonwealth (Massachusetts Health and Educational Facilities Authority (MHEFA) and housing grants) and the site is the subject to a land transfer of Commonwealth property, MEPA jurisdiction is broad and extends to all aspects of the project that may cause Damage to the Environment, as defined in the MEPA regulations.

The project is also subject to review by the Boston Redevelopment Authority (BRA) under the Article 80 Large Project Review process of the Boston Zoning Code. Accordingly, the proponent will prepare a Project Impact Report (PIR). It is my view that the planning for this project would be best served by a coordinated review and the submission of a single set of documents to satisfy the requirements of both MEPA (Section 11.09(4)(c) and the BRA (Section 80-6). The proponent should coordinate this joint review process with both agencies to establish the necessary review periods.

SCOPE

As modified by this scope, the Draft EIR should conform to Section 11.07 of the MEPA regulations for outline and content. The Draft EIR should also address the issues outlined below in detail. It should include a copy of this Certificate and all comment letters received on the ENF.

Project Description

The EIR should provide a detailed project description with a summary/history of the project. It should include existing and proposed site plans. The EIR should identify and describe the project phasing and the timing of the phases. It must identify the long-term lease arrangements between the proponents and the Commonwealth. The EIR should discuss the aesthetics of the project, and should include a conceptual-level landscaping plan and building elevations from all sides. It should identify any proposed lighting impacts on adjacent residential structures. The EIR should discuss how this project is compatible with local, regional, and state land use planning.

Alternatives Analysis

The EIR should discuss and compare the Preferred Alternative, an alternative showing the buildable bulk and density under the existing zoning provisions without zoning relief, and the No-Build Alternative. It should summarize any alternatives that have previously been explored for the project site by the proponent. The analysis should clearly present the alternative driveway/garage configurations at the site and identify the advantages and disadvantages of the Preferred Alternative. The EIR should discuss alternative building configurations on the site that might result in fewer impacts, particularly on traffic, parking, and wind and shadows. It should provide a comparative analysis that clearly shows the differences between the environmental impacts associated with each of the alternatives for each of the areas that are scoped.

Traffic

The traffic analysis presented in the EIR should be prepared in conformance with the EEA/EOT Guidelines for EIR/EIS Traffic Impact Assessment. It should identify appropriate mitigation measures for areas where the project will produce impacts on local and regional traffic operations, especially where delay increases at intersections. The unadjusted and adjusted trip generation rates must be fully explained in the EIR. Since this project contains a specialized hospital with outpatient services, the EIR should identify the number and type of outpatient services for the Massachusetts Mental Health Center (MMHC) and BWH. The EIR should provide information regarding how these outpatient visits will reach MMHC and BWH. It should include a breakdown by transportation mode and the reasoning behind these estimated trip generation numbers. It should fully describe all of the proposed components at MMHC and BWH to provide accurate trip generation estimations.

The EIR should include a Level-of-Service (LOS) analysis for the following intersections:

- Brookline Avenue/Fenwood Road;
- Brookline Avenue/Francis Street;
- Francis Street/Huntington Avenue;
- Francis Street/Binney Street;
- Fenwood Road/Binney Street;
- Fenwood Road/Vining Street;
- Fenwood Road/Huntington Avenue;
- Francis Street/Vining Street;
- Francis Street/St. Albans Road;
- Fenwood Road/St. Albans Road;
- St. Albans Road/Huntington Avenue;
- Longwood Avenue/Brookline Avenue; and
- Brookline Avenue/Riverway.

If the scope for the DPIR requires the study of other intersections, the analysis for those intersections should also be presented in the DEIR. The EIR's LOS tables should include the weekday morning and evening peak hours for each movement at these above intersections. It should verify the proposed morning and evening peak hour. The EIR should provide a traffic distribution map and background growth from other proposed projects in the area. Future conditions should cover a five-year (2014) and a ten-year (2019) time horizon to account for the phasing of the project. The EIR should examine present (2009) and future (2014 and 2019) build and no-build traffic volumes for impacted roadways and intersections. The Volume/Capacity ratio should also be provided for signalized intersections. The EIR should include a summary of average and 95th percentile vehicle queues for each intersection within the study area. The DEIR should include a LOS analysis for the Riverway/Brookline Avenue intersection evaluating a no-build scenario, a build scenario without a proposed right-turn lane on the Riverway northbound at the Brookline Avenue intersection, a build scenario with the proposed improvement, and additional proposed alternatives to a proposed right-turn only lane.

Traffic accident history for the three most recent years for which data are available should be reviewed and presented for the study area. In the DEIR, traffic accident problem areas should be identified, and solutions should be proposed.

The EIR should discuss the proponent's coordination efforts with DCR, MassHighway and BTD officials as they address regional and local traffic concerns within this area. It should provide the most current information on the proposed construction dates for any roadway improvements in the area.

The EIR should discuss the suitability of any proposed signalization changes and any roadway widening. It should discuss right-of-way (ROW) implications of possible widening and describe how such ROW's would be acquired. The EIR should include plans showing the configuration of each roadway intersection proposed for modification.

The proponent should consider participating in proposals by DCR, MassHighway, and the BTD to provide additional traffic mitigation measures to reduce the impacts on estimated delay at adjacent intersections along the Brookline Avenue corridor.

Parking

According to the ENF, parking at the site will include approximately 406 parking spaces in an underground garage under the BWH building. The EIR should identify how parking demand and the number of proposed parking spaces was determined. The proponent is also proposing to supply MMHC with 50 parking spaces when MMHC returns to the site. This may be initially done as a surface parking area and later as part of the proponent's 406-space garage. Residential units will be supplied by BWH's existing lease of approximately 90 parking spaces in the adjacent RTH garage. The EIR should identify the number of parking spaces required by zoning, and recommended by the BTD in its citywide standards. It should describe any proposed valet parking. The EIR should describe any proposed off-site parking and for whom this parking is available.

The EIR should include a comprehensive parking needs assessment. The parking needs assessment should take into account the turnover rates for employees, patients, visitors, and residences. It should describe the parking supply and demand in the Longwood Medical Area (LMA) generally. The EIR should inventory both off- and on-street parking and proposed parking fees. It should present vehicle occupancies/modal splits for the trips generated in order to estimate parking demand. Parking demand management should be a key component of the overall mitigation analysis.

Transportation Demand Management

The EIR should outline the proponent's Transportation Demand Management (TDM) Program. TDM measures to consider include: providing a greater transit subsidy to employees using public transportation and providing transit passes to each residential unit as part of the rent or management fee; employing an on-site vehicle trip reduction coordinator; implementing a rideshare matching program; a guaranteed ride home program; additional bicycle incentives; and parking management. The proponents should commit to participating in the Longwood Medical Area (LMA) Transportation Management Agency (TMA).

Public Transit

The EIR should identify the nearby Huntington Avenue/Brigham Circle Stop on the Heath Street Branch and Longwood Station on the Riverside Branch of the Green Line and MBTA bus routes and bus stops in the neighborhood. The Medical Area (MASCO) shuttle bus routes and stops in the area also should be identified. The EIR should identify what transit services have limited capacity available during peak hours. It should also identify how MBTA improvements, like the Urban Ring project may provide service to the LMA in the future. The DEIR should analyze any needed improvements to existing transit service and evaluate potential contributions that can be made by this project to improving transit service in the area.

Pedestrian and Bicycle Facilities

The EIR should show where sidewalks currently exist on a map of the area and where the proponent proposes sidewalks. It should identify the proposed bicycle facility improvements included with this project. Bicycle parking/storage areas should be identified on a plan.

Air Quality

Air Quality microscale modeling for carbon monoxide will be needed for intersections deteriorating to LOS D or worse where the project contributes ten percent or more to the existing traffic volumes. MassDEP must be consulted as to the intersections, sensitive receptors, and model input parameters to be included in these analyses.

An air quality mesoscale analysis for ozone will be needed for this project to assess the total volatile organic compound (VOC) and nitrogen oxide (NOx) emissions associated with all project-related vehicle trips and to demonstrate that VOC/NOx emissions associated with the Preferred Alternative are less than those from the no-build case in the short- and long-term. If VOC/NOx emissions from the Preferred Alternative are greater than the no-build case, reasonable and feasible VOC/NOx reduction/ mitigation measures should be included. The proponent should consult MassDEP's "Guidelines for Performing Mesoscale Analysis of Indirect Sources" to determine the appropriate study area. This section of the DEIR should discuss opportunities to enhance pedestrian, bicycle, and transit modes as required above to reduce the air quality impacts of the proposed project. The EIR should discuss the project's compliance with MassDEP's Ridesharing Regulations, 310 CMR 7.16. The mesoscale analysis should also be used to estimate indirect carbon dioxide (CO_2) emissions from transportation sources in conjunction with the GHG Policy and Protocol, as outlined further below.

The proponent should evaluate the feasibility of compliance with the Massachusetts Idling regulation (310 CMR 7.11) and the Rideshare Regulation (310 CMR 7.16) and should make commitments to such compliance wherever feasible. It should also evaluate participating in the MassDEP Diesel Retrofit Program and utilize ultra low sulfur diesel fuel in the off-road engines of construction vehicles.

Greenhouse Gas Emissions (GHG)

The DEIR should include an analysis of GHG emissions and mitigation measures in accordance with the standard requirements of the MEPA GHG Policy and Protocol ("the Policy"). The DEIR should quantify the direct and indirect GHG emissions associated with the project's energy use and transportation-related emissions. Direct emissions include on-site stationary sources, which typically emit GHGs by burning fossil fuel for heat, hot water, steam and other processes. Indirect emissions result from the consumption of energy, such as electricity, that is generated off-site by the burning of fossil fuels, and from emissions associated with vehicle use by employees, vendors, customers and others. The DEIR should outline and commit to mitigation measures to reduce GHG emissions. I refer the proponent to the Policy for additional guidance on the analysis and I strongly encourage the proponent to meet with representatives from MEPA, MassDEP and the Department of Energy Resources (DOER) prior to preparation of the DEIR.

The DEIR should include GHG emissions analysis that calculates and compares GHG emissions associated with three scenarios: 1) a Massachusetts Building Code-compliant baseline; 2) a Preferred Alternative; and 3) a project alternative with greater GHG emissions-related mitigation than the Preferred Alternative. Please note that the code currently in effect for the design and construction of this project and for the establishment of the Base Code Compliant Case is 780 CMR 13.00 7th Edition of the MA State Building Code. This edition is the 2006 with 2007 supplement to the International Energy Conservation Code (IECC) or the ASHRAE Standard 90.1 2006, with the 2007 Supplement (including Massachusetts specific supplements).

The GHG analysis should clearly demonstrate consistency with the objectives of MEPA review, one of which is to document the means by which the Proponent plans to avoid, minimize, or mitigate damage to the environment to the maximum extent feasible. The policy allows the proponent to select a model but, DEP and DOER recommend using EQUEST for stationary source modeling for buildings and building systems. The DEIR should include the modeling printout for each of the three scenarios. It should include emission tables that compare the base case (in tons of Carbon Dioxide (CO_2)) with the mitigation alternatives and show the projected reduction (in tons and percentages) by emissions source. The DEIR should clearly state modeling assumptions and explicitly note which GHG reduction measures have been modeled and provide supporting data demonstrating GHG reductions. The DEIR should identify whether certain building design or operations GHG reduction measures will be mandated by the proponent to future occupants or merely encouraged for adoption and implementation. I refer the proponent to the MassDEP comment letter (that includes contributions from DOER) for additional recommendations on the analysis of GHG emissions, data to be incorporated into the DEIR, and potential mitigation measures.

Given the phased nature of this project, the proponent should consider design options that will allow them to cost effectively integrate efficiency or renewable energy measures in the future when it is more financially or technically feasible. The proponent should not discount mitigation measures even if it is not currently feasible to quantify the GHG reduction impact including recycling of construction, office and residential materials as well as water conserving approaches such as low flow plumbing fixtures, gray water reuse, and low impact landscaping and irrigation designs. These measures will be considered when evaluating whether the project mitigated its GHG emissions to the greatest extent practicable.

The proponent should evaluate stationary source GHG mitigation alternatives as suggested by MassDEP and DOER in their comments. In support of these evaluations, the DEIR should clearly describe each building including the type, usage, and orientation. It should also describe the building envelope elements, along with the proposed design performance criteria (such as R or U-value) for each element. The DEIR should describe the building electrical and HVAC systems, including the design loads and levels, equipment selected, and the relevant performance. The DEIR should consider quantifying the GHG reductions associated with water conservation measures in its plans.

The DEIR should respond to the comments by MassDEP/DOER with respect to:

- Pursuit of Leadership in Energy and Environmental Design (LEED) and/or Energy Star certifiable project status;
- Availability of potential rebates from energy providers associated with the installation of highly efficient equipment;
- Explanation of building orientation and discussion of expected impacts on energy usage;
- Energy efficient lighting (both interior and exterior);
- Interior day-lighting of buildings;
- Duct insulation;
- Use of peak shaving or load shifting strategies;
- Super insulation;
- Window glazing;
- High-efficiency HVAC systems;
- High-albedo roofing materials;
- Incorporation of third-party building commissioning;

- Implementation of lighting motion sensors, climate control and building energy management systems. I strongly encourage the implementation of separate metering of utilities within the residential units and between separate office/institutional uses to incentivize energy conservation;
- On-site renewable energy sources. The DEIR should evaluate the use of photovoltaic (PV) systems in accordance with the recommendations of DOER.
- Combined heat and power (CHP) technologies;
- Energy performance tracking capabilities; and
- Energy Star-rated appliances.

The DEIR should also evaluate the following sustainable design elements: water conservation and the reuse of wastewater and/or stormwater; the use of non-toxic and/or recycled building materials; recycling systems or plans; solid waste reduction plans; and an annual audit program for energy consumption, waste streams and the use of renewable resources.

The DEIR should reflect a commitment to pursue additional GHG mitigation measures in response to the modeling. If the proponent chooses not to model a specific mitigation measure recommended by MassDEP because it determines the measure to be infeasible for this particular project, the DEIR should thoughtfully explain why and demonstrate that the alternative selected has avoided, minimized, and mitigated CO_2 emissions adequately.

Because the project buildings will be leased from DCAM, the proponent must consider the recommendations and energy-related measures included in Executive Order No.484, Leading by Example. The DEIR should identify measures committed to, and justify any measures which will not be adopted. In addition, the proponent should consider the guidance provided in the USDOE Office of Energy Efficiency EnergySmart Hospital Program.

The mesoscale analysis described previously should be used to estimate the indirect emissions from mobile source GHG emissions associated with the additional project related vehicle trips. The calculation should compare GHG emissions for existing and future year (full) Build and No-Build conditions and future year (full) Build with Mitigation conditions. The proponent should follow the procedures for the GHG analysis as described in the Policy. The ENF indicates that the Proponent will implement a Transportation Demand Management (TDM) program to reduce vehicle miles travelled (VMT) and related GHG emissions. The DEIR should identify TDM measures proposed for each of the alternatives and the corresponding emission reductions expected.

Wind and Shadow

The EIR should consider specific building design alternatives as a means of reducing adverse wind and shadow impacts on the ground level pedestrian environment. It should be guided by the wind tunnel testing of the LMA massing. This wind tunnel testing is essential to determine the potential impacts of wind at the pedestrian level. For purposes of the EIR, a wind analysis that evaluates pedestrian level impacts will be sufficient. Mitigation for wind impacts should be identified in the EIR.

The EIR should identify shadow impacts during the different times of the year as required by the BRA. I encourage the proponent to explore mitigation measures that could be implemented to lessen the shadow impacts of the proposed project and improve the quality of the pedestrian experience in that location.

Drainage

The EIR should evaluate potential drainage impacts on water resources, such as the Muddy River. It should present drainage calculations and plans for the management of stormwater from the proposed project. It should include a detailed description of the proposed drainage system design, including a discussion of the alternatives considered along with their impacts. The EIR should identify the quantity and quality of flows. The rates of stormwater runoff should be analyzed for the 10, 25 and 100-year storm events. The proposed drainage system should control storm flows at existing levels. The proponent should recharge roof runoff and other treated stormwater runoff from paved areas and driveways in order to retain as much as possible of the existing groundwater flows and drainage patterns. If the proponent ties into the existing City of Boston stormwater system or the Riverway's drainage system, the EIR should clarify the permits required from the City and DCR. The EIR should clarify if there will be a recharge deficit on-site. It should indicate and discuss where the Riverway, Fenwood Road, Vining Street, and the Vining Street Extension drainage systems discharge in this area.

The EIR's stormwater management should aim to maximize infiltration, slow runoff from the site, maximize the use of vegetation, capture rooftop runoff for irrigation, and minimize sediment and nutrient loading downstream. It should address the performance standards of DEP's Stormwater Management Guidelines. It should demonstrate that the design of the drainage system is consistent with these guidelines, or in the alternative, why the proponent is proposing a drainage system design not recommended by MassDEP. The EIR's stormwater analysis should evaluate the use of Low Impact Development (LID) techniques. As recommended by the Charles River Watershed Association (CRWA), the project should be developed to meet the phosphorous reduction requirements of the Total Maximum Daily Load for Nutrients in the Lower Charles River Basin. The stormwater system should reduce the sediment load to the Muddy River and reduce the peak flow. The EIR should also determine groundwater flow directions on the project site as recommended by the CRWA.

The EIR should discuss consistency of the project with the provisions of the National Pollutant Discharge Elimination System (NPDES) General Permit from the U.S. Environmental Protection Agency for stormwater discharges from construction sites. The EIR should include a discussion of best management practices employed to meet the NPDES requirements, and should include a draft Pollution Prevention Plan.

In addition, a maintenance program for the drainage system should be included in the EIR to ensure its effectiveness. This maintenance program should outline the actual maintenance operations, responsible parties, and back-up systems.

The project site is located within a Groundwater Conservation Overlay District, which is intended to promote the restoration of groundwater levels and reduce the impact of surface water runoff. The proponent will be required to construct a structure capable of retaining a specific amount of stormwater accumulated on the site. It should seek guidance for the design of this structure from the Boston Water and Sewer Commission.

Water and Wastewater

The EIR should identify any Boston Water and Sewer Commission (BWSC) water or wastewater system improvements that will be required in order to connect to the municipal water and wastewater system. It should describe the proponent's proposed water and wastewater infrastructure improvements. The EIR should provide a detailed breakdown of the estimated water demand and wastewater generation for the project. This breakdown should include the proposed outdoor watering demand for landscaping and the projected water source.
The EIR should outline the proponent's efforts to reduce water consumption and thereby reduce wastewater generation. It should show the breakdown of its water consumption and wastewater generation for each component proposed on the project site. It should provide an analysis of the required Infiltration/Inflow (I/I) removal as identified in the MassDEP and BWSC comments. The DEIR should also respond to the detailed comments in the BWSC letter.

Historical/Archaeological Issues

The Massachusetts Mental Health Center (MMHC) is listed in the State and National Registers of Historic Place. The MMHC listing includes five resources at the site: the 1912, four-story, red brick, E-shaped Main Building; the 1912 freestanding, red brick Power Plant; the 1954 five-story, red brick Research Building; the 1957, two-story, red brick Therapeutic Building; and the original 1912 cast iron and brick fence. However, only those dating from 1912 are considered "contributing" to the historical and architectural significance of MMHC. The project includes the demolition of the MMHC Buildings. The proponent is exploring the feasibility of incorporating several of the key architectural features into the new construction. Because the Commonwealth has determined that the rehabilitation of the MMHC for DMH use was infeasible, DCAM has proposed the redevelopment of the site.

The EIR should provide a comprehensive examination of the MMHC site to determine the items for potential inclusion into the replacement buildings. The Massachusetts Historical Commission (MHC) has also requested that the EIR identify potential shadows from new construction on the Riverway, which is listed on the State and National Registers. The EIR should address shadow impacts on these historic resources, or on any other historic resources within the area of the project.

Riverway Parkland Impacts

The EIR should identify not only wind and shadow impacts on the Riverway parkland, but any groundwater, drainage, or other impacts. The Riverway is part of the Emerald Necklace, and it includes the Muddy River, the Riverway and the Riverway Park. The EIR should include a figure that shows parkland trails, sidewalks, roadways, and other recreational facilities within the adjacent park. The proponent should propose mitigation to reduce any environmental impacts from traffic.

Hazardous Wastes

The EIR should present a summary of the results of any hazardous waste studies and remediation efforts undertaken at the site by the proponent. It should identify potential groundwater contamination. The BWSC reported that a draft Remediation General Permit for groundwater contamination, contaminated construction dewatering and miscellaneous surface water discharges from the project site was issued by the U.S. Environmental Protection Agency. The EIR should address this contamination on the site and identify any future remediation efforts.

Construction

The EIR should present a discussion of construction period impacts (including but not limited to noise, dust, blasting, wetlands, and traffic maintenance) and analyze feasible measures that can avoid or eliminate these impacts. It should also present a construction sequencing plan, and a traffic mitigation plan to be used during construction periods.

Recycling Issues

In its comment letter, MasssDEP encourages the proponent to evaluate construction and demolition recycling activities in the EIR. The EIR should consider future waste reduction and recycling and integrating recycled materials into the project to minimize or mitigate long-term solid waste impacts from the project.

Mitigation

The EIR should include a separate chapter on mitigation measures. This chapter on mitigation should include proposed Section 61 Findings for all state permits. The proposed Section 61 Findings should contain a clear commitment to mitigation, an estimate of the individual costs of the proposed mitigation and the identification of the parties responsible for implementing the mitigation. A schedule for the implementation of mitigation should also be included.

Response to Comments

In order to ensure that the issues raised by commenters are addressed, the EIR should include a detailed response to comments. This directive is not intended to and shall not be construed to enlarge the scope of the EIR beyond what has been expressly identified in this Certificate.

Circulation

The EIR should be circulated in compliance with Section 11.16 of the MEPA regulations and copies should also be sent to the list of "comments received" below and to Boston and Brookline officials. A copy of the EIR should be made available for public review at the Boston Public Library (Mission Hill Branch) and the Brookline Public Library.

August 7, 2009
Date

Ian A. Bowles

Cc: Ms. Sonal Gandhi, Boston Redevelopment Authority

Comments received:

Epsilon Associates, 7/10/09
Vanasse Hangen Brustlin, 7/23/09
Boston Water and Sewer Commission, 7/24/09
Massachusetts Department of Energy Resources, 7/27/09
The Mission Hill Health Movement, 7/27/09
Friends of the Muddy River, 7/27/09
Massachusetts Department of Conservation and Recreation, 7/28/09
Massachusetts Department of Environmental Protection/Northeast Regional Office, 7/28/09
Massachusetts Water Resources Authority, 7/27/09
Massachusetts Historical Commission, 7/28/09
Charles River Watershed Association, 7/28/09
Friends of Historic Mission Hill, 7/28/09

14440enf
IAB/WTG/wtg

Traffic Counts

Turning Movement Counts (TMCs)

N/S Street : Riverway
E/W Street: Vining Street
City/State : Boston, MA
Weather : Overcast

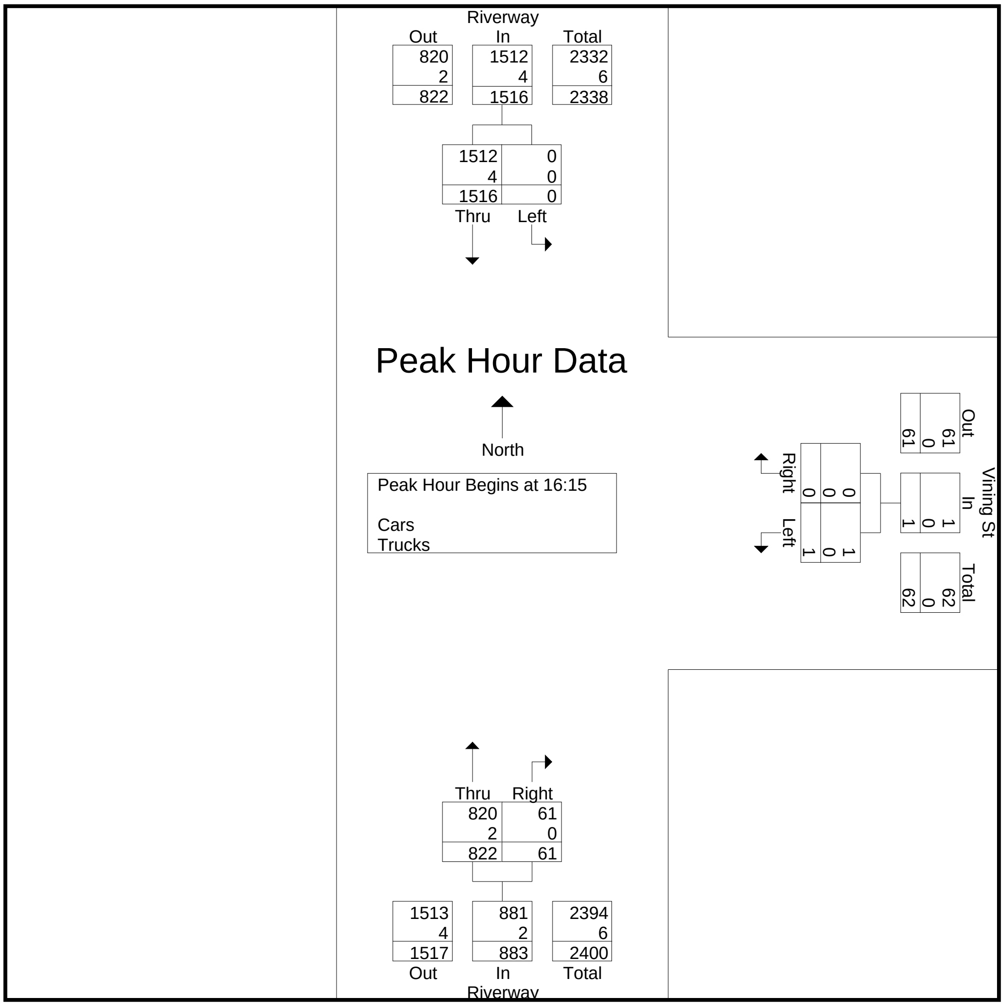
Accurate Counts
978-664-2565

File Name : 10568001
Site Code : 10568001
Start Date : 5/5/2009
Page No : 1

Groups Printed- Cars - Trucks

	Riverway From North			Vining St From East			Riverway From South					
Start Time	Left	Thru	Peds	Left	Right	Peds	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	0	286	0	0	0	4	234	16	0	4	536	540
16:15	0	389	0	1	0	7	225	19	0	7	634	641
16:30	0	361	0	0	0	8	203	13	2	10	577	587
16:45	0	375	0	0	0	6	230	13	1	7	618	625
Total	0	1411	0	1	0	25	892	61	3	28	2365	2393
17:00	0	391	0	0	0	7	164	16	0	7	571	578
17:15	0	397	0	0	0	9	220	10	3	12	627	639
17:30	0	348	0	1	0	1	195	10	1	2	554	556
17:45	0	331	0	0	0	10	205	11	1	11	547	558
Total	0	1467	0	1	0	27	784	47	5	32	2299	2331
Grand Total	0	2878	0	2	0	52	1676	108	8	60	4664	4724
Apprch %	0	100		100	0		93.9	6.1				
Total %	0	61.7		0	0		35.9	2.3		1.3	98.7	
Cars	0	2868		2	0		1669	108		0	0	4707
% Cars	0	99.7	0	100	0	100	99.6	100	100	0	0	99.6
Trucks	0	10		0	0		7	0		0	0	17
% Trucks	0	0.3	0	0	0	0	0.4	0	0	0	0	0.4

	Riverway From North			Vining St From East			Riverway From South			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 16:15										
16:15	0	389	389	**1**	0	**1**	225	**19**	**244**	**634**
16:30	0	361	361	0	0	0	203	13	216	577
16:45	0	375	375	0	0	0	**230**	13	243	618
17:00	0	**391**	**391**	0	0	0	164	16	180	571
Total Volume	0	1516	1516	1	0	1	822	61	883	2400
% App. Total	0	100		100	0		93.1	6.9		
PHF	.000	.969	.969	.250	.000	.250	.893	.803	.905	.946
Cars	0	1512	1512	1	0	1	820	61	881	2394
% Cars	0	99.7	99.7	100	0	100	99.8	100	99.8	99.8
Trucks	0	4	4	0	0	0	2	0	2	6
% Trucks	0	0.3	0.3	0	0	0	0.2	0	0.2	0.3

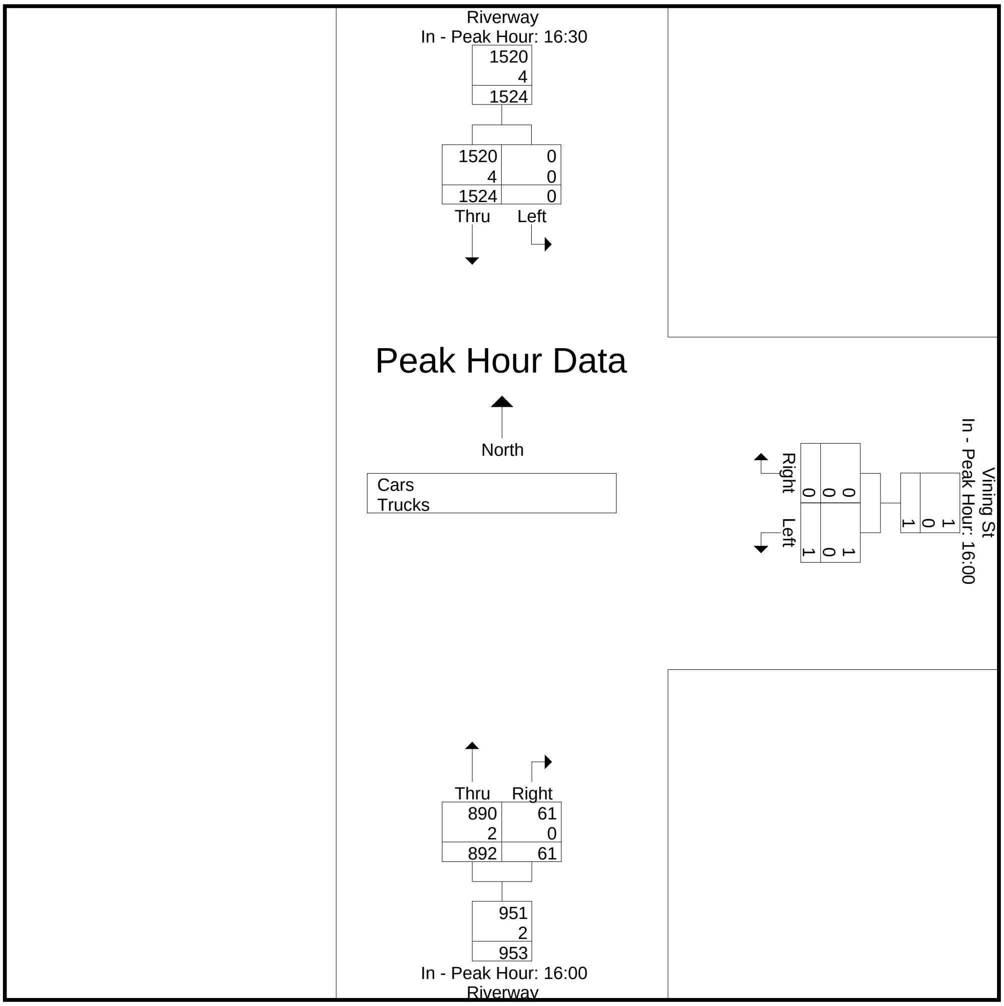


Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:30			16:00			16:00		
+0 mins.	0	361	361	0	0	0	**234**	16	**250**
+15 mins.	0	375	375	**1**	0	**1**	225	**19**	244
+30 mins.	0	391	391	0	0	0	203	13	216
+45 mins.	0	**397**	**397**	0	0	0	230	13	243
Total Volume	0	1524	1524	1	0	1	892	61	953
% App. Total	0	100		100	0		93.6	6.4	
PHF	.000	.960	.960	.250	.000	.250	.953	.803	.953
Cars	0	1520	1520	1	0	1	890	61	951
% Cars	0	99.7	99.7	100	0	100	99.8	100	99.8
Trucks	0	4	4	0	0	0	2	0	2
% Trucks	0	0.3	0.3	0	0	0	0.2	0	0.2

Accurate Counts
978-664-2565

File Name : 10568001
Site Code : 10568001
Start Date : 5/5/2009
Page No : 3



Accurate Counts
978-664-2565

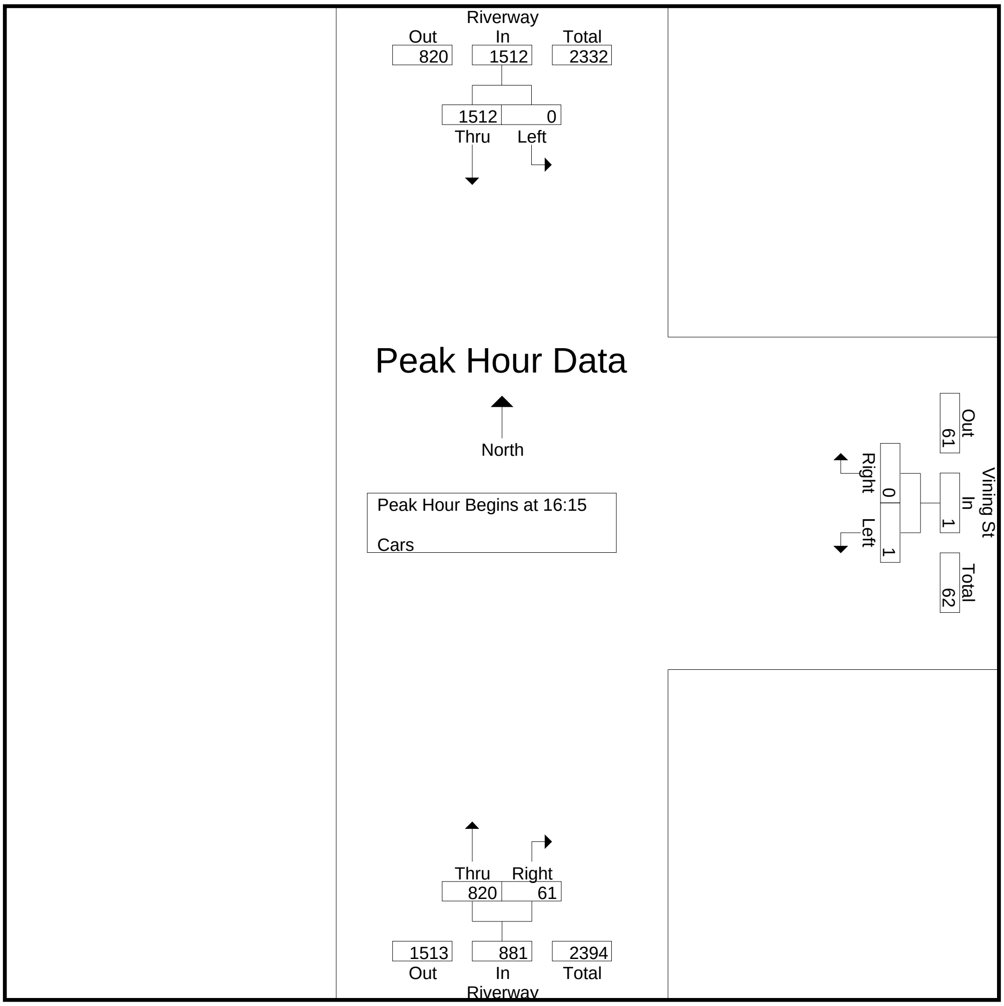
N/S Street : Riverway
E/W Street: Vining Street
City/State : Boston, MA
Weather : Overcast

File Name : 10568001
Site Code : 10568001
Start Date : 5/5/2009

Groups Printed- Cars

	Riverway From North			Vining St From East			Riverway From South					
Start Time	Left	Thru	Peds	Left	Right	Peds	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	0	286	0	0	0	4	233	16	0	4	535	539
16:15	0	388	0	1	0	7	225	19	0	7	633	640
16:30	0	360	0	0	0	8	203	13	2	10	576	586
16:45	0	373	0	0	0	6	229	13	1	7	615	622
Total	0	1407	0	1	0	25	890	61	3	28	2359	2387
17:00	0	391	0	0	0	7	163	16	0	7	570	577
17:15	0	396	0	0	0	9	219	10	3	12	625	637
17:30	0	346	0	1	0	1	193	10	1	2	550	552
17:45	0	328	0	0	0	10	204	11	1	11	543	554
Total	0	1461	0	1	0	27	779	47	5	32	2288	2320
Grand Total	0	2868	0	2	0	52	1669	108	8	60	4647	4707
Apprch %	0	100		100	0		93.9	6.1				
Total %	0	61.7		0	0		35.9	2.3		1.3	98.7	

	Riverway From North			Vining St From East			Riverway From South			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 16:15										
16:15	0	388	388	**1**	0	**1**	225	**19**	**244**	**633**
16:30	0	360	360	0	0	0	203	13	216	576
16:45	0	373	373	0	0	0	**229**	13	242	615
17:00	0	**391**	**391**	0	0	0	163	16	179	570
Total Volume	0	1512	1512	1	0	1	820	61	881	2394
% App. Total	0	100		100	0		93.1	6.9		
PHF	.000	.967	.967	.250	.000	.250	.895	.803	.903	.945



Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:30			16:00			16:00		
+0 mins.	0	360	360	0	0	0	**233**	16	**249**
+15 mins.	0	373	373	**1**	0	**1**	225	**19**	244
+30 mins.	0	391	391	0	0	0	203	13	216
+45 mins.	0	**396**	**396**	0	0	0	229	13	242
Total Volume	0	1520	1520	1	0	1	890	61	951
% App. Total	0	100		100	0		93.6	6.4	
PHF	.000	.960	.960	.250	.000	.250	.955	.803	.955

Accurate Counts
978-664-2565

File Name : 10568001
Site Code : 10568001
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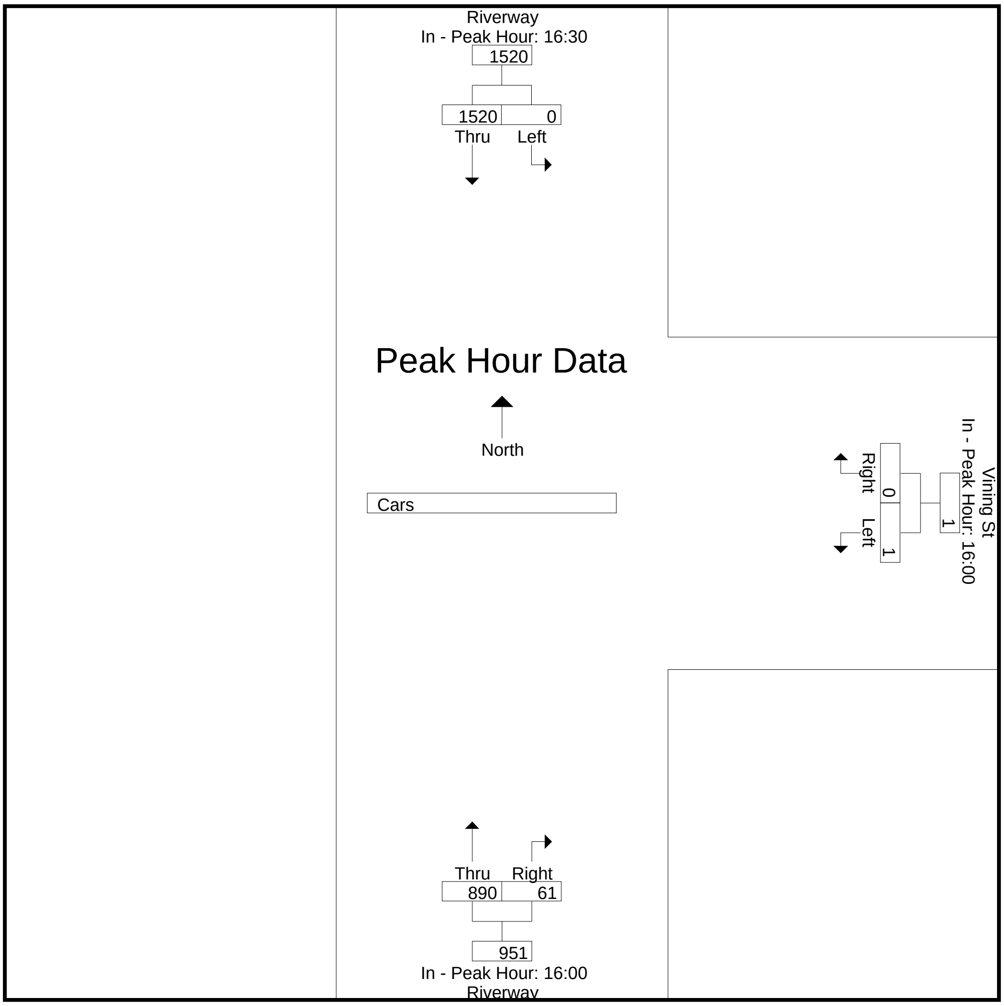
Page No : 3



N/S Street : Riverway
E/W Street: Vining Street
City/State : Boston, MA
Weather : Overcast

Accurate Counts
978-664-2565

File Name : 10568001
Site Code : 10568001
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Page No : 1

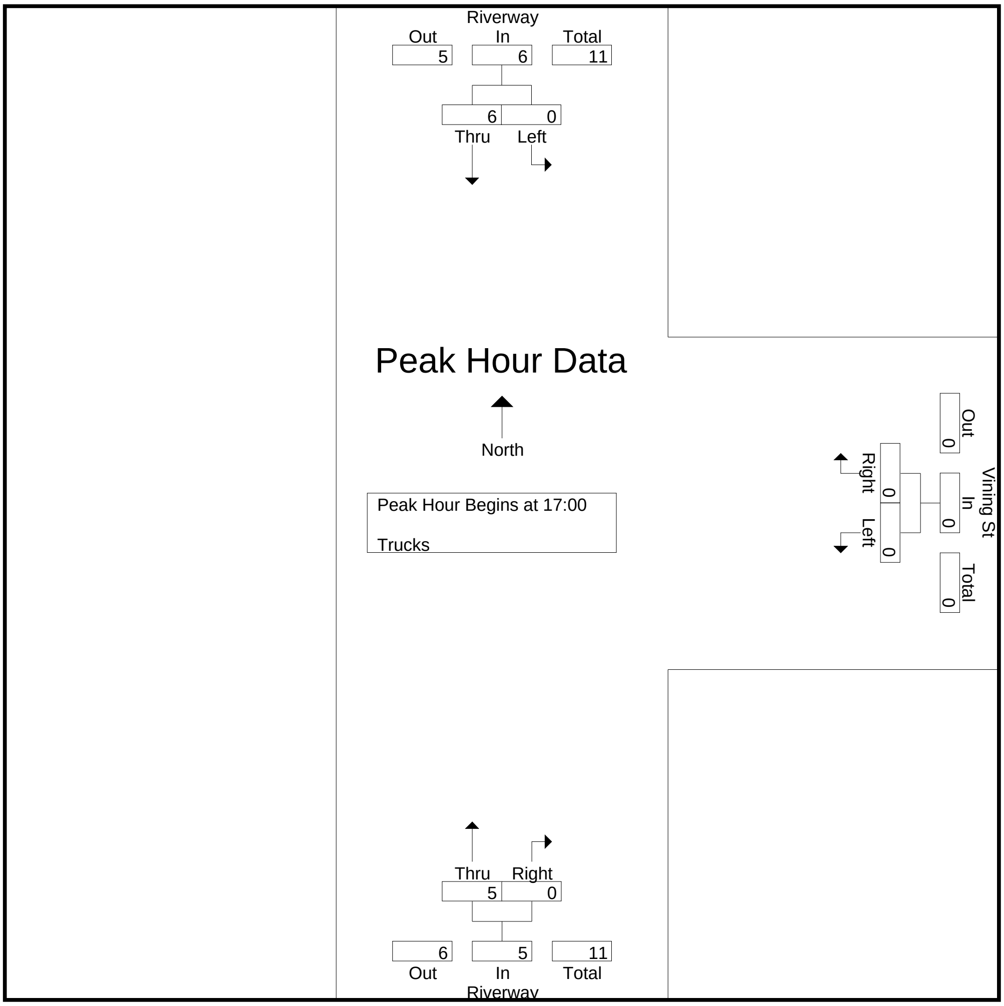
Groups Printed- Trucks

	Riverway From North			Vining St From East			Riverway From South					
Start Time	Left	Thru	Peds	Left	Right	Peds	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	0	0	0	0	0	0	1	0	0	0	1	1
16:15	0	1	0	0	0	0	0	0	0	0	1	1
16:30	0	1	0	0	0	0	0	0	0	0	1	1
16:45	0	2	0	0	0	0	1	0	0	0	3	3
Total	0	4	0	0	0	0	2	0	0	0	6	6
17:00	0	0	0	0	0	0	1	0	0	0	1	1
17:15	0	1	0	0	0	0	1	0	0	0	2	2
17:30	0	2	0	0	0	0	2	0	0	0	4	4
17:45	0	3	0	0	0	0	1	0	0	0	4	4
Total	0	6	0	0	0	0	5	0	0	0	11	11
Grand Total	0	10	0	0	0	0	7	0	0	0	17	17
Apprch %	0	100		0	0		100	0				
Total %	0	58.8		0	0		41.2	0		0	100	

	Riverway From North			Vining St From East			Riverway From South			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 17:00										
17:00	0	0	0	0	0	0	1	0	1	1
17:15	0	1	1	0	0	0	1	0	1	2
17:30	0	2	2	0	0	0	**2**	0	**2**	**4**
17:45	0	**3**	**3**	0	0	0	1	0	1	4
Total Volume	0	6	6	0	0	0	5	0	5	11
% App. Total	0	100		0	0		100	0		
PHF	.000	.500	.500	.000	.000	.000	.625	.000	.625	.688

Accurate Counts
978-664-2565

File Name : 10568001
Site Code : 10568001
Start Date : 5/5/2009
Page No : 2

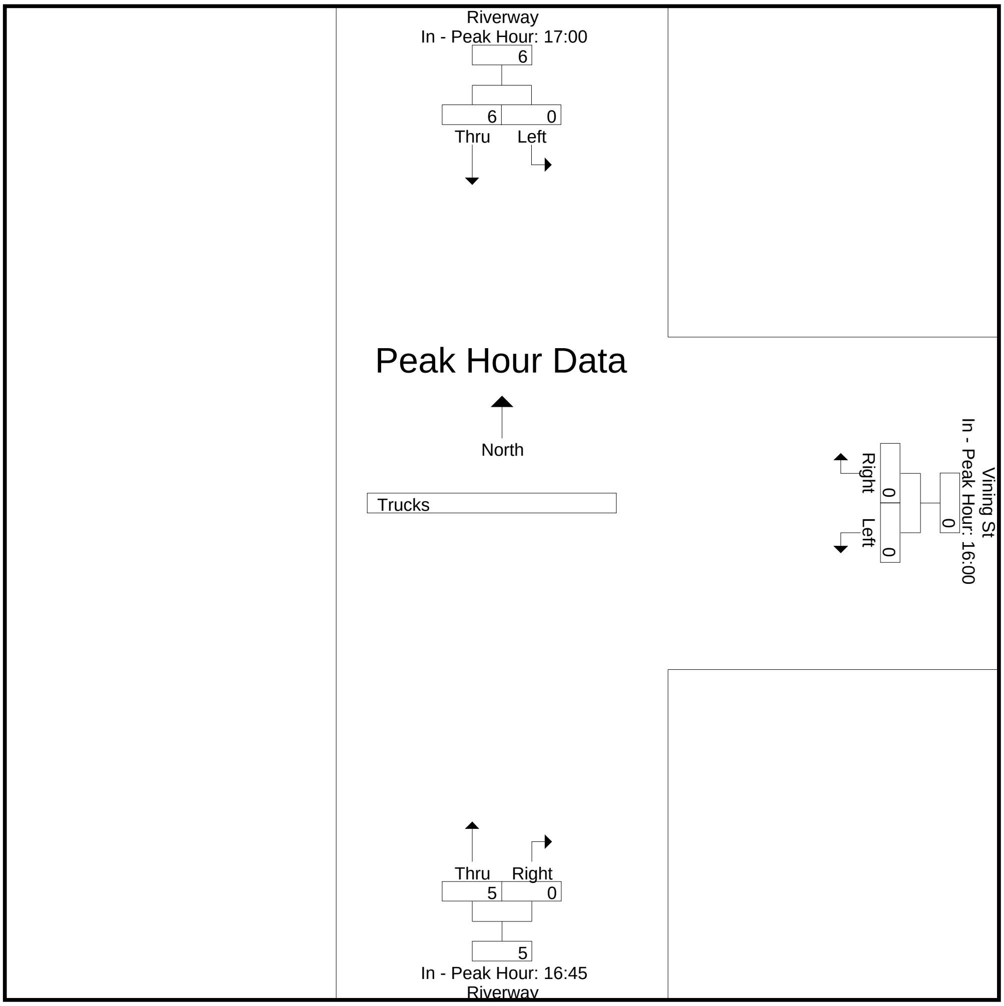


Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	17:00			16:00			16:45		
+0 mins.	0	0	0	0	0	0	1	0	1
+15 mins.	0	1	1	0	0	0	1	0	1
+30 mins.	0	2	2	0	0	0	1	0	1
+45 mins.	0	**3**	**3**	0	0	0	**2**	0	**2**
Total Volume	0	6	6	0	0	0	5	0	5
% App. Total	0	100		0	0		100	0	
PHF	.000	.500	.500	.000	.000	.000	.625	.000	.625

Accurate Counts
978-664-2565

File Name : 10568001
Site Code : 10568001
Start Date : 5/5/2009
Page No : 3



N/S Street : Riverway
E/W Street: Vining Street
City/State : Boston, MA
Weather : Overcast

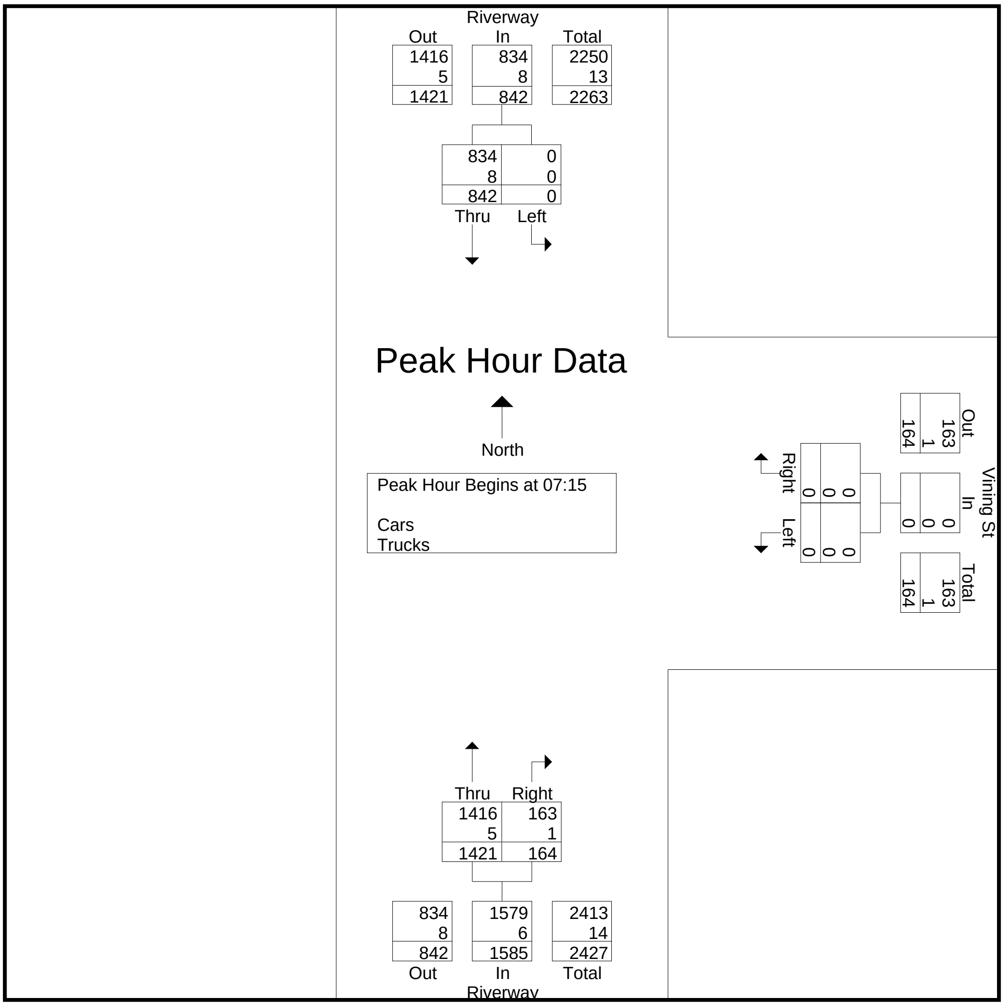
Accurate Counts
978-664-2565

File Name : 10568001
Site Code : 10568001
Start Date : 5/5/2009
Page No : 1

Groups Printed- Cars - Trucks

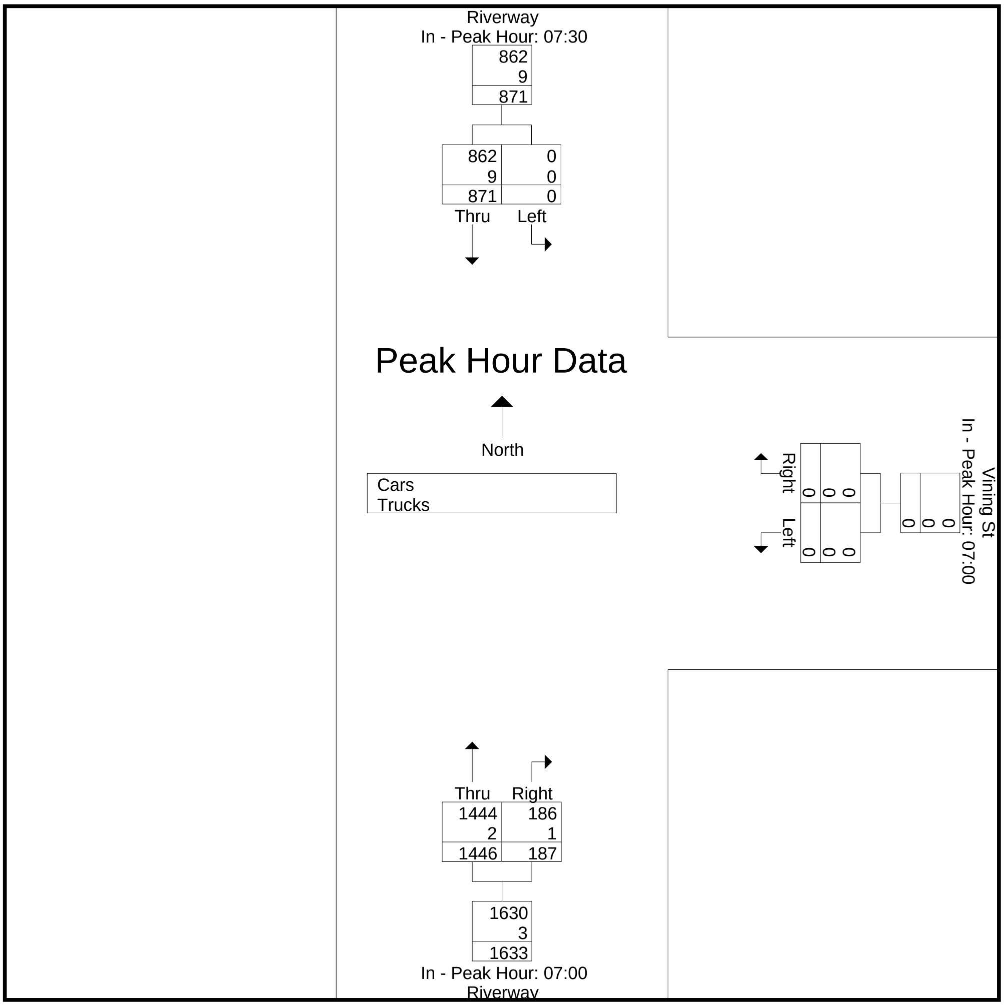
	Riverway From North			Vining St From East			Riverway From South					
Start Time	Left	Thru	Peds	Left	Right	Peds	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	0	171	0	0	0	6	366	47	0	6	584	590
07:15	0	172	0	0	0	7	369	50	0	7	591	598
07:30	0	214	0	0	0	10	364	51	0	10	629	639
07:45	0	235	0	0	0	4	347	39	0	4	621	625
Total	0	792	0	0	0	27	1446	187	0	27	2425	2452
08:00	0	221	0	0	0	9	341	24	0	9	586	595
08:15	0	201	0	0	0	7	337	34	0	7	572	579
08:30	0	173	0	0	0	11	340	37	0	11	550	561
08:45	0	155	0	0	0	8	323	31	0	8	509	517
Total	0	750	0	0	0	35	1341	126	0	35	2217	2252
Grand Total	0	1542	0	0	0	62	2787	313	0	62	4642	4704
Apprch %	0	100		0	0		89.9	10.1				
Total %	0	33.2		0	0		60	6.7		1.3	98.7	
Cars	0	1532		0	0		2777	312		0	0	4683
% Cars	0	99.4	0	0	0	100	99.6	99.7	0	0	0	99.6
Trucks	0	10		0	0		10	1		0	0	21
% Trucks	0	0.6	0	0	0	0	0.4	0.3	0	0	0	0.4

	Riverway From North			Vining St From East			Riverway From South			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:15										
07:15	0	172	172	0	0	0	**369**	50	**419**	591
07:30	0	214	214	0	0	0	364	**51**	415	**629**
07:45	0	**235**	**235**	0	0	0	347	39	386	621
08:00	0	221	221	0	0	0	341	24	365	586
Total Volume	0	842	842	0	0	0	1421	164	1585	2427
% App. Total	0	100		0	0		89.7	10.3		
PHF	.000	.896	.896	.000	.000	.000	.963	.804	.946	.965
Cars	0	834	834	0	0	0	1416	163	1579	2413
% Cars	0	99.0	99.0	0	0	0	99.6	99.4	99.6	99.4
Trucks	0	8	8	0	0	0	5	1	6	14
% Trucks	0	1.0	1.0	0	0	0	0.4	0.6	0.4	0.6



Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:30			07:00			07:00		
+0 mins.	0	214	214	0	0	0	366	47	413
+15 mins.	0	**235**	**235**	0	0	0	**369**	50	**419**
+30 mins.	0	221	221	0	0	0	364	**51**	415
+45 mins.	0	201	201	0	0	0	347	39	386
Total Volume	0	871	871	0	0	0	1446	187	1633
% App. Total	0	100		0	0		88.5	11.5	
PHF	.000	.927	.927	.000	.000	.000	.980	.917	.974
Cars	0	862	862	0	0	0	1444	186	1630
% Cars	0	99	99	0	0	0	99.9	99.5	99.8
Trucks	0	9	9	0	0	0	2	1	3
% Trucks	0	1	1	0	0	0	0.1	0.5	0.2


Riverway
In - Peak Hour: 07:30
862
9
871
862
9
871
0
0
0
Thru
Left
Peak Hour Data
North
Cars
Trucks
Vining St
In - Peak Hour: 07:00
Right
Left
0
0
0
Thru
Right
1444
2
1446
186
1
187
1630
3
1633
In - Peak Hour: 07:00
Riverway

N/S Street : Riverway
E/W Street: Vining Street
City/State : Boston, MA
Weather : Overcast

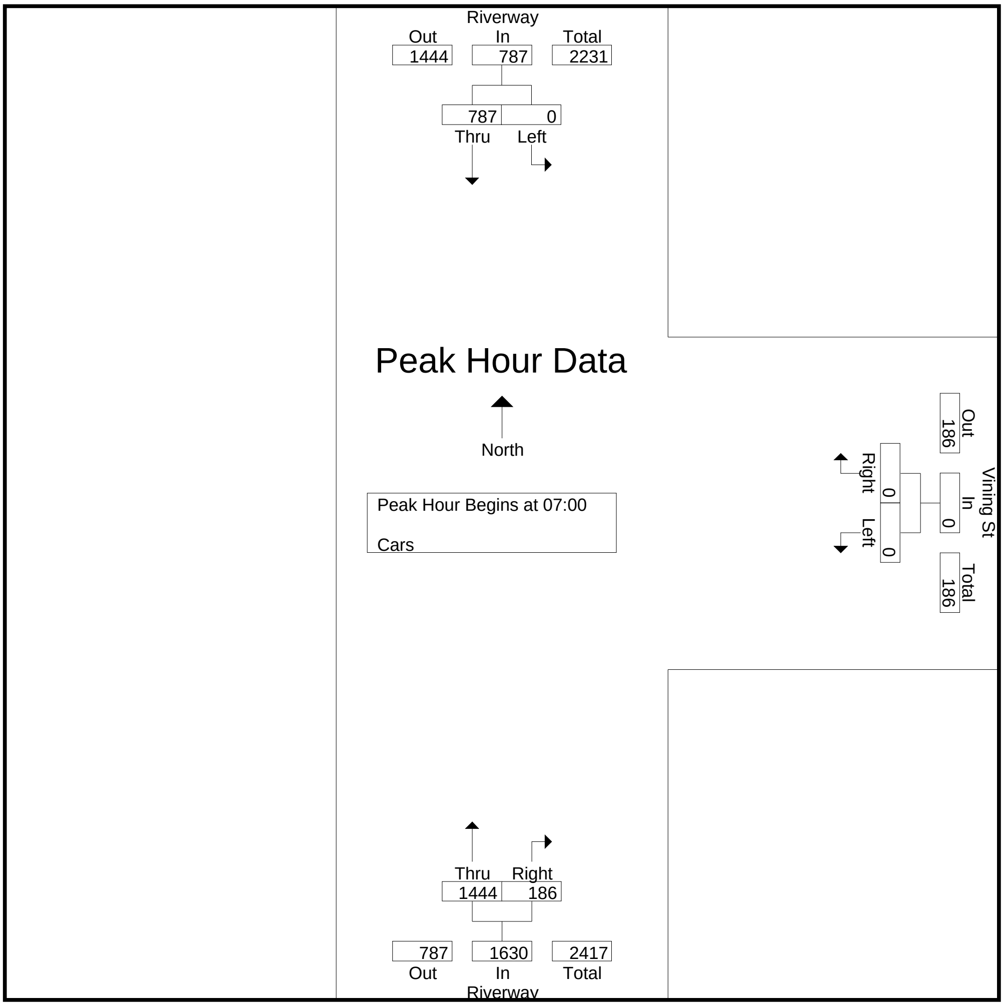
Accurate Counts
978-664-2565

File Name : 10568001
Site Code : 10568001
Start Date : 5/5/2009
Page No : 1

Groups Printed- Cars

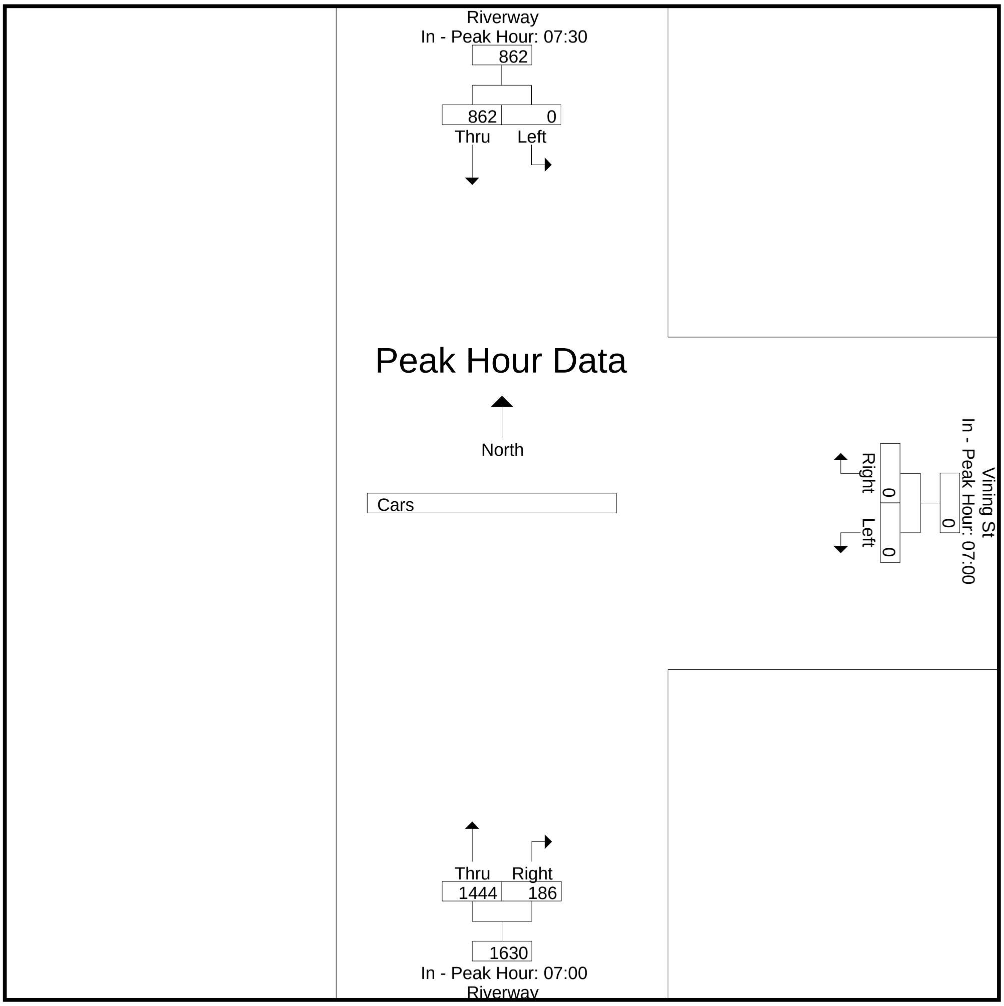
	Riverway From North			Vining St From East			Riverway From South					
Start Time	Left	Thru	Peds	Left	Right	Peds	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	0	171	0	0	0	6	366	47	0	6	584	590
07:15	0	172	0	0	0	7	369	50	0	7	591	598
07:30	0	212	0	0	0	10	363	50	0	10	625	635
07:45	0	232	0	0	0	4	346	39	0	4	617	621
Total	0	787	0	0	0	27	1444	186	0	27	2417	2444
08:00	0	218	0	0	0	9	338	24	0	9	580	589
08:15	0	200	0	0	0	7	336	34	0	7	570	577
08:30	0	172	0	0	0	11	338	37	0	11	547	558
08:45	0	155	0	0	0	8	321	31	0	8	507	515
Total	0	745	0	0	0	35	1333	126	0	35	2204	2239
Grand Total	0	1532	0	0	0	62	2777	312	0	62	4621	4683
Apprch %	0	100		0	0		89.9	10.1				
Total %	0	33.2		0	0		60.1	6.8		1.3	98.7	

	Riverway From North			Vining St From East			Riverway From South			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:00										
07:00	0	171	171	0	0	0	366	47	413	584
07:15	0	172	172	0	0	0	**369**	**50**	**419**	591
07:30	0	212	212	0	0	0	363	50	413	**625**
07:45	0	**232**	**232**	0	0	0	346	39	385	617
Total Volume	0	787	787	0	0	0	1444	186	1630	2417
% App. Total	0	100		0	0		88.6	11.4		
PHF	.000	.848	.848	.000	.000	.000	.978	.930	.973	.967



Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:30			07:00			07:00		
+0 mins.	0	212	212	0	0	0	366	47	413
+15 mins.	0	**232**	**232**	0	0	0	**369**	**50**	**419**
+30 mins.	0	218	218	0	0	0	363	50	413
+45 mins.	0	200	200	0	0	0	346	39	385
Total Volume	0	862	862	0	0	0	1444	186	1630
% App. Total	0	100		0	0		88.6	11.4	
PHF	.000	.929	.929	.000	.000	.000	.978	.930	.973


Riverway
In - Peak Hour: 07:30
862
862
0
Thru
Left
Peak Hour Data
North
Cars
Vining St
In - Peak Hour: 07:00
0
0
0
Right
Left
Thru
Right
1444
186
1630
In - Peak Hour: 07:00
Riverway

N/S Street : Riverway
E/W Street: Vining Street
City/State : Boston, MA
Weather : Overcast

Accurate Counts
978-664-2565

File Name : 10568001
Site Code : 10568001
Start Date : 5/5/2009
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Groups Printed- Trucks

	Riverway From North			Vining St From East			Riverway From South					
Start Time	Left	Thru	Peds	Left	Right	Peds	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	0	0	0	0	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0	0	0	0	0
07:30	0	2	0	0	0	0	1	1	0	0	4	4
07:45	0	3	0	0	0	0	1	0	0	0	4	4
Total	0	5	0	0	0	0	2	1	0	0	8	8
08:00	0	3	0	0	0	0	3	0	0	0	6	6
08:15	0	1	0	0	0	0	1	0	0	0	2	2
08:30	0	1	0	0	0	0	2	0	0	0	3	3
08:45	0	0	0	0	0	0	2	0	0	0	2	2
Total	0	5	0	0	0	0	8	0	0	0	13	13
Grand Total	0	10	0	0	0	0	10	1	0	0	21	21
Apprch %	0	100		0	0		90.9	9.1				
Total %	0	47.6		0	0		47.6	4.8		0	100	

	Riverway From North			Vining St From East			Riverway From South			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:30										
07:30	0	2	2	0	0	0	1	**1**	2	4
07:45	0	**3**	**3**	0	0	0	1	0	1	4
08:00	0	3	3	0	0	0	**3**	0	**3**	**6**
08:15	0	1	1	0	0	0	1	0	1	2
Total Volume	0	9	9	0	0	0	6	1	7	16
% App. Total	0	100		0	0		85.7	14.3		
PHF	.000	.750	.750	.000	.000	.000	.500	.250	.583	.667

Accurate Counts
978-664-2565

File Name : 10568001
Site Code : 10568001
Start Date : 5/5/2009
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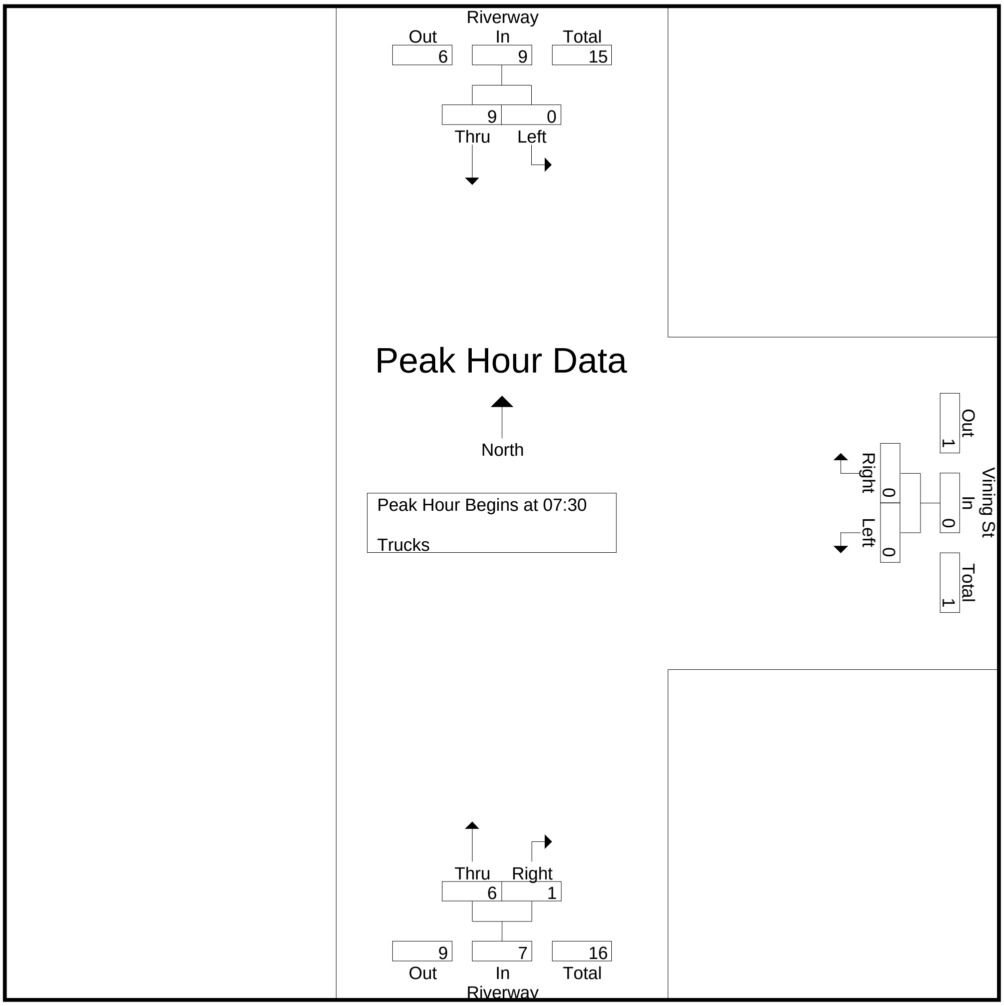
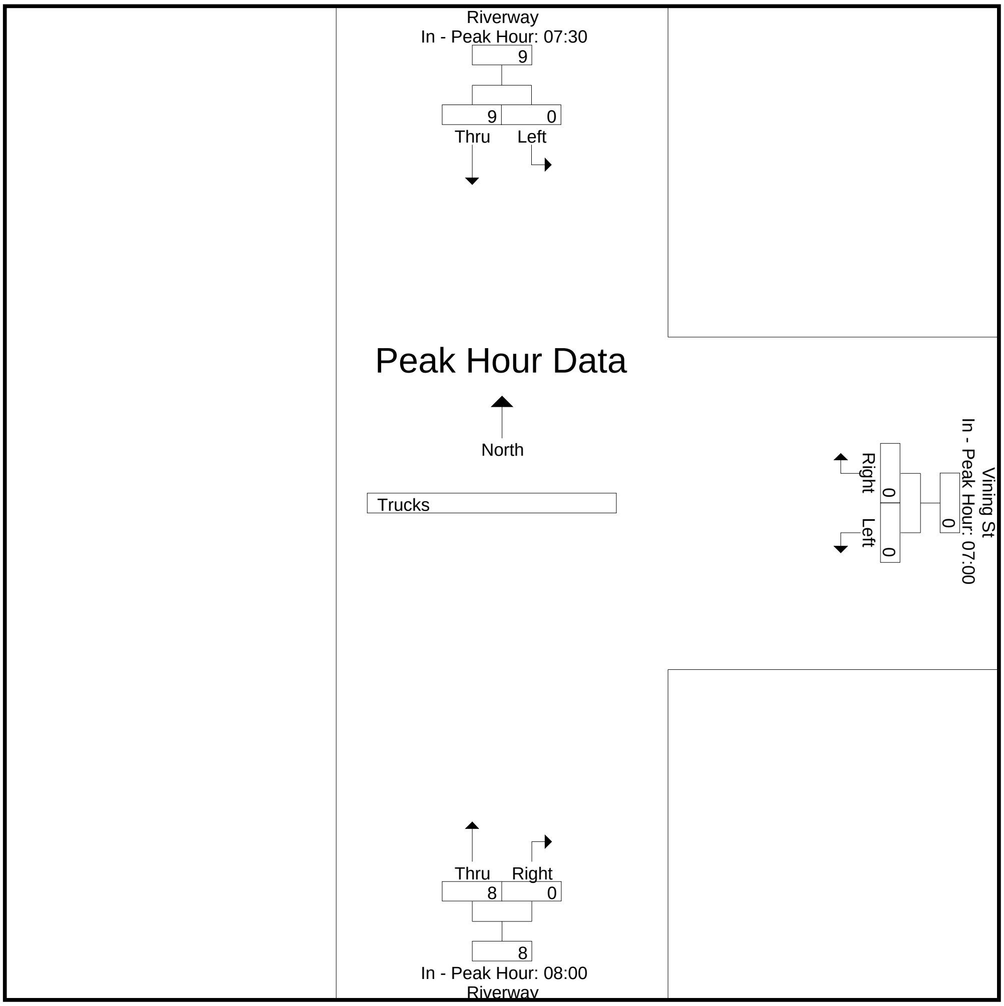


Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:30			07:00			08:00		
+0 mins.	0	2	2	0	0	0	**3**	0	**3**
+15 mins.	0	**3**	**3**	0	0	0	1	0	1
+30 mins.	0	3	3	0	0	0	2	0	2
+45 mins.	0	1	1	0	0	0	2	0	2
Total Volume	0	9	9	0	0	0	8	0	8
% App. Total	0	100		0	0		100	0	
PHF	.000	.750	.750	.000	.000	.000	.667	.000	.667

Accurate Counts
978-664-2565

File Name : 10568001
Site Code : 10568001
Start Date : 5/5/2009
Page No : 3



N/S Street : Brookline Avenue
E/W Street: Riverway
City/State : Boston, MA
Weather : Cloudy

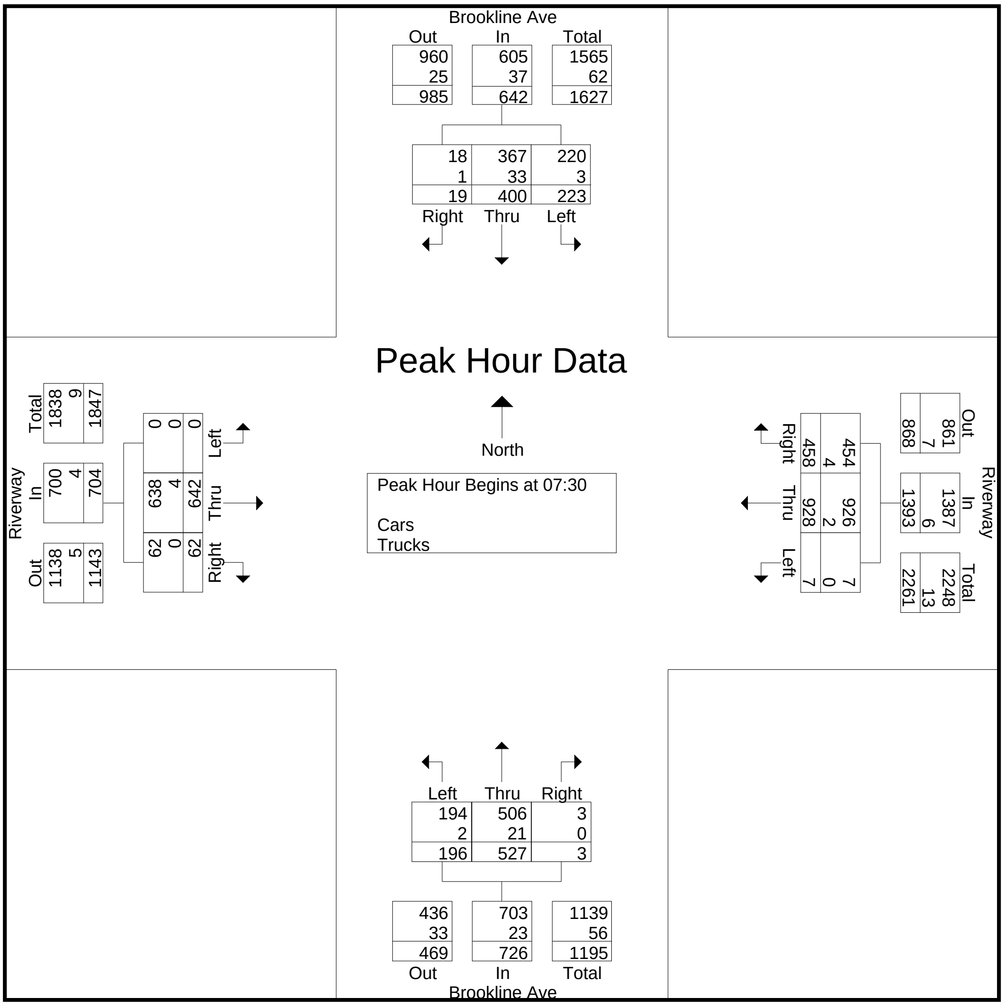
Accurate Counts
978-664-2565

File Name : 10568002
Site Code : 10568002
Start Date : 5/5/2009
Page No : 1

Groups Printed- Cars - Trucks

	Brookline Ave From North				Riverway From East				Brookline Ave From South				Riverway From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	49	73	5	2	2	253	111	6	43	124	0	0	0	128	10	11	19	798	817
07:15	55	74	4	8	2	223	145	7	64	119	0	1	0	119	14	13	29	819	848
07:30	58	95	8	18	1	250	113	18	50	126	0	0	0	156	17	28	64	874	938
07:45	54	105	1	14	0	240	107	24	53	129	0	7	0	180	20	33	78	889	967
Total	216	347	18	42	5	966	476	55	210	498	0	8	0	583	61	85	190	3380	3570
08:00	61	107	2	28	3	225	113	30	44	147	3	9	0	155	15	38	105	875	980
08:15	50	93	8	20	3	213	125	22	49	125	0	6	0	151	10	36	84	827	911
08:30	40	76	5	17	4	225	111	31	51	119	1	7	0	132	15	38	93	779	872
08:45	31	78	1	13	0	203	116	27	46	140	1	7	1	123	13	30	77	753	830
Total	182	354	16	78	10	866	465	110	190	531	5	29	1	561	53	142	359	3234	3593
Grand Total	398	701	34	120	15	1832	941	165	400	1029	5	37	1	1144	114	227	549	6614	7163
Apprch %	35.1	61.9	3		0.5	65.7	33.8		27.9	71.8	0.3		0.1	90.9	9.1				
Total %	6	10.6	0.5		0.2	27.7	14.2		6	15.6	0.1		0	17.3	1.7		7.7	92.3	
Cars	395	637	33		15	1830	933		398	986	5		1	1139	114		0	0	7035
% Cars	99.2	90.9	97.1	100	100	99.9	99.1	100	99.5	95.8	100	100	100	99.6	100	100	0	0	98.2
Trucks	3	64	1		0	2	8		2	43	0		0	5	0		0	0	128
% Trucks	0.8	9.1	2.9	0	0	0.1	0.9	0	0.5	4.2	0	0	0	0.4	0	0	0	0	1.8

	Brookline Ave From North				Riverway From East				Brookline Ave From South				Riverway From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:30																	
07:30	58	95	**8**	161	1	**250**	113	**364**	50	126	0	176	0	156	17	173	874
07:45	54	105	1	160	0	240	107	347	**53**	129	0	182	0	**180**	**20**	**200**	**889**
08:00	**61**	**107**	2	**170**	**3**	225	113	341	44	**147**	**3**	**194**	0	155	15	170	875
08:15	50	93	8	151	3	213	**125**	341	49	125	0	174	0	151	10	161	827
Total Volume	223	400	19	642	7	928	458	1393	196	527	3	726	0	642	62	704	3465
% App. Total	34.7	62.3	3		0.5	66.6	32.9		27	72.6	0.4		0	91.2	8.8		
PHF	.914	.935	.594	.944	.583	.928	.916	.957	.925	.896	.250	.936	.000	.892	.775	.880	.974
Cars	220	367	18	605	7	926	454	1387	194	506	3	703	0	638	62	700	3395
% Cars	98.7	91.8	94.7	94.2	100	99.8	99.1	99.6	99.0	96.0	100	96.8	0	99.4	100	99.4	98.0
Trucks	3	33	1	37	0	2	4	6	2	21	0	23	0	4	0	4	70
% Trucks	1.3	8.3	5.3	5.8	0	0.2	0.9	0.4	1.0	4.0	0	3.2	0	0.6	0	0.6	2.0



Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:30				07:00				07:15				07:30			
+0 mins.	58	95	**8**	161	**2**	**253**	111	366	**64**	119	0	183	0	156	17	173
+15 mins.	54	105	1	160	2	223	**145**	**370**	50	126	0	176	0	**180**	**20**	**200**
+30 mins.	**61**	**107**	2	**170**	1	250	113	364	53	129	0	182	0	155	15	170
+45 mins.	50	93	8	151	0	240	107	347	44	**147**	**3**	**194**	0	151	10	161
Total Volume	223	400	19	642	5	966	476	1447	211	521	3	735	0	642	62	704
% App. Total	34.7	62.3	3		0.3	66.8	32.9		28.7	70.9	0.4		0	91.2	8.8	
PHF	.914	.935	.594	.944	.625	.955	.821	.978	.824	.886	.250	.947	.000	.892	.775	.880
Cars	220	367	18	605	5	966	474	1445	210	497	3	710	0	638	62	700
% Cars	98.7	91.8	94.7	94.2	100	100	99.6	99.9	99.5	95.4	100	96.6	0	99.4	100	99.4
Trucks	3	33	1	37	0	0	2	2	1	24	0	25	0	4	0	4
% Trucks	1.3	8.2	5.3	5.8	0	0	0.4	0.1	0.5	4.6	0	3.4	0	0.6	0	0.6

Accurate Counts
978-664-2565

File Name : 10568002
Site Code : 10568002
Start Date : 5/5/2009
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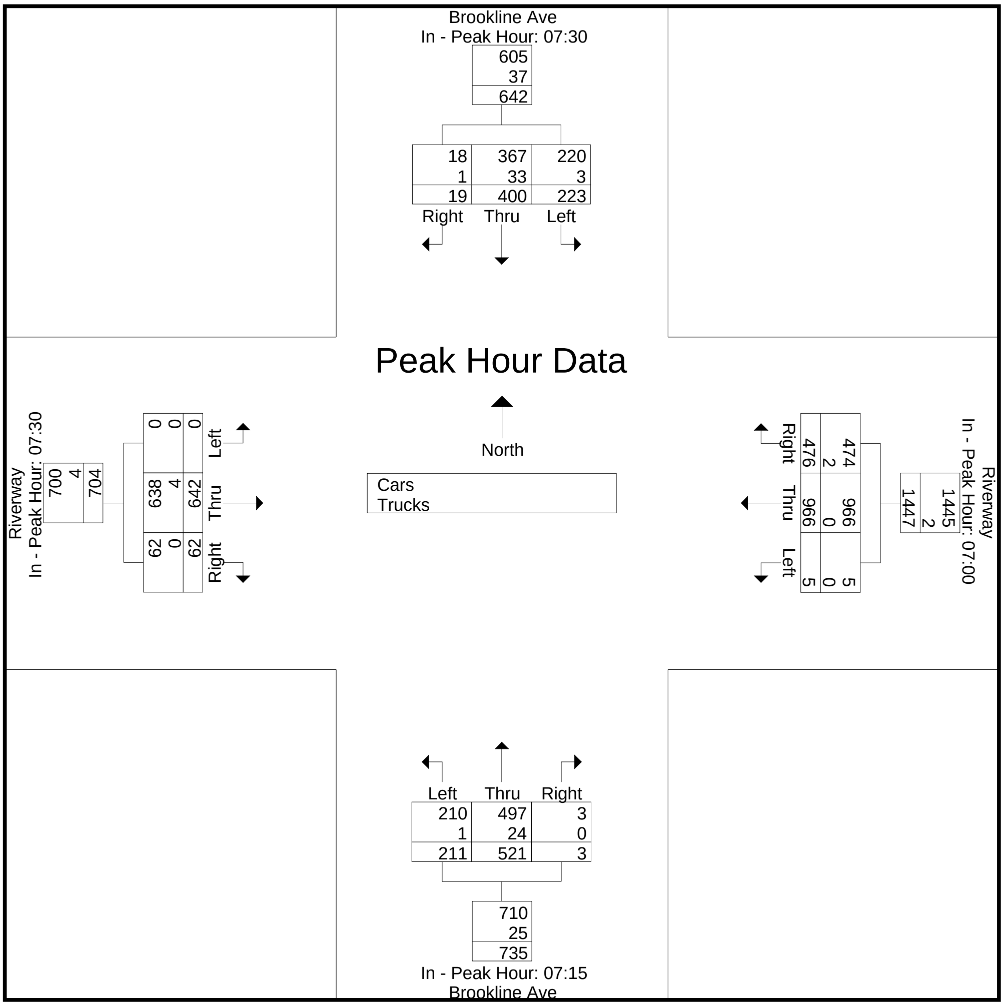


N/S Street : Brookline Avenue
E/W Street: Riverway
City/State : Boston, MA
Weather : Cloudy

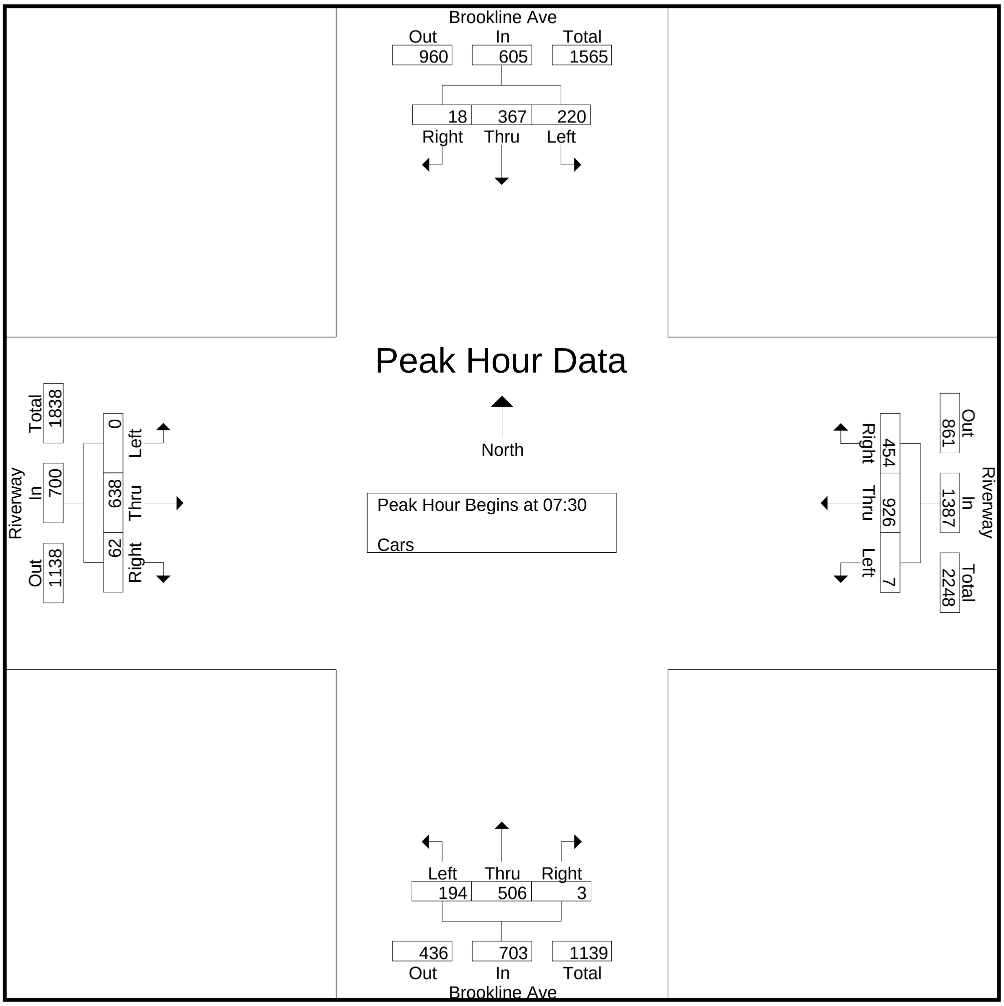
Accurate Counts
978-664-2565

File Name : 10568002
Site Code : 10568002
Start Date : 5/5/2009
Page No : 1

Groups Printed- Cars

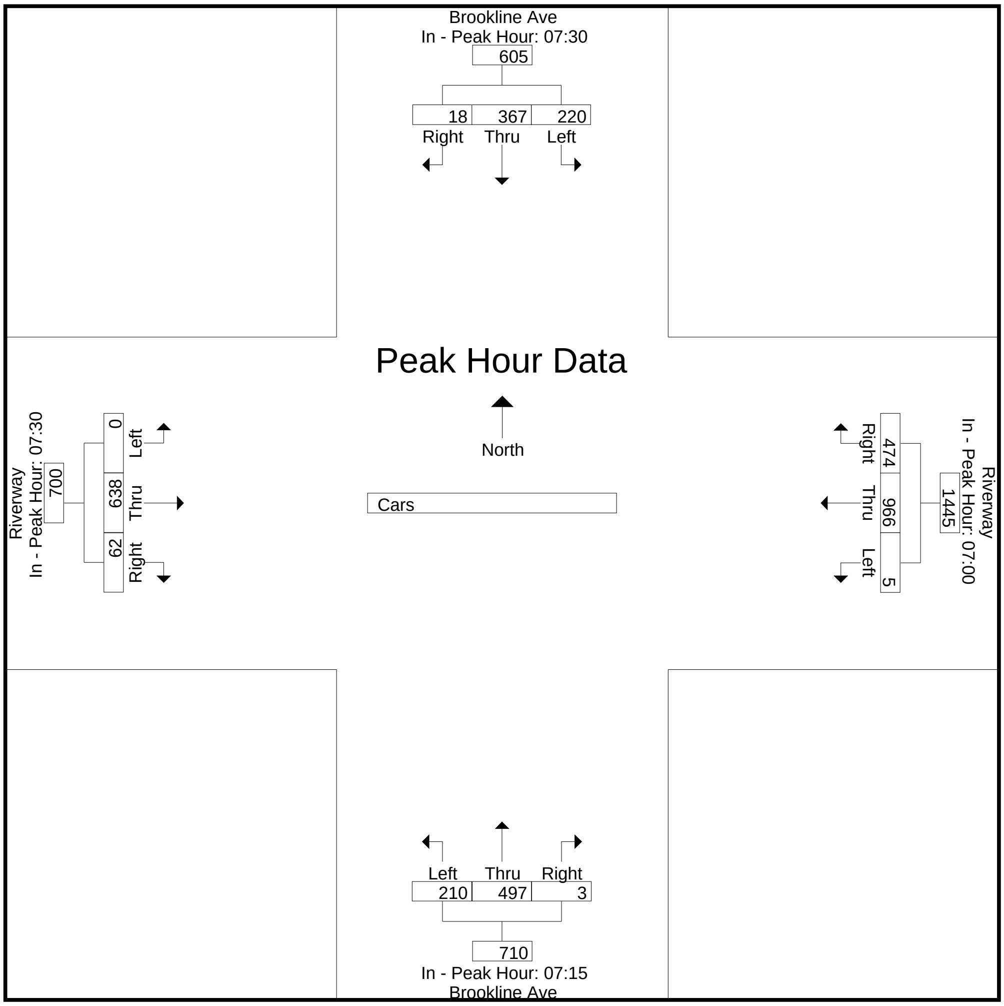
	Brookline Ave From North				Riverway From East				Brookline Ave From South				Riverway From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	49	66	5	2	2	253	111	6	43	118	0	0	0	128	10	11	19	785	804
07:15	55	66	4	8	2	223	145	7	64	111	0	1	0	119	14	13	29	803	832
07:30	57	86	7	18	1	250	112	18	49	120	0	0	0	155	17	28	64	854	918
07:45	54	97	1	14	0	240	106	24	53	122	0	7	0	177	20	33	78	870	948
Total	215	315	17	42	5	966	474	55	209	471	0	8	0	579	61	85	190	3312	3502
08:00	60	101	2	28	3	223	112	30	44	144	3	9	0	155	15	38	105	862	967
08:15	49	83	8	20	3	213	124	22	48	120	0	6	0	151	10	36	84	809	893
08:30	40	69	5	17	4	225	109	31	51	116	1	7	0	131	15	38	93	766	859
08:45	31	69	1	13	0	203	114	27	46	135	1	7	1	123	13	30	77	737	814
Total	180	322	16	78	10	864	459	110	189	515	5	29	1	560	53	142	359	3174	3533
Grand Total	395	637	33	120	15	1830	933	165	398	986	5	37	1	1139	114	227	549	6486	7035
Apprch %	37.1	59.8	3.1		0.5	65.9	33.6		28.7	71	0.4		0.1	90.8	9.1				
Total %	6.1	9.8	0.5		0.2	28.2	14.4		6.1	15.2	0.1		0	17.6	1.8		7.8	92.2	

	Brookline Ave From North				Riverway From East				Brookline Ave From South				Riverway From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:30																	
07:30	57	86	7	150	1	**250**	112	**363**	49	120	0	169	0	155	17	172	854
07:45	54	97	1	152	0	240	106	346	**53**	122	0	175	0	**177**	**20**	**197**	**870**
08:00	**60**	**101**	2	**163**	**3**	223	112	338	44	**144**	**3**	**191**	0	155	15	170	862
08:15	49	83	**8**	140	3	213	**124**	340	48	120	0	168	0	151	10	161	809
Total Volume	220	367	18	605	7	926	454	1387	194	506	3	703	0	638	62	700	3395
% App. Total	36.4	60.7	3		0.5	66.8	32.7		27.6	72	0.4		0	91.1	8.9		
PHF	.917	.908	.563	.928	.583	.926	.915	.955	.915	.878	.250	.920	.000	.901	.775	.888	.976



Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:30				07:00				07:15				07:30			
+0 mins.	57	86	7	150	**2**	**253**	111	366	**64**	111	0	175	0	155	17	172
+15 mins.	54	97	1	152	2	223	**145**	**370**	49	120	0	169	0	**177**	**20**	**197**
+30 mins.	**60**	**101**	2	**163**	1	250	112	363	53	122	0	175	0	155	15	170
+45 mins.	49	83	**8**	140	0	240	106	346	44	**144**	**3**	**191**	0	151	10	161
Total Volume	220	367	18	605	5	966	474	1445	210	497	3	710	0	638	62	700
% App. Total	36.4	60.7	3		0.3	66.9	32.8		29.6	70	0.4		0	91.1	8.9	
PHF	.917	.908	.563	.928	.625	.955	.817	.976	.820	.863	.250	.929	.000	.901	.775	.888



Brookline Ave
In - Peak Hour: 07:30
605
18
367
220
Right
Thru
Left
Peak Hour Data
North
Cars
Riverway
In - Peak Hour: 07:30
700
0
Left
638
Thru
62
Right
Riverway
In - Peak Hour: 07:00
1445
474
Right
966
Thru
5
Left
Left
Thru
Right
210
497
3
710
In - Peak Hour: 07:15
Brookline Ave

N/S Street : Brookline Avenue
E/W Street: Riverway
City/State : Boston, MA
Weather : Cloudy

Accurate Counts
978-664-2565

File Name : 10568002
Site Code : 10568002
Start Date : 5/5/2009
Page No : 1

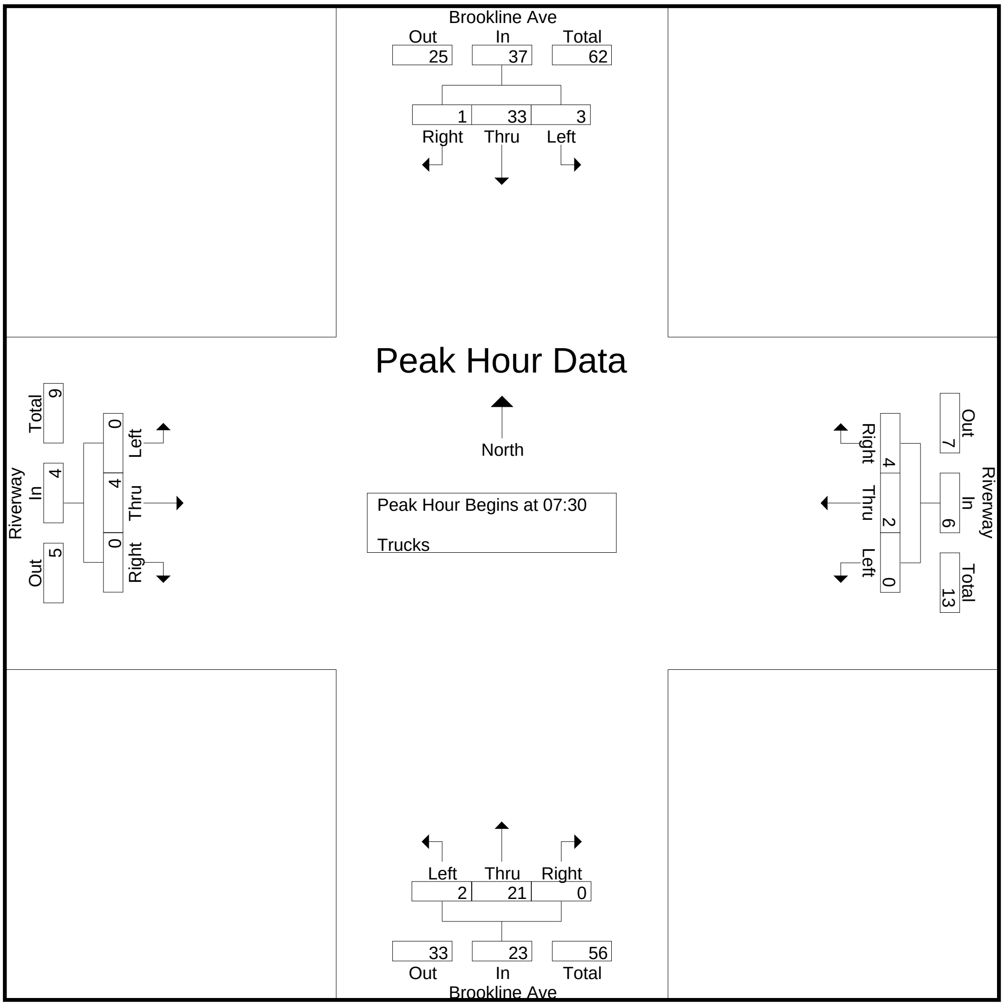
Groups Printed- Trucks

	Brookline Ave From North				Riverway From East				Brookline Ave From South				Riverway From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	0	7	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	13	13
07:15	0	8	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	16	16
07:30	1	9	1	0	0	0	1	0	1	6	0	0	0	1	0	0	0	20	20
07:45	0	8	0	0	0	0	1	0	0	7	0	0	0	3	0	0	0	19	19
Total	1	32	1	0	0	0	2	0	1	27	0	0	0	4	0	0	0	68	68
08:00	1	6	0	0	0	2	1	0	0	3	0	0	0	0	0	0	0	13	13
08:15	1	10	0	0	0	0	1	0	1	5	0	0	0	0	0	0	0	18	18
08:30	0	7	0	0	0	0	2	0	0	3	0	0	0	1	0	0	0	13	13
08:45	0	9	0	0	0	0	2	0	0	5	0	0	0	0	0	0	0	16	16
Total	2	32	0	0	0	2	6	0	1	16	0	0	0	1	0	0	0	60	60
Grand Total	3	64	1	0	0	2	8	0	2	43	0	0	0	5	0	0	0	128	128
Apprch %	4.4	94.1	1.5		0	20	80		4.4	95.6	0		0	100	0				
Total %	2.3	50	0.8		0	1.6	6.2		1.6	33.6	0		0	3.9	0		0	100	

	Brookline Ave From North				Riverway From East				Brookline Ave From South				Riverway From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:30																	
07:30	**1**	9	**1**	**11**	0	0	**1**	1	**1**	6	0	**7**	0	1	0	1	**20**
07:45	0	8	0	8	0	0	1	1	0	**7**	0	7	0	**3**	0	**3**	19
08:00	1	6	0	7	0	**2**	1	**3**	0	3	0	3	0	0	0	0	13
08:15	1	**10**	0	11	0	0	1	1	1	5	0	6	0	0	0	0	18
Total Volume	3	33	1	37	0	2	4	6	2	21	0	23	0	4	0	4	70
% App. Total	8.1	89.2	2.7		0	33.3	66.7		8.7	91.3	0		0	100	0		
PHF	.750	.825	.250	.841	.000	.250	1.000	.500	.500	.750	.000	.821	.000	.333	.000	.333	.875

Accurate Counts
978-664-2565

File Name : 10568002
Site Code : 10568002
Start Date : 5/5/2009
Page No : 2

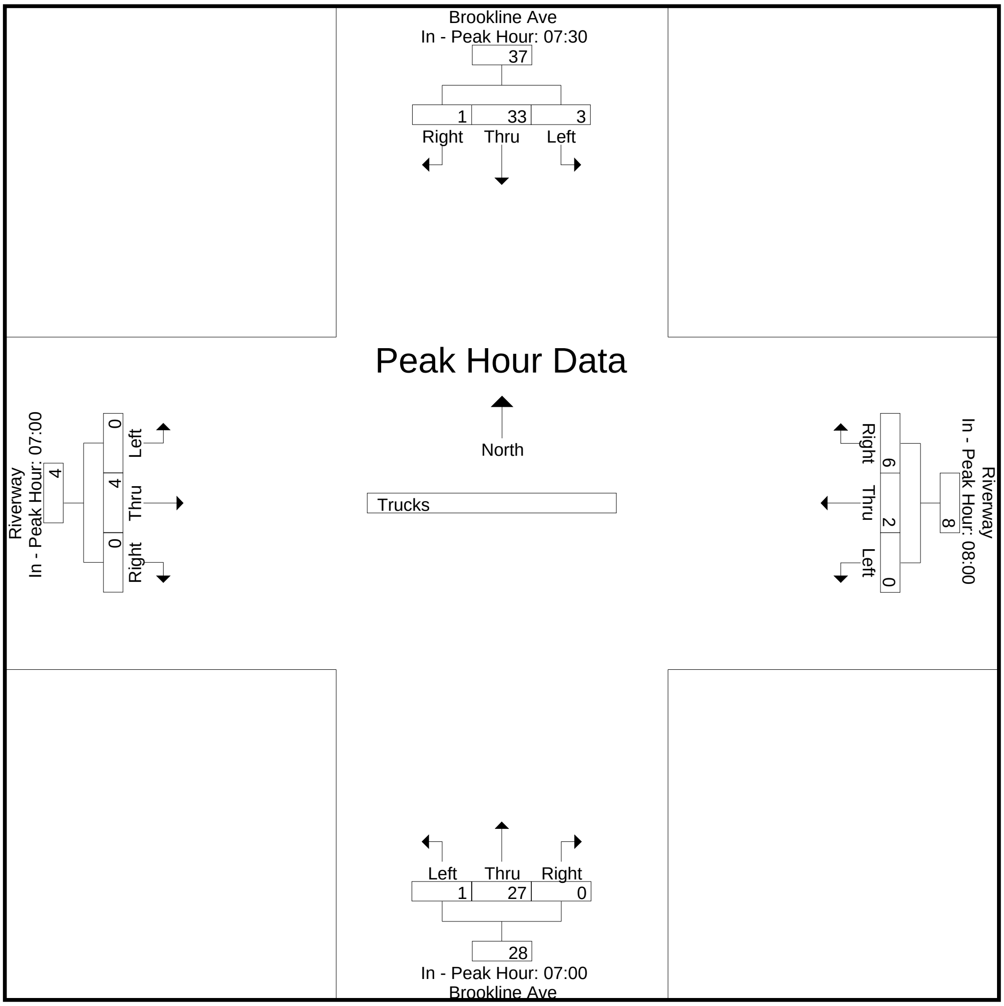


Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:30				08:00				07:00				07:00			
+0 mins.	**1**	9	**1**	**11**	0	**2**	1	**3**	0	6	0	6	0	0	0	0
+15 mins.	0	8	0	8	0	0	1	1	0	**8**	0	**8**	0	0	0	0
+30 mins.	1	6	0	7	0	0	**2**	2	**1**	6	0	7	0	1	0	1
+45 mins.	1	**10**	0	11	0	0	2	2	0	7	0	7	0	**3**	0	**3**
Total Volume	3	33	1	37	0	2	6	8	1	27	0	28	0	4	0	4
% App. Total	8.1	89.2	2.7		0	25	75		3.6	96.4	0		0	100	0	
PHF	.750	.825	.250	.841	.000	.250	.750	.667	.250	.844	.000	.875	.000	.333	.000	.333

Accurate Counts
978-664-2565

File Name : 10568002
Site Code : 10568002
Start Date : 5/5/2009
Page No : 3



N/S Street : Brookline Avenue
E/W Street: Riverway
City/State : Boston, MA
Weather : Cloudy

Accurate Counts
978-664-2565

File Name : 10568002
Site Code : 10568002
Start Date : 5/5/2009

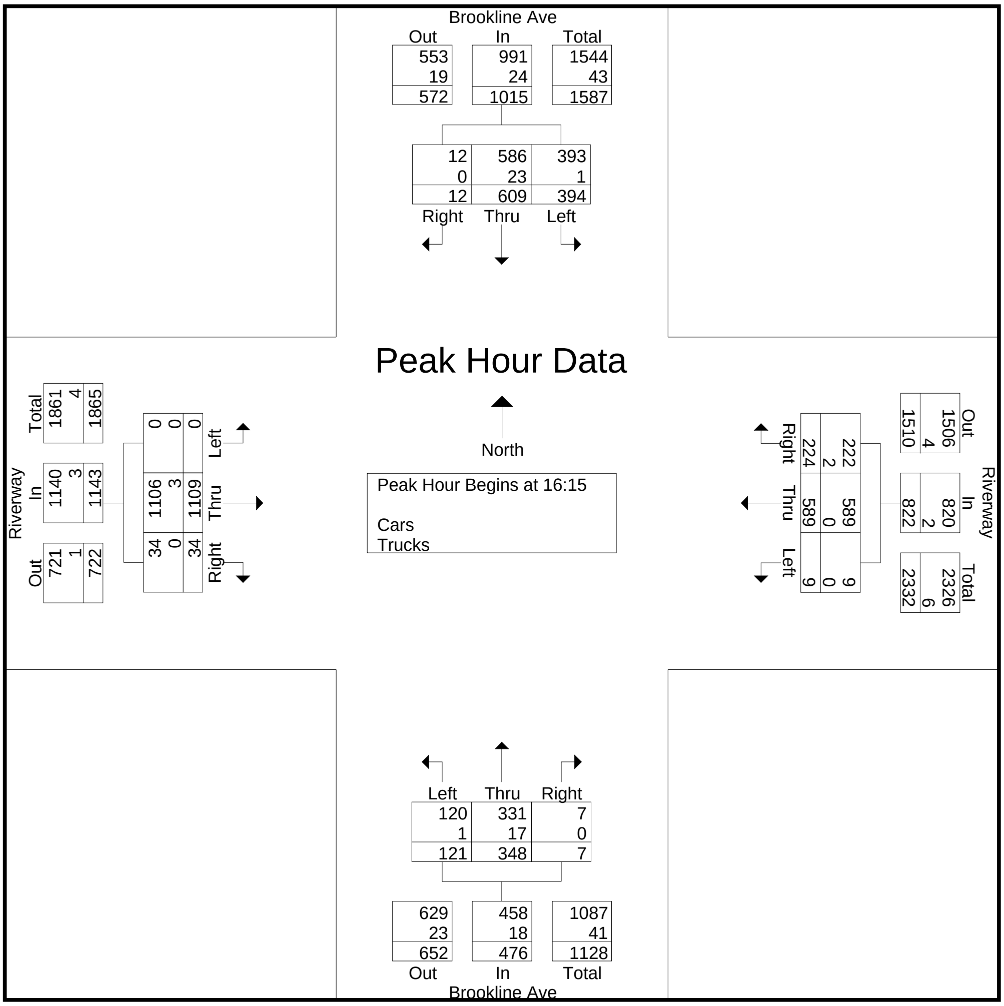
Groups Printed- Cars - Trucks

	Brookline Ave From North				Riverway From East				Brookline Ave From South				Riverway From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	73	139	12	2	2	167	66	17	42	92	2	3	0	210	13	15	37	818	855
16:15	100	161	2	14	3	153	69	15	39	102	1	4	0	288	14	13	46	932	978
16:30	107	141	5	9	2	144	53	7	22	80	2	6	0	252	7	20	42	815	857
16:45	88	151	4	0	2	172	60	22	34	72	4	4	0	283	8	13	39	878	917
Total	368	592	23	25	9	636	248	61	137	346	9	17	0	1033	42	61	164	3443	3607
17:00	99	156	1	4	2	120	42	17	26	94	0	6	0	286	5	15	42	831	873
17:15	108	152	1	5	1	159	60	19	28	88	0	14	0	291	11	11	49	899	948
17:30	102	162	1	8	7	121	67	23	22	93	3	9	0	241	10	10	50	829	879
17:45	85	192	3	5	6	134	66	8	14	85	1	4	0	245	6	10	27	837	864
Total	394	662	6	22	16	534	235	67	90	360	4	33	0	1063	32	46	168	3396	3564
Grand Total	762	1254	29	47	25	1170	483	128	227	706	13	50	0	2096	74	107	332	6839	7171
Apprch %	37.3	61.3	1.4		1.5	69.7	28.8		24	74.6	1.4		0	96.6	3.4				
Total %	11.1	18.3	0.4		0.4	17.1	7.1		3.3	10.3	0.2		0	30.6	1.1		4.6	95.4	
Cars	759	1213	29		24	1169	478		226	675	13		0	2089	73		0	0	7080
% Cars	99.6	96.7	100	100	96	99.9	99	100	99.6	95.6	100	100	0	99.7	98.6	100	0	0	98.7
Trucks	3	41	0		1	1	5		1	31	0		0	7	1		0	0	91
% Trucks	0.4	3.3	0	0	4	0.1	1	0	0.4	4.4	0	0	0	0.3	1.4	0	0	0	1.3

	Brookline Ave From North				Riverway From East				Brookline Ave From South				Riverway From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 16:15																	
16:15	100	**161**	2	**263**	**3**	153	**69**	225	**39**	**102**	1	**142**	0	**288**	**14**	**302**	**932**
16:30	**107**	141	**5**	253	2	144	53	199	22	80	2	104	0	252	7	259	815
16:45	88	151	4	243	2	**172**	60	**234**	34	72	**4**	110	0	283	8	291	878
17:00	99	156	1	256	2	120	42	164	26	94	0	120	0	286	5	291	831
Total Volume	394	609	12	1015	9	589	224	822	121	348	7	476	0	1109	34	1143	3456
% App. Total	38.8	60	1.2		1.1	71.7	27.3		25.4	73.1	1.5		0	97	3		
PHF	.921	.946	.600	.965	.750	.856	.812	.878	.776	.853	.438	.838	.000	.963	.607	.946	.927
Cars	393	586	12	991	9	589	222	820	120	331	7	458	0	1106	34	1140	3409
% Cars	99.7	96.2	100	97.6	100	100	99.1	99.8	99.2	95.1	100	96.2	0	99.7	100	99.7	98.6
Trucks	1	23	0	24	0	0	2	2	1	17	0	18	0	3	0	3	47
% Trucks	0.3	3.8	0	2.4	0	0	0.9	0.2	0.8	4.9	0	3.8	0	0.3	0	0.3	1.4

Accurate Counts
978-664-2565

File Name : 10568002
Site Code : 10568002
Start Date : 5/5/2009
Page No : 2

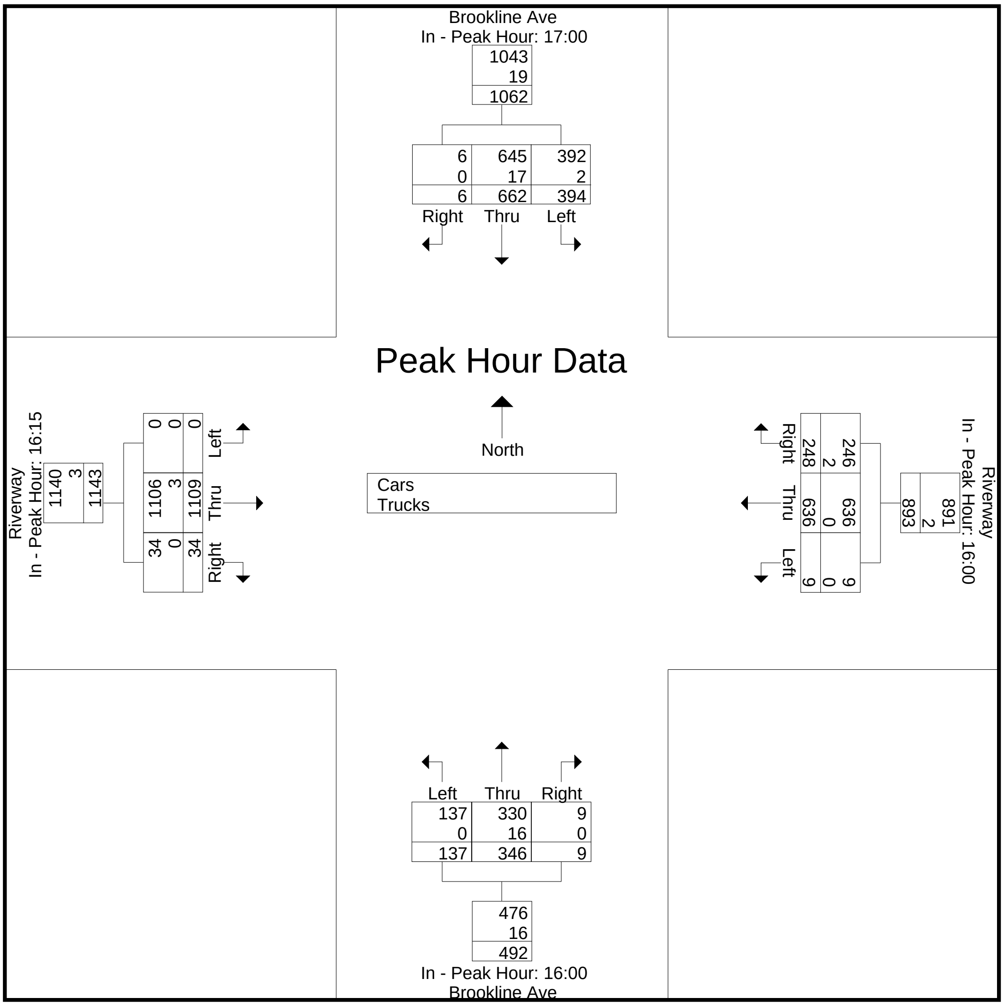


Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	17:00				16:00				16:00				16:15			
+0 mins.	99	156	1	256	2	167	66	**235**	**42**	92	2	136	0	**288**	**14**	**302**
+15 mins.	**108**	152	1	261	**3**	153	**69**	225	39	**102**	1	**142**	0	252	7	259
+30 mins.	102	162	1	265	2	144	53	199	22	80	2	104	0	283	8	291
+45 mins.	85	**192**	**3**	**280**	2	**172**	60	234	34	72	**4**	110	0	286	5	291
Total Volume	394	662	6	1062	9	636	248	893	137	346	9	492	0	1109	34	1143
% App. Total	37.1	62.3	0.6		1	71.2	27.8		27.8	70.3	1.8		0	97	3	
PHF	.912	.862	.500	.948	.750	.924	.899	.950	.815	.848	.563	.866	.000	.963	.607	.946
Cars	392	645	6	1043	9	636	246	891	137	330	9	476	0	1106	34	1140
% Cars	99.5	97.4	100	98.2	100	100	99.2	99.8	100	95.4	100	96.7	0	99.7	100	99.7
Trucks	2	17	0	19	0	0	2	2	0	16	0	16	0	3	0	3
% Trucks	0.5	2.6	0	1.8	0	0	0.8	0.2	0	4.6	0	3.3	0	0.3	0	0.3

Accurate Counts
978-664-2565

File Name : 10568002
Site Code : 10568002
Start Date : 5/5/2009
Page No : 3



N/S Street : Brookline Avenue
E/W Street: Riverway
City/State : Boston, MA
Weather : Cloudy

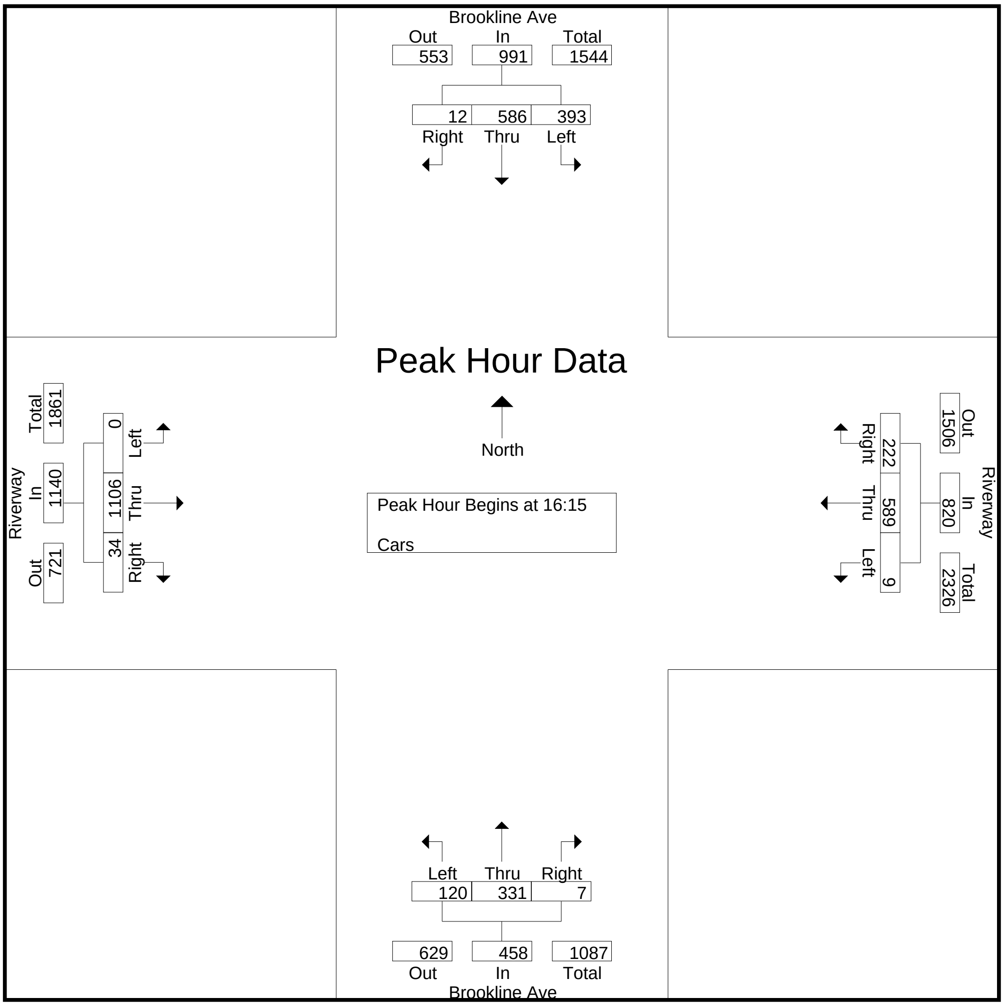
Accurate Counts
978-664-2565

File Name : 10568002
Site Code : 10568002
Start Date : 5/5/2009
Page No : 1

Groups Printed- Cars

	Brookline Ave From North				Riverway From East				Brookline Ave From South				Riverway From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	73	134	12	2	2	167	65	17	42	88	2	3	0	210	13	15	37	808	845
16:15	100	154	2	14	3	153	69	15	39	100	1	4	0	287	14	13	46	922	968
16:30	106	133	5	9	2	144	53	7	22	74	2	6	0	252	7	20	42	800	842
16:45	88	147	4	0	2	172	59	22	34	68	4	4	0	281	8	13	39	867	906
Total	367	568	23	25	9	636	246	61	137	330	9	17	0	1030	42	61	164	3397	3561
17:00	99	152	1	4	2	120	41	17	25	89	0	6	0	286	5	15	42	820	862
17:15	107	149	1	5	1	158	60	19	28	85	0	14	0	291	10	11	49	890	939
17:30	102	156	1	8	6	121	66	23	22	88	3	9	0	239	10	10	50	814	864
17:45	84	188	3	5	6	134	65	8	14	83	1	4	0	243	6	10	27	827	854
Total	392	645	6	22	15	533	232	67	89	345	4	33	0	1059	31	46	168	3351	3519
Grand Total	759	1213	29	47	24	1169	478	128	226	675	13	50	0	2089	73	107	332	6748	7080
Apprch %	37.9	60.6	1.4		1.4	70	28.6		24.7	73.9	1.4		0	96.6	3.4				
Total %	11.2	18	0.4		0.4	17.3	7.1		3.3	10	0.2		0	31	1.1		4.7	95.3	

	Brookline Ave From North				Riverway From East				Brookline Ave From South				Riverway From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 16:15																	
16:15	100	**154**	2	**256**	**3**	153	**69**	225	**39**	**100**	1	**140**	0	**287**	**14**	**301**	**922**
16:30	**106**	133	**5**	244	2	144	53	199	22	74	2	98	0	252	7	259	800
16:45	88	147	4	239	2	**172**	59	**233**	34	68	**4**	106	0	281	8	289	867
17:00	99	152	1	252	2	120	41	163	25	89	0	114	0	286	5	291	820
Total Volume	393	586	12	991	9	589	222	820	120	331	7	458	0	1106	34	1140	3409
% App. Total	39.7	59.1	1.2		1.1	71.8	27.1		26.2	72.3	1.5		0	97	3		
PHF	.927	.951	.600	.968	.750	.856	.804	.880	.769	.828	.438	.818	.000	.963	.607	.947	.924

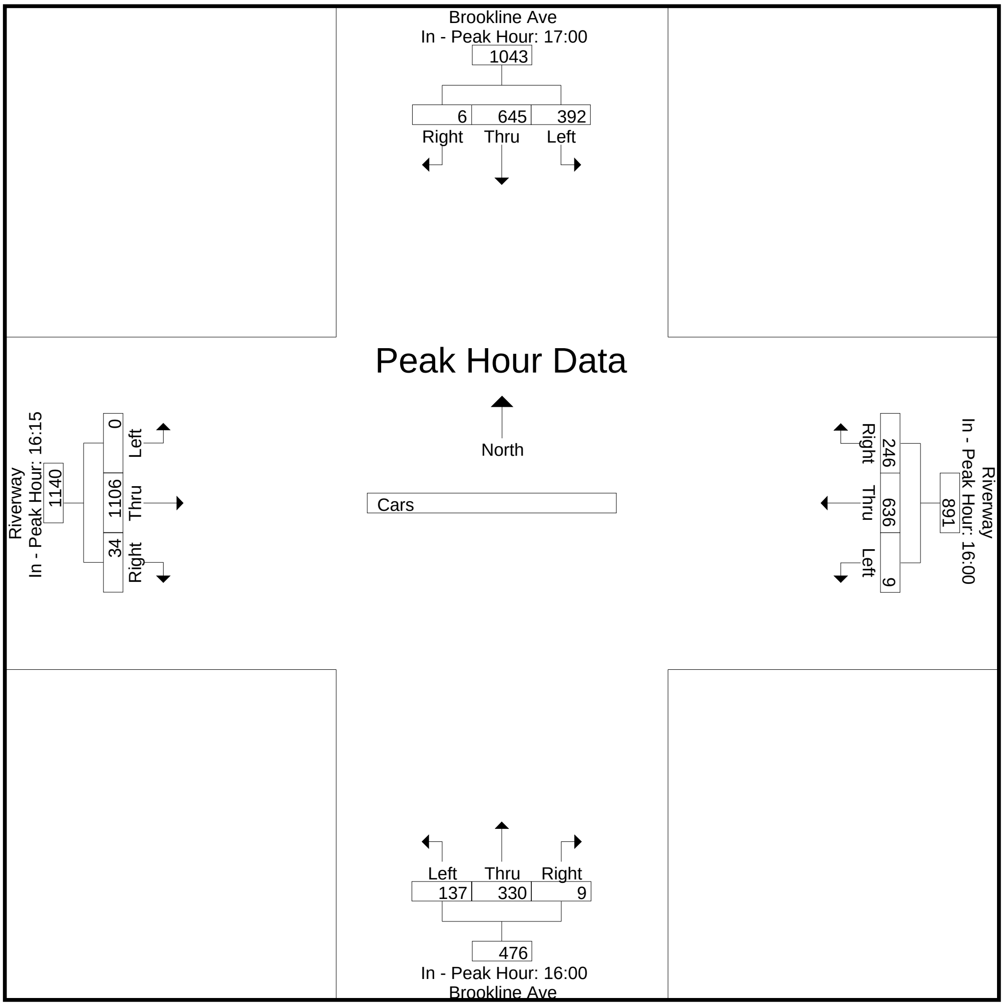


Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	17:00				16:00				16:00				16:15			
+0 mins.	99	152	1	252	2	167	65	**234**	**42**	88	2	132	0	**287**	**14**	**301**
+15 mins.	**107**	149	1	257	**3**	153	**69**	225	39	**100**	1	**140**	0	252	7	259
+30 mins.	102	156	1	259	2	144	53	199	22	74	2	98	0	281	8	289
+45 mins.	84	**188**	**3**	**275**	2	**172**	59	233	34	68	**4**	106	0	286	5	291
Total Volume	392	645	6	1043	9	636	246	891	137	330	9	476	0	1106	34	1140
% App. Total	37.6	61.8	0.6		1	71.4	27.6		28.8	69.3	1.9		0	97	3	
PHF	.916	.858	.500	.948	.750	.924	.891	.952	.815	.825	.563	.850	.000	.963	.607	.947

Accurate Counts
978-664-2565

File Name : 10568002
Site Code : 10568002
Start Date : 5/5/2009
Page No : 3



N/S Street : Brookline Avenue
E/W Street: Riverway
City/State : Boston, MA
Weather : Cloudy

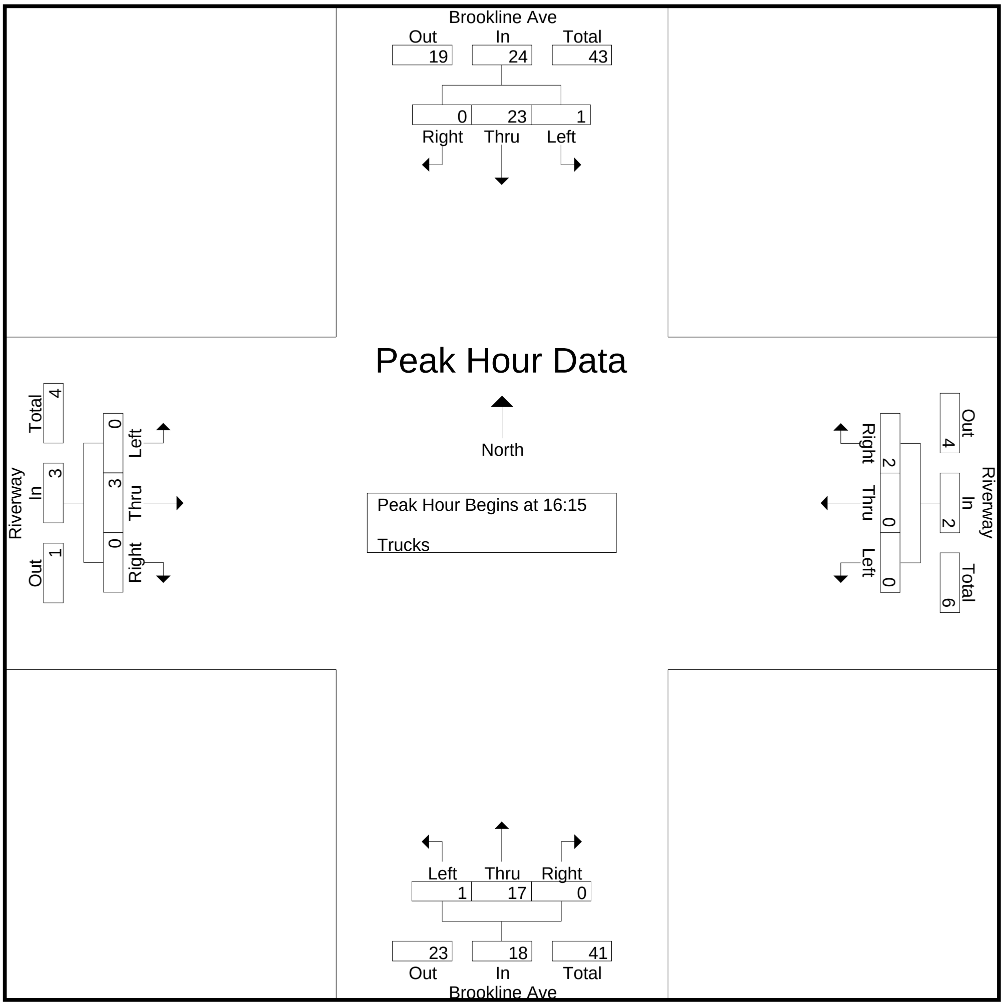
Accurate Counts
978-664-2565

File Name : 10568002
Site Code : 10568002
Start Date : 5/5/2009
Page No : 1

Groups Printed- Trucks

	Brookline Ave From North				Riverway From East				Brookline Ave From South				Riverway From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	0	5	0	0	0	0	1	0	0	4	0	0	0	0	0	0	0	10	10
16:15	0	7	0	0	0	0	0	0	0	2	0	0	0	1	0	0	0	10	10
16:30	1	8	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	15	15
16:45	0	4	0	0	0	0	1	0	0	4	0	0	0	2	0	0	0	11	11
Total	1	24	0	0	0	0	2	0	0	16	0	0	0	3	0	0	0	46	46
17:00	0	4	0	0	0	0	1	0	1	5	0	0	0	0	0	0	0	11	11
17:15	1	3	0	0	0	1	0	0	0	3	0	0	0	0	1	0	0	9	9
17:30	0	6	0	0	1	0	1	0	0	5	0	0	0	2	0	0	0	15	15
17:45	1	4	0	0	0	0	1	0	0	2	0	0	0	2	0	0	0	10	10
Total	2	17	0	0	1	1	3	0	1	15	0	0	0	4	1	0	0	45	45
Grand Total	3	41	0	0	1	1	5	0	1	31	0	0	0	7	1	0	0	91	91
Apprch %	6.8	93.2	0		14.3	14.3	71.4		3.1	96.9	0		0	87.5	12.5				
Total %	3.3	45.1	0		1.1	1.1	5.5		1.1	34.1	0		0	7.7	1.1		0	100	

	Brookline Ave From North				Riverway From East				Brookline Ave From South				Riverway From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 16:15																	
16:15	0	7	0	7	0	0	0	0	0	2	0	2	0	1	0	1	10
16:30	**1**	**8**	0	**9**	0	0	0	0	0	**6**	0	**6**	0	0	0	0	**15**
16:45	0	4	0	4	0	0	**1**	**1**	0	4	0	4	0	**2**	0	**2**	11
17:00	0	4	0	4	0	0	1	1	**1**	5	0	6	0	0	0	0	11
Total Volume	1	23	0	24	0	0	2	2	1	17	0	18	0	3	0	3	47
% App. Total	4.2	95.8	0		0	0	100		5.6	94.4	0		0	100	0		
PHF	.250	.719	.000	.667	.000	.000	.500	.500	.250	.708	.000	.750	.000	.375	.000	.375	.783

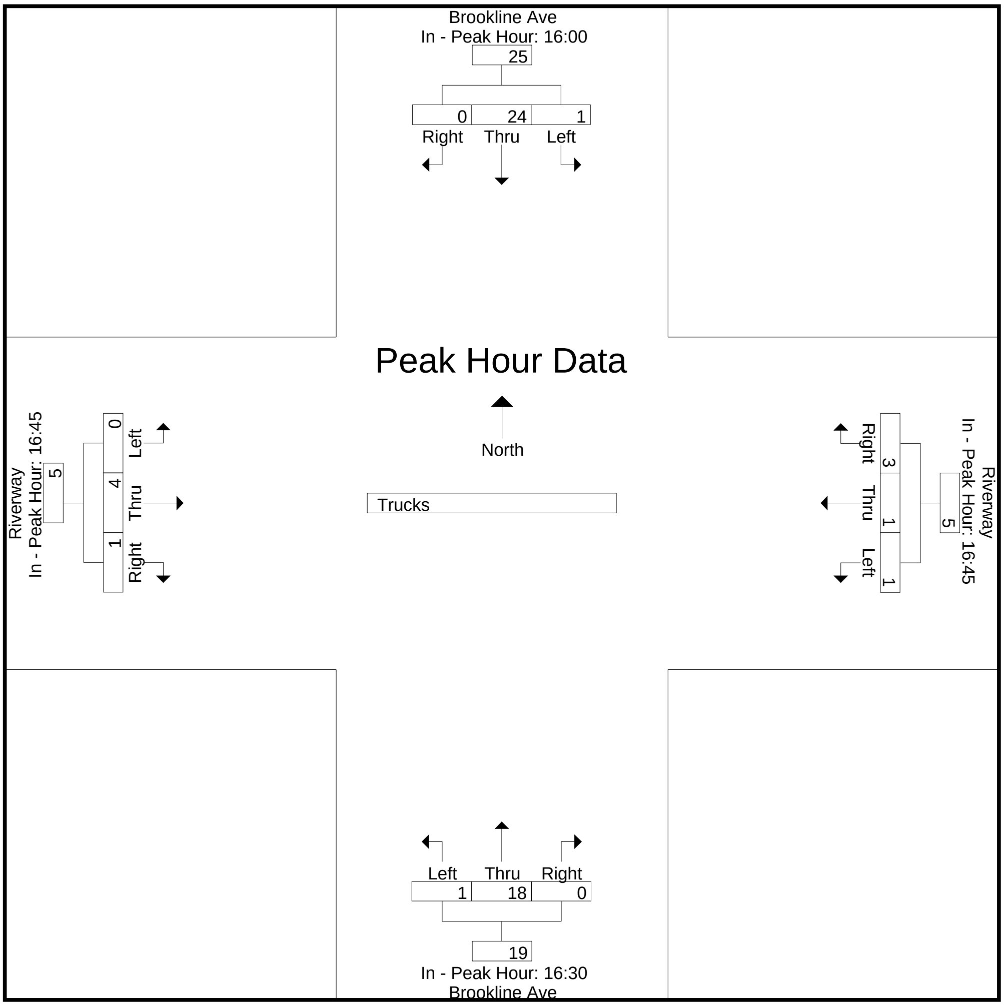


Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:00				16:45				16:30				16:45			
+0 mins.	0	5	0	5	0	0	**1**	1	0	**6**	0	**6**	0	**2**	0	**2**
+15 mins.	0	7	0	7	0	0	1	1	0	4	0	4	0	0	0	0
+30 mins.	**1**	**8**	0	**9**	0	**1**	0	1	**1**	5	0	6	0	0	**1**	1
+45 mins.	0	4	0	4	**1**	0	1	**2**	0	3	0	3	0	2	0	2
Total Volume	1	24	0	25	1	1	3	5	1	18	0	19	0	4	1	5
% App. Total	4	96	0		20	20	60		5.3	94.7	0		0	80	20	
PHF	.250	.750	.000	.694	.250	.250	.750	.625	.250	.750	.000	.792	.000	.500	.250	.625

Accurate Counts
978-664-2565

File Name : 10568002
Site Code : 10568002
Start Date : 5/5/2009
Page No : 3



N/S Street : Brookline Avenue
E/W Street: Fenwood Street
City/State : Boston, MA
Weather : Overcast

Accurate Counts
978-664-2565

File Name : 10568003
Site Code : 10568003
Start Date : 5/5/2009
Page No : 1

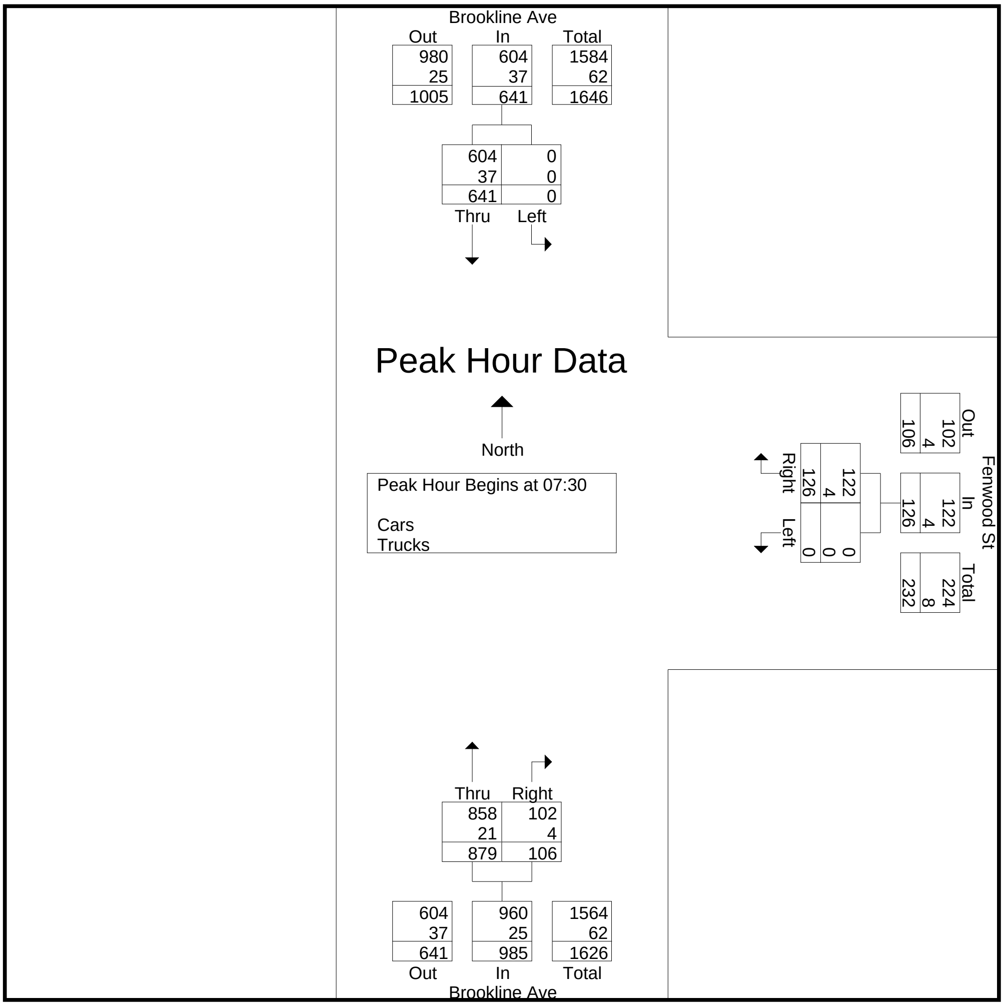
Groups Printed- Cars - Trucks

	Brookline Ave From North			Fenwood St From East			Brookline Ave From South					
Start Time	Left	Thru	Peds	Left	Right	Peds	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	0	127	0	0	12	11	209	26	0	11	374	385
07:15	0	132	0	0	15	16	225	38	0	16	410	426
07:30	0	161	0	0	20	9	206	33	0	9	420	429
07:45	0	160	0	0	28	12	209	27	0	12	424	436
Total	0	580	0	0	75	48	849	124	0	48	1628	1676
08:00	0	170	0	0	39	5	235	25	0	5	469	474
08:15	0	150	0	0	39	10	229	21	0	10	439	449
08:30	0	120	0	0	33	11	209	21	0	11	383	394
08:45	0	111	0	0	47	7	243	14	0	7	415	422
Total	0	551	0	0	158	33	916	81	0	33	1706	1739
Grand Total	0	1131	0	0	233	81	1765	205	0	81	3334	3415
Apprch %	0	100		0	100		89.6	10.4				
Total %	0	33.9		0	7		52.9	6.1		2.4	97.6	
Cars	0	1063		0	227		1718	201		0	0	3290
% Cars	0	94	0	0	97.4	100	97.3	98	0	0	0	96.3
Trucks	0	68		0	6		47	4		0	0	125
% Trucks	0	6	0	0	2.6	0	2.7	2	0	0	0	3.7

	Brookline Ave From North			Fenwood St From East			Brookline Ave From South			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:30										
07:30	0	161	161	0	20	20	206	**33**	239	420
07:45	0	160	160	0	28	28	209	27	236	424
08:00	0	**170**	**170**	0	**39**	**39**	**235**	25	**260**	**469**
08:15	0	150	150	0	39	39	229	21	250	439
Total Volume	0	641	641	0	126	126	879	106	985	1752
% App. Total	0	100		0	100		89.2	10.8		
PHF	.000	.943	.943	.000	.808	.808	.935	.803	.947	.934
Cars	0	604	604	0	122	122	858	102	960	1686
% Cars	0	94.2	94.2	0	96.8	96.8	97.6	96.2	97.5	96.2
Trucks	0	37	37	0	4	4	21	4	25	66
% Trucks	0	5.8	5.8	0	3.2	3.2	2.4	3.8	2.5	3.8

Accurate Counts
978-664-2565

File Name : 10568003
Site Code : 10568003
Start Date : 5/5/2009
Page No : 2

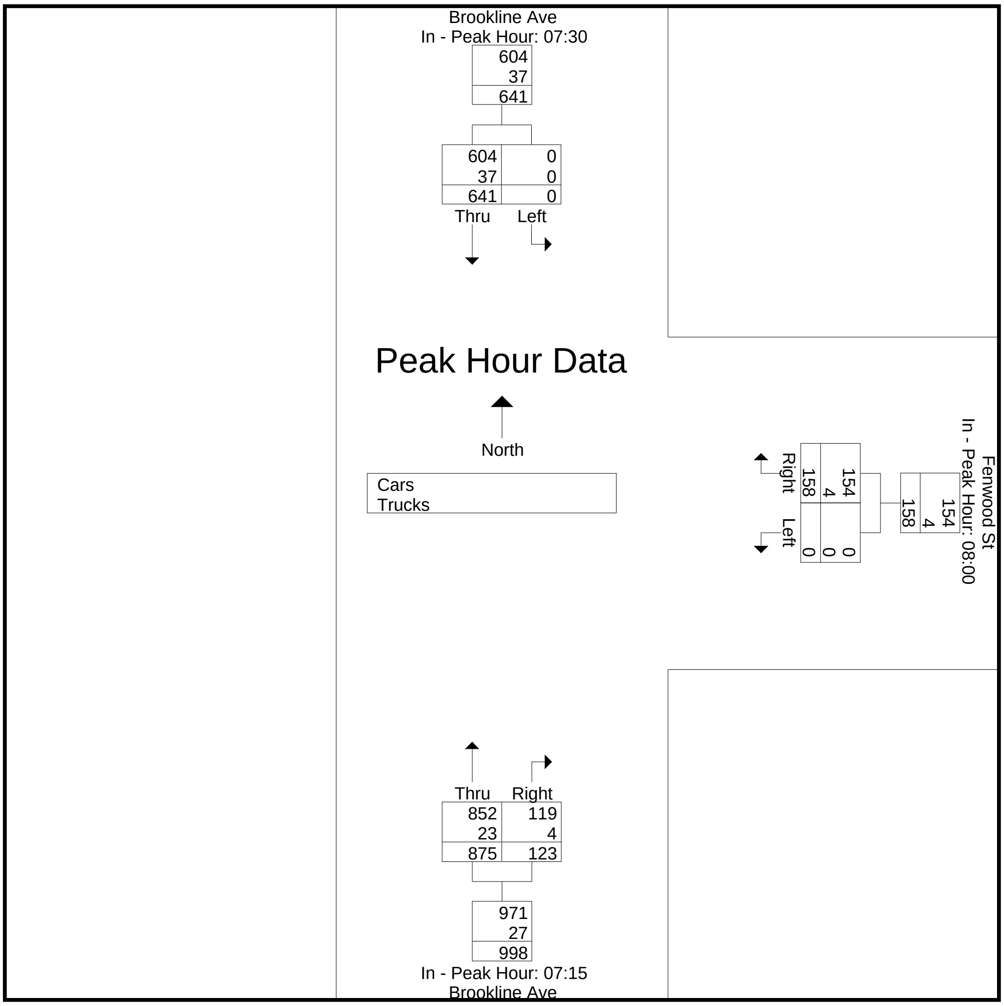


Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:30			08:00			07:15		
+0 mins.	0	161	161	0	39	39	225	**38**	**263**
+15 mins.	0	160	160	0	39	39	206	33	239
+30 mins.	0	**170**	**170**	0	33	33	209	27	236
+45 mins.	0	150	150	0	**47**	**47**	**235**	25	260
Total Volume	0	641	641	0	158	158	875	123	998
% App. Total	0	100		0	100		87.7	12.3	
PHF	.000	.943	.943	.000	.840	.840	.931	.809	.949
Cars	0	604	604	0	154	154	852	119	971
% Cars	0	94.2	94.2	0	97.5	97.5	97.4	96.7	97.3
Trucks	0	37	37	0	4	4	23	4	27
% Trucks	0	5.8	5.8	0	2.5	2.5	2.6	3.3	2.7

Accurate Counts
978-664-2565

File Name : 10568003
Site Code : 10568003
Start Date : 5/5/2009
Page No : 3



N/S Street : Brookline Avenue
E/W Street: Fenwood Street
City/State : Boston, MA
Weather : Overcast

Accurate Counts
978-664-2565

File Name : 10568003
Site Code : 10568003
Start Date : 5/5/2009
Page No : 1

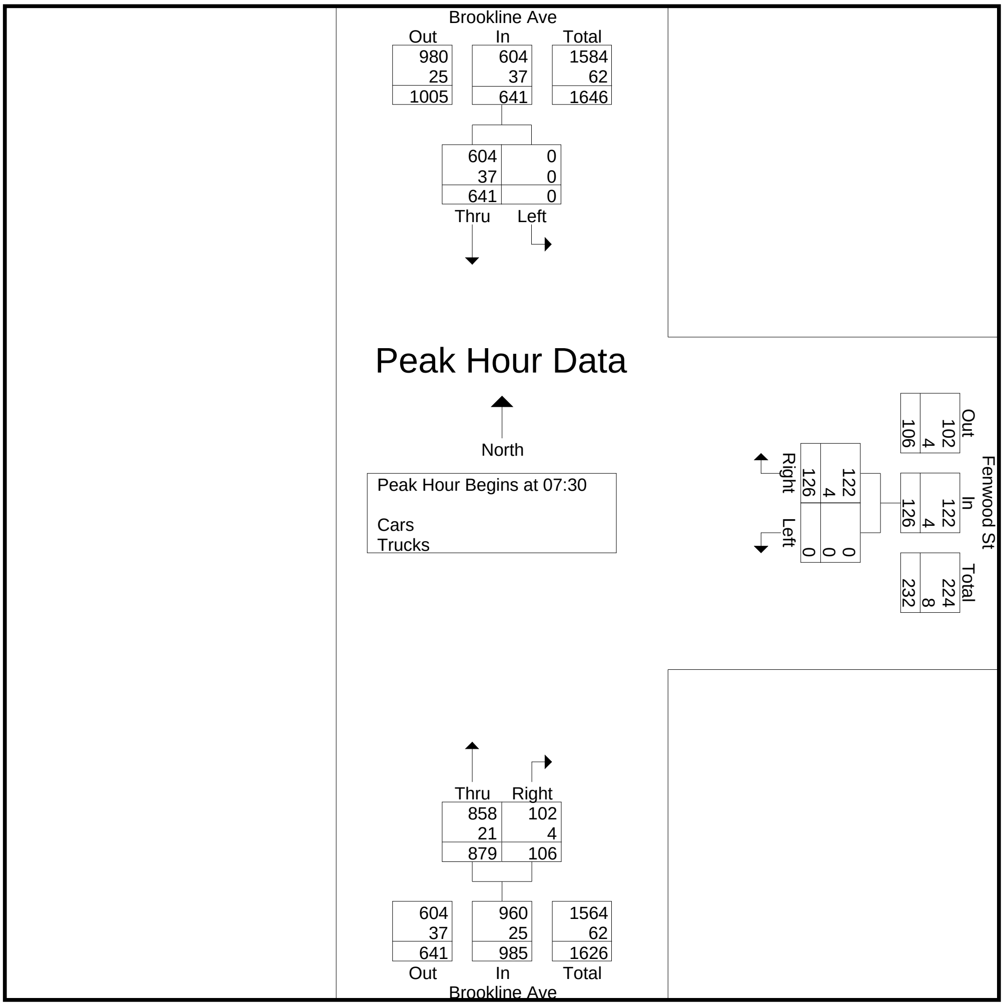
Groups Printed- Cars - Trucks

	Brookline Ave From North			Fenwood St From East			Brookline Ave From South					
Start Time	Left	Thru	Peds	Left	Right	Peds	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	0	127	0	0	12	11	209	26	0	11	374	385
07:15	0	132	0	0	15	16	225	38	0	16	410	426
07:30	0	161	0	0	20	9	206	33	0	9	420	429
07:45	0	160	0	0	28	12	209	27	0	12	424	436
Total	0	580	0	0	75	48	849	124	0	48	1628	1676
08:00	0	170	0	0	39	5	235	25	0	5	469	474
08:15	0	150	0	0	39	10	229	21	0	10	439	449
08:30	0	120	0	0	33	11	209	21	0	11	383	394
08:45	0	111	0	0	47	7	243	14	0	7	415	422
Total	0	551	0	0	158	33	916	81	0	33	1706	1739
Grand Total	0	1131	0	0	233	81	1765	205	0	81	3334	3415
Apprch %	0	100		0	100		89.6	10.4				
Total %	0	33.9		0	7		52.9	6.1		2.4	97.6	
Cars	0	1063		0	227		1718	201		0	0	3290
% Cars	0	94	0	0	97.4	100	97.3	98	0	0	0	96.3
Trucks	0	68		0	6		47	4		0	0	125
% Trucks	0	6	0	0	2.6	0	2.7	2	0	0	0	3.7

	Brookline Ave From North			Fenwood St From East			Brookline Ave From South			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:30										
07:30	0	161	161	0	20	20	206	**33**	239	420
07:45	0	160	160	0	28	28	209	27	236	424
08:00	0	**170**	**170**	0	**39**	**39**	**235**	25	**260**	**469**
08:15	0	150	150	0	39	39	229	21	250	439
Total Volume	0	641	641	0	126	126	879	106	985	1752
% App. Total	0	100		0	100		89.2	10.8		
PHF	.000	.943	.943	.000	.808	.808	.935	.803	.947	.934
Cars	0	604	604	0	122	122	858	102	960	1686
% Cars	0	94.2	94.2	0	96.8	96.8	97.6	96.2	97.5	96.2
Trucks	0	37	37	0	4	4	21	4	25	66
% Trucks	0	5.8	5.8	0	3.2	3.2	2.4	3.8	2.5	3.8

Accurate Counts
978-664-2565

File Name : 10568003
Site Code : 10568003
Start Date : 5/5/2009
Page No : 2

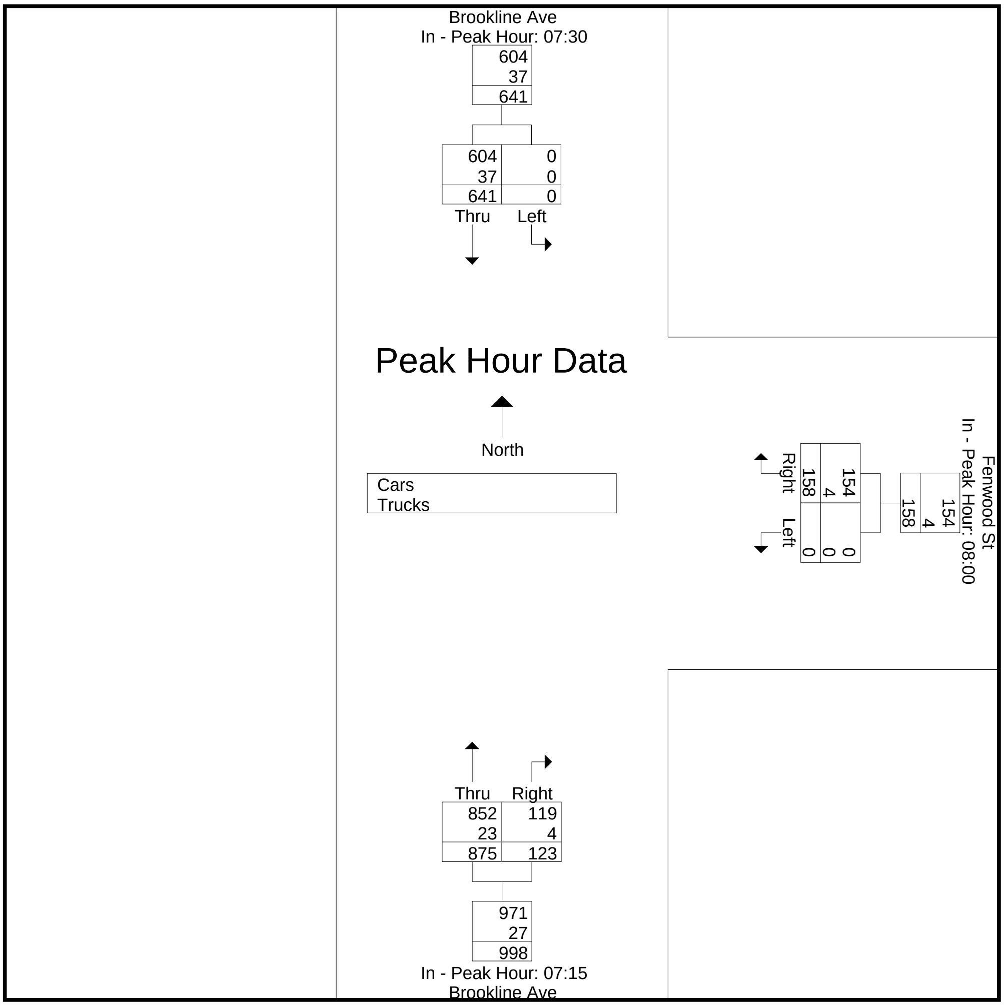


Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:30			08:00			07:15		
+0 mins.	0	161	161	0	39	39	225	**38**	**263**
+15 mins.	0	160	160	0	39	39	206	33	239
+30 mins.	0	**170**	**170**	0	33	33	209	27	236
+45 mins.	0	150	150	0	**47**	**47**	**235**	25	260
Total Volume	0	641	641	0	158	158	875	123	998
% App. Total	0	100		0	100		87.7	12.3	
PHF	.000	.943	.943	.000	.840	.840	.931	.809	.949
Cars	0	604	604	0	154	154	852	119	971
% Cars	0	94.2	94.2	0	97.5	97.5	97.4	96.7	97.3
Trucks	0	37	37	0	4	4	23	4	27
% Trucks	0	5.8	5.8	0	2.5	2.5	2.6	3.3	2.7

Accurate Counts
978-664-2565

File Name : 10568003
Site Code : 10568003
Start Date : 5/5/2009
Page No : 3



N/S Street : Brookline Avenue
E/W Street: Fenwood Street
City/State : Boston, MA
Weather : Overcast

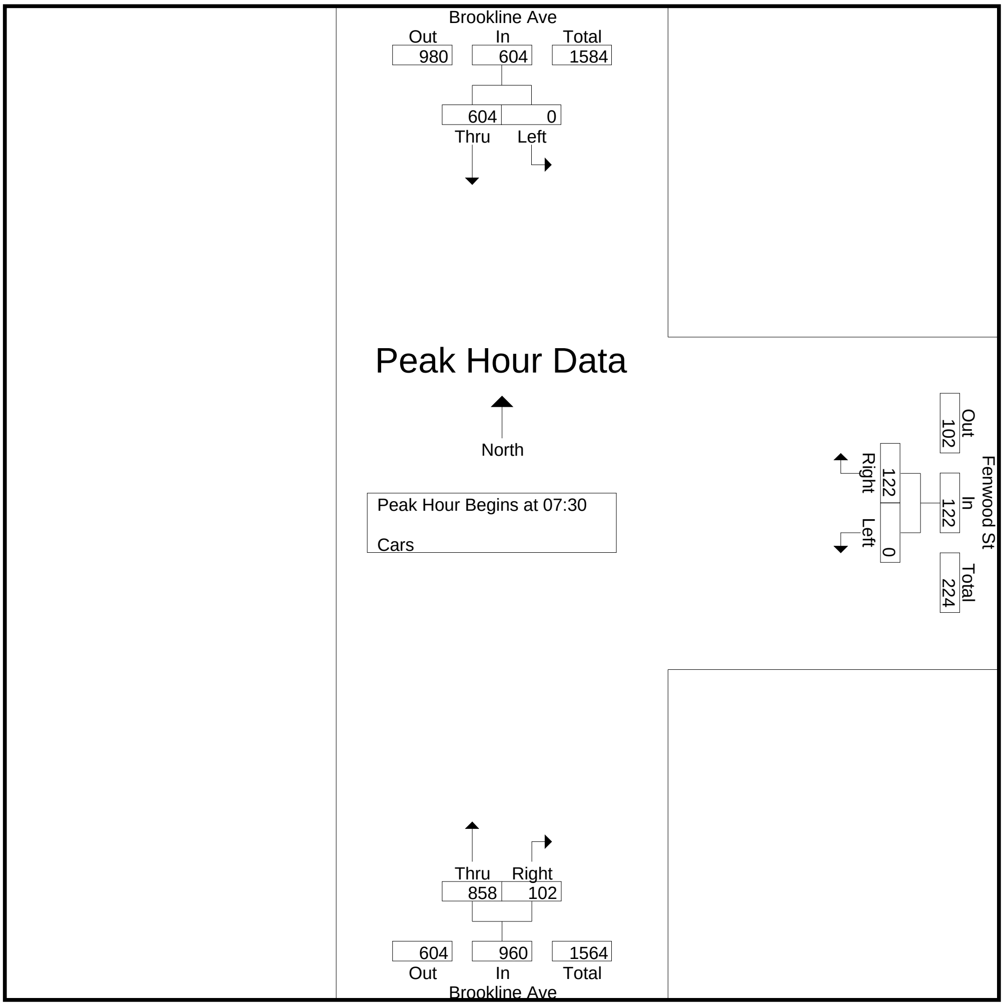
Accurate Counts
978-664-2565

File Name : 10568003
Site Code : 10568003
Start Date : 5/5/2009
Page No : 1

Groups Printed- Cars

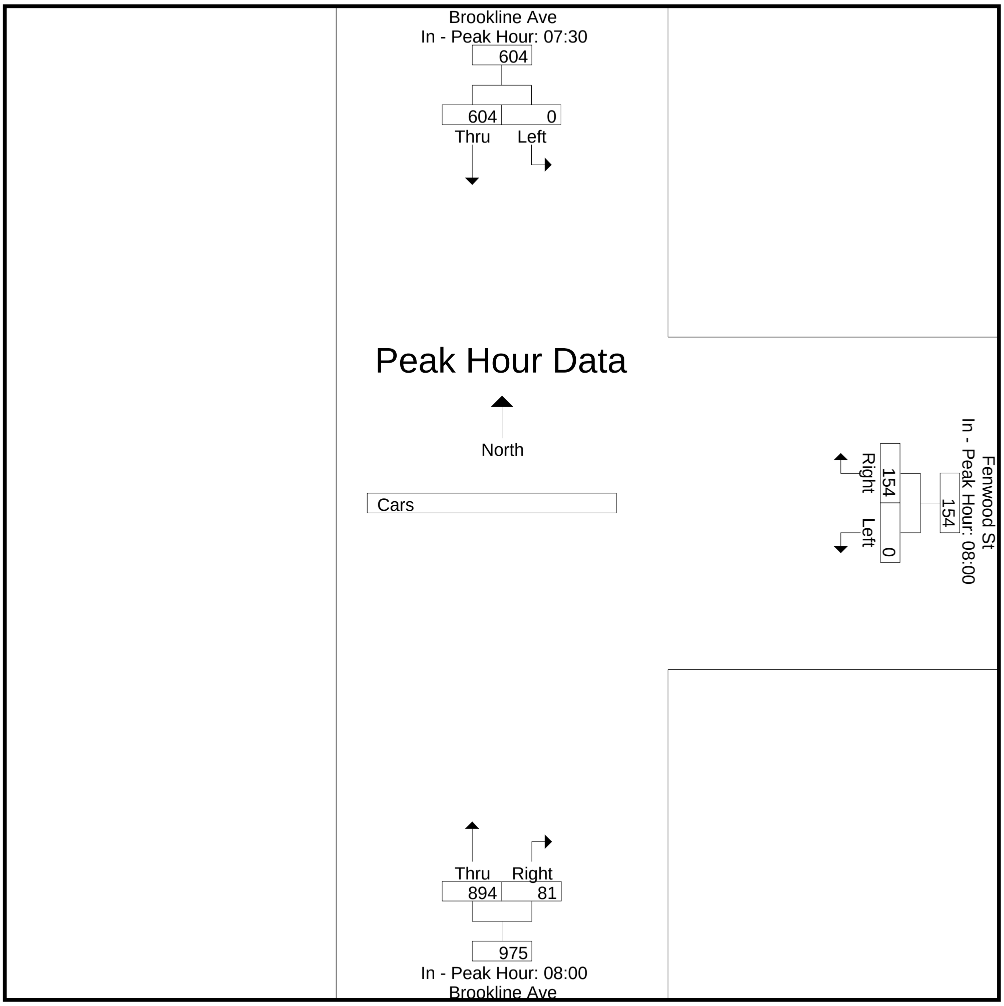
	Brookline Ave From North			Fenwood St From East			Brookline Ave From South					
Start Time	Left	Thru	Peds	Left	Right	Peds	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	0	120	0	0	11	11	203	26	0	11	360	371
07:15	0	124	0	0	15	16	217	38	0	16	394	410
07:30	0	150	0	0	20	9	203	29	0	9	402	411
07:45	0	152	0	0	27	12	201	27	0	12	407	419
Total	0	546	0	0	73	48	824	120	0	48	1563	1611
08:00	0	163	0	0	39	5	231	25	0	5	458	463
08:15	0	139	0	0	36	10	223	21	0	10	419	429
08:30	0	113	0	0	33	11	204	21	0	11	371	382
08:45	0	102	0	0	46	7	236	14	0	7	398	405
Total	0	517	0	0	154	33	894	81	0	33	1646	1679
Grand Total	0	1063	0	0	227	81	1718	201	0	81	3209	3290
Apprch %	0	100		0	100		89.5	10.5				
Total %	0	33.1		0	7.1		53.5	6.3		2.5	97.5	

	Brookline Ave From North			Fenwood St From East			Brookline Ave From South			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:30										
07:30	0	150	150	0	20	20	203	**29**	232	402
07:45	0	152	152	0	27	27	201	27	228	407
08:00	0	**163**	**163**	0	**39**	**39**	**231**	25	**256**	**458**
08:15	0	139	139	0	36	36	223	21	244	419
Total Volume	0	604	604	0	122	122	858	102	960	1686
% App. Total	0	100		0	100		89.4	10.6		
PHF	.000	.926	.926	.000	.782	.782	.929	.879	.938	.920



Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:30			08:00			08:00		
+0 mins.	0	150	150	0	39	39	231	**25**	**256**
+15 mins.	0	152	152	0	36	36	223	21	244
+30 mins.	0	**163**	**163**	0	33	33	204	21	225
+45 mins.	0	139	139	0	**46**	**46**	**236**	14	250
Total Volume	0	604	604	0	154	154	894	81	975
% App. Total	0	100		0	100		91.7	8.3	
PHF	.000	.926	.926	.000	.837	.837	.947	.810	.952


Brookline Ave
In - Peak Hour: 07:30
604
604
0
Thru
Left
Peak Hour Data
North
Cars
Fenwood St
In - Peak Hour: 08:00
154
154
0
Right
Left
Thru
Right
894
81
975
In - Peak Hour: 08:00
Brookline Ave

N/S Street : Brookline Avenue
E/W Street: Fenwood Street
City/State : Boston, MA
Weather : Overcast

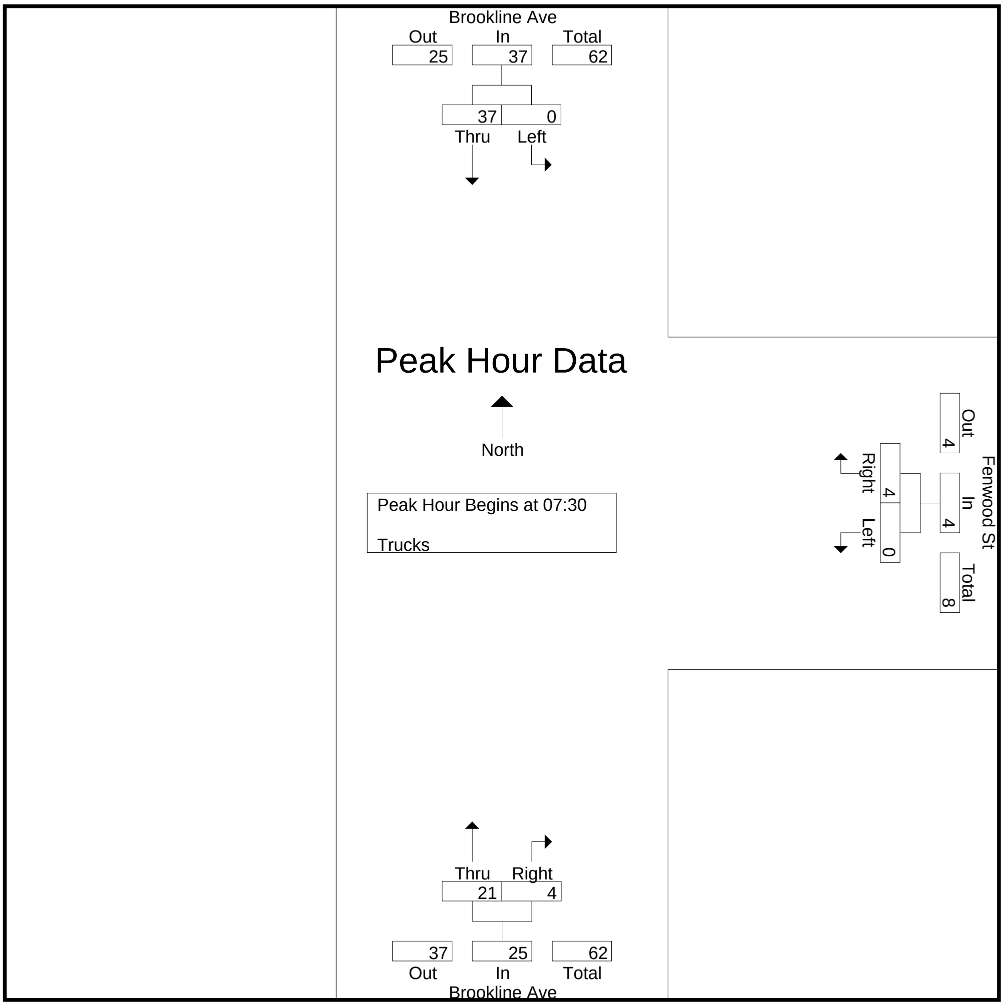
Accurate Counts
978-664-2565

File Name : 10568003
Site Code : 10568003
Start Date : 5/5/2009
Page No : 1

Groups Printed- Trucks

	Brookline Ave From North			Fenwood St From East			Brookline Ave From South					
Start Time	Left	Thru	Peds	Left	Right	Peds	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	0	7	0	0	1	0	6	0	0	0	14	14
07:15	0	8	0	0	0	0	8	0	0	0	16	16
07:30	0	11	0	0	0	0	3	4	0	0	18	18
07:45	0	8	0	0	1	0	8	0	0	0	17	17
Total	0	34	0	0	2	0	25	4	0	0	65	65
08:00	0	7	0	0	0	0	4	0	0	0	11	11
08:15	0	11	0	0	3	0	6	0	0	0	20	20
08:30	0	7	0	0	0	0	5	0	0	0	12	12
08:45	0	9	0	0	1	0	7	0	0	0	17	17
Total	0	34	0	0	4	0	22	0	0	0	60	60
Grand Total	0	68	0	0	6	0	47	4	0	0	125	125
Apprch %	0	100		0	100		92.2	7.8				
Total %	0	54.4		0	4.8		37.6	3.2		0	100	

	Brookline Ave From North			Fenwood St From East			Brookline Ave From South			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:30										
07:30	0	**11**	**11**	0	0	0	3	**4**	7	18
07:45	0	8	8	0	1	1	**8**	0	**8**	17
08:00	0	7	7	0	0	0	4	0	4	11
08:15	0	11	11	0	**3**	**3**	6	0	6	**20**
Total Volume	0	37	37	0	4	4	21	4	25	66
% App. Total	0	100		0	100		84	16		
PHF	.000	.841	.841	.000	.333	.333	.656	.250	.781	.825



Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:30			07:30			07:00		
+0 mins.	0	**11**	**11**	0	0	0	6	0	6
+15 mins.	0	8	8	0	1	1	**8**	0	**8**
+30 mins.	0	7	7	0	0	0	3	**4**	7
+45 mins.	0	11	11	0	**3**	**3**	8	0	8
Total Volume	0	37	37	0	4	4	25	4	29
% App. Total	0	100		0	100		86.2	13.8	
PHF	.000	.841	.841	.000	.333	.333	.781	.250	.906

Accurate Counts
978-664-2565

File Name : 10568003
Site Code : 10568003
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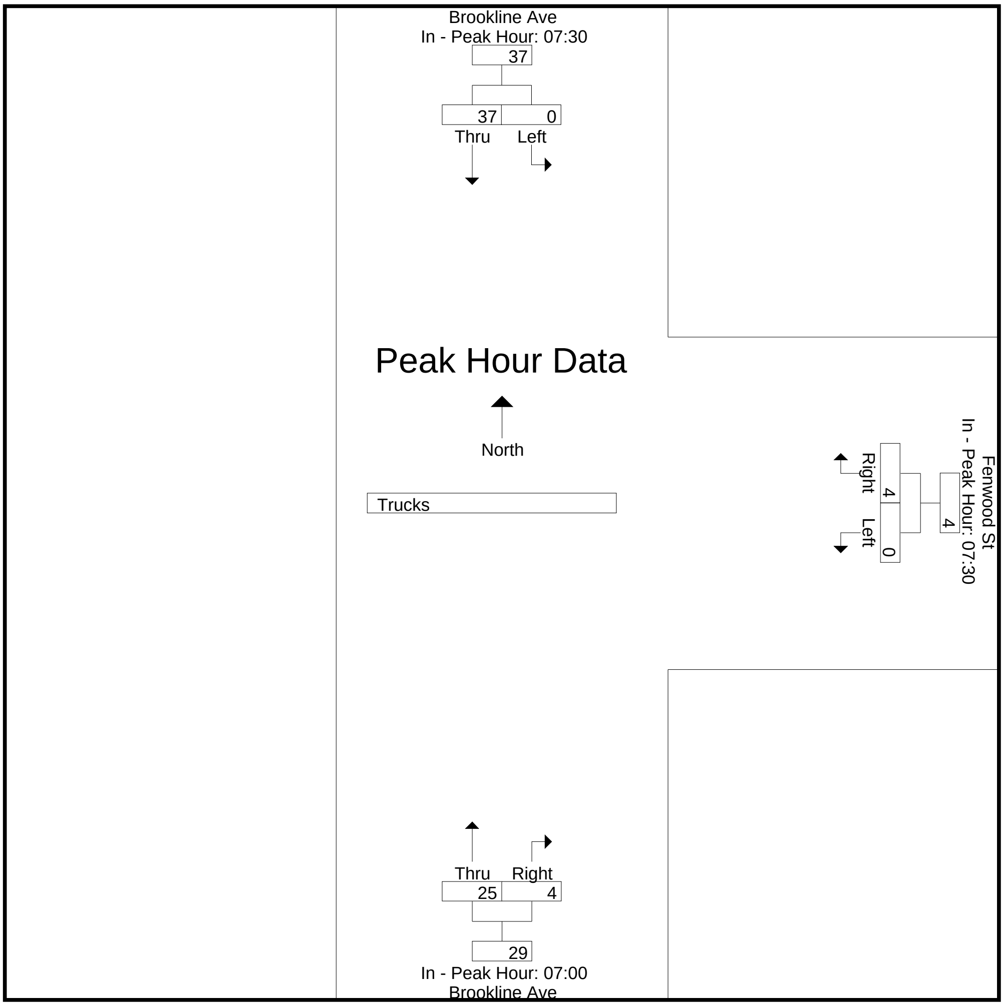


N/S Street : Brookline Avenue
E/W Street: Fenwood Street
City/State : Boston, MA
Weather : Overcast

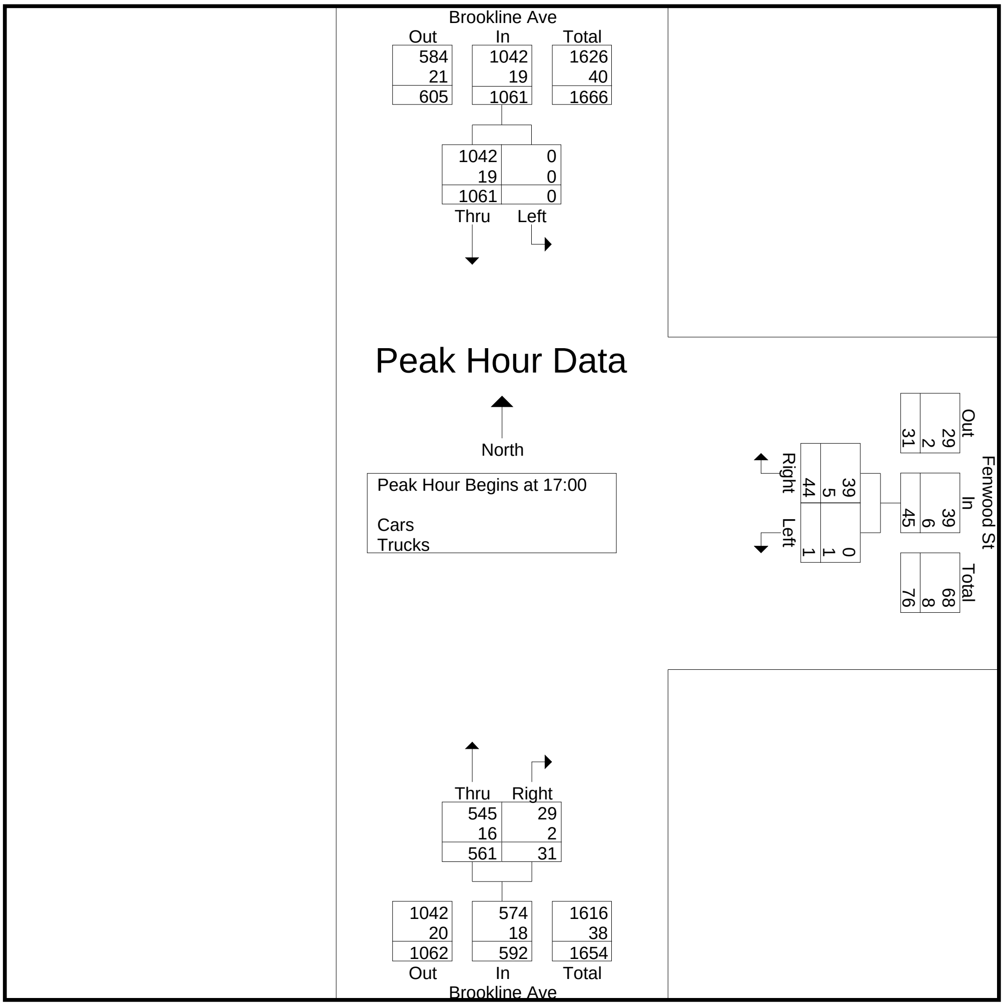
Accurate Counts
978-664-2565

File Name : 10568003
Site Code : 10568003
Start Date : 5/5/2009
Page No : 1

Groups Printed- Cars - Trucks

	Brookline Ave From North			Fenwood St From East			Brookline Ave From South					
Start Time	Left	Thru	Peds	Left	Right	Peds	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	0	224	0	0	11	10	151	7	0	10	393	403
16:15	0	263	0	0	10	14	169	1	0	14	443	457
16:30	0	253	0	0	8	15	127	6	0	15	394	409
16:45	0	243	1	0	14	23	128	4	0	24	389	413
Total	0	983	1	0	43	62	575	18	0	63	1619	1682
17:00	0	255	0	0	13	20	124	9	0	20	401	421
17:15	0	261	0	0	8	28	144	4	0	28	417	445
17:30	0	265	0	0	16	18	150	10	0	18	441	459
17:45	0	280	0	1	7	16	143	8	0	16	439	455
Total	0	1061	0	1	44	82	561	31	0	82	1698	1780
Grand Total	0	2044	1	1	87	144	1136	49	0	145	3317	3462
Apprch %	0	100		1.1	98.9		95.9	4.1				
Total %	0	61.6		0	2.6		34.2	1.5		4.2	95.8	
Cars	0	2000		0	76		1104	45		0	0	3370
% Cars	0	97.8	100	0	87.4	100	97.2	91.8	0	0	0	97.3
Trucks	0	44		1	11		32	4		0	0	92
% Trucks	0	2.2	0	100	12.6	0	2.8	8.2	0	0	0	2.7

	Brookline Ave From North			Fenwood St From East			Brookline Ave From South			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 17:00										
17:00	0	255	255	0	13	13	124	9	133	401
17:15	0	261	261	0	8	8	144	4	148	417
17:30	0	265	265	0	**16**	**16**	**150**	**10**	**160**	**441**
17:45	0	**280**	**280**	**1**	7	8	143	8	151	439
Total Volume	0	1061	1061	1	44	45	561	31	592	1698
% App. Total	0	100		2.2	97.8		94.8	5.2		
PHF	.000	.947	.947	.250	.688	.703	.935	.775	.925	.963
Cars	0	1042	1042	0	39	39	545	29	574	1655
% Cars	0	98.2	98.2	0	88.6	86.7	97.1	93.5	97.0	97.5
Trucks	0	19	19	1	5	6	16	2	18	43
% Trucks	0	1.8	1.8	100	11.4	13.3	2.9	6.5	3.0	2.5



Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	17:00			16:45			16:00		
+0 mins.	0	255	255	0	14	14	151	**7**	158
+15 mins.	0	261	261	0	13	13	**169**	1	**170**
+30 mins.	0	265	265	0	8	8	127	6	133
+45 mins.	0	**280**	**280**	0	**16**	**16**	128	4	132
Total Volume	0	1061	1061	0	51	51	575	18	593
% App. Total	0	100		0	100		97	3	
PHF	.000	.947	.947	.000	.797	.797	.851	.643	.872
Cars	0	1042	1042	0	45	45	559	16	575
% Cars	0	98.2	98.2	0	88.2	88.2	97.2	88.9	97
Trucks	0	19	19	0	6	6	16	2	18
% Trucks	0	1.8	1.8	0	11.8	11.8	2.8	11.1	3

Accurate Counts
978-664-2565

File Name : 10568003
Site Code : 10568003
Start Date : 5/5/2009
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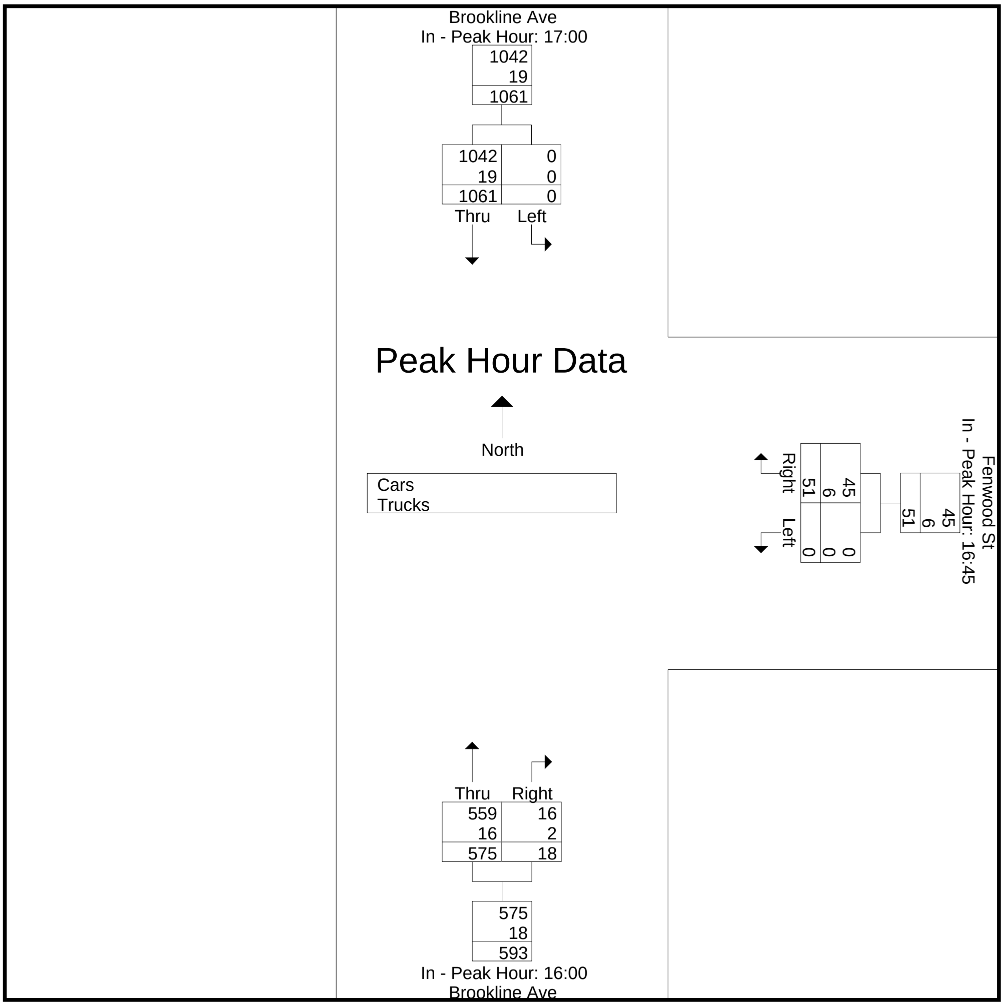

N/S Street : Brookline Avenue
E/W Street: Fenwood Street
City/State : Boston, MA
Weather : Overcast

Accurate Counts
978-664-2565

File Name : 10568003
Site Code : 10568003
Start Date : 5/5/2009
Page No : 1

Groups Printed- Cars

	Brookline Ave From North			Fenwood St From East			Brookline Ave From South					
Start Time	Left	Thru	Peds	Left	Right	Peds	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	0	219	0	0	11	10	147	6	0	10	383	393
16:15	0	256	0	0	7	14	167	1	0	14	431	445
16:30	0	244	0	0	7	15	121	6	0	15	378	393
16:45	0	239	1	0	12	23	124	3	0	24	378	402
Total	0	958	1	0	37	62	559	16	0	63	1570	1633
17:00	0	251	0	0	11	20	119	8	0	20	389	409
17:15	0	257	0	0	7	28	141	4	0	28	409	437
17:30	0	259	0	0	15	18	145	9	0	18	428	446
17:45	0	275	0	0	6	16	140	8	0	16	429	445
Total	0	1042	0	0	39	82	545	29	0	82	1655	1737
Grand Total	0	2000	1	0	76	144	1104	45	0	145	3225	3370
Apprch %	0	100		0	100		96.1	3.9				
Total %	0	62		0	2.4		34.2	1.4		4.3	95.7	

	Brookline Ave From North			Fenwood St From East			Brookline Ave From South			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 17:00										
17:00	0	251	251	0	11	11	119	8	127	389
17:15	0	257	257	0	7	7	141	4	145	409
17:30	0	259	259	0	**15**	**15**	**145**	**9**	**154**	428
17:45	0	**275**	**275**	0	6	6	140	8	148	**429**
Total Volume	0	1042	1042	0	39	39	545	29	574	1655
% App. Total	0	100		0	100		94.9	5.1		
PHF	.000	.947	.947	.000	.650	.650	.940	.806	.932	.964

Accurate Counts
978-664-2565

File Name : 10568003
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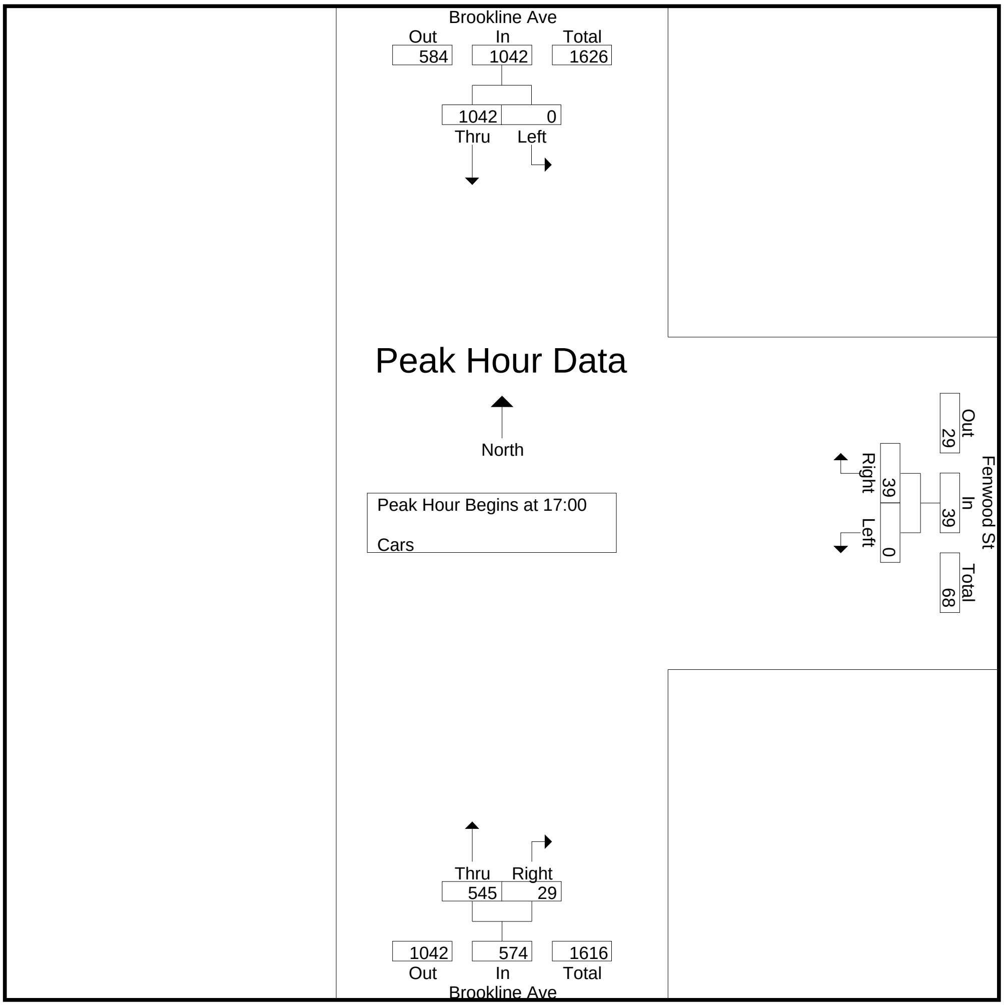
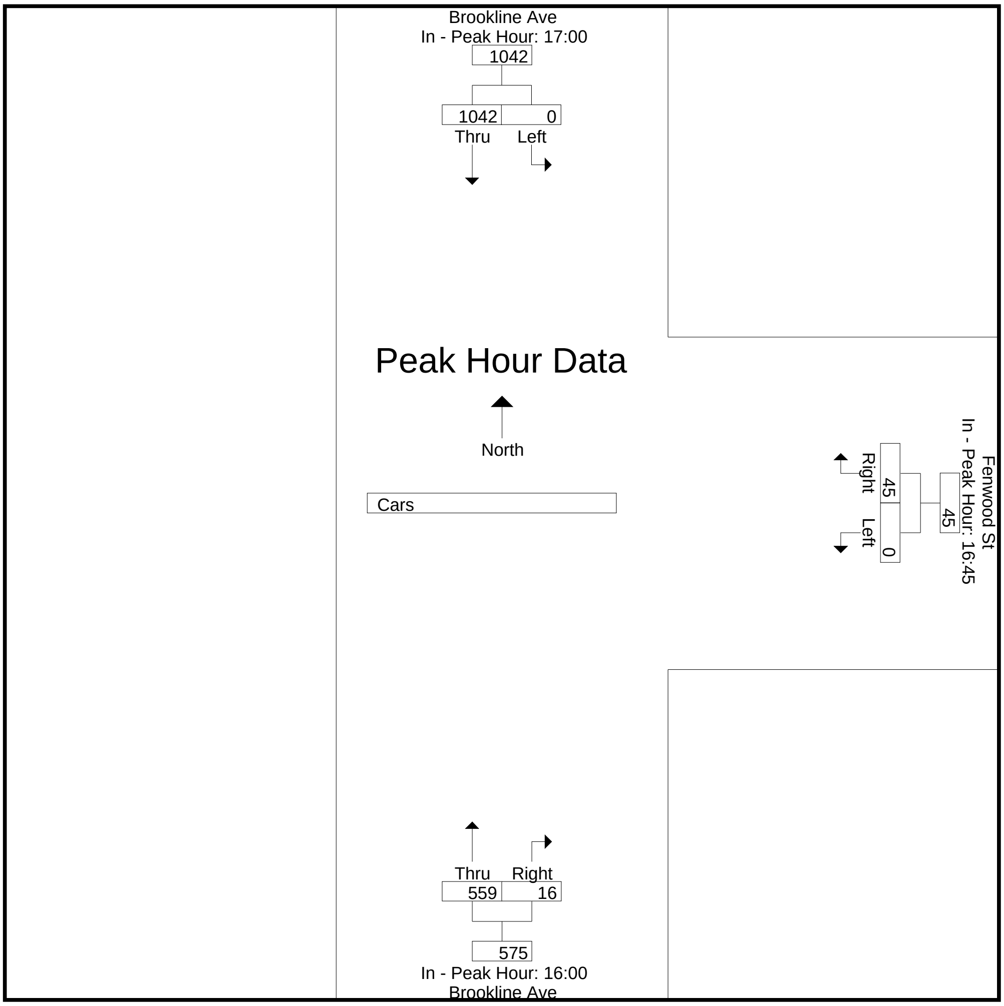


Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	17:00			16:45			16:00		
+0 mins.	0	251	251	0	12	12	147	**6**	153
+15 mins.	0	257	257	0	11	11	**167**	1	**168**
+30 mins.	0	259	259	0	7	7	121	6	127
+45 mins.	0	**275**	**275**	0	**15**	**15**	124	3	127
Total Volume	0	1042	1042	0	45	45	559	16	575
% App. Total	0	100		0	100		97.2	2.8	
PHF	.000	.947	.947	.000	.750	.750	.837	.667	.856


Brookline Ave
In - Peak Hour: 17:00
1042
1042
0
Thru
Left
Peak Hour Data
North
Cars
Fenwood St
In - Peak Hour: 16:45
45
45
0
Right
Left
Thru
Right
559
16
575
In - Peak Hour: 16:00
Brookline Ave

N/S Street : Brookline Avenue
E/W Street: Fenwood Street
City/State : Boston, MA
Weather : Overcast

Accurate Counts
978-664-2565

File Name : 10568003
Site Code : 10568003
Start Date : 5/5/2009
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Groups Printed- Trucks

	Brookline Ave From North			Fenwood St From East			Brookline Ave From South					
Start Time	Left	Thru	Peds	Left	Right	Peds	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	0	5	0	0	0	0	4	1	0	0	10	10
16:15	0	7	0	0	3	0	2	0	0	0	12	12
16:30	0	9	0	0	1	0	6	0	0	0	16	16
16:45	0	4	0	0	2	0	4	1	0	0	11	11
Total	0	25	0	0	6	0	16	2	0	0	49	49
17:00	0	4	0	0	2	0	5	1	0	0	12	12
17:15	0	4	0	0	1	0	3	0	0	0	8	8
17:30	0	6	0	0	1	0	5	1	0	0	13	13
17:45	0	5	0	1	1	0	3	0	0	0	10	10
Total	0	19	0	1	5	0	16	2	0	0	43	43
Grand Total	0	44	0	1	11	0	32	4	0	0	92	92
Apprch %	0	100		8.3	91.7		88.9	11.1				
Total %	0	47.8		1.1	12		34.8	4.3		0	100	

	Brookline Ave From North			Fenwood St From East			Brookline Ave From South			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 16:15										
16:15	0	7	7	0	**3**	**3**	2	0	2	12
16:30	0	**9**	**9**	0	1	1	**6**	0	**6**	**16**
16:45	0	4	4	0	2	2	4	**1**	5	11
17:00	0	4	4	0	2	2	5	1	6	12
Total Volume	0	24	24	0	8	8	17	2	19	51
% App. Total	0	100		0	100		89.5	10.5		
PHF	.000	.667	.667	.000	.667	.667	.708	.500	.792	.797

Accurate Counts
978-664-2565

File Name : 10568003
Site Code : 10568003
Start Date : 5/5/2009
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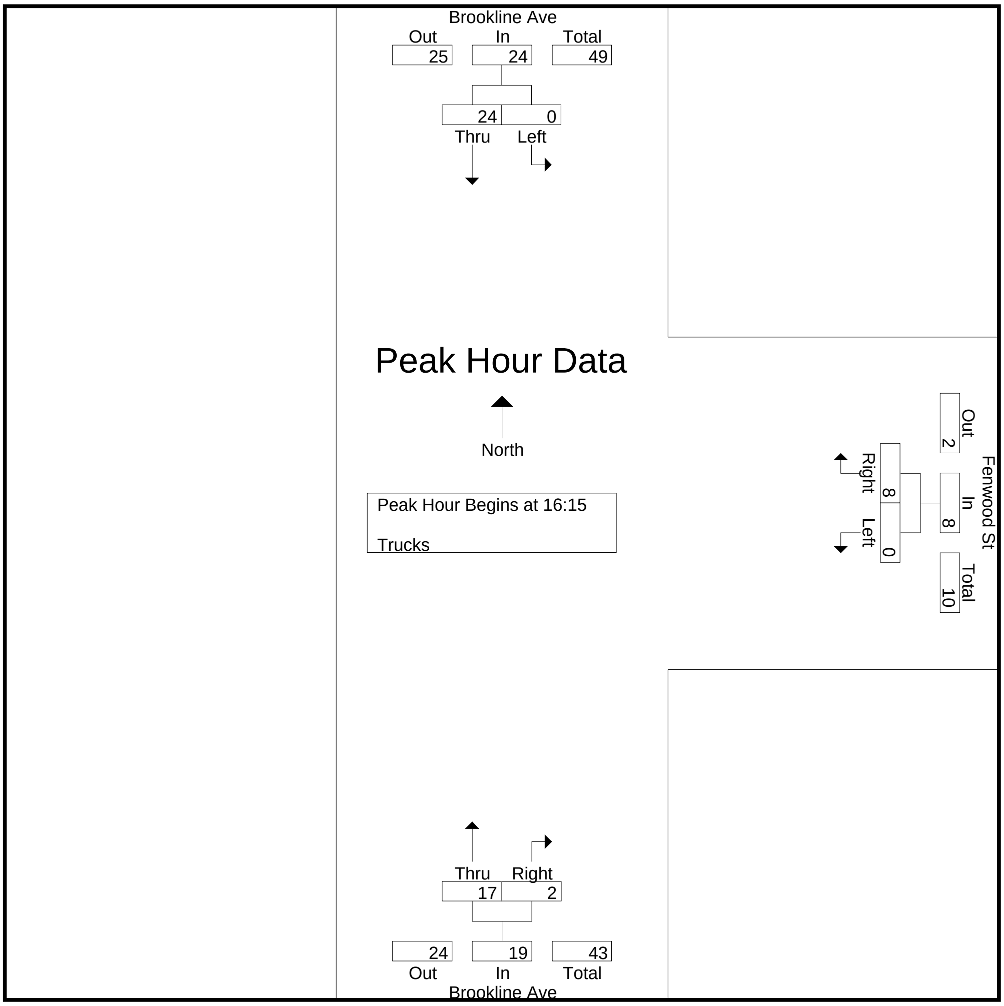
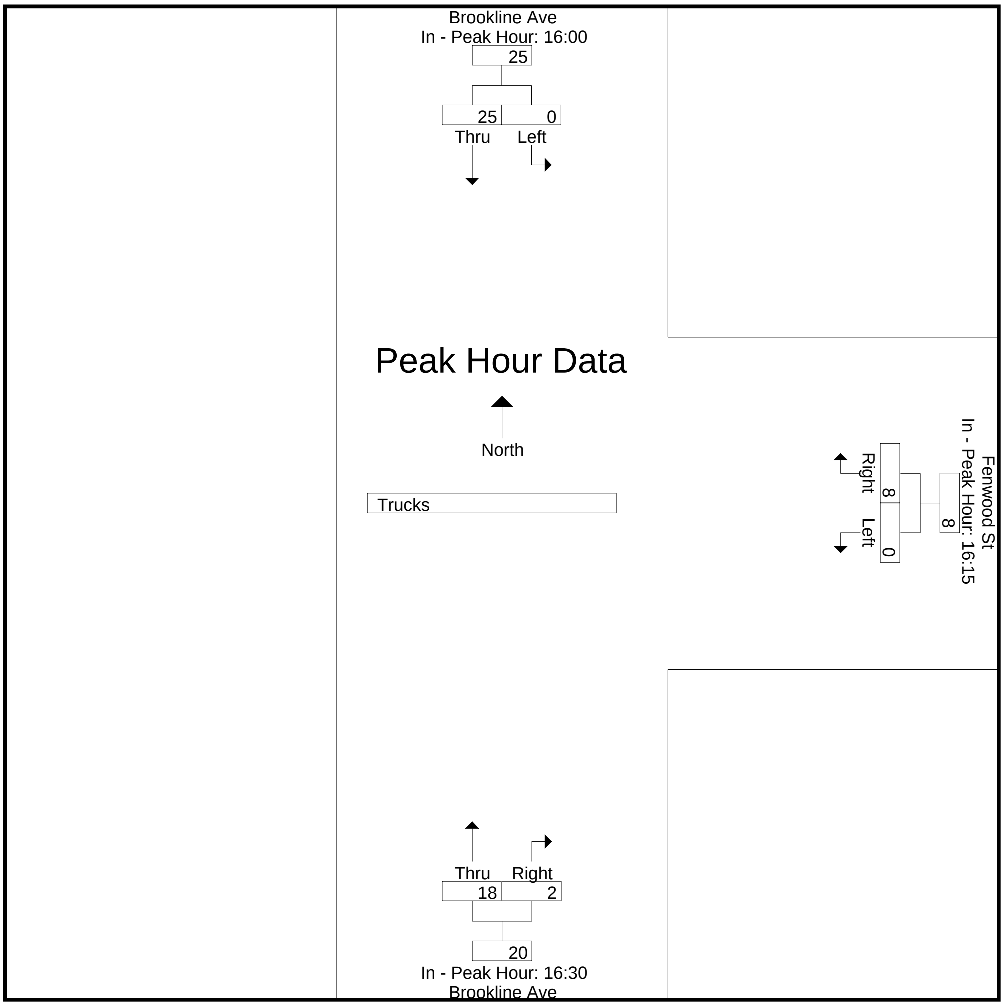


Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:00			16:15			16:30		
+0 mins.	0	5	5	0	**3**	**3**	**6**	0	**6**
+15 mins.	0	7	7	0	1	1	4	**1**	5
+30 mins.	0	**9**	**9**	0	2	2	5	1	6
+45 mins.	0	4	4	0	2	2	3	0	3
Total Volume	0	25	25	0	8	8	18	2	20
% App. Total	0	100		0	100		90	10	
PHF	.000	.694	.694	.000	.667	.667	.750	.500	.833


Brookline Ave
In - Peak Hour: 16:00
25
25
0
Thru
Left
Peak Hour Data
North
Trucks
Fenwood St
In - Peak Hour: 16:15
8
8
0
Right
Left
Thru
Right
18
2
20
In - Peak Hour: 16:30
Brookline Ave

N/S Street : Brookline Avenue
E/W Street: Francis Street
City/State : Boston, MA
Weather : Overcast

Accurate Counts
978-664-2565

File Name : 10568004
Site Code : 10568004
Start Date : 5/5/2009
Page No : 1

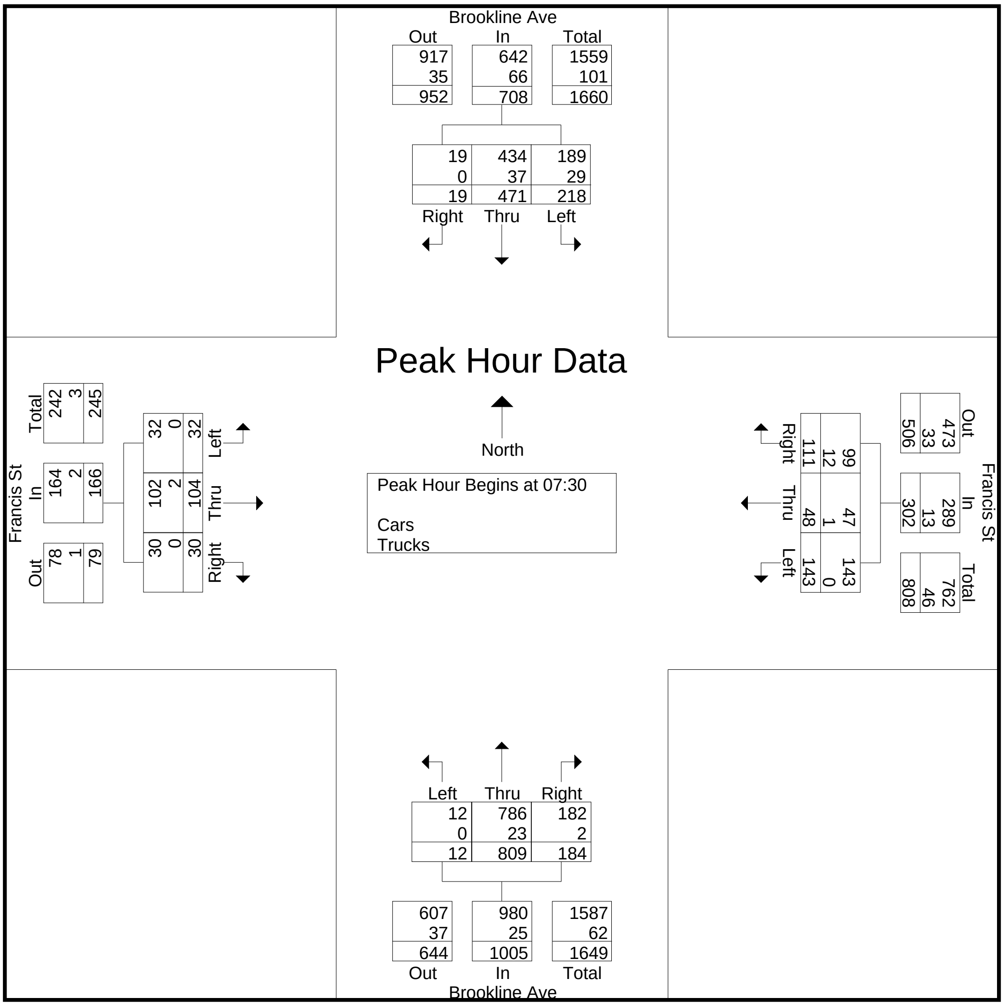
Groups Printed- Cars - Trucks

	Brookline Ave From North				Francis St From East				Brookline Ave From South				Francis St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	57	80	1	14	37	13	24	6	3	173	46	9	3	28	10	13	42	475	517
07:15	77	101	7	7	18	8	31	12	4	185	52	4	3	24	13	14	37	523	560
07:30	54	119	4	11	34	16	26	20	3	176	47	7	4	27	7	18	56	517	573
07:45	50	102	4	22	52	12	38	20	3	190	47	4	7	30	9	24	70	544	614
Total	238	402	16	54	141	49	119	58	13	724	192	24	17	109	39	69	205	2059	2264
08:00	52	129	7	20	34	10	24	30	3	225	43	7	11	24	7	22	79	569	648
08:15	62	121	4	13	23	10	23	17	3	218	47	8	10	23	7	33	71	551	622
08:30	58	84	6	10	31	19	28	27	4	191	45	5	7	22	5	30	72	500	572
08:45	55	76	8	14	32	16	25	24	11	231	48	8	12	25	4	23	69	543	612
Total	227	410	25	57	120	55	100	98	21	865	183	28	40	94	23	108	291	2163	2454
Grand Total	465	812	41	111	261	104	219	156	34	1589	375	52	57	203	62	177	496	4222	4718
Apprch %	35.3	61.6	3.1		44.7	17.8	37.5		1.7	79.5	18.8		17.7	63	19.3				
Total %	11	19.2	1		6.2	2.5	5.2		0.8	37.6	8.9		1.4	4.8	1.5		10.5	89.5	
Cars	415	747	41		258	102	192		34	1540	371		57	201	62		0	0	4516
% Cars	89.2	92	100	100	98.9	98.1	87.7	100	100	96.9	98.9	100	100	99	100	100	0	0	95.7
Trucks	50	65	0		3	2	27		0	49	4		0	2	0		0	0	202
% Trucks	10.8	8	0	0	1.1	1.9	12.3	0	0	3.1	1.1	0	0	1	0	0	0	0	4.3

	Brookline Ave From North				Francis St From East				Brookline Ave From South				Francis St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:30																	
07:30	54	119	4	177	34	**16**	26	76	**3**	176	**47**	226	4	27	7	38	517
07:45	50	102	4	156	**52**	12	**38**	**102**	3	190	47	240	7	**30**	**9**	**46**	544
08:00	52	**129**	**7**	**188**	34	10	24	68	3	**225**	43	**271**	**11**	24	7	42	**569**
08:15	**62**	121	4	187	23	10	23	56	3	218	47	268	10	23	7	40	551
Total Volume	218	471	19	708	143	48	111	302	12	809	184	1005	32	104	30	166	2181
% App. Total	30.8	66.5	2.7		47.4	15.9	36.8		1.2	80.5	18.3		19.3	62.7	18.1		
PHF	.879	.913	.679	.941	.688	.750	.730	.740	1.000	.899	.979	.927	.727	.867	.833	.902	.958
Cars	189	434	19	642	143	47	99	289	12	786	182	980	32	102	30	164	2075
% Cars	86.7	92.1	100	90.7	100	97.9	89.2	95.7	100	97.2	98.9	97.5	100	98.1	100	98.8	95.1
Trucks	29	37	0	66	0	1	12	13	0	23	2	25	0	2	0	2	106
% Trucks	13.3	7.9	0	9.3	0	2.1	10.8	4.3	0	2.8	1.1	2.5	0	1.9	0	1.2	4.9

Accurate Counts
978-664-2565

File Name : 10568004
Site Code : 10568004
Start Date : 5/5/2009
Page No : 2



Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:30				07:00				08:00				07:15			
+0 mins.	54	119	4	177	37	13	24	74	3	225	43	271	3	24	**13**	40
+15 mins.	50	102	4	156	18	8	31	57	3	218	47	268	4	27	7	38
+30 mins.	52	**129**	**7**	**188**	34	**16**	26	76	4	191	45	240	7	**30**	9	**46**
+45 mins.	**62**	121	4	187	**52**	12	**38**	**102**	**11**	**231**	**48**	**290**	**11**	24	7	42
Total Volume	218	471	19	708	141	49	119	309	21	865	183	1069	25	105	36	166
% App. Total	30.8	66.5	2.7		45.6	15.9	38.5		2	80.9	17.1		15.1	63.3	21.7	
PHF	.879	.913	.679	.941	.678	.766	.783	.757	.477	.936	.953	.922	.568	.875	.692	.902
Cars	189	434	19	642	139	49	104	292	21	841	181	1043	25	104	36	165
% Cars	86.7	92.1	100	90.7	98.6	100	87.4	94.5	100	97.2	98.9	97.6	100	99	100	99.4
Trucks	29	37	0	66	2	0	15	17	0	24	2	26	0	1	0	1
% Trucks	13.3	7.9	0	9.3	1.4	0	12.6	5.5	0	2.8	1.1	2.4	0	1	0	0.6

Accurate Counts
978-664-2565

File Name : 10568004
Site Code : 10568004
Start Date : 5/5/2009
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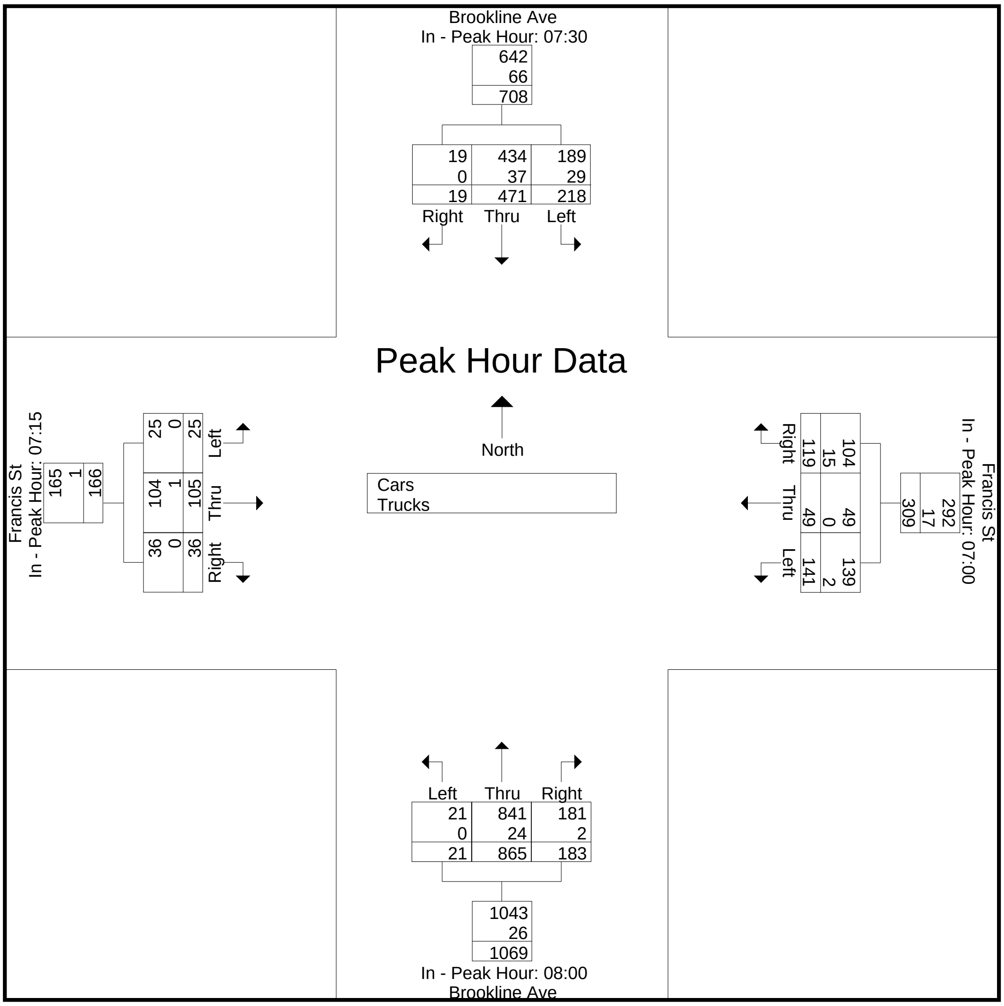


N/S Street : Brookline Avenue
E/W Street: Francis Street
City/State : Boston, MA
Weather : Overcast

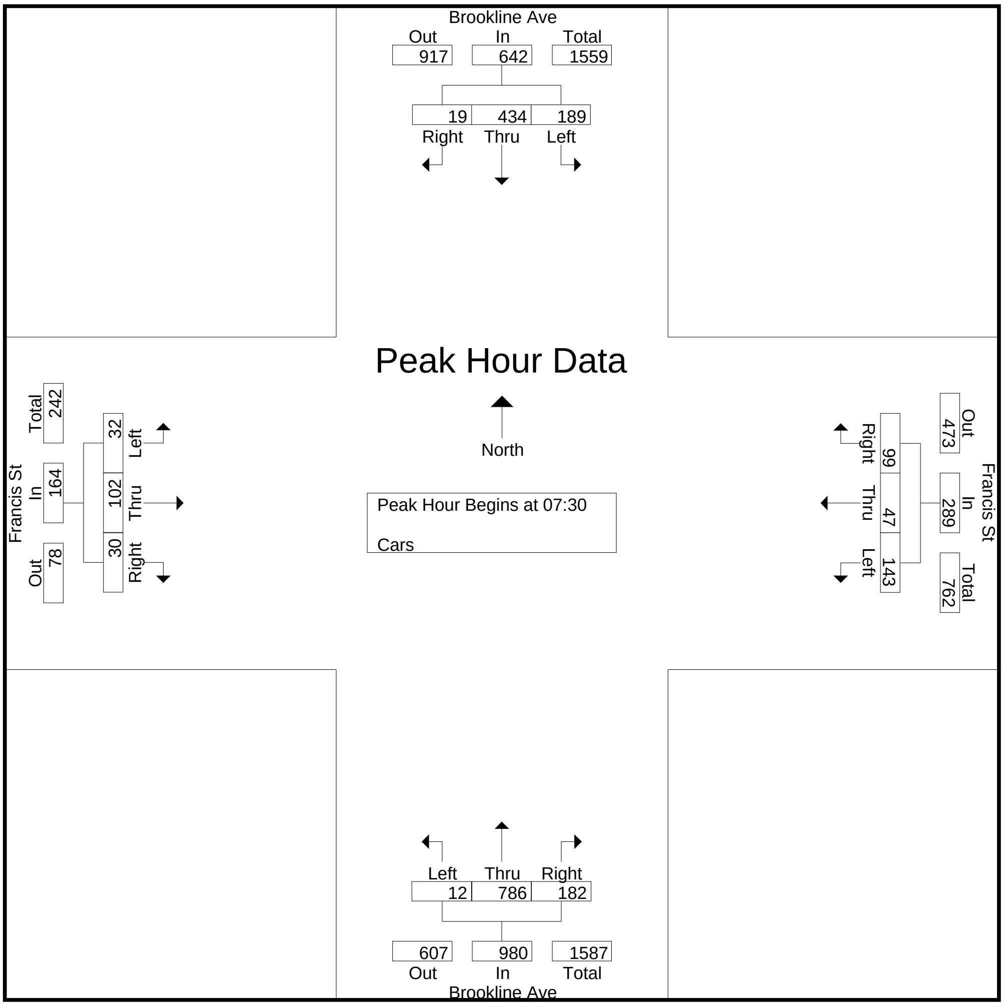
Accurate Counts
978-664-2565

File Name : 10568004
Site Code : 10568004
Start Date : 5/5/2009
Page No : 1

Groups Printed- Cars

	Brookline Ave From North				Francis St From East				Brookline Ave From South				Francis St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	51	74	1	14	36	13	19	6	3	166	46	9	3	28	10	13	42	450	492
07:15	71	94	7	7	17	8	29	12	4	177	52	4	3	24	13	14	37	499	536
07:30	48	108	4	11	34	16	23	20	3	175	45	7	4	27	7	18	56	494	550
07:45	44	94	4	22	52	12	33	20	3	181	47	4	7	29	9	24	70	515	585
Total	214	370	16	54	139	49	104	58	13	699	190	24	17	108	39	69	205	1958	2163
08:00	44	122	7	20	34	10	23	30	3	221	43	7	11	24	7	22	79	549	628
08:15	53	110	4	13	23	9	20	17	3	209	47	8	10	22	7	33	71	517	588
08:30	53	77	6	10	31	18	23	27	4	187	44	5	7	22	5	30	72	477	549
08:45	51	68	8	14	31	16	22	24	11	224	47	8	12	25	4	23	69	519	588
Total	201	377	25	57	119	53	88	98	21	841	181	28	40	93	23	108	291	2062	2353
Grand Total	415	747	41	111	258	102	192	156	34	1540	371	52	57	201	62	177	496	4020	4516
Apprch %	34.5	62.1	3.4		46.7	18.5	34.8		1.7	79.2	19.1		17.8	62.8	19.4				
Total %	10.3	18.6	1		6.4	2.5	4.8		0.8	38.3	9.2		1.4	5	1.5		11	89	

	Brookline Ave From North				Francis St From East				Brookline Ave From South				Francis St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:30																	
07:30	48	108	4	160	34	**16**	23	73	**3**	175	45	223	4	27	7	38	494
07:45	44	94	4	142	**52**	12	**33**	**97**	3	181	**47**	231	7	**29**	**9**	**45**	515
08:00	44	**122**	**7**	**173**	34	10	23	67	3	**221**	43	**267**	**11**	24	7	42	**549**
08:15	**53**	110	4	167	23	9	20	52	3	209	47	259	10	22	7	39	517
Total Volume	189	434	19	642	143	47	99	289	12	786	182	980	32	102	30	164	2075
% App. Total	29.4	67.6	3		49.5	16.3	34.3		1.2	80.2	18.6		19.5	62.2	18.3		
PHF	.892	.889	.679	.928	.688	.734	.750	.745	1.000	.889	.968	.918	.727	.879	.833	.911	.945



Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:15				07:00				08:00				07:15			
+0 mins.	**71**	94	**7**	172	36	13	19	68	3	221	43	267	3	24	**13**	40
+15 mins.	48	108	4	160	17	8	29	54	3	209	**47**	259	4	27	7	38
+30 mins.	44	94	4	142	34	**16**	23	73	4	187	44	235	7	**29**	9	**45**
+45 mins.	44	**122**	7	**173**	**52**	12	**33**	**97**	**11**	**224**	47	**282**	**11**	24	7	42
Total Volume	207	418	22	647	139	49	104	292	21	841	181	1043	25	104	36	165
% App. Total	32	64.6	3.4		47.6	16.8	35.6		2	80.6	17.4		15.2	63	21.8	
PHF	.729	.857	.786	.935	.668	.766	.788	.753	.477	.939	.963	.925	.568	.897	.692	.917

Accurate Counts
978-664-2565

File Name : 10568004
Site Code : 10568004
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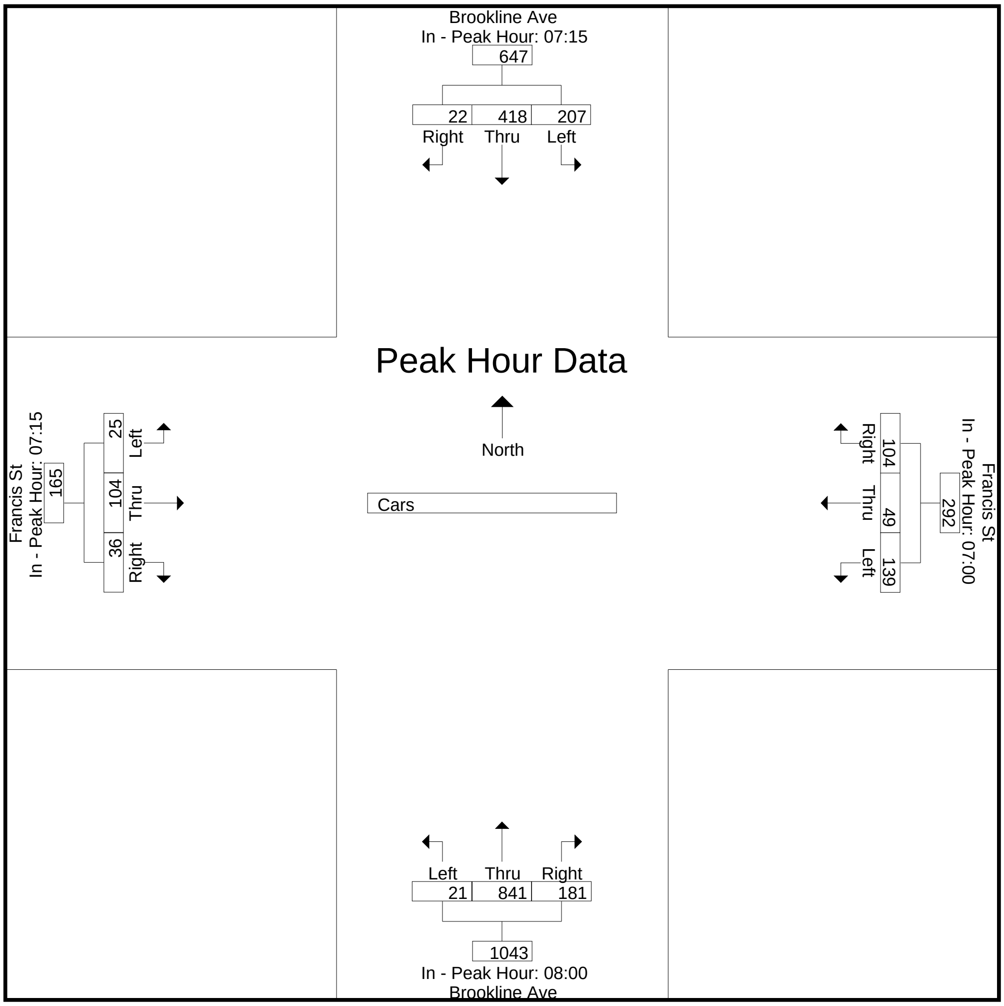

N/S Street : Brookline Avenue
E/W Street: Francis Street
City/State : Boston, MA
Weather : Overcast

Accurate Counts
978-664-2565

File Name : 10568004
Site Code : 10568004
Start Date : 5/5/2009
Page No : 1

Groups Printed- Trucks

	Brookline Ave From North				Francis St From East				Brookline Ave From South				Francis St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	6	6	0	0	1	0	5	0	0	7	0	0	0	0	0	0	0	25	25
07:15	6	7	0	0	1	0	2	0	0	8	0	0	0	0	0	0	0	24	24
07:30	6	11	0	0	0	0	3	0	0	1	2	0	0	0	0	0	0	23	23
07:45	6	8	0	0	0	0	5	0	0	9	0	0	0	1	0	0	0	29	29
Total	24	32	0	0	2	0	15	0	0	25	2	0	0	1	0	0	0	101	101
08:00	8	7	0	0	0	0	1	0	0	4	0	0	0	0	0	0	0	20	20
08:15	9	11	0	0	0	1	3	0	0	9	0	0	0	1	0	0	0	34	34
08:30	5	7	0	0	0	1	5	0	0	4	1	0	0	0	0	0	0	23	23
08:45	4	8	0	0	1	0	3	0	0	7	1	0	0	0	0	0	0	24	24
Total	26	33	0	0	1	2	12	0	0	24	2	0	0	1	0	0	0	101	101
Grand Total	50	65	0	0	3	2	27	0	0	49	4	0	0	2	0	0	0	202	202
Apprch %	43.5	56.5	0		9.4	6.2	84.4		0	92.5	7.5		0	100	0				
Total %	24.8	32.2	0		1.5	1	13.4		0	24.3	2		0	1	0		0	100	

	Brookline Ave From North				Francis St From East				Brookline Ave From South				Francis St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:30																	
07:30	6	**11**	0	17	0	0	3	3	0	1	**2**	3	0	0	0	0	23
07:45	6	8	0	14	0	0	**5**	**5**	0	**9**	0	**9**	0	**1**	0	**1**	29
08:00	8	7	0	15	0	0	1	1	0	4	0	4	0	0	0	0	20
08:15	**9**	11	0	**20**	0	**1**	3	4	0	9	0	9	0	1	0	1	**34**
Total Volume	29	37	0	66	0	1	12	13	0	23	2	25	0	2	0	2	106
% App. Total	43.9	56.1	0		0	7.7	92.3		0	92	8		0	100	0		
PHF	.806	.841	.000	.825	.000	.250	.600	.650	.000	.639	.250	.694	.000	.500	.000	.500	.779

Accurate Counts
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File Name : 10568004
Site Code : 10568004
Start Date : 5/5/2009
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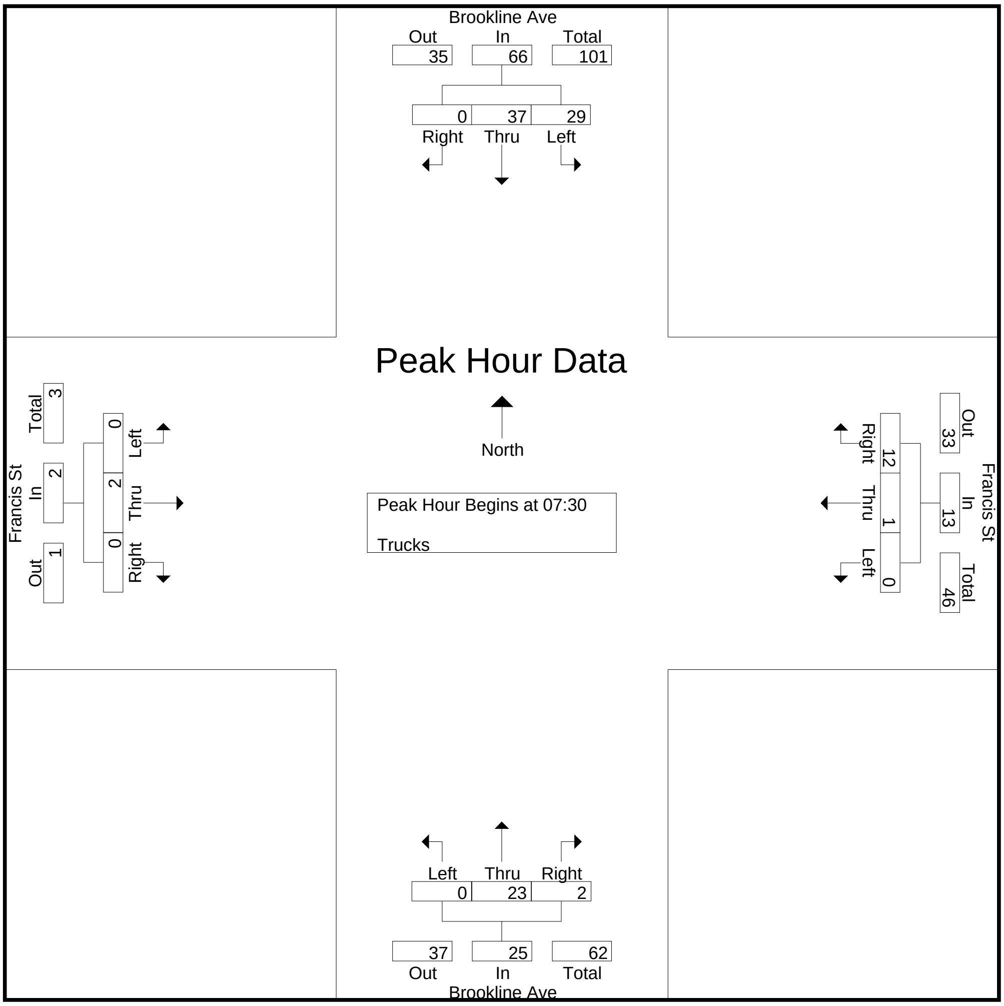
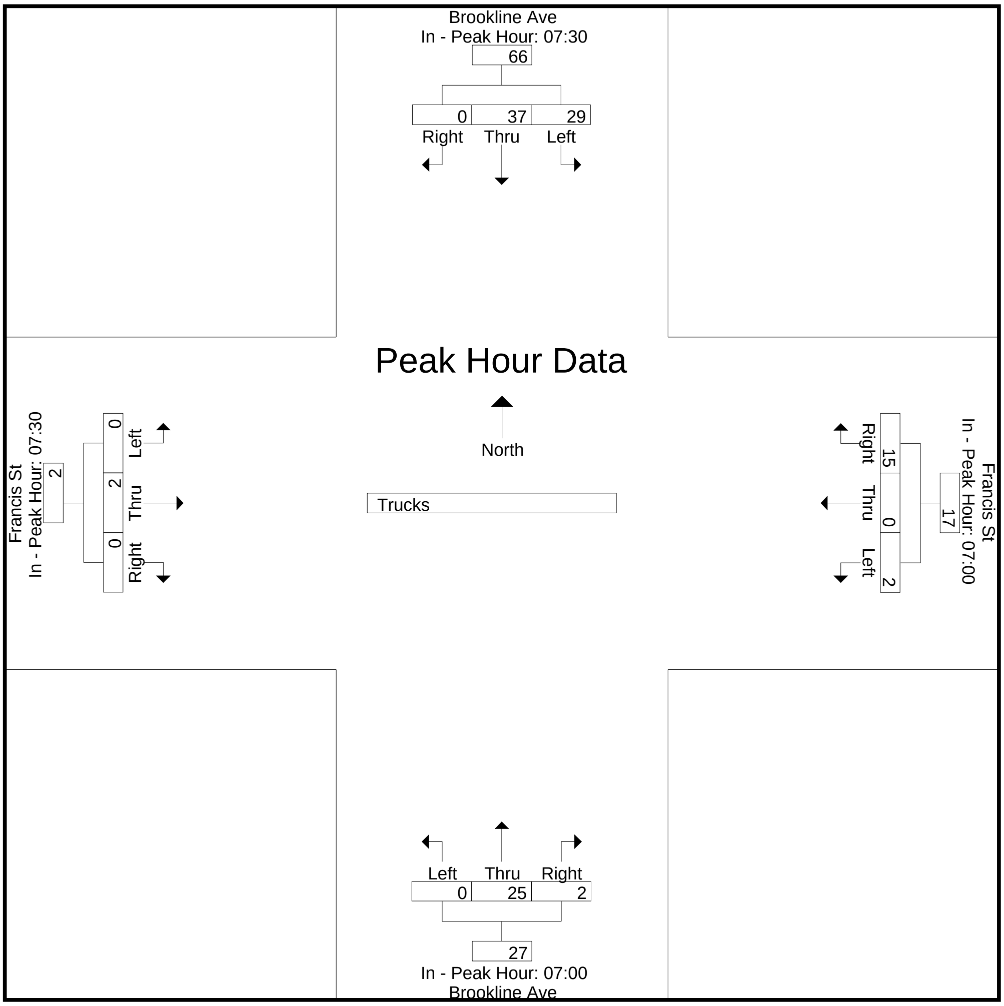


Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:30				07:00				07:00				07:30			
+0 mins.	6	**11**	0	17	**1**	0	**5**	**6**	0	7	0	7	0	0	0	0
+15 mins.	6	8	0	14	1	0	2	3	0	8	0	8	0	**1**	0	**1**
+30 mins.	8	7	0	15	0	0	3	3	0	1	**2**	3	0	0	0	0
+45 mins.	**9**	11	0	**20**	0	0	5	5	0	**9**	0	**9**	0	1	0	1
Total Volume	29	37	0	66	2	0	15	17	0	25	2	27	0	2	0	2
% App. Total	43.9	56.1	0		11.8	0	88.2		0	92.6	7.4		0	100	0	
PHF	.806	.841	.000	.825	.500	.000	.750	.708	.000	.694	.250	.750	.000	.500	.000	.500

Accurate Counts
978-664-2565

File Name : 10568004
Site Code : 10568004
Start Date : 5/5/2009
Page No : 3



N/S Street : Brookline Avenue
E/W Street: Francis Street
City/State : Boston, MA
Weather : Overcast

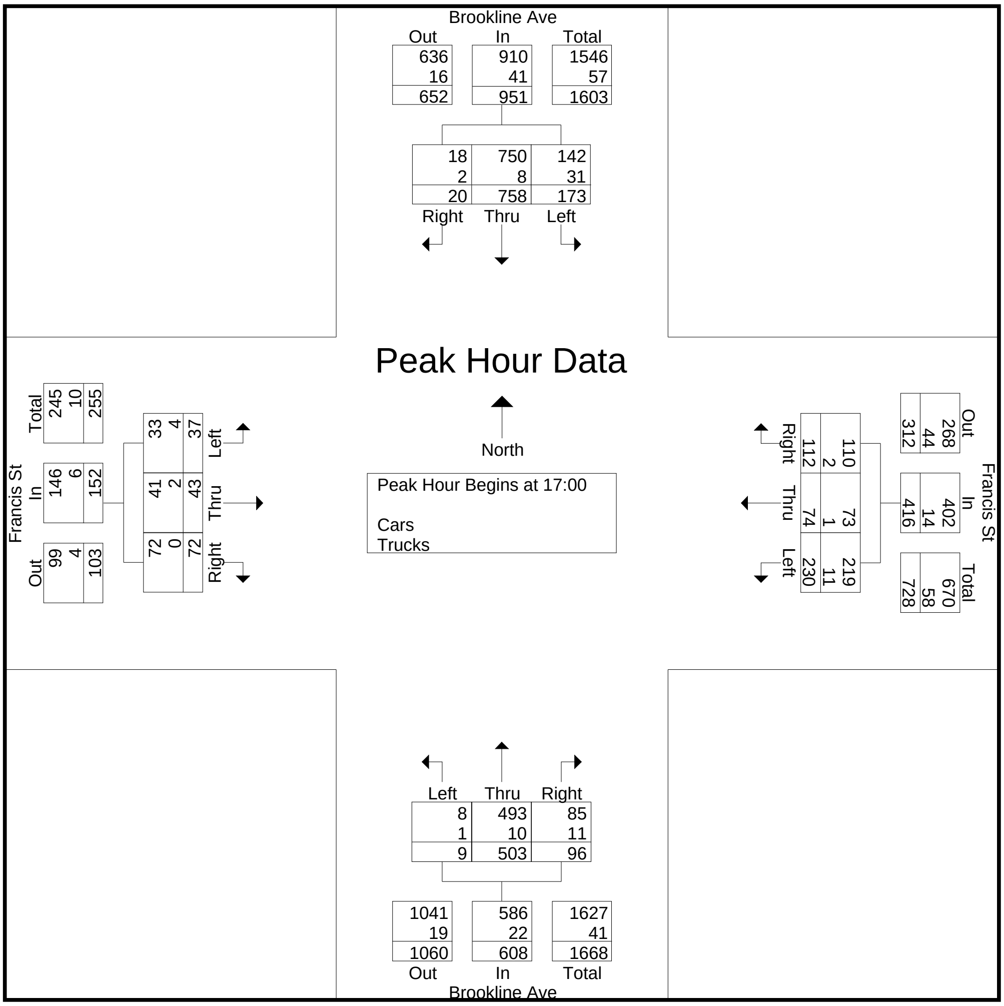
Accurate Counts
978-664-2565

File Name : 10568004
Site Code : 10568004
Start Date : 5/5/2009
Page No : 1

Groups Printed- Cars - Trucks

	Brookline Ave From North				Francis St From East				Brookline Ave From South				Francis St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	47	150	9	8	60	17	45	6	7	131	23	2	9	10	15	18	34	523	557
16:15	44	197	5	3	51	17	23	8	5	141	34	3	10	12	15	12	26	554	580
16:30	47	177	6	10	53	27	32	10	5	110	20	5	8	7	23	21	46	515	561
16:45	34	169	9	10	57	20	26	14	4	116	22	8	7	6	18	14	46	488	534
Total	172	693	29	31	221	81	126	38	21	498	99	18	34	35	71	65	152	2080	2232
17:00	42	184	4	10	55	18	37	12	1	117	19	11	12	10	16	17	50	515	565
17:15	39	190	6	12	57	14	36	23	5	118	31	10	10	11	15	16	61	532	593
17:30	41	190	5	12	53	25	21	8	3	140	20	11	8	14	20	23	54	540	594
17:45	51	194	5	8	65	17	18	15	0	128	26	7	7	8	21	21	51	540	591
Total	173	758	20	42	230	74	112	58	9	503	96	39	37	43	72	77	216	2127	2343
Grand Total	345	1451	49	73	451	155	238	96	30	1001	195	57	71	78	143	142	368	4207	4575
Apprch %	18.7	78.6	2.7		53.4	18.4	28.2		2.4	81.6	15.9		24.3	26.7	49				
Total %	8.2	34.5	1.2		10.7	3.7	5.7		0.7	23.8	4.6		1.7	1.9	3.4		8	92	
Cars	279	1428	43		430	153	235		29	979	174		61	72	143		0	0	4394
% Cars	80.9	98.4	87.8	100	95.3	98.7	98.7	100	96.7	97.8	89.2	100	85.9	92.3	100	100	0	0	96
Trucks	66	23	6		21	2	3		1	22	21		10	6	0		0	0	181
% Trucks	19.1	1.6	12.2	0	4.7	1.3	1.3	0	3.3	2.2	10.8	0	14.1	7.7	0	0	0	0	4

	Brookline Ave From North				Francis St From East				Brookline Ave From South				Francis St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 17:00																	
17:00	42	184	4	230	55	18	**37**	**110**	1	117	19	137	**12**	10	16	38	515
17:15	39	190	**6**	235	57	14	36	107	**5**	118	**31**	154	10	11	15	36	532
17:30	41	190	5	236	53	**25**	21	99	3	**140**	20	**163**	8	**14**	20	**42**	**540**
17:45	**51**	**194**	5	**250**	**65**	17	18	100	0	128	26	154	7	8	**21**	36	540
Total Volume	173	758	20	951	230	74	112	416	9	503	96	608	37	43	72	152	2127
% App. Total	18.2	79.7	2.1		55.3	17.8	26.9		1.5	82.7	15.8		24.3	28.3	47.4		
PHF	.848	.977	.833	.951	.885	.740	.757	.945	.450	.898	.774	.933	.771	.768	.857	.905	.985
Cars	142	750	18	910	219	73	110	402	8	493	85	586	33	41	72	146	2044
% Cars	82.1	98.9	90.0	95.7	95.2	98.6	98.2	96.6	88.9	98.0	88.5	96.4	89.2	95.3	100	96.1	96.1
Trucks	31	8	2	41	11	1	2	14	1	10	11	22	4	2	0	6	83
% Trucks	17.9	1.1	10.0	4.3	4.8	1.4	1.8	3.4	11.1	2.0	11.5	3.6	10.8	4.7	0	3.9	3.9



Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	17:00				16:30				16:00				17:00			
+0 mins.	42	184	4	230	53	**27**	32	**112**	**7**	131	23	161	**12**	10	16	38
+15 mins.	39	190	**6**	235	**57**	20	26	103	5	**141**	**34**	**180**	10	11	15	36
+30 mins.	41	190	5	236	55	18	**37**	110	5	110	20	135	8	**14**	20	**42**
+45 mins.	**51**	**194**	5	**250**	57	14	36	107	4	116	22	142	7	8	**21**	36
Total Volume	173	758	20	951	222	79	131	432	21	498	99	618	37	43	72	152
% App. Total	18.2	79.7	2.1		51.4	18.3	30.3		3.4	80.6	16		24.3	28.3	47.4	
PHF	.848	.977	.833	.951	.974	.731	.885	.964	.750	.883	.728	.858	.771	.768	.857	.905
Cars	142	750	18	910	211	77	130	418	21	486	89	596	33	41	72	146
% Cars	82.1	98.9	90	95.7	95	97.5	99.2	96.8	100	97.6	89.9	96.4	89.2	95.3	100	96.1
Trucks	31	8	2	41	11	2	1	14	0	12	10	22	4	2	0	6
% Trucks	17.9	1.1	10	4.3	5	2.5	0.8	3.2	0	2.4	10.1	3.6	10.8	4.7	0	3.9

Accurate Counts
978-664-2565

File Name : 10568004
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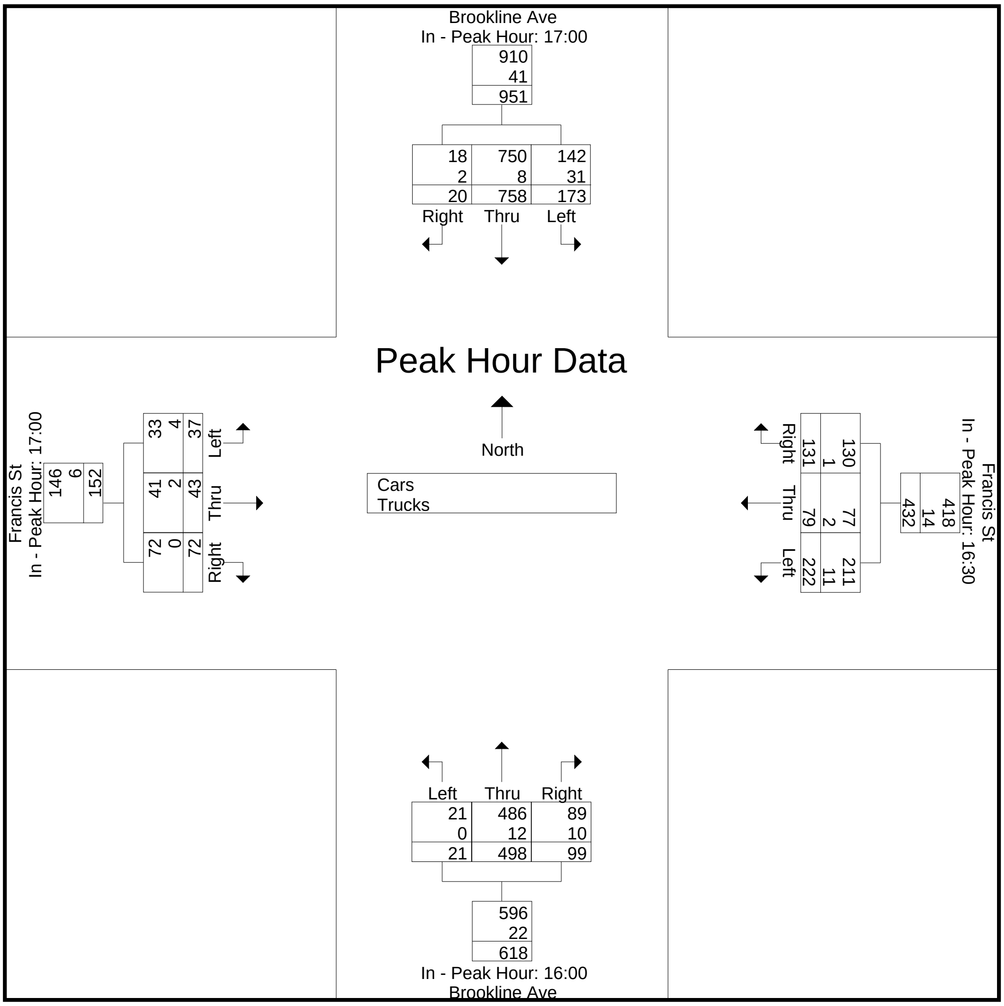

N/S Street : Brookline Avenue
E/W Street: Francis Street
City/State : Boston, MA
Weather : Overcast

Accurate Counts
978-664-2565

File Name : 10568004
Site Code : 10568004
Start Date : 5/5/2009
Page No : 1

Groups Printed- Cars

	Brookline Ave From North				Francis St From East				Brookline Ave From South				Francis St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	40	147	8	8	58	17	44	6	7	129	21	2	8	9	15	18	34	503	537
16:15	33	193	5	3	48	17	23	8	5	137	33	3	8	11	15	12	26	528	554
16:30	39	170	5	10	51	26	32	10	5	106	17	5	7	5	23	21	46	486	532
16:45	25	168	7	10	54	20	26	14	4	114	18	8	5	6	18	14	46	465	511
Total	137	678	25	31	211	80	125	38	21	486	89	18	28	31	71	65	152	1982	2134
17:00	33	183	4	10	52	18	36	12	1	113	16	11	10	10	16	17	50	492	542
17:15	31	189	5	12	54	13	36	23	4	117	28	10	9	10	15	16	61	511	572
17:30	31	187	5	12	50	25	21	8	3	136	18	11	8	13	20	23	54	517	571
17:45	47	191	4	8	63	17	17	15	0	127	23	7	6	8	21	21	51	524	575
Total	142	750	18	42	219	73	110	58	8	493	85	39	33	41	72	77	216	2044	2260
Grand Total	279	1428	43	73	430	153	235	96	29	979	174	57	61	72	143	142	368	4026	4394
Apprch %	15.9	81.6	2.5		52.6	18.7	28.7		2.5	82.8	14.7		22.1	26.1	51.8				
Total %	6.9	35.5	1.1		10.7	3.8	5.8		0.7	24.3	4.3		1.5	1.8	3.6		8.4	91.6	

	Brookline Ave From North				Francis St From East				Brookline Ave From South				Francis St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 17:00																	
17:00	33	183	4	220	52	18	**36**	**106**	1	113	16	130	**10**	10	16	36	492
17:15	31	189	**5**	225	54	13	36	103	**4**	117	**28**	149	9	10	15	34	511
17:30	31	187	5	223	50	**25**	21	96	3	**136**	18	**157**	8	**13**	20	**41**	517
17:45	**47**	**191**	4	**242**	**63**	17	17	97	0	127	23	150	6	8	**21**	35	**524**
Total Volume	142	750	18	910	219	73	110	402	8	493	85	586	33	41	72	146	2044
% App. Total	15.6	82.4	2		54.5	18.2	27.4		1.4	84.1	14.5		22.6	28.1	49.3		
PHF	.755	.982	.900	.940	.869	.730	.764	.948	.500	.906	.759	.933	.825	.788	.857	.890	.975

Accurate Counts
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File Name : 10568004
Site Code : 10568004
Start Date : 5/5/2009
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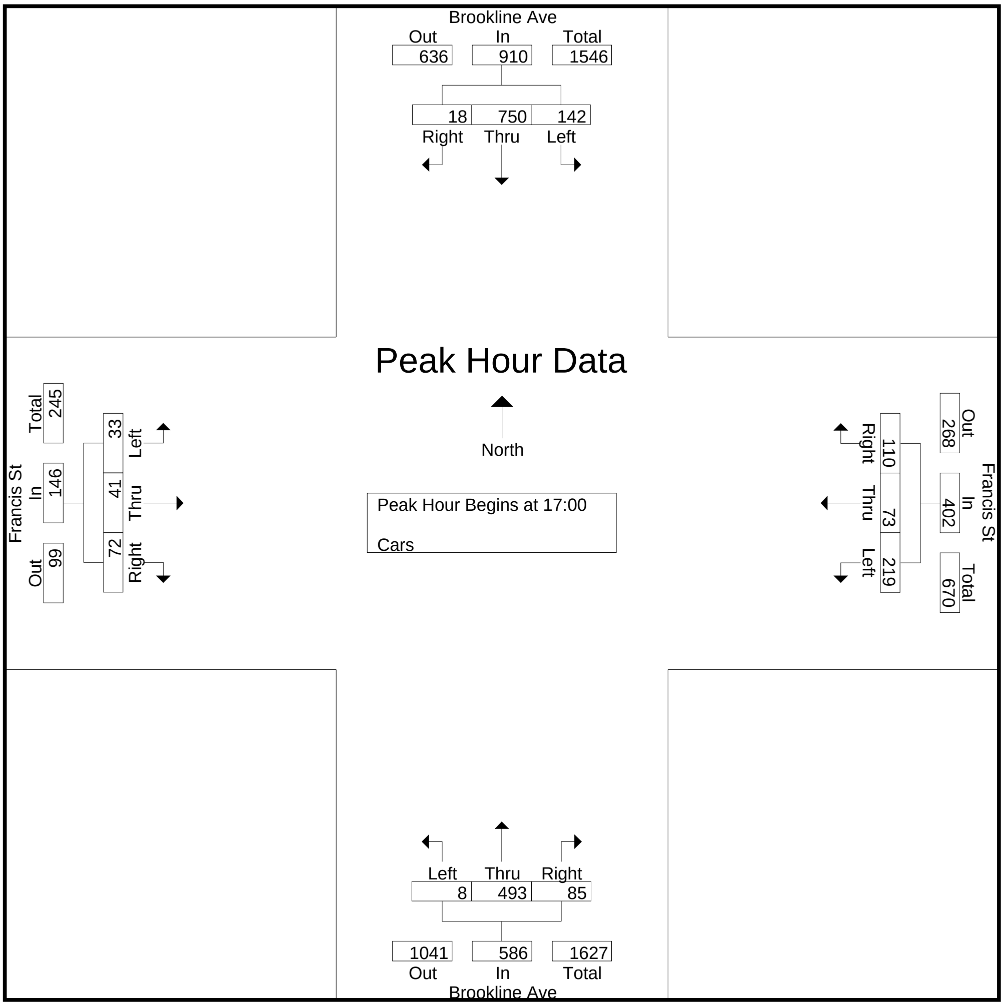

Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	17:00				16:30				16:00				17:00			
+0 mins.	33	183	4	220	51	**26**	32	**109**	**7**	129	21	157	**10**	10	16	36
+15 mins.	31	189	**5**	225	**54**	20	26	100	5	**137**	**33**	**175**	9	10	15	34
+30 mins.	31	187	5	223	52	18	**36**	106	5	106	17	128	8	**13**	20	**41**
+45 mins.	**47**	**191**	4	**242**	54	13	36	103	4	114	18	136	6	8	**21**	35
Total Volume	142	750	18	910	211	77	130	418	21	486	89	596	33	41	72	146
% App. Total	15.6	82.4	2		50.5	18.4	31.1		3.5	81.5	14.9		22.6	28.1	49.3	
PHF	.755	.982	.900	.940	.977	.740	.903	.959	.750	.887	.674	.851	.825	.788	.857	.890

Accurate Counts
978-664-2565

File Name : 10568004
Site Code : 10568004
Start Date : 5/5/2009
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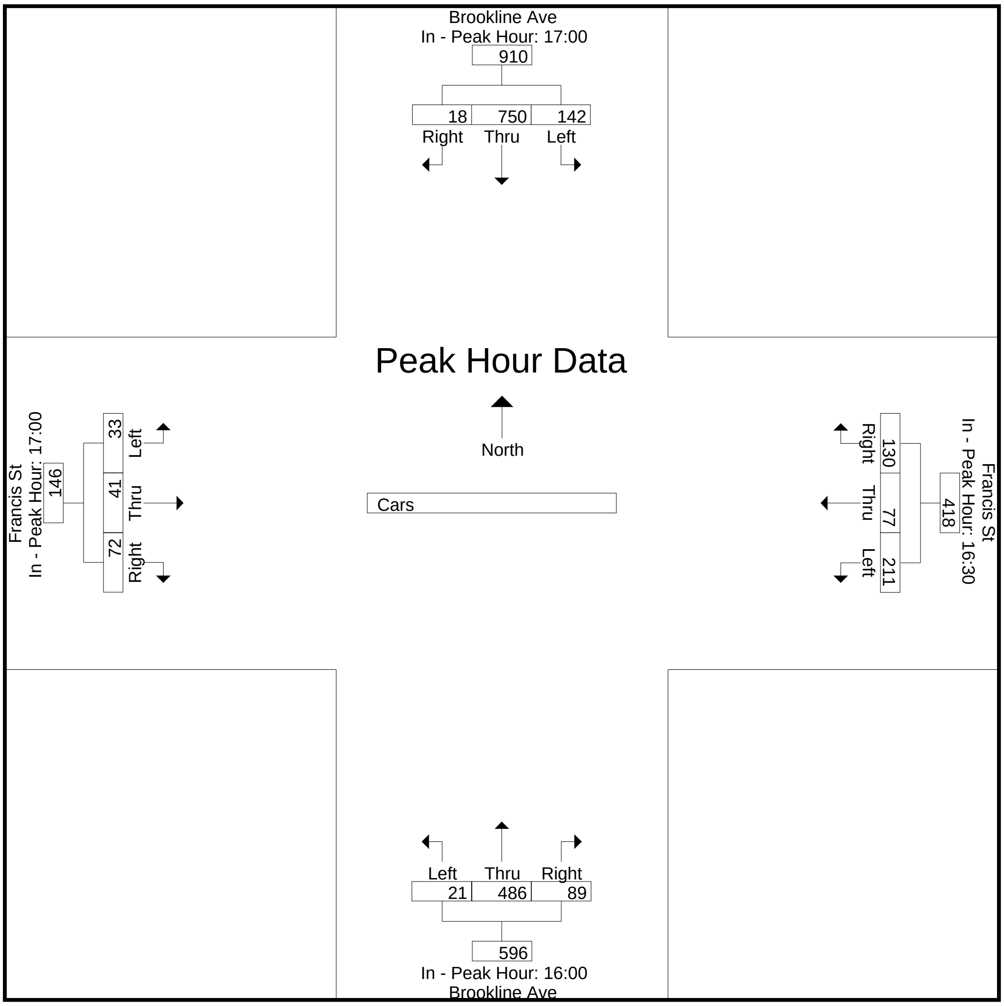


N/S Street : Brookline Avenue
E/W Street: Francis Street
City/State : Boston, MA
Weather : Overcast

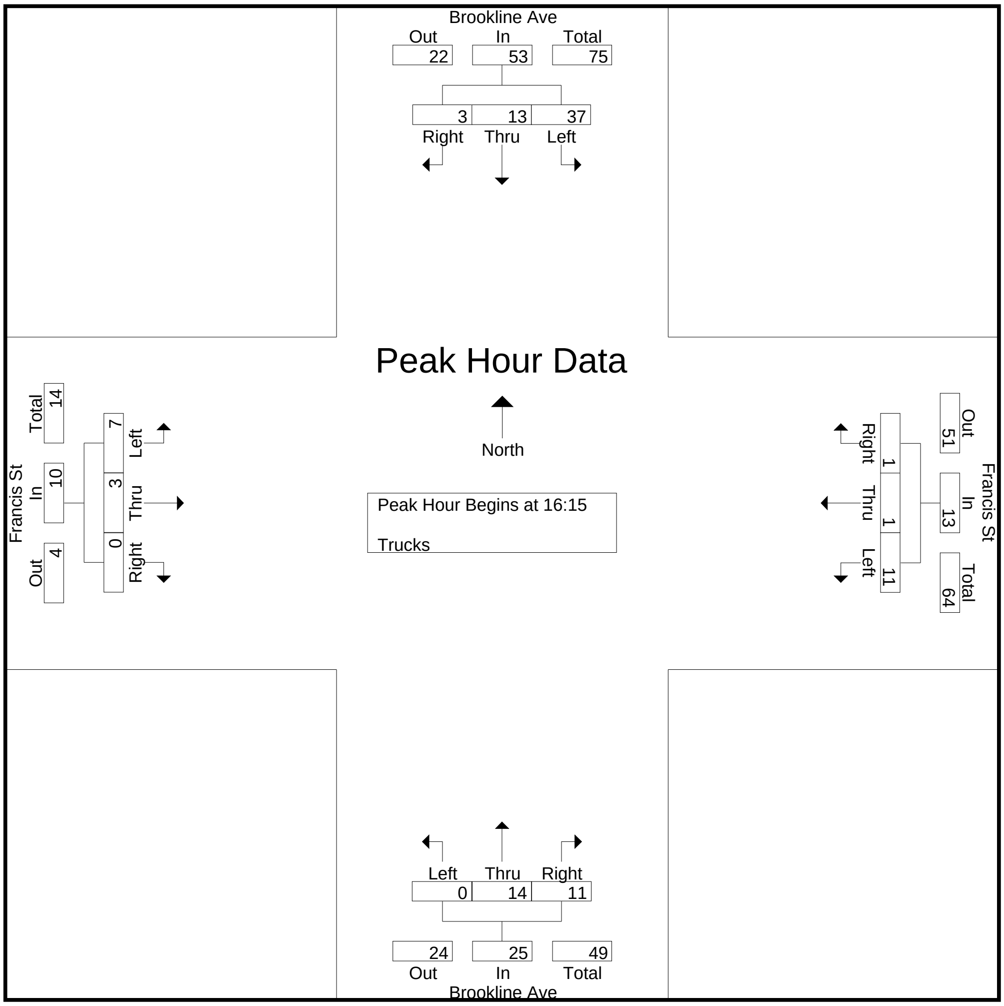
Accurate Counts
978-664-2565

File Name : 10568004
Site Code : 10568004
Start Date : 5/5/2009
Page No : 1

Groups Printed- Trucks

	Brookline Ave From North				Francis St From East				Brookline Ave From South				Francis St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	7	3	1	0	2	0	1	0	0	2	2	0	1	1	0	0	0	20	20
16:15	11	4	0	0	3	0	0	0	0	4	1	0	2	1	0	0	0	26	26
16:30	8	7	1	0	2	1	0	0	0	4	3	0	1	2	0	0	0	29	29
16:45	9	1	2	0	3	0	0	0	0	2	4	0	2	0	0	0	0	23	23
Total	35	15	4	0	10	1	1	0	0	12	10	0	6	4	0	0	0	98	98
17:00	9	1	0	0	3	0	1	0	0	4	3	0	2	0	0	0	0	23	23
17:15	8	1	1	0	3	1	0	0	1	1	3	0	1	1	0	0	0	21	21
17:30	10	3	0	0	3	0	0	0	0	4	2	0	0	1	0	0	0	23	23
17:45	4	3	1	0	2	0	1	0	0	1	3	0	1	0	0	0	0	16	16
Total	31	8	2	0	11	1	2	0	1	10	11	0	4	2	0	0	0	83	83
Grand Total	66	23	6	0	21	2	3	0	1	22	21	0	10	6	0	0	0	181	181
Apprch %	69.5	24.2	6.3		80.8	7.7	11.5		2.3	50	47.7		62.5	37.5	0				
Total %	36.5	12.7	3.3		11.6	1.1	1.7		0.6	12.2	11.6		5.5	3.3	0		0	100	

	Brookline Ave From North				Francis St From East				Brookline Ave From South				Francis St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 16:15																	
16:15	**11**	4	0	15	**3**	0	0	3	0	**4**	1	5	**2**	1	0	**3**	26
16:30	8	**7**	1	**16**	2	**1**	0	3	0	4	3	**7**	1	**2**	0	3	**29**
16:45	9	1	**2**	12	3	0	0	3	0	2	**4**	6	2	0	0	2	23
17:00	9	1	0	10	3	0	**1**	**4**	0	4	3	7	2	0	0	2	23
Total Volume	37	13	3	53	11	1	1	13	0	14	11	25	7	3	0	10	101
% App. Total	69.8	24.5	5.7		84.6	7.7	7.7		0	56	44		70	30	0		
PHF	.841	.464	.375	.828	.917	.250	.250	.813	.000	.875	.688	.893	.875	.375	.000	.833	.871

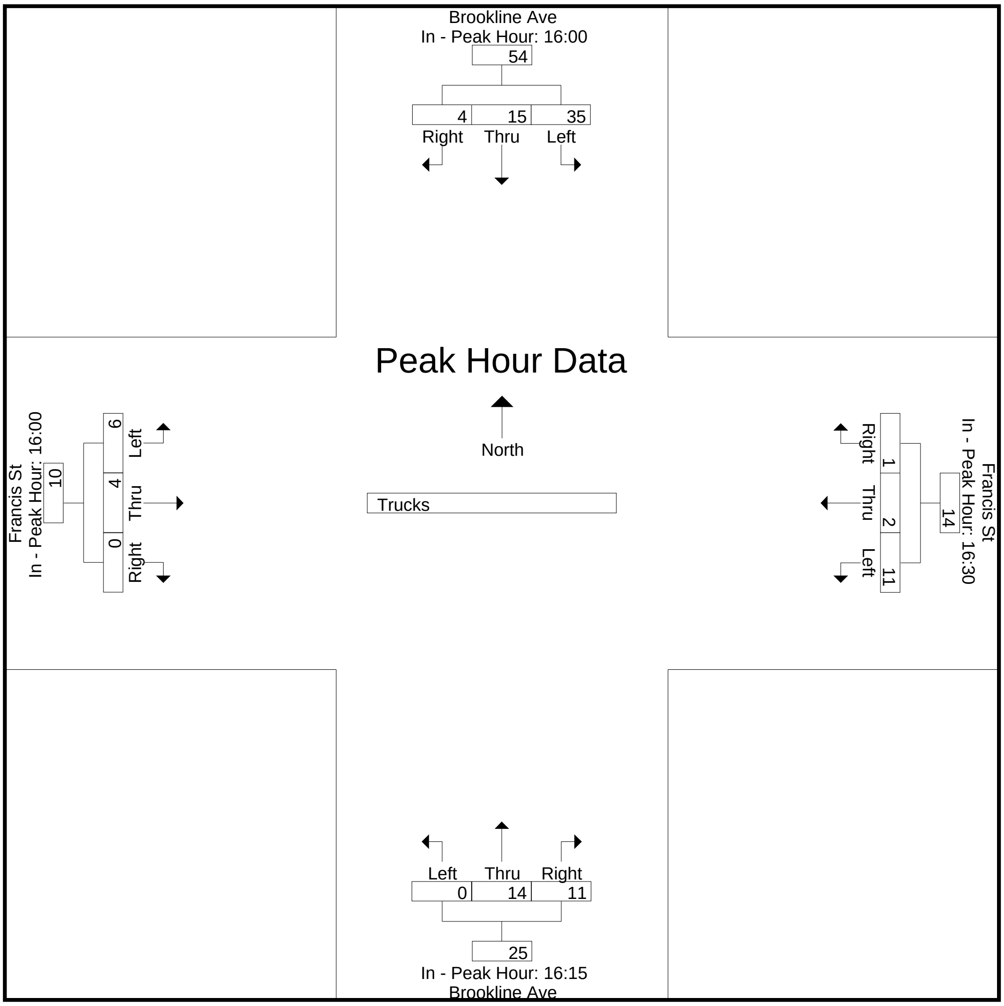


Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:00				16:30				16:15				16:00			
+0 mins.	7	3	1	11	2	**1**	0	3	0	**4**	1	5	1	1	0	2
+15 mins.	**11**	4	0	15	**3**	0	0	3	0	4	3	**7**	**2**	1	0	**3**
+30 mins.	8	**7**	1	**16**	3	0	**1**	**4**	0	2	**4**	6	1	**2**	0	3
+45 mins.	9	1	**2**	12	3	1	0	4	0	4	3	7	2	0	0	2
Total Volume	35	15	4	54	11	2	1	14	0	14	11	25	6	4	0	10
% App. Total	64.8	27.8	7.4		78.6	14.3	7.1		0	56	44		60	40	0	
PHF	.795	.536	.500	.844	.917	.500	.250	.875	.000	.875	.688	.893	.750	.500	.000	.833

Accurate Counts
978-664-2565

File Name : 10568004
Site Code : 10568004
Start Date : 5/5/2009
Page No : 3



N/S Street : Binney Street
E/W Street: Francis Street
City/State : Boston, MA
Weather : Overcast

Accurate Counts
978-664-2565

File Name : 10568005
Site Code : 10568005
Start Date : 5/5/2009
Page No : 1

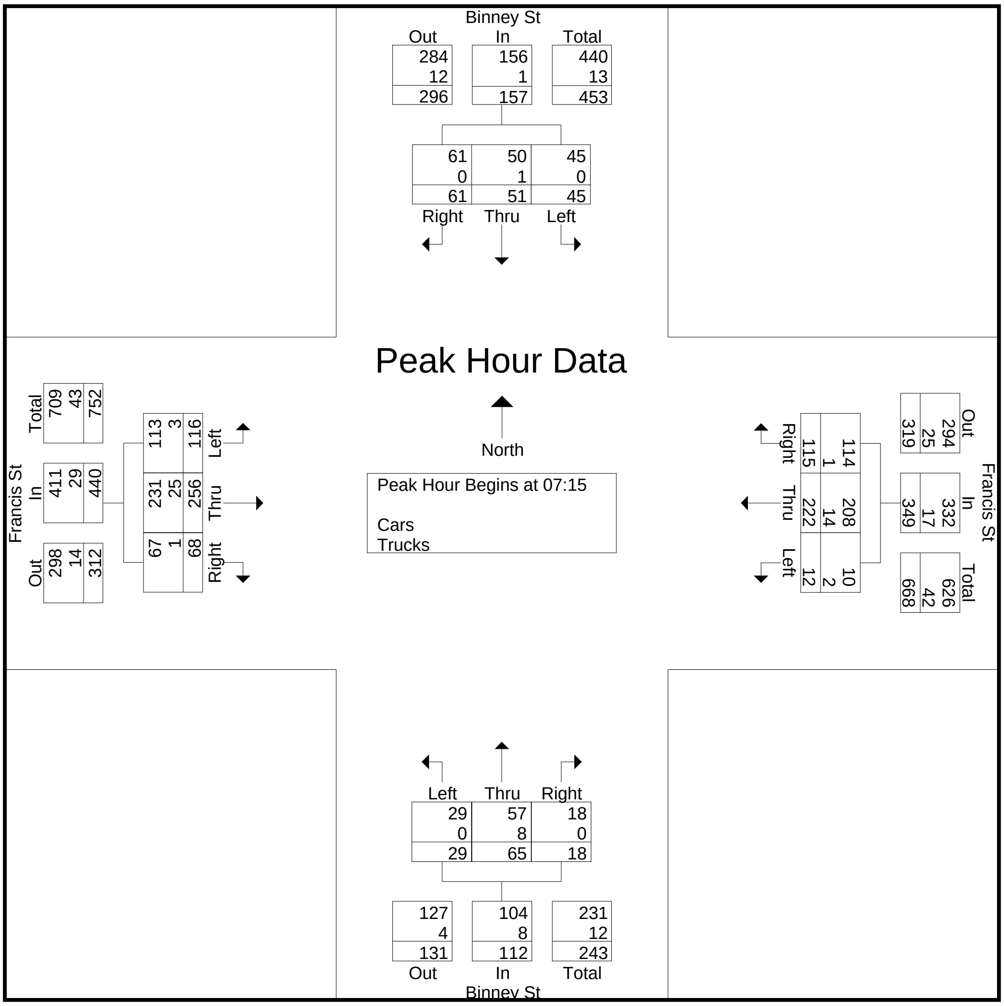
Groups Printed- Cars - Trucks

	Binney St From North				Francis St From East				Binney St From South				Francis St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	11	14	15	60	2	43	25	21	7	12	1	40	32	54	11	19	140	227	367
07:15	15	12	8	41	4	43	34	19	5	20	5	29	27	77	22	26	115	272	387
07:30	8	10	16	38	3	56	28	20	8	14	6	21	30	53	20	17	96	252	348
07:45	11	16	22	84	3	59	35	26	9	18	2	35	30	57	16	29	174	278	452
Total	45	52	61	223	12	201	122	86	29	64	14	125	119	241	69	91	525	1029	1554
08:00	11	13	15	62	2	64	18	31	7	13	5	25	29	69	10	40	158	256	414
08:15	16	13	16	65	1	41	23	21	7	12	5	32	29	58	14	37	155	235	390
08:30	18	17	14	45	6	55	32	29	5	10	2	26	33	58	9	40	140	259	399
08:45	7	14	15	49	4	51	33	17	8	16	6	39	31	62	19	31	136	266	402
Total	52	57	60	221	13	211	106	98	27	51	18	122	122	247	52	148	589	1016	1605
Grand Total	97	109	121	444	25	412	228	184	56	115	32	247	241	488	121	239	1114	2045	3159
Apprch %	29.7	33.3	37		3.8	62	34.3		27.6	56.7	15.8		28.4	57.4	14.2				
Total %	4.7	5.3	5.9		1.2	20.1	11.1		2.7	5.6	1.6		11.8	23.9	5.9		35.3	64.7	
Cars	94	107	118		21	383	226		56	99	32		233	440	117		0	0	3040
% Cars	96.9	98.2	97.5	100	84	93	99.1	100	100	86.1	100	100	96.7	90.2	96.7	100	0	0	96.2
Trucks	3	2	3		4	29	2		0	16	0		8	48	4		0	0	119
% Trucks	3.1	1.8	2.5	0	16	7	0.9	0	0	13.9	0	0	3.3	9.8	3.3	0	0	0	3.8

	Binney St From North				Francis St From East				Binney St From South				Francis St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:15																	
07:15	**15**	12	8	35	**4**	43	34	81	5	**20**	5	**30**	27	**77**	**22**	**126**	272
07:30	8	10	16	34	3	56	28	87	8	14	**6**	28	**30**	53	20	103	252
07:45	11	**16**	**22**	**49**	3	59	**35**	**97**	**9**	18	2	29	30	57	16	103	**278**
08:00	11	13	15	39	2	**64**	18	84	7	13	5	25	29	69	10	108	256
Total Volume	45	51	61	157	12	222	115	349	29	65	18	112	116	256	68	440	1058
% App. Total	28.7	32.5	38.9		3.4	63.6	33		25.9	58	16.1		26.4	58.2	15.5		
PHF	.750	.797	.693	.801	.750	.867	.821	.899	.806	.813	.750	.933	.967	.831	.773	.873	.951
Cars	45	50	61	156	10	208	114	332	29	57	18	104	113	231	67	411	1003
% Cars	100	98.0	100	99.4	83.3	93.7	99.1	95.1	100	87.7	100	92.9	97.4	90.2	98.5	93.4	94.8
Trucks	0	1	0	1	2	14	1	17	0	8	0	8	3	25	1	29	55
% Trucks	0	2.0	0	0.6	16.7	6.3	0.9	4.9	0	12.3	0	7.1	2.6	9.8	1.5	6.6	5.2

Accurate Counts
978-664-2565

File Name : 10568005
Site Code : 10568005
Start Date : 5/5/2009
Page No : 2



Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:45				07:15				07:15				07:15			
+0 mins.	11	16	**22**	**49**	**4**	43	34	81	5	**20**	5	**30**	27	**77**	**22**	**126**
+15 mins.	11	13	15	39	3	56	28	87	8	14	**6**	28	**30**	53	20	103
+30 mins.	16	13	16	45	3	59	**35**	**97**	**9**	18	2	29	30	57	16	103
+45 mins.	**18**	**17**	14	49	2	**64**	18	84	7	13	5	25	29	69	10	108
Total Volume	56	59	67	182	12	222	115	349	29	65	18	112	116	256	68	440
% App. Total	30.8	32.4	36.8		3.4	63.6	33		25.9	58	16.1		26.4	58.2	15.5	
PHF	.778	.868	.761	.929	.750	.867	.821	.899	.806	.813	.750	.933	.967	.831	.773	.873
Cars	53	58	65	176	10	208	114	332	29	57	18	104	113	231	67	411
% Cars	94.6	98.3	97	96.7	83.3	93.7	99.1	95.1	100	87.7	100	92.9	97.4	90.2	98.5	93.4
Trucks	3	1	2	6	2	14	1	17	0	8	0	8	3	25	1	29
% Trucks	5.4	1.7	3	3.3	16.7	6.3	0.9	4.9	0	12.3	0	7.1	2.6	9.8	1.5	6.6

Accurate Counts
978-664-2565

File Name : 10568005
Site Code : 10568005
Start Date : 5/5/2009
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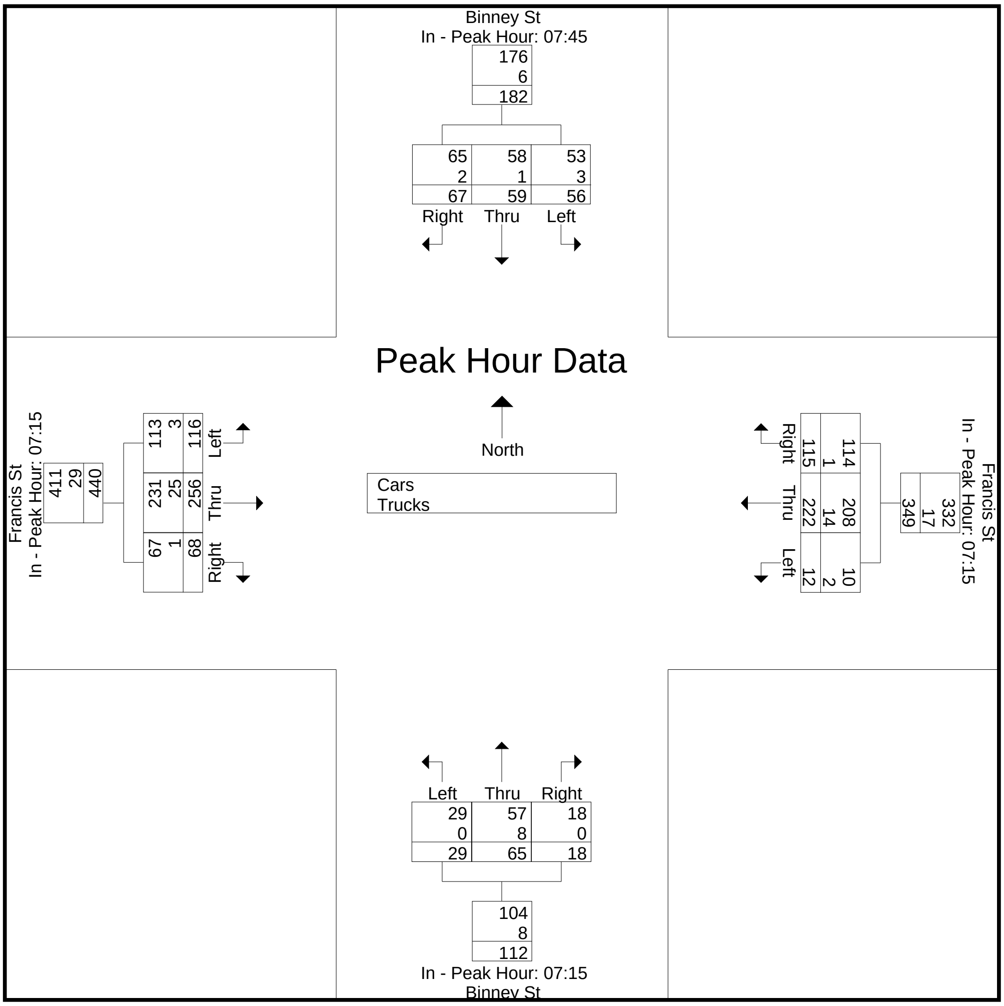


N/S Street : Binney Street
E/W Street: Francis Street
City/State : Boston, MA
Weather : Overcast

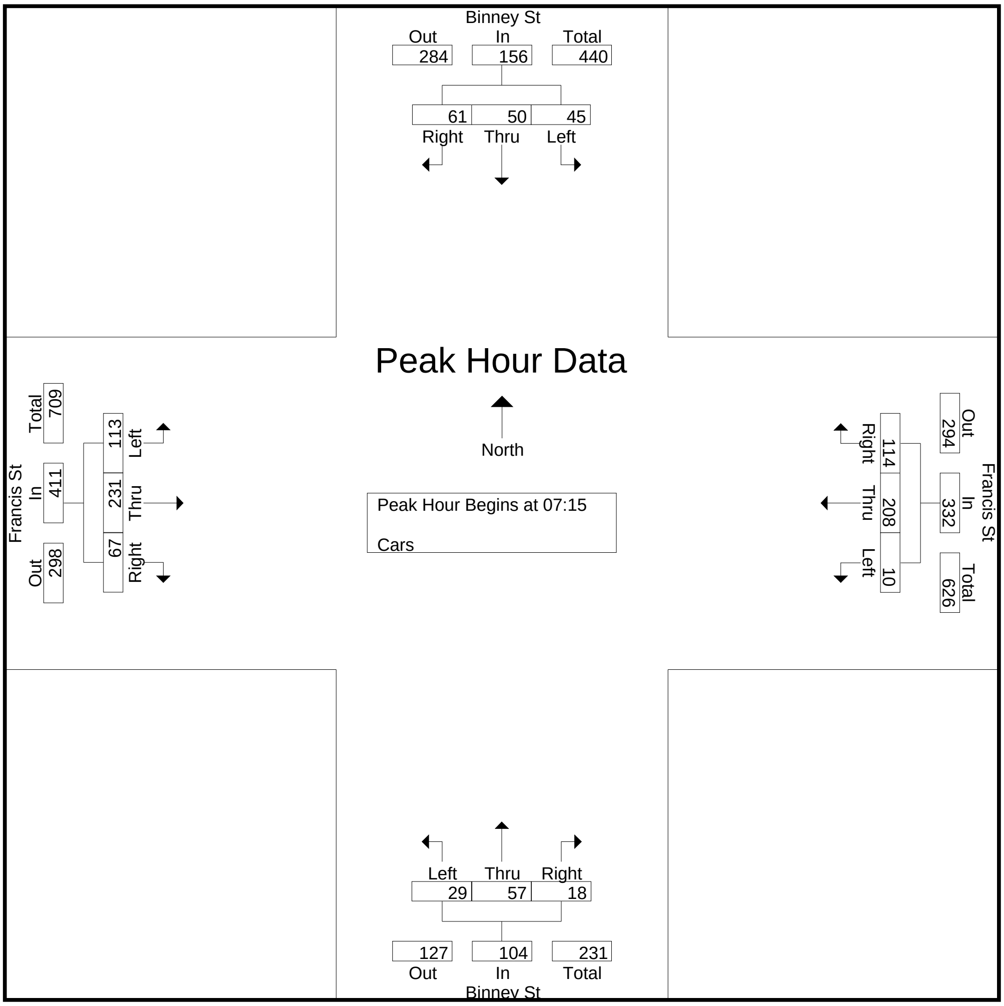
Accurate Counts
978-664-2565

File Name : 10568005
Site Code : 10568005
Start Date : 5/5/2009
Page No : 1

Groups Printed- Cars

	Binney St From North				Francis St From East				Binney St From South				Francis St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	11	14	14	60	2	40	25	21	7	10	1	40	31	49	10	19	140	214	354
07:15	15	12	8	41	3	39	34	19	5	16	5	29	26	74	22	26	115	259	374
07:30	8	10	16	38	3	54	28	20	8	14	6	21	29	46	19	17	96	241	337
07:45	11	15	22	84	2	54	34	26	9	16	2	35	29	50	16	29	174	260	434
Total	45	51	60	223	10	187	121	86	29	56	14	125	115	219	67	91	525	974	1499
08:00	11	13	15	62	2	61	18	31	7	11	5	25	29	61	10	40	158	243	401
08:15	16	13	15	65	1	38	23	21	7	10	5	32	28	51	12	37	155	219	374
08:30	15	17	13	45	5	51	31	29	5	8	2	26	31	52	9	40	140	239	379
08:45	7	13	15	49	3	46	33	17	8	14	6	39	30	57	19	31	136	251	387
Total	49	56	58	221	11	196	105	98	27	43	18	122	118	221	50	148	589	952	1541
Grand Total	94	107	118	444	21	383	226	184	56	99	32	247	233	440	117	239	1114	1926	3040
Apprch %	29.5	33.5	37		3.3	60.8	35.9		29.9	52.9	17.1		29.5	55.7	14.8				
Total %	4.9	5.6	6.1		1.1	19.9	11.7		2.9	5.1	1.7		12.1	22.8	6.1		36.6	63.4	

	Binney St From North				Francis St From East				Binney St From South				Francis St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:15																	
07:15	**15**	12	8	35	**3**	39	**34**	76	5	**16**	5	26	26	**74**	**22**	**122**	259
07:30	8	10	16	34	3	54	28	85	8	14	**6**	**28**	**29**	46	19	94	241
07:45	11	**15**	**22**	**48**	2	54	34	**90**	**9**	16	2	27	29	50	16	95	**260**
08:00	11	13	15	39	2	**61**	18	81	7	11	5	23	29	61	10	100	243
Total Volume	45	50	61	156	10	208	114	332	29	57	18	104	113	231	67	411	1003
% App. Total	28.8	32.1	39.1		3	62.7	34.3		27.9	54.8	17.3		27.5	56.2	16.3		
PHF	.750	.833	.693	.813	.833	.852	.838	.922	.806	.891	.750	.929	.974	.780	.761	.842	.964



Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:45				07:15				07:15				07:15			
+0 mins.	11	15	**22**	**48**	**3**	39	**34**	76	5	**16**	5	26	26	**74**	**22**	**122**
+15 mins.	11	13	15	39	3	54	28	85	8	14	**6**	**28**	**29**	46	19	94
+30 mins.	**16**	13	15	44	2	54	34	**90**	**9**	16	2	27	29	50	16	95
+45 mins.	15	**17**	13	45	2	**61**	18	81	7	11	5	23	29	61	10	100
Total Volume	53	58	65	176	10	208	114	332	29	57	18	104	113	231	67	411
% App. Total	30.1	33	36.9		3	62.7	34.3		27.9	54.8	17.3		27.5	56.2	16.3	
PHF	.828	.853	.739	.917	.833	.852	.838	.922	.806	.891	.750	.929	.974	.780	.761	.842

Accurate Counts
978-664-2565

File Name : 10568005
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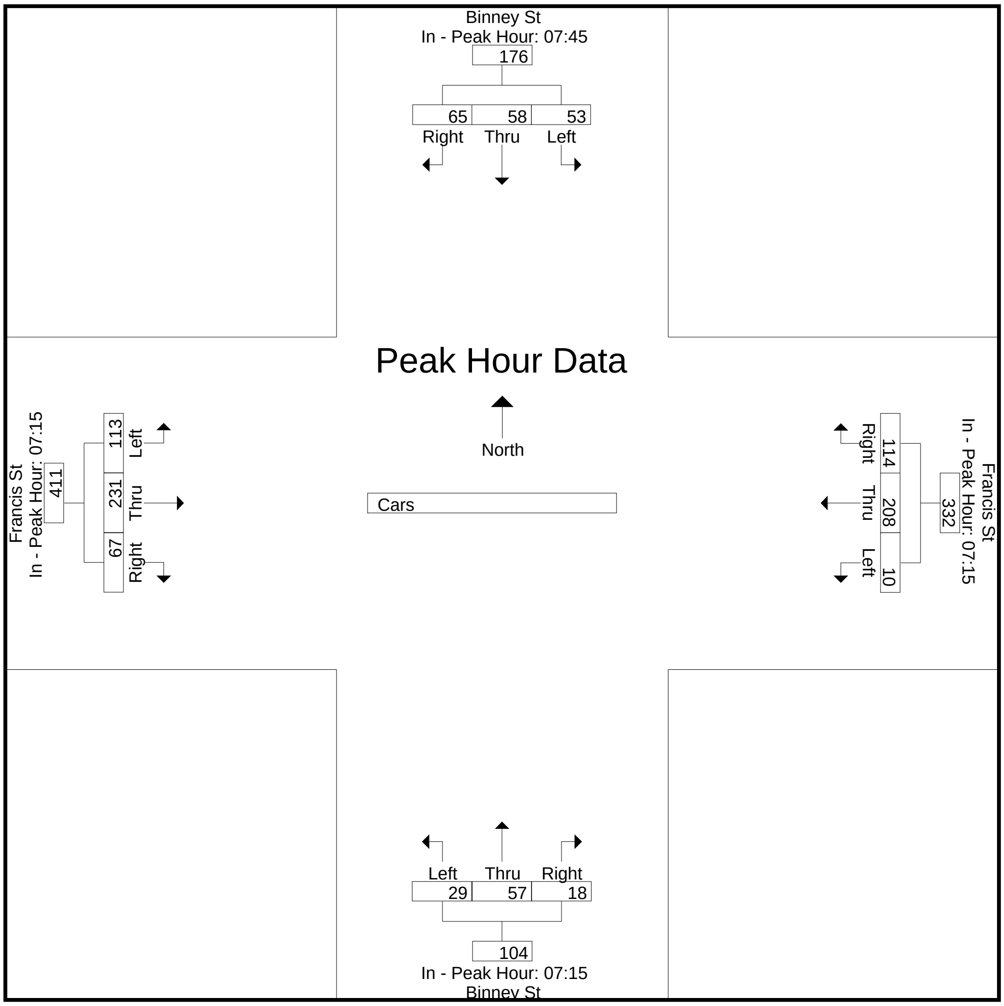


N/S Street : Binney Street
E/W Street: Francis Street
City/State : Boston, MA
Weather : Overcast

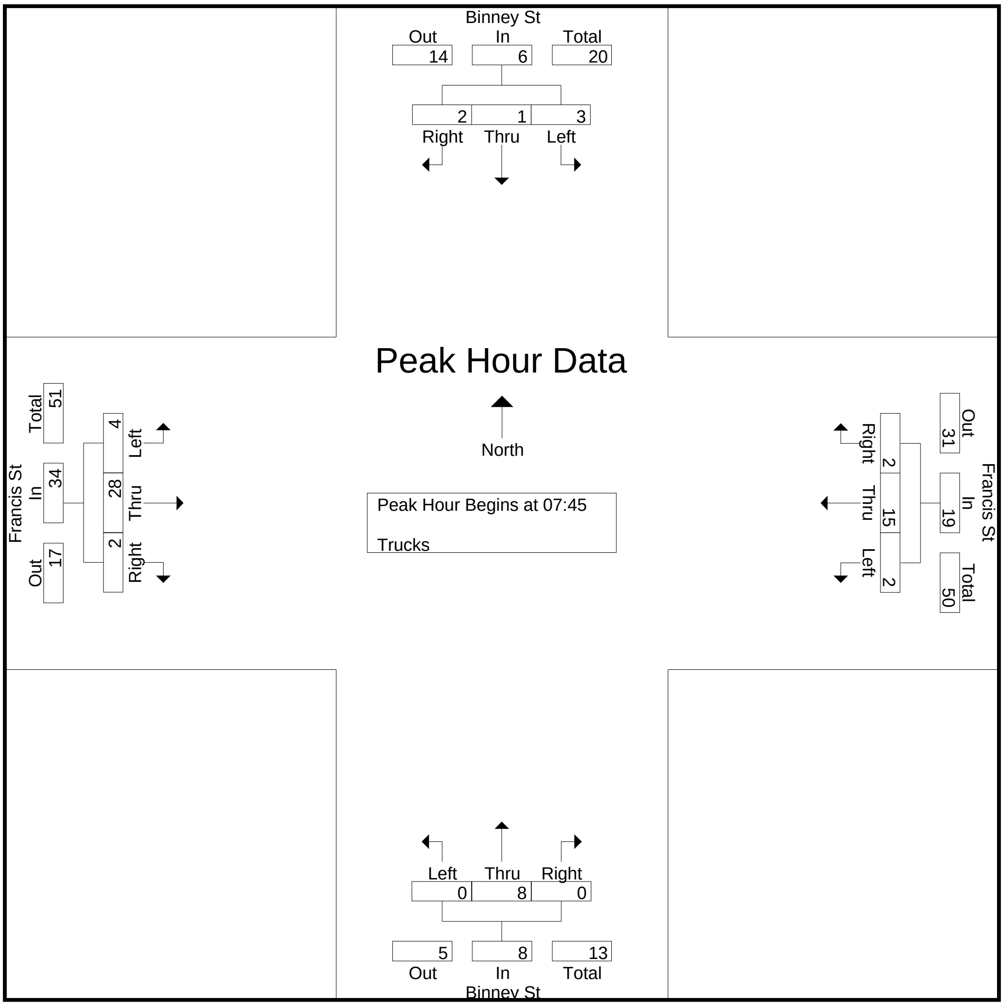
Accurate Counts
978-664-2565

File Name : 10568005
Site Code : 10568005
Start Date : 5/5/2009
Page No : 1

Groups Printed- Trucks

	Binney St From North				Francis St From East				Binney St From South				Francis St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	0	0	1	0	0	3	0	0	0	2	0	0	1	5	1	0	0	13	13
07:15	0	0	0	0	1	4	0	0	0	4	0	0	1	3	0	0	0	13	13
07:30	0	0	0	0	0	2	0	0	0	0	0	0	1	7	1	0	0	11	11
07:45	0	1	0	0	1	5	1	0	0	2	0	0	1	7	0	0	0	18	18
Total	0	1	1	0	2	14	1	0	0	8	0	0	4	22	2	0	0	55	55
08:00	0	0	0	0	0	3	0	0	0	2	0	0	0	8	0	0	0	13	13
08:15	0	0	1	0	0	3	0	0	0	2	0	0	1	7	2	0	0	16	16
08:30	3	0	1	0	1	4	1	0	0	2	0	0	2	6	0	0	0	20	20
08:45	0	1	0	0	1	5	0	0	0	2	0	0	1	5	0	0	0	15	15
Total	3	1	2	0	2	15	1	0	0	8	0	0	4	26	2	0	0	64	64
Grand Total	3	2	3	0	4	29	2	0	0	16	0	0	8	48	4	0	0	119	119
Apprch %	37.5	25	37.5		11.4	82.9	5.7		0	100	0		13.3	80	6.7				
Total %	2.5	1.7	2.5		3.4	24.4	1.7		0	13.4	0		6.7	40.3	3.4		0	100	

	Binney St From North				Francis St From East				Binney St From South				Francis St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:45																	
07:45	0	**1**	0	1	**1**	**5**	**1**	**7**	0	**2**	0	**2**	1	7	0	8	18
08:00	0	0	0	0	0	3	0	3	0	2	0	2	0	**8**	0	8	13
08:15	0	0	**1**	1	0	3	0	3	0	2	0	2	1	7	**2**	**10**	16
08:30	**3**	0	1	**4**	1	4	1	6	0	2	0	2	**2**	6	0	8	**20**
Total Volume	3	1	2	6	2	15	2	19	0	8	0	8	4	28	2	34	67
% App. Total	50	16.7	33.3		10.5	78.9	10.5		0	100	0		11.8	82.4	5.9		
PHF	.250	.250	.500	.375	.500	.750	.500	.679	.000	1.000	.000	1.000	.500	.875	.250	.850	.838



Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:45				07:45				07:00				07:30			
+0 mins.	0	**1**	0	1	**1**	**5**	**1**	**7**	0	2	0	2	**1**	7	1	9
+15 mins.	0	0	0	0	0	3	0	3	0	**4**	0	**4**	1	7	0	8
+30 mins.	0	0	**1**	1	0	3	0	3	0	0	0	0	0	**8**	0	8
+45 mins.	**3**	0	1	**4**	1	4	1	6	0	2	0	2	1	7	**2**	**10**
Total Volume	3	1	2	6	2	15	2	19	0	8	0	8	3	29	3	35
% App. Total	50	16.7	33.3		10.5	78.9	10.5		0	100	0		8.6	82.9	8.6	
PHF	.250	.250	.500	.375	.500	.750	.500	.679	.000	.500	.000	.500	.750	.906	.375	.875

Accurate Counts
978-664-2565

File Name : 10568005
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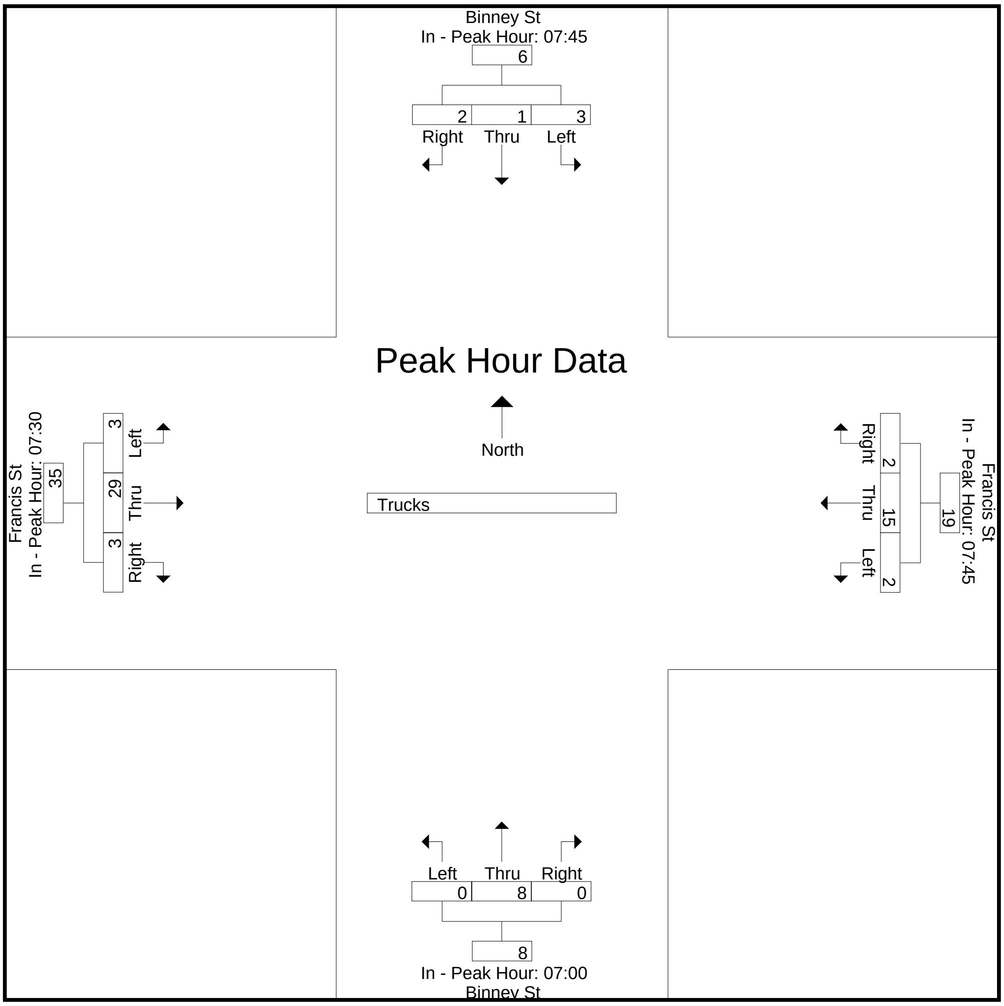


N/S Street : Binney Street
E/W Street: Francis Street
City/State : Boston, MA
Weather : Overcast

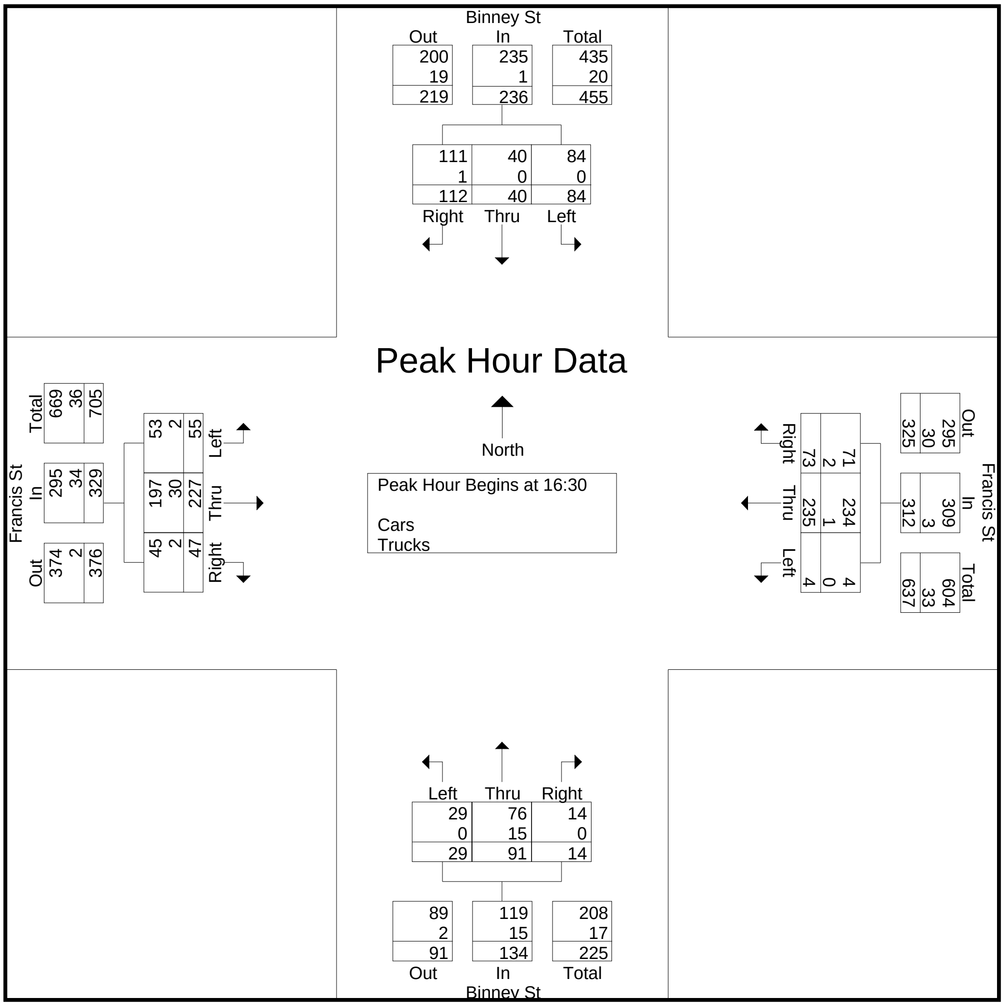
Accurate Counts
978-664-2565

File Name : 10568005
Site Code : 10568005
Start Date : 5/5/2009
Page No : 1

Groups Printed- Cars - Trucks

	Binney St From North				Francis St From East				Binney St From South				Francis St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	26	11	37	33	3	64	11	28	4	16	2	28	20	61	11	17	106	266	372
16:15	23	13	26	32	2	49	15	24	7	9	4	41	18	63	4	19	116	233	349
16:30	21	10	30	45	0	64	13	26	5	6	3	34	9	57	13	26	131	231	362
16:45	22	9	28	49	1	55	20	27	9	15	1	35	15	44	8	20	131	227	358
Total	92	43	121	159	6	232	59	105	25	46	10	138	62	225	36	82	484	957	1441
17:00	20	14	25	48	1	53	17	18	8	56	4	41	12	62	14	17	124	286	410
17:15	21	7	29	40	2	63	23	21	7	14	6	34	19	64	12	25	120	267	387
17:30	16	6	26	31	1	57	13	24	8	9	2	27	11	63	13	28	110	225	335
17:45	23	9	24	28	0	53	12	17	4	13	4	23	11	68	11	25	93	232	325
Total	80	36	104	147	4	226	65	80	27	92	16	125	53	257	50	95	447	1010	1457
Grand Total	172	79	225	306	10	458	124	185	52	138	26	263	115	482	86	177	931	1967	2898
Apprch %	36.1	16.6	47.3		1.7	77.4	20.9		24.1	63.9	12		16.8	70.6	12.6				
Total %	8.7	4	11.4		0.5	23.3	6.3		2.6	7	1.3		5.8	24.5	4.4		32.1	67.9	
Cars	172	79	224		10	457	122		52	108	26		112	430	83		0	0	2806
% Cars	100	100	99.6	100	100	99.8	98.4	100	100	78.3	100	100	97.4	89.2	96.5	100	0	0	96.8
Trucks	0	0	1		0	1	2		0	30	0		3	52	3		0	0	92
% Trucks	0	0	0.4	0	0	0.2	1.6	0	0	21.7	0	0	2.6	10.8	3.5	0	0	0	3.2

	Binney St From North				Francis St From East				Binney St From South				Francis St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 16:30																	
16:30	21	10	**30**	**61**	0	**64**	13	77	5	6	3	14	9	57	13	79	231
16:45	**22**	9	28	59	1	55	20	76	**9**	15	1	25	15	44	8	67	227
17:00	20	**14**	25	59	1	53	17	71	8	**56**	4	**68**	12	62	**14**	88	**286**
17:15	21	7	29	57	**2**	63	**23**	**88**	7	14	**6**	27	**19**	**64**	12	**95**	267
Total Volume	84	40	112	236	4	235	73	312	29	91	14	134	55	227	47	329	1011
% App. Total	35.6	16.9	47.5		1.3	75.3	23.4		21.6	67.9	10.4		16.7	69	14.3		
PHF	.955	.714	.933	.967	.500	.918	.793	.886	.806	.406	.583	.493	.724	.887	.839	.866	.884
Cars	84	40	111	235	4	234	71	309	29	76	14	119	53	197	45	295	958
% Cars	100	100	99.1	99.6	100	99.6	97.3	99.0	100	83.5	100	88.8	96.4	86.8	95.7	89.7	94.8
Trucks	0	0	1	1	0	1	2	3	0	15	0	15	2	30	2	34	53
% Trucks	0	0	0.9	0.4	0	0.4	2.7	1.0	0	16.5	0	11.2	3.6	13.2	4.3	10.3	5.2

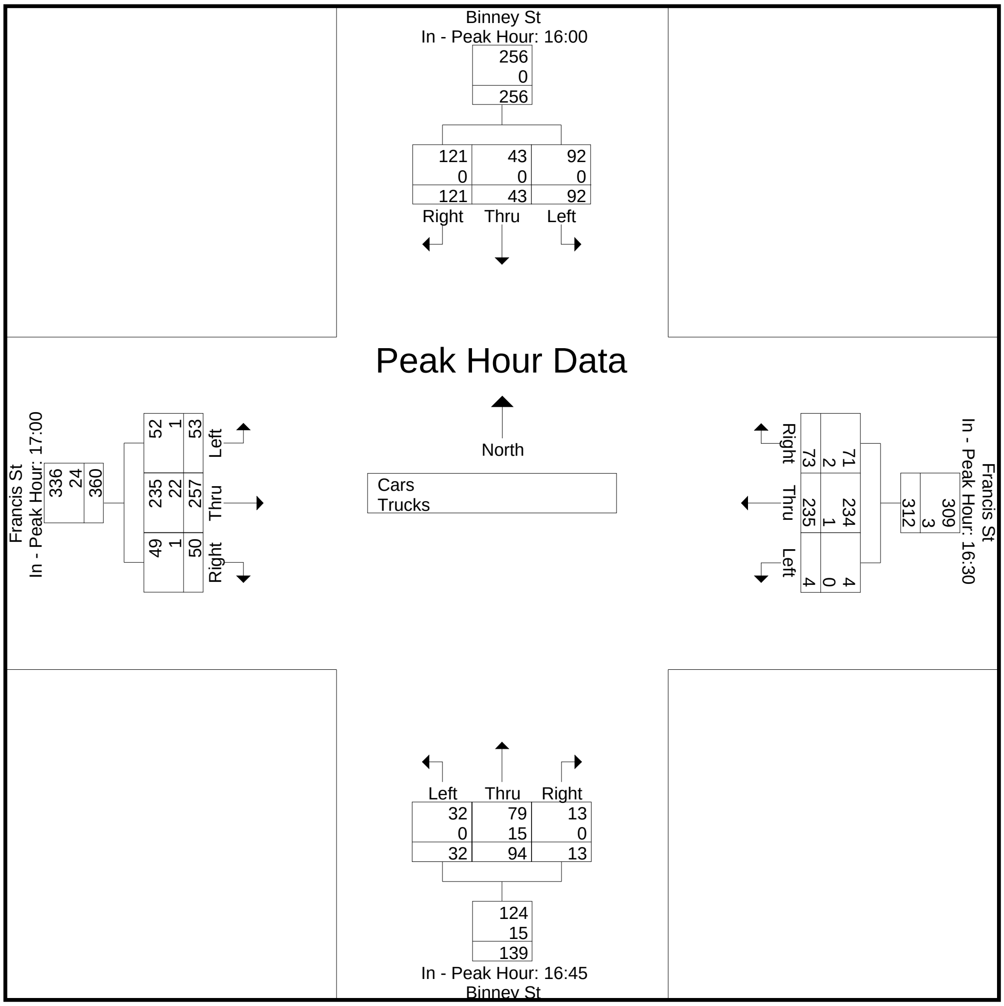


Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:00				16:30				16:45				17:00			
+0 mins.	**26**	11	**37**	**74**	0	**64**	13	77	**9**	15	1	25	12	62	**14**	88
+15 mins.	23	**13**	26	62	1	55	20	76	8	**56**	4	**68**	**19**	64	12	**95**
+30 mins.	21	10	30	61	1	53	17	71	7	14	**6**	27	11	63	13	87
+45 mins.	22	9	28	59	**2**	63	**23**	**88**	8	9	2	19	11	**68**	11	90
Total Volume	92	43	121	256	4	235	73	312	32	94	13	139	53	257	50	360
% App. Total	35.9	16.8	47.3		1.3	75.3	23.4		23	67.6	9.4		14.7	71.4	13.9	
PHF	.885	.827	.818	.865	.500	.918	.793	.886	.889	.420	.542	.511	.697	.945	.893	.947
Cars	92	43	121	256	4	234	71	309	32	79	13	124	52	235	49	336
% Cars	100	100	100	100	100	99.6	97.3	99	100	84	100	89.2	98.1	91.4	98	93.3
Trucks	0	0	0	0	0	1	2	3	0	15	0	15	1	22	1	24
% Trucks	0	0	0	0	0	0.4	2.7	1	0	16	0	10.8	1.9	8.6	2	6.7

Accurate Counts
978-664-2565

File Name : 10568005
Site Code : 10568005
Start Date : 5/5/2009
Page No : 3



N/S Street : Binney Street
E/W Street: Francis Street
City/State : Boston, MA
Weather : Overcast

Accurate Counts
978-664-2565

File Name : 10568005
Site Code : 10568005
Start Date : 5/5/2009
Page No : 1

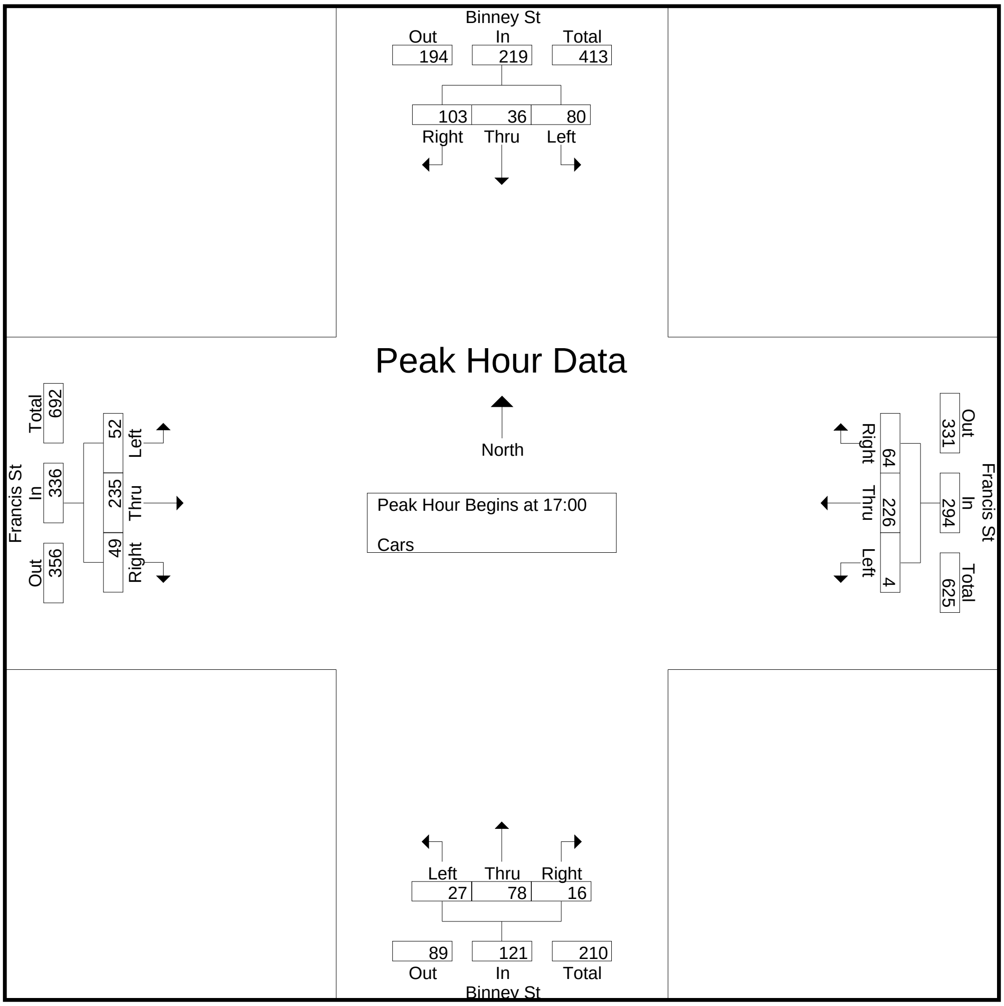
Groups Printed- Cars

	Binney St From North				Francis St From East				Binney St From South				Francis St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	26	11	37	33	3	64	11	28	4	12	2	28	19	54	10	17	106	253	359
16:15	23	13	26	32	2	49	15	24	7	5	4	41	18	54	4	19	116	220	336
16:30	21	10	30	45	0	63	13	26	5	3	3	34	9	50	12	26	131	219	350
16:45	22	9	28	49	1	55	19	27	9	10	1	35	14	37	8	20	131	213	344
Total	92	43	121	159	6	231	58	105	25	30	10	138	60	195	34	82	484	905	1389
17:00	20	14	25	48	1	53	17	18	8	54	4	41	12	55	13	17	124	276	400
17:15	21	7	28	40	2	63	22	21	7	9	6	34	18	55	12	25	120	250	370
17:30	16	6	26	31	1	57	13	24	8	6	2	27	11	63	13	28	110	222	332
17:45	23	9	24	28	0	53	12	17	4	9	4	23	11	62	11	25	93	222	315
Total	80	36	103	147	4	226	64	80	27	78	16	125	52	235	49	95	447	970	1417
Grand Total	172	79	224	306	10	457	122	185	52	108	26	263	112	430	83	177	931	1875	2806
Apprch %	36.2	16.6	47.2		1.7	77.6	20.7		28	58.1	14		17.9	68.8	13.3				
Total %	9.2	4.2	11.9		0.5	24.4	6.5		2.8	5.8	1.4		6	22.9	4.4		33.2	66.8	

	Binney St From North				Francis St From East				Binney St From South				Francis St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 17:00																	
17:00	20	**14**	25	**59**	1	53	17	71	**8**	**54**	4	**66**	12	55	**13**	80	**276**
17:15	21	7	**28**	56	**2**	**63**	**22**	**87**	7	9	**6**	22	**18**	55	12	85	250
17:30	16	6	26	48	1	57	13	71	8	6	2	16	11	**63**	13	**87**	222
17:45	**23**	9	24	56	0	53	12	65	4	9	4	17	11	62	11	84	222
Total Volume	80	36	103	219	4	226	64	294	27	78	16	121	52	235	49	336	970
% App. Total	36.5	16.4	47		1.4	76.9	21.8		22.3	64.5	13.2		15.5	69.9	14.6		
PHF	.870	.643	.920	.928	.500	.897	.727	.845	.844	.361	.667	.458	.722	.933	.942	.966	.879

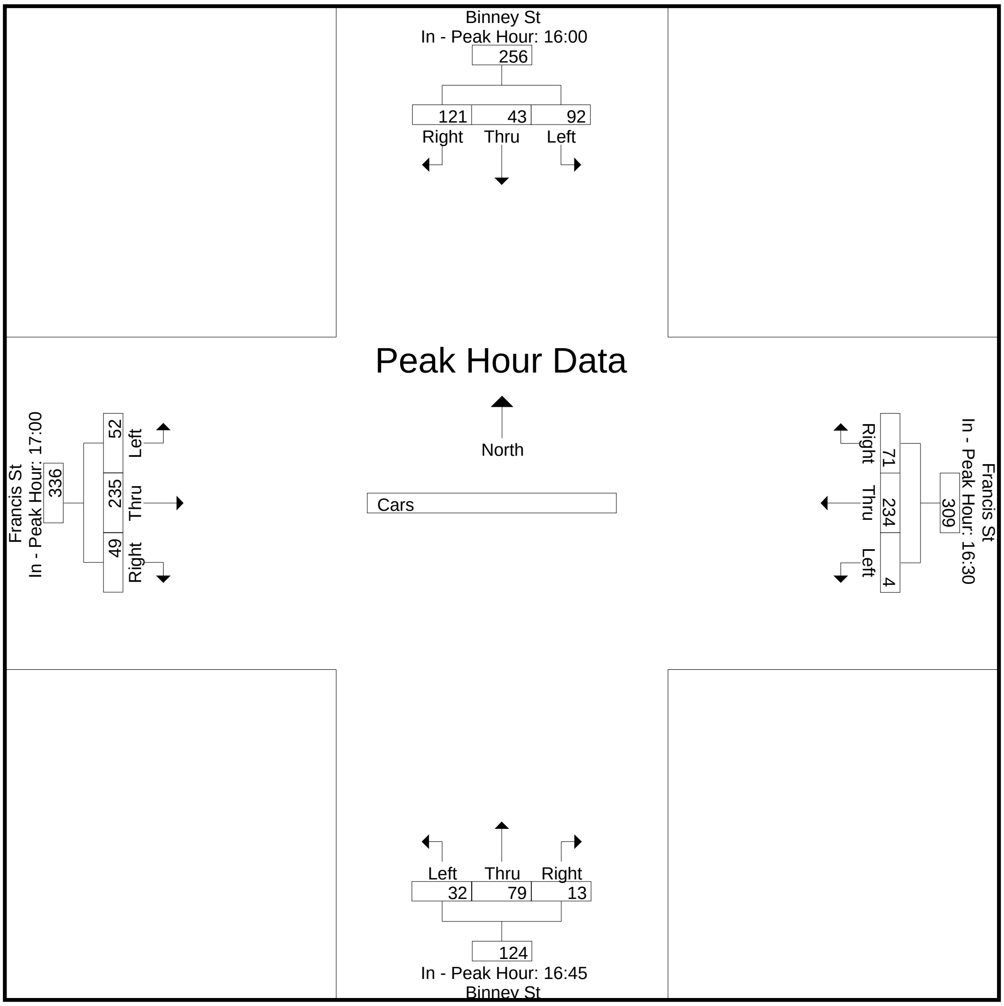
Accurate Counts
978-664-2565

File Name : 10568005
Site Code : 10568005
Start Date : 5/5/2009
Page No : 2



Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:00				16:30				16:45				17:00			
+0 mins.	**26**	11	**37**	**74**	0	**63**	13	76	**9**	10	1	20	12	55	**13**	80
+15 mins.	23	**13**	26	62	1	55	19	75	8	**54**	4	**66**	**18**	55	12	85
+30 mins.	21	10	30	61	1	53	17	71	7	9	**6**	22	11	**63**	13	**87**
+45 mins.	22	9	28	59	**2**	63	**22**	**87**	8	6	2	16	11	62	11	84
Total Volume	92	43	121	256	4	234	71	309	32	79	13	124	52	235	49	336
% App. Total	35.9	16.8	47.3		1.3	75.7	23		25.8	63.7	10.5		15.5	69.9	14.6	
PHF	.885	.827	.818	.865	.500	.929	.807	.888	.889	.366	.542	.470	.722	.933	.942	.966


Binney St
In - Peak Hour: 16:00
256
121 43 92
Right Thru Left
Peak Hour Data
North
Cars
Francis St
In - Peak Hour: 17:00
336
52 Left
235 Thru
49 Right
Francis St
In - Peak Hour: 16:30
309
71 Right
234 Thru
4 Left
Left Thru Right
32 79 13
124
In - Peak Hour: 16:45
Binney St

N/S Street : Binney Street
E/W Street: Francis Street
City/State : Boston, MA
Weather : Overcast

Accurate Counts
978-664-2565

File Name : 10568005
Site Code : 10568005
Start Date : 5/5/2009
Page No : 1

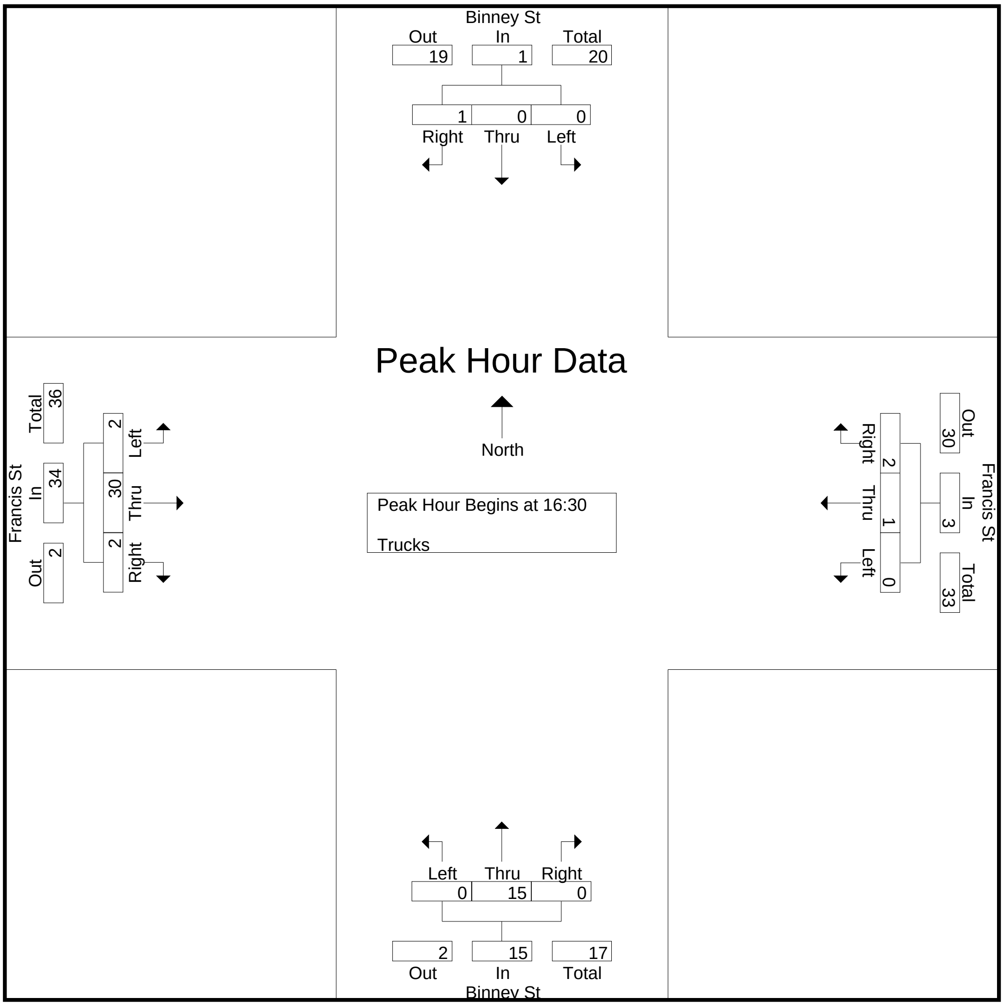
Groups Printed- Trucks

	Binney St From North				Francis St From East				Binney St From South				Francis St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	0	0	0	0	0	0	0	0	0	4	0	0	1	7	1	0	0	13	13
16:15	0	0	0	0	0	0	0	0	0	4	0	0	0	9	0	0	0	13	13
16:30	0	0	0	0	0	1	0	0	0	3	0	0	0	7	1	0	0	12	12
16:45	0	0	0	0	0	0	1	0	0	5	0	0	1	7	0	0	0	14	14
Total	0	0	0	0	0	1	1	0	0	16	0	0	2	30	2	0	0	52	52
17:00	0	0	0	0	0	0	0	0	0	2	0	0	0	7	1	0	0	10	10
17:15	0	0	1	0	0	0	1	0	0	5	0	0	1	9	0	0	0	17	17
17:30	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	3	3
17:45	0	0	0	0	0	0	0	0	0	4	0	0	0	6	0	0	0	10	10
Total	0	0	1	0	0	0	1	0	0	14	0	0	1	22	1	0	0	40	40
Grand Total	0	0	1	0	0	1	2	0	0	30	0	0	3	52	3	0	0	92	92
Apprch %	0	0	100		0	33.3	66.7		0	100	0		5.2	89.7	5.2				
Total %	0	0	1.1		0	1.1	2.2		0	32.6	0		3.3	56.5	3.3		0	100	

	Binney St From North				Francis St From East				Binney St From South				Francis St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 16:30																	
16:30	0	0	0	0	0	**1**	0	**1**	0	3	0	3	0	7	**1**	8	12
16:45	0	0	0	0	0	0	**1**	1	0	**5**	0	**5**	**1**	7	0	8	14
17:00	0	0	0	0	0	0	0	0	0	2	0	2	0	7	1	8	10
17:15	0	0	**1**	**1**	0	0	1	1	0	5	0	5	1	**9**	0	**10**	**17**
Total Volume	0	0	1	1	0	1	2	3	0	15	0	15	2	30	2	34	53
% App. Total	0	0	100		0	33.3	66.7		0	100	0		5.9	88.2	5.9		
PHF	.000	.000	.250	.250	.000	.250	.500	.750	.000	.750	.000	.750	.500	.833	.500	.850	.779

Accurate Counts
978-664-2565

File Name : 10568005
Site Code : 10568005
Start Date : 5/5/2009
Page No : 2

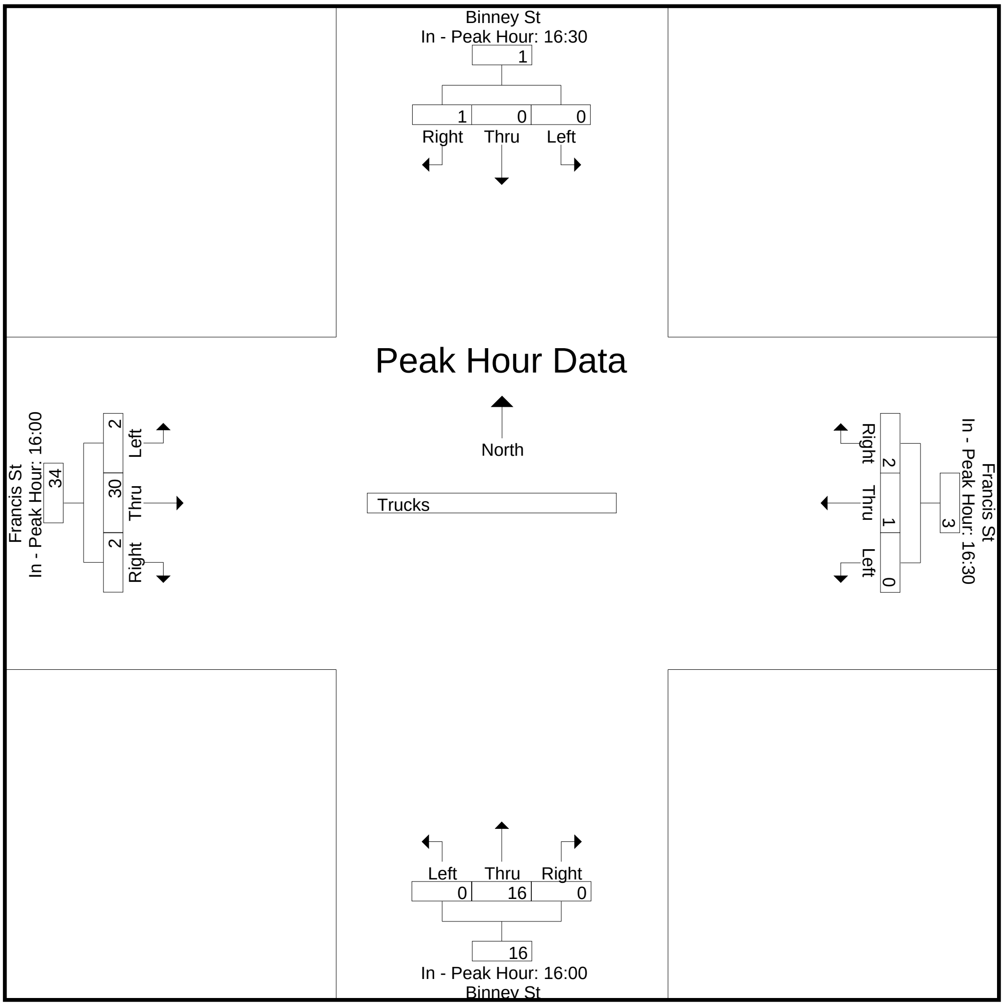


Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:30				16:30				16:00				16:00			
+0 mins.	0	0	0	0	0	**1**	0	**1**	0	4	0	4	**1**	7	**1**	**9**
+15 mins.	0	0	0	0	0	0	**1**	1	0	4	0	4	0	**9**	0	9
+30 mins.	0	0	0	0	0	0	0	0	0	3	0	3	0	7	1	8
+45 mins.	0	0	**1**	**1**	0	0	1	1	0	**5**	0	**5**	1	7	0	8
Total Volume	0	0	1	1	0	1	2	3	0	16	0	16	2	30	2	34
% App. Total	0	0	100		0	33.3	66.7		0	100	0		5.9	88.2	5.9	
PHF	.000	.000	.250	.250	.000	.250	.500	.750	.000	.800	.000	.800	.500	.833	.500	.944

Accurate Counts
978-664-2565

File Name : 10568005
Site Code : 10568005
Start Date : 5/5/2009
Page No : 3



Accurate Counts
978-664-2565

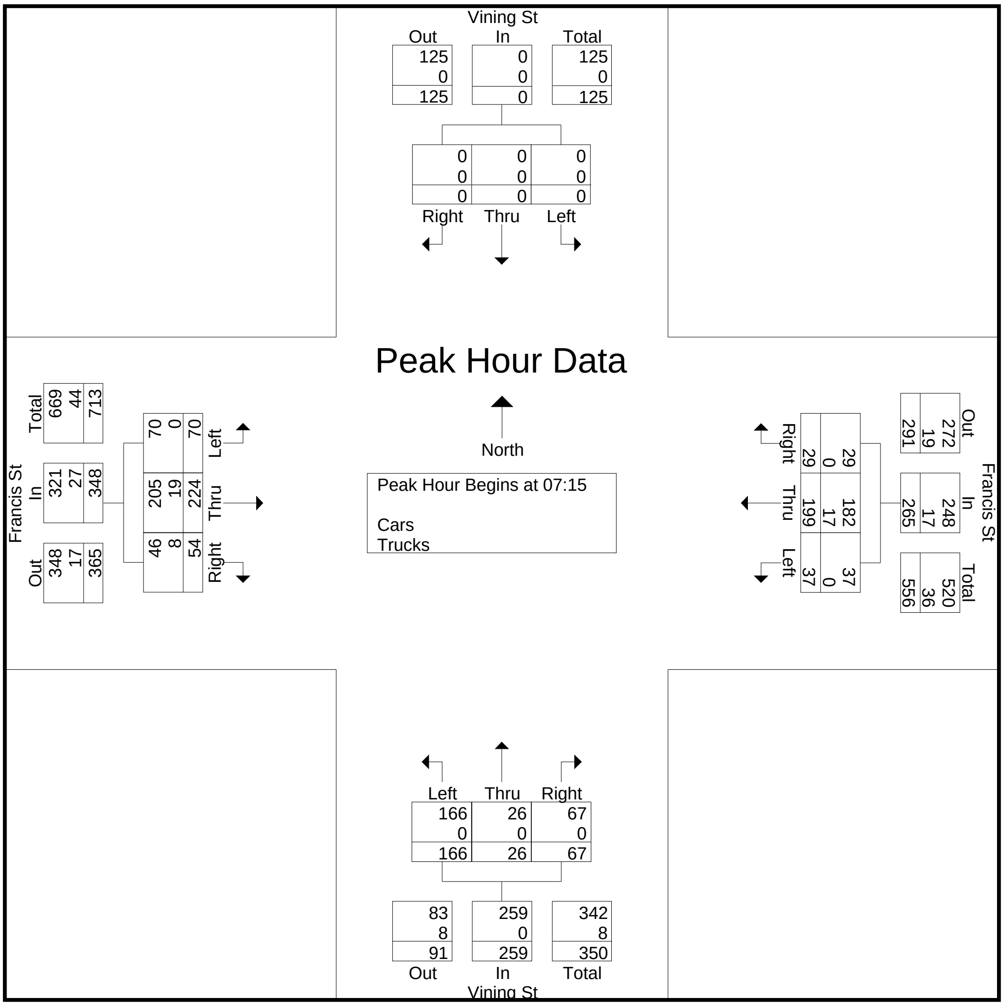
N/S Street : Vining Street
E/W Street: Francis Street
City/State : Boston, MA
Weather : Overcast

File Name : 10568006
Site Code : 10568006
Start Date : 5/5/2009
Page No : 1

Groups Printed- Cars - Trucks

	Vining St From North				Francis St From East				Vining St From South				Francis St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	0	0	0	6	8	56	9	24	37	8	11	6	20	50	12	87	123	211	334
07:15	0	0	0	14	7	45	9	21	37	6	17	3	12	66	20	87	125	219	344
07:30	0	0	0	9	13	44	4	32	51	12	20	15	16	52	13	83	139	225	364
07:45	0	0	0	9	7	53	8	22	40	7	22	12	24	39	9	91	134	209	343
Total	0	0	0	38	35	198	30	99	165	33	70	36	72	207	54	348	521	864	1385
08:00	0	0	0	19	10	57	8	31	38	1	8	12	18	67	12	78	140	219	359
08:15	0	0	0	12	4	33	9	14	32	5	13	8	21	55	9	75	109	181	290
08:30	0	0	0	19	6	73	9	12	31	12	8	8	9	67	12	85	124	227	351
08:45	0	0	0	23	7	58	7	22	26	4	5	11	13	47	13	81	137	180	317
Total	0	0	0	73	27	221	33	79	127	22	34	39	61	236	46	319	510	807	1317
Grand Total	0	0	0	111	62	419	63	178	292	55	104	75	133	443	100	667	1031	1671	2702
Apprch %	0	0	0		11.4	77	11.6		64.7	12.2	23.1		19.7	65.5	14.8				
Total %	0	0	0		3.7	25.1	3.8		17.5	3.3	6.2		8	26.5	6		38.2	61.8	
Cars	0	0	0		61	384	63		291	55	104		132	406	85		0	0	2612
% Cars	0	0	0	100	98.4	91.6	100	100	99.7	100	100	100	99.2	91.6	85	100	0	0	96.7
Trucks	0	0	0		1	35	0		1	0	0		1	37	15		0	0	90
% Trucks	0	0	0	0	1.6	8.4	0	0	0.3	0	0	0	0.8	8.4	15	0	0	0	3.3

	Vining St From North				Francis St From East				Vining St From South				Francis St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:15																	
07:15	0	0	0	0	7	45	**9**	61	37	6	17	60	12	66	**20**	**98**	219
07:30	0	0	0	0	**13**	44	4	61	**51**	**12**	20	**83**	16	52	13	81	**225**
07:45	0	0	0	0	7	53	8	68	40	7	**22**	69	**24**	39	9	72	209
08:00	0	0	0	0	10	**57**	8	**75**	38	1	8	47	18	**67**	12	97	219
Total Volume	0	0	0	0	37	199	29	265	166	26	67	259	70	224	54	348	872
% App. Total	0	0	0		14	75.1	10.9		64.1	10	25.9		20.1	64.4	15.5		
PHF	.000	.000	.000	.000	.712	.873	.806	.883	.814	.542	.761	.780	.729	.836	.675	.888	.969
Cars	0	0	0	0	37	182	29	248	166	26	67	259	70	205	46	321	828
% Cars	0	0	0	0	100	91.5	100	93.6	100	100	100	100	100	91.5	85.2	92.2	95.0
Trucks	0	0	0	0	0	17	0	17	0	0	0	0	0	19	8	27	44
% Trucks	0	0	0	0	0	8.5	0	6.4	0	0	0	0	0	8.5	14.8	7.8	5.0

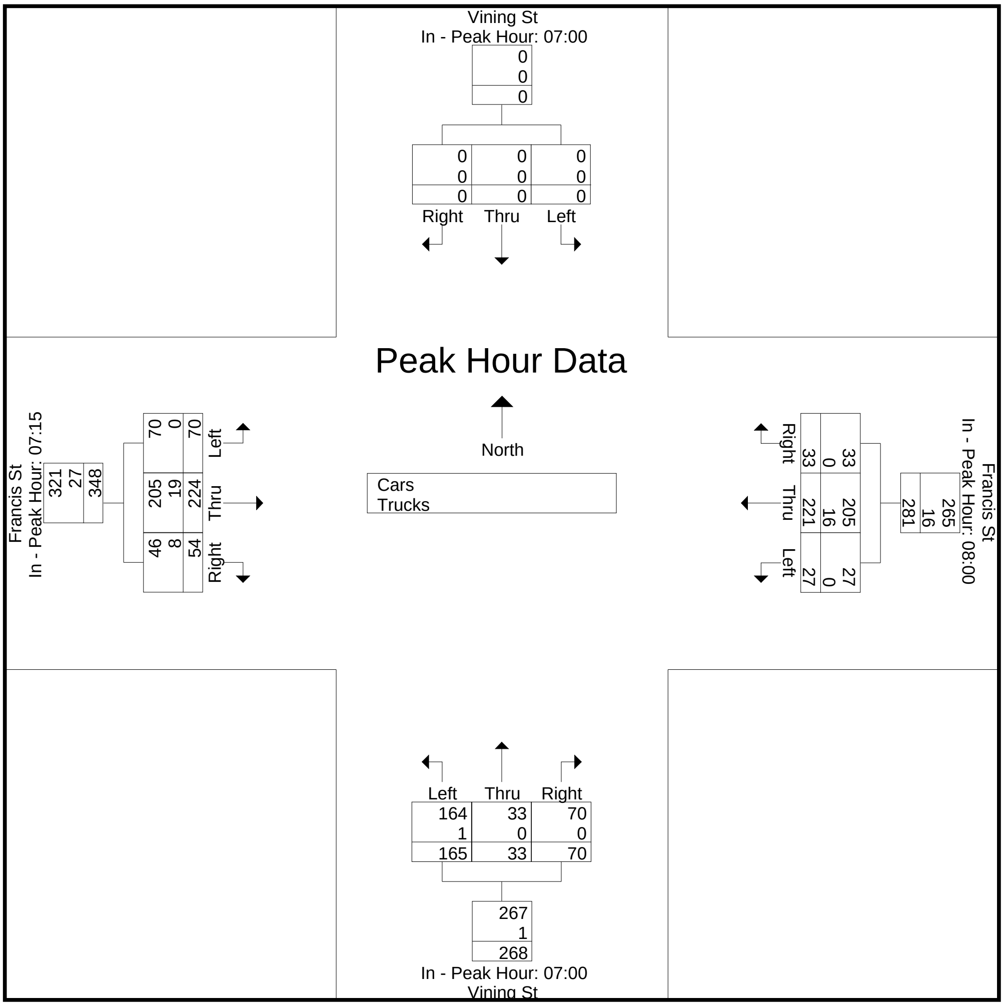


Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:00				08:00				07:00				07:15			
+0 mins.	0	0	0	0	**10**	57	8	75	37	8	11	56	12	66	**20**	**98**
+15 mins.	0	0	0	0	4	33	**9**	46	37	6	17	60	16	52	13	81
+30 mins.	0	0	0	0	6	**73**	9	**88**	**51**	**12**	20	**83**	**24**	39	9	72
+45 mins.	0	0	0	0	7	58	7	72	40	7	**22**	69	18	**67**	12	97
Total Volume	0	0	0	0	27	221	33	281	165	33	70	268	70	224	54	348
% App. Total	0	0	0		9.6	78.6	11.7		61.6	12.3	26.1		20.1	64.4	15.5	
PHF	.000	.000	.000	.000	.675	.757	.917	.798	.809	.688	.795	.807	.729	.836	.675	.888
Cars	0	0	0	0	27	205	33	265	164	33	70	267	70	205	46	321
% Cars	0	0	0	0	100	92.8	100	94.3	99.4	100	100	99.6	100	91.5	85.2	92.2
Trucks	0	0	0	0	0	16	0	16	1	0	0	1	0	19	8	27
% Trucks	0	0	0	0	0	7.2	0	5.7	0.6	0	0	0.4	0	8.5	14.8	7.8

Accurate Counts
978-664-2565

File Name : 10568006
Site Code : 10568006
Start Date : 5/5/2009
Page No : 3



N/S Street : Vining Street
E/W Street: Francis Street
City/State : Boston, MA
Weather : Overcast

Accurate Counts
978-664-2565

File Name : 10568006
Site Code : 10568006
Start Date : 5/5/2009
Page No : 1

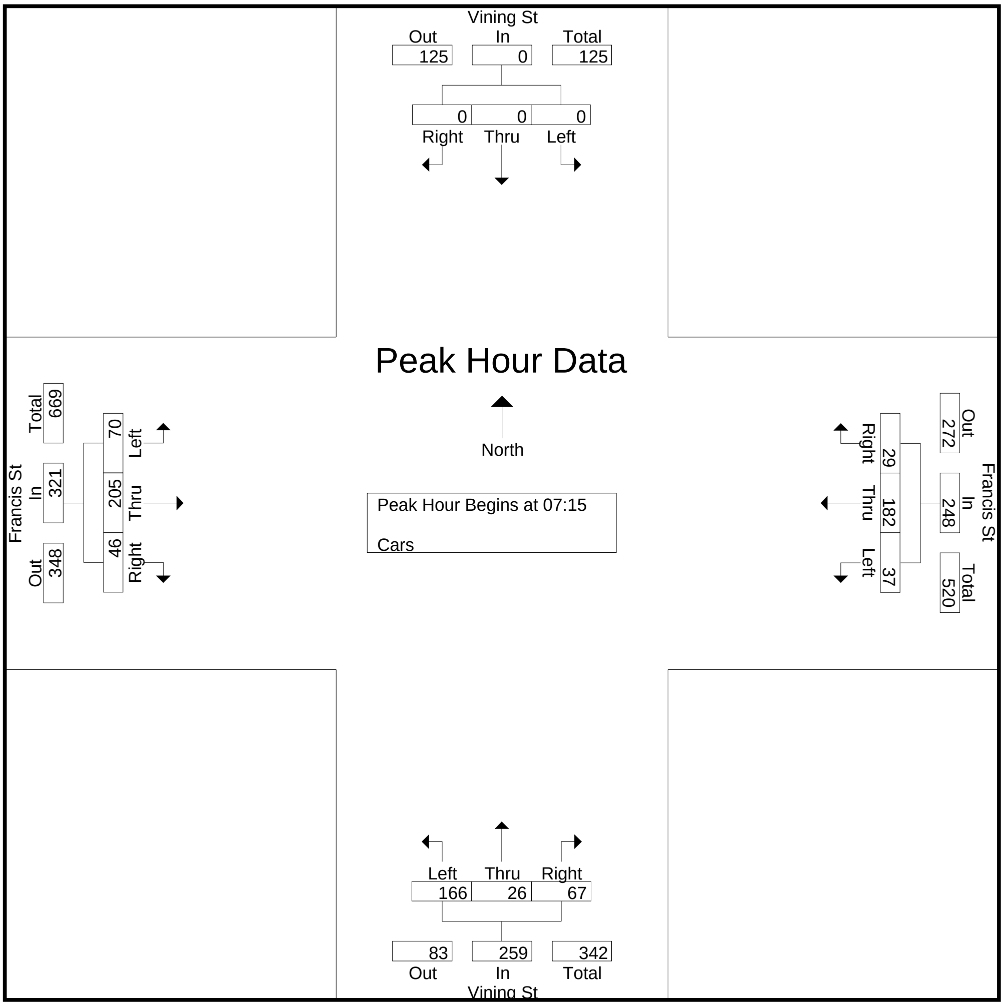
Groups Printed- Cars

	Vining St From North				Francis St From East				Vining St From South				Francis St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	0	0	0	6	7	51	9	24	36	8	11	6	19	48	10	87	123	199	322
07:15	0	0	0	14	7	40	9	21	37	6	17	3	12	62	17	87	125	207	332
07:30	0	0	0	9	13	42	4	32	51	12	20	15	16	48	11	83	139	217	356
07:45	0	0	0	9	7	46	8	22	40	7	22	12	24	36	7	91	134	197	331
Total	0	0	0	38	34	179	30	99	164	33	70	36	71	194	45	348	521	820	1341
08:00	0	0	0	19	10	54	8	31	38	1	8	12	18	59	11	78	140	207	347
08:15	0	0	0	12	4	30	9	14	32	5	13	8	21	51	7	75	109	172	281
08:30	0	0	0	19	6	67	9	12	31	12	8	8	9	59	10	85	124	211	335
08:45	0	0	0	23	7	54	7	22	26	4	5	11	13	43	12	81	137	171	308
Total	0	0	0	73	27	205	33	79	127	22	34	39	61	212	40	319	510	761	1271
Grand Total	0	0	0	111	61	384	63	178	291	55	104	75	132	406	85	667	1031	1581	2612
Apprch %	0	0	0		12	75.6	12.4		64.7	12.2	23.1		21.2	65.2	13.6				
Total %	0	0	0		3.9	24.3	4		18.4	3.5	6.6		8.3	25.7	5.4		39.5	60.5	

	Vining St From North				Francis St From East				Vining St From South				Francis St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:15																	
07:15	0	0	0	0	7	40	**9**	56	37	6	17	60	12	**62**	**17**	**91**	207
07:30	0	0	0	0	**13**	42	4	59	**51**	**12**	20	**83**	16	48	11	75	**217**
07:45	0	0	0	0	7	46	8	61	40	7	**22**	69	**24**	36	7	67	197
08:00	0	0	0	0	10	**54**	8	**72**	38	1	8	47	18	59	11	88	207
Total Volume	0	0	0	0	37	182	29	248	166	26	67	259	70	205	46	321	828
% App. Total	0	0	0		14.9	73.4	11.7		64.1	10	25.9		21.8	63.9	14.3		
PHF	.000	.000	.000	.000	.712	.843	.806	.861	.814	.542	.761	.780	.729	.827	.676	.882	.954

Accurate Counts
978-664-2565

File Name : 10568006
Site Code : 10568006
Start Date : 5/5/2009
Page No : 2

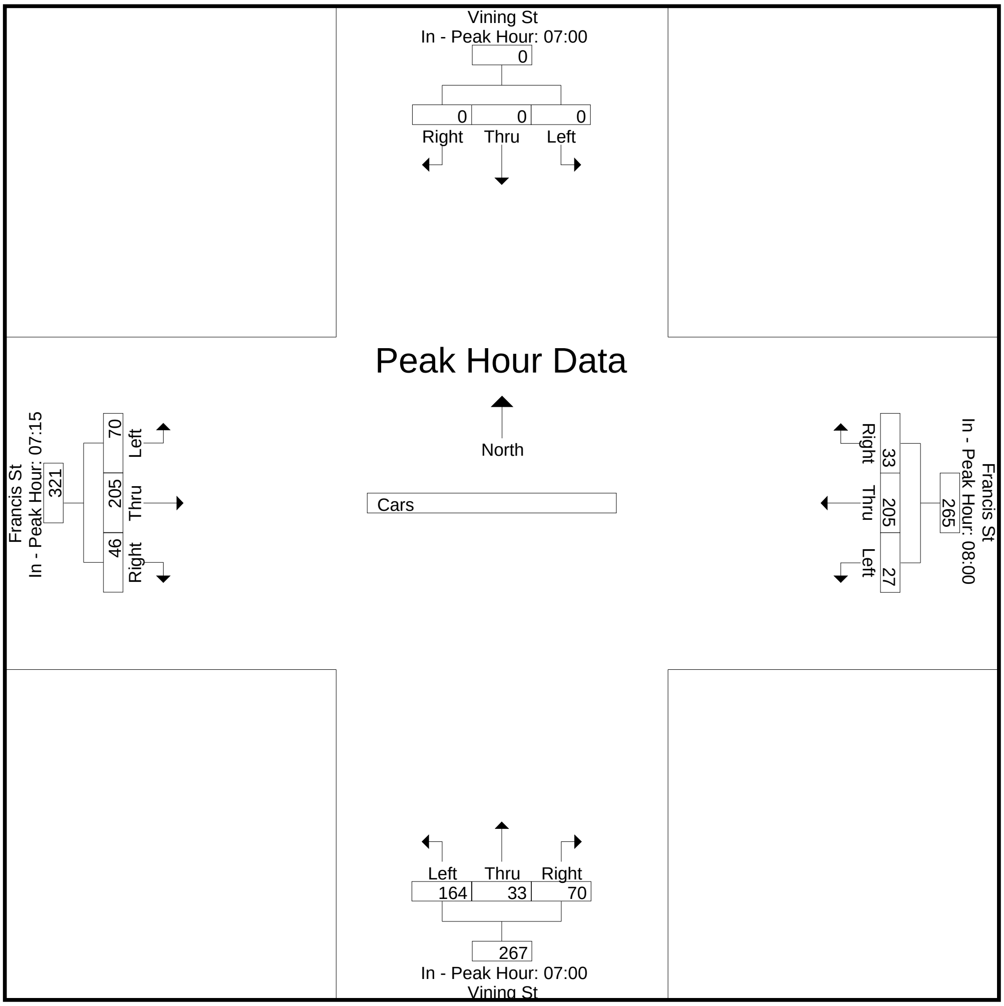


Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:00				08:00				07:00				07:15			
+0 mins.	0	0	0	0	**10**	54	8	72	36	8	11	55	12	**62**	**17**	**91**
+15 mins.	0	0	0	0	4	30	**9**	43	37	6	17	60	16	48	11	75
+30 mins.	0	0	0	0	6	**67**	9	**82**	**51**	**12**	20	**83**	**24**	36	7	67
+45 mins.	0	0	0	0	7	54	7	68	40	7	**22**	69	18	59	11	88
Total Volume	0	0	0	0	27	205	33	265	164	33	70	267	70	205	46	321
% App. Total	0	0	0		10.2	77.4	12.5		61.4	12.4	26.2		21.8	63.9	14.3	
PHF	.000	.000	.000	.000	.675	.765	.917	.808	.804	.688	.795	.804	.729	.827	.676	.882

Accurate Counts
978-664-2565

File Name : 10568006
Site Code : 10568006
Start Date : 5/5/2009
Page No : 3



N/S Street : Vining Street
E/W Street: Francis Street
City/State : Boston, MA
Weather : Overcast

Accurate Counts
978-664-2565

File Name : 10568006
Site Code : 10568006
Start Date : 5/5/2009
Page No : 1

Groups Printed- Trucks

	Vining St From North				Francis St From East				Vining St From South				Francis St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	0	0	0	0	1	5	0	0	1	0	0	0	1	2	2	0	0	12	12
07:15	0	0	0	0	0	5	0	0	0	0	0	0	0	4	3	0	0	12	12
07:30	0	0	0	0	0	2	0	0	0	0	0	0	0	4	2	0	0	8	8
07:45	0	0	0	0	0	7	0	0	0	0	0	0	0	3	2	0	0	12	12
Total	0	0	0	0	1	19	0	0	1	0	0	0	1	13	9	0	0	44	44
08:00	0	0	0	0	0	3	0	0	0	0	0	0	0	8	1	0	0	12	12
08:15	0	0	0	0	0	3	0	0	0	0	0	0	0	4	2	0	0	9	9
08:30	0	0	0	0	0	6	0	0	0	0	0	0	0	8	2	0	0	16	16
08:45	0	0	0	0	0	4	0	0	0	0	0	0	0	4	1	0	0	9	9
Total	0	0	0	0	0	16	0	0	0	0	0	0	0	24	6	0	0	46	46
Grand Total	0	0	0	0	1	35	0	0	1	0	0	0	1	37	15	0	0	90	90
Apprch %	0	0	0		2.8	97.2	0		100	0	0		1.9	69.8	28.3				
Total %	0	0	0		1.1	38.9	0		1.1	0	0		1.1	41.1	16.7		0	100	

	Vining St From North				Francis St From East				Vining St From South				Francis St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:45																	
07:45	0	0	0	0	0	**7**	0	**7**	0	0	0	0	0	3	**2**	5	12
08:00	0	0	0	0	0	3	0	3	0	0	0	0	0	**8**	1	9	12
08:15	0	0	0	0	0	3	0	3	0	0	0	0	0	4	2	6	9
08:30	0	0	0	0	0	6	0	6	0	0	0	0	0	8	2	**10**	**16**
Total Volume	0	0	0	0	0	19	0	19	0	0	0	0	0	23	7	30	49
% App. Total	0	0	0		0	100	0		0	0	0		0	76.7	23.3		
PHF	.000	.000	.000	.000	.000	.679	.000	.679	.000	.000	.000	.000	.000	.719	.875	.750	.766

Accurate Counts
978-664-2565

File Name : 10568006
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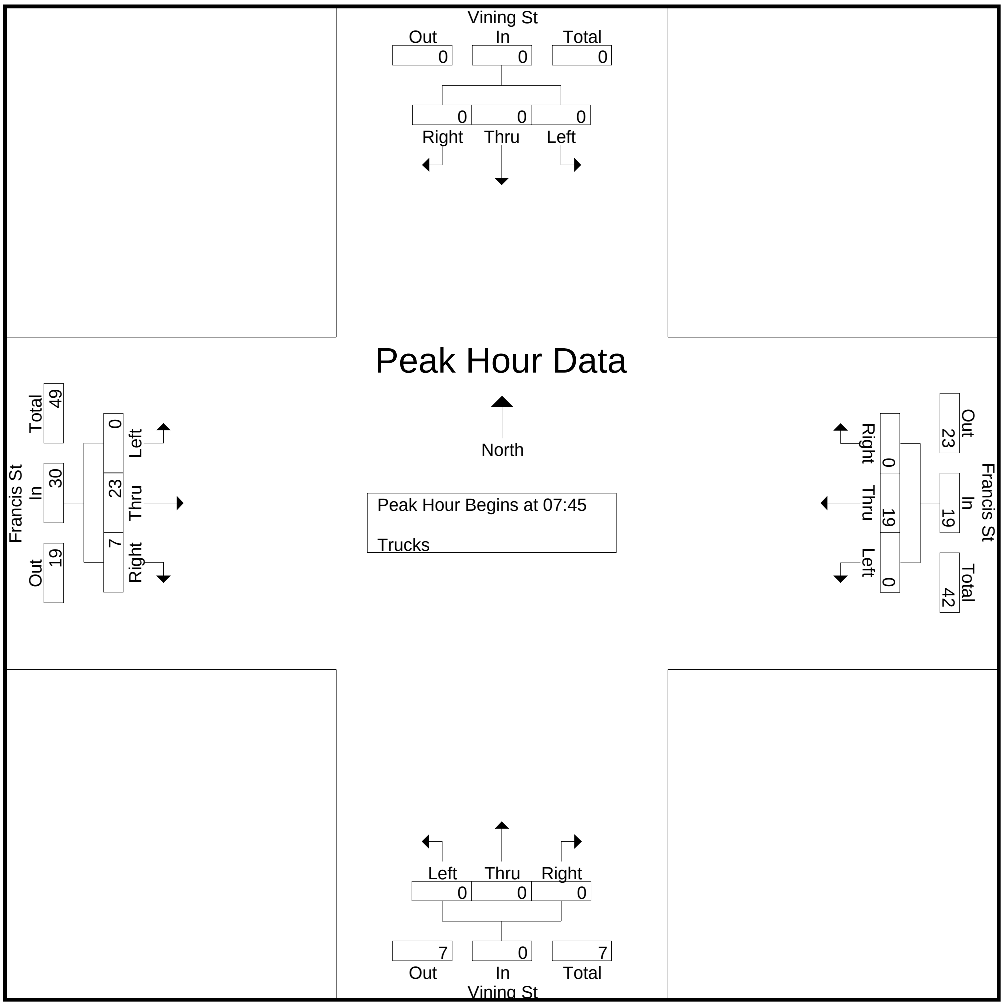
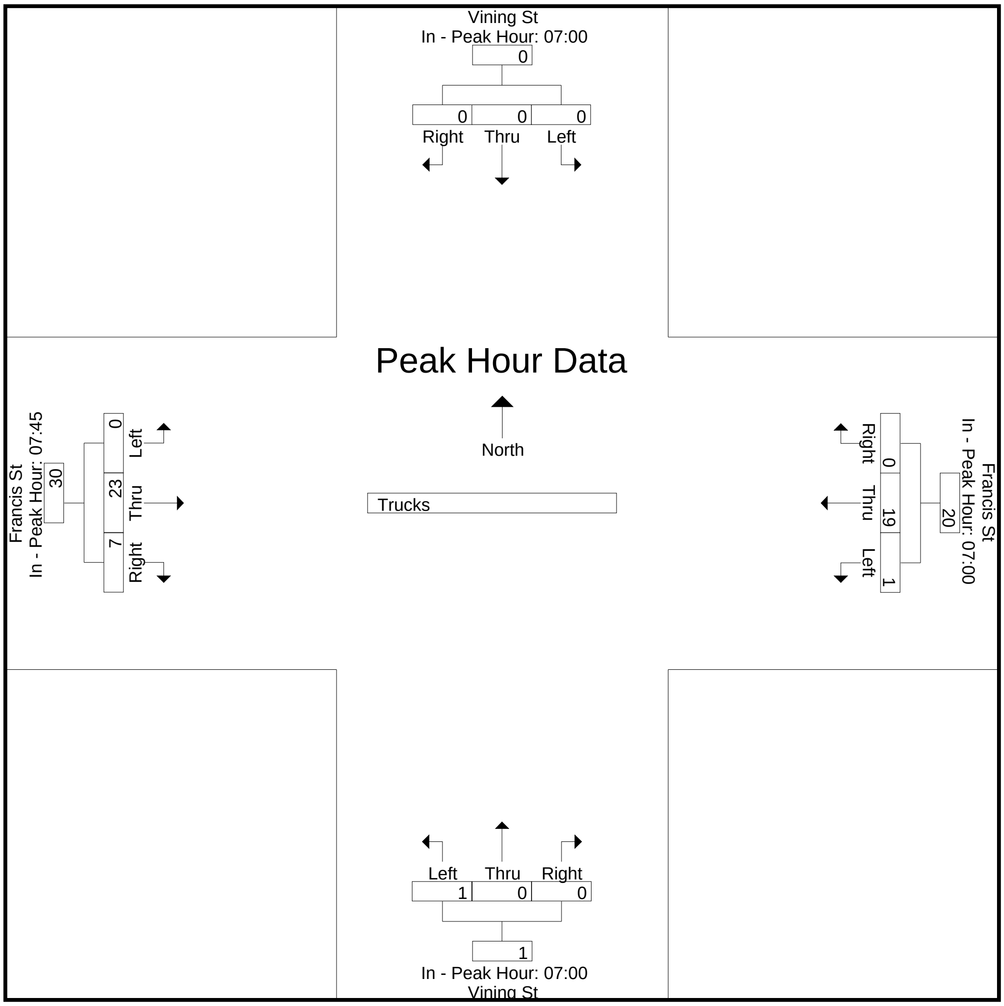


Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:00				07:00				07:00				07:45			
+0 mins.	0	0	0	0	**1**	5	0	6	**1**	0	0	**1**	0	3	**2**	5
+15 mins.	0	0	0	0	0	5	0	5	0	0	0	0	0	**8**	1	9
+30 mins.	0	0	0	0	0	2	0	2	0	0	0	0	0	4	2	6
+45 mins.	0	0	0	0	0	**7**	0	**7**	0	0	0	0	0	8	2	**10**
Total Volume	0	0	0	0	1	19	0	20	1	0	0	1	0	23	7	30
% App. Total	0	0	0		5	95	0		100	0	0		0	76.7	23.3	
PHF	.000	.000	.000	.000	.250	.679	.000	.714	.250	.000	.000	.250	.000	.719	.875	.750

Accurate Counts
978-664-2565

File Name : 10568006
Site Code : 10568006
Start Date : 5/5/2009
Page No : 3



N/S Street : Vining Street
E/W Street: Francis Street
City/State : Boston, MA
Weather : Overcast

Accurate Counts
978-664-2565

File Name : 10568006
Site Code : 10568006
Start Date : 5/5/2009
Page No : 1

Groups Printed- Cars - Trucks

	Vining St From North				Francis St From East				Vining St From South				Francis St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	0	0	0	1	7	67	7	14	16	22	10	9	14	57	14	69	93	214	307
16:15	0	0	0	29	6	52	3	11	18	16	23	4	12	69	16	91	135	215	350
16:30	0	0	0	18	6	62	8	14	21	22	9	10	15	57	12	67	109	212	321
16:45	0	0	0	11	1	67	8	7	9	13	13	13	14	47	15	88	119	187	306
Total	0	0	0	59	20	248	26	46	64	73	55	36	55	230	57	315	456	828	1284
17:00	0	0	0	22	4	57	9	11	22	10	12	17	7	65	14	73	123	200	323
17:15	0	0	0	20	6	68	10	8	22	15	7	10	11	57	21	87	125	217	342
17:30	0	0	0	13	4	42	6	9	32	13	8	5	11	58	15	56	83	189	272
17:45	0	0	0	13	10	47	11	10	18	10	9	5	20	59	19	44	72	203	275
Total	0	0	0	68	24	214	36	38	94	48	36	37	49	239	69	260	403	809	1212
Grand Total	0	0	0	127	44	462	62	84	158	121	91	73	104	469	126	575	859	1637	2496
Apprch %	0	0	0		7.7	81.3	10.9		42.7	32.7	24.6		14.9	67.1	18				
Total %	0	0	0		2.7	28.2	3.8		9.7	7.4	5.6		6.4	28.6	7.7		34.4	65.6	
Cars	0	0	0		40	453	62		157	121	91		104	428	60		0	0	2375
% Cars	0	0	0	100	90.9	98.1	100	100	99.4	100	100	100	100	91.3	47.6	100	0	0	95.2
Trucks	0	0	0		4	9	0		1	0	0		0	41	66		0	0	121
% Trucks	0	0	0	0	9.1	1.9	0	0	0.6	0	0	0	0	8.7	52.4	0	0	0	4.8

	Vining St From North				Francis St From East				Vining St From South				Francis St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 16:00																	
16:00	0	0	0	0	**7**	**67**	7	**81**	16	**22**	10	48	14	57	14	85	214
16:15	0	0	0	0	6	52	3	61	18	16	**23**	**57**	12	**69**	**16**	**97**	**215**
16:30	0	0	0	0	6	62	**8**	76	**21**	22	9	52	**15**	57	12	84	212
16:45	0	0	0	0	1	67	8	76	9	13	13	35	14	47	15	76	187
Total Volume	0	0	0	0	20	248	26	294	64	73	55	192	55	230	57	342	828
% App. Total	0	0	0		6.8	84.4	8.8		33.3	38	28.6		16.1	67.3	16.7		
PHF	.000	.000	.000	.000	.714	.925	.813	.907	.762	.830	.598	.842	.917	.833	.891	.881	.963
Cars	0	0	0	0	19	242	26	287	64	73	55	192	55	212	22	289	768
% Cars	0	0	0	0	95.0	97.6	100	97.6	100	100	100	100	100	92.2	38.6	84.5	92.8
Trucks	0	0	0	0	1	6	0	7	0	0	0	0	0	18	35	53	60
% Trucks	0	0	0	0	5.0	2.4	0	2.4	0	0	0	0	0	7.8	61.4	15.5	7.2

Accurate Counts
978-664-2565

File Name : 10568006
Site Code : 10568006
Start Date : 5/5/2009
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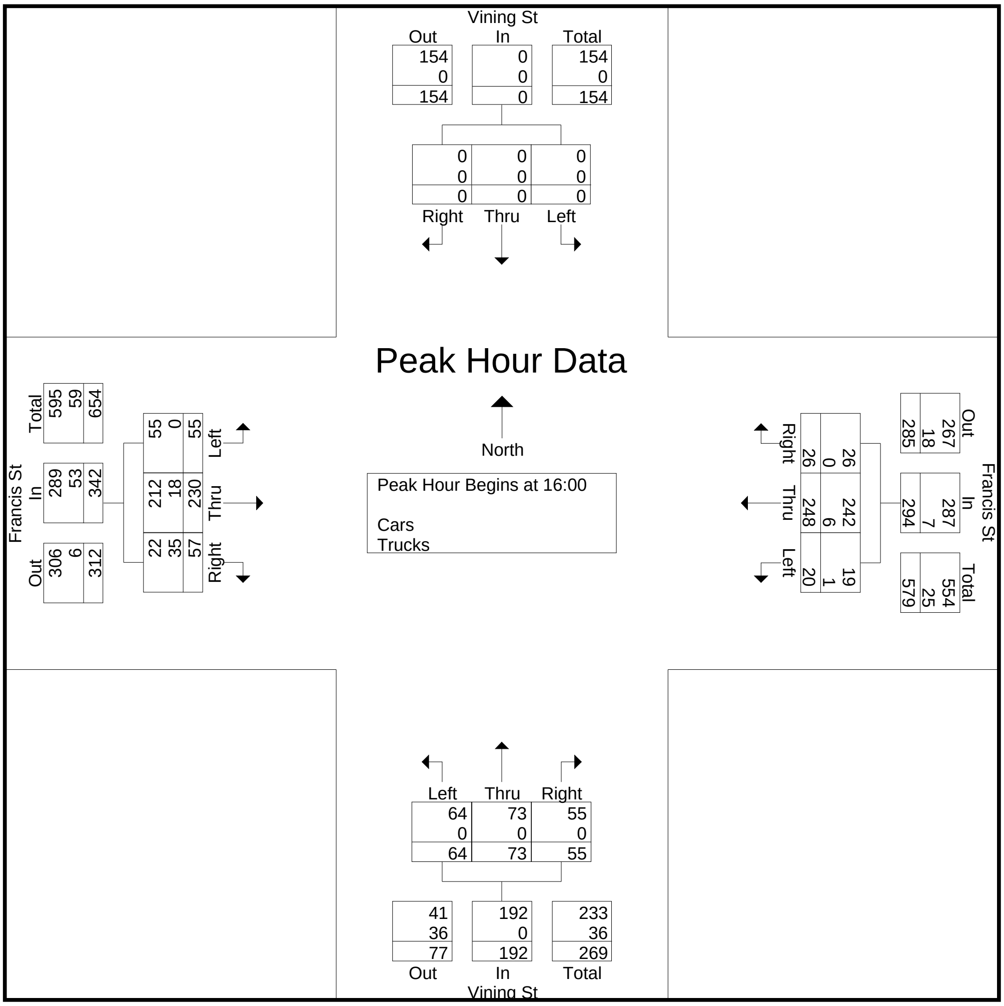

Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:00				16:30				16:00				17:00			
+0 mins.	0	0	0	0	**6**	62	8	76	16	**22**	10	48	7	**65**	14	86
+15 mins.	0	0	0	0	1	67	8	76	18	16	**23**	**57**	11	57	**21**	89
+30 mins.	0	0	0	0	4	57	9	70	**21**	22	9	52	11	58	15	84
+45 mins.	0	0	0	0	6	**68**	**10**	**84**	9	13	13	35	**20**	59	19	**98**
Total Volume	0	0	0	0	17	254	35	306	64	73	55	192	49	239	69	357
% App. Total	0	0	0		5.6	83	11.4		33.3	38	28.6		13.7	66.9	19.3	
PHF	.000	.000	.000	.000	.708	.934	.875	.911	.762	.830	.598	.842	.613	.919	.821	.911
Cars	0	0	0	0	16	249	35	300	64	73	55	192	49	216	38	303
% Cars	0	0	0	0	94.1	98	100	98	100	100	100	100	100	90.4	55.1	84.9
Trucks	0	0	0	0	1	5	0	6	0	0	0	0	0	23	31	54
% Trucks	0	0	0	0	5.9	2	0	2	0	0	0	0	0	9.6	44.9	15.1

Accurate Counts
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File Name : 10568006
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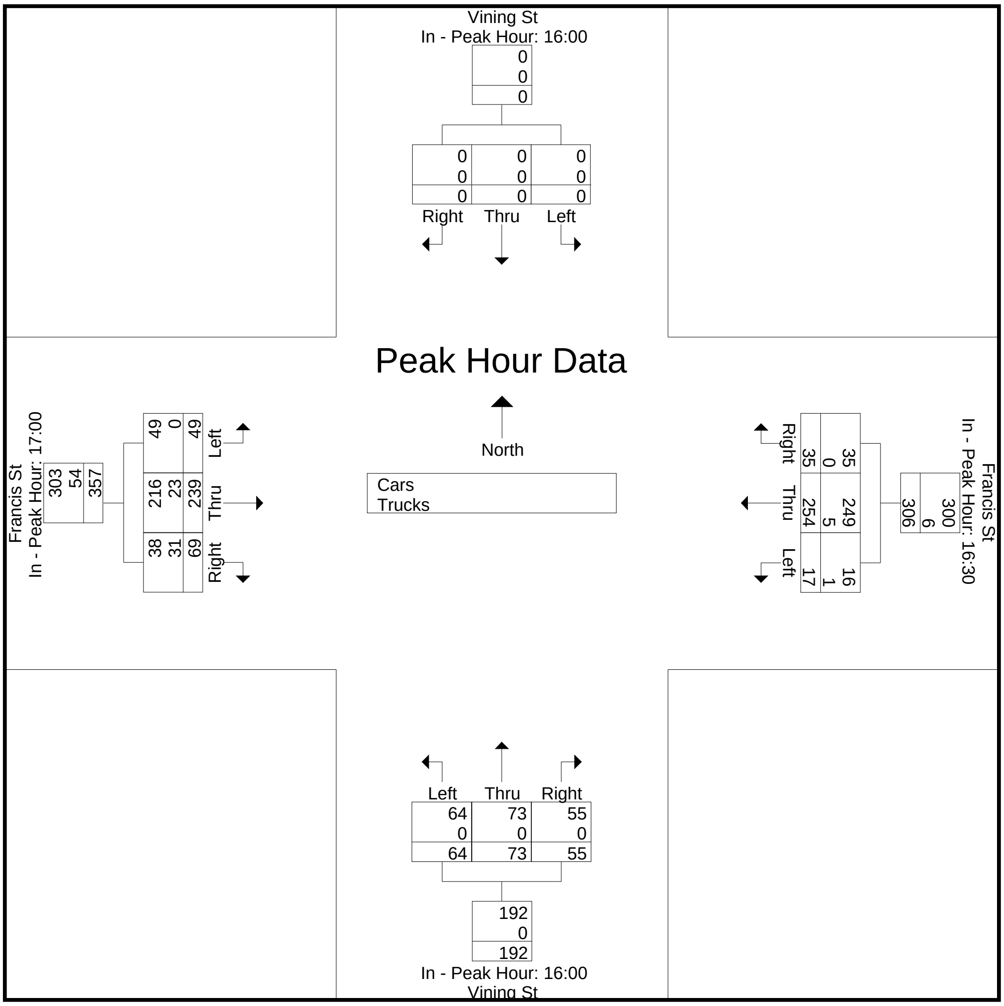


N/S Street : Vining Street
E/W Street: Francis Street
City/State : Boston, MA
Weather : Overcast

Accurate Counts
978-664-2565

File Name : 10568006
Site Code : 10568006
Start Date : 5/5/2009
Page No : 1

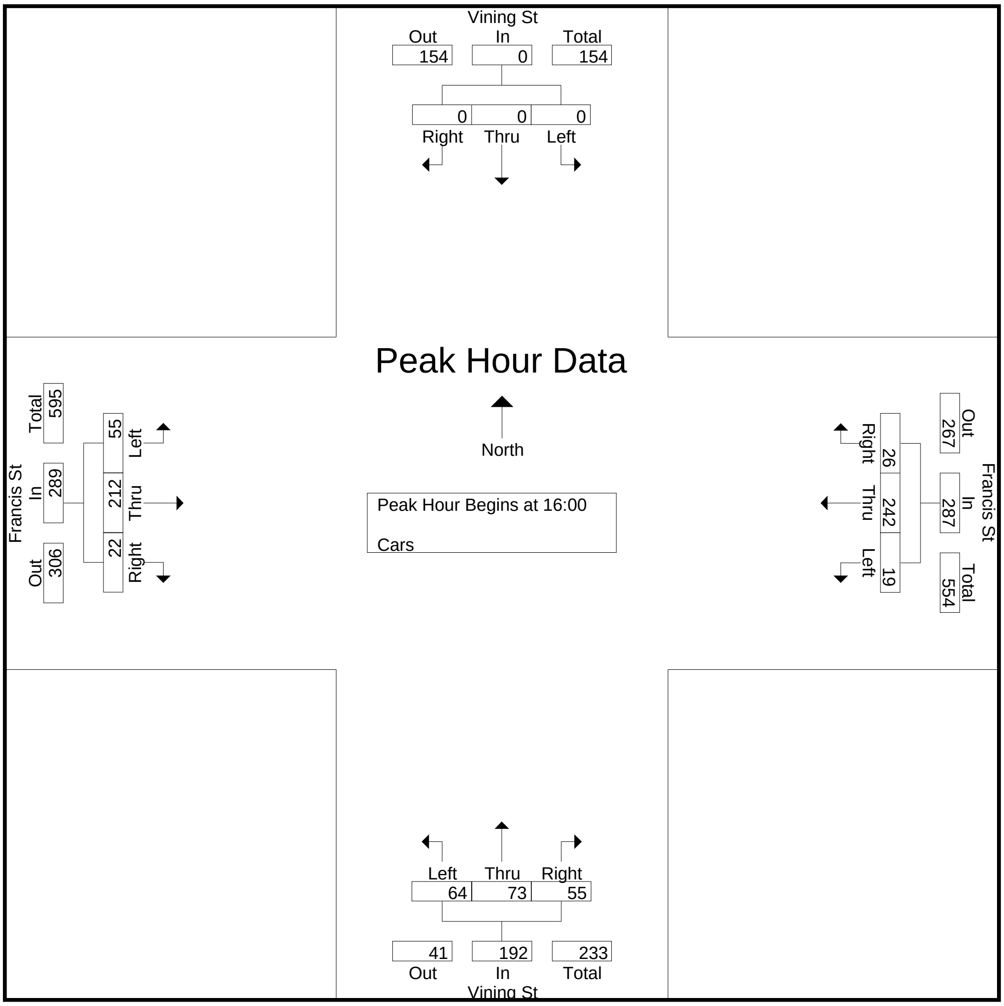
Groups Printed- Cars

	Vining St From North				Francis St From East				Vining St From South				Francis St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	0	0	0	1	7	65	7	14	16	22	10	9	14	55	5	69	93	201	294
16:15	0	0	0	29	5	52	3	11	18	16	23	4	12	61	7	91	135	197	332
16:30	0	0	0	18	6	61	8	14	21	22	9	10	15	54	4	67	109	200	309
16:45	0	0	0	11	1	64	8	7	9	13	13	13	14	42	6	88	119	170	289
Total	0	0	0	59	19	242	26	46	64	73	55	36	55	212	22	315	456	768	1224
17:00	0	0	0	22	4	57	9	11	22	10	12	17	7	60	8	73	123	189	312
17:15	0	0	0	20	5	67	10	8	22	15	7	10	11	50	12	87	125	199	324
17:30	0	0	0	13	3	42	6	9	31	13	8	5	11	54	7	56	83	175	258
17:45	0	0	0	13	9	45	11	10	18	10	9	5	20	52	11	44	72	185	257
Total	0	0	0	68	21	211	36	38	93	48	36	37	49	216	38	260	403	748	1151
Grand Total	0	0	0	127	40	453	62	84	157	121	91	73	104	428	60	575	859	1516	2375
Apprch %	0	0	0		7.2	81.6	11.2		42.5	32.8	24.7		17.6	72.3	10.1				
Total %	0	0	0		2.6	29.9	4.1		10.4	8	6		6.9	28.2	4		36.2	63.8	

	Vining St From North				Francis St From East				Vining St From South				Francis St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 16:00																	
16:00	0	0	0	0	**7**	**65**	7	**79**	16	**22**	10	48	14	55	5	74	**201**
16:15	0	0	0	0	5	52	3	60	18	16	**23**	**57**	12	**61**	**7**	**80**	197
16:30	0	0	0	0	6	61	**8**	75	**21**	22	9	52	**15**	54	4	73	200
16:45	0	0	0	0	1	64	8	73	9	13	13	35	14	42	6	62	170
Total Volume	0	0	0	0	19	242	26	287	64	73	55	192	55	212	22	289	768
% App. Total	0	0	0		6.6	84.3	9.1		33.3	38	28.6		19	73.4	7.6		
PHF	.000	.000	.000	.000	.679	.931	.813	.908	.762	.830	.598	.842	.917	.869	.786	.903	.955

Accurate Counts
978-664-2565

File Name : 10568006
Site Code : 10568006
Start Date : 5/5/2009
Page No : 2

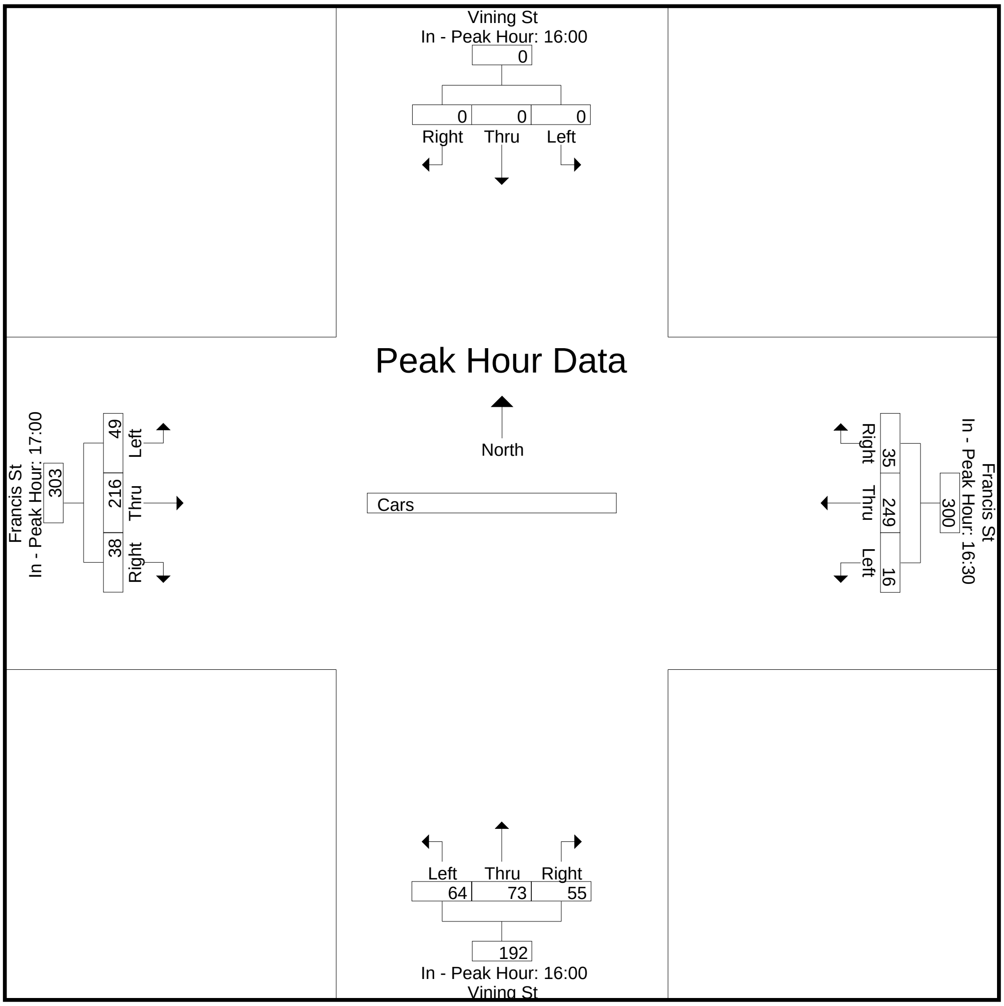


Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:00				16:30				16:00				17:00			
+0 mins.	0	0	0	0	**6**	61	8	75	16	**22**	10	48	7	**60**	8	75
+15 mins.	0	0	0	0	1	64	8	73	18	16	**23**	**57**	11	50	**12**	73
+30 mins.	0	0	0	0	4	57	9	70	**21**	22	9	52	11	54	7	72
+45 mins.	0	0	0	0	5	**67**	**10**	**82**	9	13	13	35	**20**	52	11	**83**
Total Volume	0	0	0	0	16	249	35	300	64	73	55	192	49	216	38	303
% App. Total	0	0	0		5.3	83	11.7		33.3	38	28.6		16.2	71.3	12.5	
PHF	.000	.000	.000	.000	.667	.929	.875	.915	.762	.830	.598	.842	.613	.900	.792	.913

Accurate Counts
978-664-2565

File Name : 10568006
Site Code : 10568006
Start Date : 5/5/2009
Page No : 3



N/S Street : Vining Street
E/W Street: Francis Street
City/State : Boston, MA
Weather : Overcast

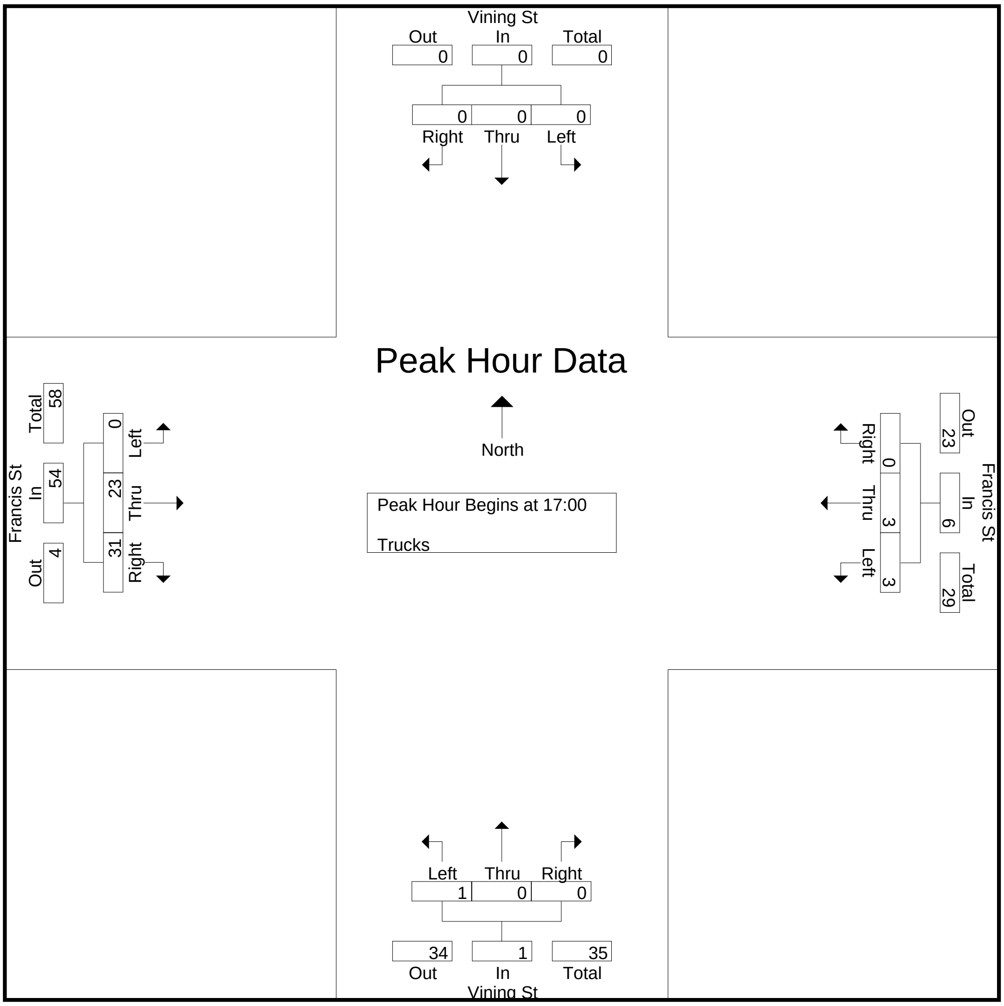
Accurate Counts
978-664-2565

File Name : 10568006
Site Code : 10568006
Start Date : 5/5/2009

Groups Printed- Trucks

	Vining St From North				Francis St From East				Vining St From South				Francis St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	0	0	0	0	0	2	0	0	0	0	0	0	0	2	9	0	0	13	13
16:15	0	0	0	0	1	0	0	0	0	0	0	0	0	8	9	0	0	18	18
16:30	0	0	0	0	0	1	0	0	0	0	0	0	0	3	8	0	0	12	12
16:45	0	0	0	0	0	3	0	0	0	0	0	0	0	5	9	0	0	17	17
Total	0	0	0	0	1	6	0	0	0	0	0	0	0	18	35	0	0	60	60
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	5	6	0	0	11	11
17:15	0	0	0	0	1	1	0	0	0	0	0	0	0	7	9	0	0	18	18
17:30	0	0	0	0	1	0	0	0	1	0	0	0	0	4	8	0	0	14	14
17:45	0	0	0	0	1	2	0	0	0	0	0	0	0	7	8	0	0	18	18
Total	0	0	0	0	3	3	0	0	1	0	0	0	0	23	31	0	0	61	61
Grand Total	0	0	0	0	4	9	0	0	1	0	0	0	0	41	66	0	0	121	121
Apprch %	0	0	0		30.8	69.2	0		100	0	0		0	38.3	61.7				
Total %	0	0	0		3.3	7.4	0		0.8	0	0		0	33.9	54.5		0	100	

	Vining St From North				Francis St From East				Vining St From South				Francis St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 17:00																	
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	5	6	11	11
17:15	0	0	0	0	**1**	1	0	2	0	0	0	0	0	**7**	**9**	**16**	**18**
17:30	0	0	0	0	1	0	0	1	**1**	0	0	**1**	0	4	8	12	14
17:45	0	0	0	0	1	**2**	0	**3**	0	0	0	0	0	7	8	15	18
Total Volume	0	0	0	0	3	3	0	6	1	0	0	1	0	23	31	54	61
% App. Total	0	0	0		50	50	0		100	0	0		0	42.6	57.4		
PHF	.000	.000	.000	.000	.750	.375	.000	.500	.250	.000	.000	.250	.000	.821	.861	.844	.847

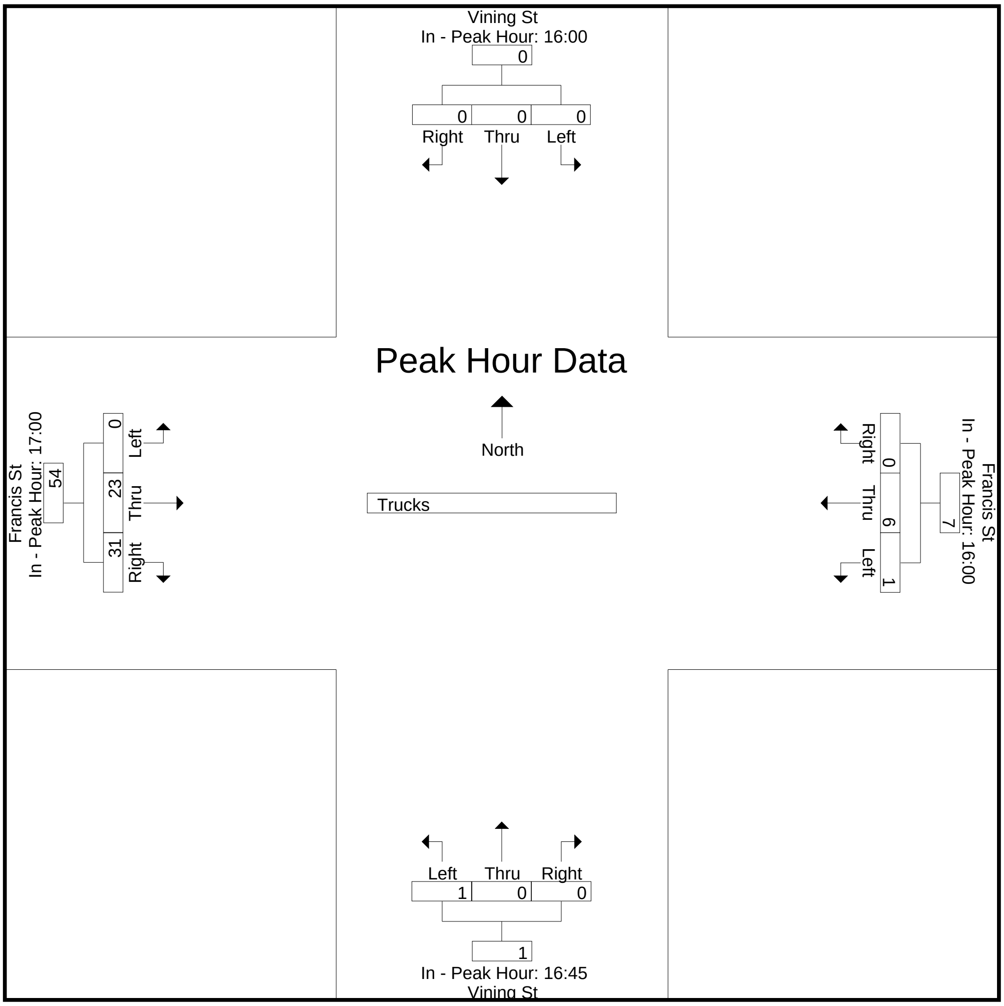


Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:00				16:00				16:45				17:00			
+0 mins.	0	0	0	0	0	2	0	2	0	0	0	0	0	5	6	11
+15 mins.	0	0	0	0	**1**	0	0	1	0	0	0	0	0	**7**	**9**	**16**
+30 mins.	0	0	0	0	0	1	0	1	0	0	0	0	0	4	8	12
+45 mins.	0	0	0	0	0	**3**	0	**3**	**1**	0	0	**1**	0	7	8	15
Total Volume	0	0	0	0	1	6	0	7	1	0	0	1	0	23	31	54
% App. Total	0	0	0		14.3	85.7	0		100	0	0		0	42.6	57.4	
PHF	.000	.000	.000	.000	.250	.500	.000	.583	.250	.000	.000	.250	.000	.821	.861	.844

Accurate Counts
978-664-2565

File Name : 10568006
Site Code : 10568006
Start Date : 5/5/2009
Page No : 3



Accurate Counts
978-664-2565

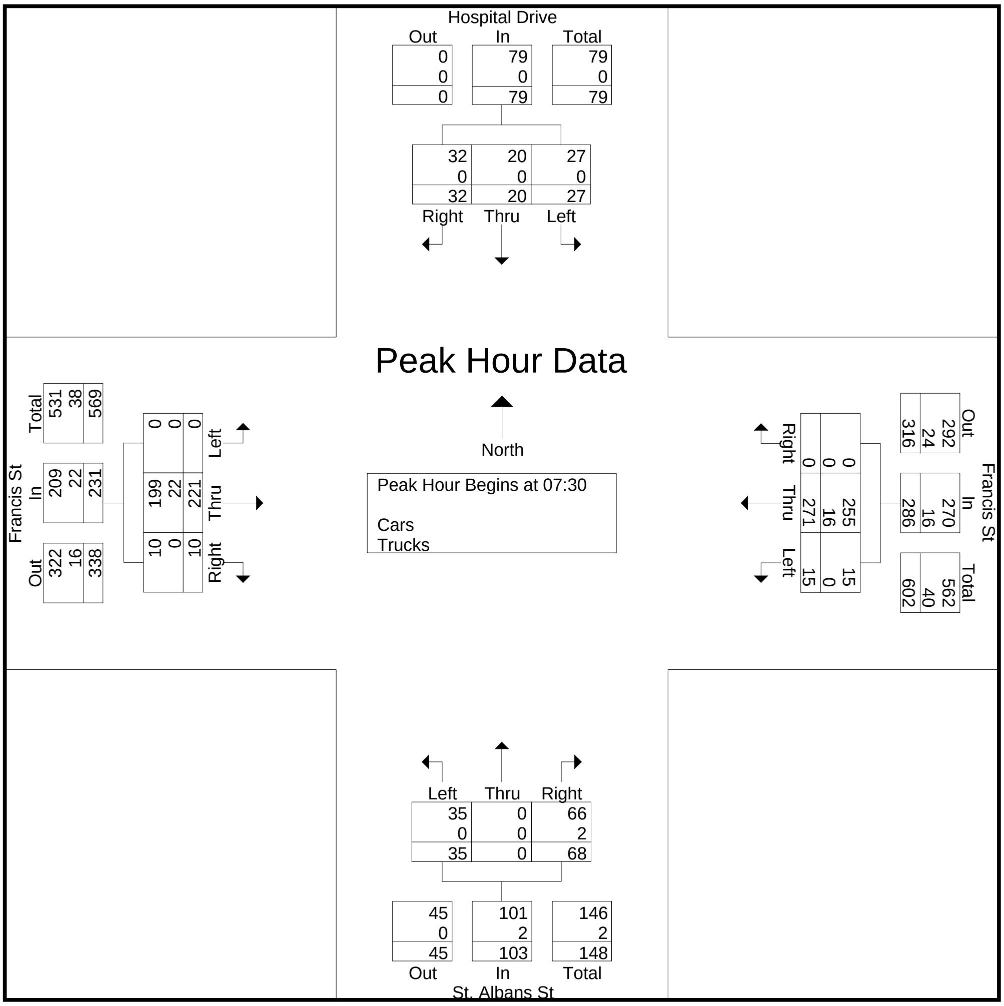
N/S Street : St. Albans Street
E/W Street: Francis Street
City/State : Boston, MA
Weather : Overcast

File Name : 10568007
Site Code : 10568007
Start Date : 5/5/2009
Page No : 1

Groups Printed- Cars - Trucks

	Hospital Drive From North				Francis St From East				St. Albans St From South				Francis St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	3	2	3	63	7	63	0	14	10	0	14	8	0	54	5	7	92	161	253
07:15	5	1	4	24	3	46	0	8	11	0	16	6	0	38	0	7	45	124	169
07:30	3	2	5	60	3	83	0	23	3	0	25	4	0	74	5	4	91	203	294
07:45	6	5	8	53	5	68	0	16	10	0	19	9	0	52	0	9	87	173	260
Total	17	10	20	200	18	260	0	61	34	0	74	27	0	218	10	27	315	661	976
08:00	6	9	11	48	3	60	0	12	9	0	11	16	0	53	2	6	82	164	246
08:15	12	4	8	56	4	60	0	17	13	0	13	15	0	42	3	3	91	159	250
08:30	11	4	12	25	5	75	0	13	11	0	20	16	0	56	2	2	56	196	252
08:45	13	9	7	31	3	71	0	18	15	0	15	16	0	41	2	2	67	176	243
Total	42	26	38	160	15	266	0	60	48	0	59	63	0	192	9	13	296	695	991
Grand Total	59	36	58	360	33	526	0	121	82	0	133	90	0	410	19	40	611	1356	1967
Apprch %	38.6	23.5	37.9		5.9	94.1	0		38.1	0	61.9		0	95.6	4.4				
Total %	4.4	2.7	4.3		2.4	38.8	0		6	0	9.8		0	30.2	1.4		31.1	68.9	
Cars	59	36	58		33	492	0		81	0	128		0	375	19		0	0	1892
% Cars	100	100	100	100	100	93.5	0	100	98.8	0	96.2	100	0	91.5	100	100	0	0	96.2
Trucks	0	0	0		0	34	0		1	0	5		0	35	0		0	0	75
% Trucks	0	0	0	0	0	6.5	0	0	1.2	0	3.8	0	0	8.5	0	0	0	0	3.8

	Hospital Drive From North				Francis St From East				St. Albans St From South				Francis St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:30																	
07:30	3	2	5	10	3	**83**	0	**86**	3	0	**25**	28	0	**74**	**5**	**79**	**203**
07:45	6	5	8	19	**5**	68	0	73	10	0	19	**29**	0	52	0	52	173
08:00	6	**9**	**11**	**26**	3	60	0	63	9	0	11	20	0	53	2	55	164
08:15	**12**	4	8	24	4	60	0	64	**13**	0	13	26	0	42	3	45	159
Total Volume	27	20	32	79	15	271	0	286	35	0	68	103	0	221	10	231	699
% App. Total	34.2	25.3	40.5		5.2	94.8	0		34	0	66		0	95.7	4.3		
PHF	.563	.556	.727	.760	.750	.816	.000	.831	.673	.000	.680	.888	.000	.747	.500	.731	.861
Cars	27	20	32	79	15	255	0	270	35	0	66	101	0	199	10	209	659
% Cars	100	100	100	100	100	94.1	0	94.4	100	0	97.1	98.1	0	90.0	100	90.5	94.3
Trucks	0	0	0	0	0	16	0	16	0	0	2	2	0	22	0	22	40
% Trucks	0	0	0	0	0	5.9	0	5.6	0	0	2.9	1.9	0	10.0	0	9.5	5.7



Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	08:00				07:30				07:00				07:30			
+0 mins.	6	**9**	11	26	3	**83**	0	**86**	10	0	14	24	0	**74**	**5**	**79**
+15 mins.	12	4	8	24	**5**	68	0	73	**11**	0	16	27	0	52	0	52
+30 mins.	11	4	**12**	27	3	60	0	63	3	0	**25**	28	0	53	2	55
+45 mins.	**13**	9	7	**29**	4	60	0	64	10	0	19	**29**	0	42	3	45
Total Volume	42	26	38	106	15	271	0	286	34	0	74	108	0	221	10	231
% App. Total	39.6	24.5	35.8		5.2	94.8	0		31.5	0	68.5		0	95.7	4.3	
PHF	.808	.722	.792	.914	.750	.816	.000	.831	.773	.000	.740	.931	.000	.747	.500	.731
Cars	42	26	38	106	15	255	0	270	34	0	74	108	0	199	10	209
% Cars	100	100	100	100	100	94.1	0	94.4	100	0	100	100	0	90	100	90.5
Trucks	0	0	0	0	0	16	0	16	0	0	0	0	0	22	0	22
% Trucks	0	0	0	0	0	5.9	0	5.6	0	0	0	0	0	10	0	9.5

Accurate Counts
978-664-2565

File Name : 10568007
Site Code : 10568007
Start Date : 5/5/2009
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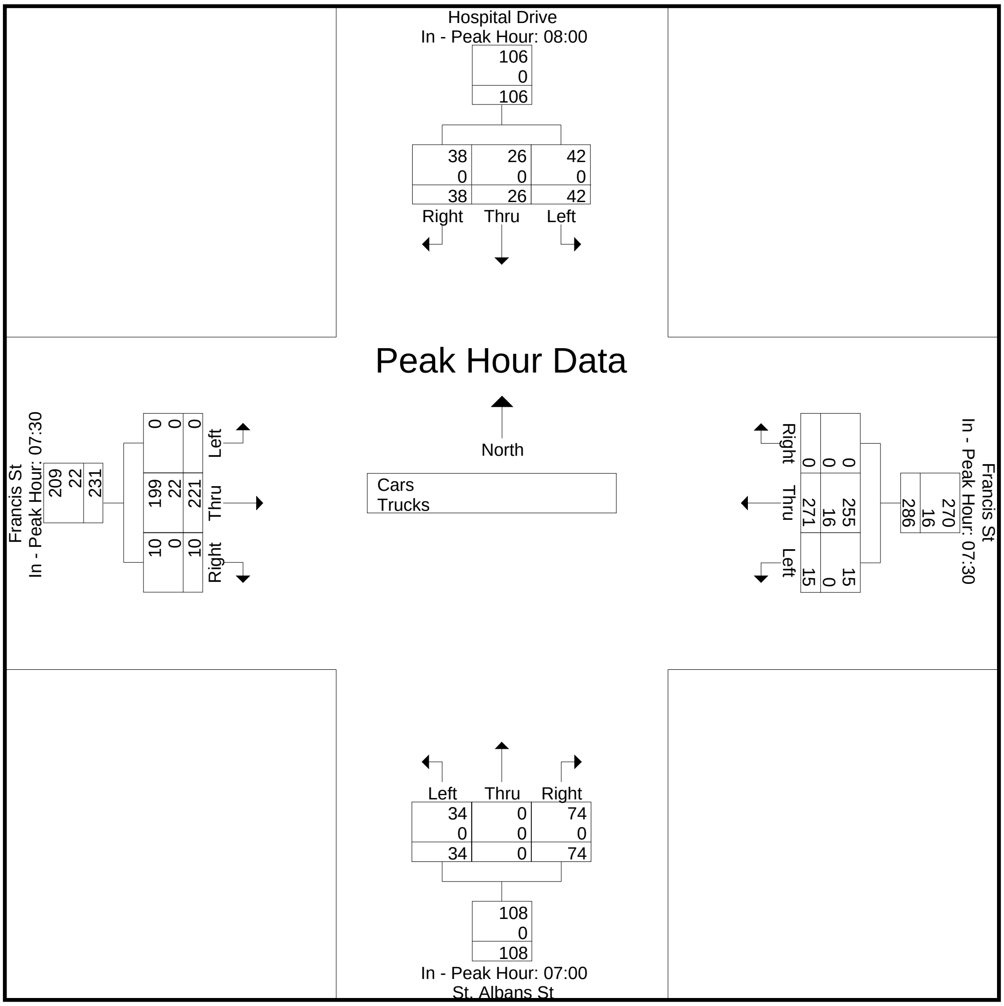


Accurate Counts
978-664-2565

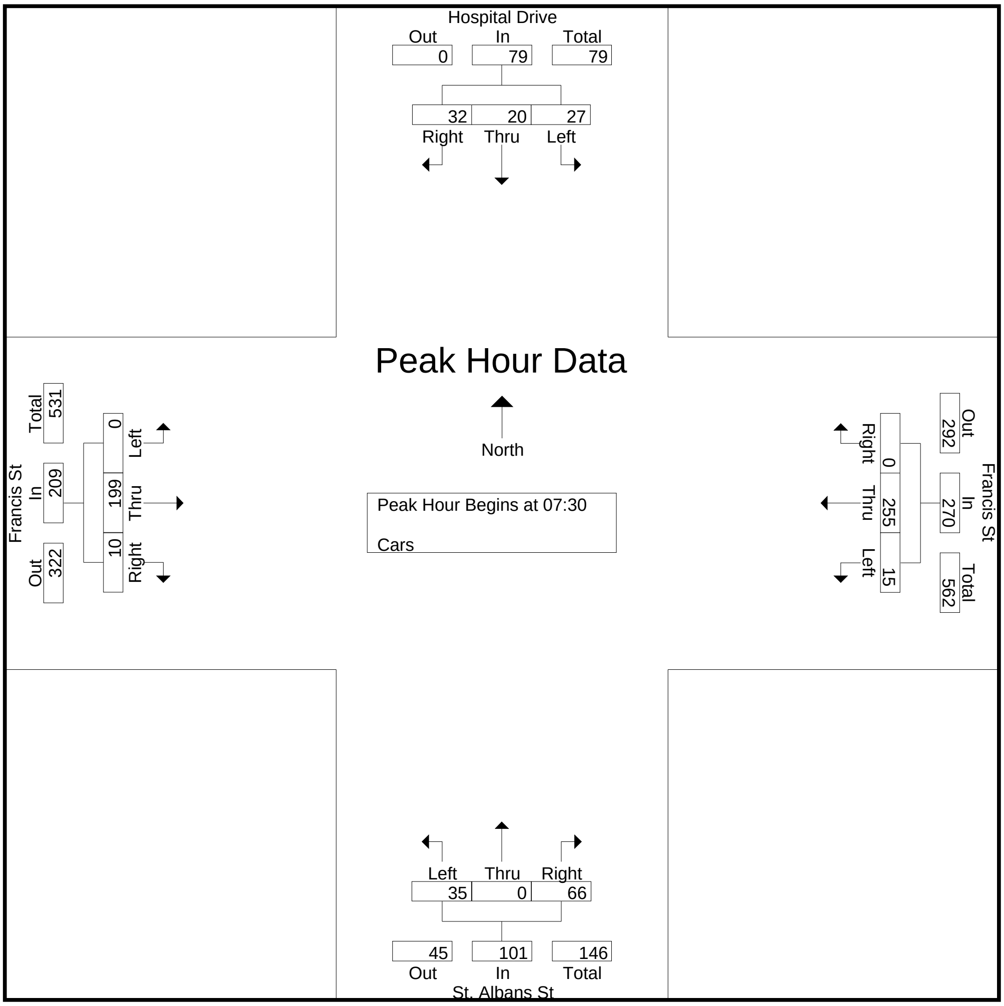
N/S Street : St. Albans Street
E/W Street: Francis Street
City/State : Boston, MA
Weather : Overcast

File Name : 10568007
Site Code : 10568007
Start Date : 5/5/2009
Page No : 1

Groups Printed- Cars

	Hospital Drive From North				Francis St From East				St. Albans St From South				Francis St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	3	2	3	63	7	59	0	14	10	0	14	8	0	52	5	7	92	155	247
07:15	5	1	4	24	3	43	0	8	11	0	16	6	0	37	0	7	45	120	165
07:30	3	2	5	60	3	79	0	23	3	0	25	4	0	69	5	4	91	194	285
07:45	6	5	8	53	5	62	0	16	10	0	19	9	0	48	0	9	87	163	250
Total	17	10	20	200	18	243	0	61	34	0	74	27	0	206	10	27	315	632	947
08:00	6	9	11	48	3	57	0	12	9	0	9	16	0	45	2	6	82	151	233
08:15	12	4	8	56	4	57	0	17	13	0	13	15	0	37	3	3	91	151	242
08:30	11	4	12	25	5	68	0	13	11	0	19	16	0	51	2	2	56	183	239
08:45	13	9	7	31	3	67	0	18	14	0	13	16	0	36	2	2	67	164	231
Total	42	26	38	160	15	249	0	60	47	0	54	63	0	169	9	13	296	649	945
Grand Total	59	36	58	360	33	492	0	121	81	0	128	90	0	375	19	40	611	1281	1892
Apprch %	38.6	23.5	37.9		6.3	93.7	0		38.8	0	61.2		0	95.2	4.8				
Total %	4.6	2.8	4.5		2.6	38.4	0		6.3	0	10		0	29.3	1.5		32.3	67.7	

	Hospital Drive From North				Francis St From East				St. Albans St From South				Francis St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:30																	
07:30	3	2	5	10	3	**79**	0	**82**	3	0	**25**	28	0	**69**	**5**	**74**	**194**
07:45	6	5	8	19	**5**	62	0	67	10	0	19	**29**	0	48	0	48	163
08:00	6	**9**	**11**	**26**	3	57	0	60	9	0	9	18	0	45	2	47	151
08:15	**12**	4	8	24	4	57	0	61	**13**	0	13	26	0	37	3	40	151
Total Volume	27	20	32	79	15	255	0	270	35	0	66	101	0	199	10	209	659
% App. Total	34.2	25.3	40.5		5.6	94.4	0		34.7	0	65.3		0	95.2	4.8		
PHF	.563	.556	.727	.760	.750	.807	.000	.823	.673	.000	.660	.871	.000	.721	.500	.706	.849



Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	08:00				07:30				07:00				07:00			
+0 mins.	6	**9**	11	26	3	**79**	0	**82**	10	0	14	24	0	52	**5**	57
+15 mins.	12	4	8	24	**5**	62	0	67	**11**	0	16	27	0	37	0	37
+30 mins.	11	4	**12**	27	3	57	0	60	3	0	**25**	28	0	**69**	5	**74**
+45 mins.	**13**	9	7	**29**	4	57	0	61	10	0	19	**29**	0	48	0	48
Total Volume	42	26	38	106	15	255	0	270	34	0	74	108	0	206	10	216
% App. Total	39.6	24.5	35.8		5.6	94.4	0		31.5	0	68.5		0	95.4	4.6	
PHF	.808	.722	.792	.914	.750	.807	.000	.823	.773	.000	.740	.931	.000	.746	.500	.730

Accurate Counts
978-664-2565

File Name : 10568007
Site Code : 10568007
Start Date : 5/5/2009
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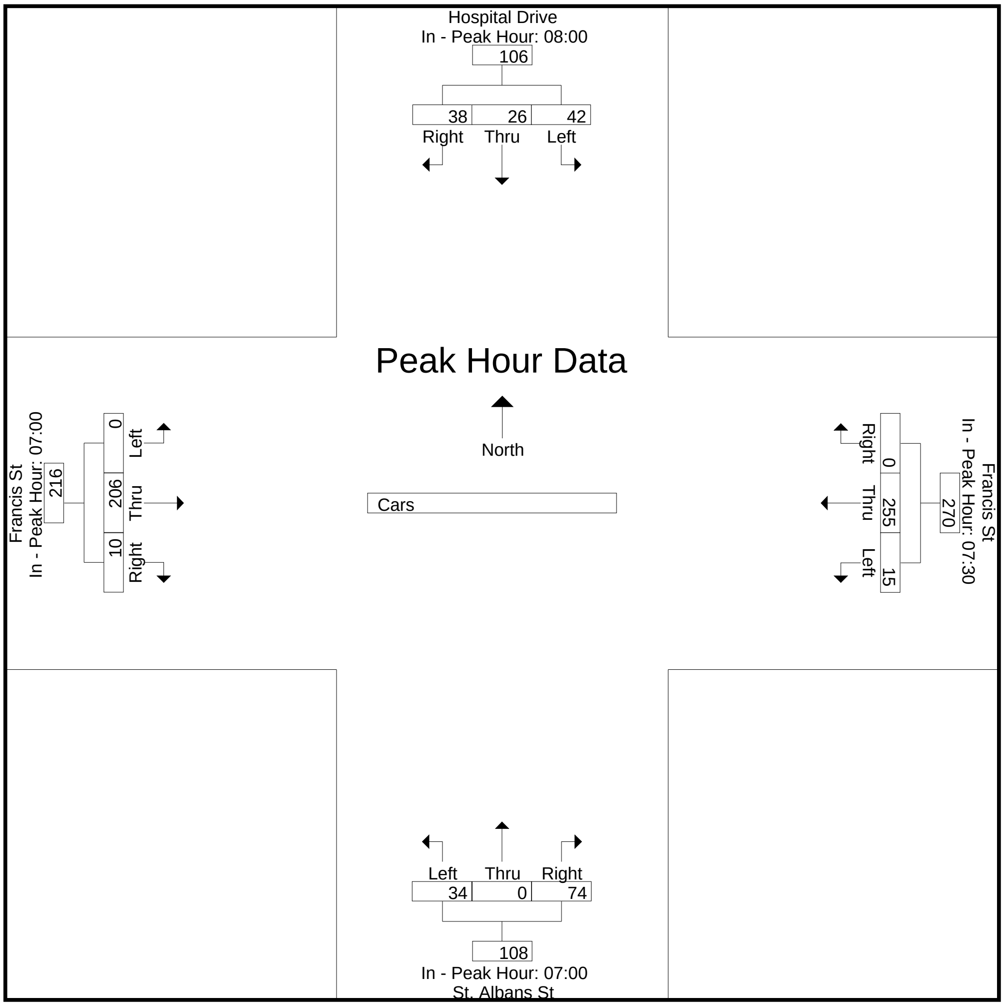


N/S Street : St. Albans Street
E/W Street: Francis Street
City/State : Boston, MA
Weather : Overcast

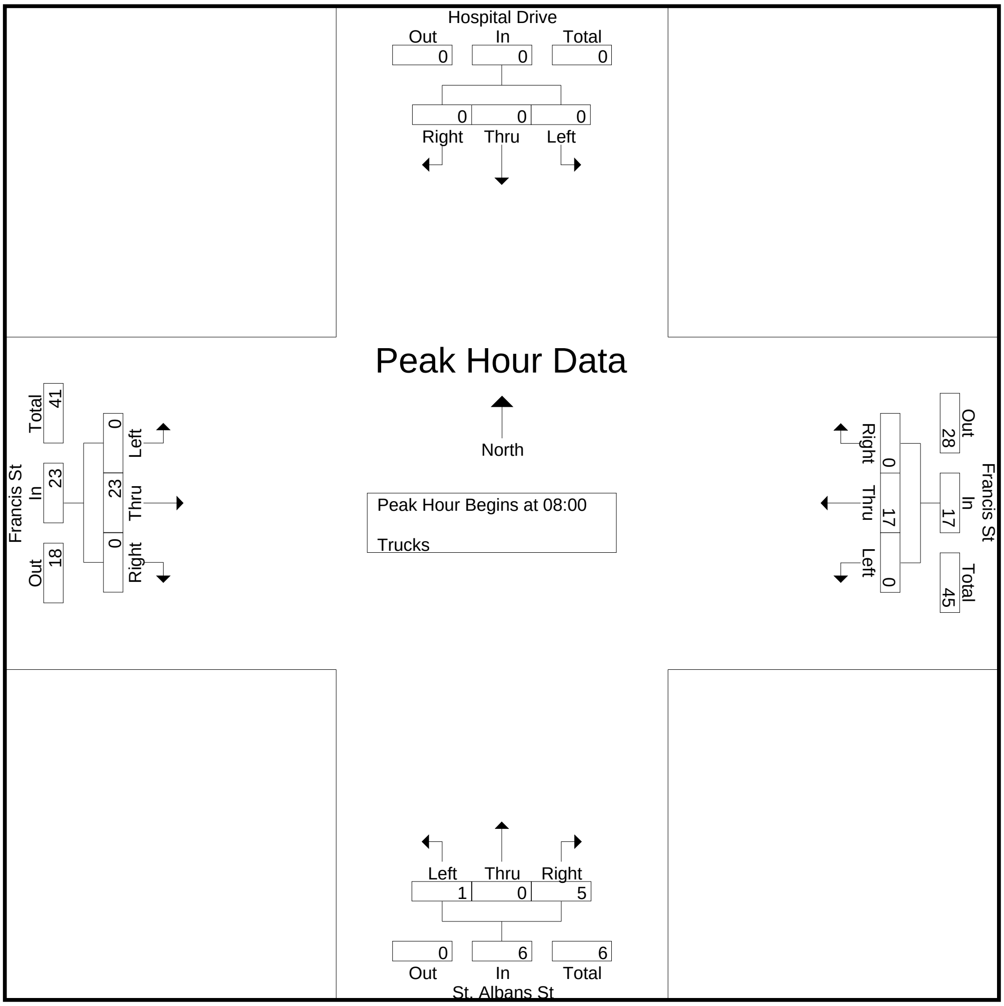
Accurate Counts
978-664-2565

File Name : 10568007
Site Code : 10568007
Start Date : 5/5/2009
Page No : 1

Groups Printed- Trucks

	Hospital Drive From North				Francis St From East				St. Albans St From South				Francis St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	0	0	0	0	0	4	0	0	0	0	0	0	0	2	0	0	0	6	6
07:15	0	0	0	0	0	3	0	0	0	0	0	0	0	1	0	0	0	4	4
07:30	0	0	0	0	0	4	0	0	0	0	0	0	0	5	0	0	0	9	9
07:45	0	0	0	0	0	6	0	0	0	0	0	0	0	4	0	0	0	10	10
Total	0	0	0	0	0	17	0	0	0	0	0	0	0	12	0	0	0	29	29
08:00	0	0	0	0	0	3	0	0	0	0	2	0	0	8	0	0	0	13	13
08:15	0	0	0	0	0	3	0	0	0	0	0	0	0	5	0	0	0	8	8
08:30	0	0	0	0	0	7	0	0	0	0	1	0	0	5	0	0	0	13	13
08:45	0	0	0	0	0	4	0	0	1	0	2	0	0	5	0	0	0	12	12
Total	0	0	0	0	0	17	0	0	1	0	5	0	0	23	0	0	0	46	46
Grand Total	0	0	0	0	0	34	0	0	1	0	5	0	0	35	0	0	0	75	75
Apprch %	0	0	0		0	100	0		16.7	0	83.3		0	100	0				
Total %	0	0	0		0	45.3	0		1.3	0	6.7		0	46.7	0		0	100	

	Hospital Drive From North				Francis St From East				St. Albans St From South				Francis St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 08:00																	
08:00	0	0	0	0	0	3	0	3	0	0	**2**	2	0	**8**	0	**8**	**13**
08:15	0	0	0	0	0	3	0	3	0	0	0	0	0	5	0	5	8
08:30	0	0	0	0	0	**7**	0	**7**	0	0	1	1	0	5	0	5	13
08:45	0	0	0	0	0	4	0	4	**1**	0	2	**3**	0	5	0	5	12
Total Volume	0	0	0	0	0	17	0	17	1	0	5	6	0	23	0	23	46
% App. Total	0	0	0		0	100	0		16.7	0	83.3		0	100	0		
PHF	.000	.000	.000	.000	.000	.607	.000	.607	.250	.000	.625	.500	.000	.719	.000	.719	.885



Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:00				07:45				08:00				08:00			
+0 mins.	0	0	0	0	0	6	0	6	0	0	**2**	2	0	**8**	0	**8**
+15 mins.	0	0	0	0	0	3	0	3	0	0	0	0	0	5	0	5
+30 mins.	0	0	0	0	0	3	0	3	0	0	1	1	0	5	0	5
+45 mins.	0	0	0	0	0	**7**	0	**7**	**1**	0	2	**3**	0	5	0	5
Total Volume	0	0	0	0	0	19	0	19	1	0	5	6	0	23	0	23
% App. Total	0	0	0		0	100	0		16.7	0	83.3		0	100	0	
PHF	.000	.000	.000	.000	.000	.679	.000	.679	.250	.000	.625	.500	.000	.719	.000	.719

Accurate Counts
978-664-2565

File Name : 10568007
Site Code : 10568007
Start Date : 5/5/2009
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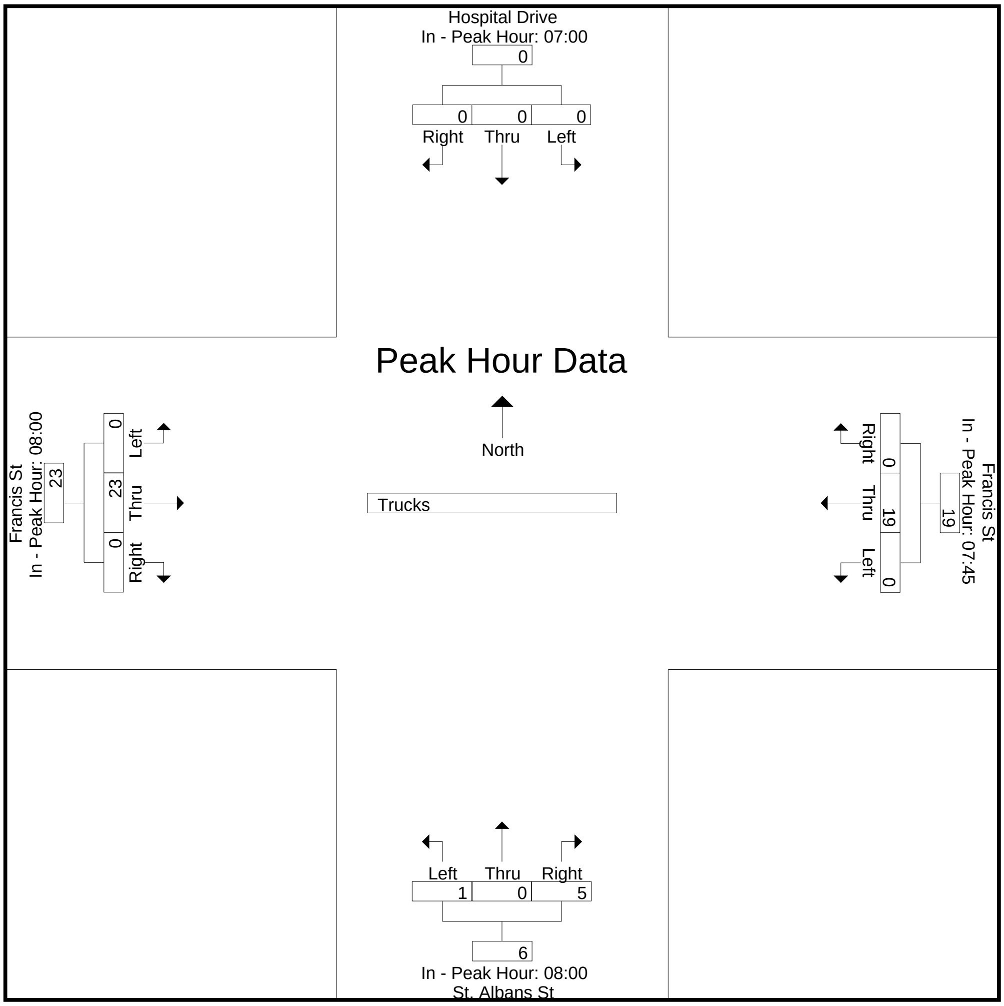


N/S Street : St. Albans Street
E/W Street: Francis Street
City/State : Boston, MA
Weather : Overcast

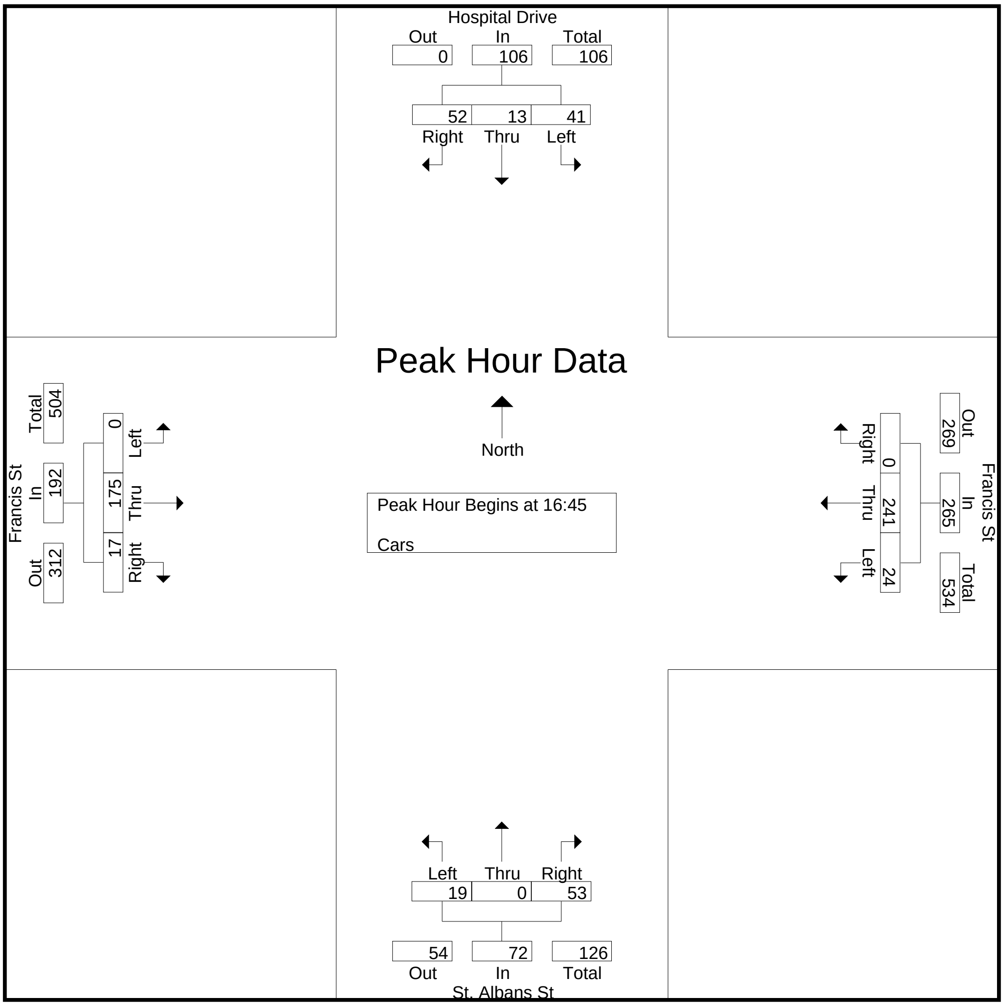
Accurate Counts
978-664-2565

File Name : 10568007
Site Code : 10568007
Start Date : 5/5/2009
Page No : 1

Groups Printed- Cars

	Hospital Drive From North				Francis St From East				St. Albans St From South				Francis St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	12	7	21	31	1	60	0	8	6	0	12	13	0	45	6	7	59	170	229
16:15	12	11	12	27	2	47	0	9	6	0	8	25	0	32	5	6	67	135	202
16:30	11	5	18	35	3	39	0	10	9	0	7	15	0	42	11	7	67	145	212
16:45	12	4	16	25	6	74	0	6	3	0	8	17	0	31	1	7	55	155	210
Total	47	27	67	118	12	220	0	33	24	0	35	70	0	150	23	27	248	605	853
17:00	10	4	13	21	6	55	0	15	8	0	17	32	0	46	7	6	74	166	240
17:15	7	4	14	18	5	62	0	16	6	0	17	20	0	47	4	2	56	166	222
17:30	12	1	9	26	7	50	0	6	2	0	11	13	0	51	5	3	48	148	196
17:45	9	0	4	26	3	57	0	6	2	0	14	6	0	48	2	2	40	139	179
Total	38	9	40	91	21	224	0	43	18	0	59	71	0	192	18	13	218	619	837
Grand Total	85	36	107	209	33	444	0	76	42	0	94	141	0	342	41	40	466	1224	1690
Apprch %	37.3	15.8	46.9		6.9	93.1	0		30.9	0	69.1		0	89.3	10.7				
Total %	6.9	2.9	8.7		2.7	36.3	0		3.4	0	7.7		0	27.9	3.3		27.6	72.4	

	Hospital Drive From North				Francis St From East				St. Albans St From South				Francis St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 16:45																	
16:45	**12**	**4**	**16**	**32**	6	**74**	0	**80**	3	0	8	11	0	31	1	32	155
17:00	10	4	13	27	6	55	0	61	**8**	0	**17**	**25**	0	46	**7**	53	**166**
17:15	7	4	14	25	5	62	0	67	6	0	17	23	0	47	4	51	166
17:30	12	1	9	22	**7**	50	0	57	2	0	11	13	0	**51**	5	**56**	148
Total Volume	41	13	52	106	24	241	0	265	19	0	53	72	0	175	17	192	635
% App. Total	38.7	12.3	49.1		9.1	90.9	0		26.4	0	73.6		0	91.1	8.9		
PHF	.854	.813	.813	.828	.857	.814	.000	.828	.594	.000	.779	.720	.000	.858	.607	.857	.956

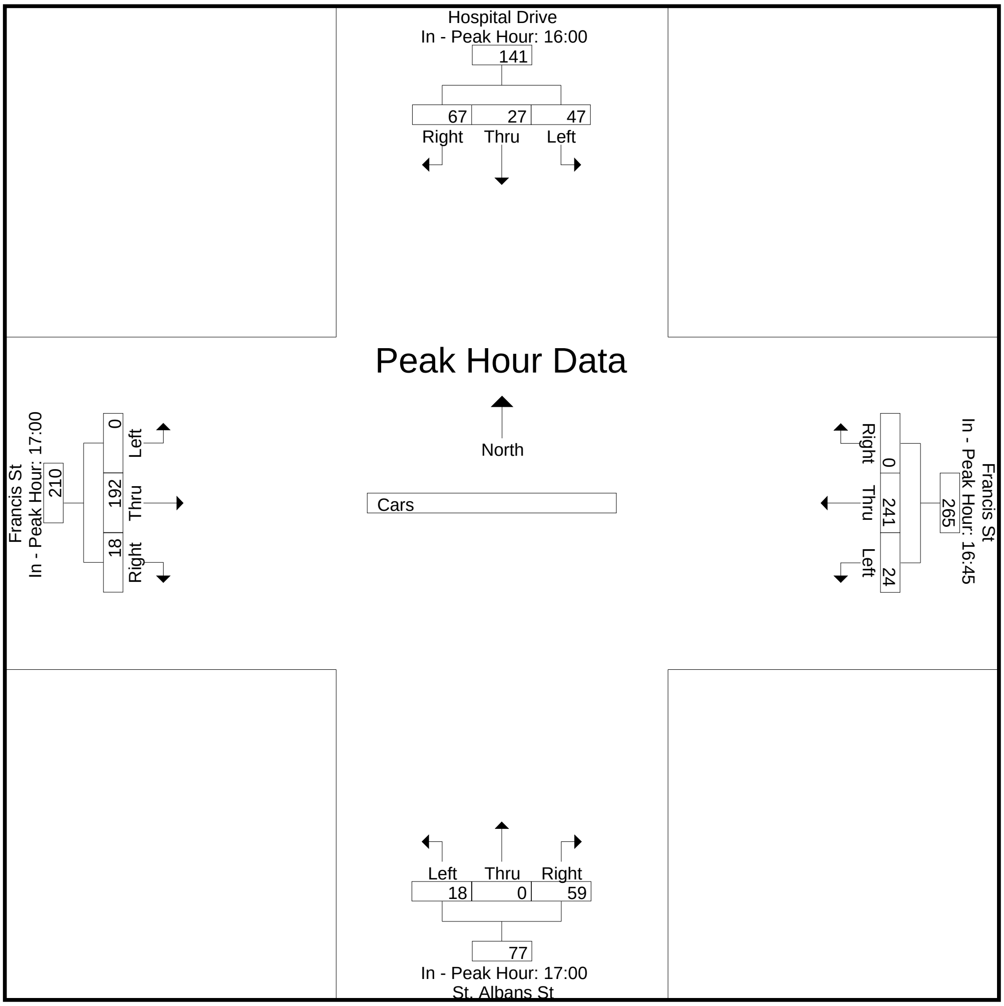


Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:00				16:45				17:00				17:00			
+0 mins.	**12**	7	**21**	**40**	6	**74**	0	**80**	**8**	0	**17**	**25**	0	46	**7**	53
+15 mins.	12	**11**	12	35	6	55	0	61	6	0	17	23	0	47	4	51
+30 mins.	11	5	18	34	5	62	0	67	2	0	11	13	0	**51**	5	**56**
+45 mins.	12	4	16	32	**7**	50	0	57	2	0	14	16	0	48	2	50
Total Volume	47	27	67	141	24	241	0	265	18	0	59	77	0	192	18	210
% App. Total	33.3	19.1	47.5		9.1	90.9	0		23.4	0	76.6		0	91.4	8.6	
PHF	.979	.614	.798	.881	.857	.814	.000	.828	.563	.000	.868	.770	.000	.941	.643	.938

Accurate Counts
978-664-2565

File Name : 10568007
Site Code : 10568007
Start Date : 5/5/2009
Page No : 3



N/S Street : St. Albans Street
E/W Street: Francis Street
City/State : Boston, MA
Weather : Overcast

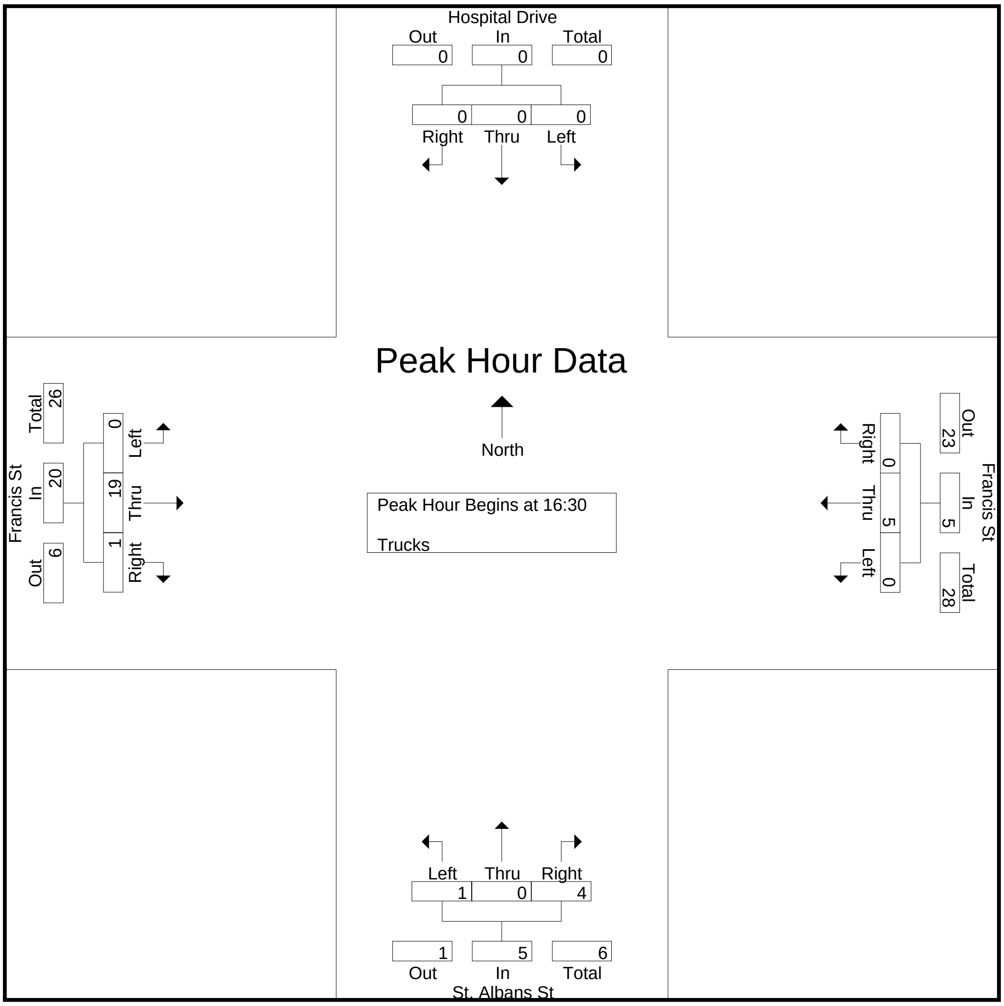
Accurate Counts
978-664-2565

File Name : 10568007
Site Code : 10568007
Start Date : 5/5/2009
Page No : 1

Groups Printed- Trucks

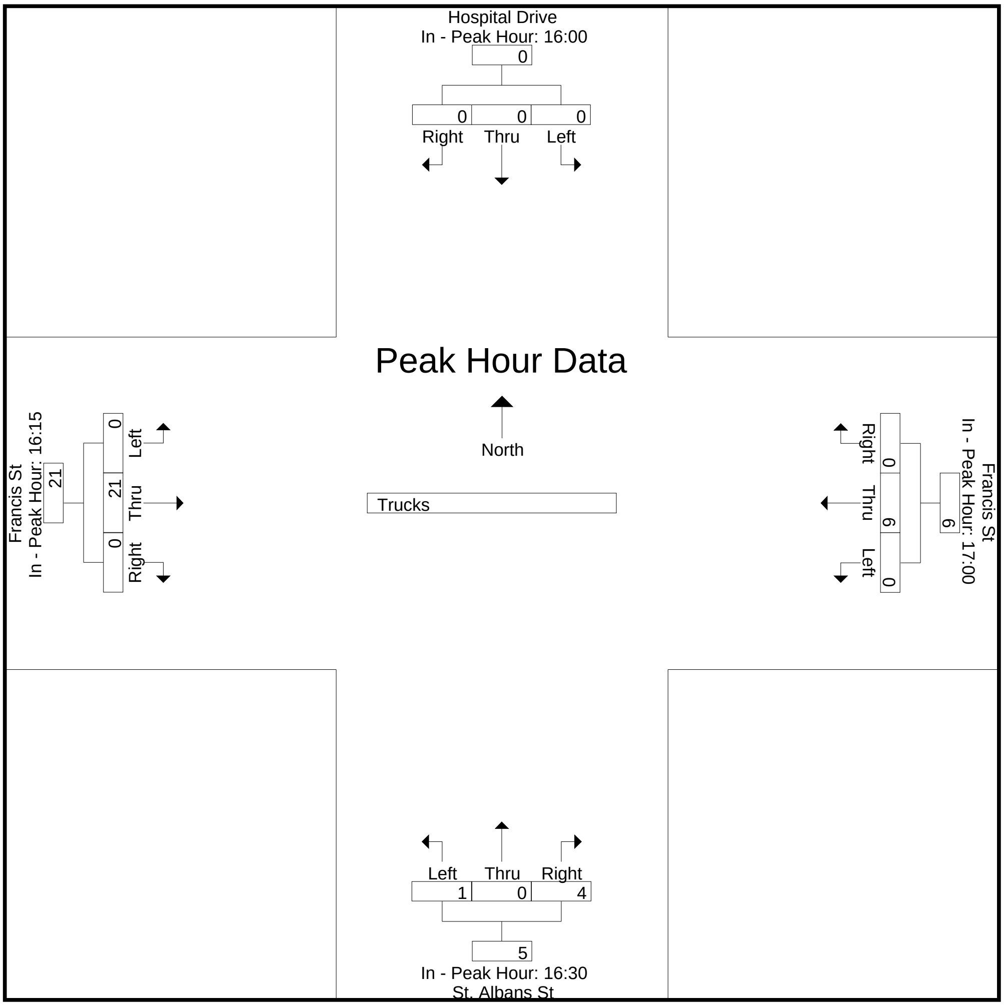
	Hospital Drive From North				Francis St From East				St. Albans St From South				Francis St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	0	0	0	0	0	1	0	0	0	0	0	0	0	3	0	0	0	4	4
16:15	0	0	0	0	1	1	0	0	0	0	1	0	0	7	0	0	0	10	10
16:30	0	0	0	0	0	1	0	0	1	0	1	0	0	4	0	0	0	7	7
16:45	0	0	0	0	0	1	0	0	0	0	0	0	0	4	0	0	0	5	5
Total	0	0	0	0	1	4	0	0	1	0	2	0	0	18	0	0	0	26	26
17:00	0	0	0	0	0	1	0	0	0	0	0	0	0	6	0	0	0	7	7
17:15	0	0	0	0	0	2	0	0	0	0	3	0	0	5	1	0	0	11	11
17:30	0	0	0	0	0	1	0	0	0	0	0	0	0	3	0	0	0	4	4
17:45	0	0	0	0	0	2	0	0	0	0	0	0	0	5	0	0	0	7	7
Total	0	0	0	0	0	6	0	0	0	0	3	0	0	19	1	0	0	29	29
Grand Total	0	0	0	0	1	10	0	0	1	0	5	0	0	37	1	0	0	55	55
Apprch %	0	0	0		9.1	90.9	0		16.7	0	83.3		0	97.4	2.6				
Total %	0	0	0		1.8	18.2	0		1.8	0	9.1		0	67.3	1.8		0	100	

	Hospital Drive From North				Francis St From East				St. Albans St From South				Francis St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 16:30																	
16:30	0	0	0	0	0	1	0	1	**1**	0	1	2	0	4	0	4	7
16:45	0	0	0	0	0	1	0	1	0	0	0	0	0	4	0	4	5
17:00	0	0	0	0	0	1	0	1	0	0	0	0	0	**6**	0	**6**	7
17:15	0	0	0	0	0	**2**	0	**2**	0	0	**3**	**3**	0	5	**1**	6	**11**
Total Volume	0	0	0	0	0	5	0	5	1	0	4	5	0	19	1	20	30
% App. Total	0	0	0		0	100	0		20	0	80		0	95	5		
PHF	.000	.000	.000	.000	.000	.625	.000	.625	.250	.000	.333	.417	.000	.792	.250	.833	.682



Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:00				17:00				16:30				16:15			
+0 mins.	0	0	0	0	0	1	0	1	**1**	0	1	2	0	**7**	0	**7**
+15 mins.	0	0	0	0	0	**2**	0	**2**	0	0	0	0	0	4	0	4
+30 mins.	0	0	0	0	0	1	0	1	0	0	0	0	0	4	0	4
+45 mins.	0	0	0	0	0	2	0	2	0	0	**3**	**3**	0	6	0	6
Total Volume	0	0	0	0	0	6	0	6	1	0	4	5	0	21	0	21
% App. Total	0	0	0		0	100	0		20	0	80		0	100	0	
PHF	.000	.000	.000	.000	.000	.750	.000	.750	.250	.000	.333	.417	.000	.750	.000	.750


Hospital Drive
In - Peak Hour: 16:00
0
0 0 0
Right Thru Left
Peak Hour Data
North
Trucks
Francis St
In - Peak Hour: 16:15
21
0 Left
21 Thru
0 Right
Francis St
In - Peak Hour: 17:00
6
0 Right
6 Thru
0 Left
Left Thru Right
1 0 4
5
In - Peak Hour: 16:30
St. Albans St

N/S Street : St. Albans Street
E/W Street: Francis Street
City/State : Boston, MA
Weather : Overcast

Accurate Counts
978-664-2565

File Name : 10568007
Site Code : 10568007
Start Date : 5/5/2009
Page No : 1

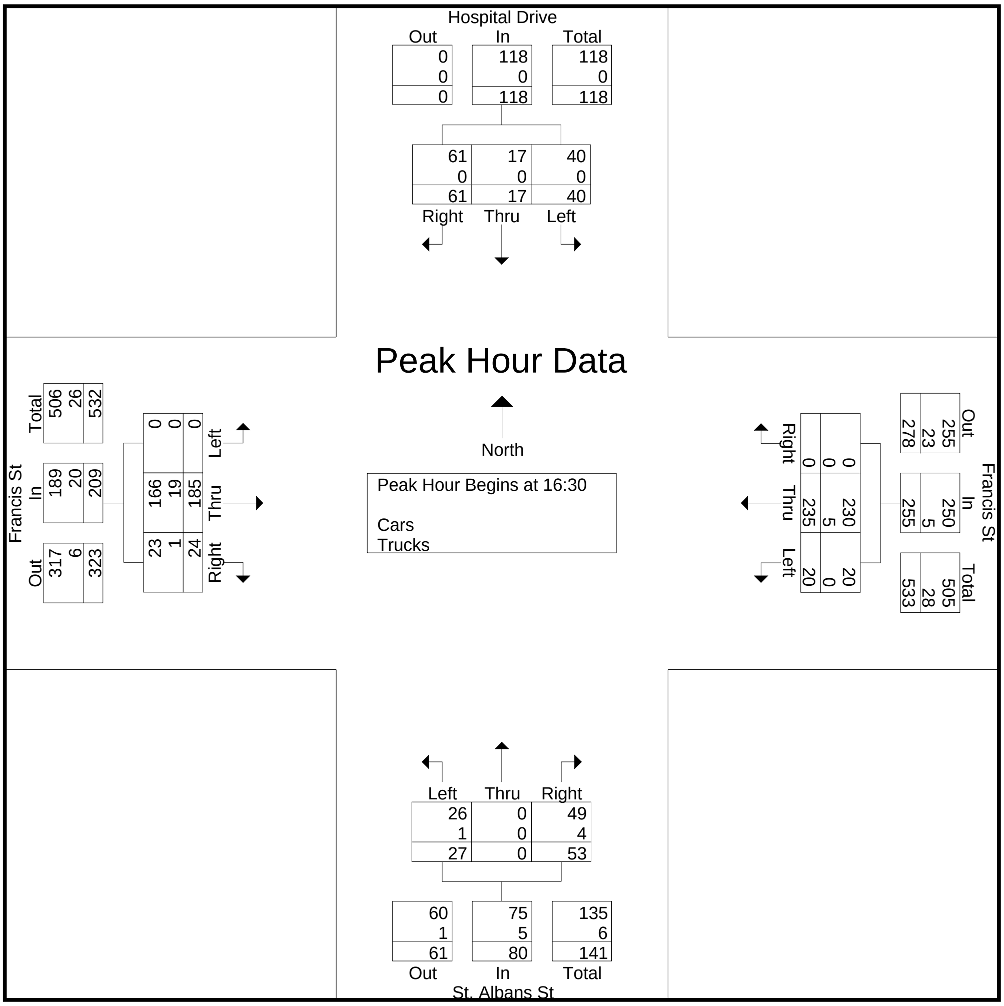
Groups Printed- Cars - Trucks

	Hospital Drive From North				Francis St From East				St. Albans St From South				Francis St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	12	7	21	31	1	61	0	8	6	0	12	13	0	48	6	7	59	174	233
16:15	12	11	12	27	3	48	0	9	6	0	9	25	0	39	5	6	67	145	212
16:30	11	5	18	35	3	40	0	10	10	0	8	15	0	46	11	7	67	152	219
16:45	12	4	16	25	6	75	0	6	3	0	8	17	0	35	1	7	55	160	215
Total	47	27	67	118	13	224	0	33	25	0	37	70	0	168	23	27	248	631	879
17:00	10	4	13	21	6	56	0	15	8	0	17	32	0	52	7	6	74	173	247
17:15	7	4	14	18	5	64	0	16	6	0	20	20	0	52	5	2	56	177	233
17:30	12	1	9	26	7	51	0	6	2	0	11	13	0	54	5	3	48	152	200
17:45	9	0	4	26	3	59	0	6	2	0	14	6	0	53	2	2	40	146	186
Total	38	9	40	91	21	230	0	43	18	0	62	71	0	211	19	13	218	648	866
Grand Total	85	36	107	209	34	454	0	76	43	0	99	141	0	379	42	40	466	1279	1745
Apprch %	37.3	15.8	46.9		7	93	0		30.3	0	69.7		0	90	10				
Total %	6.6	2.8	8.4		2.7	35.5	0		3.4	0	7.7		0	29.6	3.3		26.7	73.3	
Cars	85	36	107		33	444	0		42	0	94		0	342	41		0	0	1690
% Cars	100	100	100	100	97.1	97.8	0	100	97.7	0	94.9	100	0	90.2	97.6	100	0	0	96.8
Trucks	0	0	0		1	10	0		1	0	5		0	37	1		0	0	55
% Trucks	0	0	0	0	2.9	2.2	0	0	2.3	0	5.1	0	0	9.8	2.4	0	0	0	3.2

	Hospital Drive From North				Francis St From East				St. Albans St From South				Francis St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 16:30																	
16:30	11	**5**	**18**	**34**	3	40	0	43	**10**	0	8	18	0	46	**11**	57	152
16:45	**12**	4	16	32	**6**	**75**	0	**81**	3	0	8	11	0	35	1	36	160
17:00	10	4	13	27	6	56	0	62	8	0	17	25	0	**52**	7	**59**	173
17:15	7	4	14	25	5	64	0	69	6	0	**20**	**26**	0	52	5	57	**177**
Total Volume	40	17	61	118	20	235	0	255	27	0	53	80	0	185	24	209	662
% App. Total	33.9	14.4	51.7		7.8	92.2	0		33.8	0	66.2		0	88.5	11.5		
PHF	.833	.850	.847	.868	.833	.783	.000	.787	.675	.000	.663	.769	.000	.889	.545	.886	.935
Cars	40	17	61	118	20	230	0	250	26	0	49	75	0	166	23	189	632
% Cars	100	100	100	100	100	97.9	0	98.0	96.3	0	92.5	93.8	0	89.7	95.8	90.4	95.5
Trucks	0	0	0	0	0	5	0	5	1	0	4	5	0	19	1	20	30
% Trucks	0	0	0	0	0	2.1	0	2.0	3.7	0	7.5	6.3	0	10.3	4.2	9.6	4.5

Accurate Counts
978-664-2565

File Name : 10568007
Site Code : 10568007
Start Date : 5/5/2009
Page No : 2

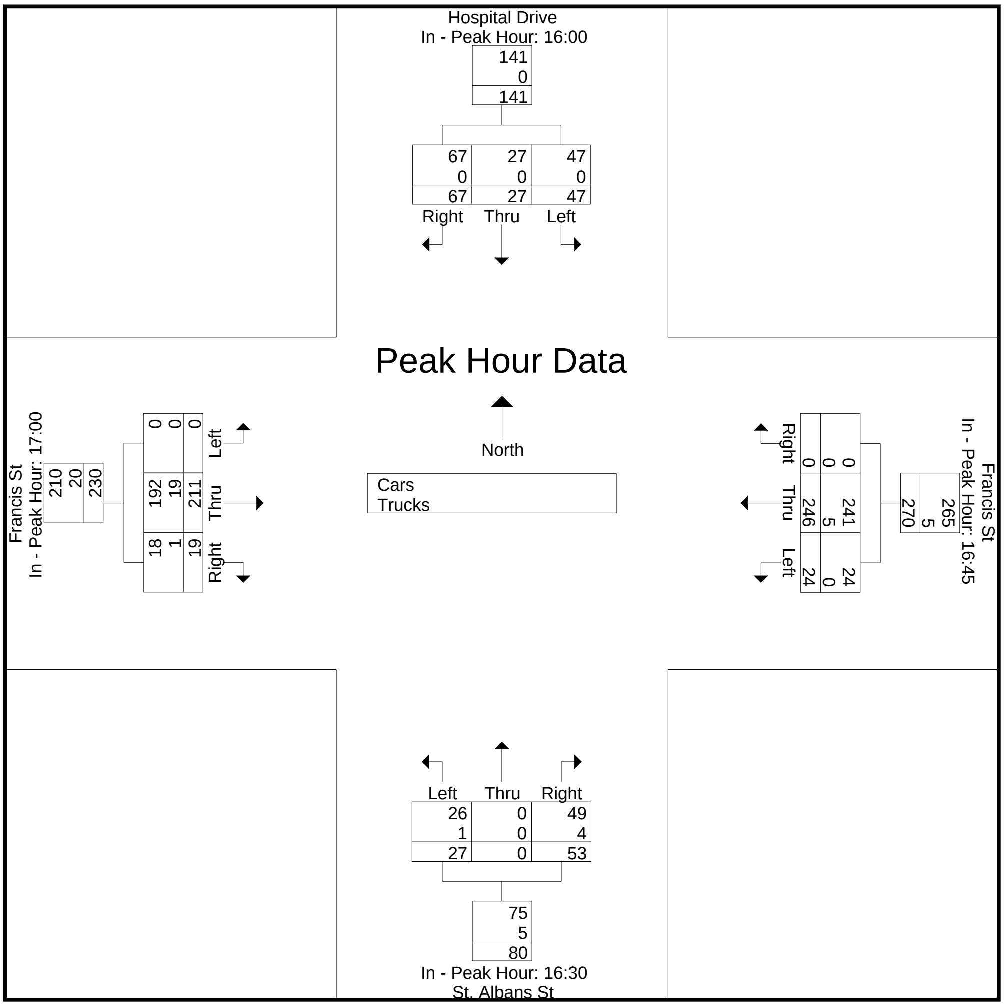


Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:00				16:45				16:30				17:00			
+0 mins.	**12**	7	**21**	**40**	6	**75**	0	**81**	**10**	0	8	18	0	52	**7**	**59**
+15 mins.	12	**11**	12	35	6	56	0	62	3	0	8	11	0	52	5	57
+30 mins.	11	5	18	34	5	64	0	69	8	0	17	25	0	**54**	5	59
+45 mins.	12	4	16	32	**7**	51	0	58	6	0	**20**	**26**	0	53	2	55
Total Volume	47	27	67	141	24	246	0	270	27	0	53	80	0	211	19	230
% App. Total	33.3	19.1	47.5		8.9	91.1	0		33.8	0	66.2		0	91.7	8.3	
PHF	.979	.614	.798	.881	.857	.820	.000	.833	.675	.000	.663	.769	.000	.977	.679	.975
Cars	47	27	67	141	24	241	0	265	26	0	49	75	0	192	18	210
% Cars	100	100	100	100	100	98	0	98.1	96.3	0	92.5	93.8	0	91	94.7	91.3
Trucks	0	0	0	0	0	5	0	5	1	0	4	5	0	19	1	20
% Trucks	0	0	0	0	0	2	0	1.9	3.7	0	7.5	6.2	0	9	5.3	8.7

Accurate Counts
978-664-2565

File Name : 10568007
Site Code : 10568007
Start Date : 5/5/2009
Page No : 3



N/S Street : Binney Street
E/W Street: Fenwood Street
City/State : Boston, MA
Weather : Overcast

Accurate Counts
978-664-2565

File Name : 10568008
Site Code : 10568008
Start Date : 5/5/2009
Page No : 1

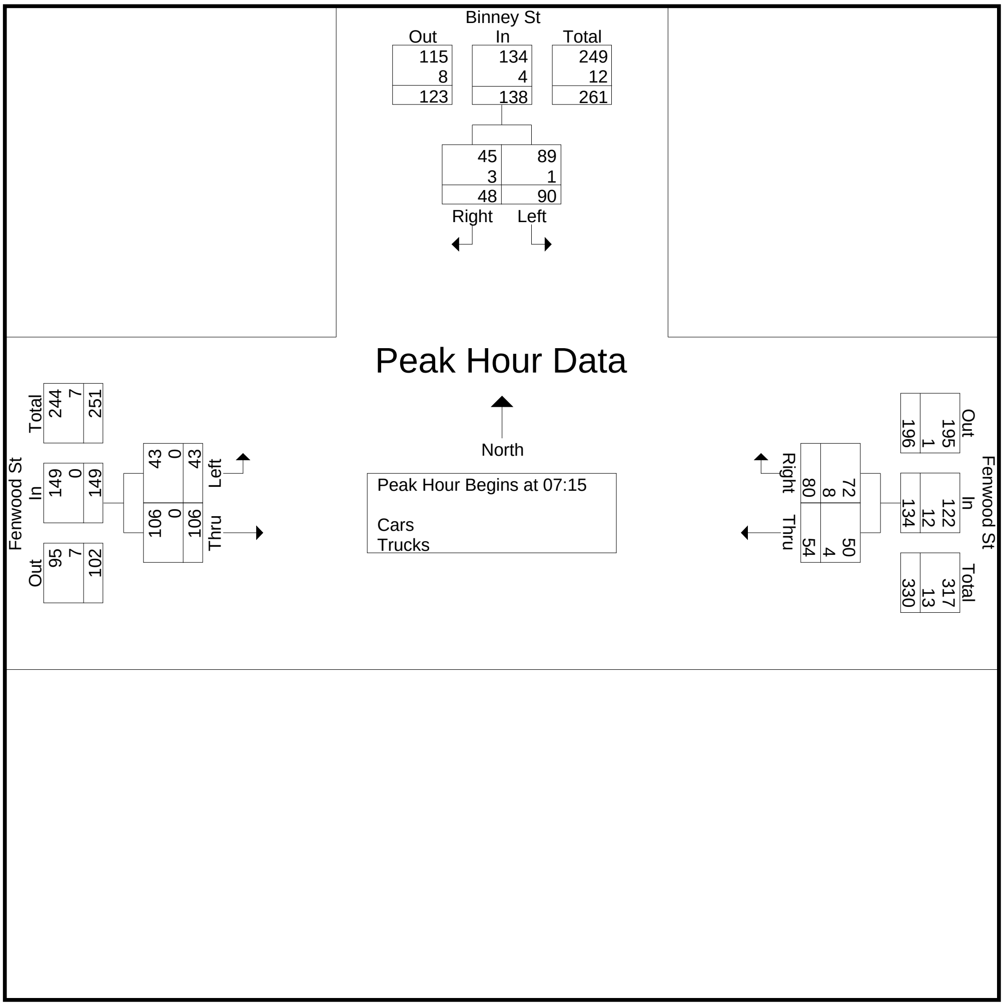
Groups Printed- Cars - Trucks

	Binney St From North			Fenwood St From East			Fenwood St From West					
Start Time	Left	Right	Peds	Thru	Right	Peds	Left	Thru	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	14	14	9	15	11	2	13	18	0	11	85	96
07:15	28	12	12	15	19	1	13	28	4	17	115	132
07:30	19	10	8	17	14	2	14	28	1	11	102	113
07:45	27	11	9	15	25	4	9	24	4	17	111	128
Total	88	47	38	62	69	9	49	98	9	56	413	469
08:00	16	15	16	7	22	4	7	26	5	25	93	118
08:15	18	14	12	6	17	2	6	19	3	17	80	97
08:30	19	14	16	12	15	1	4	19	2	19	83	102
08:45	28	8	5	6	20	1	13	12	3	9	87	96
Total	81	51	49	31	74	8	30	76	13	70	343	413
Grand Total	169	98	87	93	143	17	79	174	22	126	756	882
Apprch %	63.3	36.7		39.4	60.6		31.2	68.8				
Total %	22.4	13		12.3	18.9		10.4	23		14.3	85.7	
Cars	167	90		89	126		78	174		0	0	850
% Cars	98.8	91.8	100	95.7	88.1	100	98.7	100	100	0	0	96.4
Trucks	2	8		4	17		1	0		0	0	32
% Trucks	1.2	8.2	0	4.3	11.9	0	1.3	0	0	0	0	3.6

	Binney St From North			Fenwood St From East			Fenwood St From West			
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:15										
07:15	**28**	12	**40**	15	19	34	13	**28**	41	**115**
07:30	19	10	29	**17**	14	31	**14**	28	**42**	102
07:45	27	11	38	15	**25**	**40**	9	24	33	111
08:00	16	**15**	31	7	22	29	7	26	33	93
Total Volume	90	48	138	54	80	134	43	106	149	421
% App. Total	65.2	34.8		40.3	59.7		28.9	71.1		
PHF	.804	.800	.863	.794	.800	.838	.768	.946	.887	.915
Cars	89	45	134	50	72	122	43	106	149	405
% Cars	98.9	93.8	97.1	92.6	90.0	91.0	100	100	100	96.2
Trucks	1	3	4	4	8	12	0	0	0	16
% Trucks	1.1	6.3	2.9	7.4	10.0	9.0	0	0	0	3.8

Accurate Counts
978-664-2565

File Name : 10568008
Site Code : 10568008
Start Date : 5/5/2009
Page No : 2

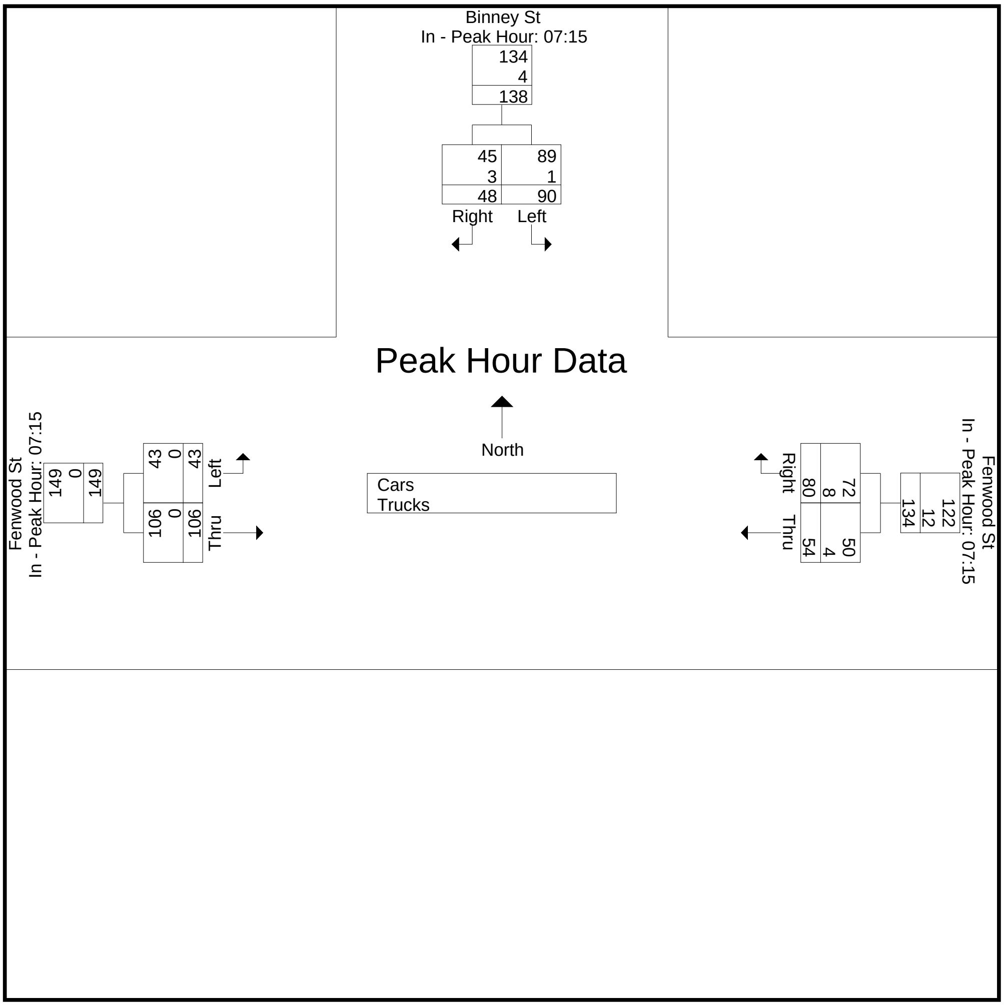


Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:15			07:15			07:15		
+0 mins.	**28**	12	**40**	15	19	34	13	**28**	41
+15 mins.	19	10	29	**17**	14	31	**14**	28	**42**
+30 mins.	27	11	38	15	**25**	**40**	9	24	33
+45 mins.	16	**15**	31	7	22	29	7	26	33
Total Volume	90	48	138	54	80	134	43	106	149
% App. Total	65.2	34.8		40.3	59.7		28.9	71.1	
PHF	.804	.800	.863	.794	.800	.838	.768	.946	.887
Cars	89	45	134	50	72	122	43	106	149
% Cars	98.9	93.8	97.1	92.6	90	91	100	100	100
Trucks	1	3	4	4	8	12	0	0	0
% Trucks	1.1	6.2	2.9	7.4	10	9	0	0	0

Accurate Counts
978-664-2565

File Name : 10568008
Site Code : 10568008
Start Date : 5/5/2009
Page No : 3



N/S Street : Binney Street
E/W Street: Fenwood Street
City/State : Boston, MA
Weather : Overcast

Accurate Counts
978-664-2565

File Name : 10568008
Site Code : 10568008
Start Date : 5/5/2009

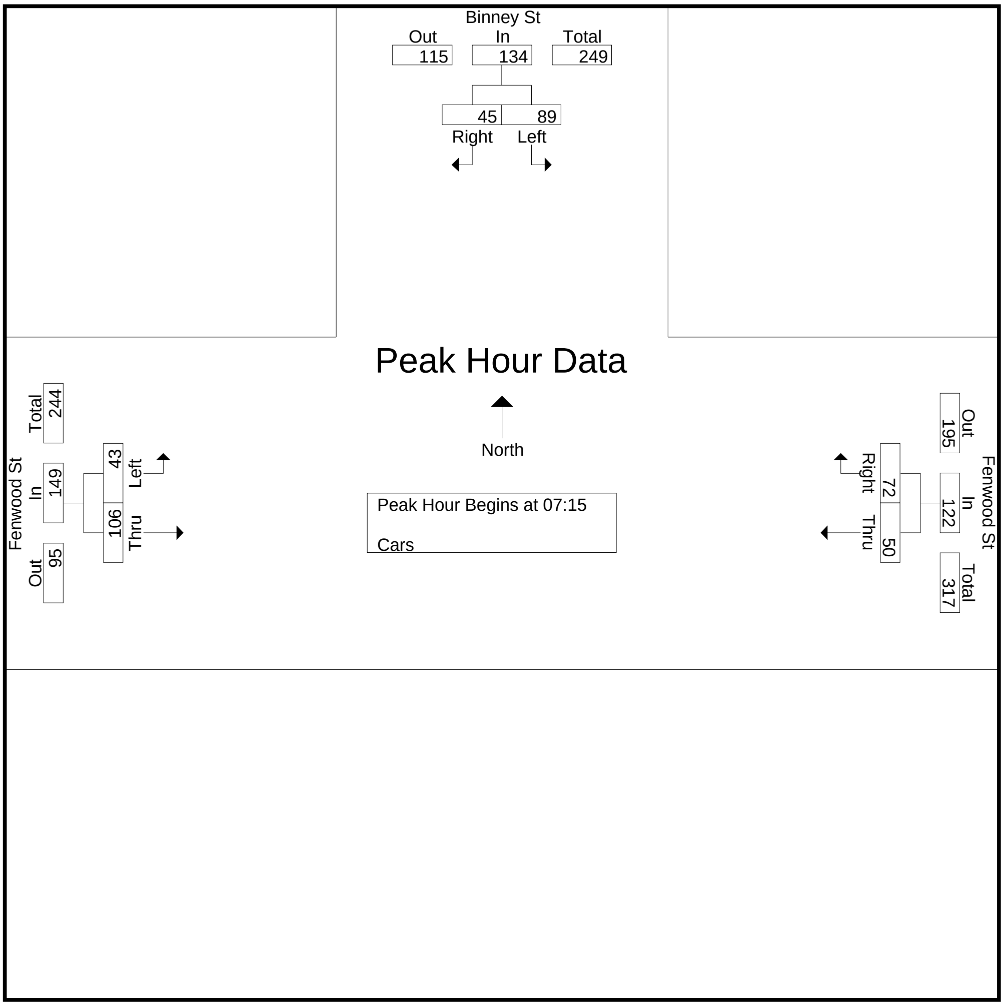
Groups Printed- Cars

	Binney St From North			Fenwood St From East			Fenwood St From West					
Start Time	Left	Right	Peds	Thru	Right	Peds	Left	Thru	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	14	13	9	15	8	2	13	18	0	11	81	92
07:15	28	11	12	15	15	1	13	28	4	17	110	127
07:30	19	9	8	14	14	2	14	28	1	11	98	109
07:45	27	10	9	15	23	4	9	24	4	17	108	125
Total	88	43	38	59	60	9	49	98	9	56	397	453
08:00	15	15	16	6	20	4	7	26	5	25	89	114
08:15	17	12	12	6	14	2	6	19	3	17	74	91
08:30	19	13	16	12	14	1	4	19	2	19	81	100
08:45	28	7	5	6	18	1	12	12	3	9	83	92
Total	79	47	49	30	66	8	29	76	13	70	327	397
Grand Total	167	90	87	89	126	17	78	174	22	126	724	850
Apprch %	65	35		41.4	58.6		31	69				
Total %	23.1	12.4		12.3	17.4		10.8	24		14.8	85.2	

	Binney St From North			Fenwood St From East			Fenwood St From West			
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:15										
07:15	**28**	11	**39**	**15**	15	30	13	**28**	41	**110**
07:30	19	9	28	14	14	28	**14**	28	**42**	98
07:45	27	10	37	15	**23**	**38**	9	24	33	108
08:00	15	**15**	30	6	20	26	7	26	33	89
Total Volume	89	45	134	50	72	122	43	106	149	405
% App. Total	66.4	33.6		41	59		28.9	71.1		
PHF	.795	.750	.859	.833	.783	.803	.768	.946	.887	.920

Accurate Counts
978-664-2565

File Name : 10568008
Site Code : 10568008
Start Date : 5/5/2009
Page No : 2

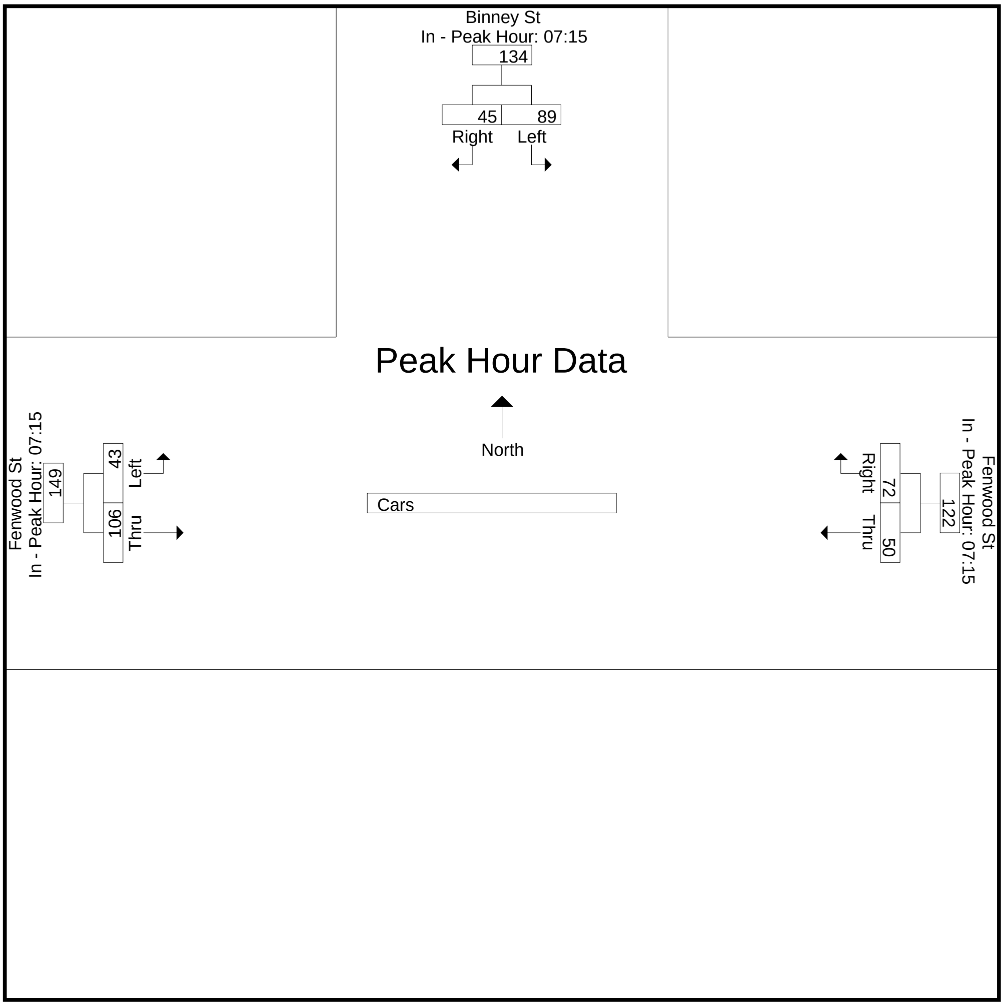


Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:15			07:15			07:15		
+0 mins.	**28**	11	**39**	**15**	15	30	13	**28**	41
+15 mins.	19	9	28	14	14	28	**14**	28	**42**
+30 mins.	27	10	37	15	**23**	**38**	9	24	33
+45 mins.	15	**15**	30	6	20	26	7	26	33
Total Volume	89	45	134	50	72	122	43	106	149
% App. Total	66.4	33.6		41	59		28.9	71.1	
PHF	.795	.750	.859	.833	.783	.803	.768	.946	.887

Accurate Counts
978-664-2565

File Name : 10568008
Site Code : 10568008
Start Date : 5/5/2009
Page No : 3



N/S Street : Binney Street
E/W Street: Fenwood Street
City/State : Boston, MA
Weather : Overcast

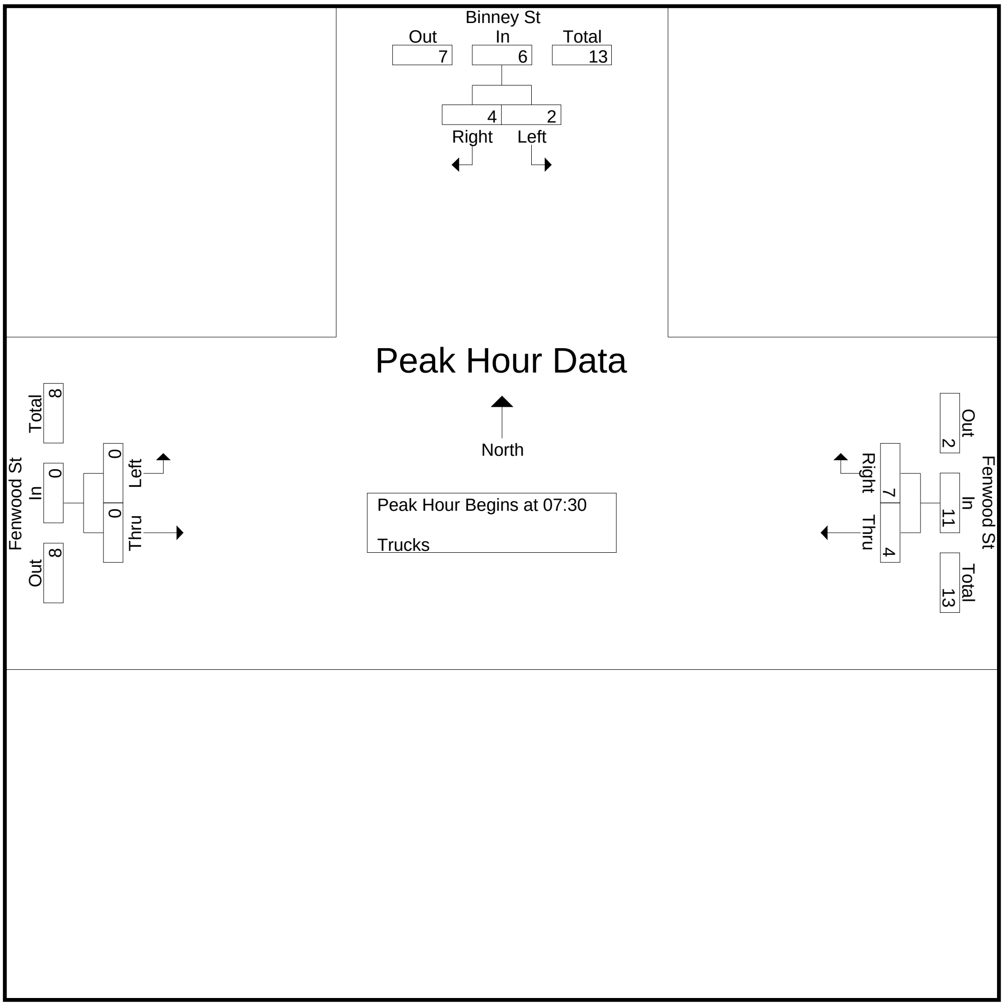
Accurate Counts
978-664-2565

File Name : 10568008
Site Code : 10568008
Start Date : 5/5/2009
Page No : 1

Groups Printed- Trucks

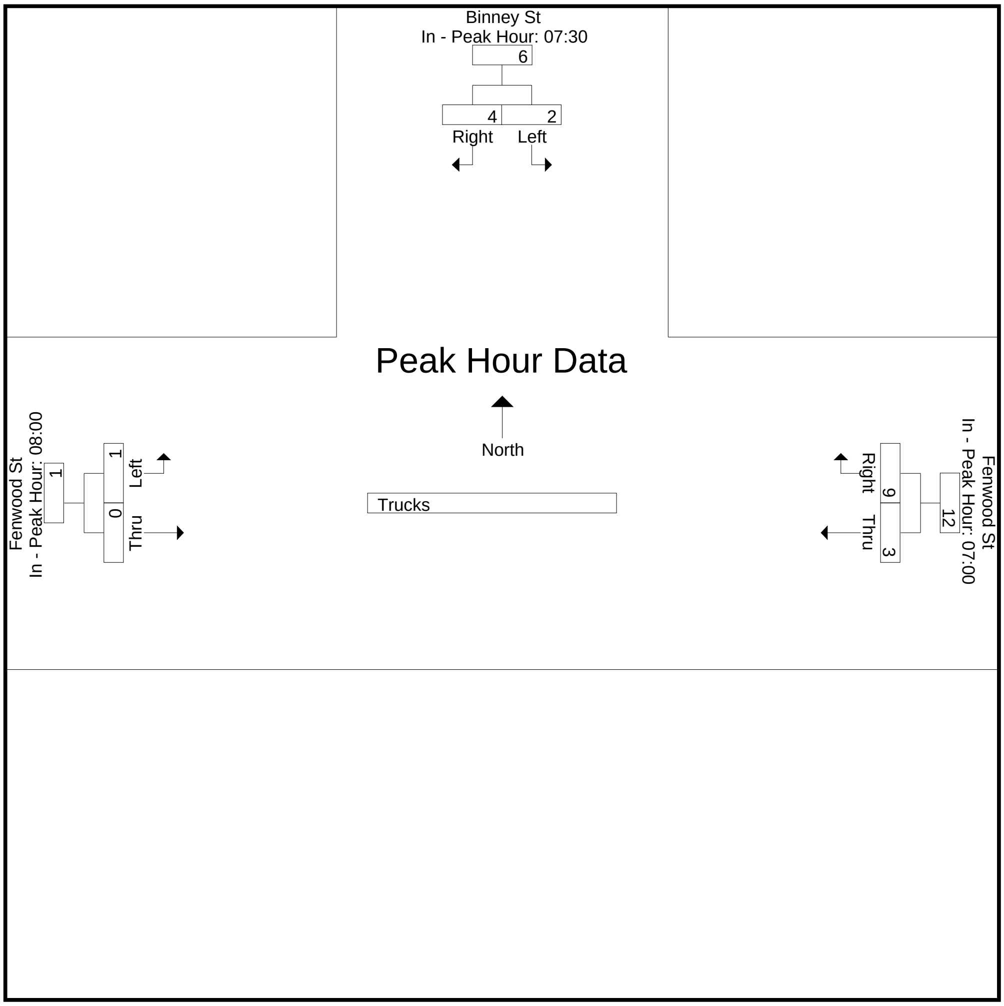
	Binney St From North			Fenwood St From East			Fenwood St From West					
Start Time	Left	Right	Peds	Thru	Right	Peds	Left	Thru	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	0	1	0	0	3	0	0	0	0	0	4	4
07:15	0	1	0	0	4	0	0	0	0	0	5	5
07:30	0	1	0	3	0	0	0	0	0	0	4	4
07:45	0	1	0	0	2	0	0	0	0	0	3	3
Total	0	4	0	3	9	0	0	0	0	0	16	16
08:00	1	0	0	1	2	0	0	0	0	0	4	4
08:15	1	2	0	0	3	0	0	0	0	0	6	6
08:30	0	1	0	0	1	0	0	0	0	0	2	2
08:45	0	1	0	0	2	0	1	0	0	0	4	4
Total	2	4	0	1	8	0	1	0	0	0	16	16
Grand Total	2	8	0	4	17	0	1	0	0	0	32	32
Apprch %	20	80		19	81		100	0				
Total %	6.2	25		12.5	53.1		3.1	0		0	100	

	Binney St From North			Fenwood St From East			Fenwood St From West			
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:30										
07:30	0	1	1	**3**	0	**3**	0	0	0	4
07:45	0	1	1	0	2	2	0	0	0	3
08:00	**1**	0	1	1	2	3	0	0	0	4
08:15	1	**2**	**3**	0	**3**	3	0	0	0	**6**
Total Volume	2	4	6	4	7	11	0	0	0	17
% App. Total	33.3	66.7		36.4	63.6		0	0		
PHF	.500	.500	.500	.333	.583	.917	.000	.000	.000	.708



Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:30			07:00			08:00		
+0 mins.	0	1	1	0	3	3	0	0	0
+15 mins.	0	1	1	0	**4**	**4**	0	0	0
+30 mins.	**1**	0	1	**3**	0	3	0	0	0
+45 mins.	1	**2**	**3**	0	2	2	**1**	0	**1**
Total Volume	2	4	6	3	9	12	1	0	1
% App. Total	33.3	66.7		25	75		100	0	
PHF	.500	.500	.500	.250	.563	.750	.250	.000	.250


Binney St
In - Peak Hour: 07:30
6
4
2
Right
Left
Peak Hour Data
North
Trucks
Fenwood St
In - Peak Hour: 08:00
1
1
0
Left
Thru
Fenwood St
In - Peak Hour: 07:00
12
9
3
Right
Thru

N/S Street : Binney Street
E/W Street: Fenwood Street
City/State : Boston, MA
Weather : Overcast

Accurate Counts
978-664-2565

File Name : 10568008
Site Code : 10568008
Start Date : 5/5/2009

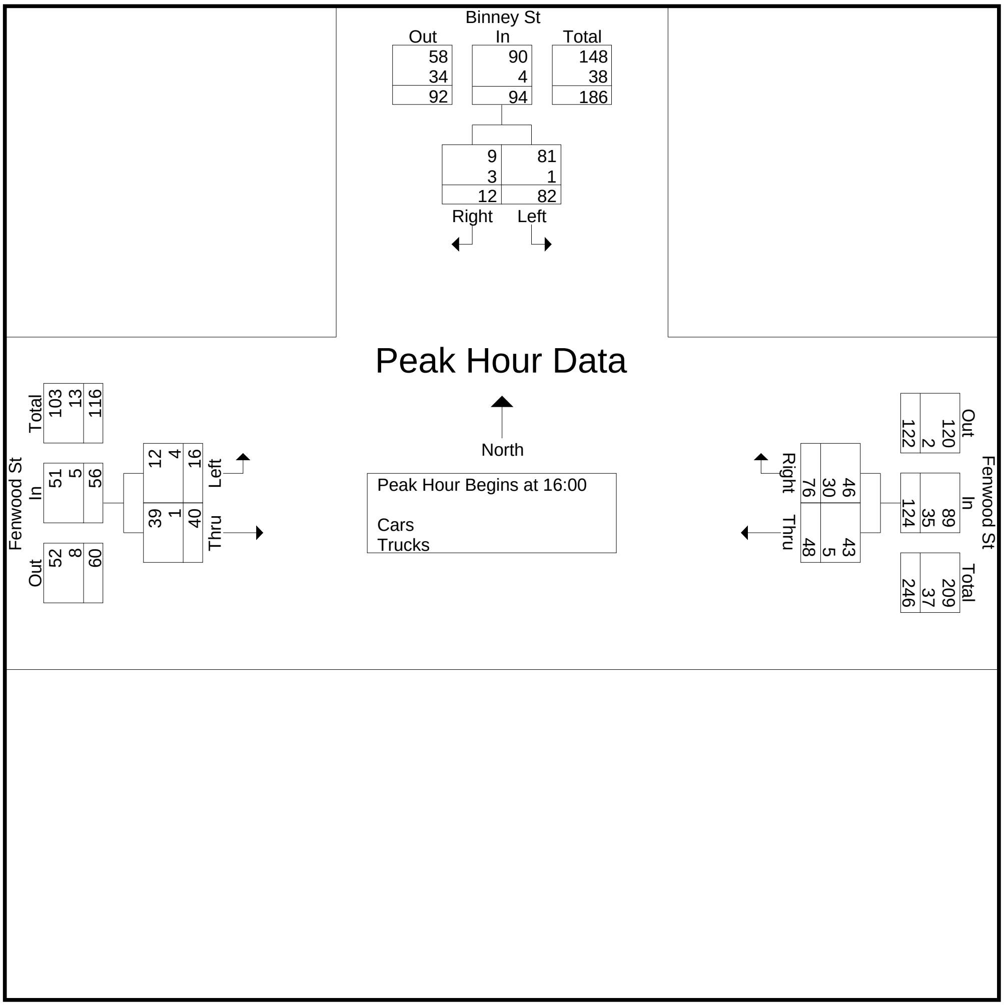
Groups Printed- Cars - Trucks

	Binney St From North			Fenwood St From East			Fenwood St From West					
Start Time	Left	Right	Peds	Thru	Right	Peds	Left	Thru	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	24	3	2	14	17	1	7	14	6	9	79	88
16:15	18	2	3	11	20	1	2	6	0	4	59	63
16:30	22	5	5	9	16	2	2	13	1	8	67	75
16:45	18	2	6	14	23	1	5	7	5	12	69	81
Total	82	12	16	48	76	5	16	40	12	33	274	307
17:00	24	1	7	12	20	1	2	7	1	9	66	75
17:15	12	1	1	9	13	0	2	0	2	3	37	40
17:30	23	2	12	16	21	3	9	10	5	20	81	101
17:45	20	2	2	5	9	2	6	11	3	7	53	60
Total	79	6	22	42	63	6	19	28	11	39	237	276
Grand Total	161	18	38	90	139	11	35	68	23	72	511	583
Apprch %	89.9	10.1		39.3	60.7		34	66				
Total %	31.5	3.5		17.6	27.2		6.8	13.3		12.3	87.7	
Cars	160	15		81	80		29	66		0	0	502
% Cars	99.4	83.3	100	90	57.6	90.9	82.9	97.1	100	0	0	86.1
Trucks	1	3		9	59		6	2		0	0	81
% Trucks	0.6	16.7	0	10	42.4	9.1	17.1	2.9	0	0	0	13.9

	Binney St From North			Fenwood St From East			Fenwood St From West			
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 16:00										
16:00	**24**	3	**27**	**14**	17	31	**7**	**14**	**21**	**79**
16:15	18	2	20	11	20	31	2	6	8	59
16:30	22	**5**	27	9	16	25	2	13	15	67
16:45	18	2	20	14	**23**	**37**	5	7	12	69
Total Volume	82	12	94	48	76	124	16	40	56	274
% App. Total	87.2	12.8		38.7	61.3		28.6	71.4		
PHF	.854	.600	.870	.857	.826	.838	.571	.714	.667	.867
Cars	81	9	90	43	46	89	12	39	51	230
% Cars	98.8	75.0	95.7	89.6	60.5	71.8	75.0	97.5	91.1	83.9
Trucks	1	3	4	5	30	35	4	1	5	44
% Trucks	1.2	25.0	4.3	10.4	39.5	28.2	25.0	2.5	8.9	16.1

Accurate Counts
978-664-2565

File Name : 10568008
Site Code : 10568008
Start Date : 5/5/2009
Page No : 2

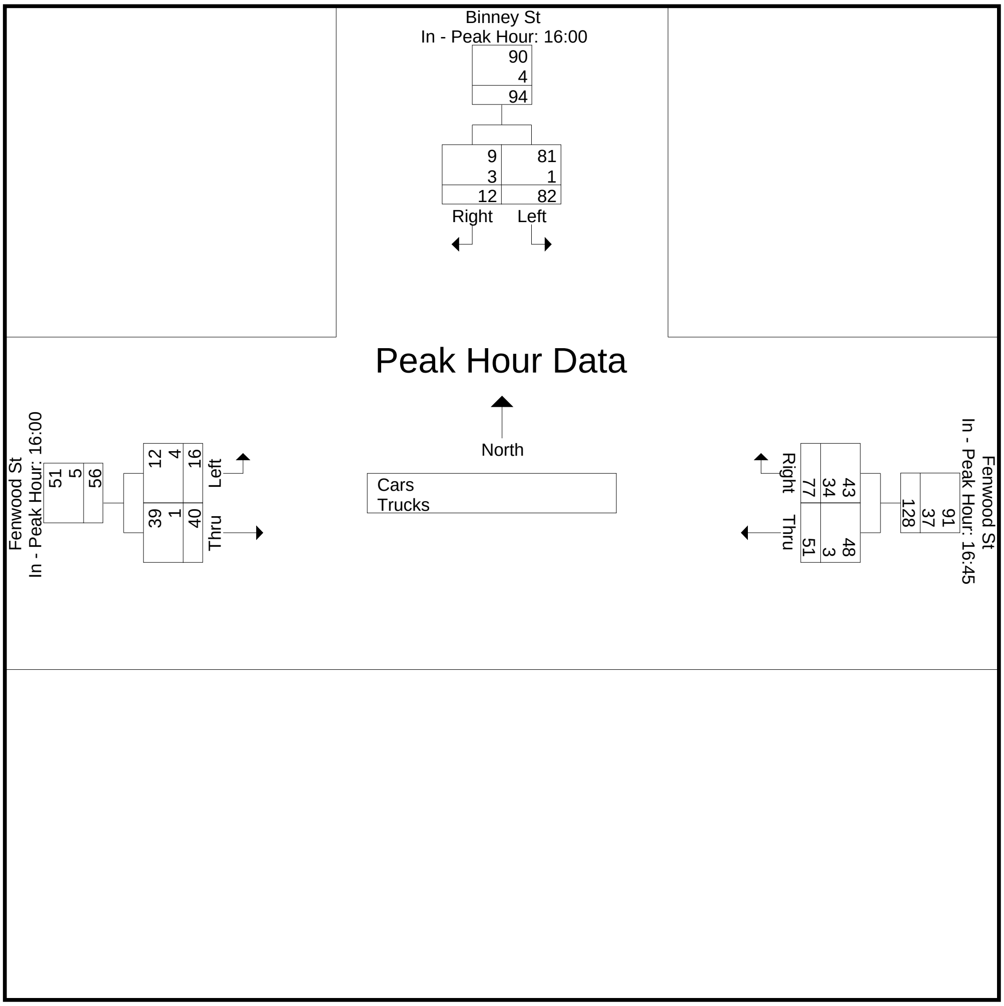


Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:00			16:45			16:00		
+0 mins.	**24**	3	**27**	14	**23**	**37**	**7**	**14**	**21**
+15 mins.	18	2	20	12	20	32	2	6	8
+30 mins.	22	**5**	27	9	13	22	2	13	15
+45 mins.	18	2	20	**16**	21	37	5	7	12
Total Volume	82	12	94	51	77	128	16	40	56
% App. Total	87.2	12.8		39.8	60.2		28.6	71.4	
PHF	.854	.600	.870	.797	.837	.865	.571	.714	.667
Cars	81	9	90	48	43	91	12	39	51
% Cars	98.8	75	95.7	94.1	55.8	71.1	75	97.5	91.1
Trucks	1	3	4	3	34	37	4	1	5
% Trucks	1.2	25	4.3	5.9	44.2	28.9	25	2.5	8.9

Accurate Counts
978-664-2565

File Name : 10568008
Site Code : 10568008
Start Date : 5/5/2009
Page No : 3



N/S Street : Binney Street
E/W Street: Fenwood Street
City/State : Boston, MA
Weather : Overcast

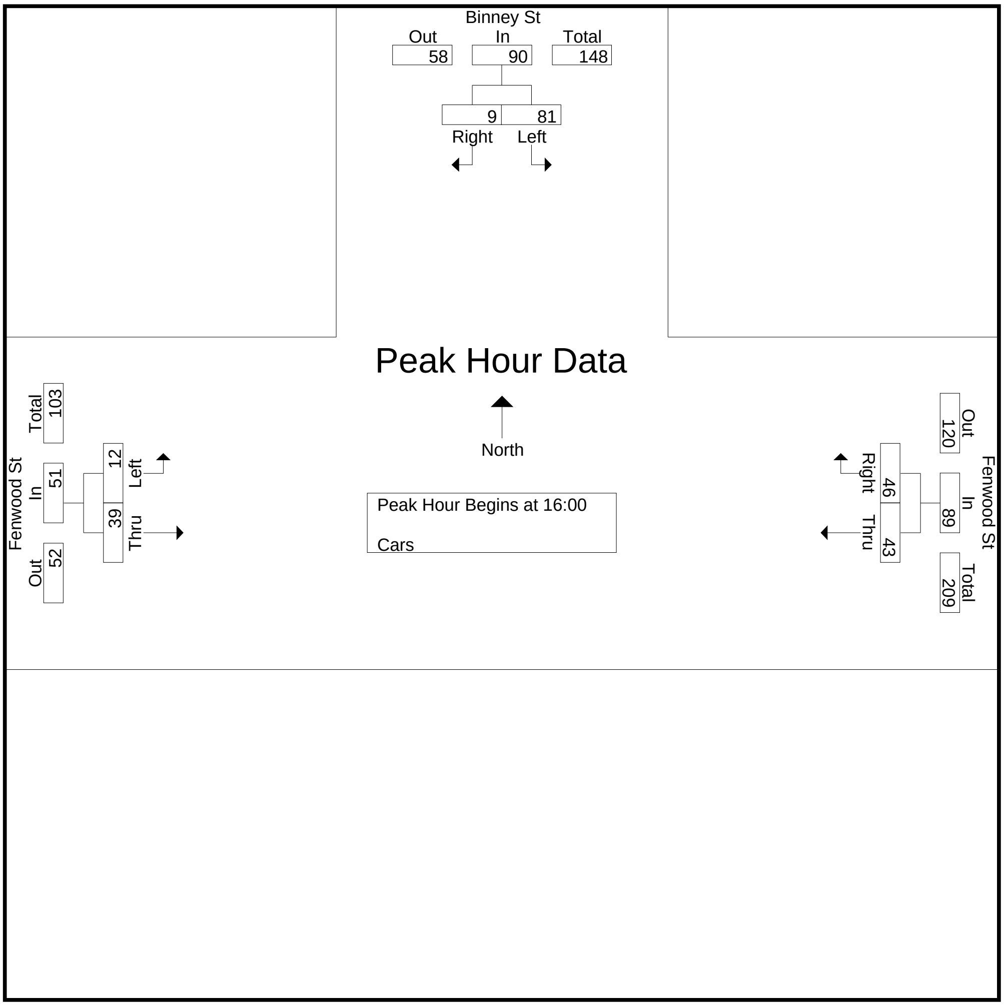
Accurate Counts
978-664-2565

File Name : 10568008
Site Code : 10568008
Start Date : 5/5/2009
Page No : 1

Groups Printed- Cars

	Binney St From North			Fenwood St From East			Fenwood St From West					
Start Time	Left	Right	Peds	Thru	Right	Peds	Left	Thru	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	23	2	2	13	10	1	5	14	6	9	67	76
16:15	18	2	3	9	12	1	1	5	0	4	47	51
16:30	22	3	5	8	10	1	2	13	1	7	58	65
16:45	18	2	6	13	14	1	4	7	5	12	58	70
Total	81	9	16	43	46	4	12	39	12	32	230	262
17:00	24	1	7	12	14	1	2	7	1	9	60	69
17:15	12	1	1	8	4	0	2	0	2	3	27	30
17:30	23	2	12	15	11	3	9	9	5	20	69	89
17:45	20	2	2	3	5	2	4	11	3	7	45	52
Total	79	6	22	38	34	6	17	27	11	39	201	240
Grand Total	160	15	38	81	80	10	29	66	23	71	431	502
Apprch %	91.4	8.6		50.3	49.7		30.5	69.5				
Total %	37.1	3.5		18.8	18.6		6.7	15.3		14.1	85.9	

	Binney St From North			Fenwood St From East			Fenwood St From West			
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 16:00										
16:00	**23**	2	**25**	**13**	10	23	**5**	**14**	**19**	**67**
16:15	18	2	20	9	12	21	1	5	6	47
16:30	22	**3**	25	8	10	18	2	13	15	58
16:45	18	2	20	13	**14**	**27**	4	7	11	58
Total Volume	81	9	90	43	46	89	12	39	51	230
% App. Total	90	10		48.3	51.7		23.5	76.5		
PHF	.880	.750	.900	.827	.821	.824	.600	.696	.671	.858

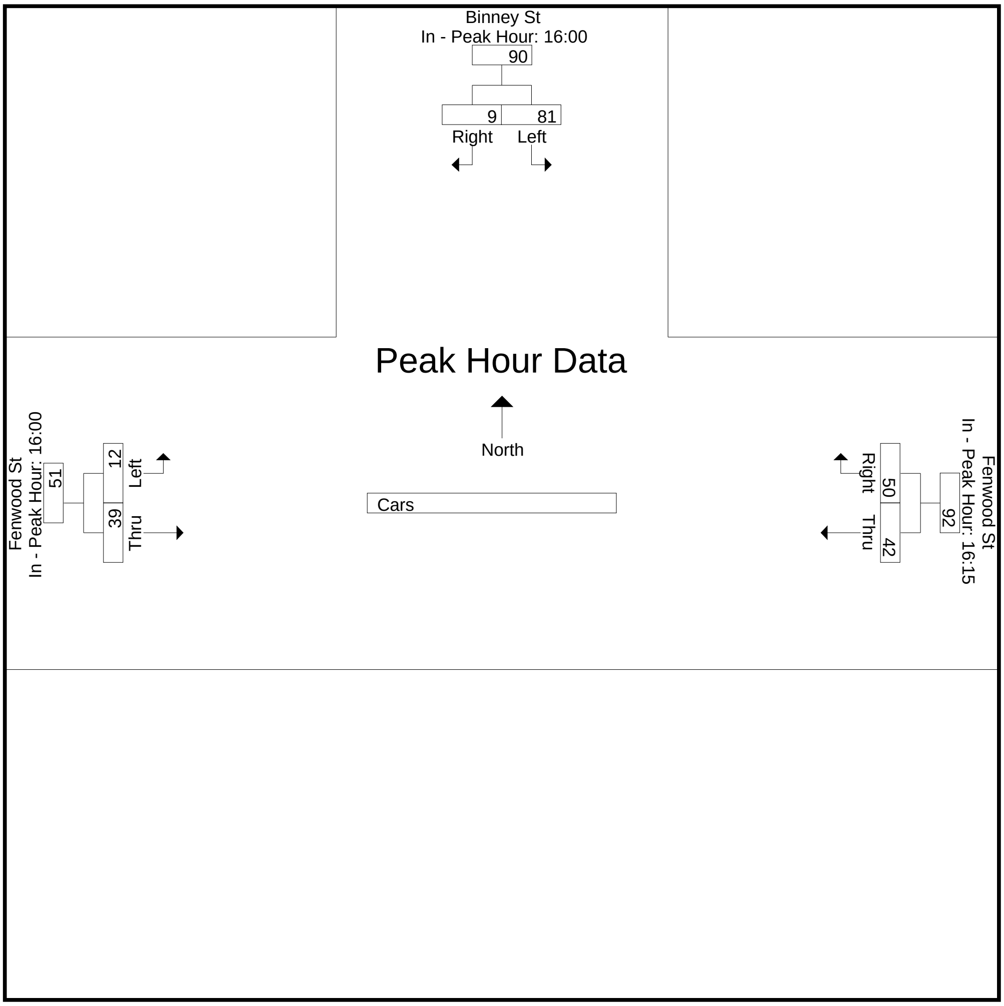


Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:00			16:15			16:00		
+0 mins.	**23**	2	**25**	9	12	21	**5**	**14**	**19**
+15 mins.	18	2	20	8	10	18	1	5	6
+30 mins.	22	**3**	25	**13**	**14**	**27**	2	13	15
+45 mins.	18	2	20	12	14	26	4	7	11
Total Volume	81	9	90	42	50	92	12	39	51
% App. Total	90	10		45.7	54.3		23.5	76.5	
PHF	.880	.750	.900	.808	.893	.852	.600	.696	.671

Accurate Counts
978-664-2565

File Name : 10568008
Site Code : 10568008
Start Date : 5/5/2009
Page No : 3



N/S Street : Binney Street
E/W Street: Fenwood Street
City/State : Boston, MA
Weather : Overcast

Accurate Counts
978-664-2565

File Name : 10568008
Site Code : 10568008
Start Date : 5/5/2009
Page No : 1

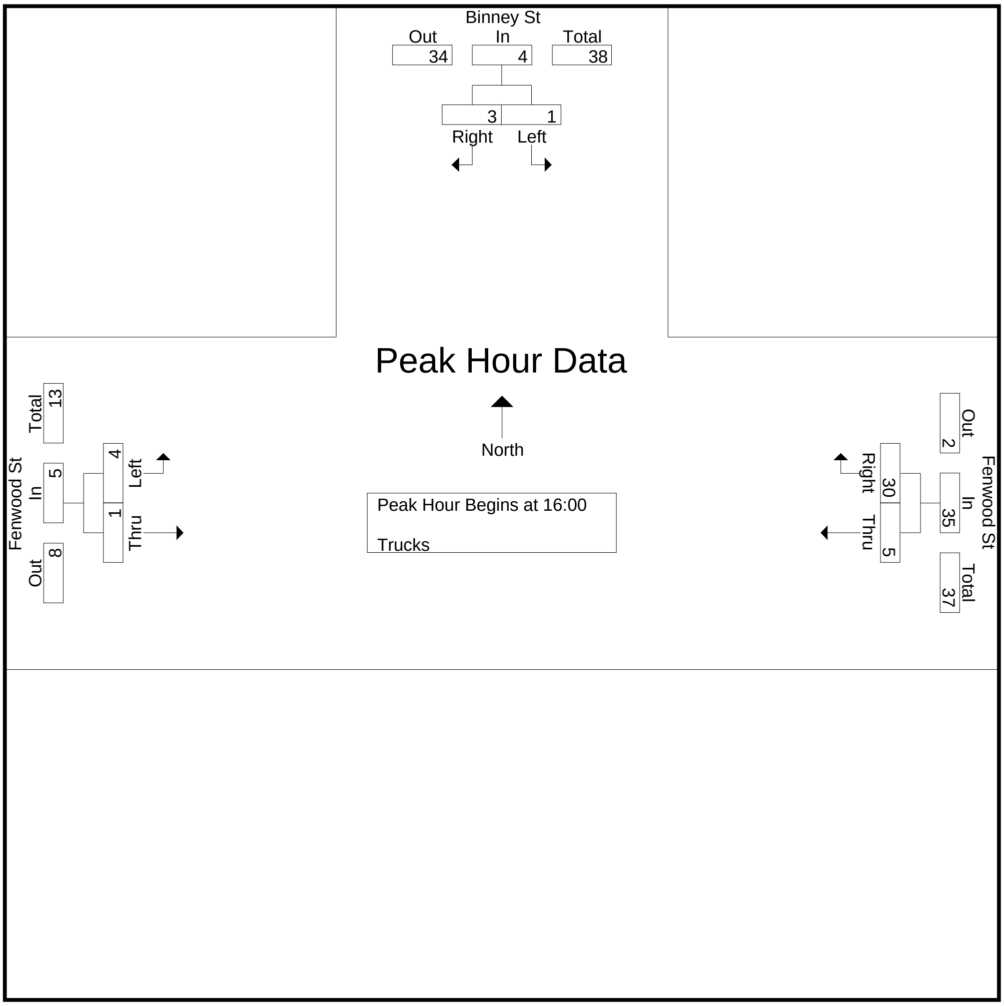
Groups Printed- Trucks

	Binney St From North			Fenwood St From East			Fenwood St From West					
Start Time	Left	Right	Peds	Thru	Right	Peds	Left	Thru	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	1	1	0	1	7	0	2	0	0	0	12	12
16:15	0	0	0	2	8	0	1	1	0	0	12	12
16:30	0	2	0	1	6	1	0	0	0	1	9	10
16:45	0	0	0	1	9	0	1	0	0	0	11	11
Total	1	3	0	5	30	1	4	1	0	1	44	45
17:00	0	0	0	0	6	0	0	0	0	0	6	6
17:15	0	0	0	1	9	0	0	0	0	0	10	10
17:30	0	0	0	1	10	0	0	1	0	0	12	12
17:45	0	0	0	2	4	0	2	0	0	0	8	8
Total	0	0	0	4	29	0	2	1	0	0	36	36
Grand Total	1	3	0	9	59	1	6	2	0	1	80	81
Apprch %	25	75		13.2	86.8		75	25				
Total %	1.2	3.8		11.2	73.8		7.5	2.5		1.2	98.8	

	Binney St From North			Fenwood St From East			Fenwood St From West			
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 16:00										
16:00	**1**	1	**2**	1	7	8	**2**	0	**2**	**12**
16:15	0	0	0	**2**	8	**10**	1	**1**	2	12
16:30	0	**2**	2	1	6	7	0	0	0	9
16:45	0	0	0	1	**9**	10	1	0	1	11
Total Volume	1	3	4	5	30	35	4	1	5	44
% App. Total	25	75		14.3	85.7		80	20		
PHF	.250	.375	.500	.625	.833	.875	.500	.250	.625	.917

Accurate Counts
978-664-2565

File Name : 10568008
Site Code : 10568008
Start Date : 5/5/2009
Page No : 2

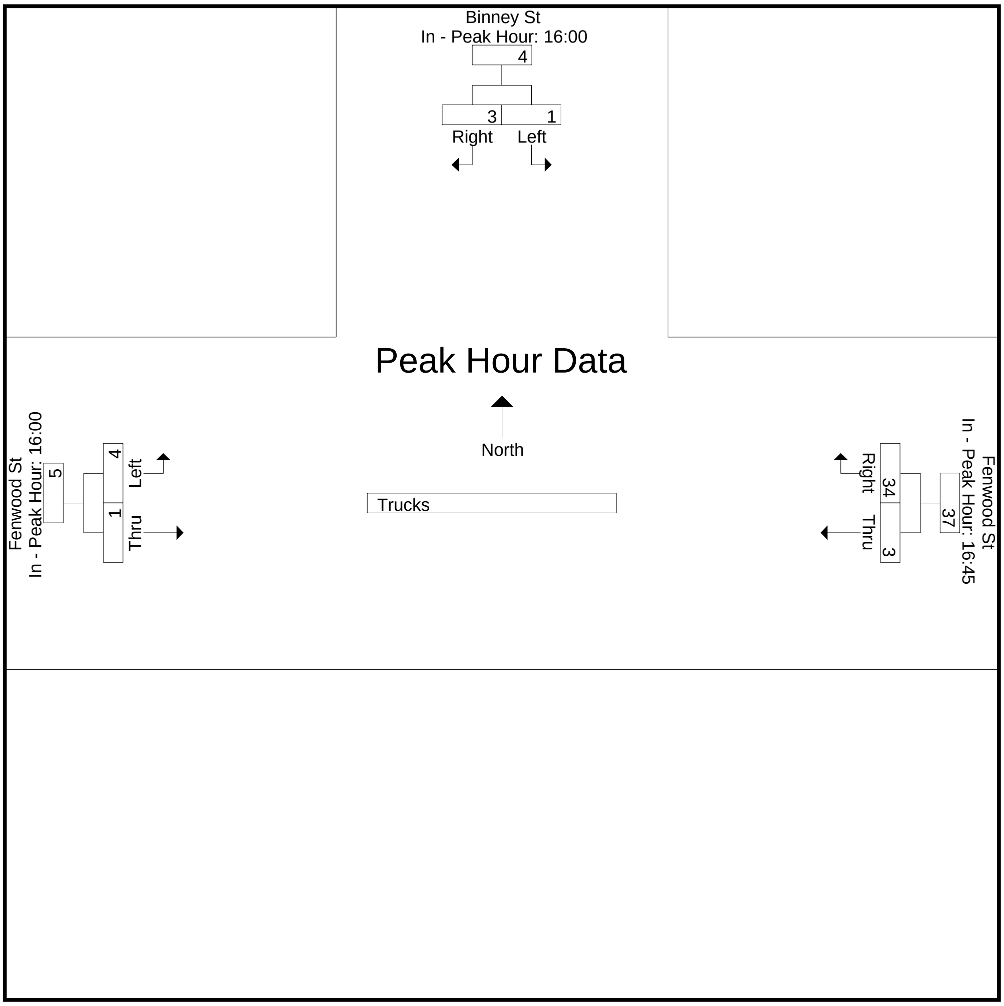


Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:00			16:45			16:00		
+0 mins.	**1**	1	**2**	**1**	9	10	**2**	0	**2**
+15 mins.	0	0	0	0	6	6	1	**1**	2
+30 mins.	0	**2**	2	1	9	10	0	0	0
+45 mins.	0	0	0	1	**10**	**11**	1	0	1
Total Volume	1	3	4	3	34	37	4	1	5
% App. Total	25	75		8.1	91.9		80	20	
PHF	.250	.375	.500	.750	.850	.841	.500	.250	.625

Accurate Counts
978-664-2565

File Name : 10568008
Site Code : 10568008
Start Date : 5/5/2009
Page No : 3



N/S Street : Vining Street
E/W Street: Fenwood Street
City/State : Boston, MA
Weather : Overcast

Accurate Counts
978-664-2565

File Name : 10568009
Site Code : 10568009
Start Date : 5/5/2009
Page No : 1

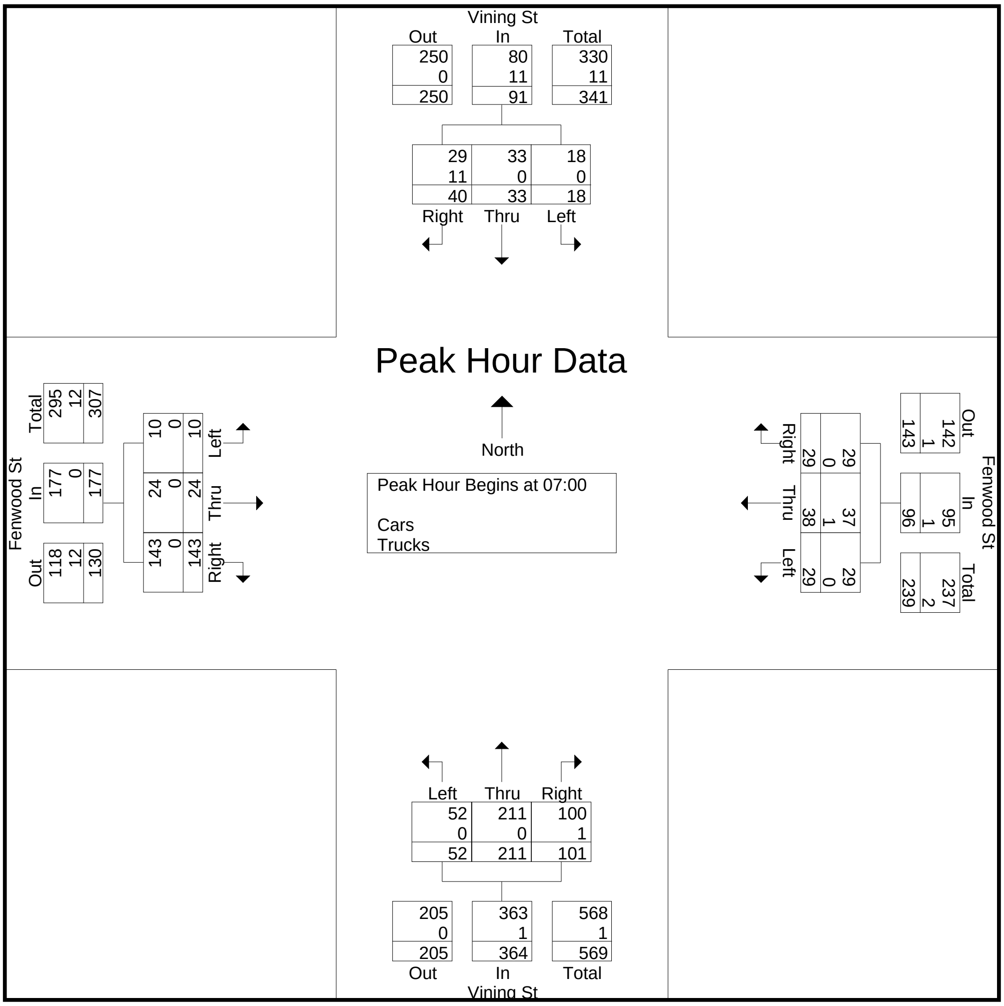
Groups Printed- Cars - Trucks

	Vining St From North				Fenwood St From East				Vining St From South				Fenwood St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	6	8	10	10	11	6	7	21	13	45	18	6	5	3	26	170	207	158	365
07:15	3	8	10	5	3	8	3	14	14	46	28	2	1	3	46	190	211	173	384
07:30	7	13	10	2	4	8	8	26	13	63	37	4	2	10	31	176	208	206	414
07:45	2	4	10	7	11	16	11	26	12	57	18	8	2	8	40	133	174	191	365
Total	18	33	40	24	29	38	29	87	52	211	101	20	10	24	143	669	800	728	1528
08:00	1	11	8	7	11	14	8	24	5	32	12	2	2	9	30	104	137	143	280
08:15	0	8	7	3	12	9	17	11	9	23	5	3	5	4	22	72	89	121	210
08:30	3	5	12	6	8	9	16	24	9	33	11	8	5	8	29	70	108	148	256
08:45	3	7	8	3	11	16	7	9	3	23	9	3	2	7	23	70	85	119	204
Total	7	31	35	19	42	48	48	68	26	111	37	16	14	28	104	316	419	531	950
Grand Total	25	64	75	43	71	86	77	155	78	322	138	36	24	52	247	985	1219	1259	2478
Apprch %	15.2	39	45.7		30.3	36.8	32.9		14.5	59.9	25.7		7.4	16.1	76.5				
Total %	2	5.1	6		5.6	6.8	6.1		6.2	25.6	11		1.9	4.1	19.6		49.2	50.8	
Cars	25	64	57		71	84	77		77	322	137		24	51	246		0	0	2454
% Cars	100	100	76	100	100	97.7	100	100	98.7	100	99.3	100	100	98.1	99.6	100	0	0	99
Trucks	0	0	18		0	2	0		1	0	1		0	1	1		0	0	24
% Trucks	0	0	24	0	0	2.3	0	0	1.3	0	0.7	0	0	1.9	0.4	0	0	0	1

	Vining St From North				Fenwood St From East				Vining St From South				Fenwood St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:00																	
07:00	6	8	**10**	24	**11**	6	7	24	13	45	18	76	**5**	3	26	34	158
07:15	3	8	10	21	3	8	3	14	**14**	46	28	88	1	3	**46**	**50**	173
07:30	**7**	**13**	10	**30**	4	8	8	20	13	**63**	**37**	**113**	2	**10**	31	43	**206**
07:45	2	4	10	16	11	**16**	**11**	**38**	12	57	18	87	2	8	40	50	191
Total Volume	18	33	40	91	29	38	29	96	52	211	101	364	10	24	143	177	728
% App. Total	19.8	36.3	44		30.2	39.6	30.2		14.3	58	27.7		5.6	13.6	80.8		
PHF	.643	.635	1.000	.758	.659	.594	.659	.632	.929	.837	.682	.805	.500	.600	.777	.885	.883
Cars	18	33	29	80	29	37	29	95	52	211	100	363	10	24	143	177	715
% Cars	100	100	72.5	87.9	100	97.4	100	99.0	100	100	99.0	99.7	100	100	100	100	98.2
Trucks	0	0	11	11	0	1	0	1	0	0	1	1	0	0	0	0	13
% Trucks	0	0	27.5	12.1	0	2.6	0	1.0	0	0	1.0	0.3	0	0	0	0	1.8

Accurate Counts
978-664-2565

File Name : 10568009
Site Code : 10568009
Start Date : 5/5/2009
Page No : 2

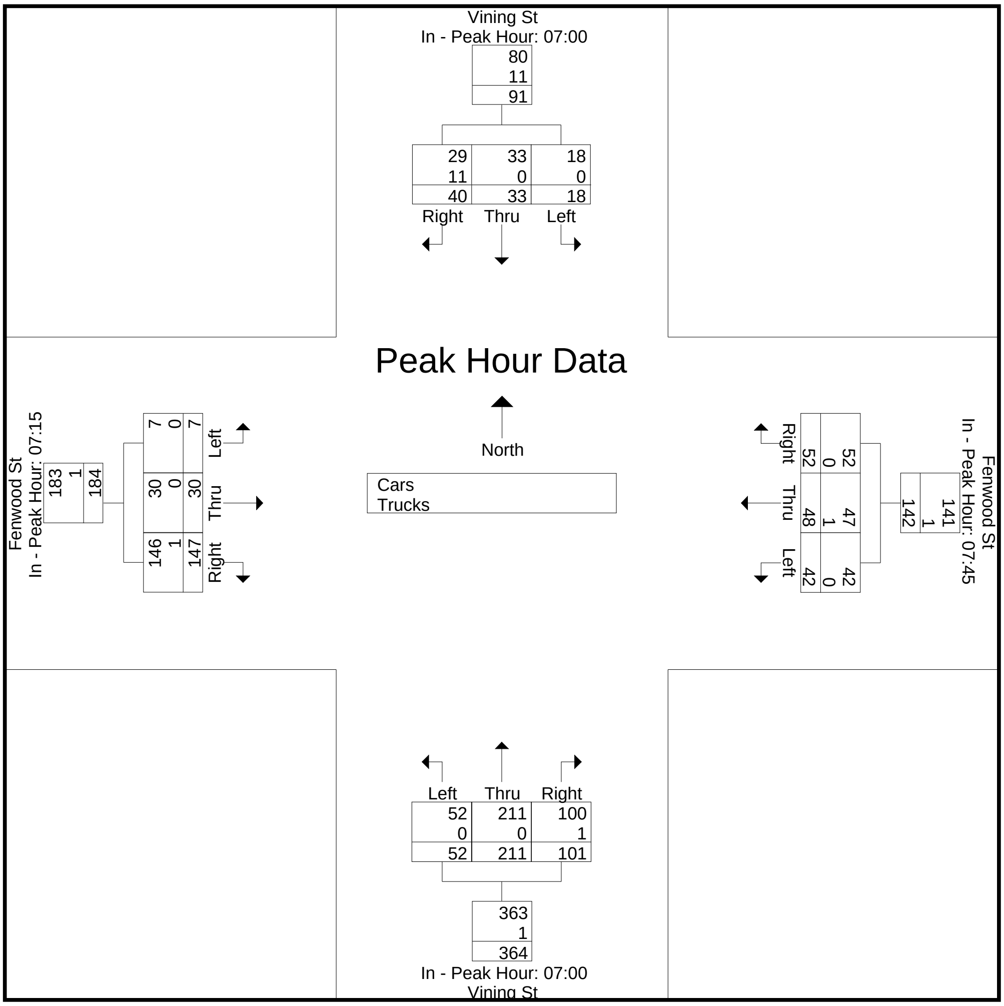


Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:00				07:45				07:00				07:15			
+0 mins.	6	8	**10**	24	11	**16**	11	**38**	13	45	18	76	1	3	**46**	**50**
+15 mins.	3	8	10	21	11	14	8	33	**14**	46	28	88	**2**	**10**	31	43
+30 mins.	**7**	**13**	10	**30**	**12**	9	**17**	38	13	**63**	**37**	**113**	2	8	40	50
+45 mins.	2	4	10	16	8	9	16	33	12	57	18	87	2	9	30	41
Total Volume	18	33	40	91	42	48	52	142	52	211	101	364	7	30	147	184
% App. Total	19.8	36.3	44		29.6	33.8	36.6		14.3	58	27.7		3.8	16.3	79.9	
PHF	.643	.635	1.000	.758	.875	.750	.765	.934	.929	.837	.682	.805	.875	.750	.799	.920
Cars	18	33	29	80	42	47	52	141	52	211	100	363	7	30	146	183
% Cars	100	100	72.5	87.9	100	97.9	100	99.3	100	100	99	99.7	100	100	99.3	99.5
Trucks	0	0	11	11	0	1	0	1	0	0	1	1	0	0	1	1
% Trucks	0	0	27.5	12.1	0	2.1	0	0.7	0	0	1	0.3	0	0	0.7	0.5

Accurate Counts
978-664-2565

File Name : 10568009
Site Code : 10568009
Start Date : 5/5/2009
Page No : 3



Accurate Counts
978-664-2565

Groups Printed- Cars

	Vining St From North				Fenwood St From East				Vining St From South				Fenwood St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	6	8	6	10	11	6	7	21	13	45	18	6	5	3	26	170	207	154	361
07:15	3	8	7	5	3	8	3	14	14	46	28	2	1	3	46	190	211	170	381
07:30	7	13	8	2	4	7	8	26	13	63	37	4	2	10	31	176	208	203	411
07:45	2	4	8	7	11	16	11	26	12	57	17	8	2	8	40	133	174	188	362
Total	18	33	29	24	29	37	29	87	52	211	100	20	10	24	143	669	800	715	1515
08:00	1	11	6	7	11	14	8	24	4	32	12	2	2	9	29	104	137	139	276
08:15	0	8	5	3	12	8	17	11	9	23	5	3	5	3	22	72	89	117	206
08:30	3	5	10	6	8	9	16	24	9	33	11	8	5	8	29	70	108	146	254
08:45	3	7	7	3	11	16	7	9	3	23	9	3	2	7	23	70	85	118	203
Total	7	31	28	19	42	47	48	68	25	111	37	16	14	27	103	316	419	520	939
Grand Total	25	64	57	43	71	84	77	155	77	322	137	36	24	51	246	985	1219	1235	2454
Apprch %	17.1	43.8	39		30.6	36.2	33.2		14.4	60.1	25.6		7.5	15.9	76.6				
Total %	2	5.2	4.6		5.7	6.8	6.2		6.2	26.1	11.1		1.9	4.1	19.9		49.7	50.3	

	Vining St From North				Fenwood St From East				Vining St From South				Fenwood St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:00																	
07:00	6	8	6	20	**11**	6	7	24	13	45	18	76	**5**	3	26	34	154
07:15	3	8	7	18	3	8	3	14	**14**	46	28	88	1	3	**46**	**50**	170
07:30	**7**	**13**	**8**	**28**	4	7	8	19	13	**63**	**37**	**113**	2	**10**	31	43	**203**
07:45	2	4	8	14	11	**16**	**11**	**38**	12	57	17	86	2	8	40	50	188
Total Volume	18	33	29	80	29	37	29	95	52	211	100	363	10	24	143	177	715
% App. Total	22.5	41.2	36.2		30.5	38.9	30.5		14.3	58.1	27.5		5.6	13.6	80.8		
PHF	.643	.635	.906	.714	.659	.578	.659	.625	.929	.837	.676	.803	.500	.600	.777	.885	.881

Accurate Counts
978-664-2565

File Name : 10568009
Site Code : 10568009
Start Date : 5/5/2009
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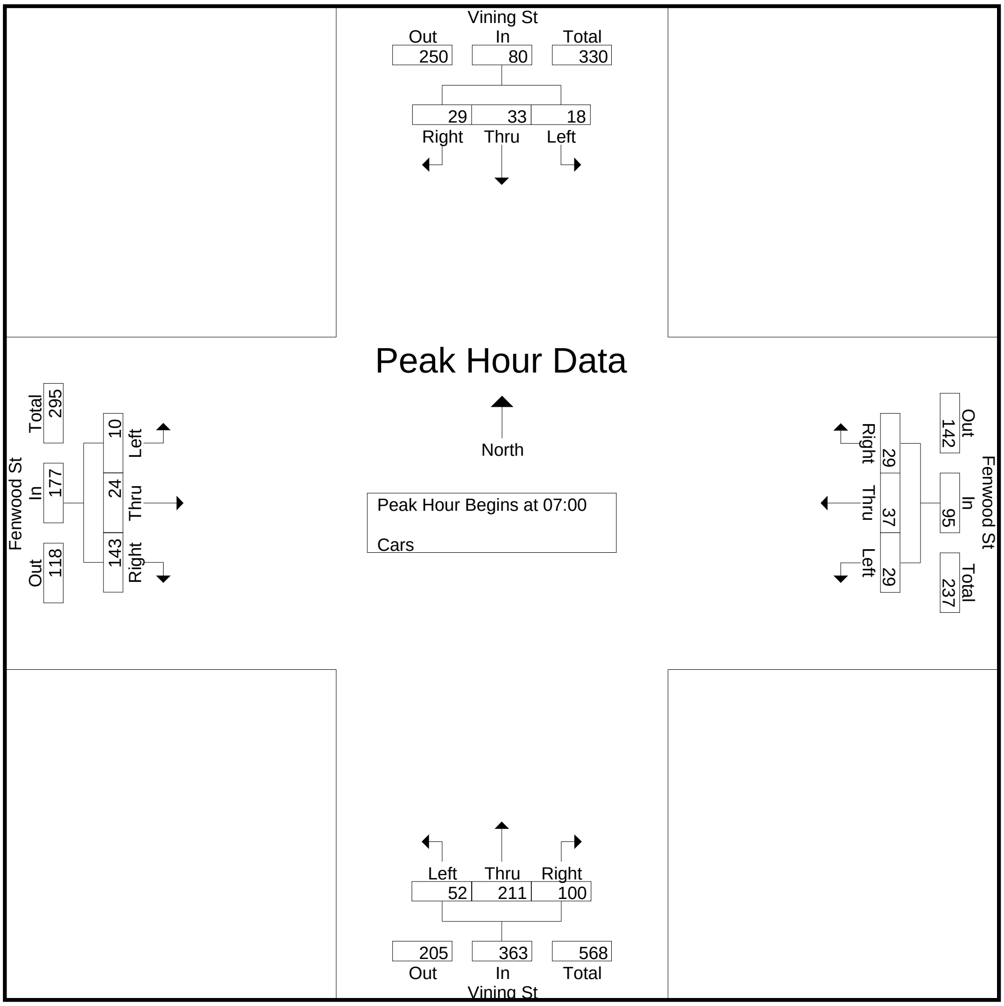
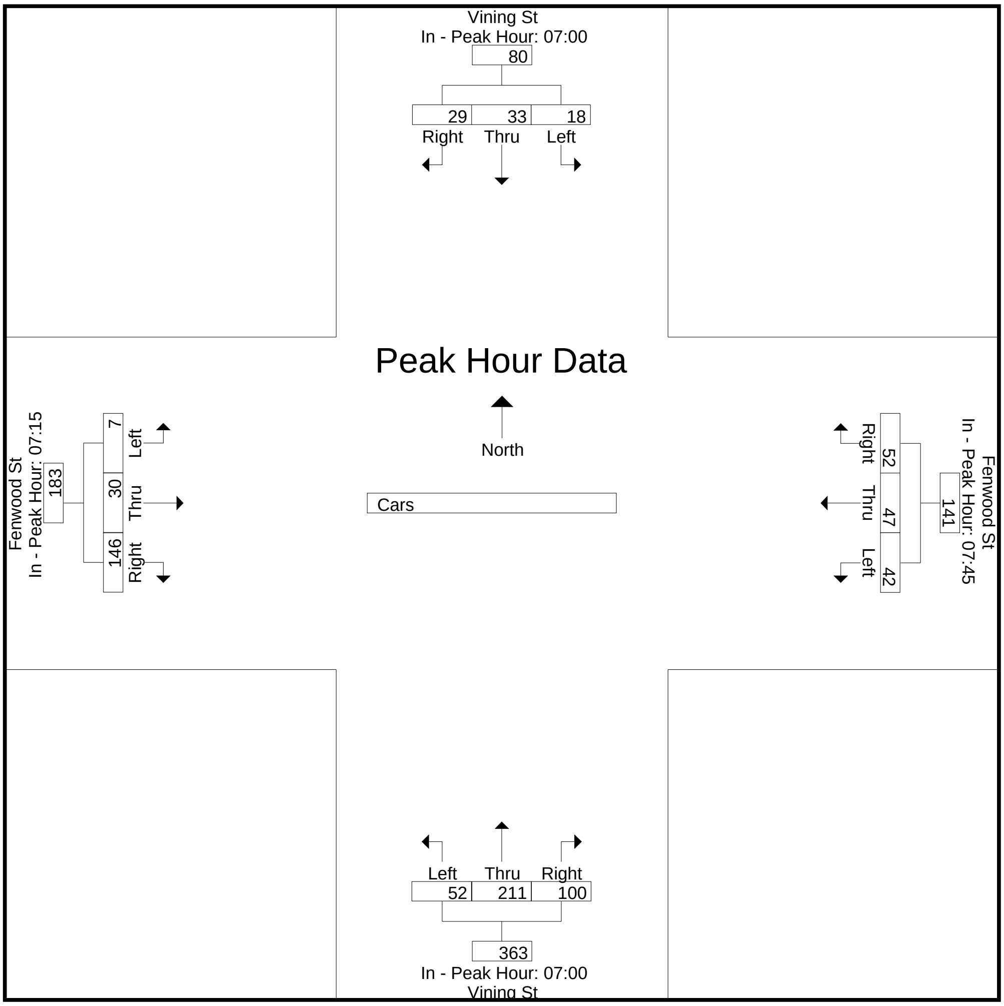


Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:00				07:45				07:00				07:15			
+0 mins.	6	8	6	20	11	**16**	11	**38**	13	45	18	76	1	3	**46**	**50**
+15 mins.	3	8	7	18	11	14	8	33	**14**	46	28	88	**2**	**10**	31	43
+30 mins.	**7**	**13**	**8**	**28**	**12**	8	**17**	37	13	**63**	**37**	**113**	2	8	40	50
+45 mins.	2	4	8	14	8	9	16	33	12	57	17	86	2	9	29	40
Total Volume	18	33	29	80	42	47	52	141	52	211	100	363	7	30	146	183
% App. Total	22.5	41.2	36.2		29.8	33.3	36.9		14.3	58.1	27.5		3.8	16.4	79.8	
PHF	.643	.635	.906	.714	.875	.734	.765	.928	.929	.837	.676	.803	.875	.750	.793	.915


Vining St
In - Peak Hour: 07:00
80
29
33
18
Right
Thru
Left
Peak Hour Data
North
Cars
Fenwood St
In - Peak Hour: 07:15
183
7
30
146
Left
Thru
Right
Fenwood St
In - Peak Hour: 07:45
141
52
47
42
Right
Thru
Left
Left
Thru
Right
52
211
100
363
In - Peak Hour: 07:00
Vining St

N/S Street : Vining Street
E/W Street: Fenwood Street
City/State : Boston, MA
Weather : Overcast

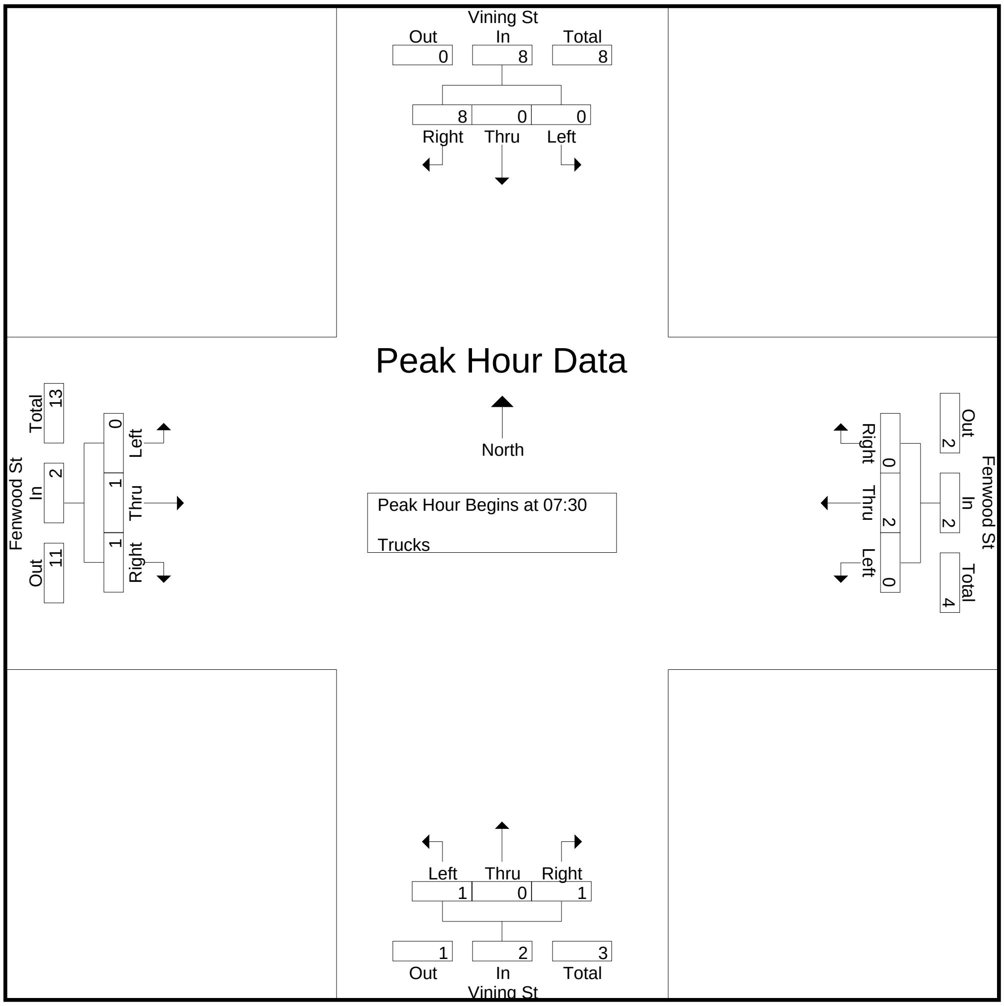
Accurate Counts
978-664-2565

File Name : 10568009
Site Code : 10568009
Start Date : 5/5/2009
Page No : 1

Groups Printed- Trucks

	Vining St From North				Fenwood St From East				Vining St From South				Fenwood St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4
07:15	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3
07:30	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	3	3
07:45	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	3	3
Total	0	0	11	0	0	1	0	0	0	0	1	0	0	0	0	0	0	13	13
08:00	0	0	2	0	0	0	0	0	1	0	0	0	0	0	1	0	0	4	4
08:15	0	0	2	0	0	1	0	0	0	0	0	0	0	1	0	0	0	4	4
08:30	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
08:45	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Total	0	0	7	0	0	1	0	0	1	0	0	0	0	1	1	0	0	11	11
Grand Total	0	0	18	0	0	2	0	0	1	0	1	0	0	1	1	0	0	24	24
Apprch %	0	0	100		0	100	0		50	0	50		0	50	50				
Total %	0	0	75		0	8.3	0		4.2	0	4.2		0	4.2	4.2		0	100	

	Vining St From North				Fenwood St From East				Vining St From South				Fenwood St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:30																	
07:30	0	0	**2**	**2**	0	**1**	0	**1**	0	0	0	0	0	0	0	0	3
07:45	0	0	2	2	0	0	0	0	0	0	**1**	**1**	0	0	0	0	3
08:00	0	0	2	2	0	0	0	0	**1**	0	0	1	0	0	**1**	**1**	**4**
08:15	0	0	2	2	0	1	0	1	0	0	0	0	0	**1**	0	1	4
Total Volume	0	0	8	8	0	2	0	2	1	0	1	2	0	1	1	2	14
% App. Total	0	0	100		0	100	0		50	0	50		0	50	50		
PHF	.000	.000	1.000	1.000	.000	.500	.000	.500	.250	.000	.250	.500	.000	.250	.250	.500	.875



Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:00				07:30				07:15				07:30			
+0 mins.	0	0	**4**	**4**	0	**1**	0	**1**	0	0	0	0	0	0	0	0
+15 mins.	0	0	3	3	0	0	0	0	0	0	0	0	0	0	0	0
+30 mins.	0	0	2	2	0	0	0	0	0	0	**1**	**1**	0	0	**1**	**1**
+45 mins.	0	0	2	2	0	1	0	1	**1**	0	0	1	0	**1**	0	1
Total Volume	0	0	11	11	0	2	0	2	1	0	1	2	0	1	1	2
% App. Total	0	0	100		0	100	0		50	0	50		0	50	50	
PHF	.000	.000	.688	.688	.000	.500	.000	.500	.250	.000	.250	.500	.000	.250	.250	.500

Accurate Counts
978-664-2565

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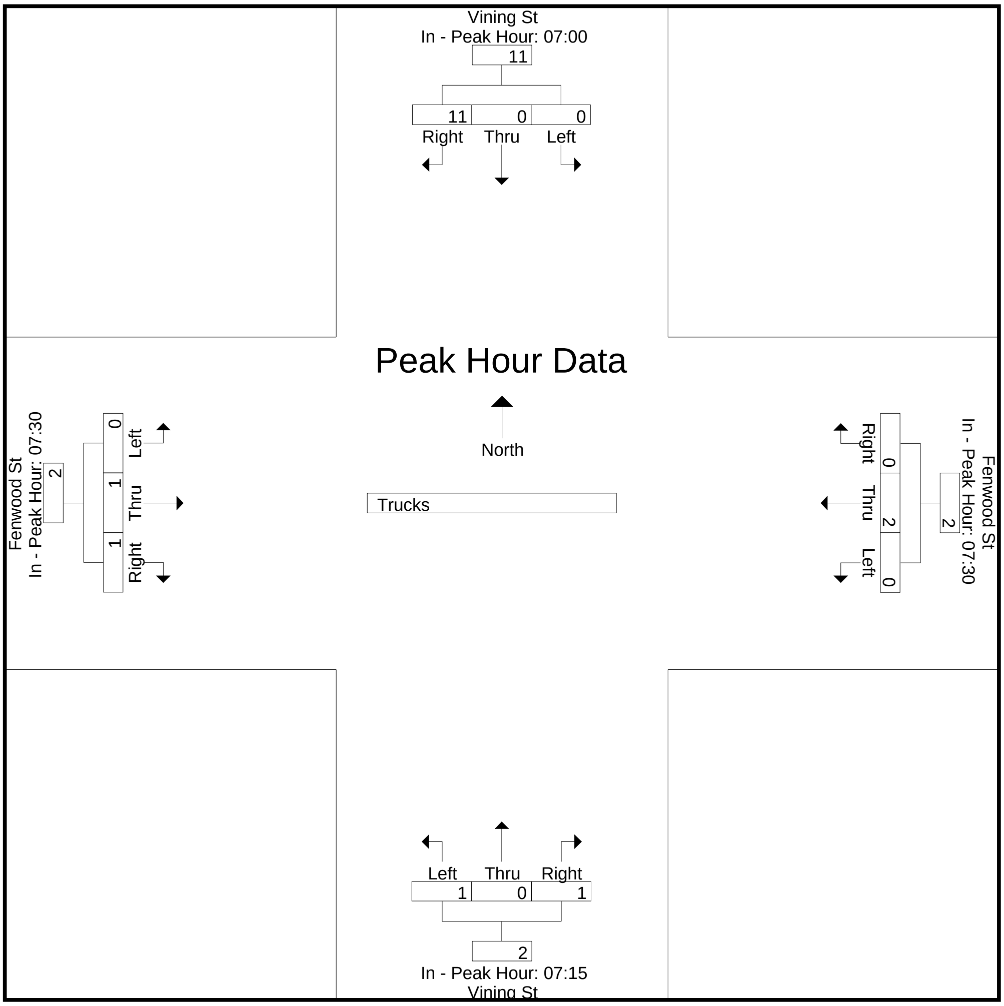


N/S Street : Vining Street
E/W Street: Fenwood Street
City/State : Boston, MA
Weather : Overcast

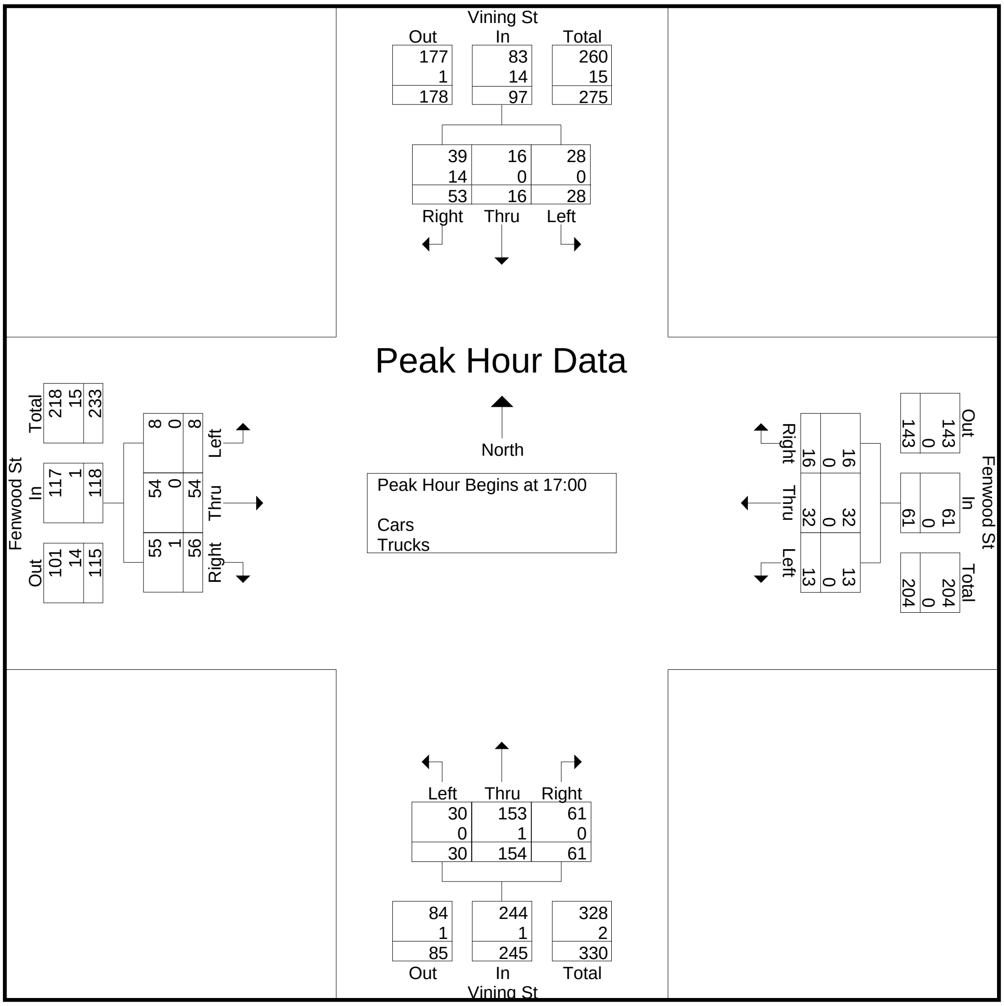
Accurate Counts
978-664-2565

File Name : 10568009
Site Code : 10568009
Start Date : 5/5/2009

Groups Printed- Cars - Trucks

	Vining St From North				Fenwood St From East				Vining St From South				Fenwood St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	3	6	8	6	3	10	7	15	12	40	14	2	3	9	24	64	87	139	226
16:15	4	2	16	13	10	3	6	10	10	46	4	1	1	9	13	62	86	124	210
16:30	3	2	14	6	5	6	7	15	9	39	10	0	6	14	17	63	84	132	216
16:45	2	1	12	4	1	8	1	12	13	38	6	1	0	9	12	69	86	103	189
Total	12	11	50	29	19	27	21	52	44	163	34	4	10	41	66	258	343	498	841
17:00	6	0	12	3	5	14	4	6	8	35	21	0	4	15	17	68	77	141	218
17:15	10	3	17	3	3	7	4	4	6	37	12	2	2	12	8	101	110	121	231
17:30	4	2	13	7	2	8	5	6	8	47	18	0	1	13	11	77	90	132	222
17:45	8	11	11	3	3	3	3	5	8	35	10	3	1	14	20	76	87	127	214
Total	28	16	53	16	13	32	16	21	30	154	61	5	8	54	56	322	364	521	885
Grand Total	40	27	103	45	32	59	37	73	74	317	95	9	18	95	122	580	707	1019	1726
Apprch %	23.5	15.9	60.6		25	46.1	28.9		15.2	65.2	19.5		7.7	40.4	51.9				
Total %	3.9	2.6	10.1		3.1	5.8	3.6		7.3	31.1	9.3		1.8	9.3	12		41	59	
Cars	39	27	73		32	59	37		74	316	95		18	93	121		0	0	1691
% Cars	97.5	100	70.9	100	100	100	100	100	100	99.7	100	100	100	97.9	99.2	100	0	0	98
Trucks	1	0	30		0	0	0		0	1	0		0	2	1		0	0	35
% Trucks	2.5	0	29.1	0	0	0	0	0	0	0.3	0	0	0	2.1	0.8	0	0	0	2

	Vining St From North				Fenwood St From East				Vining St From South				Fenwood St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 17:00																	
17:00	6	0	12	18	**5**	**14**	4	**23**	**8**	35	**21**	64	**4**	**15**	17	**36**	**141**
17:15	**10**	3	**17**	**30**	3	7	4	14	6	37	12	55	2	12	8	22	121
17:30	4	2	13	19	2	8	**5**	15	8	**47**	18	**73**	1	13	11	25	132
17:45	8	**11**	11	30	3	3	3	9	8	35	10	53	1	14	**20**	35	127
Total Volume	28	16	53	97	13	32	16	61	30	154	61	245	8	54	56	118	521
% App. Total	28.9	16.5	54.6		21.3	52.5	26.2		12.2	62.9	24.9		6.8	45.8	47.5		
PHF	.700	.364	.779	.808	.650	.571	.800	.663	.938	.819	.726	.839	.500	.900	.700	.819	.924
Cars	28	16	39	83	13	32	16	61	30	153	61	244	8	54	55	117	505
% Cars	100	100	73.6	85.6	100	100	100	100	100	99.4	100	99.6	100	100	98.2	99.2	96.9
Trucks	0	0	14	14	0	0	0	0	0	1	0	1	0	0	1	1	16
% Trucks	0	0	26.4	14.4	0	0	0	0	0	0.6	0	0.4	0	0	1.8	0.8	3.1



Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	17:00				16:15				16:45				17:00			
+0 mins.	6	0	12	18	**10**	3	6	19	**13**	38	6	57	**4**	**15**	17	**36**
+15 mins.	**10**	3	**17**	**30**	5	6	**7**	18	8	35	**21**	64	2	12	8	22
+30 mins.	4	2	13	19	1	8	1	10	6	37	12	55	1	13	11	25
+45 mins.	8	**11**	11	30	5	**14**	4	**23**	8	**47**	18	**73**	1	14	**20**	35
Total Volume	28	16	53	97	21	31	18	70	35	157	57	249	8	54	56	118
% App. Total	28.9	16.5	54.6		30	44.3	25.7		14.1	63.1	22.9		6.8	45.8	47.5	
PHF	.700	.364	.779	.808	.525	.554	.643	.761	.673	.835	.679	.853	.500	.900	.700	.819
Cars	28	16	39	83	21	31	18	70	35	156	57	248	8	54	55	117
% Cars	100	100	73.6	85.6	100	100	100	100	100	99.4	100	99.6	100	100	98.2	99.2
Trucks	0	0	14	14	0	0	0	0	0	1	0	1	0	0	1	1
% Trucks	0	0	26.4	14.4	0	0	0	0	0	0.6	0	0.4	0	0	1.8	0.8

Accurate Counts
978-664-2565

File Name : 10568009
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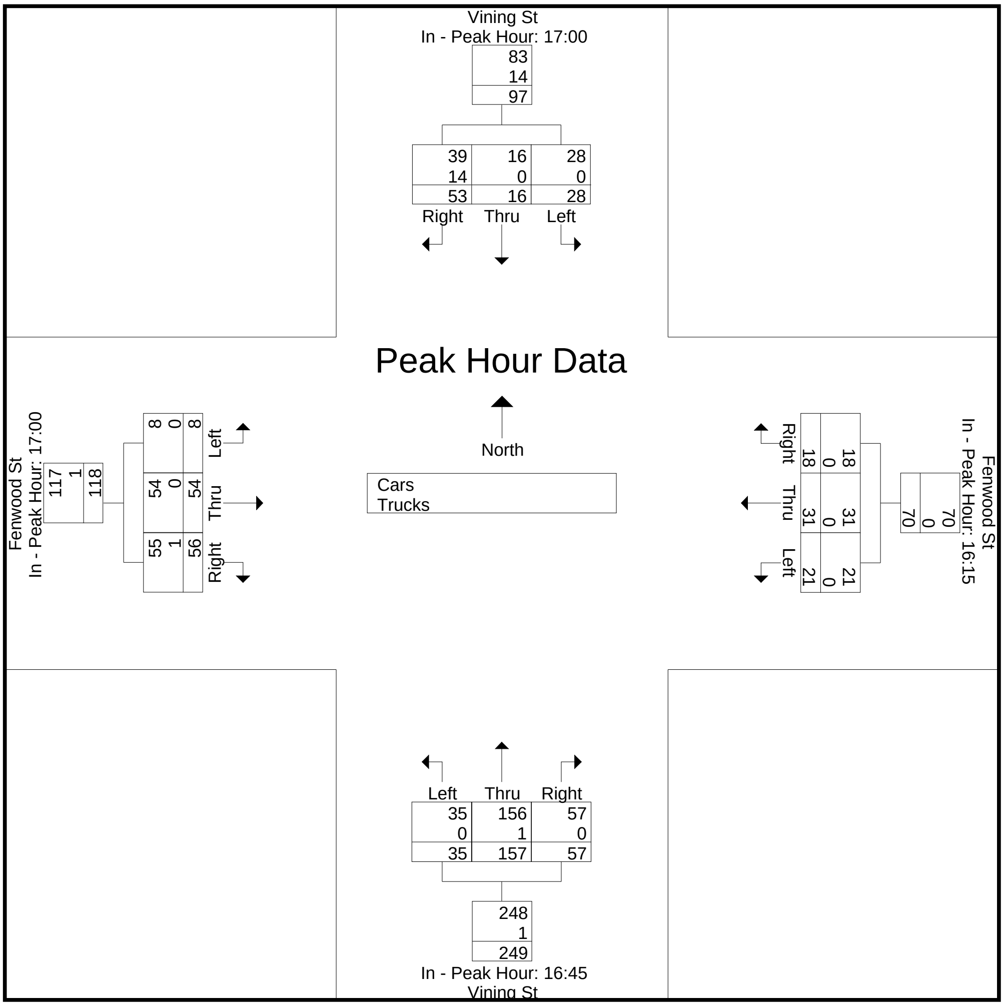


N/S Street : Vining Street
E/W Street: Fenwood Street
City/State : Boston, MA
Weather : Overcast

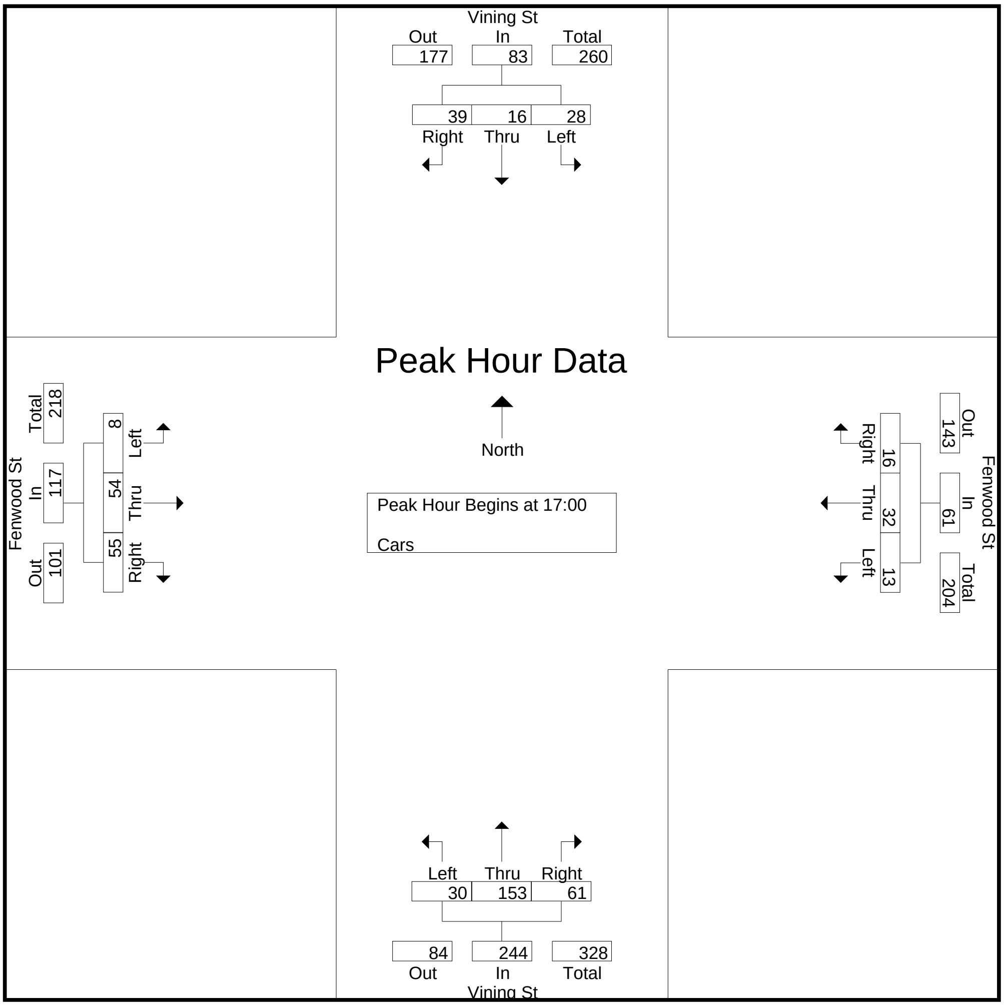
Accurate Counts
978-664-2565

File Name : 10568009
Site Code : 10568009
Start Date : 5/5/2009
Page No : 1

Groups Printed- Cars

	Vining St From North				Fenwood St From East				Vining St From South				Fenwood St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	2	6	4	6	3	10	7	15	12	40	14	2	3	8	24	64	87	133	220
16:15	4	2	12	13	10	3	6	10	10	46	4	1	1	8	13	62	86	119	205
16:30	3	2	10	6	5	6	7	15	9	39	10	0	6	14	17	63	84	128	212
16:45	2	1	8	4	1	8	1	12	13	38	6	1	0	9	12	69	86	99	185
Total	11	11	34	29	19	27	21	52	44	163	34	4	10	39	66	258	343	479	822
17:00	6	0	9	3	5	14	4	6	8	35	21	0	4	15	16	68	77	137	214
17:15	10	3	13	3	3	7	4	4	6	36	12	2	2	12	8	101	110	116	226
17:30	4	2	9	7	2	8	5	6	8	47	18	0	1	13	11	77	90	128	218
17:45	8	11	8	3	3	3	3	5	8	35	10	3	1	14	20	76	87	124	211
Total	28	16	39	16	13	32	16	21	30	153	61	5	8	54	55	322	364	505	869
Grand Total	39	27	73	45	32	59	37	73	74	316	95	9	18	93	121	580	707	984	1691
Apprch %	28.1	19.4	52.5		25	46.1	28.9		15.3	65.2	19.6		7.8	40.1	52.2				
Total %	4	2.7	7.4		3.3	6	3.8		7.5	32.1	9.7		1.8	9.5	12.3		41.8	58.2	

	Vining St From North				Fenwood St From East				Vining St From South				Fenwood St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 17:00																	
17:00	6	0	9	15	**5**	**14**	4	**23**	**8**	35	**21**	64	**4**	**15**	16	**35**	**137**
17:15	**10**	3	**13**	26	3	7	4	14	6	36	12	54	2	12	8	22	116
17:30	4	2	9	15	2	8	**5**	15	8	**47**	18	**73**	1	13	11	25	128
17:45	8	**11**	8	**27**	3	3	3	9	8	35	10	53	1	14	**20**	35	124
Total Volume	28	16	39	83	13	32	16	61	30	153	61	244	8	54	55	117	505
% App. Total	33.7	19.3	47		21.3	52.5	26.2		12.3	62.7	25		6.8	46.2	47		
PHF	.700	.364	.750	.769	.650	.571	.800	.663	.938	.814	.726	.836	.500	.900	.688	.836	.922

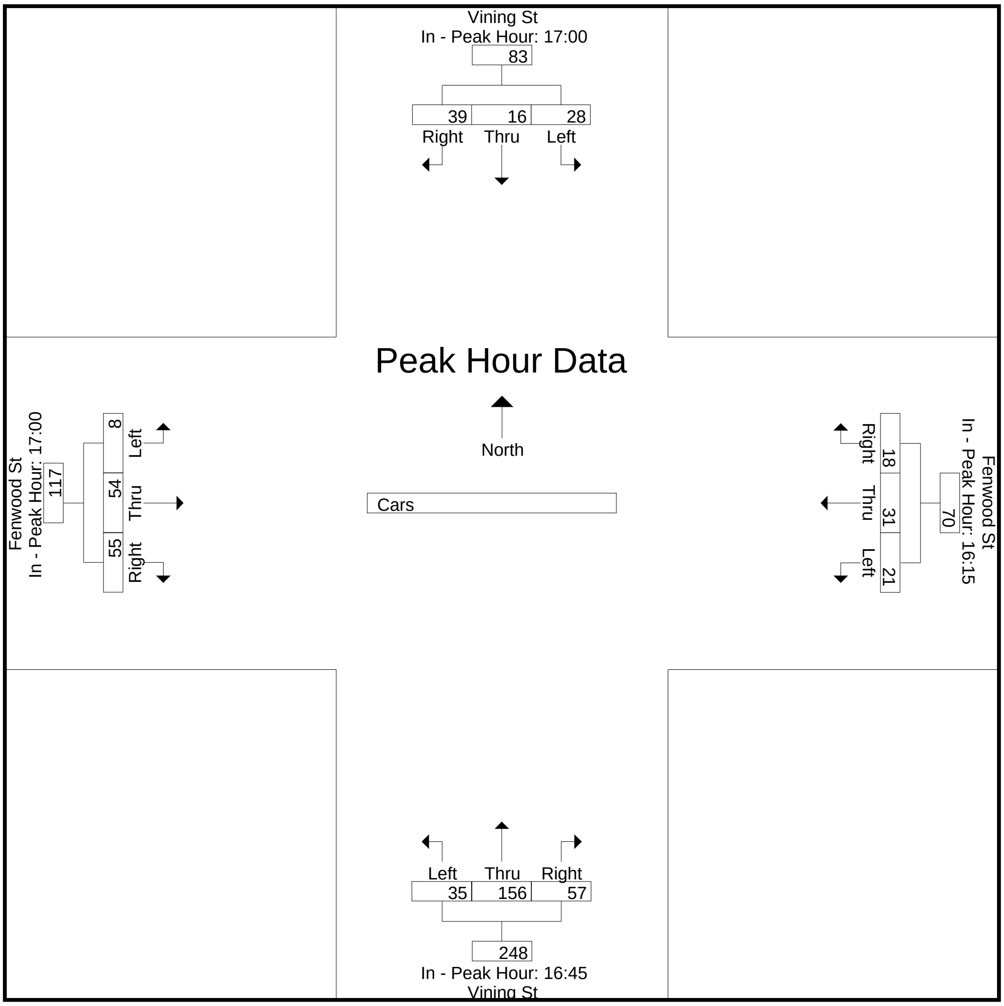


Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	17:00				16:15				16:45				17:00			
+0 mins.	6	0	9	15	**10**	3	6	19	**13**	38	6	57	**4**	**15**	16	**35**
+15 mins.	**10**	3	**13**	26	5	6	**7**	18	8	35	**21**	64	2	12	8	22
+30 mins.	4	2	9	15	1	8	1	10	6	36	12	54	1	13	11	25
+45 mins.	8	**11**	8	**27**	5	**14**	4	**23**	8	**47**	18	**73**	1	14	**20**	35
Total Volume	28	16	39	83	21	31	18	70	35	156	57	248	8	54	55	117
% App. Total	33.7	19.3	47		30	44.3	25.7		14.1	62.9	23		6.8	46.2	47	
PHF	.700	.364	.750	.769	.525	.554	.643	.761	.673	.830	.679	.849	.500	.900	.688	.836

Accurate Counts
978-664-2565

File Name : 10568009
Site Code : 10568009
Start Date : 5/5/2009
Page No : 3



N/S Street : Vining Street
E/W Street: Fenwood Street
City/State : Boston, MA
Weather : Overcast

Accurate Counts
978-664-2565

File Name : 10568009
Site Code : 10568009
Start Date : 5/5/2009
Page No : 1

Groups Printed- Trucks

	Vining St From North				Fenwood St From East				Vining St From South				Fenwood St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	1	0	4	0	0	0	0	0	0	0	0	0	0	1	0	0	0	6	6
16:15	0	0	4	0	0	0	0	0	0	0	0	0	0	1	0	0	0	5	5
16:30	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4
16:45	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4
Total	1	0	16	0	0	0	0	0	0	0	0	0	0	2	0	0	0	19	19
17:00	0	0	3	0	0	0	0	0	0	0	0	0	0	0	1	0	0	4	4
17:15	0	0	4	0	0	0	0	0	0	1	0	0	0	0	0	0	0	5	5
17:30	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4
17:45	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3
Total	0	0	14	0	0	0	0	0	0	1	0	0	0	0	1	0	0	16	16
Grand Total	1	0	30	0	0	0	0	0	0	1	0	0	0	2	1	0	0	35	35
Apprch %	3.2	0	96.8		0	0	0		0	100	0		0	66.7	33.3				
Total %	2.9	0	85.7		0	0	0		0	2.9	0		0	5.7	2.9		0	100	

	Vining St From North				Fenwood St From East				Vining St From South				Fenwood St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 16:00																	
16:00	**1**	0	**4**	**5**	0	0	0	0	0	0	0	0	0	**1**	0	**1**	**6**
16:15	0	0	4	4	0	0	0	0	0	0	0	0	0	1	0	1	5
16:30	0	0	4	4	0	0	0	0	0	0	0	0	0	0	0	0	4
16:45	0	0	4	4	0	0	0	0	0	0	0	0	0	0	0	0	4
Total Volume	1	0	16	17	0	0	0	0	0	0	0	0	0	2	0	2	19
% App. Total	5.9	0	94.1		0	0	0		0	0	0		0	100	0		
PHF	.250	.000	1.000	.850	.000	.000	.000	.000	.000	.000	.000	.000	.000	.500	.000	.500	.792

Accurate Counts
978-664-2565

File Name : 10568009
Site Code : 10568009
Start Date : 5/5/2009
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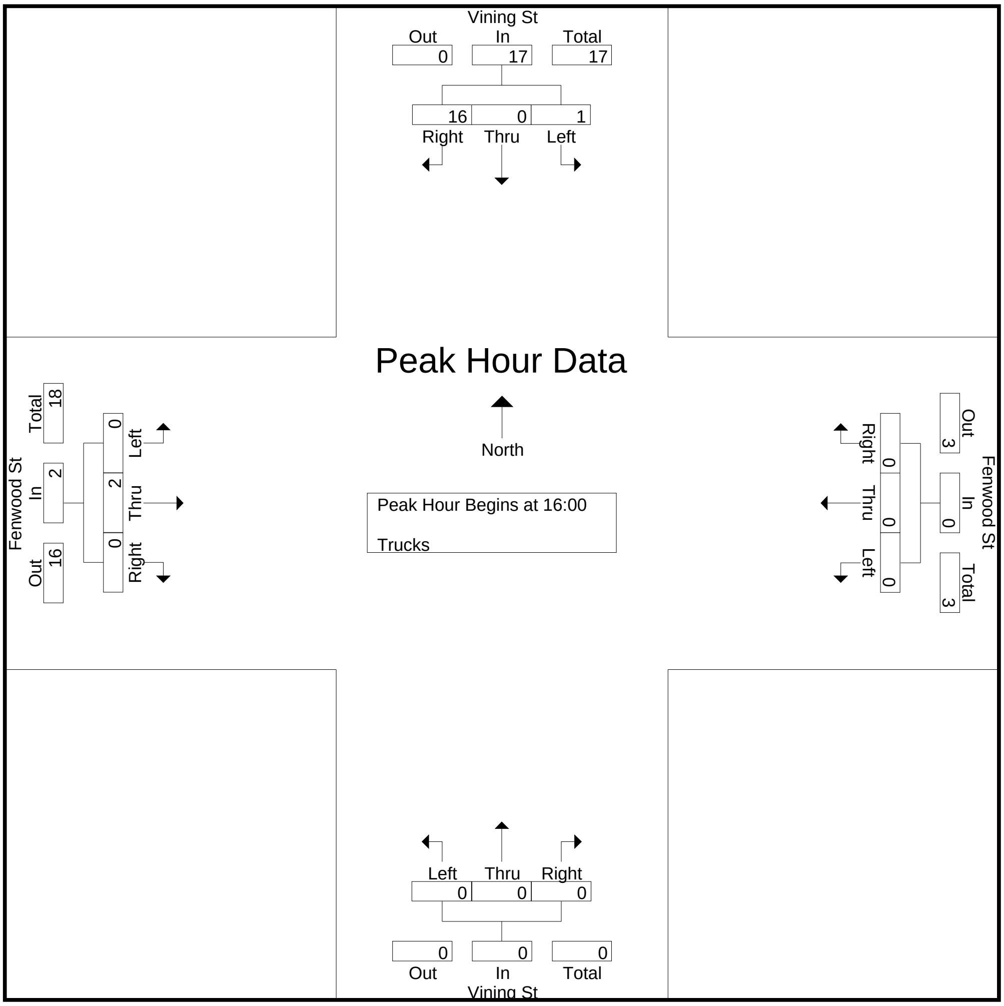
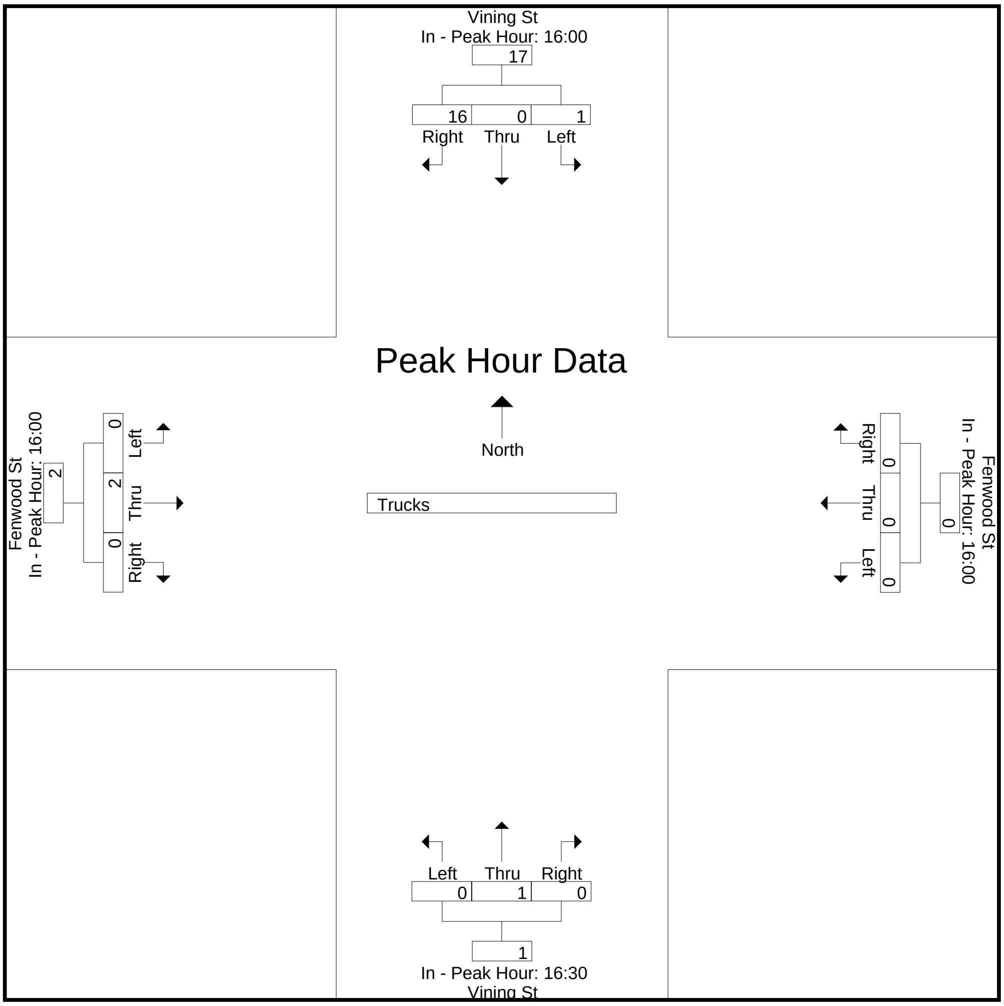


Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:00				16:00				16:30				16:00			
+0 mins.	**1**	0	**4**	**5**	0	0	0	0	0	0	0	0	0	**1**	0	**1**
+15 mins.	0	0	4	4	0	0	0	0	0	0	0	0	0	1	0	1
+30 mins.	0	0	4	4	0	0	0	0	0	0	0	0	0	0	0	0
+45 mins.	0	0	4	4	0	0	0	0	0	**1**	0	**1**	0	0	0	0
Total Volume	1	0	16	17	0	0	0	0	0	1	0	1	0	2	0	2
% App. Total	5.9	0	94.1		0	0	0		0	100	0		0	100	0	
PHF	.250	.000	1.000	.850	.000	.000	.000	.000	.000	.250	.000	.250	.000	.500	.000	.500

Accurate Counts
978-664-2565

File Name : 10568009
Site Code : 10568009
Start Date : 5/5/2009
Page No : 3



N/S Street : St. Albans Street
E/W Street: Fenwood Street
City/State : Boston, MA
Weather : Overcast

Accurate Counts
978-664-2565

File Name : 10568010
Site Code : 10568010
Start Date : 5/5/2009

Groups Printed- Cars - Trucks

	St. Albans St From North				Fenwood St From East				St. Albans St From South				Fenwood St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	0	8	8	9	0	0	2	3	10	10	0	6	17	0	8	5	23	63	86
07:15	0	9	1	5	5	2	2	5	13	12	0	3	23	0	21	4	17	88	105
07:30	0	5	2	2	4	3	0	3	15	4	0	6	21	0	30	7	18	84	102
07:45	0	6	7	9	4	7	4	4	28	12	0	2	11	0	17	11	26	96	122
Total	0	28	18	25	13	12	8	15	66	38	0	17	72	0	76	27	84	331	415
08:00	0	9	4	5	2	11	3	1	15	10	0	4	7	0	11	8	18	72	90
08:15	0	8	6	3	2	11	7	3	23	15	0	7	6	0	5	2	15	83	98
08:30	0	1	7	2	1	3	3	8	19	15	0	7	11	0	10	4	21	70	91
08:45	0	6	9	6	2	8	6	9	23	21	0	6	6	0	13	10	31	94	125
Total	0	24	26	16	7	33	19	21	80	61	0	24	30	0	39	24	85	319	404
Grand Total	0	52	44	41	20	45	27	36	146	99	0	41	102	0	115	51	169	650	819
Apprch %	0	54.2	45.8		21.7	48.9	29.3		59.6	40.4	0		47	0	53				
Total %	0	8	6.8		3.1	6.9	4.2		22.5	15.2	0		15.7	0	17.7		20.6	79.4	
Cars	0	52	44		19	44	24		145	96	0		102	0	113		0	0	808
% Cars	0	100	100	100	95	97.8	88.9	100	99.3	97	0	100	100	0	98.3	100	0	0	98.7
Trucks	0	0	0		1	1	3		1	3	0		0	0	2		0	0	11
% Trucks	0	0	0	0	5	2.2	11.1	0	0.7	3	0	0	0	0	1.7	0	0	0	1.3

	St. Albans St From North				Fenwood St From East				St. Albans St From South				Fenwood St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:15																	
07:15	0	**9**	1	10	**5**	2	2	9	13	**12**	0	25	**23**	0	21	44	88
07:30	0	5	2	7	4	3	0	7	15	4	0	19	21	0	**30**	**51**	84
07:45	0	6	**7**	**13**	4	7	**4**	15	**28**	12	0	**40**	11	0	17	28	**96**
08:00	0	9	4	13	2	**11**	3	**16**	15	10	0	25	7	0	11	18	72
Total Volume	0	29	14	43	15	23	9	47	71	38	0	109	62	0	79	141	340
% App. Total	0	67.4	32.6		31.9	48.9	19.1		65.1	34.9	0		44	0	56		
PHF	.000	.806	.500	.827	.750	.523	.563	.734	.634	.792	.000	.681	.674	.000	.658	.691	.885
Cars	0	29	14	43	14	23	8	45	70	38	0	108	62	0	78	140	336
% Cars	0	100	100	100	93.3	100	88.9	95.7	98.6	100	0	99.1	100	0	98.7	99.3	98.8
Trucks	0	0	0	0	1	0	1	2	1	0	0	1	0	0	1	1	4
% Trucks	0	0	0	0	6.7	0	11.1	4.3	1.4	0	0	0.9	0	0	1.3	0.7	1.2

Accurate Counts
978-664-2565

File Name : 10568010
Site Code : 10568010
Start Date : 5/5/2009
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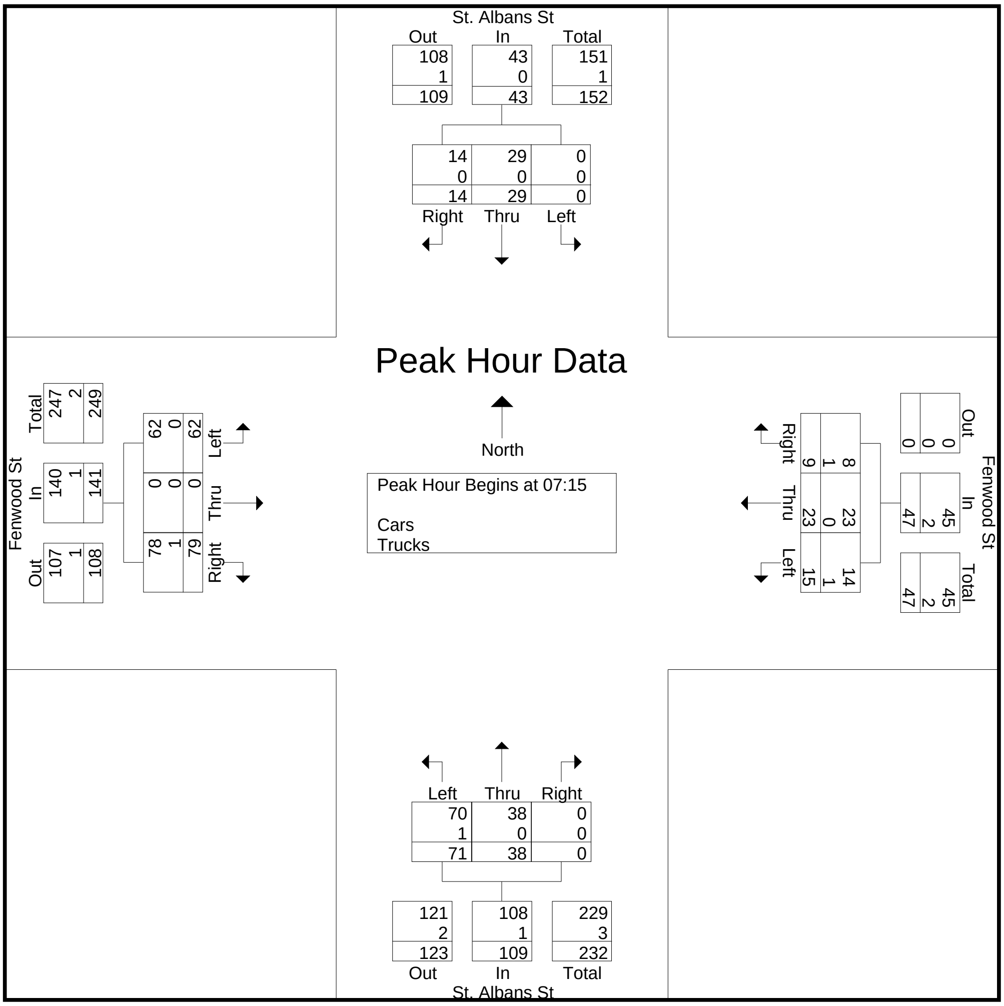

Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	08:00				08:00				08:00				07:00			
+0 mins.	0	**9**	4	13	**2**	**11**	3	16	15	10	0	25	17	0	8	25
+15 mins.	0	8	6	14	2	11	**7**	**20**	**23**	15	0	38	**23**	0	21	44
+30 mins.	0	1	7	8	1	3	3	7	19	15	0	34	21	0	**30**	**51**
+45 mins.	0	6	**9**	**15**	2	8	6	16	23	**21**	0	**44**	11	0	17	28
Total Volume	0	24	26	50	7	33	19	59	80	61	0	141	72	0	76	148
% App. Total	0	48	52		11.9	55.9	32.2		56.7	43.3	0		48.6	0	51.4	
PHF	.000	.667	.722	.833	.875	.750	.679	.738	.870	.726	.000	.801	.783	.000	.633	.725
Cars	0	24	26	50	7	32	16	55	80	58	0	138	72	0	75	147
% Cars	0	100	100	100	100	97	84.2	93.2	100	95.1	0	97.9	100	0	98.7	99.3
Trucks	0	0	0	0	0	1	3	4	0	3	0	3	0	0	1	1
% Trucks	0	0	0	0	0	3	15.8	6.8	0	4.9	0	2.1	0	0	1.3	0.7

Accurate Counts
978-664-2565

File Name : 10568010
Site Code : 10568010
Start Date : 5/5/2009
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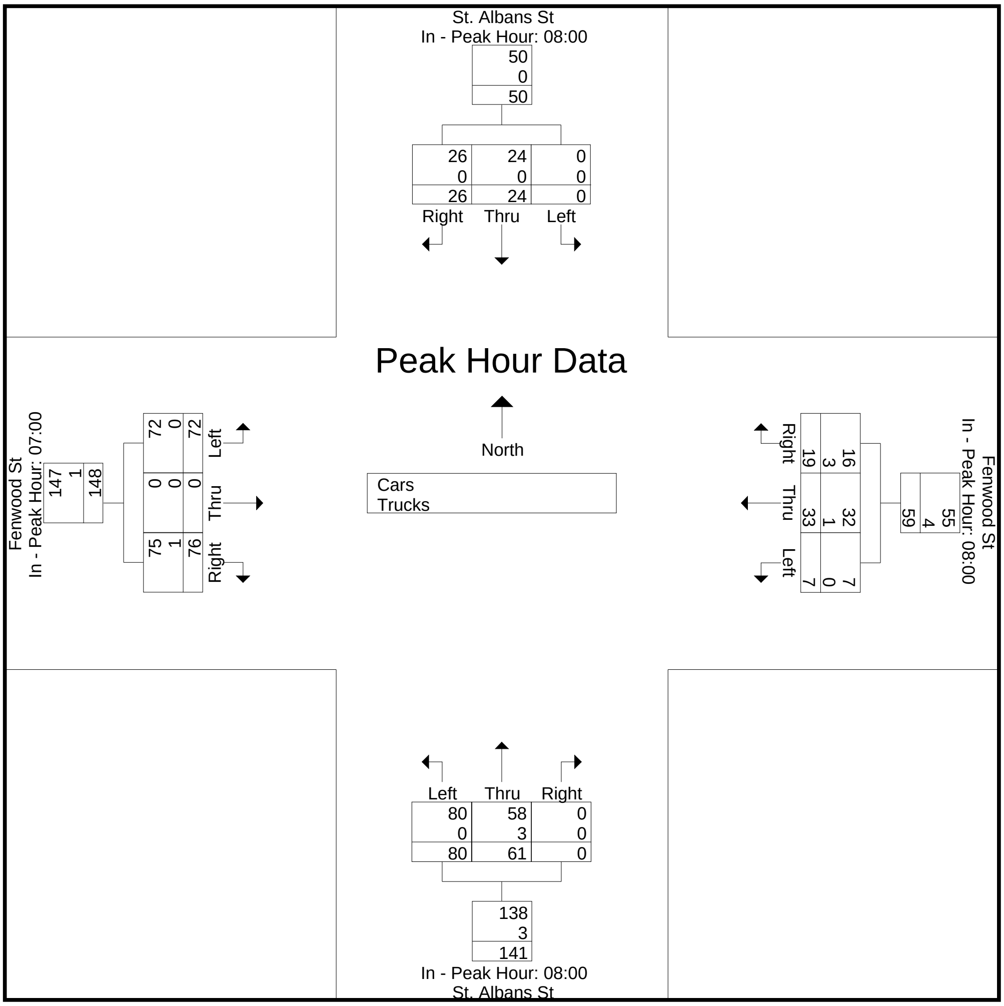


N/S Street : St. Albans Street
E/W Street: Fenwood Street
City/State : Boston, MA
Weather : Overcast

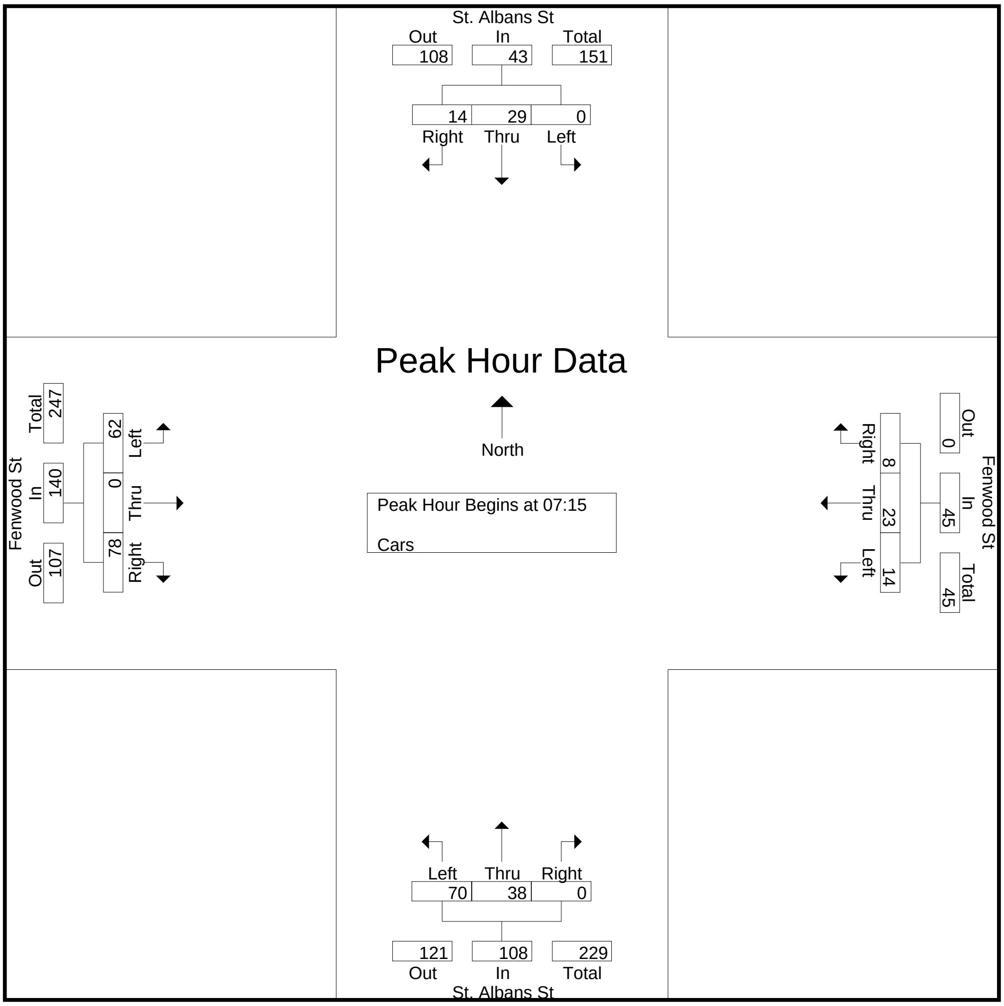
Accurate Counts
978-664-2565

File Name : 10568010
Site Code : 10568010
Start Date : 5/5/2009
Page No : 1

Groups Printed- Cars

	St. Albans St From North				Fenwood St From East				St. Albans St From South				Fenwood St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	0	8	8	9	0	0	2	3	10	10	0	6	17	0	8	5	23	63	86
07:15	0	9	1	5	5	2	2	5	13	12	0	3	23	0	21	4	17	88	105
07:30	0	5	2	2	3	3	0	3	14	4	0	6	21	0	30	7	18	82	100
07:45	0	6	7	9	4	7	4	4	28	12	0	2	11	0	16	11	26	95	121
Total	0	28	18	25	12	12	8	15	65	38	0	17	72	0	75	27	84	328	412
08:00	0	9	4	5	2	11	2	1	15	10	0	4	7	0	11	8	18	71	89
08:15	0	8	6	3	2	10	7	3	23	15	0	7	6	0	5	2	15	82	97
08:30	0	1	7	2	1	3	3	8	19	14	0	7	11	0	9	4	21	68	89
08:45	0	6	9	6	2	8	4	9	23	19	0	6	6	0	13	10	31	90	121
Total	0	24	26	16	7	32	16	21	80	58	0	24	30	0	38	24	85	311	396
Grand Total	0	52	44	41	19	44	24	36	145	96	0	41	102	0	113	51	169	639	808
Apprch %	0	54.2	45.8		21.8	50.6	27.6		60.2	39.8	0		47.4	0	52.6				
Total %	0	8.1	6.9		3	6.9	3.8		22.7	15	0		16	0	17.7		20.9	79.1	

	St. Albans St From North				Fenwood St From East				St. Albans St From South				Fenwood St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:15																	
07:15	0	**9**	1	10	**5**	2	2	9	13	**12**	0	25	**23**	0	21	44	88
07:30	0	5	2	7	3	3	0	6	14	4	0	18	21	0	**30**	**51**	82
07:45	0	6	**7**	**13**	4	7	**4**	**15**	**28**	12	0	**40**	11	0	16	27	**95**
08:00	0	9	4	13	2	**11**	2	15	15	10	0	25	7	0	11	18	71
Total Volume	0	29	14	43	14	23	8	45	70	38	0	108	62	0	78	140	336
% App. Total	0	67.4	32.6		31.1	51.1	17.8		64.8	35.2	0		44.3	0	55.7		
PHF	.000	.806	.500	.827	.700	.523	.500	.750	.625	.792	.000	.675	.674	.000	.650	.686	.884



Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	08:00				07:45				08:00				07:00			
+0 mins.	0	**9**	4	13	**4**	7	4	15	15	10	0	25	17	0	8	25
+15 mins.	0	8	6	14	2	**11**	2	15	**23**	15	0	38	**23**	0	21	44
+30 mins.	0	1	7	8	2	10	**7**	**19**	19	14	0	33	21	0	**30**	**51**
+45 mins.	0	6	**9**	**15**	1	3	3	7	23	**19**	0	**42**	11	0	16	27
Total Volume	0	24	26	50	9	31	16	56	80	58	0	138	72	0	75	147
% App. Total	0	48	52		16.1	55.4	28.6		58	42	0		49	0	51	
PHF	.000	.667	.722	.833	.563	.705	.571	.737	.870	.763	.000	.821	.783	.000	.625	.721

Accurate Counts
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File Name : 10568010
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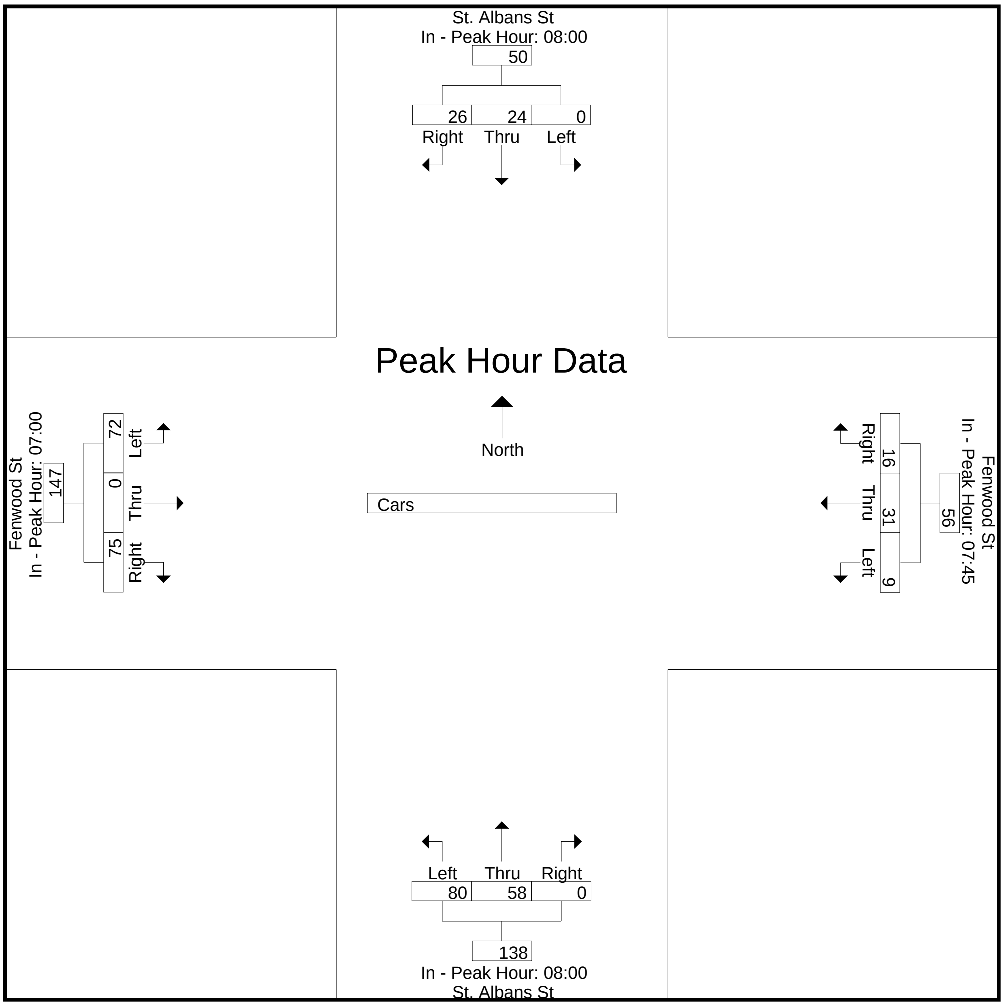

N/S Street : St. Albans Street
E/W Street: Fenwood Street
City/State : Boston, MA
Weather : Overcast

Accurate Counts
978-664-2565

File Name : 10568010
Site Code : 10568010
Start Date : 5/5/2009
Page No : 1

Groups Printed- Trucks

	St. Albans St From North				Fenwood St From East				St. Albans St From South				Fenwood St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	2	2
07:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
Total	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	3	3
08:00	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1
08:15	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1
08:30	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	2	2
08:45	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0	4	4
Total	0	0	0	0	0	1	3	0	0	3	0	0	0	0	1	0	0	8	8
Grand Total	0	0	0	0	1	1	3	0	1	3	0	0	0	0	2	0	0	11	11
Apprch %	0	0	0		20	20	60		25	75	0		0	0	100				
Total %	0	0	0		9.1	9.1	27.3		9.1	27.3	0		0	0	18.2		0	100	

	St. Albans St From North				Fenwood St From East				St. Albans St From South				Fenwood St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 08:00																	
08:00	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1
08:15	0	0	0	0	0	**1**	0	1	0	0	0	0	0	0	0	0	1
08:30	0	0	0	0	0	0	0	0	0	1	0	1	0	0	**1**	**1**	2
08:45	0	0	0	0	0	0	**2**	**2**	0	**2**	0	**2**	0	0	0	0	**4**
Total Volume	0	0	0	0	0	1	3	4	0	3	0	3	0	0	1	1	8
% App. Total	0	0	0		0	25	75		0	100	0		0	0	100		
PHF	.000	.000	.000	.000	.000	.250	.375	.500	.000	.375	.000	.375	.000	.000	.250	.250	.500

Accurate Counts
978-664-2565

File Name : 10568010
Site Code : 10568010
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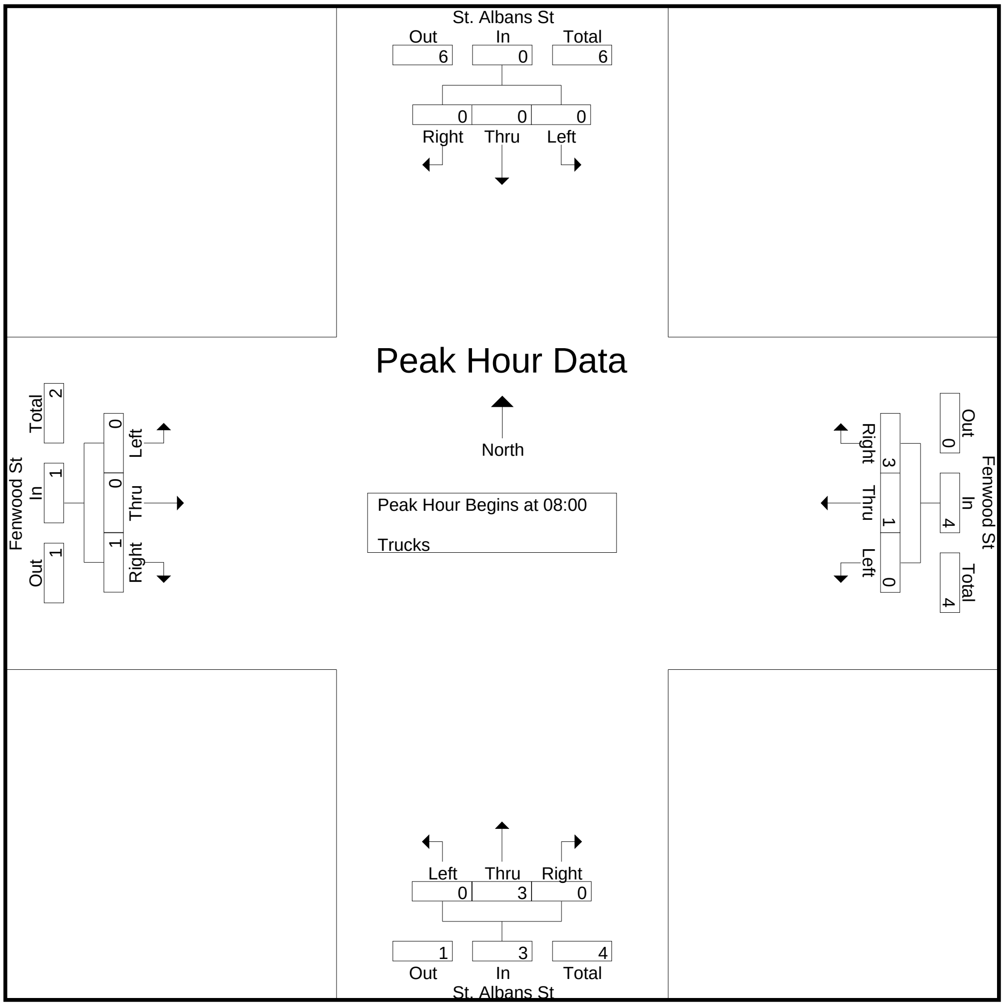

Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:00				08:00				08:00				07:45			
+0 mins.	0	0	0	0	0	0	1	1	0	0	0	0	0	0	**1**	**1**
+15 mins.	0	0	0	0	0	**1**	0	1	0	0	0	0	0	0	0	0
+30 mins.	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0
+45 mins.	0	0	0	0	0	0	**2**	**2**	0	**2**	0	**2**	0	0	1	1
Total Volume	0	0	0	0	0	1	3	4	0	3	0	3	0	0	2	2
% App. Total	0	0	0		0	25	75		0	100	0		0	0	100	
PHF	.000	.000	.000	.000	.000	.250	.375	.500	.000	.375	.000	.375	.000	.000	.500	.500

Accurate Counts
978-664-2565

File Name : 10568010
Site Code : 10568010
Start Date : 5/5/2009
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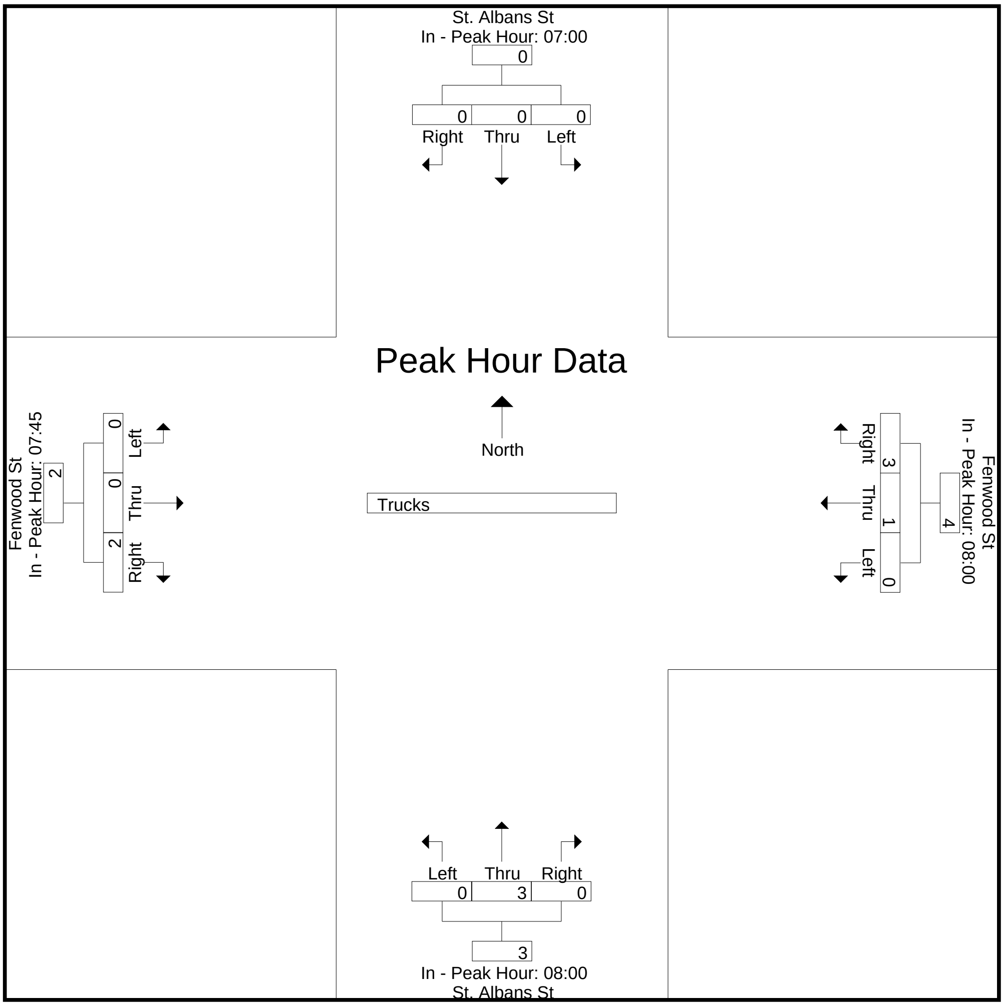

N/S Street : St. Albans Street
E/W Street: Fenwood Street
City/State : Boston, MA
Weather : Overcast

Accurate Counts
978-664-2565

File Name : 10568010
Site Code : 10568010
Start Date : 5/5/2009
Page No : 1

Groups Printed- Cars - Trucks

	St. Albans St From North				Fenwood St From East				St. Albans St From South				Fenwood St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	0	8	4	6	6	9	2	1	6	9	0	4	6	0	21	11	22	71	93
16:15	0	17	6	3	3	3	5	1	7	6	0	14	6	0	13	9	27	66	93
16:30	0	15	4	5	5	5	2	4	9	13	1	3	4	0	24	6	18	82	100
16:45	0	10	1	8	3	6	5	6	5	5	0	5	3	0	14	6	25	52	77
Total	0	50	15	22	17	23	14	12	27	33	1	26	19	0	72	32	92	271	363
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	0	14	4	12	9	10	3	4	12	8	0	1	10	1	31	8	25	102	127
17:30	0	9	2	3	6	5	4	9	5	14	0	9	9	1	30	6	27	85	112
17:45	0	15	3	1	4	7	0	2	8	3	0	4	11	1	26	7	14	78	92
Total	0	38	9	16	19	22	7	15	25	25	0	14	30	3	87	21	66	265	331
Grand Total	0	88	24	38	36	45	21	27	52	58	1	40	49	3	159	53	158	536	694
Apprch %	0	78.6	21.4		35.3	44.1	20.6		46.8	52.3	0.9		23.2	1.4	75.4				
Total %	0	16.4	4.5		6.7	8.4	3.9		9.7	10.8	0.2		9.1	0.6	29.7		22.8	77.2	
Cars	0	85	24		33	45	21		50	52	1		48	3	156		0	0	676
% Cars	0	96.6	100	100	91.7	100	100	100	96.2	89.7	100	100	98	100	98.1	100	0	0	97.4
Trucks	0	3	0		3	0	0		2	6	0		1	0	3		0	0	18
% Trucks	0	3.4	0	0	8.3	0	0	0	3.8	10.3	0	0	2	0	1.9	0	0	0	2.6

	St. Albans St From North				Fenwood St From East				St. Albans St From South				Fenwood St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 16:00																	
16:00	0	8	4	12	**6**	**9**	2	**17**	6	9	0	15	**6**	0	21	27	71
16:15	0	**17**	**6**	**23**	3	3	**5**	11	7	6	0	13	6	0	13	19	66
16:30	0	15	4	19	5	5	2	12	**9**	**13**	**1**	**23**	4	0	**24**	**28**	**82**
16:45	0	10	1	11	3	6	5	14	5	5	0	10	3	0	14	17	52
Total Volume	0	50	15	65	17	23	14	54	27	33	1	61	19	0	72	91	271
% App. Total	0	76.9	23.1		31.5	42.6	25.9		44.3	54.1	1.6		20.9	0	79.1		
PHF	.000	.735	.625	.707	.708	.639	.700	.794	.750	.635	.250	.663	.792	.000	.750	.813	.826
Cars	0	48	15	63	14	23	14	51	26	30	1	57	18	0	69	87	258
% Cars	0	96.0	100	96.9	82.4	100	100	94.4	96.3	90.9	100	93.4	94.7	0	95.8	95.6	95.2
Trucks	0	2	0	2	3	0	0	3	1	3	0	4	1	0	3	4	13
% Trucks	0	4.0	0	3.1	17.6	0	0	5.6	3.7	9.1	0	6.6	5.3	0	4.2	4.4	4.8

Accurate Counts
978-664-2565

File Name : 10568010
Site Code : 10568010
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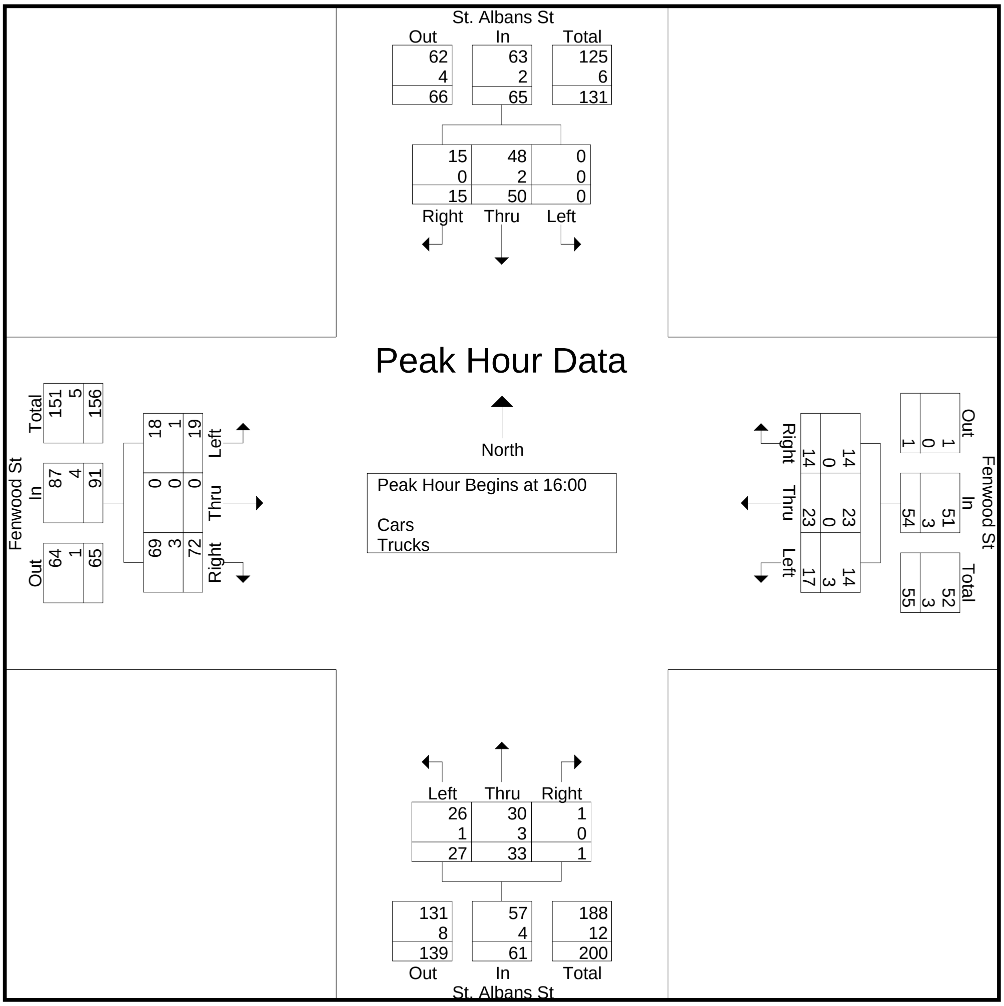
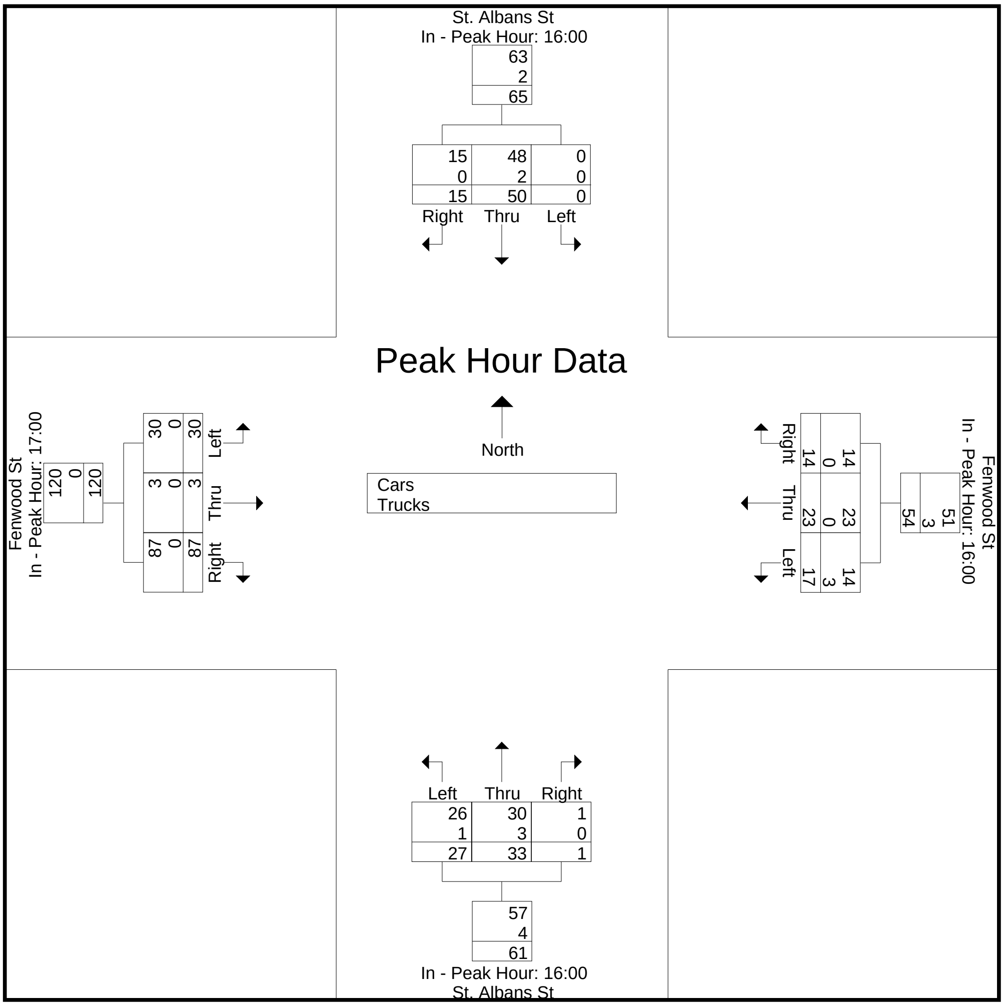


Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:00				16:00				16:00				17:00			
+0 mins.	0	8	4	12	**6**	**9**	2	**17**	6	9	0	15	0	0	0	0
+15 mins.	0	**17**	**6**	**23**	3	3	**5**	11	7	6	0	13	10	**1**	**31**	**42**
+30 mins.	0	15	4	19	5	5	2	12	**9**	**13**	**1**	**23**	9	1	30	40
+45 mins.	0	10	1	11	3	6	5	14	5	5	0	10	**11**	1	26	38
Total Volume	0	50	15	65	17	23	14	54	27	33	1	61	30	3	87	120
% App. Total	0	76.9	23.1		31.5	42.6	25.9		44.3	54.1	1.6		25	2.5	72.5	
PHF	.000	.735	.625	.707	.708	.639	.700	.794	.750	.635	.250	.663	.682	.750	.702	.714
Cars	0	48	15	63	14	23	14	51	26	30	1	57	30	3	87	120
% Cars	0	96	100	96.9	82.4	100	100	94.4	96.3	90.9	100	93.4	100	100	100	100
Trucks	0	2	0	2	3	0	0	3	1	3	0	4	0	0	0	0
% Trucks	0	4	0	3.1	17.6	0	0	5.6	3.7	9.1	0	6.6	0	0	0	0

Accurate Counts
978-664-2565

File Name : 10568010
Site Code : 10568010
Start Date : 5/5/2009
Page No : 3



N/S Street : St. Albans Street
E/W Street: Fenwood Street
City/State : Boston, MA
Weather : Overcast

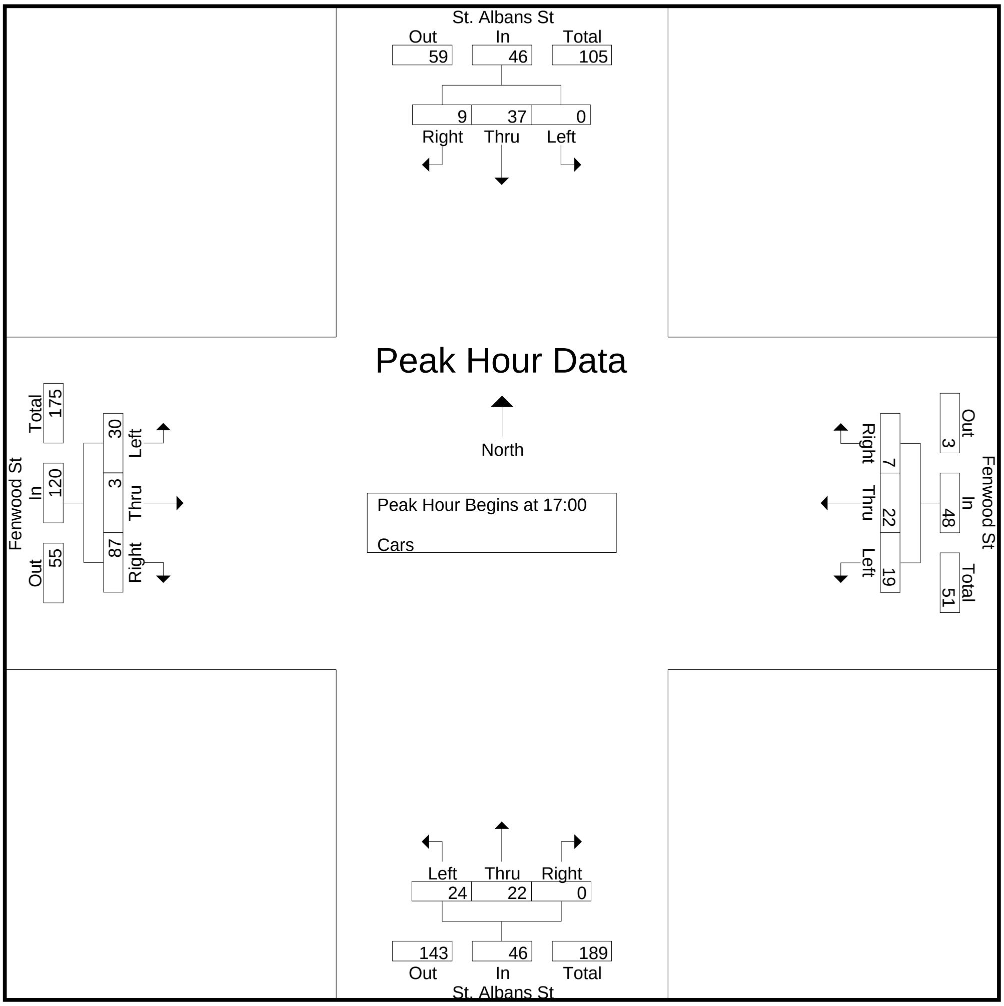
Accurate Counts
978-664-2565

File Name : 10568010
Site Code : 10568010
Start Date : 5/5/2009
Page No : 1

Groups Printed- Cars

	St. Albans St From North				Fenwood St From East				St. Albans St From South				Fenwood St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	0	8	4	6	5	9	2	1	6	9	0	4	5	0	19	11	22	67	89
16:15	0	16	6	3	3	3	5	1	6	4	0	14	6	0	12	9	27	61	88
16:30	0	15	4	5	3	5	2	4	9	12	1	3	4	0	24	6	18	79	97
16:45	0	9	1	8	3	6	5	6	5	5	0	5	3	0	14	6	25	51	76
Total	0	48	15	22	14	23	14	12	26	30	1	26	18	0	69	32	92	258	350
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	0	14	4	12	9	10	3	4	11	8	0	1	10	1	31	8	25	101	126
17:30	0	8	2	3	6	5	4	9	5	11	0	9	9	1	30	6	27	81	108
17:45	0	15	3	1	4	7	0	2	8	3	0	4	11	1	26	7	14	78	92
Total	0	37	9	16	19	22	7	15	24	22	0	14	30	3	87	21	66	260	326
Grand Total	0	85	24	38	33	45	21	27	50	52	1	40	48	3	156	53	158	518	676
Apprch %	0	78	22		33.3	45.5	21.2		48.5	50.5	1		23.2	1.4	75.4				
Total %	0	16.4	4.6		6.4	8.7	4.1		9.7	10	0.2		9.3	0.6	30.1		23.4	76.6	

	St. Albans St From North				Fenwood St From East				St. Albans St From South				Fenwood St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 17:00																	
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	0	14	**4**	**18**	**9**	**10**	3	**22**	**11**	8	0	**19**	10	**1**	**31**	**42**	**101**
17:30	0	8	2	10	6	5	**4**	15	5	**11**	0	16	9	1	30	40	81
17:45	0	**15**	3	18	4	7	0	11	8	3	0	11	**11**	1	26	38	78
Total Volume	0	37	9	46	19	22	7	48	24	22	0	46	30	3	87	120	260
% App. Total	0	80.4	19.6		39.6	45.8	14.6		52.2	47.8	0		25	2.5	72.5		
PHF	.000	.617	.563	.639	.528	.550	.438	.545	.545	.500	.000	.605	.682	.750	.702	.714	.644

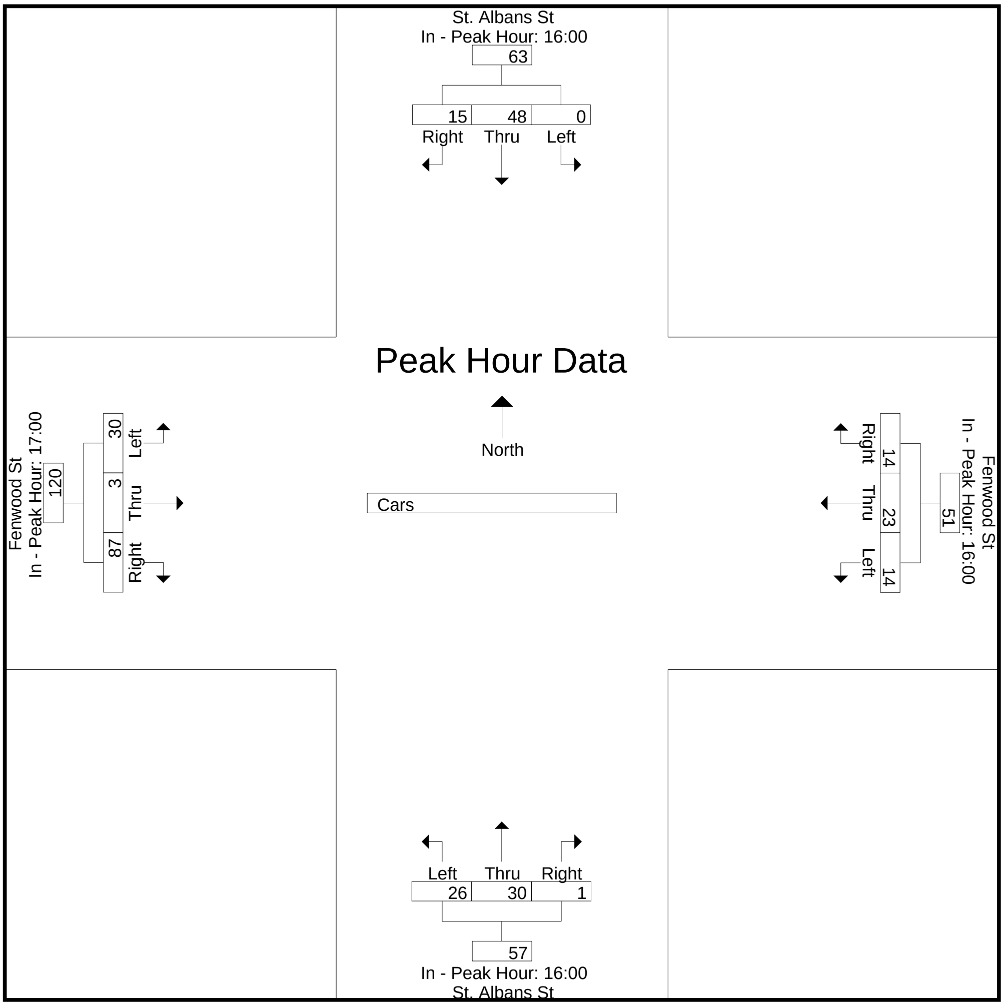


Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:00				16:00				16:00				17:00			
+0 mins.	0	8	4	12	**5**	**9**	2	**16**	6	9	0	15	0	0	0	0
+15 mins.	0	**16**	**6**	**22**	3	3	**5**	11	6	4	0	10	10	**1**	**31**	**42**
+30 mins.	0	15	4	19	3	5	2	10	**9**	**12**	**1**	**22**	9	1	30	40
+45 mins.	0	9	1	10	3	6	5	14	5	5	0	10	**11**	1	26	38
Total Volume	0	48	15	63	14	23	14	51	26	30	1	57	30	3	87	120
% App. Total	0	76.2	23.8		27.5	45.1	27.5		45.6	52.6	1.8		25	2.5	72.5	
PHF	.000	.750	.625	.716	.700	.639	.700	.797	.722	.625	.250	.648	.682	.750	.702	.714

Accurate Counts
978-664-2565

File Name : 10568010
Site Code : 10568010
Start Date : 5/5/2009
Page No : 3



N/S Street : St. Albans Street
E/W Street: Fenwood Street
City/State : Boston, MA
Weather : Overcast

Accurate Counts
978-664-2565

File Name : 10568010
Site Code : 10568010
Start Date : 5/5/2009
Page No : 1

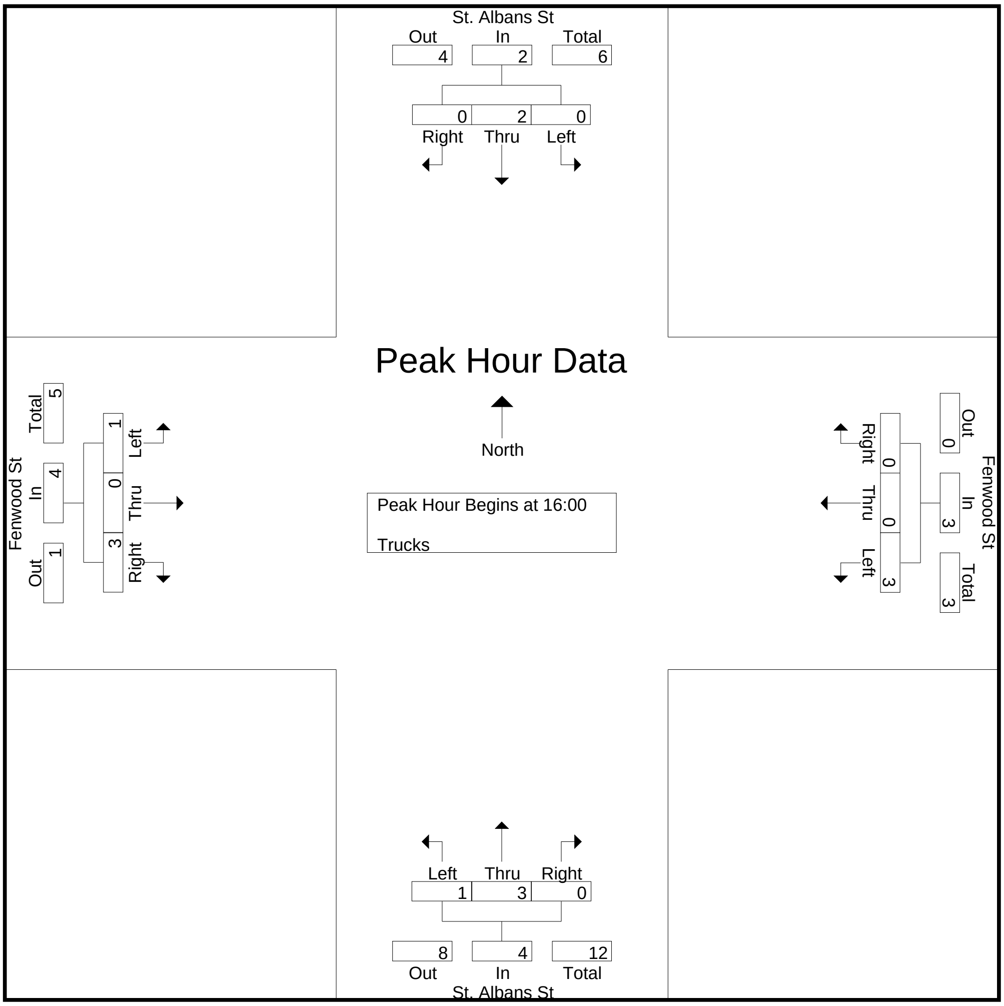
Groups Printed- Trucks

	St. Albans St From North				Fenwood St From East				St. Albans St From South				Fenwood St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	0	0	0	0	1	0	0	0	0	0	0	0	1	0	2	0	0	4	4
16:15	0	1	0	0	0	0	0	0	1	2	0	0	0	0	1	0	0	5	5
16:30	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	3	3
16:45	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Total	0	2	0	0	3	0	0	0	1	3	0	0	1	0	3	0	0	13	13
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1
17:30	0	1	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	4	4
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	1	0	0	0	0	0	0	1	3	0	0	0	0	0	0	0	5	5
Grand Total	0	3	0	0	3	0	0	0	2	6	0	0	1	0	3	0	0	18	18
Apprch %	0	100	0		100	0	0		25	75	0		25	0	75				
Total %	0	16.7	0		16.7	0	0		11.1	33.3	0		5.6	0	16.7		0	100	

	St. Albans St From North				Fenwood St From East				St. Albans St From South				Fenwood St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 16:00																	
16:00	0	0	0	0	1	0	0	1	0	0	0	0	**1**	0	**2**	**3**	4
16:15	0	**1**	0	**1**	0	0	0	0	**1**	**2**	0	**3**	0	0	1	1	**5**
16:30	0	0	0	0	**2**	0	0	**2**	0	1	0	1	0	0	0	0	3
16:45	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Total Volume	0	2	0	2	3	0	0	3	1	3	0	4	1	0	3	4	13
% App. Total	0	100	0		100	0	0		25	75	0		25	0	75		
PHF	.000	.500	.000	.500	.375	.000	.000	.375	.250	.375	.000	.333	.250	.000	.375	.333	.650

Accurate Counts
978-664-2565

File Name : 10568010
Site Code : 10568010
Start Date : 5/5/2009
Page No : 2



Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:00				16:00				16:00				16:00			
+0 mins.	0	0	0	0	1	0	0	1	0	0	0	0	**1**	0	**2**	**3**
+15 mins.	0	**1**	0	**1**	0	0	0	0	**1**	**2**	0	**3**	0	0	1	1
+30 mins.	0	0	0	0	**2**	0	0	**2**	0	1	0	1	0	0	0	0
+45 mins.	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	2	0	2	3	0	0	3	1	3	0	4	1	0	3	4
% App. Total	0	100	0		100	0	0		25	75	0		25	0	75	
PHF	.000	.500	.000	.500	.375	.000	.000	.375	.250	.375	.000	.333	.250	.000	.375	.333

Accurate Counts
978-664-2565

File Name : 10568010
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Start Date : 5/5/2009
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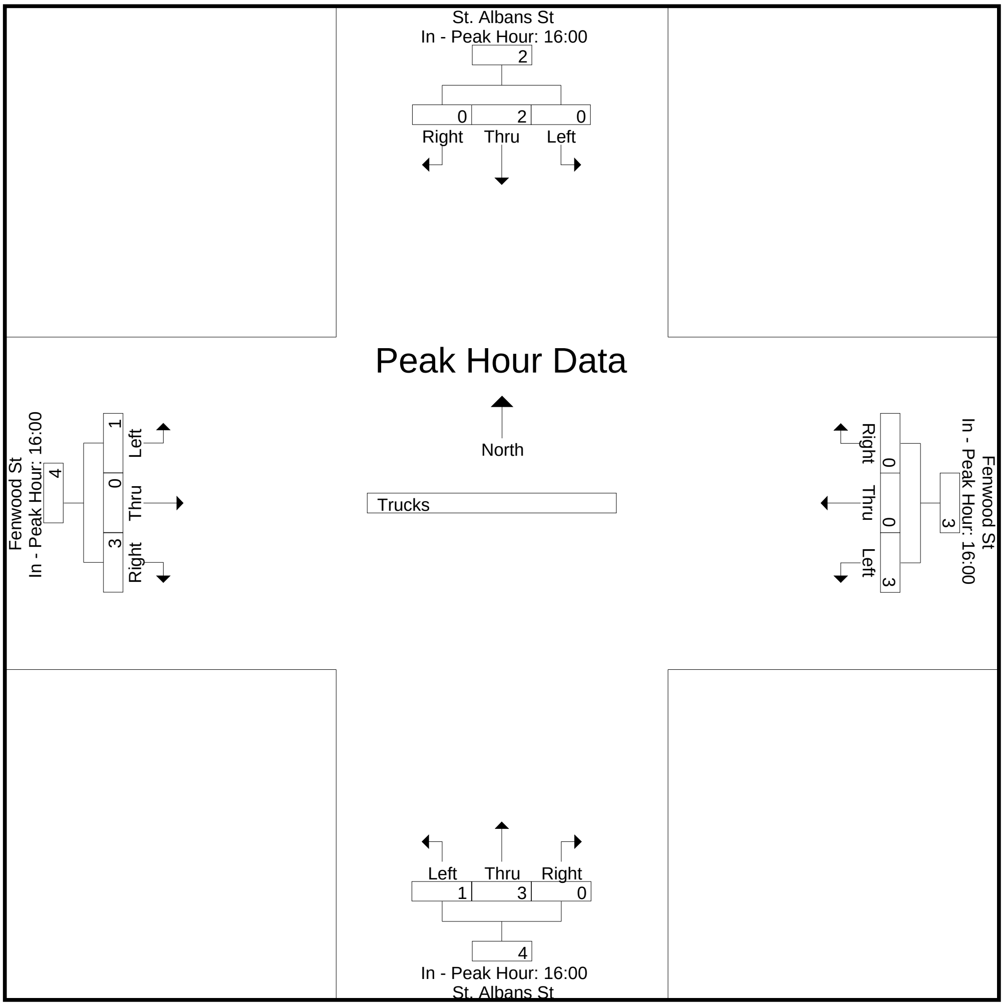


N/S Street : Huntington Street
E/W Street: Francis St / Tremont St
City/State : Boston, MA
Weather : Overcast

Accurate Counts
978-664-2565

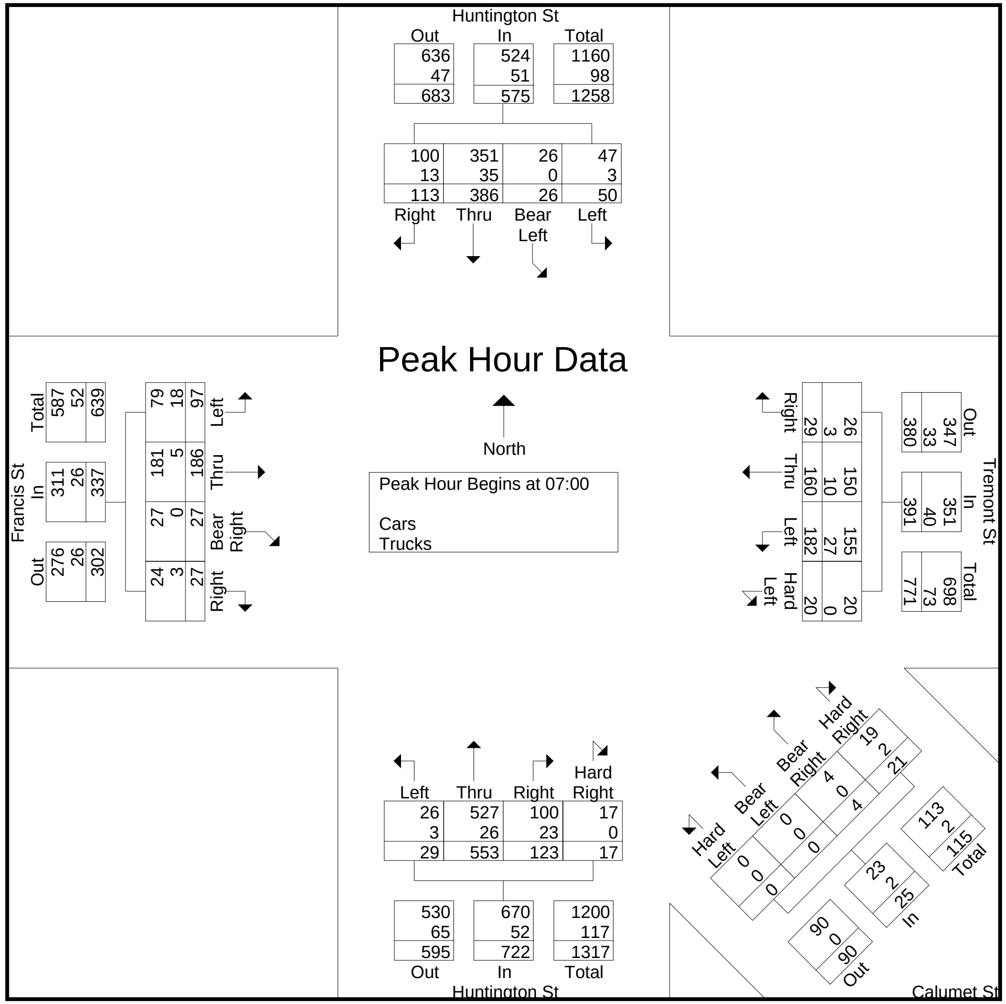
File Name : 10568011
Site Code : 10568011
Start Date : 5/5/2009
Page No : 1

Groups Printed- Cars - Trucks

	Huntington St From North						Tremont St From East					Calumet St From Southeast					Huntington St From South					Francis St From West							
Start Time	Left	Bear Left	Thru	Right	U-Trn	Peds	Hard Left	Left	Thru	Right	Peds	Hard Left	Bear Left	Bear Right	Hard Right	Peds	Left	Thru	Right	Hard Right	Peds	Left	Thru	Bear Right	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	8	5	74	28	2	118	4	31	47	10	62	0	0	0	4	29	12	147	32	6	25	20	45	6	4	4	240	483	723
07:15	9	6	105	29	5	94	5	47	30	5	59	0	0	0	5	18	8	128	29	4	14	20	44	8	6	16	206	488	694
07:30	16	9	114	25	1	153	5	53	43	9	79	0	0	1	4	18	3	145	32	3	13	32	44	8	12	30	294	558	852
07:45	17	6	93	31	4	179	6	51	40	5	77	0	0	3	8	26	6	133	30	4	34	25	53	5	5	18	338	521	859
Total	50	26	386	113	12	544	20	182	160	29	277	0	0	4	21	91	29	553	123	17	86	97	186	27	27	68	1078	2050	3128
08:00	17	17	77	20	1	146	8	44	38	6	63	0	0	0	11	6	7	122	30	6	14	22	25	8	8	27	257	466	723
08:15	9	7	81	26	0	114	4	35	27	4	70	0	0	1	4	8	5	152	31	0	23	20	42	7	9	33	248	464	712
08:30	8	5	82	14	5	107	5	39	49	9	46	0	0	0	11	12	6	147	31	2	21	18	46	7	11	14	205	490	695
08:45	6	4	98	26	1	119	8	51	38	2	64	0	0	2	5	12	6	168	27	3	26	23	40	6	9	42	264	522	786
Total	40	33	338	86	7	486	25	169	152	21	243	0	0	3	31	38	24	589	119	11	84	83	153	28	37	116	974	1942	2916
Grand Total	90	59	724	199	19	{\fs14 1030}	45	351	312	50	520	0	0	7	52	129	53	1142	242	28	170	180	339	55	64	184	2052	3992	6044
Apprch %	8.4	5.5	67.5	18.6			5.9	46.3	41.2	6.6		0	0	11.9	88.1		3.6	78	16.5	1.9		28.2	53.1	8.6	10				
Total %	2.3	1.5	18.1	5			1.1	8.8	7.8	1.3		0	0	0.2	1.3		1.3	28.6	6.1	0.7		4.5	8.5	1.4	1.6		34	66	
Cars	86	59	665	176			45	301	292	42		0	0	7	47		49	1091	202	28		141	322	55	56		0	0	5710
% Cars	95.6	100	91.9	88.4	100	100	100	85.8	93.6	84	99.6	0	0	100	90.4	100	92.5	95.5	83.5	100	98.2	78.3	95	100	87.5	99.5	0	0	94.5
Trucks	4	0	59	23			0	50	20	8		0	0	0	5		4	51	40	0		39	17	0	8		0	0	334
% Trucks	4.4	0	8.1	11.6	0	0	0	14.2	6.4	16	0.4	0	0	0	9.6	0	7.5	4.5	16.5	0	1.8	21.7	5	0	12.5	0.5	0	0	5.5

	Huntington St From North					Tremont St From East					Calumet St From Southeast					Huntington St From South					Francis St From West					
Start Time	Left	Bear Left	Thru	Right	App. Total	Hard Left	Left	Thru	Right	App. Total	Hard Left	Bear Left	Bear Right	Hard Right	App. Total	Left	Thru	Right	Hard Right	App. Total	Left	Thru	Bear Right	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																										
Peak Hour for Entire Intersection Begins at 07:00																										
07:00	8	5	74	28	115	4	31	**47**	**10**	92	0	0	0	4	4	**12**	**147**	**32**	**6**	**197**	20	45	6	4	75	483
07:15	9	6	105	29	149	5	47	30	5	87	0	0	0	5	5	8	128	29	4	169	20	44	**8**	6	78	488
07:30	16	**9**	**114**	25	**164**	5	**53**	43	9	**110**	0	0	1	4	5	3	145	32	3	183	**32**	44	8	**12**	**96**	**558**
07:45	**17**	6	93	**31**	147	**6**	51	40	5	102	0	0	**3**	**8**	**11**	6	133	30	4	173	25	**53**	5	5	88	521
Total Volume	50	26	386	113	575	20	182	160	29	391	0	0	4	21	25	29	553	123	17	722	97	186	27	27	337	2050
% App. Total	8.7	4.5	67.1	19.7		5.1	46.5	40.9	7.4		0	0	16	84		4	76.6	17	2.4		28.8	55.2	8	8		
PHF	.735	.722	.846	.911	.877	.833	.858	.851	.725	.889	.000	.000	.333	.656	.568	.604	.940	.961	.708	.916	.758	.877	.844	.563	.878	.918
Cars	47	26	351	100	524	20	155	150	26	351	0	0	4	19	23	26	527	100	17	670	79	181	27	24	311	1879

Trucks	3	0	35	13	51	0	27	10	3	40	0	0	0	2	2	3	26	23	0	52	18	5	0	3	26	171
% Trucks	6.0	0	9.1	11.5	8.9	0	14.8	6.3	10.3	10.2	0	0	0	9.5	8.0	10.3	4.7	18.7	0	7.2	18.6	2.7	0	11.1	7.7	8.3



Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:15					07:15					07:45					08:00					07:00				
+0 mins.	9	6	105	29	149	5	47	30	5	87	0	0	**3**	8	**11**	**7**	122	30	**6**	165	20	45	6	4	75
+15 mins.	16	9	**114**	25	**164**	5	**53**	**43**	**9**	**110**	0	0	0	**11**	11	5	152	**31**	0	188	20	44	**8**	6	78
+30 mins.	**17**	6	93	**31**	147	6	51	40	5	102	0	0	1	4	5	6	147	31	2	186	**32**	44	8	**12**	**96**
+45 mins.	17	**17**	77	20	131	**8**	44	38	6	96	0	0	0	11	11	6	**168**	27	3	**204**	25	**53**	5	5	88
Total Volume	59	38	389	105	591	24	195	151	25	395	0	0	4	34	38	24	589	119	11	743	97	186	27	27	337
% App. Total	10	6.4	65.8	17.8		6.1	49.4	38.2	6.3		0	0	10.5	89.5		3.2	79.3	16	1.5		28.8	55.2	8	8	
PHF	.868	.559	.853	.847	.901	.750	.920	.878	.694	.898	.000	.000	.333	.773	.864	.857	.876	.960	.458	.911	.758	.877	.844	.563	.878
Cars	55	38	354	93	540	24	172	145	20	361	0	0	4	31	35	23	564	102	11	700	79	181	27	24	311
% Cars	93.2	100	91	88.6	91.4	100	88.2	96	80	91.4	0	0	100	91.2	92.1	95.8	95.8	85.7	100	94.2	81.4	97.3	100	88.9	92.3
Trucks	4	0	35	12	51	0	23	6	5	34	0	0	0	3	3	1	25	17	0	43	18	5	0	3	26
% Trucks	6.8	0	9	11.4	8.6	0	11.8	4	20	8.6	0	0	0	8.8	7.9	4.2	4.2	14.3	0	5.8	18.6	2.7	0	11.1	7.7

Accurate Counts
978-664-2565

File Name : 10568011
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Start Date : 5/5/2009
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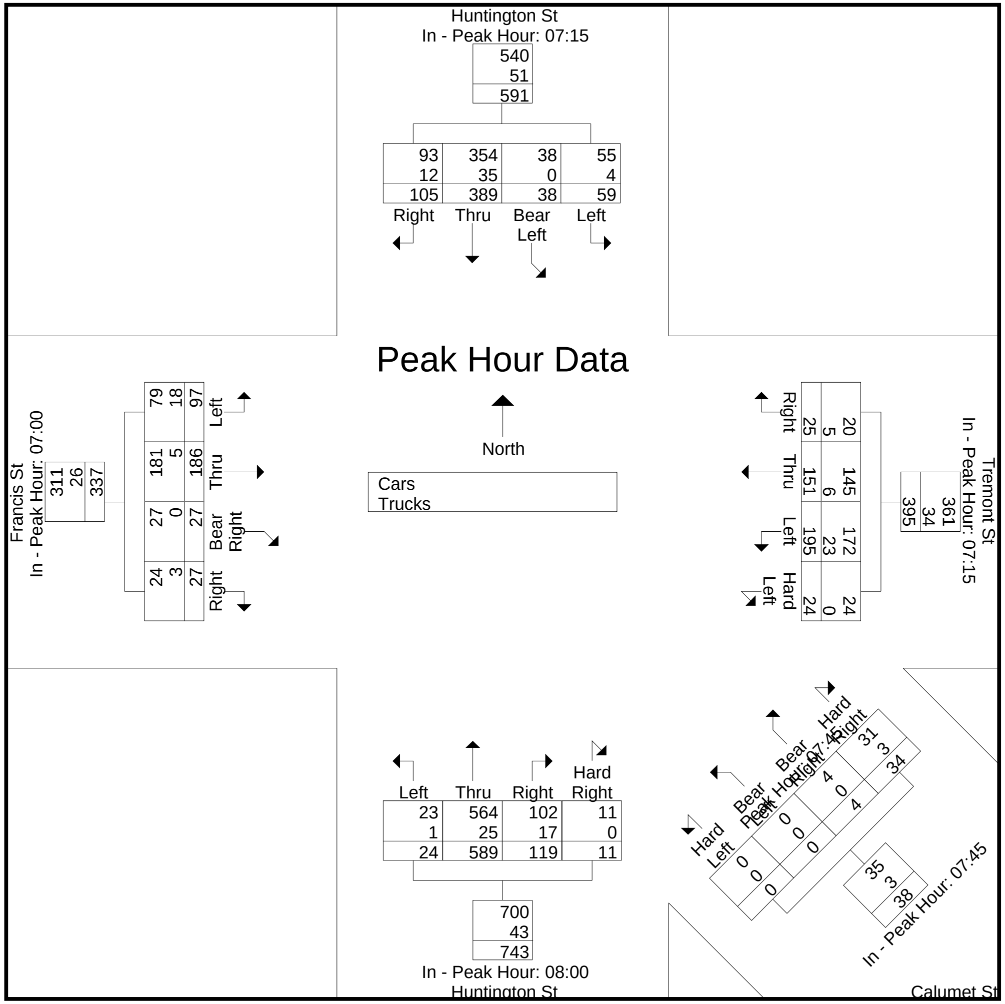

N/S Street : Huntington Street
E/W Street: Francis St / Tremont St
City/State : Boston, MA
Weather : Overcast

Accurate Counts
978-664-2565

File Name : 10568011
Site Code : 10568011
Start Date : 5/5/2009

Groups Printed- Cars

	Huntington St From North						Tremont St From East					Calumet St From Southeast					Huntington St From South					Francis St From West							
Start Time	Left	Bear Left	Thru	Right	U-Trn	Peds	Hard Left	Left	Thru	Right	Peds	Hard Left	Bear Left	Bear Right	Hard Right	Peds	Left	Thru	Right	Hard Right	Peds	Left	Thru	Bear Right	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	8	5	66	26	2	118	4	22	42	10	62	0	0	0	3	29	11	138	25	6	25	14	42	6	3	4	240	431	671
07:15	8	6	93	25	5	94	5	42	27	5	59	0	0	0	4	18	8	122	24	4	13	18	44	8	6	16	205	449	654
07:30	15	9	106	23	1	153	5	47	42	7	79	0	0	1	4	18	3	141	24	3	13	27	43	8	10	30	294	518	812
07:45	16	6	86	26	4	179	6	44	39	4	77	0	0	3	8	26	4	126	27	4	33	20	52	5	5	18	337	481	818
Total	47	26	351	100	12	544	20	155	150	26	277	0	0	4	19	91	26	527	100	17	84	79	181	27	24	68	1076	1879	2955
08:00	16	17	69	19	1	146	8	39	37	4	63	0	0	0	9	6	7	114	25	6	13	16	24	8	8	27	256	426	682
08:15	9	7	79	23	0	114	4	31	25	3	69	0	0	1	4	8	5	148	27	0	23	16	38	7	8	33	247	435	682
08:30	8	5	75	11	5	107	5	34	44	8	46	0	0	0	10	12	5	142	29	2	21	11	43	7	7	13	204	446	650
08:45	6	4	91	23	1	119	8	42	36	1	63	0	0	2	5	12	6	160	21	3	26	19	36	6	9	42	263	478	741
Total	39	33	314	76	7	486	25	146	142	16	241	0	0	3	28	38	23	564	102	11	83	62	141	28	32	115	970	1785	2755
Grand Total	86	59	665	176	19	{\fs14 1030}	45	301	292	42	518	0	0	7	47	129	49	1091	202	28	167	141	322	55	56	183	2046	3664	5710
Apprch %	8.7	6	67.4	17.8			6.6	44.3	42.9	6.2		0	0	13	87		3.6	79.6	14.7	2		24.6	56.1	9.6	9.8				
Total %	2.3	1.6	18.1	4.8			1.2	8.2	8	1.1		0	0	0.2	1.3		1.3	29.8	5.5	0.8		3.8	8.8	1.5	1.5		35.8	64.2	

	Huntington St From North					Tremont St From East					Calumet St From Southeast					Huntington St From South					Francis St From West					
Start Time	Left	Bear Left	Thru	Right	App. Total	Hard Left	Left	Thru	Right	App. Total	Hard Left	Bear Left	Bear Right	Hard Right	App. Total	Left	Thru	Right	Hard Right	App. Total	Left	Thru	Bear Right	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																										
Peak Hour for Entire Intersection Begins at 07:00																										
07:00	8	5	66	**26**	105	4	22	**42**	**10**	78	0	0	0	3	3	**11**	138	25	**6**	**180**	14	42	6	3	65	431
07:15	8	6	93	25	132	5	42	27	5	79	0	0	0	4	4	8	122	24	4	158	18	44	**8**	6	76	449
07:30	15	**9**	**106**	23	**153**	5	**47**	42	7	**101**	0	0	1	4	5	3	**141**	24	3	171	**27**	43	8	**10**	**88**	**518**
07:45	**16**	6	86	26	134	**6**	44	39	4	93	0	0	**3**	**8**	**11**	4	126	**27**	4	161	20	**52**	5	5	82	481
Total Volume	47	26	351	100	524	20	155	150	26	351	0	0	4	19	23	26	527	100	17	670	79	181	27	24	311	1879
% App. Total	9	5	67	19.1		5.7	44.2	42.7	7.4		0	0	17.4	82.6		3.9	78.7	14.9	2.5		25.4	58.2	8.7	7.7		
PHF	.734	.722	.828	.962	.856	.833	.824	.893	.650	.869	.000	.000	.333	.594	.523	.591	.934	.926	.708	.931	.731	.870	.844	.600	.884	.907

Accurate Counts
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File Name : 10568011
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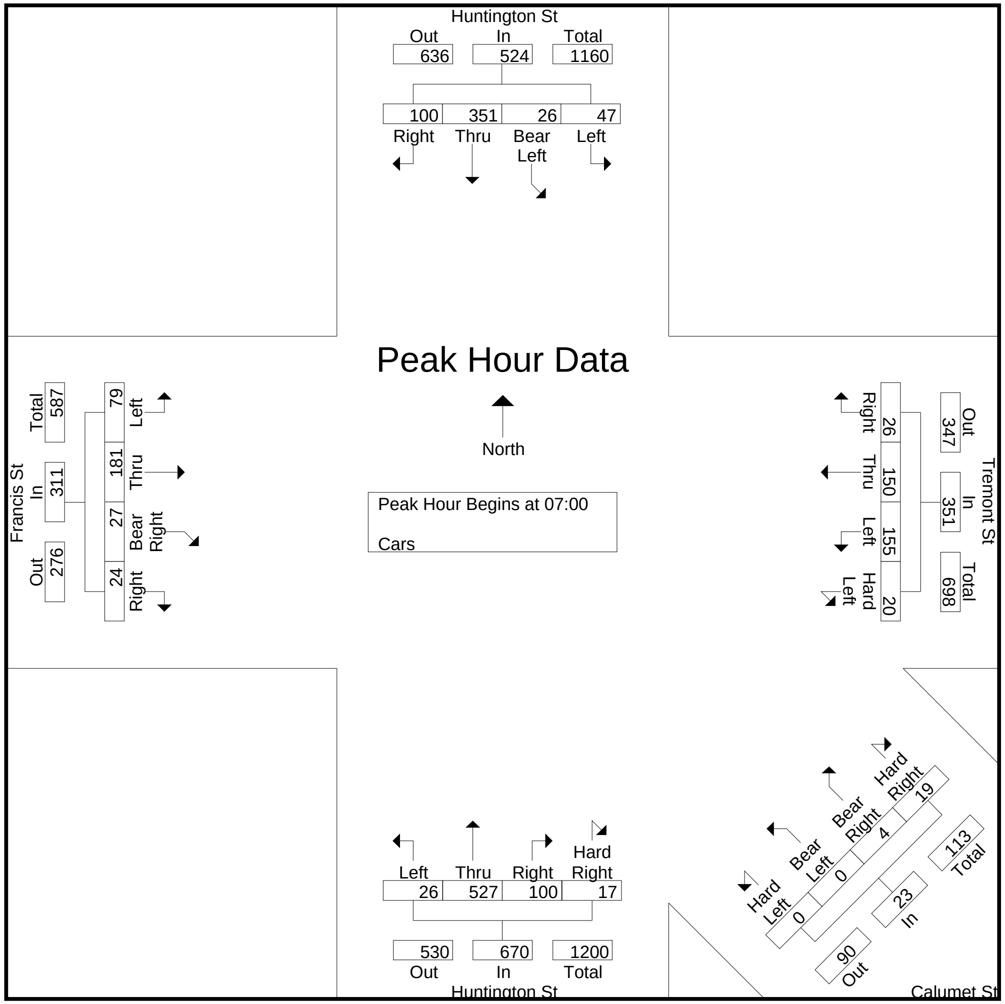

Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:15					07:15					07:45					08:00					07:00				
+0 mins.	8	6	93	25	132	5	42	27	5	79	0	0	**3**	8	**11**	**7**	114	25	**6**	152	14	42	6	3	65
+15 mins.	15	9	**106**	23	**153**	5	**47**	**42**	**7**	**101**	0	0	0	9	9	5	148	27	0	180	18	44	**8**	6	76
+30 mins.	**16**	6	86	**26**	134	6	44	39	4	93	0	0	1	4	5	5	142	**29**	2	178	**27**	43	8	**10**	**88**
+45 mins.	16	**17**	69	19	121	**8**	39	37	4	88	0	0	0	**10**	10	6	**160**	21	3	**190**	20	**52**	5	5	82
Total Volume	55	38	354	93	540	24	172	145	20	361	0	0	4	31	35	23	564	102	11	700	79	181	27	24	311
% App. Total	10.2	7	65.6	17.2		6.6	47.6	40.2	5.5		0	0	11.4	88.6		3.3	80.6	14.6	1.6		25.4	58.2	8.7	7.7	
PHF	.859	.559	.835	.894	.882	.750	.915	.863	.714	.894	.000	.000	.333	.775	.795	.821	.881	.879	.458	.921	.731	.870	.844	.600	.884

Accurate Counts
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File Name : 10568011
Site Code : 10568011
Start Date : 5/5/2009
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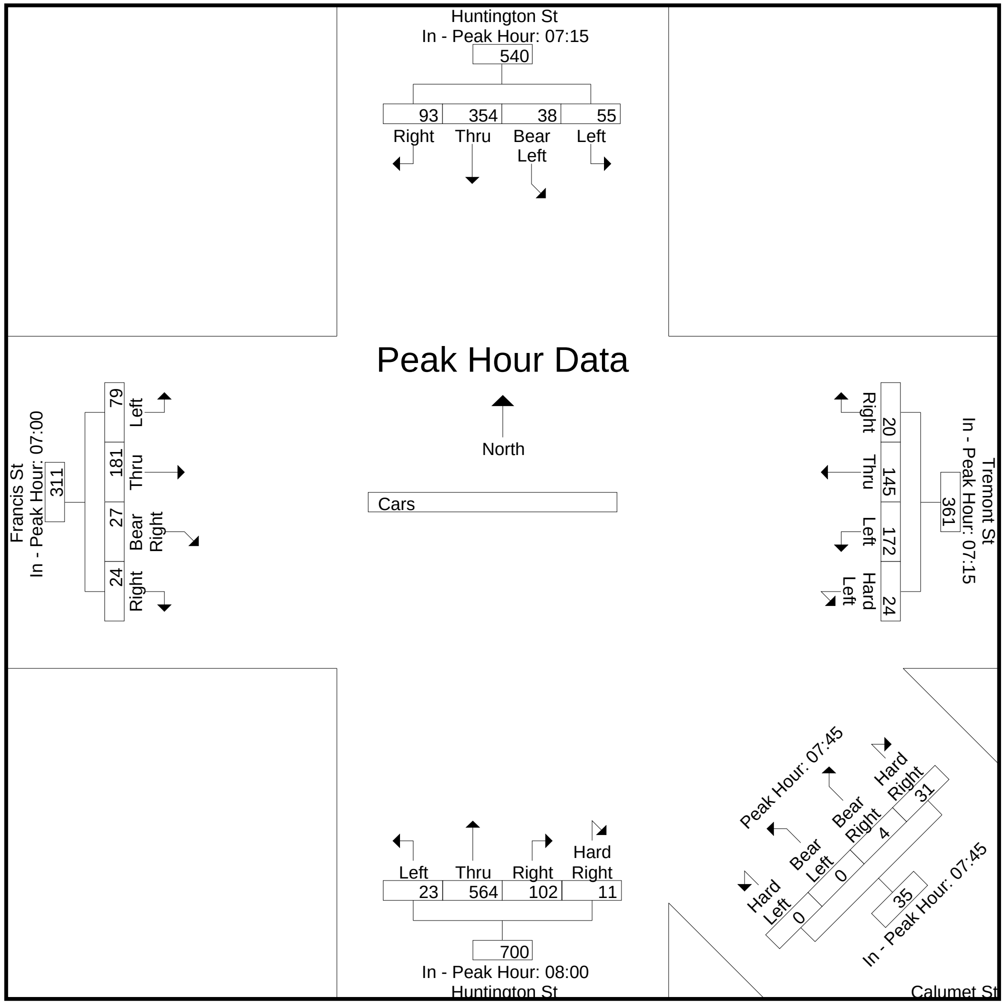

N/S Street : Huntington Street
E/W Street: Francis St / Tremont St
City/State : Boston, MA
Weather : Overcast

Accurate Counts
978-664-2565

File Name : 10568011
Site Code : 10568011
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Groups Printed- Trucks

	Huntington St From North						Tremont St From East					Calumet St From Southeast					Huntington St From South					Francis St From West							
Start Time	Left	Bear Left	Thru	Right	U-Trn	Peds	Hard Left	Left	Thru	Right	Peds	Hard Left	Bear Left	Bear Right	Hard Right	Peds	Left	Thru	Right	Hard Right	Peds	Left	Thru	Bear Right	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	0	0	8	2	0	0	0	9	5	0	0	0	0	0	1	0	1	9	7	0	0	6	3	0	1	0	0	52	52
07:15	1	0	12	4	0	0	0	5	3	0	0	0	0	0	1	0	0	6	5	0	1	2	0	0	0	0	1	39	40
07:30	1	0	8	2	0	0	0	6	1	2	0	0	0	0	0	0	0	4	8	0	0	5	1	0	2	0	0	40	40
07:45	1	0	7	5	0	0	0	7	1	1	0	0	0	0	0	0	2	7	3	0	1	5	1	0	0	0	1	40	41
Total	3	0	35	13	0	0	0	27	10	3	0	0	0	0	2	0	3	26	23	0	2	18	5	0	3	0	2	171	173
08:00	1	0	8	1	0	0	0	5	1	2	0	0	0	0	2	0	0	8	5	0	1	6	1	0	0	0	1	40	41
08:15	0	0	2	3	0	0	0	4	2	1	1	0	0	0	0	0	0	4	4	0	0	4	4	0	1	0	1	29	30
08:30	0	0	7	3	0	0	0	5	5	1	0	0	0	0	1	0	1	5	2	0	0	7	3	0	4	1	1	44	45
08:45	0	0	7	3	0	0	0	9	2	1	1	0	0	0	0	0	0	8	6	0	0	4	4	0	0	0	1	44	45
Total	1	0	24	10	0	0	0	23	10	5	2	0	0	0	3	0	1	25	17	0	1	21	12	0	5	1	4	157	161
Grand Total	4	0	59	23	0	0	0	50	20	8	2	0	0	0	5	0	4	51	40	0	3	39	17	0	8	1	6	328	334
Apprch %	4.7	0	68.6	26.7			0	64.1	25.6	10.3		0	0	0	100		4.2	53.7	42.1	0		60.9	26.6	0	12.5				
Total %	1.2	0	18	7			0	15.2	6.1	2.4		0	0	0	1.5		1.2	15.5	12.2	0		11.9	5.2	0	2.4		1.8	98.2	

	Huntington St From North					Tremont St From East					Calumet St From Southeast					Huntington St From South					Francis St From West					
Start Time	Left	Bear Left			App. Total	Hard Left				App. Total	Hard Left	Bear Left	Bear Right	Hard Right	App. Total				Hard Right	App. Total			Bear Right	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																										
Peak Hour for Entire Intersection Begins at 07:00																										
07:00	0	0	8	2	10	0	**9**	**5**	0	**14**	0	0	0	**1**	**1**	1	**9**	7	0	**17**	**6**	**3**	0	1	**10**	**52**
07:15	**1**	0	**12**	4	**17**	0	5	3	0	8	0	0	0	1	1	0	6	5	0	11	2	0	0	0	2	39
07:30	1	0	8	2	11	0	6	1	**2**	9	0	0	0	0	0	0	4	**8**	0	12	5	1	0	**2**	8	40
07:45	1	0	7	**5**	13	0	7	1	1	9	0	0	0	0	0	**2**	7	3	0	12	5	1	0	0	6	40
Total Volume	3	0	35	13	51	0	27	10	3	40	0	0	0	2	2	3	26	23	0	52	18	5	0	3	26	171
% App. Total	5.9	0	68.6	25.5		0	67.5	25	7.5		0	0	0	100		5.8	50	44.2	0		69.2	19.2	0	11.5		
PHF	.750	.000	.729	.650	.750	.000	.750	.500	.375	.714	.000	.000	.000	.500	.500	.375	.722	.719	.000	.765	.750	.417	.000	.375	.650	.822

Accurate Counts
978-664-2565

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Site Code : 10568011
Start Date : 5/5/2009
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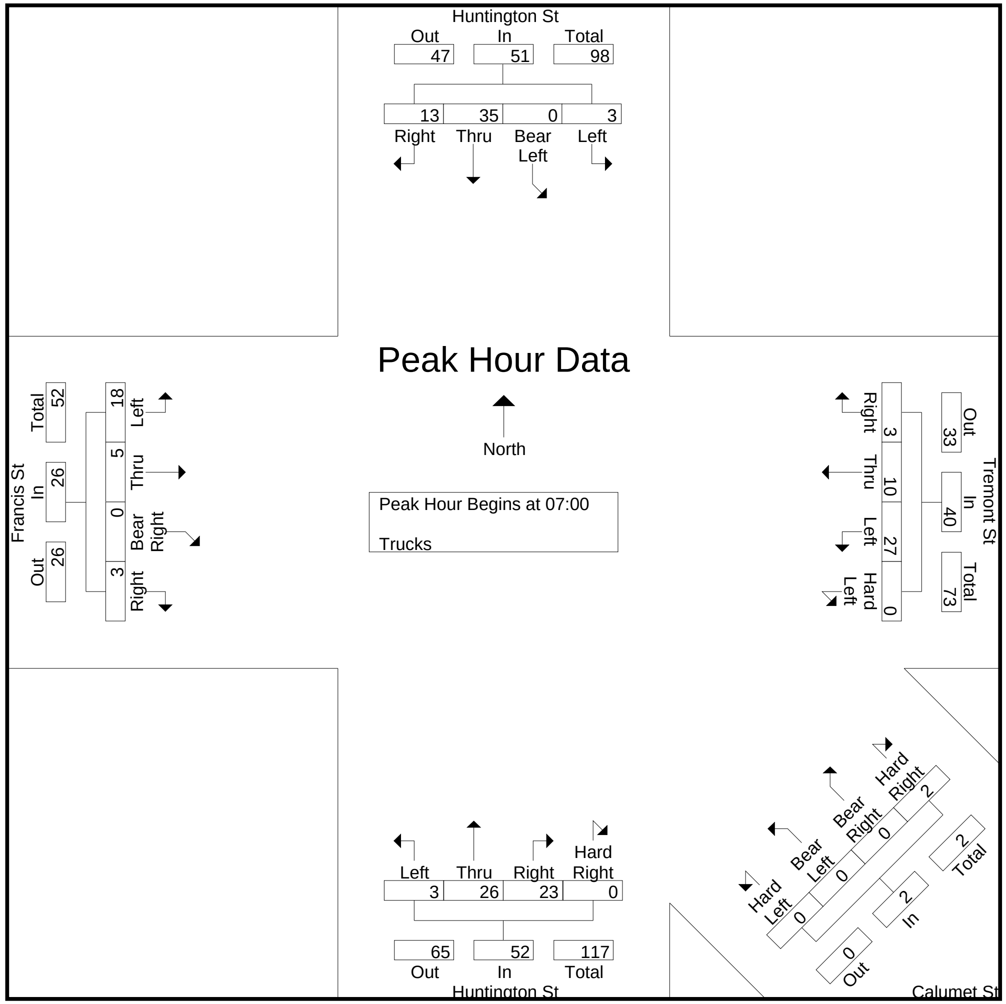

Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:00					07:00					07:15					07:00					08:00				
+0 mins.	0	0	8	2	10	0	**9**	**5**	0	**14**	0	0	0	1	1	1	**9**	7	0	**17**	6	1	0	0	7
+15 mins.	**1**	0	**12**	4	**17**	0	5	3	0	8	0	0	0	0	0	0	6	5	0	11	4	**4**	0	1	9
+30 mins.	1	0	8	2	11	0	6	1	**2**	9	0	0	0	0	0	0	4	**8**	0	12	**7**	3	0	**4**	**14**
+45 mins.	1	0	7	**5**	13	0	7	1	1	9	0	0	0	**2**	**2**	**2**	7	3	0	12	4	4	0	0	8
Total Volume	3	0	35	13	51	0	27	10	3	40	0	0	0	3	3	3	26	23	0	52	21	12	0	5	38
% App. Total	5.9	0	68.6	25.5		0	67.5	25	7.5		0	0	0	100		5.8	50	44.2	0		55.3	31.6	0	13.2	
PHF	.750	.000	.729	.650	.750	.000	.750	.500	.375	.714	.000	.000	.000	.375	.375	.375	.722	.719	.000	.765	.750	.750	.000	.313	.679

Accurate Counts
978-664-2565

File Name : 10568011
Site Code : 10568011
Start Date : 5/5/2009
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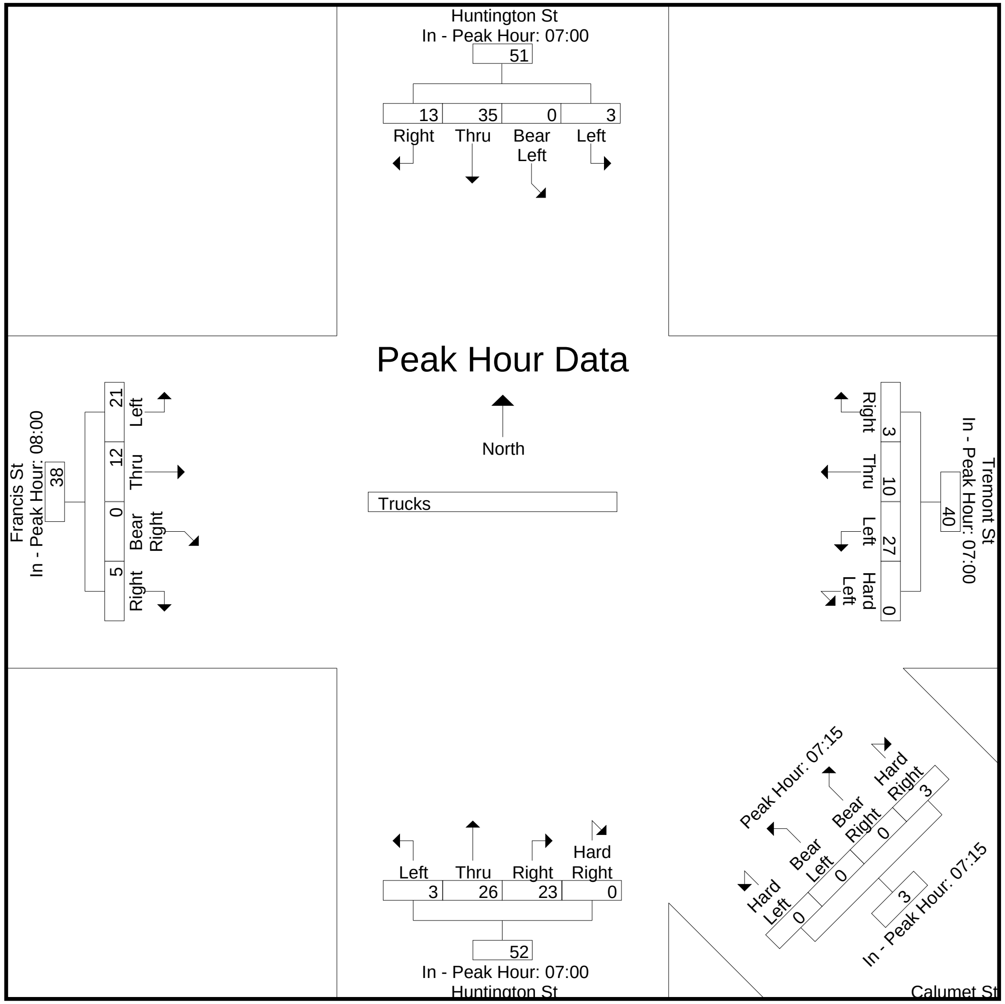


N/S Street : Huntington Street
E/W Street: Francis St / Tremont St
City/State : Boston, MA
Weather : Overcast

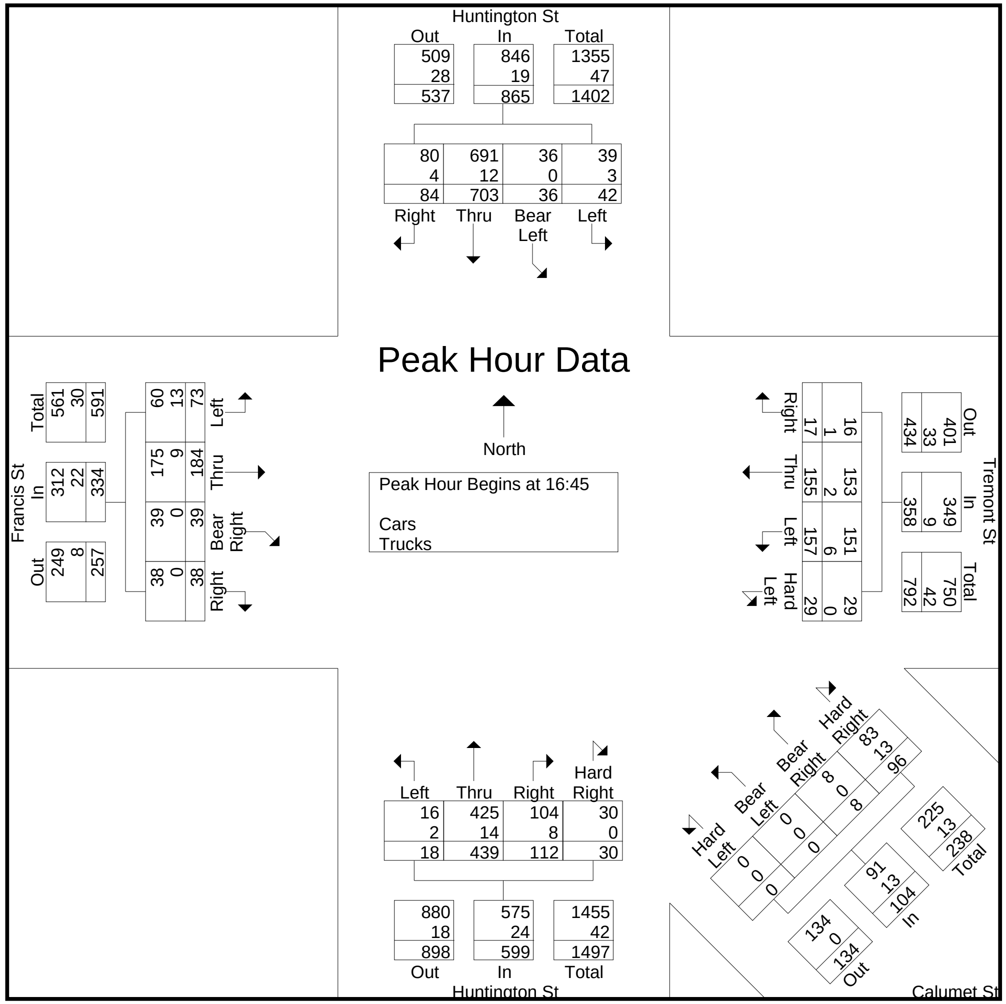
Accurate Counts
978-664-2565

File Name : 10568011
Site Code : 10568011
Start Date : 5/5/2009
Page No : 1

Groups Printed- Cars - Trucks

	Huntington St From North						Tremont St From East					Calumet St From Southeast					Huntington St From South					Francis St From West							
Start Time	Left	Bear Left	Thru	Right	U-Trn	Peds	Hard Left	Left	Thru	Right	Peds	Hard Left	Bear Left	Bear Right	Hard Right	Peds	Left	Thru	Right	Hard Right	Peds	Left	Thru	Bear Right	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	10	8	142	25	4	128	8	42	29	6	71	4	0	0	33	10	2	113	24	2	27	20	48	3	12	17	257	531	788
16:15	13	14	149	19	1	114	3	51	27	3	79	0	0	0	16	14	2	115	38	11	33	24	44	4	7	29	270	540	810
16:30	14	11	165	15	2	146	10	42	28	1	79	1	1	0	20	0	2	127	26	7	35	14	40	3	9	32	294	536	830
16:45	14	7	181	28	1	91	7	38	45	3	54	0	0	0	26	8	4	108	29	8	31	15	44	14	12	24	209	583	792
Total	51	40	637	87	8	479	28	173	129	13	283	5	1	0	95	32	10	463	117	28	126	73	176	24	40	102	1030	2190	3220
17:00	13	10	160	23	5	96	6	36	45	5	78	0	0	3	31	12	5	109	32	11	41	12	51	9	7	23	255	568	823
17:15	9	11	192	19	1	80	9	43	30	4	68	0	0	1	28	6	5	104	18	9	22	19	47	11	8	17	194	567	761
17:30	6	8	170	14	1	80	7	40	35	5	46	0	0	4	11	4	4	118	33	2	14	27	42	5	11	22	167	542	709
17:45	13	15	177	33	11	94	12	40	27	3	80	0	0	0	22	17	3	110	22	14	18	21	40	12	13	17	237	577	814
Total	41	44	699	89	18	350	34	159	137	17	272	0	0	8	92	39	17	441	105	36	95	79	180	37	39	79	853	2254	3107
Grand Total	92	84	1336	176	26	829	62	332	266	30	555	5	1	8	187	71	27	904	222	64	221	152	356	61	79	181	1883	4444	6327
Apprch %	5.5	5	79.1	10.4			9	48.1	38.6	4.3		2.5	0.5	4	93		2.2	74.3	18.2	5.3		23.5	54.9	9.4	12.2				
Total %	2.1	1.9	30.1	4			1.4	7.5	6	0.7		0.1	0	0.2	4.2		0.6	20.3	5	1.4		3.4	8	1.4	1.8		29.8	70.2	
Cars	86	84	1308	168			62	312	262	28		5	1	8	174		24	880	202	64		124	339	61	79		0	0	6149
% Cars	93.5	100	97.9	95.5	100	100	100	94	98.5	93.3	100	100	100	100	93	100	88.9	97.3	91	100	97.7	81.6	95.2	100	100	100	0	0	97.2
Trucks	6	0	28	8			0	20	4	2		0	0	0	13		3	24	20	0		28	17	0	0		0	0	178
% Trucks	6.5	0	2.1	4.5	0	0	0	6	1.5	6.7	0	0	0	0	7	0	11.1	2.7	9	0	2.3	18.4	4.8	0	0	0	0	0	2.8

	Huntington St From North					Tremont St From East					Calumet St From Southeast					Huntington St From South					Francis St From West					
Start Time	Left	Bear Left	Thru	Right	App. Total	Hard Left	Left	Thru	Right	App. Total	Hard Left	Bear Left	Bear Right	Hard Right	App. Total	Left	Thru	Right	Hard Right	App. Total	Left	Thru	Bear Right	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																										
Peak Hour for Entire Intersection Begins at 16:45																										
16:45	**14**	7	181	**28**	230	7	38	**45**	3	**93**	0	0	0	26	26	4	108	29	8	149	15	44	**14**	**12**	**85**	**583**
17:00	13	10	160	23	206	6	36	45	**5**	92	0	0	3	**31**	**34**	**5**	109	32	**11**	**157**	12	**51**	9	7	79	568
17:15	9	**11**	**192**	19	**231**	**9**	**43**	30	4	86	0	0	1	28	29	5	104	18	9	136	19	47	11	8	85	567
17:30	6	8	170	14	198	7	40	35	5	87	0	0	**4**	11	15	4	**118**	**33**	2	157	**27**	42	5	11	85	542
Total Volume	42	36	703	84	865	29	157	155	17	358	0	0	8	96	104	18	439	112	30	599	73	184	39	38	334	2260
% App. Total	4.9	4.2	81.3	9.7		8.1	43.9	43.3	4.7		0	0	7.7	92.3		3	73.3	18.7	5		21.9	55.1	11.7	11.4		
PHF	.750	.818	.915	.750	.936	.806	.913	.861	.850	.962	.000	.000	.500	.774	.765	.900	.930	.848	.682	.954	.676	.902	.696	.792	.982	.969
Cars	39	36	691	80	846	29	151	153	16	349	0	0	8	83	91	16	425	104	30	575	60	175	39	38	312	2173
% Cars	92.9	100	98.3	95.2	97.8	100	96.2	98.7	94.1	97.5	0	0	100	86.5	87.5	88.9	96.8	92.9	100	96.0	82.2	95.1	100	100	93.4	96.2
Trucks	3	0	12	4	19	0	6	2	1	9	0	0	0	13	13	2	14	8	0	24	13	9	0	0	22	87
% Trucks	7.1	0	1.7	4.8	2.2	0	3.8	1.3	5.9	2.5	0	0	0	13.5	12.5	11.1	3.2	7.1	0	4.0	17.8	4.9	0	0	6.6	3.8



Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	17:00					16:45					16:30					16:15					17:00				
+0 mins.	**13**	10	160	23	206	7	38	**45**	3	**93**	**1**	**1**	0	20	22	2	115	**38**	**11**	**166**	12	**51**	9	7	79
+15 mins.	9	11	**192**	19	231	6	36	45	**5**	92	0	0	0	26	26	2	**127**	26	7	162	19	47	11	8	85
+30 mins.	6	8	170	14	198	**9**	**43**	30	4	86	0	0	**3**	**31**	**34**	4	108	29	8	149	**27**	42	5	11	85
+45 mins.	13	**15**	177	**33**	**238**	7	40	35	5	87	0	0	1	28	29	**5**	109	32	11	157	21	40	**12**	**13**	**86**
Total Volume	41	44	699	89	873	29	157	155	17	358	1	1	4	105	111	13	459	125	37	634	79	180	37	39	335
% App. Total	4.7	5	80.1	10.2		8.1	43.9	43.3	4.7		0.9	0.9	3.6	94.6		2.1	72.4	19.7	5.8		23.6	53.7	11	11.6	
PHF	.788	.733	.910	.674	.917	.806	.913	.861	.850	.962	.250	.250	.333	.847	.816	.650	.904	.822	.841	.955	.731	.882	.771	.750	.974
Cars	40	44	687	85	856	29	151	153	16	349	1	1	4	92	98	10	447	111	37	605	63	171	37	39	310
% Cars	97.6	100	98.3	95.5	98.1	100	96.2	98.7	94.1	97.5	100	100	100	87.6	88.3	76.9	97.4	88.8	100	95.4	79.7	95	100	100	92.5
Trucks	1	0	12	4	17	0	6	2	1	9	0	0	0	13	13	3	12	14	0	29	16	9	0	0	25
% Trucks	2.4	0	1.7	4.5	1.9	0	3.8	1.3	5.9	2.5	0	0	0	12.4	11.7	23.1	2.6	11.2	0	4.6	20.3	5	0	0	7.5

Accurate Counts
978-664-2565

File Name : 10568011
Site Code : 10568011
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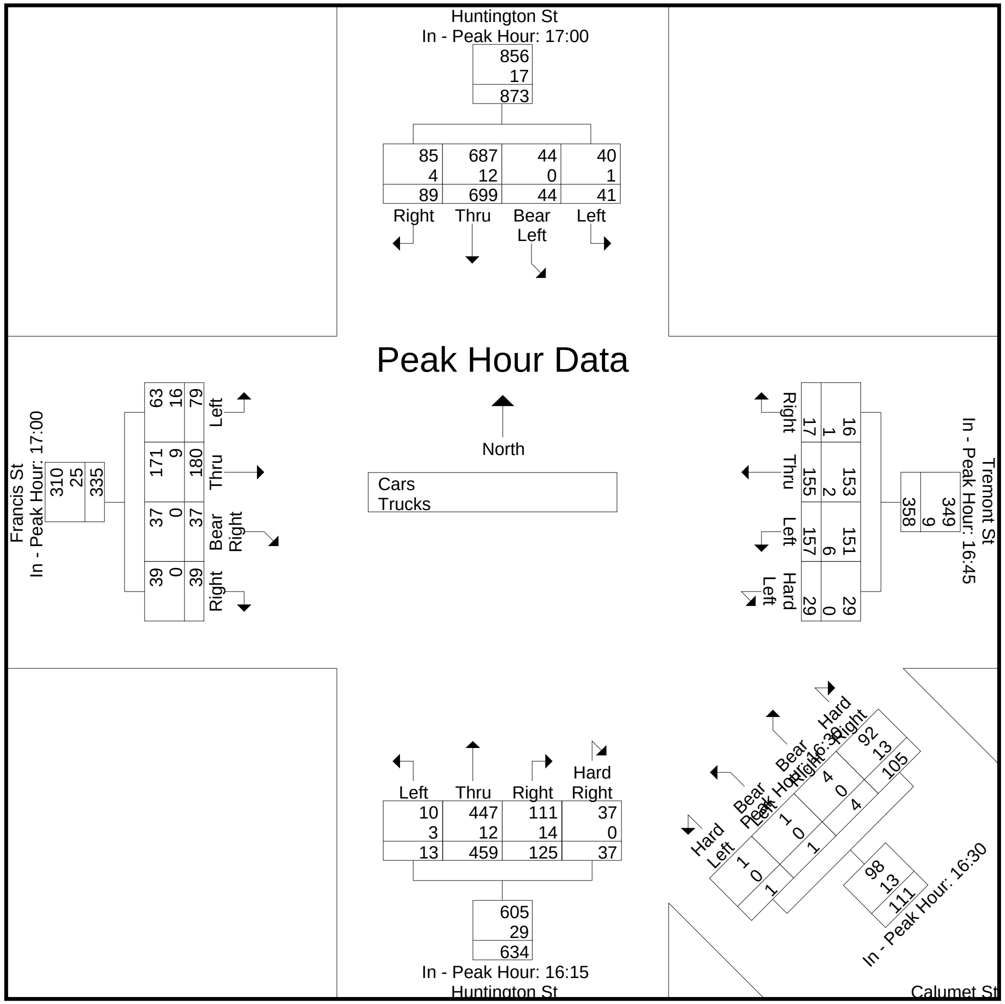

Accurate Counts
978-664-2565

N/S Street : Huntington Street
E/W Street: Francis St / Tremont St
City/State : Boston, MA
Weather : Overcast

File Name : 10568011
Site Code : 10568011
Start Date : 5/5/2009
Page No : 1

Groups Printed- Cars

	Huntington St From North						Tremont St From East					Calumet St From Southeast					Huntington St From South					Francis St From West							
Start Time	Left	Bear Left	Thru	Right	U-Trn	Peds	Hard Left	Left	Thru	Right	Peds	Hard Left	Bear Left	Bear Right	Hard Right	Peds	Left	Thru	Right	Hard Right	Peds	Left	Thru	Bear Right	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	10	8	135	24	4	128	8	39	29	5	71	4	0	0	33	10	2	110	22	2	27	18	45	3	12	17	257	509	766
16:15	11	14	147	18	1	114	3	46	26	3	79	0	0	0	16	14	1	113	33	11	33	20	41	4	7	29	270	514	784
16:30	13	11	161	15	2	146	10	37	28	1	79	1	1	0	20	0	2	125	23	7	35	11	40	3	9	32	294	518	812
16:45	12	7	178	26	1	91	7	38	44	3	54	0	0	0	20	8	2	104	26	8	31	12	42	14	12	24	209	555	764
Total	46	40	621	83	8	479	28	160	127	12	283	5	1	0	89	32	7	452	104	28	126	61	168	24	40	102	1030	2096	3126
17:00	13	10	158	22	5	96	6	34	45	4	78	0	0	3	31	12	5	105	29	11	41	9	49	9	7	23	255	550	805
17:15	8	11	191	18	1	80	9	39	29	4	68	0	0	1	21	6	5	102	17	9	22	15	45	11	8	17	194	543	737
17:30	6	8	164	14	1	80	7	40	35	5	46	0	0	4	11	4	4	114	32	2	14	24	39	5	11	22	167	525	692
17:45	13	15	174	31	11	94	12	39	26	3	80	0	0	0	22	17	3	107	20	14	13	15	38	12	13	17	232	557	789
Total	40	44	687	85	18	350	34	152	135	16	272	0	0	8	85	39	17	428	98	36	90	63	171	37	39	79	848	2175	3023
Grand Total	86	84	1308	168	26	829	62	312	262	28	555	5	1	8	174	71	24	880	202	64	216	124	339	61	79	181	1878	4271	6149
Apprch %	5.2	5.1	79.5	10.2			9.3	47	39.5	4.2		2.7	0.5	4.3	92.6		2.1	75.2	17.3	5.5		20.6	56.2	10.1	13.1				
Total %	2	2	30.6	3.9			1.5	7.3	6.1	0.7		0.1	0	0.2	4.1		0.6	20.6	4.7	1.5		2.9	7.9	1.4	1.8		30.5	69.5	

	Huntington St From North					Tremont St From East					Calumet St From Southeast					Huntington St From South					Francis St From West					
Start Time	Left	Bear Left	Thru	Right	App. Total	Hard Left	Left	Thru	Right	App. Total	Hard Left	Bear Left	Bear Right	Hard Right	App. Total	Left	Thru	Right	Hard Right	App. Total	Left	Thru	Bear Right	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																										
Peak Hour for Entire Intersection Begins at 17:00																										
17:00	**13**	10	158	22	203	6	34	**45**	4	**89**	0	0	3	**31**	**34**	**5**	105	29	11	150	9	**49**	9	7	74	550
17:15	8	11	**191**	18	228	9	39	29	4	81	0	0	1	21	22	5	102	17	9	133	15	45	11	8	**79**	543
17:30	6	8	164	14	192	7	**40**	35	**5**	87	0	0	**4**	11	15	4	**114**	**32**	2	**152**	**24**	39	5	11	79	525
17:45	13	**15**	174	**31**	**233**	**12**	39	26	3	80	0	0	0	22	22	3	107	20	**14**	144	15	38	**12**	**13**	78	**557**
Total Volume	40	44	687	85	856	34	152	135	16	337	0	0	8	85	93	17	428	98	36	579	63	171	37	39	310	2175
% App. Total	4.7	5.1	80.3	9.9		10.1	45.1	40.1	4.7		0	0	8.6	91.4		2.9	73.9	16.9	6.2		20.3	55.2	11.9	12.6		
PHF	.769	.733	.899	.685	.918	.708	.950	.750	.800	.947	.000	.000	.500	.685	.684	.850	.939	.766	.643	.952	.656	.872	.771	.750	.981	.976

Accurate Counts
978-664-2565

File Name : 10568011
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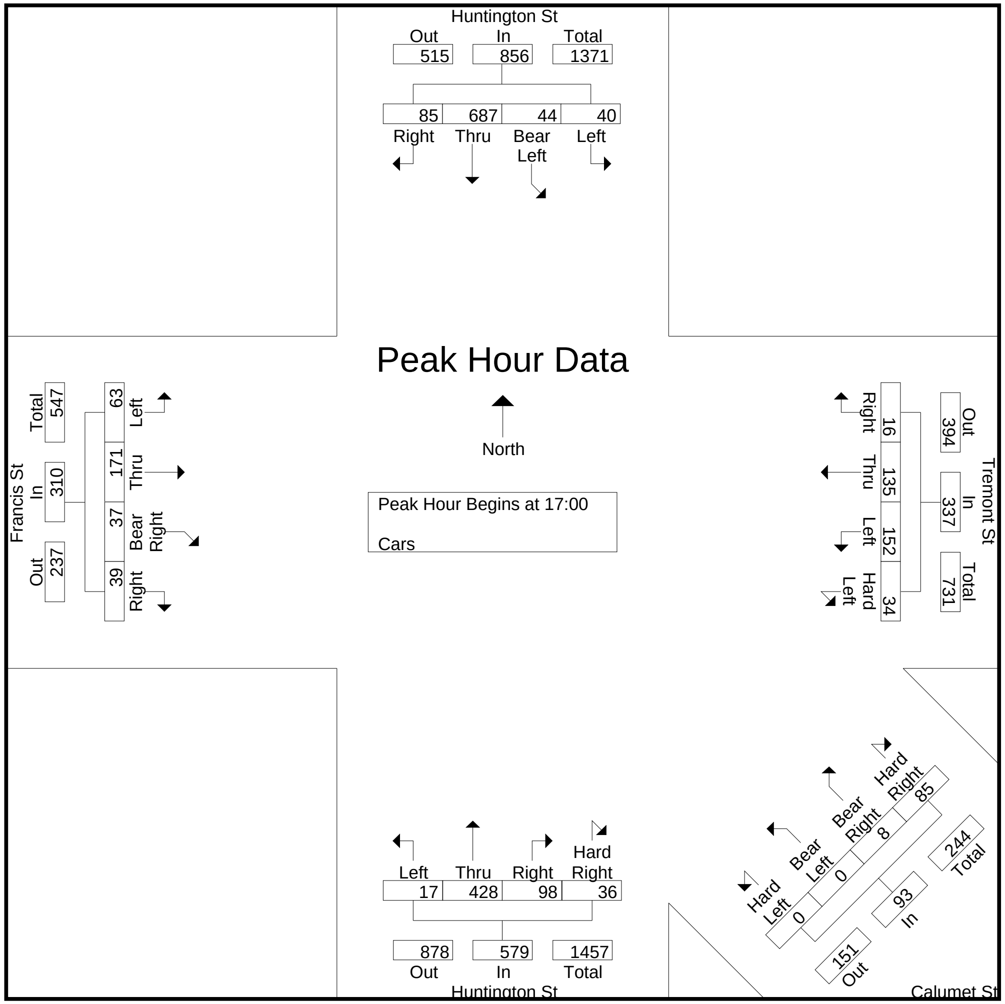

Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	17:00					16:45					16:30					16:15					16:45				
+0 mins.	**13**	10	158	22	203	7	38	44	3	**92**	**1**	**1**	0	20	22	1	113	**33**	**11**	**158**	12	42	**14**	**12**	**80**
+15 mins.	8	11	**191**	18	228	6	34	**45**	4	89	0	0	0	20	20	2	**125**	23	7	157	9	**49**	9	7	74
+30 mins.	6	8	164	14	192	**9**	39	29	4	81	0	0	**3**	**31**	**34**	2	104	26	8	140	15	45	11	8	79
+45 mins.	13	**15**	174	**31**	**233**	7	**40**	35	**5**	87	0	0	1	21	22	**5**	105	29	11	150	**24**	39	5	11	79
Total Volume	40	44	687	85	856	29	151	153	16	349	1	1	4	92	98	10	447	111	37	605	60	175	39	38	312
% App. Total	4.7	5.1	80.3	9.9		8.3	43.3	43.8	4.6		1	1	4.1	93.9		1.7	73.9	18.3	6.1		19.2	56.1	12.5	12.2	
PHF	.769	.733	.899	.685	.918	.806	.944	.850	.800	.948	.250	.250	.333	.742	.721	.500	.894	.841	.841	.957	.625	.893	.696	.792	.975

Accurate Counts
978-664-2565

File Name : 10568011
Site Code : 10568011
Start Date : 5/5/2009
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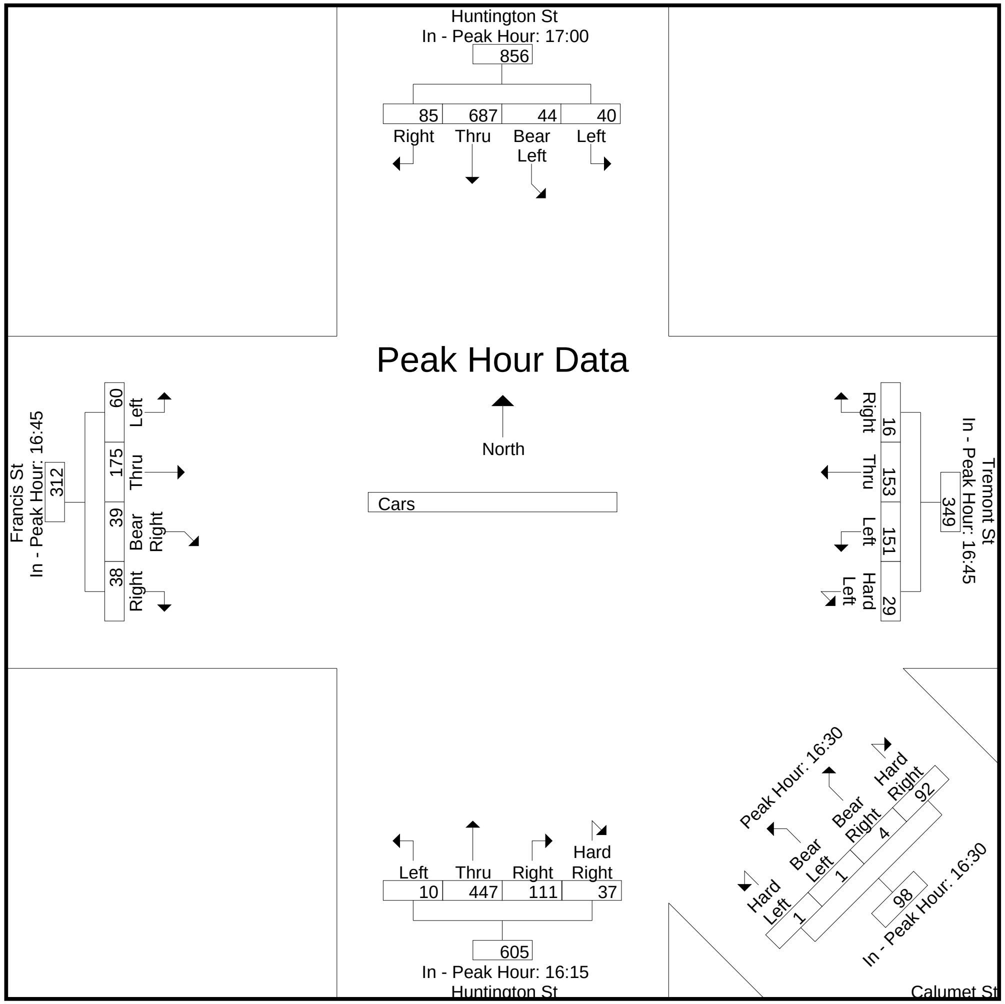

N/S Street : Huntington Street
E/W Street: Francis St / Tremont St
City/State : Boston, MA
Weather : Overcast

Accurate Counts
978-664-2565

File Name : 10568011
Site Code : 10568011
Start Date : 5/5/2009
Page No : 1

Groups Printed- Trucks

	Huntington St From North						Tremont St From East					Calumet St From Southeast					Huntington St From South					Francis St From West							
Start Time	Left	Bear Left	Thru	Right	U-Trn	Peds	Hard Left	Left	Thru	Right	Peds	Hard Left	Bear Left	Bear Right	Hard Right	Peds	Left	Thru	Right	Hard Right	Peds	Left	Thru	Bear Right	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	0	0	7	1	0	0	0	3	0	1	0	0	0	0	0	0	0	3	2	0	0	2	3	0	0	0	0	22	22
16:15	2	0	2	1	0	0	0	5	1	0	0	0	0	0	0	0	1	2	5	0	0	4	3	0	0	0	0	26	26
16:30	1	0	4	0	0	0	0	5	0	0	0	0	0	0	0	0	0	2	3	0	0	3	0	0	0	0	0	18	18
16:45	2	0	3	2	0	0	0	0	1	0	0	0	0	0	6	0	2	4	3	0	0	3	2	0	0	0	0	28	28
Total	5	0	16	4	0	0	0	13	2	1	0	0	0	0	6	0	3	11	13	0	0	12	8	0	0	0	0	94	94
17:00	0	0	2	1	0	0	0	2	0	1	0	0	0	0	0	0	0	4	3	0	0	3	2	0	0	0	0	18	18
17:15	1	0	1	1	0	0	0	4	1	0	0	0	0	0	7	0	0	2	1	0	0	4	2	0	0	0	0	24	24
17:30	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1	0	0	3	3	0	0	0	0	17	17
17:45	0	0	3	2	0	0	0	1	1	0	0	0	0	0	0	0	0	3	2	0	5	6	2	0	0	0	5	20	25
Total	1	0	12	4	0	0	0	7	2	1	0	0	0	0	7	0	0	13	7	0	5	16	9	0	0	0	5	79	84
Grand Total	6	0	28	8	0	0	0	20	4	2	0	0	0	0	13	0	3	24	20	0	5	28	17	0	0	0	5	173	178
Apprch %	14.3	0	66.7	19			0	76.9	15.4	7.7		0	0	0	100		6.4	51.1	42.6	0		62.2	37.8	0	0				
Total %	3.5	0	16.2	4.6			0	11.6	2.3	1.2		0	0	0	7.5		1.7	13.9	11.6	0		16.2	9.8	0	0		2.8	97.2	

	Huntington St From North					Tremont St From East					Calumet St From Southeast					Huntington St From South					Francis St From West					
Start Time	Left	Bear Left			App. Total	Hard Left				App. Total	Hard Left	Bear Left	Bear Right	Hard Right	App. Total				Hard Right	App. Total			Bear Right	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																										
Peak Hour for Entire Intersection Begins at 16:00																										
16:00	0	0	**7**	1	**8**	0	3	0	**1**	4	0	0	0	0	0	0	3	2	0	5	2	**3**	0	0	5	22
16:15	**2**	0	2	1	5	0	**5**	**1**	0	**6**	0	0	0	0	0	1	2	**5**	0	8	**4**	3	0	0	**7**	26
16:30	1	0	4	0	5	0	5	0	0	5	0	0	0	0	0	0	2	3	0	5	3	0	0	0	3	18
16:45	2	0	3	**2**	7	0	0	1	0	1	0	0	0	**6**	**6**	**2**	**4**	3	0	**9**	3	2	0	0	5	**28**
Total Volume	5	0	16	4	25	0	13	2	1	16	0	0	0	6	6	3	11	13	0	27	12	8	0	0	20	94
% App. Total	20	0	64	16		0	81.2	12.5	6.2		0	0	0	100		11.1	40.7	48.1	0		60	40	0	0		
PHF	.625	.000	.571	.500	.781	.000	.650	.500	.250	.667	.000	.000	.000	.250	.250	.375	.688	.650	.000	.750	.750	.667	.000	.000	.714	.839

Accurate Counts
978-664-2565

File Name : 10568011
Site Code : 10568011
Start Date : 5/5/2009
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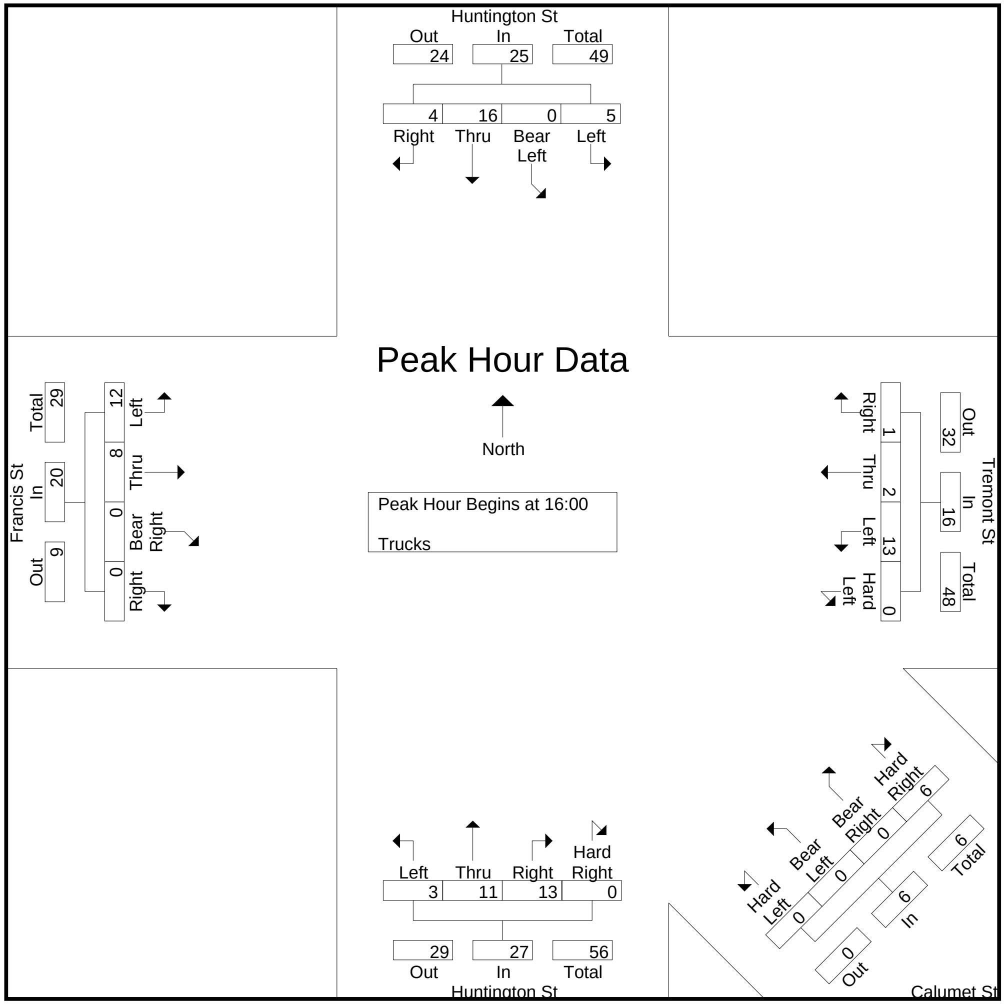
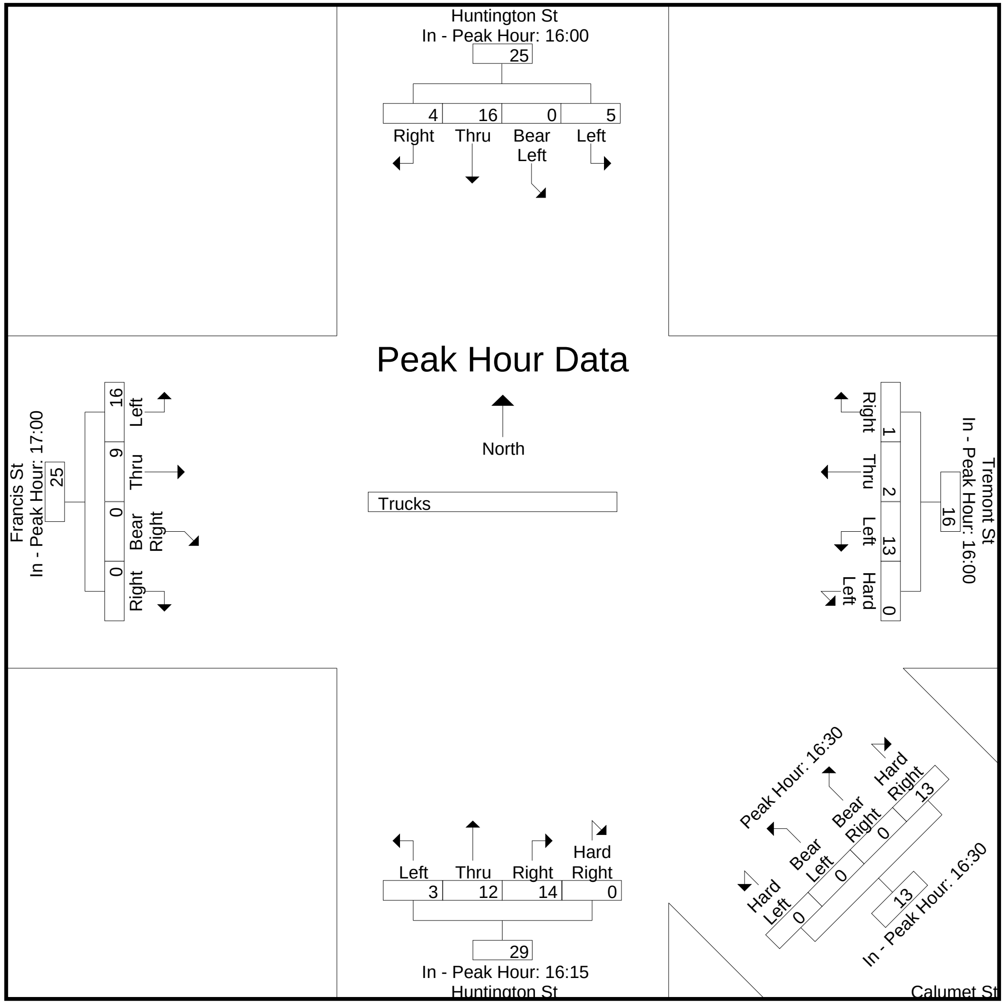


Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:00					16:00					16:30					16:15					17:00				
+0 mins.	0	0	**7**	1	**8**	0	3	0	**1**	4	0	0	0	0	0	1	2	**5**	0	8	3	2	0	0	5
+15 mins.	**2**	0	2	1	5	0	**5**	**1**	0	**6**	0	0	0	6	6	0	2	3	0	5	4	2	0	0	6
+30 mins.	1	0	4	0	5	0	5	0	0	5	0	0	0	0	0	**2**	**4**	3	0	**9**	3	**3**	0	0	6
+45 mins.	2	0	3	**2**	7	0	0	1	0	1	0	0	0	**7**	**7**	0	4	3	0	7	**6**	2	0	0	**8**
Total Volume	5	0	16	4	25	0	13	2	1	16	0	0	0	13	13	3	12	14	0	29	16	9	0	0	25
% App. Total	20	0	64	16		0	81.2	12.5	6.2		0	0	0	100		10.3	41.4	48.3	0		64	36	0	0	
PHF	.625	.000	.571	.500	.781	.000	.650	.500	.250	.667	.000	.000	.000	.464	.464	.375	.750	.700	.000	.806	.667	.750	.000	.000	.781


Huntington St
In - Peak Hour: 16:00
25
4 16 0 5
Right Thru Bear Left Left
Peak Hour Data
North
Trucks
Francis St
In - Peak Hour: 17:00
25
16 Left
9 Thru
0 Bear Right
0 Right
Tremont St
In - Peak Hour: 16:00
16
1 Right
2 Thru
13 Left
0 Hard Left
Left Thru Right Hard Right
3 12 14 0
29
In - Peak Hour: 16:15
Huntington St
Peak Hour: 16:30
Hard Left Bear Left Bear Right Hard Right
0 0 0 13
13
In - Peak Hour: 16:30
Calumet St

N/S Street : Huntington Avenue
E/W Street: Fenwood Street
City/State : Boston, MA
Weather : Overcast

Accurate Counts
978-664-2565

File Name : 10568012
Site Code : 10568012
Start Date : 5/5/2009
Page No : 1

Groups Printed- Cars - Trucks

	Huntington Ave From North			Huntington Ave From South			Fenwood St From West					
Start Time	Thru	Right	Peds	Left	Thru	Peds	Left	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	107	2	0	3	197	13	0	0	37	50	309	359
07:15	154	4	0	3	169	7	0	0	28	35	330	365
07:30	173	6	0	7	181	3	0	0	33	36	367	403
07:45	141	9	0	4	173	27	0	0	42	69	327	396
Total	575	21	0	17	720	50	0	0	140	190	1333	1523
08:00	119	9	1	12	165	7	0	0	20	28	305	333
08:15	112	13	1	8	185	12	0	0	53	66	318	384
08:30	126	7	3	6	189	14	0	0	54	71	328	399
08:45	150	8	5	9	204	20	0	0	52	77	371	448
Total	507	37	10	35	743	53	0	0	179	242	1322	1564
Grand Total	1082	58	10	52	1463	103	0	0	319	432	2655	3087
Apprch %	94.9	5.1		3.4	96.6		0	0				
Total %	40.8	2.2		2	55.1		0	0		14	86	
Cars	968	54		50	1368		0	0		0	0	2872
% Cars	89.5	93.1	100	96.2	93.5	100	0	0	100	0	0	93
Trucks	114	4		2	95		0	0		0	0	215
% Trucks	10.5	6.9	0	3.8	6.5	0	0	0	0	0	0	7

	Huntington Ave From North			Huntington Ave From South			Fenwood St From West			
Start Time	Thru	Right	App. Total	Left	Thru	App. Total	Left	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:00										
07:00	107	2	109	3	**197**	**200**	0	0	0	309
07:15	154	4	158	3	169	172	0	0	0	330
07:30	**173**	6	**179**	**7**	181	188	0	0	0	**367**
07:45	141	**9**	150	4	173	177	0	0	0	327
Total Volume	575	21	596	17	720	737	0	0	0	1333
% App. Total	96.5	3.5		2.3	97.7		0	0		
PHF	.831	.583	.832	.607	.914	.921	.000	.000	.000	.908
Cars	511	20	531	17	668	685	0	0	0	1216
% Cars	88.9	95.2	89.1	100	92.8	92.9	0	0	0	91.2
Trucks	64	1	65	0	52	52	0	0	0	117
% Trucks	11.1	4.8	10.9	0	7.2	7.1	0	0	0	8.8

Accurate Counts
978-664-2565

File Name : 10568012
Site Code : 10568012
Start Date : 5/5/2009
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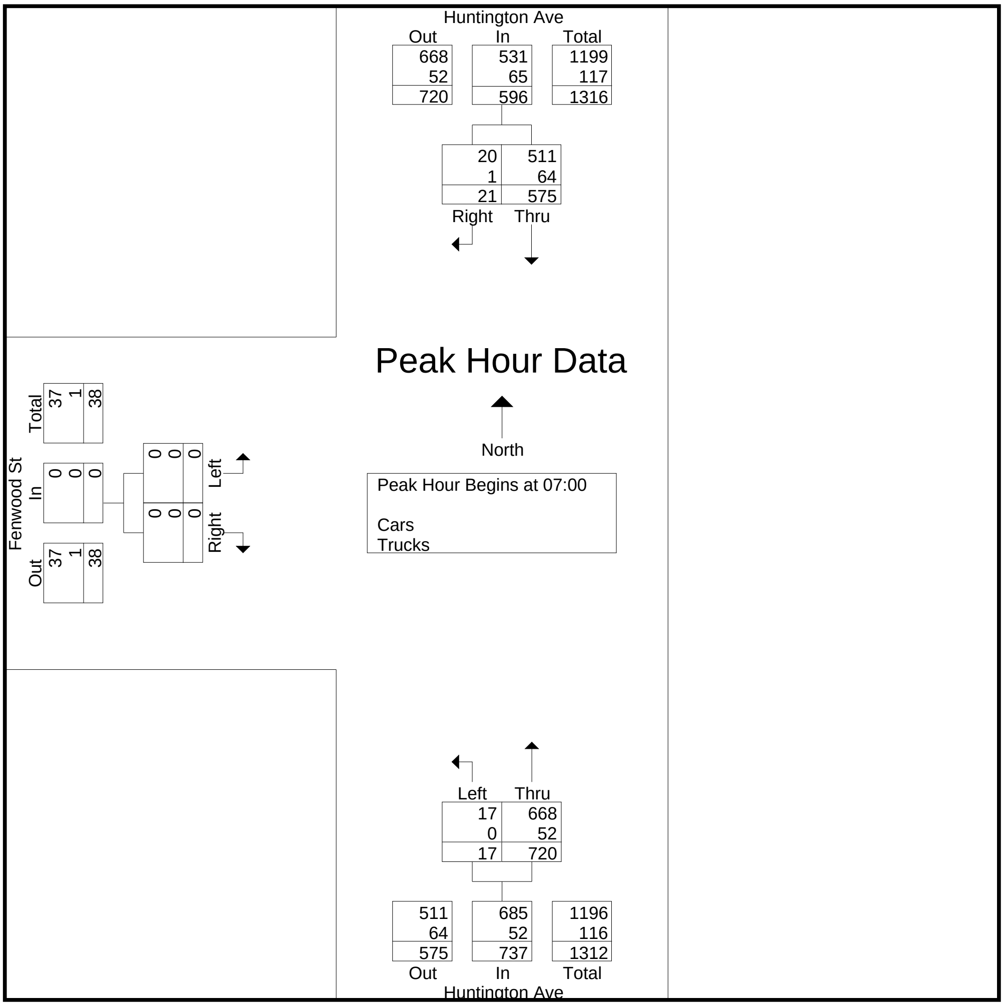
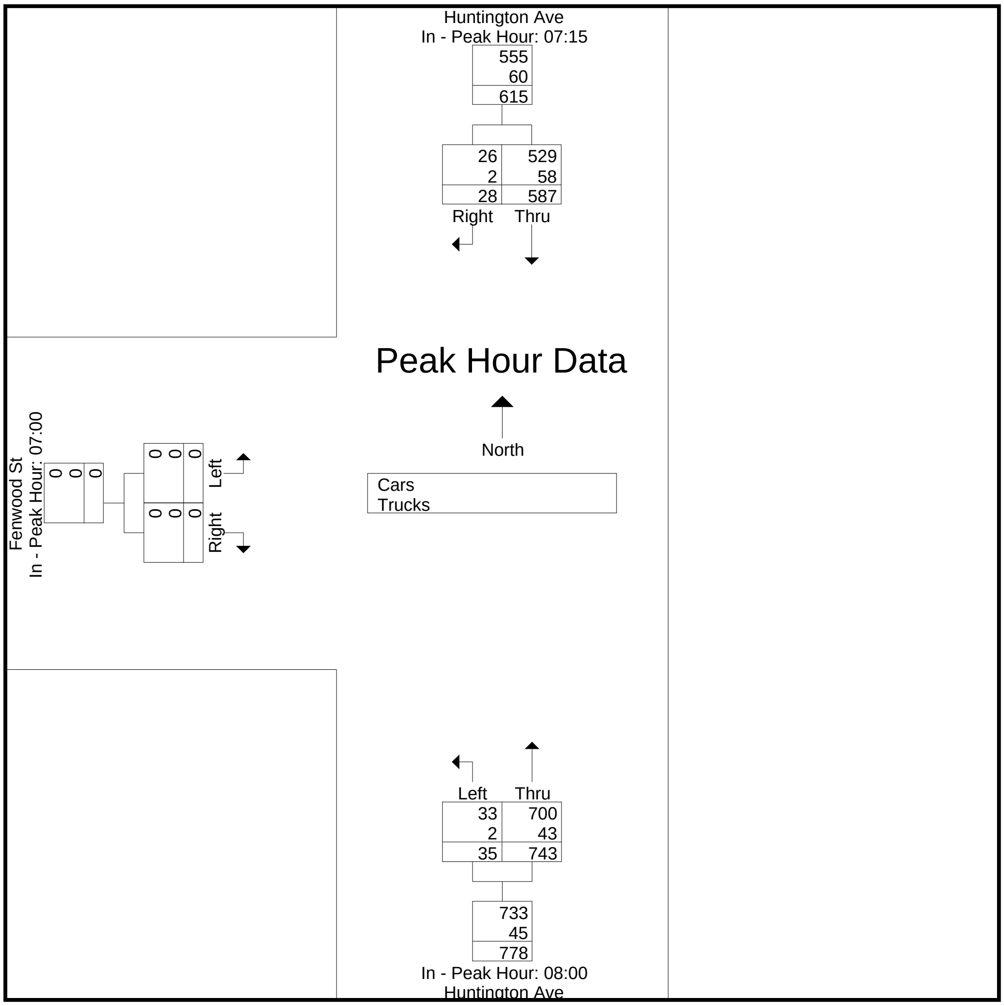


Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:15			08:00			07:00		
+0 mins.	154	4	158	**12**	165	177	0	0	0
+15 mins.	**173**	6	**179**	8	185	193	0	0	0
+30 mins.	141	**9**	150	6	189	195	0	0	0
+45 mins.	119	9	128	9	**204**	**213**	0	0	0
Total Volume	587	28	615	35	743	778	0	0	0
% App. Total	95.4	4.6		4.5	95.5		0	0	
PHF	.848	.778	.859	.729	.911	.913	.000	.000	.000
Cars	529	26	555	33	700	733	0	0	0
% Cars	90.1	92.9	90.2	94.3	94.2	94.2	0	0	0
Trucks	58	2	60	2	43	45	0	0	0
% Trucks	9.9	7.1	9.8	5.7	5.8	5.8	0	0	0

Accurate Counts
978-664-2565

File Name : 10568012
Site Code : 10568012
Start Date : 5/5/2009
Page No : 3



N/S Street : Huntington Avenue
E/W Street: Fenwood Street
City/State : Boston, MA
Weather : Overcast

Accurate Counts
978-664-2565

File Name : 10568012
Site Code : 10568012
Start Date : 5/5/2009
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Groups Printed- Cars

	Huntington Ave From North			Huntington Ave From South			Fenwood St From West					
Start Time	Thru	Right	Peds	Left	Thru	Peds	Left	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	89	2	0	3	180	13	0	0	37	50	274	324
07:15	137	4	0	3	158	7	0	0	28	35	302	337
07:30	158	5	0	7	169	3	0	0	33	36	339	375
07:45	127	9	0	4	161	27	0	0	42	69	301	370
Total	511	20	0	17	668	50	0	0	140	190	1216	1406
08:00	107	8	1	11	152	7	0	0	20	28	278	306
08:15	103	13	1	8	177	12	0	0	53	66	301	367
08:30	111	7	3	5	181	14	0	0	54	71	304	375
08:45	136	6	5	9	190	20	0	0	52	77	341	418
Total	457	34	10	33	700	53	0	0	179	242	1224	1466
Grand Total	968	54	10	50	1368	103	0	0	319	432	2440	2872
Apprch %	94.7	5.3		3.5	96.5		0	0				
Total %	39.7	2.2		2	56.1		0	0		15	85	

	Huntington Ave From North			Huntington Ave From South			Fenwood St From West			
Start Time	Thru	Right	App. Total	Left	Thru	App. Total	Left	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 08:00										
08:00	107	8	115	**11**	152	163	0	0	0	278
08:15	103	**13**	116	8	177	185	0	0	0	301
08:30	111	7	118	5	181	186	0	0	0	304
08:45	**136**	6	**142**	9	**190**	**199**	0	0	0	**341**
Total Volume	457	34	491	33	700	733	0	0	0	1224
% App. Total	93.1	6.9		4.5	95.5		0	0		
PHF	.840	.654	.864	.750	.921	.921	.000	.000	.000	.897

File Name : 10568012
Site Code : 10568012
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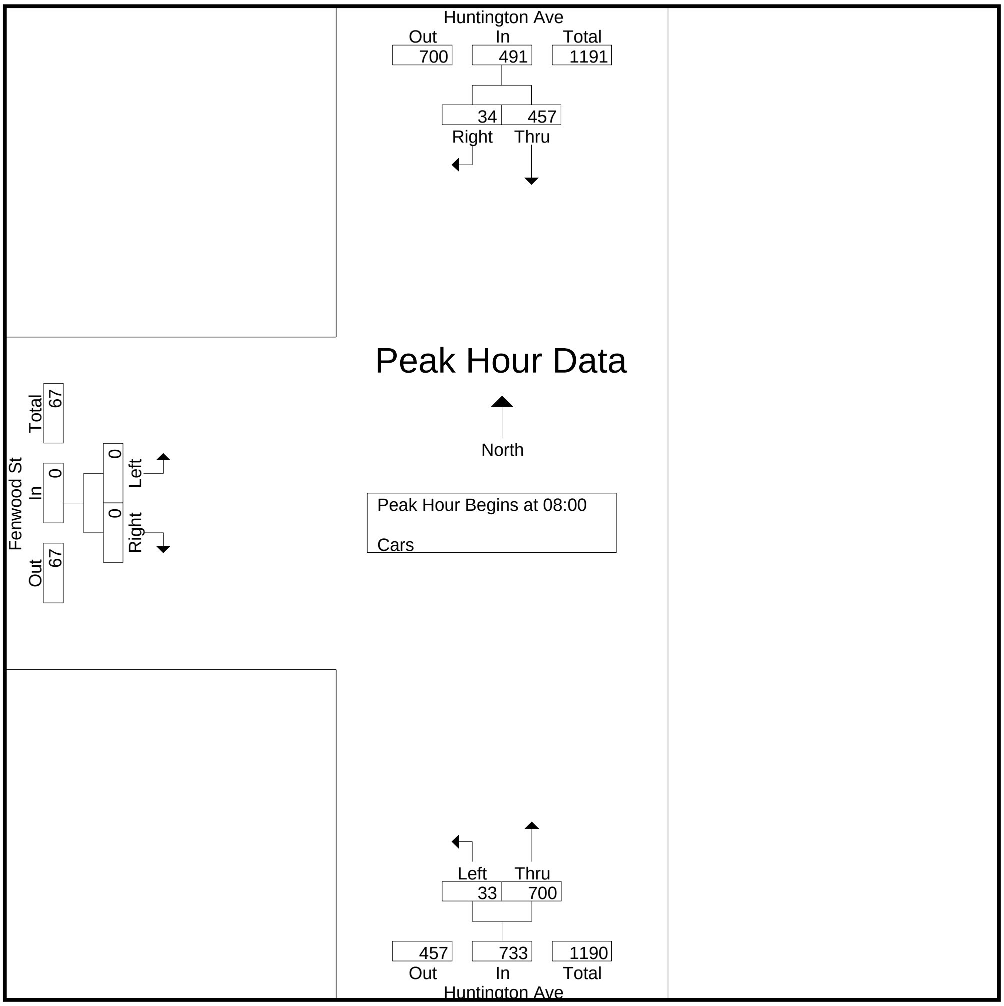

Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:15			08:00			07:00		
+0 mins.	137	4	141	**11**	152	163	0	0	0
+15 mins.	**158**	5	**163**	8	177	185	0	0	0
+30 mins.	127	**9**	136	5	181	186	0	0	0
+45 mins.	107	8	115	9	**190**	**199**	0	0	0
Total Volume	529	26	555	33	700	733	0	0	0
% App. Total	95.3	4.7		4.5	95.5		0	0	
PHF	.837	.722	.851	.750	.921	.921	.000	.000	.000

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File Name : 10568012
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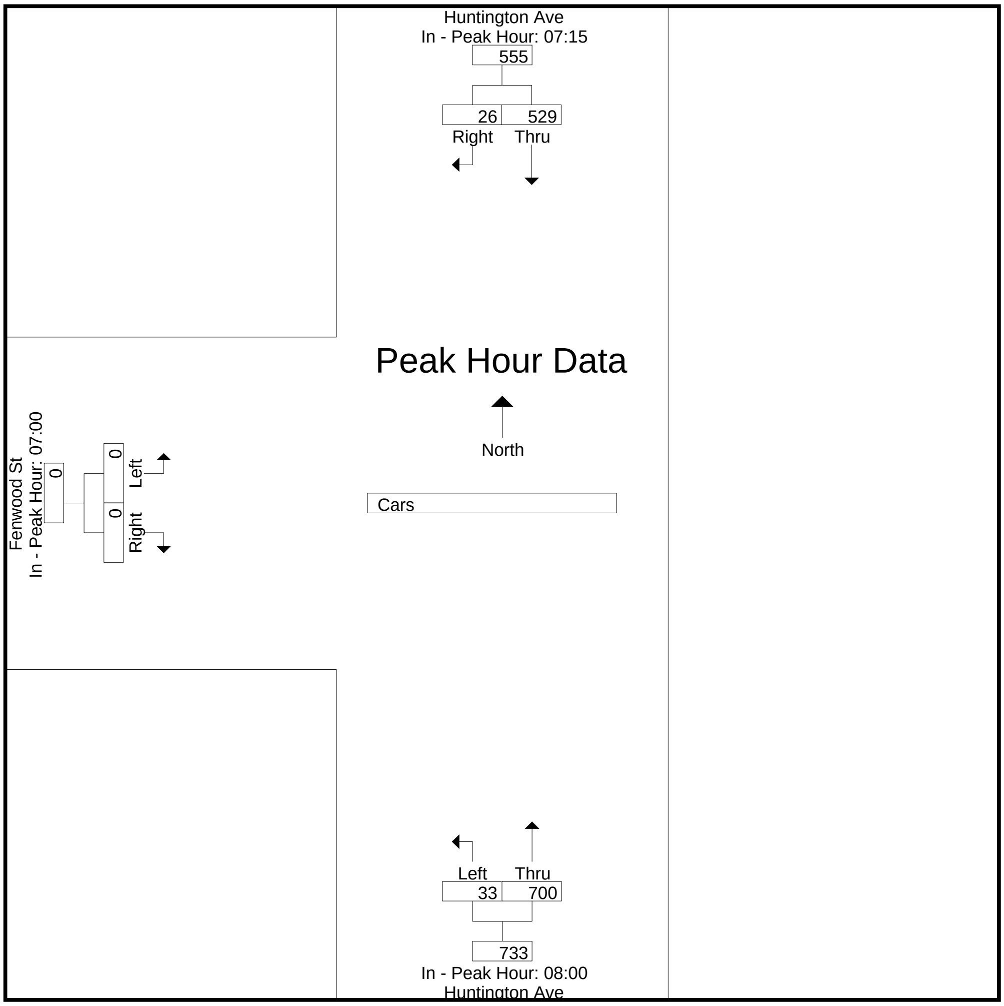


N/S Street : Huntington Avenue
E/W Street: Fenwood Street
City/State : Boston, MA
Weather : Overcast

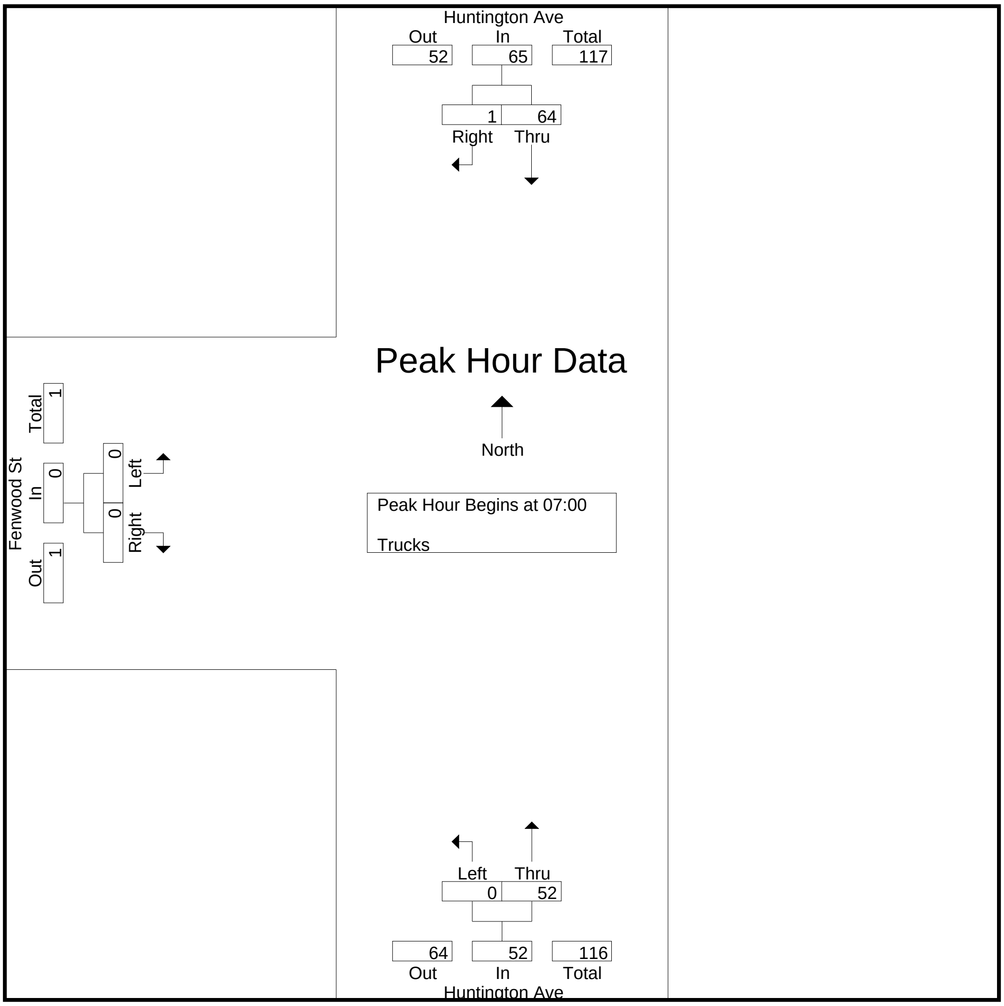
Accurate Counts
978-664-2565

File Name : 10568012
Site Code : 10568012
Start Date : 5/5/2009
Page No : 1

Groups Printed- Trucks

	Huntington Ave From North			Huntington Ave From South			Fenwood St From West					
Start Time	Thru	Right	Peds	Left	Thru	Peds	Left	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	18	0	0	0	17	0	0	0	0	0	35	35
07:15	17	0	0	0	11	0	0	0	0	0	28	28
07:30	15	1	0	0	12	0	0	0	0	0	28	28
07:45	14	0	0	0	12	0	0	0	0	0	26	26
Total	64	1	0	0	52	0	0	0	0	0	117	117
08:00	12	1	0	1	13	0	0	0	0	0	27	27
08:15	9	0	0	0	8	0	0	0	0	0	17	17
08:30	15	0	0	1	8	0	0	0	0	0	24	24
08:45	14	2	0	0	14	0	0	0	0	0	30	30
Total	50	3	0	2	43	0	0	0	0	0	98	98
Grand Total	114	4	0	2	95	0	0	0	0	0	215	215
Apprch %	96.6	3.4		2.1	97.9		0	0				
Total %	53	1.9		0.9	44.2		0	0		0	100	

	Huntington Ave From North			Huntington Ave From South			Fenwood St From West			
Start Time	Thru	Right	App. Total	Left	Thru	App. Total	Left	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:00										
07:00	**18**	0	**18**	0	**17**	**17**	0	0	0	**35**
07:15	17	0	17	0	11	11	0	0	0	28
07:30	15	**1**	16	0	12	12	0	0	0	28
07:45	14	0	14	0	12	12	0	0	0	26
Total Volume	64	1	65	0	52	52	0	0	0	117
% App. Total	98.5	1.5		0	100		0	0		
PHF	.889	.250	.903	.000	.765	.765	.000	.000	.000	.836



Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:00			07:00			07:00		
+0 mins.	**18**	0	**18**	0	**17**	**17**	0	0	0
+15 mins.	17	0	17	0	11	11	0	0	0
+30 mins.	15	**1**	16	0	12	12	0	0	0
+45 mins.	14	0	14	0	12	12	0	0	0
Total Volume	64	1	65	0	52	52	0	0	0
% App. Total	98.5	1.5		0	100		0	0	
PHF	.889	.250	.903	.000	.765	.765	.000	.000	.000

Accurate Counts
978-664-2565

File Name : 10568012
Site Code : 10568012
Start Date : 5/5/2009
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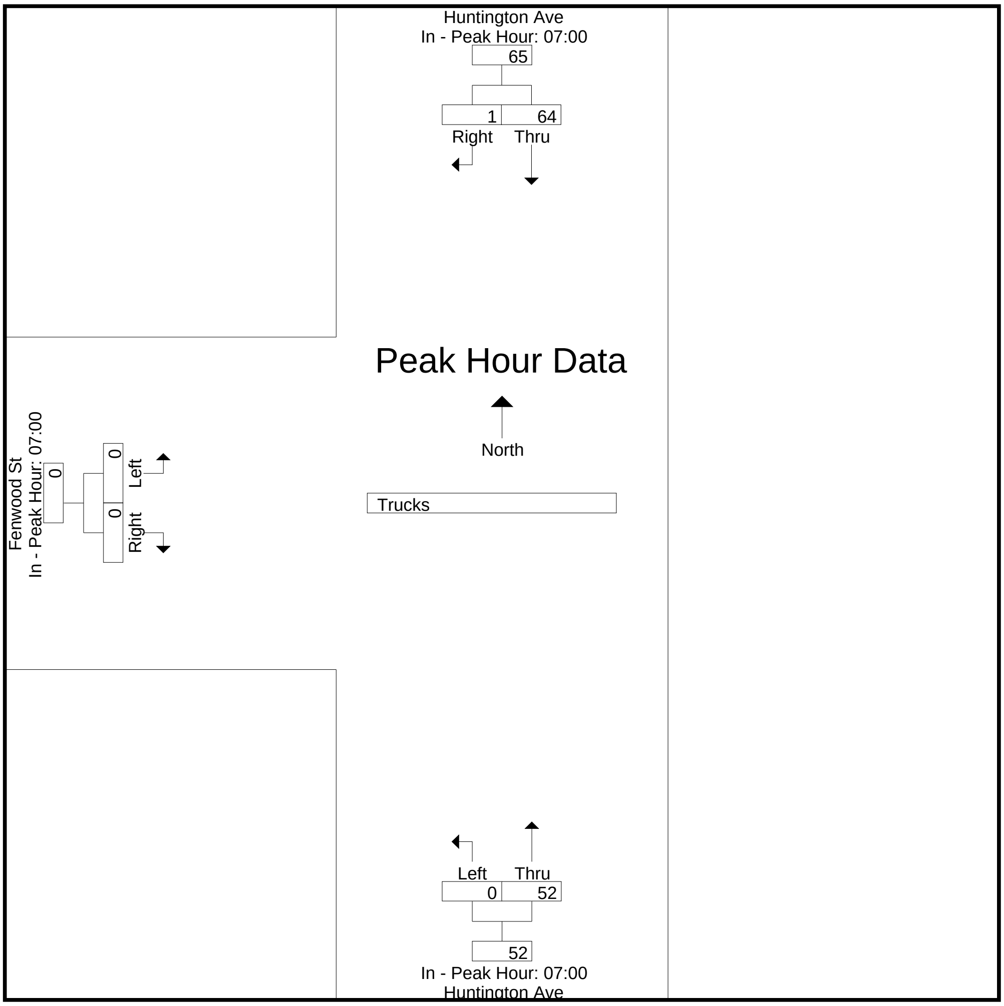


Accurate Counts
978-664-2565

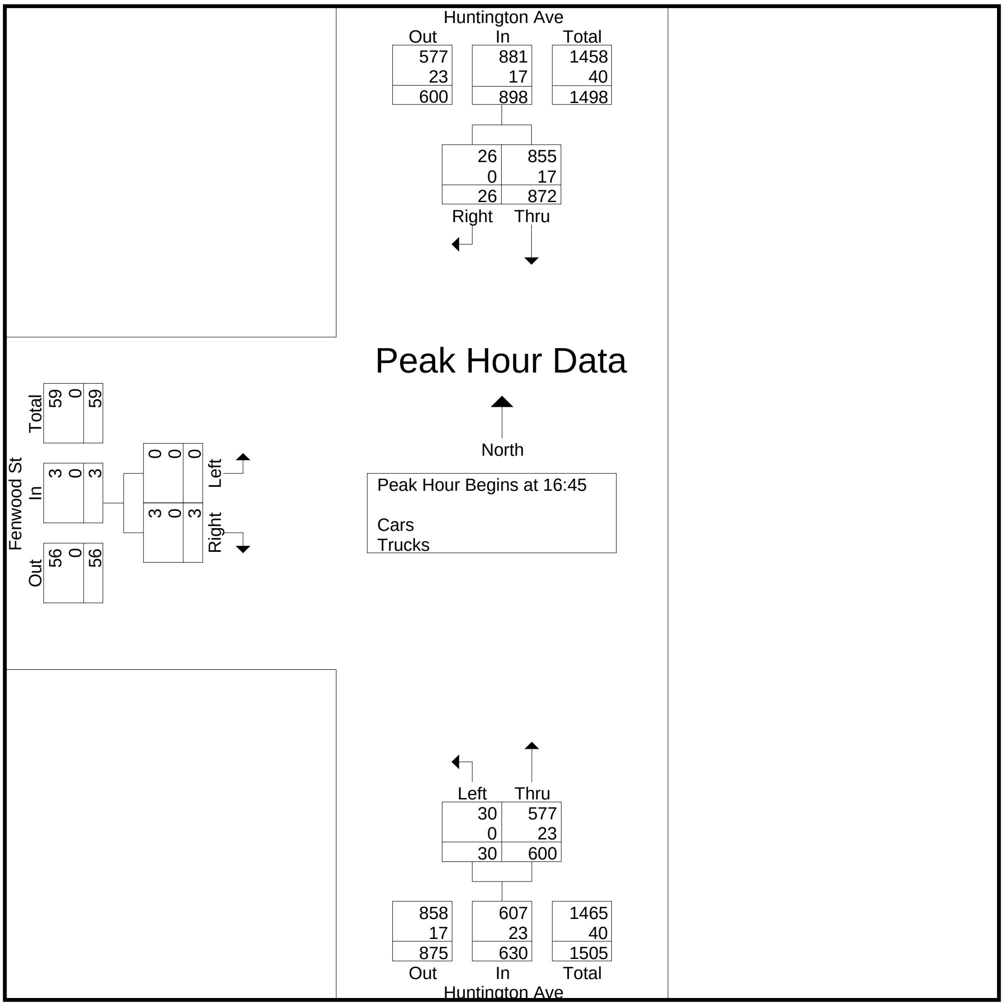
N/S Street : Huntington Avenue
E/W Street: Fenwood Street
City/State : Boston, MA
Weather : Overcast

File Name : 10568012
Site Code : 10568012
Start Date : 5/5/2009
Page No : 1

Groups Printed- Cars - Trucks

	Huntington Ave From North			Huntington Ave From South			Fenwood St From West					
Start Time	Thru	Right	Peds	Left	Thru	Peds	Left	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	189	7	3	8	141	2	0	0	20	25	345	370
16:15	203	6	1	5	167	9	0	0	38	48	381	429
16:30	211	5	1	8	163	3	0	0	33	37	387	424
16:45	220	9	2	7	149	3	0	1	31	36	386	422
Total	823	27	7	28	620	17	0	1	122	146	1499	1645
17:00	197	7	2	11	155	2	0	1	28	32	371	403
17:15	236	7	0	6	135	3	0	1	35	38	385	423
17:30	219	3	1	6	161	3	0	0	38	42	389	431
17:45	225	3	1	4	149	2	0	0	26	29	381	410
Total	877	20	4	27	600	10	0	2	127	141	1526	1667
Grand Total	1700	47	11	55	1220	27	0	3	249	287	3025	3312
Apprch %	97.3	2.7		4.3	95.7		0	100				
Total %	56.2	1.6		1.8	40.3		0	0.1		8.7	91.3	
Cars	1653	46		54	1173		0	3		0	0	3216
% Cars	97.2	97.9	100	98.2	96.1	100	0	100	100	0	0	97.1
Trucks	47	1		1	47		0	0		0	0	96
% Trucks	2.8	2.1	0	1.8	3.9	0	0	0	0	0	0	2.9

	Huntington Ave From North			Huntington Ave From South			Fenwood St From West			
Start Time	Thru	Right	App. Total	Left	Thru	App. Total	Left	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 16:45										
16:45	220	**9**	229	7	149	156	0	**1**	**1**	386
17:00	197	7	204	**11**	155	166	0	1	1	371
17:15	**236**	7	**243**	6	135	141	0	1	1	385
17:30	219	3	222	6	**161**	**167**	0	0	0	**389**
Total Volume	872	26	898	30	600	630	0	3	3	1531
% App. Total	97.1	2.9		4.8	95.2		0	100		
PHF	.924	.722	.924	.682	.932	.943	.000	.750	.750	.984
Cars	855	26	881	30	577	607	0	3	3	1491
% Cars	98.1	100	98.1	100	96.2	96.3	0	100	100	97.4
Trucks	17	0	17	0	23	23	0	0	0	40
% Trucks	1.9	0	1.9	0	3.8	3.7	0	0	0	2.6



Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:45			16:15			16:30		
+0 mins.	220	**9**	229	5	**167**	**172**	0	0	0
+15 mins.	197	7	204	8	163	171	0	**1**	**1**
+30 mins.	**236**	7	**243**	7	149	156	0	1	1
+45 mins.	219	3	222	**11**	155	166	0	1	1
Total Volume	872	26	898	31	634	665	0	3	3
% App. Total	97.1	2.9		4.7	95.3		0	100	
PHF	.924	.722	.924	.705	.949	.967	.000	.750	.750
Cars	855	26	881	30	605	635	0	3	3
% Cars	98.1	100	98.1	96.8	95.4	95.5	0	100	100
Trucks	17	0	17	1	29	30	0	0	0
% Trucks	1.9	0	1.9	3.2	4.6	4.5	0	0	0

Accurate Counts
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Site Code : 10568012
Start Date : 5/5/2009
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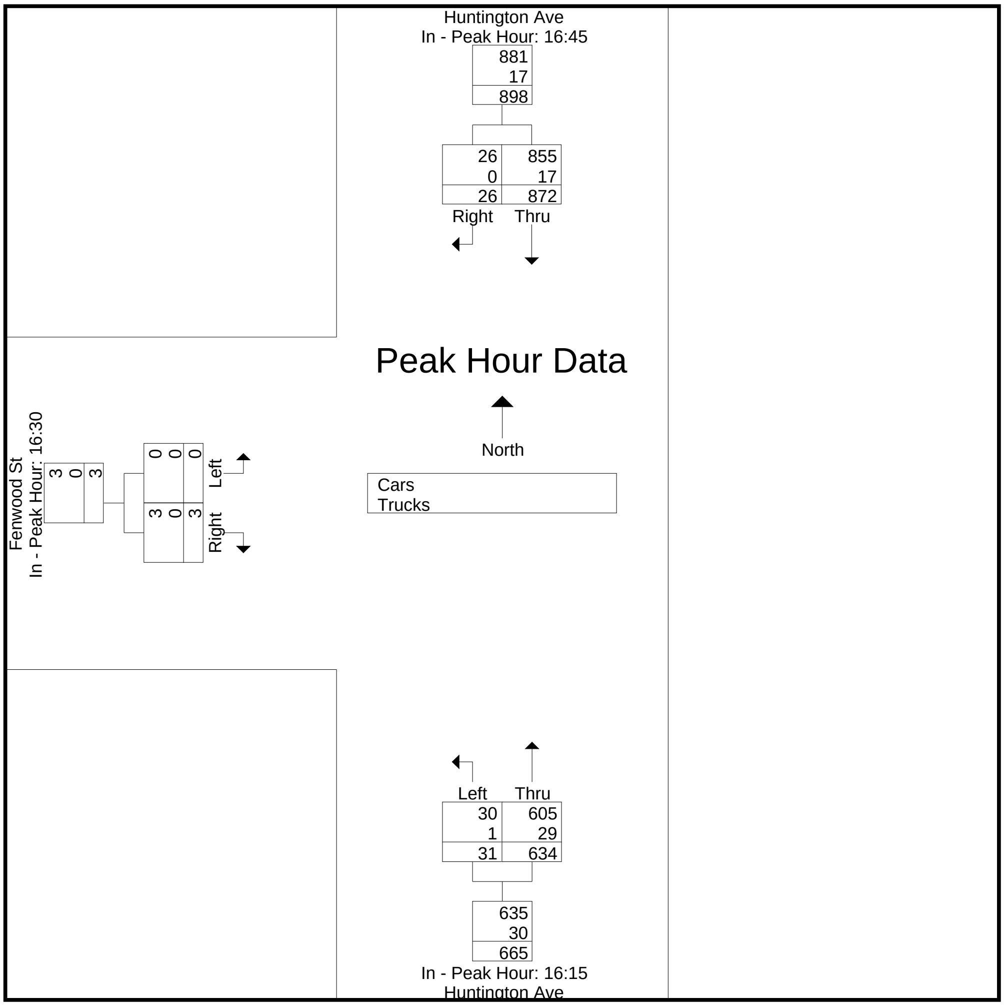


N/S Street : Huntington Avenue
E/W Street: Fenwood Street
City/State : Boston, MA
Weather : Overcast

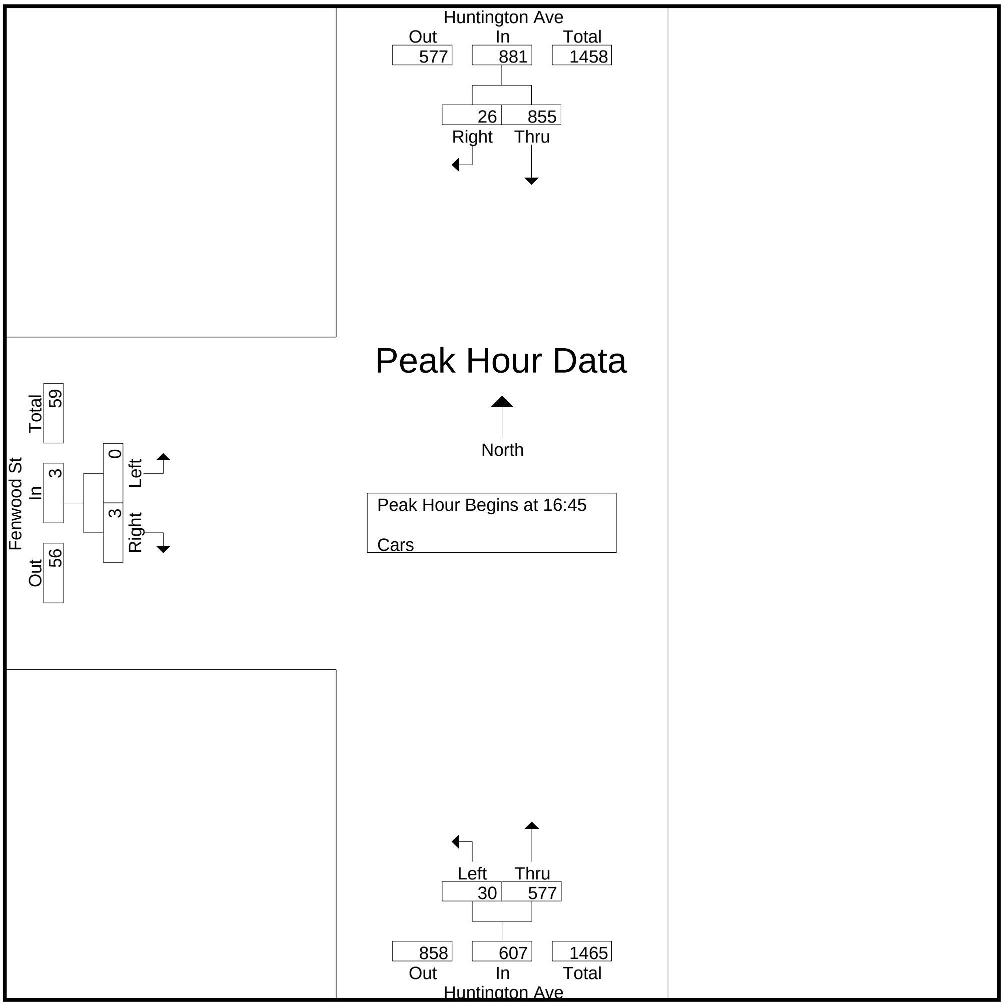
Accurate Counts
978-664-2565

File Name : 10568012
Site Code : 10568012
Start Date : 5/5/2009
Page No : 1

Groups Printed- Cars

	Huntington Ave From North			Huntington Ave From South			Fenwood St From West					
Start Time	Thru	Right	Peds	Left	Thru	Peds	Left	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	179	7	3	8	136	2	0	0	20	25	330	355
16:15	195	6	1	5	159	9	0	0	38	48	365	413
16:30	203	4	1	7	157	3	0	0	33	37	371	408
16:45	218	9	2	7	140	3	0	1	31	36	375	411
Total	795	26	7	27	592	17	0	1	122	146	1441	1587
17:00	193	7	2	11	149	2	0	1	28	32	361	393
17:15	231	7	0	6	132	3	0	1	35	38	377	415
17:30	213	3	1	6	156	3	0	0	38	42	378	420
17:45	221	3	1	4	144	2	0	0	26	29	372	401
Total	858	20	4	27	581	10	0	2	127	141	1488	1629
Grand Total	1653	46	11	54	1173	27	0	3	249	287	2929	3216
Apprch %	97.3	2.7		4.4	95.6		0	100				
Total %	56.4	1.6		1.8	40		0	0.1		8.9	91.1	

	Huntington Ave From North			Huntington Ave From South			Fenwood St From West			
Start Time	Thru	Right	App. Total	Left	Thru	App. Total	Left	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 16:45										
16:45	218	**9**	227	7	140	147	0	**1**	**1**	375
17:00	193	7	200	**11**	149	160	0	1	1	361
17:15	**231**	7	**238**	6	132	138	0	1	1	377
17:30	213	3	216	6	**156**	**162**	0	0	0	**378**
Total Volume	855	26	881	30	577	607	0	3	3	1491
% App. Total	97	3		4.9	95.1		0	100		
PHF	.925	.722	.925	.682	.925	.937	.000	.750	.750	.986



Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:45			16:15			16:30		
+0 mins.	218	**9**	227	5	**159**	**164**	0	0	0
+15 mins.	193	7	200	7	157	164	0	**1**	**1**
+30 mins.	**231**	7	**238**	7	140	147	0	1	1
+45 mins.	213	3	216	**11**	149	160	0	1	1
Total Volume	855	26	881	30	605	635	0	3	3
% App. Total	97	3		4.7	95.3		0	100	
PHF	.925	.722	.925	.682	.951	.968	.000	.750	.750

Accurate Counts
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Start Date : 5/5/2009
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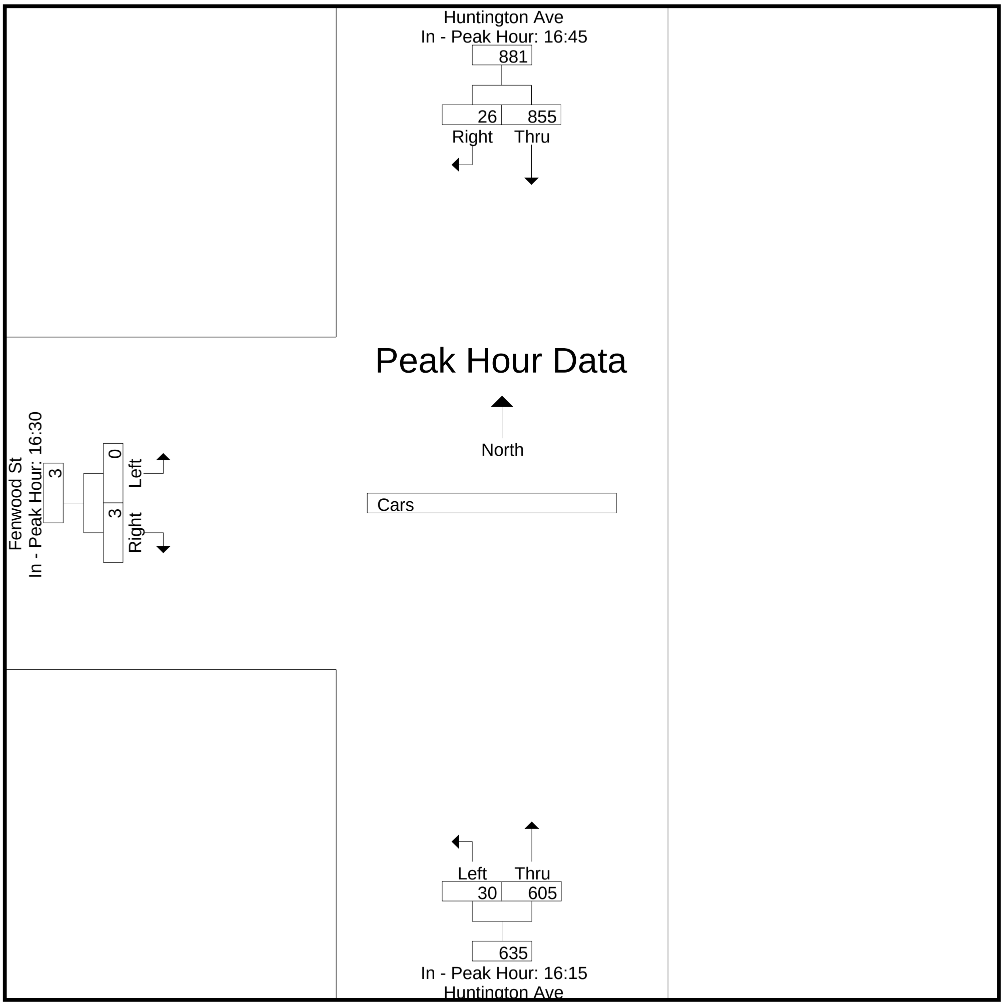


N/S Street : Huntington Avenue
E/W Street: Fenwood Street
City/State : Boston, MA
Weather : Overcast

Accurate Counts
978-664-2565

File Name : 10568012
Site Code : 10568012
Start Date : 5/5/2009
Page No : 1

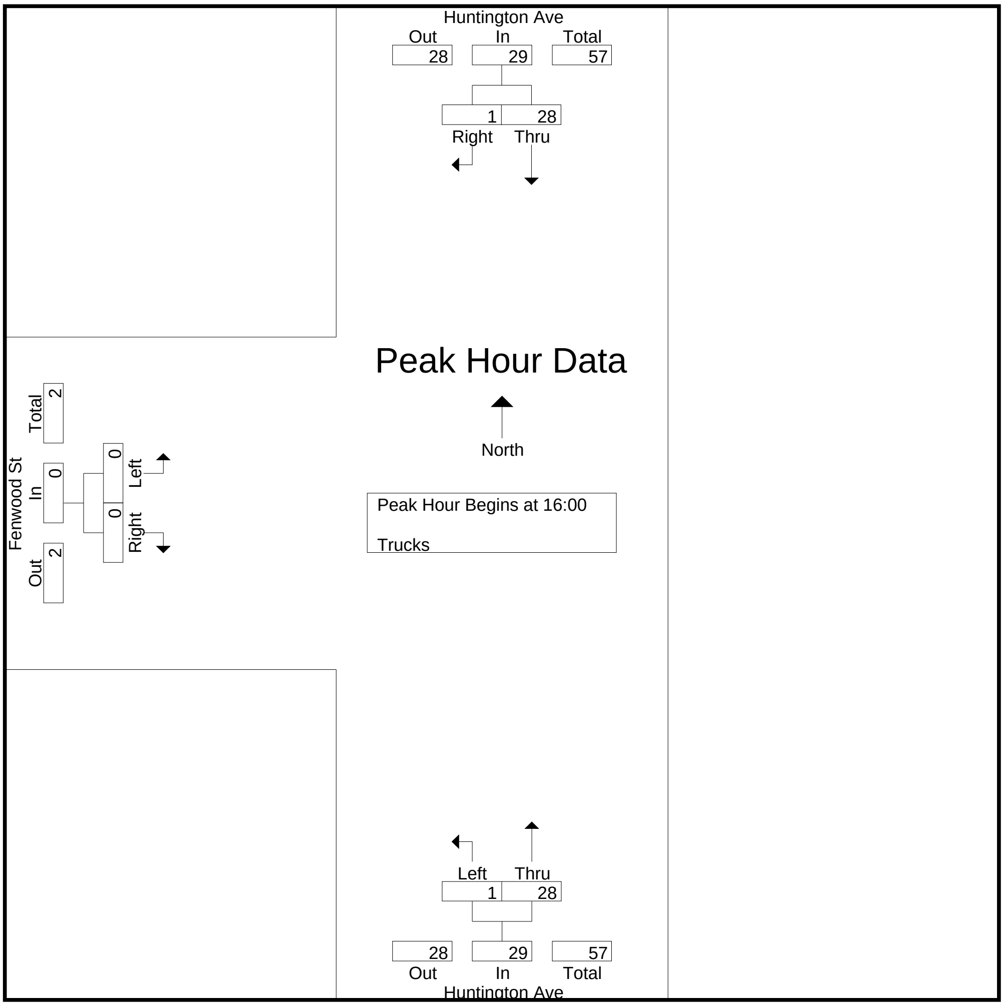
Groups Printed- Trucks

	Huntington Ave From North			Huntington Ave From South			Fenwood St From West					
Start Time	Thru	Right	Peds	Left	Thru	Peds	Left	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	10	0	0	0	5	0	0	0	0	0	15	15
16:15	8	0	0	0	8	0	0	0	0	0	16	16
16:30	8	1	0	1	6	0	0	0	0	0	16	16
16:45	2	0	0	0	9	0	0	0	0	0	11	11
Total	28	1	0	1	28	0	0	0	0	0	58	58
17:00	4	0	0	0	6	0	0	0	0	0	10	10
17:15	5	0	0	0	3	0	0	0	0	0	8	8
17:30	6	0	0	0	5	0	0	0	0	0	11	11
17:45	4	0	0	0	5	0	0	0	0	0	9	9
Total	19	0	0	0	19	0	0	0	0	0	38	38
Grand Total	47	1	0	1	47	0	0	0	0	0	96	96
Apprch %	97.9	2.1		2.1	97.9		0	0				
Total %	49	1		1	49		0	0		0	100	

	Huntington Ave From North			Huntington Ave From South			Fenwood St From West			
Start Time	Thru	Right	App. Total	Left	Thru	App. Total	Left	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 16:00										
16:00	**10**	0	**10**	0	5	5	0	0	0	15
16:15	8	0	8	0	8	8	0	0	0	**16**
16:30	8	**1**	9	**1**	6	7	0	0	0	16
16:45	2	0	2	0	**9**	**9**	0	0	0	11
Total Volume	28	1	29	1	28	29	0	0	0	58
% App. Total	96.6	3.4		3.4	96.6		0	0		
PHF	.700	.250	.725	.250	.778	.806	.000	.000	.000	.906

Accurate Counts
978-664-2565

File Name : 10568012
Site Code : 10568012
Start Date : 5/5/2009
Page No : 2

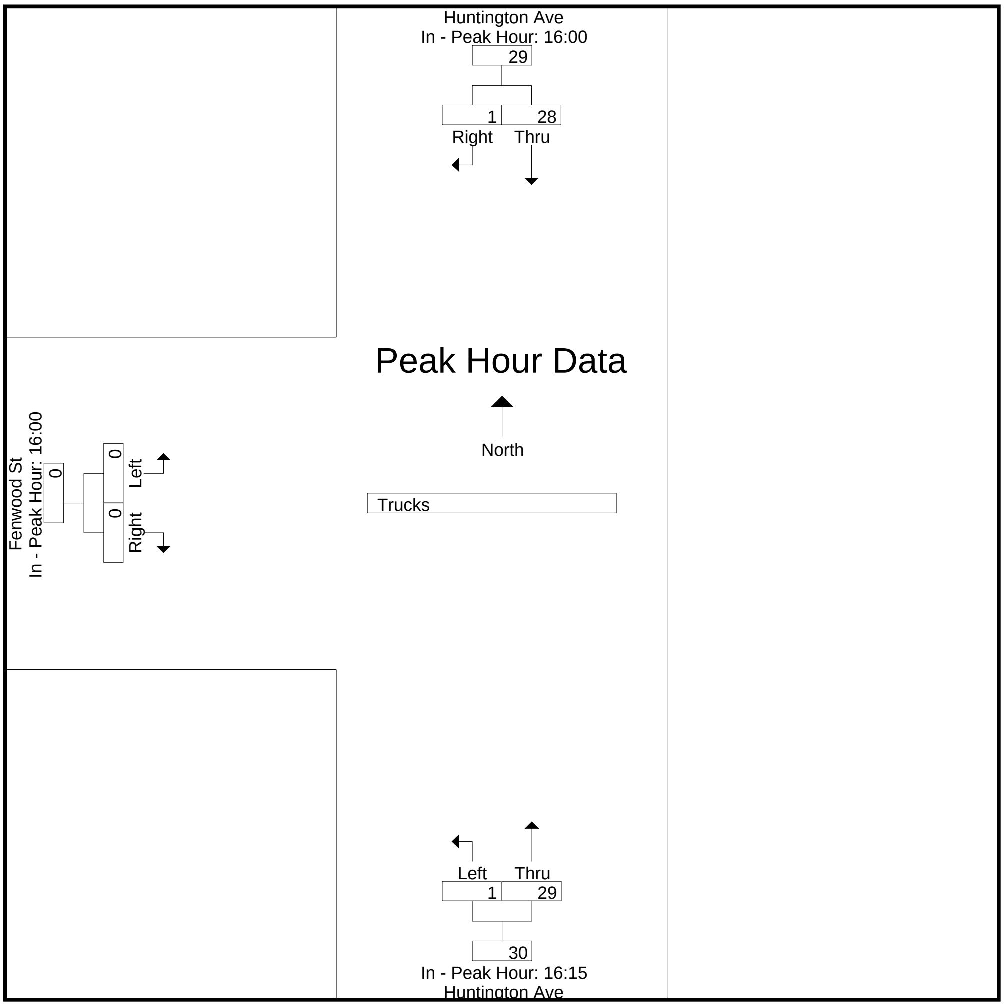


Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:00			16:15			16:00		
+0 mins.	**10**	0	**10**	0	8	8	0	0	0
+15 mins.	8	0	8	**1**	6	7	0	0	0
+30 mins.	8	**1**	9	0	**9**	**9**	0	0	0
+45 mins.	2	0	2	0	6	6	0	0	0
Total Volume	28	1	29	1	29	30	0	0	0
% App. Total	96.6	3.4		3.3	96.7		0	0	
PHF	.700	.250	.725	.250	.806	.833	.000	.000	.000

Accurate Counts
978-664-2565

File Name : 10568012
Site Code : 10568012
Start Date : 5/5/2009
Page No : 3



Accurate Counts
978-664-2565

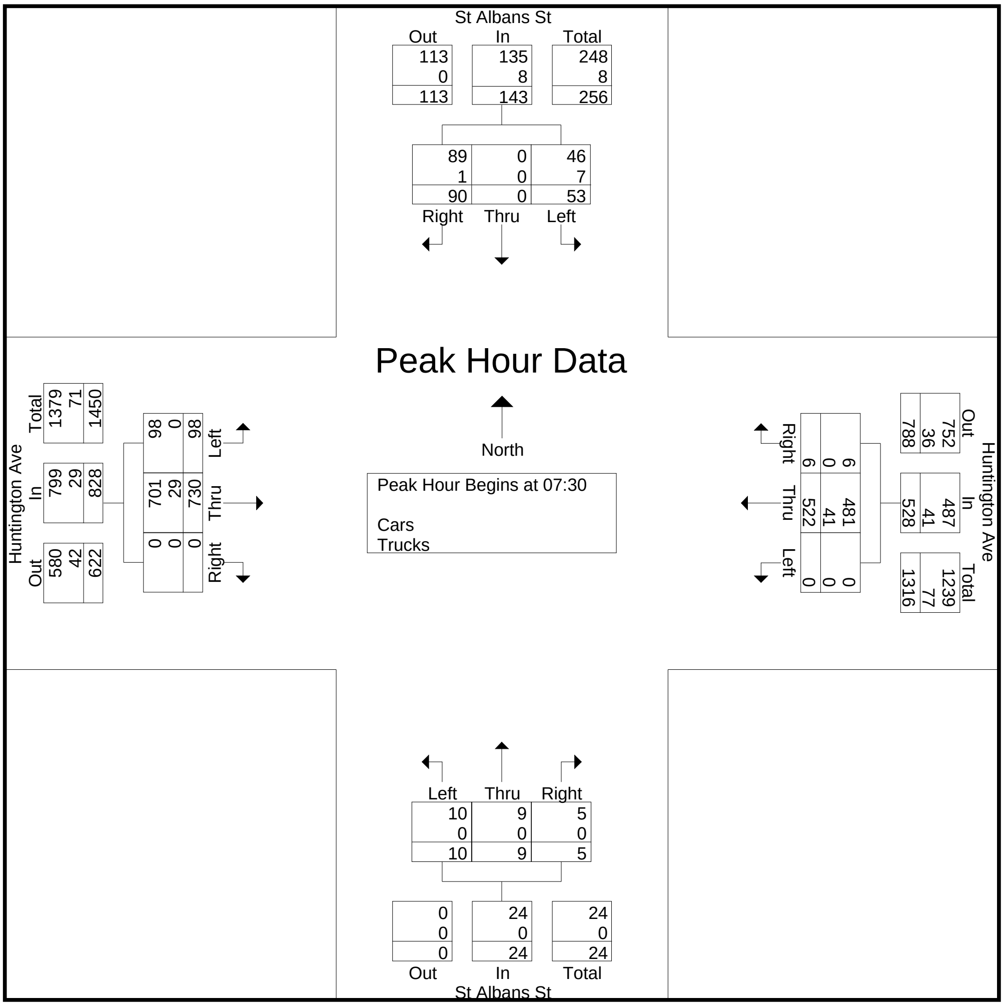
N/S Street : St Albans Street
E/W Street: Huntington Avenue
City/State : Boston, MA
Weather : Overcast

File Name : 10568013
Site Code : 10568013
Start Date : 5/5/2009
Page No : 1

Groups Printed- Cars - Trucks

	St Albans St From North				Huntington Ave From East				St Albans St From South				Huntington Ave From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	3	0	17	13	0	104	2	0	1	0	0	17	17	186	0	4	34	330	364
07:15	10	0	31	9	0	150	3	1	5	2	1	13	17	164	0	5	28	383	411
07:30	13	0	31	10	0	155	1	5	3	4	3	16	14	160	0	10	41	384	425
07:45	14	0	17	13	0	126	1	1	3	3	2	15	33	178	0	14	43	377	420
Total	40	0	96	45	0	535	7	7	12	9	6	61	81	688	0	33	146	1474	1620
08:00	14	0	26	7	0	124	2	1	1	1	0	16	23	173	0	9	33	364	397
08:15	12	0	16	21	0	117	2	1	3	1	0	15	28	219	0	3	40	398	438
08:30	7	0	12	16	0	126	4	2	4	1	2	27	21	187	0	5	50	364	414
08:45	14	0	15	22	0	118	2	4	1	3	1	32	33	179	0	15	73	366	439
Total	47	0	69	66	0	485	10	8	9	6	3	90	105	758	0	32	196	1492	1688
Grand Total	87	0	165	111	0	1020	17	15	21	15	9	151	186	1446	0	65	342	2966	3308
Apprch %	34.5	0	65.5		0	98.4	1.6		46.7	33.3	20		11.4	88.6	0				
Total %	2.9	0	5.6		0	34.4	0.6		0.7	0.5	0.3		6.3	48.8	0		10.3	89.7	
Cars	77	0	163		0	934	17		21	15	8		184	1366	0		0	0	3127
% Cars	88.5	0	98.8	100	0	91.6	100	100	100	100	88.9	100	98.9	94.5	0	100	0	0	94.5
Trucks	10	0	2		0	86	0		0	0	1		2	80	0		0	0	181
% Trucks	11.5	0	1.2	0	0	8.4	0	0	0	0	11.1	0	1.1	5.5	0	0	0	0	5.5

	St Albans St From North				Huntington Ave From East				St Albans St From South				Huntington Ave From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:30																	
07:30	13	0	**31**	**44**	0	**155**	1	**156**	**3**	**4**	**3**	**10**	14	160	0	174	384
07:45	**14**	0	17	31	0	126	1	127	3	3	2	8	**33**	178	0	211	377
08:00	14	0	26	40	0	124	**2**	126	1	1	0	2	23	173	0	196	364
08:15	12	0	16	28	0	117	2	119	3	1	0	4	28	**219**	0	**247**	**398**
Total Volume	53	0	90	143	0	522	6	528	10	9	5	24	98	730	0	828	1523
% App. Total	37.1	0	62.9		0	98.9	1.1		41.7	37.5	20.8		11.8	88.2	0		
PHF	.946	.000	.726	.813	.000	.842	.750	.846	.833	.563	.417	.600	.742	.833	.000	.838	.957
Cars	46	0	89	135	0	481	6	487	10	9	5	24	98	701	0	799	1445
% Cars	86.8	0	98.9	94.4	0	92.1	100	92.2	100	100	100	100	100	96.0	0	96.5	94.9
Trucks	7	0	1	8	0	41	0	41	0	0	0	0	0	29	0	29	78
% Trucks	13.2	0	1.1	5.6	0	7.9	0	7.8	0	0	0	0	0	4.0	0	3.5	5.1



Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:15				07:15				07:15				08:00			
+0 mins.	10	0	**31**	41	0	150	**3**	153	**5**	2	1	8	23	173	0	196
+15 mins.	13	0	31	**44**	0	**155**	1	**156**	3	**4**	**3**	**10**	28	**219**	0	**247**
+30 mins.	**14**	0	17	31	0	126	1	127	3	3	2	8	21	187	0	208
+45 mins.	14	0	26	40	0	124	2	126	1	1	0	2	**33**	179	0	212
Total Volume	51	0	105	156	0	555	7	562	12	10	6	28	105	758	0	863
% App. Total	32.7	0	67.3		0	98.8	1.2		42.9	35.7	21.4		12.2	87.8	0	
PHF	.911	.000	.847	.886	.000	.895	.583	.901	.600	.625	.500	.700	.795	.865	.000	.873
Cars	44	0	104	148	0	511	7	518	12	10	6	28	103	723	0	826
% Cars	86.3	0	99	94.9	0	92.1	100	92.2	100	100	100	100	98.1	95.4	0	95.7
Trucks	7	0	1	8	0	44	0	44	0	0	0	0	2	35	0	37
% Trucks	13.7	0	1	5.1	0	7.9	0	7.8	0	0	0	0	1.9	4.6	0	4.3

Accurate Counts
978-664-2565

File Name : 10568013
Site Code : 10568013
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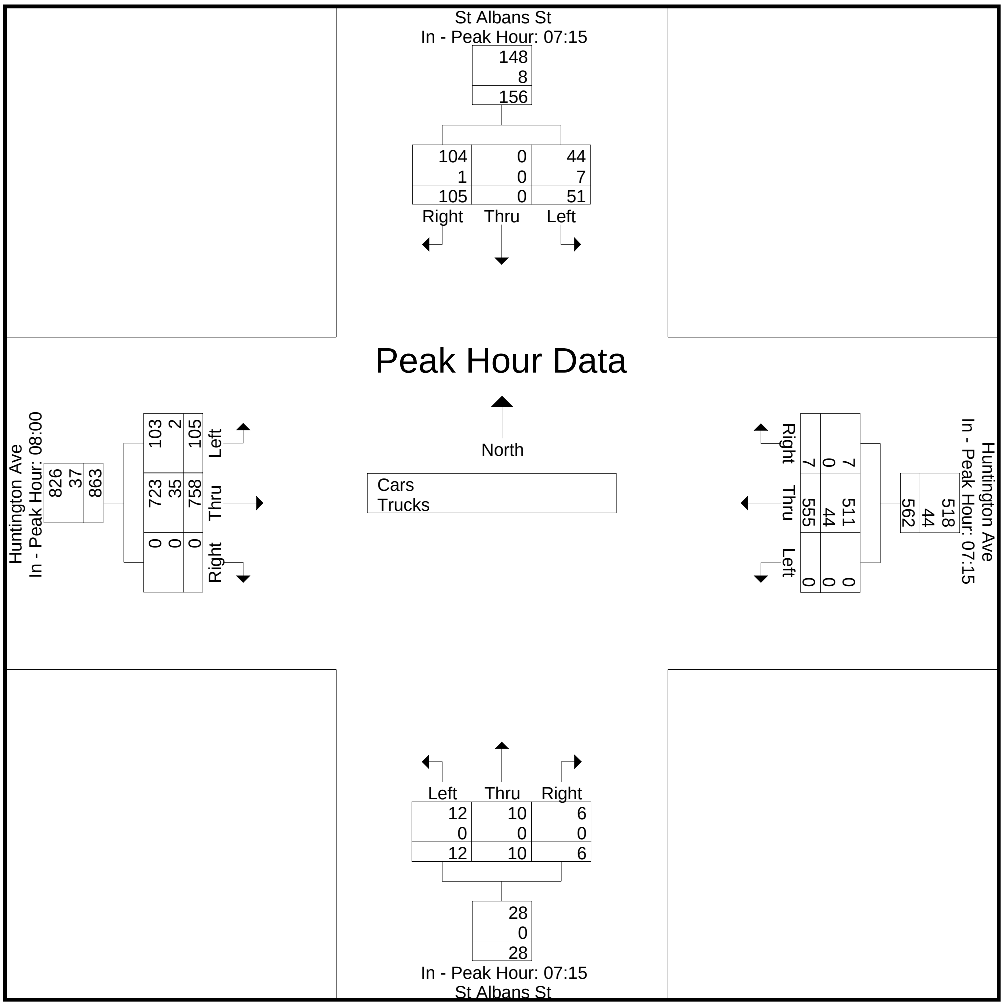

N/S Street : St Albans Street
E/W Street: Huntington Avenue
City/State : Boston, MA
Weather : Overcast

Accurate Counts
978-664-2565

File Name : 10568013
Site Code : 10568013
Start Date : 5/5/2009

Groups Printed- Cars

	St Albans St From North				Huntington Ave From East				St Albans St From South				Huntington Ave From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	3	0	17	13	0	90	2	0	1	0	0	17	17	170	0	4	34	300	334
07:15	9	0	31	9	0	140	3	1	5	2	1	13	17	151	0	5	28	359	387
07:30	11	0	31	10	0	141	1	5	3	4	3	16	14	156	0	10	41	364	405
07:45	11	0	16	13	0	116	1	1	3	3	2	15	33	166	0	14	43	351	394
Total	34	0	95	45	0	487	7	7	12	9	6	61	81	643	0	33	146	1374	1520
08:00	13	0	26	7	0	114	2	1	1	1	0	16	23	167	0	9	33	347	380
08:15	11	0	16	21	0	110	2	1	3	1	0	15	28	212	0	3	40	383	423
08:30	6	0	12	16	0	111	4	2	4	1	1	27	21	179	0	5	50	339	389
08:45	13	0	14	22	0	112	2	4	1	3	1	32	31	165	0	15	73	342	415
Total	43	0	68	66	0	447	10	8	9	6	2	90	103	723	0	32	196	1411	1607
Grand Total	77	0	163	111	0	934	17	15	21	15	8	151	184	1366	0	65	342	2785	3127
Apprch %	32.1	0	67.9		0	98.2	1.8		47.7	34.1	18.2		11.9	88.1	0				
Total %	2.8	0	5.9		0	33.5	0.6		0.8	0.5	0.3		6.6	49	0		10.9	89.1	

	St Albans St From North				Huntington Ave From East				St Albans St From South				Huntington Ave From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:30																	
07:30	11	0	**31**	**42**	0	**141**	1	**142**	**3**	**4**	**3**	**10**	14	156	0	170	364
07:45	11	0	16	27	0	116	1	117	3	3	2	8	**33**	166	0	199	351
08:00	**13**	0	26	39	0	114	**2**	116	1	1	0	2	23	167	0	190	347
08:15	11	0	16	27	0	110	2	112	3	1	0	4	28	**212**	0	**240**	**383**
Total Volume	46	0	89	135	0	481	6	487	10	9	5	24	98	701	0	799	1445
% App. Total	34.1	0	65.9		0	98.8	1.2		41.7	37.5	20.8		12.3	87.7	0		
PHF	.885	.000	.718	.804	.000	.853	.750	.857	.833	.563	.417	.600	.742	.827	.000	.832	.943

Accurate Counts
978-664-2565

File Name : 10568013
Site Code : 10568013
Start Date : 5/5/2009
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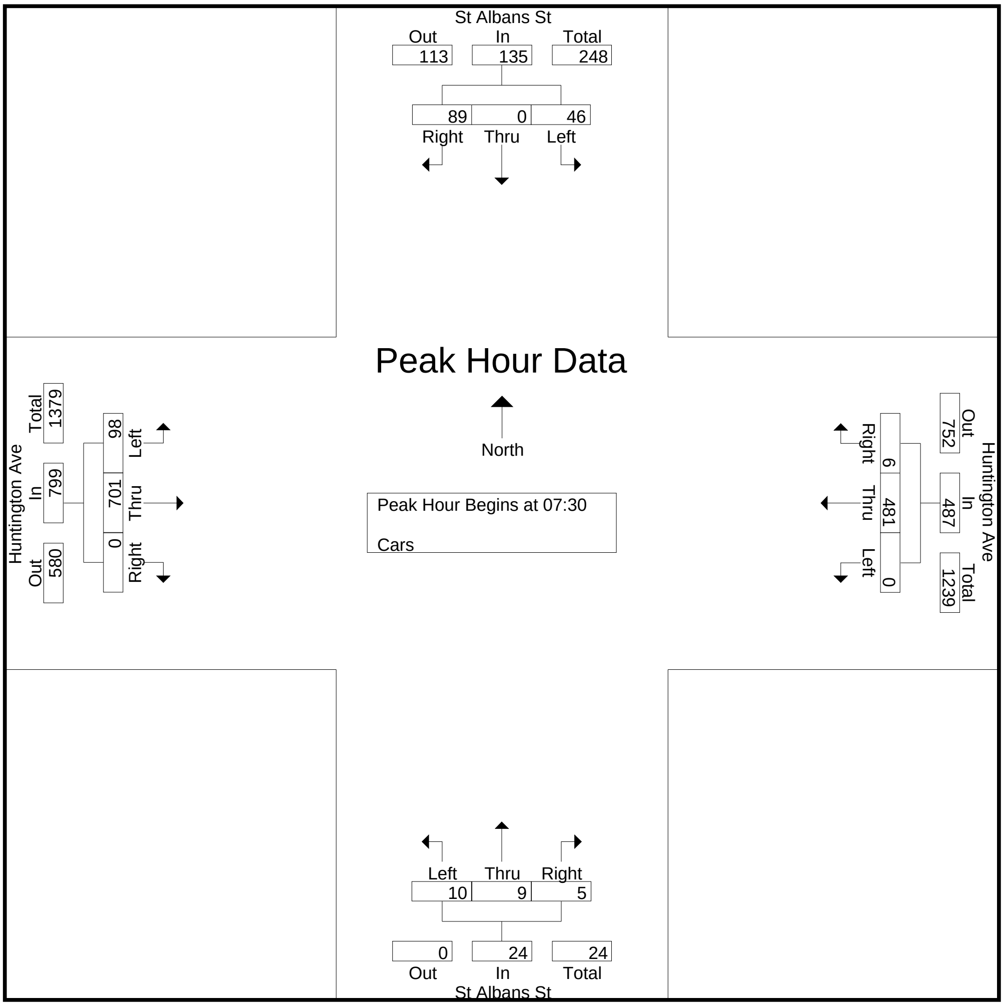

Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:15				07:15				07:15				07:45			
+0 mins.	9	0	**31**	40	0	140	**3**	**143**	**5**	2	1	8	**33**	166	0	199
+15 mins.	11	0	31	**42**	0	**141**	1	142	3	**4**	**3**	**10**	23	167	0	190
+30 mins.	11	0	16	27	0	116	1	117	3	3	2	8	28	**212**	0	**240**
+45 mins.	**13**	0	26	39	0	114	2	116	1	1	0	2	21	179	0	200
Total Volume	44	0	104	148	0	511	7	518	12	10	6	28	105	724	0	829
% App. Total	29.7	0	70.3		0	98.6	1.4		42.9	35.7	21.4		12.7	87.3	0	
PHF	.846	.000	.839	.881	.000	.906	.583	.906	.600	.625	.500	.700	.795	.854	.000	.864

Accurate Counts
978-664-2565

File Name : 10568013
Site Code : 10568013
Start Date : 5/5/2009
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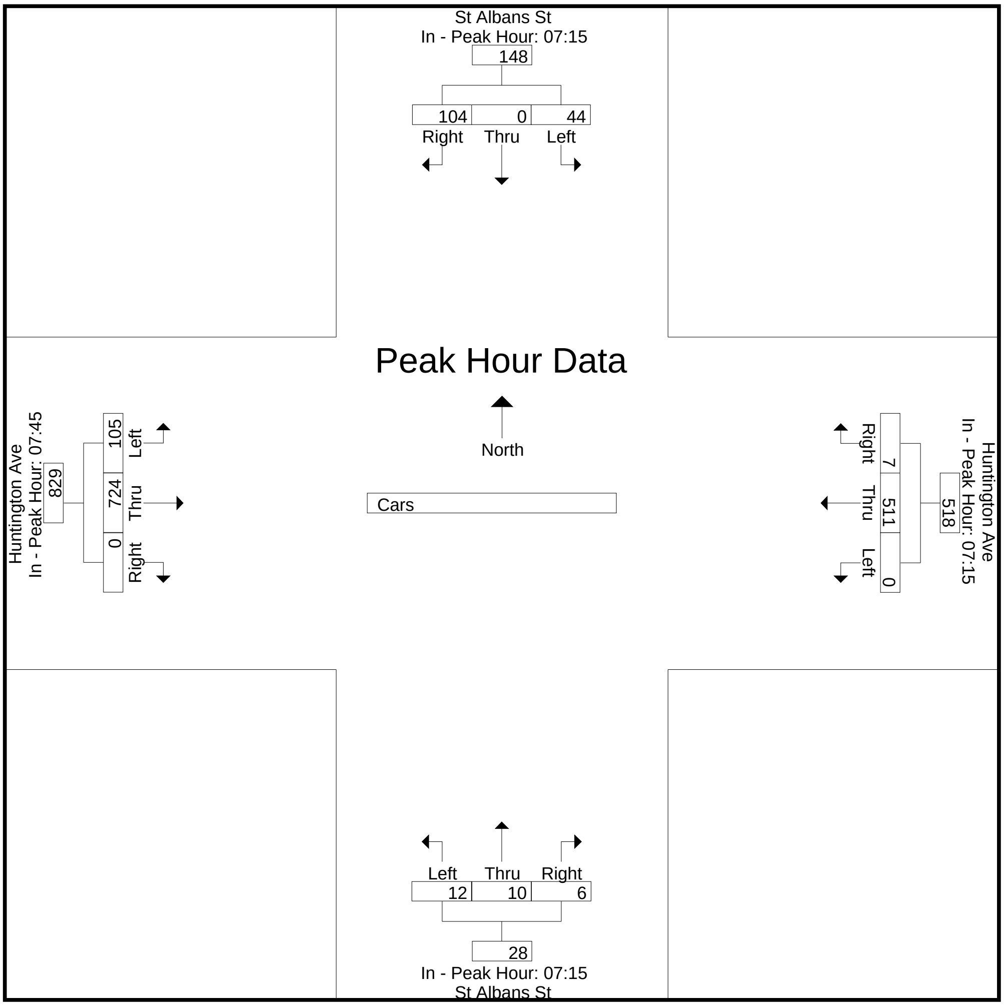


N/S Street : St Albans Street
E/W Street: Huntington Avenue
City/State : Boston, MA
Weather : Overcast

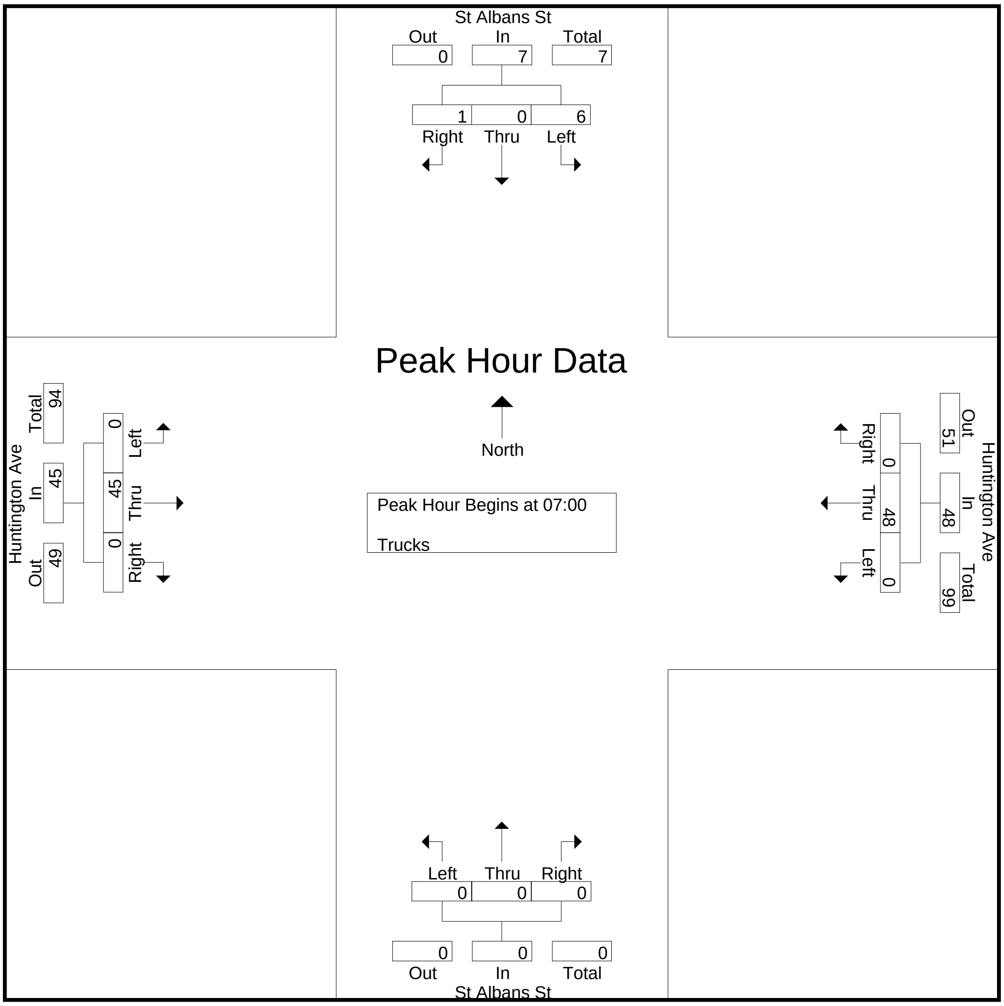
Accurate Counts
978-664-2565

File Name : 10568013
Site Code : 10568013
Start Date : 5/5/2009
Page No : 1

Groups Printed- Trucks

	St Albans St From North				Huntington Ave From East				St Albans St From South				Huntington Ave From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	0	0	0	0	0	14	0	0	0	0	0	0	0	16	0	0	0	30	30
07:15	1	0	0	0	0	10	0	0	0	0	0	0	0	13	0	0	0	24	24
07:30	2	0	0	0	0	14	0	0	0	0	0	0	0	4	0	0	0	20	20
07:45	3	0	1	0	0	10	0	0	0	0	0	0	0	12	0	0	0	26	26
Total	6	0	1	0	0	48	0	0	0	0	0	0	0	45	0	0	0	100	100
08:00	1	0	0	0	0	10	0	0	0	0	0	0	0	6	0	0	0	17	17
08:15	1	0	0	0	0	7	0	0	0	0	0	0	0	7	0	0	0	15	15
08:30	1	0	0	0	0	15	0	0	0	0	1	0	0	8	0	0	0	25	25
08:45	1	0	1	0	0	6	0	0	0	0	0	0	2	14	0	0	0	24	24
Total	4	0	1	0	0	38	0	0	0	0	1	0	2	35	0	0	0	81	81
Grand Total	10	0	2	0	0	86	0	0	0	0	1	0	2	80	0	0	0	181	181
Apprch %	83.3	0	16.7		0	100	0		0	0	100		2.4	97.6	0				
Total %	5.5	0	1.1		0	47.5	0		0	0	0.6		1.1	44.2	0		0	100	

	St Albans St From North				Huntington Ave From East				St Albans St From South				Huntington Ave From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:00																	
07:00	0	0	0	0	0	**14**	0	**14**	0	0	0	0	0	**16**	0	**16**	**30**
07:15	1	0	0	1	0	10	0	10	0	0	0	0	0	13	0	13	24
07:30	2	0	0	2	0	14	0	14	0	0	0	0	0	4	0	4	20
07:45	**3**	0	**1**	**4**	0	10	0	10	0	0	0	0	0	12	0	12	26
Total Volume	6	0	1	7	0	48	0	48	0	0	0	0	0	45	0	45	100
% App. Total	85.7	0	14.3		0	100	0		0	0	0		0	100	0		
PHF	.500	.000	.250	.438	.000	.857	.000	.857	.000	.000	.000	.000	.000	.703	.000	.703	.833



Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:15				07:00				07:45				07:00			
+0 mins.	1	0	0	1	0	**14**	0	**14**	0	0	0	0	0	**16**	0	**16**
+15 mins.	2	0	0	2	0	10	0	10	0	0	0	0	0	13	0	13
+30 mins.	**3**	0	**1**	**4**	0	14	0	14	0	0	0	0	0	4	0	4
+45 mins.	1	0	0	1	0	10	0	10	0	0	**1**	**1**	0	12	0	12
Total Volume	7	0	1	8	0	48	0	48	0	0	1	1	0	45	0	45
% App. Total	87.5	0	12.5		0	100	0		0	0	100		0	100	0	
PHF	.583	.000	.250	.500	.000	.857	.000	.857	.000	.000	.250	.250	.000	.703	.000	.703

Accurate Counts
978-664-2565

File Name : 10568013
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Start Date : 5/5/2009
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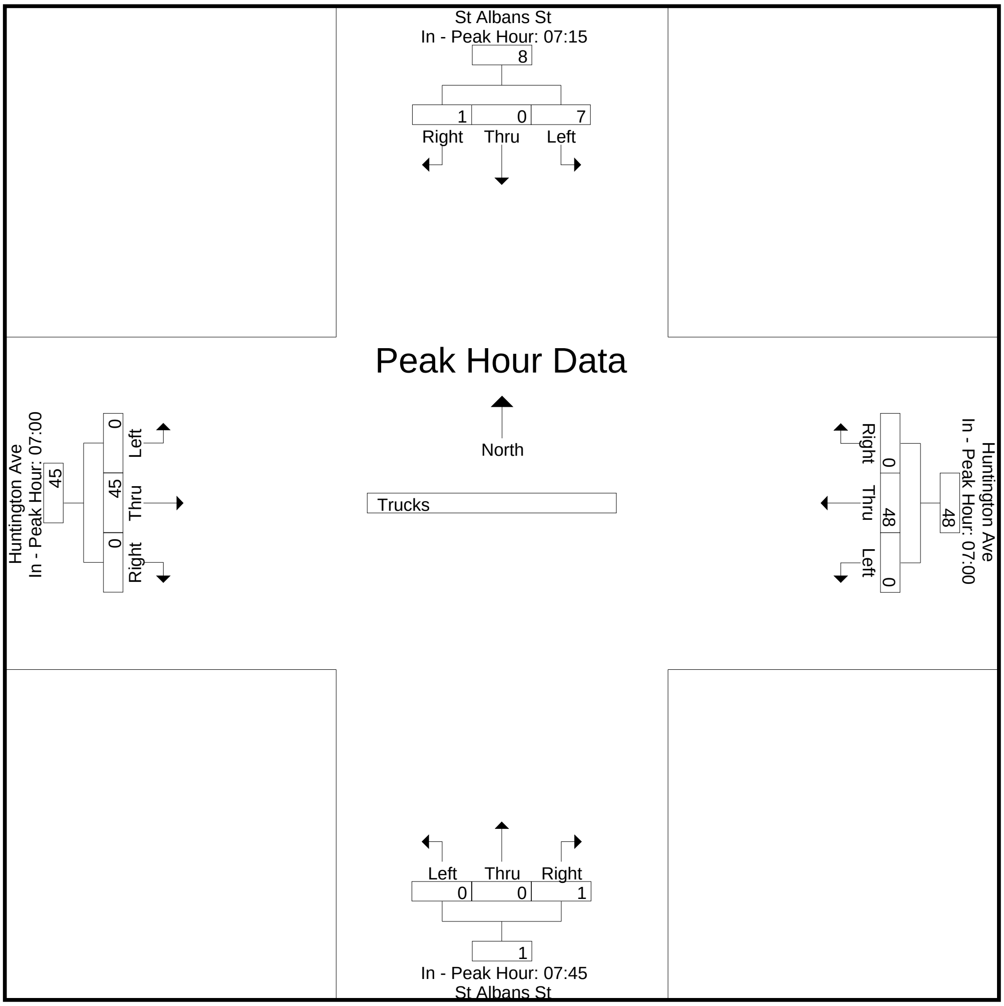


N/S Street : St Albans Street
E/W Street: Huntington Avenue
City/State : Boston, MA
Weather : Overcast

Accurate Counts
978-664-2565

File Name : 10568013
Site Code : 10568013
Start Date : 5/5/2009
Page No : 1

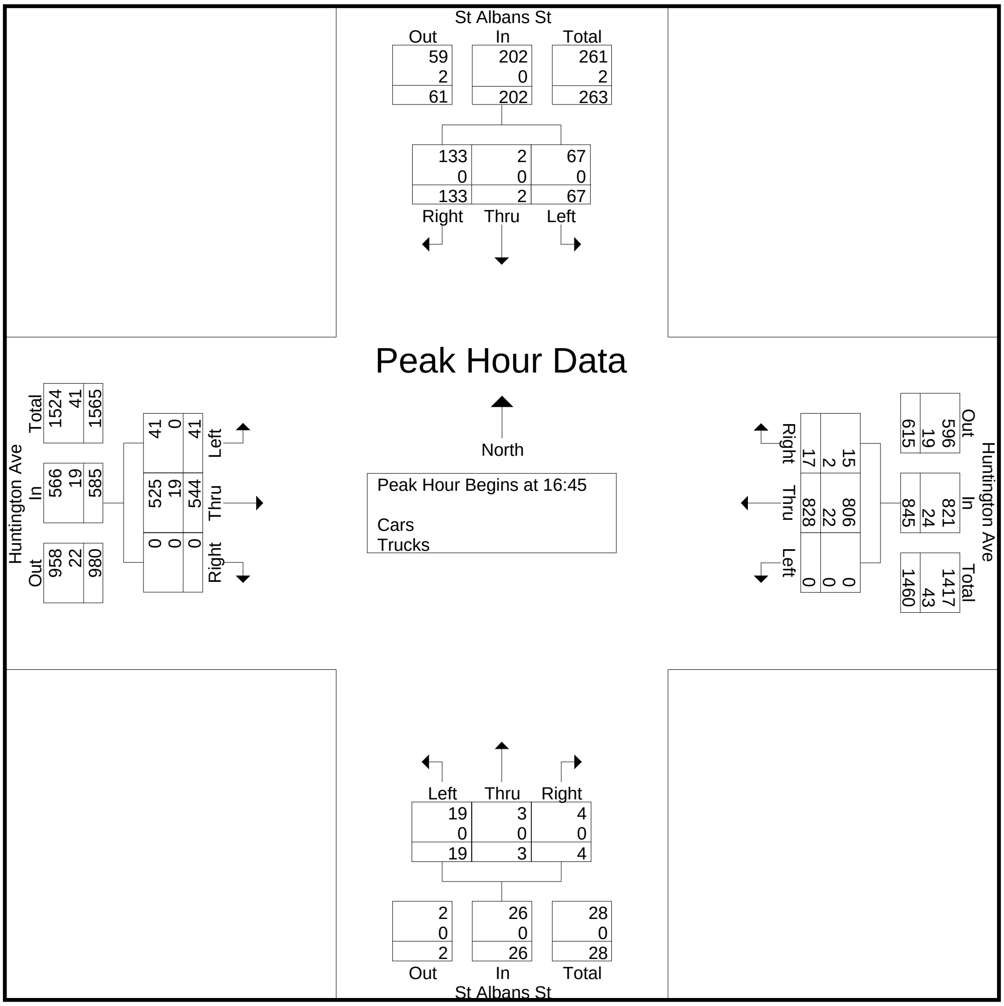
Groups Printed- Cars - Trucks

	St Albans St From North				Huntington Ave From East				St Albans St From South				Huntington Ave From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	11	1	35	14	0	199	4	3	4	1	2	21	11	133	0	7	45	401	446
16:15	15	0	24	34	0	186	2	3	3	0	1	20	14	176	0	4	61	421	482
16:30	4	0	28	14	0	198	1	1	3	0	0	2	9	115	0	0	17	358	375
16:45	10	0	24	16	0	194	4	2	2	0	2	10	8	127	0	0	28	371	399
Total	40	1	111	78	0	777	11	9	12	1	5	53	42	551	0	11	151	1551	1702
17:00	22	2	39	18	0	199	4	0	8	1	1	35	14	146	0	2	55	436	491
17:15	19	0	33	31	0	214	5	4	8	1	1	21	9	130	0	3	59	420	479
17:30	16	0	37	19	0	221	4	4	1	1	0	32	10	141	0	8	63	431	494
17:45	9	0	26	22	0	198	2	3	3	1	1	35	6	117	0	1	61	363	424
Total	66	2	135	90	0	832	15	11	20	4	3	123	39	534	0	14	238	1650	1888
Grand Total	106	3	246	168	0	1609	26	20	32	5	8	176	81	1085	0	25	389	3201	3590
Apprch %	29.9	0.8	69.3		0	98.4	1.6		71.1	11.1	17.8		6.9	93.1	0				
Total %	3.3	0.1	7.7		0	50.3	0.8		1	0.2	0.2		2.5	33.9	0		10.8	89.2	
Cars	104	3	243		0	1561	24		32	5	8		79	1051	0		0	0	3498
% Cars	98.1	100	98.8	99.4	0	97	92.3	100	100	100	100	100	97.5	96.9	0	100	0	0	97.4
Trucks	2	0	3		0	48	2		0	0	0		2	34	0		0	0	92
% Trucks	1.9	0	1.2	0.6	0	3	7.7	0	0	0	0	0	2.5	3.1	0	0	0	0	2.6

	St Albans St From North				Huntington Ave From East				St Albans St From South				Huntington Ave From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 16:45																	
16:45	10	0	24	34	0	194	4	198	2	0	**2**	4	8	127	0	135	371
17:00	**22**	**2**	**39**	**63**	0	199	4	203	**8**	**1**	1	**10**	**14**	**146**	0	**160**	**436**
17:15	19	0	33	52	0	214	**5**	219	8	1	1	10	9	130	0	139	420
17:30	16	0	37	53	0	**221**	4	**225**	1	1	0	2	10	141	0	151	431
Total Volume	67	2	133	202	0	828	17	845	19	3	4	26	41	544	0	585	1658
% App. Total	33.2	1	65.8		0	98	2		73.1	11.5	15.4		7	93	0		
PHF	.761	.250	.853	.802	.000	.937	.850	.939	.594	.750	.500	.650	.732	.932	.000	.914	.951
Cars	67	2	133	202	0	806	15	821	19	3	4	26	41	525	0	566	1615
% Cars	100	100	100	100	0	97.3	88.2	97.2	100	100	100	100	100	96.5	0	96.8	97.4
Trucks	0	0	0	0	0	22	2	24	0	0	0	0	0	19	0	19	43
% Trucks	0	0	0	0	0	2.7	11.8	2.8	0	0	0	0	0	3.5	0	3.2	2.6

Accurate Counts
978-664-2565

File Name : 10568013
Site Code : 10568013
Start Date : 5/5/2009
Page No : 2

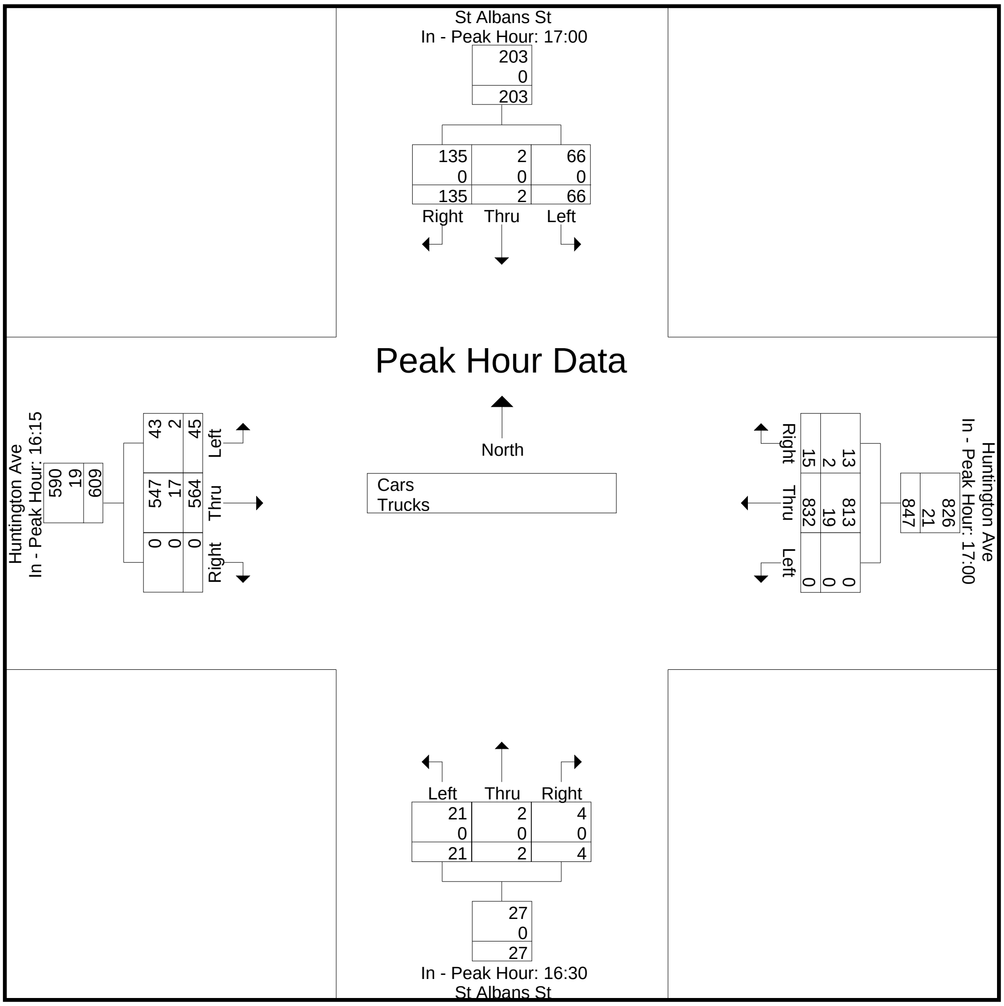


Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	17:00				17:00				16:30				16:15			
+0 mins.	**22**	**2**	**39**	**63**	0	199	4	203	3	0	0	3	**14**	**176**	0	**190**
+15 mins.	19	0	33	52	0	214	**5**	219	2	0	**2**	4	9	115	0	124
+30 mins.	16	0	37	53	0	**221**	4	**225**	**8**	**1**	1	**10**	8	127	0	135
+45 mins.	9	0	26	35	0	198	2	200	8	1	1	10	14	146	0	160
Total Volume	66	2	135	203	0	832	15	847	21	2	4	27	45	564	0	609
% App. Total	32.5	1	66.5		0	98.2	1.8		77.8	7.4	14.8		7.4	92.6	0	
PHF	.750	.250	.865	.806	.000	.941	.750	.941	.656	.500	.500	.675	.804	.801	.000	.801
Cars	66	2	135	203	0	813	13	826	21	2	4	27	43	547	0	590
% Cars	100	100	100	100	0	97.7	86.7	97.5	100	100	100	100	95.6	97	0	96.9
Trucks	0	0	0	0	0	19	2	21	0	0	0	0	2	17	0	19
% Trucks	0	0	0	0	0	2.3	13.3	2.5	0	0	0	0	4.4	3	0	3.1

Accurate Counts
978-664-2565

File Name : 10568013
Site Code : 10568013
Start Date : 5/5/2009
Page No : 3



N/S Street : St Albans Street
E/W Street: Huntington Avenue
City/State : Boston, MA
Weather : Overcast

Accurate Counts
978-664-2565

File Name : 10568013
Site Code : 10568013
Start Date : 5/5/2009
Page No : 1

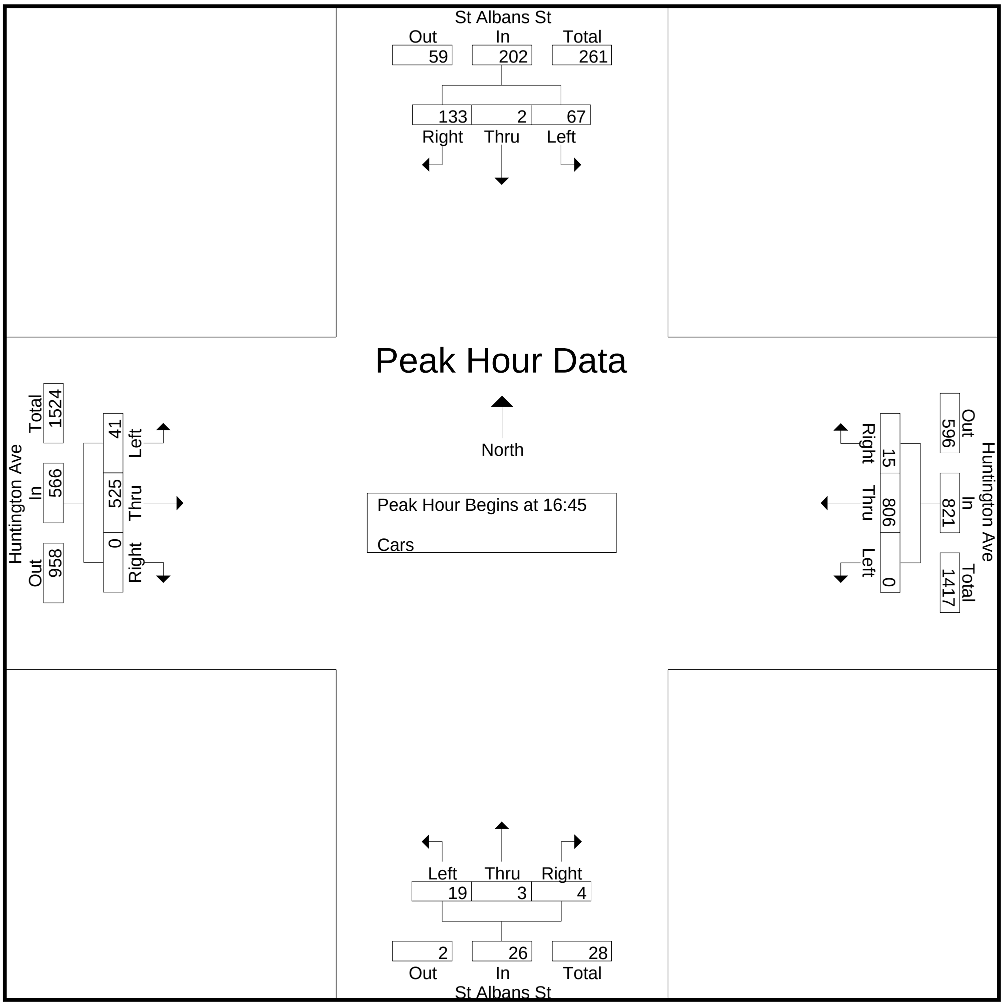
Groups Printed- Cars

	St Albans St From North				Huntington Ave From East				St Albans St From South				Huntington Ave From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	11	1	32	13	0	189	4	3	4	1	2	21	11	129	0	7	44	384	428
16:15	14	0	24	34	0	182	2	3	3	0	1	20	13	173	0	4	61	412	473
16:30	3	0	28	14	0	190	1	1	3	0	0	2	8	110	0	0	17	343	360
16:45	10	0	24	16	0	187	4	2	2	0	2	10	8	122	0	0	28	359	387
Total	38	1	108	77	0	748	11	9	12	1	5	53	40	534	0	11	150	1498	1648
17:00	22	2	39	18	0	196	4	0	8	1	1	35	14	142	0	2	55	429	484
17:15	19	0	33	31	0	210	3	4	8	1	1	21	9	125	0	3	59	409	468
17:30	16	0	37	19	0	213	4	4	1	1	0	32	10	136	0	8	63	418	481
17:45	9	0	26	22	0	194	2	3	3	1	1	35	6	114	0	1	61	356	417
Total	66	2	135	90	0	813	13	11	20	4	3	123	39	517	0	14	238	1612	1850
Grand Total	104	3	243	167	0	1561	24	20	32	5	8	176	79	1051	0	25	388	3110	3498
Apprch %	29.7	0.9	69.4		0	98.5	1.5		71.1	11.1	17.8		7	93	0				
Total %	3.3	0.1	7.8		0	50.2	0.8		1	0.2	0.3		2.5	33.8	0		11.1	88.9	

	St Albans St From North				Huntington Ave From East				St Albans St From South				Huntington Ave From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 16:45																	
16:45	10	0	24	34	0	187	**4**	191	2	0	**2**	4	8	122	0	130	359
17:00	**22**	**2**	**39**	**63**	0	196	4	200	**8**	**1**	1	**10**	**14**	**142**	0	**156**	**429**
17:15	19	0	33	52	0	210	3	213	8	1	1	10	9	125	0	134	409
17:30	16	0	37	53	0	**213**	4	**217**	1	1	0	2	10	136	0	146	418
Total Volume	67	2	133	202	0	806	15	821	19	3	4	26	41	525	0	566	1615
% App. Total	33.2	1	65.8		0	98.2	1.8		73.1	11.5	15.4		7.2	92.8	0		
PHF	.761	.250	.853	.802	.000	.946	.938	.946	.594	.750	.500	.650	.732	.924	.000	.907	.941

Accurate Counts
978-664-2565

File Name : 10568013
Site Code : 10568013
Start Date : 5/5/2009
Page No : 2

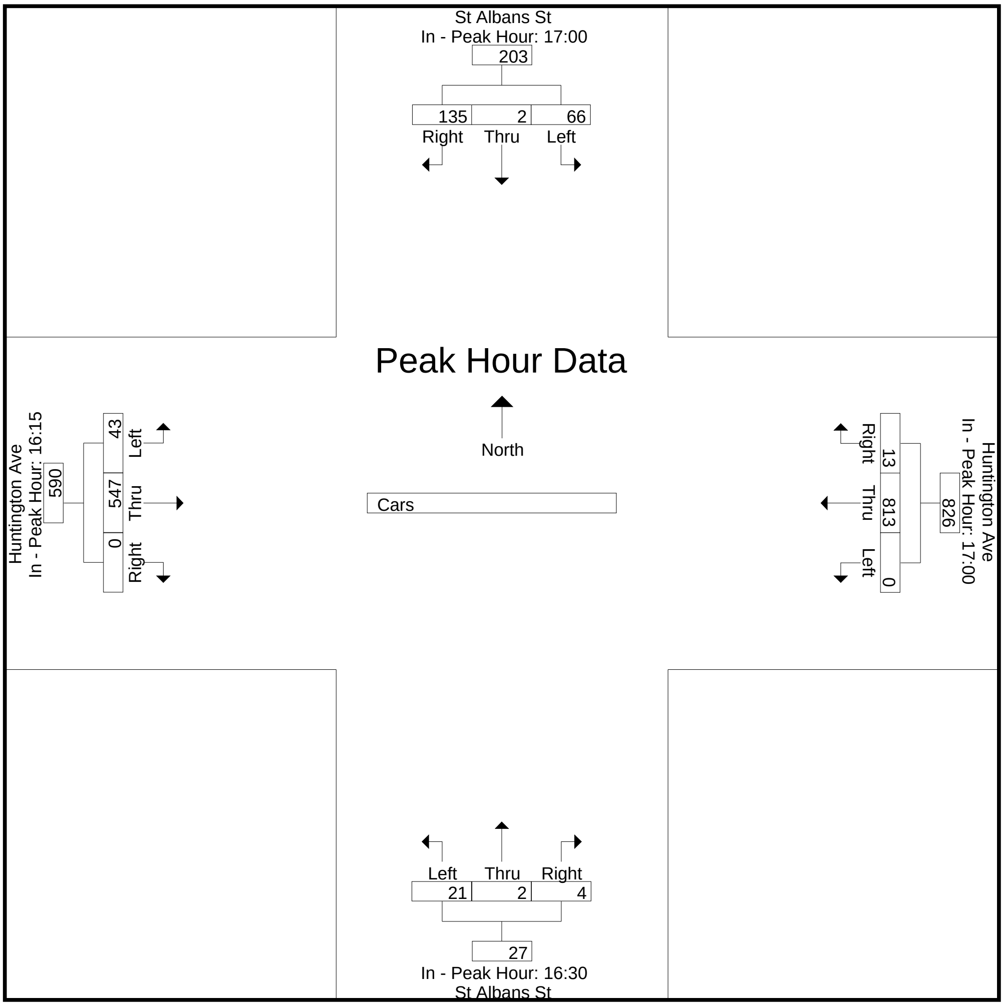


Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	17:00				17:00				16:30				16:15			
+0 mins.	**22**	**2**	**39**	**63**	0	196	**4**	200	3	0	0	3	13	**173**	0	**186**
+15 mins.	19	0	33	52	0	210	3	213	2	0	**2**	4	8	110	0	118
+30 mins.	16	0	37	53	0	**213**	4	**217**	**8**	**1**	1	**10**	8	122	0	130
+45 mins.	9	0	26	35	0	194	2	196	8	1	1	10	**14**	142	0	156
Total Volume	66	2	135	203	0	813	13	826	21	2	4	27	43	547	0	590
% App. Total	32.5	1	66.5		0	98.4	1.6		77.8	7.4	14.8		7.3	92.7	0	
PHF	.750	.250	.865	.806	.000	.954	.813	.952	.656	.500	.500	.675	.768	.790	.000	.793

Accurate Counts
978-664-2565

File Name : 10568013
Site Code : 10568013
Start Date : 5/5/2009
Page No : 3



N/S Street : St Albans Street
E/W Street: Huntington Avenue
City/State : Boston, MA
Weather : Overcast

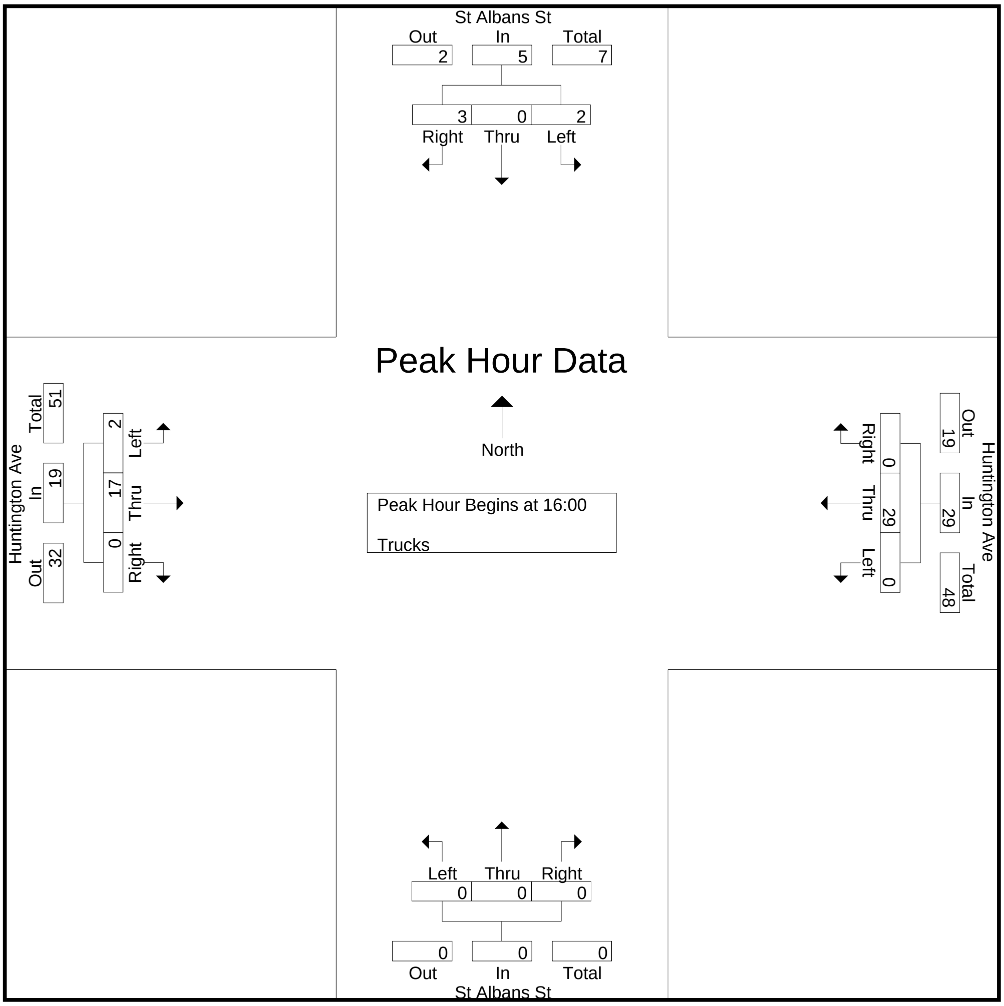
Accurate Counts
978-664-2565

File Name : 10568013
Site Code : 10568013
Start Date : 5/5/2009
Page No : 1

Groups Printed- Trucks

	St Albans St From North				Huntington Ave From East				St Albans St From South				Huntington Ave From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	0	0	3	1	0	10	0	0	0	0	0	0	0	4	0	0	1	17	18
16:15	1	0	0	0	0	4	0	0	0	0	0	0	1	3	0	0	0	9	9
16:30	1	0	0	0	0	8	0	0	0	0	0	0	1	5	0	0	0	15	15
16:45	0	0	0	0	0	7	0	0	0	0	0	0	0	5	0	0	0	12	12
Total	2	0	3	1	0	29	0	0	0	0	0	0	2	17	0	0	1	53	54
17:00	0	0	0	0	0	3	0	0	0	0	0	0	0	4	0	0	0	7	7
17:15	0	0	0	0	0	4	2	0	0	0	0	0	0	5	0	0	0	11	11
17:30	0	0	0	0	0	8	0	0	0	0	0	0	0	5	0	0	0	13	13
17:45	0	0	0	0	0	4	0	0	0	0	0	0	0	3	0	0	0	7	7
Total	0	0	0	0	0	19	2	0	0	0	0	0	0	17	0	0	0	38	38
Grand Total	2	0	3	1	0	48	2	0	0	0	0	0	2	34	0	0	1	91	92
Apprch %	40	0	60		0	96	4		0	0	0		5.6	94.4	0				
Total %	2.2	0	3.3		0	52.7	2.2		0	0	0		2.2	37.4	0		1.1	98.9	

	St Albans St From North				Huntington Ave From East				St Albans St From South				Huntington Ave From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 16:00																	
16:00	0	0	**3**	**3**	0	**10**	0	**10**	0	0	0	0	0	4	0	4	**17**
16:15	**1**	0	0	1	0	4	0	4	0	0	0	0	**1**	3	0	4	9
16:30	1	0	0	1	0	8	0	8	0	0	0	0	1	**5**	0	**6**	15
16:45	0	0	0	0	0	7	0	7	0	0	0	0	0	5	0	5	12
Total Volume	2	0	3	5	0	29	0	29	0	0	0	0	2	17	0	19	53
% App. Total	40	0	60		0	100	0		0	0	0		10.5	89.5	0		
PHF	.500	.000	.250	.417	.000	.725	.000	.725	.000	.000	.000	.000	.500	.850	.000	.792	.779



Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:00				16:00				16:00				16:30			
+0 mins.	0	0	**3**	**3**	0	**10**	0	**10**	0	0	0	0	**1**	**5**	0	**6**
+15 mins.	**1**	0	0	1	0	4	0	4	0	0	0	0	0	5	0	5
+30 mins.	1	0	0	1	0	8	0	8	0	0	0	0	0	4	0	4
+45 mins.	0	0	0	0	0	7	0	7	0	0	0	0	0	5	0	5
Total Volume	2	0	3	5	0	29	0	29	0	0	0	0	1	19	0	20
% App. Total	40	0	60		0	100	0		0	0	0		5	95	0	
PHF	.500	.000	.250	.417	.000	.725	.000	.725	.000	.000	.000	.000	.250	.950	.000	.833

Accurate Counts
978-664-2565

File Name : 10568013
Site Code : 10568013
Start Date : 5/5/2009
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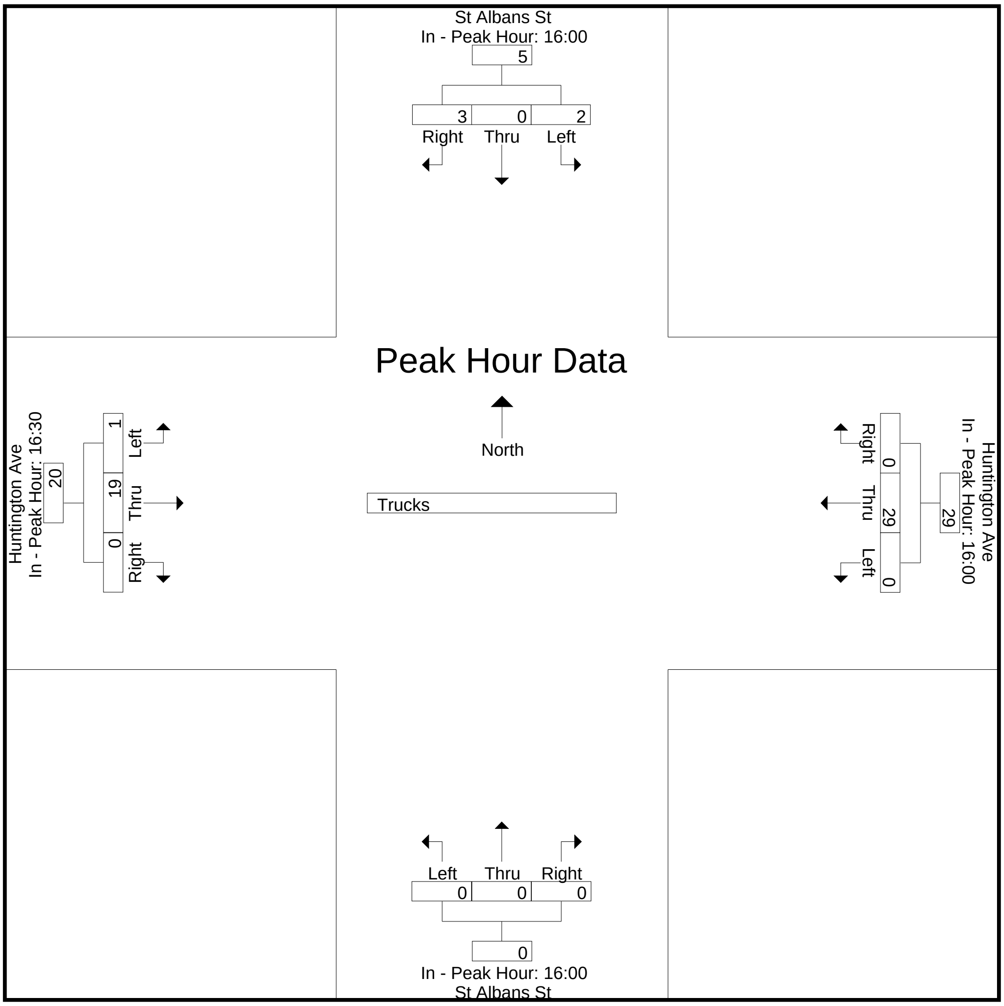


Accurate Counts
978-664-2565

N/S Street : Riverway
E/W Street: Longwood Avenue
City/State : Boston, MA
Weather : Clear

File Name : 10568001
Site Code : 10568001
Start Date : 8/19/2009
Page No : 1

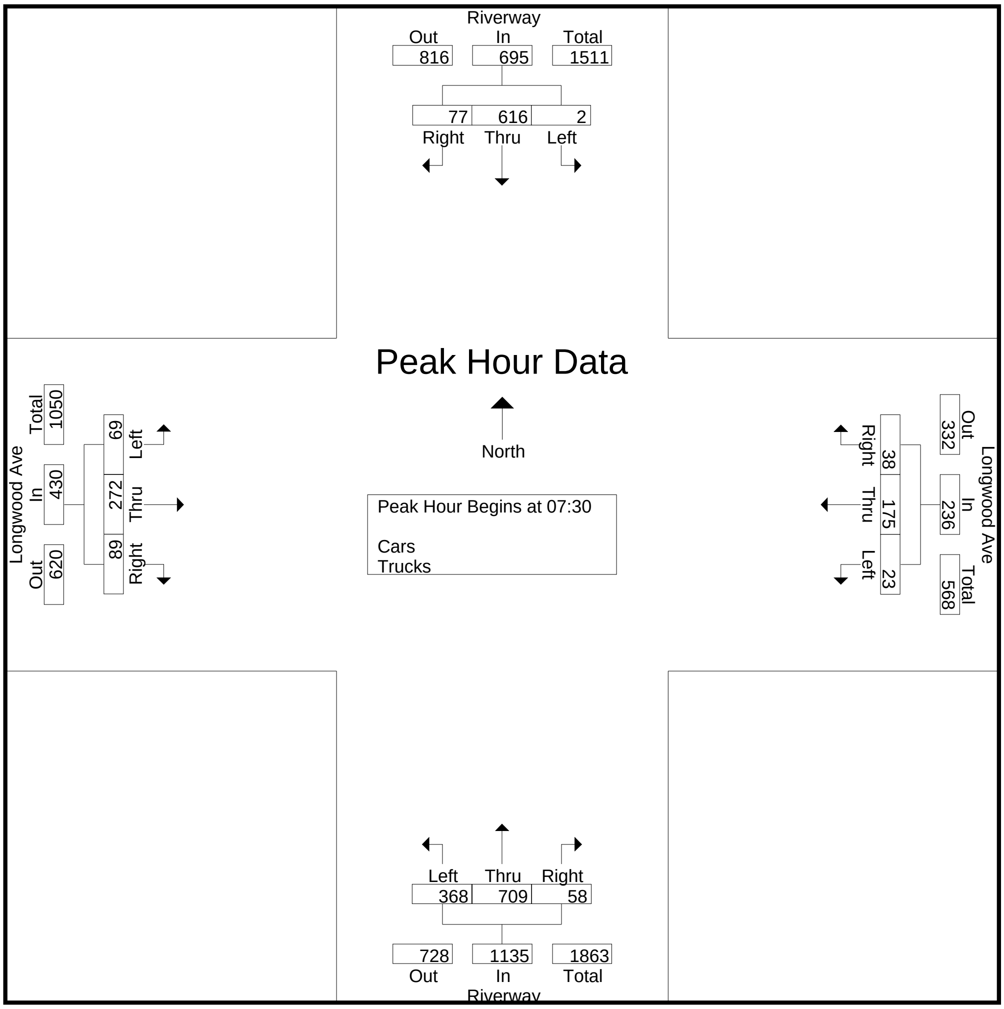
Groups Printed- Cars - Trucks

	Riverway From North				Longwood Ave From East				Riverway From South				Longwood Ave From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	0	99	13	176	4	21	6	18	81	136	17	18	8	43	16	3	215	444	659
07:15	0	151	13	115	11	33	9	7	76	174	14	24	13	55	14	0	146	563	709
07:30	1	162	10	155	5	44	15	12	103	183	15	24	13	60	23	0	191	634	825
07:45	1	149	21	135	4	42	7	11	92	154	19	18	16	72	24	0	164	601	765
Total	2	561	57	581	24	140	37	48	352	647	65	84	50	230	77	3	716	2242	2958
08:00	0	151	24	212	5	41	8	9	83	205	9	13	15	54	23	5	239	618	857
08:15	0	154	22	237	9	48	8	7	90	167	15	18	25	86	19	0	262	643	905
08:30	0	146	21	219	6	48	5	3	92	149	17	12	24	66	13	0	234	587	821
08:45	0	143	23	239	4	59	3	1	80	166	15	60	29	88	15	0	300	625	925
Total	0	594	90	907	24	196	24	20	345	687	56	103	93	294	70	5	1035	2473	3508
Grand Total	2	1155	147	1488	48	336	61	68	697	1334	121	187	143	524	147	8	1751	4715	6466
Apprch %	0.2	88.6	11.3		10.8	75.5	13.7		32.4	62	5.6		17.6	64.4	18.1				
Total %	0	24.5	3.1		1	7.1	1.3		14.8	28.3	2.6		3	11.1	3.1		27.1	72.9	
Cars	2	1131	146		47	322	56		696	1329	119		142	513	146		0	0	5905
% Cars	100	97.9	99.3	66.7	97.9	95.8	91.8	100	99.9	99.6	98.3	100	99.3	97.9	99.3	100	0	0	91.3
Trucks	0	24	1		1	14	5		1	5	2		1	11	1		0	0	561
% Trucks	0	2.1	0.7	33.3	2.1	4.2	8.2	0	0.1	0.4	1.7	0	0.7	2.1	0.7	0	0	0	8.7

	Riverway From North				Longwood Ave From East				Riverway From South				Longwood Ave From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:30																	
07:30	1	162	10	173	5	44	15	64	103	183	15	301	13	60	23	96	634
07:45	1	149	21	171	4	42	7	53	92	154	19	265	16	72	24	112	601
08:00	0	151	24	175	5	41	8	54	83	205	9	297	15	54	23	92	618
08:15	0	154	22	176	9	48	8	65	90	167	15	272	25	86	19	130	643
Total Volume	2	616	77	695	23	175	38	236	368	709	58	1135	69	272	89	430	2496
% App. Total	0.3	88.6	11.1		9.7	74.2	16.1		32.4	62.5	5.1		16	63.3	20.7		
PHF	.500	.951	.802	.987	.639	.911	.633	.908	.893	.865	.763	.943	.690	.791	.927	.827	.970

Accurate Counts
978-664-2565

File Name : 10568001
Site Code : 10568001
Start Date : 8/19/2009
Page No : 2

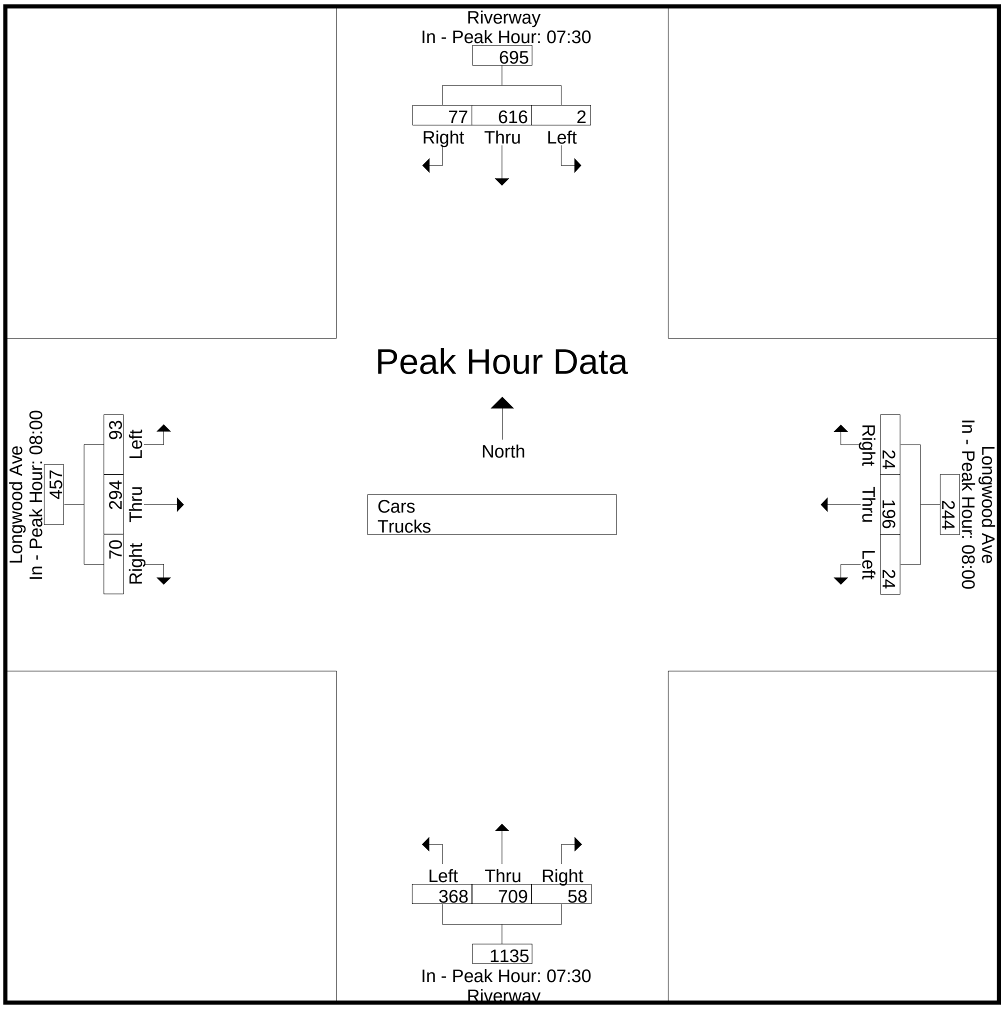


Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:30				08:00				07:30				08:00			
+0 mins.	1	162	10	173	5	41	8	54	103	183	15	301	15	54	23	92
+15 mins.	1	149	21	171	9	48	8	65	92	154	19	265	25	86	19	130
+30 mins.	0	151	24	175	6	48	5	59	83	205	9	297	24	66	13	103
+45 mins.	0	154	22	176	4	59	3	66	90	167	15	272	29	88	15	132
Total Volume	2	616	77	695	24	196	24	244	368	709	58	1135	93	294	70	457
% App. Total	0.3	88.6	11.1		9.8	80.3	9.8		32.4	62.5	5.1		20.4	64.3	15.3	
PHF	.500	.951	.802	.987	.667	.831	.750	.924	.893	.865	.763	.943	.802	.835	.761	.866

Accurate Counts
978-664-2565

File Name : 10568001
Site Code : 10568001
Start Date : 8/19/2009
Page No : 3



N/S Street : Riverway
E/W Street: Longwood Avenue
City/State : Boston, MA
Weather : Clear

File Name : 10568001
Site Code : 10568001
Start Date : 8/19/2009

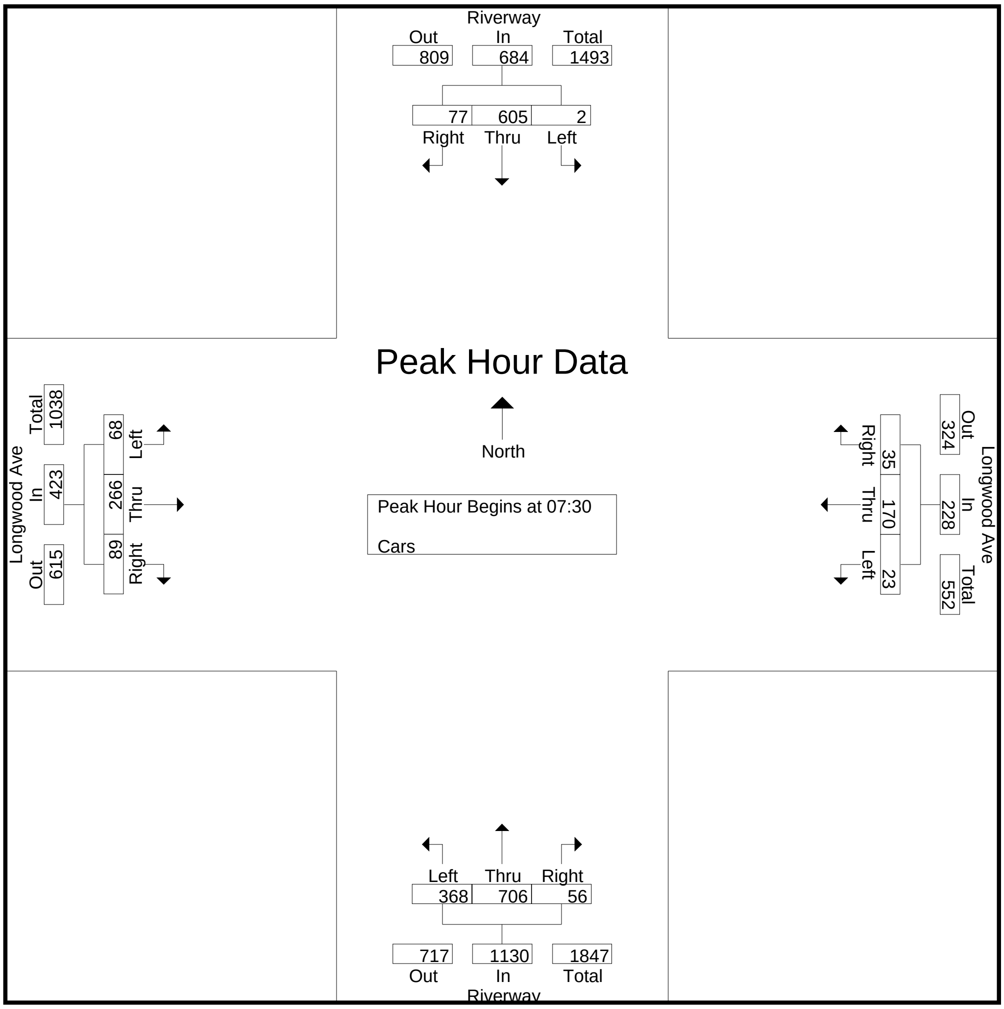
Groups Printed- Cars

	Riverway From North				Longwood Ave From East				Riverway From South				Longwood Ave From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	0	97	13	144	3	18	6	18	81	136	17	18	8	40	16	3	183	435	618
07:15	0	150	13	66	11	30	9	7	75	172	14	24	13	53	13	0	97	553	650
07:30	1	160	10	92	5	42	14	12	103	183	15	24	13	58	23	0	128	627	755
07:45	1	147	21	92	4	42	7	11	92	154	18	18	16	69	24	0	121	595	716
Total	2	554	57	394	23	132	36	48	351	645	64	84	50	220	76	3	529	2210	2739
08:00	0	147	24	127	5	39	7	9	83	203	9	13	15	54	23	5	154	609	763
08:15	0	151	22	154	9	47	7	7	90	166	14	18	24	85	19	0	179	634	813
08:30	0	142	20	164	6	46	4	3	92	149	17	12	24	66	13	0	179	579	758
08:45	0	137	23	154	4	58	2	1	80	166	15	60	29	88	15	0	215	617	832
Total	0	577	89	599	24	190	20	20	345	684	55	103	92	293	70	5	727	2439	3166
Grand Total	2	1131	146	993	47	322	56	68	696	1329	119	187	142	513	146	8	1256	4649	5905
Apprch %	0.2	88.4	11.4		11.1	75.8	13.2		32.5	62	5.6		17.7	64	18.2				
Total %	0	24.3	3.1		1	6.9	1.2		15	28.6	2.6		3.1	11	3.1		21.3	78.7	

	Riverway From North				Longwood Ave From East				Riverway From South				Longwood Ave From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:30																	
07:30	1	160	10	171	5	42	14	61	103	183	15	301	13	58	23	94	627
07:45	1	147	21	169	4	42	7	53	92	154	18	264	16	69	24	109	595
08:00	0	147	24	171	5	39	7	51	83	203	9	295	15	54	23	92	609
08:15	0	151	22	173	9	47	7	63	90	166	14	270	24	85	19	128	634
Total Volume	2	605	77	684	23	170	35	228	368	706	56	1130	68	266	89	423	2465
% App. Total	0.3	88.5	11.3		10.1	74.6	15.4		32.6	62.5	5		16.1	62.9	21		
PHF	.500	.945	.802	.988	.639	.904	.625	.905	.893	.869	.778	.939	.708	.782	.927	.826	.972

Accurate Counts
978-664-2565

File Name : 10568001
Site Code : 10568001
Start Date : 8/19/2009
Page No : 2

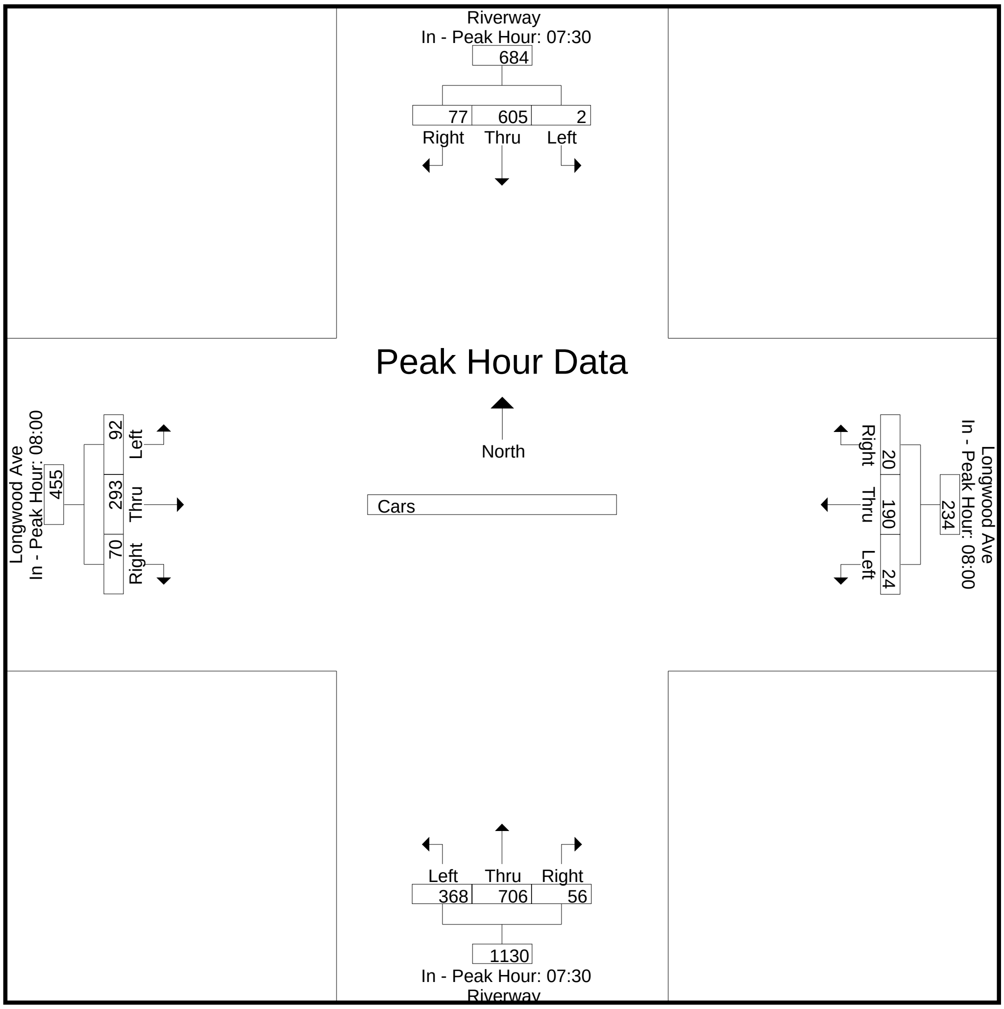


Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:30				08:00				07:30				08:00			
+0 mins.	1	160	10	171	5	39	7	51	103	183	15	301	15	54	23	92
+15 mins.	1	147	21	169	9	47	7	63	92	154	18	264	24	85	19	128
+30 mins.	0	147	24	171	6	46	4	56	83	203	9	295	24	66	13	103
+45 mins.	0	151	22	173	4	58	2	64	90	166	14	270	29	88	15	132
Total Volume	2	605	77	684	24	190	20	234	368	706	56	1130	92	293	70	455
% App. Total	0.3	88.5	11.3		10.3	81.2	8.5		32.6	62.5	5		20.2	64.4	15.4	
PHF	.500	.945	.802	.988	.667	.819	.714	.914	.893	.869	.778	.939	.793	.832	.761	.862

Accurate Counts
978-664-2565

File Name : 10568001
Site Code : 10568001
Start Date : 8/19/2009
Page No : 3



Accurate Counts
978-664-2565

N/S Street : Riverway
E/W Street: Longwood Avenue
City/State : Boston, MA
Weather : Clear

File Name : 10568001
Site Code : 10568001
Start Date : 8/19/2009
Page No : 1

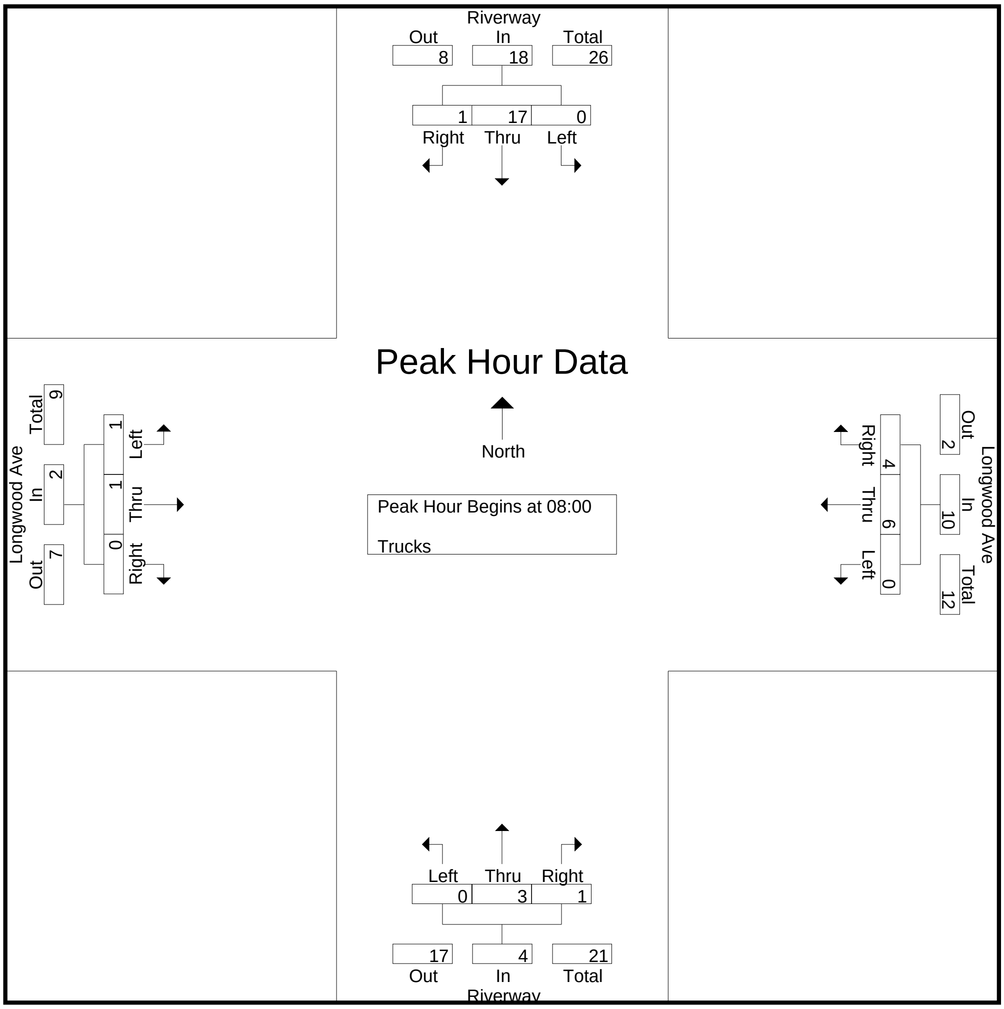
Groups Printed- Trucks

	Riverway From North				Longwood Ave From East				Riverway From South				Longwood Ave From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	0	2	0	32	1	3	0	0	0	0	0	0	0	3	0	0	32	9	41
07:15	0	1	0	49	0	3	0	0	1	2	0	0	0	2	1	0	49	10	59
07:30	0	2	0	63	0	2	1	0	0	0	0	0	0	2	0	0	63	7	70
07:45	0	2	0	43	0	0	0	0	0	0	1	0	0	3	0	0	43	6	49
Total	0	7	0	187	1	8	1	0	1	2	1	0	0	10	1	0	187	32	219
08:00	0	4	0	85	0	2	1	0	0	2	0	0	0	0	0	0	85	9	94
08:15	0	3	0	83	0	1	1	0	0	1	1	0	1	1	0	0	83	9	92
08:30	0	4	1	55	0	2	1	0	0	0	0	0	0	0	0	0	55	8	63
08:45	0	6	0	85	0	1	1	0	0	0	0	0	0	0	0	0	85	8	93
Total	0	17	1	308	0	6	4	0	0	3	1	0	1	1	0	0	308	34	342
Grand Total	0	24	1	495	1	14	5	0	1	5	2	0	1	11	1	0	495	66	561
Apprch %	0	96	4		5	70	25		12.5	62.5	25		7.7	84.6	7.7				
Total %	0	36.4	1.5		1.5	21.2	7.6		1.5	7.6	3		1.5	16.7	1.5		88.2	11.8	

	Riverway From North				Longwood Ave From East				Riverway From South				Longwood Ave From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 08:00																	
08:00	0	4	0	4	0	2	1	3	0	2	0	2	0	0	0	0	9
08:15	0	3	0	3	0	1	1	2	0	1	1	2	1	1	0	2	9
08:30	0	4	1	5	0	2	1	3	0	0	0	0	0	0	0	0	8
08:45	0	6	0	6	0	1	1	2	0	0	0	0	0	0	0	0	8
Total Volume	0	17	1	18	0	6	4	10	0	3	1	4	1	1	0	2	34
% App. Total	0	94.4	5.6		0	60	40		0	75	25		50	50	0		
PHF	.000	.708	.250	.750	.000	.750	1.000	.833	.000	.375	.250	.500	.250	.250	.000	.250	.944

Accurate Counts
978-664-2565

File Name : 10568001
Site Code : 10568001
Start Date : 8/19/2009
Page No : 2

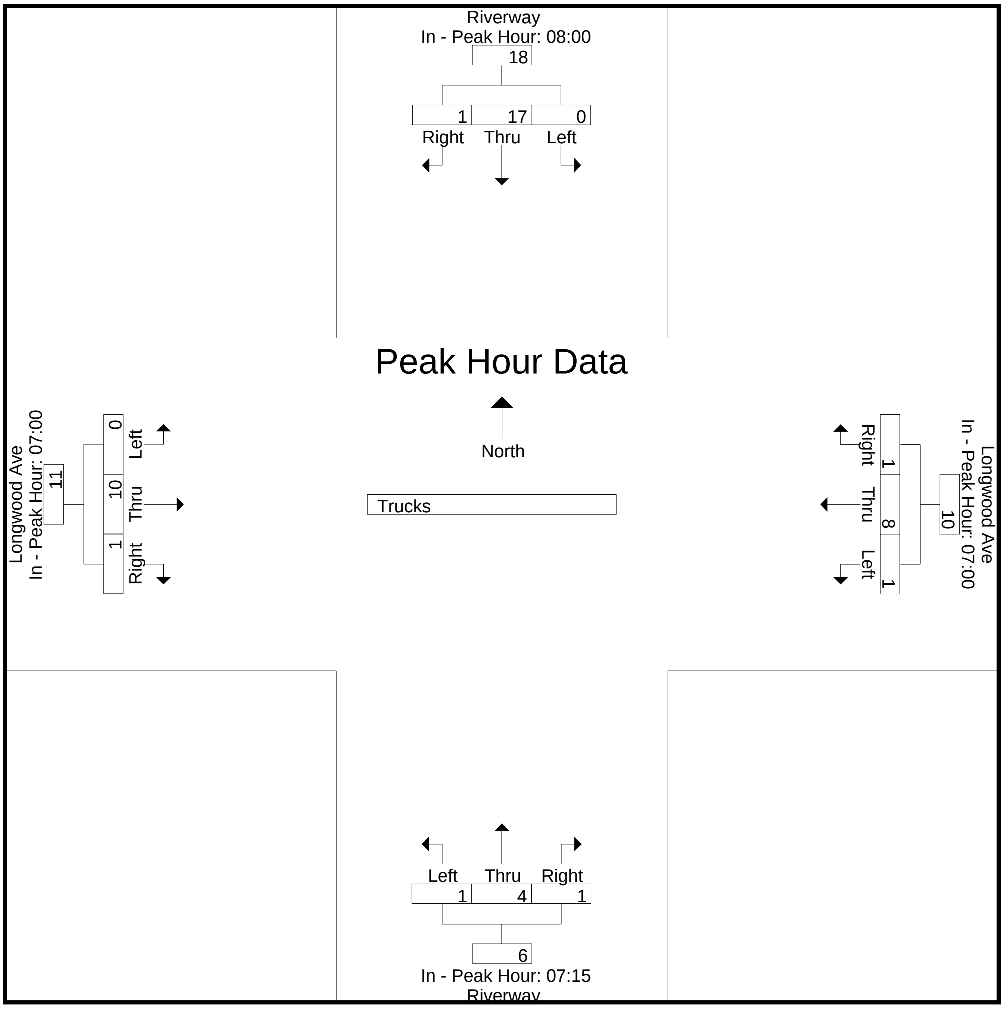


Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	08:00				07:00				07:15				07:00			
+0 mins.	0	4	0	4	1	3	0	4	1	2	0	3	0	3	0	3
+15 mins.	0	3	0	3	0	3	0	3	0	0	0	0	0	2	1	3
+30 mins.	0	4	1	5	0	2	1	3	0	0	1	1	0	2	0	2
+45 mins.	0	6	0	6	0	0	0	0	0	2	0	2	0	3	0	3
Total Volume	0	17	1	18	1	8	1	10	1	4	1	6	0	10	1	11
% App. Total	0	94.4	5.6		10	80	10		16.7	66.7	16.7		0	90.9	9.1	
PHF	.000	.708	.250	.750	.250	.667	.250	.625	.250	.500	.250	.500	.000	.833	.250	.917

Accurate Counts
978-664-2565

File Name : 10568001
Site Code : 10568001
Start Date : 8/19/2009
Page No : 3



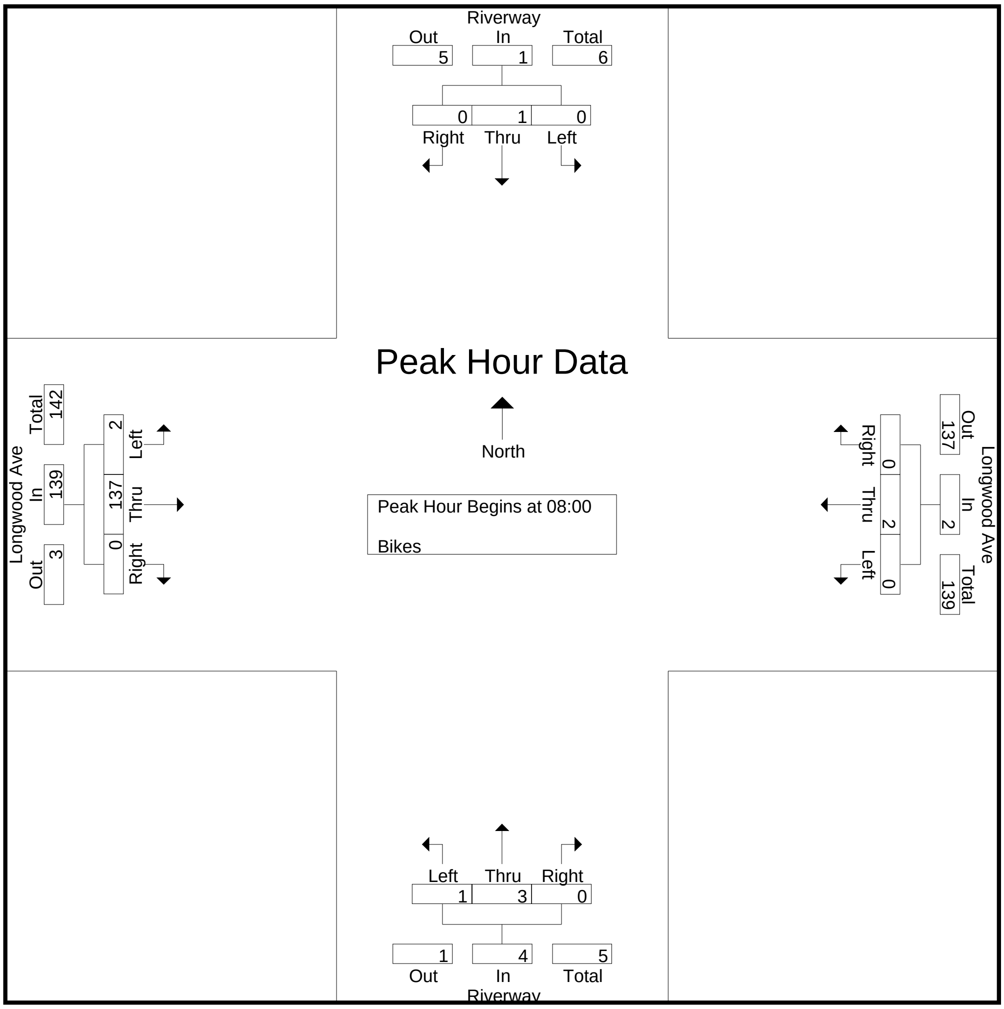
N/S Street : Riverway
E/W Street: Longwood Avenue
City/State : Boston, MA
Weather : Clear

File Name : 10568001
Site Code : 10568001
Start Date : 8/19/2009
Page No : 1

Groups Printed- Bikes

	Riverway From North			Longwood Ave From East			Riverway From South			Longwood Ave From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
07:00	0	0	0	0	0	0	0	1	0	0	12	0	13
07:15	0	0	0	0	1	0	0	0	0	0	20	0	21
07:30	0	0	0	0	0	0	0	0	0	1	14	0	15
07:45	0	0	0	0	0	0	0	0	0	1	28	0	29
Total	0	0	0	0	1	0	0	1	0	2	74	0	78
08:00	0	0	0	0	0	0	0	1	0	0	19	0	20
08:15	0	1	0	0	1	0	1	1	0	0	46	0	50
08:30	0	0	0	0	0	0	0	0	0	0	26	0	26
08:45	0	0	0	0	1	0	0	1	0	2	46	0	50
Total	0	1	0	0	2	0	1	3	0	2	137	0	146
Grand Total	0	1	0	0	3	0	1	4	0	4	211	0	224
Apprch %	0	100	0	0	100	0	20	80	0	1.9	98.1	0	
Total %	0	0.4	0	0	1.3	0	0.4	1.8	0	1.8	94.2	0	

	Riverway From North				Longwood Ave From East				Riverway From South				Longwood Ave From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 08:00																	
08:00	0	0	0	0	0	0	0	0	0	1	0	1	0	19	0	19	20
08:15	0	1	0	1	0	1	0	1	1	1	0	2	0	46	0	46	50
08:30	0	0	0	0	0	0	0	0	0	0	0	0	0	26	0	26	26
08:45	0	0	0	0	0	1	0	1	0	1	0	1	2	46	0	48	50
Total Volume	0	1	0	1	0	2	0	2	1	3	0	4	2	137	0	139	146
% App. Total	0	100	0		0	100	0		25	75	0		1.4	98.6	0		
PHF	.000	.250	.000	.250	.000	.500	.000	.500	.250	.750	.000	.500	.250	.745	.000	.724	.730



Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1

Peak Hour for Each Approach Begins at:

	07:30				08:00				08:00				08:00			
+0 mins.	0	0	0	0	0	0	0	0	0	1	0	1	0	19	0	19
+15 mins.	0	0	0	0	0	1	0	1	1	1	0	2	0	46	0	46
+30 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	26	0	26
+45 mins.	0	1	0	1	0	1	0	1	0	1	0	1	2	46	0	48
Total Volume	0	1	0	1	0	2	0	2	1	3	0	4	2	137	0	139
% App. Total	0	100	0		0	100	0		25	75	0		1.4	98.6	0	
PHF	.000	.250	.000	.250	.000	.500	.000	.500	.250	.750	.000	.500	.250	.745	.000	.724

Accurate Counts
978-664-2565

File Name : 10568001
Site Code : 10568001
Start Date : 8/19/2009
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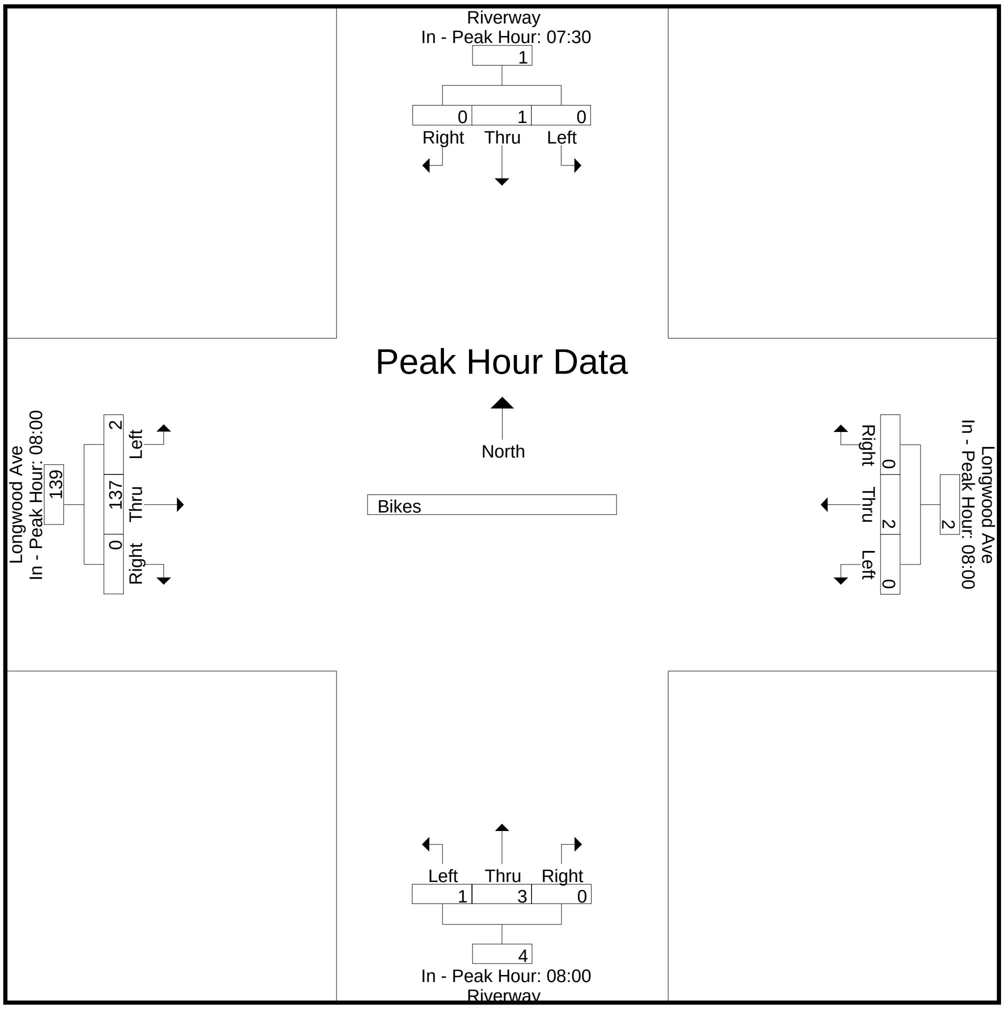


Accurate Counts
978-664-2565

N/S Street : Riverway
E/W Street: Longwood Avenue
City/State : Boston, MA
Weather : Clear

File Name : 10568001
Site Code : 10568001
Start Date : 8/19/2009
Page No : 1

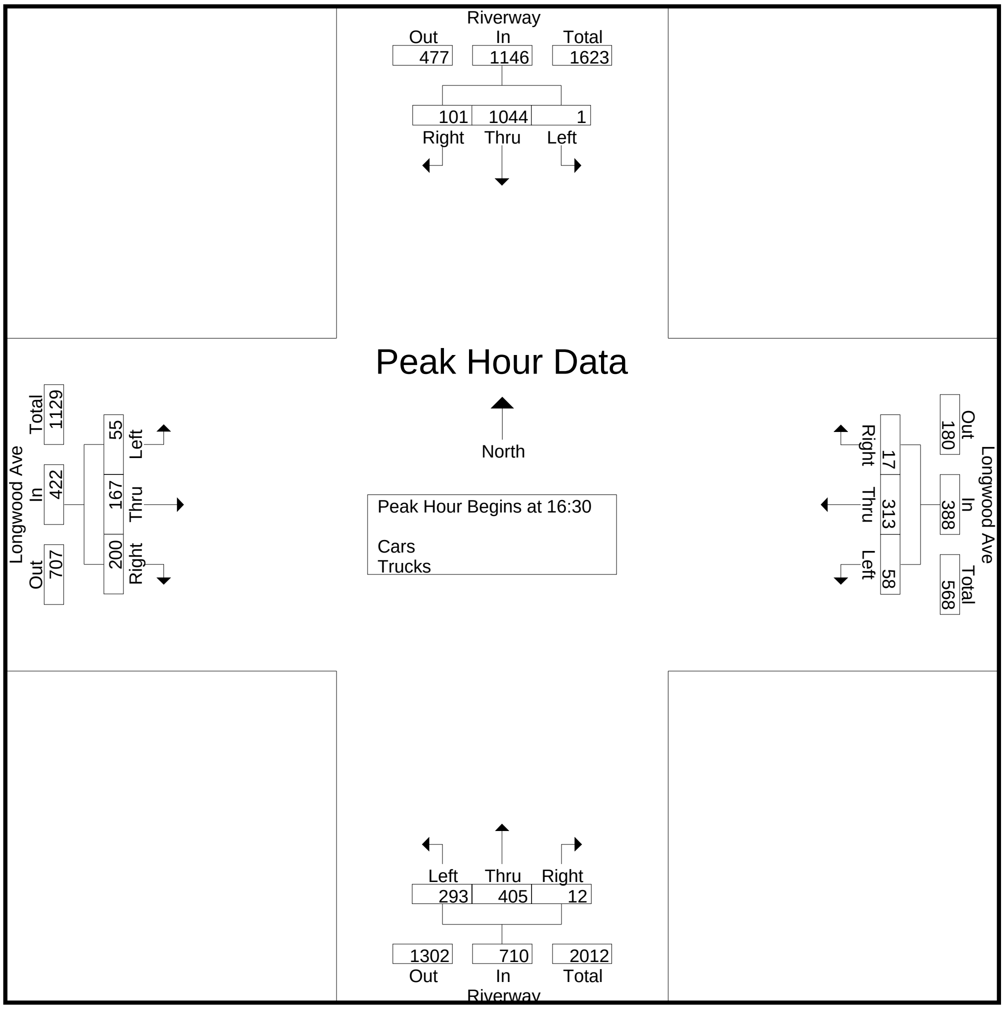
Groups Printed- Cars - Trucks

	Riverway From North				Longwood Ave From East				Riverway From South				Longwood Ave From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	1	256	24	133	8	56	9	1	56	103	3	17	16	47	49	0	151	628	779
16:15	1	251	26	143	15	71	7	0	64	101	3	14	20	41	47	5	162	647	809
16:30	0	260	30	155	19	77	5	0	68	98	2	25	4	45	31	3	183	639	822
16:45	1	257	21	151	11	73	5	4	82	101	2	12	17	45	53	13	180	668	848
Total	3	1024	101	582	53	277	26	5	270	403	10	68	57	178	180	21	676	2582	3258
17:00	0	246	21	182	13	81	4	1	69	109	3	10	18	39	58	6	199	661	860
17:15	0	281	29	143	15	82	3	1	74	97	5	10	16	38	58	1	155	698	853
17:30	1	234	37	130	12	104	7	1	60	102	2	9	12	33	32	0	140	636	776
17:45	1	224	22	155	6	78	2	8	69	91	0	20	19	52	54	3	186	618	804
Total	2	985	109	610	46	345	16	11	272	399	10	49	65	162	202	10	680	2613	3293
Grand Total	5	2009	210	1192	99	622	42	16	542	802	20	117	122	340	382	31	1356	5195	6551
Apprch %	0.2	90.3	9.4		13	81.5	5.5		39.7	58.8	1.5		14.5	40.3	45.3				
Total %	0.1	38.7	4		1.9	12	0.8		10.4	15.4	0.4		2.3	6.5	7.4		20.7	79.3	
Cars	5	1993	209		99	611	39		537	795	18		122	330	380		0	0	6169
% Cars	100	99.2	99.5	72.7	100	98.2	92.9	100	99.1	99.1	90	100	100	97.1	99.5	100	0	0	94.2
Trucks	0	16	1		0	11	3		5	7	2		0	10	2		0	0	382
% Trucks	0	0.8	0.5	27.3	0	1.8	7.1	0	0.9	0.9	10	0	0	2.9	0.5	0	0	0	5.8

	Riverway From North				Longwood Ave From East				Riverway From South				Longwood Ave From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 16:30																	
16:30	0	260	30	290	19	77	5	101	68	98	2	168	4	45	31	80	639
16:45	1	257	21	279	11	73	5	89	82	101	2	185	17	45	53	115	668
17:00	0	246	21	267	13	81	4	98	69	109	3	181	18	39	58	115	661
17:15	0	281	29	310	15	82	3	100	74	97	5	176	16	38	58	112	698
Total Volume	1	1044	101	1146	58	313	17	388	293	405	12	710	55	167	200	422	2666
% App. Total	0.1	91.1	8.8		14.9	80.7	4.4		41.3	57	1.7		13	39.6	47.4		
PHF	.250	.929	.842	.924	.763	.954	.850	.960	.893	.929	.600	.959	.764	.928	.862	.917	.955

Accurate Counts
978-664-2565

File Name : 10568001
Site Code : 10568001
Start Date : 8/19/2009
Page No : 2



Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:30				16:45				16:30				17:00			
+0 mins.	0	260	30	290	11	73	5	89	68	98	2	168	18	39	58	115
+15 mins.	1	257	21	279	13	81	4	98	82	101	2	185	16	38	58	112
+30 mins.	0	246	21	267	15	82	3	100	69	109	3	181	12	33	32	77
+45 mins.	0	281	29	310	12	104	7	123	74	97	5	176	19	52	54	125
Total Volume	1	1044	101	1146	51	340	19	410	293	405	12	710	65	162	202	429
% App. Total	0.1	91.1	8.8		12.4	82.9	4.6		41.3	57	1.7		15.2	37.8	47.1	
PHF	.250	.929	.842	.924	.850	.817	.679	.833	.893	.929	.600	.959	.855	.779	.871	.858

File Name : 10568001
Site Code : 10568001
Start Date : 8/19/2009
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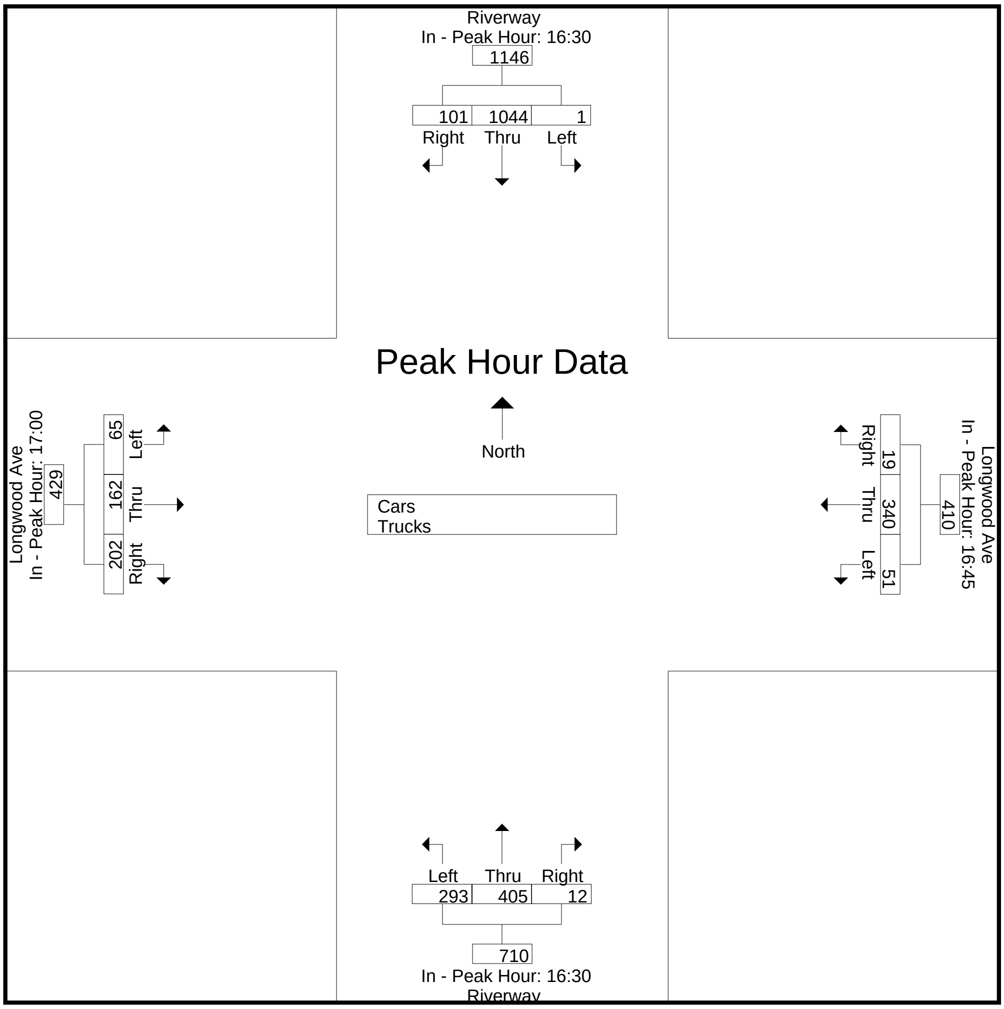


Accurate Counts
978-664-2565

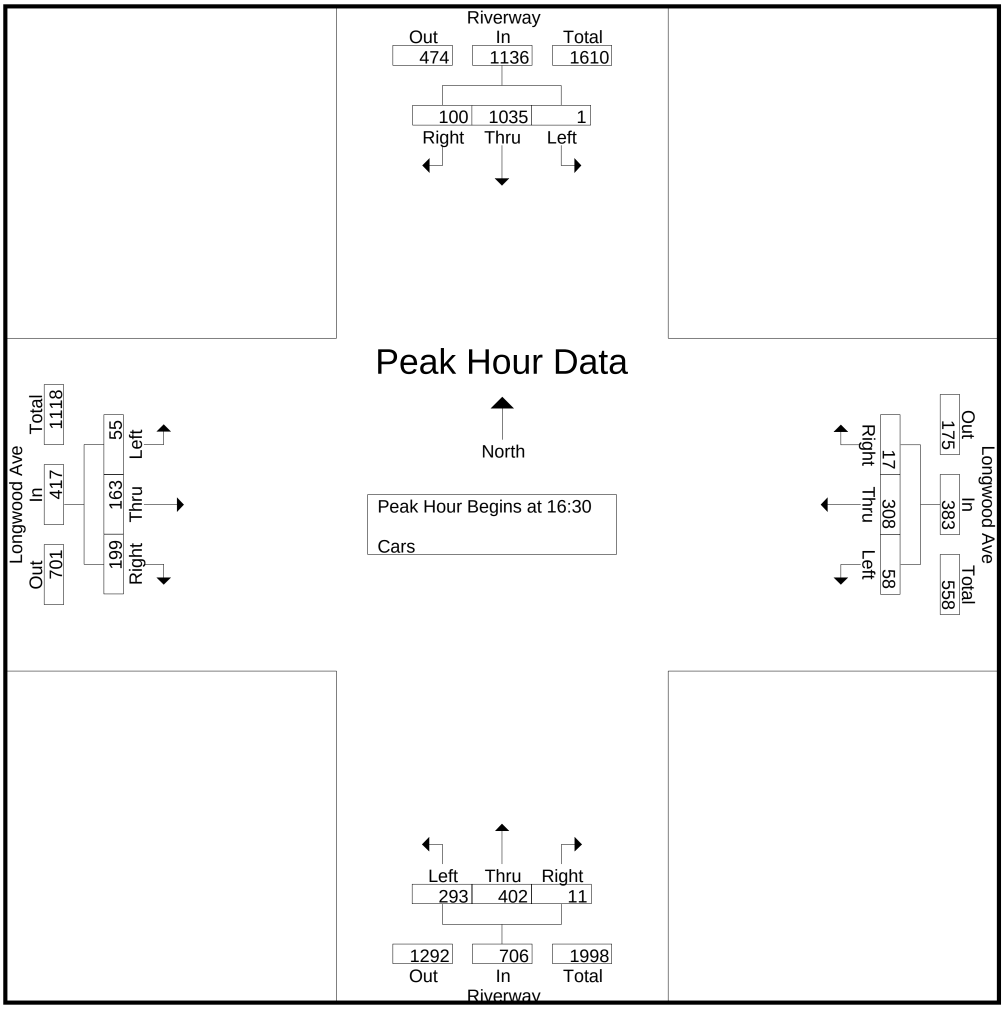
N/S Street : Riverway
E/W Street: Longwood Avenue
City/State : Boston, MA
Weather : Clear

File Name : 10568001
Site Code : 10568001
Start Date : 8/19/2009
Page No : 1

Groups Printed- Cars

	Riverway From North				Longwood Ave From East				Riverway From South				Longwood Ave From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	1	252	24	106	8	56	8	1	55	102	3	17	16	46	49	0	124	620	744
16:15	1	249	26	100	15	68	5	0	63	100	2	14	20	38	46	5	119	633	752
16:30	0	258	30	120	19	75	5	0	68	96	2	25	4	44	31	3	148	632	780
16:45	1	254	21	108	11	72	5	4	82	100	2	12	17	45	52	13	137	662	799
Total	3	1013	101	434	53	271	23	5	268	398	9	68	57	173	178	21	528	2547	3075
17:00	0	244	20	120	13	80	4	1	69	109	2	10	18	39	58	6	137	656	793
17:15	0	279	29	96	15	81	3	1	74	97	5	10	16	35	58	1	108	692	800
17:30	1	234	37	96	12	102	7	1	58	101	2	9	12	32	32	0	106	630	736
17:45	1	223	22	121	6	77	2	8	68	90	0	20	19	51	54	3	152	613	765
Total	2	980	108	433	46	340	16	11	269	397	9	49	65	157	202	10	503	2591	3094
Grand Total	5	1993	209	867	99	611	39	16	537	795	18	117	122	330	380	31	1031	5138	6169
Apprch %	0.2	90.3	9.5		13.2	81.6	5.2		39.8	58.9	1.3		14.7	39.7	45.7				
Total %	0.1	38.8	4.1		1.9	11.9	0.8		10.5	15.5	0.4		2.4	6.4	7.4		16.7	83.3	

	Riverway From North				Longwood Ave From East				Riverway From South				Longwood Ave From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 16:30																	
16:30	0	258	30	288	19	75	5	99	68	96	2	166	4	44	31	79	632
16:45	1	254	21	276	11	72	5	88	82	100	2	184	17	45	52	114	662
17:00	0	244	20	264	13	80	4	97	69	109	2	180	18	39	58	115	656
17:15	0	279	29	308	15	81	3	99	74	97	5	176	16	35	58	109	692
Total Volume	1	1035	100	1136	58	308	17	383	293	402	11	706	55	163	199	417	2642
% App. Total	0.1	91.1	8.8		15.1	80.4	4.4		41.5	56.9	1.6		13.2	39.1	47.7		
PHF	.250	.927	.833	.922	.763	.951	.850	.967	.893	.922	.550	.959	.764	.906	.858	.907	.954

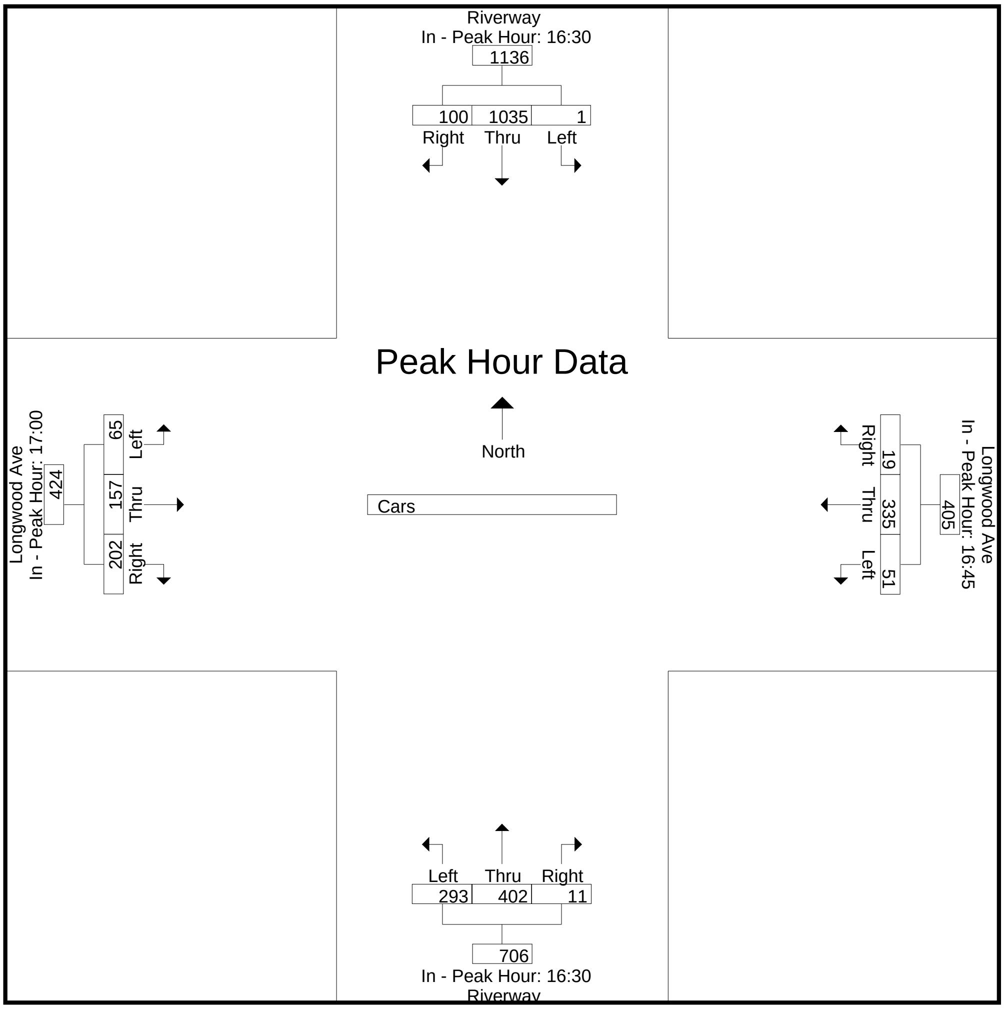


Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:30				16:45				16:30				17:00			
+0 mins.	0	258	30	288	11	72	5	88	68	96	2	166	18	39	58	115
+15 mins.	1	254	21	276	13	80	4	97	82	100	2	184	16	35	58	109
+30 mins.	0	244	20	264	15	81	3	99	69	109	2	180	12	32	32	76
+45 mins.	0	279	29	308	12	102	7	121	74	97	5	176	19	51	54	124
Total Volume	1	1035	100	1136	51	335	19	405	293	402	11	706	65	157	202	424
% App. Total	0.1	91.1	8.8		12.6	82.7	4.7		41.5	56.9	1.6		15.3	37	47.6	
PHF	.250	.927	.833	.922	.850	.821	.679	.837	.893	.922	.550	.959	.855	.770	.871	.855

Accurate Counts
978-664-2565

File Name : 10568001
Site Code : 10568001
Start Date : 8/19/2009
Page No : 3



Accurate Counts
978-664-2565

N/S Street : Riverway
E/W Street: Longwood Avenue
City/State : Boston, MA
Weather : Clear

File Name : 10568001
Site Code : 10568001
Start Date : 8/19/2009
Page No : 1

Groups Printed- Trucks

	Riverway From North				Longwood Ave From East				Riverway From South				Longwood Ave From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	0	4	0	27	0	0	1	0	1	1	0	0	0	1	0	0	27	8	35
16:15	0	2	0	43	0	3	2	0	1	1	1	0	0	3	1	0	43	14	57
16:30	0	2	0	35	0	2	0	0	0	2	0	0	0	1	0	0	35	7	42
16:45	0	3	0	43	0	1	0	0	0	1	0	0	0	0	1	0	43	6	49
Total	0	11	0	148	0	6	3	0	2	5	1	0	0	5	2	0	148	35	183
17:00	0	2	1	62	0	1	0	0	0	0	1	0	0	0	0	0	62	5	67
17:15	0	2	0	47	0	1	0	0	0	0	0	0	0	3	0	0	47	6	53
17:30	0	0	0	34	0	2	0	0	2	1	0	0	0	1	0	0	34	6	40
17:45	0	1	0	34	0	1	0	0	1	1	0	0	0	1	0	0	34	5	39
Total	0	5	1	177	0	5	0	0	3	2	1	0	0	5	0	0	177	22	199
Grand Total	0	16	1	325	0	11	3	0	5	7	2	0	0	10	2	0	325	57	382
Apprch %	0	94.1	5.9		0	78.6	21.4		35.7	50	14.3		0	83.3	16.7				
Total %	0	28.1	1.8		0	19.3	5.3		8.8	12.3	3.5		0	17.5	3.5		85.1	14.9	

	Riverway From North				Longwood Ave From East				Riverway From South				Longwood Ave From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 16:00																	
16:00	0	4	0	4	0	0	1	1	1	1	0	2	0	1	0	1	8
16:15	0	2	0	2	0	3	2	5	1	1	1	3	0	3	1	4	14
16:30	0	2	0	2	0	2	0	2	0	2	0	2	0	1	0	1	7
16:45	0	3	0	3	0	1	0	1	0	1	0	1	0	0	1	1	6
Total Volume	0	11	0	11	0	6	3	9	2	5	1	8	0	5	2	7	35
% App. Total	0	100	0		0	66.7	33.3		25	62.5	12.5		0	71.4	28.6		
PHF	.000	.688	.000	.688	.000	.500	.375	.450	.500	.625	.250	.667	.000	.417	.500	.438	.625

File Name : 10568001
Site Code : 10568001
Start Date : 8/19/2009
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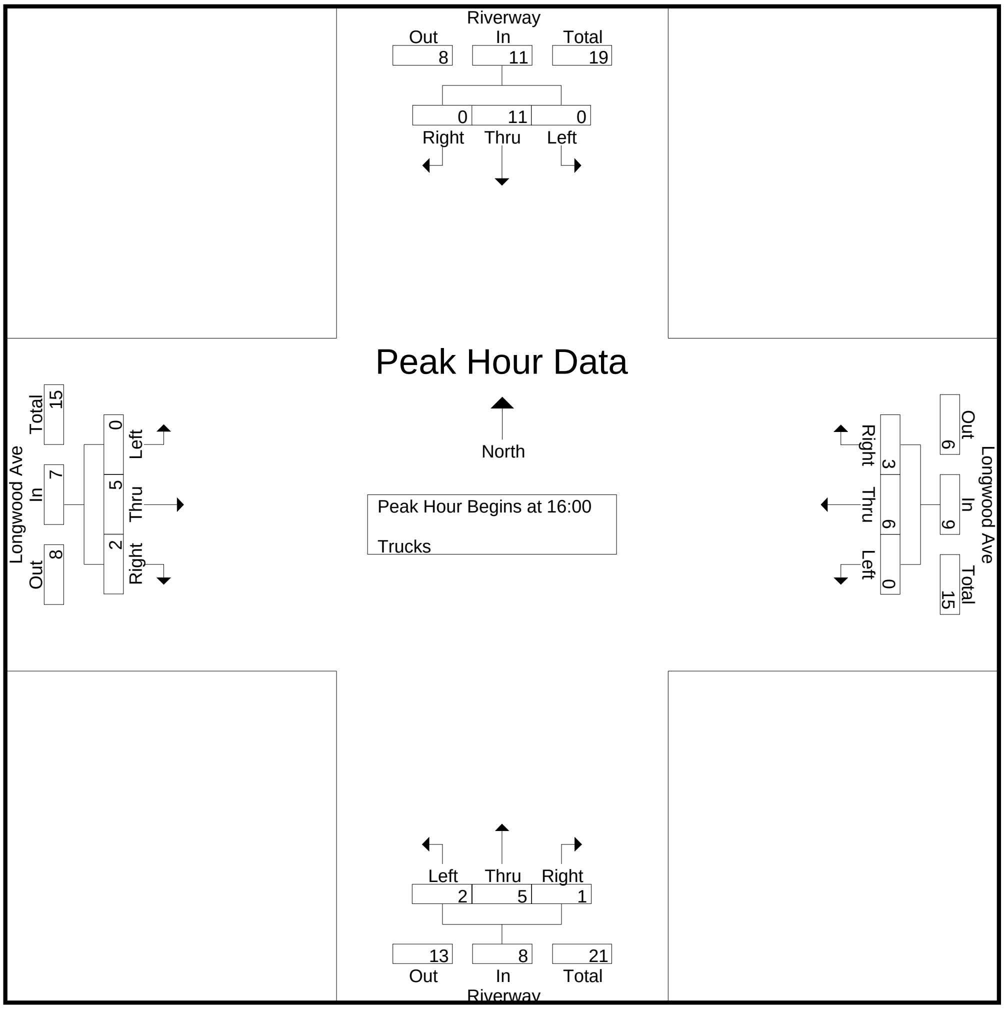

Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:00				16:00				16:00				16:00			
+0 mins.	0	4	0	4	0	0	1	1	1	1	0	2	0	1	0	1
+15 mins.	0	2	0	2	0	3	2	5	1	1	1	3	0	3	1	4
+30 mins.	0	2	0	2	0	2	0	2	0	2	0	2	0	1	0	1
+45 mins.	0	3	0	3	0	1	0	1	0	1	0	1	0	0	1	1
Total Volume	0	11	0	11	0	6	3	9	2	5	1	8	0	5	2	7
% App. Total	0	100	0		0	66.7	33.3		25	62.5	12.5		0	71.4	28.6	
PHF	.000	.688	.000	.688	.000	.500	.375	.450	.500	.625	.250	.667	.000	.417	.500	.438

Accurate Counts
978-664-2565

File Name : 10568001
Site Code : 10568001
Start Date : 8/19/2009
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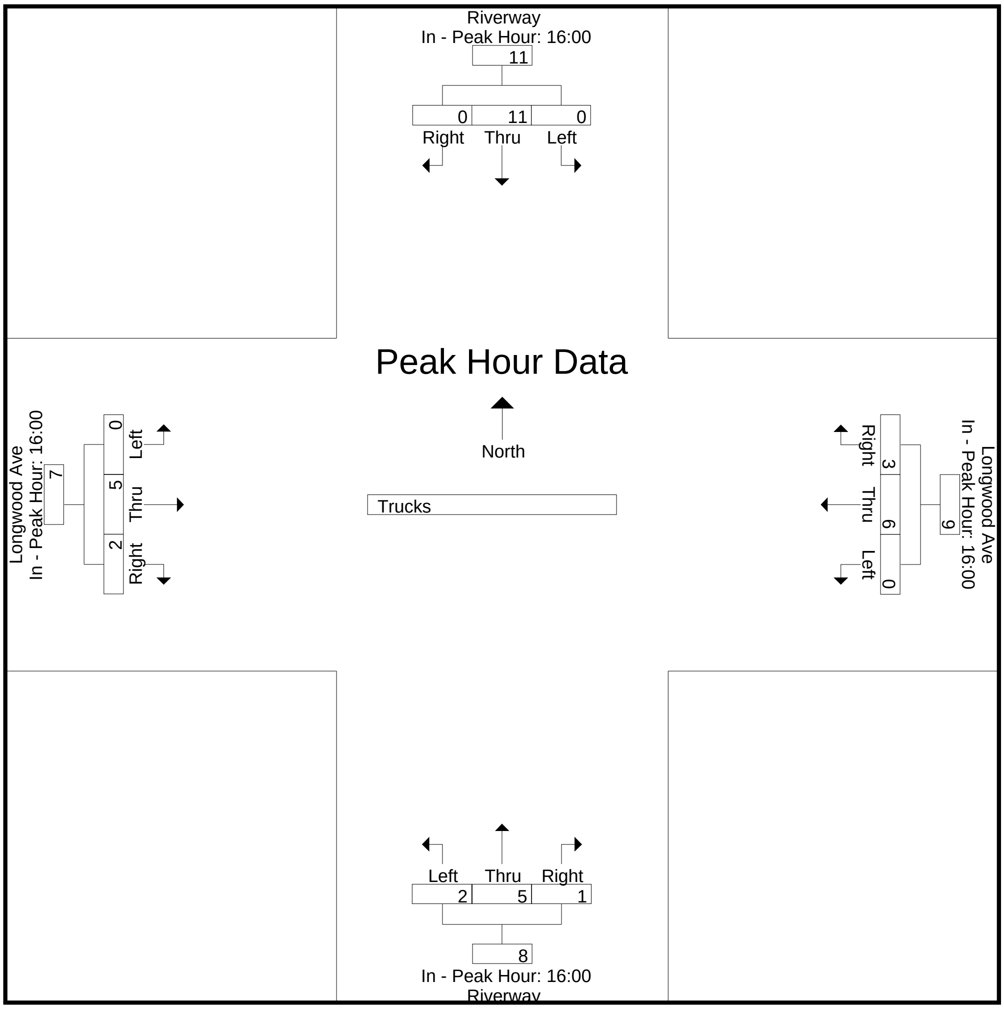


Accurate Counts
978-664-2565

N/S Street : Riverway
E/W Street: Longwood Avenue
City/State : Boston, MA
Weather : Clear

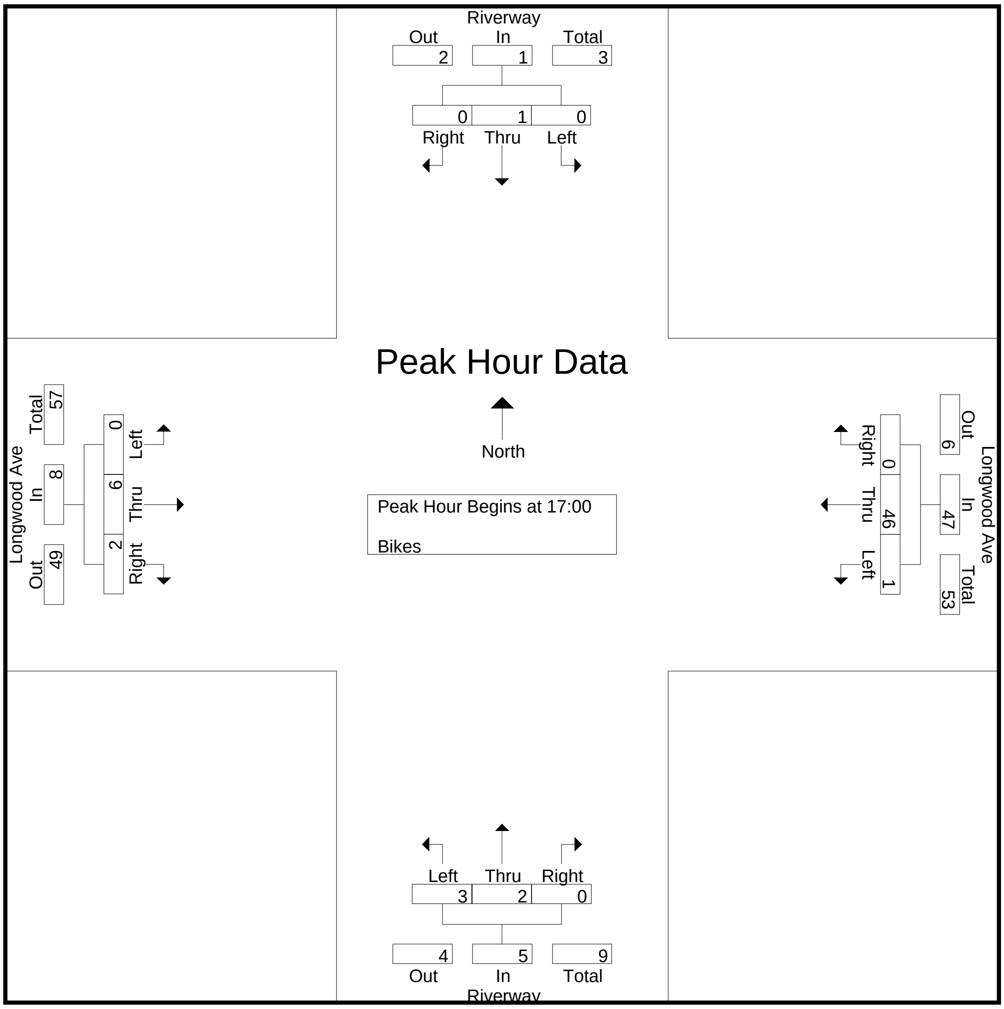
File Name : 10568001
Site Code : 10568001
Start Date : 8/19/2009
Page No : 1

Groups Printed- Bikes

	Riverway From North			Longwood Ave From East			Riverway From South			Longwood Ave From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
16:00	0	2	0	0	6	0	0	0	0	0	3	0	11
16:15	0	0	2	0	12	0	0	0	0	0	0	0	14
16:30	0	0	0	0	7	0	1	0	0	0	2	0	10
16:45	0	0	0	0	6	0	0	2	0	0	1	0	9
Total	0	2	2	0	31	0	1	2	0	0	6	0	44
17:00	0	0	0	0	13	0	2	2	0	0	1	0	18
17:15	0	1	0	0	10	0	1	0	0	0	2	1	15
17:30	0	0	0	0	6	0	0	0	0	0	1	0	7
17:45	0	0	0	1	17	0	0	0	0	0	2	1	21
Total	0	1	0	1	46	0	3	2	0	0	6	2	61
Grand Total	0	3	2	1	77	0	4	4	0	0	12	2	105
Apprch %	0	60	40	1.3	98.7	0	50	50	0	0	85.7	14.3	
Total %	0	2.9	1.9	1	73.3	0	3.8	3.8	0	0	11.4	1.9	

	Riverway From North				Longwood Ave From East				Riverway From South				Longwood Ave From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 17:00																	
17:00	0	0	0	0	0	13	0	13	2	2	0	4	0	1	0	1	18
17:15	0	1	0	1	0	10	0	10	1	0	0	1	0	2	1	3	15
17:30	0	0	0	0	0	6	0	6	0	0	0	0	0	1	0	1	7
17:45	0	0	0	0	1	17	0	18	0	0	0	0	0	2	1	3	21
Total Volume	0	1	0	1	1	46	0	47	3	2	0	5	0	6	2	8	61
% App. Total	0	100	0		2.1	97.9	0		60	40	0		0	75	25		
PHF	.000	.250	.000	.250	.250	.676	.000	.653	.375	.250	.000	.313	.000	.750	.500	.667	.726

File Name : 10568001
Site Code : 10568001
Start Date : 8/19/2009
Page No : 2



Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:00				17:00				16:30				17:00			
+0 mins.	0	2	0	2	0	13	0	13	1	0	0	1	0	1	0	1
+15 mins.	0	0	2	2	0	10	0	10	0	2	0	2	0	2	1	3
+30 mins.	0	0	0	0	0	6	0	6	2	2	0	4	0	1	0	1
+45 mins.	0	0	0	0	1	17	0	18	1	0	0	1	0	2	1	3
Total Volume	0	2	2	4	1	46	0	47	4	4	0	8	0	6	2	8
% App. Total	0	50	50		2.1	97.9	0		50	50	0		0	75	25	
PHF	.000	.250	.250	.500	.250	.676	.000	.653	.500	.500	.000	.500	.000	.750	.500	.667

Accurate Counts
978-664-2565

File Name : 10568001
Site Code : 10568001
Start Date : 8/19/2009
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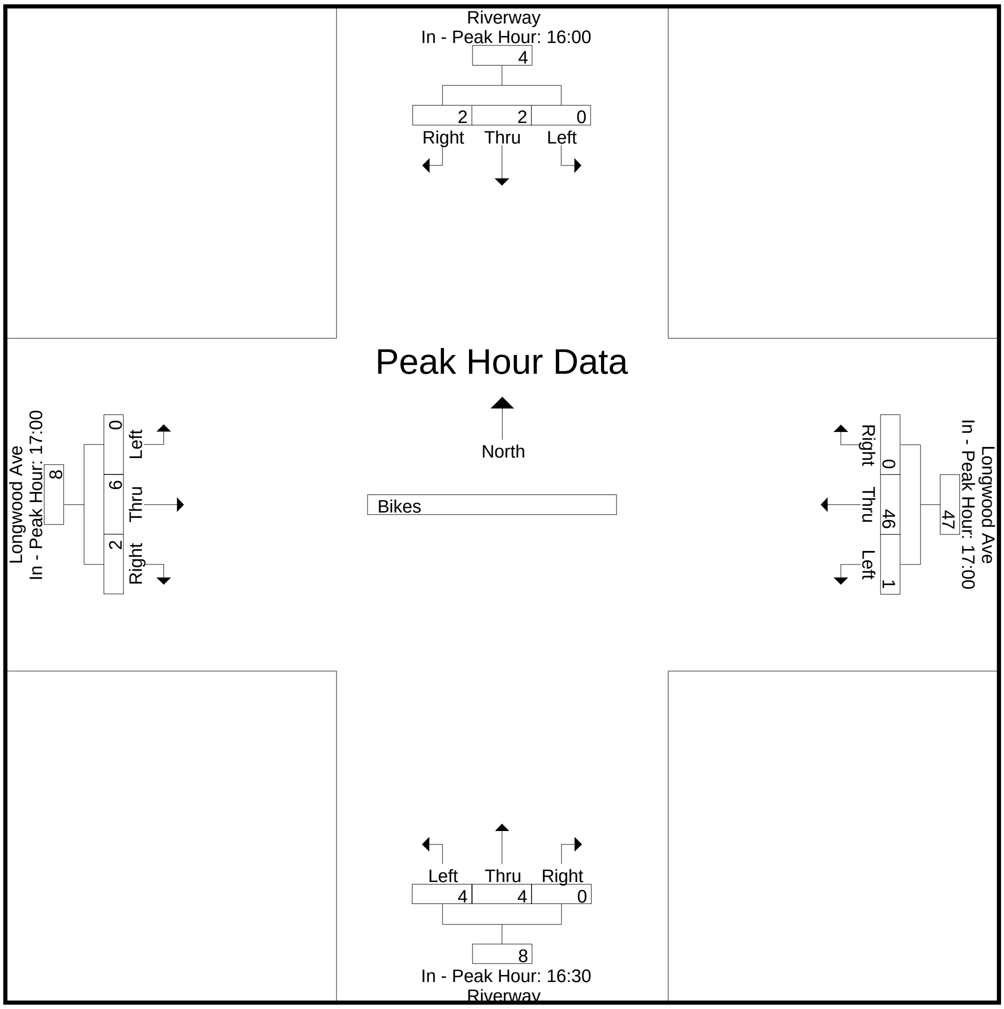

Accurate Counts
978-664-2565

N/S Street : Brookline Avenue
E/W Street: Longwood Avenue
City/State : Boston, MA
Weather : Clear

File Name : 10568002
Site Code : 10568002
Start Date : 8/21/2009
Page No : 1

Groups Printed- Cars - Trucks

	Brookline Ave From North				Longwood Ave From East				Brookline Ave From South				Longwood Ave From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	55	133	42	69	25	22	41	20	7	147	39	85	7	29	2	23	197	549	746
07:15	64	129	39	90	16	25	64	33	6	141	35	97	13	31	3	53	273	566	839
07:30	47	138	49	90	22	29	64	26	5	175	49	106	14	44	4	18	240	640	880
07:45	47	130	32	111	19	36	59	28	9	167	43	96	12	34	8	26	261	596	857
Total	213	530	162	360	82	112	228	107	27	630	166	384	46	138	17	120	971	2351	3322
08:00	41	112	33	111	24	38	63	30	9	178	51	119	21	56	5	18	278	631	909
08:15	62	129	21	164	20	42	59	43	14	153	52	131	13	53	6	51	389	624	1013
08:30	57	128	21	174	19	43	55	33	14	156	57	161	13	53	6	26	394	622	1016
08:45	46	101	26	122	15	23	41	37	6	109	44	97	17	35	6	52	308	469	777
Total	206	470	101	571	78	146	218	143	43	596	204	508	64	197	23	147	1369	2346	3715
Grand Total	419	1000	263	931	160	258	446	250	70	1226	370	892	110	335	40	267	2340	4697	7037
Apprch %	24.9	59.5	15.6		18.5	29.9	51.6		4.2	73.6	22.2		22.7	69.1	8.2				
Total %	8.9	21.3	5.6		3.4	5.5	9.5		1.5	26.1	7.9		2.3	7.1	0.9		33.3	66.7	
Cars	377	946	258		124	248	367		64	1150	347		108	323	39		0	0	6691
% Cars	90	94.6	98.1	100	77.5	96.1	82.3	100	91.4	93.8	93.8	100	98.2	96.4	97.5	100	0	0	95.1
Trucks	42	54	5		36	10	79		6	76	23		2	12	1		0	0	346
% Trucks	10	5.4	1.9	0	22.5	3.9	17.7	0	8.6	6.2	6.2	0	1.8	3.6	2.5	0	0	0	4.9

	Brookline Ave From North				Longwood Ave From East				Brookline Ave From South				Longwood Ave From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:30																	
07:30	47	138	49	234	22	29	64	115	5	175	49	229	14	44	4	62	640
07:45	47	130	32	209	19	36	59	114	9	167	43	219	12	34	8	54	596
08:00	41	112	33	186	24	38	63	125	9	178	51	238	21	56	5	82	631
08:15	62	129	21	212	20	42	59	121	14	153	52	219	13	53	6	72	624
Total Volume	197	509	135	841	85	145	245	475	37	673	195	905	60	187	23	270	2491
% App. Total	23.4	60.5	16.1		17.9	30.5	51.6		4.1	74.4	21.5		22.2	69.3	8.5		
PHF	.794	.922	.689	.899	.885	.863	.957	.950	.661	.945	.938	.951	.714	.835	.719	.823	.973

File Name : 10568002
Site Code : 10568002
Start Date : 8/21/2009
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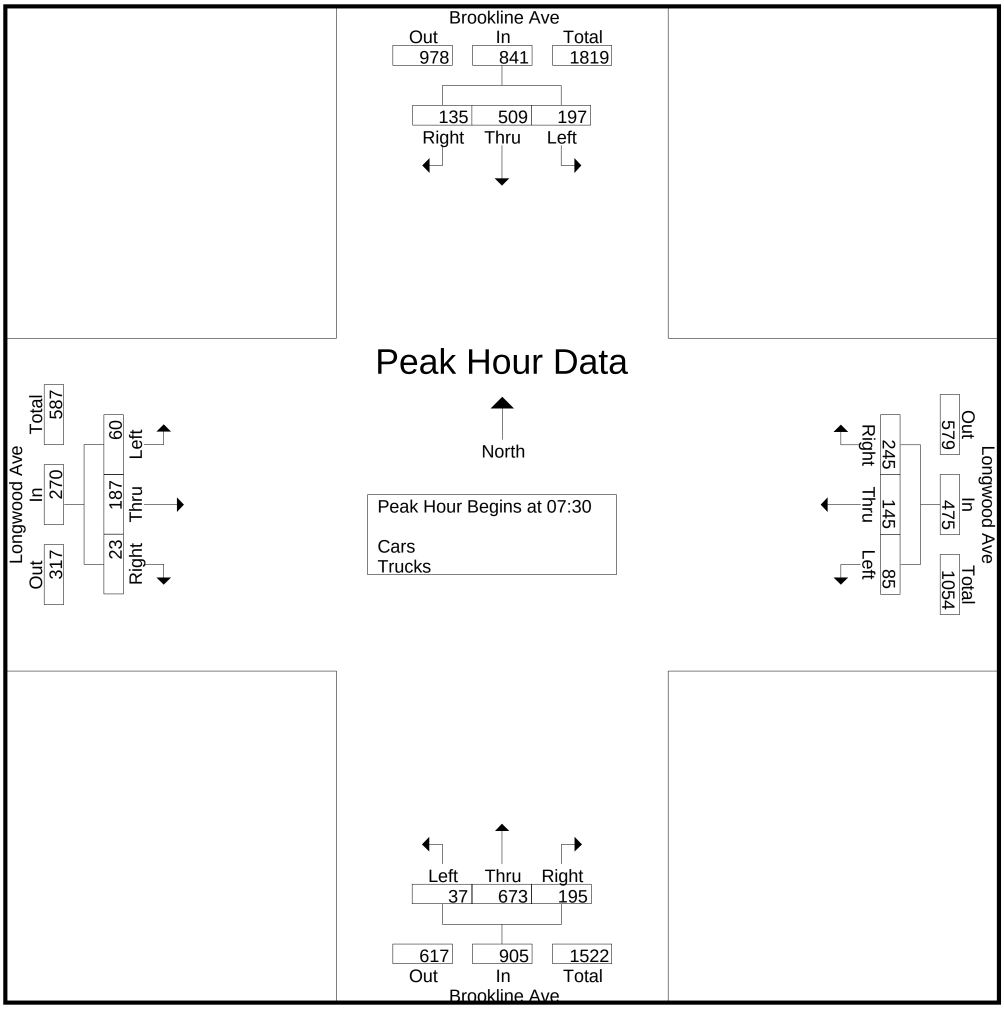

Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:00				07:45				07:30				08:00			
+0 mins.	55	133	42	230	19	36	59	114	5	175	49	229	21	56	5	82
+15 mins.	64	129	39	232	24	38	63	125	9	167	43	219	13	53	6	72
+30 mins.	47	138	49	234	20	42	59	121	9	178	51	238	13	53	6	72
+45 mins.	47	130	32	209	19	43	55	117	14	153	52	219	17	35	6	58
Total Volume	213	530	162	905	82	159	236	477	37	673	195	905	64	197	23	284
% App. Total	23.5	58.6	17.9		17.2	33.3	49.5		4.1	74.4	21.5		22.5	69.4	8.1	
PHF	.832	.960	.827	.967	.854	.924	.937	.954	.661	.945	.938	.951	.762	.879	.958	.866

Accurate Counts
978-664-2565

File Name : 10568002
Site Code : 10568002
Start Date : 8/21/2009
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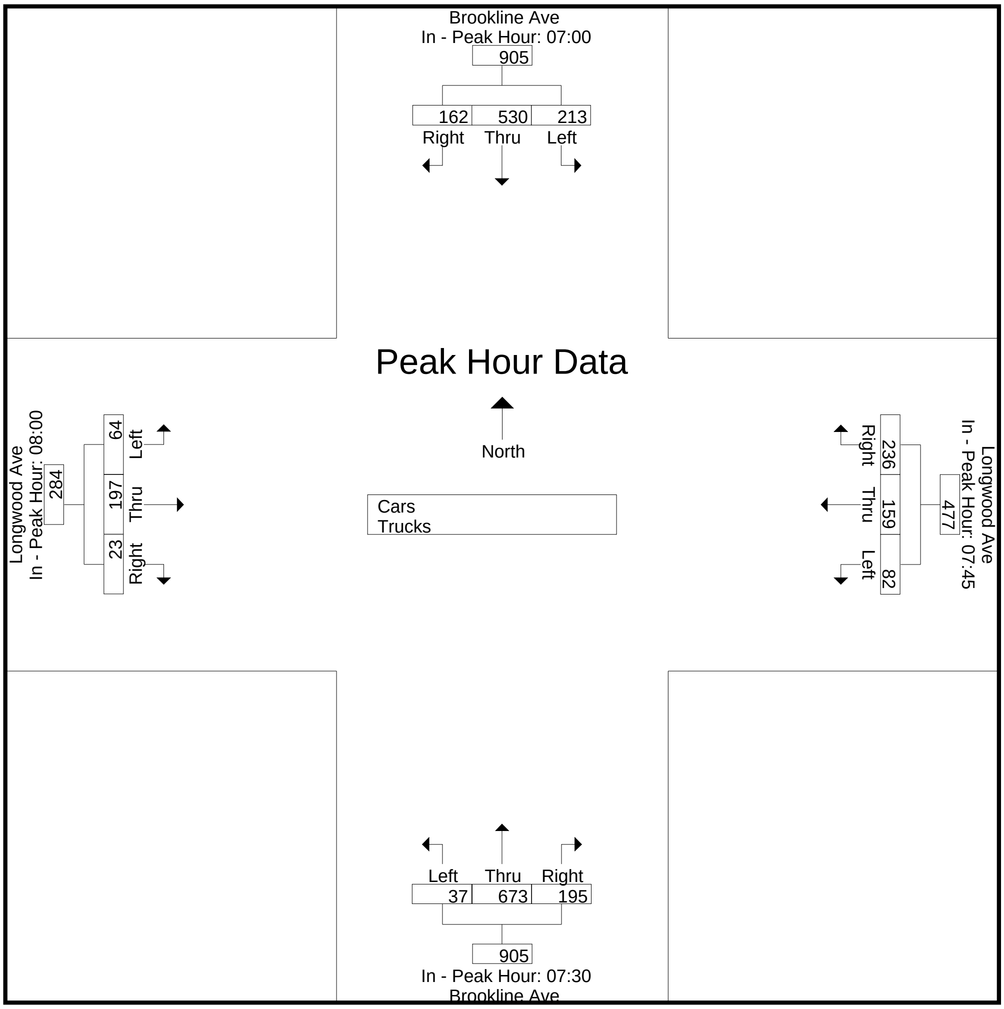


N/S Street : Brookline Avenue
E/W Street: Longwood Avenue
City/State : Boston, MA
Weather : Clear

File Name : 10568002
Site Code : 10568002
Start Date : 8/21/2009

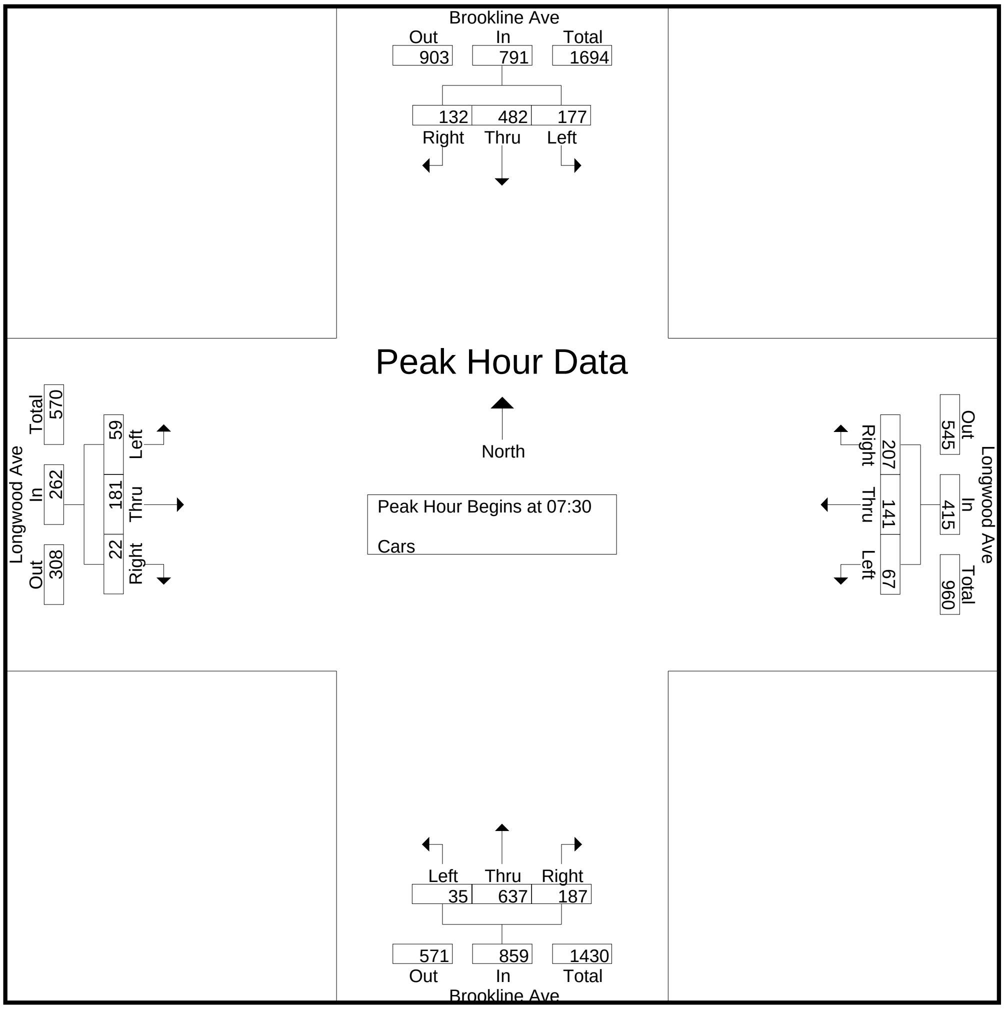
Groups Printed- Cars

	Brookline Ave From North				Longwood Ave From East				Brookline Ave From South				Longwood Ave From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	50	125	41	69	20	19	31	20	5	133	37	85	7	28	2	23	197	498	695
07:15	57	123	39	90	11	25	49	33	5	133	31	97	13	29	3	53	273	518	791
07:30	45	133	47	90	17	28	55	26	5	170	46	106	14	42	4	18	240	606	846
07:45	41	122	31	111	14	36	49	28	8	159	43	96	11	33	8	26	261	555	816
Total	193	503	158	360	62	108	184	107	23	595	157	384	45	132	17	120	971	2177	3148
08:00	36	106	33	111	19	37	53	30	9	163	51	119	21	55	4	18	278	587	865
08:15	55	121	21	164	17	40	50	43	13	145	47	131	13	51	6	51	389	579	968
08:30	50	121	21	174	15	41	46	33	13	147	50	161	13	51	6	26	394	574	968
08:45	43	95	25	122	11	22	34	37	6	100	42	97	16	34	6	52	308	434	742
Total	184	443	100	571	62	140	183	143	41	555	190	508	63	191	22	147	1369	2174	3543
Grand Total	377	946	258	931	124	248	367	250	64	1150	347	892	108	323	39	267	2340	4351	6691
Apprch %	23.8	59.8	16.3		16.8	33.6	49.7		4.1	73.7	22.2		23	68.7	8.3				
Total %	8.7	21.7	5.9		2.8	5.7	8.4		1.5	26.4	8		2.5	7.4	0.9		35	65	

	Brookline Ave From North				Longwood Ave From East				Brookline Ave From South				Longwood Ave From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:30																	
07:30	45	133	47	225	17	28	55	100	5	170	46	221	14	42	4	60	606
07:45	41	122	31	194	14	36	49	99	8	159	43	210	11	33	8	52	555
08:00	36	106	33	175	19	37	53	109	9	163	51	223	21	55	4	80	587
08:15	55	121	21	197	17	40	50	107	13	145	47	205	13	51	6	70	579
Total Volume	177	482	132	791	67	141	207	415	35	637	187	859	59	181	22	262	2327
% App. Total	22.4	60.9	16.7		16.1	34	49.9		4.1	74.2	21.8		22.5	69.1	8.4		
PHF	.805	.906	.702	.879	.882	.881	.941	.952	.673	.937	.917	.963	.702	.823	.688	.819	.960

Accurate Counts
978-664-2565

File Name : 10568002
Site Code : 10568002
Start Date : 8/21/2009
Page No : 2



Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1

Peak Hour for Each Approach Begins at:

	07:00				07:45				07:30				08:00			
+0 mins.	50	125	41	216	14	36	49	99	5	170	46	221	21	55	4	80
+15 mins.	57	123	39	219	19	37	53	109	8	159	43	210	13	51	6	70
+30 mins.	45	133	47	225	17	40	50	107	9	163	51	223	13	51	6	70
+45 mins.	41	122	31	194	15	41	46	102	13	145	47	205	16	34	6	56
Total Volume	193	503	158	854	65	154	198	417	35	637	187	859	63	191	22	276
% App. Total	22.6	58.9	18.5		15.6	36.9	47.5		4.1	74.2	21.8		22.8	69.2	8	
PHF	.846	.945	.840	.949	.855	.939	.934	.956	.673	.937	.917	.963	.750	.868	.917	.863

Accurate Counts
978-664-2565

File Name : 10568002
Site Code : 10568002
Start Date : 8/21/2009
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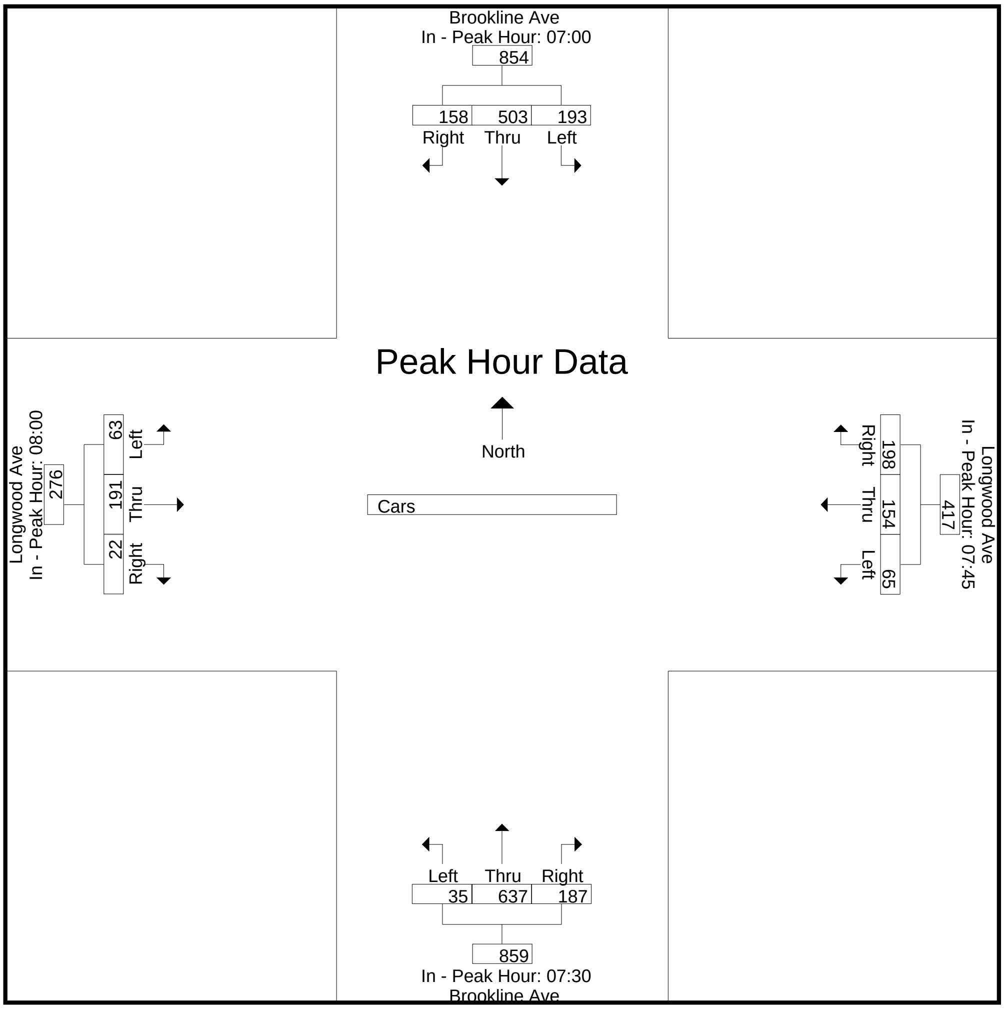

Accurate Counts
978-664-2565

N/S Street : Brookline Avenue
E/W Street: Longwood Avenue
City/State : Boston, MA
Weather : Clear

File Name : 10568002
Site Code : 10568002
Start Date : 8/21/2009
Page No : 1

Groups Printed- Trucks

	Brookline Ave From North				Longwood Ave From East				Brookline Ave From South				Longwood Ave From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	5	8	1	0	5	3	10	0	2	14	2	0	0	1	0	0	0	51	51
07:15	7	6	0	0	5	0	15	0	1	8	4	0	0	2	0	0	0	48	48
07:30	2	5	2	0	5	1	9	0	0	5	3	0	0	2	0	0	0	34	34
07:45	6	8	1	0	5	0	10	0	1	8	0	0	1	1	0	0	0	41	41
Total	20	27	4	0	20	4	44	0	4	35	9	0	1	6	0	0	0	174	174
08:00	5	6	0	0	5	1	10	0	0	15	0	0	0	1	1	0	0	44	44
08:15	7	8	0	0	3	2	9	0	1	8	5	0	0	2	0	0	0	45	45
08:30	7	7	0	0	4	2	9	0	1	9	7	0	0	2	0	0	0	48	48
08:45	3	6	1	0	4	1	7	0	0	9	2	0	1	1	0	0	0	35	35
Total	22	27	1	0	16	6	35	0	2	41	14	0	1	6	1	0	0	172	172
Grand Total	42	54	5	0	36	10	79	0	6	76	23	0	2	12	1	0	0	346	346
Apprch %	41.6	53.5	5		28.8	8	63.2		5.7	72.4	21.9		13.3	80	6.7				
Total %	12.1	15.6	1.4		10.4	2.9	22.8		1.7	22	6.6		0.6	3.5	0.3		0	100	

	Brookline Ave From North				Longwood Ave From East				Brookline Ave From South				Longwood Ave From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:45																	
07:45	6	8	1	15	5	0	10	15	1	8	0	9	1	1	0	2	41
08:00	5	6	0	11	5	1	10	16	0	15	0	15	0	1	1	2	44
08:15	7	8	0	15	3	2	9	14	1	8	5	14	0	2	0	2	45
08:30	7	7	0	14	4	2	9	15	1	9	7	17	0	2	0	2	48
Total Volume	25	29	1	55	17	5	38	60	3	40	12	55	1	6	1	8	178
% App. Total	45.5	52.7	1.8		28.3	8.3	63.3		5.5	72.7	21.8		12.5	75	12.5		
PHF	.893	.906	.250	.917	.850	.625	.950	.938	.750	.667	.429	.809	.250	.750	.250	1.000	.927

Accurate Counts
978-664-2565

File Name : 10568002
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Start Date : 8/21/2009
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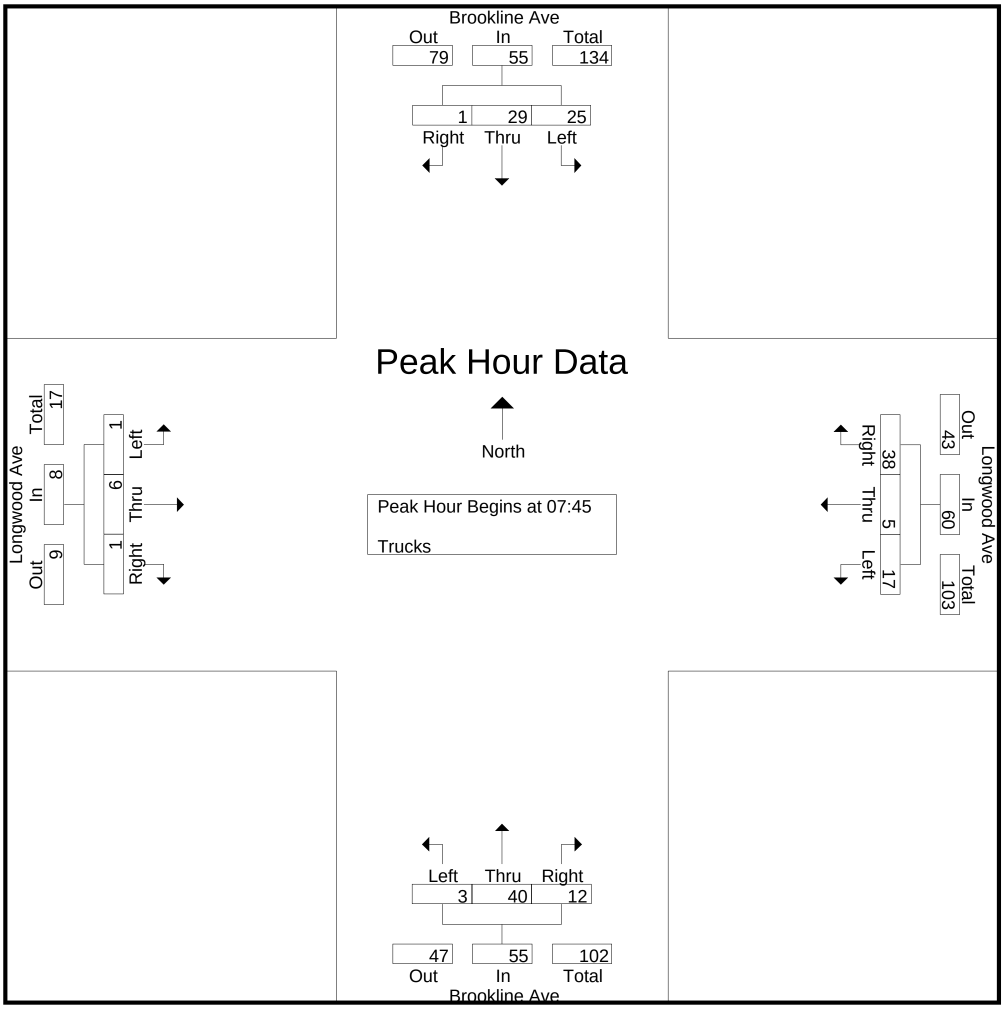
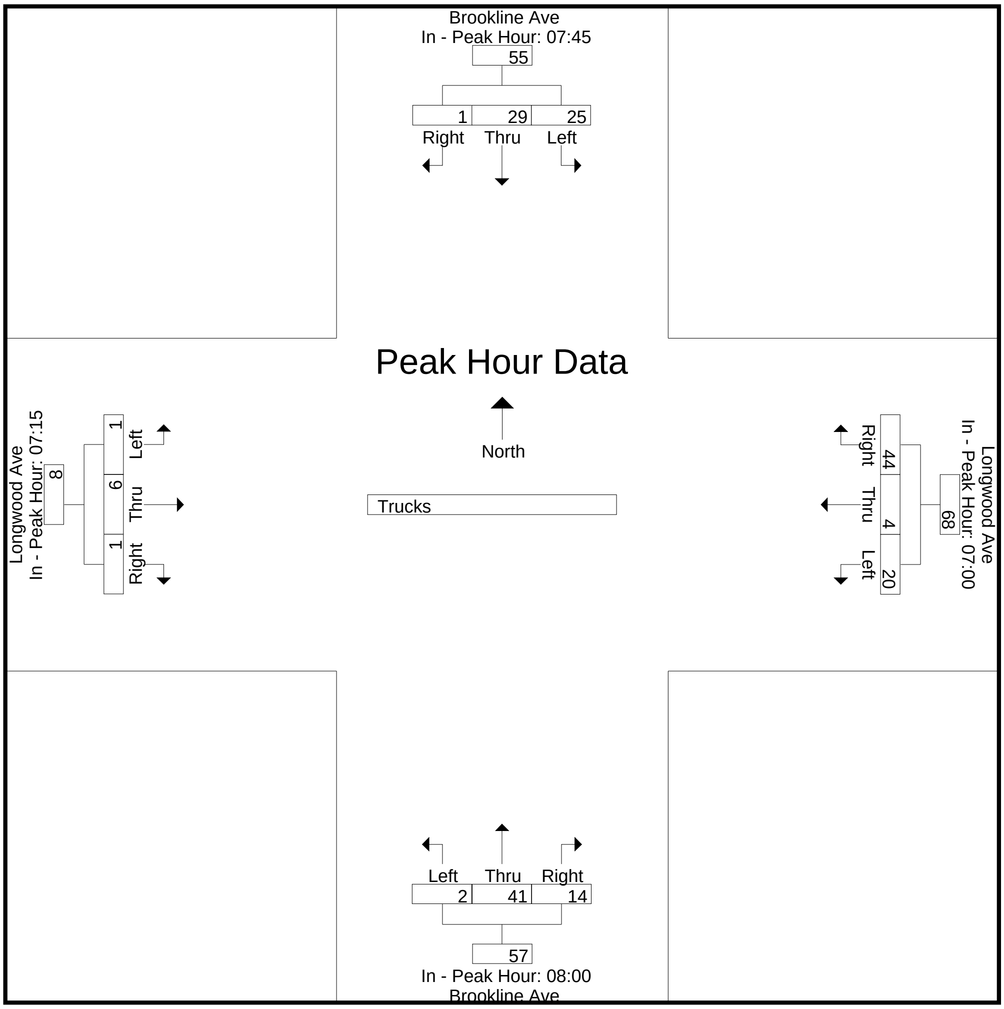


Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:45				07:00				08:00				07:15			
+0 mins.	6	8	1	15	5	3	10	18	0	15	0	15	0	2	0	2
+15 mins.	5	6	0	11	5	0	15	20	1	8	5	14	0	2	0	2
+30 mins.	7	8	0	15	5	1	9	15	1	9	7	17	1	1	0	2
+45 mins.	7	7	0	14	5	0	10	15	0	9	2	11	0	1	1	2
Total Volume	25	29	1	55	20	4	44	68	2	41	14	57	1	6	1	8
% App. Total	45.5	52.7	1.8		29.4	5.9	64.7		3.5	71.9	24.6		12.5	75	12.5	
PHF	.893	.906	.250	.917	1.000	.333	.733	.850	.500	.683	.500	.838	.250	.750	.250	1.000

File Name : 10568002
Site Code : 10568002
Start Date : 8/21/2009
Page No : 3



Accurate Counts
978-664-2565

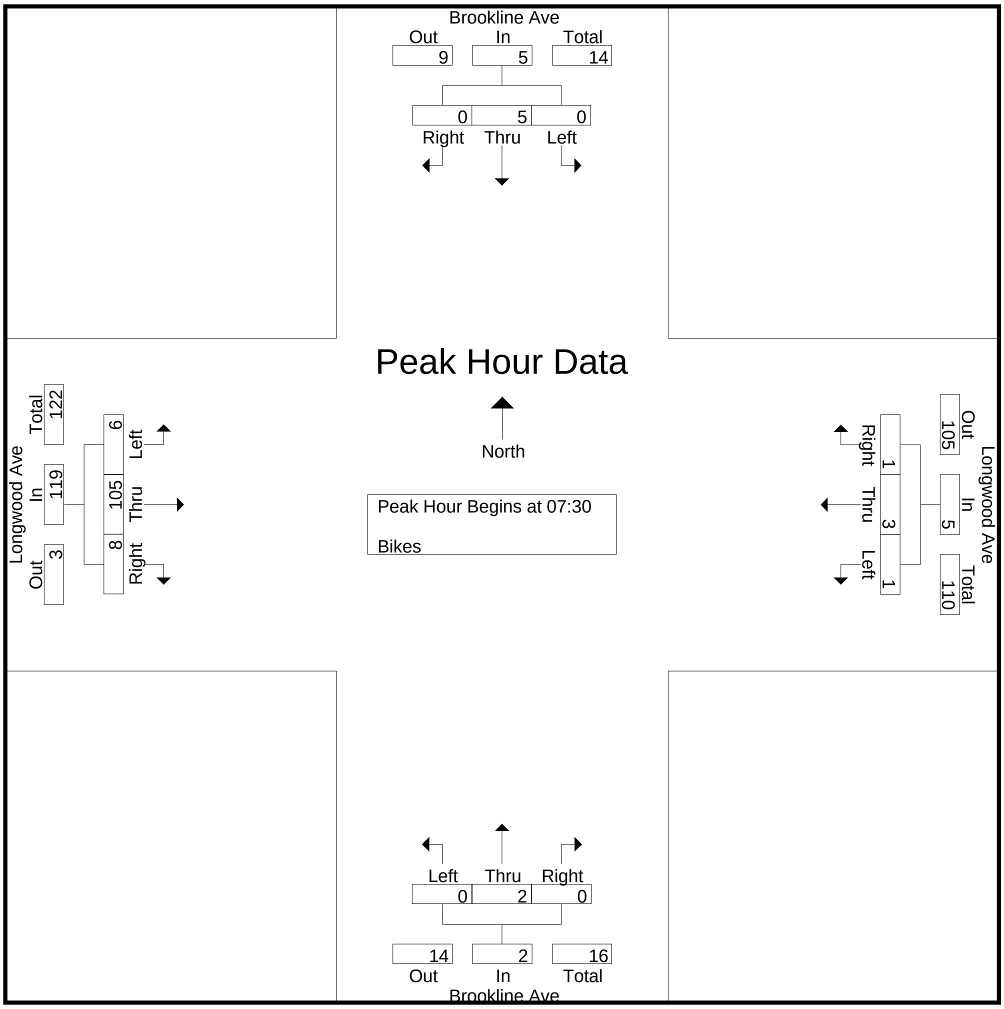
N/S Street : Brookline Avenue
E/W Street: Longwood Avenue
City/State : Boston, MA
Weather : Clear

File Name : 10568002
Site Code : 10568002
Start Date : 8/21/2009
Page No : 1

Groups Printed- Bikes

	Brookline Ave From North			Longwood Ave From East			Brookline Ave From South			Longwood Ave From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
07:00	0	1	0	0	1	0	0	1	0	1	6	0	10
07:15	0	3	0	0	2	1	1	4	0	1	16	1	29
07:30	0	0	0	0	0	0	0	0	0	0	12	0	12
07:45	0	0	0	0	0	0	0	0	0	3	36	2	41
Total	0	4	0	0	3	1	1	5	0	5	70	3	92
08:00	0	2	0	0	1	1	0	1	0	3	32	1	41
08:15	0	3	0	1	2	0	0	1	0	0	25	5	37
08:30	0	0	0	0	0	0	0	0	0	0	0	0	0
08:45	2	1	0	0	2	0	0	0	0	3	17	1	26
Total	2	6	0	1	5	1	0	2	0	6	74	7	104
Grand Total	2	10	0	1	8	2	1	7	0	11	144	10	196
Apprch %	16.7	83.3	0	9.1	72.7	18.2	12.5	87.5	0	6.7	87.3	6.1	
Total %	1	5.1	0	0.5	4.1	1	0.5	3.6	0	5.6	73.5	5.1	

	Brookline Ave From North				Longwood Ave From East				Brookline Ave From South				Longwood Ave From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:30																	
07:30	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	12	12
07:45	0	0	0	0	0	0	0	0	0	0	0	0	3	36	2	41	41
08:00	0	2	0	2	0	1	1	2	0	1	0	1	3	32	1	36	41
08:15	0	3	0	3	1	2	0	3	0	1	0	1	0	25	5	30	37
Total Volume	0	5	0	5	1	3	1	5	0	2	0	2	6	105	8	119	131
% App. Total	0	100	0		20	60	20		0	100	0		5	88.2	6.7		
PHF	.000	.417	.000	.417	.250	.375	.250	.417	.000	.500	.000	.500	.500	.729	.400	.726	.799



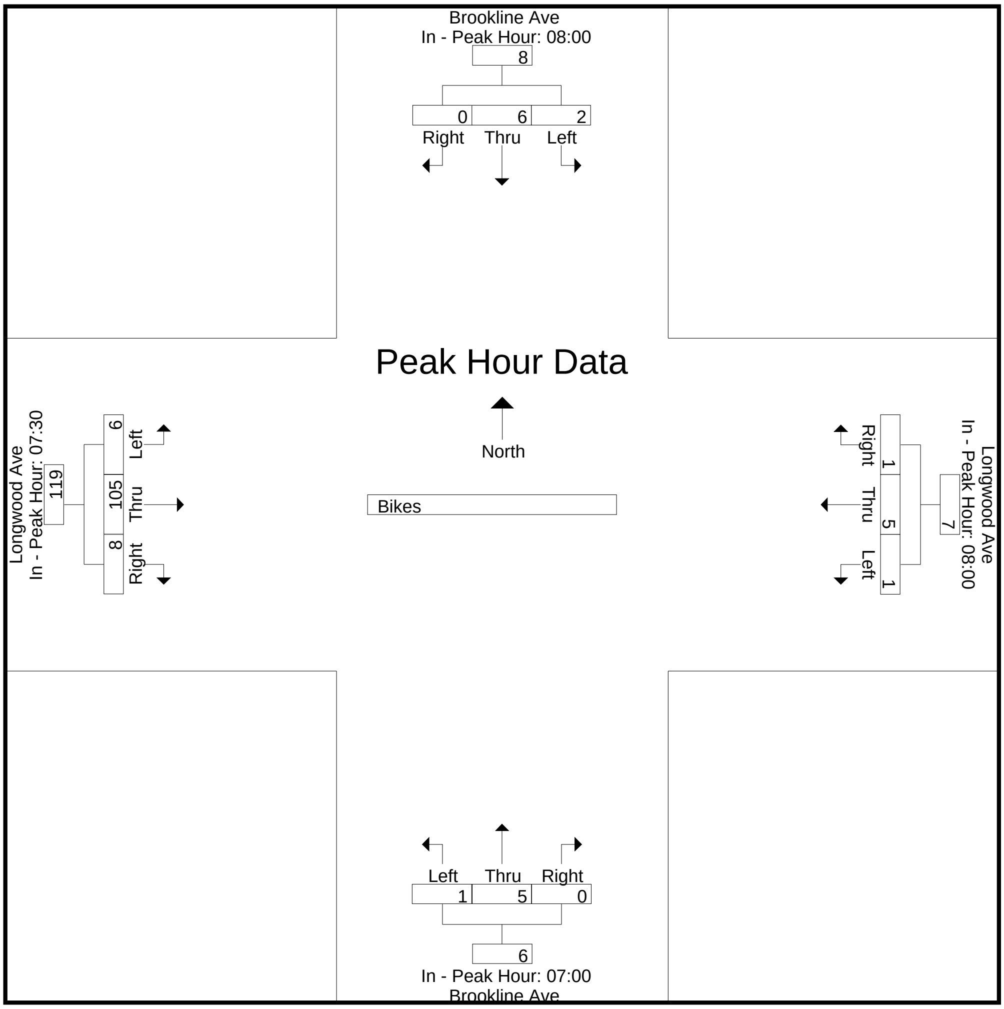
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1

Peak Hour for Each Approach Begins at:

	08:00				08:00				07:00				07:30			
+0 mins.	0	2	0	2	0	1	1	2	0	1	0	1	0	12	0	12
+15 mins.	0	3	0	3	1	2	0	3	1	4	0	5	3	36	2	41
+30 mins.	0	0	0	0	0	0	0	0	0	0	0	0	3	32	1	36
+45 mins.	2	1	0	3	0	2	0	2	0	0	0	0	0	25	5	30
Total Volume	2	6	0	8	1	5	1	7	1	5	0	6	6	105	8	119
% App. Total	25	75	0		14.3	71.4	14.3		16.7	83.3	0		5	88.2	6.7	
PHF	.250	.500	.000	.667	.250	.625	.250	.583	.250	.313	.000	.300	.500	.729	.400	.726

Accurate Counts
978-664-2565

File Name : 10568002
Site Code : 10568002
Start Date : 8/21/2009
Page No : 3



Accurate Counts
978-664-2565

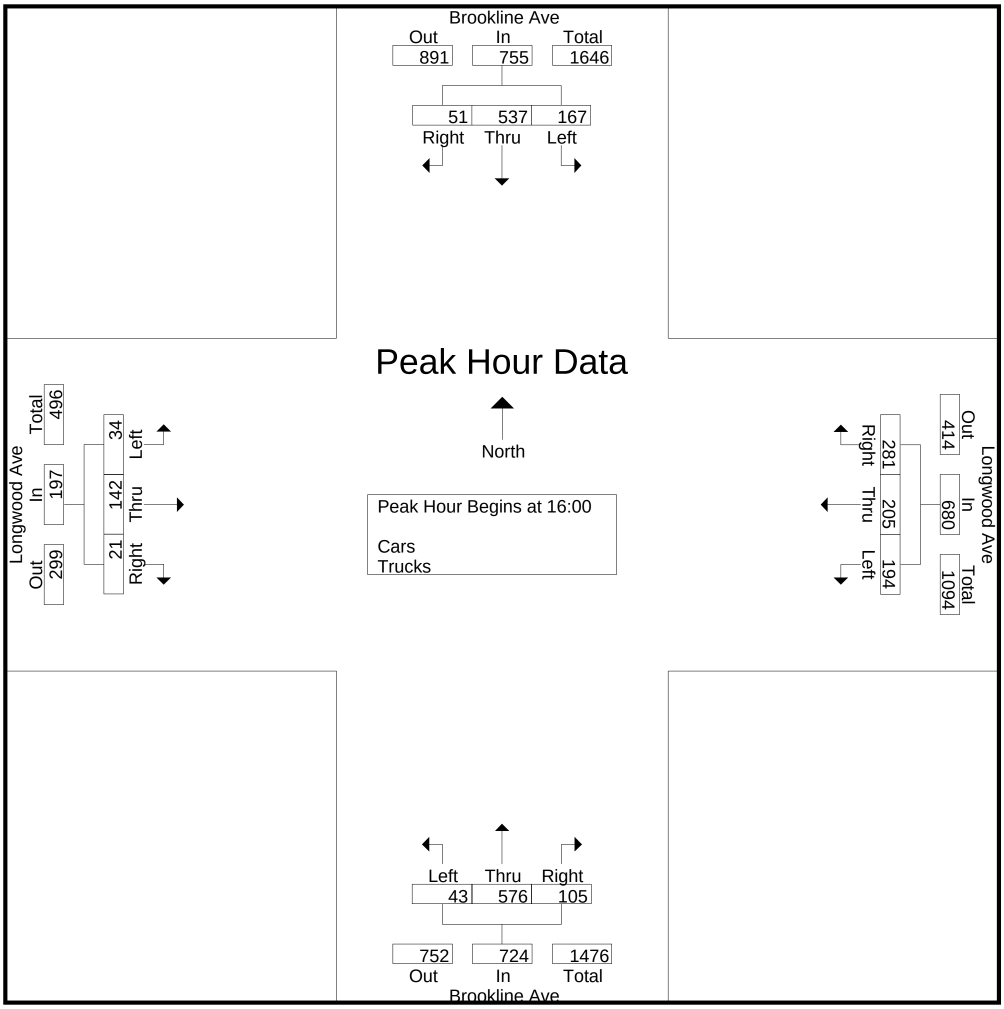
N/S Street : Brookline Avenue
E/W Street: Longwood Avenue
City/State : Boston, MA
Weather : Clear

File Name : 10568002
Site Code : 10568002
Start Date : 8/21/2009
Page No : 1

Groups Printed- Cars - Trucks

	Brookline Ave From North				Longwood Ave From East				Brookline Ave From South				Longwood Ave From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	42	147	11	113	49	44	70	37	9	138	29	79	11	40	7	39	268	597	865
16:15	41	113	16	88	59	57	73	39	13	151	28	99	12	32	3	45	271	598	869
16:30	47	130	10	102	45	58	73	53	14	147	18	125	3	42	5	48	328	592	920
16:45	37	147	14	96	41	46	65	16	7	140	30	106	8	28	6	55	273	569	842
Total	167	537	51	399	194	205	281	145	43	576	105	409	34	142	21	187	1140	2356	3496
17:00	46	123	8	108	62	46	67	49	17	128	14	177	9	32	9	71	405	561	966
17:15	42	160	14	141	49	57	51	31	17	141	20	98	12	31	4	39	309	598	907
17:30	46	119	14	112	49	51	69	46	15	124	17	111	16	31	10	66	335	561	896
17:45	27	135	22	106	50	52	64	19	10	152	23	120	7	31	7	50	295	580	875
Total	161	537	58	467	210	206	251	145	59	545	74	506	44	125	30	226	1344	2300	3644
Grand Total	328	1074	109	866	404	411	532	290	102	1121	179	915	78	267	51	413	2484	4656	7140
Apprch %	21.7	71.1	7.2		30	30.5	39.5		7.3	80	12.8		19.7	67.4	12.9				
Total %	7	23.1	2.3		8.7	8.8	11.4		2.2	24.1	3.8		1.7	5.7	1.1		34.8	65.2	
Cars	301	1025	98		378	388	471		101	1085	168		77	258	50		0	0	6884
% Cars	91.8	95.4	89.9	100	93.6	94.4	88.5	100	99	96.8	93.9	100	98.7	96.6	98	100	0	0	96.4
Trucks	27	49	11		26	23	61		1	36	11		1	9	1		0	0	256
% Trucks	8.2	4.6	10.1	0	6.4	5.6	11.5	0	1	3.2	6.1	0	1.3	3.4	2	0	0	0	3.6

	Brookline Ave From North				Longwood Ave From East				Brookline Ave From South				Longwood Ave From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 16:00																	
16:00	42	147	11	200	49	44	70	163	9	138	29	176	11	40	7	58	597
16:15	41	113	16	170	59	57	73	189	13	151	28	192	12	32	3	47	598
16:30	47	130	10	187	45	58	73	176	14	147	18	179	3	42	5	50	592
16:45	37	147	14	198	41	46	65	152	7	140	30	177	8	28	6	42	569
Total Volume	167	537	51	755	194	205	281	680	43	576	105	724	34	142	21	197	2356
% App. Total	22.1	71.1	6.8		28.5	30.1	41.3		5.9	79.6	14.5		17.3	72.1	10.7		
PHF	.888	.913	.797	.944	.822	.884	.962	.899	.768	.954	.875	.943	.708	.845	.750	.849	.985

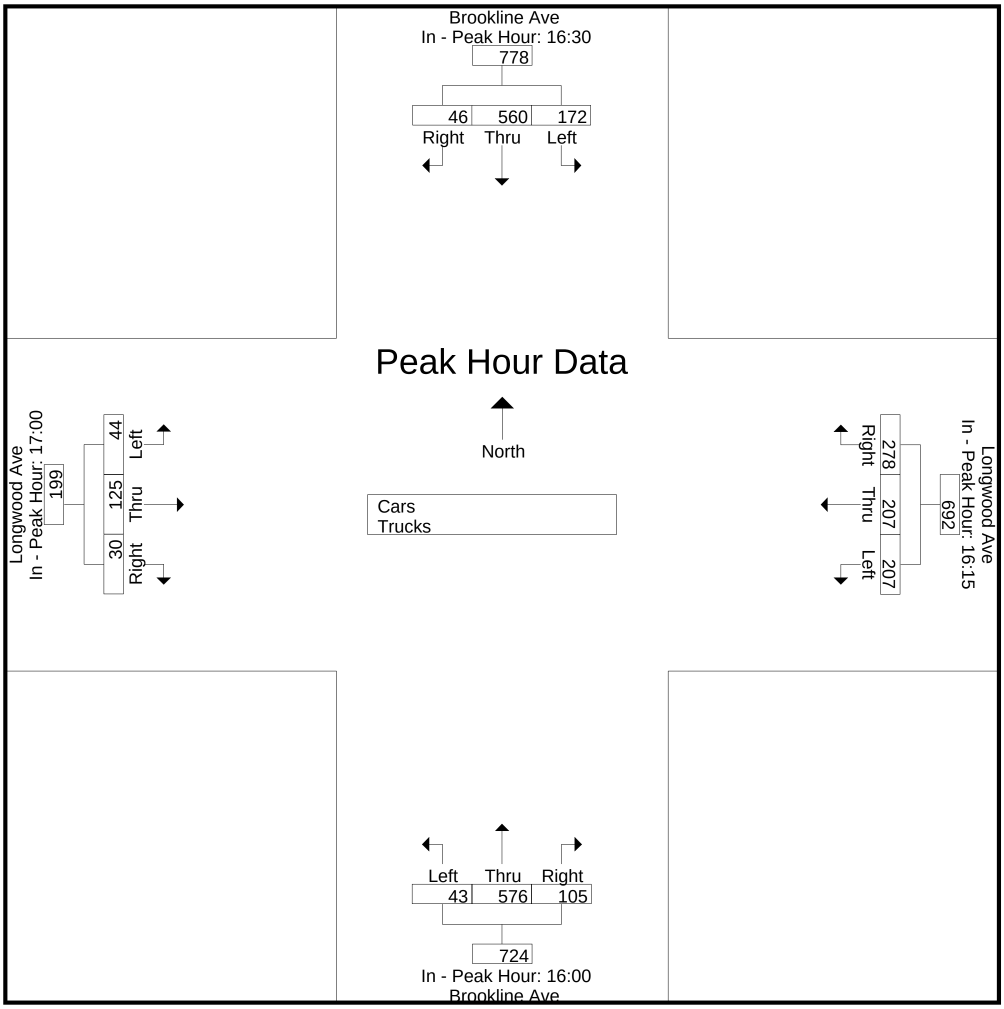


Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:30				16:15				16:00				17:00			
+0 mins.	47	130	10	187	59	57	73	189	9	138	29	176	9	32	9	50
+15 mins.	37	147	14	198	45	58	73	176	13	151	28	192	12	31	4	47
+30 mins.	46	123	8	177	41	46	65	152	14	147	18	179	16	31	10	57
+45 mins.	42	160	14	216	62	46	67	175	7	140	30	177	7	31	7	45
Total Volume	172	560	46	778	207	207	278	692	43	576	105	724	44	125	30	199
% App. Total	22.1	72	5.9		29.9	29.9	40.2		5.9	79.6	14.5		22.1	62.8	15.1	
PHF	.915	.875	.821	.900	.835	.892	.952	.915	.768	.954	.875	.943	.688	.977	.750	.873

Accurate Counts
978-664-2565

File Name : 10568002
Site Code : 10568002
Start Date : 8/21/2009
Page No : 3



Accurate Counts
978-664-2565

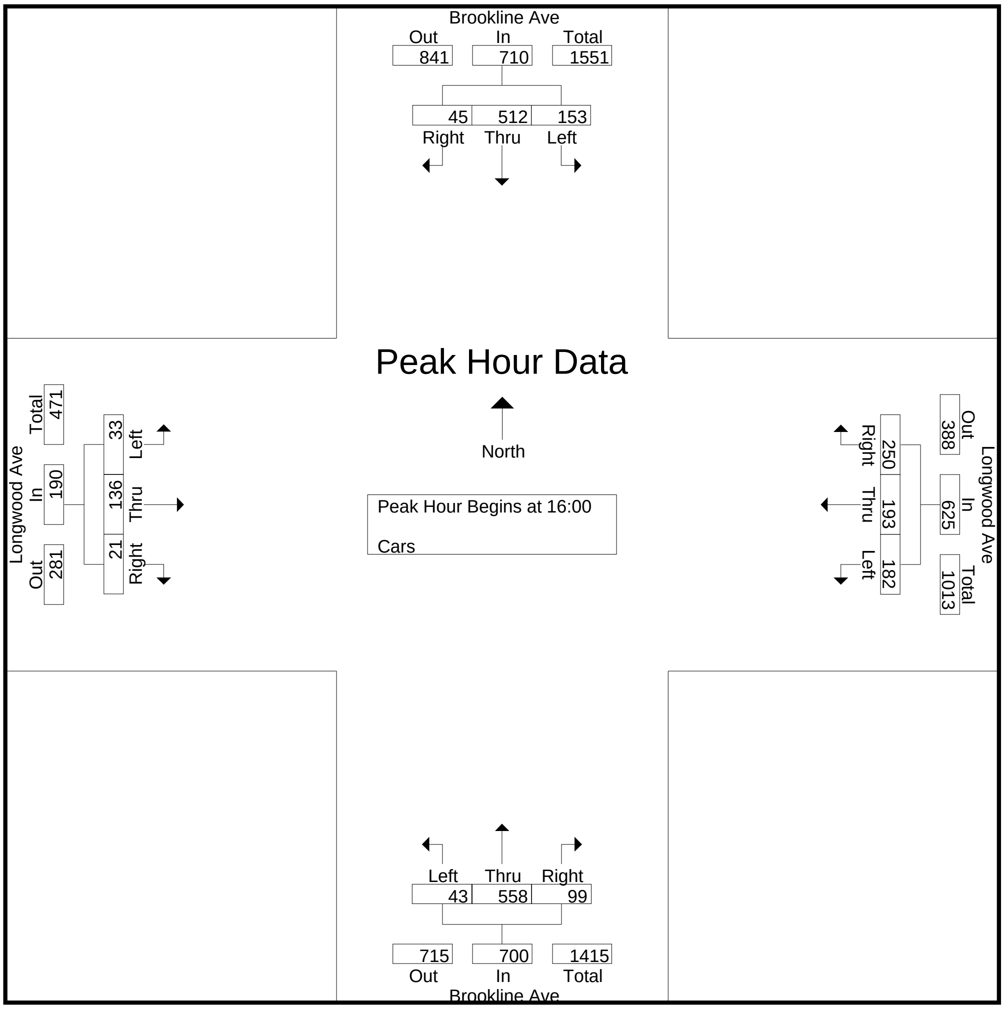
N/S Street : Brookline Avenue
E/W Street: Longwood Avenue
City/State : Boston, MA
Weather : Clear

File Name : 10568002
Site Code : 10568002
Start Date : 8/21/2009
Page No : 1

Groups Printed- Cars

	Brookline Ave From North				Longwood Ave From East				Brookline Ave From South				Longwood Ave From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	37	141	9	113	46	41	59	37	9	133	28	79	11	39	7	39	268	560	828
16:15	38	108	13	88	55	53	67	39	13	148	25	99	11	30	3	45	271	564	835
16:30	45	126	10	102	42	55	65	53	14	142	17	125	3	40	5	48	328	564	892
16:45	33	137	13	96	39	44	59	16	7	135	29	106	8	27	6	55	273	537	810
Total	153	512	45	399	182	193	250	145	43	558	99	409	33	136	21	187	1140	2225	3365
17:00	45	116	7	108	59	44	59	49	17	123	13	177	9	31	9	71	405	532	937
17:15	37	155	12	141	47	52	46	31	17	137	18	98	12	30	4	39	309	567	876
17:30	41	115	14	112	45	49	61	46	14	120	17	111	16	31	9	66	335	532	867
17:45	25	127	20	106	45	50	55	19	10	147	21	120	7	30	7	50	295	544	839
Total	148	513	53	467	196	195	221	145	58	527	69	506	44	122	29	226	1344	2175	3519
Grand Total	301	1025	98	866	378	388	471	290	101	1085	168	915	77	258	50	413	2484	4400	6884
Apprch %	21.1	72	6.9		30.6	31.4	38.1		7.5	80.1	12.4		20	67	13				
Total %	6.8	23.3	2.2		8.6	8.8	10.7		2.3	24.7	3.8		1.8	5.9	1.1		36.1	63.9	

	Brookline Ave From North				Longwood Ave From East				Brookline Ave From South				Longwood Ave From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 16:00																	
16:00	37	141	9	187	46	41	59	146	9	133	28	170	11	39	7	57	560
16:15	38	108	13	159	55	53	67	175	13	148	25	186	11	30	3	44	564
16:30	45	126	10	181	42	55	65	162	14	142	17	173	3	40	5	48	564
16:45	33	137	13	183	39	44	59	142	7	135	29	171	8	27	6	41	537
Total Volume	153	512	45	710	182	193	250	625	43	558	99	700	33	136	21	190	2225
% App. Total	21.5	72.1	6.3		29.1	30.9	40		6.1	79.7	14.1		17.4	71.6	11.1		
PHF	.850	.908	.865	.949	.827	.877	.933	.893	.768	.943	.853	.941	.750	.850	.750	.833	.986

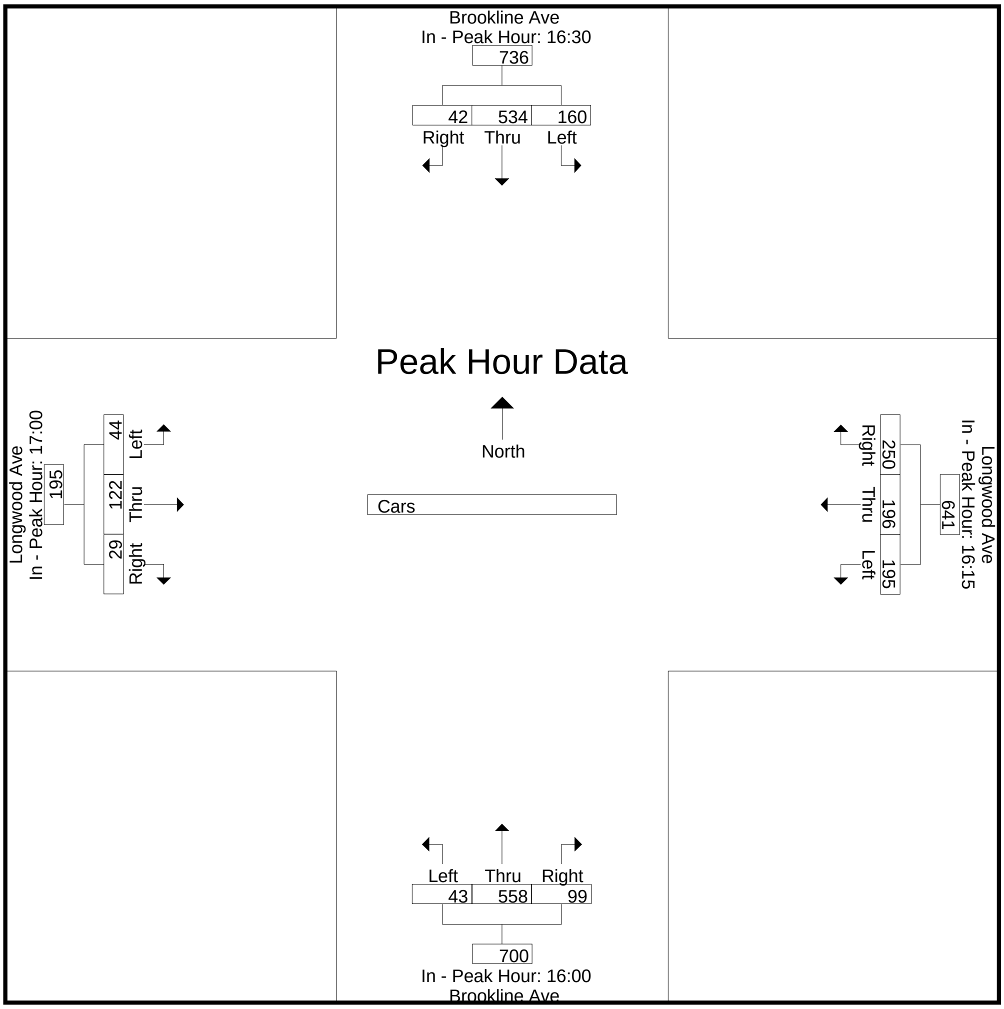


Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:30				16:15				16:00				17:00			
+0 mins.	45	126	10	181	55	53	67	175	9	133	28	170	9	31	9	49
+15 mins.	33	137	13	183	42	55	65	162	13	148	25	186	12	30	4	46
+30 mins.	45	116	7	168	39	44	59	142	14	142	17	173	16	31	9	56
+45 mins.	37	155	12	204	59	44	59	162	7	135	29	171	7	30	7	44
Total Volume	160	534	42	736	195	196	250	641	43	558	99	700	44	122	29	195
% App. Total	21.7	72.6	5.7		30.4	30.6	39		6.1	79.7	14.1		22.6	62.6	14.9	
PHF	.889	.861	.808	.902	.826	.891	.933	.916	.768	.943	.853	.941	.688	.984	.806	.871

Accurate Counts
978-664-2565

File Name : 10568002
Site Code : 10568002
Start Date : 8/21/2009
Page No : 3



Accurate Counts
978-664-2565

N/S Street : Brookline Avenue
E/W Street: Longwood Avenue
City/State : Boston, MA
Weather : Clear

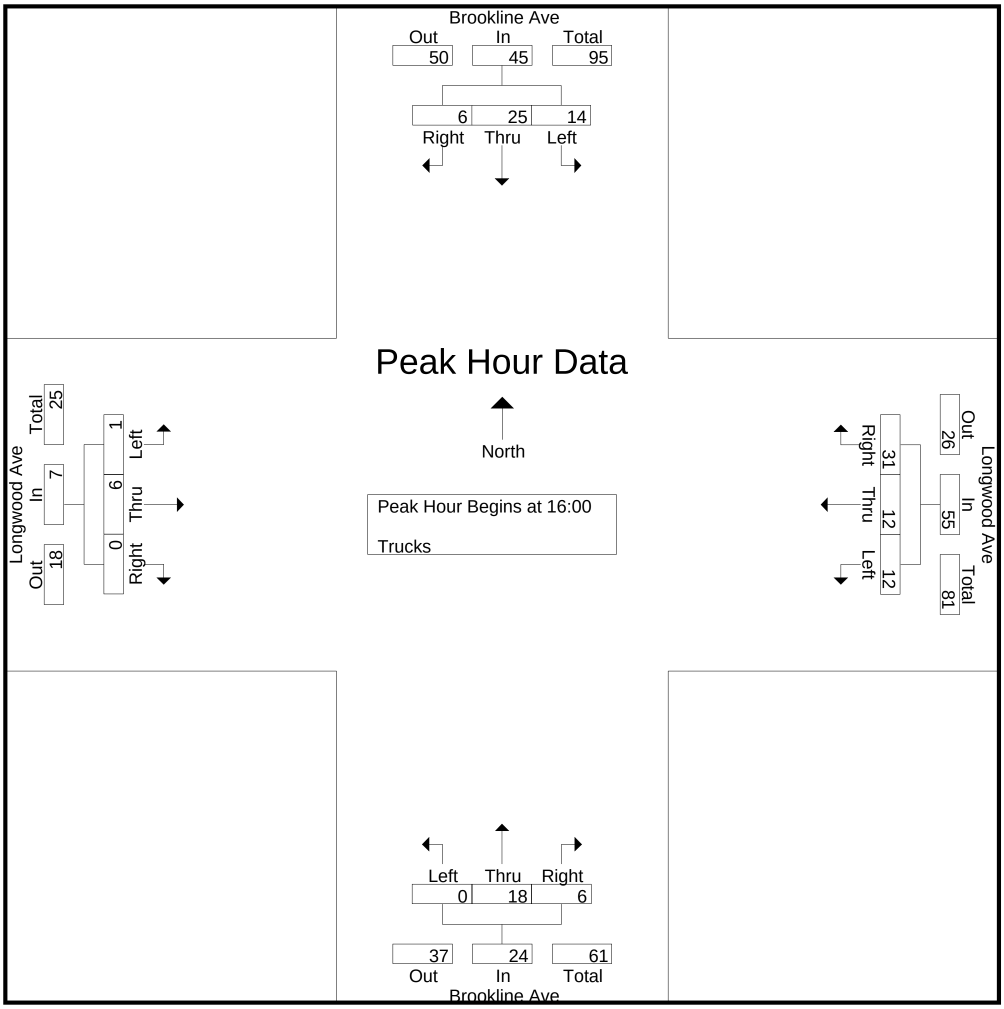
File Name : 10568002
Site Code : 10568002
Start Date : 8/21/2009
Page No : 1

Groups Printed- Trucks

	Brookline Ave From North				Longwood Ave From East				Brookline Ave From South				Longwood Ave From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	5	6	2	0	3	3	11	0	0	5	1	0	0	1	0	0	0	37	37
16:15	3	5	3	0	4	4	6	0	0	3	3	0	1	2	0	0	0	34	34
16:30	2	4	0	0	3	3	8	0	0	5	1	0	0	2	0	0	0	28	28
16:45	4	10	1	0	2	2	6	0	0	5	1	0	0	1	0	0	0	32	32
Total	14	25	6	0	12	12	31	0	0	18	6	0	1	6	0	0	0	131	131
17:00	1	7	1	0	3	2	8	0	0	5	1	0	0	1	0	0	0	29	29
17:15	5	5	2	0	2	5	5	0	0	4	2	0	0	1	0	0	0	31	31
17:30	5	4	0	0	4	2	8	0	1	4	0	0	0	0	1	0	0	29	29
17:45	2	8	2	0	5	2	9	0	0	5	2	0	0	1	0	0	0	36	36
Total	13	24	5	0	14	11	30	0	1	18	5	0	0	3	1	0	0	125	125
Grand Total	27	49	11	0	26	23	61	0	1	36	11	0	1	9	1	0	0	256	256
Apprch %	31	56.3	12.6		23.6	20.9	55.5		2.1	75	22.9		9.1	81.8	9.1				
Total %	10.5	19.1	4.3		10.2	9	23.8		0.4	14.1	4.3		0.4	3.5	0.4		0	100	

	Brookline Ave From North				Longwood Ave From East				Brookline Ave From South				Longwood Ave From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 16:00																	
16:00	5	6	2	13	3	3	11	17	0	5	1	6	0	1	0	1	37
16:15	3	5	3	11	4	4	6	14	0	3	3	6	1	2	0	3	34
16:30	2	4	0	6	3	3	8	14	0	5	1	6	0	2	0	2	28
16:45	4	10	1	15	2	2	6	10	0	5	1	6	0	1	0	1	32
Total Volume	14	25	6	45	12	12	31	55	0	18	6	24	1	6	0	7	131
% App. Total	31.1	55.6	13.3		21.8	21.8	56.4		0	75	25		14.3	85.7	0		
PHF	.700	.625	.500	.750	.750	.750	.705	.809	.000	.900	.500	1.000	.250	.750	.000	.583	.885

File Name : 10568002
Site Code : 10568002
Start Date : 8/21/2009
Page No : 2

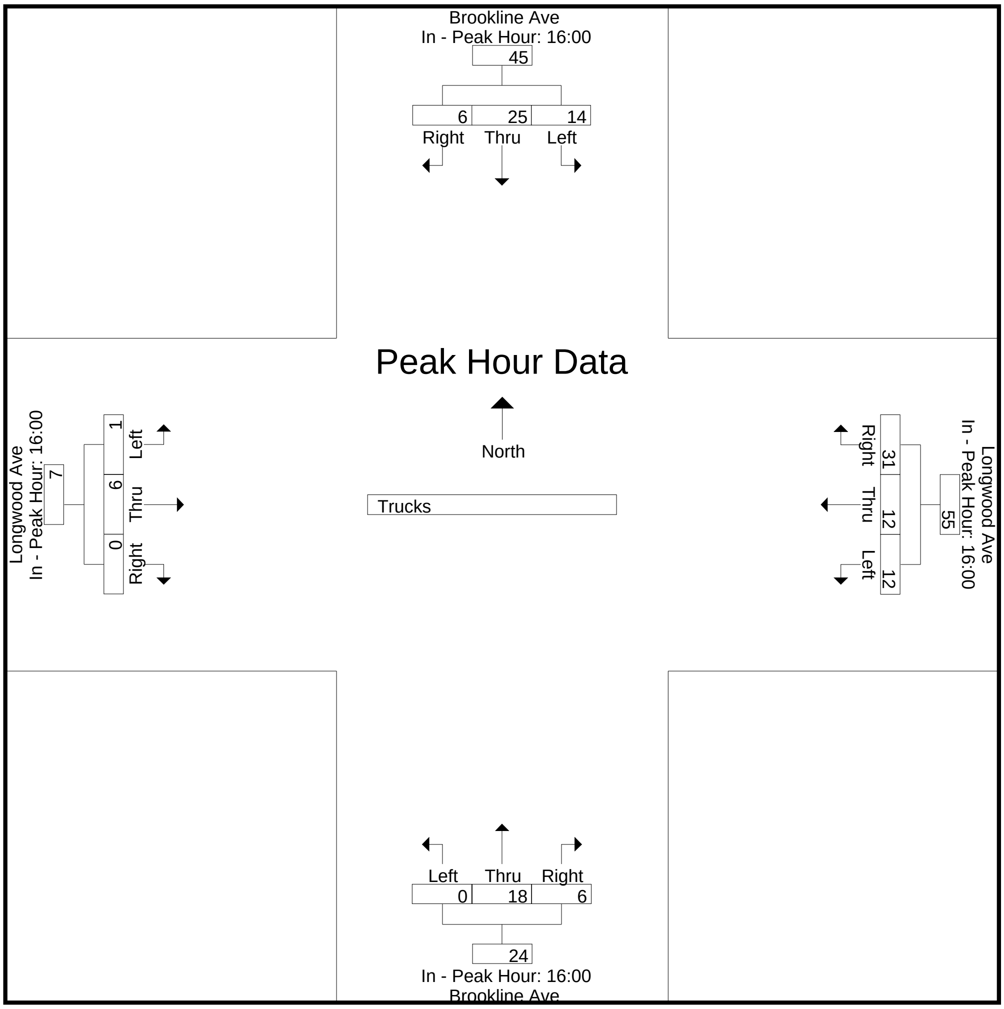


Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:00				16:00				16:00				16:00			
+0 mins.	5	6	2	13	3	3	11	17	0	5	1	6	0	1	0	1
+15 mins.	3	5	3	11	4	4	6	14	0	3	3	6	1	2	0	3
+30 mins.	2	4	0	6	3	3	8	14	0	5	1	6	0	2	0	2
+45 mins.	4	10	1	15	2	2	6	10	0	5	1	6	0	1	0	1
Total Volume	14	25	6	45	12	12	31	55	0	18	6	24	1	6	0	7
% App. Total	31.1	55.6	13.3		21.8	21.8	56.4		0	75	25		14.3	85.7	0	
PHF	.700	.625	.500	.750	.750	.750	.705	.809	.000	.900	.500	1.000	.250	.750	.000	.583

Accurate Counts
978-664-2565

File Name : 10568002
Site Code : 10568002
Start Date : 8/21/2009
Page No : 3



N/S Street : Brookline Avenue
E/W Street: Longwood Avenue
City/State : Boston, MA
Weather : Clear

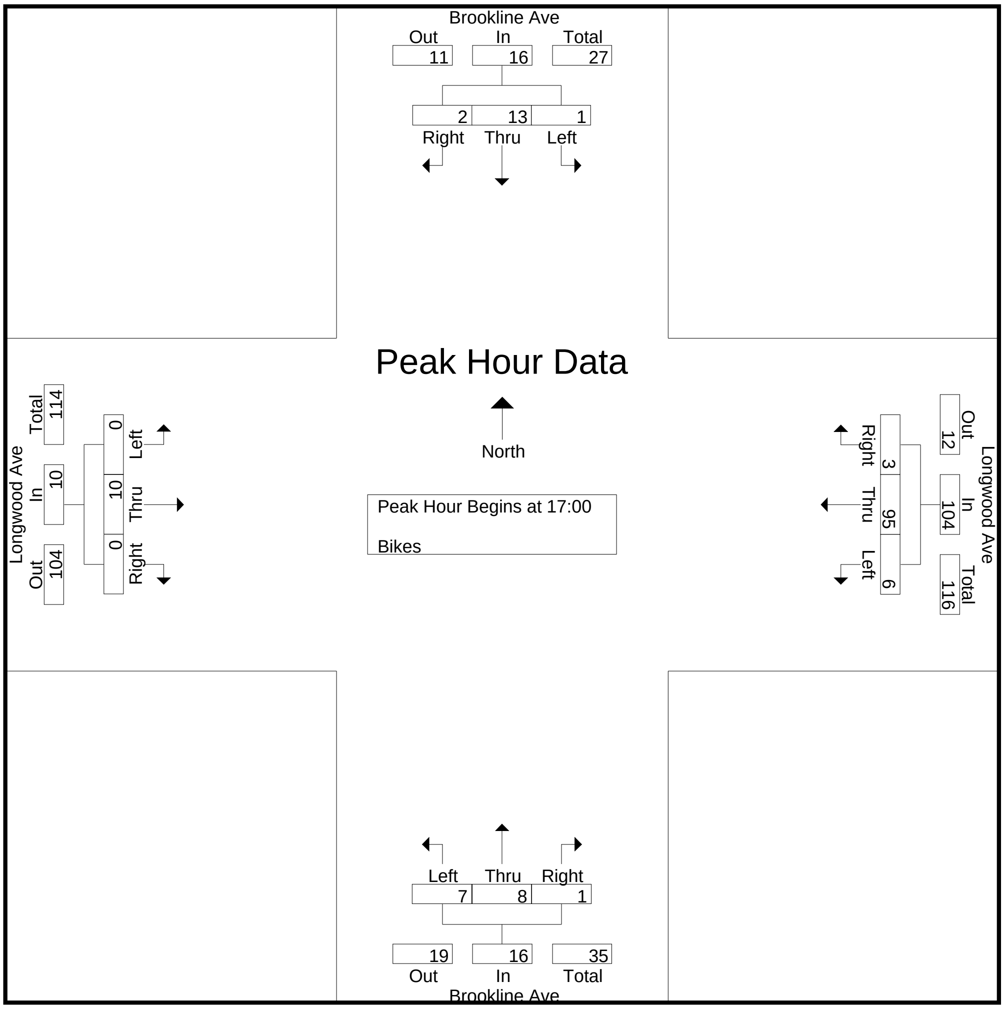
File Name : 10568002
Site Code : 10568002
Start Date : 8/21/2009

Groups Printed- Bikes

	Brookline Ave From North			Longwood Ave From East			Brookline Ave From South			Longwood Ave From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
16:00	0	1	1	1	4	0	0	0	0	0	3	0	10
16:15	0	3	0	0	12	0	1	1	0	0	2	0	19
16:30	0	4	1	0	14	0	1	1	0	0	3	0	24
16:45	0	1	0	2	7	1	2	4	0	0	0	0	17
Total	0	9	2	3	37	1	4	6	0	0	8	0	70
17:00	0	4	0	2	18	1	4	1	1	0	1	0	32
17:15	1	3	2	2	28	1	2	2	0	0	2	0	43
17:30	0	3	0	1	25	1	1	3	0	0	6	0	40
17:45	0	3	0	1	24	0	0	2	0	0	1	0	31
Total	1	13	2	6	95	3	7	8	1	0	10	0	146
Grand Total	1	22	4	9	132	4	11	14	1	0	18	0	216
Apprch %	3.7	81.5	14.8	6.2	91	2.8	42.3	53.8	3.8	0	100	0	
Total %	0.5	10.2	1.9	4.2	61.1	1.9	5.1	6.5	0.5	0	8.3	0	

	Brookline Ave From North				Longwood Ave From East				Brookline Ave From South				Longwood Ave From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 17:00																	
17:00	0	4	0	4	2	18	1	21	4	1	1	6	0	1	0	1	32
17:15	1	3	2	6	2	28	1	31	2	2	0	4	0	2	0	2	43
17:30	0	3	0	3	1	25	1	27	1	3	0	4	0	6	0	6	40
17:45	0	3	0	3	1	24	0	25	0	2	0	2	0	1	0	1	31
Total Volume	1	13	2	16	6	95	3	104	7	8	1	16	0	10	0	10	146
% App. Total	6.2	81.2	12.5		5.8	91.3	2.9		43.8	50	6.2		0	100	0		
PHF	.250	.813	.250	.667	.750	.848	.750	.839	.438	.667	.250	.667	.000	.417	.000	.417	.849

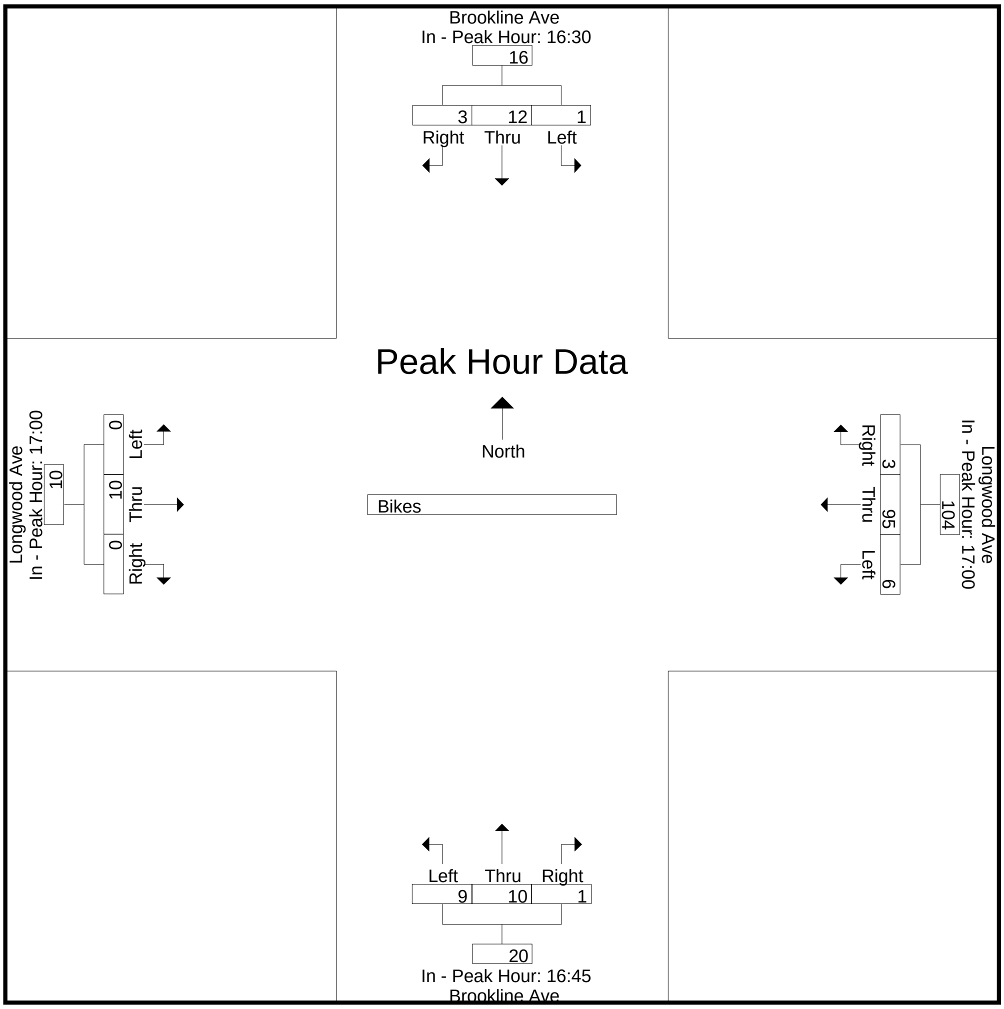
File Name : 10568002
Site Code : 10568002
Start Date : 8/21/2009



Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:30				17:00				16:45				17:00			
+0 mins.	0	4	1	5	2	18	1	21	2	4	0	6	0	1	0	1
+15 mins.	0	1	0	1	2	28	1	31	4	1	1	6	0	2	0	2
+30 mins.	0	4	0	4	1	25	1	27	2	2	0	4	0	6	0	6
+45 mins.	1	3	2	6	1	24	0	25	1	3	0	4	0	1	0	1
Total Volume	1	12	3	16	6	95	3	104	9	10	1	20	0	10	0	10
% App. Total	6.2	75	18.8		5.8	91.3	2.9		45	50	5		0	100	0	
PHF	.250	.750	.375	.667	.750	.848	.750	.839	.563	.625	.250	.833	.000	.417	.000	.417

File Name : 10568002
Site Code : 10568002
Start Date : 8/21/2009
Page No : 3



Accurate Counts
978-664-2565

N/S Street : Binney Street
E/W Street: Longwood Avenue
City/State : Boston, MA
Weather : Clear

File Name : 10568003
Site Code : 10568003
Start Date : 8/19/2009
Page No : 1

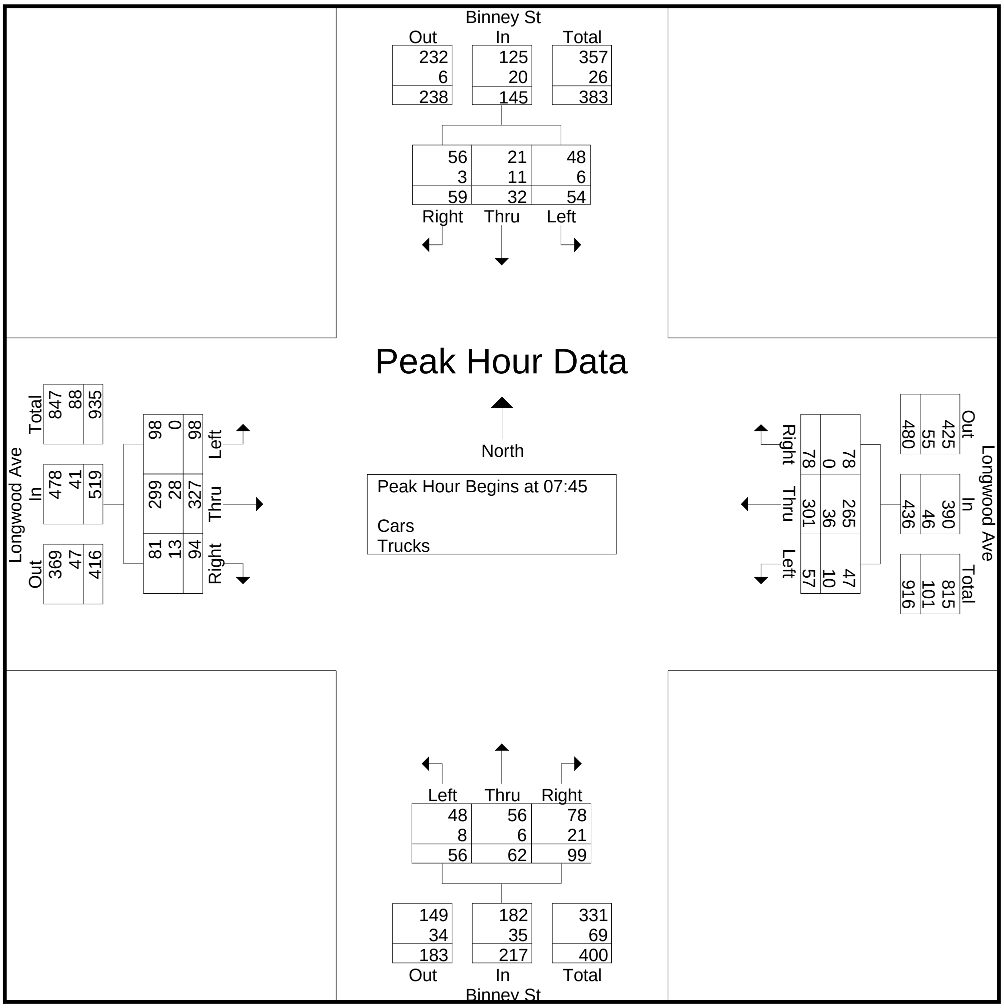
Groups Printed- Cars - Trucks

	Binney St From North				Longwood Ave From East				Binney St From South				Longwood Ave From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	16	5	10	50	12	61	12	14	12	13	30	45	20	69	26	13	122	286	408
07:15	14	8	18	70	8	63	9	44	12	5	20	60	19	55	25	11	185	256	441
07:30	14	10	20	54	17	83	10	50	17	6	17	70	25	81	16	18	192	316	508
07:45	14	11	16	82	9	81	17	38	20	13	25	88	27	94	22	12	220	349	569
Total	58	34	64	256	46	288	48	146	61	37	92	263	91	299	89	54	719	1207	1926
08:00	7	7	15	94	22	69	20	29	11	20	27	81	30	83	23	9	213	334	547
08:15	15	5	13	93	10	72	22	46	13	16	25	125	20	78	28	9	273	317	590
08:30	18	9	15	107	16	79	19	34	12	13	22	89	21	72	21	8	238	317	555
08:45	12	6	12	86	8	68	15	29	10	12	18	81	22	80	17	7	203	280	483
Total	52	27	55	380	56	288	76	138	46	61	92	376	93	313	89	33	927	1248	2175
Grand Total	110	61	119	636	102	576	124	284	107	98	184	639	184	612	178	87	1646	2455	4101
Apprch %	37.9	21	41		12.7	71.8	15.5		27.5	25.2	47.3		18.9	62.8	18.3				
Total %	4.5	2.5	4.8		4.2	23.5	5.1		4.4	4	7.5		7.5	24.9	7.3		40.1	59.9	
Cars	99	42	115		85	490	123		86	89	148		184	558	157		0	0	3822
% Cars	90	68.9	96.6	100	83.3	85.1	99.2	100	80.4	90.8	80.4	100	100	91.2	88.2	100	0	0	93.2
Trucks	11	19	4		17	86	1		21	9	36		0	54	21		0	0	279
% Trucks	10	31.1	3.4	0	16.7	14.9	0.8	0	19.6	9.2	19.6	0	0	8.8	11.8	0	0	0	6.8

	Binney St From North				Longwood Ave From East				Binney St From South				Longwood Ave From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:45																	
07:45	14	11	16	41	9	81	17	107	20	13	25	58	27	94	22	143	349
08:00	7	7	15	29	22	69	20	111	11	20	27	58	30	83	23	136	334
08:15	15	5	13	33	10	72	22	104	13	16	25	54	20	78	28	126	317
08:30	18	9	15	42	16	79	19	114	12	13	22	47	21	72	21	114	317
Total Volume	54	32	59	145	57	301	78	436	56	62	99	217	98	327	94	519	1317
% App. Total	37.2	22.1	40.7		13.1	69	17.9		25.8	28.6	45.6		18.9	63	18.1		
PHF	.750	.727	.922	.863	.648	.929	.886	.956	.700	.775	.917	.935	.817	.870	.839	.907	.943
Cars	48	21	56	125	47	265	78	390	48	56	78	182	98	299	81	478	1175
% Cars	88.9	65.6	94.9	86.2	82.5	88.0	100	89.4	85.7	90.3	78.8	83.9	100	91.4	86.2	92.1	89.2
Trucks	6	11	3	20	10	36	0	46	8	6	21	35	0	28	13	41	142
% Trucks	11.1	34.4	5.1	13.8	17.5	12.0	0	10.6	14.3	9.7	21.2	16.1	0	8.6	13.8	7.9	10.8

Accurate Counts
978-664-2565

File Name : 10568003
Site Code : 10568003
Start Date : 8/19/2009
Page No : 2

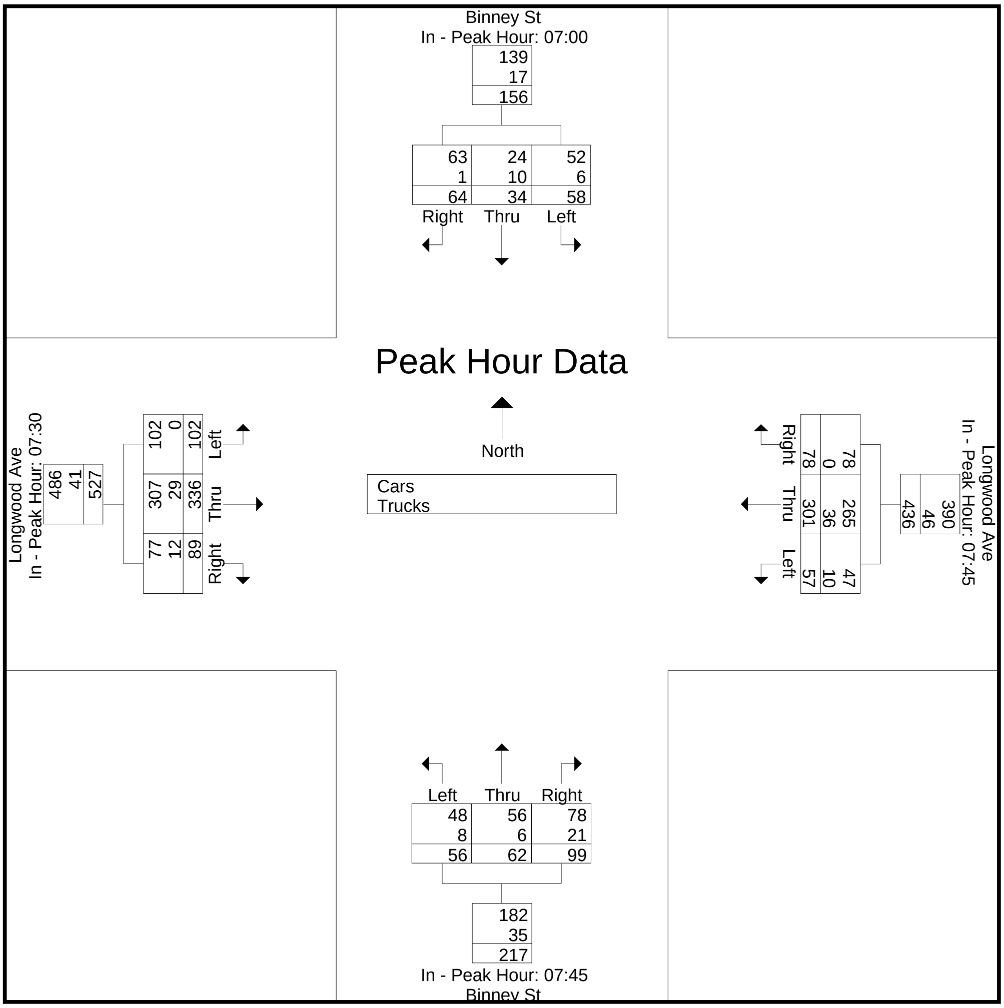


Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:00				07:45				07:45				07:30			
+0 mins.	16	5	10	31	9	81	17	107	20	13	25	58	25	81	16	122
+15 mins.	14	8	18	40	22	69	20	111	11	20	27	58	27	94	22	143
+30 mins.	14	10	20	44	10	72	22	104	13	16	25	54	30	83	23	136
+45 mins.	14	11	16	41	16	79	19	114	12	13	22	47	20	78	28	126
Total Volume	58	34	64	156	57	301	78	436	56	62	99	217	102	336	89	527
% App. Total	37.2	21.8	41		13.1	69	17.9		25.8	28.6	45.6		19.4	63.8	16.9	
PHF	.906	.773	.800	.886	.648	.929	.886	.956	.700	.775	.917	.935	.850	.894	.795	.921
Cars	52	24	63	139	47	265	78	390	48	56	78	182	102	307	77	486
% Cars	89.7	70.6	98.4	89.1	82.5	88	100	89.4	85.7	90.3	78.8	83.9	100	91.4	86.5	92.2
Trucks	6	10	1	17	10	36	0	46	8	6	21	35	0	29	12	41
% Trucks	10.3	29.4	1.6	10.9	17.5	12	0	10.6	14.3	9.7	21.2	16.1	0	8.6	13.5	7.8

Accurate Counts
978-664-2565

File Name : 10568003
Site Code : 10568003
Start Date : 8/19/2009
Page No : 3



Accurate Counts
978-664-2565

N/S Street : Binney Street
E/W Street: Longwood Avenue
City/State : Boston, MA
Weather : Clear

File Name : 10568003
Site Code : 10568003
Start Date : 8/19/2009
Page No : 1

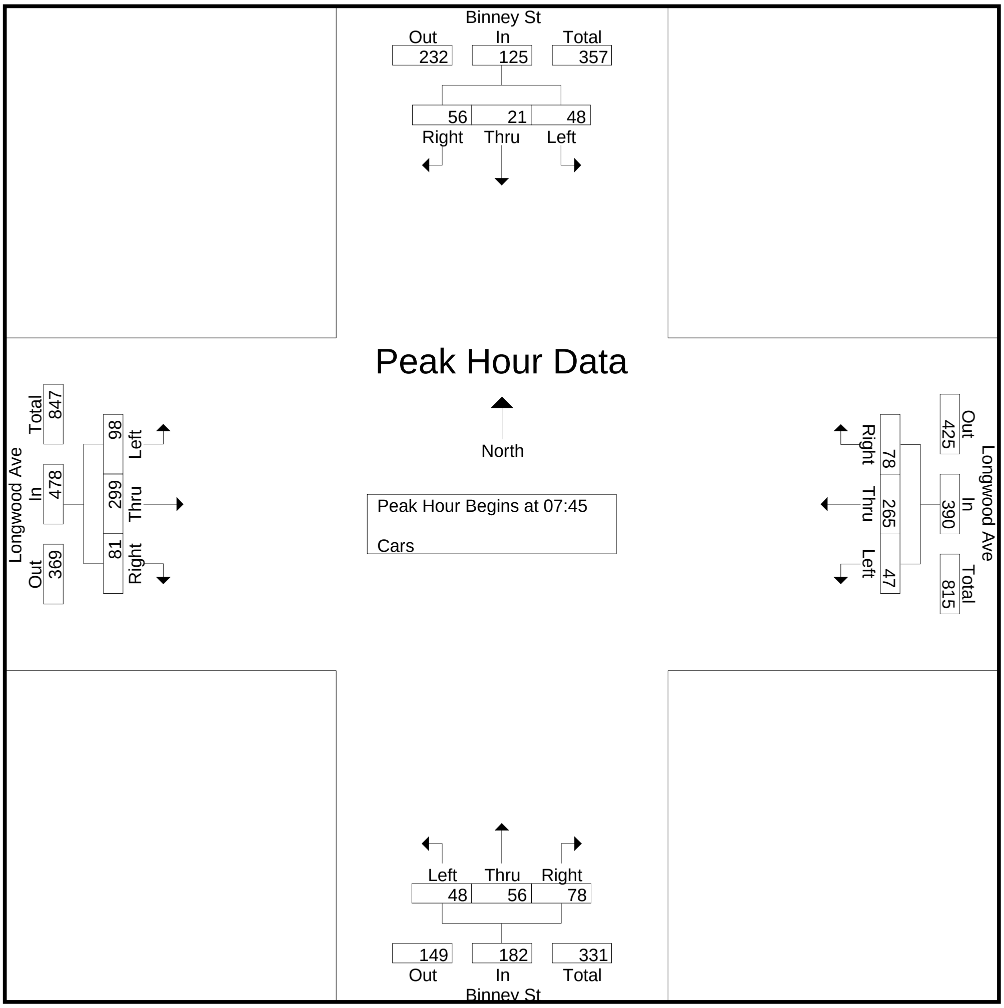
Groups Printed- Cars

	Binney St From North				Longwood Ave From East				Binney St From South				Longwood Ave From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	14	3	9	50	9	49	12	14	8	12	25	45	20	62	23	13	122	246	368
07:15	13	8	18	70	7	48	9	44	8	5	16	60	19	47	23	11	185	221	406
07:30	13	6	20	54	15	67	9	50	13	6	14	70	25	75	15	18	192	278	470
07:45	12	7	16	82	9	75	17	38	18	12	22	88	27	87	18	12	220	320	540
Total	52	24	63	256	40	239	47	146	47	35	77	263	91	271	79	54	719	1065	1784
08:00	6	5	15	94	15	59	20	29	8	18	23	81	30	74	21	9	213	294	507
08:15	13	3	11	93	8	63	22	46	11	14	15	125	20	71	23	9	273	274	547
08:30	17	6	14	107	15	68	19	34	11	12	18	89	21	67	19	8	238	287	525
08:45	11	4	12	86	7	61	15	29	9	10	15	81	22	75	15	7	203	256	459
Total	47	18	52	380	45	251	76	138	39	54	71	376	93	287	78	33	927	1111	2038
Grand Total	99	42	115	636	85	490	123	284	86	89	148	639	184	558	157	87	1646	2176	3822
Apprch %	38.7	16.4	44.9		12.2	70.2	17.6		26.6	27.6	45.8		20.5	62.1	17.5				
Total %	4.5	1.9	5.3		3.9	22.5	5.7		4	4.1	6.8		8.5	25.6	7.2		43.1	56.9	

	Binney St From North				Longwood Ave From East				Binney St From South				Longwood Ave From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:45																	
07:45	12	7	16	35	9	75	17	101	18	12	22	52	27	87	18	132	320
08:00	6	5	15	26	15	59	20	94	8	18	23	49	30	74	21	125	294
08:15	13	3	11	27	8	63	22	93	11	14	15	40	20	71	23	114	274
08:30	17	6	14	37	15	68	19	102	11	12	18	41	21	67	19	107	287
Total Volume	48	21	56	125	47	265	78	390	48	56	78	182	98	299	81	478	1175
% App. Total	38.4	16.8	44.8		12.1	67.9	20		26.4	30.8	42.9		20.5	62.6	16.9		
PHF	.706	.750	.875	.845	.783	.883	.886	.956	.667	.778	.848	.875	.817	.859	.880	.905	.918

Accurate Counts
978-664-2565

File Name : 10568003
Site Code : 10568003
Start Date : 8/19/2009
Page No : 2

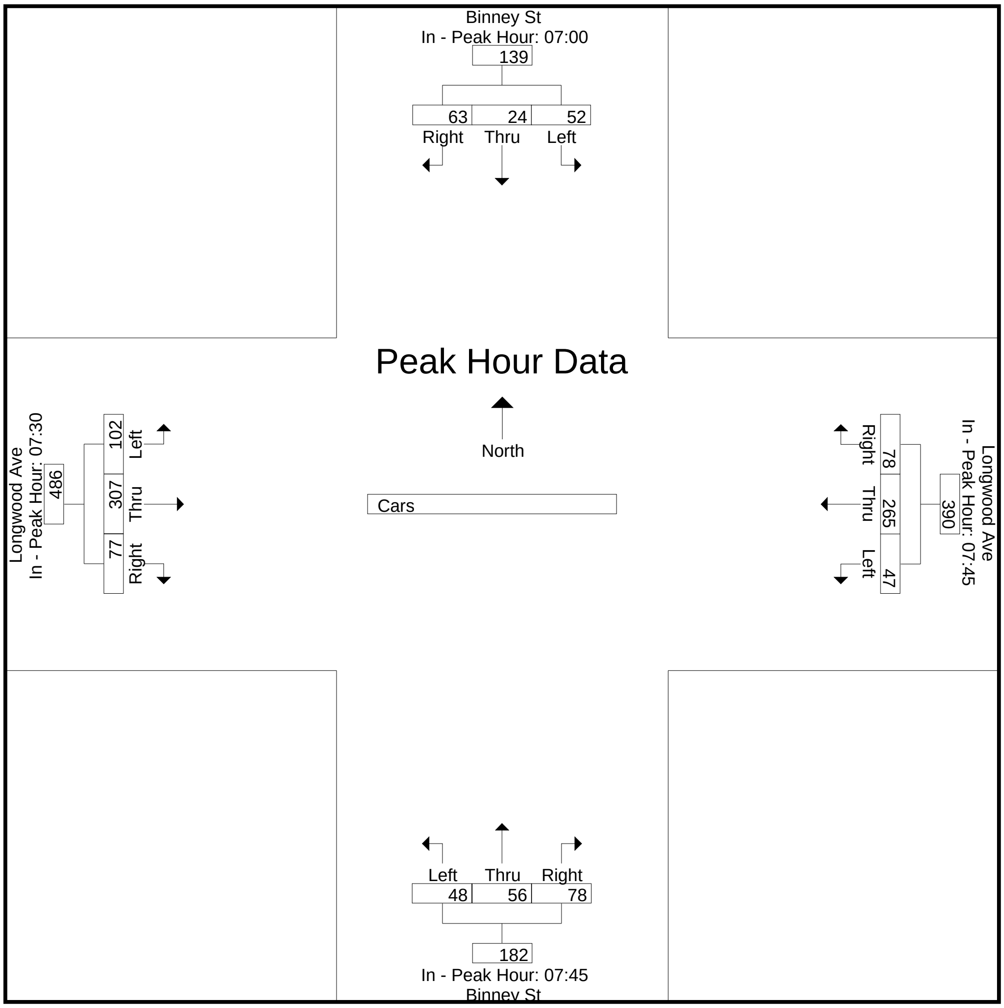


Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:00				07:45				07:45				07:30			
+0 mins.	14	3	9	26	9	75	17	101	18	12	22	52	25	75	15	115
+15 mins.	13	8	18	39	15	59	20	94	8	18	23	49	27	87	18	132
+30 mins.	13	6	20	39	8	63	22	93	11	14	15	40	30	74	21	125
+45 mins.	12	7	16	35	15	68	19	102	11	12	18	41	20	71	23	114
Total Volume	52	24	63	139	47	265	78	390	48	56	78	182	102	307	77	486
% App. Total	37.4	17.3	45.3		12.1	67.9	20		26.4	30.8	42.9		21	63.2	15.8	
PHF	.929	.750	.788	.891	.783	.883	.886	.956	.667	.778	.848	.875	.850	.882	.837	.920

Accurate Counts
978-664-2565

File Name : 10568003
Site Code : 10568003
Start Date : 8/19/2009
Page No : 3



Accurate Counts
978-664-2565

N/S Street : Binney Street
E/W Street: Longwood Avenue
City/State : Boston, MA
Weather : Clear

File Name : 10568003
Site Code : 10568003
Start Date : 8/19/2009
Page No : 1

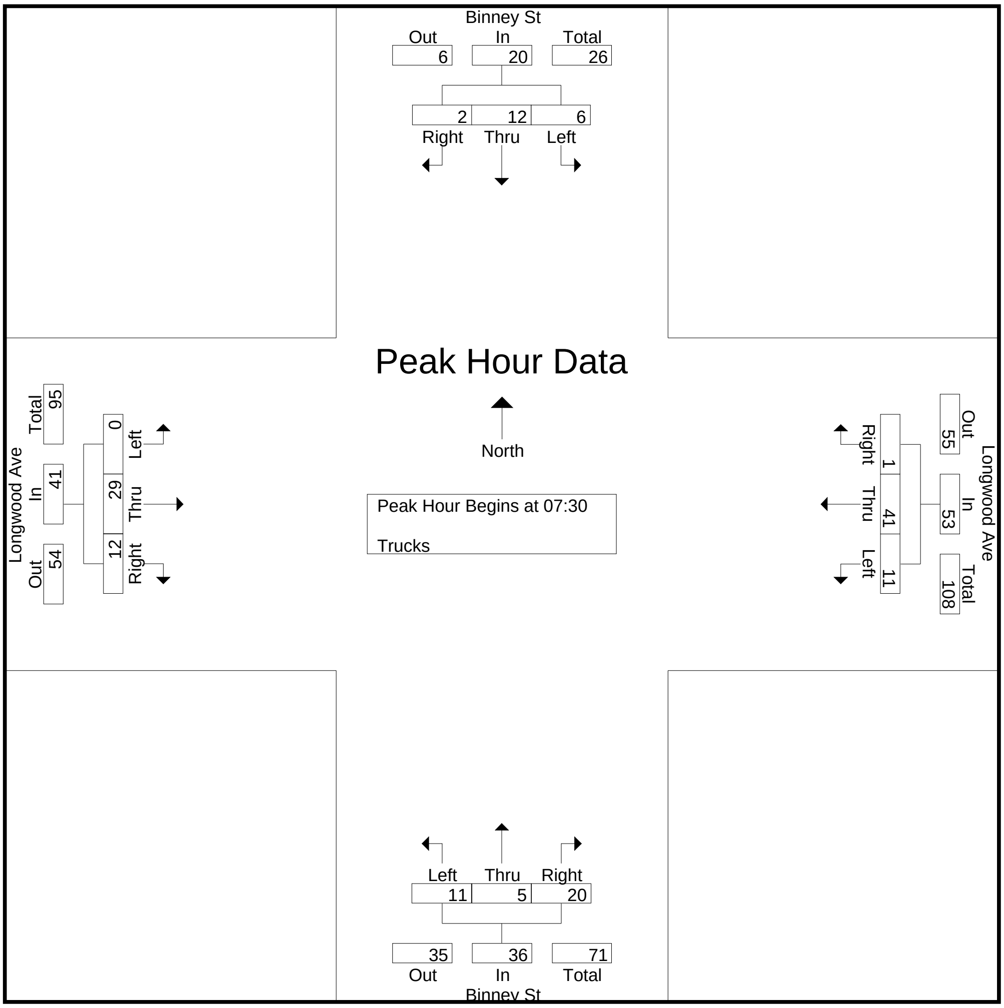
Groups Printed- Trucks

	Binney St From North				Longwood Ave From East				Binney St From South				Longwood Ave From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	2	2	1	0	3	12	0	0	4	1	5	0	0	7	3	0	0	40	40
07:15	1	0	0	0	1	15	0	0	4	0	4	0	0	8	2	0	0	35	35
07:30	1	4	0	0	2	16	1	0	4	0	3	0	0	6	1	0	0	38	38
07:45	2	4	0	0	0	6	0	0	2	1	3	0	0	7	4	0	0	29	29
Total	6	10	1	0	6	49	1	0	14	2	15	0	0	28	10	0	0	142	142
08:00	1	2	0	0	7	10	0	0	3	2	4	0	0	9	2	0	0	40	40
08:15	2	2	2	0	2	9	0	0	2	2	10	0	0	7	5	0	0	43	43
08:30	1	3	1	0	1	11	0	0	1	1	4	0	0	5	2	0	0	30	30
08:45	1	2	0	0	1	7	0	0	1	2	3	0	0	5	2	0	0	24	24
Total	5	9	3	0	11	37	0	0	7	7	21	0	0	26	11	0	0	137	137
Grand Total	11	19	4	0	17	86	1	0	21	9	36	0	0	54	21	0	0	279	279
Apprch %	32.4	55.9	11.8		16.3	82.7	1		31.8	13.6	54.5		0	72	28				
Total %	3.9	6.8	1.4		6.1	30.8	0.4		7.5	3.2	12.9		0	19.4	7.5		0	100	

	Binney St From North				Longwood Ave From East				Binney St From South				Longwood Ave From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:30																	
07:30	1	4	0	5	2	16	1	19	4	0	3	7	0	6	1	7	38
07:45	2	4	0	6	0	6	0	6	2	1	3	6	0	7	4	11	29
08:00	1	2	0	3	7	10	0	17	3	2	4	9	0	9	2	11	40
08:15	2	2	2	6	2	9	0	11	2	2	10	14	0	7	5	12	43
Total Volume	6	12	2	20	11	41	1	53	11	5	20	36	0	29	12	41	150
% App. Total	30	60	10		20.8	77.4	1.9		30.6	13.9	55.6		0	70.7	29.3		
PHF	.750	.750	.250	.833	.393	.641	.250	.697	.688	.625	.500	.643	.000	.806	.600	.854	.872

Accurate Counts
978-664-2565

File Name : 10568003
Site Code : 10568003
Start Date : 8/19/2009
Page No : 2

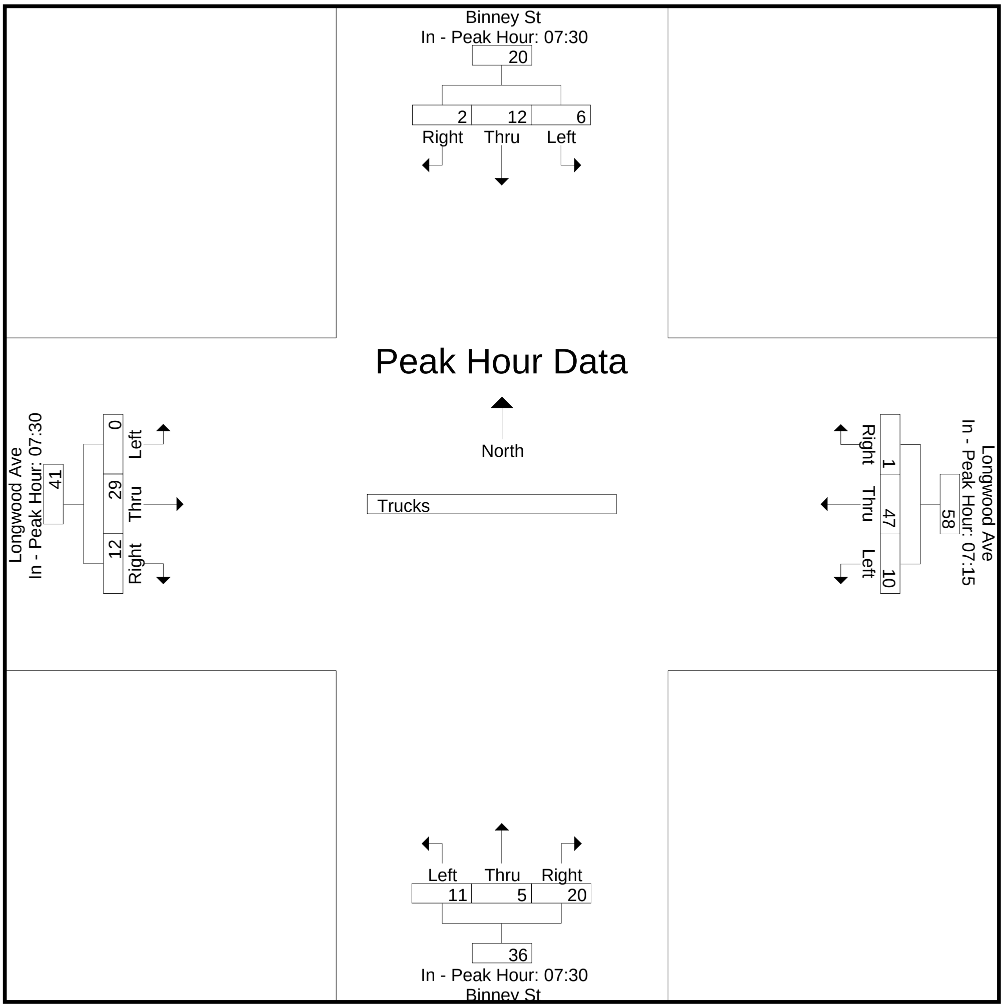


Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:30				07:15				07:30				07:30			
+0 mins.	1	4	0	5	1	15	0	16	4	0	3	7	0	6	1	7
+15 mins.	2	4	0	6	2	16	1	19	2	1	3	6	0	7	4	11
+30 mins.	1	2	0	3	0	6	0	6	3	2	4	9	0	9	2	11
+45 mins.	2	2	2	6	7	10	0	17	2	2	10	14	0	7	5	12
Total Volume	6	12	2	20	10	47	1	58	11	5	20	36	0	29	12	41
% App. Total	30	60	10		17.2	81	1.7		30.6	13.9	55.6		0	70.7	29.3	
PHF	.750	.750	.250	.833	.357	.734	.250	.763	.688	.625	.500	.643	.000	.806	.600	.854

Accurate Counts
978-664-2565

File Name : 10568003
Site Code : 10568003
Start Date : 8/19/2009
Page No : 3



Accurate Counts
978-664-2565

N/S Street : Binney Street
E/W Street: Longwood Avenue
City/State : Boston, MA
Weather : Clear

File Name : 10568003
Site Code : 10568003
Start Date : 8/19/2009
Page No : 1

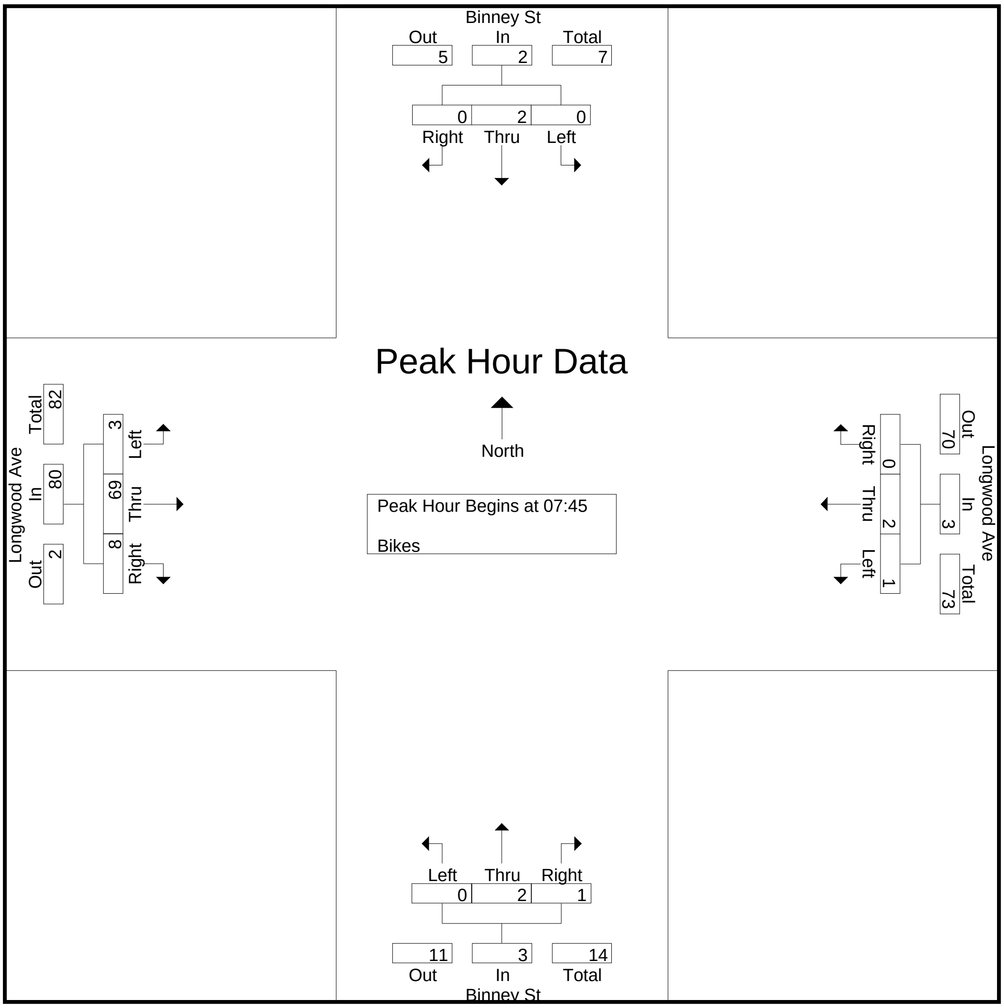
Groups Printed- Bikes

	Binney St From North			Longwood Ave From East			Binney St From South			Longwood Ave From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
07:00	0	1	0	0	2	0	0	1	0	1	4	2	11
07:15	0	0	0	0	2	1	1	0	0	1	6	4	15
07:30	0	0	0	0	0	0	0	0	0	0	13	0	13
07:45	0	0	0	0	2	0	0	0	1	1	13	3	20
Total	0	1	0	0	6	1	1	1	1	3	36	9	59
08:00	0	1	0	1	0	0	0	0	0	0	11	2	15
08:15	0	0	0	0	0	0	0	0	0	2	20	2	24
08:30	0	1	0	0	0	0	0	2	0	0	25	1	29
08:45	0	0	0	0	0	0	0	0	0	0	19	1	20
Total	0	2	0	1	0	0	0	2	0	2	75	6	88
Grand Total	0	3	0	1	6	1	1	3	1	5	111	15	147
Apprch %	0	100	0	12.5	75	12.5	20	60	20	3.8	84.7	11.5	
Total %	0	2	0	0.7	4.1	0.7	0.7	2	0.7	3.4	75.5	10.2	

	Binney St From North				Longwood Ave From East				Binney St From South				Longwood Ave From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:45																	
07:45	0	0	0	0	0	2	0	2	0	0	1	1	1	13	3	17	20
08:00	0	1	0	1	1	0	0	1	0	0	0	0	0	11	2	13	15
08:15	0	0	0	0	0	0	0	0	0	0	0	0	2	20	2	24	24
08:30	0	1	0	1	0	0	0	0	0	2	0	2	0	25	1	26	29
Total Volume	0	2	0	2	1	2	0	3	0	2	1	3	3	69	8	80	88
% App. Total	0	100	0		33.3	66.7	0		0	66.7	33.3		3.8	86.2	10		
PHF	.000	.500	.000	.500	.250	.250	.000	.375	.000	.250	.250	.375	.375	.690	.667	.769	.759

Accurate Counts
978-664-2565

File Name : 10568003
Site Code : 10568003
Start Date : 8/19/2009
Page No : 2

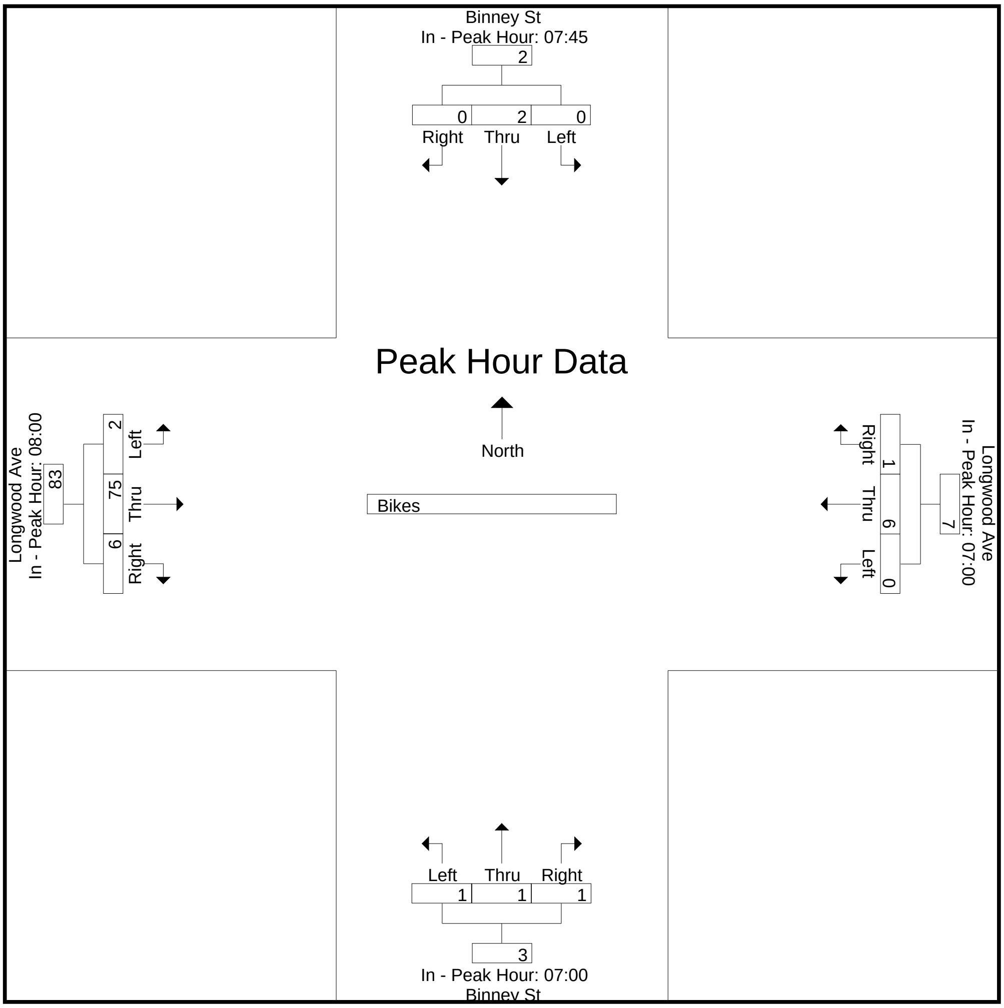


Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:45				07:00				07:00				08:00			
+0 mins.	0	0	0	0	0	2	0	2	0	1	0	1	0	11	2	13
+15 mins.	0	1	0	1	0	2	1	3	1	0	0	1	2	20	2	24
+30 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	25	1	26
+45 mins.	0	1	0	1	0	2	0	2	0	0	1	1	0	19	1	20
Total Volume	0	2	0	2	0	6	1	7	1	1	1	3	2	75	6	83
% App. Total	0	100	0		0	85.7	14.3		33.3	33.3	33.3		2.4	90.4	7.2	
PHF	.000	.500	.000	.500	.000	.750	.250	.583	.250	.250	.250	.750	.250	.750	.750	.798

Accurate Counts
978-664-2565

File Name : 10568003
Site Code : 10568003
Start Date : 8/19/2009
Page No : 3



Accurate Counts
978-664-2565

N/S Street : Binney Street
E/W Street: Longwood Avenue
City/State : Boston, MA
Weather : Clear

File Name : 10568003
Site Code : 10568003
Start Date : 8/19/2009
Page No : 1

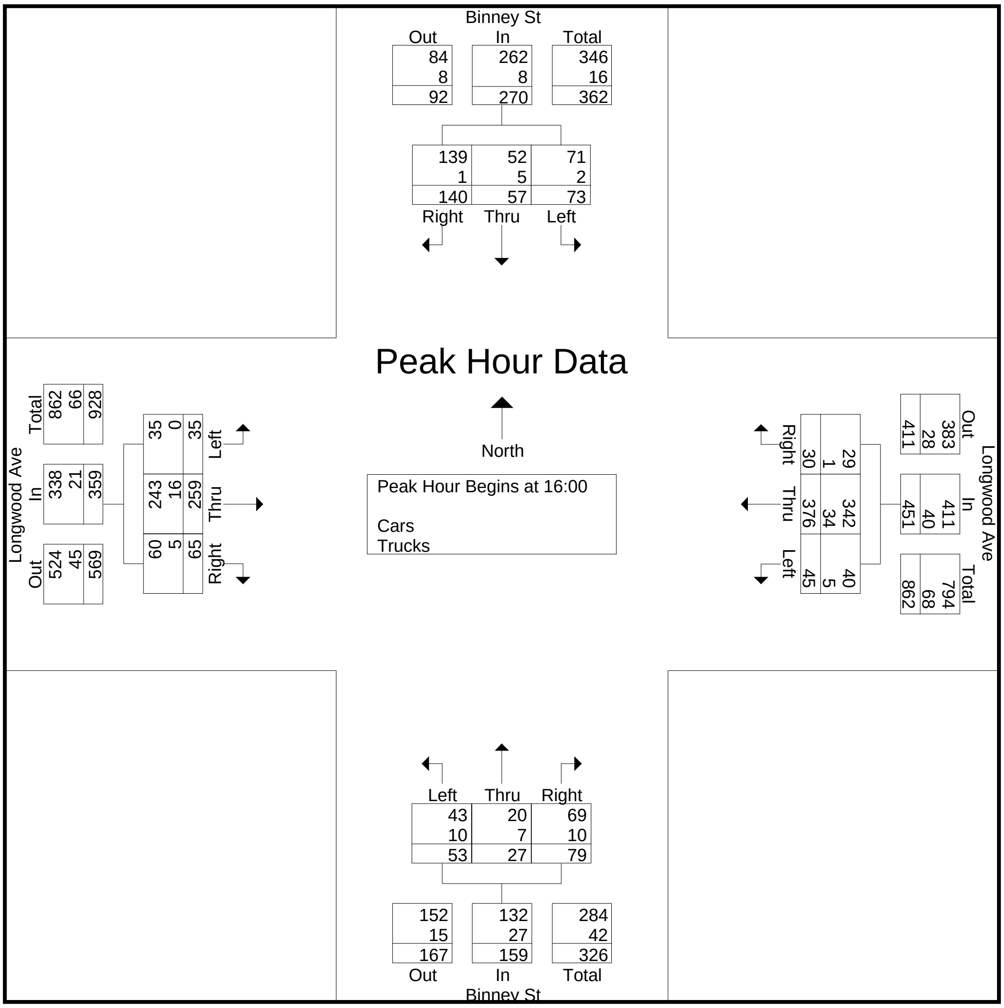
Groups Printed- Cars - Trucks

	Binney St From North				Longwood Ave From East				Binney St From South				Longwood Ave From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	16	16	37	83	6	103	9	50	17	10	17	81	10	85	15	18	232	341	573
16:15	23	14	36	95	13	85	10	29	14	6	29	85	11	57	16	14	223	314	537
16:30	19	13	36	105	14	84	8	41	13	9	11	82	8	56	18	27	255	289	544
16:45	15	14	31	91	12	104	3	32	9	2	22	104	6	61	16	11	238	295	533
Total	73	57	140	374	45	376	30	152	53	27	79	352	35	259	65	70	948	1239	2187
17:00	14	13	35	86	11	100	6	26	11	10	22	74	4	71	24	13	199	321	520
17:15	10	23	31	71	14	98	6	24	8	3	17	83	14	57	8	15	193	289	482
17:30	6	9	20	102	14	111	6	30	8	5	22	81	6	57	13	7	220	277	497
17:45	7	8	19	86	10	94	4	28	7	4	16	77	5	50	11	6	197	235	432
Total	37	53	105	345	49	403	22	108	34	22	77	315	29	235	56	41	809	1122	1931
Grand Total	110	110	245	719	94	779	52	260	87	49	156	667	64	494	121	111	1757	2361	4118
Apprch %	23.7	23.7	52.7		10.2	84.2	5.6		29.8	16.8	53.4		9.4	72.8	17.8				
Total %	4.7	4.7	10.4		4	33	2.2		3.7	2.1	6.6		2.7	20.9	5.1		42.7	57.3	
Cars	108	101	244		88	708	51		65	36	137		64	468	110		0	0	3937
% Cars	98.2	91.8	99.6	100	93.6	90.9	98.1	100	74.7	73.5	87.8	100	100	94.7	90.9	100	0	0	95.6
Trucks	2	9	1		6	71	1		22	13	19		0	26	11		0	0	181
% Trucks	1.8	8.2	0.4	0	6.4	9.1	1.9	0	25.3	26.5	12.2	0	0	5.3	9.1	0	0	0	4.4

	Binney St From North				Longwood Ave From East				Binney St From South				Longwood Ave From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 16:00																	
16:00	16	16	37	69	6	103	9	118	17	10	17	44	10	85	15	110	341
16:15	23	14	36	73	13	85	10	108	14	6	29	49	11	57	16	84	314
16:30	19	13	36	68	14	84	8	106	13	9	11	33	8	56	18	82	289
16:45	15	14	31	60	12	104	3	119	9	2	22	33	6	61	16	83	295
Total Volume	73	57	140	270	45	376	30	451	53	27	79	159	35	259	65	359	1239
% App. Total	27	21.1	51.9		10	83.4	6.7		33.3	17	49.7		9.7	72.1	18.1		
PHF	.793	.891	.946	.925	.804	.904	.750	.947	.779	.675	.681	.811	.795	.762	.903	.816	.908
Cars	71	52	139	262	40	342	29	411	43	20	69	132	35	243	60	338	1143
% Cars	97.3	91.2	99.3	97.0	88.9	91.0	96.7	91.1	81.1	74.1	87.3	83.0	100	93.8	92.3	94.2	92.3
Trucks	2	5	1	8	5	34	1	40	10	7	10	27	0	16	5	21	96
% Trucks	2.7	8.8	0.7	3.0	11.1	9.0	3.3	8.9	18.9	25.9	12.7	17.0	0	6.2	7.7	5.8	7.7

Accurate Counts
978-664-2565

File Name : 10568003
Site Code : 10568003
Start Date : 8/19/2009
Page No : 2



Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:00				16:45				16:00				16:00			
+0 mins.	16	16	37	69	12	104	3	119	17	10	17	44	10	85	15	110
+15 mins.	23	14	36	73	11	100	6	117	14	6	29	49	11	57	16	84
+30 mins.	19	13	36	68	14	98	6	118	13	9	11	33	8	56	18	82
+45 mins.	15	14	31	60	14	111	6	131	9	2	22	33	6	61	16	83
Total Volume	73	57	140	270	51	413	21	485	53	27	79	159	35	259	65	359
% App. Total	27	21.1	51.9		10.5	85.2	4.3		33.3	17	49.7		9.7	72.1	18.1	
PHF	.793	.891	.946	.925	.911	.930	.875	.926	.779	.675	.681	.811	.795	.762	.903	.816
Cars	71	52	139	262	50	375	21	446	43	20	69	132	35	243	60	338
% Cars	97.3	91.2	99.3	97	98	90.8	100	92	81.1	74.1	87.3	83	100	93.8	92.3	94.2
Trucks	2	5	1	8	1	38	0	39	10	7	10	27	0	16	5	21
% Trucks	2.7	8.8	0.7	3	2	9.2	0	8	18.9	25.9	12.7	17	0	6.2	7.7	5.8

Accurate Counts
978-664-2565

File Name : 10568003
Site Code : 10568003
Start Date : 8/19/2009
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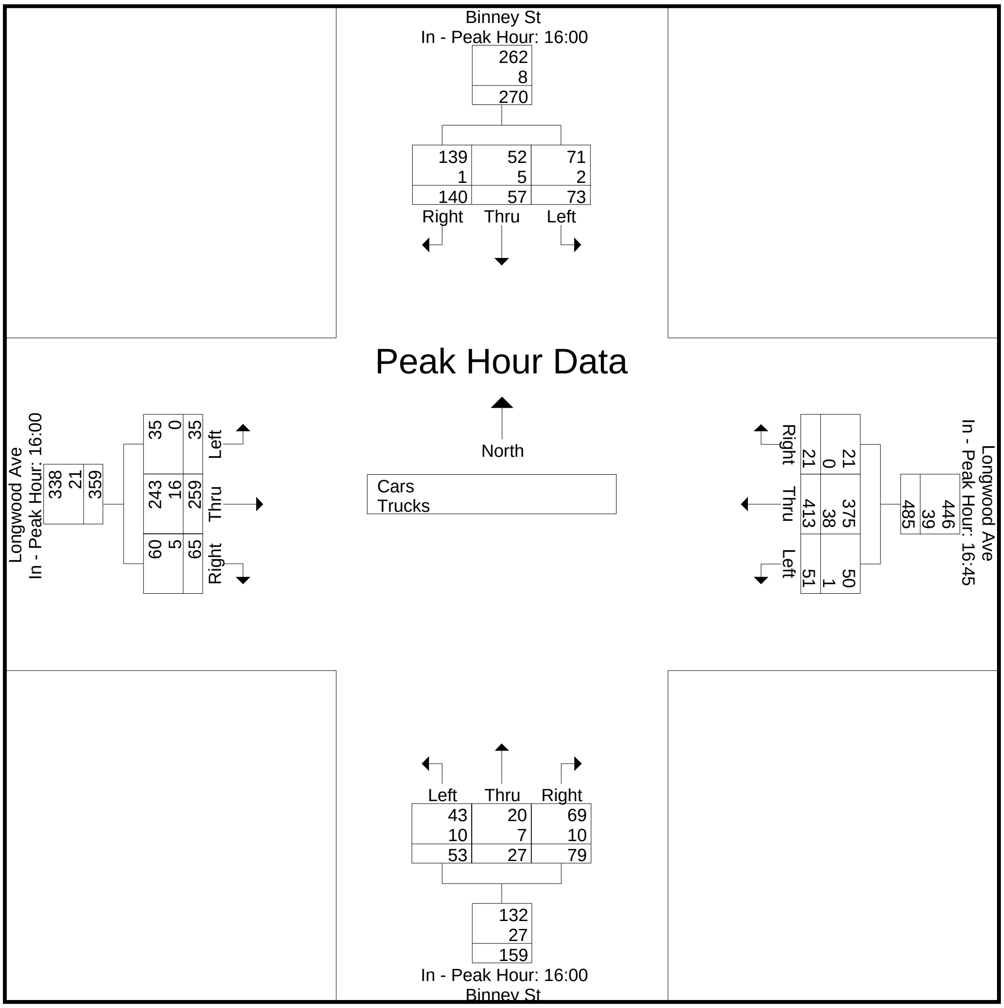


Accurate Counts
978-664-2565

N/S Street : Binney Street
E/W Street: Longwood Avenue
City/State : Boston, MA
Weather : Clear

File Name : 10568003
Site Code : 10568003
Start Date : 8/19/2009
Page No : 1

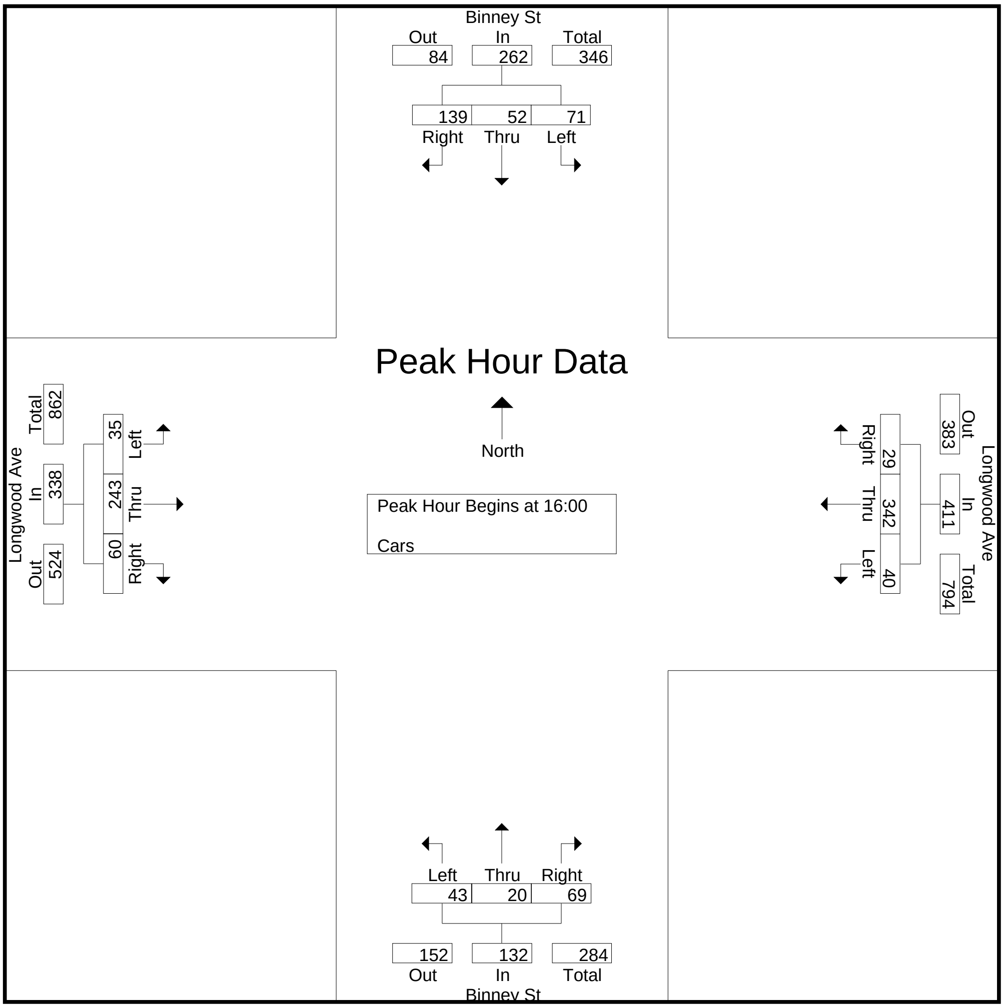
Groups Printed- Cars

	Binney St From North				Longwood Ave From East				Binney St From South				Longwood Ave From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	16	14	37	83	5	93	9	50	15	6	14	81	10	78	14	18	232	311	543
16:15	21	13	35	95	12	77	10	29	11	4	26	85	11	56	15	14	223	291	514
16:30	19	11	36	105	11	76	7	41	11	9	10	82	8	51	17	27	255	266	521
16:45	15	14	31	91	12	96	3	32	6	1	19	104	6	58	14	11	238	275	513
Total	71	52	139	374	40	342	29	152	43	20	69	352	35	243	60	70	948	1143	2091
17:00	14	12	35	86	10	90	6	26	8	7	19	74	4	69	21	13	199	295	494
17:15	10	20	31	71	14	86	6	24	6	1	14	83	14	52	7	15	193	261	454
17:30	6	9	20	102	14	103	6	30	4	5	20	81	6	55	12	7	220	260	480
17:45	7	8	19	86	10	87	4	28	4	3	15	77	5	49	10	6	197	221	418
Total	37	49	105	345	48	366	22	108	22	16	68	315	29	225	50	41	809	1037	1846
Grand Total	108	101	244	719	88	708	51	260	65	36	137	667	64	468	110	111	1757	2180	3937
Apprch %	23.8	22.3	53.9		10.4	83.6	6		27.3	15.1	57.6		10	72.9	17.1				
Total %	5	4.6	11.2		4	32.5	2.3		3	1.7	6.3		2.9	21.5	5		44.6	55.4	

	Binney St From North				Longwood Ave From East				Binney St From South				Longwood Ave From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 16:00																	
16:00	16	14	37	67	5	93	9	107	15	6	14	35	10	78	14	102	311
16:15	21	13	35	69	12	77	10	99	11	4	26	41	11	56	15	82	291
16:30	19	11	36	66	11	76	7	94	11	9	10	30	8	51	17	76	266
16:45	15	14	31	60	12	96	3	111	6	1	19	26	6	58	14	78	275
Total Volume	71	52	139	262	40	342	29	411	43	20	69	132	35	243	60	338	1143
% App. Total	27.1	19.8	53.1		9.7	83.2	7.1		32.6	15.2	52.3		10.4	71.9	17.8		
PHF	.845	.929	.939	.949	.833	.891	.725	.926	.717	.556	.663	.805	.795	.779	.882	.828	.919

Accurate Counts
978-664-2565

File Name : 10568003
Site Code : 10568003
Start Date : 8/19/2009
Page No : 2

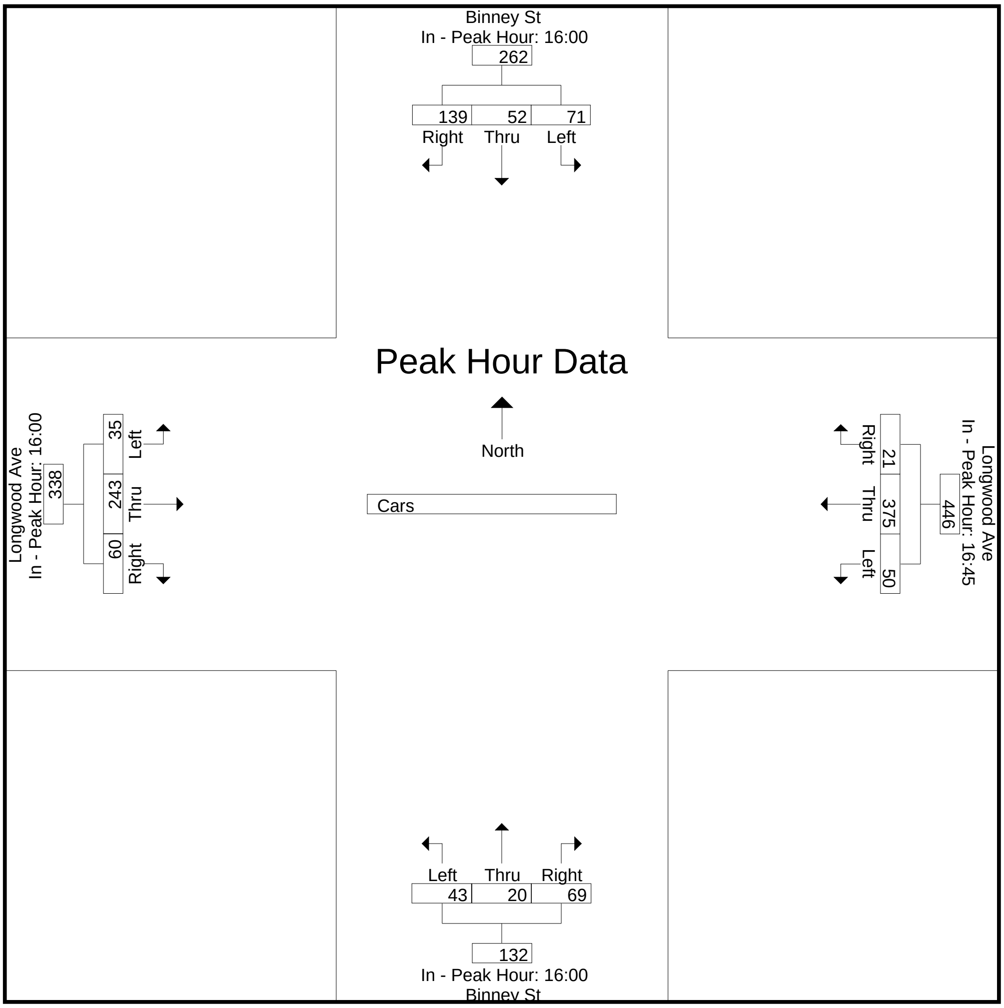


Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:00				16:45				16:00				16:00			
+0 mins.	16	14	37	67	12	96	3	111	15	6	14	35	10	78	14	102
+15 mins.	21	13	35	69	10	90	6	106	11	4	26	41	11	56	15	82
+30 mins.	19	11	36	66	14	86	6	106	11	9	10	30	8	51	17	76
+45 mins.	15	14	31	60	14	103	6	123	6	1	19	26	6	58	14	78
Total Volume	71	52	139	262	50	375	21	446	43	20	69	132	35	243	60	338
% App. Total	27.1	19.8	53.1		11.2	84.1	4.7		32.6	15.2	52.3		10.4	71.9	17.8	
PHF	.845	.929	.939	.949	.893	.910	.875	.907	.717	.556	.663	.805	.795	.779	.882	.828

Accurate Counts
978-664-2565

File Name : 10568003
Site Code : 10568003
Start Date : 8/19/2009
Page No : 3



Accurate Counts
978-664-2565

N/S Street : Binney Street
E/W Street: Longwood Avenue
City/State : Boston, MA
Weather : Clear

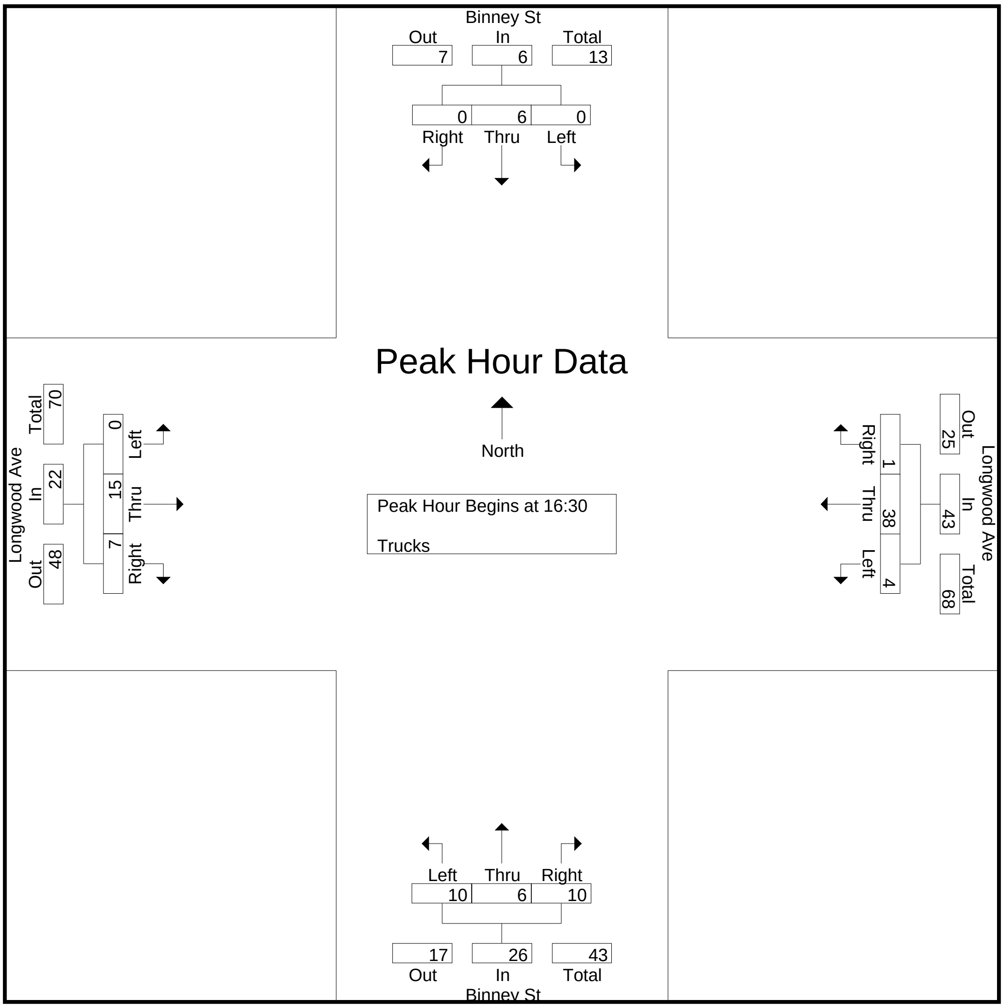
File Name : 10568003
Site Code : 10568003
Start Date : 8/19/2009

Groups Printed- Trucks

	Binney St From North				Longwood Ave From East				Binney St From South				Longwood Ave From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	0	2	0	0	1	10	0	0	2	4	3	0	0	7	1	0	0	30	30
16:15	2	1	1	0	1	8	0	0	3	2	3	0	0	1	1	0	0	23	23
16:30	0	2	0	0	3	8	1	0	2	0	1	0	0	5	1	0	0	23	23
16:45	0	0	0	0	0	8	0	0	3	1	3	0	0	3	2	0	0	20	20
Total	2	5	1	0	5	34	1	0	10	7	10	0	0	16	5	0	0	96	96
17:00	0	1	0	0	1	10	0	0	3	3	3	0	0	2	3	0	0	26	26
17:15	0	3	0	0	0	12	0	0	2	2	3	0	0	5	1	0	0	28	28
17:30	0	0	0	0	0	8	0	0	4	0	2	0	0	2	1	0	0	17	17
17:45	0	0	0	0	0	7	0	0	3	1	1	0	0	1	1	0	0	14	14
Total	0	4	0	0	1	37	0	0	12	6	9	0	0	10	6	0	0	85	85
Grand Total	2	9	1	0	6	71	1	0	22	13	19	0	0	26	11	0	0	181	181
Apprch %	16.7	75	8.3		7.7	91	1.3		40.7	24.1	35.2		0	70.3	29.7				
Total %	1.1	5	0.6		3.3	39.2	0.6		12.2	7.2	10.5		0	14.4	6.1		0	100	

	Binney St From North				Longwood Ave From East				Binney St From South				Longwood Ave From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 16:30																	
16:30	0	2	0	2	3	8	1	12	2	0	1	3	0	5	1	6	23
16:45	0	0	0	0	0	8	0	8	3	1	3	7	0	3	2	5	20
17:00	0	1	0	1	1	10	0	11	3	3	3	9	0	2	3	5	26
17:15	0	3	0	3	0	12	0	12	2	2	3	7	0	5	1	6	28
Total Volume	0	6	0	6	4	38	1	43	10	6	10	26	0	15	7	22	97
% App. Total	0	100	0		9.3	88.4	2.3		38.5	23.1	38.5		0	68.2	31.8		
PHF	.000	.500	.000	.500	.333	.792	.250	.896	.833	.500	.833	.722	.000	.750	.583	.917	.866

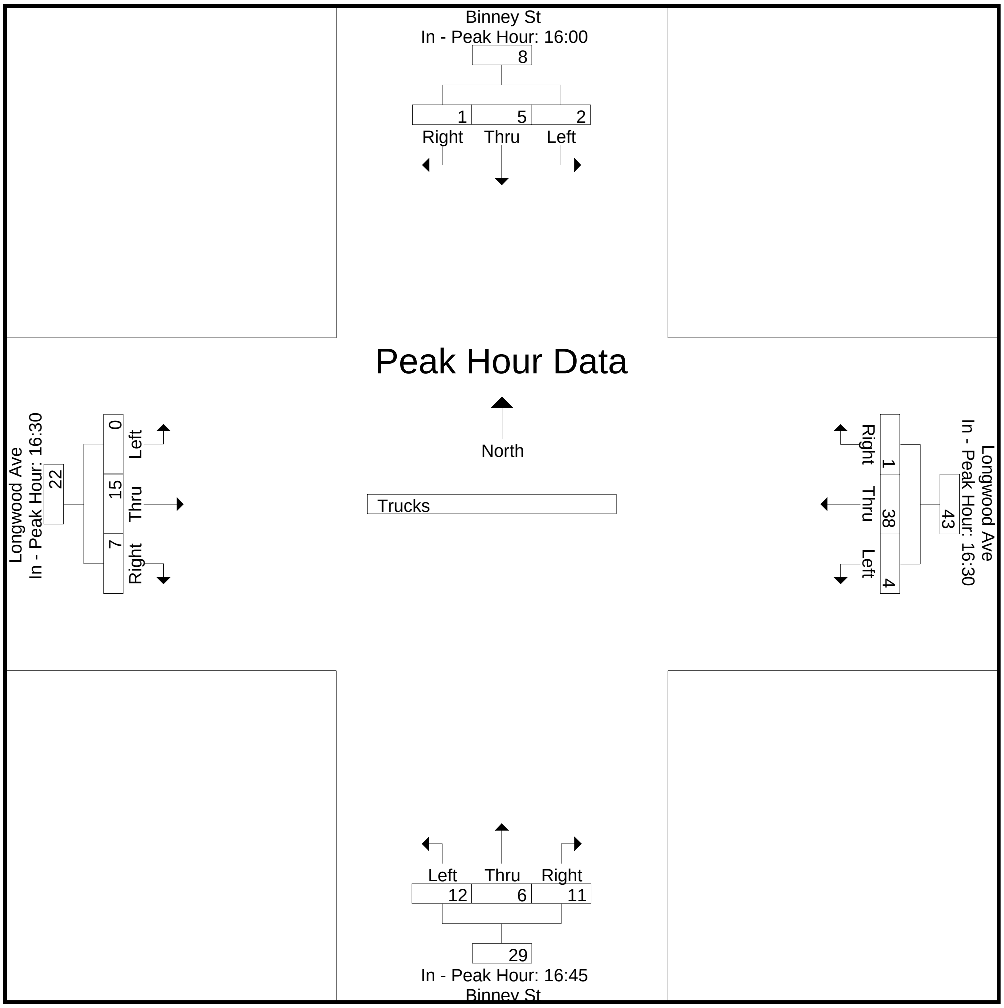
File Name : 10568003
Site Code : 10568003
Start Date : 8/19/2009
Page No : 2



Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:00				16:30				16:45				16:30			
+0 mins.	0	2	0	2	3	8	1	12	3	1	3	7	0	5	1	6
+15 mins.	2	1	1	4	0	8	0	8	3	3	3	9	0	3	2	5
+30 mins.	0	2	0	2	1	10	0	11	2	2	3	7	0	2	3	5
+45 mins.	0	0	0	0	0	12	0	12	4	0	2	6	0	5	1	6
Total Volume	2	5	1	8	4	38	1	43	12	6	11	29	0	15	7	22
% App. Total	25	62.5	12.5		9.3	88.4	2.3		41.4	20.7	37.9		0	68.2	31.8	
PHF	.250	.625	.250	.500	.333	.792	.250	.896	.750	.500	.917	.806	.000	.750	.583	.917

File Name : 10568003
Site Code : 10568003
Start Date : 8/19/2009
Page No : 3



Accurate Counts
978-664-2565

N/S Street : Binney Street
E/W Street: Longwood Avenue
City/State : Boston, MA
Weather : Clear

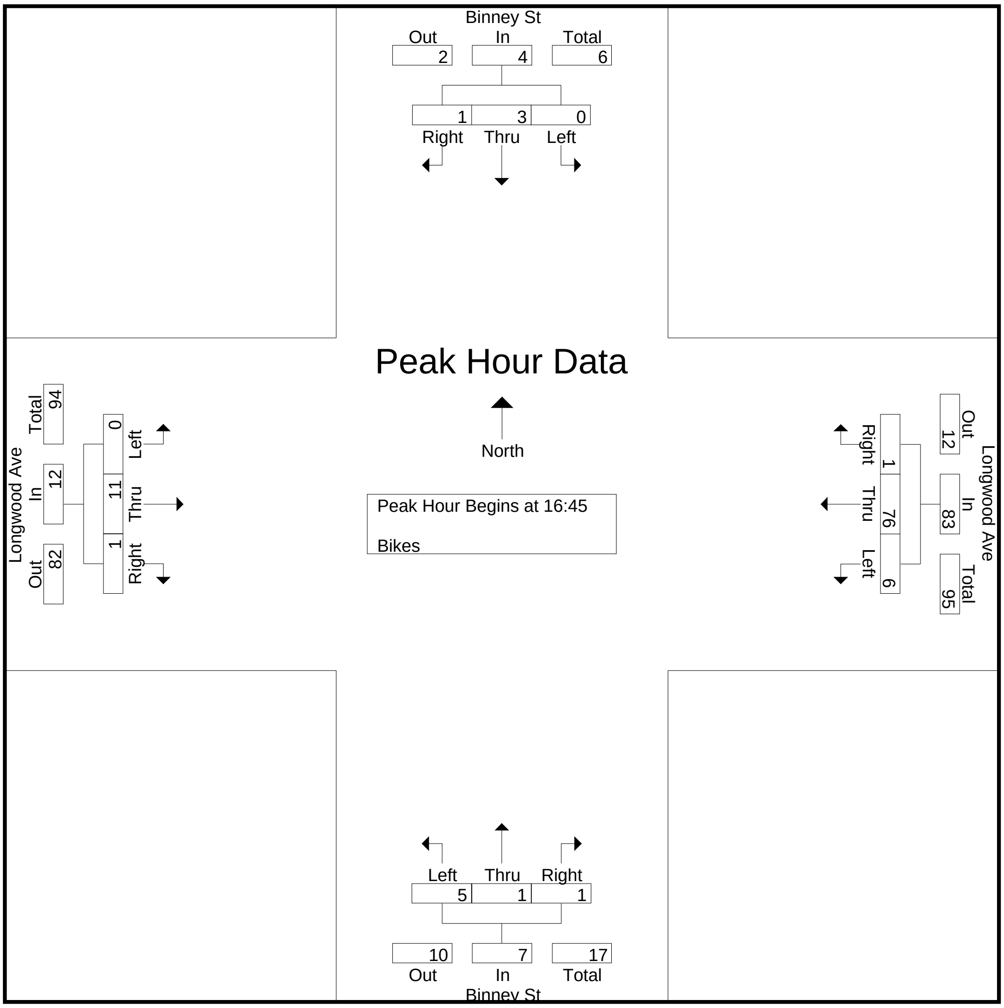
File Name : 10568003
Site Code : 10568003
Start Date : 8/19/2009
Page No : 1

Groups Printed- Bikes

	Binney St From North			Longwood Ave From East			Binney St From South			Longwood Ave From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
16:00	0	0	0	0	4	0	1	0	1	1	0	0	7
16:15	0	1	0	0	10	0	0	3	0	0	4	0	18
16:30	0	0	2	2	9	0	1	1	0	0	3	1	19
16:45	0	1	0	1	18	1	1	0	0	0	2	0	24
Total	0	2	2	3	41	1	3	4	1	1	9	1	68
17:00	0	1	0	1	16	0	2	1	0	0	5	1	27
17:15	0	0	1	2	21	0	0	0	0	0	1	0	25
17:30	0	1	0	2	21	0	2	0	1	0	3	0	30
17:45	0	0	0	2	16	0	1	0	1	0	2	0	22
Total	0	2	1	7	74	0	5	1	2	0	11	1	104
Grand Total	0	4	3	10	115	1	8	5	3	1	20	2	172
Apprch %	0	57.1	42.9	7.9	91.3	0.8	50	31.2	18.8	4.3	87	8.7	
Total %	0	2.3	1.7	5.8	66.9	0.6	4.7	2.9	1.7	0.6	11.6	1.2	

	Binney St From North				Longwood Ave From East				Binney St From South				Longwood Ave From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 16:45																	
16:45	0	1	0	1	1	18	1	20	1	0	0	1	0	2	0	2	24
17:00	0	1	0	1	1	16	0	17	2	1	0	3	0	5	1	6	27
17:15	0	0	1	1	2	21	0	23	0	0	0	0	0	1	0	1	25
17:30	0	1	0	1	2	21	0	23	2	0	1	3	0	3	0	3	30
Total Volume	0	3	1	4	6	76	1	83	5	1	1	7	0	11	1	12	106
% App. Total	0	75	25		7.2	91.6	1.2		71.4	14.3	14.3		0	91.7	8.3		
PHF	.000	.750	.250	1.000	.750	.905	.250	.902	.625	.250	.250	.583	.000	.550	.250	.500	.883

File Name : 10568003
Site Code : 10568003
Start Date : 8/19/2009
Page No : 2



Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:15				16:45				16:15				16:15			
+0 mins.	0	1	0	1	1	18	1	20	0	3	0	3	0	4	0	4
+15 mins.	0	0	2	2	1	16	0	17	1	1	0	2	0	3	1	4
+30 mins.	0	1	0	1	2	21	0	23	1	0	0	1	0	2	0	2
+45 mins.	0	1	0	1	2	21	0	23	2	1	0	3	0	5	1	6
Total Volume	0	3	2	5	6	76	1	83	4	5	0	9	0	14	2	16
% App. Total	0	60	40		7.2	91.6	1.2		44.4	55.6	0		0	87.5	12.5	
PHF	.000	.750	.250	.625	.750	.905	.250	.902	.500	.417	.000	.750	.000	.700	.500	.667

File Name : 10568003
Site Code : 10568003
Start Date : 8/19/2009
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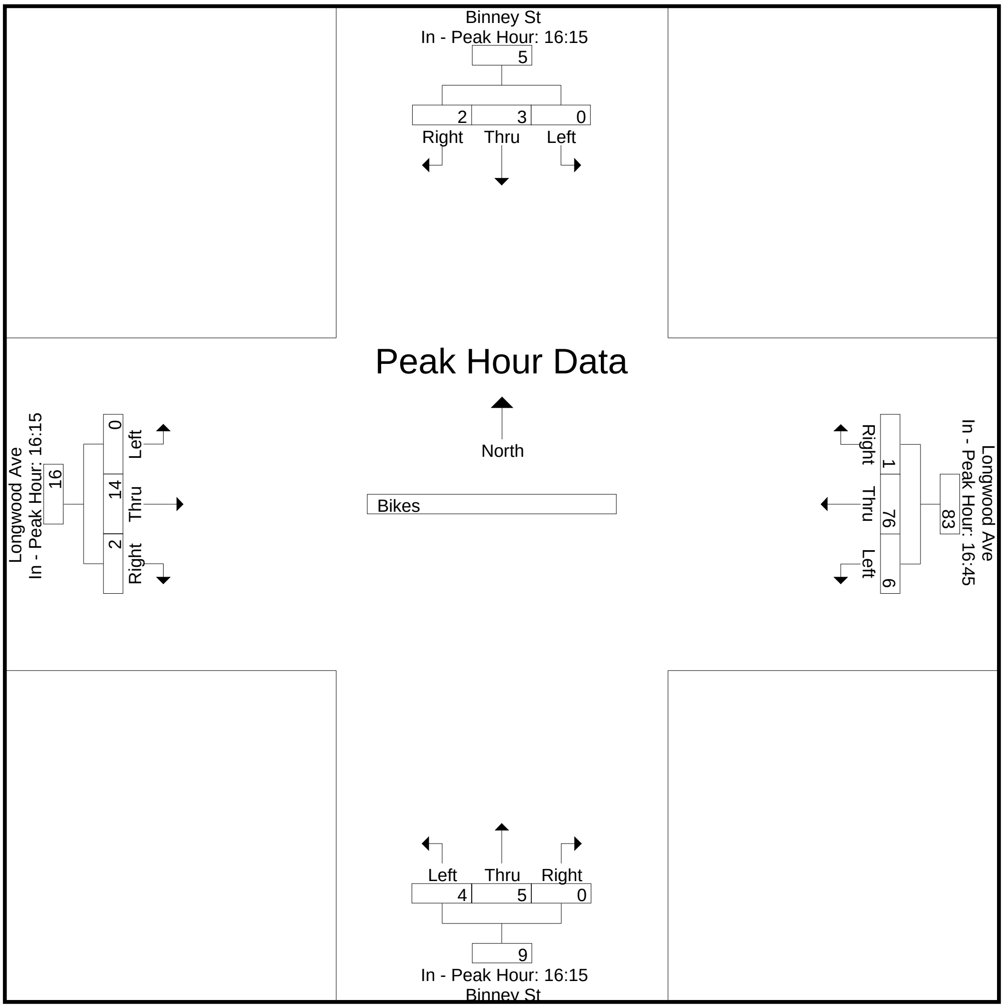


Accurate Counts
978-664-2565

N/S Street : Longwood Avenue
E/W Street: Longwood Avenue
City/State : Boston, MA
Weather : Clear

File Name : 10568004
Site Code : 10568004
Start Date : 8/19/2009
Page No : 1

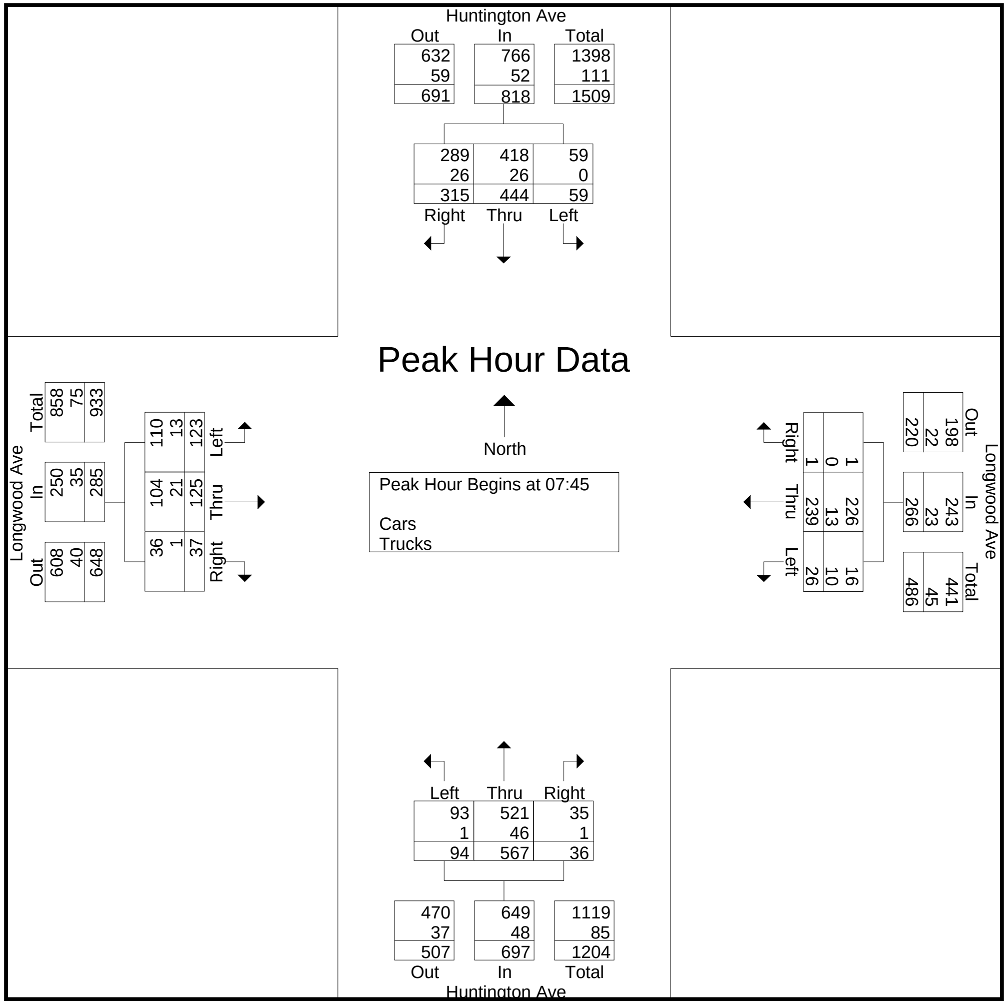
Groups Printed- Cars - Trucks

	Huntington Ave From North					Longwood Ave From East				Huntington Ave From South					Longwood Ave From West						
Start Time	Left	Thru	Right	U-Trn	Peds	Left	Thru	Right	Peds	Left	Thru	Right	U-Trn	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	5	76	50	0	56	9	37	1	16	17	85	7	3	18	30	30	9	13	106	356	462
07:15	10	94	56	0	57	2	38	0	25	11	102	7	2	19	20	31	5	16	119	376	495
07:30	12	114	74	1	105	3	43	0	17	18	132	6	1	20	26	29	7	19	163	464	627
07:45	12	99	75	1	107	8	66	0	18	25	129	5	4	18	38	30	9	38	186	496	682
Total	39	383	255	2	325	22	184	1	76	71	448	25	10	75	114	120	30	86	574	1692	2266
08:00	8	109	66	2	145	4	61	1	32	21	148	9	4	18	26	29	11	33	234	493	727
08:15	16	108	94	2	152	8	63	0	33	23	144	8	4	23	30	27	11	22	236	532	768
08:30	23	128	80	0	146	6	49	0	25	25	146	14	5	17	29	39	6	25	218	545	763
08:45	17	102	78	3	118	6	47	1	29	22	130	11	3	29	27	30	9	29	211	480	691
Total	64	447	318	7	561	24	220	2	119	91	568	42	16	87	112	125	37	109	899	2050	2949
Grand Total	103	830	573	9	886	46	404	3	195	162	1016	67	26	162	226	245	67	195	1473	3742	5215
Apprch %	6.8	55.1	38			10.2	89.2	0.7		13	81.6	5.4			42	45.5	12.5				
Total %	2.8	22.2	15.3			1.2	10.8	0.1		4.3	27.2	1.8			6	6.5	1.8		28.2	71.8	
Cars	102	768	511			30	375	3		158	940	65			198	206	64		0	0	4892
% Cars	99	92.5	89.2	100	99.9	65.2	92.8	100	100	97.5	92.5	97	100	100	87.6	84.1	95.5	100	0	0	93.8
Trucks	1	62	62			16	29	0		4	76	2			28	39	3		0	0	323
% Trucks	1	7.5	10.8	0	0.1	34.8	7.2	0	0	2.5	7.5	3	0	0	12.4	15.9	4.5	0	0	0	6.2

	Huntington Ave From North				Longwood Ave From East				Huntington Ave From South				Longwood Ave From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:45																	
07:45	12	99	75	186	8	66	0	74	25	129	5	159	38	30	9	77	496
08:00	8	109	66	183	4	61	1	66	21	148	9	178	26	29	11	66	493
08:15	16	108	94	218	8	63	0	71	23	144	8	175	30	27	11	68	532
08:30	23	128	80	231	6	49	0	55	25	146	14	185	29	39	6	74	545
Total Volume	59	444	315	818	26	239	1	266	94	567	36	697	123	125	37	285	2066
% App. Total	7.2	54.3	38.5		9.8	89.8	0.4		13.5	81.3	5.2		43.2	43.9	13		
PHF	.641	.867	.838	.885	.813	.905	.250	.899	.940	.958	.643	.942	.809	.801	.841	.925	.948
Cars	59	418	289	766	16	226	1	243	93	521	35	649	110	104	36	250	1908
% Cars	100	94.1	91.7	93.6	61.5	94.6	100	91.4	98.9	91.9	97.2	93.1	89.4	83.2	97.3	87.7	92.4
Trucks	0	26	26	52	10	13	0	23	1	46	1	48	13	21	1	35	158
% Trucks	0	5.9	8.3	6.4	38.5	5.4	0	8.6	1.1	8.1	2.8	6.9	10.6	16.8	2.7	12.3	7.6

Accurate Counts
978-664-2565

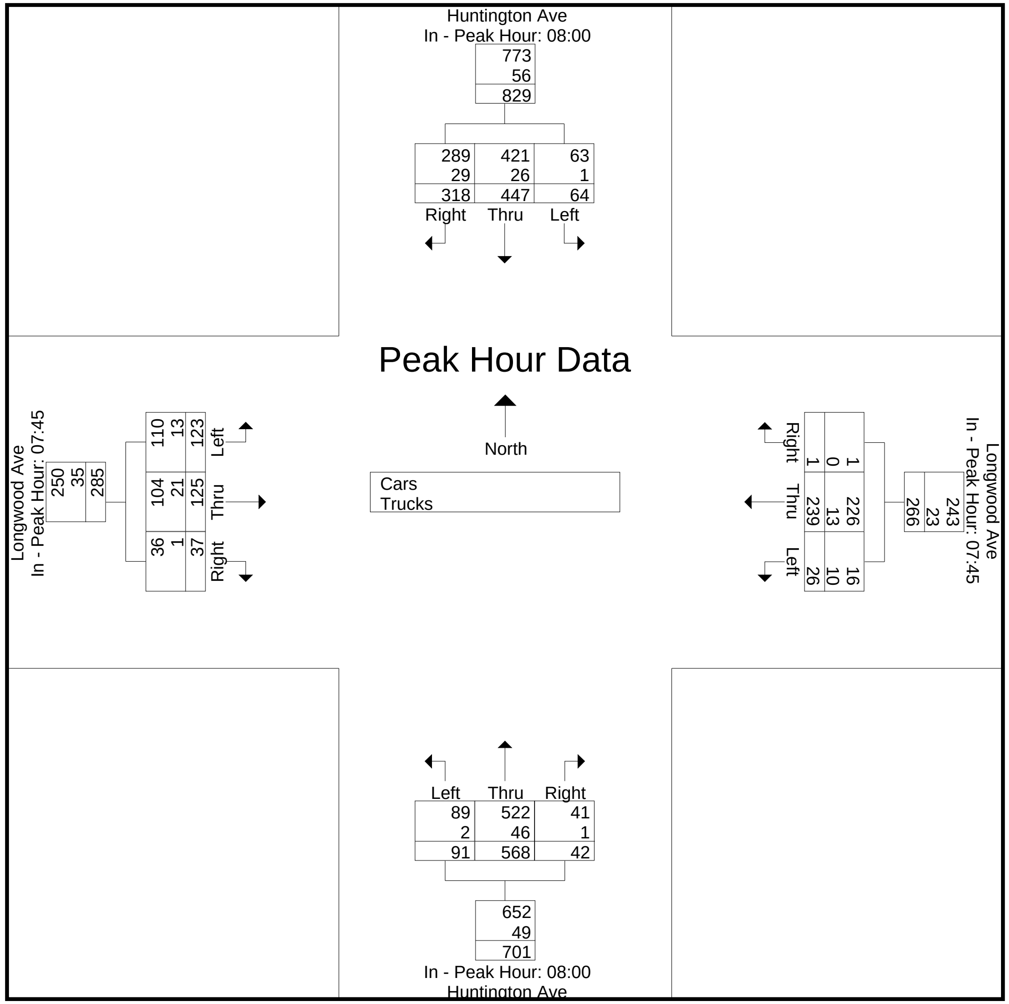
File Name : 10568004
Site Code : 10568004
Start Date : 8/19/2009
Page No : 2



Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	08:00				07:45				08:00				07:45			
+0 mins.	8	109	66	183	8	66	0	74	21	148	9	178	38	30	9	77
+15 mins.	16	108	94	218	4	61	1	66	23	144	8	175	26	29	11	66
+30 mins.	23	128	80	231	8	63	0	71	25	146	14	185	30	27	11	68
+45 mins.	17	102	78	197	6	49	0	55	22	130	11	163	29	39	6	74
Total Volume	64	447	318	829	26	239	1	266	91	568	42	701	123	125	37	285
% App. Total	7.7	53.9	38.4		9.8	89.8	0.4		13	81	6		43.2	43.9	13	
PHF	.696	.873	.846	.897	.813	.905	.250	.899	.910	.959	.750	.947	.809	.801	.841	.925
Cars	63	421	289	773	16	226	1	243	89	522	41	652	110	104	36	250

% Cars	98.4	94.2	90.9	93.2	61.5	94.6	100	91.4	97.8	91.9	97.6	93	89.4	83.2	97.3	87.7
Trucks	1	26	29	56	10	13	0	23	2	46	1	49	13	21	1	35
% Trucks	1.6	5.8	9.1	6.8	38.5	5.4	0	8.6	2.2	8.1	2.4	7	10.6	16.8	2.7	12.3



N/S Street : Longwood Avenue
E/W Street: Longwood Avenue
City/State : Boston, MA
Weather : Clear

File Name : 10568004
Site Code : 10568004
Start Date : 8/19/2009

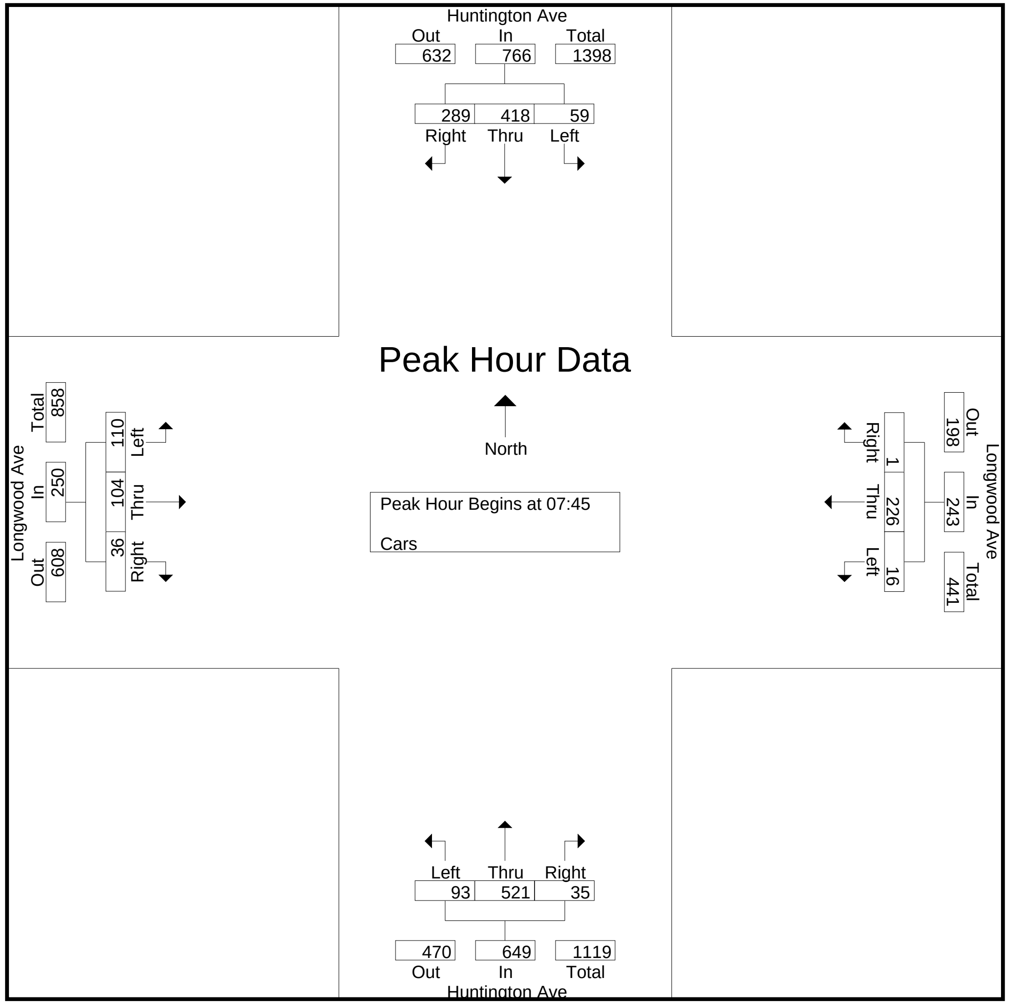
Groups Printed- Cars

	Huntington Ave From North					Longwood Ave From East				Huntington Ave From South					Longwood Ave From West						
Start Time	Left	Thru	Right	U-Trn	Peds	Left	Thru	Right	Peds	Left	Thru	Right	U-Trn	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	5	65	43	0	56	7	33	1	16	17	78	7	3	18	26	25	8	13	106	315	421
07:15	10	86	46	0	57	0	34	0	25	11	95	7	2	19	17	25	5	16	119	336	455
07:30	12	107	65	1	105	2	41	0	17	16	125	6	1	20	22	26	7	19	163	429	592
07:45	12	89	68	1	107	4	62	0	18	25	120	4	4	18	36	27	9	38	186	456	642
Total	39	347	222	2	325	13	170	1	76	69	418	24	10	75	101	103	29	86	574	1536	2110
08:00	8	105	59	2	145	3	58	1	32	21	138	9	4	18	24	21	10	33	234	457	691
08:15	16	103	87	2	152	5	60	0	33	22	131	8	4	23	25	22	11	22	236	490	726
08:30	23	121	75	0	146	4	46	0	25	25	132	14	5	17	25	34	6	25	218	505	723
08:45	16	92	68	3	117	5	41	1	29	21	121	10	3	29	23	26	8	29	210	432	642
Total	63	421	289	7	560	17	205	2	119	89	522	41	16	87	97	103	35	109	898	1884	2782
Grand Total	102	768	511	9	885	30	375	3	195	158	940	65	26	162	198	206	64	195	1472	3420	4892
Apprch %	7.4	55.6	37			7.4	91.9	0.7		13.6	80.8	5.6			42.3	44	13.7				
Total %	3	22.5	14.9			0.9	11	0.1		4.6	27.5	1.9			5.8	6	1.9		30.1	69.9	

	Huntington Ave From North				Longwood Ave From East				Huntington Ave From South				Longwood Ave From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:45																	
07:45	12	89	68	169	4	62	0	66	25	120	4	149	36	27	9	72	456
08:00	8	105	59	172	3	58	1	62	21	138	9	168	24	21	10	55	457
08:15	16	103	87	206	5	60	0	65	22	131	8	161	25	22	11	58	490
08:30	23	121	75	219	4	46	0	50	25	132	14	171	25	34	6	65	505
Total Volume	59	418	289	766	16	226	1	243	93	521	35	649	110	104	36	250	1908
% App. Total	7.7	54.6	37.7		6.6	93	0.4		14.3	80.3	5.4		44	41.6	14.4		
PHF	.641	.864	.830	.874	.800	.911	.250	.920	.930	.944	.625	.949	.764	.765	.818	.868	.945

Accurate Counts
978-664-2565

File Name : 10568004
Site Code : 10568004
Start Date : 8/19/2009
Page No : 2

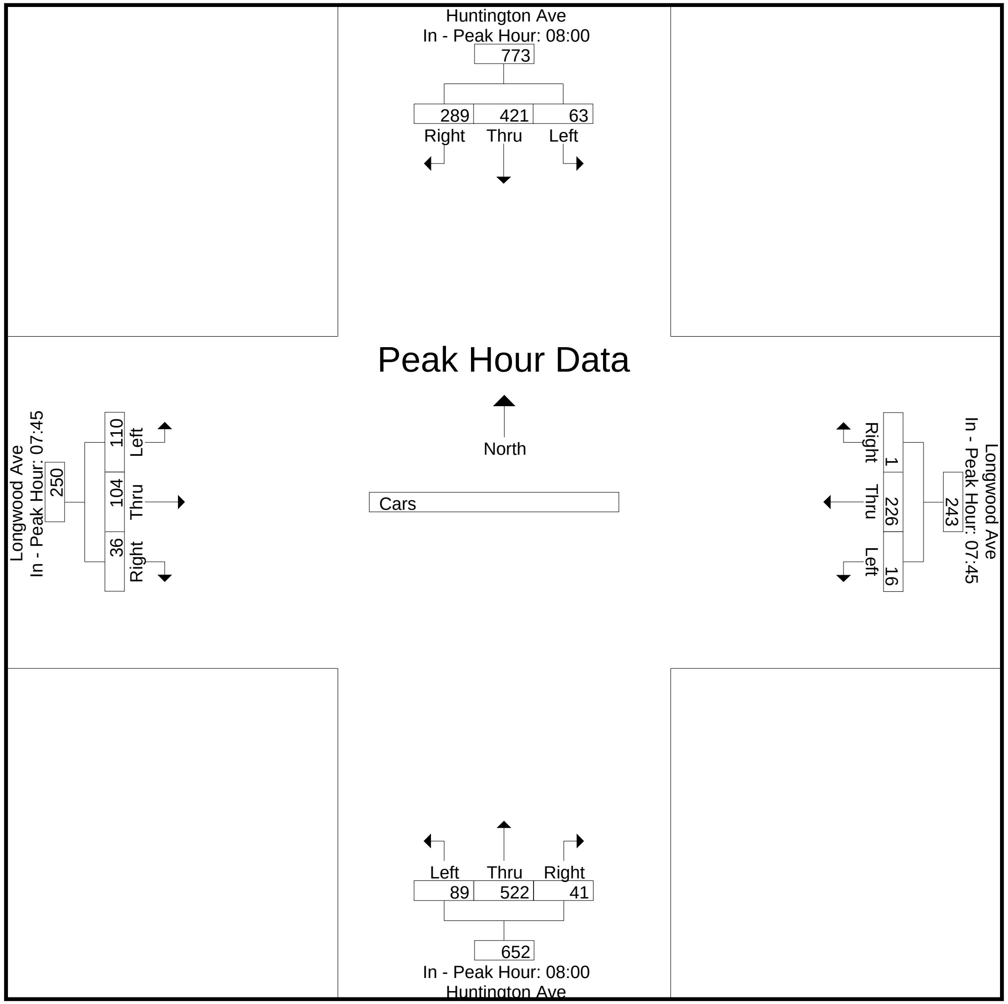


Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	08:00				07:45				08:00				07:45			
+0 mins.	8	105	59	172	4	62	0	66	21	138	9	168	36	27	9	72
+15 mins.	16	103	87	206	3	58	1	62	22	131	8	161	24	21	10	55
+30 mins.	23	121	75	219	5	60	0	65	25	132	14	171	25	22	11	58
+45 mins.	16	92	68	176	4	46	0	50	21	121	10	152	25	34	6	65
Total Volume	63	421	289	773	16	226	1	243	89	522	41	652	110	104	36	250
% App. Total	8.2	54.5	37.4		6.6	93	0.4		13.7	80.1	6.3		44	41.6	14.4	
PHF	.685	.870	.830	.882	.800	.911	.250	.920	.890	.946	.732	.953	.764	.765	.818	.868

Accurate Counts
978-664-2565

File Name : 10568004
Site Code : 10568004
Start Date : 8/19/2009
Page No : 3



Accurate Counts
978-664-2565

N/S Street : Longwood Avenue
E/W Street: Longwood Avenue
City/State : Boston, MA
Weather : Clear

File Name : 10568004
Site Code : 10568004
Start Date : 8/19/2009
Page No : 1

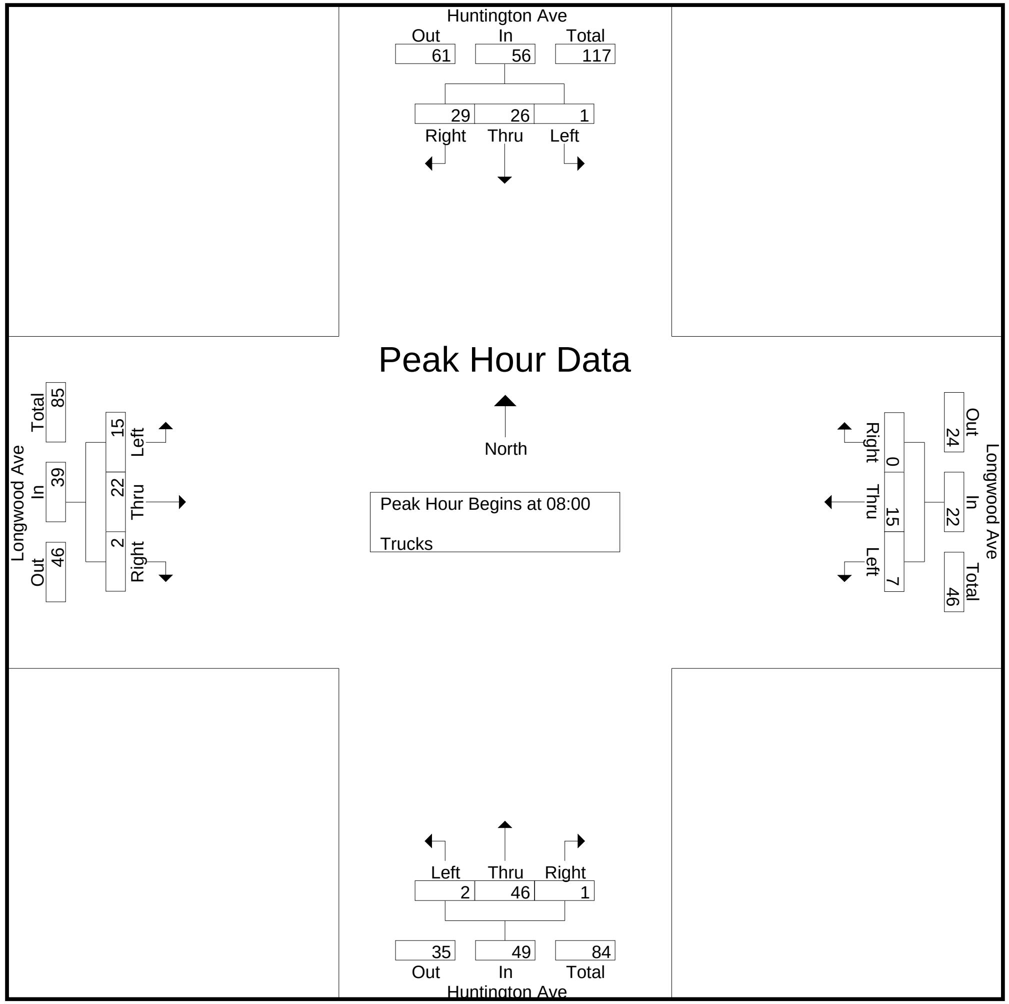
Groups Printed- Trucks

	Huntington Ave From North					Longwood Ave From East				Huntington Ave From South					Longwood Ave From West						
Start Time	Left	Thru	Right	U-Trn	Peds	Left	Thru	Right	Peds	Left	Thru	Right	U-Trn	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	0	11	7	0	0	2	4	0	0	0	7	0	0	0	4	5	1	0	0	41	41
07:15	0	8	10	0	0	2	4	0	0	0	7	0	0	0	3	6	0	0	0	40	40
07:30	0	7	9	0	0	1	2	0	0	2	7	0	0	0	4	3	0	0	0	35	35
07:45	0	10	7	0	0	4	4	0	0	0	9	1	0	0	2	3	0	0	0	40	40
Total	0	36	33	0	0	9	14	0	0	2	30	1	0	0	13	17	1	0	0	156	156
08:00	0	4	7	0	0	1	3	0	0	0	10	0	0	0	2	8	1	0	0	36	36
08:15	0	5	7	0	0	3	3	0	0	1	13	0	0	0	5	5	0	0	0	42	42
08:30	0	7	5	0	0	2	3	0	0	0	14	0	0	0	4	5	0	0	0	40	40
08:45	1	10	10	0	1	1	6	0	0	1	9	1	0	0	4	4	1	0	1	48	49
Total	1	26	29	0	1	7	15	0	0	2	46	1	0	0	15	22	2	0	1	166	167
Grand Total	1	62	62	0	1	16	29	0	0	4	76	2	0	0	28	39	3	0	1	322	323
Apprch %	0.8	49.6	49.6			35.6	64.4	0		4.9	92.7	2.4			40	55.7	4.3				
Total %	0.3	19.3	19.3			5	9	0		1.2	23.6	0.6			8.7	12.1	0.9		0.3	99.7	

	Huntington Ave From North				Longwood Ave From East				Huntington Ave From South				Longwood Ave From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 08:00																	
08:00	0	4	7	11	1	3	0	4	0	10	0	10	2	8	1	11	36
08:15	0	5	7	12	3	3	0	6	1	13	0	14	5	5	0	10	42
08:30	0	7	5	12	2	3	0	5	0	14	0	14	4	5	0	9	40
08:45	1	10	10	21	1	6	0	7	1	9	1	11	4	4	1	9	48
Total Volume	1	26	29	56	7	15	0	22	2	46	1	49	15	22	2	39	166
% App. Total	1.8	46.4	51.8		31.8	68.2	0		4.1	93.9	2		38.5	56.4	5.1		
PHF	.250	.650	.725	.667	.583	.625	.000	.786	.500	.821	.250	.875	.750	.688	.500	.886	.865

Accurate Counts
978-664-2565

File Name : 10568004
Site Code : 10568004
Start Date : 8/19/2009
Page No : 2



Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:00				07:00				08:00				08:00			
+0 mins.	0	11	7	18	2	4	0	6	0	10	0	10	2	8	1	11
+15 mins.	0	8	10	18	2	4	0	6	1	13	0	14	5	5	0	10
+30 mins.	0	7	9	16	1	2	0	3	0	14	0	14	4	5	0	9
+45 mins.	0	10	7	17	4	4	0	8	1	9	1	11	4	4	1	9
Total Volume	0	36	33	69	9	14	0	23	2	46	1	49	15	22	2	39
% App. Total	0	52.2	47.8		39.1	60.9	0		4.1	93.9	2		38.5	56.4	5.1	
PHF	.000	.818	.825	.958	.563	.875	.000	.719	.500	.821	.250	.875	.750	.688	.500	.886

Accurate Counts
978-664-2565

File Name : 10568004
Site Code : 10568004
Start Date : 8/19/2009
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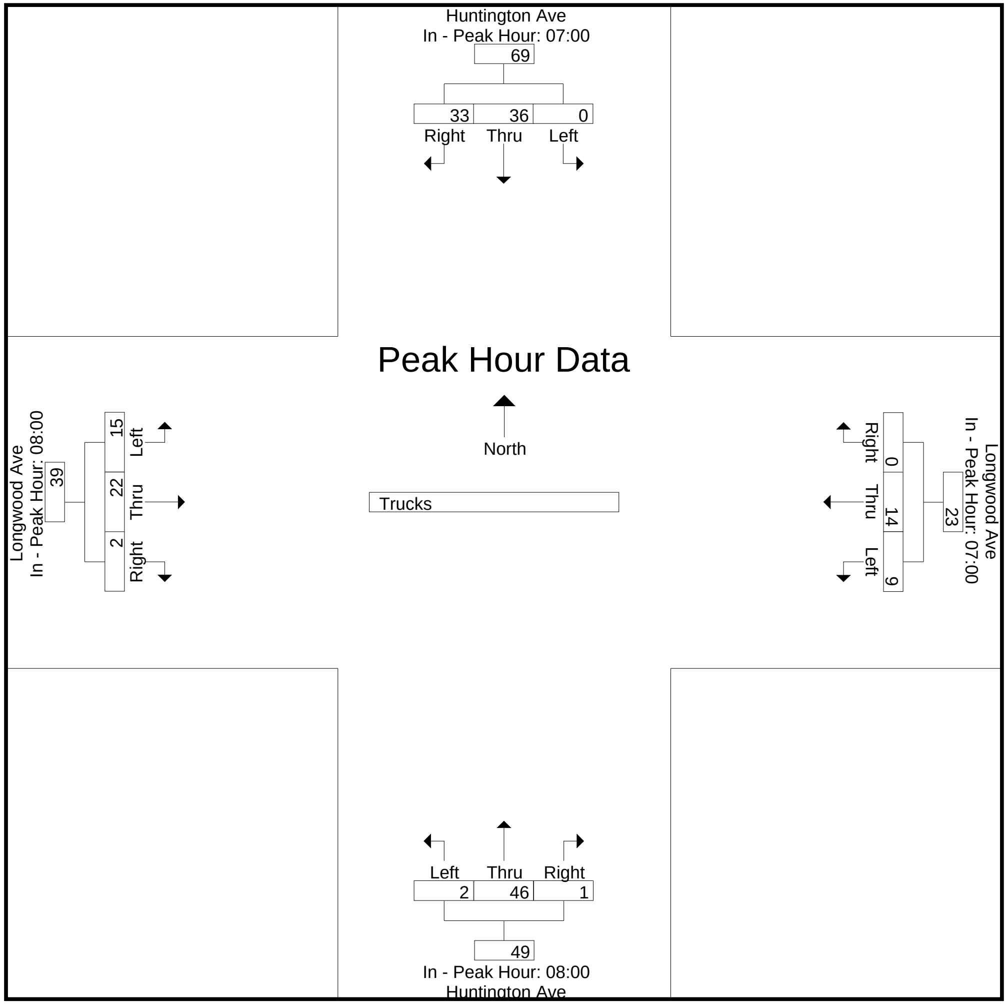


Accurate Counts
978-664-2565

N/S Street : Longwood Avenue
E/W Street: Longwood Avenue
City/State : Boston, MA
Weather : Clear

File Name : 10568004
Site Code : 10568004
Start Date : 8/19/2009
Page No : 1

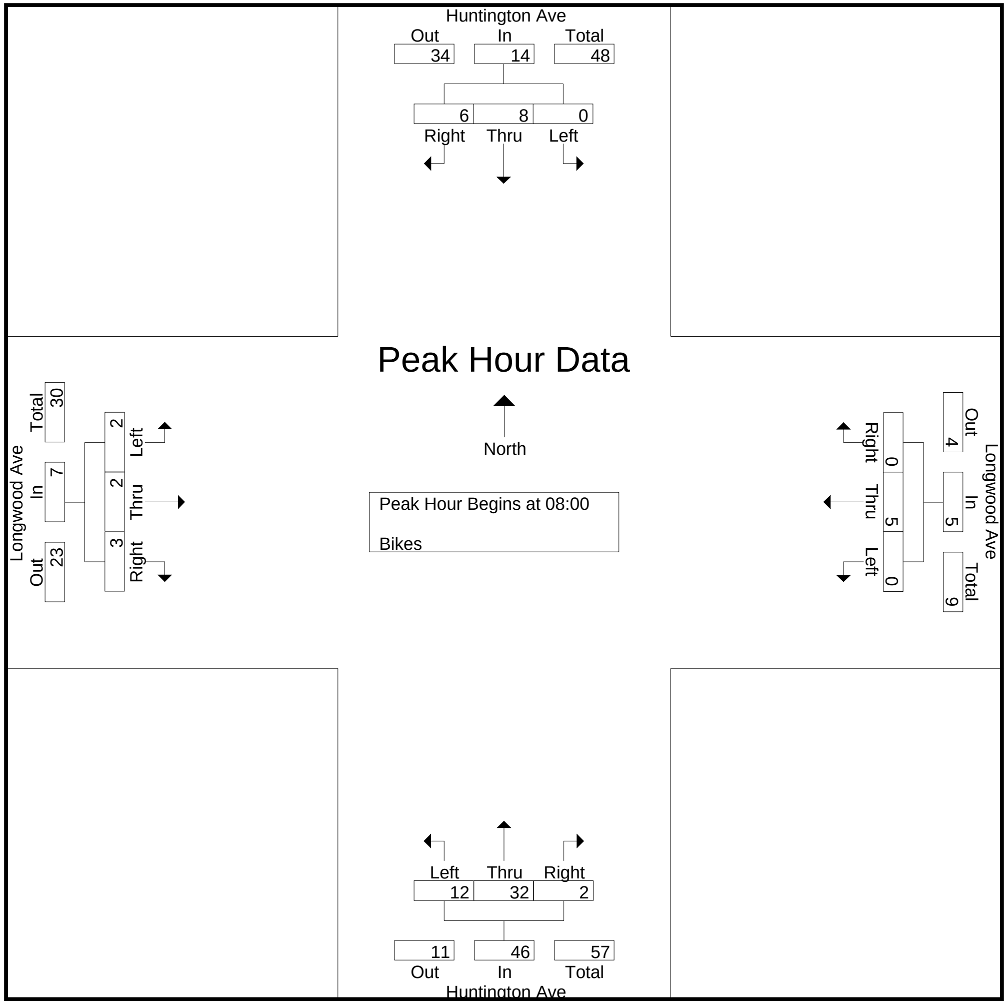
Groups Printed- Bikes

	Huntington Ave From North			Longwood Ave From East			Huntington Ave From South			Longwood Ave From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
07:00	0	1	3	1	1	0	0	3	0	0	0	0	9
07:15	0	0	2	0	2	0	0	5	0	1	0	0	10
07:30	0	0	1	1	1	0	0	4	0	1	0	0	8
07:45	0	1	0	0	3	0	2	6	0	3	1	0	16
Total	0	2	6	2	7	0	2	18	0	5	1	0	43
08:00	0	0	2	0	3	0	3	2	1	0	0	2	13
08:15	0	2	1	0	2	0	2	5	0	0	2	0	14
08:30	0	3	2	0	0	0	1	11	1	2	0	1	21
08:45	0	3	1	0	0	0	6	14	0	0	0	0	24
Total	0	8	6	0	5	0	12	32	2	2	2	3	72
Grand Total	0	10	12	2	12	0	14	50	2	7	3	3	115
Apprch %	0	45.5	54.5	14.3	85.7	0	21.2	75.8	3	53.8	23.1	23.1	
Total %	0	8.7	10.4	1.7	10.4	0	12.2	43.5	1.7	6.1	2.6	2.6	

	Huntington Ave From North				Longwood Ave From East				Huntington Ave From South				Longwood Ave From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 08:00																	
08:00	0	0	2	2	0	3	0	3	3	2	1	6	0	0	2	2	13
08:15	0	2	1	3	0	2	0	2	2	5	0	7	0	2	0	2	14
08:30	0	3	2	5	0	0	0	0	1	11	1	13	2	0	1	3	21
08:45	0	3	1	4	0	0	0	0	6	14	0	20	0	0	0	0	24
Total Volume	0	8	6	14	0	5	0	5	12	32	2	46	2	2	3	7	72
% App. Total	0	57.1	42.9		0	100	0		26.1	69.6	4.3		28.6	28.6	42.9		
PHF	.000	.667	.750	.700	.000	.417	.000	.417	.500	.571	.500	.575	.250	.250	.375	.583	.750

Accurate Counts
978-664-2565

File Name : 10568004
Site Code : 10568004
Start Date : 8/19/2009
Page No : 2



Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	08:00				07:15				08:00				07:45			
+0 mins.	0	0	2	2	0	2	0	2	3	2	1	6	3	1	0	4
+15 mins.	0	2	1	3	1	1	0	2	2	5	0	7	0	0	2	2
+30 mins.	0	3	2	5	0	3	0	3	1	11	1	13	0	2	0	2
+45 mins.	0	3	1	4	0	3	0	3	6	14	0	20	2	0	1	3
Total Volume	0	8	6	14	1	9	0	10	12	32	2	46	5	3	3	11
% App. Total	0	57.1	42.9		10	90	0		26.1	69.6	4.3		45.5	27.3	27.3	
PHF	.000	.667	.750	.700	.250	.750	.000	.833	.500	.571	.500	.575	.417	.375	.375	.688

Accurate Counts
978-664-2565

File Name : 10568004
Site Code : 10568004
Start Date : 8/19/2009
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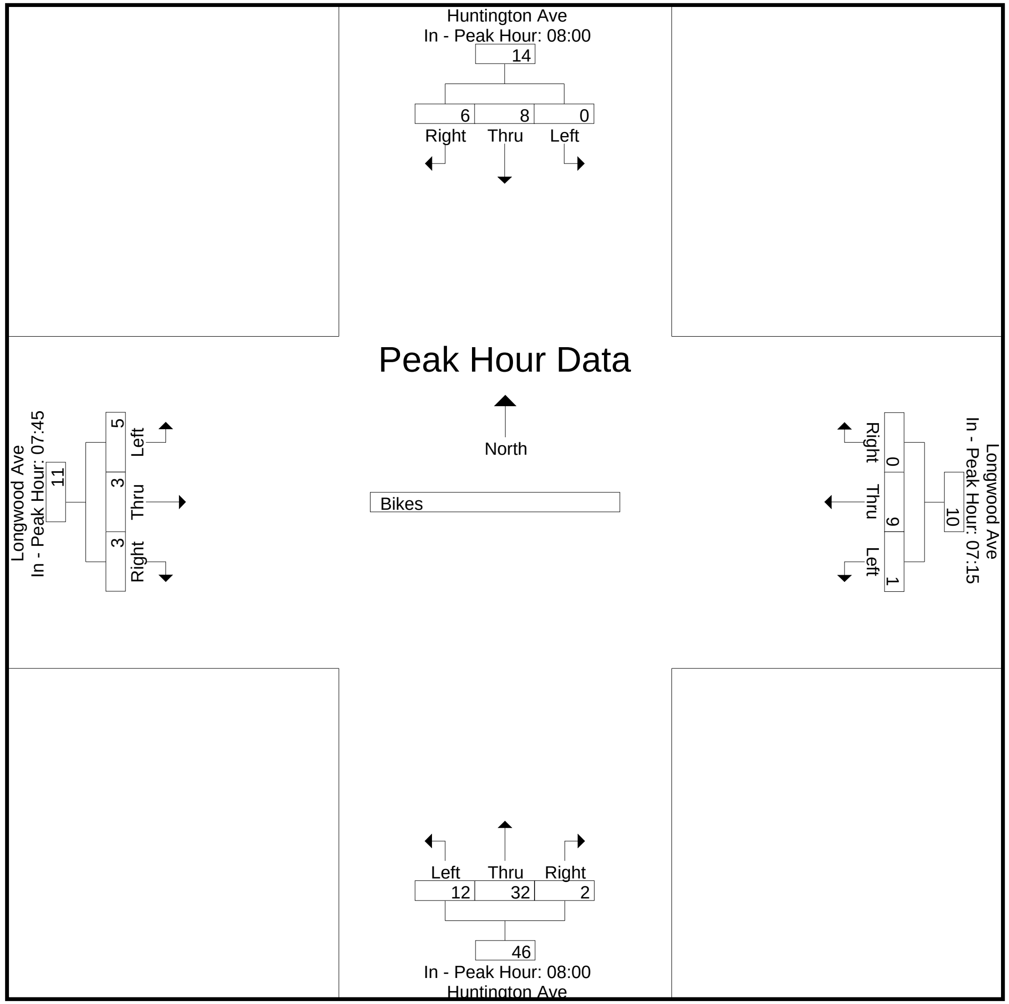

Accurate Counts
978-664-2565

N/S Street : Longwood Avenue
E/W Street: Longwood Avenue
City/State : Boston, MA
Weather : Clear

File Name : 10568004
Site Code : 10568004
Start Date : 8/19/2009
Page No : 1

Groups Printed- Cars - Trucks

	Huntington Ave From North					Longwood Ave From East				Huntington Ave From South					Longwood Ave From West						
Start Time	Left	Thru	Right	U-Trn	Peds	Left	Thru	Right	Peds	Left	Thru	Right	U-Trn	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	25	126	47	3	138	4	20	0	36	18	89	13	6	80	47	39	15	19	282	443	725
16:15	30	126	32	1	166	4	38	0	37	31	125	8	4	37	36	45	19	56	301	494	795
16:30	27	169	45	0	166	8	34	1	42	5	141	9	2	45	41	47	21	45	300	548	848
16:45	32	143	30	2	178	6	33	0	45	17	126	10	4	65	29	40	17	59	353	483	836
Total	114	564	154	6	648	22	125	1	160	71	481	40	16	227	153	171	72	179	1236	1968	3204
17:00	22	143	29	1	225	8	27	3	43	13	128	8	7	30	36	42	19	58	364	478	842
17:15	36	166	33	4	140	2	33	1	33	12	138	9	3	32	23	50	29	39	251	532	783
17:30	25	143	35	2	182	2	20	1	39	10	154	3	1	31	38	41	22	34	289	494	783
17:45	18	159	27	2	116	7	38	0	36	9	142	10	3	28	33	37	17	52	237	497	734
Total	101	611	124	9	663	19	118	5	151	44	562	30	14	121	130	170	87	183	1141	2001	3142
Grand Total	215	1175	278	15	1311	41	243	6	311	115	1043	70	30	348	283	341	159	362	2377	3969	6346
Apprch %	12.9	70.4	16.7			14.1	83.8	2.1		9.4	84.9	5.7			36.1	43.6	20.3				
Total %	5.4	29.6	7			1	6.1	0.2		2.9	26.3	1.8			7.1	8.6	4		37.5	62.5	
Cars	213	1147	253			41	235	6		113	988	57			274	334	152		0	0	6190
% Cars	99.1	97.6	91	100	100	100	96.7	100	100	98.3	94.7	81.4	100	100	96.8	97.9	95.6	100	0	0	97.5
Trucks	2	28	25			0	8	0		2	55	13			9	7	7		0	0	156
% Trucks	0.9	2.4	9	0	0	0	3.3	0	0	1.7	5.3	18.6	0	0	3.2	2.1	4.4	0	0	0	2.5

	Huntington Ave From North				Longwood Ave From East				Huntington Ave From South				Longwood Ave From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 16:30																	
16:30	27	169	45	241	8	34	1	43	5	141	9	155	41	47	21	109	548
16:45	32	143	30	205	6	33	0	39	17	126	10	153	29	40	17	86	483
17:00	22	143	29	194	8	27	3	38	13	128	8	149	36	42	19	97	478
17:15	36	166	33	235	2	33	1	36	12	138	9	159	23	50	29	102	532
Total Volume	117	621	137	875	24	127	5	156	47	533	36	616	129	179	86	394	2041
% App. Total	13.4	71	15.7		15.4	81.4	3.2		7.6	86.5	5.8		32.7	45.4	21.8		
PHF	.813	.919	.761	.908	.750	.934	.417	.907	.691	.945	.900	.969	.787	.895	.741	.904	.931
Cars	116	609	124	849	24	123	5	152	45	505	30	580	123	176	83	382	1963
% Cars	99.1	98.1	90.5	97.0	100	96.9	100	97.4	95.7	94.7	83.3	94.2	95.3	98.3	96.5	97.0	96.2
Trucks	1	12	13	26	0	4	0	4	2	28	6	36	6	3	3	12	78
% Trucks	0.9	1.9	9.5	3.0	0	3.1	0	2.6	4.3	5.3	16.7	5.8	4.7	1.7	3.5	3.0	3.8

Accurate Counts
978-664-2565

File Name : 10568004
Site Code : 10568004
Start Date : 8/19/2009
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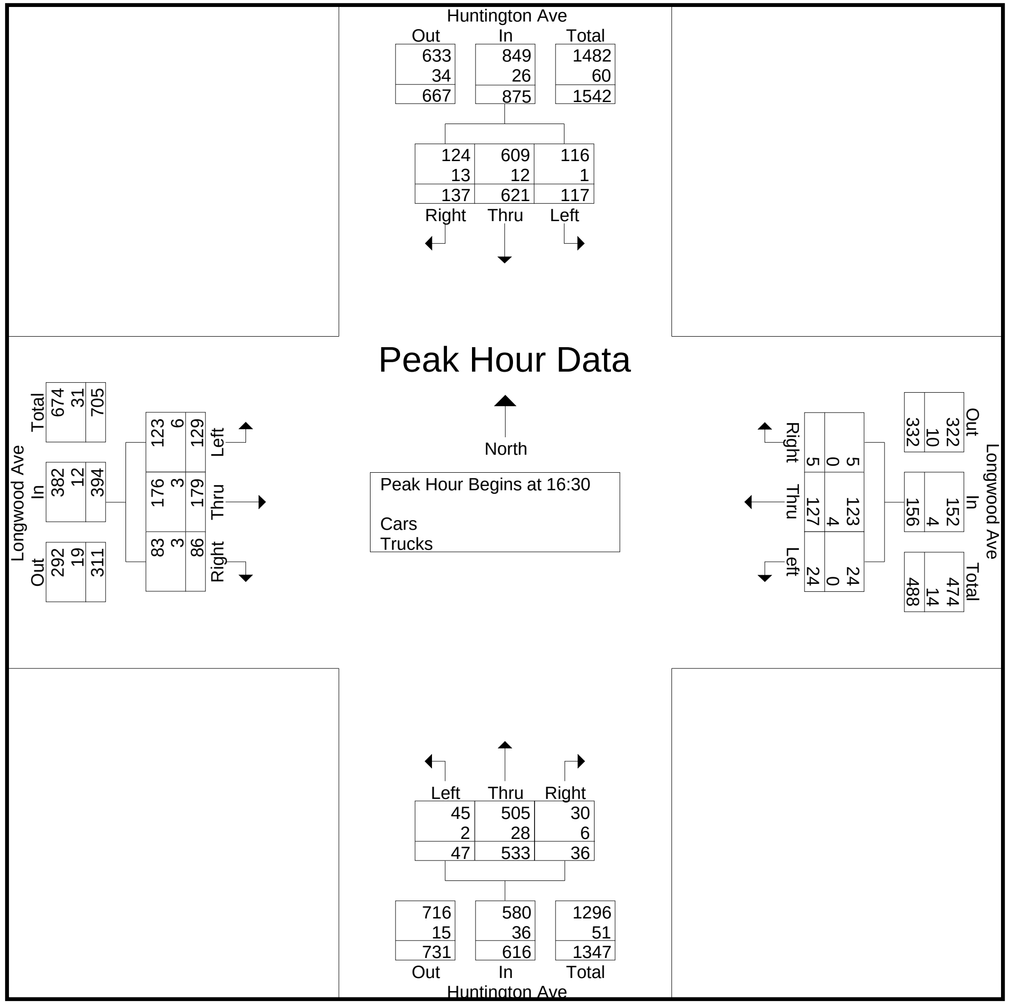
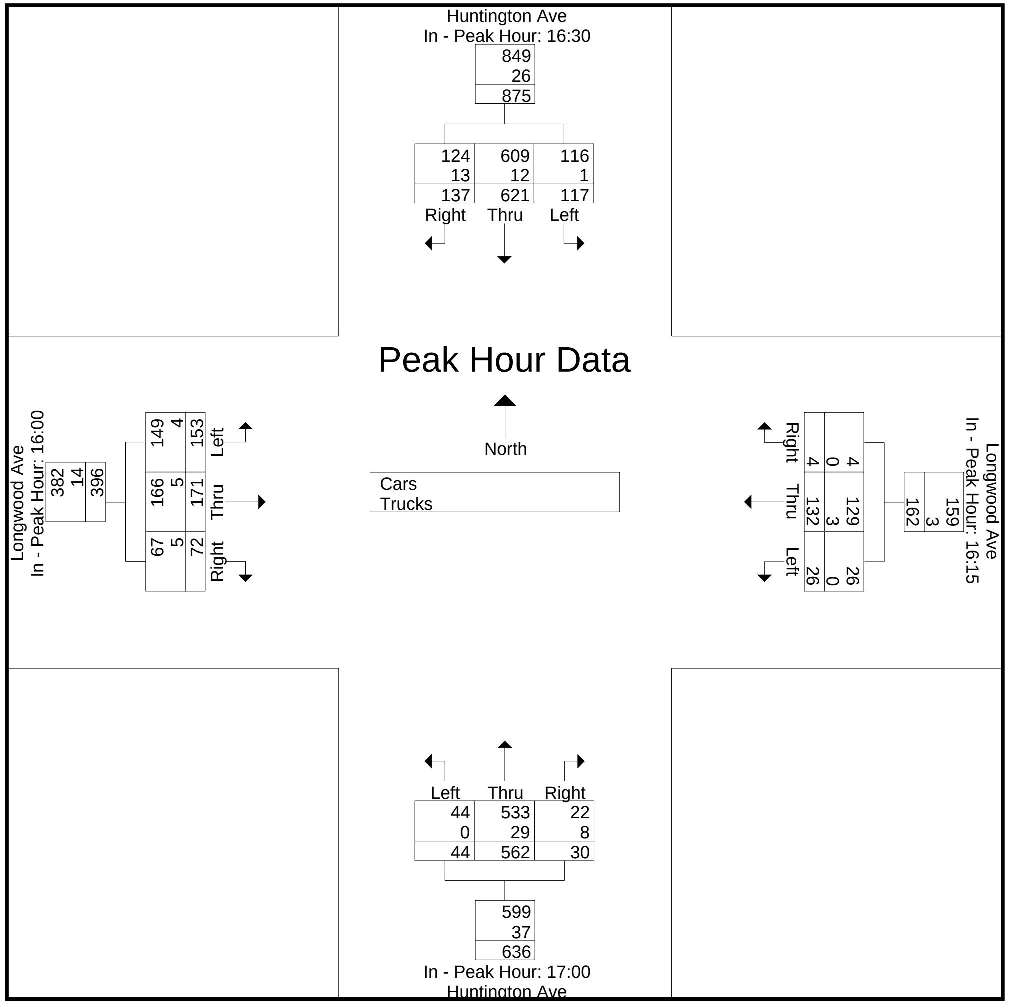


Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:30				16:15				17:00				16:00			
+0 mins.	27	169	45	241	4	38	0	42	13	128	8	149	47	39	15	101
+15 mins.	32	143	30	205	8	34	1	43	12	138	9	159	36	45	19	100
+30 mins.	22	143	29	194	6	33	0	39	10	154	3	167	41	47	21	109
+45 mins.	36	166	33	235	8	27	3	38	9	142	10	161	29	40	17	86
Total Volume	117	621	137	875	26	132	4	162	44	562	30	636	153	171	72	396
% App. Total	13.4	71	15.7		16	81.5	2.5		6.9	88.4	4.7		38.6	43.2	18.2	
PHF	.813	.919	.761	.908	.813	.868	.333	.942	.846	.912	.750	.952	.814	.910	.857	.908
Cars	116	609	124	849	26	129	4	159	44	533	22	599	149	166	67	382

% Cars	99.1	98.1	90.5	97	100	97.7	100	98.1	100	94.8	73.3	94.2	97.4	97.1	93.1	96.5
Trucks	1	12	13	26	0	3	0	3	0	29	8	37	4	5	5	14
% Trucks	0.9	1.9	9.5	3	0	2.3	0	1.9	0	5.2	26.7	5.8	2.6	2.9	6.9	3.5



Accurate Counts
978-664-2565

N/S Street : Longwood Avenue
E/W Street: Longwood Avenue
City/State : Boston, MA
Weather : Clear

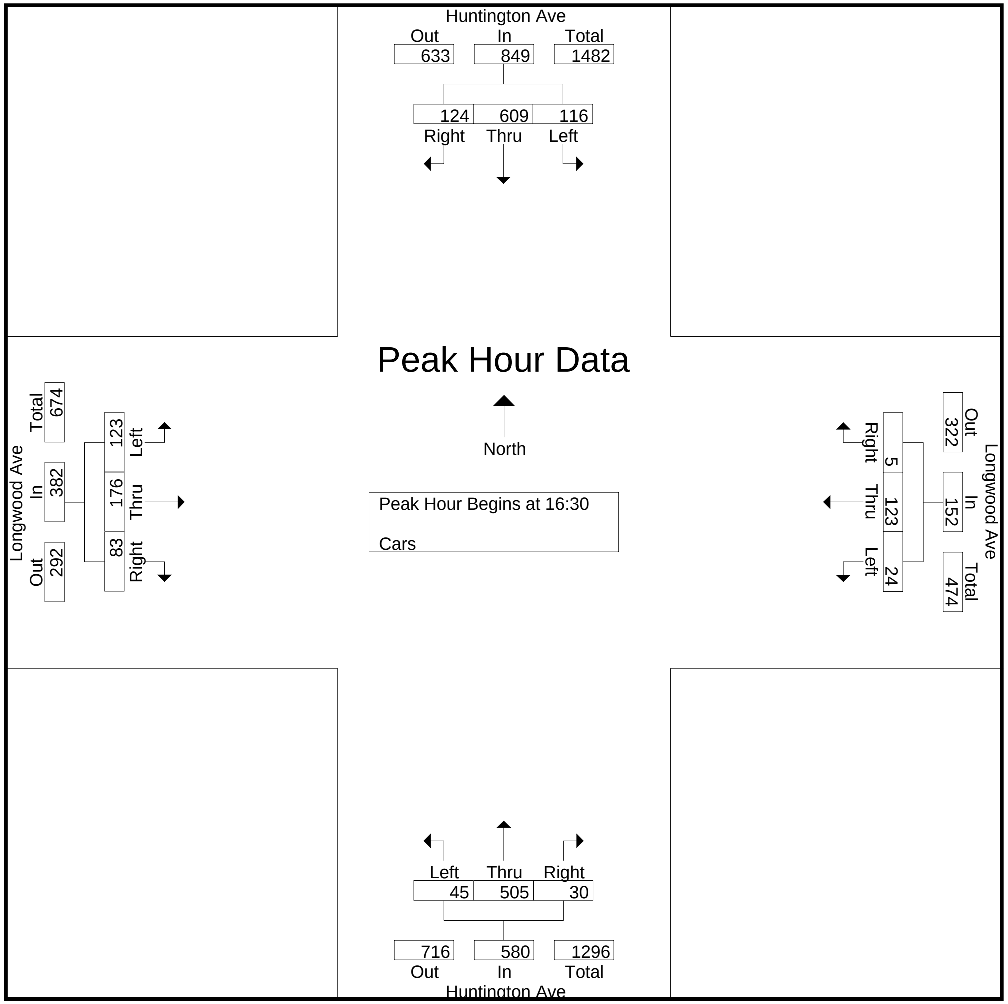
File Name : 10568004
Site Code : 10568004
Start Date : 8/19/2009
Page No : 1

Groups Printed- Cars

	Huntington Ave From North					Longwood Ave From East				Huntington Ave From South					Longwood Ave From West						
Start Time	Left	Thru	Right	U-Trn	Peds	Left	Thru	Right	Peds	Left	Thru	Right	U-Trn	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	25	121	43	3	138	4	19	0	36	18	84	11	6	80	46	38	13	19	282	422	704
16:15	29	125	27	1	166	4	38	0	37	31	116	8	4	37	36	43	18	56	301	475	776
16:30	27	166	41	0	166	8	32	1	42	5	136	7	2	45	39	46	20	45	300	528	828
16:45	31	138	28	2	178	6	32	0	45	15	119	9	4	65	28	39	16	59	353	461	814
Total	112	550	139	6	648	22	121	1	160	69	455	35	16	227	149	166	67	179	1236	1886	3122
17:00	22	141	24	1	225	8	27	3	43	13	123	6	7	30	34	42	19	58	364	462	826
17:15	36	164	31	4	140	2	32	1	33	12	127	8	3	32	22	49	28	39	251	512	763
17:30	25	138	33	2	182	2	19	1	39	10	147	2	1	31	37	41	22	34	289	477	766
17:45	18	154	26	2	116	7	36	0	36	9	136	6	3	28	32	36	16	52	237	476	713
Total	101	597	114	9	663	19	114	5	151	44	533	22	14	121	125	168	85	183	1141	1927	3068
Grand Total	213	1147	253	15	1311	41	235	6	311	113	988	57	30	348	274	334	152	362	2377	3813	6190
Apprch %	13.2	71.1	15.7			14.5	83.3	2.1		9.8	85.3	4.9			36.1	43.9	20				
Total %	5.6	30.1	6.6			1.1	6.2	0.2		3	25.9	1.5			7.2	8.8	4		38.4	61.6	

	Huntington Ave From North				Longwood Ave From East				Huntington Ave From South				Longwood Ave From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 16:30																	
16:30	27	166	41	234	8	32	1	41	5	136	7	148	39	46	20	105	528
16:45	31	138	28	197	6	32	0	38	15	119	9	143	28	39	16	83	461
17:00	22	141	24	187	8	27	3	38	13	123	6	142	34	42	19	95	462
17:15	36	164	31	231	2	32	1	35	12	127	8	147	22	49	28	99	512
Total Volume	116	609	124	849	24	123	5	152	45	505	30	580	123	176	83	382	1963
% App. Total	13.7	71.7	14.6		15.8	80.9	3.3		7.8	87.1	5.2		32.2	46.1	21.7		
PHF	.806	.917	.756	.907	.750	.961	.417	.927	.750	.928	.833	.980	.788	.898	.741	.910	.929

File Name : 10568004
Site Code : 10568004
Start Date : 8/19/2009

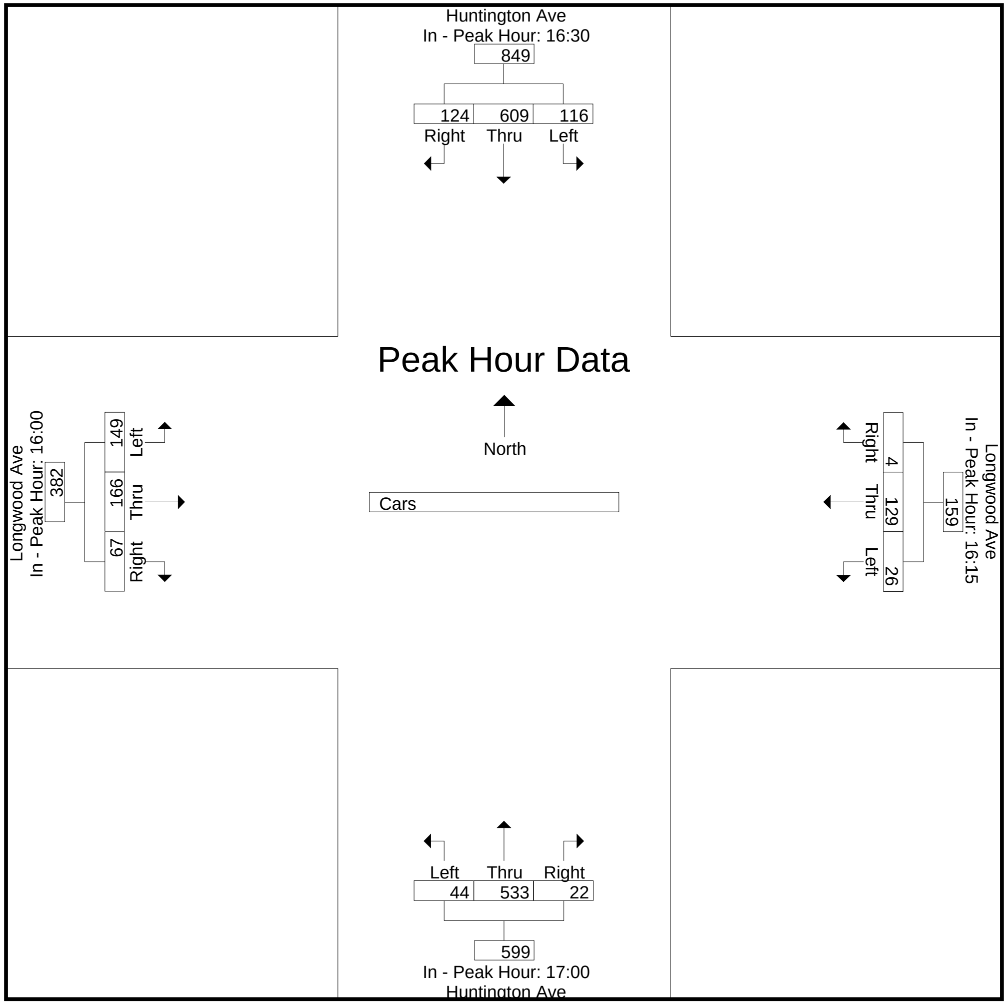


Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:30				16:15				17:00				16:00			
+0 mins.	27	166	41	234	4	38	0	42	13	123	6	142	46	38	13	97
+15 mins.	31	138	28	197	8	32	1	41	12	127	8	147	36	43	18	97
+30 mins.	22	141	24	187	6	32	0	38	10	147	2	159	39	46	20	105
+45 mins.	36	164	31	231	8	27	3	38	9	136	6	151	28	39	16	83
Total Volume	116	609	124	849	26	129	4	159	44	533	22	599	149	166	67	382
% App. Total	13.7	71.7	14.6		16.4	81.1	2.5		7.3	89	3.7		39	43.5	17.5	
PHF	.806	.917	.756	.907	.813	.849	.333	.946	.846	.906	.688	.942	.810	.902	.838	.910

Accurate Counts
978-664-2565

File Name : 10568004
Site Code : 10568004
Start Date : 8/19/2009
Page No : 3



Accurate Counts
978-664-2565

N/S Street : Longwood Avenue
E/W Street: Longwood Avenue
City/State : Boston, MA
Weather : Clear

File Name : 10568004
Site Code : 10568004
Start Date : 8/19/2009
Page No : 1

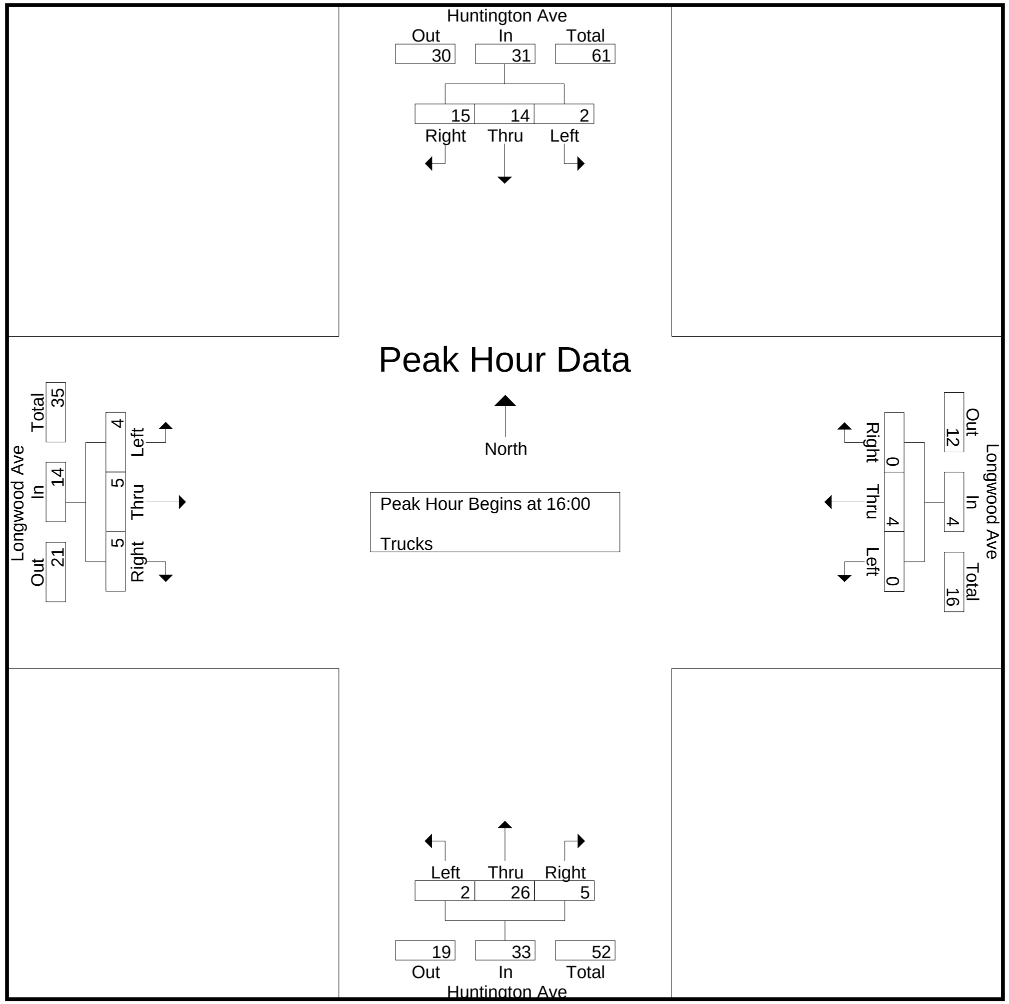
Groups Printed- Trucks

	Huntington Ave From North					Longwood Ave From East				Huntington Ave From South					Longwood Ave From West						
Start Time	Left	Thru	Right	U-Trn	Peds	Left	Thru	Right	Peds	Left	Thru	Right	U-Trn	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
16:00	0	5	4	0	0	0	1	0	0	0	5	2	0	0	1	1	2	0	0	21	21
16:15	1	1	5	0	0	0	0	0	0	0	9	0	0	0	0	2	1	0	0	19	19
16:30	0	3	4	0	0	0	2	0	0	0	5	2	0	0	2	1	1	0	0	20	20
16:45	1	5	2	0	0	0	1	0	0	2	7	1	0	0	1	1	1	0	0	22	22
Total	2	14	15	0	0	0	4	0	0	2	26	5	0	0	4	5	5	0	0	82	82
17:00	0	2	5	0	0	0	0	0	0	0	5	2	0	0	2	0	0	0	0	16	16
17:15	0	2	2	0	0	0	1	0	0	0	11	1	0	0	1	1	1	0	0	20	20
17:30	0	5	2	0	0	0	1	0	0	0	7	1	0	0	1	0	0	0	0	17	17
17:45	0	5	1	0	0	0	2	0	0	0	6	4	0	0	1	1	1	0	0	21	21
Total	0	14	10	0	0	0	4	0	0	0	29	8	0	0	5	2	2	0	0	74	74
Grand Total	2	28	25	0	0	0	8	0	0	2	55	13	0	0	9	7	7	0	0	156	156
Apprch %	3.6	50.9	45.5			0	100	0		2.9	78.6	18.6			39.1	30.4	30.4				
Total %	1.3	17.9	16			0	5.1	0		1.3	35.3	8.3			5.8	4.5	4.5		0	100	

	Huntington Ave From North				Longwood Ave From East				Huntington Ave From South				Longwood Ave From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 16:00																	
16:00	0	5	4	9	0	1	0	1	0	5	2	7	1	1	2	4	21
16:15	1	1	5	7	0	0	0	0	0	9	0	9	0	2	1	3	19
16:30	0	3	4	7	0	2	0	2	0	5	2	7	2	1	1	4	20
16:45	1	5	2	8	0	1	0	1	2	7	1	10	1	1	1	3	22
Total Volume	2	14	15	31	0	4	0	4	2	26	5	33	4	5	5	14	82
% App. Total	6.5	45.2	48.4		0	100	0		6.1	78.8	15.2		28.6	35.7	35.7		
PHF	.500	.700	.750	.861	.000	.500	.000	.500	.250	.722	.625	.825	.500	.625	.625	.875	.932

Accurate Counts
978-664-2565

File Name : 10568004
Site Code : 10568004
Start Date : 8/19/2009
Page No : 2



Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:00				16:00				16:45				16:00			
+0 mins.	0	5	4	9	0	1	0	1	2	7	1	10	1	1	2	4
+15 mins.	1	1	5	7	0	0	0	0	0	5	2	7	0	2	1	3
+30 mins.	0	3	4	7	0	2	0	2	0	11	1	12	2	1	1	4
+45 mins.	1	5	2	8	0	1	0	1	0	7	1	8	1	1	1	3
Total Volume	2	14	15	31	0	4	0	4	2	30	5	37	4	5	5	14
% App. Total	6.5	45.2	48.4		0	100	0		5.4	81.1	13.5		28.6	35.7	35.7	
PHF	.500	.700	.750	.861	.000	.500	.000	.500	.250	.682	.625	.771	.500	.625	.625	.875

Accurate Counts
978-664-2565

File Name : 10568004
Site Code : 10568004
Start Date : 8/19/2009
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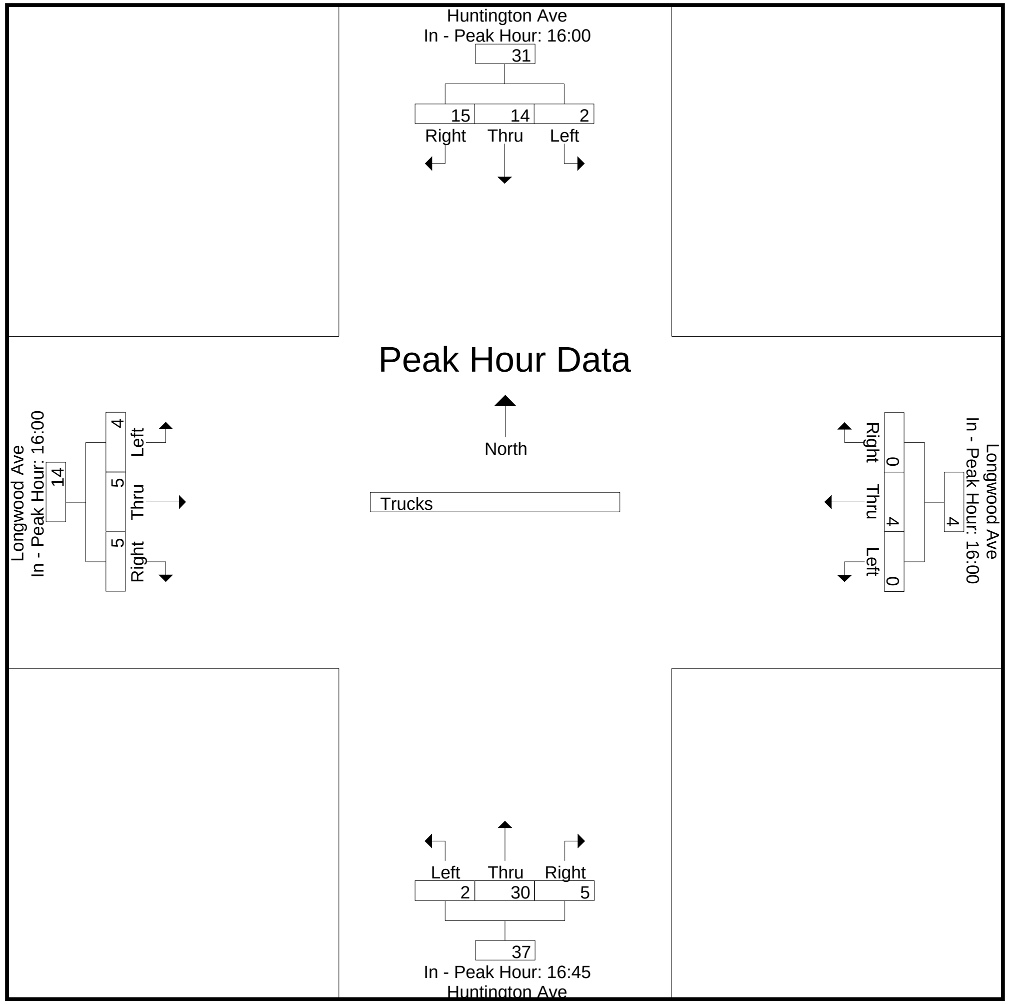


Accurate Counts
978-664-2565

N/S Street : Longwood Avenue
E/W Street: Longwood Avenue
City/State : Boston, MA
Weather : Clear

File Name : 10568004
Site Code : 10568004
Start Date : 8/19/2009
Page No : 1

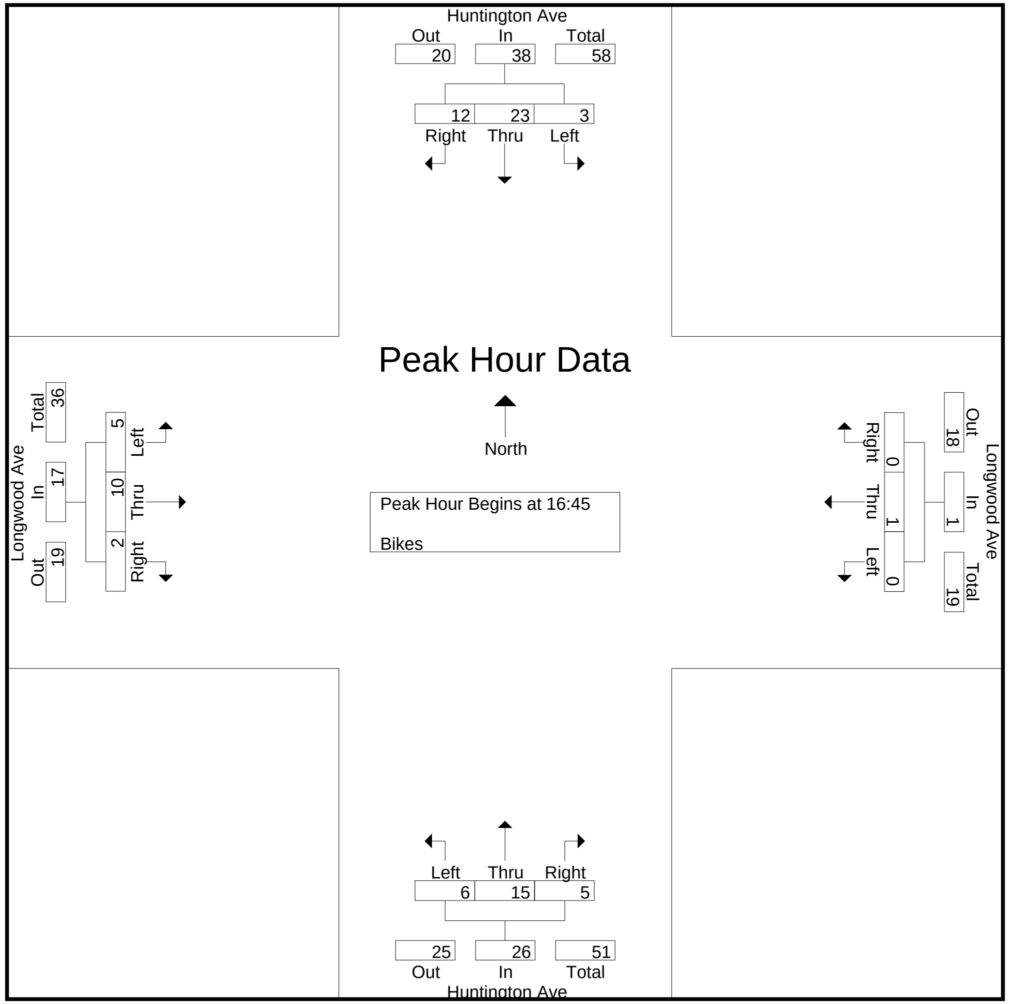
Groups Printed- Bikes

	Huntington Ave From North			Longwood Ave From East			Huntington Ave From South			Longwood Ave From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
16:00	2	1	0	0	0	0	0	2	0	1	2	0	8
16:15	1	8	1	0	0	0	0	1	0	0	1	2	14
16:30	1	7	0	0	2	0	0	6	0	1	0	0	17
16:45	0	8	3	0	0	0	0	3	1	2	4	1	22
Total	4	24	4	0	2	0	0	12	1	4	7	3	61
17:00	1	4	3	0	1	0	0	2	2	1	3	1	18
17:15	1	5	1	0	0	0	4	5	1	1	2	0	20
17:30	1	6	5	0	0	0	2	5	1	1	1	0	22
17:45	0	5	0	0	4	0	1	3	0	1	1	0	15
Total	3	20	9	0	5	0	7	15	4	4	7	1	75
Grand Total	7	44	13	0	7	0	7	27	5	8	14	4	136
Apprch %	10.9	68.8	20.3	0	100	0	17.9	69.2	12.8	30.8	53.8	15.4	
Total %	5.1	32.4	9.6	0	5.1	0	5.1	19.9	3.7	5.9	10.3	2.9	

	Huntington Ave From North				Longwood Ave From East				Huntington Ave From South				Longwood Ave From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 16:45																	
16:45	0	8	3	11	0	0	0	0	0	3	1	4	2	4	1	7	22
17:00	1	4	3	8	0	1	0	1	0	2	2	4	1	3	1	5	18
17:15	1	5	1	7	0	0	0	0	4	5	1	10	1	2	0	3	20
17:30	1	6	5	12	0	0	0	0	2	5	1	8	1	1	0	2	22
Total Volume	3	23	12	38	0	1	0	1	6	15	5	26	5	10	2	17	82
% App. Total	7.9	60.5	31.6		0	100	0		23.1	57.7	19.2		29.4	58.8	11.8		
PHF	.750	.719	.600	.792	.000	.250	.000	.250	.375	.750	.625	.650	.625	.625	.500	.607	.932

Accurate Counts
978-664-2565

File Name : 10568004
Site Code : 10568004
Start Date : 8/19/2009
Page No : 2

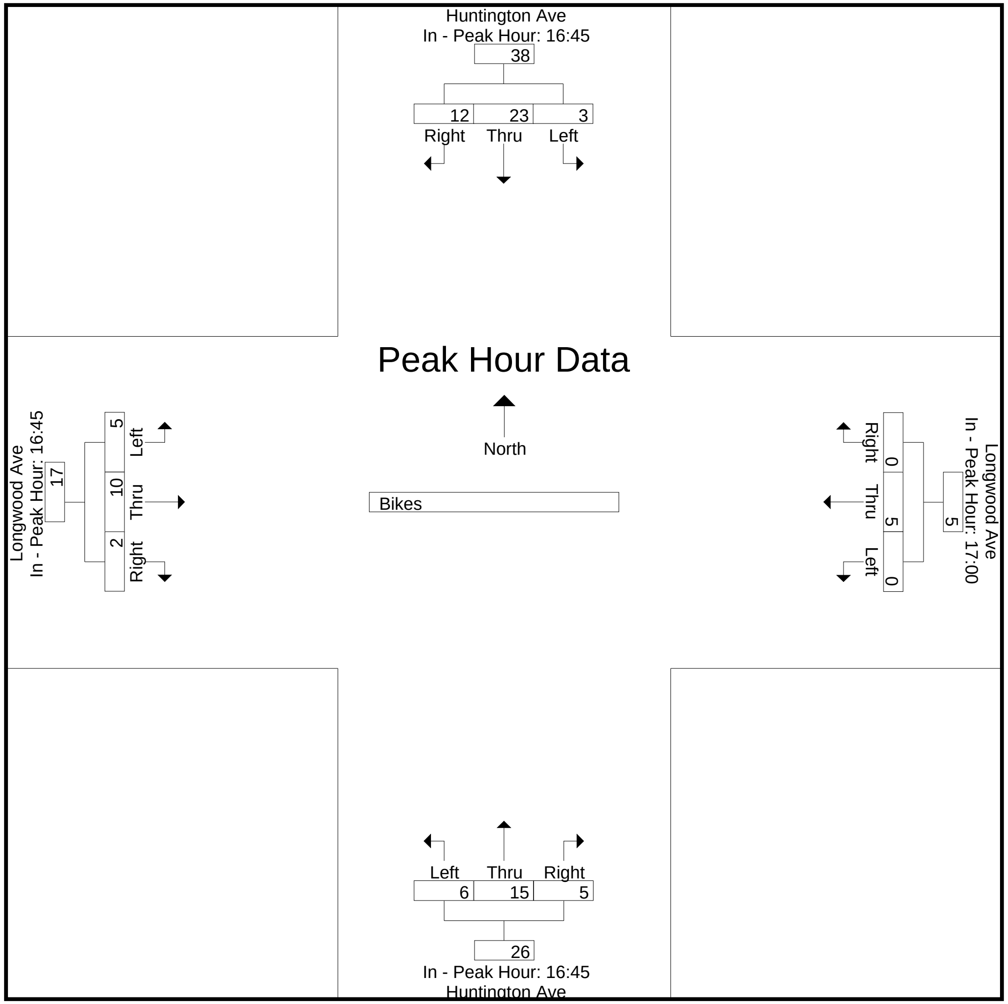


Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:45				17:00				16:45				16:45			
+0 mins.	0	8	3	11	0	1	0	1	0	3	1	4	2	4	1	7
+15 mins.	1	4	3	8	0	0	0	0	0	2	2	4	1	3	1	5
+30 mins.	1	5	1	7	0	0	0	0	4	5	1	10	1	2	0	3
+45 mins.	1	6	5	12	0	4	0	4	2	5	1	8	1	1	0	2
Total Volume	3	23	12	38	0	5	0	5	6	15	5	26	5	10	2	17
% App. Total	7.9	60.5	31.6		0	100	0		23.1	57.7	19.2		29.4	58.8	11.8	
PHF	.750	.719	.600	.792	.000	.313	.000	.313	.375	.750	.625	.650	.625	.625	.500	.607

Accurate Counts
978-664-2565

File Name : 10568004
Site Code : 10568004
Start Date : 8/19/2009
Page No : 3



N/S Street : Vining St / Garage
E/W Street: Vining St / Parking Lot
City/State : Boston, MA
Weather : Clear

File Name : 10568005
Site Code : 10568005
Start Date : 8/19/2009
Page No : 1

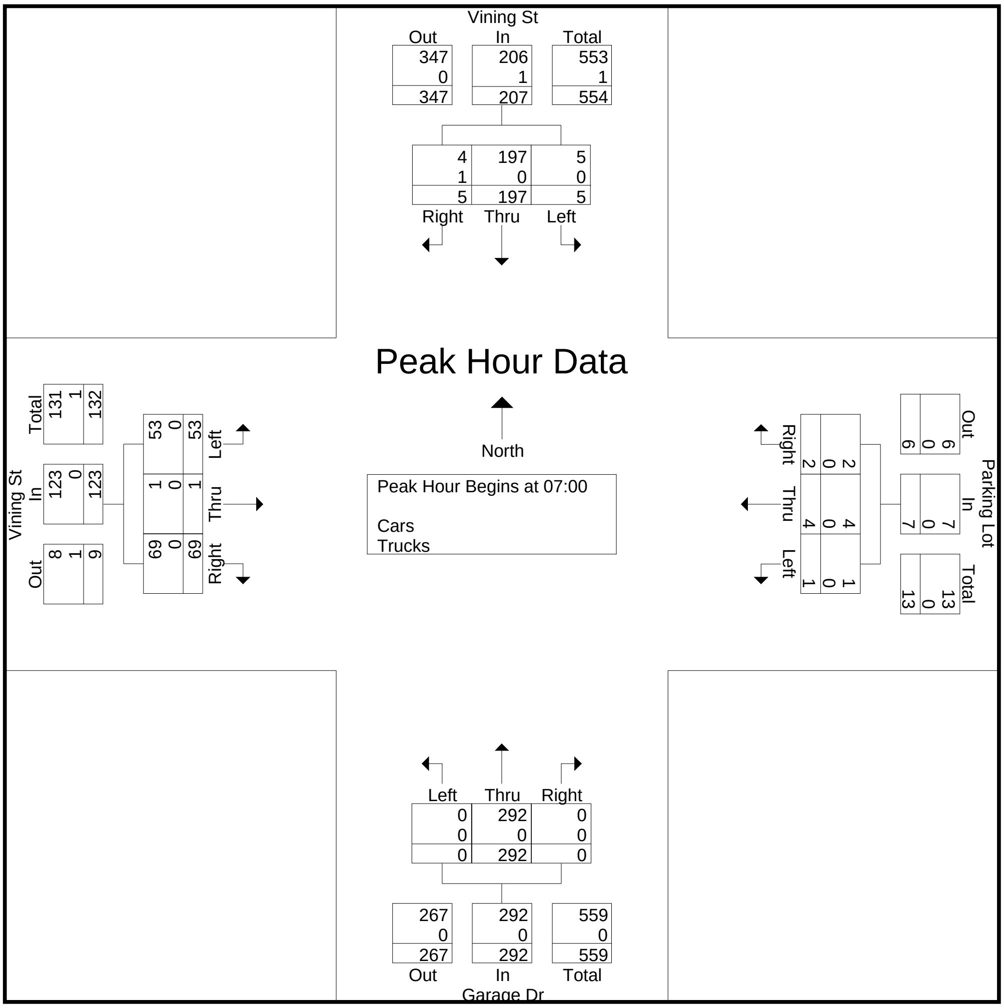
Groups Printed- Cars - Trucks

	Vining St From North				Parking Lot From East				Garage Dr From South				Vining St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	2	43	1	14	0	1	1	30	0	58	0	7	13	0	14	142	193	133	326
07:15	0	44	0	12	0	0	0	23	0	98	0	5	17	0	18	162	202	177	379
07:30	0	58	4	2	0	1	0	32	0	94	0	11	9	0	21	165	210	187	397
07:45	3	52	0	19	1	2	1	42	0	42	0	7	14	1	16	108	176	132	308
Total	5	197	5	47	1	4	2	127	0	292	0	30	53	1	69	577	781	629	1410
08:00	0	33	1	10	0	0	2	24	1	40	0	4	21	1	10	77	115	109	224
08:15	1	37	2	8	0	0	0	27	0	25	0	11	17	0	14	70	116	96	212
08:30	1	46	4	10	0	0	2	27	1	17	0	6	29	0	8	69	112	108	220
08:45	1	43	2	8	1	0	1	20	0	16	0	4	25	0	14	63	95	103	198
Total	3	159	9	36	1	0	5	98	2	98	0	25	92	1	46	279	438	416	854
Grand Total	8	356	14	83	2	4	7	225	2	390	0	55	145	2	115	856	1219	1045	2264
Apprch %	2.1	94.2	3.7		15.4	30.8	53.8		0.5	99.5	0		55.3	0.8	43.9				
Total %	0.8	34.1	1.3		0.2	0.4	0.7		0.2	37.3	0		13.9	0.2	11		53.8	46.2	
Cars	8	356	13		2	4	7		2	390	0		144	2	115		0	0	2262
% Cars	100	100	92.9	100	100	100	100	100	100	100	0	100	99.3	100	100	100	0	0	99.9
Trucks	0	0	1		0	0	0		0	0	0		1	0	0		0	0	2
% Trucks	0	0	7.1	0	0	0	0	0	0	0	0	0	0.7	0	0	0	0	0	0.1

	Vining St From North				Parking Lot From East				Garage Dr From South				Vining St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:00																	
07:00	2	43	1	46	0	1	1	2	0	58	0	58	13	0	14	27	133
07:15	0	44	0	44	0	0	0	0	0	98	0	98	17	0	18	35	177
07:30	0	58	4	62	0	1	0	1	0	94	0	94	9	0	21	30	187
07:45	3	52	0	55	1	2	1	4	0	42	0	42	14	1	16	31	132
Total Volume	5	197	5	207	1	4	2	7	0	292	0	292	53	1	69	123	629
% App. Total	2.4	95.2	2.4		14.3	57.1	28.6		0	100	0		43.1	0.8	56.1		
PHF	.417	.849	.313	.835	.250	.500	.500	.438	.000	.745	.000	.745	.779	.250	.821	.879	.841
Cars	5	197	4	206	1	4	2	7	0	292	0	292	53	1	69	123	628
% Cars	100	100	80.0	99.5	100	100	100	100	0	100	0	100	100	100	100	100	99.8
Trucks	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1
% Trucks	0	0	20.0	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0.2

Accurate Counts
978-664-2565

File Name : 10568005
Site Code : 10568005
Start Date : 8/19/2009
Page No : 2

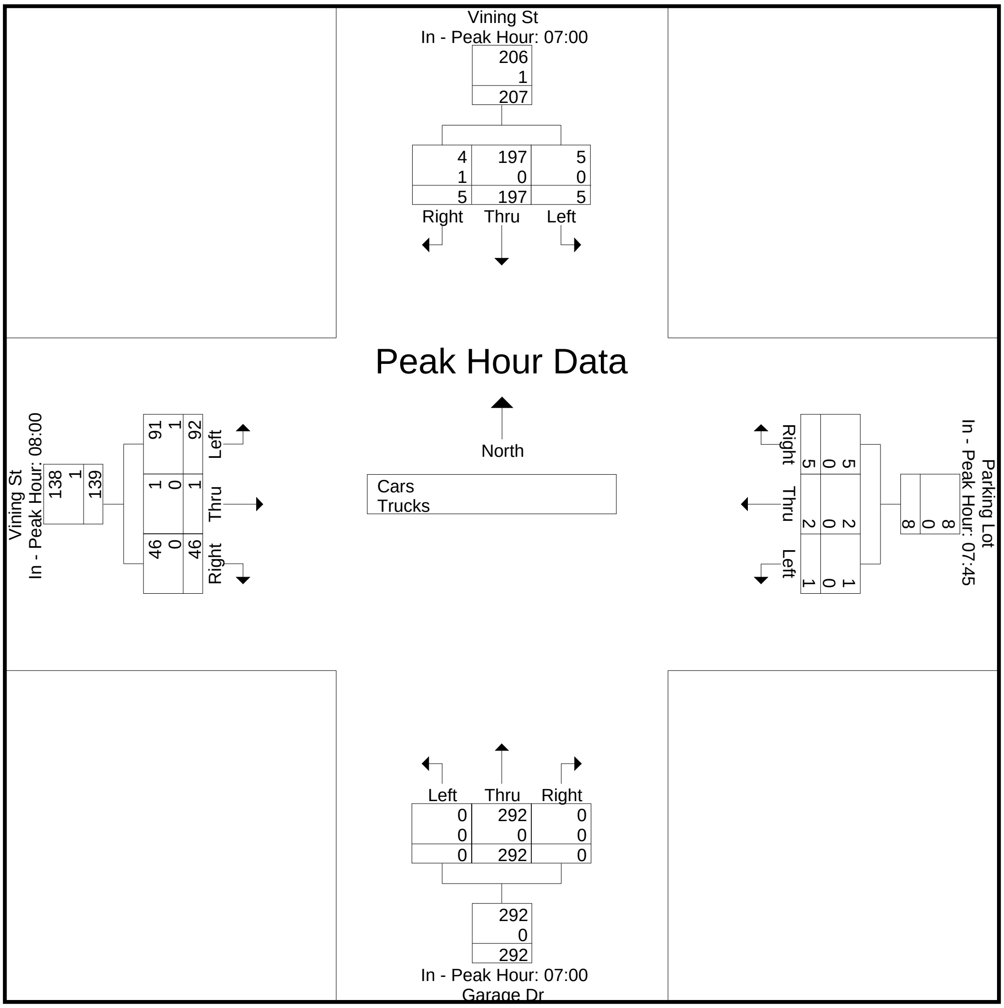


Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:00				07:45				07:00				08:00			
+0 mins.	2	43	1	46	1	2	1	4	0	58	0	58	21	1	10	32
+15 mins.	0	44	0	44	0	0	2	2	0	98	0	98	17	0	14	31
+30 mins.	0	58	4	62	0	0	0	0	0	94	0	94	29	0	8	37
+45 mins.	3	52	0	55	0	0	2	2	0	42	0	42	25	0	14	39
Total Volume	5	197	5	207	1	2	5	8	0	292	0	292	92	1	46	139
% App. Total	2.4	95.2	2.4		12.5	25	62.5		0	100	0		66.2	0.7	33.1	
PHF	.417	.849	.313	.835	.250	.250	.625	.500	.000	.745	.000	.745	.793	.250	.821	.891
Cars	5	197	4	206	1	2	5	8	0	292	0	292	91	1	46	138
% Cars	100	100	80	99.5	100	100	100	100	0	100	0	100	98.9	100	100	99.3
Trucks	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	1
% Trucks	0	0	20	0.5	0	0	0	0	0	0	0	0	1.1	0	0	0.7

Accurate Counts
978-664-2565

File Name : 10568005
Site Code : 10568005
Start Date : 8/19/2009
Page No : 3



Accurate Counts
978-664-2565

N/S Street : Vining St / Garage
E/W Street: Vining St / Parking Lot
City/State : Boston, MA
Weather : Clear

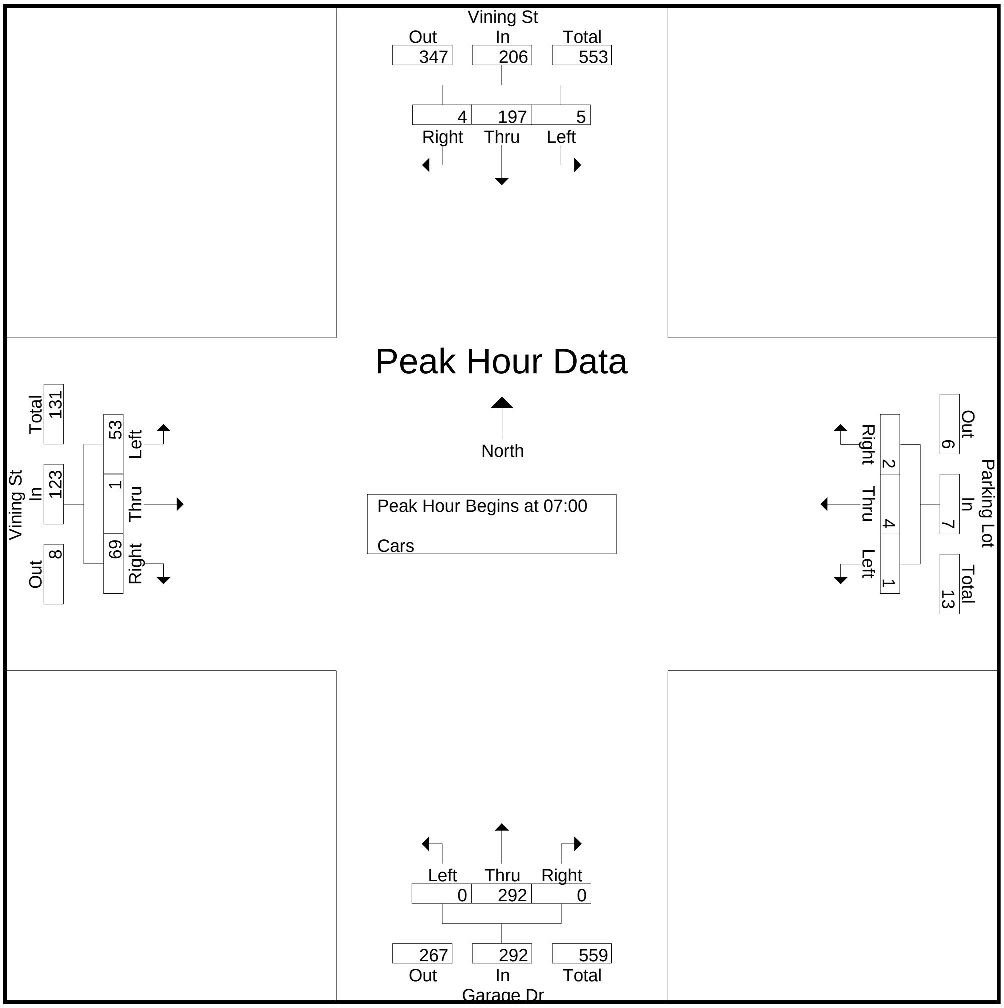
File Name : 10568005
Site Code : 10568005
Start Date : 8/19/2009
Page No : 1

Groups Printed- Cars

	Vining St From North				Parking Lot From East				Garage Dr From South				Vining St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	2	43	1	14	0	1	1	30	0	58	0	7	13	0	14	142	193	133	326
07:15	0	44	0	12	0	0	0	23	0	98	0	5	17	0	18	162	202	177	379
07:30	0	58	3	2	0	1	0	32	0	94	0	11	9	0	21	165	210	186	396
07:45	3	52	0	19	1	2	1	42	0	42	0	7	14	1	16	108	176	132	308
Total	5	197	4	47	1	4	2	127	0	292	0	30	53	1	69	577	781	628	1409
08:00	0	33	1	10	0	0	2	24	1	40	0	4	21	1	10	77	115	109	224
08:15	1	37	2	8	0	0	0	27	0	25	0	11	16	0	14	70	116	95	211
08:30	1	46	4	10	0	0	2	27	1	17	0	6	29	0	8	69	112	108	220
08:45	1	43	2	8	1	0	1	20	0	16	0	4	25	0	14	63	95	103	198
Total	3	159	9	36	1	0	5	98	2	98	0	25	91	1	46	279	438	415	853
Grand Total	8	356	13	83	2	4	7	225	2	390	0	55	144	2	115	856	1219	1043	2262
Apprch %	2.1	94.4	3.4		15.4	30.8	53.8		0.5	99.5	0		55.2	0.8	44.1				
Total %	0.8	34.1	1.2		0.2	0.4	0.7		0.2	37.4	0		13.8	0.2	11		53.9	46.1	

	Vining St From North				Parking Lot From East				Garage Dr From South				Vining St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:00																	
07:00	2	43	1	46	0	1	1	2	0	58	0	58	13	0	14	27	133
07:15	0	44	0	44	0	0	0	0	0	98	0	98	17	0	18	35	177
07:30	0	58	3	61	0	1	0	1	0	94	0	94	9	0	21	30	186
07:45	3	52	0	55	1	2	1	4	0	42	0	42	14	1	16	31	132
Total Volume	5	197	4	206	1	4	2	7	0	292	0	292	53	1	69	123	628
% App. Total	2.4	95.6	1.9		14.3	57.1	28.6		0	100	0		43.1	0.8	56.1		
PHF	.417	.849	.333	.844	.250	.500	.500	.438	.000	.745	.000	.745	.779	.250	.821	.879	.844

File Name : 10568005
Site Code : 10568005
Start Date : 8/19/2009
Page No : 2

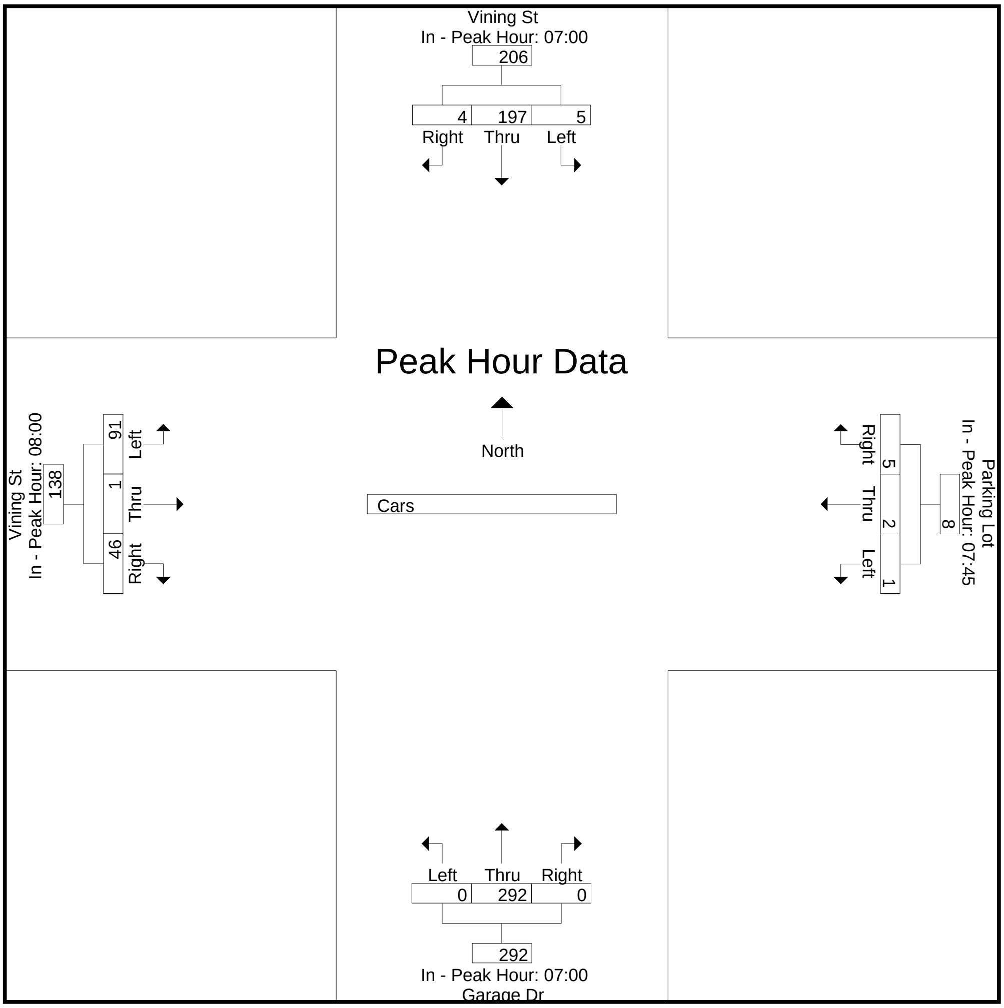


Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:00				07:45				07:00				08:00			
+0 mins.	2	43	1	46	1	2	1	4	0	58	0	58	21	1	10	32
+15 mins.	0	44	0	44	0	0	2	2	0	98	0	98	16	0	14	30
+30 mins.	0	58	3	61	0	0	0	0	0	94	0	94	29	0	8	37
+45 mins.	3	52	0	55	0	0	2	2	0	42	0	42	25	0	14	39
Total Volume	5	197	4	206	1	2	5	8	0	292	0	292	91	1	46	138
% App. Total	2.4	95.6	1.9		12.5	25	62.5		0	100	0		65.9	0.7	33.3	
PHF	.417	.849	.333	.844	.250	.250	.625	.500	.000	.745	.000	.745	.784	.250	.821	.885

Accurate Counts
978-664-2565

File Name : 10568005
Site Code : 10568005
Start Date : 8/19/2009
Page No : 3



Accurate Counts
978-664-2565

N/S Street : Vining St / Garage
E/W Street: Vining St / Parking Lot
City/State : Boston, MA
Weather : Clear

File Name : 10568005
Site Code : 10568005
Start Date : 8/19/2009
Page No : 1

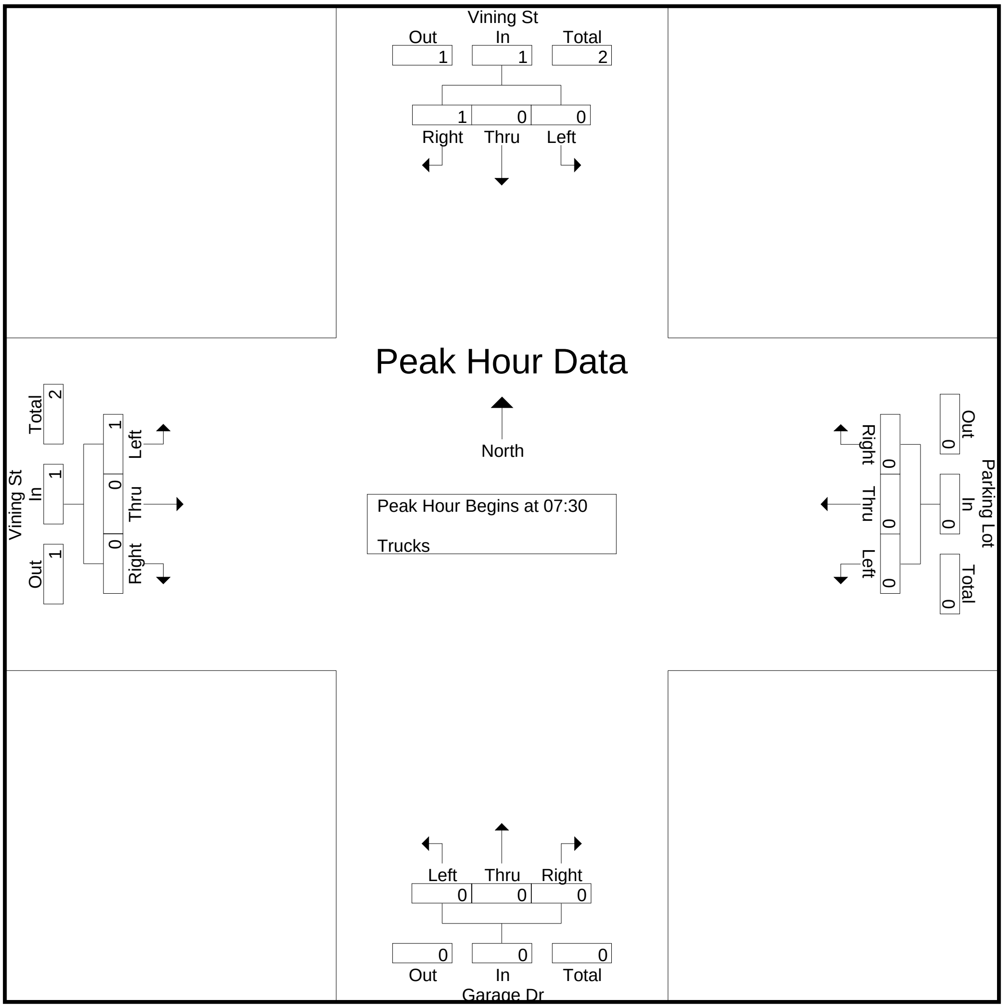
Groups Printed- Trucks

	Vining St From North				Parking Lot From East				Garage Dr From South				Vining St From West						
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
07:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
08:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1
08:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1
Grand Total	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	2
Apprch %	0	0	100		0	0	0		0	0	0		100	0	0				
Total %	0	0	50		0	0	0		0	0	0		50	0	0		0	100	

	Vining St From North				Parking Lot From East				Garage Dr From South				Vining St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:30																	
07:30	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1
07:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
Total Volume	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	1	2
% App. Total	0	0	100		0	0	0		0	0	0		100	0	0		
PHF	.000	.000	.250	.250	.000	.000	.000	.000	.000	.000	.000	.000	.250	.000	.000	.250	.500

Accurate Counts
978-664-2565

File Name : 10568005
Site Code : 10568005
Start Date : 8/19/2009
Page No : 2

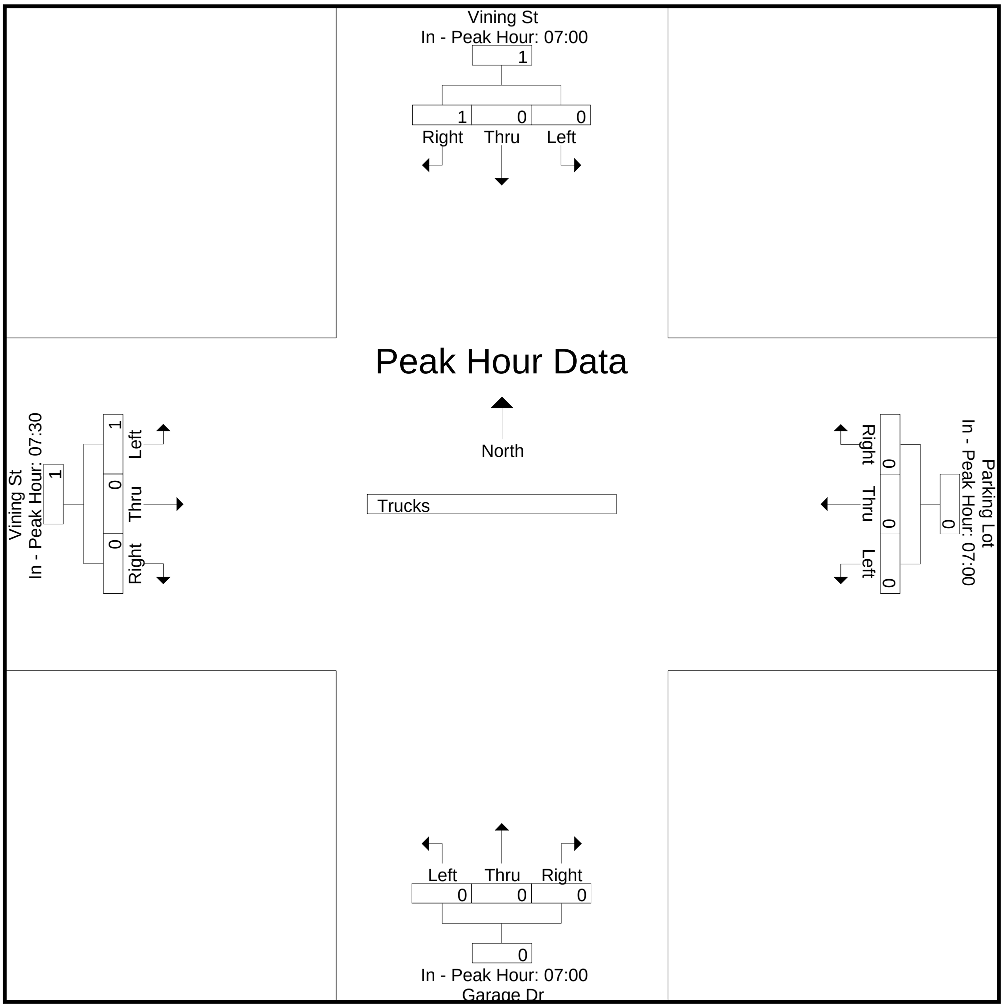


Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:00				07:00				07:00				07:30			
+0 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+15 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+30 mins.	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
+45 mins.	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Total Volume	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	1
% App. Total	0	0	100		0	0	0		0	0	0		100	0	0	
PHF	.000	.000	.250	.250	.000	.000	.000	.000	.000	.000	.000	.000	.250	.000	.000	.250

Accurate Counts
978-664-2565

File Name : 10568005
Site Code : 10568005
Start Date : 8/19/2009
Page No : 3



N/S Street : Vining St / Garage
E/W Street: Vining St / Parking Lot
City/State : Boston, MA
Weather : Clear

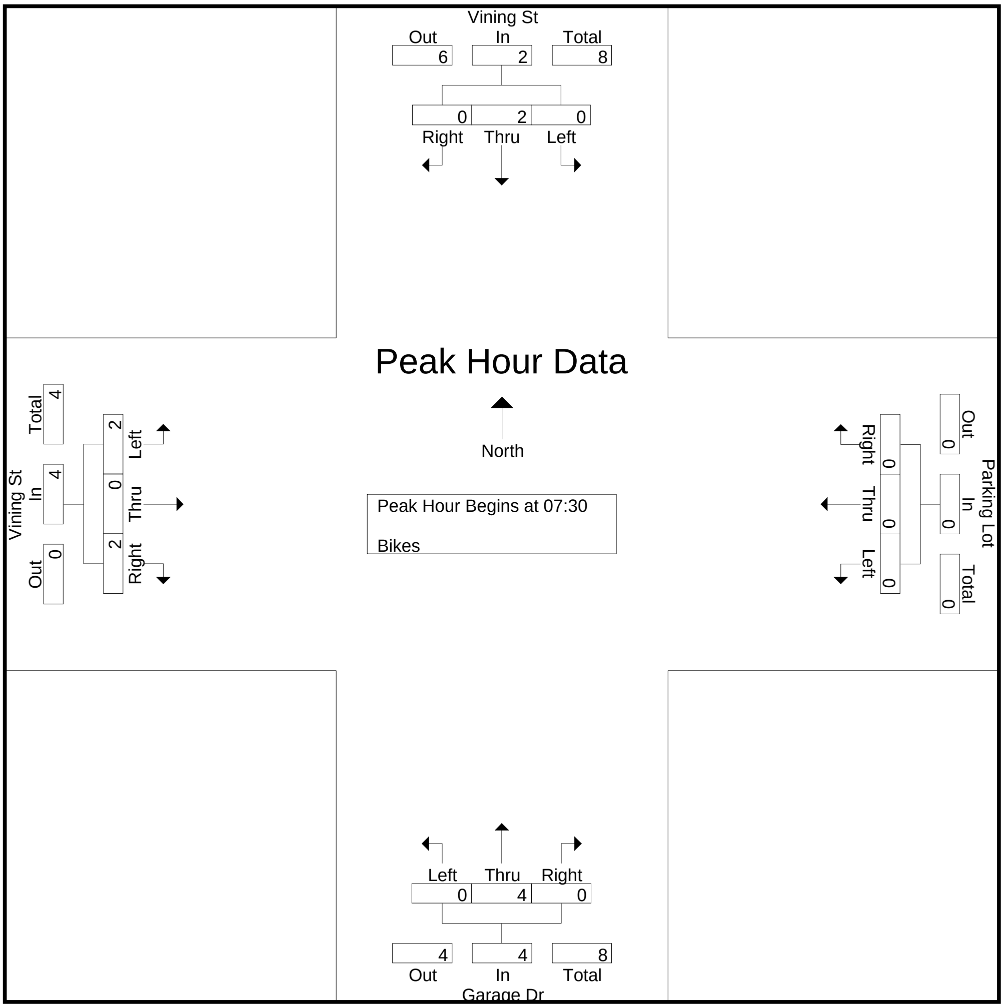
File Name : 10568005
Site Code : 10568005
Start Date : 8/19/2009
Page No : 1

Groups Printed- Bikes

	Vining St From North			Parking Lot From East			Garage Dr From South			Vining St From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
07:00	0	1	0	0	0	0	0	0	0	0	0	0	1
07:15	0	0	0	0	0	0	0	0	0	0	0	2	2
07:30	0	1	0	0	0	0	0	0	0	0	0	0	1
07:45	0	0	0	0	0	0	0	1	0	2	0	0	3
Total	0	2	0	0	0	0	0	1	0	2	0	2	7
08:00	0	1	0	0	0	0	0	1	0	0	0	0	2
08:15	0	0	0	0	0	0	0	2	0	0	0	2	4
08:30	0	0	0	0	0	0	0	0	0	1	0	0	1
08:45	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	1	0	0	0	0	0	3	0	1	0	2	7
Grand Total	0	3	0	0	0	0	0	4	0	3	0	4	14
Apprch %	0	100	0	0	0	0	0	100	0	42.9	0	57.1	
Total %	0	21.4	0	0	0	0	0	28.6	0	21.4	0	28.6	

	Vining St From North				Parking Lot From East				Garage Dr From South				Vining St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:30																	
07:30	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
07:45	0	0	0	0	0	0	0	0	0	1	0	1	2	0	0	2	3
08:00	0	1	0	1	0	0	0	0	0	1	0	1	0	0	0	0	2
08:15	0	0	0	0	0	0	0	0	0	2	0	2	0	0	2	2	4
Total Volume	0	2	0	2	0	0	0	0	0	4	0	4	2	0	2	4	10
% App. Total	0	100	0		0	0	0		0	100	0		50	0	50		
PHF	.000	.500	.000	.500	.000	.000	.000	.000	.000	.500	.000	.500	.250	.000	.250	.500	.625

File Name : 10568005
Site Code : 10568005
Start Date : 8/19/2009
Page No : 2

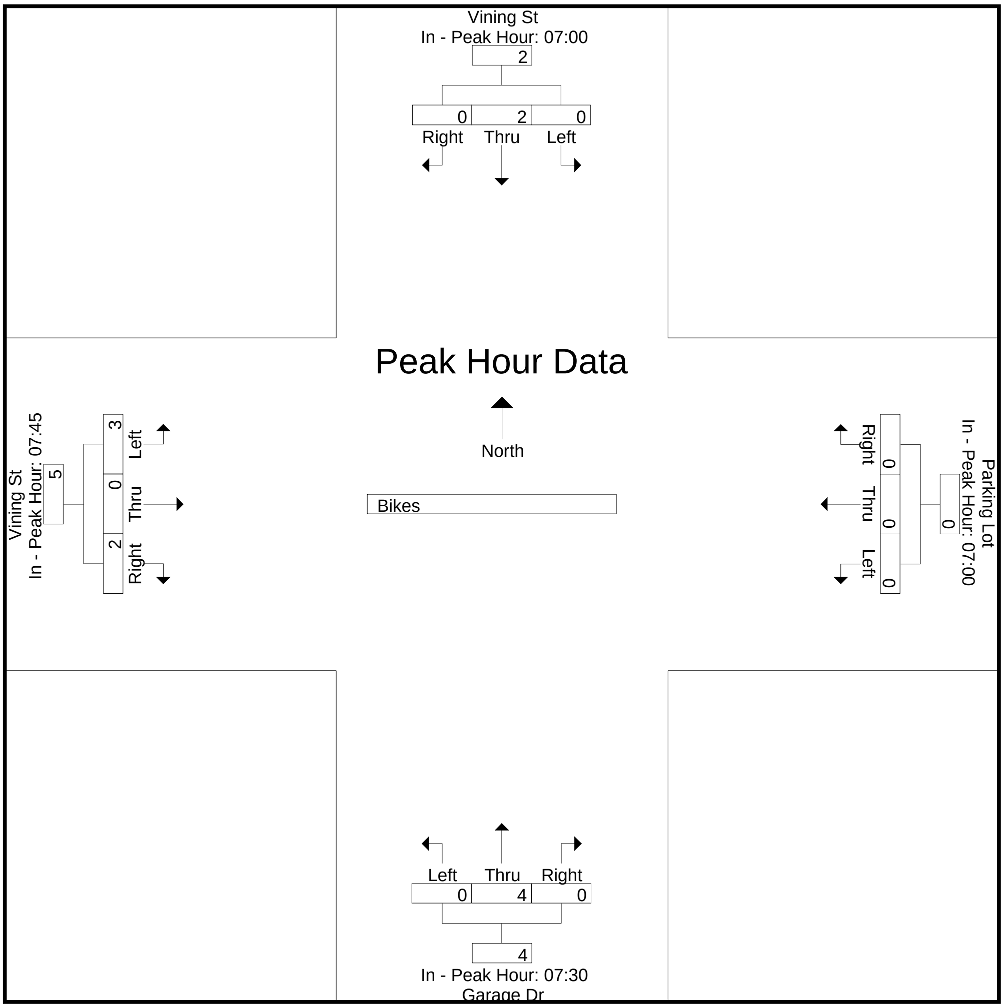


Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:00				07:00				07:30				07:45			
+0 mins.	0	1	0	1	0	0	0	0	0	0	0	0	2	0	0	2
+15 mins.	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0
+30 mins.	0	1	0	1	0	0	0	0	0	1	0	1	0	0	2	2
+45 mins.	0	0	0	0	0	0	0	0	0	2	0	2	1	0	0	1
Total Volume	0	2	0	2	0	0	0	0	0	4	0	4	3	0	2	5
% App. Total	0	100	0		0	0	0		0	100	0		60	0	40	
PHF	.000	.500	.000	.500	.000	.000	.000	.000	.000	.500	.000	.500	.375	.000	.250	.625

Accurate Counts
978-664-2565

File Name : 10568005
Site Code : 10568005
Start Date : 8/19/2009
Page No : 3



Accurate Counts
978-664-2565

N/S Street : Vining St / Garage
E/W Street: Vining St / Parking Lot
City/State : Boston, MA
Weather : Clear

File Name : 10568005
Site Code : 10568005
Start Date : 8/19/2009
Page No : 1

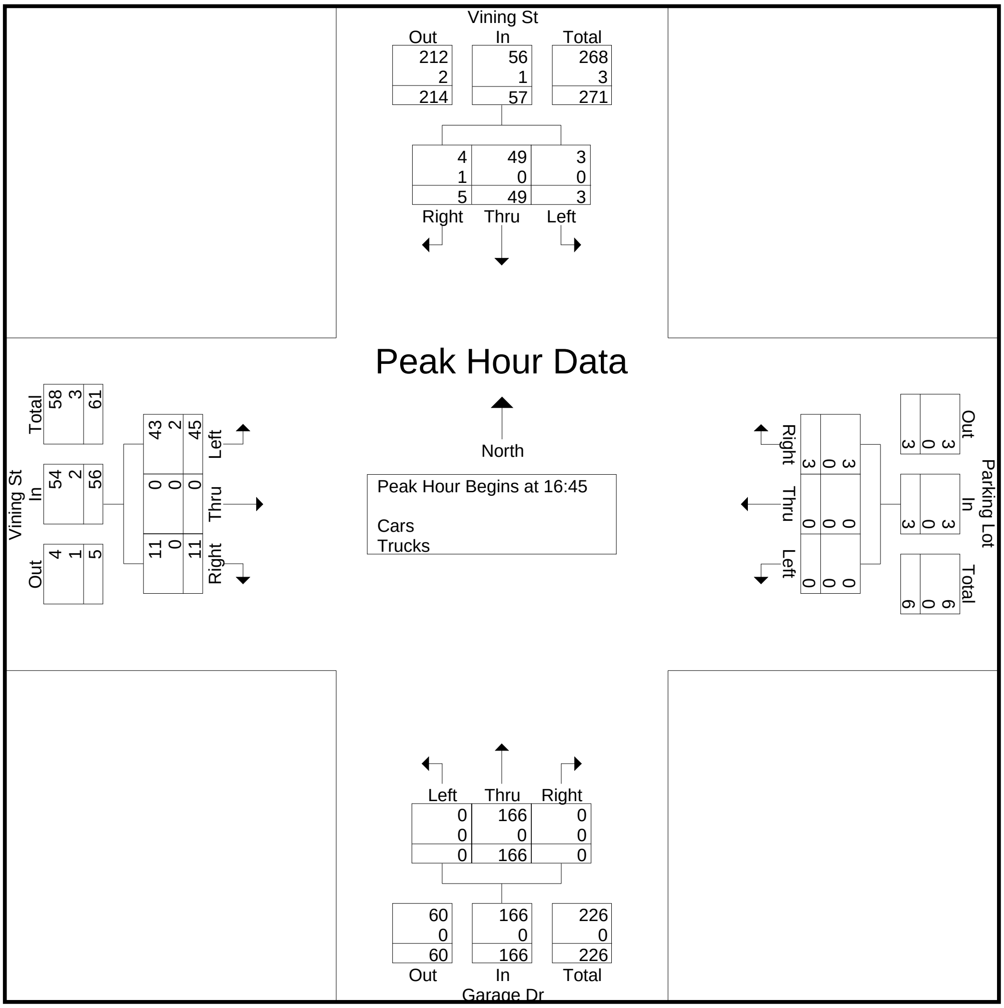
Groups Printed- Cars - Trucks

	Vining St From North			Parking Lot From East			Garage Dr From South			Vining St From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
16:00	1	15	1	0	0	1	0	26	0	13	0	1	58
16:15	0	23	2	0	0	0	0	35	0	12	0	3	75
16:30	0	10	2	0	0	2	1	32	0	6	0	1	54
16:45	1	19	0	0	0	0	0	37	0	15	0	3	75
Total	2	67	5	0	0	3	1	130	0	46	0	8	262
17:00	0	10	1	0	0	1	0	43	0	12	0	3	70
17:15	0	11	1	0	0	1	0	48	0	9	0	3	73
17:30	2	9	3	0	0	1	0	38	0	9	0	2	64
17:45	1	7	2	0	0	1	1	37	0	11	0	2	62
Total	3	37	7	0	0	4	1	166	0	41	0	10	269
Grand Total	5	104	12	0	0	7	2	296	0	87	0	18	531
Apprch %	4.1	86	9.9	0	0	100	0.7	99.3	0	82.9	0	17.1	
Total %	0.9	19.6	2.3	0	0	1.3	0.4	55.7	0	16.4	0	3.4	
Cars	5	104	11	0	0	7	2	296	0	85	0	18	528
% Cars	100	100	91.7	0	0	100	100	100	0	97.7	0	100	99.4
Trucks	0	0	1	0	0	0	0	0	0	2	0	0	3
% Trucks	0	0	8.3	0	0	0	0	0	0	2.3	0	0	0.6

	Vining St From North				Parking Lot From East				Garage Dr From South				Vining St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 16:45																	
16:45	1	19	0	20	0	0	0	0	0	37	0	37	15	0	3	18	75
17:00	0	10	1	11	0	0	1	1	0	43	0	43	12	0	3	15	70
17:15	0	11	1	12	0	0	1	1	0	48	0	48	9	0	3	12	73
17:30	2	9	3	14	0	0	1	1	0	38	0	38	9	0	2	11	64
Total Volume	3	49	5	57	0	0	3	3	0	166	0	166	45	0	11	56	282
% App. Total	5.3	86	8.8		0	0	100		0	100	0		80.4	0	19.6		
PHF	.375	.645	.417	.713	.000	.000	.750	.750	.000	.865	.000	.865	.750	.000	.917	.778	.940
Cars	3	49	4	56	0	0	3	3	0	166	0	166	43	0	11	54	279
% Cars	100	100	80.0	98.2	0	0	100	100	0	100	0	100	95.6	0	100	96.4	98.9
Trucks	0	0	1	1	0	0	0	0	0	0	0	0	2	0	0	2	3
% Trucks	0	0	20.0	1.8	0	0	0	0	0	0	0	0	4.4	0	0	3.6	1.1

Accurate Counts
978-664-2565

File Name : 10568005
Site Code : 10568005
Start Date : 8/19/2009
Page No : 2

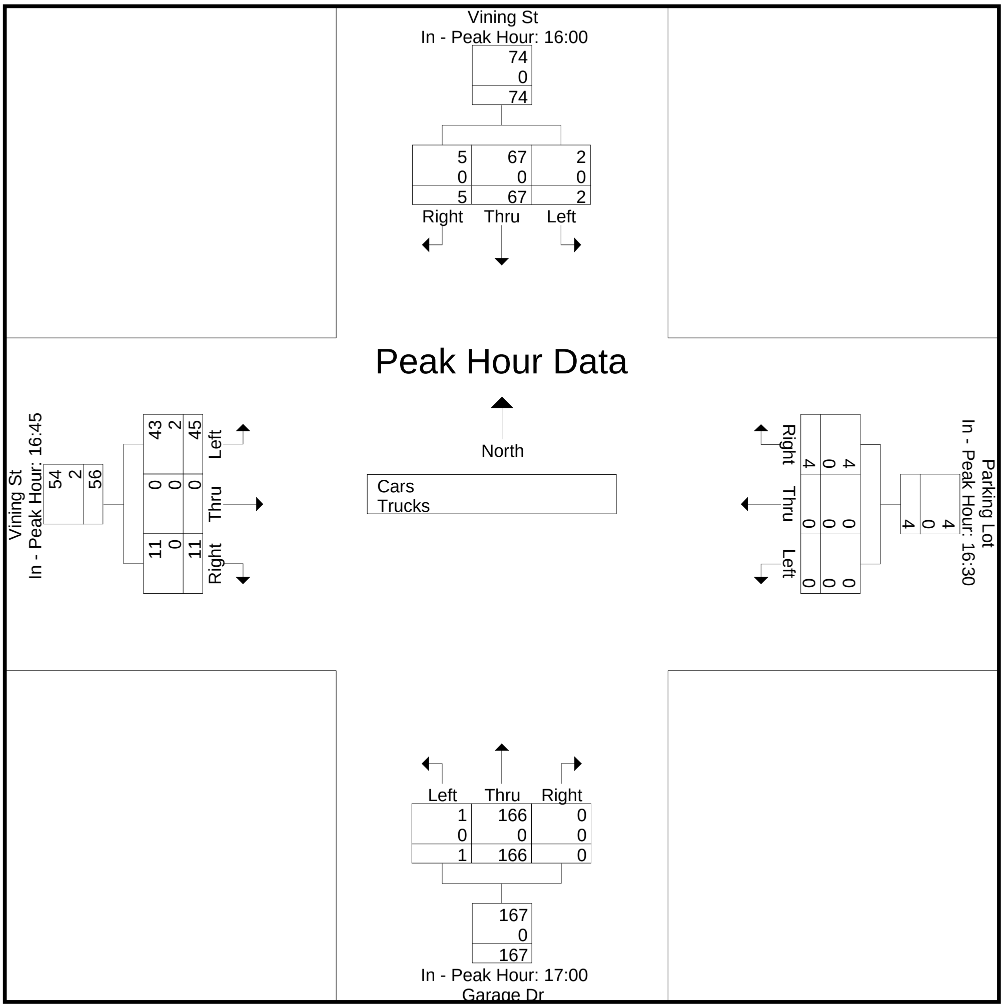


Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:00				16:30				17:00				16:45			
+0 mins.	1	15	1	17	0	0	2	2	0	43	0	43	15	0	3	18
+15 mins.	0	23	2	25	0	0	0	0	0	48	0	48	12	0	3	15
+30 mins.	0	10	2	12	0	0	1	1	0	38	0	38	9	0	3	12
+45 mins.	1	19	0	20	0	0	1	1	1	37	0	38	9	0	2	11
Total Volume	2	67	5	74	0	0	4	4	1	166	0	167	45	0	11	56
% App. Total	2.7	90.5	6.8		0	0	100		0.6	99.4	0		80.4	0	19.6	
PHF	.500	.728	.625	.740	.000	.000	.500	.500	.250	.865	.000	.870	.750	.000	.917	.778
Cars	2	67	5	74	0	0	4	4	1	166	0	167	43	0	11	54
% Cars	100	100	100	100	0	0	100	100	100	100	0	100	95.6	0	100	96.4
Trucks	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
% Trucks	0	0	0	0	0	0	0	0	0	0	0	0	4.4	0	0	3.6

Accurate Counts
978-664-2565

File Name : 10568005
Site Code : 10568005
Start Date : 8/19/2009
Page No : 3



Accurate Counts
978-664-2565

N/S Street : Vining St / Garage
E/W Street: Vining St / Parking Lot
City/State : Boston, MA
Weather : Clear

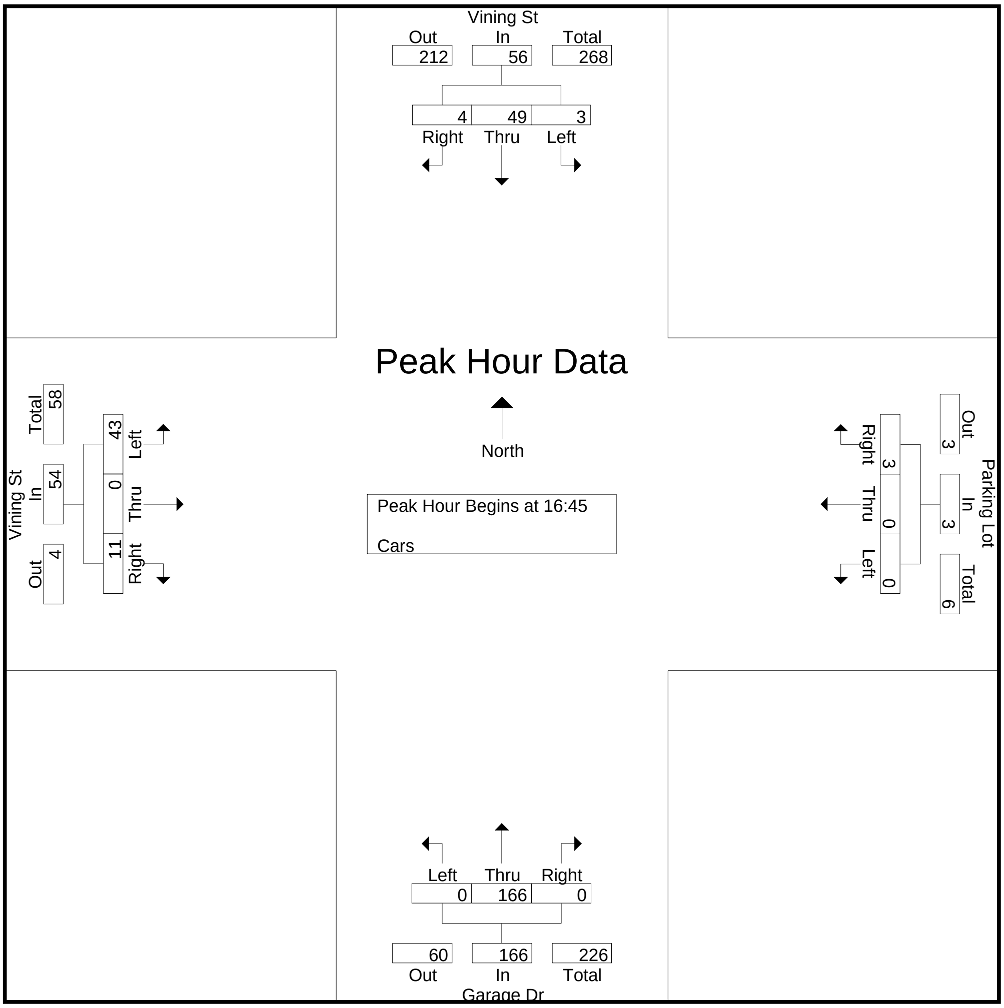
File Name : 10568005
Site Code : 10568005
Start Date : 8/19/2009
Page No : 1

Groups Printed- Cars

	Vining St From North			Parking Lot From East			Garage Dr From South			Vining St From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
16:00	1	15	1	0	0	1	0	26	0	13	0	1	58
16:15	0	23	2	0	0	0	0	35	0	12	0	3	75
16:30	0	10	2	0	0	2	1	32	0	6	0	1	54
16:45	1	19	0	0	0	0	0	37	0	15	0	3	75
Total	2	67	5	0	0	3	1	130	0	46	0	8	262
17:00	0	10	0	0	0	1	0	43	0	12	0	3	69
17:15	0	11	1	0	0	1	0	48	0	8	0	3	72
17:30	2	9	3	0	0	1	0	38	0	8	0	2	63
17:45	1	7	2	0	0	1	1	37	0	11	0	2	62
Total	3	37	6	0	0	4	1	166	0	39	0	10	266
Grand Total	5	104	11	0	0	7	2	296	0	85	0	18	528
Apprch %	4.2	86.7	9.2	0	0	100	0.7	99.3	0	82.5	0	17.5	
Total %	0.9	19.7	2.1	0	0	1.3	0.4	56.1	0	16.1	0	3.4	

	Vining St From North				Parking Lot From East				Garage Dr From South				Vining St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 16:45																	
16:45	1	19	0	20	0	0	0	0	0	37	0	37	15	0	3	18	75
17:00	0	10	0	10	0	0	1	1	0	43	0	43	12	0	3	15	69
17:15	0	11	1	12	0	0	1	1	0	48	0	48	8	0	3	11	72
17:30	2	9	3	14	0	0	1	1	0	38	0	38	8	0	2	10	63
Total Volume	3	49	4	56	0	0	3	3	0	166	0	166	43	0	11	54	279
% App. Total	5.4	87.5	7.1		0	0	100		0	100	0		79.6	0	20.4		
PHF	.375	.645	.333	.700	.000	.000	.750	.750	.000	.865	.000	.865	.717	.000	.917	.750	.930

File Name : 10568005
Site Code : 10568005
Start Date : 8/19/2009
Page No : 2

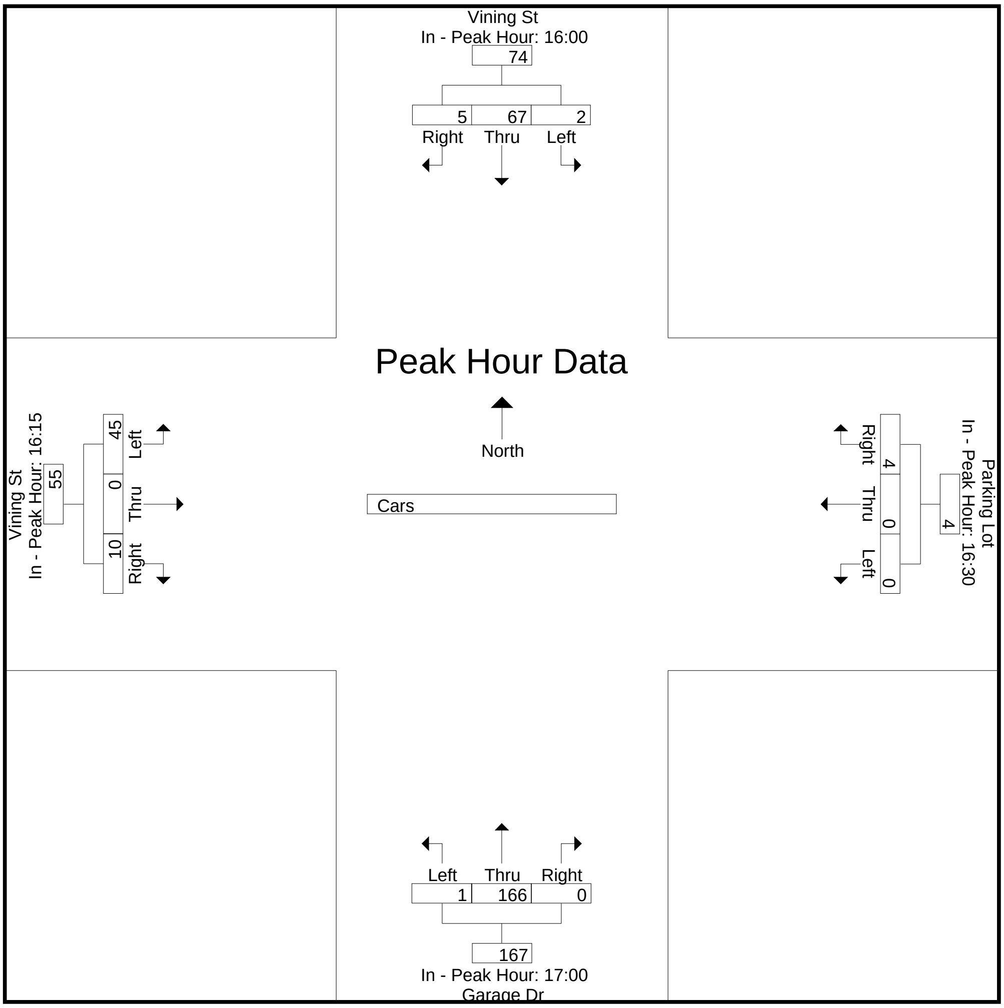


Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:00				16:30				17:00				16:15			
+0 mins.	1	15	1	17	0	0	2	2	0	43	0	43	12	0	3	15
+15 mins.	0	23	2	25	0	0	0	0	0	48	0	48	6	0	1	7
+30 mins.	0	10	2	12	0	0	1	1	0	38	0	38	15	0	3	18
+45 mins.	1	19	0	20	0	0	1	1	1	37	0	38	12	0	3	15
Total Volume	2	67	5	74	0	0	4	4	1	166	0	167	45	0	10	55
% App. Total	2.7	90.5	6.8		0	0	100		0.6	99.4	0		81.8	0	18.2	
PHF	.500	.728	.625	.740	.000	.000	.500	.500	.250	.865	.000	.870	.750	.000	.833	.764

Accurate Counts
978-664-2565

File Name : 10568005
Site Code : 10568005
Start Date : 8/19/2009
Page No : 3



Accurate Counts
978-664-2565

N/S Street : Vining St / Garage
E/W Street: Vining St / Parking Lot
City/State : Boston, MA
Weather : Clear

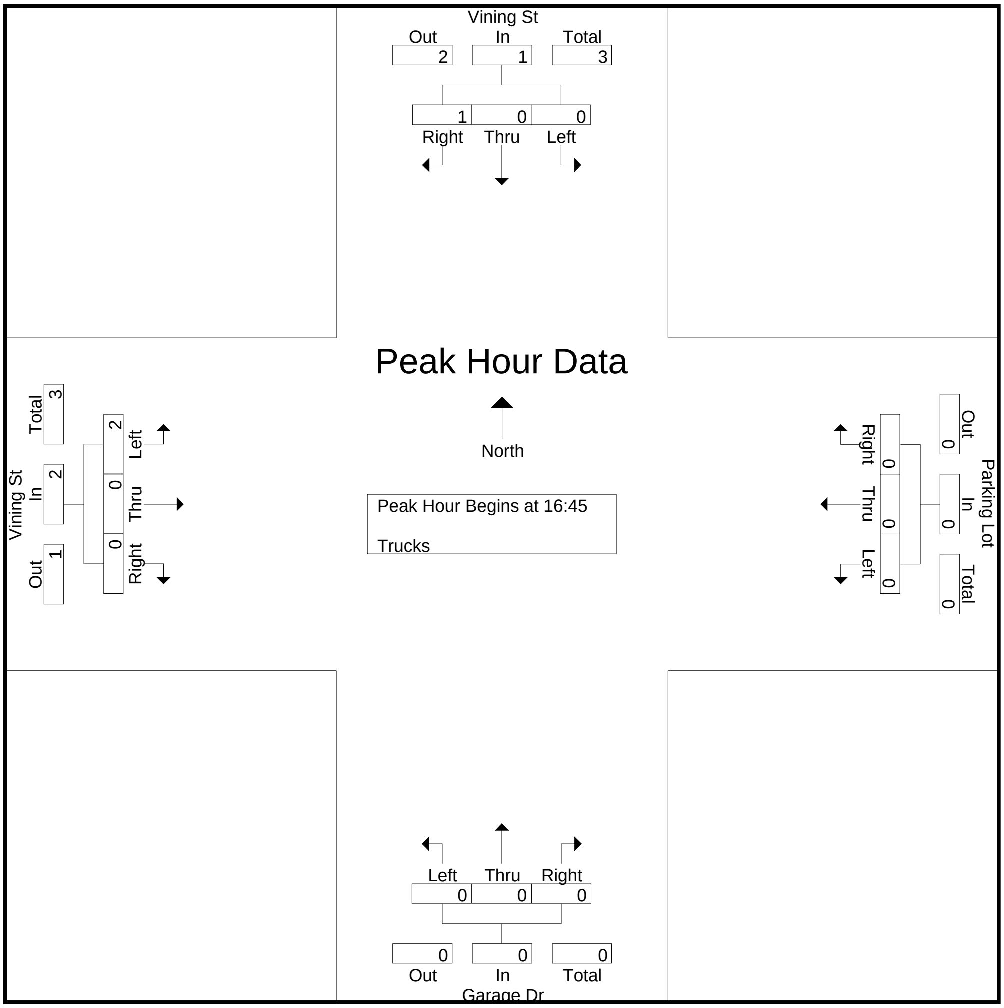
File Name : 10568005
Site Code : 10568005
Start Date : 8/19/2009
Page No : 1

Groups Printed- Trucks

	Vining St From North			Parking Lot From East			Garage Dr From South			Vining St From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
16:00	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30	0	0	0	0	0	0	0	0	0	0	0	0	0
16:45	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	0	0	1	0	0	0	0	0	0	0	0	0	1
17:15	0	0	0	0	0	0	0	0	0	1	0	0	1
17:30	0	0	0	0	0	0	0	0	0	1	0	0	1
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	1	0	0	0	0	0	0	2	0	0	3
Grand Total	0	0	1	0	0	0	0	0	0	2	0	0	3
Apprch %	0	0	100	0	0	0	0	0	0	100	0	0	
Total %	0	0	33.3	0	0	0	0	0	0	66.7	0	0	

	Vining St From North				Parking Lot From East				Garage Dr From South				Vining St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 16:45																	
16:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1
17:15	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
17:30	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
Total Volume	0	0	1	1	0	0	0	0	0	0	0	0	2	0	0	2	3
% App. Total	0	0	100		0	0	0		0	0	0		100	0	0		
PHF	.000	.000	.250	.250	.000	.000	.000	.000	.000	.000	.000	.000	.500	.000	.000	.500	.750

File Name : 10568005
Site Code : 10568005
Start Date : 8/19/2009
Page No : 2

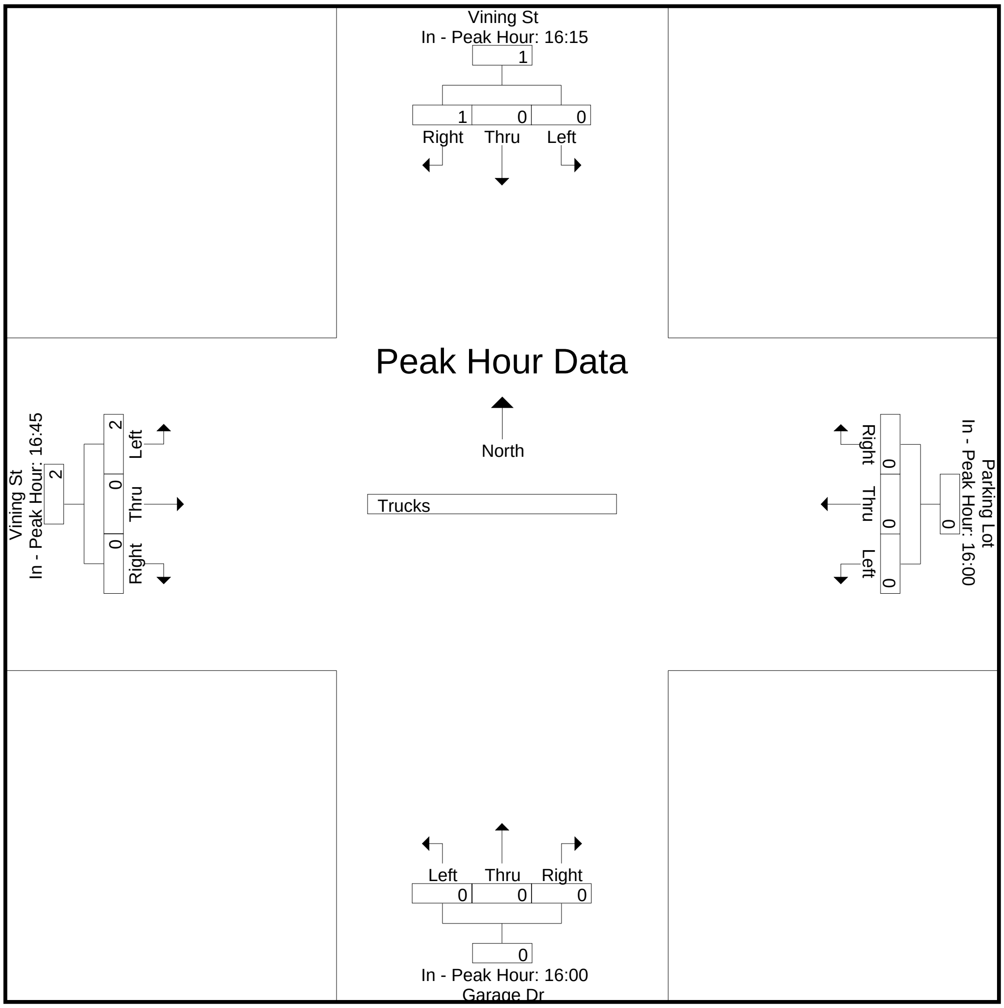


Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:15				16:00				16:00				16:45			
+0 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+15 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+30 mins.	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
+45 mins.	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	1
Total Volume	0	0	1	1	0	0	0	0	0	0	0	0	2	0	0	2
% App. Total	0	0	100		0	0	0		0	0	0		100	0	0	
PHF	.000	.000	.250	.250	.000	.000	.000	.000	.000	.000	.000	.000	.500	.000	.000	.500

Accurate Counts
978-664-2565

File Name : 10568005
Site Code : 10568005
Start Date : 8/19/2009
Page No : 3



Accurate Counts
978-664-2565

N/S Street : Vining St / Garage
E/W Street: Vining St / Parking Lot
City/State : Boston, MA
Weather : Clear

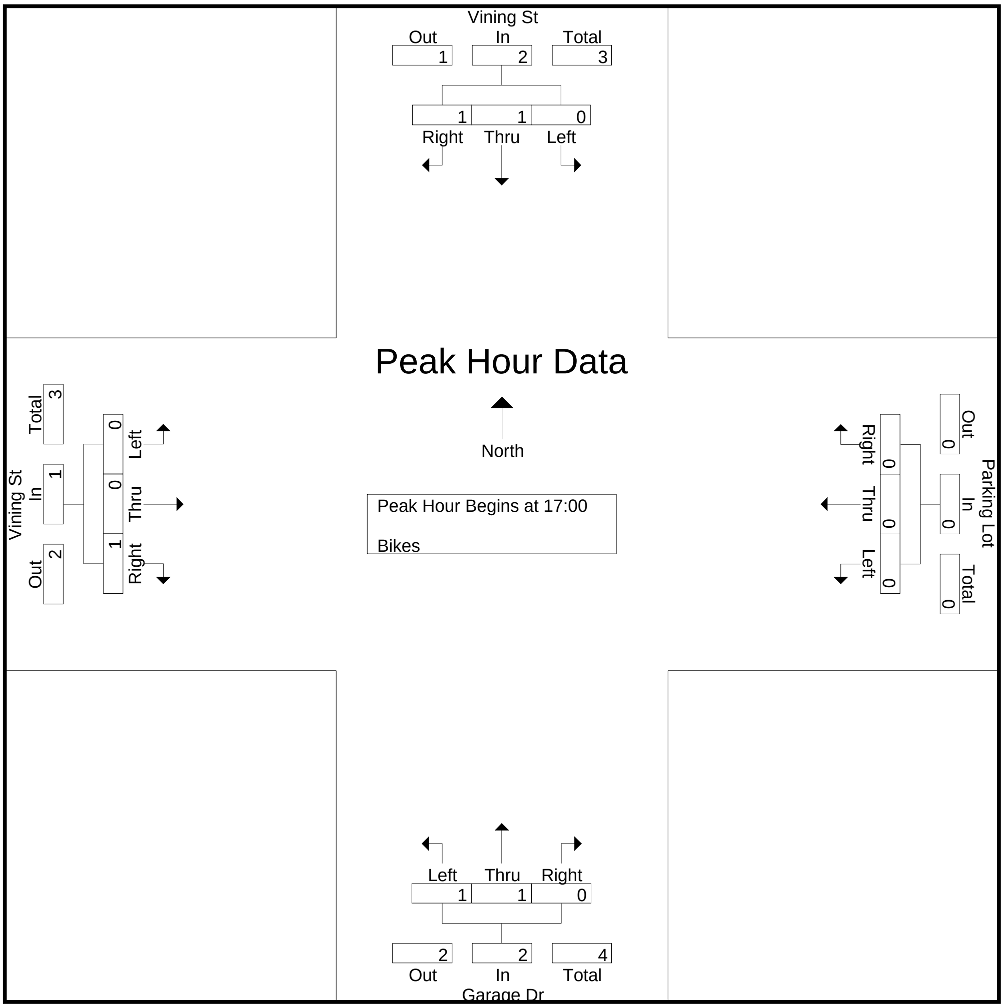
File Name : 10568005
Site Code : 10568005
Start Date : 8/19/2009
Page No : 1

Groups Printed- Bikes

	Vining St From North			Parking Lot From East			Garage Dr From South			Vining St From West			
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Int. Total
16:00	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30	0	0	0	0	0	0	0	0	0	0	0	0	0
16:45	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	0	0	0	0	0	0	0	0	0	0	0	1	1
17:15	0	1	1	0	0	0	0	0	0	0	0	0	2
17:30	0	0	0	0	0	0	1	0	0	0	0	0	1
17:45	0	0	0	0	0	0	0	1	0	0	0	0	1
Total	0	1	1	0	0	0	1	1	0	0	0	1	5
Grand Total	0	1	1	0	0	0	1	1	0	0	0	1	5
Apprch %	0	50	50	0	0	0	50	50	0	0	0	100	
Total %	0	20	20	0	0	0	20	20	0	0	0	20	

	Vining St From North				Parking Lot From East				Garage Dr From South				Vining St From West				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 17:00																	
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
17:15	0	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	2
17:30	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1
17:45	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1
Total Volume	0	1	1	2	0	0	0	0	1	1	0	2	0	0	1	1	5
% App. Total	0	50	50		0	0	0		50	50	0		0	0	100		
PHF	.000	.250	.250	.250	.000	.000	.000	.000	.250	.250	.000	.500	.000	.000	.250	.250	.625

File Name : 10568005
Site Code : 10568005
Start Date : 8/19/2009
Page No : 2

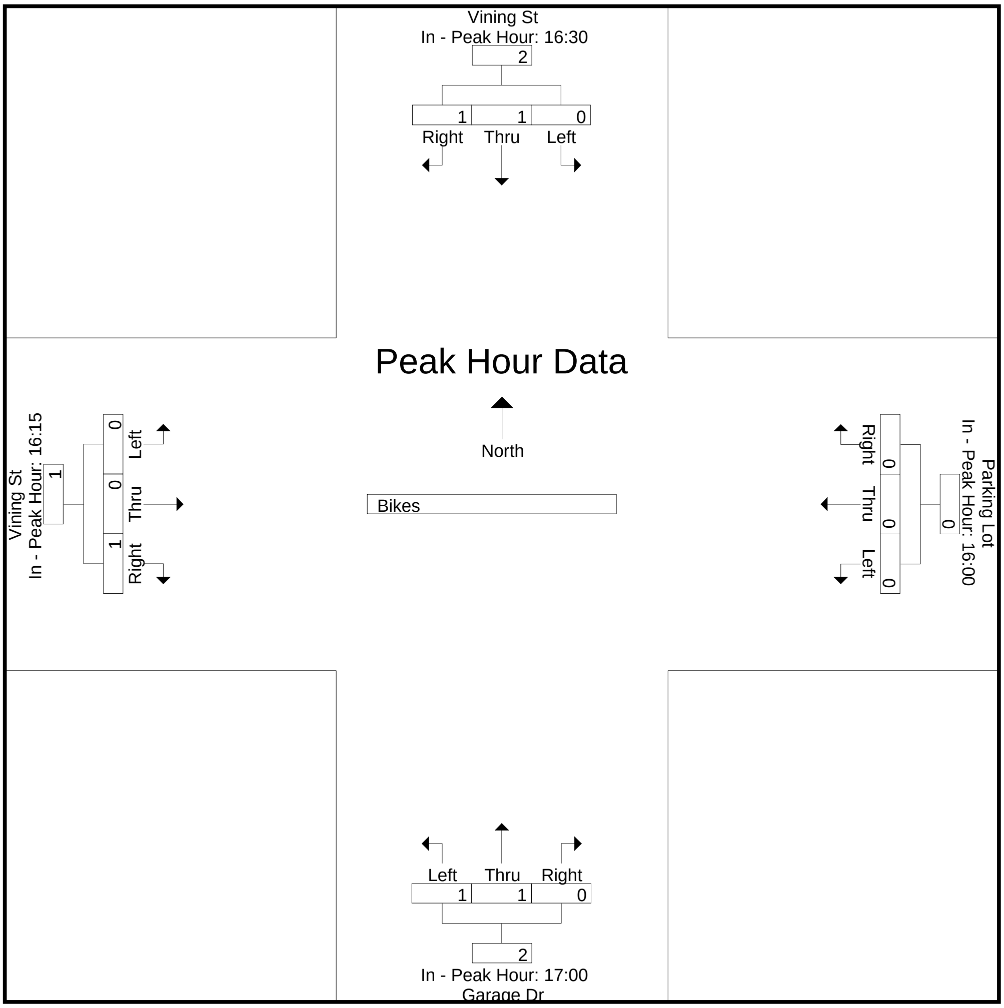


Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	16:30				16:00				17:00				16:15			
+0 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+15 mins.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+30 mins.	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
+45 mins.	0	1	1	2	0	0	0	0	0	1	0	1	0	0	1	1
Total Volume	0	1	1	2	0	0	0	0	1	1	0	2	0	0	1	1
% App. Total	0	50	50		0	0	0		50	50	0		0	0	100	
PHF	.000	.250	.250	.250	.000	.000	.000	.000	.250	.250	.000	.500	.000	.000	.250	.250

Accurate Counts
978-664-2565

File Name : 10568005
Site Code : 10568005
Start Date : 8/19/2009
Page No : 3



Automatic Traffic Recorder (ATR) Counts

Accurate Counts
978-664-2565

Location : Francis Street @ #70
Location :
City/State: Boston, MA
Counter : 16432

10568001
Site Code: 10568001

Start Time	05-May-0 Tue	WB Morning	WB Afternoon	Hour Totals Morning	Hour Totals Afternoon	EB Morning	EB Afternoon	Hour Totals Morning	Hour Totals Afternoon	Combined Totals Morning	Combined Totals Afternoon
12:00		15	55			12	83				
12:15		3	62			19	85				
12:30		9	47			18	96				
12:45		12	55	39	219	12	70	61	334	100	553
01:00		11	67			11	91				
01:15		7	62			10	80				
01:30		8	59			8	92				
01:45		5	70	31	258	7	81	36	344	67	602
02:00		6	65			13	75				
02:15		2	53			6	91				
02:30		8	63			4	50				
02:45		8	70	24	251	6	66	29	282	53	533
03:00		5	68			6	81				
03:15		2	62			5	62				
03:30		4	55			7	54				
03:45		3	78	14	263	4	57	22	254	36	517
04:00		6	65			1	70				
04:15		6	58			8	84				
04:30		4	66			2	68				
04:45		5	57	21	246	7	74	18	296	39	542
05:00		10	85			18	67				
05:15		14	57			15	78				
05:30		10	61			32	73				
05:45		19	56	53	259	49	76	114	294	167	553
06:00		23	60			44	80				
06:15		38	68			44	81				
06:30		40	64			65	77				
06:45		59	75	160	267	64	62	217	300	377	567
07:00		77	55			70	67				
07:15		66	54			85	62				
07:30		83	45			74	55				
07:45		80	45	306	199	56	61	285	245	591	444
08:00		78	45			76	58				
08:15		63	46			76	47				
08:30		80	45			70	45				
08:45		65	30	286	166	74	47	296	197	582	363
09:00		73	44			68	52				
09:15		67	33			73	40				
09:30		60	23			89	37				
09:45		54	15	254	115	93	36	323	165	577	280
10:00		76	26			84	39				
10:15		75	19			81	38				
10:30		64	32			96	41				
10:45		73	29	288	106	59	28	320	146	608	252
11:00		72	34			87	37				
11:15		68	32			81	43				
11:30		58	36			70	37				
11:45		71	31	269	133	73	30	311	147	580	280
Total		1745	2482			2032	3004			3777	5486
Percent		41.3%	58.7%			40.3%	59.7%			40.8%	59.2%
Grand Total		1745	2482			2032	3004			3777	5486
Percent		41.3%	58.7%			40.3%	59.7%			40.8%	59.2%

ADT   ADT 9,263   AADT 9,263

Accurate Counts
978-664-2565

Location : Francis Street @ #70
Location :
City/State: Boston, MA
Counter : 16432

10568001
Site Code: 10568001

Start Time	04-May-09 WB	EB	Tue WB	EB	Wed WB	EB	Thu WB	EB	Fri WB	EB	Sat WB	EB	Sun WB	EB	Week Average WB	EB
12:00 AM	*	*	39	61	*	*	*	*	*	*	*	*	*	*	39	61
01:00	*	*	31	36	*	*	*	*	*	*	*	*	*	*	31	36
02:00	*	*	24	29	*	*	*	*	*	*	*	*	*	*	24	29
03:00	*	*	14	22	*	*	*	*	*	*	*	*	*	*	14	22
04:00	*	*	21	18	*	*	*	*	*	*	*	*	*	*	21	18
05:00	*	*	53	114	*	*	*	*	*	*	*	*	*	*	53	114
06:00	*	*	160	217	*	*	*	*	*	*	*	*	*	*	160	217
07:00	*	*	**306**	285	*	*	*	*	*	*	*	*	*	*	**306**	285
08:00	*	*	286	296	*	*	*	*	*	*	*	*	*	*	286	296
09:00	*	*	254	**323**	*	*	*	*	*	*	*	*	*	*	254	**323**
10:00	*	*	288	320	*	*	*	*	*	*	*	*	*	*	288	320
11:00	*	*	269	311	*	*	*	*	*	*	*	*	*	*	269	311
12:00 PM	*	*	219	334	*	*	*	*	*	*	*	*	*	*	219	334
01:00	*	*	258	**344**	*	*	*	*	*	*	*	*	*	*	258	**344**
02:00	*	*	251	282	*	*	*	*	*	*	*	*	*	*	251	282
03:00	*	*	263	254	*	*	*	*	*	*	*	*	*	*	263	254
04:00	*	*	246	296	*	*	*	*	*	*	*	*	*	*	246	296
05:00	*	*	259	294	*	*	*	*	*	*	*	*	*	*	259	294
06:00	*	*	**267**	300	*	*	*	*	*	*	*	*	*	*	**267**	300
07:00	*	*	199	245	*	*	*	*	*	*	*	*	*	*	199	245
08:00	*	*	166	197	*	*	*	*	*	*	*	*	*	*	166	197
09:00	*	*	115	165	*	*	*	*	*	*	*	*	*	*	115	165
10:00	*	*	106	146	*	*	*	*	*	*	*	*	*	*	106	146
11:00	*	*	133	147	*	*	*	*	*	*	*	*	*	*	133	147
Lane	0	0	4227	5036	0	0	0	0	0	0	0	0	0	0	4227	5036
Day	0		9263		0		0		0		0		0		9263	
AM Peak			07:00	09:00											07:00	09:00
Vol.			306	323											306	323
PM Peak			18:00	13:00											18:00	13:00
Vol.			267	344											267	344
Comb. Total	0		9263		0		0		0		0		0		9263	
ADT	ADT 9,263		AADT 9,263													

Synchro (LOS) Analysis

Existing 2009

Lane Group	EBT	EBR	WBL	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	876	210	248	503	186	223	185
v/c Ratio	0.96	0.38	1.37	0.34	0.95	0.36	0.53
Control Delay	36.9	14.5	209.6	4.3	92.3	21.2	35.8
Queue Delay	36.2	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	73.1	14.5	209.6	4.3	92.3	21.2	35.8
Queue Length 50th (ft)	303	69	~117	36	111	62	76
Queue Length 95th (ft)	m#366	m80	m#233	m46	#237	97	#225
Internal Link Dist (ft)	176			771		331	256
Turn Bay Length (ft)		150	150		100		
Base Capacity (vph)	908	559	181	1494	196	621	347
Starvation Cap Reductn	102	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.09	0.38	1.37	0.34	0.95	0.36	0.53

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	12	12	12	15	11	14	14	14
Total Lost time (s)		4.0	4.0	4.0	4.0		4.0	4.0			4.0	
Lane Util. Factor		0.95	1.00	1.00	0.95		1.00	1.00			1.00	
Frt		1.00	0.85	1.00	0.99		1.00	0.89			0.97	
Flt Protected		1.00	1.00	0.95	1.00		0.95	1.00			0.99	
Satd. Flow (prot)		2971	1330	1404	2988		1562	1613			1740	
Flt Permitted		0.72	1.00	0.19	1.00		0.58	1.00			0.94	
Satd. Flow (perm)		2152	1330	276	2988		952	1613			1641	
Volume (vph)	13	776	189	233	451	22	138	46	119	25	105	36
Peak-hour factor, PHF	0.90	0.90	0.90	0.94	0.94	0.94	0.74	0.74	0.74	0.90	0.90	0.90
Adj. Flow (vph)	14	862	210	248	480	23	186	62	161	28	117	40
RTOR Reduction (vph)	0	0	0	0	0	0	0	72	0	0	8	0
Lane Group Flow (vph)	0	876	210	248	503	0	186	151	0	0	177	0
Heavy Vehicles (%)	2%	2%	2%	8%	8%	8%	4%	4%	4%	1%	1%	1%
Turn Type	Perm		Perm	D.P+P			Perm			Perm		
Protected Phases		1		4	1 4			3			3	
Permitted Phases	1		1	1			3			3		
Actuated Green, G (s)		39.6	39.6	43.6	47.6		34.0	34.0			34.0	
Effective Green, g (s)		39.6	39.6	43.6	47.6		34.0	34.0			34.0	
Actuated g/C Ratio		0.40	0.40	0.44	0.48		0.34	0.34			0.34	
Clearance Time (s)		4.0	4.0	4.0			4.0	4.0			4.0	
Vehicle Extension (s)		3.0	3.0	3.0			3.0	3.0			3.0	
Lane Grp Cap (vph)		852	527	165	1422		324	548			558	
v/s Ratio Prot				c0.06	0.17			0.09				
v/s Ratio Perm		0.41	0.16	c0.59			c0.20				0.11	
v/c Ratio		1.03	0.40	1.50	0.35		0.57	0.28			0.32	
Uniform Delay, d1		30.2	21.7	28.3	16.5		27.1	24.0			24.4	
Progression Factor		0.67	0.65	0.64	0.26		1.21	1.29			1.00	
Incremental Delay, d2		31.1	1.3	247.5	0.5		2.3	0.3			0.3	
Delay (s)		51.5	15.4	265.7	4.7		35.1	31.3			24.7	
Level of Service		D	B	F	A		D	C			C	
Approach Delay (s)		44.5			90.9			33.0			24.7	
Approach LOS		D			F			C			C	

Intersection Summary			
HCM Average Control Delay	55.4	HCM Level of Service	E
HCM Volume to Capacity ratio	1.09		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	22.4
Intersection Capacity Utilization	73.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	875	123	0	623	0	57
Peak Hour Factor	0.95	0.95	0.92	0.92	0.65	0.65
Hourly flow rate (vph)	921	129	0	677	0	88
Pedestrians	42			42	42	
Lane Width (ft)	11.0			10.0	14.0	
Walking Speed (ft/s)	4.0			4.0	4.0	
Percent Blockage	3			3	4	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)	94			256		
pX, platoon unblocked			0.82		0.86	0.82
vC, conflicting volume			1093		1408	609
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			894		1023	305
tC, single (s)			4.2		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	83
cM capacity (veh/h)			579		187	530

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	614	436	339	339	88
Volume Left	0	0	0	0	0
Volume Right	0	129	0	0	88
cSH	1700	1700	1700	1700	530
Volume to Capacity	0.36	0.26	0.20	0.20	0.17
Queue Length 95th (ft)	0	0	0	0	15
Control Delay (s)	0.0	0.0	0.0	0.0	13.1
Lane LOS					B
Approach Delay (s)	0.0		0.0		13.1
Approach LOS					B

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	50.2%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	222	551	248	430	1481	796
v/c Ratio	3.47	0.87	1.88	0.50	1.01	0.54
Control Delay	1164.7	53.3	440.4	20.1	52.2	20.5
Queue Delay	0.0	31.4	0.0	0.0	0.4	0.0
Total Delay	1164.7	84.7	440.4	20.1	52.6	20.5
Queue Length 50th (ft)	~253	179	~215	67	~584	203
Queue Length 95th (ft)	#371	#272	m#364	m97	#723	247
Internal Link Dist (ft)		849		14	255	366
Turn Bay Length (ft)						
Base Capacity (vph)	64	635	132	864	1467	1485
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	111	0	0	2	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	3.47	1.05	1.88	0.50	1.01	0.54

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	10	10	10	11	11	11	10	10	10
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			0.95			0.95	
Frt	1.00	1.00		1.00	0.99			0.95			0.99	
Flt Protected	0.95	1.00		0.95	1.00			1.00			1.00	
Satd. Flow (prot)	1525	2887		1444	2872			2982			2958	
Flt Permitted	0.20	1.00		0.20	1.00			0.95			1.00	
Satd. Flow (perm)	315	2887		303	2872			2839			2958	
Volume (vph)	211	521	3	228	381	15	6	938	478	0	610	66
Peak-hour factor, PHF	0.95	0.95	0.95	0.92	0.92	0.92	0.96	0.96	0.96	0.85	0.85	0.85
Adj. Flow (vph)	222	548	3	248	414	16	6	977	498	0	718	78
RTOR Reduction (vph)	0	0	0	0	3	0	0	49	0	0	6	0
Lane Group Flow (vph)	222	551	0	248	427	0	0	1433	0	0	790	0
Heavy Vehicles (%)	3%	3%	3%	5%	5%	5%	0%	0%	0%	1%	1%	1%
Parking (#/hr)		1	1									
Turn Type	Perm			D.P+P			Perm					
Protected Phases		1		4	1 4			3			3	
Permitted Phases	1			1			3					
Actuated Green, G (s)	18.4	18.4		20.4	26.4			48.0			48.0	
Effective Green, g (s)	20.4	20.4		24.4	28.4			50.0			50.0	
Actuated g/C Ratio	0.20	0.20		0.24	0.28			0.50			0.50	
Clearance Time (s)	6.0	6.0		6.0				6.0			6.0	
Vehicle Extension (s)	3.0	3.0		3.0				3.0			3.0	
Lane Grp Cap (vph)	64	589		120	816			1420			1479	
v/s Ratio Prot		0.19		c0.08	0.15						0.27	
v/s Ratio Perm	c0.71			0.42				c0.50				
v/c Ratio	3.47	0.94		2.07	0.52			1.01			0.53	
Uniform Delay, d1	39.8	39.2		36.9	30.1			25.0			17.1	
Progression Factor	1.00	1.00		0.66	0.64			1.00			1.00	
Incremental Delay, d2	1149.1	24.2		504.2	2.1			26.1			1.4	
Delay (s)	1188.9	63.3		528.6	21.2			51.1			18.4	
Level of Service	F	E		F	C			D			B	
Approach Delay (s)		386.6			206.8			51.1			18.4	
Approach LOS		F			F			D			B	

Intersection Summary			
HCM Average Control Delay	142.0	HCM Level of Service	F
HCM Volume to Capacity ratio	1.74		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	25.6
Intersection Capacity Utilization	90.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	0	274	0	3	187	5	1	3	3	61	2	65
Peak Hour Factor	0.70	0.70	0.70	0.79	0.79	0.79	0.44	0.44	0.44	0.91	0.91	0.91
Hourly flow rate (vph)	0	391	0	4	237	6	2	7	7	67	2	71

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	391	247	16	141
Volume Left (vph)	0	4	2	67
Volume Right (vph)	0	6	7	71
Hadj (s)	0.00	0.00	-0.23	-0.21
Departure Headway (s)	4.6	4.8	5.4	5.2
Degree Utilization, x	0.50	0.33	0.02	0.20
Capacity (veh/h)	746	714	556	618
Control Delay (s)	12.2	10.1	8.6	9.5
Approach Delay (s)	12.2	10.1	8.6	9.5
Approach LOS	B	B	A	A

Intersection Summary			
Delay	11.0		
HCM Level of Service	B		
Intersection Capacity Utilization	42.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	29	65	18	45	51	61	12	222	115	116	256	68
Peak Hour Factor	0.93	0.93	0.93	0.80	0.80	0.80	0.90	0.90	0.90	0.87	0.87	0.87
Hourly flow rate (vph)	31	70	19	56	64	76	13	247	128	133	294	78
Pedestrians		222			337			321			337	
Lane Width (ft)		13.0			13.0			12.0			10.5	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		20			30			27			25	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								270			411	
pX, platoon unblocked												
vC, conflicting volume	1604	1560	876	1610	1535	985	594			711		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1604	1560	876	1610	1535	985	594			711		
tC, single (s)	7.2	6.6	6.3	7.1	6.5	6.2	4.1			4.2		
tC, 2 stage (s)												
tF (s)	3.6	4.1	3.4	3.5	4.0	3.3	2.2			2.3		
p0 queue free %	0	0	90	0	0	52	98			78		
cM capacity (veh/h)	0	47	200	0	50	159	773			602		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total	120	196	388	133	372
Volume Left	31	56	13	133	0
Volume Right	19	76	128	0	78
cSH	0	0	773	602	1700
Volume to Capacity	Err	Err	0.02	0.22	0.22
Queue Length 95th (ft)	Err	Err	1	21	0
Control Delay (s)	Err	Err	0.5	12.7	0.0
Lane LOS	F	F	A	B	
Approach Delay (s)	Err	Err	0.5	3.3	
Approach LOS	F	F			

Intersection Summary			
Average Delay	Err		
Intersection Capacity Utilization	72.8%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	90	48	54	80	43	106
Peak Hour Factor	0.86	0.86	0.84	0.84	0.89	0.89
Hourly flow rate (vph)	105	56	64	95	48	119
Pedestrians	59		56			59
Lane Width (ft)	12.0		12.0			12.0
Walking Speed (ft/s)	4.0		4.0			4.0
Percent Blockage	5		5			5
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	443	230			219	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	443	230			219	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	79	92			96	
cM capacity (veh/h)	498	729			1296	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	160	160	167
Volume Left	105	0	48
Volume Right	56	95	0
cSH	560	1700	1296
Volume to Capacity	0.29	0.09	0.04
Queue Length 95th (ft)	29	0	3
Control Delay (s)	14.0	0.0	2.5
Lane LOS	B		A
Approach Delay (s)	14.0	0.0	2.5
Approach LOS	B		

Intersection Summary			
Average Delay	5.5		
Intersection Capacity Utilization	44.8%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	NBT	SBL	SBT
Lane Group Flow (vph)	332	301	79	313
v/c Ratio	0.59	0.74	0.45	0.71
Control Delay	16.9	35.5	42.7	44.6
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	16.9	35.5	42.7	44.6
Queue Length 50th (ft)	109	195	49	190
Queue Length 95th (ft)	178	m162	m57	m174
Internal Link Dist (ft)	167	410		190
Turn Bay Length (ft)			150	
Base Capacity (vph)	563	824	357	881
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.59	0.37	0.22	0.36

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	16	12	12	12	12	12	12	12	12	10	12	12
Total Lost time (s)		4.0						4.0		4.0	4.0	
Lane Util. Factor		1.00						1.00		1.00	1.00	
Frpb, ped/bikes		0.92						0.94		1.00	0.93	
Flpb, ped/bikes		0.61						0.98		0.79	1.00	
Frt		0.97						0.99		1.00	0.97	
Flt Protected		0.97						0.99		0.95	1.00	
Satd. Flow (prot)		892						1453		1110	1430	
Flt Permitted		0.97						0.82		0.42	1.00	
Satd. Flow (perm)		892						1197		490	1430	
Volume (vph)	166	26	67	0	0	0	37	199	29	70	224	54
Peak-hour factor, PHF	0.78	0.78	0.78	0.25	0.25	0.25	0.88	0.88	0.88	0.89	0.89	0.89
Adj. Flow (vph)	213	33	86	0	0	0	42	226	33	79	252	61
RTOR Reduction (vph)	0	7	0	0	0	0	0	8	0	0	15	0
Lane Group Flow (vph)	0	325	0	0	0	0	0	293	0	79	298	0
Confl. Peds. (#/hr)	339		96	96		339	110		225	225		110
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	6%	6%	6%	8%	8%	8%
Turn Type	Perm						Perm			Perm		
Protected Phases		2						1			1	
Permitted Phases	2						1			1		
Actuated Green, G (s)		62.3						29.7		29.7	29.7	
Effective Green, g (s)		62.3						29.7		29.7	29.7	
Actuated g/C Ratio		0.62						0.30		0.30	0.30	
Clearance Time (s)		4.0						4.0		4.0	4.0	
Vehicle Extension (s)		3.0						3.0		3.0	3.0	
Lane Grp Cap (vph)		556						356		146	425	
v/s Ratio Prot											0.21	
v/s Ratio Perm		0.36						c0.25		0.16		
v/c Ratio		0.58						0.82		0.54	0.70	
Uniform Delay, d1		11.2						32.7		29.4	31.2	
Progression Factor		1.00						1.13		1.26	1.28	
Incremental Delay, d2		1.6						2.1		10.7	7.3	
Delay (s)		12.8						38.9		47.8	47.3	
Level of Service		B						D		D	D	
Approach Delay (s)		12.8			0.0			38.9			47.4	
Approach LOS		B			A			D			D	

Intersection Summary			
HCM Average Control Delay	33.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	69.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	44	198	95	13	36	38	29	46	30	7	30	147
Peak Hour Factor	0.75	0.75	0.75	0.73	0.73	0.73	0.69	0.69	0.69	0.92	0.92	0.92
Hourly flow rate (vph)	59	264	127	18	49	52	42	67	43	8	33	160

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	449	119	152	200
Volume Left (vph)	59	18	42	8
Volume Right (vph)	127	52	43	160
Hadj (s)	-0.13	-0.06	-0.10	-0.45
Departure Headway (s)	4.9	5.5	5.6	5.2
Degree Utilization, x	0.62	0.18	0.24	0.29
Capacity (veh/h)	699	585	563	618
Control Delay (s)	15.6	9.7	10.4	10.3
Approach Delay (s)	15.6	9.7	10.4	10.3
Approach LOS	C	A	B	B

Intersection Summary			
Delay	12.8		
HCM Level of Service	B		
Intersection Capacity Utilization	57.1%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	33	0	71	20	17	28	14	257	0	0	217	7
Peak Hour Factor	0.90	0.90	0.90	0.63	0.63	0.63	0.79	0.79	0.79	0.71	0.71	0.71
Hourly flow rate (vph)	37	0	79	32	27	44	18	325	0	0	306	10
Pedestrians		94			244			244			185	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		8			20			20			15	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								452			490	
pX, platoon unblocked	0.92	0.92	0.92	0.92	0.92		0.92					
vC, conflicting volume	1008	1009	649	1238	1014	754	409			569		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1009	1010	616	1260	1016	754	356			569		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.2		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.3		
p0 queue free %	59	100	76	38	83	84	98			100		
cM capacity (veh/h)	90	158	330	52	159	278	1002			776		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	63	53	103	343	315
Volume Left	37	0	32	18	0
Volume Right	26	53	44	0	10
cSH	129	330	109	1002	1700
Volume to Capacity	0.49	0.16	0.95	0.02	0.19
Queue Length 95th (ft)	56	14	146	1	0
Control Delay (s)	56.7	18.0	144.7	0.6	0.0
Lane LOS	F	C	F	A	
Approach Delay (s)	39.1		144.7	0.6	0.0
Approach LOS	E		F		

Intersection Summary			
Average Delay	22.4		
Intersection Capacity Utilization	49.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	71	38	0	0	29	14	15	23	9	62	0	79
Peak Hour Factor	0.68	0.68	0.68	0.83	0.83	0.83	0.73	0.73	0.73	0.69	0.69	0.69
Hourly flow rate (vph)	104	56	0	0	35	17	21	32	12	90	0	114
Pedestrians		45			51			34			51	
Lane Width (ft)		11.0			11.0			16.0			11.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		3			4			4			4	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								376				
pX, platoon unblocked												
vC, conflicting volume	446	418	136	429	469	140	159			95		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	446	418	136	429	469	140	159			95		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	74	88	100	100	92	98	98			94		
cM capacity (veh/h)	398	452	850	404	424	844	1359			1447		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	160	52	64	204
Volume Left	104	0	21	90
Volume Right	0	17	12	114
cSH	416	506	1359	1447
Volume to Capacity	0.39	0.10	0.02	0.06
Queue Length 95th (ft)	45	8	1	5
Control Delay (s)	19.0	12.9	2.5	3.7
Lane LOS	C	B	A	A
Approach Delay (s)	19.0	12.9	2.5	3.7
Approach LOS	C	B		

Intersection Summary			
Average Delay	9.6		
Intersection Capacity Utilization	35.9%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	WBL	WBT	NBT	SBT	SBR2	NER2
Lane Group Flow (vph)	735	109	552	440	345	36	44
v/c Ratio	2.58	0.77	1.04	2.06	1.26	0.13	0.28
Control Delay	740.5	47.3	72.2	511.9	171.1	22.3	45.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	740.5	47.3	72.2	511.9	171.1	22.3	45.8
Queue Length 50th (ft)	~422	62	~202	~399	~281	17	26
Queue Length 95th (ft)	#544	m#74	m#319	#592	#421	m23	49
Internal Link Dist (ft)	165		1295	704	372		
Turn Bay Length (ft)		50				50	
Base Capacity (vph)	285	142	532	214	273	270	159
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	2.58	0.77	1.04	2.06	1.26	0.13	0.28

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	EBR2	WBL2	WBL	WBT	WBR	NBL2	NBL	NBT	NBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)		4.0				4.0	4.0				4.0	
Lane Util. Factor		0.95				0.91	0.91				1.00	
Frt		0.97				1.00	0.97				0.99	
Flt Protected		1.00				0.95	1.00				0.97	
Satd. Flow (prot)		2600				1266	2655				1273	
Flt Permitted		0.68				0.25	0.81				0.25	
Satd. Flow (perm)		1778				333	2162				323	
Volume (vph)	24	528	121	17	70	38	389	105	24	195	151	25
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.91	0.91	0.91	0.91	0.90	0.90	0.90	0.90
Adj. Flow (vph)	26	562	129	18	77	42	427	115	27	217	168	28
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	735	0	0	0	109	552	0	0	0	440	0
Heavy Vehicles (%)	7%	7%	7%	7%	9%	9%	9%	9%	9%	9%	9%	9%
Bus Blockages (#/hr)	0	0	0	0	0	0	3	3	0	0	7	7
Parking (#/hr)		1	1	1						1	1	1
Turn Type	Perm				D.P+P	D.P+P			D.P+P	D.P+P		
Protected Phases		1			9	9	1 9		3	3	3 4	
Permitted Phases	1				1	1			4	4		
Actuated Green, G (s)		15.0				22.0	22.0				33.0	
Effective Green, g (s)		16.0				23.0	23.0				34.0	
Actuated g/C Ratio		0.16				0.23	0.23				0.34	
Clearance Time (s)		5.0				4.0						
Vehicle Extension (s)		3.0				3.0						
Lane Grp Cap (vph)		284				142	532				214	
v/s Ratio Prot						0.05	c0.07				c0.23	
v/s Ratio Perm		c0.41				0.12	0.17				c0.47	
v/c Ratio		2.59				0.77	1.04				2.06	
Uniform Delay, d1		42.0				47.3	38.5				33.0	
Progression Factor		0.93				0.61	0.72				1.00	
Incremental Delay, d2		724.5				16.5	43.5				491.1	
Delay (s)		763.6				45.6	71.4				524.1	
Level of Service		F				D	E				F	
Approach Delay (s)		763.6					67.1				524.1	
Approach LOS		F					E				F	

Intersection Summary			
HCM Average Control Delay	397.2	HCM Level of Service	F
HCM Volume to Capacity ratio	2.08		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	43.0
Intersection Capacity Utilization	89.7%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBL	SBT	SBR	SBR2	NER2
Lane Configurations					
Ideal Flow (vphpl)	1900	1900	1900	1900	1900
Lane Width	11	16	11	11	14
Total Lost time (s)		4.0		4.0	4.0
Lane Util. Factor		1.00		1.00	1.00
Frt		0.99		0.85	0.86
Flt Protected		0.98		1.00	1.00
Satd. Flow (prot)		1571		1175	1447
Flt Permitted		0.74		1.00	1.00
Satd. Flow (perm)		1188		1175	1447
Volume (vph)	99	166	29	31	32
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.73
Adj. Flow (vph)	116	195	34	36	44
RTOR Reduction (vph)	0	0	0	0	0
Lane Group Flow (vph)	0	345	0	36	44
Heavy Vehicles (%)	7%	7%	7%	7%	9%
Bus Blockages (#/hr)	0	0	0	0	0
Parking (#/hr)		1	1	1	
Turn Type	Perm			Prot	Over
Protected Phases		4		4	3
Permitted Phases	4				
Actuated Green, G (s)		22.0		22.0	11.0
Effective Green, g (s)		23.0		23.0	11.0
Actuated g/C Ratio		0.23		0.23	0.11
Clearance Time (s)		5.0		5.0	4.0
Vehicle Extension (s)		3.0		3.0	3.0
Lane Grp Cap (vph)		273		270	159
v/s Ratio Prot				0.03	0.03
v/s Ratio Perm		0.29			
v/c Ratio		1.26		0.13	0.28
Uniform Delay, d1		38.5		30.6	40.8
Progression Factor		0.77		0.69	1.00
Incremental Delay, d2		141.9		0.9	4.3
Delay (s)		171.5		21.9	45.1
Level of Service		F		C	D
Approach Delay (s)		157.4			
Approach LOS		F			

Intersection Summary

Lane Group	EBT	WBT
Lane Group Flow (vph)	751	716
v/c Ratio	0.30	0.25
Control Delay	0.3	0.0
Queue Delay	0.0	0.0
Total Delay	0.3	0.0
Queue Length 50th (ft)	0	0
Queue Length 95th (ft)	0	m0
Internal Link Dist (ft)	373	165
Turn Bay Length (ft)		
Base Capacity (vph)	2482	2835
Starvation Cap Reductn	0	0
Spillback Cap Reductn	0	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.30	0.25

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	11	11	12	12	12
Total Lost time (s)		4.0	4.0			
Lane Util. Factor		0.95	0.95			
Frt		1.00	0.99			
Flt Protected		1.00	1.00			
Satd. Flow (prot)		2714	2835			
Flt Permitted		0.91	1.00			
Satd. Flow (perm)		2486	2835			
Volume (vph)	26	688	587	28	0	0
Peak-hour factor, PHF	0.95	0.95	0.86	0.86	0.25	0.25
Adj. Flow (vph)	27	724	683	33	0	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	751	716	0	0	0
Heavy Vehicles (%)	7%	7%	10%	10%	0%	0%
Bus Blockages (#/hr)	0	6	0	0	0	0
Parking (#/hr)		5		5		
Turn Type	Perm					
Protected Phases		1	1			
Permitted Phases	1					
Actuated Green, G (s)		100.0	100.0			
Effective Green, g (s)		100.0	100.0			
Actuated g/C Ratio		1.00	1.00			
Clearance Time (s)		4.0	4.0			
Vehicle Extension (s)		3.0	3.0			
Lane Grp Cap (vph)		2486	2835			
v/s Ratio Prot			0.25			
v/s Ratio Perm		c0.30				
v/c Ratio		0.30	0.25			
Uniform Delay, d1		0.0	0.0			
Progression Factor		1.00	1.00			
Incremental Delay, d2		0.3	0.0			
Delay (s)		0.3	0.0			
Level of Service		A	A			
Approach Delay (s)		0.3	0.0		0.0	
Approach LOS		A	A		A	

Intersection Summary			
HCM Average Control Delay	0.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	45.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	SET	NWT	NET	SWT
Lane Group Flow (vph)	847	625	40	175
v/c Ratio	0.52	0.30	0.18	0.64
Control Delay	6.1	8.7	31.4	29.8
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	6.1	8.7	31.4	29.8
Queue Length 50th (ft)	77	136	18	50
Queue Length 95th (ft)	161	123	33	111
Internal Link Dist (ft)	339	373	163	400
Turn Bay Length (ft)				
Base Capacity (vph)	1641	2099	276	319
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.52	0.30	0.14	0.55

Intersection Summary

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	11	12	12	11	12	12	12	12	12	16	12
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		0.95			0.95			1.00			1.00	
Frt		1.00			1.00			0.97			0.91	
Flt Protected		0.99			1.00			0.98			0.98	
Satd. Flow (prot)		2755			2721			1624			1469	
Flt Permitted		0.79			1.00			0.83			0.88	
Satd. Flow (perm)		2196			2721			1369			1317	
Volume (vph)	87	675	0	0	555	7	12	10	6	51	0	105
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.70	0.70	0.70	0.89	0.89	0.89
Adj. Flow (vph)	97	750	0	0	617	8	17	14	9	57	0	118
RTOR Reduction (vph)	0	0	0	0	0	0	0	8	0	0	77	0
Lane Group Flow (vph)	0	847	0	0	625	0	0	32	0	0	98	0
Heavy Vehicles (%)	5%	5%	5%	8%	8%	8%	0%	0%	0%	5%	5%	5%
Bus Blockages (#/hr)	0	6	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)		5			5						2	
Turn Type	Perm						Perm			Perm		
Protected Phases		1			1			3			3	
Permitted Phases	1						3			3		
Actuated Green, G (s)		77.1			77.1			14.9			14.9	
Effective Green, g (s)		77.1			77.1			14.9			14.9	
Actuated g/C Ratio		0.77			0.77			0.15			0.15	
Clearance Time (s)		4.0			4.0			4.0			4.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		1693			2098			204			196	
v/s Ratio Prot					0.23							
v/s Ratio Perm		c0.39						0.02			c0.07	
v/c Ratio		0.50			0.30			0.16			0.50	
Uniform Delay, d1		4.3			3.4			37.1			39.1	
Progression Factor		1.00			2.24			1.00			0.98	
Incremental Delay, d2		1.1			0.4			0.4			2.0	
Delay (s)		5.3			8.0			37.5			40.3	
Level of Service		A			A			D			D	
Approach Delay (s)		5.3			8.0			37.5			40.3	
Approach LOS		A			A			D			D	

Intersection Summary			
HCM Average Control Delay	10.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	63.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	100	625	51	527	298	297	307
v/c Ratio	0.59	0.44	0.31	0.72	0.73	0.67	1.38
Control Delay	69.1	12.0	43.9	28.6	35.0	40.0	220.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	69.1	12.0	43.9	28.6	35.0	40.0	220.9
Queue Length 50th (ft)	70	224	30	269	153	167	~261
Queue Length 95th (ft)	m0	m21	65	#467	#318	209	m#389
Internal Link Dist (ft)		1295		1669		389	1718
Turn Bay Length (ft)	85		75				
Base Capacity (vph)	215	1432	211	737	410	443	223
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.47	0.44	0.24	0.72	0.73	0.67	1.38

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	11	11	10	11	11	16	16	16	11	11	11
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0			4.0	
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00		1.00			1.00	
Frpb, ped/bikes	1.00	0.98		1.00	1.00	0.65		1.00			0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00			0.93	
Frt	1.00	0.99		1.00	1.00	0.85		1.00			0.98	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00			0.98	
Satd. Flow (prot)	1430	2896		1404	1494	832		1578			1307	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.97			0.56	
Satd. Flow (perm)	1430	2896		1404	1494	832		1529			751	
Volume (vph)	86	511	27	46	480	271	17	208	1	110	119	32
Peak-hour factor, PHF	0.86	0.86	0.86	0.91	0.91	0.91	0.76	0.76	0.76	0.85	0.85	0.85
Adj. Flow (vph)	100	594	31	51	527	298	22	274	1	129	140	38
RTOR Reduction (vph)	0	4	0	0	0	0	0	0	0	0	5	0
Lane Group Flow (vph)	100	621	0	51	527	298	0	297	0	0	302	0
Confl. Peds. (#/hr)	106		92	92		106	75		414	414		75
Confl. Bikes (#/hr)			17			1			9			1
Heavy Vehicles (%)	6%	6%	6%	8%	8%	8%	9%	9%	9%	12%	12%	12%
Bus Blockages (#/hr)	0	0	0	0	6	6	0	0	0	0	0	0
Parking (#/hr)							1	1	1			
Turn Type	Prot			Prot		Perm	Perm			Perm		
Protected Phases	1	2		1	2			3			3	
Permitted Phases						2	3			3		
Actuated Green, G (s)	10.5	47.5		10.5	47.5	47.5		28.0			28.0	
Effective Green, g (s)	10.5	48.5		10.5	48.5	48.5		29.0			29.0	
Actuated g/C Ratio	0.10	0.48		0.10	0.48	0.48		0.29			0.29	
Clearance Time (s)	4.0	5.0		4.0	5.0	5.0		5.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	150	1405		147	725	404		443			218	
v/s Ratio Prot	c0.07	0.21		0.04	0.35							
v/s Ratio Perm						c0.36		0.19			c0.40	
v/c Ratio	0.67	0.44		0.35	0.73	0.74		0.67			1.39	
Uniform Delay, d1	43.1	16.9		41.6	20.5	20.6		31.3			35.5	
Progression Factor	1.65	0.67		1.00	1.00	1.00		1.00			1.06	
Incremental Delay, d2	1.0	0.1		1.4	6.3	11.4		4.0			193.6	
Delay (s)	71.9	11.5		43.0	26.8	32.1		35.2			231.2	
Level of Service	E	B		D	C	C		D			F	
Approach Delay (s)		19.8			29.5			35.2			231.2	
Approach LOS		B			C			D			F	

Intersection Summary			
HCM Average Control Delay	55.2	HCM Level of Service	E
HCM Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	76.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	232	97	78	444	575
v/c Ratio	0.82	0.44	0.25	0.63	0.63
Control Delay	50.1	39.7	9.1	32.6	22.8
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	50.1	39.7	9.1	32.6	22.8
Queue Length 50th (ft)	106	55	0	132	120
Queue Length 95th (ft)	m132	96	34	192	m96
Internal Link Dist (ft)	821	168		1718	335
Turn Bay Length (ft)					
Base Capacity (vph)	356	287	374	709	916
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.65	0.34	0.21	0.63	0.63

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1600	1600	1600	1600	1600	1600
Lane Width	13	13	13	12	12	10	10	11	11	10	10	10
Total Lost time (s)		4.0			4.0	4.0		4.0			4.0	
Lane Util. Factor		1.00			1.00	1.00		0.95			0.95	
Frpb, ped/bikes		1.00			1.00	0.99		1.00			0.99	
Flpb, ped/bikes		1.00			1.00	1.00		1.00			1.00	
Frt		0.94			1.00	0.85		0.98			0.97	
Flt Protected		0.98			0.97	1.00		0.99			0.99	
Satd. Flow (prot)		1407			1511	1217		2154			2260	
Flt Permitted		0.87			0.63	1.00		0.80			0.75	
Satd. Flow (perm)		1239			980	1217		1745			1710	
Volume (vph)	60	44	89	49	36	69	56	296	56	101	313	86
Peak-hour factor, PHF	0.83	0.83	0.83	0.88	0.88	0.88	0.92	0.92	0.92	0.87	0.87	0.87
Adj. Flow (vph)	72	53	107	56	41	78	61	322	61	116	360	99
RTOR Reduction (vph)	0	34	0	0	0	62	0	12	0	0	15	0
Lane Group Flow (vph)	0	198	0	0	97	16	0	432	0	0	560	0
Confl. Bikes (#/hr)						1			4			43
Heavy Vehicles (%)	16%	16%	16%	10%	10%	10%	15%	15%	15%	8%	8%	8%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	17	17	0	0	0
Turn Type	Perm			Perm		Perm	Perm			D.P+P		
Protected Phases		3			3			1		10	1 10	
Permitted Phases	3			3		3	1			1		
Actuated Green, G (s)		19.0			19.0	19.0		39.6			51.4	
Effective Green, g (s)		20.0			20.0	20.0		40.6			50.4	
Actuated g/C Ratio		0.20			0.20	0.20		0.41			0.50	
Clearance Time (s)		5.0			5.0	5.0		5.0				
Vehicle Extension (s)		3.0			3.0	3.0		3.0				
Lane Grp Cap (vph)		248			196	243		708			916	
v/s Ratio Prot											c0.06	
v/s Ratio Perm		c0.16			0.10	0.01		0.25			c0.25	
v/c Ratio		0.80			0.49	0.06		0.61			0.61	
Uniform Delay, d1		38.1			35.5	32.4		23.5			17.8	
Progression Factor		1.03			1.00	1.00		1.15			1.22	
Incremental Delay, d2		13.8			2.0	0.1		2.8			0.1	
Delay (s)		53.2			37.5	32.5		29.8			21.8	
Level of Service		D			D	C		C			C	
Approach Delay (s)		53.2			35.3			29.8			21.8	
Approach LOS		D			D			C			C	

Intersection Summary			
HCM Average Control Delay	31.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	29.6
Intersection Capacity Utilization	63.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	32	922	216	719	88	139	272	80	307
v/c Ratio	0.63	1.31	1.38	0.66	1.42	0.54	0.52	0.48	1.09
Control Delay	78.3	187.6	239.3	24.1	283.2	42.4	4.5	44.9	119.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	78.3	187.6	239.3	24.1	283.2	42.4	4.5	44.9	119.2
Queue Length 50th (ft)	21	~397	~184	179	~73	60	0	45	~222
Queue Length 95th (ft)	m27	m#441	#329	246	m#145	m110	m16	75	#293
Internal Link Dist (ft)		771		938		335			755
Turn Bay Length (ft)	70		350					170	
Base Capacity (vph)	51	704	157	1087	62	259	524	168	281
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.63	1.31	1.38	0.66	1.42	0.54	0.52	0.48	1.09

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
Lane Width	10	10	10	10	10	10	10	10	10	10	10	10
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	*0.95		1.00	0.95		1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	1.00	0.99	1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.97		1.00	0.97		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1216	2347		1205	2313		1120	1179	993	1240	1275	
Flt Permitted	0.13	1.00		0.95	1.00		0.26	1.00	1.00	0.59	1.00	
Satd. Flow (perm)	171	2347		1205	2313		306	1179	993	772	1275	
Volume (vph)	29	661	178	199	509	153	81	128	250	60	210	20
Peak-hour factor, PHF	0.91	0.91	0.91	0.92	0.92	0.92	0.92	0.92	0.92	0.75	0.75	0.75
Adj. Flow (vph)	32	726	196	216	553	166	88	139	272	80	280	27
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	177	0	0	0
Lane Group Flow (vph)	32	922	0	216	719	0	88	139	95	80	307	0
Confl. Bikes (#/hr)			5			5			3			96
Heavy Vehicles (%)	5%	5%	5%	6%	6%	6%	14%	14%	14%	3%	3%	3%
Turn Type	Perm			custom			Perm		pm+ov	Perm		
Protected Phases		1		4	1 4			3	4		3	
Permitted Phases	1			4			3		3	3		
Actuated Green, G (s)	30.0	30.0		15.0	47.0		22.0	22.0	37.0	22.0	22.0	
Effective Green, g (s)	30.0	30.0		13.0	47.0		22.0	22.0	35.0	22.0	22.0	
Actuated g/C Ratio	0.30	0.30		0.13	0.47		0.22	0.22	0.35	0.22	0.22	
Clearance Time (s)	4.0	4.0		2.0			4.0	4.0	2.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0			3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	51	704		157	1087		67	259	387	170	281	
v/s Ratio Prot		c0.39		c0.18	0.31			0.12	0.03		0.24	
v/s Ratio Perm	0.19						c0.29		0.06	0.10		
v/c Ratio	0.63	1.31		1.38	0.66		1.31	0.54	0.25	0.47	1.09	
Uniform Delay, d1	30.2	35.0		43.5	20.4		39.0	34.5	23.1	33.9	39.0	
Progression Factor	1.58	1.59		1.00	1.00		0.97	1.01	0.51	1.00	1.00	
Incremental Delay, d2	24.9	144.4		203.9	1.5		205.5	1.8	0.3	2.1	80.7	
Delay (s)	72.6	200.0		247.4	21.9		243.2	36.7	12.2	36.0	119.7	
Level of Service	E	F		F	C		F	D	B	D	F	
Approach Delay (s)		195.8			74.0			59.7			102.4	
Approach LOS		F			E			E			F	

Intersection Summary			
HCM Average Control Delay	117.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.32		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	35.0
Intersection Capacity Utilization	81.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	377	823	628	69	28	226	351	99
v/c Ratio	0.72	0.88	0.70	0.15	0.19	0.49	1.07	0.13
Control Delay	21.1	41.0	31.9	6.6	28.4	29.2	102.7	8.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.1	41.0	31.9	6.6	28.4	29.2	102.7	8.8
Queue Length 50th (ft)	98	225	161	0	12	100	~229	23
Queue Length 95th (ft)	204	#330	223	29	35	166	#364	43
Internal Link Dist (ft)		360	496			755	339	
Turn Bay Length (ft)	200				50			100
Base Capacity (vph)	520	962	922	480	145	457	328	765
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.73	0.86	0.68	0.14	0.19	0.49	1.07	0.13

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1600	1600	1600
Lane Width	10	10	10	10	10	10	11	12	12	11	11	14
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	0.95			0.95	1.00	1.00	1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00			1.00	1.00	1.00	0.94			1.00	1.00
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00	1.00			0.96	1.00
Frt	1.00	0.99			1.00	0.85	1.00	0.97			1.00	0.85
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00			0.99	1.00
Satd. Flow (prot)	1501	2964			3002	1343	1510	1501			1301	1280
Flt Permitted	0.27	1.00			0.95	1.00	0.32	1.00			0.85	1.00
Satd. Flow (perm)	424	2964			2861	1343	506	1501			1121	1280
Volume (vph)	354	716	57	2	613	68	25	160	39	57	241	84
Peak-hour factor, PHF	0.94	0.94	0.94	0.98	0.98	0.98	0.88	0.88	0.88	0.85	0.85	0.85
Adj. Flow (vph)	377	762	61	2	626	69	28	182	44	67	284	99
RTOR Reduction (vph)	0	7	0	0	0	47	0	10	0	0	0	0
Lane Group Flow (vph)	377	816	0	0	628	22	28	216	0	0	351	99
Confl. Peds. (#/hr)									300	300		
Confl. Bikes (#/hr)			1						1			81
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	4%	4%	4%	2%	2%	2%
Turn Type	pm+pt			Perm		Perm	Perm			Perm		pt+ov
Protected Phases	1	3			3			4			4	1 4
Permitted Phases	3			3		3	4			4		
Actuated Green, G (s)	49.2	27.2			27.2	27.2	25.8	25.8			25.8	52.8
Effective Green, g (s)	51.2	28.2			28.2	28.2	26.8	26.8			26.8	53.8
Actuated g/C Ratio	0.57	0.31			0.31	0.31	0.30	0.30			0.30	0.60
Clearance Time (s)	5.0	5.0			5.0	5.0	5.0	5.0			5.0	
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0			3.0	
Lane Grp Cap (vph)	516	929			896	421	151	447			334	765
v/s Ratio Prot	c0.19	c0.28						0.14				0.08
v/s Ratio Perm	0.23				0.22	0.02	0.06				c0.31	
v/c Ratio	0.73	0.88			0.70	0.05	0.19	0.48			1.05	0.13
Uniform Delay, d1	12.5	29.3			27.2	21.6	23.5	25.9			31.6	7.9
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2	5.3	9.5			2.5	0.1	2.7	3.7			63.2	0.3
Delay (s)	17.7	38.7			29.7	21.6	26.2	29.6			94.8	8.2
Level of Service	B	D			C	C	C	C			F	A
Approach Delay (s)		32.1			28.9			29.3			75.8	
Approach LOS		C			C			C			E	

Intersection Summary			
HCM Average Control Delay	38.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	90.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	554	101	161	781	252	224	155
v/c Ratio	1.41	0.39	0.30	0.45	0.84	0.42	0.33
Control Delay	237.4	54.2	28.9	29.9	65.6	26.4	23.5
Queue Delay	0.0	0.0	0.0	0.2	0.0	0.0	0.0
Total Delay	237.4	54.2	28.9	30.1	65.6	26.4	23.5
Queue Length 50th (ft)	~280	67	84	240	191	104	69
Queue Length 95th (ft)	m#365	m106	m#143	m354	m237	m141	104
Internal Link Dist (ft)	176			771		331	256
Turn Bay Length (ft)		150	150		100		
Base Capacity (vph)	392	261	538	1752	364	637	559
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	269	0	0	3
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.41	0.39	0.30	0.53	0.69	0.35	0.28

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	12	12	12	15	11	14	14	14
Total Lost time (s)		4.0	4.0	4.0	4.0		4.0	4.0			4.0	
Lane Util. Factor		0.95	1.00	1.00	0.95		1.00	1.00			1.00	
Frt		1.00	0.85	1.00	1.00		1.00	0.91			0.94	
Flt Protected		1.00	1.00	0.95	1.00		0.95	1.00			0.99	
Satd. Flow (prot)		2912	1304	1444	3079		1547	1628			1638	
Flt Permitted		0.66	1.00	0.19	1.00		0.59	1.00			0.88	
Satd. Flow (perm)		1932	1304	281	3079		969	1628			1463	
Volume (vph)	13	491	92	156	733	24	222	77	120	37	41	69
Peak-hour factor, PHF	0.91	0.91	0.91	0.97	0.97	0.97	0.88	0.88	0.88	0.95	0.95	0.95
Adj. Flow (vph)	14	540	101	161	756	25	252	88	136	39	43	73
RTOR Reduction (vph)	0	0	0	0	0	0	0	50	0	0	29	0
Lane Group Flow (vph)	0	554	101	161	781	0	252	174	0	0	126	0
Heavy Vehicles (%)	4%	4%	4%	5%	5%	5%	5%	5%	5%	3%	3%	3%
Turn Type	Perm		Perm	D.P+P			Perm			Perm		
Protected Phases		1		4	1 4			3			3	
Permitted Phases	1		1	1			3			3		
Actuated Green, G (s)		21.6	21.6	61.9	65.9		35.7	35.7			35.7	
Effective Green, g (s)		21.6	21.6	61.9	65.9		35.7	35.7			35.7	
Actuated g/C Ratio		0.18	0.18	0.52	0.55		0.30	0.30			0.30	
Clearance Time (s)		4.0	4.0	4.0			4.0	4.0			4.0	
Vehicle Extension (s)		3.0	3.0	3.0			3.0	3.0			3.0	
Lane Grp Cap (vph)		348	235	536	1691		288	484			435	
v/s Ratio Prot				0.10	c0.25			0.11				
v/s Ratio Perm		c0.29	0.08	0.05			c0.26				0.09	
v/c Ratio		1.59	0.43	0.30	0.46		0.88	0.36			0.29	
Uniform Delay, d1		49.2	43.7	17.0	16.3		40.0	33.2			32.4	
Progression Factor		1.15	1.20	1.48	1.50		1.09	1.16			1.00	
Incremental Delay, d2		276.8	4.4	1.0	0.7		23.9	0.5			0.4	
Delay (s)		333.3	56.8	26.2	25.1		67.7	38.9			32.8	
Level of Service		F	E	C	C		E	D			C	
Approach Delay (s)		290.6			25.3			54.1			32.8	
Approach LOS		F			C			D			C	

Intersection Summary			
HCM Average Control Delay	110.0	HCM Level of Service	F
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	22.4
Intersection Capacity Utilization	75.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	546	27	0	1024	0	51
Peak Hour Factor	0.90	0.90	0.97	0.97	0.80	0.80
Hourly flow rate (vph)	607	30	0	1056	0	64
Pedestrians	89			89	89	
Lane Width (ft)	11.0			10.0	14.0	
Walking Speed (ft/s)	4.0			4.0	4.0	
Percent Blockage	7			6	9	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)	94			256		
pX, platoon unblocked			0.89		0.91	0.89
vC, conflicting volume			726		1328	496
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			574		912	317
tC, single (s)			4.1		7.0	7.1
tC, 2 stage (s)						
tF (s)			2.2		3.6	3.4
p0 queue free %			100		100	87
cM capacity (veh/h)			812		198	498

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	404	232	528	528	64
Volume Left	0	0	0	0	0
Volume Right	0	30	0	0	64
cSH	1700	1700	1700	1700	498
Volume to Capacity	0.24	0.14	0.31	0.31	0.13
Queue Length 95th (ft)	0	0	0	0	11
Control Delay (s)	0.0	0.0	0.0	0.0	13.3
Lane LOS					B
Approach Delay (s)	0.0		0.0		13.3
Approach LOS					B

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	50.9%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	113	365	409	647	866	1305
v/c Ratio	2.13	0.57	1.21	0.56	0.98	1.07
Control Delay	592.1	45.4	149.1	29.4	61.6	81.3
Queue Delay	0.0	0.0	0.0	1.7	0.0	0.0
Total Delay	592.1	45.4	149.1	31.1	61.6	81.3
Queue Length 50th (ft)	~140	133	~376	240	~377	~632
Queue Length 95th (ft)	#260	184	m#441	m170	#508	#730
Internal Link Dist (ft)		849		14	255	366
Turn Bay Length (ft)						
Base Capacity (vph)	53	642	337	1163	880	1223
Starvation Cap Reductn	0	0	0	338	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	2.13	0.57	1.21	0.78	0.98	1.07

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	10	10	10	11	11	11	10	10	10
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			0.95			0.95	
Frt	1.00	1.00		1.00	1.00			0.96			1.00	
Flt Protected	0.95	1.00		0.95	1.00			1.00			1.00	
Satd. Flow (prot)	1510	2853		1486	2968			3006			2989	
Flt Permitted	0.15	1.00		0.39	1.00			0.79			1.00	
Satd. Flow (perm)	243	2853		606	2968			2376			2989	
Volume (vph)	110	347	7	397	621	7	12	572	229	0	1101	34
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.94	0.94	0.94	0.87	0.87	0.87
Adj. Flow (vph)	113	358	7	409	640	7	13	609	244	0	1266	39
RTOR Reduction (vph)	0	0	0	0	1	0	0	30	0	0	2	0
Lane Group Flow (vph)	113	365	0	409	646	0	0	836	0	0	1303	0
Heavy Vehicles (%)	4%	4%	4%	2%	2%	2%	0%	0%	0%	1%	1%	1%
Parking (#/hr)		1	1									
Turn Type	Perm			D.P+P			Perm					
Protected Phases		1		4	1 4			3			3	
Permitted Phases	1			1			3					
Actuated Green, G (s)	24.2	24.2		38.2	44.2			47.0			47.0	
Effective Green, g (s)	26.2	26.2		42.2	46.2			49.0			49.0	
Actuated g/C Ratio	0.22	0.22		0.35	0.38			0.41			0.41	
Clearance Time (s)	6.0	6.0		6.0				6.0			6.0	
Vehicle Extension (s)	3.0	3.0		3.0				3.0			3.0	
Lane Grp Cap (vph)	53	623		330	1143			970			1221	
v/s Ratio Prot		0.13		c0.16	0.22						c0.44	
v/s Ratio Perm	c0.47			0.27				0.35				
v/c Ratio	2.13	0.59		1.24	0.57			0.86			1.07	
Uniform Delay, d1	46.9	42.0		35.7	29.0			32.4			35.5	
Progression Factor	1.00	1.00		1.06	0.97			1.00			1.00	
Incremental Delay, d2	566.9	4.0		128.1	1.7			10.0			45.8	
Delay (s)	613.8	46.0		165.9	29.8			42.4			81.3	
Level of Service	F	D		F	C			D			F	
Approach Delay (s)		180.3			82.5			42.4			81.3	
Approach LOS		F			F			D			F	

Intersection Summary			
HCM Average Control Delay	85.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.40		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	28.8
Intersection Capacity Utilization	80.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	0	166	0	3	49	5	0	0	3	45	0	11
Peak Hour Factor	0.86	0.86	0.86	0.71	0.71	0.71	0.75	0.75	0.75	0.78	0.78	0.78
Hourly flow rate (vph)	0	193	0	4	69	7	0	0	4	58	0	14

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	193	80	4	72
Volume Left (vph)	0	4	0	58
Volume Right (vph)	0	7	4	14
Hadj (s)	0.00	-0.01	-0.60	0.11
Departure Headway (s)	4.2	4.3	4.0	4.6
Degree Utilization, x	0.22	0.10	0.00	0.09
Capacity (veh/h)	844	818	830	727
Control Delay (s)	8.4	7.7	7.0	8.1
Approach Delay (s)	8.4	7.7	7.0	8.1
Approach LOS	A	A	A	A

Intersection Summary			
Delay	8.1		
HCM Level of Service	A		
Intersection Capacity Utilization	33.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	32	54	13	79	36	108	5	228	73	57	233	47
Peak Hour Factor	0.88	0.88	0.88	0.94	0.94	0.94	0.89	0.89	0.89	0.87	0.87	0.87
Hourly flow rate (vph)	36	61	15	84	38	115	6	256	82	66	268	54
Pedestrians		227			258			258			258	
Lane Width (ft)		13.0			13.0			12.0			10.5	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		20			23			22			19	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								270			411	
pX, platoon unblocked	0.97	0.97	0.95	0.97	0.97	0.96	0.95			0.96		
vC, conflicting volume	1353	1260	780	1269	1246	813	549			596		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1310	1214	768	1222	1199	806	524			581		
tC, single (s)	7.2	6.6	6.4	7.1	6.5	6.2	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.1	3.4	3.5	4.0	3.3	2.3			2.2		
p0 queue free %	0	33	93	0	62	50	99			91		
cM capacity (veh/h)	19	91	226	27	100	231	764			738		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total	112	237	344	66	322
Volume Left	36	84	6	66	0
Volume Right	15	115	82	0	54
cSH	42	60	764	738	1700
Volume to Capacity	2.67	3.97	0.01	0.09	0.19
Queue Length 95th (ft)	306	Err	1	7	0
Control Delay (s)	961.1	Err	0.2	10.4	0.0
Lane LOS	F	F	A	B	
Approach Delay (s)	961.1	Err	0.2	1.8	
Approach LOS	F	F			

Intersection Summary			
Average Delay	2295.3		
Intersection Capacity Utilization	72.3%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	77	6	51	77	18	24
Peak Hour Factor	0.83	0.83	0.55	0.55	0.86	0.86
Hourly flow rate (vph)	93	7	93	140	21	28
Pedestrians	39		31			39
Lane Width (ft)	12.0		12.0			12.0
Walking Speed (ft/s)	4.0		4.0			4.0
Percent Blockage	3		3			3
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	302	241			272	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	302	241			272	
tC, single (s)	6.4	6.2			4.4	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.5	
p0 queue free %	86	99			98	
cM capacity (veh/h)	641	752			1113	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	100	233	49
Volume Left	93	0	21
Volume Right	7	140	0
cSH	648	1700	1113
Volume to Capacity	0.15	0.14	0.02
Queue Length 95th (ft)	14	0	1
Control Delay (s)	11.6	0.0	3.6
Lane LOS	B		A
Approach Delay (s)	11.6	0.0	3.6
Approach LOS	B		

Intersection Summary			
Average Delay	3.5		
Intersection Capacity Utilization	36.6%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	NBT	SBL	SBT
Lane Group Flow (vph)	211	300	51	347
v/c Ratio	0.84	0.31	0.09	0.31
Control Delay	67.9	8.7	5.5	5.3
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	67.9	8.7	5.5	5.3
Queue Length 50th (ft)	149	73	6	65
Queue Length 95th (ft)	190	163	20	86
Internal Link Dist (ft)	167	410		190
Turn Bay Length (ft)			150	
Base Capacity (vph)	338	980	543	1118
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.62	0.31	0.09	0.31

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	16	12	12	12	12	12	12	12	12	10	12	12
Total Lost time (s)		4.0						4.0		4.0	4.0	
Lane Util. Factor		1.00						1.00		1.00	1.00	
Frpb, ped/bikes		0.97						0.97		1.00	0.96	
Flpb, ped/bikes		0.70						1.00		0.86	1.00	
Frt		0.97						0.98		1.00	0.97	
Flt Protected		0.98						1.00		0.95	1.00	
Satd. Flow (prot)		1078						1396		1272	1554	
Flt Permitted		0.98						0.98		0.58	1.00	
Satd. Flow (perm)		1078						1366		771	1554	
Volume (vph)	85	51	40	0	0	0	15	234	33	43	227	65
Peak-hour factor, PHF	0.83	0.83	0.83	0.25	0.25	0.25	0.94	0.94	0.94	0.84	0.84	0.84
Adj. Flow (vph)	102	61	48	0	0	0	16	249	35	51	270	77
RTOR Reduction (vph)	0	10	0	0	0	0	0	3	0	0	7	0
Lane Group Flow (vph)	0	201	0	0	0	0	0	297	0	51	340	0
Confl. Peds. (#/hr)	304		35	35		304	45		66	66		45
Heavy Vehicles (%)	1%	1%	1%	0%	0%	0%	16%	16%	16%	2%	2%	2%
Turn Type	Perm						Perm			Perm		
Protected Phases		2						1			1	
Permitted Phases	2						1			1		
Actuated Green, G (s)		26.8						85.2		85.2	85.2	
Effective Green, g (s)		26.8						85.2		85.2	85.2	
Actuated g/C Ratio		0.22						0.71		0.71	0.71	
Clearance Time (s)		4.0						4.0		4.0	4.0	
Vehicle Extension (s)		3.0						3.0		3.0	3.0	
Lane Grp Cap (vph)		241						970		547	1103	
v/s Ratio Prot											c0.22	
v/s Ratio Perm		0.19						0.22		0.07		
v/c Ratio		0.83						0.31		0.09	0.31	
Uniform Delay, d1		44.5						6.4		5.4	6.5	
Progression Factor		1.00						1.00		0.65	0.60	
Incremental Delay, d2		21.2						0.8		0.3	0.7	
Delay (s)		65.7						7.3		3.9	4.6	
Level of Service		E						A		A	A	
Approach Delay (s)		65.7			0.0			7.3			4.5	
Approach LOS		E			A			A			A	

Intersection Summary			
HCM Average Control Delay	19.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	55.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	35	157	57	22	6	54	11	37	14	7	49	48
Peak Hour Factor	0.85	0.85	0.85	0.68	0.68	0.68	0.72	0.72	0.72	0.67	0.67	0.67
Hourly flow rate (vph)	41	185	67	32	9	79	15	51	19	10	73	72

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	293	121	86	155
Volume Left (vph)	41	32	15	10
Volume Right (vph)	67	79	19	72
Hadj (s)	-0.11	-0.04	-0.08	-0.26
Departure Headway (s)	4.6	4.8	5.0	4.7
Degree Utilization, x	0.37	0.16	0.12	0.20
Capacity (veh/h)	747	691	647	691
Control Delay (s)	10.2	8.8	8.7	9.0
Approach Delay (s)	10.2	8.8	8.7	9.0
Approach LOS	B	A	A	A

Intersection Summary			
Delay	9.5		
HCM Level of Service	A		
Intersection Capacity Utilization	37.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	19	0	56	41	13	52	24	246	0	0	193	18
Peak Hour Factor	0.72	0.72	0.72	0.83	0.83	0.83	0.89	0.89	0.89	0.83	0.83	0.83
Hourly flow rate (vph)	26	0	78	49	16	63	27	276	0	0	233	22
Pedestrians		80			101			101			90	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		7			8			8			8	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								452			490	
pX, platoon unblocked												
vC, conflicting volume	814	755	424	853	766	467	334			377		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	814	755	424	853	766	467	334			377		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.3			2.2		
p0 queue free %	86	100	85	72	94	88	98			100		
cM capacity (veh/h)	186	280	535	176	280	508	1103			1082		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	52	52	128	303	254
Volume Left	26	0	49	27	0
Volume Right	26	52	63	0	22
cSH	275	535	277	1103	1700
Volume to Capacity	0.19	0.10	0.46	0.02	0.15
Queue Length 95th (ft)	17	8	57	2	0
Control Delay (s)	21.1	12.5	28.6	1.0	0.0
Lane LOS	C	B	D	A	
Approach Delay (s)	16.8		28.6	1.0	0.0
Approach LOS	C		D		

Intersection Summary			
Average Delay	7.2		
Intersection Capacity Utilization	55.4%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	30	30	0	0	48	10	22	28	12	33	0	101
Peak Hour Factor	0.75	0.75	0.75	0.81	0.81	0.81	0.82	0.82	0.82	0.70	0.70	0.70
Hourly flow rate (vph)	40	40	0	0	59	12	27	34	15	47	0	144
Pedestrians		46			51			45			51	
Lane Width (ft)		11.0			11.0			16.0			11.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		4			4			5			4	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								376				
pX, platoon unblocked												
vC, conflicting volume	401	366	163	378	431	143	190			100		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	401	366	163	378	431	143	190			100		
tC, single (s)	7.2	6.6	6.3	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.1	3.4	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	90	92	100	100	87	99	98			97		
cM capacity (veh/h)	412	488	796	449	453	832	1347			1447		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	80	72	76	191
Volume Left	40	0	27	47
Volume Right	0	12	15	144
cSH	447	492	1347	1447
Volume to Capacity	0.18	0.15	0.02	0.03
Queue Length 95th (ft)	16	13	2	3
Control Delay (s)	14.8	13.6	2.8	2.1
Lane LOS	B	B	A	A
Approach Delay (s)	14.8	13.6	2.8	2.1
Approach LOS	B	B		

Intersection Summary			
Average Delay	6.6		
Intersection Capacity Utilization	32.5%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	WBL	WBT	NBT	SBT	SBR2	NER2
Lane Group Flow (vph)	631	91	837	373	302	39	137
v/c Ratio	1.48	0.60	0.85	2.14	1.28	0.18	1.09
Control Delay	259.7	20.7	27.6	554.6	190.1	37.4	150.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	259.7	20.7	27.6	554.6	190.1	37.4	150.2
Queue Length 50th (ft)	~297	45	301	~351	~246	21	~99
Queue Length 95th (ft)	#421	m45	m280	#535	#412	52	#172
Internal Link Dist (ft)	165		1295	704	372		
Turn Bay Length (ft)		50				50	
Base Capacity (vph)	426	152	981	174	236	212	126
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.48	0.60	0.85	2.14	1.28	0.18	1.09

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	EBR2	WBL2	WBL	WBT	WBR	NBL2	NBL	NBT	NBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)		4.0				4.0	4.0				4.0	
Lane Util. Factor		0.95				0.91	0.91				1.00	
Frt		0.96				1.00	0.98				0.99	
Flt Protected		1.00				0.95	1.00				0.97	
Satd. Flow (prot)		2660				1353	2885				1352	
Flt Permitted		0.70				0.17	1.00				0.21	
Satd. Flow (perm)		1854				248	2885				289	
Volume (vph)	18	439	112	30	50	36	703	84	29	157	155	17
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.94	0.94	0.94	0.94	0.96	0.96	0.96	0.96
Adj. Flow (vph)	19	462	118	32	53	38	748	89	30	164	161	18
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	631	0	0	0	91	837	0	0	0	373	0
Heavy Vehicles (%)	4%	4%	4%	4%	2%	2%	2%	2%	3%	3%	3%	3%
Bus Blockages (#/hr)	0	0	0	0	0	0	3	3	0	0	7	7
Parking (#/hr)		1	1	1						1	1	1
Turn Type	Perm				D.P+P	D.P+P			D.P+P	D.P+P		
Protected Phases		1			9	9	1 9		3	3	3 4	
Permitted Phases	1				1	1			4	4		
Actuated Green, G (s)		22.0				29.0	29.0				26.0	
Effective Green, g (s)		23.0				30.0	30.0				27.0	
Actuated g/C Ratio		0.23				0.30	0.30				0.27	
Clearance Time (s)		5.0				4.0						
Vehicle Extension (s)		3.0				3.0						
Lane Grp Cap (vph)		426				152	981				174	
v/s Ratio Prot						0.04	c0.06				c0.19	
v/s Ratio Perm		c0.34				0.14	0.23				c0.39	
v/c Ratio		1.48				0.60	0.85				2.14	
Uniform Delay, d1		38.5				27.3	32.9				36.5	
Progression Factor		1.02				0.73	0.84				1.00	
Incremental Delay, d2		228.6				0.6	0.7				533.4	
Delay (s)		267.9				20.5	28.5				569.9	
Level of Service		F				C	C				F	
Approach Delay (s)		267.9					27.7				569.9	
Approach LOS		F					C				F	

Intersection Summary			
HCM Average Control Delay	202.7	HCM Level of Service	F
HCM Volume to Capacity ratio	1.74		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	43.0
Intersection Capacity Utilization	93.9%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBL	SBT	SBR	SBR2	NER2
Lane Configurations					
Ideal Flow (vphpl)	1900	1900	1900	1900	1900
Lane Width	11	16	11	11	14
Total Lost time (s)		4.0		4.0	4.0
Lane Util. Factor		1.00		1.00	1.00
Frt		0.98		0.85	0.86
Flt Protected		0.99		1.00	1.00
Satd. Flow (prot)		1570		1175	1396
Flt Permitted		0.83		1.00	1.00
Satd. Flow (perm)		1311		1175	1396
Volume (vph)	73	184	39	38	104
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.76
Adj. Flow (vph)	74	188	40	39	137
RTOR Reduction (vph)	0	0	0	0	0
Lane Group Flow (vph)	0	302	0	39	137
Heavy Vehicles (%)	7%	7%	7%	7%	13%
Bus Blockages (#/hr)	0	0	0	0	0
Parking (#/hr)		1	1	1	
Turn Type	Perm			Prot	Over
Protected Phases		4		4	3
Permitted Phases	4				
Actuated Green, G (s)		17.0		17.0	9.0
Effective Green, g (s)		18.0		18.0	9.0
Actuated g/C Ratio		0.18		0.18	0.09
Clearance Time (s)		5.0		5.0	4.0
Vehicle Extension (s)		3.0		3.0	3.0
Lane Grp Cap (vph)		236		212	126
v/s Ratio Prot				0.03	0.10
v/s Ratio Perm		0.23			
v/c Ratio		1.28		0.18	1.09
Uniform Delay, d1		41.0		34.8	45.5
Progression Factor		1.00		1.00	1.00
Incremental Delay, d2		154.3		1.9	105.5
Delay (s)		195.3		36.7	151.0
Level of Service		F		D	F
Approach Delay (s)		177.2			
Approach LOS		F			

Intersection Summary

Lane Group	EBT	WBT
Lane Group Flow (vph)	646	976
v/c Ratio	0.27	0.32
Control Delay	0.3	0.0
Queue Delay	0.1	0.0
Total Delay	0.3	0.0
Queue Length 50th (ft)	0	0
Queue Length 95th (ft)	0	m0
Internal Link Dist (ft)	373	165
Turn Bay Length (ft)		
Base Capacity (vph)	2419	3037
Starvation Cap Reductn	0	0
Spillback Cap Reductn	618	79
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.36	0.33

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	11	11	12	12	12
Total Lost time (s)		4.0	4.0			
Lane Util. Factor		0.95	0.95			
Frt		1.00	1.00			
Flt Protected		1.00	1.00			
Satd. Flow (prot)		2764	3036			
Flt Permitted		0.87	1.00			
Satd. Flow (perm)		2422	3036			
Volume (vph)	30	577	872	26	0	0
Peak-hour factor, PHF	0.94	0.94	0.92	0.92	0.75	0.75
Adj. Flow (vph)	32	614	948	28	0	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	646	976	0	0	0
Heavy Vehicles (%)	5%	5%	3%	3%	0%	0%
Bus Blockages (#/hr)	0	6	0	0	0	0
Parking (#/hr)		5		5		
Turn Type	Perm					
Protected Phases		1	1			
Permitted Phases	1					
Actuated Green, G (s)		100.0	100.0			
Effective Green, g (s)		100.0	100.0			
Actuated g/C Ratio		1.00	1.00			
Clearance Time (s)		4.0	4.0			
Vehicle Extension (s)		3.0	3.0			
Lane Grp Cap (vph)		2422	3036			
v/s Ratio Prot			c0.32			
v/s Ratio Perm		0.27				
v/c Ratio		0.27	0.32			
Uniform Delay, d1		0.0	0.0			
Progression Factor		1.00	1.00			
Incremental Delay, d2		0.2	0.0			
Delay (s)		0.2	0.0			
Level of Service		A	A			
Approach Delay (s)		0.2	0.0		0.0	
Approach LOS		A	A		A	

Intersection Summary			
HCM Average Control Delay	0.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	45.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	SET	NWT	NET	SWT
Lane Group Flow (vph)	643	899	40	250
v/c Ratio	0.38	0.43	0.18	0.76
Control Delay	6.6	5.4	29.3	38.5
Queue Delay	0.0	0.2	0.0	0.0
Total Delay	6.6	5.5	29.3	38.5
Queue Length 50th (ft)	62	55	19	100
Queue Length 95th (ft)	136	365	29	137
Internal Link Dist (ft)	339	373	163	400
Turn Bay Length (ft)				
Base Capacity (vph)	1694	2091	269	380
Starvation Cap Reductn	0	374	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.38	0.52	0.15	0.66

Intersection Summary

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	11	12	12	11	12	12	12	12	12	16	12
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		0.95			0.95			1.00			1.00	
Frt		1.00			1.00			0.98			0.91	
Flt Protected		1.00			1.00			0.97			0.98	
Satd. Flow (prot)		2814			2850			1617			1544	
Flt Permitted		0.84			1.00			0.66			0.87	
Satd. Flow (perm)		2369			2850			1108			1373	
Volume (vph)	41	544	0	0	828	17	19	3	4	67	0	133
Peak-hour factor, PHF	0.91	0.91	0.91	0.94	0.94	0.94	0.65	0.65	0.65	0.80	0.80	0.80
Adj. Flow (vph)	45	598	0	0	881	18	29	5	6	84	0	166
RTOR Reduction (vph)	0	0	0	0	1	0	0	5	0	0	73	0
Lane Group Flow (vph)	0	643	0	0	898	0	0	35	0	0	177	0
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	6	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)		5			5						2	
Turn Type	Perm						Perm			Perm		
Protected Phases		1			1			3			3	
Permitted Phases	1						3			3		
Actuated Green, G (s)		73.3			73.3			18.7			18.7	
Effective Green, g (s)		73.3			73.3			18.7			18.7	
Actuated g/C Ratio		0.73			0.73			0.19			0.19	
Clearance Time (s)		4.0			4.0			4.0			4.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		1736			2089			207			257	
v/s Ratio Prot					c0.32							
v/s Ratio Perm		0.27						0.03			c0.13	
v/c Ratio		0.37			0.43			0.17			0.69	
Uniform Delay, d1		4.9			5.2			34.1			37.9	
Progression Factor		1.00			0.78			1.00			1.01	
Incremental Delay, d2		0.6			0.6			0.4			7.5	
Delay (s)		5.5			4.7			34.5			45.8	
Level of Service		A			A			C			D	
Approach Delay (s)		5.5			4.7			34.5			45.8	
Approach LOS		A			A			C			D	

Intersection Summary			
HCM Average Control Delay	11.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	67.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	70	600	141	767	144	157	407
v/c Ratio	0.37	0.46	0.73	1.07	0.51	0.36	1.26
Control Delay	53.9	5.7	62.9	82.2	28.0	31.0	171.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	53.9	5.7	62.9	82.2	28.0	31.0	171.2
Queue Length 50th (ft)	43	49	86	~563	65	79	~323
Queue Length 95th (ft)	m40	m37	#156	#761	128	131	#511
Internal Link Dist (ft)		1295		1669		389	1718
Turn Bay Length (ft)	85		75				
Base Capacity (vph)	215	1315	221	718	282	440	323
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.33	0.46	0.64	1.07	0.51	0.36	1.26

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	11	11	10	11	11	16	16	16	11	11	11
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0			4.0	
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00		1.00			1.00	
Frpb, ped/bikes	1.00	0.97		1.00	1.00	0.46		0.98			0.96	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		0.99			0.91	
Frt	1.00	0.99		1.00	1.00	0.85		0.99			0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.99			0.98	
Satd. Flow (prot)	1430	2862		1472	1566	616		1641			1349	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.92			0.78	
Satd. Flow (perm)	1430	2862		1472	1566	616		1517			1076	
Volume (vph)	67	546	30	124	675	127	18	113	5	126	173	87
Peak-hour factor, PHF	0.96	0.96	0.96	0.88	0.88	0.88	0.87	0.87	0.87	0.95	0.95	0.95
Adj. Flow (vph)	70	569	31	141	767	144	21	130	6	133	182	92
RTOR Reduction (vph)	0	4	0	0	0	0	0	0	0	0	11	0
Lane Group Flow (vph)	70	596	0	141	767	144	0	157	0	0	396	0
Confl. Peds. (#/hr)	190		160	160		190	158		725	725		158
Confl. Bikes (#/hr)			15			23			1			10
Heavy Vehicles (%)	6%	6%	6%	3%	3%	3%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	6	6	0	0	0	0	0	0
Parking (#/hr)							1	1	1			
Turn Type	Prot			Prot		Perm	Perm			Perm		
Protected Phases	1	2		1	2			3			3	
Permitted Phases						2	3			3		
Actuated Green, G (s)	13.2	44.8		13.2	44.8	44.8		28.0			28.0	
Effective Green, g (s)	13.2	45.8		13.2	45.8	45.8		29.0			29.0	
Actuated g/C Ratio	0.13	0.46		0.13	0.46	0.46		0.29			0.29	
Clearance Time (s)	4.0	5.0		4.0	5.0	5.0		5.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	189	1311		194	717	282		440			312	
v/s Ratio Prot	0.05	0.21		c0.10	c0.49							
v/s Ratio Perm						0.23		0.10			c0.37	
v/c Ratio	0.37	0.45		0.73	1.07	0.51		0.36			1.27	
Uniform Delay, d1	39.6	18.6		41.7	27.1	19.2		28.1			35.5	
Progression Factor	1.36	0.30		1.00	1.00	1.00		1.00			1.00	
Incremental Delay, d2	0.1	0.1		12.7	53.8	6.5		0.5			144.5	
Delay (s)	54.1	5.6		54.4	80.9	25.6		28.6			180.0	
Level of Service	D	A		D	F	C		C			F	
Approach Delay (s)		10.7			69.8			28.6			180.0	
Approach LOS		B			E			C			F	

Intersection Summary			
HCM Average Control Delay	69.3	HCM Level of Service	E
HCM Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	85.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	176	121	150	567	396
v/c Ratio	0.79	0.60	0.47	0.57	0.32
Control Delay	50.8	59.1	11.4	28.9	14.6
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	50.8	59.1	11.4	28.9	14.6
Queue Length 50th (ft)	90	90	0	186	99
Queue Length 95th (ft)	m134	131	47	#316	m126
Internal Link Dist (ft)	821	168		1718	335
Turn Bay Length (ft)					
Base Capacity (vph)	437	465	537	989	1226
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.40	0.26	0.28	0.57	0.32

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1600	1600	1600	1600	1600	1600
Lane Width	13	13	13	12	12	10	10	11	11	10	10	10
Total Lost time (s)		4.0			4.0	4.0		4.0			4.0	
Lane Util. Factor		1.00			1.00	1.00		0.95			0.95	
Frpb, ped/bikes		0.99			1.00	0.98		0.98			0.93	
Flpb, ped/bikes		1.00			1.00	1.00		0.97			0.99	
Frt		0.92			1.00	0.85		0.99			0.97	
Flt Protected		0.99			0.98	1.00		1.00			1.00	
Satd. Flow (prot)		1310			1641	1308		2226			2132	
Flt Permitted		0.76			0.63	1.00		0.87			0.88	
Satd. Flow (perm)		1003			1057	1308		1938			1888	
Volume (vph)	40	20	83	45	59	129	51	455	21	30	246	61
Peak-hour factor, PHF	0.81	0.81	0.81	0.86	0.86	0.86	0.93	0.93	0.93	0.85	0.85	0.85
Adj. Flow (vph)	49	25	102	52	69	150	55	489	23	35	289	72
RTOR Reduction (vph)	0	53	0	0	0	128	0	2	0	0	9	0
Lane Group Flow (vph)	0	123	0	0	121	22	0	565	0	0	387	0
Confl. Peds. (#/hr)							500		500	500		500
Confl. Bikes (#/hr)			1			3			76			11
Heavy Vehicles (%)	21%	21%	21%	2%	2%	2%	8%	8%	8%	6%	6%	6%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	17	17	0	0	0
Turn Type	Perm			Perm		Perm	Perm			D.P+P		
Protected Phases		3			3			1		10	1 10	
Permitted Phases	3			3		3	1			1		
Actuated Green, G (s)		16.3			16.3	16.3		58.9			75.5	
Effective Green, g (s)		17.3			17.3	17.3		59.9			76.5	
Actuated g/C Ratio		0.14			0.14	0.14		0.50			0.64	
Clearance Time (s)		5.0			5.0	5.0		5.0				
Vehicle Extension (s)		3.0			3.0	3.0		3.0				
Lane Grp Cap (vph)		145			152	189		967			1237	
v/s Ratio Prot											c0.04	
v/s Ratio Perm		c0.12			0.11	0.02		c0.29			0.16	
v/c Ratio		0.85			0.80	0.11		0.58			0.31	
Uniform Delay, d1		50.1			49.6	44.7		21.2			9.8	
Progression Factor		0.90			1.00	1.00		1.00			1.44	
Incremental Delay, d2		33.7			24.3	0.3		2.6			0.1	
Delay (s)		78.6			74.0	45.0		23.8			14.2	
Level of Service		E			E	D		C			B	
Approach Delay (s)		78.6			57.9			23.8			14.2	
Approach LOS		E			E			C			B	

Intersection Summary			
HCM Average Control Delay	34.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	26.2
Intersection Capacity Utilization	60.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	60	653	192	673	217	215	271	52	176
v/c Ratio	1.30	1.06	0.91	0.67	0.94	0.53	0.44	0.24	0.43
Control Delay	184.5	53.9	73.2	33.1	70.3	26.9	3.4	31.9	35.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Total Delay	184.5	53.9	73.2	33.1	70.3	26.9	3.5	31.9	35.1
Queue Length 50th (ft)	~49	~310	105	226	105	50	0	29	104
Queue Length 95th (ft)	m#49	m237	#254	295	m#297	m112	m4	60	162
Internal Link Dist (ft)		771		938		335			755
Turn Bay Length (ft)	70		350					170	
Base Capacity (vph)	46	618	210	999	244	427	611	232	433
Starvation Cap Reductn	0	0	0	0	0	0	39	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.30	1.06	0.91	0.67	0.89	0.50	0.47	0.22	0.41

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
Lane Width	10	10	10	10	10	10	10	10	10	10	10	10
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	*0.95		1.00	0.95		1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	0.96	1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.98		1.00	0.99		1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1240	2375		1205	2373		1193	1256	1029	1252	1275	
Flt Permitted	0.13	1.00		0.19	1.00		0.57	1.00	1.00	0.51	1.00	
Satd. Flow (perm)	167	2375		235	2373		710	1256	1029	671	1275	
Volume (vph)	56	533	81	171	549	50	202	200	252	45	122	29
Peak-hour factor, PHF	0.94	0.94	0.94	0.89	0.89	0.89	0.93	0.93	0.93	0.86	0.86	0.86
Adj. Flow (vph)	60	567	86	192	617	56	217	215	271	52	142	34
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	150	0	0	0
Lane Group Flow (vph)	60	653	0	192	673	0	217	215	121	52	176	0
Confl. Bikes (#/hr)			10			11			78			9
Heavy Vehicles (%)	3%	3%	3%	6%	6%	6%	7%	7%	7%	2%	2%	2%
Bus Blockages (#/hr)	0	10	10	0	0	0	0	0	0	0	0	0
Turn Type	Perm			D.P+P			Perm		pm+ov	Perm		
Protected Phases		1		4	1 4			3	4		3	
Permitted Phases	1			1			3		3	3		
Actuated Green, G (s)	31.3	31.3		48.5	50.5		38.5	38.5	55.7	38.5	38.5	
Effective Green, g (s)	31.3	31.3		46.5	50.5		38.5	38.5	53.7	38.5	38.5	
Actuated g/C Ratio	0.26	0.26		0.39	0.42		0.32	0.32	0.45	0.32	0.32	
Clearance Time (s)	4.0	4.0		2.0			4.0	4.0	2.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0			3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	44	619		214	999		228	403	495	215	409	
v/s Ratio Prot		0.27		c0.11	0.28			0.17	0.03		0.14	
v/s Ratio Perm	c0.36			0.23			c0.31		0.09	0.08		
v/c Ratio	1.36	1.05		0.90	0.67		0.95	0.53	0.24	0.24	0.43	
Uniform Delay, d1	44.4	44.4		28.7	28.1		39.8	33.4	20.6	30.0	32.1	
Progression Factor	0.51	0.47		1.00	1.00		0.68	0.68	0.66	1.00	1.00	
Incremental Delay, d2	176.4	29.0		34.6	1.8		41.4	1.1	0.2	0.6	0.7	
Delay (s)	199.0	50.0		63.3	29.9		68.5	23.9	13.8	30.6	32.8	
Level of Service	F	D		E	C		E	C	B	C	C	
Approach Delay (s)		62.6			37.3			33.8			32.3	
Approach LOS		E			D			C			C	

Intersection Summary			
HCM Average Control Delay	43.0	HCM Level of Service	D
HCM Volume to Capacity ratio	1.10		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	35.0
Intersection Capacity Utilization	74.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	300	444	1121	119	61	433	239	221
v/c Ratio	0.66	0.40	1.07	0.21	0.35	1.07	2.41	0.26
Control Delay	25.4	22.4	77.0	4.9	35.1	98.1	686.4	12.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.4	22.4	77.0	4.9	35.1	98.1	686.4	12.0
Queue Length 50th (ft)	104	96	~374	0	29	~274	~227	63
Queue Length 95th (ft)	196	137	#501	34	61	#404	#371	105
Internal Link Dist (ft)		360	496			755	339	
Turn Bay Length (ft)	200				50			100
Base Capacity (vph)	454	1098	1050	558	173	406	99	836
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.66	0.40	1.07	0.21	0.35	1.07	2.41	0.26

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	12	12	11	11	14
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	0.95			0.95	1.00	1.00	1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00			1.00	0.98	1.00	0.98			1.00	1.00
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00	1.00			0.97	1.00
Frt	1.00	1.00			1.00	0.85	1.00	0.99			1.00	0.85
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00			0.99	1.00
Satd. Flow (prot)	1501	2987			3002	1315	1555	1650			1565	1535
Flt Permitted	0.12	1.00			0.95	1.00	0.43	1.00			0.25	1.00
Satd. Flow (perm)	192	2987			2866	1315	708	1650			404	1535
Volume (vph)	285	409	12	2	1018	108	51	340	19	63	155	201
Peak-hour factor, PHF	0.95	0.95	0.95	0.91	0.91	0.91	0.83	0.83	0.83	0.91	0.91	0.91
Adj. Flow (vph)	300	431	13	2	1119	119	61	410	23	69	170	221
RTOR Reduction (vph)	0	3	0	0	0	75	0	2	0	0	0	0
Lane Group Flow (vph)	300	441	0	0	1121	44	61	431	0	0	239	221
Confl. Peds. (#/hr)									300	300		
Confl. Bikes (#/hr)			4			1			35			5
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Turn Type	pm+pt			Perm		Perm	Perm			Perm		pt+ov
Protected Phases	1	3			3			4			4	1 4
Permitted Phases	3			3		3	4			4		
Actuated Green, G (s)	54.0	32.0			32.0	32.0	21.0	21.0			21.0	48.0
Effective Green, g (s)	56.0	33.0			33.0	33.0	22.0	22.0			22.0	49.0
Actuated g/C Ratio	0.62	0.37			0.37	0.37	0.24	0.24			0.24	0.54
Clearance Time (s)	5.0	5.0			5.0	5.0	5.0	5.0			5.0	
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0			3.0	
Lane Grp Cap (vph)	454	1095			1051	482	173	403			99	836
v/s Ratio Prot	c0.17	0.15						0.26				0.14
v/s Ratio Perm	0.24				c0.39	0.03	0.09				c0.59	
v/c Ratio	0.66	0.40			1.07	0.09	0.35	1.07			2.41	0.26
Uniform Delay, d1	18.8	21.2			28.5	18.7	28.1	34.0			34.0	10.9
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2	3.6	0.2			47.3	0.1	5.6	64.4			666.0	0.8
Delay (s)	22.4	21.4			75.8	18.8	33.7	98.4			700.0	11.7
Level of Service	C	C			E	B	C	F			F	B
Approach Delay (s)		21.8			70.4			90.4			369.3	
Approach LOS		C			E			F			F	

Intersection Summary			
HCM Average Control Delay	108.2	HCM Level of Service	F
HCM Volume to Capacity ratio	1.33		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	96.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

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Lane Group	EBT	EBR	WBL	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	970	239	268	543	201	233	191
v/c Ratio	1.09	0.43	1.71	0.36	1.07	0.38	0.60
Control Delay	72.7	15.1	351.3	4.3	122.2	21.1	39.7
Queue Delay	57.9	1.0	0.0	0.0	0.0	0.0	0.0
Total Delay	130.6	16.0	351.3	4.3	122.2	21.1	39.7
Queue Length 50th (ft)	~381	82	~178	42	124	68	82
Queue Length 95th (ft)	m#398	m88	m#219	m50	m#249	m100	#249
Internal Link Dist (ft)	176			771		331	256
Turn Bay Length (ft)		150	150		100		
Base Capacity (vph)	890	559	157	1494	188	620	317
Starvation Cap Reductn	98	139	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.22	0.57	1.71	0.36	1.07	0.38	0.60

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	12	12	12	15	11	14	14	14
Total Lost time (s)		4.0	4.0	4.0	4.0		4.0	4.0			4.0	
Lane Util. Factor		0.95	1.00	1.00	0.95		1.00	1.00			1.00	
Frt		1.00	0.85	1.00	0.99		1.00	0.89			0.97	
Flt Protected		1.00	1.00	0.95	1.00		0.95	1.00			0.99	
Satd. Flow (prot)		2970	1330	1404	2988		1562	1613			1740	
Flt Permitted		0.71	1.00	0.15	1.00		0.57	1.00			0.93	
Satd. Flow (perm)		2110	1330	217	2988		940	1613			1637	
Volume (vph)	14	859	215	252	488	23	149	48	124	26	109	37
Peak-hour factor, PHF	0.90	0.90	0.90	0.94	0.94	0.94	0.74	0.74	0.74	0.90	0.90	0.90
Adj. Flow (vph)	16	954	239	268	519	24	201	65	168	29	121	41
RTOR Reduction (vph)	0	0	0	0	0	0	0	71	0	0	7	0
Lane Group Flow (vph)	0	970	239	268	543	0	201	162	0	0	184	0
Heavy Vehicles (%)	2%	2%	2%	8%	8%	8%	4%	4%	4%	1%	1%	1%
Turn Type	Perm		Perm	D.P+P			Perm			Perm		
Protected Phases		1		4	1 4			3			3	
Permitted Phases	1		1	1			3			3		
Actuated Green, G (s)		39.6	39.6	43.6	47.6		34.0	34.0			34.0	
Effective Green, g (s)		39.6	39.6	43.6	47.6		34.0	34.0			34.0	
Actuated g/C Ratio		0.40	0.40	0.44	0.48		0.34	0.34			0.34	
Clearance Time (s)		4.0	4.0	4.0			4.0	4.0			4.0	
Vehicle Extension (s)		3.0	3.0	3.0			3.0	3.0			3.0	
Lane Grp Cap (vph)		836	527	142	1422		320	548			557	
v/s Ratio Prot				c0.08	0.18			0.10				
v/s Ratio Perm		0.46	0.18	c0.75			c0.21				0.11	
v/c Ratio		1.16	0.45	1.89	0.38		0.63	0.30			0.33	
Uniform Delay, d1		30.2	22.2	27.6	16.8		27.7	24.2			24.5	
Progression Factor		0.70	0.66	0.80	0.26		1.17	1.23			1.00	
Incremental Delay, d2		79.1	1.4	412.1	0.4		3.5	0.3			0.3	
Delay (s)		100.2	16.0	434.1	4.7		35.9	30.0			24.9	
Level of Service		F	B	F	A		D	C			C	
Approach Delay (s)		83.6			146.6			32.7			24.9	
Approach LOS		F			F			C			C	

Intersection Summary			
HCM Average Control Delay	90.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.34		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	22.4
Intersection Capacity Utilization	77.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	979	137	0	687	0	60
Peak Hour Factor	0.95	0.95	0.92	0.92	0.65	0.65
Hourly flow rate (vph)	1031	144	0	747	0	92
Pedestrians	42			42	42	
Lane Width (ft)	11.0			10.0	14.0	
Walking Speed (ft/s)	4.0			4.0	4.0	
Percent Blockage	3			3	4	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)	94			256		
pX, platoon unblocked			0.81		0.85	0.81
vC, conflicting volume			1217		1560	671
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1027		1145	350
tC, single (s)			4.2		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	81
cM capacity (veh/h)			505		154	487

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	687	488	373	373	92
Volume Left	0	0	0	0	0
Volume Right	0	144	0	0	92
cSH	1700	1700	1700	1700	487
Volume to Capacity	0.40	0.29	0.22	0.22	0.19
Queue Length 95th (ft)	0	0	0	0	17
Control Delay (s)	0.0	0.0	0.0	0.0	14.1
Lane LOS					B
Approach Delay (s)	0.0		0.0		14.1
Approach LOS					B

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	53.9%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	228	598	268	463	1590	822
v/c Ratio	3.56	0.94	2.25	0.54	1.08	0.55
Control Delay	1206.2	63.3	604.4	22.7	73.7	20.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	1206.2	63.3	604.4	22.7	73.7	20.8
Queue Length 50th (ft)	~261	198	~265	78	~655	213
Queue Length 95th (ft)	#380	#307	m#395	m118	#795	257
Internal Link Dist (ft)		849		14	255	366
Turn Bay Length (ft)						
Base Capacity (vph)	64	635	119	864	1473	1485
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	3.56	0.94	2.25	0.54	1.08	0.55

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	10	10	10	11	11	11	10	10	10
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			0.95			0.95	
Frt	1.00	1.00		1.00	0.99			0.95			0.99	
Flt Protected	0.95	1.00		0.95	1.00			1.00			1.00	
Satd. Flow (prot)	1525	2887		1444	2872			2970			2959	
Flt Permitted	0.20	1.00		0.20	1.00			0.95			1.00	
Satd. Flow (perm)	315	2887		298	2872			2828			2959	
Volume (vph)	217	565	3	247	410	16	6	971	550	0	631	68
Peak-hour factor, PHF	0.95	0.95	0.95	0.92	0.92	0.92	0.96	0.96	0.96	0.85	0.85	0.85
Adj. Flow (vph)	228	595	3	268	446	17	6	1011	573	0	742	80
RTOR Reduction (vph)	0	0	0	0	3	0	0	59	0	0	6	0
Lane Group Flow (vph)	228	598	0	268	460	0	0	1531	0	0	816	0
Heavy Vehicles (%)	3%	3%	3%	5%	5%	5%	0%	0%	0%	1%	1%	1%
Parking (#/hr)		1	1									
Turn Type	Perm			D.P+P			Perm					
Protected Phases		1		4	1 4			3			3	
Permitted Phases	1			1			3					
Actuated Green, G (s)	18.4	18.4		20.4	26.4			48.0			48.0	
Effective Green, g (s)	20.4	20.4		24.4	28.4			50.0			50.0	
Actuated g/C Ratio	0.20	0.20		0.24	0.28			0.50			0.50	
Clearance Time (s)	6.0	6.0		6.0				6.0			6.0	
Vehicle Extension (s)	3.0	3.0		3.0				3.0			3.0	
Lane Grp Cap (vph)	64	589		119	816			1414			1480	
v/s Ratio Prot		0.21		c0.09	0.16						0.28	
v/s Ratio Perm	c0.72			0.46				c0.54				
v/c Ratio	3.56	1.02		2.25	0.56			1.08			0.55	
Uniform Delay, d1	39.8	39.8		37.2	30.5			25.0			17.3	
Progression Factor	1.00	1.00		0.70	0.71			1.00			1.00	
Incremental Delay, d2	1191.0	41.0		585.3	2.3			49.7			1.5	
Delay (s)	1230.8	80.8		611.4	24.0			74.7			18.7	
Level of Service	F	F		F	C			E			B	
Approach Delay (s)		398.2			239.4			74.7			18.7	
Approach LOS		F			F			E			B	

Intersection Summary			
HCM Average Control Delay	160.8	HCM Level of Service	F
HCM Volume to Capacity ratio	1.82		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	25.6
Intersection Capacity Utilization	97.0%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	0	285	0	3	167	5	1	3	3	60	2	71
Peak Hour Factor	0.70	0.70	0.70	0.79	0.79	0.79	0.44	0.44	0.44	0.91	0.91	0.91
Hourly flow rate (vph)	0	407	0	4	211	6	2	7	7	66	2	78

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	407	222	16	146
Volume Left (vph)	0	4	2	66
Volume Right (vph)	0	6	7	78
Hadj (s)	0.00	0.00	-0.23	-0.23
Departure Headway (s)	4.6	4.8	5.4	5.2
Degree Utilization, x	0.52	0.30	0.02	0.21
Capacity (veh/h)	749	707	558	624
Control Delay (s)	12.5	9.9	8.5	9.5
Approach Delay (s)	12.5	9.9	8.5	9.5
Approach LOS	B	A	A	A

Intersection Summary			
Delay	11.2		
HCM Level of Service	B		
Intersection Capacity Utilization	44.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	32	74	19	89	11	70	12	238	124	129	252	72
Peak Hour Factor	0.93	0.93	0.93	0.80	0.80	0.80	0.90	0.90	0.90	0.87	0.87	0.87
Hourly flow rate (vph)	34	80	20	111	14	88	13	264	138	148	290	83
Pedestrians		222			337			321			337	
Lane Width (ft)		13.0			13.0			12.0			10.5	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		20			30			27			25	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								270			411	
pX, platoon unblocked												
vC, conflicting volume	1641	1615	874	1664	1588	1007	594			739		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1641	1615	874	1664	1588	1007	594			739		
tC, single (s)	7.2	6.6	6.3	7.1	6.5	6.2	4.1			4.2		
tC, 2 stage (s)												
tF (s)	3.6	4.1	3.4	3.5	4.0	3.3	2.2			2.3		
p0 queue free %	0	0	90	0	69	43	98			75		
cM capacity (veh/h)	8	41	200	0	44	154	773			588		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total	134	212	416	148	372
Volume Left	34	111	13	148	0
Volume Right	20	88	138	0	83
cSH	22	0	773	588	1700
Volume to Capacity	6.11	Err	0.02	0.25	0.22
Queue Length 95th (ft)	Err	Err	1	25	0
Control Delay (s)	Err	Err	0.5	13.2	0.0
Lane LOS	F	F	A	B	
Approach Delay (s)	Err	Err	0.5	3.8	
Approach LOS	F	F			

Intersection Summary			
Average Delay	Err		
Intersection Capacity Utilization	78.6%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	53	50	57	85	51	113
Peak Hour Factor	0.86	0.86	0.84	0.84	0.89	0.89
Hourly flow rate (vph)	62	58	68	101	57	127
Pedestrians	59		56			59
Lane Width (ft)	12.0		12.0			12.0
Walking Speed (ft/s)	4.0		4.0			4.0
Percent Blockage	5		5			5
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	475	236			228	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	475	236			228	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	87	92			96	
cM capacity (veh/h)	473	723			1286	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	120	169	184
Volume Left	62	0	57
Volume Right	58	101	0
cSH	569	1700	1286
Volume to Capacity	0.21	0.10	0.04
Queue Length 95th (ft)	20	0	3
Control Delay (s)	13.0	0.0	2.7
Lane LOS	B		A
Approach Delay (s)	13.0	0.0	2.7
Approach LOS	B		

Intersection Summary			
Average Delay	4.4		
Intersection Capacity Utilization	45.5%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	NBT	SBL	SBT
Lane Group Flow (vph)	336	335	81	357
v/c Ratio	0.59	0.89	0.50	0.86
Control Delay	17.8	41.9	41.8	52.8
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	17.8	41.9	41.8	52.8
Queue Length 50th (ft)	102	221	47	205
Queue Length 95th (ft)	205	m167	m50	m175
Internal Link Dist (ft)	167	410		190
Turn Bay Length (ft)			150	
Base Capacity (vph)	566	810	354	887
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.59	0.41	0.23	0.40

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	16	12	12	12	12	12	12	12	12	10	12	12
Total Lost time (s)		4.0						4.0		4.0	4.0	
Lane Util. Factor		1.00						1.00		1.00	1.00	
Frpb, ped/bikes		0.92						0.93		1.00	0.94	
Flpb, ped/bikes		0.59						0.98		0.82	1.00	
Frt		0.97						0.98		1.00	0.97	
Flt Protected		0.97						0.99		0.95	1.00	
Satd. Flow (prot)		873						1445		1152	1440	
Flt Permitted		0.97						0.66		0.37	1.00	
Satd. Flow (perm)		873						961		446	1440	
Volume (vph)	174	21	67	0	0	0	41	217	36	72	260	58
Peak-hour factor, PHF	0.78	0.78	0.78	0.25	0.25	0.25	0.88	0.88	0.88	0.89	0.89	0.89
Adj. Flow (vph)	223	27	86	0	0	0	47	247	41	81	292	65
RTOR Reduction (vph)	0	6	0	0	0	0	0	9	0	0	15	0
Lane Group Flow (vph)	0	330	0	0	0	0	0	326	0	81	342	0
Confl. Peds. (#/hr)	339		96	96		339	110		225	225		110
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	6%	6%	6%	8%	8%	8%
Turn Type	Perm						Perm			Perm		
Protected Phases		2						1			1	
Permitted Phases	2						1			1		
Actuated Green, G (s)		64.1						27.9		27.9	27.9	
Effective Green, g (s)		64.1						27.9		27.9	27.9	
Actuated g/C Ratio		0.64						0.28		0.28	0.28	
Clearance Time (s)		4.0						4.0		4.0	4.0	
Vehicle Extension (s)		3.0						3.0		3.0	3.0	
Lane Grp Cap (vph)		560						268		124	402	
v/s Ratio Prot											0.24	
v/s Ratio Perm		0.38						c0.34		0.18		
v/c Ratio		0.59						1.22		0.65	0.85	
Uniform Delay, d1		10.3						36.1		31.8	34.1	
Progression Factor		1.00						1.21		1.20	1.21	
Incremental Delay, d2		1.6						100.1		18.1	15.3	
Delay (s)		11.9						143.5		56.3	56.4	
Level of Service		B						F		E	E	
Approach Delay (s)		11.9			0.0			143.5			56.4	
Approach LOS		B			A			F			E	

Intersection Summary			
HCM Average Control Delay	69.2	HCM Level of Service	E
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	73.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	48	199	100	13	42	39	36	48	31	7	31	115
Peak Hour Factor	0.75	0.75	0.75	0.73	0.73	0.73	0.69	0.69	0.69	0.92	0.92	0.92
Hourly flow rate (vph)	64	265	133	18	58	53	52	70	45	8	34	125

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	463	129	167	166
Volume Left (vph)	64	18	52	8
Volume Right (vph)	133	53	45	125
Hadj (s)	-0.13	-0.05	-0.08	-0.42
Departure Headway (s)	4.9	5.5	5.7	5.3
Degree Utilization, x	0.63	0.20	0.26	0.25
Capacity (veh/h)	703	590	564	598
Control Delay (s)	16.0	9.8	10.6	10.1
Approach Delay (s)	16.0	9.8	10.6	10.1
Approach LOS	C	A	B	B

Intersection Summary			
Delay	13.1		
HCM Level of Service	B		
Intersection Capacity Utilization	61.0%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	31	0	74	13	16	27	17	255	0	0	229	7
Peak Hour Factor	0.90	0.90	0.90	0.63	0.63	0.63	0.79	0.79	0.79	0.71	0.71	0.71
Hourly flow rate (vph)	34	0	82	21	25	43	22	323	0	0	323	10
Pedestrians		94			244			244			185	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		8			20			20			15	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								452			490	
pX, platoon unblocked	0.91	0.91	0.91	0.91	0.91		0.91					
vC, conflicting volume	1028	1031	665	1264	1036	752	426			567		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1031	1034	631	1291	1040	752	368			567		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.2		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.3		
p0 queue free %	60	100	74	56	83	85	98			100		
cM capacity (veh/h)	87	151	320	47	151	279	982			778		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	62	55	89	344	332
Volume Left	34	0	21	22	0
Volume Right	27	55	43	0	10
cSH	128	320	117	982	1700
Volume to Capacity	0.48	0.17	0.76	0.02	0.20
Queue Length 95th (ft)	55	15	106	2	0
Control Delay (s)	56.8	18.5	96.9	0.8	0.0
Lane LOS	F	C	F	A	
Approach Delay (s)	38.8		96.9	0.8	0.0
Approach LOS	E		F		

Intersection Summary			
Average Delay	15.2		
Intersection Capacity Utilization	51.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	74	37	0	0	29	17	16	27	9	65	0	83
Peak Hour Factor	0.68	0.68	0.68	0.83	0.83	0.83	0.73	0.73	0.73	0.69	0.69	0.69
Hourly flow rate (vph)	109	54	0	0	35	20	22	37	12	94	0	120
Pedestrians		45			51			34			51	
Lane Width (ft)		11.0			11.0			16.0			11.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		3			4			4			4	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								376				
pX, platoon unblocked												
vC, conflicting volume	469	438	139	448	492	145	165			100		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	469	438	139	448	492	145	165			100		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	71	88	100	100	91	98	98			93		
cM capacity (veh/h)	381	439	847	391	410	838	1353			1440		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	163	55	71	214
Volume Left	109	0	22	94
Volume Right	0	20	12	120
cSH	398	506	1353	1440
Volume to Capacity	0.41	0.11	0.02	0.07
Queue Length 95th (ft)	49	9	1	5
Control Delay (s)	20.2	13.0	2.5	3.7
Lane LOS	C	B	A	A
Approach Delay (s)	20.2	13.0	2.5	3.7
Approach LOS	C	B		

Intersection Summary			
Average Delay	9.9		
Intersection Capacity Utilization	37.0%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	WBL	WBT	NBT	SBT	SBR2	NER2
Lane Group Flow (vph)	794	113	573	457	359	36	45
v/c Ratio	2.68	0.80	1.07	2.22	1.32	0.13	0.28
Control Delay	785.7	48.7	77.7	583.6	189.9	20.5	46.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	785.7	48.7	77.7	583.6	189.9	20.5	46.0
Queue Length 50th (ft)	~461	56	~216	~434	~304	12	27
Queue Length 95th (ft)	#583	m#74	m#332	#630	m#408	m20	50
Internal Link Dist (ft)	165		1295	704	372		
Turn Bay Length (ft)		50				50	
Base Capacity (vph)	296	142	538	206	272	270	159
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	2.68	0.80	1.07	2.22	1.32	0.13	0.28

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	EBR2	WBL2	WBL	WBT	WBR	NBL2	NBL	NBT	NBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)		4.0				4.0	4.0				4.0	
Lane Util. Factor		0.95				0.91	0.91				1.00	
Frt		0.97				1.00	0.97				0.99	
Flt Protected		1.00				0.95	1.00				0.97	
Satd. Flow (prot)		2605				1266	2658				1273	
Flt Permitted		0.71				0.25	0.83				0.22	
Satd. Flow (perm)		1850				333	2197				287	
Volume (vph)	17	587	125	18	72	39	408	106	25	202	158	26
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.91	0.91	0.91	0.91	0.90	0.90	0.90	0.90
Adj. Flow (vph)	18	624	133	19	79	43	448	116	28	224	176	29
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	794	0	0	0	113	573	0	0	0	457	0
Heavy Vehicles (%)	7%	7%	7%	7%	9%	9%	9%	9%	9%	9%	9%	9%
Bus Blockages (#/hr)	0	0	0	0	0	0	3	3	0	0	7	7
Parking (#/hr)		1	1	1						1	1	1
Turn Type	Perm				D.P+P	D.P+P			D.P+P	D.P+P		
Protected Phases		1			9	9	1 9		3	3	3 4	
Permitted Phases	1				1	1			4	4		
Actuated Green, G (s)		15.0				22.0	22.0				33.0	
Effective Green, g (s)		16.0				23.0	23.0				34.0	
Actuated g/C Ratio		0.16				0.23	0.23				0.34	
Clearance Time (s)		5.0				4.0						
Vehicle Extension (s)		3.0				3.0						
Lane Grp Cap (vph)		296				142	538				206	
v/s Ratio Prot						0.06	c0.07				c0.24	
v/s Ratio Perm		c0.43				0.13	0.17				c0.51	
v/c Ratio		2.68				0.80	1.07				2.22	
Uniform Delay, d1		42.0				47.5	38.5				33.0	
Progression Factor		0.92				0.57	0.66				1.00	
Incremental Delay, d2		766.3				19.1	51.2				563.8	
Delay (s)		804.8				46.2	76.5				596.8	
Level of Service		F				D	E				F	
Approach Delay (s)		804.8					71.5				596.8	
Approach LOS		F					E				F	

Intersection Summary			
HCM Average Control Delay	434.0	HCM Level of Service	F
HCM Volume to Capacity ratio	2.21		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	43.0
Intersection Capacity Utilization	93.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBL	SBT	SBR	SBR2	NER2
Lane Configurations					
Ideal Flow (vphpl)	1900	1900	1900	1900	1900
Lane Width	11	16	11	11	14
Total Lost time (s)		4.0		4.0	4.0
Lane Util. Factor		1.00		1.00	1.00
Frt		0.99		0.85	0.86
Flt Protected		0.98		1.00	1.00
Satd. Flow (prot)		1571		1175	1447
Flt Permitted		0.74		1.00	1.00
Satd. Flow (perm)		1182		1175	1447
Volume (vph)	102	173	30	31	33
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.73
Adj. Flow (vph)	120	204	35	36	45
RTOR Reduction (vph)	0	0	0	0	0
Lane Group Flow (vph)	0	359	0	36	45
Heavy Vehicles (%)	7%	7%	7%	7%	9%
Bus Blockages (#/hr)	0	0	0	0	0
Parking (#/hr)		1	1	1	
Turn Type	Perm			Prot	Over
Protected Phases		4		4	3
Permitted Phases	4				
Actuated Green, G (s)		22.0		22.0	11.0
Effective Green, g (s)		23.0		23.0	11.0
Actuated g/C Ratio		0.23		0.23	0.11
Clearance Time (s)		5.0		5.0	4.0
Vehicle Extension (s)		3.0		3.0	3.0
Lane Grp Cap (vph)		272		270	159
v/s Ratio Prot				0.03	0.03
v/s Ratio Perm		0.30			
v/c Ratio		1.32		0.13	0.28
Uniform Delay, d1		38.5		30.6	40.9
Progression Factor		0.68		0.63	1.00
Incremental Delay, d2		163.2		0.8	4.4
Delay (s)		189.4		20.1	45.3
Level of Service		F		C	D
Approach Delay (s)		174.0			
Approach LOS		F			

Intersection Summary

Lane Group	EBT	WBT
Lane Group Flow (vph)	812	745
v/c Ratio	0.33	0.26
Control Delay	0.3	0.0
Queue Delay	0.0	0.0
Total Delay	0.3	0.0
Queue Length 50th (ft)	0	0
Queue Length 95th (ft)	0	m0
Internal Link Dist (ft)	373	165
Turn Bay Length (ft)		
Base Capacity (vph)	2480	2835
Starvation Cap Reductn	0	0
Spillback Cap Reductn	0	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.33	0.26

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	11	11	12	12	12
Total Lost time (s)		4.0	4.0			
Lane Util. Factor		0.95	0.95			
Frt		1.00	0.99			
Flt Protected		1.00	1.00			
Satd. Flow (prot)		2714	2834			
Flt Permitted		0.91	1.00			
Satd. Flow (perm)		2483	2834			
Volume (vph)	27	745	609	32	0	0
Peak-hour factor, PHF	0.95	0.95	0.86	0.86	0.25	0.25
Adj. Flow (vph)	28	784	708	37	0	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	812	745	0	0	0
Heavy Vehicles (%)	7%	7%	10%	10%	0%	0%
Bus Blockages (#/hr)	0	6	0	0	0	0
Parking (#/hr)		5		5		
Turn Type	Perm					
Protected Phases		1	1			
Permitted Phases	1					
Actuated Green, G (s)		100.0	100.0			
Effective Green, g (s)		100.0	100.0			
Actuated g/C Ratio		1.00	1.00			
Clearance Time (s)		4.0	4.0			
Vehicle Extension (s)		3.0	3.0			
Lane Grp Cap (vph)		2483	2834			
v/s Ratio Prot			0.26			
v/s Ratio Perm		c0.33				
v/c Ratio		0.33	0.26			
Uniform Delay, d1		0.0	0.0			
Progression Factor		1.00	1.00			
Incremental Delay, d2		0.3	0.0			
Delay (s)		0.3	0.0			
Level of Service		A	A			
Approach Delay (s)		0.3	0.0		0.0	
Approach LOS		A	A		A	

Intersection Summary			
HCM Average Control Delay	0.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	48.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	SET	NWT	NET	SWT
Lane Group Flow (vph)	911	647	40	181
v/c Ratio	0.56	0.31	0.18	0.66
Control Delay	6.8	8.7	31.0	31.3
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	6.8	8.7	31.0	31.3
Queue Length 50th (ft)	87	103	18	55
Queue Length 95th (ft)	190	130	33	115
Internal Link Dist (ft)	339	373	163	400
Turn Bay Length (ft)				
Base Capacity (vph)	1628	2091	277	319
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.56	0.31	0.14	0.57

Intersection Summary

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	11	12	12	11	12	12	12	12	12	16	12
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		0.95			0.95			1.00			1.00	
Frt		1.00			1.00			0.97			0.91	
Flt Protected		0.99			1.00			0.98			0.98	
Satd. Flow (prot)		2756			2721			1624			1470	
Flt Permitted		0.79			1.00			0.82			0.88	
Satd. Flow (perm)		2199			2721			1367			1314	
Volume (vph)	88	732	0	0	575	7	12	10	6	53	0	108
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.70	0.70	0.70	0.89	0.89	0.89
Adj. Flow (vph)	98	813	0	0	639	8	17	14	9	60	0	121
RTOR Reduction (vph)	0	0	0	0	0	0	0	8	0	0	75	0
Lane Group Flow (vph)	0	911	0	0	647	0	0	32	0	0	106	0
Heavy Vehicles (%)	5%	5%	5%	8%	8%	8%	0%	0%	0%	5%	5%	5%
Bus Blockages (#/hr)	0	6	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)		5			5						2	
Turn Type	Perm						Perm			Perm		
Protected Phases		1			1			3			3	
Permitted Phases	1						3			3		
Actuated Green, G (s)		76.8			76.8			15.2			15.2	
Effective Green, g (s)		76.8			76.8			15.2			15.2	
Actuated g/C Ratio		0.77			0.77			0.15			0.15	
Clearance Time (s)		4.0			4.0			4.0			4.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		1689			2090			208			200	
v/s Ratio Prot					0.24							
v/s Ratio Perm		c0.41						0.02			c0.08	
v/c Ratio		0.54			0.31			0.16			0.53	
Uniform Delay, d1		4.6			3.5			36.8			39.1	
Progression Factor		1.00			2.14			1.00			0.98	
Incremental Delay, d2		1.2			0.4			0.4			2.5	
Delay (s)		5.8			7.9			37.2			40.6	
Level of Service		A			A			D			D	
Approach Delay (s)		5.8			7.9			37.2			40.6	
Approach LOS		A			A			D			D	

Intersection Summary			
HCM Average Control Delay	10.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	65.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	151	647	53	549	373	320	142	185
v/c Ratio	0.77	0.49	0.27	0.81	0.99	0.72	1.05	0.44
Control Delay	71.8	13.6	41.9	35.7	74.3	42.5	116.9	32.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	71.8	13.6	41.9	35.7	74.3	42.5	116.9	32.3
Queue Length 50th (ft)	105	232	30	302	~244	183	~100	87
Queue Length 95th (ft)	m0	m20	68	#498	#434	226	m#165	m125
Internal Link Dist (ft)		1295		1669		389		1718
Turn Bay Length (ft)	85		75					
Base Capacity (vph)	215	1313	211	676	376	445	135	417
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.70	0.49	0.25	0.81	0.99	0.72	1.05	0.44

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	11	11	10	11	11	16	16	16	11	11	11
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00		1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.98		1.00	1.00	0.65		1.00		1.00	0.98	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00		0.84	1.00	
Frt	1.00	0.99		1.00	1.00	0.85		1.00		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00		0.95	1.00	
Satd. Flow (prot)	1430	2894		1404	1494	831		1576		1181	1402	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.97		0.38	1.00	
Satd. Flow (perm)	1430	2894		1404	1494	831		1534		468	1402	
Volume (vph)	130	528	28	48	500	339	18	224	1	121	124	33
Peak-hour factor, PHF	0.86	0.86	0.86	0.91	0.91	0.91	0.76	0.76	0.76	0.85	0.85	0.85
Adj. Flow (vph)	151	614	33	53	549	373	24	295	1	142	146	39
RTOR Reduction (vph)	0	4	0	0	0	0	0	0	0	0	10	0
Lane Group Flow (vph)	151	643	0	53	549	373	0	320	0	142	175	0
Confl. Peds. (#/hr)	106		92	92		106	75		414	414		75
Confl. Bikes (#/hr)			17			1			9			1
Heavy Vehicles (%)	6%	6%	6%	8%	8%	8%	9%	9%	9%	12%	12%	12%
Bus Blockages (#/hr)	0	0	0	0	6	6	0	0	0	0	0	0
Parking (#/hr)							1	1	1			
Turn Type	Prot			Prot		Perm	Perm			Perm		
Protected Phases	1	2		1	2			3			3	
Permitted Phases						2	3			3		
Actuated Green, G (s)	13.7	44.3		13.7	44.3	44.3		28.0		28.0	28.0	
Effective Green, g (s)	13.7	45.3		13.7	45.3	45.3		29.0		29.0	29.0	
Actuated g/C Ratio	0.14	0.45		0.14	0.45	0.45		0.29		0.29	0.29	
Clearance Time (s)	4.0	5.0		4.0	5.0	5.0		5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	196	1311		192	677	376		445		136	407	
v/s Ratio Prot	c0.11	0.22		0.04	0.37						0.12	
v/s Ratio Perm						c0.45		0.21		c0.30		
v/c Ratio	0.77	0.49		0.28	0.81	0.99		0.72		1.04	0.43	
Uniform Delay, d1	41.6	19.2		38.7	23.6	27.2		31.8		35.5	28.8	
Progression Factor	1.68	0.69		1.00	1.00	1.00		1.00		1.06	1.10	
Incremental Delay, d2	1.7	0.1		0.8	10.2	44.5		5.5		75.0	0.5	
Delay (s)	71.6	13.3		39.5	33.8	71.6		37.3		112.7	32.2	
Level of Service	E	B		D	C	E		D		F	C	
Approach Delay (s)		24.4			48.6			37.3			67.2	
Approach LOS		C			D			D			E	

Intersection Summary			
HCM Average Control Delay	41.6	HCM Level of Service	D
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	78.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	259	110	81	520	623
v/c Ratio	0.85	0.47	0.25	0.86	0.73
Control Delay	51.1	39.8	8.7	40.4	26.0
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	51.1	39.8	8.7	40.4	26.0
Queue Length 50th (ft)	106	59	0	167	131
Queue Length 95th (ft)	m141	108	35	m#233	m95
Internal Link Dist (ft)	821	168		1718	335
Turn Bay Length (ft)					
Base Capacity (vph)	355	281	376	604	852
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.73	0.39	0.22	0.86	0.73

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1600	1600	1600	1600	1600	1600
Lane Width	13	13	13	12	12	10	10	11	11	10	10	10
Total Lost time (s)		4.0			4.0	4.0		4.0			4.0	
Lane Util. Factor		1.00			1.00	1.00		0.95			0.95	
Frpb, ped/bikes		1.00			1.00	0.99		1.00			0.99	
Flpb, ped/bikes		1.00			1.00	1.00		1.00			1.00	
Frt		0.94			1.00	0.85		0.98			0.97	
Flt Protected		0.99			0.97	1.00		0.99			0.99	
Satd. Flow (prot)		1404			1515	1217		2157			2253	
Flt Permitted		0.87			0.64	1.00		0.71			0.71	
Satd. Flow (perm)		1235			997	1217		1545			1611	
Volume (vph)	65	48	102	51	46	71	82	339	58	105	335	102
Peak-hour factor, PHF	0.83	0.83	0.83	0.88	0.88	0.88	0.92	0.92	0.92	0.87	0.87	0.87
Adj. Flow (vph)	78	58	123	58	52	81	89	368	63	121	385	117
RTOR Reduction (vph)	0	34	0	0	0	63	0	10	0	0	17	0
Lane Group Flow (vph)	0	225	0	0	110	18	0	510	0	0	606	0
Confl. Bikes (#/hr)						1			4			43
Heavy Vehicles (%)	16%	16%	16%	10%	10%	10%	15%	15%	15%	8%	8%	8%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	17	17	0	0	0
Turn Type	Perm			Perm		Perm	Perm			D.P+P		
Protected Phases		3			3			1		10	1 10	
Permitted Phases	3			3		3	1			1		
Actuated Green, G (s)		20.7			20.7	20.7		38.3			49.7	
Effective Green, g (s)		21.7			21.7	21.7		39.3			48.7	
Actuated g/C Ratio		0.22			0.22	0.22		0.39			0.49	
Clearance Time (s)		5.0			5.0	5.0		5.0				
Vehicle Extension (s)		3.0			3.0	3.0		3.0				
Lane Grp Cap (vph)		268			216	264		607			845	
v/s Ratio Prot											c0.07	
v/s Ratio Perm		c0.18			0.11	0.01		c0.33			0.28	
v/c Ratio		0.84			0.51	0.07		0.84			0.72	
Uniform Delay, d1		37.5			34.5	31.1		27.5			20.2	
Progression Factor		1.03			1.00	1.00		1.07			1.22	
Incremental Delay, d2		15.0			1.9	0.1		7.0			0.3	
Delay (s)		53.7			36.3	31.2		36.5			25.0	
Level of Service		D			D	C		D			C	
Approach Delay (s)		53.7			34.2			36.5			25.0	
Approach LOS		D			C			D			C	

Intersection Summary			
HCM Average Control Delay	34.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	29.6
Intersection Capacity Utilization	68.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	85	972	241	845	92	177	285	93	336
v/c Ratio	1.67	1.38	1.54	0.79	1.88	0.68	0.53	0.64	1.21
Control Delay	357.0	214.9	302.4	28.8	469.0	49.3	3.8	57.6	160.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	357.0	214.9	302.4	28.8	469.0	49.3	3.8	57.6	160.1
Queue Length 50th (ft)	~80	~433	~217	230	~87	87	0	54	~263
Queue Length 95th (ft)	m#89	m#408	#369	315	m#125	m111	m0	90	#333
Internal Link Dist (ft)		771		938		335			755
Turn Bay Length (ft)	70		350					170	
Base Capacity (vph)	51	704	157	1075	49	259	533	145	277
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.67	1.38	1.54	0.79	1.88	0.68	0.53	0.64	1.21

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
Lane Width	10	10	10	10	10	10	10	10	10	10	10	10
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	*0.95		1.00	0.95		1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	1.00	0.99	1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.97		1.00	0.96		1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1216	2346		1205	2286		1120	1179	993	1240	1262	
Flt Permitted	0.13	1.00		0.95	1.00		0.21	1.00	1.00	0.51	1.00	
Satd. Flow (perm)	171	2346		1205	2286		242	1179	993	670	1262	
Volume (vph)	77	695	189	222	547	230	85	163	262	70	220	32
Peak-hour factor, PHF	0.91	0.91	0.91	0.92	0.92	0.92	0.92	0.92	0.92	0.75	0.75	0.75
Adj. Flow (vph)	85	764	208	241	595	250	92	177	285	93	293	43
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	185	0	0	0
Lane Group Flow (vph)	85	972	0	241	845	0	92	177	100	93	336	0
Confl. Bikes (#/hr)			5			5			3			96
Heavy Vehicles (%)	5%	5%	5%	6%	6%	6%	14%	14%	14%	3%	3%	3%
Turn Type	Perm			custom			Perm		pm+ov	Perm		
Protected Phases		1		4	1 4			3	4		3	
Permitted Phases	1			4			3		3	3		
Actuated Green, G (s)	30.0	30.0		15.0	47.0		22.0	22.0	37.0	22.0	22.0	
Effective Green, g (s)	30.0	30.0		13.0	47.0		22.0	22.0	35.0	22.0	22.0	
Actuated g/C Ratio	0.30	0.30		0.13	0.47		0.22	0.22	0.35	0.22	0.22	
Clearance Time (s)	4.0	4.0		2.0			4.0	4.0	2.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0			3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	51	704		157	1074		53	259	387	147	278	
v/s Ratio Prot		0.41		c0.20	0.37			0.15	0.03		0.27	
v/s Ratio Perm	c0.50						c0.38		0.07	0.14		
v/c Ratio	1.67	1.38		1.54	0.79		1.74	0.68	0.26	0.63	1.21	
Uniform Delay, d1	35.0	35.0		43.5	22.3		39.0	35.8	23.2	35.3	39.0	
Progression Factor	1.57	1.58		1.00	1.00		1.06	1.08	0.43	1.00	1.00	
Incremental Delay, d2	322.8	173.8		270.1	3.9		378.0	4.9	0.2	8.6	122.6	
Delay (s)	377.8	229.3		313.6	26.2		419.4	43.5	10.3	43.9	161.6	
Level of Service	F	F		F	C		F	D	B	D	F	
Approach Delay (s)		241.2			89.9			88.8			136.1	
Approach LOS		F			F			F			F	

Intersection Summary			
HCM Average Control Delay	147.2	HCM Level of Service	F
HCM Volume to Capacity ratio	1.66		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	35.0
Intersection Capacity Utilization	86.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	390	849	650	71	28	240	382	102
v/c Ratio	0.76	0.89	0.71	0.15	0.23	0.53	1.22	0.13
Control Delay	23.9	42.2	32.1	6.5	30.4	30.5	156.0	8.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.9	42.2	32.1	6.5	30.4	30.5	156.0	8.8
Queue Length 50th (ft)	110	236	169	0	12	108	~272	24
Queue Length 95th (ft)	#250	#348	232	29	36	178	#409	44
Internal Link Dist (ft)		360	496			755	339	
Turn Bay Length (ft)	200				50			100
Base Capacity (vph)	515	961	922	481	122	449	313	759
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.76	0.88	0.70	0.15	0.23	0.53	1.22	0.13

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1600	1600	1600
Lane Width	10	10	10	10	10	10	11	12	12	11	11	14
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	0.95			0.95	1.00	1.00	1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00			1.00	1.00	1.00	0.94			1.00	1.00
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00	1.00			0.97	1.00
Frt	1.00	0.99			1.00	0.85	1.00	0.97			1.00	0.85
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00			0.99	1.00
Satd. Flow (prot)	1501	2966			3002	1343	1510	1506			1306	1280
Flt Permitted	0.26	1.00			0.95	1.00	0.27	1.00			0.82	1.00
Satd. Flow (perm)	408	2966			2861	1343	425	1506			1078	1280
Volume (vph)	367	742	56	2	635	70	25	172	40	59	266	87
Peak-hour factor, PHF	0.94	0.94	0.94	0.98	0.98	0.98	0.88	0.88	0.88	0.85	0.85	0.85
Adj. Flow (vph)	390	789	60	2	648	71	28	195	45	69	313	102
RTOR Reduction (vph)	0	6	0	0	0	48	0	9	0	0	0	0
Lane Group Flow (vph)	390	843	0	0	650	23	28	231	0	0	382	102
Confl. Peds. (#/hr)									300	300		
Confl. Bikes (#/hr)			1						1			81
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	4%	4%	4%	2%	2%	2%
Turn Type	pm+pt			Perm		Perm	Perm			Perm		pt+ov
Protected Phases	1	3			3			4			4	1 4
Permitted Phases	3			3		3	4			4		
Actuated Green, G (s)	49.7	27.7			27.7	27.7	25.3	25.3			25.3	52.3
Effective Green, g (s)	51.7	28.7			28.7	28.7	26.3	26.3			26.3	53.3
Actuated g/C Ratio	0.57	0.32			0.32	0.32	0.29	0.29			0.29	0.59
Clearance Time (s)	5.0	5.0			5.0	5.0	5.0	5.0			5.0	
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0			3.0	
Lane Grp Cap (vph)	514	946			912	428	124	440			315	758
v/s Ratio Prot	c0.19	c0.28						0.15				0.08
v/s Ratio Perm	0.24				0.23	0.02	0.07				c0.35	
v/c Ratio	0.76	0.89			0.71	0.05	0.23	0.52			1.21	0.13
Uniform Delay, d1	12.5	29.2			27.0	21.2	24.1	26.6			31.8	8.1
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2	6.3	10.5			2.7	0.1	4.2	4.4			121.4	0.4
Delay (s)	18.9	39.7			29.7	21.3	28.3	31.0			153.3	8.5
Level of Service	B	D			C	C	C	C			F	A
Approach Delay (s)		33.2			28.8			30.8			122.7	
Approach LOS		C			C			C			F	

Intersection Summary			
HCM Average Control Delay	47.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	94.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	595	126	168	875	282	236	159
v/c Ratio	1.54	0.48	0.35	0.53	0.85	0.40	0.31
Control Delay	288.6	57.4	31.5	33.9	62.2	24.2	21.4
Queue Delay	0.0	0.0	0.0	0.3	0.0	0.0	0.0
Total Delay	288.6	57.4	31.5	34.2	62.2	24.2	21.4
Queue Length 50th (ft)	~319	85	93	273	208	106	66
Queue Length 95th (ft)	m#396	m125	m#140	m404	m274	m152	108
Internal Link Dist (ft)	176			771		331	256
Turn Bay Length (ft)		150	150		100		
Base Capacity (vph)	387	261	485	1646	375	658	576
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	269	0	0	3
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.54	0.48	0.35	0.64	0.75	0.36	0.28

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	12	12	12	15	11	14	14	14
Total Lost time (s)		4.0	4.0	4.0	4.0		4.0	4.0			4.0	
Lane Util. Factor		0.95	1.00	1.00	0.95		1.00	1.00			1.00	
Frt		1.00	0.85	1.00	1.00		1.00	0.91			0.94	
Flt Protected		1.00	1.00	0.95	1.00		0.95	1.00			0.99	
Satd. Flow (prot)		2912	1304	1444	3080		1547	1627			1638	
Flt Permitted		0.65	1.00	0.19	1.00		0.60	1.00			0.88	
Satd. Flow (perm)		1909	1304	281	3080		985	1627			1460	
Volume (vph)	14	528	115	163	824	25	248	81	127	38	42	71
Peak-hour factor, PHF	0.91	0.91	0.91	0.97	0.97	0.97	0.88	0.88	0.88	0.95	0.95	0.95
Adj. Flow (vph)	15	580	126	168	849	26	282	92	144	40	44	75
RTOR Reduction (vph)	0	0	0	0	0	0	0	48	0	0	27	0
Lane Group Flow (vph)	0	595	126	168	875	0	282	188	0	0	132	0
Heavy Vehicles (%)	4%	4%	4%	5%	5%	5%	5%	5%	5%	3%	3%	3%
Turn Type	Perm		Perm	D.P+P			Perm			Perm		
Protected Phases		1		4	1 4			3			3	
Permitted Phases	1		1	1			3			3		
Actuated Green, G (s)		21.6	21.6	57.7	61.7		39.9	39.9			39.9	
Effective Green, g (s)		21.6	21.6	57.7	61.7		39.9	39.9			39.9	
Actuated g/C Ratio		0.18	0.18	0.48	0.51		0.33	0.33			0.33	
Clearance Time (s)		4.0	4.0	4.0			4.0	4.0			4.0	
Vehicle Extension (s)		3.0	3.0	3.0			3.0	3.0			3.0	
Lane Grp Cap (vph)		344	235	485	1584		328	541			485	
v/s Ratio Prot				0.10	c0.28			0.12				
v/s Ratio Perm		c0.31	0.10	0.06			c0.29				0.09	
v/c Ratio		1.73	0.54	0.35	0.55		0.86	0.35			0.27	
Uniform Delay, d1		49.2	44.7	19.6	19.8		37.4	30.2			29.4	
Progression Factor		1.17	1.22	1.43	1.43		1.09	1.15			1.00	
Incremental Delay, d2		337.1	6.3	1.4	1.0		19.2	0.4			0.3	
Delay (s)		394.7	60.6	29.4	29.3		60.1	35.3			29.7	
Level of Service		F	E	C	C		E	D			C	
Approach Delay (s)		336.3			29.3			48.8			29.7	
Approach LOS		F			C			D			C	

Intersection Summary			
HCM Average Control Delay	124.2	HCM Level of Service	F
HCM Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	22.4
Intersection Capacity Utilization	81.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	602	31	0	1143	0	56
Peak Hour Factor	0.90	0.90	0.97	0.97	0.80	0.80
Hourly flow rate (vph)	669	34	0	1178	0	70
Pedestrians	89			89	89	
Lane Width (ft)	11.0			10.0	14.0	
Walking Speed (ft/s)	4.0			4.0	4.0	
Percent Blockage	7			6	9	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)	94			256		
pX, platoon unblocked			0.88		0.88	0.88
vC, conflicting volume			792		1453	530
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			628		969	329
tC, single (s)			4.1		7.0	7.1
tC, 2 stage (s)						
tF (s)			2.2		3.6	3.4
p0 queue free %			100		100	85
cM capacity (veh/h)			764		175	481

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	446	257	589	589	70
Volume Left	0	0	0	0	0
Volume Right	0	34	0	0	70
cSH	1700	1700	1700	1700	481
Volume to Capacity	0.26	0.15	0.35	0.35	0.15
Queue Length 95th (ft)	0	0	0	0	13
Control Delay (s)	0.0	0.0	0.0	0.0	13.8
Lane LOS					B
Approach Delay (s)	0.0		0.0		13.8
Approach LOS					B

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	54.6%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	116	401	479	696	912	1346
v/c Ratio	2.19	0.62	1.48	0.60	1.04	1.10
Control Delay	616.1	46.9	257.9	27.6	74.0	92.9
Queue Delay	0.0	0.0	0.0	2.2	0.0	0.0
Total Delay	616.1	46.9	257.9	29.8	74.0	92.9
Queue Length 50th (ft)	~144	148	~414	264	~414	~668
Queue Length 95th (ft)	#267	203	m#587	m177	#547	#765
Internal Link Dist (ft)		849		14	255	366
Turn Bay Length (ft)						
Base Capacity (vph)	53	642	323	1163	881	1223
Starvation Cap Reductn	0	0	0	319	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	2.19	0.62	1.48	0.82	1.04	1.10

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	10	10	10	11	11	11	10	10	10
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			0.95			0.95	
Frt	1.00	1.00		1.00	1.00			0.96			1.00	
Flt Protected	0.95	1.00		0.95	1.00			1.00			1.00	
Satd. Flow (prot)	1510	2854		1486	2968			3000			2990	
Flt Permitted	0.15	1.00		0.35	1.00			0.77			1.00	
Satd. Flow (perm)	243	2854		547	2968			2312			2990	
Volume (vph)	113	382	7	465	668	7	12	592	253	0	1139	32
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.94	0.94	0.94	0.87	0.87	0.87
Adj. Flow (vph)	116	394	7	479	689	7	13	630	269	0	1309	37
RTOR Reduction (vph)	0	0	0	0	1	0	0	33	0	0	1	0
Lane Group Flow (vph)	116	401	0	479	695	0	0	879	0	0	1345	0
Heavy Vehicles (%)	4%	4%	4%	2%	2%	2%	0%	0%	0%	1%	1%	1%
Parking (#/hr)		1	1									
Turn Type	Perm			D.P+P			Perm					
Protected Phases		1		4	1 4			3			3	
Permitted Phases	1			1			3					
Actuated Green, G (s)	24.2	24.2		38.2	44.2			47.0			47.0	
Effective Green, g (s)	26.2	26.2		42.2	46.2			49.0			49.0	
Actuated g/C Ratio	0.22	0.22		0.35	0.38			0.41			0.41	
Clearance Time (s)	6.0	6.0		6.0				6.0			6.0	
Vehicle Extension (s)	3.0	3.0		3.0				3.0			3.0	
Lane Grp Cap (vph)	53	623		318	1143			944			1221	
v/s Ratio Prot		0.14		c0.20	0.23						c0.45	
v/s Ratio Perm	c0.48			0.33				0.38				
v/c Ratio	2.19	0.64		1.51	0.61			0.93			1.10	
Uniform Delay, d1	46.9	42.7		35.4	29.6			33.9			35.5	
Progression Factor	1.00	1.00		1.02	0.88			1.00			1.00	
Incremental Delay, d2	591.5	5.1		240.7	2.0			16.8			58.2	
Delay (s)	638.4	47.7		276.8	28.0			50.7			93.7	
Level of Service	F	D		F	C			D			F	
Approach Delay (s)		180.2			129.4			50.7			93.7	
Approach LOS		F			F			D			F	

Intersection Summary			
HCM Average Control Delay	105.7	HCM Level of Service	F
HCM Volume to Capacity ratio	1.48		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	28.8
Intersection Capacity Utilization	87.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	0	153	0	3	37	5	0	0	3	44	0	12
Peak Hour Factor	0.86	0.86	0.86	0.71	0.71	0.71	0.75	0.75	0.75	0.78	0.78	0.78
Hourly flow rate (vph)	0	178	0	4	52	7	0	0	4	56	0	15

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	178	63	4	72
Volume Left (vph)	0	4	0	56
Volume Right (vph)	0	7	4	15
Hadj (s)	0.00	-0.02	-0.60	0.10
Departure Headway (s)	4.1	4.2	3.9	4.5
Degree Utilization, x	0.20	0.07	0.00	0.09
Capacity (veh/h)	849	824	852	745
Control Delay (s)	8.2	7.6	6.9	8.0
Approach Delay (s)	8.2	7.6	6.9	8.0
Approach LOS	A	A	A	A

Intersection Summary			
Delay	8.0		
HCM Level of Service	A		
Intersection Capacity Utilization	33.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	39	59	13	100	20	120	5	237	77	68	230	49
Peak Hour Factor	0.88	0.88	0.88	0.94	0.94	0.94	0.89	0.89	0.89	0.87	0.87	0.87
Hourly flow rate (vph)	44	67	15	106	21	128	6	266	87	78	264	56
Pedestrians		227			258			258			258	
Lane Width (ft)		13.0			13.0			12.0			10.5	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		20			23			22			19	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								270			411	
pX, platoon unblocked	0.95	0.95	0.95	0.95	0.95		0.95					
vC, conflicting volume	1393	1298	778	1306	1283	826	548			611		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1414	1314	766	1322	1298	826	524			611		
tC, single (s)	7.2	6.6	6.4	7.1	6.5	6.2	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.1	3.4	3.5	4.0	3.3	2.3			2.2		
p0 queue free %	0	13	93	0	75	45	99			90		
cM capacity (veh/h)	16	77	227	13	84	234	765			746		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total	126	255	358	78	321
Volume Left	44	106	6	78	0
Volume Right	15	128	87	0	56
cSH	34	28	765	746	1700
Volume to Capacity	3.74	9.04	0.01	0.10	0.19
Queue Length 95th (ft)	Err	Err	1	9	0
Control Delay (s)	Err	Err	0.2	10.4	0.0
Lane LOS	F	F	A	B	
Approach Delay (s)	Err	Err	0.2	2.0	
Approach LOS	F	F			

Intersection Summary			
Average Delay	3350.3		
Intersection Capacity Utilization	75.4%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	63	6	56	87	21	25
Peak Hour Factor	0.83	0.83	0.55	0.55	0.86	0.86
Hourly flow rate (vph)	76	7	102	158	24	29
Pedestrians	39		31			39
Lane Width (ft)	12.0		12.0			12.0
Walking Speed (ft/s)	4.0		4.0			4.0
Percent Blockage	3		3			3
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	329	259			299	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	329	259			299	
tC, single (s)	6.4	6.2			4.4	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.5	
p0 queue free %	88	99			98	
cM capacity (veh/h)	617	734			1087	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	83	260	53
Volume Left	76	0	24
Volume Right	7	158	0
cSH	626	1700	1087
Volume to Capacity	0.13	0.15	0.02
Queue Length 95th (ft)	11	0	2
Control Delay (s)	11.6	0.0	3.9
Lane LOS	B		A
Approach Delay (s)	11.6	0.0	3.9
Approach LOS	B		

Intersection Summary			
Average Delay	3.0		
Intersection Capacity Utilization	36.7%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	NBT	SBL	SBT
Lane Group Flow (vph)	173	353	54	369
v/c Ratio	0.84	0.38	0.10	0.33
Control Delay	70.2	9.3	5.2	5.4
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	70.2	9.3	5.2	5.4
Queue Length 50th (ft)	118	86	6	42
Queue Length 95th (ft)	157	205	18	134
Internal Link Dist (ft)	167	410		190
Turn Bay Length (ft)			150	
Base Capacity (vph)	281	943	523	1127
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.62	0.37	0.10	0.33

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	16	12	12	12	12	12	12	12	12	10	12	12
Total Lost time (s)		4.0						4.0		4.0	4.0	
Lane Util. Factor		1.00						1.00		1.00	1.00	
Frpb, ped/bikes		0.96						0.94		1.00	0.96	
Flpb, ped/bikes		0.58						1.00		0.87	1.00	
Frt		0.96						0.97		1.00	0.97	
Flt Protected		0.97						1.00		0.95	1.00	
Satd. Flow (prot)		874						1327		1293	1555	
Flt Permitted		0.97						0.98		0.54	1.00	
Satd. Flow (perm)		874						1300		741	1555	
Volume (vph)	96	7	41	0	0	0	16	236	80	45	242	68
Peak-hour factor, PHF	0.83	0.83	0.83	0.25	0.25	0.25	0.94	0.94	0.94	0.84	0.84	0.84
Adj. Flow (vph)	116	8	49	0	0	0	17	251	85	54	288	81
RTOR Reduction (vph)	0	13	0	0	0	0	0	7	0	0	7	0
Lane Group Flow (vph)	0	160	0	0	0	0	0	346	0	54	362	0
Confl. Peds. (#/hr)	304		35	35		304	45		66	66		45
Heavy Vehicles (%)	1%	1%	1%	0%	0%	0%	16%	16%	16%	2%	2%	2%
Turn Type	Perm						Perm			Perm		
Protected Phases		2						1			1	
Permitted Phases	2						1			1		
Actuated Green, G (s)		26.4						85.6		85.6	85.6	
Effective Green, g (s)		26.4						85.6		85.6	85.6	
Actuated g/C Ratio		0.22						0.71		0.71	0.71	
Clearance Time (s)		4.0						4.0		4.0	4.0	
Vehicle Extension (s)		3.0						3.0		3.0	3.0	
Lane Grp Cap (vph)		192						927		529	1109	
v/s Ratio Prot											0.23	
v/s Ratio Perm		0.18						c0.27		0.07		
v/c Ratio		0.83						0.37		0.10	0.33	
Uniform Delay, d1		44.7						6.7		5.3	6.4	
Progression Factor		1.00						1.00		0.60	0.60	
Incremental Delay, d2		25.3						1.1		0.4	0.8	
Delay (s)		70.0						7.9		3.6	4.6	
Level of Service		E						A		A	A	
Approach Delay (s)		70.0			0.0			7.9			4.5	
Approach LOS		E			A			A			A	

Intersection Summary			
HCM Average Control Delay	17.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	58.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	46	124	66	23	7	56	13	38	14	7	51	34
Peak Hour Factor	0.85	0.85	0.85	0.68	0.68	0.68	0.72	0.72	0.72	0.67	0.67	0.67
Hourly flow rate (vph)	54	146	78	34	10	82	18	53	19	10	76	51

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	278	126	90	137
Volume Left (vph)	54	34	18	10
Volume Right (vph)	78	82	19	51
Hadj (s)	-0.13	-0.03	-0.07	-0.21
Departure Headway (s)	4.5	4.8	5.0	4.8
Degree Utilization, x	0.35	0.17	0.12	0.18
Capacity (veh/h)	755	701	656	686
Control Delay (s)	9.9	8.7	8.7	8.8
Approach Delay (s)	9.9	8.7	8.7	8.8
Approach LOS	A	A	A	A

Intersection Summary			
Delay	9.3		
HCM Level of Service	A		
Intersection Capacity Utilization	38.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	17	0	61	21	10	76	25	240	0	0	211	19
Peak Hour Factor	0.72	0.72	0.72	0.83	0.83	0.83	0.89	0.89	0.89	0.83	0.83	0.83
Hourly flow rate (vph)	24	0	85	25	12	92	28	270	0	0	254	23
Pedestrians		80			101			101			90	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		7			8			8			8	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								452			490	
pX, platoon unblocked												
vC, conflicting volume	859	773	447	878	784	461	357			371		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	859	773	447	878	784	461	357			371		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.3			2.2		
p0 queue free %	86	100	84	85	96	82	97			100		
cM capacity (veh/h)	164	273	519	166	273	512	1081			1088		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	52	56	129	298	277
Volume Left	24	0	25	28	0
Volume Right	28	56	92	0	23
cSH	261	519	343	1081	1700
Volume to Capacity	0.20	0.11	0.38	0.03	0.16
Queue Length 95th (ft)	18	9	42	2	0
Control Delay (s)	22.2	12.8	21.7	1.0	0.0
Lane LOS	C	B	C	A	
Approach Delay (s)	17.3		21.7	1.0	0.0
Approach LOS	C		C		

Intersection Summary			
Average Delay	6.1		
Intersection Capacity Utilization	57.3%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	31	28	0	0	46	11	23	30	12	37	0	108
Peak Hour Factor	0.75	0.75	0.75	0.81	0.81	0.81	0.82	0.82	0.82	0.70	0.70	0.70
Hourly flow rate (vph)	41	37	0	0	57	14	28	37	15	53	0	154
Pedestrians		46			51			45			51	
Lane Width (ft)		11.0			11.0			16.0			11.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		4			4			5			4	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								376				
pX, platoon unblocked												
vC, conflicting volume	422	387	168	398	457	146	200			102		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	422	387	168	398	457	146	200			102		
tC, single (s)	7.2	6.6	6.3	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.1	3.4	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	90	92	100	100	87	98	98			96		
cM capacity (veh/h)	397	472	791	435	436	830	1335			1444		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	79	70	79	207
Volume Left	41	0	28	53
Volume Right	0	14	15	154
cSH	429	480	1335	1444
Volume to Capacity	0.18	0.15	0.02	0.04
Queue Length 95th (ft)	17	13	2	3
Control Delay (s)	15.3	13.8	2.9	2.2
Lane LOS	C	B	A	A
Approach Delay (s)	15.3	13.8	2.9	2.2
Approach LOS	C	B		

Intersection Summary			
Average Delay	6.5		
Intersection Capacity Utilization	33.4%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	WBL	WBT	NBT	SBT	SBR2	NER2
Lane Group Flow (vph)	646	94	901	390	314	33	142
v/c Ratio	1.44	0.62	0.92	2.35	1.34	0.16	1.13
Control Delay	243.1	20.6	29.3	645.3	211.9	36.8	161.7
Queue Delay	8.7	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	251.9	20.6	29.3	645.3	211.9	36.8	161.7
Queue Length 50th (ft)	~300	46	325	~385	~262	18	~106
Queue Length 95th (ft)	#425	m48	m310	#572	#431	46	#180
Internal Link Dist (ft)	165		1295	704	372		
Turn Bay Length (ft)		50				50	
Base Capacity (vph)	448	152	983	166	235	212	126
Starvation Cap Reductn	6	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.46	0.62	0.92	2.35	1.34	0.16	1.13

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	EBR2	WBL2	WBL	WBT	WBR	NBL2	NBL	NBT	NBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)		4.0				4.0	4.0				4.0	
Lane Util. Factor		0.95				0.91	0.91				1.00	
Frt		0.96				1.00	0.99				0.99	
Flt Protected		1.00				0.95	1.00				0.97	
Satd. Flow (prot)		2662				1353	2889				1352	
Flt Permitted		0.73				0.17	1.00				0.18	
Satd. Flow (perm)		1948				248	2889				245	
Volume (vph)	8	459	116	31	52	37	765	82	30	163	163	18
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.94	0.94	0.94	0.94	0.96	0.96	0.96	0.96
Adj. Flow (vph)	8	483	122	33	55	39	814	87	31	170	170	19
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	646	0	0	0	94	901	0	0	0	390	0
Heavy Vehicles (%)	4%	4%	4%	4%	2%	2%	2%	2%	3%	3%	3%	3%
Bus Blockages (#/hr)	0	0	0	0	0	0	3	3	0	0	7	7
Parking (#/hr)		1	1	1						1	1	1
Turn Type	Perm				D.P+P	D.P+P			D.P+P	D.P+P		
Protected Phases		1			9	9	1 9		3	3	3 4	
Permitted Phases	1				1	1			4	4		
Actuated Green, G (s)		22.0				29.0	29.0				26.0	
Effective Green, g (s)		23.0				30.0	30.0				27.0	
Actuated g/C Ratio		0.23				0.30	0.30				0.27	
Clearance Time (s)		5.0				4.0						
Vehicle Extension (s)		3.0				3.0						
Lane Grp Cap (vph)		448				152	982				166	
v/s Ratio Prot						0.04	c0.06				c0.21	
v/s Ratio Perm		c0.33				0.14	0.25				c0.42	
v/c Ratio		1.44				0.62	0.92				2.35	
Uniform Delay, d1		38.5				27.5	33.8				36.5	
Progression Factor		1.05				0.71	0.84				1.00	
Incremental Delay, d2		211.0				0.7	1.5				625.6	
Delay (s)		251.3				20.1	29.8				662.1	
Level of Service		F				C	C				F	
Approach Delay (s)		251.3					28.9				662.1	
Approach LOS		F					C				F	

Intersection Summary			
HCM Average Control Delay	215.2	HCM Level of Service	F
HCM Volume to Capacity ratio	1.83		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	43.0
Intersection Capacity Utilization	97.9%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBL	SBT	SBR	SBR2	NER2
Lane Configurations					
Ideal Flow (vphpl)	1900	1900	1900	1900	1900
Lane Width	11	16	11	11	14
Total Lost time (s)		4.0		4.0	4.0
Lane Util. Factor		1.00		1.00	1.00
Frt		0.98		0.85	0.86
Flt Protected		0.99		1.00	1.00
Satd. Flow (prot)		1570		1175	1396
Flt Permitted		0.82		1.00	1.00
Satd. Flow (perm)		1304		1175	1396
Volume (vph)	74	193	40	32	108
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.76
Adj. Flow (vph)	76	197	41	33	142
RTOR Reduction (vph)	0	0	0	0	0
Lane Group Flow (vph)	0	314	0	33	142
Heavy Vehicles (%)	7%	7%	7%	7%	13%
Bus Blockages (#/hr)	0	0	0	0	0
Parking (#/hr)		1	1	1	
Turn Type	Perm			Prot	Over
Protected Phases		4		4	3
Permitted Phases	4				
Actuated Green, G (s)		17.0		17.0	9.0
Effective Green, g (s)		18.0		18.0	9.0
Actuated g/C Ratio		0.18		0.18	0.09
Clearance Time (s)		5.0		5.0	4.0
Vehicle Extension (s)		3.0		3.0	3.0
Lane Grp Cap (vph)		235		212	126
v/s Ratio Prot				0.03	0.10
v/s Ratio Perm		0.24			
v/c Ratio		1.34		0.16	1.13
Uniform Delay, d1		41.0		34.6	45.5
Progression Factor		1.00		1.00	1.00
Incremental Delay, d2		177.3		1.6	118.4
Delay (s)		218.3		36.1	163.9
Level of Service		F		D	F
Approach Delay (s)		200.9			
Approach LOS		F			

Intersection Summary

Lane Group	EBT	WBT
Lane Group Flow (vph)	661	1043
v/c Ratio	0.28	0.34
Control Delay	0.3	0.0
Queue Delay	0.2	0.0
Total Delay	0.4	0.0
Queue Length 50th (ft)	0	0
Queue Length 95th (ft)	0	m0
Internal Link Dist (ft)	373	165
Turn Bay Length (ft)		
Base Capacity (vph)	2394	3037
Starvation Cap Reductn	0	0
Spillback Cap Reductn	819	111
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.42	0.36

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	11	11	12	12	12
Total Lost time (s)		4.0	4.0			
Lane Util. Factor		0.95	0.95			
Frt		1.00	1.00			
Flt Protected		1.00	1.00			
Satd. Flow (prot)		2764	3037			
Flt Permitted		0.87	1.00			
Satd. Flow (perm)		2399	3037			
Volume (vph)	31	590	933	27	0	0
Peak-hour factor, PHF	0.94	0.94	0.92	0.92	0.75	0.75
Adj. Flow (vph)	33	628	1014	29	0	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	661	1043	0	0	0
Heavy Vehicles (%)	5%	5%	3%	3%	0%	0%
Bus Blockages (#/hr)	0	6	0	0	0	0
Parking (#/hr)		5		5		
Turn Type	Perm					
Protected Phases		1	1			
Permitted Phases	1					
Actuated Green, G (s)		100.0	100.0			
Effective Green, g (s)		100.0	100.0			
Actuated g/C Ratio		1.00	1.00			
Clearance Time (s)		4.0	4.0			
Vehicle Extension (s)		3.0	3.0			
Lane Grp Cap (vph)		2399	3037			
v/s Ratio Prot			c0.34			
v/s Ratio Perm		0.28				
v/c Ratio		0.28	0.34			
Uniform Delay, d1		0.0	0.0			
Progression Factor		1.00	1.00			
Incremental Delay, d2		0.3	0.0			
Delay (s)		0.3	0.0			
Level of Service		A	A			
Approach Delay (s)		0.3	0.0		0.0	
Approach LOS		A	A		A	

Intersection Summary			
HCM Average Control Delay	0.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	47.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	SET	NWT	NET	SWT
Lane Group Flow (vph)	655	963	42	258
v/c Ratio	0.40	0.46	0.19	0.76
Control Delay	7.1	6.3	29.1	38.2
Queue Delay	0.0	0.2	0.0	0.0
Total Delay	7.1	6.4	29.1	38.2
Queue Length 50th (ft)	67	61	20	104
Queue Length 95th (ft)	145	402	30	141
Internal Link Dist (ft)	339	373	163	400
Turn Bay Length (ft)				
Base Capacity (vph)	1645	2071	266	386
Starvation Cap Reductn	0	320	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.40	0.55	0.16	0.67

Intersection Summary

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	11	12	12	11	12	12	12	12	12	16	12
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		0.95			0.95			1.00			1.00	
Frt		1.00			1.00			0.98			0.91	
Flt Protected		1.00			1.00			0.96			0.98	
Satd. Flow (prot)		2815			2850			1617			1544	
Flt Permitted		0.84			1.00			0.65			0.88	
Satd. Flow (perm)		2359			2850			1094			1375	
Volume (vph)	40	556	0	0	887	18	20	3	4	69	0	138
Peak-hour factor, PHF	0.91	0.91	0.91	0.94	0.94	0.94	0.65	0.65	0.65	0.80	0.80	0.80
Adj. Flow (vph)	44	611	0	0	944	19	31	5	6	86	0	172
RTOR Reduction (vph)	0	0	0	0	1	0	0	5	0	0	73	0
Lane Group Flow (vph)	0	655	0	0	962	0	0	37	0	0	185	0
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	6	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)		5			5						2	
Turn Type	Perm						Perm			Perm		
Protected Phases		1			1			3			3	
Permitted Phases	1						3			3		
Actuated Green, G (s)		72.6			72.6			19.4			19.4	
Effective Green, g (s)		72.6			72.6			19.4			19.4	
Actuated g/C Ratio		0.73			0.73			0.19			0.19	
Clearance Time (s)		4.0			4.0			4.0			4.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		1713			2069			212			267	
v/s Ratio Prot					c0.34							
v/s Ratio Perm		0.28						0.03			c0.13	
v/c Ratio		0.38			0.47			0.18			0.69	
Uniform Delay, d1		5.2			5.7			33.6			37.5	
Progression Factor		1.00			0.83			1.00			1.01	
Incremental Delay, d2		0.6			0.7			0.4			7.5	
Delay (s)		5.8			5.4			34.0			45.4	
Level of Service		A			A			C			D	
Approach Delay (s)		5.8			5.4			34.0			45.4	
Approach LOS		A			A			C			D	

Intersection Summary			
HCM Average Control Delay	11.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	69.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	76	620	145	831	165	164	162	301
v/c Ratio	0.40	0.45	0.74	1.10	0.55	0.40	0.90	0.75
Control Delay	54.1	5.3	63.9	91.1	29.3	32.8	81.7	43.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	54.1	5.3	63.9	91.1	29.3	32.8	81.7	43.0
Queue Length 50th (ft)	47	50	88	~649	78	83	96	155
Queue Length 95th (ft)	m43	m39	#162	#850	153	136	#214	254
Internal Link Dist (ft)		1295		1669		389		1718
Turn Bay Length (ft)	85		75					
Base Capacity (vph)	215	1386	221	756	298	446	198	437
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.35	0.45	0.66	1.10	0.55	0.37	0.82	0.69

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	11	11	10	11	11	16	16	16	11	11	11
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00		1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.97		1.00	1.00	0.46		0.99		1.00	0.93	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		0.99		0.72	1.00	
Frt	1.00	0.99		1.00	1.00	0.85		1.00		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.99		0.95	1.00	
Satd. Flow (prot)	1430	2862		1472	1566	617		1635		1112	1435	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.89		0.56	1.00	
Satd. Flow (perm)	1430	2862		1472	1566	617		1464		659	1435	
Volume (vph)	73	564	31	128	731	145	19	118	5	154	188	98
Peak-hour factor, PHF	0.96	0.96	0.96	0.88	0.88	0.88	0.87	0.87	0.87	0.95	0.95	0.95
Adj. Flow (vph)	76	588	32	145	831	165	22	136	6	162	198	103
RTOR Reduction (vph)	0	4	0	0	0	0	0	0	0	0	19	0
Lane Group Flow (vph)	76	616	0	145	831	165	0	164	0	162	282	0
Confl. Peds. (#/hr)	190		160	160		190	158		725	725		158
Confl. Bikes (#/hr)			15			23			1			10
Heavy Vehicles (%)	6%	6%	6%	3%	3%	3%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	6	6	0	0	0	0	0	0
Parking (#/hr)							1	1	1			
Turn Type	Prot			Prot		Perm	Perm			Perm		
Protected Phases	1	2		1	2			3			3	
Permitted Phases						2	3			3		
Actuated Green, G (s)	13.3	47.3		13.3	47.3	47.3		25.4		25.4	25.4	
Effective Green, g (s)	13.3	48.3		13.3	48.3	48.3		26.4		26.4	26.4	
Actuated g/C Ratio	0.13	0.48		0.13	0.48	0.48		0.26		0.26	0.26	
Clearance Time (s)	4.0	5.0		4.0	5.0	5.0		5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	190	1382		196	756	298		386		174	379	
v/s Ratio Prot	0.05	0.22		c0.10	c0.53						0.20	
v/s Ratio Perm						0.27		0.11		c0.25		
v/c Ratio	0.40	0.45		0.74	1.10	0.55		0.42		0.93	0.74	
Uniform Delay, d1	39.7	17.0		41.7	25.8	18.2		30.5		35.9	33.7	
Progression Factor	1.36	0.29		1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	0.1	0.1		13.6	63.3	7.2		0.8		48.4	7.7	
Delay (s)	54.1	4.9		55.3	89.1	25.5		31.3		84.3	41.4	
Level of Service	D	A		E	F	C		C		F	D	
Approach Delay (s)		10.3			75.6			31.3			56.4	
Approach LOS		B			E			C			E	

Intersection Summary			
HCM Average Control Delay	50.6	HCM Level of Service	D
HCM Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	94.0%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	223	128	156	607	451
v/c Ratio	0.82	0.52	0.42	0.71	0.39
Control Delay	51.0	49.6	9.1	36.1	19.1
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	51.0	49.6	9.1	36.1	19.1
Queue Length 50th (ft)	124	91	0	239	137
Queue Length 95th (ft)	m169	129	44	#375	m135
Internal Link Dist (ft)	821	168		1718	335
Turn Bay Length (ft)					
Base Capacity (vph)	438	449	541	849	1157
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.51	0.29	0.29	0.71	0.39

Intersection Summary
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1600	1600	1600	1600	1600	1600
Lane Width	13	13	13	12	12	10	10	11	11	10	10	10
Total Lost time (s)		4.0			4.0	4.0		4.0			4.0	
Lane Util. Factor		1.00			1.00	1.00		0.95			0.95	
Frpb, ped/bikes		0.99			1.00	0.98		0.98			0.92	
Flpb, ped/bikes		1.00			1.00	1.00		0.97			0.99	
Frt		0.92			1.00	0.85		0.99			0.97	
Flt Protected		0.99			0.98	1.00		0.99			1.00	
Satd. Flow (prot)		1315			1641	1309		2217			2131	
Flt Permitted		0.81			0.64	1.00		0.83			0.88	
Satd. Flow (perm)		1078			1071	1309		1853			1887	
Volume (vph)	47	26	108	47	63	134	66	476	22	31	285	68
Peak-hour factor, PHF	0.81	0.81	0.81	0.86	0.86	0.86	0.93	0.93	0.93	0.85	0.85	0.85
Adj. Flow (vph)	58	32	133	55	73	156	71	512	24	36	335	80
RTOR Reduction (vph)	0	54	0	0	0	127	0	2	0	0	10	0
Lane Group Flow (vph)	0	169	0	0	128	29	0	605	0	0	441	0
Confl. Peds. (#/hr)							500		500	500		500
Confl. Bikes (#/hr)			1			3			76			11
Heavy Vehicles (%)	21%	21%	21%	2%	2%	2%	8%	8%	8%	6%	6%	6%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	17	17	0	0	0
Turn Type	Perm			Perm		Perm	Perm			D.P+P		
Protected Phases		3			3			1		10	1 10	
Permitted Phases	3			3		3	1			1		
Actuated Green, G (s)		21.0			21.0	21.0		54.8			70.8	
Effective Green, g (s)		22.0			22.0	22.0		55.8			71.8	
Actuated g/C Ratio		0.18			0.18	0.18		0.46			0.60	
Clearance Time (s)		5.0			5.0	5.0		5.0				
Vehicle Extension (s)		3.0			3.0	3.0		3.0				
Lane Grp Cap (vph)		198			196	240		862			1162	
v/s Ratio Prot											c0.05	
v/s Ratio Perm		c0.16			0.12	0.02		c0.33			0.18	
v/c Ratio		0.85			0.65	0.12		0.70			0.38	
Uniform Delay, d1		47.4			45.5	40.9		25.5			12.5	
Progression Factor		0.89			1.00	1.00		1.00			1.41	
Incremental Delay, d2		27.5			7.6	0.2		4.7			0.1	
Delay (s)		69.6			53.0	41.1		30.2			17.7	
Level of Service		E			D	D		C			B	
Approach Delay (s)		69.6			46.5			30.2			17.7	
Approach LOS		E			D			C			B	

Intersection Summary			
HCM Average Control Delay	35.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	26.2
Intersection Capacity Utilization	65.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	84	734	206	728	226	235	287	141	176
v/c Ratio	1.91	1.24	1.04	0.75	0.96	0.57	0.46	0.66	0.42
Control Delay	439.2	136.1	108.1	36.2	73.0	29.2	3.1	50.9	34.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Total Delay	439.2	136.1	108.1	36.2	73.0	29.2	3.2	50.9	34.5
Queue Length 50th (ft)	~89	~380	~150	254	75	74	0	91	104
Queue Length 95th (ft)	m#85	m#262	#301	328	m#301	m120	m3	161	162
Internal Link Dist (ft)		771		938		335			755
Turn Bay Length (ft)	70		350					170	
Base Capacity (vph)	44	590	199	975	244	427	628	220	434
Starvation Cap Reductn	0	0	0	0	0	0	33	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.91	1.24	1.04	0.75	0.93	0.55	0.48	0.64	0.41

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
Lane Width	10	10	10	10	10	10	10	10	10	10	10	10
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	*0.95		1.00	0.95		1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	0.96	1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.97		1.00	0.98		1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1240	2360		1205	2361		1193	1256	1030	1252	1276	
Flt Permitted	0.13	1.00		0.13	1.00		0.57	1.00	1.00	0.49	1.00	
Satd. Flow (perm)	174	2360		169	2361		714	1256	1030	641	1276	
Volume (vph)	79	574	116	183	576	72	210	219	267	121	123	28
Peak-hour factor, PHF	0.94	0.94	0.94	0.89	0.89	0.89	0.93	0.93	0.93	0.86	0.86	0.86
Adj. Flow (vph)	84	611	123	206	647	81	226	235	287	141	143	33
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	155	0	0	0
Lane Group Flow (vph)	84	734	0	206	728	0	226	235	132	141	176	0
Confl. Bikes (#/hr)			10			11			78			9
Heavy Vehicles (%)	3%	3%	3%	6%	6%	6%	7%	7%	7%	2%	2%	2%
Bus Blockages (#/hr)	0	10	10	0	0	0	0	0	0	0	0	0
Turn Type	Perm			D.P+P			Perm		pm+ov	Perm		
Protected Phases		1		4	1 4			3	4		3	
Permitted Phases	1			1			3		3	3		
Actuated Green, G (s)	30.0	30.0		47.6	49.6		39.4	39.4	57.0	39.4	39.4	
Effective Green, g (s)	30.0	30.0		45.6	49.6		39.4	39.4	55.0	39.4	39.4	
Actuated g/C Ratio	0.25	0.25		0.38	0.41		0.33	0.33	0.46	0.33	0.33	
Clearance Time (s)	4.0	4.0		2.0			4.0	4.0	2.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0			3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	44	590		199	976		234	412	506	210	419	
v/s Ratio Prot		0.31		c0.13	0.31			0.19	0.03		0.14	
v/s Ratio Perm	c0.48			0.26			c0.32		0.09	0.22		
v/c Ratio	1.91	1.24		1.04	0.75		0.97	0.57	0.26	0.67	0.42	
Uniform Delay, d1	45.0	45.0		33.7	29.9		39.6	33.3	20.0	34.7	31.4	
Progression Factor	0.53	0.52		1.00	1.00		0.73	0.74	0.59	1.00	1.00	
Incremental Delay, d2	416.7	111.2		73.3	3.1		41.8	1.5	0.2	8.2	0.7	
Delay (s)	440.4	134.6		107.1	33.0		70.9	26.2	12.0	42.9	32.1	
Level of Service	F	F		F	C		E	C	B	D	C	
Approach Delay (s)		166.0			49.3			34.3			36.9	
Approach LOS		F			D			C			D	

Intersection Summary			
HCM Average Control Delay	77.8	HCM Level of Service	E
HCM Volume to Capacity ratio	1.32		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	35.0
Intersection Capacity Utilization	78.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	313	459	1160	123	59	465	256	229
v/c Ratio	0.69	0.42	1.10	0.22	0.37	1.15	3.76	0.27
Control Delay	27.0	22.6	90.1	4.9	36.1	123.9	1293.3	12.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.0	22.6	90.1	4.9	36.1	123.9	1293.3	12.1
Queue Length 50th (ft)	112	100	~399	0	28	~313	~265	65
Queue Length 95th (ft)	208	143	#527	35	60	#444	#387	109
Internal Link Dist (ft)		360	496			755	339	
Turn Bay Length (ft)	200				50			100
Base Capacity (vph)	454	1098	1050	560	161	406	68	836
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.69	0.42	1.10	0.22	0.37	1.15	3.76	0.27

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	12	12	11	11	14
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	0.95			0.95	1.00	1.00	1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00			1.00	0.98	1.00	0.98			1.00	1.00
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00	1.00			0.97	1.00
Frt	1.00	1.00			1.00	0.85	1.00	0.99			1.00	0.85
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00			0.99	1.00
Satd. Flow (prot)	1501	2988			3002	1315	1555	1653			1574	1535
Flt Permitted	0.12	1.00			0.95	1.00	0.40	1.00			0.17	1.00
Satd. Flow (perm)	192	2988			2866	1315	658	1653			279	1535
Volume (vph)	297	424	12	2	1054	112	49	367	19	65	168	208
Peak-hour factor, PHF	0.95	0.95	0.95	0.91	0.91	0.91	0.83	0.83	0.83	0.91	0.91	0.91
Adj. Flow (vph)	313	446	13	2	1158	123	59	442	23	71	185	229
RTOR Reduction (vph)	0	3	0	0	0	78	0	2	0	0	0	0
Lane Group Flow (vph)	313	456	0	0	1160	45	59	463	0	0	256	229
Confl. Peds. (#/hr)									300	300		
Confl. Bikes (#/hr)			4			1			35			5
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Turn Type	pm+pt			Perm		Perm	Perm			Perm		pt+ov
Protected Phases	1	3			3			4			4	1 4
Permitted Phases	3			3		3	4			4		
Actuated Green, G (s)	54.0	32.0			32.0	32.0	21.0	21.0			21.0	48.0
Effective Green, g (s)	56.0	33.0			33.0	33.0	22.0	22.0			22.0	49.0
Actuated g/C Ratio	0.62	0.37			0.37	0.37	0.24	0.24			0.24	0.54
Clearance Time (s)	5.0	5.0			5.0	5.0	5.0	5.0			5.0	
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0			3.0	
Lane Grp Cap (vph)	454	1096			1051	482	161	404			68	836
v/s Ratio Prot	c0.18	0.15						0.28				0.15
v/s Ratio Perm	0.25				c0.40	0.03	0.09				c0.92	
v/c Ratio	0.69	0.42			1.10	0.09	0.37	1.15			3.76	0.27
Uniform Delay, d1	19.6	21.3			28.5	18.7	28.2	34.0			34.0	11.0
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2	4.3	0.3			60.7	0.1	6.3	90.7			1279.2	0.8
Delay (s)	24.0	21.6			89.2	18.8	34.5	124.7			1313.2	11.8
Level of Service	C	C			F	B	C	F			F	B
Approach Delay (s)		22.5			82.4			114.6			698.7	
Approach LOS		C			F			F			F	

Intersection Summary			
HCM Average Control Delay	170.4	HCM Level of Service	F
HCM Volume to Capacity ratio	1.73		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	101.0%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

No-Build 2021

	→	↘	↙	←	↖	↑	↓
Lane Group	EBT	EBR	WBL	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	994	250	283	558	205	241	195
v/c Ratio	1.12	0.45	1.87	0.37	1.12	0.39	0.67
Control Delay	83.0	15.3	424.1	4.4	137.2	20.4	43.9
Queue Delay	60.2	1.1	0.0	0.0	0.0	0.0	0.0
Total Delay	143.1	16.3	424.1	4.4	137.2	20.4	43.9
Queue Length 50th (ft)	~397	86	~184	44	130	67	86
Queue Length 95th (ft)	m#402	m91	m#234	m50	m#255	m98	#268
Internal Link Dist (ft)	176			771		331	256
Turn Bay Length (ft)		150	150		100		
Base Capacity (vph)	890	559	151	1494	183	624	293
Starvation Cap Reductn	98	137	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.26	0.59	1.87	0.37	1.12	0.39	0.67

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	12	12	12	15	11	14	14	14
Total Lost time (s)		4.0	4.0	4.0	4.0		4.0	4.0			4.0	
Lane Util. Factor		0.95	1.00	1.00	0.95		1.00	1.00			1.00	
Frt		1.00	0.85	1.00	0.99		1.00	0.89			0.97	
Flt Protected		1.00	1.00	0.95	1.00		0.95	1.00			0.99	
Satd. Flow (prot)		2971	1330	1404	2987		1562	1609			1740	
Flt Permitted		0.71	1.00	0.14	1.00		0.57	1.00			0.93	
Satd. Flow (perm)		2110	1330	203	2987		933	1609			1632	
Volume (vph)	14	880	225	266	500	24	152	47	131	27	111	38
Peak-hour factor, PHF	0.90	0.90	0.90	0.94	0.94	0.94	0.74	0.74	0.74	0.90	0.90	0.90
Adj. Flow (vph)	16	978	250	283	532	26	205	64	177	30	123	42
RTOR Reduction (vph)	0	0	0	0	0	0	0	77	0	0	7	0
Lane Group Flow (vph)	0	994	250	283	558	0	205	164	0	0	188	0
Heavy Vehicles (%)	2%	2%	2%	8%	8%	8%	4%	4%	4%	1%	1%	1%
Turn Type	Perm		Perm	D.P+P			Perm			Perm		
Protected Phases		1		4	1 4			3			3	
Permitted Phases	1		1	1			3			3		
Actuated Green, G (s)		39.6	39.6	43.6	47.6		34.0	34.0			34.0	
Effective Green, g (s)		39.6	39.6	43.6	47.6		34.0	34.0			34.0	
Actuated g/C Ratio		0.40	0.40	0.44	0.48		0.34	0.34			0.34	
Clearance Time (s)		4.0	4.0	4.0			4.0	4.0			4.0	
Vehicle Extension (s)		3.0	3.0	3.0			3.0	3.0			3.0	
Lane Grp Cap (vph)		836	527	137	1422		317	547			555	
v/s Ratio Prot				c0.08	0.19			0.10				
v/s Ratio Perm		0.47	0.19	c0.82			c0.22				0.12	
v/c Ratio		1.19	0.47	2.07	0.39		0.65	0.30			0.34	
Uniform Delay, d1		30.2	22.5	27.4	16.9		27.9	24.3			24.6	
Progression Factor		0.70	0.66	0.87	0.26		1.16	1.22			1.00	
Incremental Delay, d2		90.8	1.4	490.6	0.4		4.0	0.3			0.4	
Delay (s)		112.1	16.2	514.5	4.8		36.5	29.9			25.0	
Level of Service		F	B	F	A		D	C			C	
Approach Delay (s)		92.8			176.3			32.9			25.0	
Approach LOS		F			F			C			C	

Intersection Summary			
HCM Average Control Delay	103.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.45		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	22.4
Intersection Capacity Utilization	79.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	1008	136	0	704	0	61
Peak Hour Factor	0.95	0.95	0.92	0.92	0.65	0.65
Hourly flow rate (vph)	1061	143	0	765	0	94
Pedestrians	42			42	42	
Lane Width (ft)	11.0			10.0	14.0	
Walking Speed (ft/s)	4.0			4.0	4.0	
Percent Blockage	3			3	4	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)	94			256		
pX, platoon unblocked			0.81		0.86	0.81
vC, conflicting volume			1246		1599	686
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1064		1179	368
tC, single (s)			4.2		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	80
cM capacity (veh/h)			489		147	474

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	707	497	383	383	94
Volume Left	0	0	0	0	0
Volume Right	0	143	0	0	94
cSH	1700	1700	1700	1700	474
Volume to Capacity	0.42	0.29	0.23	0.23	0.20
Queue Length 95th (ft)	0	0	0	0	18
Control Delay (s)	0.0	0.0	0.0	0.0	14.5
Lane LOS					B
Approach Delay (s)	0.0		0.0		14.5
Approach LOS					B

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	54.8%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	234	608	276	471	1636	843
v/c Ratio	3.66	0.96	2.32	0.54	1.11	0.57
Control Delay	1247.7	66.3	633.4	23.1	85.0	21.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	1247.7	66.3	633.4	23.1	85.0	21.1
Queue Length 50th (ft)	~269	202	~280	81	~687	220
Queue Length 95th (ft)	#391	#314	m#401	m120	#827	266
Internal Link Dist (ft)		849		14	255	366
Turn Bay Length (ft)						
Base Capacity (vph)	64	635	119	865	1474	1485
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	3.66	0.96	2.32	0.54	1.11	0.57

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	10	10	10	11	11	11	10	10	10
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			0.95			0.95	
Frt	1.00	1.00		1.00	0.99			0.95			0.99	
Flt Protected	0.95	1.00		0.95	1.00			1.00			1.00	
Satd. Flow (prot)	1525	2887		1444	2872			2970			2959	
Flt Permitted	0.20	1.00		0.20	1.00			0.95			1.00	
Satd. Flow (perm)	315	2887		298	2872			2828			2959	
Volume (vph)	222	575	3	254	418	16	6	996	568	0	647	70
Peak-hour factor, PHF	0.95	0.95	0.95	0.92	0.92	0.92	0.96	0.96	0.96	0.85	0.85	0.85
Adj. Flow (vph)	234	605	3	276	454	17	6	1038	592	0	761	82
RTOR Reduction (vph)	0	0	0	0	3	0	0	60	0	0	6	0
Lane Group Flow (vph)	234	608	0	276	468	0	0	1576	0	0	837	0
Heavy Vehicles (%)	3%	3%	3%	5%	5%	5%	0%	0%	0%	1%	1%	1%
Parking (#/hr)		1	1									
Turn Type	Perm			D.P+P			Perm					
Protected Phases		1		4	1 4			3			3	
Permitted Phases	1			1			3					
Actuated Green, G (s)	18.4	18.4		20.4	26.4			48.0			48.0	
Effective Green, g (s)	20.4	20.4		24.4	28.4			50.0			50.0	
Actuated g/C Ratio	0.20	0.20		0.24	0.28			0.50			0.50	
Clearance Time (s)	6.0	6.0		6.0				6.0			6.0	
Vehicle Extension (s)	3.0	3.0		3.0				3.0			3.0	
Lane Grp Cap (vph)	64	589		119	816			1414			1480	
v/s Ratio Prot		0.21		c0.09	0.16						0.28	
v/s Ratio Perm	c0.74			0.47				c0.56				
v/c Ratio	3.66	1.03		2.32	0.57			1.11			0.57	
Uniform Delay, d1	39.8	39.8		37.3	30.6			25.0			17.4	
Progression Factor	1.00	1.00		0.71	0.72			1.00			1.00	
Incremental Delay, d2	1232.8	45.6		614.6	2.4			61.9			1.6	
Delay (s)	1272.6	85.4		641.1	24.4			86.9			19.0	
Level of Service	F	F		F	C			F			B	
Approach Delay (s)		415.4			252.2			86.9			19.0	
Approach LOS		F			F			F			B	

Intersection Summary			
HCM Average Control Delay	171.2	HCM Level of Service	F
HCM Volume to Capacity ratio	1.87		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	25.6
Intersection Capacity Utilization	99.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	0	292	0	3	171	5	1	3	3	61	2	73
Peak Hour Factor	0.70	0.70	0.70	0.79	0.79	0.79	0.44	0.44	0.44	0.91	0.91	0.91
Hourly flow rate (vph)	0	417	0	4	216	6	2	7	7	67	2	80

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	417	227	16	149
Volume Left (vph)	0	4	2	67
Volume Right (vph)	0	6	7	80
Hadj (s)	0.00	0.00	-0.23	-0.23
Departure Headway (s)	4.6	4.9	5.5	5.2
Degree Utilization, x	0.54	0.31	0.02	0.22
Capacity (veh/h)	746	703	551	619
Control Delay (s)	12.9	10.0	8.6	9.7
Approach Delay (s)	12.9	10.0	8.6	9.7
Approach LOS	B	B	A	A

Intersection Summary			
Delay	11.4		
HCM Level of Service	B		
Intersection Capacity Utilization	44.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	31	75	19	94	1	68	12	251	127	132	259	74
Peak Hour Factor	0.93	0.93	0.93	0.80	0.80	0.80	0.90	0.90	0.90	0.87	0.87	0.87
Hourly flow rate (vph)	33	81	20	118	1	85	13	279	141	152	298	85
Pedestrians		222			337			321			337	
Lane Width (ft)		13.0			13.0			12.0			10.5	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		20			30			27			25	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								270			411	
pX, platoon unblocked												
vC, conflicting volume	1664	1649	883	1696	1621	1023	605			757		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1664	1649	883	1696	1621	1023	605			757		
tC, single (s)	7.2	6.6	6.3	7.1	6.5	6.2	4.1			4.2		
tC, 2 stage (s)												
tF (s)	3.6	4.1	3.4	3.5	4.0	3.3	2.2			2.3		
p0 queue free %	0	0	90	0	97	44	98			74		
cM capacity (veh/h)	10	39	198	0	42	151	766			579		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total	134	204	433	152	383
Volume Left	33	118	13	152	0
Volume Right	20	85	141	0	85
cSH	25	0	766	579	1700
Volume to Capacity	5.47	Err	0.02	0.26	0.23
Queue Length 95th (ft)	Err	Err	1	26	0
Control Delay (s)	Err	Err	0.5	13.4	0.0
Lane LOS	F	F	A	B	
Approach Delay (s)	Err	Err	0.5	3.8	
Approach LOS	F	F			

Intersection Summary			
Average Delay	Err		
Intersection Capacity Utilization	79.7%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	54	20	56	87	49	103
Peak Hour Factor	0.86	0.86	0.84	0.84	0.89	0.89
Hourly flow rate (vph)	63	23	67	104	55	116
Pedestrians	59		56			59
Lane Width (ft)	12.0		12.0			12.0
Walking Speed (ft/s)	4.0		4.0			4.0
Percent Blockage	5		5			5
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	459	236			229	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	459	236			229	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	87	97			96	
cM capacity (veh/h)	484	723			1284	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	86	170	171
Volume Left	63	0	55
Volume Right	23	104	0
cSH	532	1700	1284
Volume to Capacity	0.16	0.10	0.04
Queue Length 95th (ft)	14	0	3
Control Delay (s)	13.1	0.0	2.8
Lane LOS	B		A
Approach Delay (s)	13.1	0.0	2.8
Approach LOS	B		

Intersection Summary			
Average Delay	3.8		
Intersection Capacity Utilization	44.4%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	NBT	SBL	SBT
Lane Group Flow (vph)	326	352	75	391
v/c Ratio	0.61	0.90	0.45	0.90
Control Delay	19.8	40.9	36.9	55.2
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	19.8	40.9	36.9	55.2
Queue Length 50th (ft)	104	232	42	221
Queue Length 95th (ft)	214	m179	m43	m178
Internal Link Dist (ft)	167	410		190
Turn Bay Length (ft)			150	
Base Capacity (vph)	533	807	351	893
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.61	0.44	0.21	0.44

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	16	12	12	12	12	12	12	12	12	10	12	12
Total Lost time (s)		4.0						4.0		4.0	4.0	
Lane Util. Factor		1.00						1.00		1.00	1.00	
Frpb, ped/bikes		0.92						0.93		1.00	0.94	
Flpb, ped/bikes		0.57						0.99		0.83	1.00	
Frt		0.96						0.98		1.00	0.97	
Flt Protected		0.97						0.99		0.95	1.00	
Satd. Flow (prot)		834						1447		1165	1450	
Flt Permitted		0.97						0.62		0.36	1.00	
Satd. Flow (perm)		834						898		444	1450	
Volume (vph)	178	8	69	0	0	0	42	229	39	67	289	59
Peak-hour factor, PHF	0.78	0.78	0.78	0.25	0.25	0.25	0.88	0.88	0.88	0.89	0.89	0.89
Adj. Flow (vph)	228	10	88	0	0	0	48	260	44	75	325	66
RTOR Reduction (vph)	0	7	0	0	0	0	0	9	0	0	14	0
Lane Group Flow (vph)	0	319	0	0	0	0	0	343	0	75	377	0
Confl. Peds. (#/hr)	339		96	96		339	110		225	225		110
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	6%	6%	6%	8%	8%	8%
Turn Type	Perm						Perm			Perm		
Protected Phases		2						1			1	
Permitted Phases	2						1			1		
Actuated Green, G (s)		63.1						28.9		28.9	28.9	
Effective Green, g (s)		63.1						28.9		28.9	28.9	
Actuated g/C Ratio		0.63						0.29		0.29	0.29	
Clearance Time (s)		4.0						4.0		4.0	4.0	
Vehicle Extension (s)		3.0						3.0		3.0	3.0	
Lane Grp Cap (vph)		526						260		128	419	
v/s Ratio Prot											0.26	
v/s Ratio Perm		0.38						c0.38		0.17		
v/c Ratio		0.61						1.32		0.59	0.90	
Uniform Delay, d1		11.0						35.6		30.4	34.2	
Progression Factor		1.00						1.18		1.17	1.17	
Incremental Delay, d2		2.0						145.8		12.9	19.0	
Delay (s)		13.0						187.7		48.4	59.0	
Level of Service		B						F		D	E	
Approach Delay (s)		13.0			0.0			187.7			57.3	
Approach LOS		B			A			F			E	

Intersection Summary			
HCM Average Control Delay	84.8	HCM Level of Service	F
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	75.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	49	204	103	13	43	40	37	47	32	1	31	118
Peak Hour Factor	0.75	0.75	0.75	0.73	0.73	0.73	0.69	0.69	0.69	0.92	0.92	0.92
Hourly flow rate (vph)	65	272	137	18	59	55	54	68	46	1	34	128

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	475	132	168	163
Volume Left (vph)	65	18	54	1
Volume Right (vph)	137	55	46	128
Hadj (s)	-0.13	-0.05	-0.08	-0.45
Departure Headway (s)	4.9	5.5	5.7	5.3
Degree Utilization, x	0.65	0.20	0.27	0.24
Capacity (veh/h)	704	588	560	593
Control Delay (s)	16.6	9.9	10.7	10.0
Approach Delay (s)	16.6	9.9	10.7	10.0
Approach LOS	C	A	B	B

Intersection Summary			
Delay	13.4		
HCM Level of Service	B		
Intersection Capacity Utilization	71.8%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	32	0	75	18	16	32	17	286	0	0	248	7
Peak Hour Factor	0.90	0.90	0.90	0.63	0.63	0.63	0.79	0.79	0.79	0.71	0.71	0.71
Hourly flow rate (vph)	36	0	83	29	25	51	22	362	0	0	349	10
Pedestrians		94			244			244			185	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		8			20			20			15	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								452			490	
pX, platoon unblocked	0.87	0.87	0.87	0.87	0.87		0.87					
vC, conflicting volume	1102	1097	692	1331	1102	791	453			606		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1117	1112	647	1380	1117	791	372			606		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.2		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.3		
p0 queue free %	48	100	72	26	81	81	98			100		
cM capacity (veh/h)	68	130	301	38	131	265	939			752		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	63	56	105	384	359
Volume Left	36	0	29	22	0
Volume Right	28	56	51	0	10
cSH	103	301	93	939	1700
Volume to Capacity	0.62	0.18	1.13	0.02	0.21
Queue Length 95th (ft)	75	17	177	2	0
Control Delay (s)	84.6	19.6	216.5	0.7	0.0
Lane LOS	F	C	F	A	
Approach Delay (s)	54.2		216.5	0.7	0.0
Approach LOS	F		F		

Intersection Summary			
Average Delay	30.4		
Intersection Capacity Utilization	53.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	76	38	0	0	29	17	16	25	9	66	0	85
Peak Hour Factor	0.68	0.68	0.68	0.83	0.83	0.83	0.73	0.73	0.73	0.69	0.69	0.69
Hourly flow rate (vph)	112	56	0	0	35	20	22	34	12	96	0	123
Pedestrians		45			51			34			51	
Lane Width (ft)		11.0			11.0			16.0			11.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		3			4			4			4	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								376				
pX, platoon unblocked												
vC, conflicting volume	471	439	141	450	495	142	168			98		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	471	439	141	450	495	142	168			98		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	71	87	100	100	91	98	98			93		
cM capacity (veh/h)	379	437	846	388	408	841	1349			1443		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	168	55	68	219
Volume Left	112	0	22	96
Volume Right	0	20	12	123
cSH	397	504	1349	1443
Volume to Capacity	0.42	0.11	0.02	0.07
Queue Length 95th (ft)	51	9	1	5
Control Delay (s)	20.5	13.0	2.6	3.7
Lane LOS	C	B	A	A
Approach Delay (s)	20.5	13.0	2.6	3.7
Approach LOS	C	B		

Intersection Summary			
Average Delay	10.1		
Intersection Capacity Utilization	37.1%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	WBL	WBT	NBT	SBT	SBR2	NER2
Lane Group Flow (vph)	816	125	598	469	380	36	47
v/c Ratio	2.94	0.88	0.84	2.43	1.43	0.13	0.30
Control Delay	898.1	59.1	29.8	677.5	234.2	20.5	46.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	898.1	59.1	29.8	677.5	234.2	20.5	46.4
Queue Length 50th (ft)	~483	60	210	~468	~338	12	28
Queue Length 95th (ft)	#607	m#82	m254	#666	m#424	m20	51
Internal Link Dist (ft)	165		1295	704	372		
Turn Bay Length (ft)		50				50	
Base Capacity (vph)	278	142	715	193	266	270	159
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	2.94	0.88	0.84	2.43	1.43	0.13	0.30

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	EBR2	WBL2	WBL	WBT	WBR	NBL2	NBL	NBT	NBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)		4.0				4.0	4.0				4.0	
Lane Util. Factor		0.95				0.91	0.91				1.00	
Frt		0.97				1.00	0.96				0.99	
Flt Protected		1.00				0.95	1.00				0.97	
Satd. Flow (prot)		2605				1266	2646				1273	
Flt Permitted		0.67				0.25	1.00				0.18	
Satd. Flow (perm)		1737				333	2646				231	
Volume (vph)	20	602	128	18	74	40	416	128	26	207	162	27
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.91	0.91	0.91	0.91	0.90	0.90	0.90	0.90
Adj. Flow (vph)	21	640	136	19	81	44	457	141	29	230	180	30
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	816	0	0	0	125	598	0	0	0	469	0
Heavy Vehicles (%)	7%	7%	7%	7%	9%	9%	9%	9%	9%	9%	9%	9%
Bus Blockages (#/hr)	0	0	0	0	0	0	3	3	0	0	7	7
Parking (#/hr)		1	1	1						1	1	1
Turn Type	Perm				D.P+P	D.P+P			D.P+P	D.P+P		
Protected Phases		1			9	9	1 9		3	3	3 4	
Permitted Phases	1				1	1			4	4		
Actuated Green, G (s)		15.0				22.0	22.0				33.0	
Effective Green, g (s)		16.0				23.0	23.0				34.0	
Actuated g/C Ratio		0.16				0.23	0.23				0.34	
Clearance Time (s)		5.0				4.0						
Vehicle Extension (s)		3.0				3.0						
Lane Grp Cap (vph)		278				142	714				193	
v/s Ratio Prot						0.06	c0.06				c0.27	
v/s Ratio Perm		c0.47				0.14	0.17				c0.56	
v/c Ratio		2.94				0.88	0.84				2.43	
Uniform Delay, d1		42.0				48.0	36.7				33.0	
Progression Factor		0.91				0.55	0.62				1.00	
Incremental Delay, d2		880.2				31.0	5.7				659.0	
Delay (s)		918.4				57.4	28.3				692.0	
Level of Service		F				E	C				F	
Approach Delay (s)		918.4					33.3				692.0	
Approach LOS		F					C				F	

Intersection Summary			
HCM Average Control Delay	481.5	HCM Level of Service	F
HCM Volume to Capacity ratio	2.40		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	43.0
Intersection Capacity Utilization	96.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBL	SBT	SBR	SBR2	NER2
Lane Configurations					
Ideal Flow (vphpl)	1900	1900	1900	1900	1900
Lane Width	11	16	11	11	14
Total Lost time (s)		4.0		4.0	4.0
Lane Util. Factor		1.00		1.00	1.00
Frt		0.99		0.85	0.86
Flt Protected		0.98		1.00	1.00
Satd. Flow (prot)		1570		1175	1447
Flt Permitted		0.72		1.00	1.00
Satd. Flow (perm)		1156		1175	1447
Volume (vph)	116	177	31	31	34
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.73
Adj. Flow (vph)	136	208	36	36	47
RTOR Reduction (vph)	0	0	0	0	0
Lane Group Flow (vph)	0	380	0	36	47
Heavy Vehicles (%)	7%	7%	7%	7%	9%
Bus Blockages (#/hr)	0	0	0	0	0
Parking (#/hr)		1	1	1	
Turn Type	Perm			Prot	Over
Protected Phases		4		4	3
Permitted Phases	4				
Actuated Green, G (s)		22.0		22.0	11.0
Effective Green, g (s)		23.0		23.0	11.0
Actuated g/C Ratio		0.23		0.23	0.11
Clearance Time (s)		5.0		5.0	4.0
Vehicle Extension (s)		3.0		3.0	3.0
Lane Grp Cap (vph)		266		270	159
v/s Ratio Prot				0.03	0.03
v/s Ratio Perm		0.33			
v/c Ratio		1.43		0.13	0.30
Uniform Delay, d1		38.5		30.6	40.9
Progression Factor		0.66		0.63	1.00
Incremental Delay, d2		208.9		0.8	4.7
Delay (s)		234.2		20.1	45.6
Level of Service		F		C	D
Approach Delay (s)		215.6			
Approach LOS		F			

Intersection Summary

Lane Group	EBT	WBT
Lane Group Flow (vph)	836	763
v/c Ratio	0.34	0.27
Control Delay	0.3	0.0
Queue Delay	0.0	0.0
Total Delay	0.3	0.0
Queue Length 50th (ft)	0	0
Queue Length 95th (ft)	0	m0
Internal Link Dist (ft)	373	165
Turn Bay Length (ft)		
Base Capacity (vph)	2474	2835
Starvation Cap Reductn	0	0
Spillback Cap Reductn	0	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.34	0.27

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	11	11	12	12	12
Total Lost time (s)		4.0	4.0			
Lane Util. Factor		0.95	0.95			
Frt		1.00	0.99			
Flt Protected		1.00	1.00			
Satd. Flow (prot)		2714	2835			
Flt Permitted		0.91	1.00			
Satd. Flow (perm)		2477	2835			
Volume (vph)	28	767	625	31	0	0
Peak-hour factor, PHF	0.95	0.95	0.86	0.86	0.25	0.25
Adj. Flow (vph)	29	807	727	36	0	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	836	763	0	0	0
Heavy Vehicles (%)	7%	7%	10%	10%	0%	0%
Bus Blockages (#/hr)	0	6	0	0	0	0
Parking (#/hr)		5		5		
Turn Type	Perm					
Protected Phases		1	1			
Permitted Phases	1					
Actuated Green, G (s)		100.0	100.0			
Effective Green, g (s)		100.0	100.0			
Actuated g/C Ratio		1.00	1.00			
Clearance Time (s)		4.0	4.0			
Vehicle Extension (s)		3.0	3.0			
Lane Grp Cap (vph)		2477	2835			
v/s Ratio Prot			0.27			
v/s Ratio Perm		c0.34				
v/c Ratio		0.34	0.27			
Uniform Delay, d1		0.0	0.0			
Progression Factor		1.00	1.00			
Incremental Delay, d2		0.3	0.0			
Delay (s)		0.3	0.0			
Level of Service		A	A			
Approach Delay (s)		0.3	0.0		0.0	
Approach LOS		A	A		A	

Intersection Summary			
HCM Average Control Delay	0.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	49.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	SET	NWT	NET	SWT
Lane Group Flow (vph)	937	665	44	186
v/c Ratio	0.58	0.32	0.19	0.67
Control Delay	7.3	10.8	31.6	31.4
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	7.3	10.8	31.6	31.4
Queue Length 50th (ft)	93	109	20	57
Queue Length 95th (ft)	208	146	35	118
Internal Link Dist (ft)	339	373	163	400
Turn Bay Length (ft)				
Base Capacity (vph)	1605	2085	274	321
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.58	0.32	0.16	0.58

Intersection Summary

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	11	12	12	11	12	12	12	12	12	16	12
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		0.95			0.95			1.00			1.00	
Frt		1.00			1.00			0.97			0.91	
Flt Protected		0.99			1.00			0.98			0.98	
Satd. Flow (prot)		2756			2721			1628			1470	
Flt Permitted		0.79			1.00			0.81			0.88	
Satd. Flow (perm)		2187			2721			1343			1322	
Volume (vph)	90	753	0	0	591	7	13	11	6	54	0	111
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.70	0.70	0.70	0.89	0.89	0.89
Adj. Flow (vph)	100	837	0	0	657	8	19	16	9	61	0	125
RTOR Reduction (vph)	0	0	0	0	0	0	0	8	0	0	76	0
Lane Group Flow (vph)	0	937	0	0	665	0	0	36	0	0	110	0
Heavy Vehicles (%)	5%	5%	5%	8%	8%	8%	0%	0%	0%	5%	5%	5%
Bus Blockages (#/hr)	0	6	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)		5			5						2	
Turn Type	Perm						Perm			Perm		
Protected Phases		1			1			3			3	
Permitted Phases	1						3			3		
Actuated Green, G (s)		76.6			76.6			15.4			15.4	
Effective Green, g (s)		76.6			76.6			15.4			15.4	
Actuated g/C Ratio		0.77			0.77			0.15			0.15	
Clearance Time (s)		4.0			4.0			4.0			4.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		1675			2084			207			204	
v/s Ratio Prot					0.24							
v/s Ratio Perm		c0.43						0.03			c0.08	
v/c Ratio		0.56			0.32			0.18			0.54	
Uniform Delay, d1		4.8			3.6			36.8			39.0	
Progression Factor		1.00			2.57			1.00			0.96	
Incremental Delay, d2		1.4			0.4			0.4			2.7	
Delay (s)		6.1			9.7			37.2			40.3	
Level of Service		A			A			D			D	
Approach Delay (s)		6.1			9.7			37.2			40.3	
Approach LOS		A			A			D			D	

Intersection Summary			
HCM Average Control Delay	11.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	67.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	155	677	54	582	377	328	142	189
v/c Ratio	0.78	0.52	0.28	0.86	1.01	0.74	1.07	0.45
Control Delay	71.2	14.7	41.9	40.3	77.9	43.5	120.5	32.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	71.2	14.7	41.9	40.3	77.9	43.5	120.5	32.3
Queue Length 50th (ft)	108	243	31	331	~259	188	~102	90
Queue Length 95th (ft)	m0	m21	68	#546	#439	232	m#160	m124
Internal Link Dist (ft)		1295		1669		389		1718
Turn Bay Length (ft)	85		75					
Base Capacity (vph)	215	1309	211	674	375	445	133	417
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.72	0.52	0.26	0.86	1.01	0.74	1.07	0.45

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	11	11	10	11	11	16	16	16	11	11	11
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00		1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.98		1.00	1.00	0.65		1.00		1.00	0.98	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00		0.85	1.00	
Frt	1.00	0.99		1.00	1.00	0.85		1.00		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00		0.95	1.00	
Satd. Flow (prot)	1430	2895		1404	1494	831		1577		1185	1402	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.97		0.37	1.00	
Satd. Flow (perm)	1430	2895		1404	1494	831		1535		458	1402	
Volume (vph)	133	553	29	49	530	343	18	230	1	121	127	34
Peak-hour factor, PHF	0.86	0.86	0.86	0.91	0.91	0.91	0.76	0.76	0.76	0.85	0.85	0.85
Adj. Flow (vph)	155	643	34	54	582	377	24	303	1	142	149	40
RTOR Reduction (vph)	0	4	0	0	0	0	0	0	0	0	10	0
Lane Group Flow (vph)	155	673	0	54	582	377	0	328	0	142	179	0
Confl. Peds. (#/hr)	106		92	92		106	75		414	414		75
Confl. Bikes (#/hr)			17			1			9			1
Heavy Vehicles (%)	6%	6%	6%	8%	8%	8%	9%	9%	9%	12%	12%	12%
Bus Blockages (#/hr)	0	0	0	0	6	6	0	0	0	0	0	0
Parking (#/hr)							1	1	1			
Turn Type	Prot			Prot		Perm	Perm			Perm		
Protected Phases	1	2		1	2			3			3	
Permitted Phases						2	3			3		
Actuated Green, G (s)	13.9	44.1		13.9	44.1	44.1		28.0		28.0	28.0	
Effective Green, g (s)	13.9	45.1		13.9	45.1	45.1		29.0		29.0	29.0	
Actuated g/C Ratio	0.14	0.45		0.14	0.45	0.45		0.29		0.29	0.29	
Clearance Time (s)	4.0	5.0		4.0	5.0	5.0		5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	199	1306		195	674	375		445		133	407	
v/s Ratio Prot	c0.11	0.23		0.04	0.39						0.13	
v/s Ratio Perm						c0.45		0.21		c0.31		
v/c Ratio	0.78	0.52		0.28	0.86	1.01		0.74		1.07	0.44	
Uniform Delay, d1	41.6	19.6		38.5	24.7	27.4		32.1		35.5	28.9	
Progression Factor	1.66	0.73		1.00	1.00	1.00		1.00		1.06	1.09	
Incremental Delay, d2	1.8	0.1		0.8	13.8	47.8		6.3		81.5	0.5	
Delay (s)	70.7	14.4		39.3	38.5	75.3		38.3		119.2	32.1	
Level of Service	E	B		D	D	E		D		F	C	
Approach Delay (s)		24.9			52.2			38.3			69.4	
Approach LOS		C			D			D			E	

Intersection Summary			
HCM Average Control Delay	43.6	HCM Level of Service	D
HCM Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	80.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	260	112	83	531	636
v/c Ratio	0.84	0.46	0.25	0.89	0.77
Control Delay	47.8	39.2	8.6	42.5	27.0
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	47.8	39.2	8.6	42.5	27.0
Queue Length 50th (ft)	106	60	0	~174	134
Queue Length 95th (ft)	m139	109	35	m#240	m95
Internal Link Dist (ft)	821	168		1718	335
Turn Bay Length (ft)					
Base Capacity (vph)	355	280	378	598	830
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.73	0.40	0.22	0.89	0.77

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1600	1600	1600	1600	1600	1600
Lane Width	13	13	13	12	12	10	10	11	11	10	10	10
Total Lost time (s)		4.0			4.0	4.0		4.0			4.0	
Lane Util. Factor		1.00			1.00	1.00		0.95			0.95	
Frpb, ped/bikes		1.00			1.00	0.99		1.00			0.99	
Flpb, ped/bikes		1.00			1.00	1.00		1.00			1.00	
Frt		0.94			1.00	0.85		0.98			0.97	
Flt Protected		0.99			0.97	1.00		0.99			0.99	
Satd. Flow (prot)		1405			1515	1217		2157			2254	
Flt Permitted		0.87			0.65	1.00		0.71			0.70	
Satd. Flow (perm)		1236			1008	1217		1534			1587	
Volume (vph)	65	49	102	52	47	73	82	348	59	108	343	103
Peak-hour factor, PHF	0.83	0.83	0.83	0.88	0.88	0.88	0.92	0.92	0.92	0.87	0.87	0.87
Adj. Flow (vph)	78	59	123	59	53	83	89	378	64	124	394	118
RTOR Reduction (vph)	0	34	0	0	0	64	0	10	0	0	17	0
Lane Group Flow (vph)	0	226	0	0	112	19	0	521	0	0	619	0
Confl. Bikes (#/hr)						1			4			43
Heavy Vehicles (%)	16%	16%	16%	10%	10%	10%	15%	15%	15%	8%	8%	8%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	17	17	0	0	0
Turn Type	Perm			Perm		Perm	Perm			D.P+P		
Protected Phases		3			3			1		10	1 10	
Permitted Phases	3			3		3	1			1		
Actuated Green, G (s)		21.4			21.4	21.4		38.0			49.0	
Effective Green, g (s)		22.4			22.4	22.4		39.0			48.0	
Actuated g/C Ratio		0.22			0.22	0.22		0.39			0.48	
Clearance Time (s)		5.0			5.0	5.0		5.0				
Vehicle Extension (s)		3.0			3.0	3.0		3.0				
Lane Grp Cap (vph)		277			226	273		598			822	
v/s Ratio Prot											c0.07	
v/s Ratio Perm		c0.18			0.11	0.02		c0.34			0.29	
v/c Ratio		0.82			0.50	0.07		0.87			0.75	
Uniform Delay, d1		36.8			33.9	30.6		28.2			21.2	
Progression Factor		1.05			1.00	1.00		1.08			1.21	
Incremental Delay, d2		11.5			1.7	0.1		8.4			0.4	
Delay (s)		50.1			35.6	30.7		38.8			25.9	
Level of Service		D			D	C		D			C	
Approach Delay (s)		50.1			33.5			38.8			25.9	
Approach LOS		D			C			D			C	

Intersection Summary			
HCM Average Control Delay	34.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	29.6
Intersection Capacity Utilization	69.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	89	998	246	871	95	182	290	96	349
v/c Ratio	1.75	1.42	1.57	0.81	1.94	0.70	0.54	0.68	1.26
Control Delay	386.1	229.9	315.4	30.1	493.5	50.1	3.8	61.7	177.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	386.1	229.9	315.4	30.1	493.5	50.1	3.8	61.7	177.6
Queue Length 50th (ft)	~84	~451	~224	241	~93	90	0	56	~281
Queue Length 95th (ft)	m#92	m#413	#377	331	m#126	m113	m0	#99	#349
Internal Link Dist (ft)		771		938		335			755
Turn Bay Length (ft)	70		350					170	
Base Capacity (vph)	51	704	157	1075	49	259	536	141	277
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.75	1.42	1.57	0.81	1.94	0.70	0.54	0.68	1.26

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
Lane Width	10	10	10	10	10	10	10	10	10	10	10	10
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	*0.95		1.00	0.95		1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	1.00	0.99	1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.97		1.00	0.96		1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1216	2346		1205	2286		1120	1179	993	1240	1259	
Flt Permitted	0.13	1.00		0.95	1.00		0.18	1.00	1.00	0.50	1.00	
Satd. Flow (perm)	171	2346		1205	2286		214	1179	993	657	1259	
Volume (vph)	81	714	194	226	565	236	87	167	267	72	226	36
Peak-hour factor, PHF	0.91	0.91	0.91	0.92	0.92	0.92	0.92	0.92	0.92	0.75	0.75	0.75
Adj. Flow (vph)	89	785	213	246	614	257	95	182	290	96	301	48
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	189	0	0	0
Lane Group Flow (vph)	89	998	0	246	871	0	95	182	102	96	349	0
Confl. Bikes (#/hr)			5			5			3			96
Heavy Vehicles (%)	5%	5%	5%	6%	6%	6%	14%	14%	14%	3%	3%	3%
Turn Type	Perm			custom			Perm		pm+ov	Perm		
Protected Phases		1		4	1 4			3	4		3	
Permitted Phases	1			4			3		3	3		
Actuated Green, G (s)	30.0	30.0		15.0	47.0		22.0	22.0	37.0	22.0	22.0	
Effective Green, g (s)	30.0	30.0		13.0	47.0		22.0	22.0	35.0	22.0	22.0	
Actuated g/C Ratio	0.30	0.30		0.13	0.47		0.22	0.22	0.35	0.22	0.22	
Clearance Time (s)	4.0	4.0		2.0			4.0	4.0	2.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0			3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	51	704		157	1074		47	259	387	145	277	
v/s Ratio Prot		0.43		c0.20	0.38			0.15	0.03		0.28	
v/s Ratio Perm	c0.52						c0.44		0.07	0.15		
v/c Ratio	1.75	1.42		1.57	0.81		2.02	0.70	0.26	0.66	1.26	
Uniform Delay, d1	35.0	35.0		43.5	22.7		39.0	36.0	23.3	35.6	39.0	
Progression Factor	1.57	1.58		1.00	1.00		1.07	1.08	0.44	1.00	1.00	
Incremental Delay, d2	353.4	189.9		283.6	4.7		504.4	5.5	0.2	10.8	142.8	
Delay (s)	408.4	245.2		327.1	27.4		546.0	44.3	10.5	46.4	181.8	
Level of Service	F	F		F	C		F	D	B	D	F	
Approach Delay (s)		258.5			93.4			111.0			152.6	
Approach LOS		F			F			F			F	

Intersection Summary			
HCM Average Control Delay	160.5	HCM Level of Service	F
HCM Volume to Capacity ratio	1.80		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	35.0
Intersection Capacity Utilization	89.0%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	399	870	666	73	28	249	396	105
v/c Ratio	0.78	0.91	0.72	0.15	0.25	0.56	1.31	0.14
Control Delay	26.0	43.8	32.4	6.4	31.6	31.4	191.8	8.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.0	43.8	32.4	6.4	31.6	31.4	191.8	8.9
Queue Length 50th (ft)	121	244	174	0	12	113	~293	25
Queue Length 95th (ft)	#268	#363	239	30	36	185	#433	45
Internal Link Dist (ft)		360	496			755	339	
Turn Bay Length (ft)	200				50			100
Base Capacity (vph)	512	961	922	482	112	445	302	755
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.78	0.91	0.72	0.15	0.25	0.56	1.31	0.14

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1600	1600	1600
Lane Width	10	10	10	10	10	10	11	12	12	11	11	14
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	0.95			0.95	1.00	1.00	1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00			1.00	1.00	1.00	0.94			1.00	1.00
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00	1.00			0.97	1.00
Frt	1.00	0.99			1.00	0.85	1.00	0.97			1.00	0.85
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00			0.99	1.00
Satd. Flow (prot)	1501	2966			3002	1343	1510	1505			1307	1280
Flt Permitted	0.25	1.00			0.95	1.00	0.24	1.00			0.79	1.00
Satd. Flow (perm)	395	2966			2861	1343	389	1505			1046	1280
Volume (vph)	375	760	57	2	651	72	25	178	41	60	276	89
Peak-hour factor, PHF	0.94	0.94	0.94	0.98	0.98	0.98	0.88	0.88	0.88	0.85	0.85	0.85
Adj. Flow (vph)	399	809	61	2	664	73	28	202	47	71	325	105
RTOR Reduction (vph)	0	6	0	0	0	50	0	9	0	0	0	0
Lane Group Flow (vph)	399	864	0	0	666	23	28	240	0	0	396	105
Confl. Peds. (#/hr)									300	300		
Confl. Bikes (#/hr)			1						1			81
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	4%	4%	4%	2%	2%	2%
Turn Type	pm+pt			Perm		Perm	Perm			Perm		pt+ov
Protected Phases	1	3			3			4			4	1 4
Permitted Phases	3			3		3	4			4		
Actuated Green, G (s)	49.9	27.9			27.9	27.9	25.1	25.1			25.1	52.1
Effective Green, g (s)	51.9	28.9			28.9	28.9	26.1	26.1			26.1	53.1
Actuated g/C Ratio	0.58	0.32			0.32	0.32	0.29	0.29			0.29	0.59
Clearance Time (s)	5.0	5.0			5.0	5.0	5.0	5.0			5.0	
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0			3.0	
Lane Grp Cap (vph)	510	952			919	431	113	436			303	755
v/s Ratio Prot	c0.20	c0.29						0.16				0.08
v/s Ratio Perm	0.25				0.23	0.02	0.07				c0.38	
v/c Ratio	0.78	0.91			0.72	0.05	0.25	0.55			1.31	0.14
Uniform Delay, d1	12.9	29.3			27.0	21.1	24.4	27.0			32.0	8.2
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2	7.7	12.1			2.9	0.1	5.2	4.9			160.0	0.4
Delay (s)	20.6	41.3			29.9	21.2	29.6	31.9			191.9	8.6
Level of Service	C	D			C	C	C	C			F	A
Approach Delay (s)		34.8			29.0			31.7			153.5	
Approach LOS		C			C			C			F	

Intersection Summary			
HCM Average Control Delay	54.3	HCM Level of Service	D
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	97.1%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	608	132	175	898	289	245	163
v/c Ratio	1.57	0.51	0.37	0.56	0.85	0.40	0.31
Control Delay	302.3	57.9	32.1	34.3	61.1	22.9	21.0
Queue Delay	0.0	0.0	0.0	0.4	0.0	0.0	0.0
Total Delay	302.3	57.9	32.1	34.7	61.1	22.9	21.0
Queue Length 50th (ft)	~330	90	101	281	209	104	66
Queue Length 95th (ft)	m#401	m129	m#140	m417	m287	m158	110
Internal Link Dist (ft)	176			771		331	256
Turn Bay Length (ft)		150	150		100		
Base Capacity (vph)	387	261	468	1609	373	663	576
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	258	0	0	3
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.57	0.51	0.37	0.66	0.77	0.37	0.28

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	12	12	12	15	11	14	14	14
Total Lost time (s)		4.0	4.0	4.0	4.0		4.0	4.0			4.0	
Lane Util. Factor		0.95	1.00	1.00	0.95		1.00	1.00			1.00	
Frt		1.00	0.85	1.00	1.00		1.00	0.91			0.94	
Flt Protected		1.00	1.00	0.95	1.00		0.95	1.00			0.99	
Satd. Flow (prot)		2912	1304	1444	3080		1547	1621			1637	
Flt Permitted		0.65	1.00	0.19	1.00		0.60	1.00			0.88	
Satd. Flow (perm)		1909	1304	281	3080		984	1621			1455	
Volume (vph)	14	540	120	170	845	26	254	79	136	39	43	73
Peak-hour factor, PHF	0.91	0.91	0.91	0.97	0.97	0.97	0.88	0.88	0.88	0.95	0.95	0.95
Adj. Flow (vph)	15	593	132	175	871	27	289	90	155	41	45	77
RTOR Reduction (vph)	0	0	0	0	0	0	0	52	0	0	27	0
Lane Group Flow (vph)	0	608	132	175	898	0	289	193	0	0	136	0
Heavy Vehicles (%)	4%	4%	4%	5%	5%	5%	5%	5%	5%	3%	3%	3%
Turn Type	Perm		Perm	D.P+P			Perm			Perm		
Protected Phases		1		4	1 4			3			3	
Permitted Phases	1		1	1			3			3		
Actuated Green, G (s)		21.6	21.6	56.3	60.3		41.3	41.3			41.3	
Effective Green, g (s)		21.6	21.6	56.3	60.3		41.3	41.3			41.3	
Actuated g/C Ratio		0.18	0.18	0.47	0.50		0.34	0.34			0.34	
Clearance Time (s)		4.0	4.0	4.0			4.0	4.0			4.0	
Vehicle Extension (s)		3.0	3.0	3.0			3.0	3.0			3.0	
Lane Grp Cap (vph)		344	235	468	1548		339	558			501	
v/s Ratio Prot				0.11	c0.29			0.12				
v/s Ratio Perm		c0.32	0.10	0.07			c0.29				0.09	
v/c Ratio		1.77	0.56	0.37	0.58		0.85	0.35			0.27	
Uniform Delay, d1		49.2	44.9	20.7	21.0		36.5	29.3			28.5	
Progression Factor		1.17	1.21	1.40	1.40		1.09	1.15			1.00	
Incremental Delay, d2		353.6	6.7	1.6	1.1		17.9	0.4			0.3	
Delay (s)		411.3	61.2	30.6	30.4		57.8	34.0			28.8	
Level of Service		F	E	C	C		E	C			C	
Approach Delay (s)		348.8			30.4			46.9			28.8	
Approach LOS		F			C			D			C	

Intersection Summary			
HCM Average Control Delay	127.7	HCM Level of Service	F
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	22.4
Intersection Capacity Utilization	82.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	619	30	0	1172	0	56
Peak Hour Factor	0.90	0.90	0.97	0.97	0.80	0.80
Hourly flow rate (vph)	688	33	0	1208	0	70
Pedestrians	89			89	89	
Lane Width (ft)	11.0			10.0	14.0	
Walking Speed (ft/s)	4.0			4.0	4.0	
Percent Blockage	7			6	9	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)	94			256		
pX, platoon unblocked			0.88		0.87	0.88
vC, conflicting volume			810		1487	539
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			644		985	334
tC, single (s)			4.1		7.0	7.1
tC, 2 stage (s)						
tF (s)			2.2		3.6	3.4
p0 queue free %			100		100	85
cM capacity (veh/h)			751		169	476

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	459	263	604	604	70
Volume Left	0	0	0	0	0
Volume Right	0	33	0	0	70
cSH	1700	1700	1700	1700	476
Volume to Capacity	0.27	0.15	0.36	0.36	0.15
Queue Length 95th (ft)	0	0	0	0	13
Control Delay (s)	0.0	0.0	0.0	0.0	13.9
Lane LOS					B
Approach Delay (s)	0.0		0.0		13.9
Approach LOS					B

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	55.5%	ICU Level of Service	B
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	120	408	494	733	938	1381
v/c Ratio	2.26	0.64	1.54	0.63	1.07	1.13
Control Delay	648.2	47.3	281.4	27.6	86.2	103.5
Queue Delay	0.0	0.0	0.0	2.7	0.0	0.0
Total Delay	648.2	47.3	281.4	30.4	86.2	103.5
Queue Length 50th (ft)	~151	151	~444	279	~440	~698
Queue Length 95th (ft)	#275	207	m#620	m202	#574	#795
Internal Link Dist (ft)		849		14	255	366
Turn Bay Length (ft)						
Base Capacity (vph)	53	642	321	1164	873	1223
Starvation Cap Reductn	0	0	0	307	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	2.26	0.64	1.54	0.86	1.07	1.13

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	10	10	10	11	11	11	10	10	10
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			0.95			0.95	
Frt	1.00	1.00		1.00	1.00			0.96			1.00	
Flt Protected	0.95	1.00		0.95	1.00			1.00			1.00	
Satd. Flow (prot)	1510	2854		1486	2969			2999			2990	
Flt Permitted	0.15	1.00		0.34	1.00			0.74			1.00	
Satd. Flow (perm)	243	2854		535	2969			2233			2990	
Volume (vph)	116	389	7	479	704	7	13	607	261	0	1168	33
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.94	0.94	0.94	0.87	0.87	0.87
Adj. Flow (vph)	120	401	7	494	726	7	14	646	278	0	1343	38
RTOR Reduction (vph)	0	0	0	0	1	0	0	33	0	0	1	0
Lane Group Flow (vph)	120	408	0	494	732	0	0	905	0	0	1380	0
Heavy Vehicles (%)	4%	4%	4%	2%	2%	2%	0%	0%	0%	1%	1%	1%
Parking (#/hr)		1	1									
Turn Type	Perm			D.P+P			Perm					
Protected Phases		1		4	1 4			3			3	
Permitted Phases	1			1			3					
Actuated Green, G (s)	24.2	24.2		38.2	44.2			47.0			47.0	
Effective Green, g (s)	26.2	26.2		42.2	46.2			49.0			49.0	
Actuated g/C Ratio	0.22	0.22		0.35	0.38			0.41			0.41	
Clearance Time (s)	6.0	6.0		6.0				6.0			6.0	
Vehicle Extension (s)	3.0	3.0		3.0				3.0			3.0	
Lane Grp Cap (vph)	53	623		315	1143			912			1221	
v/s Ratio Prot		0.14		c0.21	0.25						c0.46	
v/s Ratio Perm	c0.49			0.34				0.41				
v/c Ratio	2.26	0.65		1.57	0.64			0.99			1.13	
Uniform Delay, d1	46.9	42.8		35.2	30.1			35.3			35.5	
Progression Factor	1.00	1.00		1.00	0.86			1.00			1.00	
Incremental Delay, d2	624.3	5.3		267.8	2.2			28.0			69.3	
Delay (s)	671.2	48.1		303.0	28.0			63.3			104.8	
Level of Service	F	D		F	C			E			F	
Approach Delay (s)		189.7			138.7			63.3			104.8	
Approach LOS		F			F			E			F	

Intersection Summary			
HCM Average Control Delay	116.5	HCM Level of Service	F
HCM Volume to Capacity ratio	1.53		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	28.8
Intersection Capacity Utilization	90.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	0	157	0	3	38	5	0	0	3	45	0	12
Peak Hour Factor	0.86	0.86	0.86	0.71	0.71	0.71	0.75	0.75	0.75	0.78	0.78	0.78
Hourly flow rate (vph)	0	183	0	4	54	7	0	0	4	58	0	15

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	183	65	4	73
Volume Left (vph)	0	4	0	58
Volume Right (vph)	0	7	4	15
Hadj (s)	0.00	-0.02	-0.60	0.10
Departure Headway (s)	4.2	4.3	3.9	4.5
Degree Utilization, x	0.21	0.08	0.00	0.09
Capacity (veh/h)	848	822	847	741
Control Delay (s)	8.3	7.6	6.9	8.0
Approach Delay (s)	8.3	7.6	6.9	8.0
Approach LOS	A	A	A	A

Intersection Summary			
Delay	8.1		
HCM Level of Service	A		
Intersection Capacity Utilization	33.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	37	58	13	110	6	117	5	255	79	70	241	50
Peak Hour Factor	0.88	0.88	0.88	0.94	0.94	0.94	0.89	0.89	0.89	0.87	0.87	0.87
Hourly flow rate (vph)	42	66	15	117	6	124	6	287	89	80	277	57
Pedestrians		227			258			258			258	
Lane Width (ft)		13.0			13.0			12.0			10.5	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		20			23			22			19	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								270			411	
pX, platoon unblocked	0.94	0.94	0.94	0.94	0.94		0.94					
vC, conflicting volume	1421	1338	791	1344	1323	847	561			633		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1446	1358	778	1364	1342	847	535			633		
tC, single (s)	7.2	6.6	6.4	7.1	6.5	6.2	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.1	3.4	3.5	4.0	3.3	2.3			2.2		
p0 queue free %	0	7	93	0	92	45	99			89		
cM capacity (veh/h)	17	71	222	9	78	227	753			732		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total	123	248	381	80	334
Volume Left	42	117	6	80	0
Volume Right	15	124	89	0	57
cSH	35	18	753	732	1700
Volume to Capacity	3.47	13.87	0.01	0.11	0.20
Queue Length 95th (ft)	Err	Err	1	9	0
Control Delay (s)	Err	Err	0.2	10.5	0.0
Lane LOS	F	F	A	B	
Approach Delay (s)	Err	Err	0.2	2.0	
Approach LOS	F	F			

Intersection Summary			
Average Delay	3177.7		
Intersection Capacity Utilization	77.3%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	65	0	56	89	16	5
Peak Hour Factor	0.83	0.83	0.55	0.55	0.86	0.86
Hourly flow rate (vph)	78	0	102	162	19	6
Pedestrians	39		31			39
Lane Width (ft)	12.0		12.0			12.0
Walking Speed (ft/s)	4.0		4.0			4.0
Percent Blockage	3		3			3
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	296	261			303	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	296	261			303	
tC, single (s)	6.4	6.2			4.4	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.5	
p0 queue free %	88	100			98	
cM capacity (veh/h)	648	733			1083	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	78	264	24
Volume Left	78	0	19
Volume Right	0	162	0
cSH	648	1700	1083
Volume to Capacity	0.12	0.16	0.02
Queue Length 95th (ft)	10	0	1
Control Delay (s)	11.3	0.0	6.4
Lane LOS	B		A
Approach Delay (s)	11.3	0.0	6.4
Approach LOS	B		

Intersection Summary			
Average Delay	2.8		
Intersection Capacity Utilization	33.3%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	NBT	SBL	SBT
Lane Group Flow (vph)	169	375	50	397
v/c Ratio	0.84	0.40	0.10	0.35
Control Delay	70.3	9.8	5.3	5.9
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	70.3	9.8	5.3	5.9
Queue Length 50th (ft)	114	94	6	42
Queue Length 95th (ft)	152	226	21	182
Internal Link Dist (ft)	167	410		190
Turn Bay Length (ft)			150	
Base Capacity (vph)	273	947	513	1132
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.62	0.40	0.10	0.35

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	16	12	12	12	12	12	12	12	12	10	12	12
Total Lost time (s)		4.0						4.0		4.0	4.0	
Lane Util. Factor		1.00						1.00		1.00	1.00	
Frpb, ped/bikes		0.96						0.94		1.00	0.96	
Flpb, ped/bikes		0.56						1.00		0.88	1.00	
Frt		0.96						0.97		1.00	0.97	
Flt Protected		0.97						1.00		0.95	1.00	
Satd. Flow (prot)		842						1332		1302	1561	
Flt Permitted		0.97						0.98		0.53	1.00	
Satd. Flow (perm)		842						1304		728	1561	
Volume (vph)	98	0	42	0	0	0	16	254	83	42	264	70
Peak-hour factor, PHF	0.83	0.83	0.83	0.25	0.25	0.25	0.94	0.94	0.94	0.84	0.84	0.84
Adj. Flow (vph)	118	0	51	0	0	0	17	270	88	50	314	83
RTOR Reduction (vph)	0	15	0	0	0	0	0	7	0	0	6	0
Lane Group Flow (vph)	0	154	0	0	0	0	0	368	0	50	391	0
Confl. Peds. (#/hr)	304		35	35		304	45		66	66		45
Heavy Vehicles (%)	1%	1%	1%	0%	0%	0%	16%	16%	16%	2%	2%	2%
Turn Type	Perm						Perm			Perm		
Protected Phases		2						1			1	
Permitted Phases	2						1			1		
Actuated Green, G (s)		26.5						85.5		85.5	85.5	
Effective Green, g (s)		26.5						85.5		85.5	85.5	
Actuated g/C Ratio		0.22						0.71		0.71	0.71	
Clearance Time (s)		4.0						4.0		4.0	4.0	
Vehicle Extension (s)		3.0						3.0		3.0	3.0	
Lane Grp Cap (vph)		186						929		519	1112	
v/s Ratio Prot											0.25	
v/s Ratio Perm		0.18						c0.28		0.07		
v/c Ratio		0.83						0.40		0.10	0.35	
Uniform Delay, d1		44.6						6.9		5.3	6.6	
Progression Factor		1.00						1.00		0.60	0.62	
Incremental Delay, d2		25.2						1.3		0.4	0.9	
Delay (s)		69.8						8.2		3.6	5.0	
Level of Service		E						A		A	A	
Approach Delay (s)		69.8			0.0			8.2			4.8	
Approach LOS		E			A			A			A	

Intersection Summary			
HCM Average Control Delay	17.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	59.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	47	127	68	24	7	57	13	38	14	0	51	35
Peak Hour Factor	0.85	0.85	0.85	0.68	0.68	0.68	0.72	0.72	0.72	0.67	0.67	0.67
Hourly flow rate (vph)	55	149	80	35	10	84	18	53	19	0	76	52

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	285	129	90	128
Volume Left (vph)	55	35	18	0
Volume Right (vph)	80	84	19	52
Hadj (s)	-0.13	-0.03	-0.07	-0.24
Departure Headway (s)	4.5	4.8	5.0	4.8
Degree Utilization, x	0.35	0.17	0.13	0.17
Capacity (veh/h)	759	704	655	686
Control Delay (s)	9.9	8.7	8.7	8.7
Approach Delay (s)	9.9	8.7	8.7	8.7
Approach LOS	A	A	A	A

Intersection Summary			
Delay	9.3		
HCM Level of Service	A		
Intersection Capacity Utilization	38.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	17	0	62	31	10	84	26	273	0	0	228	19
Peak Hour Factor	0.72	0.72	0.72	0.83	0.83	0.83	0.89	0.89	0.89	0.83	0.83	0.83
Hourly flow rate (vph)	24	0	86	37	12	101	29	307	0	0	275	23
Pedestrians		80			101			101			90	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		7			8			8			8	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								452			490	
pX, platoon unblocked												
vC, conflicting volume	929	832	467	939	844	498	378			408		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	929	832	467	939	844	498	378			408		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.3			2.2		
p0 queue free %	83	100	83	75	95	79	97			100		
cM capacity (veh/h)	141	251	506	149	251	488	1062			1054		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	52	57	151	336	298
Volume Left	24	0	37	29	0
Volume Right	29	57	101	0	23
cSH	234	506	298	1062	1700
Volume to Capacity	0.22	0.11	0.51	0.03	0.18
Queue Length 95th (ft)	21	10	67	2	0
Control Delay (s)	24.8	13.0	28.8	1.0	0.0
Lane LOS	C	B	D	A	
Approach Delay (s)	18.6		28.8	1.0	0.0
Approach LOS	C		D		

Intersection Summary			
Average Delay	7.5		
Intersection Capacity Utilization	61.2%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	32	29	0	0	47	11	24	30	13	37	0	111
Peak Hour Factor	0.75	0.75	0.75	0.81	0.81	0.81	0.82	0.82	0.82	0.70	0.70	0.70
Hourly flow rate (vph)	43	39	0	0	58	14	29	37	16	53	0	159
Pedestrians		46			51			45			51	
Lane Width (ft)		11.0			11.0			16.0			11.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		4			4			5			4	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								376				
pX, platoon unblocked												
vC, conflicting volume	428	393	170	403	464	147	205			103		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	428	393	170	403	464	147	205			103		
tC, single (s)	7.2	6.6	6.3	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.1	3.4	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	89	92	100	100	87	98	98			96		
cM capacity (veh/h)	392	468	789	430	431	829	1331			1442		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	81	72	82	211
Volume Left	43	0	29	53
Volume Right	0	14	16	159
cSH	424	474	1331	1442
Volume to Capacity	0.19	0.15	0.02	0.04
Queue Length 95th (ft)	17	13	2	3
Control Delay (s)	15.5	13.9	2.9	2.1
Lane LOS	C	B	A	A
Approach Delay (s)	15.5	13.9	2.9	2.1
Approach LOS	C	B		

Intersection Summary			
Average Delay	6.6		
Intersection Capacity Utilization	33.6%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	WBL	WBT	NBT	SBT	SBR2	NER2
Lane Group Flow (vph)	664	97	932	399	343	36	146
v/c Ratio	1.52	0.64	0.95	2.43	1.52	0.17	1.16
Control Delay	276.1	21.2	30.9	682.2	288.6	37.1	171.4
Queue Delay	3.1	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	279.2	21.2	30.9	682.2	288.6	37.1	171.4
Queue Length 50th (ft)	~310	47	339	~400	~307	20	~111
Queue Length 95th (ft)	#442	m48	m311	#587	#481	49	#184
Internal Link Dist (ft)	165		1295	704	372		
Turn Bay Length (ft)		50				50	
Base Capacity (vph)	437	152	981	164	225	212	126
Starvation Cap Reductn	2	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.53	0.64	0.95	2.43	1.52	0.17	1.16

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	EBR2	WBL2	WBL	WBT	WBR	NBL2	NBL	NBT	NBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)		4.0				4.0	4.0				4.0	
Lane Util. Factor		0.95				0.91	0.91				1.00	
Frt		0.96				1.00	0.98				0.99	
Flt Protected		1.00				0.95	1.00				0.97	
Satd. Flow (prot)		2662				1353	2885				1352	
Flt Permitted		0.71				0.17	1.00				0.17	
Satd. Flow (perm)		1899				248	2885				234	
Volume (vph)	9	471	119	32	54	38	783	93	31	167	167	18
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.94	0.94	0.94	0.94	0.96	0.96	0.96	0.96
Adj. Flow (vph)	9	496	125	34	57	40	833	99	32	174	174	19
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	664	0	0	0	97	932	0	0	0	399	0
Heavy Vehicles (%)	4%	4%	4%	4%	2%	2%	2%	2%	3%	3%	3%	3%
Bus Blockages (#/hr)	0	0	0	0	0	0	3	3	0	0	7	7
Parking (#/hr)		1	1	1						1	1	1
Turn Type	Perm				D.P+P	D.P+P			D.P+P	D.P+P		
Protected Phases		1			9	9	1 9		3	3	3 4	
Permitted Phases	1				1	1			4	4		
Actuated Green, G (s)		22.0				29.0	29.0				26.0	
Effective Green, g (s)		23.0				30.0	30.0				27.0	
Actuated g/C Ratio		0.23				0.30	0.30				0.27	
Clearance Time (s)		5.0				4.0						
Vehicle Extension (s)		3.0				3.0						
Lane Grp Cap (vph)		437				152	981				164	
v/s Ratio Prot						0.04	c0.07				c0.22	
v/s Ratio Perm		c0.35				0.15	0.26				c0.44	
v/c Ratio		1.52				0.64	0.95				2.43	
Uniform Delay, d1		38.5				27.6	34.3				36.5	
Progression Factor		1.06				0.71	0.83				1.00	
Incremental Delay, d2		245.0				0.8	2.6				662.9	
Delay (s)		285.7				20.4	31.2				699.4	
Level of Service		F				C	C				F	
Approach Delay (s)		285.7					30.2				699.4	
Approach LOS		F					C				F	

Intersection Summary			
HCM Average Control Delay	240.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.91		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	43.0
Intersection Capacity Utilization	101.4%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBL	SBT	SBR	SBR2	NER2
Lane Configurations					
Ideal Flow (vphpl)	1900	1900	1900	1900	1900
Lane Width	11	16	11	11	14
Total Lost time (s)		4.0		4.0	4.0
Lane Util. Factor		1.00		1.00	1.00
Frt		0.98		0.85	0.86
Flt Protected		0.99		1.00	1.00
Satd. Flow (prot)		1569		1175	1396
Flt Permitted		0.79		1.00	1.00
Satd. Flow (perm)		1251		1175	1396
Volume (vph)	97	198	41	35	111
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.76
Adj. Flow (vph)	99	202	42	36	146
RTOR Reduction (vph)	0	0	0	0	0
Lane Group Flow (vph)	0	343	0	36	146
Heavy Vehicles (%)	7%	7%	7%	7%	13%
Bus Blockages (#/hr)	0	0	0	0	0
Parking (#/hr)		1	1	1	
Turn Type	Perm			Prot	Over
Protected Phases		4		4	3
Permitted Phases	4				
Actuated Green, G (s)		17.0		17.0	9.0
Effective Green, g (s)		18.0		18.0	9.0
Actuated g/C Ratio		0.18		0.18	0.09
Clearance Time (s)		5.0		5.0	4.0
Vehicle Extension (s)		3.0		3.0	3.0
Lane Grp Cap (vph)		225		212	126
v/s Ratio Prot				0.03	0.10
v/s Ratio Perm		0.27			
v/c Ratio		1.52		0.17	1.16
Uniform Delay, d1		41.0		34.7	45.5
Progression Factor		1.00		1.00	1.00
Incremental Delay, d2		257.3		1.7	129.1
Delay (s)		298.3		36.4	174.6
Level of Service		F		D	F
Approach Delay (s)		273.4			
Approach LOS		F			

Intersection Summary

Lane Group	EBT	WBT
Lane Group Flow (vph)	679	1071
v/c Ratio	0.28	0.35
Control Delay	0.3	0.1
Queue Delay	0.1	0.0
Total Delay	0.4	0.1
Queue Length 50th (ft)	0	0
Queue Length 95th (ft)	0	m0
Internal Link Dist (ft)	373	165
Turn Bay Length (ft)		
Base Capacity (vph)	2383	3037
Starvation Cap Reductn	0	0
Spillback Cap Reductn	587	127
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.38	0.37

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	11	11	12	12	12
Total Lost time (s)		4.0	4.0			
Lane Util. Factor		0.95	0.95			
Frt		1.00	1.00			
Flt Protected		1.00	1.00			
Satd. Flow (prot)		2764	3037			
Flt Permitted		0.86	1.00			
Satd. Flow (perm)		2387	3037			
Volume (vph)	32	606	959	27	0	0
Peak-hour factor, PHF	0.94	0.94	0.92	0.92	0.75	0.75
Adj. Flow (vph)	34	645	1042	29	0	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	679	1071	0	0	0
Heavy Vehicles (%)	5%	5%	3%	3%	0%	0%
Bus Blockages (#/hr)	0	6	0	0	0	0
Parking (#/hr)		5		5		
Turn Type	Perm					
Protected Phases		1	1			
Permitted Phases	1					
Actuated Green, G (s)		100.0	100.0			
Effective Green, g (s)		100.0	100.0			
Actuated g/C Ratio		1.00	1.00			
Clearance Time (s)		4.0	4.0			
Vehicle Extension (s)		3.0	3.0			
Lane Grp Cap (vph)		2387	3037			
v/s Ratio Prot			c0.35			
v/s Ratio Perm		0.28				
v/c Ratio		0.28	0.35			
Uniform Delay, d1		0.0	0.0			
Progression Factor		1.00	1.00			
Incremental Delay, d2		0.3	0.0			
Delay (s)		0.3	0.0			
Level of Service		A	A			
Approach Delay (s)		0.3	0.0		0.0	
Approach LOS		A	A		A	

Intersection Summary			
HCM Average Control Delay	0.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	48.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	SET	NWT	NET	SWT
Lane Group Flow (vph)	672	988	42	265
v/c Ratio	0.42	0.48	0.18	0.76
Control Delay	7.6	7.2	28.3	38.2
Queue Delay	0.0	0.2	0.0	0.0
Total Delay	7.6	7.4	28.3	38.2
Queue Length 50th (ft)	74	65	19	109
Queue Length 95th (ft)	157	411	30	144
Internal Link Dist (ft)	339	373	163	400
Turn Bay Length (ft)				
Base Capacity (vph)	1606	2049	268	389
Starvation Cap Reductn	0	294	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.42	0.56	0.16	0.68

Intersection Summary

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	11	12	12	11	12	12	12	12	12	16	12
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		0.95			0.95			1.00			1.00	
Frt		1.00			1.00			0.98			0.91	
Flt Protected		1.00			1.00			0.96			0.98	
Satd. Flow (prot)		2815			2850			1617			1544	
Flt Permitted		0.83			1.00			0.66			0.87	
Satd. Flow (perm)		2346			2850			1105			1373	
Volume (vph)	41	571	0	0	911	18	20	3	4	71	0	141
Peak-hour factor, PHF	0.91	0.91	0.91	0.94	0.94	0.94	0.65	0.65	0.65	0.80	0.80	0.80
Adj. Flow (vph)	45	627	0	0	969	19	31	5	6	89	0	176
RTOR Reduction (vph)	0	0	0	0	1	0	0	5	0	0	72	0
Lane Group Flow (vph)	0	672	0	0	987	0	0	37	0	0	193	0
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	6	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)		5			5						2	
Turn Type	Perm						Perm			Perm		
Protected Phases		1			1			3			3	
Permitted Phases	1						3			3		
Actuated Green, G (s)		71.9			71.9			20.1			20.1	
Effective Green, g (s)		71.9			71.9			20.1			20.1	
Actuated g/C Ratio		0.72			0.72			0.20			0.20	
Clearance Time (s)		4.0			4.0			4.0			4.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		1687			2049			222			276	
v/s Ratio Prot					c0.35							
v/s Ratio Perm		0.29						0.03			c0.14	
v/c Ratio		0.40			0.48			0.17			0.70	
Uniform Delay, d1		5.5			6.0			33.0			37.1	
Progression Factor		1.00			0.89			1.00			1.01	
Incremental Delay, d2		0.7			0.8			0.4			7.5	
Delay (s)		6.2			6.2			33.4			45.1	
Level of Service		A			A			C			D	
Approach Delay (s)		6.2			6.2			33.4			45.1	
Approach LOS		A			A			C			D	

Intersection Summary			
HCM Average Control Delay	12.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	71.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	79	658	149	861	166	167	162	308
v/c Ratio	0.41	0.48	0.75	1.14	0.56	0.41	0.90	0.77
Control Delay	52.7	5.9	65.1	107.8	29.7	32.8	82.2	43.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	52.7	5.9	65.1	107.8	29.7	32.8	82.2	43.9
Queue Length 50th (ft)	48	59	91	~689	79	85	96	161
Queue Length 95th (ft)	m41	m43	#169	#892	154	139	#214	261
Internal Link Dist (ft)		1295		1669		389		1718
Turn Bay Length (ft)	85		75					
Base Capacity (vph)	215	1380	221	753	296	447	197	438
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.37	0.48	0.67	1.14	0.56	0.37	0.82	0.70

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	11	11	10	11	11	16	16	16	11	11	11
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00		1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.97		1.00	1.00	0.46		0.99		1.00	0.93	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		0.99		0.72	1.00	
Frt	1.00	0.99		1.00	1.00	0.85		1.00		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.99		0.95	1.00	
Satd. Flow (prot)	1430	2865		1472	1566	617		1636		1116	1436	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.88		0.56	1.00	
Satd. Flow (perm)	1430	2865		1472	1566	617		1447		656	1436	
Volume (vph)	76	600	32	131	758	146	19	121	5	154	193	100
Peak-hour factor, PHF	0.96	0.96	0.96	0.88	0.88	0.88	0.87	0.87	0.87	0.95	0.95	0.95
Adj. Flow (vph)	79	625	33	149	861	166	22	139	6	162	203	105
RTOR Reduction (vph)	0	4	0	0	0	0	0	0	0	0	19	0
Lane Group Flow (vph)	79	654	0	149	861	166	0	167	0	162	289	0
Confl. Peds. (#/hr)	190		160	160		190	158		725	725		158
Confl. Bikes (#/hr)			15			23			1			10
Heavy Vehicles (%)	6%	6%	6%	3%	3%	3%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	6	6	0	0	0	0	0	0
Parking (#/hr)							1	1	1			
Turn Type	Prot			Prot		Perm	Perm			Perm		
Protected Phases	1	2		1	2			3			3	
Permitted Phases						2	3			3		
Actuated Green, G (s)	13.4	47.1		13.4	47.1	47.1		25.5		25.5	25.5	
Effective Green, g (s)	13.4	48.1		13.4	48.1	48.1		26.5		26.5	26.5	
Actuated g/C Ratio	0.13	0.48		0.13	0.48	0.48		0.26		0.26	0.26	
Clearance Time (s)	4.0	5.0		4.0	5.0	5.0		5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	192	1378		197	753	297		383		174	381	
v/s Ratio Prot	0.06	0.23		c0.10	c0.55						0.20	
v/s Ratio Perm						0.27		0.12		c0.25		
v/c Ratio	0.41	0.47		0.76	1.14	0.56		0.44		0.93	0.76	
Uniform Delay, d1	39.7	17.5		41.7	25.9	18.4		30.5		35.9	33.8	
Progression Factor	1.32	0.31		1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	0.1	0.1		15.2	79.9	7.4		0.8		48.4	8.4	
Delay (s)	52.7	5.5		56.9	105.9	25.8		31.3		84.3	42.2	
Level of Service	D	A		E	F	C		C		F	D	
Approach Delay (s)		10.6			88.4			31.3			56.7	
Approach LOS		B			F			C			E	

Intersection Summary			
HCM Average Control Delay	56.3	HCM Level of Service	E
HCM Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	96.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	221	132	159	620	463
v/c Ratio	0.82	0.54	0.43	0.73	0.40
Control Delay	49.7	51.0	9.2	36.8	18.5
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	49.7	51.0	9.2	36.8	18.5
Queue Length 50th (ft)	121	95	0	247	141
Queue Length 95th (ft)	m160	133	45	#388	m132
Internal Link Dist (ft)	821	168		1718	335
Turn Bay Length (ft)					
Base Capacity (vph)	442	450	543	846	1150
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.50	0.29	0.29	0.73	0.40

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1600	1600	1600	1600	1600	1600
Lane Width	13	13	13	12	12	10	10	11	11	10	10	10
Total Lost time (s)		4.0			4.0	4.0		4.0			4.0	
Lane Util. Factor		1.00			1.00	1.00		0.95			0.95	
Frpb, ped/bikes		0.99			1.00	0.98		0.98			0.92	
Flpb, ped/bikes		1.00			1.00	1.00		0.97			0.99	
Frt		0.92			1.00	0.85		0.99			0.97	
Flt Protected		0.99			0.98	1.00		0.99			1.00	
Satd. Flow (prot)		1315			1642	1309		2221			2135	
Flt Permitted		0.80			0.63	1.00		0.83			0.88	
Satd. Flow (perm)		1066			1059	1309		1855			1879	
Volume (vph)	45	27	107	48	65	137	66	488	22	32	292	69
Peak-hour factor, PHF	0.81	0.81	0.81	0.86	0.86	0.86	0.93	0.93	0.93	0.85	0.85	0.85
Adj. Flow (vph)	56	33	132	56	76	159	71	525	24	38	344	81
RTOR Reduction (vph)	0	55	0	0	0	130	0	2	0	0	10	0
Lane Group Flow (vph)	0	166	0	0	132	29	0	618	0	0	453	0
Confl. Peds. (#/hr)							500		500	500		500
Confl. Bikes (#/hr)			1			3			76			11
Heavy Vehicles (%)	21%	21%	21%	2%	2%	2%	8%	8%	8%	6%	6%	6%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	17	17	0	0	0
Turn Type	Perm			Perm		Perm	Perm			D.P+P		
Protected Phases		3			3			1		10	1 10	
Permitted Phases	3			3		3	1			1		
Actuated Green, G (s)		20.6			20.6	20.6		54.8			71.2	
Effective Green, g (s)		21.6			21.6	21.6		55.8			72.2	
Actuated g/C Ratio		0.18			0.18	0.18		0.46			0.60	
Clearance Time (s)		5.0			5.0	5.0		5.0				
Vehicle Extension (s)		3.0			3.0	3.0		3.0				
Lane Grp Cap (vph)		192			191	236		863			1166	
v/s Ratio Prot											c0.05	
v/s Ratio Perm		c0.16			0.12	0.02		c0.33			0.18	
v/c Ratio		0.86			0.69	0.12		0.72			0.39	
Uniform Delay, d1		47.8			46.1	41.2		25.7			12.4	
Progression Factor		0.86			1.00	1.00		1.00			1.39	
Incremental Delay, d2		30.0			10.3	0.2		5.1			0.1	
Delay (s)		71.3			56.4	41.5		30.8			17.3	
Level of Service		E			E	D		C			B	
Approach Delay (s)		71.3			48.2			30.8			17.3	
Approach LOS		E			D			C			B	

Intersection Summary			
HCM Average Control Delay	35.7	HCM Level of Service	D
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	26.2
Intersection Capacity Utilization	66.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	88	756	210	744	231	242	291	144	182
v/c Ratio	2.00	1.28	1.15	0.79	0.96	0.56	0.46	0.67	0.42
Control Delay	479.0	152.7	143.4	38.8	72.0	28.5	3.1	50.9	34.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Total Delay	479.0	152.7	143.4	38.8	72.0	28.5	3.2	50.9	34.0
Queue Length 50th (ft)	~95	~400	~157	262	92	79	0	95	108
Queue Length 95th (ft)	m#93	m#273	#309	338	m#307	m121	m3	#169	167
Internal Link Dist (ft)		771		938		335			755
Turn Bay Length (ft)	70		350					170	
Base Capacity (vph)	44	590	183	944	241	429	629	216	436
Starvation Cap Reductn	0	0	0	0	0	0	35	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	2.00	1.28	1.15	0.79	0.96	0.56	0.49	0.67	0.42

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
Lane Width	10	10	10	10	10	10	10	10	10	10	10	10
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	*0.95		1.00	0.95		1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	0.96	1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.97		1.00	0.98		1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1240	2360		1205	2361		1193	1256	1028	1252	1275	
Flt Permitted	0.13	1.00		0.13	1.00		0.57	1.00	1.00	0.49	1.00	
Satd. Flow (perm)	174	2360		169	2361		711	1256	1028	640	1275	
Volume (vph)	83	591	119	187	588	74	215	225	271	124	126	30
Peak-hour factor, PHF	0.94	0.94	0.94	0.89	0.89	0.89	0.93	0.93	0.93	0.86	0.86	0.86
Adj. Flow (vph)	88	629	127	210	661	83	231	242	291	144	147	35
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	158	0	0	0
Lane Group Flow (vph)	88	756	0	210	744	0	231	242	133	144	182	0
Confl. Bikes (#/hr)			10			11			78			9
Heavy Vehicles (%)	3%	3%	3%	6%	6%	6%	7%	7%	7%	2%	2%	2%
Bus Blockages (#/hr)	0	10	10	0	0	0	0	0	0	0	0	0
Turn Type	Perm			D.P+P			Perm		pm+ov	Perm		
Protected Phases		1		4	1 4			3	4		3	
Permitted Phases	1			1			3		3	3		
Actuated Green, G (s)	30.0	30.0		46.0	48.0		41.0	41.0	57.0	41.0	41.0	
Effective Green, g (s)	30.0	30.0		44.0	48.0		41.0	41.0	55.0	41.0	41.0	
Actuated g/C Ratio	0.25	0.25		0.37	0.40		0.34	0.34	0.46	0.34	0.34	
Clearance Time (s)	4.0	4.0		2.0			4.0	4.0	2.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0			3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	44	590		183	944		243	429	505	219	436	
v/s Ratio Prot		0.32		c0.13	0.32			0.19	0.03		0.14	
v/s Ratio Perm	c0.51			0.29			c0.32		0.10	0.23		
v/c Ratio	2.00	1.28		1.15	0.79		0.95	0.56	0.26	0.66	0.42	
Uniform Delay, d1	45.0	45.0		32.9	31.5		38.5	32.2	20.0	33.5	30.3	
Progression Factor	0.53	0.53		1.00	1.00		0.73	0.74	0.59	1.00	1.00	
Incremental Delay, d2	457.2	127.8		111.8	4.4		37.0	1.3	0.2	6.9	0.6	
Delay (s)	480.9	151.6		144.7	36.0		65.3	25.2	12.0	40.5	31.0	
Level of Service	F	F		F	D		E	C	B	D	C	
Approach Delay (s)		185.9			59.9			32.3			35.2	
Approach LOS		F			E			C			D	

Intersection Summary			
HCM Average Control Delay	86.6	HCM Level of Service	F
HCM Volume to Capacity ratio	1.36		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	35.0
Intersection Capacity Utilization	80.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	318	469	1190	126	60	480	265	234
v/c Ratio	0.70	0.43	1.13	0.22	0.39	1.18	5.20	0.28
Control Delay	27.7	22.7	100.9	4.8	37.3	136.1	1941.6	12.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.7	22.7	100.9	4.8	37.3	136.1	1941.6	12.1
Queue Length 50th (ft)	115	102	~418	0	29	~331	~266	67
Queue Length 95th (ft)	#214	146	#546	36	62	#463	#420	112
Internal Link Dist (ft)		360	496			755	339	
Turn Bay Length (ft)	200				50			100
Base Capacity (vph)	454	1098	1050	562	154	407	51	836
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.70	0.43	1.13	0.22	0.39	1.18	5.20	0.28

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	12	12	11	11	14
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	0.95			0.95	1.00	1.00	1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00			1.00	0.98	1.00	0.98			1.00	1.00
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00	1.00			0.98	1.00
Frt	1.00	1.00			1.00	0.85	1.00	0.99			1.00	0.85
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00			0.99	1.00
Satd. Flow (prot)	1501	2988			3002	1315	1555	1654			1576	1535
Flt Permitted	0.12	1.00			0.95	1.00	0.39	1.00			0.13	1.00
Satd. Flow (perm)	192	2988			2866	1315	632	1654			208	1535
Volume (vph)	302	433	12	2	1081	115	50	379	19	67	174	213
Peak-hour factor, PHF	0.95	0.95	0.95	0.91	0.91	0.91	0.83	0.83	0.83	0.91	0.91	0.91
Adj. Flow (vph)	318	456	13	2	1188	126	60	457	23	74	191	234
RTOR Reduction (vph)	0	3	0	0	0	80	0	2	0	0	0	0
Lane Group Flow (vph)	318	466	0	0	1190	46	60	478	0	0	265	234
Confl. Peds. (#/hr)									300	300		
Confl. Bikes (#/hr)			4			1			35			5
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Turn Type	pm+pt			Perm		Perm	Perm			Perm		pt+ov
Protected Phases	1	3			3			4			4	1 4
Permitted Phases	3			3		3	4			4		
Actuated Green, G (s)	54.0	32.0			32.0	32.0	21.0	21.0			21.0	48.0
Effective Green, g (s)	56.0	33.0			33.0	33.0	22.0	22.0			22.0	49.0
Actuated g/C Ratio	0.62	0.37			0.37	0.37	0.24	0.24			0.24	0.54
Clearance Time (s)	5.0	5.0			5.0	5.0	5.0	5.0			5.0	
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0			3.0	
Lane Grp Cap (vph)	454	1096			1051	482	154	404			51	836
v/s Ratio Prot	c0.18	0.16						0.29				0.15
v/s Ratio Perm	0.26				c0.42	0.04	0.09				c1.28	
v/c Ratio	0.70	0.43			1.13	0.10	0.39	1.18			5.20	0.28
Uniform Delay, d1	20.0	21.4			28.5	18.7	28.4	34.0			34.0	11.0
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2	4.8	0.3			71.7	0.1	7.3	104.8			1931.0	0.8
Delay (s)	24.9	21.7			100.2	18.8	35.7	138.8			1965.0	11.9
Level of Service	C	C			F	B	D	F			F	B
Approach Delay (s)		22.9			92.4			127.3			1049.1	
Approach LOS		C			F			F			F	

Intersection Summary			
HCM Average Control Delay	232.9	HCM Level of Service	F
HCM Volume to Capacity ratio	2.16		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	103.3%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

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Lane Group	EBT	EBR	WBL	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	970	242	273	543	203	241	191
v/c Ratio	1.09	0.43	1.74	0.36	1.08	0.39	0.64
Control Delay	72.6	15.0	365.1	4.3	125.0	21.9	42.4
Queue Delay	57.9	1.0	0.0	0.0	0.0	0.0	0.0
Total Delay	130.5	16.0	365.1	4.3	125.0	21.9	42.4
Queue Length 50th (ft)	~380	83	~183	42	126	74	83
Queue Length 95th (ft)	m#396	m88	m#223	m49	m#249	m106	#258
Internal Link Dist (ft)	176			771		331	256
Turn Bay Length (ft)		150	150		100		
Base Capacity (vph)	890	559	157	1494	188	619	297
Starvation Cap Reductn	98	139	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.22	0.58	1.74	0.36	1.08	0.39	0.64

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	12	12	12	15	11	14	14	14
Total Lost time (s)		4.0	4.0	4.0	4.0		4.0	4.0			4.0	
Lane Util. Factor		0.95	1.00	1.00	0.95		1.00	1.00			1.00	
Frt		1.00	0.85	1.00	0.99		1.00	0.89			0.97	
Flt Protected		1.00	1.00	0.95	1.00		0.95	1.00			0.99	
Satd. Flow (prot)		2970	1330	1404	2988		1562	1614			1740	
Flt Permitted		0.71	1.00	0.15	1.00		0.57	1.00			0.93	
Satd. Flow (perm)		2110	1330	217	2988		940	1614			1635	
Volume (vph)	14	859	218	257	488	23	150	50	128	26	109	37
Peak-hour factor, PHF	0.90	0.90	0.90	0.94	0.94	0.94	0.74	0.74	0.74	0.90	0.90	0.90
Adj. Flow (vph)	16	954	242	273	519	24	203	68	173	29	121	41
RTOR Reduction (vph)	0	0	0	0	0	0	0	70	0	0	7	0
Lane Group Flow (vph)	0	970	242	273	543	0	203	171	0	0	184	0
Heavy Vehicles (%)	2%	2%	2%	8%	8%	8%	4%	4%	4%	1%	1%	1%
Turn Type	Perm		Perm	D.P+P			Perm			Perm		
Protected Phases		1		4	1 4			3			3	
Permitted Phases	1		1	1			3			3		
Actuated Green, G (s)		39.6	39.6	43.6	47.6		34.0	34.0			34.0	
Effective Green, g (s)		39.6	39.6	43.6	47.6		34.0	34.0			34.0	
Actuated g/C Ratio		0.40	0.40	0.44	0.48		0.34	0.34			0.34	
Clearance Time (s)		4.0	4.0	4.0			4.0	4.0			4.0	
Vehicle Extension (s)		3.0	3.0	3.0			3.0	3.0			3.0	
Lane Grp Cap (vph)		836	527	142	1422		320	549			556	
v/s Ratio Prot				c0.08	0.18			0.11				
v/s Ratio Perm		0.46	0.18	c0.76			c0.22				0.11	
v/c Ratio		1.16	0.46	1.92	0.38		0.63	0.31			0.33	
Uniform Delay, d1		30.2	22.3	27.6	16.8		27.8	24.4			24.5	
Progression Factor		0.70	0.65	0.81	0.26		1.17	1.22			1.00	
Incremental Delay, d2		79.0	1.4	427.7	0.4		3.7	0.3			0.4	
Delay (s)		100.1	16.0	449.9	4.7		36.2	30.0			24.9	
Level of Service		F	B	F	A		D	C			C	
Approach Delay (s)		83.3			153.7			32.9			24.9	
Approach LOS		F			F			C			C	

Intersection Summary			
HCM Average Control Delay	92.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.36		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	22.4
Intersection Capacity Utilization	78.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	981	140	0	688	0	60
Peak Hour Factor	0.95	0.95	0.92	0.92	0.65	0.65
Hourly flow rate (vph)	1033	147	0	748	0	92
Pedestrians	42			42	42	
Lane Width (ft)	11.0			10.0	14.0	
Walking Speed (ft/s)	4.0			4.0	4.0	
Percent Blockage	3			3	4	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)	94			256		
pX, platoon unblocked			0.81		0.85	0.81
vC, conflicting volume			1222		1564	674
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1034		1150	353
tC, single (s)			4.2		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	81
cM capacity (veh/h)			502		153	484

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	688	492	374	374	92
Volume Left	0	0	0	0	0
Volume Right	0	147	0	0	92
cSH	1700	1700	1700	1700	484
Volume to Capacity	0.40	0.29	0.22	0.22	0.19
Queue Length 95th (ft)	0	0	0	0	17
Control Delay (s)	0.0	0.0	0.0	0.0	14.2
Lane LOS					B
Approach Delay (s)	0.0		0.0		14.2
Approach LOS					B

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	54.1%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	228	602	268	464	1591	822
v/c Ratio	3.56	0.95	2.25	0.54	1.08	0.55
Control Delay	1206.2	64.5	604.2	22.8	73.6	20.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	1206.2	64.5	604.2	22.8	73.6	20.8
Queue Length 50th (ft)	~261	200	~265	78	~655	213
Queue Length 95th (ft)	#380	#310	m#393	m119	#795	257
Internal Link Dist (ft)		849		14	255	366
Turn Bay Length (ft)						
Base Capacity (vph)	64	635	119	865	1474	1485
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	3.56	0.95	2.25	0.54	1.08	0.55

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	10	10	10	11	11	11	10	10	10
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			0.95			0.95	
Frt	1.00	1.00		1.00	0.99			0.95			0.99	
Flt Protected	0.95	1.00		0.95	1.00			1.00			1.00	
Satd. Flow (prot)	1525	2887		1444	2872			2970			2959	
Flt Permitted	0.20	1.00		0.20	1.00			0.95			1.00	
Satd. Flow (perm)	315	2887		298	2872			2828			2959	
Volume (vph)	217	569	3	247	411	16	6	971	551	0	631	68
Peak-hour factor, PHF	0.95	0.95	0.95	0.92	0.92	0.92	0.96	0.96	0.96	0.85	0.85	0.85
Adj. Flow (vph)	228	599	3	268	447	17	6	1011	574	0	742	80
RTOR Reduction (vph)	0	0	0	0	3	0	0	60	0	0	6	0
Lane Group Flow (vph)	228	602	0	268	461	0	0	1532	0	0	816	0
Heavy Vehicles (%)	3%	3%	3%	5%	5%	5%	0%	0%	0%	1%	1%	1%
Parking (#/hr)		1	1									
Turn Type	Perm			D.P+P			Perm					
Protected Phases		1		4	1 4			3			3	
Permitted Phases	1			1			3					
Actuated Green, G (s)	18.4	18.4		20.4	26.4			48.0			48.0	
Effective Green, g (s)	20.4	20.4		24.4	28.4			50.0			50.0	
Actuated g/C Ratio	0.20	0.20		0.24	0.28			0.50			0.50	
Clearance Time (s)	6.0	6.0		6.0				6.0			6.0	
Vehicle Extension (s)	3.0	3.0		3.0				3.0			3.0	
Lane Grp Cap (vph)	64	589		119	816			1414			1480	
v/s Ratio Prot		0.21		c0.09	0.16						0.28	
v/s Ratio Perm	c0.72			0.46				c0.54				
v/c Ratio	3.56	1.02		2.25	0.57			1.08			0.55	
Uniform Delay, d1	39.8	39.8		37.2	30.5			25.0			17.3	
Progression Factor	1.00	1.00		0.70	0.71			1.00			1.00	
Incremental Delay, d2	1191.0	42.8		585.2	2.3			49.8			1.5	
Delay (s)	1230.8	82.6		611.4	24.1			74.8			18.7	
Level of Service	F	F		F	C			E			B	
Approach Delay (s)		398.0			239.1			74.8			18.7	
Approach LOS		F			F			E			B	

Intersection Summary			
HCM Average Control Delay	161.0	HCM Level of Service	F
HCM Volume to Capacity ratio	1.82		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	25.6
Intersection Capacity Utilization	97.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	0	285	0	3	167	39	1	3	3	70	2	71
Peak Hour Factor	0.70	0.70	0.70	0.79	0.79	0.79	0.44	0.44	0.44	0.91	0.91	0.91
Hourly flow rate (vph)	0	407	0	4	211	49	2	7	7	77	2	78

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	407	265	16	157
Volume Left (vph)	0	4	2	77
Volume Right (vph)	0	49	7	78
Hadj (s)	0.00	-0.09	-0.23	-0.20
Departure Headway (s)	4.7	4.8	5.6	5.3
Degree Utilization, x	0.53	0.35	0.02	0.23
Capacity (veh/h)	733	714	537	607
Control Delay (s)	13.0	10.4	8.7	9.9
Approach Delay (s)	13.0	10.4	8.7	9.9
Approach LOS	B	B	A	A

Intersection Summary			
Delay	11.5		
HCM Level of Service	B		
Intersection Capacity Utilization	44.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	32	73	19	86	0	66	12	249	125	130	243	73
Peak Hour Factor	0.93	0.93	0.93	0.80	0.80	0.80	0.90	0.90	0.90	0.87	0.87	0.87
Hourly flow rate (vph)	34	78	20	108	0	82	13	277	139	149	279	84
Pedestrians		222			337			321			337	
Lane Width (ft)		13.0			13.0			12.0			10.5	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		20			30			27			25	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								270			411	
pX, platoon unblocked	0.97	0.97		0.97	0.97	0.97				0.97		
vC, conflicting volume	1634	1621	864	1669	1594	1020	585			753		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1652	1639	864	1688	1611	1021	585			746		
tC, single (s)	7.2	6.6	6.3	7.1	6.5	6.2	4.1			4.2		
tC, 2 stage (s)												
tF (s)	3.6	4.1	3.4	3.5	4.0	3.3	2.2			2.3		
p0 queue free %	0	0	90	0	100	44	98			74		
cM capacity (veh/h)	10	38	203	0	41	147	779			568		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total	133	190	429	149	363
Volume Left	34	108	13	149	0
Volume Right	20	82	139	0	84
cSH	24	0	779	568	1700
Volume to Capacity	5.49	Err	0.02	0.26	0.21
Queue Length 95th (ft)	Err	Err	1	26	0
Control Delay (s)	Err	Err	0.5	13.6	0.0
Lane LOS	F	F	A	B	
Approach Delay (s)	Err	Err	0.5	4.0	
Approach LOS	F	F			

Intersection Summary			
Average Delay	Err		
Intersection Capacity Utilization	77.9%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	58	18	56	88	48	107
Peak Hour Factor	0.86	0.86	0.84	0.84	0.89	0.89
Hourly flow rate (vph)	67	21	67	105	54	120
Pedestrians	59		56			59
Lane Width (ft)	12.0		12.0			12.0
Walking Speed (ft/s)	4.0		4.0			4.0
Percent Blockage	5		5			5
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	462	237			230	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	462	237			230	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	86	97			96	
cM capacity (veh/h)	483	723			1283	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	88	171	174
Volume Left	67	0	54
Volume Right	21	105	0
cSH	524	1700	1283
Volume to Capacity	0.17	0.10	0.04
Queue Length 95th (ft)	15	0	3
Control Delay (s)	13.3	0.0	2.7
Lane LOS	B		A
Approach Delay (s)	13.3	0.0	2.7
Approach LOS	B		

Intersection Summary			
Average Delay	3.8		
Intersection Capacity Utilization	44.6%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	NBT	SBL	SBT
Lane Group Flow (vph)	324	339	62	362
v/c Ratio	0.60	0.90	0.39	0.88
Control Delay	18.4	42.2	36.7	54.4
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	18.4	42.2	36.7	54.4
Queue Length 50th (ft)	100	225	34	205
Queue Length 95th (ft)	204	m171	m38	m175
Internal Link Dist (ft)	167	410		190
Turn Bay Length (ft)			150	
Base Capacity (vph)	540	814	354	881
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.60	0.42	0.18	0.41

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	16	12	12	12	12	12	12	12	12	10	12	12
Total Lost time (s)		4.0						4.0		4.0	4.0	
Lane Util. Factor		1.00						1.00		1.00	1.00	
Frpb, ped/bikes		0.92						0.95		1.00	0.93	
Flpb, ped/bikes		0.57						0.98		0.82	1.00	
Frt		0.96						0.99		1.00	0.97	
Flt Protected		0.97						0.99		0.95	1.00	
Satd. Flow (prot)		830						1472		1157	1431	
Flt Permitted		0.97						0.62		0.37	1.00	
Satd. Flow (perm)		830						914		446	1431	
Volume (vph)	178	7	68	0	0	0	46	224	28	55	260	62
Peak-hour factor, PHF	0.78	0.78	0.78	0.25	0.25	0.25	0.88	0.88	0.88	0.89	0.89	0.89
Adj. Flow (vph)	228	9	87	0	0	0	52	255	32	62	292	70
RTOR Reduction (vph)	0	7	0	0	0	0	0	7	0	0	16	0
Lane Group Flow (vph)	0	317	0	0	0	0	0	332	0	62	346	0
Confl. Peds. (#/hr)	339		96	96		339	110		225	225		110
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	6%	6%	6%	8%	8%	8%
Turn Type	Perm						Perm			Perm		
Protected Phases		2						1			1	
Permitted Phases	2						1			1		
Actuated Green, G (s)		64.3						27.7		27.7	27.7	
Effective Green, g (s)		64.3						27.7		27.7	27.7	
Actuated g/C Ratio		0.64						0.28		0.28	0.28	
Clearance Time (s)		4.0						4.0		4.0	4.0	
Vehicle Extension (s)		3.0						3.0		3.0	3.0	
Lane Grp Cap (vph)		534						253		124	396	
v/s Ratio Prot											0.24	
v/s Ratio Perm		0.38						c0.36		0.14		
v/c Ratio		0.59						1.31		0.50	0.87	
Uniform Delay, d1		10.3						36.2		30.3	34.5	
Progression Factor		1.00						1.19		1.20	1.20	
Incremental Delay, d2		1.8						142.8		10.1	17.4	
Delay (s)		12.1						185.6		46.4	58.7	
Level of Service		B						F		D	E	
Approach Delay (s)		12.1			0.0			185.6			56.9	
Approach LOS		B			A			F			E	

Intersection Summary			
HCM Average Control Delay	83.7	HCM Level of Service	F
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	73.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	52	202	103	13	51	39	49	46	31	0	30	127
Peak Hour Factor	0.75	0.75	0.75	0.73	0.73	0.73	0.69	0.69	0.69	0.92	0.92	0.92
Hourly flow rate (vph)	69	269	137	18	70	53	71	67	45	0	33	138

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	476	141	183	171
Volume Left (vph)	69	18	71	0
Volume Right (vph)	137	53	45	138
Hadj (s)	-0.13	-0.03	-0.05	-0.47
Departure Headway (s)	5.0	5.6	5.8	5.4
Degree Utilization, x	0.67	0.22	0.29	0.26
Capacity (veh/h)	689	572	550	582
Control Delay (s)	17.4	10.2	11.2	10.3
Approach Delay (s)	17.4	10.2	11.2	10.3
Approach LOS	C	B	B	B

Intersection Summary			
Delay	14.0		
HCM Level of Service	B		
Intersection Capacity Utilization	72.6%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	31	0	74	13	16	27	22	261	0	0	230	7
Peak Hour Factor	0.90	0.90	0.90	0.63	0.63	0.63	0.79	0.79	0.79	0.71	0.71	0.71
Hourly flow rate (vph)	34	0	82	21	25	43	28	330	0	0	324	10
Pedestrians		94			244			244			185	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		8			20			20			15	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								452			490	
pX, platoon unblocked	0.93	0.93	0.93	0.93	0.93		0.93					
vC, conflicting volume	1050	1053	667	1285	1058	759	428			574		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1053	1057	644	1305	1062	759	388			574		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.2		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.3		
p0 queue free %	60	100	75	57	83	84	97			100		
cM capacity (veh/h)	86	150	325	48	150	276	995			772		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	62	55	89	358	334
Volume Left	34	0	21	28	0
Volume Right	27	55	43	0	10
cSH	127	325	118	995	1700
Volume to Capacity	0.49	0.17	0.76	0.03	0.20
Queue Length 95th (ft)	56	15	106	2	0
Control Delay (s)	57.5	18.3	96.7	1.0	0.0
Lane LOS	F	C	F	A	
Approach Delay (s)	39.1		96.7	1.0	0.0
Approach LOS	E		F		

Intersection Summary			
Average Delay	15.0		
Intersection Capacity Utilization	54.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	76	37	0	0	29	22	16	31	9	65	0	84
Peak Hour Factor	0.68	0.68	0.68	0.83	0.83	0.83	0.73	0.73	0.73	0.69	0.69	0.69
Hourly flow rate (vph)	112	54	0	0	35	27	22	42	12	94	0	122
Pedestrians		45			51			34			51	
Lane Width (ft)		11.0			11.0			16.0			11.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		3			4			4			4	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								376				
pX, platoon unblocked												
vC, conflicting volume	482	444	140	454	499	151	167			106		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	482	444	140	454	499	151	167			106		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	70	87	100	100	91	97	98			93		
cM capacity (veh/h)	370	435	846	386	406	832	1351			1434		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	166	61	77	216
Volume Left	112	0	22	94
Volume Right	0	27	12	122
cSH	389	522	1351	1434
Volume to Capacity	0.43	0.12	0.02	0.07
Queue Length 95th (ft)	52	10	1	5
Control Delay (s)	21.0	12.8	2.3	3.7
Lane LOS	C	B	A	A
Approach Delay (s)	21.0	12.8	2.3	3.7
Approach LOS	C	B		

Intersection Summary			
Average Delay	10.1		
Intersection Capacity Utilization	37.8%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	WBL	WBT	NBT	SBT	SBR2	NER2
Lane Group Flow (vph)	794	116	586	457	360	35	45
v/c Ratio	2.74	0.82	1.06	2.23	1.33	0.13	0.28
Control Delay	810.4	50.5	74.3	588.4	193.1	20.7	46.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	810.4	50.5	74.3	588.4	193.1	20.7	46.0
Queue Length 50th (ft)	~463	56	~221	~434	~307	12	27
Queue Length 95th (ft)	#586	m#75	m#326	#630	m#402	m20	50
Internal Link Dist (ft)	165		1295	704	372		
Turn Bay Length (ft)		50				50	
Base Capacity (vph)	290	142	554	205	271	270	159
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	2.74	0.82	1.06	2.23	1.33	0.13	0.28

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	EBR2	WBL2	WBL	WBT	WBR	NBL2	NBL	NBT	NBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)		4.0				4.0	4.0				4.0	
Lane Util. Factor		0.95				0.91	0.91				1.00	
Frt		0.97				1.00	0.97				0.99	
Flt Protected		1.00				0.95	1.00				0.97	
Satd. Flow (prot)		2605				1266	2653				1273	
Flt Permitted		0.70				0.25	0.87				0.22	
Satd. Flow (perm)		1816				333	2306				284	
Volume (vph)	17	587	125	18	72	39	412	116	25	202	158	26
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.91	0.91	0.91	0.91	0.90	0.90	0.90	0.90
Adj. Flow (vph)	18	624	133	19	79	43	453	127	28	224	176	29
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	794	0	0	0	116	586	0	0	0	457	0
Heavy Vehicles (%)	7%	7%	7%	7%	9%	9%	9%	9%	9%	9%	9%	9%
Bus Blockages (#/hr)	0	0	0	0	0	0	3	3	0	0	7	7
Parking (#/hr)		1	1	1						1	1	1
Turn Type	Perm				D.P+P	D.P+P			D.P+P	D.P+P		
Protected Phases		1			9	9	1 9		3	3	3 4	
Permitted Phases	1				1	1			4	4		
Actuated Green, G (s)		15.0				22.0	22.0				33.0	
Effective Green, g (s)		16.0				23.0	23.0				34.0	
Actuated g/C Ratio		0.16				0.23	0.23				0.34	
Clearance Time (s)		5.0				4.0						
Vehicle Extension (s)		3.0				3.0						
Lane Grp Cap (vph)		291				142	555				205	
v/s Ratio Prot						0.06	c0.07				c0.24	
v/s Ratio Perm		c0.44				0.13	0.17				c0.51	
v/c Ratio		2.73				0.82	1.06				2.23	
Uniform Delay, d1		42.0				47.6	38.5				33.0	
Progression Factor		0.91				0.56	0.65				1.00	
Incremental Delay, d2		787.1				21.2	47.3				568.7	
Delay (s)		825.5				47.7	72.3				601.7	
Level of Service		F				D	E				F	
Approach Delay (s)		825.5					68.2				601.7	
Approach LOS		F					E				F	

Intersection Summary			
HCM Average Control Delay	438.9	HCM Level of Service	F
HCM Volume to Capacity ratio	2.22		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	43.0
Intersection Capacity Utilization	94.0%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBL	SBT	SBR	SBR2	NER2
Lane Configurations					
Ideal Flow (vphpl)	1900	1900	1900	1900	1900
Lane Width	11	16	11	11	14
Total Lost time (s)		4.0		4.0	4.0
Lane Util. Factor		1.00		1.00	1.00
Frt		0.99		0.85	0.86
Flt Protected		0.98		1.00	1.00
Satd. Flow (prot)		1571		1175	1447
Flt Permitted		0.74		1.00	1.00
Satd. Flow (perm)		1180		1175	1447
Volume (vph)	103	173	30	30	33
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.73
Adj. Flow (vph)	121	204	35	35	45
RTOR Reduction (vph)	0	0	0	0	0
Lane Group Flow (vph)	0	360	0	35	45
Heavy Vehicles (%)	7%	7%	7%	7%	9%
Bus Blockages (#/hr)	0	0	0	0	0
Parking (#/hr)		1	1	1	
Turn Type	Perm			Prot	Over
Protected Phases		4		4	3
Permitted Phases	4				
Actuated Green, G (s)		22.0		22.0	11.0
Effective Green, g (s)		23.0		23.0	11.0
Actuated g/C Ratio		0.23		0.23	0.11
Clearance Time (s)		5.0		5.0	4.0
Vehicle Extension (s)		3.0		3.0	3.0
Lane Grp Cap (vph)		271		270	159
v/s Ratio Prot				0.03	0.03
v/s Ratio Perm		0.31			
v/c Ratio		1.33		0.13	0.28
Uniform Delay, d1		38.5		30.6	40.9
Progression Factor		0.68		0.64	1.00
Incremental Delay, d2		166.6		0.8	4.4
Delay (s)		192.6		20.3	45.3
Level of Service		F		C	D
Approach Delay (s)		177.3			
Approach LOS		F			

Intersection Summary

Lane Group	EBT	WBT
Lane Group Flow (vph)	813	749
v/c Ratio	0.33	0.26
Control Delay	0.3	0.0
Queue Delay	0.0	0.0
Total Delay	0.3	0.0
Queue Length 50th (ft)	0	0
Queue Length 95th (ft)	0	m0
Internal Link Dist (ft)	373	165
Turn Bay Length (ft)		
Base Capacity (vph)	2474	2832
Starvation Cap Reductn	0	0
Spillback Cap Reductn	0	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.33	0.26

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	11	11	12	12	12
Total Lost time (s)		4.0	4.0			
Lane Util. Factor		0.95	0.95			
Frt		1.00	0.99			
Flt Protected		1.00	1.00			
Satd. Flow (prot)		2714	2832			
Flt Permitted		0.91	1.00			
Satd. Flow (perm)		2476	2832			
Volume (vph)	28	745	609	35	0	0
Peak-hour factor, PHF	0.95	0.95	0.86	0.86	0.25	0.25
Adj. Flow (vph)	29	784	708	41	0	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	813	749	0	0	0
Heavy Vehicles (%)	7%	7%	10%	10%	0%	0%
Bus Blockages (#/hr)	0	6	0	0	0	0
Parking (#/hr)		5		5		
Turn Type	Perm					
Protected Phases		1	1			
Permitted Phases	1					
Actuated Green, G (s)		100.0	100.0			
Effective Green, g (s)		100.0	100.0			
Actuated g/C Ratio		1.00	1.00			
Clearance Time (s)		4.0	4.0			
Vehicle Extension (s)		3.0	3.0			
Lane Grp Cap (vph)		2476	2832			
v/s Ratio Prot			0.26			
v/s Ratio Perm		c0.33				
v/c Ratio		0.33	0.26			
Uniform Delay, d1		0.0	0.0			
Progression Factor		1.00	1.00			
Incremental Delay, d2		0.3	0.0			
Delay (s)		0.3	0.0			
Level of Service		A	A			
Approach Delay (s)		0.3	0.0		0.0	
Approach LOS		A	A		A	

Intersection Summary			
HCM Average Control Delay	0.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	48.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	SET	NWT	NET	SWT
Lane Group Flow (vph)	913	647	40	184
v/c Ratio	0.56	0.31	0.18	0.66
Control Delay	7.0	8.9	30.8	31.1
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	7.0	8.9	30.8	31.1
Queue Length 50th (ft)	88	104	18	55
Queue Length 95th (ft)	194	131	33	116
Internal Link Dist (ft)	339	373	163	400
Turn Bay Length (ft)				
Base Capacity (vph)	1616	2087	277	322
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.56	0.31	0.14	0.57

Intersection Summary

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	11	12	12	11	12	12	12	12	12	16	12
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		0.95			0.95			1.00			1.00	
Frt		1.00			1.00			0.97			0.91	
Flt Protected		0.99			1.00			0.98			0.98	
Satd. Flow (prot)		2755			2721			1624			1469	
Flt Permitted		0.79			1.00			0.82			0.88	
Satd. Flow (perm)		2190			2721			1363			1316	
Volume (vph)	90	732	0	0	575	7	12	10	6	53	0	110
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.70	0.70	0.70	0.89	0.89	0.89
Adj. Flow (vph)	100	813	0	0	639	8	17	14	9	60	0	124
RTOR Reduction (vph)	0	0	0	0	0	0	0	8	0	0	77	0
Lane Group Flow (vph)	0	913	0	0	647	0	0	32	0	0	107	0
Heavy Vehicles (%)	5%	5%	5%	8%	8%	8%	0%	0%	0%	5%	5%	5%
Bus Blockages (#/hr)	0	6	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)		5			5						2	
Turn Type	Perm						Perm			Perm		
Protected Phases		1			1			3			3	
Permitted Phases	1						3			3		
Actuated Green, G (s)		76.7			76.7			15.3			15.3	
Effective Green, g (s)		76.7			76.7			15.3			15.3	
Actuated g/C Ratio		0.77			0.77			0.15			0.15	
Clearance Time (s)		4.0			4.0			4.0			4.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		1680			2087			209			201	
v/s Ratio Prot					0.24							
v/s Ratio Perm		c0.42						0.02			c0.08	
v/c Ratio		0.54			0.31			0.15			0.53	
Uniform Delay, d1		4.7			3.6			36.7			39.0	
Progression Factor		1.00			2.17			1.00			0.98	
Incremental Delay, d2		1.3			0.4			0.3			2.7	
Delay (s)		5.9			8.1			37.1			40.8	
Level of Service		A			A			D			D	
Approach Delay (s)		5.9			8.1			37.1			40.8	
Approach LOS		A			A			D			D	

Intersection Summary			
HCM Average Control Delay	11.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	66.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	151	648	53	564	370	320	141	185
v/c Ratio	0.77	0.49	0.27	0.83	0.98	0.72	1.04	0.44
Control Delay	71.7	13.7	41.9	37.5	72.2	42.5	114.7	32.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	71.7	13.7	41.9	37.5	72.2	42.5	114.7	32.2
Queue Length 50th (ft)	105	232	30	315	~237	183	~98	87
Queue Length 95th (ft)	m0	m20	68	#519	#429	226	m#162	m125
Internal Link Dist (ft)		1295		1669		389		1718
Turn Bay Length (ft)	85		75					
Base Capacity (vph)	215	1313	211	676	376	445	135	417
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.70	0.49	0.25	0.83	0.98	0.72	1.04	0.44

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	11	11	10	11	11	16	16	16	11	11	11
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00		1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.98		1.00	1.00	0.65		1.00		1.00	0.98	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00		0.84	1.00	
Frt	1.00	0.99		1.00	1.00	0.85		1.00		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00		0.95	1.00	
Satd. Flow (prot)	1430	2894		1404	1494	831		1576		1181	1402	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.97		0.38	1.00	
Satd. Flow (perm)	1430	2894		1404	1494	831		1534		468	1402	
Volume (vph)	130	529	28	48	513	337	18	224	1	120	124	33
Peak-hour factor, PHF	0.86	0.86	0.86	0.91	0.91	0.91	0.76	0.76	0.76	0.85	0.85	0.85
Adj. Flow (vph)	151	615	33	53	564	370	24	295	1	141	146	39
RTOR Reduction (vph)	0	4	0	0	0	0	0	0	0	0	10	0
Lane Group Flow (vph)	151	644	0	53	564	370	0	320	0	141	175	0
Confl. Peds. (#/hr)	106		92	92		106	75		414	414		75
Confl. Bikes (#/hr)			17			1			9			1
Heavy Vehicles (%)	6%	6%	6%	8%	8%	8%	9%	9%	9%	12%	12%	12%
Bus Blockages (#/hr)	0	0	0	0	6	6	0	0	0	0	0	0
Parking (#/hr)							1	1	1			
Turn Type	Prot			Prot		Perm	Perm			Perm		
Protected Phases	1	2		1	2			3			3	
Permitted Phases						2	3			3		
Actuated Green, G (s)	13.7	44.3		13.7	44.3	44.3		28.0		28.0	28.0	
Effective Green, g (s)	13.7	45.3		13.7	45.3	45.3		29.0		29.0	29.0	
Actuated g/C Ratio	0.14	0.45		0.14	0.45	0.45		0.29		0.29	0.29	
Clearance Time (s)	4.0	5.0		4.0	5.0	5.0		5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	196	1311		192	677	376		445		136	407	
v/s Ratio Prot	c0.11	0.22		0.04	0.38						0.12	
v/s Ratio Perm						c0.44		0.21		c0.30		
v/c Ratio	0.77	0.49		0.28	0.83	0.98		0.72		1.04	0.43	
Uniform Delay, d1	41.6	19.2		38.7	24.0	27.0		31.8		35.5	28.8	
Progression Factor	1.67	0.69		1.00	1.00	1.00		1.00		1.06	1.10	
Incremental Delay, d2	1.7	0.1		0.8	11.5	42.6		5.5		72.8	0.5	
Delay (s)	71.4	13.4		39.5	35.5	69.6		37.3		110.5	32.1	
Level of Service	E	B		D	D	E		D		F	C	
Approach Delay (s)		24.4			48.5			37.3			66.0	
Approach LOS		C			D			D			E	

Intersection Summary			
HCM Average Control Delay	41.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	78.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	258	110	81	518	624
v/c Ratio	0.83	0.46	0.24	0.85	0.74
Control Delay	48.2	38.9	8.6	39.8	26.4
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	48.2	38.9	8.6	39.8	26.4
Queue Length 50th (ft)	106	59	0	165	132
Queue Length 95th (ft)	m139	108	35	m#232	m96
Internal Link Dist (ft)	821	168		1718	335
Turn Bay Length (ft)					
Base Capacity (vph)	355	282	376	609	841
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.73	0.39	0.22	0.85	0.74

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1600	1600	1600	1600	1600	1600
Lane Width	13	13	13	12	12	10	10	11	11	10	10	10
Total Lost time (s)		4.0			4.0	4.0		4.0			4.0	
Lane Util. Factor		1.00			1.00	1.00		0.95			0.95	
Frpb, ped/bikes		1.00			1.00	0.99		1.00			0.99	
Flpb, ped/bikes		1.00			1.00	1.00		1.00			1.00	
Frt		0.94			1.00	0.85		0.98			0.97	
Flt Protected		0.99			0.97	1.00		0.99			0.99	
Satd. Flow (prot)		1405			1515	1217		2157			2252	
Flt Permitted		0.87			0.65	1.00		0.71			0.71	
Satd. Flow (perm)		1235			1011	1217		1553			1611	
Volume (vph)	65	48	101	51	46	71	80	339	58	105	335	103
Peak-hour factor, PHF	0.83	0.83	0.83	0.88	0.88	0.88	0.92	0.92	0.92	0.87	0.87	0.87
Adj. Flow (vph)	78	58	122	58	52	81	87	368	63	121	385	118
RTOR Reduction (vph)	0	34	0	0	0	63	0	10	0	0	18	0
Lane Group Flow (vph)	0	224	0	0	110	18	0	508	0	0	606	0
Confl. Bikes (#/hr)						1			4			43
Heavy Vehicles (%)	16%	16%	16%	10%	10%	10%	15%	15%	15%	8%	8%	8%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	17	17	0	0	0
Turn Type	Perm			Perm		Perm	Perm			D.P+P		
Protected Phases		3			3			1		10	1 10	
Permitted Phases	3			3		3	1			1		
Actuated Green, G (s)		21.2			21.2	21.2		38.3			49.2	
Effective Green, g (s)		22.2			22.2	22.2		39.3			48.2	
Actuated g/C Ratio		0.22			0.22	0.22		0.39			0.48	
Clearance Time (s)		5.0			5.0	5.0		5.0				
Vehicle Extension (s)		3.0			3.0	3.0		3.0				
Lane Grp Cap (vph)		274			224	270		610			834	
v/s Ratio Prot											c0.06	
v/s Ratio Perm		c0.18			0.11	0.01		c0.33			0.29	
v/c Ratio		0.82			0.49	0.07		0.83			0.73	
Uniform Delay, d1		37.0			34.0	30.7		27.4			20.7	
Progression Factor		1.04			1.00	1.00		1.07			1.22	
Incremental Delay, d2		12.3			1.7	0.1		6.7			0.3	
Delay (s)		50.8			35.7	30.8		36.1			25.5	
Level of Service		D			D	C		D			C	
Approach Delay (s)		50.8			33.6			36.1			25.5	
Approach LOS		D			C			D			C	

Intersection Summary			
HCM Average Control Delay	34.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	29.6
Intersection Capacity Utilization	68.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	87	974	243	849	92	177	284	93	336
v/c Ratio	1.71	1.38	1.55	0.79	1.88	0.68	0.53	0.64	1.21
Control Delay	373.2	216.0	307.6	28.9	469.7	49.3	3.8	57.6	160.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	373.2	216.0	307.6	28.9	469.7	49.3	3.8	57.6	160.1
Queue Length 50th (ft)	~82	~435	~220	232	~87	86	0	54	~263
Queue Length 95th (ft)	m#90	m#411	#372	317	m#129	m112	m0	90	#333
Internal Link Dist (ft)		771		938		335			755
Turn Bay Length (ft)	70		350					170	
Base Capacity (vph)	51	704	157	1075	49	259	532	145	277
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.71	1.38	1.55	0.79	1.88	0.68	0.53	0.64	1.21

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
Lane Width	10	10	10	10	10	10	10	10	10	10	10	10
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	*0.95		1.00	0.95		1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	1.00	0.99	1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.97		1.00	0.96		1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1216	2346		1205	2286		1120	1179	993	1240	1262	
Flt Permitted	0.13	1.00		0.95	1.00		0.21	1.00	1.00	0.51	1.00	
Satd. Flow (perm)	171	2346		1205	2286		242	1179	993	670	1262	
Volume (vph)	79	697	189	224	551	230	85	163	261	70	220	32
Peak-hour factor, PHF	0.91	0.91	0.91	0.92	0.92	0.92	0.92	0.92	0.92	0.75	0.75	0.75
Adj. Flow (vph)	87	766	208	243	599	250	92	177	284	93	293	43
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	185	0	0	0
Lane Group Flow (vph)	87	974	0	243	849	0	92	177	99	93	336	0
Confl. Bikes (#/hr)			5			5			3			96
Heavy Vehicles (%)	5%	5%	5%	6%	6%	6%	14%	14%	14%	3%	3%	3%
Turn Type	Perm			custom			Perm		pm+ov	Perm		
Protected Phases		1		4	1 4			3	4		3	
Permitted Phases	1			4			3		3	3		
Actuated Green, G (s)	30.0	30.0		15.0	47.0		22.0	22.0	37.0	22.0	22.0	
Effective Green, g (s)	30.0	30.0		13.0	47.0		22.0	22.0	35.0	22.0	22.0	
Actuated g/C Ratio	0.30	0.30		0.13	0.47		0.22	0.22	0.35	0.22	0.22	
Clearance Time (s)	4.0	4.0		2.0			4.0	4.0	2.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0			3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	51	704		157	1074		53	259	387	147	278	
v/s Ratio Prot		0.42		c0.20	0.37			0.15	0.03		0.27	
v/s Ratio Perm	c0.51						c0.38		0.07	0.14		
v/c Ratio	1.71	1.38		1.55	0.79		1.74	0.68	0.26	0.63	1.21	
Uniform Delay, d1	35.0	35.0		43.5	22.3		39.0	35.8	23.2	35.3	39.0	
Progression Factor	1.57	1.58		1.00	1.00		1.06	1.07	0.43	1.00	1.00	
Incremental Delay, d2	339.7	175.1		275.5	4.0		378.7	5.0	0.2	8.6	122.6	
Delay (s)	394.8	230.4		319.0	26.4		420.0	43.5	10.2	43.9	161.6	
Level of Service	F	F		F	C		F	D	B	D	F	
Approach Delay (s)		243.8			91.5			89.0			136.1	
Approach LOS		F			F			F			F	

Intersection Summary			
HCM Average Control Delay	148.7	HCM Level of Service	F
HCM Volume to Capacity ratio	1.68		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	35.0
Intersection Capacity Utilization	87.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	391	850	650	71	28	244	382	102
v/c Ratio	0.76	0.89	0.71	0.15	0.23	0.54	1.23	0.13
Control Delay	24.1	42.3	32.1	6.5	30.4	30.9	159.5	8.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.1	42.3	32.1	6.5	30.4	30.9	159.5	8.8
Queue Length 50th (ft)	110	236	169	0	12	111	~273	24
Queue Length 95th (ft)	#251	#349	232	29	36	182	#411	44
Internal Link Dist (ft)		360	496			755	339	
Turn Bay Length (ft)	200				50			100
Base Capacity (vph)	515	961	922	481	122	448	311	758
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.76	0.88	0.70	0.15	0.23	0.54	1.23	0.13

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1600	1600	1600
Lane Width	10	10	10	10	10	10	11	12	12	11	11	14
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	0.95			0.95	1.00	1.00	1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00			1.00	1.00	1.00	0.94			1.00	1.00
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00	1.00			0.97	1.00
Frt	1.00	0.99			1.00	0.85	1.00	0.97			1.00	0.85
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00			0.99	1.00
Satd. Flow (prot)	1501	2966			3002	1343	1510	1502			1306	1280
Flt Permitted	0.26	1.00			0.95	1.00	0.27	1.00			0.81	1.00
Satd. Flow (perm)	408	2966			2861	1343	425	1502			1069	1280
Volume (vph)	368	743	56	2	635	70	25	173	41	59	266	87
Peak-hour factor, PHF	0.94	0.94	0.94	0.98	0.98	0.98	0.88	0.88	0.88	0.85	0.85	0.85
Adj. Flow (vph)	391	790	60	2	648	71	28	197	47	69	313	102
RTOR Reduction (vph)	0	6	0	0	0	48	0	9	0	0	0	0
Lane Group Flow (vph)	391	844	0	0	650	23	28	235	0	0	382	102
Confl. Peds. (#/hr)									300	300		
Confl. Bikes (#/hr)			1						1			81
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	4%	4%	4%	2%	2%	2%
Turn Type	pm+pt			Perm		Perm	Perm			Perm		pt+ov
Protected Phases	1	3			3			4			4	1 4
Permitted Phases	3			3		3	4			4		
Actuated Green, G (s)	49.7	27.7			27.7	27.7	25.3	25.3			25.3	52.3
Effective Green, g (s)	51.7	28.7			28.7	28.7	26.3	26.3			26.3	53.3
Actuated g/C Ratio	0.57	0.32			0.32	0.32	0.29	0.29			0.29	0.59
Clearance Time (s)	5.0	5.0			5.0	5.0	5.0	5.0			5.0	
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0			3.0	
Lane Grp Cap (vph)	514	946			912	428	124	439			312	758
v/s Ratio Prot	c0.19	c0.28						0.16				0.08
v/s Ratio Perm	0.24				0.23	0.02	0.07				c0.36	
v/c Ratio	0.76	0.89			0.71	0.05	0.23	0.53			1.22	0.13
Uniform Delay, d1	12.6	29.2			27.0	21.2	24.1	26.7			31.8	8.1
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2	6.5	10.6			2.7	0.1	4.2	4.6			126.2	0.4
Delay (s)	19.1	39.8			29.7	21.3	28.3	31.3			158.0	8.5
Level of Service	B	D			C	C	C	C			F	A
Approach Delay (s)		33.3			28.8			31.0			126.5	
Approach LOS		C			C			C			F	

Intersection Summary			
HCM Average Control Delay	48.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	95.0%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	598	129	169	875	289	247	160
v/c Ratio	1.56	0.49	0.36	0.54	0.85	0.41	0.30
Control Delay	298.6	57.6	32.2	34.7	61.2	24.5	20.9
Queue Delay	0.0	0.0	0.0	0.3	0.0	0.0	0.0
Total Delay	298.6	57.6	32.2	35.0	61.2	24.5	20.9
Queue Length 50th (ft)	~323	88	97	274	210	112	64
Queue Length 95th (ft)	m#402	m128	m#139	m403	m285	m163	108
Internal Link Dist (ft)	176			771		331	256
Turn Bay Length (ft)		150	150		100		
Base Capacity (vph)	383	261	472	1618	375	659	576
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	254	0	0	3
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.56	0.49	0.36	0.64	0.77	0.37	0.28

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	12	12	12	15	11	14	14	14
Total Lost time (s)		4.0	4.0	4.0	4.0		4.0	4.0			4.0	
Lane Util. Factor		0.95	1.00	1.00	0.95		1.00	1.00			1.00	
Frt		1.00	0.85	1.00	1.00		1.00	0.91			0.94	
Flt Protected		1.00	1.00	0.95	1.00		0.95	1.00			0.99	
Satd. Flow (prot)		2912	1304	1444	3080		1547	1628			1638	
Flt Permitted		0.65	1.00	0.19	1.00		0.61	1.00			0.88	
Satd. Flow (perm)		1888	1304	281	3080		988	1628			1458	
Volume (vph)	15	530	117	164	824	25	254	85	132	38	43	71
Peak-hour factor, PHF	0.91	0.91	0.91	0.97	0.97	0.97	0.88	0.88	0.88	0.95	0.95	0.95
Adj. Flow (vph)	16	582	129	169	849	26	289	97	150	40	45	75
RTOR Reduction (vph)	0	0	0	0	0	0	0	47	0	0	27	0
Lane Group Flow (vph)	0	598	129	169	875	0	289	200	0	0	133	0
Heavy Vehicles (%)	4%	4%	4%	5%	5%	5%	5%	5%	5%	3%	3%	3%
Turn Type	Perm		Perm	D.P+P			Perm			Perm		
Protected Phases		1		4	1 4			3			3	
Permitted Phases	1		1	1			3			3		
Actuated Green, G (s)		21.6	21.6	56.6	60.6		41.0	41.0			41.0	
Effective Green, g (s)		21.6	21.6	56.6	60.6		41.0	41.0			41.0	
Actuated g/C Ratio		0.18	0.18	0.47	0.50		0.34	0.34			0.34	
Clearance Time (s)		4.0	4.0	4.0			4.0	4.0			4.0	
Vehicle Extension (s)		3.0	3.0	3.0			3.0	3.0			3.0	
Lane Grp Cap (vph)		340	235	472	1555		338	556			498	
v/s Ratio Prot				0.10	c0.28			0.12				
v/s Ratio Perm		c0.32	0.10	0.06			c0.29				0.09	
v/c Ratio		1.76	0.55	0.36	0.56		0.86	0.36			0.27	
Uniform Delay, d1		49.2	44.8	20.3	20.5		36.7	29.7			28.6	
Progression Factor		1.17	1.21	1.43	1.43		1.09	1.15			1.00	
Incremental Delay, d2		350.2	6.6	1.5	1.1		18.2	0.4			0.3	
Delay (s)		407.7	60.9	30.5	30.4		58.4	34.5			28.9	
Level of Service		F	E	C	C		E	C			C	
Approach Delay (s)		346.2			30.5			47.3			28.9	
Approach LOS		F			C			D			C	

Intersection Summary			
HCM Average Control Delay	127.1	HCM Level of Service	F
HCM Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	22.4
Intersection Capacity Utilization	81.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	604	31	0	1149	0	58
Peak Hour Factor	0.90	0.90	0.97	0.97	0.80	0.80
Hourly flow rate (vph)	671	34	0	1185	0	72
Pedestrians	89			89	89	
Lane Width (ft)	11.0			10.0	14.0	
Walking Speed (ft/s)	4.0			4.0	4.0	
Percent Blockage	7			6	9	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)	94			256		
pX, platoon unblocked			0.88		0.88	0.88
vC, conflicting volume			795		1459	531
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			629		968	329
tC, single (s)			4.1		7.0	7.1
tC, 2 stage (s)						
tF (s)			2.2		3.6	3.4
p0 queue free %			100		100	85
cM capacity (veh/h)			762		175	481

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	447	258	592	592	72
Volume Left	0	0	0	0	0
Volume Right	0	34	0	0	72
cSH	1700	1700	1700	1700	481
Volume to Capacity	0.26	0.15	0.35	0.35	0.15
Queue Length 95th (ft)	0	0	0	0	13
Control Delay (s)	0.0	0.0	0.0	0.0	13.8
Lane LOS					B
Approach Delay (s)	0.0		0.0		13.8
Approach LOS					B

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	54.8%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	116	403	480	701	912	1346
v/c Ratio	2.19	0.63	1.49	0.60	1.04	1.10
Control Delay	616.1	47.0	258.9	27.3	74.0	92.9
Queue Delay	0.0	0.0	0.0	2.2	0.0	0.0
Total Delay	616.1	47.0	258.9	29.4	74.0	92.9
Queue Length 50th (ft)	~144	148	~417	266	~414	~668
Queue Length 95th (ft)	#267	205	m#590	m182	#547	#765
Internal Link Dist (ft)		849		14	255	366
Turn Bay Length (ft)						
Base Capacity (vph)	53	642	323	1164	881	1223
Starvation Cap Reductn	0	0	0	314	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	2.19	0.63	1.49	0.82	1.04	1.10

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	10	10	10	11	11	11	10	10	10
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			0.95			0.95	
Frt	1.00	1.00		1.00	1.00			0.96			1.00	
Flt Protected	0.95	1.00		0.95	1.00			1.00			1.00	
Satd. Flow (prot)	1510	2854		1486	2968			3000			2990	
Flt Permitted	0.15	1.00		0.35	1.00			0.77			1.00	
Satd. Flow (perm)	243	2854		543	2968			2312			2990	
Volume (vph)	113	384	7	466	673	7	12	592	253	0	1139	32
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.94	0.94	0.94	0.87	0.87	0.87
Adj. Flow (vph)	116	396	7	480	694	7	13	630	269	0	1309	37
RTOR Reduction (vph)	0	0	0	0	1	0	0	33	0	0	1	0
Lane Group Flow (vph)	116	403	0	480	700	0	0	879	0	0	1345	0
Heavy Vehicles (%)	4%	4%	4%	2%	2%	2%	0%	0%	0%	1%	1%	1%
Parking (#/hr)		1	1									
Turn Type	Perm			D.P+P			Perm					
Protected Phases		1		4	1 4			3			3	
Permitted Phases	1			1			3					
Actuated Green, G (s)	24.2	24.2		38.2	44.2			47.0			47.0	
Effective Green, g (s)	26.2	26.2		42.2	46.2			49.0			49.0	
Actuated g/C Ratio	0.22	0.22		0.35	0.38			0.41			0.41	
Clearance Time (s)	6.0	6.0		6.0				6.0			6.0	
Vehicle Extension (s)	3.0	3.0		3.0				3.0			3.0	
Lane Grp Cap (vph)	53	623		317	1143			944			1221	
v/s Ratio Prot		0.14		c0.20	0.24						c0.45	
v/s Ratio Perm	c0.48			0.33				0.38				
v/c Ratio	2.19	0.65		1.51	0.61			0.93			1.10	
Uniform Delay, d1	46.9	42.7		35.3	29.7			33.9			35.5	
Progression Factor	1.00	1.00		1.01	0.86			1.00			1.00	
Incremental Delay, d2	591.5	5.1		244.1	2.0			16.8			58.2	
Delay (s)	638.4	47.8		279.6	27.7			50.7			93.7	
Level of Service	F	D		F	C			D			F	
Approach Delay (s)		179.8			130.1			50.7			93.7	
Approach LOS		F			F			D			F	

Intersection Summary			
HCM Average Control Delay	105.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.49		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	28.8
Intersection Capacity Utilization	87.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	0	153	0	3	37	16	0	0	3	80	0	12
Peak Hour Factor	0.86	0.86	0.86	0.71	0.71	0.71	0.75	0.75	0.75	0.78	0.78	0.78
Hourly flow rate (vph)	0	178	0	4	52	23	0	0	4	103	0	15

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	178	79	4	118
Volume Left (vph)	0	4	0	103
Volume Right (vph)	0	23	4	15
Hadj (s)	0.00	-0.13	-0.60	0.16
Departure Headway (s)	4.3	4.3	4.0	4.6
Degree Utilization, x	0.21	0.09	0.00	0.15
Capacity (veh/h)	814	802	824	728
Control Delay (s)	8.4	7.7	7.0	8.5
Approach Delay (s)	8.4	7.7	7.0	8.5
Approach LOS	A	A	A	A

Intersection Summary			
Delay	8.3		
HCM Level of Service	A		
Intersection Capacity Utilization	33.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	44	58	13	96	7	109	5	249	81	71	227	49
Peak Hour Factor	0.88	0.88	0.88	0.94	0.94	0.94	0.89	0.89	0.89	0.87	0.87	0.87
Hourly flow rate (vph)	50	66	15	102	7	116	6	280	91	82	261	56
Pedestrians		227			258			258			258	
Lane Width (ft)		13.0			13.0			12.0			10.5	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		20			23			22			19	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								270			411	
pX, platoon unblocked	0.95	0.95	0.95	0.95	0.95		0.95					
vC, conflicting volume	1393	1319	774	1324	1302	841	544			629		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1413	1335	763	1341	1317	841	521			629		
tC, single (s)	7.2	6.6	6.4	7.1	6.5	6.2	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.1	3.4	3.5	4.0	3.3	2.3			2.2		
p0 queue free %	0	11	94	0	91	49	99			89		
cM capacity (veh/h)	20	74	228	12	81	229	768			735		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total	131	226	376	82	317
Volume Left	50	102	6	82	0
Volume Right	15	116	91	0	56
cSH	37	24	768	735	1700
Volume to Capacity	3.51	9.42	0.01	0.11	0.19
Queue Length 95th (ft)	Err	Err	1	9	0
Control Delay (s)	Err	Err	0.2	10.5	0.0
Lane LOS	F	F	A	B	
Approach Delay (s)	Err	9999.0	0.2	2.2	
Approach LOS	F	F			

Intersection Summary			
Average Delay	3148.8		
Intersection Capacity Utilization	73.7%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	65	0	58	96	15	7
Peak Hour Factor	0.83	0.83	0.55	0.55	0.86	0.86
Hourly flow rate (vph)	78	0	105	175	17	8
Pedestrians	39		31			39
Lane Width (ft)	12.0		12.0			12.0
Walking Speed (ft/s)	4.0		4.0			4.0
Percent Blockage	3		3			3
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	306	271			319	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	306	271			319	
tC, single (s)	6.4	6.2			4.4	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.5	
p0 queue free %	88	100			98	
cM capacity (veh/h)	640	723			1068	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	78	280	26
Volume Left	78	0	17
Volume Right	0	175	0
cSH	640	1700	1068
Volume to Capacity	0.12	0.16	0.02
Queue Length 95th (ft)	10	0	1
Control Delay (s)	11.4	0.0	5.8
Lane LOS	B		A
Approach Delay (s)	11.4	0.0	5.8
Approach LOS	B		

Intersection Summary			
Average Delay	2.7		
Intersection Capacity Utilization	32.6%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	NBT	SBL	SBT
Lane Group Flow (vph)	182	356	43	370
v/c Ratio	0.83	0.40	0.09	0.35
Control Delay	65.8	11.3	6.4	7.0
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	65.8	11.3	6.4	7.0
Queue Length 50th (ft)	124	98	5	62
Queue Length 95th (ft)	158	234	24	179
Internal Link Dist (ft)	167	410		190
Turn Bay Length (ft)			150	
Base Capacity (vph)	275	919	508	1098
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.66	0.39	0.08	0.34

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	16	12	12	12	12	12	12	12	12	10	12	12
Total Lost time (s)		4.0						4.0		4.0	4.0	
Lane Util. Factor		1.00						1.00		1.00	1.00	
Frpb, ped/bikes		0.96						0.94		1.00	0.96	
Flpb, ped/bikes		0.55						1.00		0.88	1.00	
Frt		0.96						0.97		1.00	0.97	
Flt Protected		0.97						1.00		0.95	1.00	
Satd. Flow (prot)		830						1332		1301	1554	
Flt Permitted		0.97						0.97		0.54	1.00	
Satd. Flow (perm)		830						1300		735	1554	
Volume (vph)	108	0	43	0	0	0	18	240	77	36	242	69
Peak-hour factor, PHF	0.83	0.83	0.83	0.25	0.25	0.25	0.94	0.94	0.94	0.84	0.84	0.84
Adj. Flow (vph)	130	0	52	0	0	0	19	255	82	43	288	82
RTOR Reduction (vph)	0	13	0	0	0	0	0	8	0	0	7	0
Lane Group Flow (vph)	0	169	0	0	0	0	0	348	0	43	363	0
Confl. Peds. (#/hr)	304		35	35		304	45		66	66		45
Heavy Vehicles (%)	1%	1%	1%	0%	0%	0%	16%	16%	16%	2%	2%	2%
Turn Type	Perm						Perm			Perm		
Protected Phases		2						1			1	
Permitted Phases	2						1			1		
Actuated Green, G (s)		29.8						82.2		82.2	82.2	
Effective Green, g (s)		29.8						82.2		82.2	82.2	
Actuated g/C Ratio		0.25						0.68		0.68	0.68	
Clearance Time (s)		4.0						4.0		4.0	4.0	
Vehicle Extension (s)		3.0						3.0		3.0	3.0	
Lane Grp Cap (vph)		206						891		503	1064	
v/s Ratio Prot											0.23	
v/s Ratio Perm		0.20						c0.27		0.06		
v/c Ratio		0.82						0.39		0.09	0.34	
Uniform Delay, d1		42.6						8.1		6.3	7.8	
Progression Factor		1.00						1.00		0.62	0.65	
Incremental Delay, d2		22.4						1.3		0.3	0.9	
Delay (s)		65.0						9.4		4.3	5.9	
Level of Service		E						A		A	A	
Approach Delay (s)		65.0			0.0			9.4			5.7	
Approach LOS		E			A			A			A	

Intersection Summary			
HCM Average Control Delay	18.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	61.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	59	138	74	23	10	56	17	37	14	0	50	37
Peak Hour Factor	0.85	0.85	0.85	0.68	0.68	0.68	0.72	0.72	0.72	0.67	0.67	0.67
Hourly flow rate (vph)	69	162	87	34	15	82	24	51	19	0	75	55

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	319	131	94	130
Volume Left (vph)	69	34	24	0
Volume Right (vph)	87	82	19	55
Hadj (s)	-0.12	-0.02	-0.06	-0.26
Departure Headway (s)	4.5	4.8	5.1	4.9
Degree Utilization, x	0.40	0.18	0.13	0.18
Capacity (veh/h)	755	691	637	670
Control Delay (s)	10.5	8.9	8.9	8.9
Approach Delay (s)	10.5	8.9	8.9	8.9
Approach LOS	B	A	A	A

Intersection Summary			
Delay	9.7		
HCM Level of Service	A		
Intersection Capacity Utilization	41.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	17	0	64	21	10	76	27	242	0	0	213	19
Peak Hour Factor	0.72	0.72	0.72	0.83	0.83	0.83	0.89	0.89	0.89	0.83	0.83	0.83
Hourly flow rate (vph)	24	0	89	25	12	92	30	272	0	0	257	23
Pedestrians		80			101			101			90	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		7			8			8			8	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								452			490	
pX, platoon unblocked												
vC, conflicting volume	868	782	449	892	793	463	360			373		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	868	782	449	892	793	463	360			373		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.3			2.2		
p0 queue free %	85	100	83	84	96	82	97			100		
cM capacity (veh/h)	161	269	518	160	269	511	1079			1086		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	53	59	129	302	280
Volume Left	24	0	25	30	0
Volume Right	30	59	92	0	23
cSH	261	518	337	1079	1700
Volume to Capacity	0.20	0.11	0.38	0.03	0.16
Queue Length 95th (ft)	19	10	43	2	0
Control Delay (s)	22.3	12.8	22.1	1.1	0.0
Lane LOS	C	B	C	A	
Approach Delay (s)	17.3		22.1	1.1	0.0
Approach LOS	C		C		

Intersection Summary			
Average Delay	6.2		
Intersection Capacity Utilization	57.6%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	32	28	0	0	46	12	23	30	12	40	0	114
Peak Hour Factor	0.75	0.75	0.75	0.81	0.81	0.81	0.82	0.82	0.82	0.70	0.70	0.70
Hourly flow rate (vph)	43	37	0	0	57	15	28	37	15	57	0	163
Pedestrians		46			51			45			51	
Lane Width (ft)		11.0			11.0			16.0			11.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		4			4			5			4	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								376				
pX, platoon unblocked												
vC, conflicting volume	436	400	172	410	474	146	209			102		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	436	400	172	410	474	146	209			102		
tC, single (s)	7.2	6.6	6.3	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.1	3.4	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	89	92	100	100	87	98	98			96		
cM capacity (veh/h)	386	463	787	425	425	830	1326			1444		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	80	72	79	220
Volume Left	43	0	28	57
Volume Right	0	15	15	163
cSH	418	473	1326	1444
Volume to Capacity	0.19	0.15	0.02	0.04
Queue Length 95th (ft)	17	13	2	3
Control Delay (s)	15.6	14.0	2.9	2.2
Lane LOS	C	B	A	A
Approach Delay (s)	15.6	14.0	2.9	2.2
Approach LOS	C	B		

Intersection Summary			
Average Delay	6.6		
Intersection Capacity Utilization	34.2%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	WBL	WBT	NBT	SBT	SBR2	NER2
Lane Group Flow (vph)	646	94	905	390	319	33	142
v/c Ratio	1.45	0.62	0.92	2.38	1.38	0.16	1.13
Control Delay	245.9	20.7	29.5	658.1	227.4	36.8	161.7
Queue Delay	7.3	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	253.3	20.7	29.5	658.1	227.4	36.8	161.7
Queue Length 50th (ft)	~301	46	328	~388	~271	18	~106
Queue Length 95th (ft)	#425	m48	m310	#575	#440	46	#180
Internal Link Dist (ft)	165		1295	704	372		
Turn Bay Length (ft)		50				50	
Base Capacity (vph)	446	152	982	164	232	212	126
Starvation Cap Reductn	5	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.46	0.62	0.92	2.38	1.38	0.16	1.13

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	EBR2	WBL2	WBL	WBT	WBR	NBL2	NBL	NBT	NBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)		4.0				4.0	4.0				4.0	
Lane Util. Factor		0.95				0.91	0.91				1.00	
Frt		0.96				1.00	0.98				0.99	
Flt Protected		1.00				0.95	1.00				0.97	
Satd. Flow (prot)		2662				1353	2888				1352	
Flt Permitted		0.73				0.17	1.00				0.17	
Satd. Flow (perm)		1939				248	2888				234	
Volume (vph)	8	459	116	31	52	37	765	86	30	163	163	18
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.94	0.94	0.94	0.94	0.96	0.96	0.96	0.96
Adj. Flow (vph)	8	483	122	33	55	39	814	91	31	170	170	19
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	646	0	0	0	94	905	0	0	0	390	0
Heavy Vehicles (%)	4%	4%	4%	4%	2%	2%	2%	2%	3%	3%	3%	3%
Bus Blockages (#/hr)	0	0	0	0	0	0	3	3	0	0	7	7
Parking (#/hr)		1	1	1						1	1	1
Turn Type	Perm				D.P+P	D.P+P			D.P+P	D.P+P		
Protected Phases		1			9	9	1 9		3	3	3 4	
Permitted Phases	1				1	1			4	4		
Actuated Green, G (s)		22.0				29.0	29.0				26.0	
Effective Green, g (s)		23.0				30.0	30.0				27.0	
Actuated g/C Ratio		0.23				0.30	0.30				0.27	
Clearance Time (s)		5.0				4.0						
Vehicle Extension (s)		3.0				3.0						
Lane Grp Cap (vph)		446				152	982				164	
v/s Ratio Prot						0.04	c0.06				c0.21	
v/s Ratio Perm		c0.33				0.14	0.25				c0.43	
v/c Ratio		1.45				0.62	0.92				2.38	
Uniform Delay, d1		38.5				27.5	33.9				36.5	
Progression Factor		1.05				0.70	0.84				1.00	
Incremental Delay, d2		213.8				0.7	1.6				638.5	
Delay (s)		254.3				20.0	29.9				675.0	
Level of Service		F				C	C				F	
Approach Delay (s)		254.3					29.0				675.0	
Approach LOS		F					C				F	

Intersection Summary			
HCM Average Control Delay	219.8	HCM Level of Service	F
HCM Volume to Capacity ratio	1.85		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	43.0
Intersection Capacity Utilization	98.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBL	SBT	SBR	SBR2	NER2
Lane Configurations					
Ideal Flow (vphpl)	1900	1900	1900	1900	1900
Lane Width	11	16	11	11	14
Total Lost time (s)		4.0		4.0	4.0
Lane Util. Factor		1.00		1.00	1.00
Frt		0.98		0.85	0.86
Flt Protected		0.99		1.00	1.00
Satd. Flow (prot)		1570		1175	1396
Flt Permitted		0.81		1.00	1.00
Satd. Flow (perm)		1288		1175	1396
Volume (vph)	79	193	40	32	108
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.76
Adj. Flow (vph)	81	197	41	33	142
RTOR Reduction (vph)	0	0	0	0	0
Lane Group Flow (vph)	0	319	0	33	142
Heavy Vehicles (%)	7%	7%	7%	7%	13%
Bus Blockages (#/hr)	0	0	0	0	0
Parking (#/hr)		1	1	1	
Turn Type	Perm			Prot	Over
Protected Phases		4		4	3
Permitted Phases	4				
Actuated Green, G (s)		17.0		17.0	9.0
Effective Green, g (s)		18.0		18.0	9.0
Actuated g/C Ratio		0.18		0.18	0.09
Clearance Time (s)		5.0		5.0	4.0
Vehicle Extension (s)		3.0		3.0	3.0
Lane Grp Cap (vph)		232		212	126
v/s Ratio Prot				0.03	0.10
v/s Ratio Perm		0.25			
v/c Ratio		1.38		0.16	1.13
Uniform Delay, d1		41.0		34.6	45.5
Progression Factor		1.00		1.00	1.00
Incremental Delay, d2		193.6		1.6	118.4
Delay (s)		234.6		36.1	163.9
Level of Service		F		D	F
Approach Delay (s)		216.0			
Approach LOS		F			

Intersection Summary

Lane Group	EBT	WBT
Lane Group Flow (vph)	661	1043
v/c Ratio	0.28	0.34
Control Delay	0.3	0.0
Queue Delay	0.2	0.0
Total Delay	0.4	0.0
Queue Length 50th (ft)	0	0
Queue Length 95th (ft)	0	m0
Internal Link Dist (ft)	373	165
Turn Bay Length (ft)		
Base Capacity (vph)	2394	3037
Starvation Cap Reductn	0	0
Spillback Cap Reductn	814	117
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.42	0.36

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	11	11	12	12	12
Total Lost time (s)		4.0	4.0			
Lane Util. Factor		0.95	0.95			
Frt		1.00	1.00			
Flt Protected		1.00	1.00			
Satd. Flow (prot)		2764	3037			
Flt Permitted		0.87	1.00			
Satd. Flow (perm)		2399	3037			
Volume (vph)	31	590	933	27	0	0
Peak-hour factor, PHF	0.94	0.94	0.92	0.92	0.75	0.75
Adj. Flow (vph)	33	628	1014	29	0	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	661	1043	0	0	0
Heavy Vehicles (%)	5%	5%	3%	3%	0%	0%
Bus Blockages (#/hr)	0	6	0	0	0	0
Parking (#/hr)		5		5		
Turn Type	Perm					
Protected Phases		1	1			
Permitted Phases	1					
Actuated Green, G (s)		100.0	100.0			
Effective Green, g (s)		100.0	100.0			
Actuated g/C Ratio		1.00	1.00			
Clearance Time (s)		4.0	4.0			
Vehicle Extension (s)		3.0	3.0			
Lane Grp Cap (vph)		2399	3037			
v/s Ratio Prot			c0.34			
v/s Ratio Perm		0.28				
v/c Ratio		0.28	0.34			
Uniform Delay, d1		0.0	0.0			
Progression Factor		1.00	1.00			
Incremental Delay, d2		0.3	0.0			
Delay (s)		0.3	0.0			
Level of Service		A	A			
Approach Delay (s)		0.3	0.0		0.0	
Approach LOS		A	A		A	

Intersection Summary			
HCM Average Control Delay	0.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	47.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	SET	NWT	NET	SWT
Lane Group Flow (vph)	656	963	42	265
v/c Ratio	0.40	0.47	0.19	0.76
Control Delay	7.2	6.5	28.8	37.8
Queue Delay	0.0	0.2	0.0	0.0
Total Delay	7.2	6.6	28.8	37.8
Queue Length 50th (ft)	68	61	20	106
Queue Length 95th (ft)	148	402	30	142
Internal Link Dist (ft)	339	373	163	400
Turn Bay Length (ft)				
Base Capacity (vph)	1641	2062	265	392
Starvation Cap Reductn	0	316	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.40	0.55	0.16	0.68

Intersection Summary

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	11	12	12	11	12	12	12	12	12	16	12
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		0.95			0.95			1.00			1.00	
Frt		1.00			1.00			0.98			0.91	
Flt Protected		1.00			1.00			0.96			0.98	
Satd. Flow (prot)		2815			2850			1617			1543	
Flt Permitted		0.84			1.00			0.65			0.88	
Satd. Flow (perm)		2359			2850			1088			1377	
Volume (vph)	40	557	0	0	887	18	20	3	4	69	0	143
Peak-hour factor, PHF	0.91	0.91	0.91	0.94	0.94	0.94	0.65	0.65	0.65	0.80	0.80	0.80
Adj. Flow (vph)	44	612	0	0	944	19	31	5	6	86	0	179
RTOR Reduction (vph)	0	0	0	0	1	0	0	5	0	0	76	0
Lane Group Flow (vph)	0	656	0	0	962	0	0	37	0	0	189	0
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	6	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)		5			5						2	
Turn Type	Perm						Perm			Perm		
Protected Phases		1			1			3			3	
Permitted Phases	1						3			3		
Actuated Green, G (s)		72.3			72.3			19.7			19.7	
Effective Green, g (s)		72.3			72.3			19.7			19.7	
Actuated g/C Ratio		0.72			0.72			0.20			0.20	
Clearance Time (s)		4.0			4.0			4.0			4.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		1706			2061			214			271	
v/s Ratio Prot					c0.34							
v/s Ratio Perm		0.28						0.03			c0.14	
v/c Ratio		0.38			0.47			0.17			0.70	
Uniform Delay, d1		5.3			5.8			33.4			37.4	
Progression Factor		1.00			0.84			1.00			1.01	
Incremental Delay, d2		0.7			0.7			0.4			7.6	
Delay (s)		6.0			5.6			33.8			45.3	
Level of Service		A			A			C			D	
Approach Delay (s)		6.0			5.6			33.8			45.3	
Approach LOS		A			A			C			D	

Intersection Summary			
HCM Average Control Delay	11.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	70.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	76	625	145	835	164	164	162	301
v/c Ratio	0.40	0.45	0.74	1.10	0.55	0.40	0.90	0.75
Control Delay	53.7	5.4	63.9	93.0	29.2	32.8	81.7	43.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	53.7	5.4	63.9	93.0	29.2	32.8	81.7	43.0
Queue Length 50th (ft)	47	52	88	~654	78	83	96	155
Queue Length 95th (ft)	m42	m40	#162	#856	151	136	#214	254
Internal Link Dist (ft)		1295		1669		389		1718
Turn Bay Length (ft)	85		75					
Base Capacity (vph)	215	1386	221	756	298	446	198	437
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.35	0.45	0.66	1.10	0.55	0.37	0.82	0.69

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	11	11	10	11	11	16	16	16	11	11	11
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00		1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.97		1.00	1.00	0.46		0.99		1.00	0.93	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		0.99		0.72	1.00	
Frt	1.00	0.99		1.00	1.00	0.85		1.00		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.99		0.95	1.00	
Satd. Flow (prot)	1430	2863		1472	1566	617		1635		1112	1435	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.89		0.56	1.00	
Satd. Flow (perm)	1430	2863		1472	1566	617		1464		659	1435	
Volume (vph)	73	569	31	128	735	144	19	118	5	154	188	98
Peak-hour factor, PHF	0.96	0.96	0.96	0.88	0.88	0.88	0.87	0.87	0.87	0.95	0.95	0.95
Adj. Flow (vph)	76	593	32	145	835	164	22	136	6	162	198	103
RTOR Reduction (vph)	0	4	0	0	0	0	0	0	0	0	19	0
Lane Group Flow (vph)	76	621	0	145	835	164	0	164	0	162	282	0
Confl. Peds. (#/hr)	190		160	160		190	158		725	725		158
Confl. Bikes (#/hr)			15			23			1			10
Heavy Vehicles (%)	6%	6%	6%	3%	3%	3%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	6	6	0	0	0	0	0	0
Parking (#/hr)							1	1	1			
Turn Type	Prot			Prot		Perm	Perm			Perm		
Protected Phases	1	2		1	2			3			3	
Permitted Phases						2	3			3		
Actuated Green, G (s)	13.3	47.3		13.3	47.3	47.3		25.4		25.4	25.4	
Effective Green, g (s)	13.3	48.3		13.3	48.3	48.3		26.4		26.4	26.4	
Actuated g/C Ratio	0.13	0.48		0.13	0.48	0.48		0.26		0.26	0.26	
Clearance Time (s)	4.0	5.0		4.0	5.0	5.0		5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	190	1383		196	756	298		386		174	379	
v/s Ratio Prot	0.05	0.22		c0.10	c0.53						0.20	
v/s Ratio Perm						0.27		0.11		c0.25		
v/c Ratio	0.40	0.45		0.74	1.10	0.55		0.42		0.93	0.74	
Uniform Delay, d1	39.7	17.1		41.7	25.8	18.2		30.5		35.9	33.7	
Progression Factor	1.35	0.29		1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	0.1	0.1		13.6	65.2	7.1		0.8		48.4	7.7	
Delay (s)	53.7	5.1		55.3	91.0	25.3		31.3		84.3	41.4	
Level of Service	D	A		E	F	C		C		F	D	
Approach Delay (s)		10.3			77.1			31.3			56.4	
Approach LOS		B			E			C			E	

Intersection Summary			
HCM Average Control Delay	51.2	HCM Level of Service	D
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	94.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	223	128	156	606	451
v/c Ratio	0.82	0.52	0.43	0.71	0.39
Control Delay	50.0	49.7	9.1	35.9	19.0
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	50.0	49.7	9.1	35.9	19.0
Queue Length 50th (ft)	124	91	0	238	137
Queue Length 95th (ft)	m158	129	44	#374	m135
Internal Link Dist (ft)	821	168		1718	335
Turn Bay Length (ft)					
Base Capacity (vph)	440	449	541	853	1158
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.51	0.29	0.29	0.71	0.39

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1600	1600	1600	1600	1600	1600
Lane Width	13	13	13	12	12	10	10	11	11	10	10	10
Total Lost time (s)		4.0			4.0	4.0		4.0			4.0	
Lane Util. Factor		1.00			1.00	1.00		0.95			0.95	
Frpb, ped/bikes		0.99			1.00	0.98		0.98			0.92	
Flpb, ped/bikes		1.00			1.00	1.00		0.97			0.99	
Frt		0.92			1.00	0.85		0.99			0.97	
Flt Protected		0.99			0.98	1.00		0.99			1.00	
Satd. Flow (prot)		1315			1641	1309		2218			2131	
Flt Permitted		0.81			0.64	1.00		0.83			0.88	
Satd. Flow (perm)		1078			1071	1309		1857			1887	
Volume (vph)	47	26	108	47	63	134	65	476	22	31	285	68
Peak-hour factor, PHF	0.81	0.81	0.81	0.86	0.86	0.86	0.93	0.93	0.93	0.85	0.85	0.85
Adj. Flow (vph)	58	32	133	55	73	156	70	512	24	36	335	80
RTOR Reduction (vph)	0	54	0	0	0	127	0	2	0	0	10	0
Lane Group Flow (vph)	0	169	0	0	128	29	0	604	0	0	441	0
Confl. Peds. (#/hr)							500		500	500		500
Confl. Bikes (#/hr)			1			3			76			11
Heavy Vehicles (%)	21%	21%	21%	2%	2%	2%	8%	8%	8%	6%	6%	6%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	17	17	0	0	0
Turn Type	Perm			Perm		Perm	Perm			D.P+P		
Protected Phases		3			3			1		10	1 10	
Permitted Phases	3			3		3	1			1		
Actuated Green, G (s)		21.0			21.0	21.0		54.8			70.8	
Effective Green, g (s)		22.0			22.0	22.0		55.8			71.8	
Actuated g/C Ratio		0.18			0.18	0.18		0.46			0.60	
Clearance Time (s)		5.0			5.0	5.0		5.0				
Vehicle Extension (s)		3.0			3.0	3.0		3.0				
Lane Grp Cap (vph)		198			196	240		864			1162	
v/s Ratio Prot											c0.05	
v/s Ratio Perm		c0.16			0.12	0.02		c0.33			0.18	
v/c Ratio		0.85			0.65	0.12		0.70			0.38	
Uniform Delay, d1		47.4			45.5	40.9		25.4			12.5	
Progression Factor		0.86			1.00	1.00		1.00			1.41	
Incremental Delay, d2		27.4			7.6	0.2		4.7			0.1	
Delay (s)		68.3			53.0	41.1		30.1			17.8	
Level of Service		E			D	D		C			B	
Approach Delay (s)		68.3			46.5			30.1			17.8	
Approach LOS		E			D			C			B	

Intersection Summary			
HCM Average Control Delay	35.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	26.2
Intersection Capacity Utilization	65.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	88	737	206	729	226	235	288	141	176
v/c Ratio	2.00	1.25	1.04	0.75	0.96	0.57	0.46	0.66	0.42
Control Delay	479.0	138.4	108.1	36.3	73.0	29.2	3.1	50.9	34.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Total Delay	479.0	138.4	108.1	36.3	73.0	29.2	3.2	50.9	34.5
Queue Length 50th (ft)	~95	~382	~150	254	74	74	0	91	104
Queue Length 95th (ft)	m#93	m#261	#301	329	m#305	m120	m3	161	162
Internal Link Dist (ft)		771		938		335			755
Turn Bay Length (ft)	70		350					170	
Base Capacity (vph)	44	590	199	975	244	427	628	220	434
Starvation Cap Reductn	0	0	0	0	0	0	33	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	2.00	1.25	1.04	0.75	0.93	0.55	0.48	0.64	0.41

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
Lane Width	10	10	10	10	10	10	10	10	10	10	10	10
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	*0.95		1.00	0.95		1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	0.96	1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.97		1.00	0.98		1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1240	2361		1205	2361		1193	1256	1030	1252	1276	
Flt Permitted	0.13	1.00		0.13	1.00		0.57	1.00	1.00	0.49	1.00	
Satd. Flow (perm)	174	2361		169	2361		714	1256	1030	641	1276	
Volume (vph)	83	577	116	183	577	72	210	219	268	121	123	28
Peak-hour factor, PHF	0.94	0.94	0.94	0.89	0.89	0.89	0.93	0.93	0.93	0.86	0.86	0.86
Adj. Flow (vph)	88	614	123	206	648	81	226	235	288	141	143	33
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	156	0	0	0
Lane Group Flow (vph)	88	737	0	206	729	0	226	235	132	141	176	0
Confl. Bikes (#/hr)			10			11			78			9
Heavy Vehicles (%)	3%	3%	3%	6%	6%	6%	7%	7%	7%	2%	2%	2%
Bus Blockages (#/hr)	0	10	10	0	0	0	0	0	0	0	0	0
Turn Type	Perm			D.P+P			Perm		pm+ov	Perm		
Protected Phases		1		4	1 4			3	4		3	
Permitted Phases	1			1			3		3	3		
Actuated Green, G (s)	30.0	30.0		47.6	49.6		39.4	39.4	57.0	39.4	39.4	
Effective Green, g (s)	30.0	30.0		45.6	49.6		39.4	39.4	55.0	39.4	39.4	
Actuated g/C Ratio	0.25	0.25		0.38	0.41		0.33	0.33	0.46	0.33	0.33	
Clearance Time (s)	4.0	4.0		2.0			4.0	4.0	2.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0			3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	44	590		199	976		234	412	506	210	419	
v/s Ratio Prot		0.31		c0.13	0.31			0.19	0.03		0.14	
v/s Ratio Perm	c0.51			0.26			c0.32		0.09	0.22		
v/c Ratio	2.00	1.25		1.04	0.75		0.97	0.57	0.26	0.67	0.42	
Uniform Delay, d1	45.0	45.0		33.8	29.9		39.6	33.3	20.0	34.7	31.4	
Progression Factor	0.52	0.52		1.00	1.00		0.73	0.74	0.60	1.00	1.00	
Incremental Delay, d2	457.2	113.5		73.3	3.2		41.9	1.5	0.2	8.2	0.7	
Delay (s)	480.8	136.9		107.1	33.0		70.9	26.2	12.2	42.9	32.1	
Level of Service	F	F		F	C		E	C	B	D	C	
Approach Delay (s)		173.6			49.3			34.3			36.9	
Approach LOS		F			D			C			D	

Intersection Summary			
HCM Average Control Delay	80.2	HCM Level of Service	F
HCM Volume to Capacity ratio	1.35		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	35.0
Intersection Capacity Utilization	78.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	314	462	1160	123	59	469	256	229
v/c Ratio	0.69	0.42	1.10	0.22	0.37	1.16	4.00	0.27
Control Delay	27.1	22.6	90.1	4.9	36.1	127.4	1399.9	12.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.1	22.6	90.1	4.9	36.1	127.4	1399.9	12.1
Queue Length 50th (ft)	113	101	~399	0	28	~318	~268	65
Queue Length 95th (ft)	208	144	#527	35	60	#449	#391	109
Internal Link Dist (ft)		360	496			755	339	
Turn Bay Length (ft)	200				50			100
Base Capacity (vph)	454	1098	1050	560	161	406	64	836
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.69	0.42	1.10	0.22	0.37	1.16	4.00	0.27

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	12	12	11	11	14
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	0.95			0.95	1.00	1.00	1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00			1.00	0.98	1.00	0.98			1.00	1.00
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00	1.00			0.98	1.00
Frt	1.00	1.00			1.00	0.85	1.00	0.99			1.00	0.85
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00			0.99	1.00
Satd. Flow (prot)	1501	2988			3002	1315	1555	1651			1574	1535
Flt Permitted	0.12	1.00			0.95	1.00	0.40	1.00			0.17	1.00
Satd. Flow (perm)	192	2988			2866	1315	658	1651			264	1535
Volume (vph)	298	427	12	2	1054	112	49	369	20	65	168	208
Peak-hour factor, PHF	0.95	0.95	0.95	0.91	0.91	0.91	0.83	0.83	0.83	0.91	0.91	0.91
Adj. Flow (vph)	314	449	13	2	1158	123	59	445	24	71	185	229
RTOR Reduction (vph)	0	3	0	0	0	78	0	2	0	0	0	0
Lane Group Flow (vph)	314	459	0	0	1160	45	59	467	0	0	256	229
Confl. Peds. (#/hr)									300	300		
Confl. Bikes (#/hr)			4			1			35			5
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Turn Type	pm+pt			Perm		Perm	Perm			Perm		pt+ov
Protected Phases	1	3			3			4			4	1 4
Permitted Phases	3			3		3	4			4		
Actuated Green, G (s)	54.0	32.0			32.0	32.0	21.0	21.0			21.0	48.0
Effective Green, g (s)	56.0	33.0			33.0	33.0	22.0	22.0			22.0	49.0
Actuated g/C Ratio	0.62	0.37			0.37	0.37	0.24	0.24			0.24	0.54
Clearance Time (s)	5.0	5.0			5.0	5.0	5.0	5.0			5.0	
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0			3.0	
Lane Grp Cap (vph)	454	1096			1051	482	161	404			65	836
v/s Ratio Prot	c0.18	0.15						0.28				0.15
v/s Ratio Perm	0.25				c0.40	0.03	0.09				c0.97	
v/c Ratio	0.69	0.42			1.10	0.09	0.37	1.16			3.94	0.27
Uniform Delay, d1	19.7	21.3			28.5	18.7	28.2	34.0			34.0	11.0
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2	4.5	0.3			60.7	0.1	6.3	94.4			1358.4	0.8
Delay (s)	24.2	21.6			89.2	18.8	34.5	128.4			1392.4	11.8
Level of Service	C	C			F	B	C	F			F	B
Approach Delay (s)		22.6			82.4			117.9			740.5	
Approach LOS		C			F			F			F	

Intersection Summary			
HCM Average Control Delay	177.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.79		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	101.3%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Full Build 2021

Lane Group	EBT	EBR	WBL	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	1000	259	311	558	232	264	198
v/c Ratio	1.13	0.46	2.09	0.37	1.30	0.43	0.84
Control Delay	89.1	15.0	517.5	4.3	197.6	20.7	63.4
Queue Delay	61.4	1.2	0.0	0.0	0.0	0.0	0.0
Total Delay	150.5	16.2	517.5	4.3	197.6	20.7	63.4
Queue Length 50th (ft)	~405	88	~225	43	~164	72	95
Queue Length 95th (ft)	m#393	m90	m#271	m48	m#293	m113	#298
Internal Link Dist (ft)	176			771		331	256
Turn Bay Length (ft)		150	150		100		
Base Capacity (vph)	882	559	149	1494	179	621	236
Starvation Cap Reductn	97	137	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.27	0.61	2.09	0.37	1.30	0.43	0.84

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	12	12	12	15	11	14	14	14
Total Lost time (s)		4.0	4.0	4.0	4.0		4.0	4.0			4.0	
Lane Util. Factor		0.95	1.00	1.00	0.95		1.00	1.00			1.00	
Frt		1.00	0.85	1.00	0.99		1.00	0.89			0.97	
Flt Protected		1.00	1.00	0.95	1.00		0.95	1.00			0.99	
Satd. Flow (prot)		2970	1330	1404	2987		1562	1612			1741	
Flt Permitted		0.70	1.00	0.13	1.00		0.56	1.00			0.93	
Satd. Flow (perm)		2091	1330	199	2987		927	1612			1628	
Volume (vph)	15	885	233	292	500	24	172	54	141	27	113	38
Peak-hour factor, PHF	0.90	0.90	0.90	0.94	0.94	0.94	0.74	0.74	0.74	0.90	0.90	0.90
Adj. Flow (vph)	17	983	259	311	532	26	232	73	191	30	126	42
RTOR Reduction (vph)	0	0	0	0	0	0	0	73	0	0	7	0
Lane Group Flow (vph)	0	1000	259	311	558	0	232	191	0	0	191	0
Heavy Vehicles (%)	2%	2%	2%	8%	8%	8%	4%	4%	4%	1%	1%	1%
Turn Type	Perm		Perm	D.P+P			Perm			Perm		
Protected Phases		1		4	1 4			3			3	
Permitted Phases	1		1	1			3			3		
Actuated Green, G (s)		39.6	39.6	43.6	47.6		34.0	34.0			34.0	
Effective Green, g (s)		39.6	39.6	43.6	47.6		34.0	34.0			34.0	
Actuated g/C Ratio		0.40	0.40	0.44	0.48		0.34	0.34			0.34	
Clearance Time (s)		4.0	4.0	4.0			4.0	4.0			4.0	
Vehicle Extension (s)		3.0	3.0	3.0			3.0	3.0			3.0	
Lane Grp Cap (vph)		828	527	135	1422		315	548			554	
v/s Ratio Prot				c0.09	0.19			0.12				
v/s Ratio Perm		0.48	0.19	c0.91			c0.25				0.12	
v/c Ratio		1.21	0.49	2.30	0.39		0.74	0.35			0.34	
Uniform Delay, d1		30.2	22.6	27.2	16.9		29.1	24.7			24.7	
Progression Factor		0.68	0.64	0.89	0.26		1.11	1.09			1.00	
Incremental Delay, d2		98.5	1.4	596.2	0.3		7.7	0.3			0.4	
Delay (s)		119.2	15.9	620.5	4.7		39.8	27.3			25.0	
Level of Service		F	B	F	A		D	C			C	
Approach Delay (s)		98.0			225.1			33.1			25.0	
Approach LOS		F			F			C			C	

Intersection Summary			
HCM Average Control Delay	120.6	HCM Level of Service	F
HCM Volume to Capacity ratio	1.62		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	22.4
Intersection Capacity Utilization	82.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	1016	161	0	724	0	67
Peak Hour Factor	0.95	0.95	0.92	0.92	0.65	0.65
Hourly flow rate (vph)	1069	169	0	787	0	103
Pedestrians	42			42	42	
Lane Width (ft)	11.0			10.0	14.0	
Walking Speed (ft/s)	4.0			4.0	4.0	
Percent Blockage	3			3	4	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)	94			256		
pX, platoon unblocked			0.81		0.86	0.81
vC, conflicting volume			1281		1632	703
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1107		1219	390
tC, single (s)			4.2		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	78
cM capacity (veh/h)			471		138	459

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	713	526	393	393	103
Volume Left	0	0	0	0	0
Volume Right	0	169	0	0	103
cSH	1700	1700	1700	1700	459
Volume to Capacity	0.42	0.31	0.23	0.23	0.22
Queue Length 95th (ft)	0	0	0	0	21
Control Delay (s)	0.0	0.0	0.0	0.0	15.1
Lane LOS					C
Approach Delay (s)	0.0		0.0		15.1
Approach LOS					C

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	56.1%	ICU Level of Service	B
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	234	642	282	488	1638	843
v/c Ratio	3.66	1.01	2.37	0.56	1.11	0.57
Control Delay	1247.7	78.3	653.8	23.7	85.4	21.1
Queue Delay	0.0	0.0	0.0	0.3	0.0	0.0
Total Delay	1247.7	78.3	653.8	24.0	85.4	21.1
Queue Length 50th (ft)	~269	~220	~293	88	~688	220
Queue Length 95th (ft)	#391	#341	m#389	m122	#827	266
Internal Link Dist (ft)		849		14	255	366
Turn Bay Length (ft)						
Base Capacity (vph)	64	635	119	865	1474	1485
Starvation Cap Reductn	0	0	0	78	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	3.66	1.01	2.37	0.62	1.11	0.57

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	10	10	10	11	11	11	10	10	10
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			0.95			0.95	
Frt	1.00	1.00		1.00	0.99			0.95			0.99	
Flt Protected	0.95	1.00		0.95	1.00			1.00			1.00	
Satd. Flow (prot)	1525	2887		1444	2873			2969			2959	
Flt Permitted	0.20	1.00		0.20	1.00			0.95			1.00	
Satd. Flow (perm)	315	2887		298	2873			2827			2959	
Volume (vph)	222	607	3	259	433	16	6	996	570	0	647	70
Peak-hour factor, PHF	0.95	0.95	0.95	0.92	0.92	0.92	0.96	0.96	0.96	0.85	0.85	0.85
Adj. Flow (vph)	234	639	3	282	471	17	6	1038	594	0	761	82
RTOR Reduction (vph)	0	0	0	0	3	0	0	61	0	0	6	0
Lane Group Flow (vph)	234	642	0	282	485	0	0	1578	0	0	837	0
Heavy Vehicles (%)	3%	3%	3%	5%	5%	5%	0%	0%	0%	1%	1%	1%
Parking (#/hr)		1	1									
Turn Type	Perm			D.P+P			Perm					
Protected Phases		1		4	1 4			3			3	
Permitted Phases	1			1			3					
Actuated Green, G (s)	18.4	18.4		20.4	26.4			48.0			48.0	
Effective Green, g (s)	20.4	20.4		24.4	28.4			50.0			50.0	
Actuated g/C Ratio	0.20	0.20		0.24	0.28			0.50			0.50	
Clearance Time (s)	6.0	6.0		6.0				6.0			6.0	
Vehicle Extension (s)	3.0	3.0		3.0				3.0			3.0	
Lane Grp Cap (vph)	64	589		119	816			1414			1480	
v/s Ratio Prot		0.22		c0.10	0.17						0.28	
v/s Ratio Perm	c0.74			0.49				c0.56				
v/c Ratio	3.66	1.09		2.37	0.59			1.12			0.57	
Uniform Delay, d1	39.8	39.8		37.6	30.8			25.0			17.4	
Progression Factor	1.00	1.00		0.73	0.73			1.00			1.00	
Incremental Delay, d2	1232.8	63.9		635.2	2.4			62.3			1.6	
Delay (s)	1272.6	103.7		662.6	24.9			87.3			19.0	
Level of Service	F	F		F	C			F			B	
Approach Delay (s)		416.0			258.5			87.3			19.0	
Approach LOS		F			F			F			B	

Intersection Summary			
HCM Average Control Delay	175.0	HCM Level of Service	F
HCM Volume to Capacity ratio	1.88		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	25.6
Intersection Capacity Utilization	100.5%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	0	318	0	3	178	127	1	3	3	103	2	74
Peak Hour Factor	0.70	0.70	0.70	0.79	0.79	0.79	0.44	0.44	0.44	0.91	0.91	0.91
Hourly flow rate (vph)	0	454	0	4	225	161	2	7	7	113	2	81

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	454	390	16	197
Volume Left (vph)	0	4	2	113
Volume Right (vph)	0	161	7	81
Hadj (s)	0.00	-0.23	-0.23	-0.13
Departure Headway (s)	5.1	5.0	6.2	5.9
Degree Utilization, x	0.64	0.54	0.03	0.32
Capacity (veh/h)	682	695	456	550
Control Delay (s)	16.8	13.6	9.4	11.6
Approach Delay (s)	16.8	13.6	9.4	11.6
Approach LOS	C	B	A	B

Intersection Summary			
Delay	14.5		
HCM Level of Service	B		
Intersection Capacity Utilization	54.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	45	77	19	99	7	71	12	271	132	134	282	85
Peak Hour Factor	0.93	0.93	0.93	0.80	0.80	0.80	0.90	0.90	0.90	0.87	0.87	0.87
Hourly flow rate (vph)	48	83	20	124	9	89	13	301	147	154	324	98
Pedestrians		222			337			321			337	
Lane Width (ft)		13.0			13.0			12.0			10.5	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		20			30			27			25	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								270			411	
pX, platoon unblocked												
vC, conflicting volume	1734	1714	916	1753	1690	1048	644			785		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1734	1714	916	1753	1690	1048	644			785		
tC, single (s)	7.2	6.6	6.3	7.1	6.5	6.2	4.1			4.2		
tC, 2 stage (s)												
tF (s)	3.6	4.1	3.4	3.5	4.0	3.3	2.2			2.3		
p0 queue free %	0	0	89	0	77	39	98			73		
cM capacity (veh/h)	7	35	189	0	37	146	741			565		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total	152	221	461	154	422
Volume Left	48	124	13	154	0
Volume Right	20	89	147	0	98
cSH	16	0	741	565	1700
Volume to Capacity	9.51	Err	0.02	0.27	0.25
Queue Length 95th (ft)	Err	Err	1	28	0
Control Delay (s)	Err	Err	0.5	13.7	0.0
Lane LOS	F	F	A	B	
Approach Delay (s)	Err	Err	0.5	3.7	
Approach LOS	F	F			

Intersection Summary			
Average Delay	Err		
Intersection Capacity Utilization	84.0%	ICU Level of Service	E
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	73	20	62	104	49	128
Peak Hour Factor	0.86	0.86	0.84	0.84	0.89	0.89
Hourly flow rate (vph)	85	23	74	124	55	144
Pedestrians	59		56			59
Lane Width (ft)	12.0		12.0			12.0
Walking Speed (ft/s)	4.0		4.0			4.0
Percent Blockage	5		5			5
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	505	254			257	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	505	254			257	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	81	97			96	
cM capacity (veh/h)	455	707			1255	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	108	198	199
Volume Left	85	0	55
Volume Right	23	124	0
cSH	493	1700	1255
Volume to Capacity	0.22	0.12	0.04
Queue Length 95th (ft)	21	0	3
Control Delay (s)	14.3	0.0	2.5
Lane LOS	B		A
Approach Delay (s)	14.3	0.0	2.5
Approach LOS	B		

Intersection Summary			
Average Delay	4.1		
Intersection Capacity Utilization	46.3%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	NBT	SBL	SBT
Lane Group Flow (vph)	364	380	75	410
v/c Ratio	0.73	0.91	0.40	0.85
Control Delay	28.0	37.6	29.0	41.0
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	28.0	37.6	29.0	41.0
Queue Length 50th (ft)	146	251	40	219
Queue Length 95th (ft)	#313	m158	m33	m143
Internal Link Dist (ft)	167	410		190
Turn Bay Length (ft)			150	
Base Capacity (vph)	500	768	349	877
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.73	0.49	0.21	0.47

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	16	12	12	12	12	12	12	12	12	10	12	12
Total Lost time (s)		4.0						4.0		4.0	4.0	
Lane Util. Factor		1.00						1.00		1.00	1.00	
Frpb, ped/bikes		0.91						0.94		1.00	0.93	
Flpb, ped/bikes		0.57						0.98		0.84	1.00	
Frt		0.96						0.98		1.00	0.97	
Flt Protected		0.97						0.99		0.95	1.00	
Satd. Flow (prot)		832						1447		1174	1422	
Flt Permitted		0.97						0.58		0.39	1.00	
Satd. Flow (perm)		832						842		484	1422	
Volume (vph)	199	8	77	0	0	0	62	234	39	67	290	75
Peak-hour factor, PHF	0.78	0.78	0.78	0.25	0.25	0.25	0.88	0.88	0.88	0.89	0.89	0.89
Adj. Flow (vph)	255	10	99	0	0	0	70	266	44	75	326	84
RTOR Reduction (vph)	0	8	0	0	0	0	0	8	0	0	16	0
Lane Group Flow (vph)	0	356	0	0	0	0	0	372	0	75	394	0
Confl. Peds. (#/hr)	339		96	96		339	110		225	225		110
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	6%	6%	6%	8%	8%	8%
Turn Type	Perm						Perm			Perm		
Protected Phases		2						1			1	
Permitted Phases	2						1			1		
Actuated Green, G (s)		59.3						32.7		32.7	32.7	
Effective Green, g (s)		59.3						32.7		32.7	32.7	
Actuated g/C Ratio		0.59						0.33		0.33	0.33	
Clearance Time (s)		4.0						4.0		4.0	4.0	
Vehicle Extension (s)		3.0						3.0		3.0	3.0	
Lane Grp Cap (vph)		493						275		158	465	
v/s Ratio Prot											0.28	
v/s Ratio Perm		0.43						c0.44		0.16		
v/c Ratio		0.72						1.35		0.47	0.85	
Uniform Delay, d1		14.5						33.7		26.8	31.3	
Progression Factor		1.00						1.14		1.11	1.12	
Incremental Delay, d2		5.2						160.8		5.2	9.7	
Delay (s)		19.7						199.3		35.0	44.7	
Level of Service		B						F		D	D	
Approach Delay (s)		19.7			0.0			199.3			43.2	
Approach LOS		B			A			F			D	

Intersection Summary			
HCM Average Control Delay	84.5	HCM Level of Service	F
HCM Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	80.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	72	233	119	13	79	40	86	47	32	1	31	162
Peak Hour Factor	0.75	0.75	0.75	0.73	0.73	0.73	0.69	0.69	0.69	0.92	0.92	0.92
Hourly flow rate (vph)	96	311	159	18	108	55	125	68	46	1	34	176

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	565	181	239	211
Volume Left (vph)	96	18	125	1
Volume Right (vph)	159	55	46	176
Hadj (s)	-0.12	0.01	0.00	-0.48
Departure Headway (s)	5.7	6.5	6.7	6.3
Degree Utilization, x	0.89	0.33	0.44	0.37
Capacity (veh/h)	624	496	502	529
Control Delay (s)	37.6	12.7	14.8	12.9
Approach Delay (s)	37.6	12.7	14.8	12.9
Approach LOS	E	B	B	B

Intersection Summary			
Delay	24.9		
HCM Level of Service	C		
Intersection Capacity Utilization	79.6%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	32	0	83	18	16	32	36	311	0	0	257	7
Peak Hour Factor	0.90	0.90	0.90	0.63	0.63	0.63	0.79	0.79	0.79	0.71	0.71	0.71
Hourly flow rate (vph)	36	0	92	29	25	51	46	394	0	0	362	10
Pedestrians		94			244			244			185	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		8			20			20			15	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								452			490	
pX, platoon unblocked												
vC, conflicting volume	1194	1190	705	1432	1195	823	466			638		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1194	1190	705	1432	1195	823	466			638		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.2		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.3		
p0 queue free %	47	100	71	27	81	80	95			100		
cM capacity (veh/h)	67	131	320	39	132	254	995			731		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	66	61	105	439	372
Volume Left	36	0	29	46	0
Volume Right	31	61	51	0	10
cSH	106	320	94	995	1700
Volume to Capacity	0.62	0.19	1.12	0.05	0.22
Queue Length 95th (ft)	77	17	175	4	0
Control Delay (s)	83.5	18.9	212.4	1.4	0.0
Lane LOS	F	C	F	A	
Approach Delay (s)	52.4		212.4	1.4	0.0
Approach LOS	F		F		

Intersection Summary			
Average Delay	28.3		
Intersection Capacity Utilization	60.5%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	82	38	0	0	30	36	16	49	9	74	0	93
Peak Hour Factor	0.68	0.68	0.68	0.83	0.83	0.83	0.73	0.73	0.73	0.69	0.69	0.69
Hourly flow rate (vph)	121	56	0	0	36	43	22	67	12	107	0	135
Pedestrians		45			51			34			51	
Lane Width (ft)		11.0			11.0			16.0			11.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		3			4			4			4	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								376				
pX, platoon unblocked												
vC, conflicting volume	556	501	146	512	562	175	180			130		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	556	501	146	512	562	175	180			130		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	62	86	100	100	90	95	98			92		
cM capacity (veh/h)	317	399	839	346	370	806	1336			1404		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	176	80	101	242
Volume Left	121	0	22	107
Volume Right	0	43	12	135
cSH	339	525	1336	1404
Volume to Capacity	0.52	0.15	0.02	0.08
Queue Length 95th (ft)	71	13	1	6
Control Delay (s)	26.6	13.1	1.8	3.8
Lane LOS	D	B	A	A
Approach Delay (s)	26.6	13.1	1.8	3.8
Approach LOS	D	B		

Intersection Summary			
Average Delay	11.4		
Intersection Capacity Utilization	40.2%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	WBL	WBT	NBT	SBT	SBR2	NER2
Lane Group Flow (vph)	816	125	668	470	401	36	47
v/c Ratio	3.29	0.88	0.94	2.61	1.54	0.13	0.30
Control Delay	1056.7	51.6	36.3	759.0	281.4	23.3	46.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	1056.7	51.6	36.3	759.0	281.4	23.3	46.4
Queue Length 50th (ft)	~494	52	229	~487	~368	12	28
Queue Length 95th (ft)	#617	m62	m#263	#685	m#484	m22	51
Internal Link Dist (ft)	165		1295	704	372		
Turn Bay Length (ft)		50				50	
Base Capacity (vph)	248	142	710	180	261	270	159
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	3.29	0.88	0.94	2.61	1.54	0.13	0.30

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	EBR2	WBL2	WBL	WBT	WBR	NBL2	NBL	NBT	NBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)		4.0				4.0	4.0				4.0	
Lane Util. Factor		0.95				0.91	0.91				1.00	
Frt		0.97				1.00	0.96				0.99	
Flt Protected		1.00				0.95	1.00				0.97	
Satd. Flow (prot)		2605				1266	2627				1273	
Flt Permitted		0.60				0.25	1.00				0.14	
Satd. Flow (perm)		1552				333	2627				177	
Volume (vph)	20	602	128	18	74	40	436	172	26	208	162	27
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.91	0.91	0.91	0.91	0.90	0.90	0.90	0.90
Adj. Flow (vph)	21	640	136	19	81	44	479	189	29	231	180	30
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	816	0	0	0	125	668	0	0	0	470	0
Heavy Vehicles (%)	7%	7%	7%	7%	9%	9%	9%	9%	9%	9%	9%	9%
Bus Blockages (#/hr)	0	0	0	0	0	0	3	3	0	0	7	7
Parking (#/hr)		1	1	1						1	1	1
Turn Type	Perm				D.P+P	D.P+P			D.P+P	D.P+P		
Protected Phases		1			9	9	1 9		3	3	3 4	
Permitted Phases	1				1	1			4	4		
Actuated Green, G (s)		15.0				22.0	22.0				33.0	
Effective Green, g (s)		16.0				23.0	23.0				34.0	
Actuated g/C Ratio		0.16				0.23	0.23				0.34	
Clearance Time (s)		5.0				4.0						
Vehicle Extension (s)		3.0				3.0						
Lane Grp Cap (vph)		248				142	709				181	
v/s Ratio Prot						0.06	c0.07				c0.29	
v/s Ratio Perm		c0.53				0.14	0.19				c0.60	
v/c Ratio		3.29				0.88	0.94				2.60	
Uniform Delay, d1		42.0				48.0	37.8				33.0	
Progression Factor		0.90				0.51	0.59				1.00	
Incremental Delay, d2		1040.5				25.4	12.5				734.3	
Delay (s)		1078.4				49.7	34.7				767.3	
Level of Service		F				D	C				F	
Approach Delay (s)		1078.4					37.0				767.3	
Approach LOS		F					D				F	

Intersection Summary			
HCM Average Control Delay	541.0	HCM Level of Service	F
HCM Volume to Capacity ratio	2.61		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	43.0
Intersection Capacity Utilization	99.4%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBL	SBT	SBR	SBR2	NER2
Lane Configurations					
Ideal Flow (vphpl)	1900	1900	1900	1900	1900
Lane Width	11	16	11	11	14
Total Lost time (s)		4.0		4.0	4.0
Lane Util. Factor		1.00		1.00	1.00
Frt		0.99		0.85	0.86
Flt Protected		0.98		1.00	1.00
Satd. Flow (prot)		1569		1175	1447
Flt Permitted		0.71		1.00	1.00
Satd. Flow (perm)		1134		1175	1447
Volume (vph)	131	179	31	31	34
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.73
Adj. Flow (vph)	154	211	36	36	47
RTOR Reduction (vph)	0	0	0	0	0
Lane Group Flow (vph)	0	401	0	36	47
Heavy Vehicles (%)	7%	7%	7%	7%	9%
Bus Blockages (#/hr)	0	0	0	0	0
Parking (#/hr)		1	1	1	
Turn Type	Perm			Prot	Over
Protected Phases		4		4	3
Permitted Phases	4				
Actuated Green, G (s)		22.0		22.0	11.0
Effective Green, g (s)		23.0		23.0	11.0
Actuated g/C Ratio		0.23		0.23	0.11
Clearance Time (s)		5.0		5.0	4.0
Vehicle Extension (s)		3.0		3.0	3.0
Lane Grp Cap (vph)		261		270	159
v/s Ratio Prot				0.03	0.03
v/s Ratio Perm		0.35			
v/c Ratio		1.54		0.13	0.30
Uniform Delay, d1		38.5		30.6	40.9
Progression Factor		0.71		0.72	1.00
Incremental Delay, d2		256.0		0.8	4.7
Delay (s)		283.4		22.8	45.6
Level of Service		F		C	D
Approach Delay (s)		261.9			
Approach LOS		F			

Intersection Summary

Lane Group	EBT	WBT
Lane Group Flow (vph)	840	787
v/c Ratio	0.34	0.28
Control Delay	0.3	0.0
Queue Delay	0.0	0.0
Total Delay	0.3	0.0
Queue Length 50th (ft)	0	0
Queue Length 95th (ft)	0	m0
Internal Link Dist (ft)	373	165
Turn Bay Length (ft)		
Base Capacity (vph)	2447	2824
Starvation Cap Reductn	0	0
Spillback Cap Reductn	0	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.34	0.28

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	11	11	12	12	12
Total Lost time (s)		4.0	4.0			
Lane Util. Factor		0.95	0.95			
Frt		1.00	0.99			
Flt Protected		1.00	1.00			
Satd. Flow (prot)		2713	2823			
Flt Permitted		0.90	1.00			
Satd. Flow (perm)		2448	2823			
Volume (vph)	31	767	625	52	0	0
Peak-hour factor, PHF	0.95	0.95	0.86	0.86	0.25	0.25
Adj. Flow (vph)	33	807	727	60	0	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	840	787	0	0	0
Heavy Vehicles (%)	7%	7%	10%	10%	0%	0%
Bus Blockages (#/hr)	0	6	0	0	0	0
Parking (#/hr)		5		5		
Turn Type	Perm					
Protected Phases		1	1			
Permitted Phases	1					
Actuated Green, G (s)		100.0	100.0			
Effective Green, g (s)		100.0	100.0			
Actuated g/C Ratio		1.00	1.00			
Clearance Time (s)		4.0	4.0			
Vehicle Extension (s)		3.0	3.0			
Lane Grp Cap (vph)		2448	2823			
v/s Ratio Prot			0.28			
v/s Ratio Perm		c0.34				
v/c Ratio		0.34	0.28			
Uniform Delay, d1		0.0	0.0			
Progression Factor		1.00	1.00			
Incremental Delay, d2		0.3	0.0			
Delay (s)		0.3	0.0			
Level of Service		A	A			
Approach Delay (s)		0.3	0.0		0.0	
Approach LOS		A	A		A	

Intersection Summary			
HCM Average Control Delay	0.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	52.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	SET	NWT	NET	SWT
Lane Group Flow (vph)	947	665	44	195
v/c Ratio	0.60	0.32	0.19	0.68
Control Delay	7.8	10.6	31.4	31.3
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	7.8	10.6	31.4	31.3
Queue Length 50th (ft)	96	115	20	59
Queue Length 95th (ft)	223	148	35	119
Internal Link Dist (ft)	339	373	163	400
Turn Bay Length (ft)				
Base Capacity (vph)	1569	2079	272	328
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.60	0.32	0.16	0.59

Intersection Summary

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	11	12	12	11	12	12	12	12	12	16	12
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		0.95			0.95			1.00			1.00	
Frt		1.00			1.00			0.97			0.91	
Flt Protected		0.99			1.00			0.98			0.98	
Satd. Flow (prot)		2755			2721			1628			1467	
Flt Permitted		0.78			1.00			0.80			0.89	
Satd. Flow (perm)		2159			2721			1325			1323	
Volume (vph)	96	756	0	0	591	7	13	11	6	54	0	119
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.70	0.70	0.70	0.89	0.89	0.89
Adj. Flow (vph)	107	840	0	0	657	8	19	16	9	61	0	134
RTOR Reduction (vph)	0	0	0	0	0	0	0	8	0	0	81	0
Lane Group Flow (vph)	0	947	0	0	665	0	0	36	0	0	114	0
Heavy Vehicles (%)	5%	5%	5%	8%	8%	8%	0%	0%	0%	5%	5%	5%
Bus Blockages (#/hr)	0	6	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)		5			5						2	
Turn Type	Perm						Perm			Perm		
Protected Phases		1			1			3			3	
Permitted Phases	1						3			3		
Actuated Green, G (s)		76.4			76.4			15.6			15.6	
Effective Green, g (s)		76.4			76.4			15.6			15.6	
Actuated g/C Ratio		0.76			0.76			0.16			0.16	
Clearance Time (s)		4.0			4.0			4.0			4.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		1649			2079			207			206	
v/s Ratio Prot					0.24							
v/s Ratio Perm		c0.44						0.03			c0.09	
v/c Ratio		0.57			0.32			0.18			0.55	
Uniform Delay, d1		5.0			3.7			36.6			39.0	
Progression Factor		1.00			2.48			1.00			0.96	
Incremental Delay, d2		1.5			0.4			0.4			3.2	
Delay (s)		6.4			9.5			37.0			40.8	
Level of Service		A			A			D			D	
Approach Delay (s)		6.4			9.5			37.0			40.8	
Approach LOS		A			A			D			D	

Intersection Summary			
HCM Average Control Delay	11.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	68.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	156	694	54	656	379	328	147	189
v/c Ratio	0.78	0.53	0.28	0.97	1.01	0.74	1.11	0.45
Control Delay	70.3	15.5	41.9	57.8	79.5	43.5	130.3	32.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	70.3	15.5	41.9	57.8	79.5	43.5	130.3	32.2
Queue Length 50th (ft)	108	249	31	407	~262	188	~108	89
Queue Length 95th (ft)	m0	m21	68	#653	#442	232	m#163	m122
Internal Link Dist (ft)		1295		1669		389		1718
Turn Bay Length (ft)	85		75					
Base Capacity (vph)	215	1310	211	673	375	445	133	417
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.73	0.53	0.26	0.97	1.01	0.74	1.11	0.45

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	11	11	10	11	11	16	16	16	11	11	11
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00		1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.98		1.00	1.00	0.65		1.00		1.00	0.98	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00		0.85	1.00	
Frt	1.00	0.99		1.00	1.00	0.85		1.00		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00		0.95	1.00	
Satd. Flow (prot)	1430	2896		1404	1494	831		1577		1185	1402	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.97		0.37	1.00	
Satd. Flow (perm)	1430	2896		1404	1494	831		1535		458	1402	
Volume (vph)	134	568	29	49	597	345	18	230	1	125	127	34
Peak-hour factor, PHF	0.86	0.86	0.86	0.91	0.91	0.91	0.76	0.76	0.76	0.85	0.85	0.85
Adj. Flow (vph)	156	660	34	54	656	379	24	303	1	147	149	40
RTOR Reduction (vph)	0	4	0	0	0	0	0	0	0	0	10	0
Lane Group Flow (vph)	156	690	0	54	656	379	0	328	0	147	179	0
Confl. Peds. (#/hr)	106		92	92		106	75		414	414		75
Confl. Bikes (#/hr)			17			1			9			1
Heavy Vehicles (%)	6%	6%	6%	8%	8%	8%	9%	9%	9%	12%	12%	12%
Bus Blockages (#/hr)	0	0	0	0	6	6	0	0	0	0	0	0
Parking (#/hr)							1	1	1			
Turn Type	Prot			Prot		Perm	Perm			Perm		
Protected Phases	1	2		1	2			3			3	
Permitted Phases						2	3			3		
Actuated Green, G (s)	13.9	44.1		13.9	44.1	44.1		28.0		28.0	28.0	
Effective Green, g (s)	13.9	45.1		13.9	45.1	45.1		29.0		29.0	29.0	
Actuated g/C Ratio	0.14	0.45		0.14	0.45	0.45		0.29		0.29	0.29	
Clearance Time (s)	4.0	5.0		4.0	5.0	5.0		5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	199	1306		195	674	375		445		133	407	
v/s Ratio Prot	c0.11	0.24		0.04	0.44						0.13	
v/s Ratio Perm						c0.46		0.21		c0.32		
v/c Ratio	0.78	0.53		0.28	0.97	1.01		0.74		1.11	0.44	
Uniform Delay, d1	41.6	19.8		38.5	26.9	27.4		32.1		35.5	28.9	
Progression Factor	1.64	0.76		1.00	1.00	1.00		1.00		1.06	1.09	
Incremental Delay, d2	1.9	0.1		0.8	28.7	49.2		6.3		92.4	0.5	
Delay (s)	69.9	15.2		39.3	55.6	76.6		38.3		129.9	32.0	
Level of Service	E	B		D	E	E		D		F	C	
Approach Delay (s)		25.3			62.1			38.3			74.8	
Approach LOS		C			E			D			E	

Intersection Summary			
HCM Average Control Delay	48.7	HCM Level of Service	D
HCM Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	84.3%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	271	118	83	533	644
v/c Ratio	0.87	0.49	0.25	0.91	0.77
Control Delay	50.3	39.9	8.6	44.9	27.5
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	50.3	39.9	8.6	44.9	27.5
Queue Length 50th (ft)	114	63	0	~178	136
Queue Length 95th (ft)	m145	115	35	m#243	m94
Internal Link Dist (ft)	821	168		1718	335
Turn Bay Length (ft)					
Base Capacity (vph)	352	281	378	585	832
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.77	0.42	0.22	0.91	0.77

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1600	1600	1600	1600	1600	1600
Lane Width	13	13	13	12	12	10	10	11	11	10	10	10
Total Lost time (s)		4.0			4.0	4.0		4.0			4.0	
Lane Util. Factor		1.00			1.00	1.00		0.95			0.95	
Frpb, ped/bikes		1.00			1.00	0.99		1.00			0.99	
Flpb, ped/bikes		1.00			1.00	1.00		1.00			1.00	
Frt		0.94			1.00	0.85		0.98			0.97	
Flt Protected		0.98			0.98	1.00		0.99			0.99	
Satd. Flow (prot)		1404			1517	1217		2157			2250	
Flt Permitted		0.84			0.65	1.00		0.70			0.70	
Satd. Flow (perm)		1197			1015	1217		1515			1583	
Volume (vph)	70	49	106	52	52	73	84	348	59	108	343	110
Peak-hour factor, PHF	0.83	0.83	0.83	0.88	0.88	0.88	0.92	0.92	0.92	0.87	0.87	0.87
Adj. Flow (vph)	84	59	128	59	59	83	91	378	64	124	394	126
RTOR Reduction (vph)	0	34	0	0	0	64	0	10	0	0	19	0
Lane Group Flow (vph)	0	237	0	0	118	19	0	523	0	0	625	0
Confl. Bikes (#/hr)						1			4			43
Heavy Vehicles (%)	16%	16%	16%	10%	10%	10%	15%	15%	15%	8%	8%	8%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	17	17	0	0	0
Turn Type	Perm			Perm		Perm	Perm			D.P+P		
Protected Phases		3			3			1		10	1 10	
Permitted Phases	3			3		3	1			1		
Actuated Green, G (s)		21.4			21.4	21.4		37.7			49.0	
Effective Green, g (s)		22.4			22.4	22.4		38.7			48.0	
Actuated g/C Ratio		0.22			0.22	0.22		0.39			0.48	
Clearance Time (s)		5.0			5.0	5.0		5.0				
Vehicle Extension (s)		3.0			3.0	3.0		3.0				
Lane Grp Cap (vph)		268			227	273		586			822	
v/s Ratio Prot											c0.07	
v/s Ratio Perm		c0.20			0.12	0.02		c0.35			0.29	
v/c Ratio		0.88			0.52	0.07		0.89			0.76	
Uniform Delay, d1		37.5			34.1	30.6		28.7			21.3	
Progression Factor		1.06			1.00	1.00		1.08			1.22	
Incremental Delay, d2		17.0			2.0	0.1		9.9			0.4	
Delay (s)		57.0			36.1	30.7		40.8			26.4	
Level of Service		E			D	C		D			C	
Approach Delay (s)		57.0			33.9			40.8			26.4	
Approach LOS		E			C			D			C	

Intersection Summary			
HCM Average Control Delay	37.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	29.6
Intersection Capacity Utilization	70.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	99	1004	253	896	95	182	296	96	353
v/c Ratio	1.94	1.43	1.61	0.83	1.94	0.70	0.55	0.68	1.28
Control Delay	459.5	232.0	333.7	31.5	491.7	49.5	3.7	61.7	184.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	459.5	232.0	333.7	31.5	491.7	49.5	3.7	61.7	184.9
Queue Length 50th (ft)	~98	~455	~233	253	~93	90	0	56	~287
Queue Length 95th (ft)	m#103	m#411	#388	346	m#123	m110	m0	#99	#355
Internal Link Dist (ft)		771		938		335			755
Turn Bay Length (ft)	70		350					170	
Base Capacity (vph)	51	704	157	1076	49	259	540	141	276
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.94	1.43	1.61	0.83	1.94	0.70	0.55	0.68	1.28

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
Lane Width	10	10	10	10	10	10	10	10	10	10	10	10
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	*0.95		1.00	0.95		1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	1.00	0.99	1.00	0.98	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.97		1.00	0.96		1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1216	2347		1205	2290		1120	1179	993	1240	1256	
Flt Permitted	0.13	1.00		0.95	1.00		0.18	1.00	1.00	0.50	1.00	
Satd. Flow (perm)	171	2347		1205	2290		214	1179	993	657	1256	
Volume (vph)	90	720	194	233	588	236	87	167	272	72	226	39
Peak-hour factor, PHF	0.91	0.91	0.91	0.92	0.92	0.92	0.92	0.92	0.92	0.75	0.75	0.75
Adj. Flow (vph)	99	791	213	253	639	257	95	182	296	96	301	52
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	192	0	0	0
Lane Group Flow (vph)	99	1004	0	253	896	0	95	182	104	96	353	0
Confl. Bikes (#/hr)			5			5			3			96
Heavy Vehicles (%)	5%	5%	5%	6%	6%	6%	14%	14%	14%	3%	3%	3%
Turn Type	Perm			custom			Perm		pm+ov	Perm		
Protected Phases		1		4	1 4			3	4		3	
Permitted Phases	1			4			3		3	3		
Actuated Green, G (s)	30.0	30.0		15.0	47.0		22.0	22.0	37.0	22.0	22.0	
Effective Green, g (s)	30.0	30.0		13.0	47.0		22.0	22.0	35.0	22.0	22.0	
Actuated g/C Ratio	0.30	0.30		0.13	0.47		0.22	0.22	0.35	0.22	0.22	
Clearance Time (s)	4.0	4.0		2.0			4.0	4.0	2.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0			3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	51	704		157	1076		47	259	387	145	276	
v/s Ratio Prot		0.43		c0.21	0.39			0.15	0.03		0.28	
v/s Ratio Perm	c0.58						c0.44		0.07	0.15		
v/c Ratio	1.94	1.43		1.61	0.83		2.02	0.70	0.27	0.66	1.28	
Uniform Delay, d1	35.0	35.0		43.5	23.1		39.0	36.0	23.3	35.6	39.0	
Progression Factor	1.57	1.56		1.00	1.00		1.07	1.07	0.45	1.00	1.00	
Incremental Delay, d2	430.0	192.5		302.6	5.6		502.6	5.3	0.2	10.8	150.5	
Delay (s)	484.9	247.3		346.1	28.7		544.2	43.8	10.6	46.4	189.5	
Level of Service	F	F		F	C		F	D	B	D	F	
Approach Delay (s)		268.6			98.6			109.6			158.9	
Approach LOS		F			F			F			F	

Intersection Summary			
HCM Average Control Delay	166.1	HCM Level of Service	F
HCM Volume to Capacity ratio	1.90		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	35.0
Intersection Capacity Utilization	90.0%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	403	874	666	73	28	259	402	105
v/c Ratio	0.79	0.91	0.72	0.15	0.26	0.58	1.36	0.14
Control Delay	26.7	44.0	32.4	6.4	32.4	32.1	211.8	8.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.7	44.0	32.4	6.4	32.4	32.1	211.8	8.9
Queue Length 50th (ft)	124	246	174	0	12	119	~304	25
Queue Length 95th (ft)	#274	#365	239	30	37	193	#444	45
Internal Link Dist (ft)		360	496			755	339	
Turn Bay Length (ft)	200				50			100
Base Capacity (vph)	512	962	922	482	107	444	296	755
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.79	0.91	0.72	0.15	0.26	0.58	1.36	0.14

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1600	1600	1600
Lane Width	10	10	10	10	10	10	11	12	12	11	11	14
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	0.95			0.95	1.00	1.00	1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00			1.00	1.00	1.00	0.94			1.00	1.00
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00	1.00			0.97	1.00
Frt	1.00	0.99			1.00	0.85	1.00	0.97			1.00	0.85
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00			0.99	1.00
Satd. Flow (prot)	1501	2967			3002	1343	1510	1499			1309	1280
Flt Permitted	0.25	1.00			0.95	1.00	0.23	1.00			0.77	1.00
Satd. Flow (perm)	396	2967			2861	1343	373	1499			1022	1280
Volume (vph)	379	764	57	2	651	72	25	183	45	60	281	89
Peak-hour factor, PHF	0.94	0.94	0.94	0.98	0.98	0.98	0.88	0.88	0.88	0.85	0.85	0.85
Adj. Flow (vph)	403	813	61	2	664	73	28	208	51	71	331	105
RTOR Reduction (vph)	0	6	0	0	0	49	0	10	0	0	0	0
Lane Group Flow (vph)	403	868	0	0	666	24	28	249	0	0	402	105
Confl. Peds. (#/hr)									300	300		
Confl. Bikes (#/hr)			1						1			81
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	4%	4%	4%	2%	2%	2%
Turn Type	pm+pt			Perm		Perm	Perm			Perm		pt+ov
Protected Phases	1	3			3			4			4	1 4
Permitted Phases	3			3		3	4			4		
Actuated Green, G (s)	50.0	28.0			28.0	28.0	25.0	25.0			25.0	52.0
Effective Green, g (s)	52.0	29.0			29.0	29.0	26.0	26.0			26.0	53.0
Actuated g/C Ratio	0.58	0.32			0.32	0.32	0.29	0.29			0.29	0.59
Clearance Time (s)	5.0	5.0			5.0	5.0	5.0	5.0			5.0	
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0			3.0	
Lane Grp Cap (vph)	511	956			922	433	108	433			295	754
v/s Ratio Prot	c0.20	c0.29						0.17				0.08
v/s Ratio Perm	0.25				0.23	0.02	0.08				c0.39	
v/c Ratio	0.79	0.91			0.72	0.05	0.26	0.58			1.36	0.14
Uniform Delay, d1	13.0	29.2			26.9	21.0	24.6	27.3			32.0	8.3
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2	7.9	12.1			2.8	0.1	5.7	5.5			183.6	0.4
Delay (s)	20.9	41.3			29.8	21.1	30.3	32.8			215.6	8.7
Level of Service	C	D			C	C	C	C			F	A
Approach Delay (s)		34.9			28.9			32.5			172.7	
Approach LOS		C			C			C			F	

Intersection Summary			
HCM Average Control Delay	57.9	HCM Level of Service	E
HCM Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	98.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	626	136	190	898	342	285	164
v/c Ratio	1.69	0.52	0.56	0.67	0.80	0.38	0.25
Control Delay	351.9	58.6	41.2	42.1	46.0	18.5	17.2
Queue Delay	0.0	0.0	0.0	0.9	0.0	0.0	0.0
Total Delay	351.9	58.6	41.2	42.9	46.0	18.5	17.2
Queue Length 50th (ft)	~354	94	114	301	220	113	52
Queue Length 95th (ft)	m#427	m132	m#164	m417	#396	162	111
Internal Link Dist (ft)	176			771		331	256
Turn Bay Length (ft)		150	150		100		
Base Capacity (vph)	371	261	340	1335	426	746	648
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	191	0	0	3
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.69	0.52	0.56	0.78	0.80	0.38	0.25

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	12	12	12	15	11	14	14	14
Total Lost time (s)		4.0	4.0	4.0	4.0		4.0	4.0			4.0	
Lane Util. Factor		0.95	1.00	1.00	0.95		1.00	1.00			1.00	
Frt		1.00	0.85	1.00	1.00		1.00	0.91			0.94	
Flt Protected		1.00	1.00	0.95	1.00		0.95	1.00			0.99	
Satd. Flow (prot)		2911	1304	1444	3080		1547	1625			1638	
Flt Permitted		0.63	1.00	0.19	1.00		0.63	1.00			0.87	
Satd. Flow (perm)		1829	1304	281	3080		1024	1625			1447	
Volume (vph)	17	552	124	184	845	26	301	96	155	39	44	73
Peak-hour factor, PHF	0.91	0.91	0.91	0.97	0.97	0.97	0.88	0.88	0.88	0.95	0.95	0.95
Adj. Flow (vph)	19	607	136	190	871	27	342	109	176	41	46	77
RTOR Reduction (vph)	0	0	0	0	0	0	0	43	0	0	23	0
Lane Group Flow (vph)	0	626	136	190	898	0	342	243	0	0	141	0
Heavy Vehicles (%)	4%	4%	4%	5%	5%	5%	5%	5%	5%	3%	3%	3%
Turn Type	Perm		Perm	D.P+P			Perm			Perm		
Protected Phases		1		4	1 4			3			3	
Permitted Phases	1		1	1			3			3		
Actuated Green, G (s)		21.6	21.6	45.6	49.6		52.0	52.0			52.0	
Effective Green, g (s)		21.6	21.6	45.6	49.6		52.0	52.0			52.0	
Actuated g/C Ratio		0.18	0.18	0.38	0.41		0.43	0.43			0.43	
Clearance Time (s)		4.0	4.0	4.0			4.0	4.0			4.0	
Vehicle Extension (s)		3.0	3.0	3.0			3.0	3.0			3.0	
Lane Grp Cap (vph)		329	235	339	1273		444	704			627	
v/s Ratio Prot				0.11	c0.29			0.15				
v/s Ratio Perm		c0.34	0.10	0.10			c0.33				0.10	
v/c Ratio		1.90	0.58	0.56	0.71		0.77	0.34			0.22	
Uniform Delay, d1		49.2	45.0	28.1	29.2		28.9	22.6			21.3	
Progression Factor		1.17	1.22	1.41	1.36		1.03	1.01			1.00	
Incremental Delay, d2		414.3	7.3	4.5	2.3		7.8	0.3			0.2	
Delay (s)		472.0	62.1	44.0	42.0		37.5	23.2			21.5	
Level of Service		F	E	D	D		D	C			C	
Approach Delay (s)		398.8			42.4			31.0			21.5	
Approach LOS		F			D			C			C	

Intersection Summary			
HCM Average Control Delay	141.2	HCM Level of Service	F
HCM Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	22.4
Intersection Capacity Utilization	86.2%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	623	39	0	1219	0	71
Peak Hour Factor	0.90	0.90	0.97	0.97	0.80	0.80
Hourly flow rate (vph)	692	43	0	1257	0	89
Pedestrians	89			89	89	
Lane Width (ft)	11.0			10.0	14.0	
Walking Speed (ft/s)	4.0			4.0	4.0	
Percent Blockage	7			6	9	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)	94			256		
pX, platoon unblocked			0.87		0.83	0.87
vC, conflicting volume			825		1520	546
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			654		968	334
tC, single (s)			4.1		7.0	7.1
tC, 2 stage (s)						
tF (s)			2.2		3.6	3.4
p0 queue free %			100		100	81
cM capacity (veh/h)			741		166	474

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	461	274	628	628	89
Volume Left	0	0	0	0	0
Volume Right	0	43	0	0	89
cSH	1700	1700	1700	1700	474
Volume to Capacity	0.27	0.16	0.37	0.37	0.19
Queue Length 95th (ft)	0	0	0	0	17
Control Delay (s)	0.0	0.0	0.0	0.0	14.3
Lane LOS					B
Approach Delay (s)	0.0		0.0		14.3
Approach LOS					B

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	56.9%	ICU Level of Service	B
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	120	420	505	770	939	1381
v/c Ratio	2.26	0.65	1.59	0.66	1.08	1.13
Control Delay	648.2	47.8	301.7	24.4	86.7	103.5
Queue Delay	0.0	0.0	0.0	4.1	0.0	0.0
Total Delay	648.2	47.8	301.7	28.5	86.7	103.5
Queue Length 50th (ft)	~151	156	~446	298	~441	~698
Queue Length 95th (ft)	#275	214	m#659	244	#575	#795
Internal Link Dist (ft)		849		14	255	366
Turn Bay Length (ft)						
Base Capacity (vph)	53	643	317	1164	873	1223
Starvation Cap Reductn	0	0	0	306	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	2.26	0.65	1.59	0.90	1.08	1.13

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	10	10	10	11	11	11	10	10	10
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			0.95			0.95	
Frt	1.00	1.00		1.00	1.00			0.96			1.00	
Flt Protected	0.95	1.00		0.95	1.00			1.00			1.00	
Satd. Flow (prot)	1510	2854		1486	2969			2998			2990	
Flt Permitted	0.15	1.00		0.33	1.00			0.74			1.00	
Satd. Flow (perm)	243	2854		516	2969			2233			2990	
Volume (vph)	116	401	7	490	740	7	13	607	262	0	1168	33
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.94	0.94	0.94	0.87	0.87	0.87
Adj. Flow (vph)	120	413	7	505	763	7	14	646	279	0	1343	38
RTOR Reduction (vph)	0	0	0	0	1	0	0	33	0	0	1	0
Lane Group Flow (vph)	120	420	0	505	769	0	0	906	0	0	1380	0
Heavy Vehicles (%)	4%	4%	4%	2%	2%	2%	0%	0%	0%	1%	1%	1%
Parking (#/hr)		1	1									
Turn Type	Perm			D.P+P			Perm					
Protected Phases		1		4	1 4			3			3	
Permitted Phases	1			1			3					
Actuated Green, G (s)	24.2	24.2		38.2	44.2			47.0			47.0	
Effective Green, g (s)	26.2	26.2		42.2	46.2			49.0			49.0	
Actuated g/C Ratio	0.22	0.22		0.35	0.38			0.41			0.41	
Clearance Time (s)	6.0	6.0		6.0				6.0			6.0	
Vehicle Extension (s)	3.0	3.0		3.0				3.0			3.0	
Lane Grp Cap (vph)	53	623		311	1143			912			1221	
v/s Ratio Prot		0.15		c0.22	0.26						c0.46	
v/s Ratio Perm	c0.49			0.35				0.41				
v/c Ratio	2.26	0.67		1.62	0.67			0.99			1.13	
Uniform Delay, d1	46.9	43.0		35.1	30.6			35.3			35.5	
Progression Factor	1.00	1.00		0.83	0.73			1.00			1.00	
Incremental Delay, d2	624.3	5.8		291.3	2.3			28.2			69.3	
Delay (s)	671.2	48.7		320.6	24.8			63.6			104.8	
Level of Service	F	D		F	C			E			F	
Approach Delay (s)		187.1			142.0			63.6			104.8	
Approach LOS		F			F			E			F	

Intersection Summary			
HCM Average Control Delay	117.6	HCM Level of Service	F
HCM Volume to Capacity ratio	1.54		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	28.8
Intersection Capacity Utilization	91.4%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	0	171	0	3	62	37	0	0	3	185	0	15
Peak Hour Factor	0.86	0.86	0.86	0.71	0.71	0.71	0.75	0.75	0.75	0.78	0.78	0.78
Hourly flow rate (vph)	0	199	0	4	87	52	0	0	4	237	0	19

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	199	144	4	256
Volume Left (vph)	0	4	0	237
Volume Right (vph)	0	52	4	19
Hadj (s)	0.00	-0.18	-0.60	0.21
Departure Headway (s)	4.8	4.7	4.5	4.9
Degree Utilization, x	0.26	0.19	0.00	0.35
Capacity (veh/h)	710	720	710	687
Control Delay (s)	9.5	8.7	7.5	10.6
Approach Delay (s)	9.5	8.7	7.5	10.6
Approach LOS	A	A	A	B

Intersection Summary			
Delay	9.8		
HCM Level of Service	A		
Intersection Capacity Utilization	39.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	71	64	13	113	9	118	5	292	92	73	249	57
Peak Hour Factor	0.88	0.88	0.88	0.94	0.94	0.94	0.89	0.89	0.89	0.87	0.87	0.87
Hourly flow rate (vph)	81	73	15	120	10	126	6	328	103	84	286	66
Pedestrians		227			258			258			258	
Lane Width (ft)		13.0			13.0			12.0			10.5	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		20			23			22			19	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								270			411	
pX, platoon unblocked	0.93	0.93	0.93	0.93	0.93		0.93					
vC, conflicting volume	1493	1414	804	1412	1396	896	579			689		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1529	1445	790	1442	1424	896	548			689		
tC, single (s)	7.2	6.6	6.4	7.1	6.5	6.2	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.1	3.4	3.5	4.0	3.3	2.3			2.2		
p0 queue free %	0	0	93	0	86	41	99			88		
cM capacity (veh/h)	13	61	216	0	68	213	735			698		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total	168	255	437	84	352
Volume Left	81	120	6	84	0
Volume Right	15	126	103	0	66
cSH	22	0	735	698	1700
Volume to Capacity	7.65	Err	0.01	0.12	0.21
Queue Length 95th (ft)	Err	Err	1	10	0
Control Delay (s)	Err	Err	0.2	10.9	0.0
Lane LOS	F	F	A	B	
Approach Delay (s)	Err	Err	0.2	2.1	
Approach LOS	F	F			

Intersection Summary			
Average Delay	Err		
Intersection Capacity Utilization	79.0%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	75	0	71	129	16	14
Peak Hour Factor	0.83	0.83	0.55	0.55	0.86	0.86
Hourly flow rate (vph)	90	0	129	235	19	16
Pedestrians	39		31			39
Lane Width (ft)	12.0		12.0			12.0
Walking Speed (ft/s)	4.0		4.0			4.0
Percent Blockage	3		3			3
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	370	324			403	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	370	324			403	
tC, single (s)	6.4	6.2			4.4	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.5	
p0 queue free %	85	100			98	
cM capacity (veh/h)	587	675			991	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	90	364	35
Volume Left	90	0	19
Volume Right	0	235	0
cSH	587	1700	991
Volume to Capacity	0.15	0.21	0.02
Queue Length 95th (ft)	14	0	1
Control Delay (s)	12.2	0.0	4.7
Lane LOS	B		A
Approach Delay (s)	12.2	0.0	4.7
Approach LOS	B		

Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	34.3%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	NBT	SBL	SBT
Lane Group Flow (vph)	244	387	50	411
v/c Ratio	0.73	0.55	0.13	0.48
Control Delay	41.0	23.0	14.2	16.5
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	41.0	23.0	14.2	16.5
Queue Length 50th (ft)	148	177	15	154
Queue Length 95th (ft)	182	347	m54	348
Internal Link Dist (ft)	167	410		190
Turn Bay Length (ft)			150	
Base Capacity (vph)	340	834	454	1007
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.72	0.46	0.11	0.41

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	16	12	12	12	12	12	12	12	12	10	12	12
Total Lost time (s)		4.0						4.0		4.0	4.0	
Lane Util. Factor		1.00						1.00		1.00	1.00	
Frpb, ped/bikes		0.96						0.94		1.00	0.96	
Flpb, ped/bikes		0.55						1.00		0.91	1.00	
Frt		0.96						0.97		1.00	0.97	
Flt Protected		0.97						1.00		0.95	1.00	
Satd. Flow (prot)		828						1334		1346	1550	
Flt Permitted		0.97						0.96		0.48	1.00	
Satd. Flow (perm)		828						1282		678	1550	
Volume (vph)	145	0	57	0	0	0	24	257	83	42	266	79
Peak-hour factor, PHF	0.83	0.83	0.83	0.25	0.25	0.25	0.94	0.94	0.94	0.84	0.84	0.84
Adj. Flow (vph)	175	0	69	0	0	0	26	273	88	50	317	94
RTOR Reduction (vph)	0	10	0	0	0	0	0	11	0	0	11	0
Lane Group Flow (vph)	0	234	0	0	0	0	0	376	0	50	400	0
Confl. Peds. (#/hr)	304		35	35		304	45		66	66		45
Heavy Vehicles (%)	1%	1%	1%	0%	0%	0%	16%	16%	16%	2%	2%	2%
Turn Type	Perm						Perm			Perm		
Protected Phases		2						1			1	
Permitted Phases	2						1			1		
Actuated Green, G (s)		46.6						65.4		65.4	65.4	
Effective Green, g (s)		46.6						65.4		65.4	65.4	
Actuated g/C Ratio		0.39						0.55		0.55	0.55	
Clearance Time (s)		4.0						4.0		4.0	4.0	
Vehicle Extension (s)		3.0						3.0		3.0	3.0	
Lane Grp Cap (vph)		322						699		370	845	
v/s Ratio Prot											0.26	
v/s Ratio Perm		0.28						c0.29		0.07		
v/c Ratio		0.73						0.54		0.14	0.47	
Uniform Delay, d1		31.3						17.6		13.4	16.7	
Progression Factor		1.00						1.00		0.75	0.78	
Incremental Delay, d2		7.9						3.0		0.7	1.9	
Delay (s)		39.1						20.5		10.7	14.9	
Level of Service		D						C		B	B	
Approach Delay (s)		39.1			0.0			20.5			14.4	
Approach LOS		D			A			C			B	

Intersection Summary			
HCM Average Control Delay	22.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	71.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	102	189	105	24	23	57	33	38	14	0	51	54
Peak Hour Factor	0.85	0.85	0.85	0.68	0.68	0.68	0.72	0.72	0.72	0.67	0.67	0.67
Hourly flow rate (vph)	120	222	124	35	34	84	46	53	19	0	76	81

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	466	153	118	157
Volume Left (vph)	120	35	46	0
Volume Right (vph)	124	84	19	81
Hadj (s)	-0.11	0.02	0.00	-0.31
Departure Headway (s)	4.8	5.4	5.8	5.4
Degree Utilization, x	0.62	0.23	0.19	0.23
Capacity (veh/h)	720	616	546	592
Control Delay (s)	15.4	9.9	10.1	10.0
Approach Delay (s)	15.4	9.9	10.1	10.0
Approach LOS	C	A	B	B

Intersection Summary			
Delay	12.8		
HCM Level of Service	B		
Intersection Capacity Utilization	51.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	17	0	78	31	10	84	33	283	0	0	245	19
Peak Hour Factor	0.72	0.72	0.72	0.83	0.83	0.83	0.89	0.89	0.89	0.83	0.83	0.83
Hourly flow rate (vph)	24	0	108	37	12	101	37	318	0	0	295	23
Pedestrians		80			101			101			90	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		7			8			8			8	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								452			490	
pX, platoon unblocked												
vC, conflicting volume	976	880	488	1009	891	509	398			419		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	976	880	488	1009	891	509	398			419		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.3			2.2		
p0 queue free %	82	100	78	70	95	79	96			100		
cM capacity (veh/h)	130	234	492	125	234	481	1044			1044		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	60	72	151	355	318
Volume Left	24	0	37	37	0
Volume Right	36	72	101	0	23
cSH	234	492	269	1044	1700
Volume to Capacity	0.26	0.15	0.56	0.04	0.19
Queue Length 95th (ft)	25	13	79	3	0
Control Delay (s)	25.6	13.6	34.3	1.2	0.0
Lane LOS	D	B	D	A	
Approach Delay (s)	19.0		34.3	1.2	0.0
Approach LOS	C		D		

Intersection Summary			
Average Delay	8.5		
Intersection Capacity Utilization	63.2%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	34	29	0	0	47	18	24	41	13	53	0	132
Peak Hour Factor	0.75	0.75	0.75	0.81	0.81	0.81	0.82	0.82	0.82	0.70	0.70	0.70
Hourly flow rate (vph)	45	39	0	0	58	22	29	50	16	76	0	189
Pedestrians		46			51			45			51	
Lane Width (ft)		11.0			11.0			16.0			11.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		4			4			5			4	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								376				
pX, platoon unblocked												
vC, conflicting volume	510	467	185	478	553	160	235			117		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	510	467	185	478	553	160	235			117		
tC, single (s)	7.2	6.6	6.3	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.1	3.4	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	86	91	100	100	85	97	98			95		
cM capacity (veh/h)	331	417	774	376	377	815	1297			1426		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	84	80	95	264
Volume Left	45	0	29	76
Volume Right	0	22	16	189
cSH	366	443	1297	1426
Volume to Capacity	0.23	0.18	0.02	0.05
Queue Length 95th (ft)	22	16	2	4
Control Delay (s)	17.7	14.9	2.5	2.5
Lane LOS	C	B	A	A
Approach Delay (s)	17.7	14.9	2.5	2.5
Approach LOS	C	B		

Intersection Summary			
Average Delay	6.9		
Intersection Capacity Utilization	37.8%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	WBL	WBT	NBT	SBT	SBR2	NER2
Lane Group Flow (vph)	664	97	960	401	377	36	146
v/c Ratio	1.52	0.64	0.98	2.45	1.75	0.17	1.16
Control Delay	276.4	20.9	33.7	687.6	385.6	37.1	171.4
Queue Delay	3.1	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	279.5	20.9	33.7	687.6	385.6	37.1	171.4
Queue Length 50th (ft)	~299	48	352	~403	~359	20	~111
Queue Length 95th (ft)	#442	m46	m305	#591	#539	49	#184
Internal Link Dist (ft)	165		1295	704	372		
Turn Bay Length (ft)		50				50	
Base Capacity (vph)	437	152	979	164	215	212	126
Starvation Cap Reductn	2	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.53	0.64	0.98	2.45	1.75	0.17	1.16

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	EBR2	WBL2	WBL	WBT	WBR	NBL2	NBL	NBT	NBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)		4.0				4.0	4.0				4.0	
Lane Util. Factor		0.95				0.91	0.91				1.00	
Frt		0.96				1.00	0.98				0.99	
Flt Protected		1.00				0.95	1.00				0.97	
Satd. Flow (prot)		2662				1353	2878				1352	
Flt Permitted		0.71				0.17	1.00				0.17	
Satd. Flow (perm)		1899				248	2878				234	
Volume (vph)	9	471	119	32	54	38	792	110	31	168	168	18
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.94	0.94	0.94	0.94	0.96	0.96	0.96	0.96
Adj. Flow (vph)	9	496	125	34	57	40	843	117	32	175	175	19
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	664	0	0	0	97	960	0	0	0	401	0
Heavy Vehicles (%)	4%	4%	4%	4%	2%	2%	2%	2%	3%	3%	3%	3%
Bus Blockages (#/hr)	0	0	0	0	0	0	3	3	0	0	7	7
Parking (#/hr)		1	1	1						1	1	1
Turn Type	Perm				D.P+P	D.P+P			D.P+P	D.P+P		
Protected Phases		1			9	9	1 9		3	3	3 4	
Permitted Phases	1				1	1			4	4		
Actuated Green, G (s)		22.0				29.0	29.0				26.0	
Effective Green, g (s)		23.0				30.0	30.0				27.0	
Actuated g/C Ratio		0.23				0.30	0.30				0.27	
Clearance Time (s)		5.0				4.0						
Vehicle Extension (s)		3.0				3.0						
Lane Grp Cap (vph)		437				152	979				164	
v/s Ratio Prot						0.04	c0.07				c0.22	
v/s Ratio Perm		c0.35				0.15	0.26				c0.44	
v/c Ratio		1.52				0.64	0.98				2.45	
Uniform Delay, d1		38.5				27.6	34.7				36.5	
Progression Factor		1.07				0.70	0.83				1.00	
Incremental Delay, d2		245.0				0.8	5.1				668.4	
Delay (s)		286.3				20.1	33.8				704.9	
Level of Service		F				C	C				F	
Approach Delay (s)		286.3					32.5				704.9	
Approach LOS		F					C				F	

Intersection Summary			
HCM Average Control Delay	255.2	HCM Level of Service	F
HCM Volume to Capacity ratio	1.92		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	43.0
Intersection Capacity Utilization	103.8%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBL	SBT	SBR	SBR2	NER2
Lane Configurations					
Ideal Flow (vphpl)	1900	1900	1900	1900	1900
Lane Width	11	16	11	11	14
Total Lost time (s)		4.0		4.0	4.0
Lane Util. Factor		1.00		1.00	1.00
Frt		0.98		0.85	0.86
Flt Protected		0.98		1.00	1.00
Satd. Flow (prot)		1567		1175	1396
Flt Permitted		0.75		1.00	1.00
Satd. Flow (perm)		1197		1175	1396
Volume (vph)	129	199	41	35	111
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.76
Adj. Flow (vph)	132	203	42	36	146
RTOR Reduction (vph)	0	0	0	0	0
Lane Group Flow (vph)	0	377	0	36	146
Heavy Vehicles (%)	7%	7%	7%	7%	13%
Bus Blockages (#/hr)	0	0	0	0	0
Parking (#/hr)		1	1	1	
Turn Type	Perm			Prot	Over
Protected Phases		4		4	3
Permitted Phases	4				
Actuated Green, G (s)		17.0		17.0	9.0
Effective Green, g (s)		18.0		18.0	9.0
Actuated g/C Ratio		0.18		0.18	0.09
Clearance Time (s)		5.0		5.0	4.0
Vehicle Extension (s)		3.0		3.0	3.0
Lane Grp Cap (vph)		215		212	126
v/s Ratio Prot				0.03	0.10
v/s Ratio Perm		0.31			
v/c Ratio		1.75		0.17	1.16
Uniform Delay, d1		41.0		34.7	45.5
Progression Factor		1.00		1.00	1.00
Incremental Delay, d2		357.5		1.7	129.1
Delay (s)		398.5		36.4	174.6
Level of Service		F		D	F
Approach Delay (s)		367.0			
Approach LOS		F			

Intersection Summary

Lane Group	EBT	WBT
Lane Group Flow (vph)	680	1082
v/c Ratio	0.29	0.36
Control Delay	0.3	0.1
Queue Delay	0.2	0.0
Total Delay	0.4	0.1
Queue Length 50th (ft)	0	0
Queue Length 95th (ft)	0	m0
Internal Link Dist (ft)	373	165
Turn Bay Length (ft)		
Base Capacity (vph)	2369	3031
Starvation Cap Reductn	0	0
Spillback Cap Reductn	757	146
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.42	0.38

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	11	11	12	12	12
Total Lost time (s)		4.0	4.0			
Lane Util. Factor		0.95	0.95			
Frt		1.00	0.99			
Flt Protected		1.00	1.00			
Satd. Flow (prot)		2763	3032			
Flt Permitted		0.86	1.00			
Satd. Flow (perm)		2375	3032			
Volume (vph)	33	606	959	37	0	0
Peak-hour factor, PHF	0.94	0.94	0.92	0.92	0.75	0.75
Adj. Flow (vph)	35	645	1042	40	0	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	680	1082	0	0	0
Heavy Vehicles (%)	5%	5%	3%	3%	0%	0%
Bus Blockages (#/hr)	0	6	0	0	0	0
Parking (#/hr)		5		5		
Turn Type	Perm					
Protected Phases		1	1			
Permitted Phases	1					
Actuated Green, G (s)		100.0	100.0			
Effective Green, g (s)		100.0	100.0			
Actuated g/C Ratio		1.00	1.00			
Clearance Time (s)		4.0	4.0			
Vehicle Extension (s)		3.0	3.0			
Lane Grp Cap (vph)		2375	3032			
v/s Ratio Prot			c0.36			
v/s Ratio Perm		0.29				
v/c Ratio		0.29	0.36			
Uniform Delay, d1		0.0	0.0			
Progression Factor		1.00	1.00			
Incremental Delay, d2		0.3	0.0			
Delay (s)		0.3	0.0			
Level of Service		A	A			
Approach Delay (s)		0.3	0.0		0.0	
Approach LOS		A	A		A	

Intersection Summary			
HCM Average Control Delay	0.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	49.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	SET	NWT	NET	SWT
Lane Group Flow (vph)	676	988	42	291
v/c Ratio	0.43	0.49	0.18	0.77
Control Delay	8.6	8.3	27.0	36.6
Queue Delay	0.0	0.2	0.0	0.0
Total Delay	8.6	8.4	27.0	36.6
Queue Length 50th (ft)	80	66	19	116
Queue Length 95th (ft)	171	411	29	150
Internal Link Dist (ft)	339	373	163	400
Turn Bay Length (ft)				
Base Capacity (vph)	1555	2010	265	413
Starvation Cap Reductn	0	279	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.43	0.57	0.16	0.70

Intersection Summary

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	11	12	12	11	12	12	12	12	12	16	12
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		0.95			0.95			1.00			1.00	
Frt		1.00			1.00			0.98			0.91	
Flt Protected		1.00			1.00			0.96			0.98	
Satd. Flow (prot)		2815			2850			1617			1540	
Flt Permitted		0.82			1.00			0.65			0.89	
Satd. Flow (perm)		2329			2850			1091			1384	
Volume (vph)	43	572	0	0	911	18	20	3	4	71	0	162
Peak-hour factor, PHF	0.91	0.91	0.91	0.94	0.94	0.94	0.65	0.65	0.65	0.80	0.80	0.80
Adj. Flow (vph)	47	629	0	0	969	19	31	5	6	89	0	202
RTOR Reduction (vph)	0	0	0	0	1	0	0	5	0	0	81	0
Lane Group Flow (vph)	0	676	0	0	987	0	0	37	0	0	210	0
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	6	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)		5			5						2	
Turn Type	Perm						Perm			Perm		
Protected Phases		1			1			3			3	
Permitted Phases	1						3			3		
Actuated Green, G (s)		70.5			70.5			21.5			21.5	
Effective Green, g (s)		70.5			70.5			21.5			21.5	
Actuated g/C Ratio		0.70			0.70			0.22			0.22	
Clearance Time (s)		4.0			4.0			4.0			4.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		1642			2009			235			298	
v/s Ratio Prot					c0.35							
v/s Ratio Perm		0.29						0.03			c0.15	
v/c Ratio		0.41			0.49			0.16			0.71	
Uniform Delay, d1		6.1			6.7			31.9			36.3	
Progression Factor		1.00			0.93			1.00			1.01	
Incremental Delay, d2		0.8			0.8			0.3			7.4	
Delay (s)		6.9			7.0			32.2			44.1	
Level of Service		A			A			C			D	
Approach Delay (s)		6.9			7.0			32.2			44.1	
Approach LOS		A			A			C			D	

Intersection Summary			
HCM Average Control Delay	12.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	72.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	79	691	149	891	167	167	173	308
v/c Ratio	0.41	0.51	0.75	1.21	0.58	0.39	0.93	0.74
Control Delay	51.0	7.1	65.1	134.3	30.7	32.1	86.0	41.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	51.0	7.1	65.1	134.3	30.7	32.1	86.0	41.5
Queue Length 50th (ft)	47	71	91	~729	80	85	105	161
Queue Length 95th (ft)	m39	m51	#169	#933	156	139	#233	261
Internal Link Dist (ft)		1295		1669		389		1718
Turn Bay Length (ft)	85		75					
Base Capacity (vph)	215	1353	221	737	290	447	197	438
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.37	0.51	0.67	1.21	0.58	0.37	0.88	0.70

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	11	11	10	11	11	16	16	16	11	11	11
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00		1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.98		1.00	1.00	0.46		0.99		1.00	0.94	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		0.99		0.73	1.00	
Frt	1.00	0.99		1.00	1.00	0.85		1.00		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.99		0.95	1.00	
Satd. Flow (prot)	1430	2869		1472	1566	616		1637		1118	1440	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.90		0.57	1.00	
Satd. Flow (perm)	1430	2869		1472	1566	616		1491		665	1440	
Volume (vph)	76	632	32	131	784	147	19	121	5	164	193	100
Peak-hour factor, PHF	0.96	0.96	0.96	0.88	0.88	0.88	0.87	0.87	0.87	0.95	0.95	0.95
Adj. Flow (vph)	79	658	33	149	891	167	22	139	6	173	203	105
RTOR Reduction (vph)	0	3	0	0	0	0	0	0	0	0	19	0
Lane Group Flow (vph)	79	688	0	149	891	167	0	167	0	173	289	0
Confl. Peds. (#/hr)	190		160	160		190	158		725	725		158
Confl. Bikes (#/hr)			15			23			1			10
Heavy Vehicles (%)	6%	6%	6%	3%	3%	3%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	6	6	0	0	0	0	0	0
Parking (#/hr)							1	1	1			
Turn Type	Prot			Prot		Perm	Perm			Perm		
Protected Phases	1	2		1	2			3			3	
Permitted Phases						2	3			3		
Actuated Green, G (s)	13.4	46.1		13.4	46.1	46.1		26.5		26.5	26.5	
Effective Green, g (s)	13.4	47.1		13.4	47.1	47.1		27.5		27.5	27.5	
Actuated g/C Ratio	0.13	0.47		0.13	0.47	0.47		0.28		0.28	0.28	
Clearance Time (s)	4.0	5.0		4.0	5.0	5.0		5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	192	1351		197	738	290		410		183	396	
v/s Ratio Prot	0.06	0.24		c0.10	c0.57						0.20	
v/s Ratio Perm						0.27		0.11		c0.26		
v/c Ratio	0.41	0.51		0.76	1.21	0.58		0.41		0.95	0.73	
Uniform Delay, d1	39.7	18.4		41.7	26.4	19.2		29.6		35.5	32.9	
Progression Factor	1.28	0.36		1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	0.1	0.1		15.2	105.8	8.1		0.7		50.4	6.8	
Delay (s)	50.9	6.7		56.9	132.3	27.3		30.3		85.9	39.7	
Level of Service	D	A		E	F	C		C		F	D	
Approach Delay (s)		11.3			108.4			30.3			56.3	
Approach LOS		B			F			C			E	

Intersection Summary			
HCM Average Control Delay	65.4	HCM Level of Service	E
HCM Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	97.7%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	247	133	159	621	469
v/c Ratio	0.84	0.48	0.40	0.76	0.43
Control Delay	50.0	45.6	8.0	39.1	21.5
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	50.0	45.6	8.0	39.1	21.5
Queue Length 50th (ft)	147	92	0	~271	143
Queue Length 95th (ft)	180	128	43	#391	m132
Internal Link Dist (ft)	821	168		1718	335
Turn Bay Length (ft)					
Base Capacity (vph)	432	440	543	813	1089
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.57	0.30	0.29	0.76	0.43

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1600	1600	1600	1600	1600	1600
Lane Width	13	13	13	12	12	10	10	11	11	10	10	10
Total Lost time (s)		4.0			4.0	4.0		4.0			4.0	
Lane Util. Factor		1.00			1.00	1.00		0.95			0.95	
Frpb, ped/bikes		0.99			1.00	0.98		0.98			0.92	
Flpb, ped/bikes		1.00			1.00	1.00		0.97			0.99	
Frt		0.92			1.00	0.85		0.99			0.97	
Flt Protected		0.99			0.98	1.00		0.99			1.00	
Satd. Flow (prot)		1316			1642	1310		2221			2112	
Flt Permitted		0.80			0.67	1.00		0.83			0.88	
Satd. Flow (perm)		1064			1121	1310		1847			1857	
Volume (vph)	57	27	117	48	66	137	67	488	22	32	292	74
Peak-hour factor, PHF	0.81	0.81	0.81	0.86	0.86	0.86	0.93	0.93	0.93	0.85	0.85	0.85
Adj. Flow (vph)	70	33	144	56	77	159	72	525	24	38	344	87
RTOR Reduction (vph)	0	50	0	0	0	126	0	2	0	0	12	0
Lane Group Flow (vph)	0	197	0	0	133	33	0	619	0	0	457	0
Confl. Peds. (#/hr)							500		500	500		500
Confl. Bikes (#/hr)			1			3			76			11
Heavy Vehicles (%)	21%	21%	21%	2%	2%	2%	8%	8%	8%	6%	6%	6%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	17	17	0	0	0
Turn Type	Perm			Perm		Perm	Perm			D.P+P		
Protected Phases		3			3			1		10	1 10	
Permitted Phases	3			3		3	1			1		
Actuated Green, G (s)		24.0			24.0	24.0		53.0			67.8	
Effective Green, g (s)		25.0			25.0	25.0		54.0			68.8	
Actuated g/C Ratio		0.21			0.21	0.21		0.45			0.57	
Clearance Time (s)		5.0			5.0	5.0		5.0				
Vehicle Extension (s)		3.0			3.0	3.0		3.0				
Lane Grp Cap (vph)		222			234	273		831			1096	
v/s Ratio Prot											c0.05	
v/s Ratio Perm		c0.19			0.12	0.03		c0.33			0.19	
v/c Ratio		0.89			0.57	0.12		0.74			0.42	
Uniform Delay, d1		46.1			42.7	38.6		27.3			14.4	
Progression Factor		0.83			1.00	1.00		1.00			1.38	
Incremental Delay, d2		30.4			3.1	0.2		6.0			0.1	
Delay (s)		68.8			45.8	38.8		33.3			19.9	
Level of Service		E			D	D		C			B	
Approach Delay (s)		68.8			42.0			33.3			19.9	
Approach LOS		E			D			C			B	

Intersection Summary			
HCM Average Control Delay	36.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	26.2
Intersection Capacity Utilization	68.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	110	766	216	757	231	242	304	144	184
v/c Ratio	2.50	1.30	1.18	0.80	0.96	0.56	0.48	0.67	0.42
Control Delay	699.6	160.9	154.6	39.5	72.4	28.5	3.0	50.9	34.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Total Delay	699.6	160.9	154.6	39.5	72.4	28.5	3.1	50.9	34.1
Queue Length 50th (ft)	~131	~407	~167	268	91	84	0	95	109
Queue Length 95th (ft)	m#119	m#263	#321	347	m#293	m119	m2	#169	168
Internal Link Dist (ft)		771		938		335			755
Turn Bay Length (ft)	70		350					170	
Base Capacity (vph)	44	590	183	945	240	429	636	216	435
Starvation Cap Reductn	0	0	0	0	0	0	29	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	2.50	1.30	1.18	0.80	0.96	0.56	0.50	0.67	0.42

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
Lane Width	10	10	10	10	10	10	10	10	10	10	10	10
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	*0.95		1.00	0.95		1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	0.96	1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.98		1.00	0.98		1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1240	2361		1205	2362		1193	1256	1028	1252	1273	
Flt Permitted	0.13	1.00		0.13	1.00		0.56	1.00	1.00	0.49	1.00	
Satd. Flow (perm)	174	2361		169	2362		708	1256	1028	640	1273	
Volume (vph)	103	601	119	192	600	74	215	225	283	124	126	32
Peak-hour factor, PHF	0.94	0.94	0.94	0.89	0.89	0.89	0.93	0.93	0.93	0.86	0.86	0.86
Adj. Flow (vph)	110	639	127	216	674	83	231	242	304	144	147	37
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	165	0	0	0
Lane Group Flow (vph)	110	766	0	216	757	0	231	242	139	144	184	0
Confl. Bikes (#/hr)			10			11			78			9
Heavy Vehicles (%)	3%	3%	3%	6%	6%	6%	7%	7%	7%	2%	2%	2%
Bus Blockages (#/hr)	0	10	10	0	0	0	0	0	0	0	0	0
Turn Type	Perm			D.P+P			Perm		pm+ov	Perm		
Protected Phases		1		4	1 4			3	4		3	
Permitted Phases	1			1			3		3	3		
Actuated Green, G (s)	30.0	30.0		46.0	48.0		41.0	41.0	57.0	41.0	41.0	
Effective Green, g (s)	30.0	30.0		44.0	48.0		41.0	41.0	55.0	41.0	41.0	
Actuated g/C Ratio	0.25	0.25		0.37	0.40		0.34	0.34	0.46	0.34	0.34	
Clearance Time (s)	4.0	4.0		2.0			4.0	4.0	2.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0			3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	44	590		183	945		242	429	505	219	435	
v/s Ratio Prot		0.32		c0.14	0.32			0.19	0.03		0.14	
v/s Ratio Perm	c0.63			0.30			c0.33		0.10	0.23		
v/c Ratio	2.50	1.30		1.18	0.80		0.95	0.56	0.28	0.66	0.42	
Uniform Delay, d1	45.0	45.0		32.9	31.8		38.6	32.2	20.2	33.5	30.4	
Progression Factor	0.55	0.55		1.00	1.00		0.74	0.74	0.55	1.00	1.00	
Incremental Delay, d2	681.1	135.4		123.5	4.9		37.2	1.2	0.2	6.9	0.7	
Delay (s)	706.0	160.2		156.4	36.7		65.7	25.2	11.3	40.5	31.1	
Level of Service	F	F		F	D		E	C	B	D	C	
Approach Delay (s)		228.8			63.3			31.8			35.2	
Approach LOS		F			E			C			D	

Intersection Summary			
HCM Average Control Delay	101.0	HCM Level of Service	F
HCM Volume to Capacity ratio	1.55		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	35.0
Intersection Capacity Utilization	81.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	328	479	1190	126	60	504	269	234
v/c Ratio	0.72	0.44	1.13	0.22	0.39	1.25	5.98	0.28
Control Delay	29.3	22.9	100.9	4.8	37.7	162.2	2296.4	12.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	29.3	22.9	100.9	4.8	37.7	162.2	2296.4	12.1
Queue Length 50th (ft)	122	105	~418	0	29	~362	~277	67
Queue Length 95th (ft)	#231	150	#546	36	62	#495	#432	112
Internal Link Dist (ft)		360	496			755	339	
Turn Bay Length (ft)	200				50			100
Base Capacity (vph)	454	1098	1050	562	152	404	45	836
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.72	0.44	1.13	0.22	0.39	1.25	5.98	0.28

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	12	12	11	11	14
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	0.95			0.95	1.00	1.00	1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00			1.00	0.98	1.00	0.98			1.00	1.00
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00	1.00			0.98	1.00
Frt	1.00	1.00			1.00	0.85	1.00	0.99			1.00	0.85
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00			0.99	1.00
Satd. Flow (prot)	1501	2988			3002	1315	1555	1640			1580	1535
Flt Permitted	0.12	1.00			0.95	1.00	0.38	1.00			0.12	1.00
Satd. Flow (perm)	192	2988			2866	1315	621	1640			186	1535
Volume (vph)	312	443	12	2	1081	115	50	391	27	67	177	213
Peak-hour factor, PHF	0.95	0.95	0.95	0.91	0.91	0.91	0.83	0.83	0.83	0.91	0.91	0.91
Adj. Flow (vph)	328	466	13	2	1188	126	60	471	33	74	195	234
RTOR Reduction (vph)	0	2	0	0	0	80	0	3	0	0	0	0
Lane Group Flow (vph)	328	477	0	0	1190	46	60	501	0	0	269	234
Confl. Peds. (#/hr)									300	300		
Confl. Bikes (#/hr)			4			1			35			5
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Turn Type	pm+pt			Perm		Perm	Perm			Perm		pt+ov
Protected Phases	1	3			3			4			4	1 4
Permitted Phases	3			3		3	4			4		
Actuated Green, G (s)	54.0	32.0			32.0	32.0	21.0	21.0			21.0	48.0
Effective Green, g (s)	56.0	33.0			33.0	33.0	22.0	22.0			22.0	49.0
Actuated g/C Ratio	0.62	0.37			0.37	0.37	0.24	0.24			0.24	0.54
Clearance Time (s)	5.0	5.0			5.0	5.0	5.0	5.0			5.0	
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0			3.0	
Lane Grp Cap (vph)	454	1096			1051	482	152	401			45	836
v/s Ratio Prot	c0.18	0.16						0.31				0.15
v/s Ratio Perm	0.27				c0.42	0.04	0.10				c1.45	
v/c Ratio	0.72	0.44			1.13	0.10	0.39	1.25			5.98	0.28
Uniform Delay, d1	20.5	21.5			28.5	18.7	28.4	34.0			34.0	11.0
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2	5.6	0.3			71.7	0.1	7.5	131.4			2287.0	0.8
Delay (s)	26.1	21.8			100.2	18.8	35.9	165.4			2321.0	11.9
Level of Service	C	C			F	B	D	F			F	B
Approach Delay (s)		23.5			92.4			151.6			1246.8	
Approach LOS		C			F			F			F	

Intersection Summary			
HCM Average Control Delay	267.5	HCM Level of Service	F
HCM Volume to Capacity ratio	2.36		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	105.5%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Right-Turn Analysis 2021

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	234	642	282	488	1044	594	843
v/c Ratio	3.66	1.01	2.37	0.56	0.70	0.59	0.57
Control Delay	1247.7	78.3	653.8	23.6	24.7	4.5	21.1
Queue Delay	0.0	0.0	0.0	0.3	0.0	0.0	0.0
Total Delay	1247.7	78.3	653.8	23.9	24.7	4.5	21.1
Queue Length 50th (ft)	~269	~220	~291	88	305	0	220
Queue Length 95th (ft)	#391	#341	m#387	m123	396	70	266
Internal Link Dist (ft)		849		14	255		366
Turn Bay Length (ft)						300	
Base Capacity (vph)	64	635	119	865	1492	1000	1485
Starvation Cap Reductn	0	0	0	78	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	3.66	1.01	2.37	0.62	0.70	0.59	0.57

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	10	10	10	11	11	11	10	10	10
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			0.95	1.00		0.95	
Frt	1.00	1.00		1.00	0.99			1.00	0.85		0.99	
Flt Protected	0.95	1.00		0.95	1.00			1.00	1.00		1.00	
Satd. Flow (prot)	1525	2887		1444	2873			3140	1405		2959	
Flt Permitted	0.20	1.00		0.20	1.00			0.95	1.00		1.00	
Satd. Flow (perm)	315	2887		298	2873			2985	1405		2959	
Volume (vph)	222	607	3	259	433	16	6	996	570	0	647	70
Peak-hour factor, PHF	0.95	0.95	0.95	0.92	0.92	0.92	0.96	0.96	0.96	0.85	0.85	0.85
Adj. Flow (vph)	234	639	3	282	471	17	6	1038	594	0	761	82
RTOR Reduction (vph)	0	0	0	0	3	0	0	0	297	0	6	0
Lane Group Flow (vph)	234	642	0	282	485	0	0	1044	297	0	837	0
Heavy Vehicles (%)	3%	3%	3%	5%	5%	5%	0%	0%	0%	1%	1%	1%
Parking (#/hr)		1	1									
Turn Type	Perm			D.P+P			Perm		Perm	Perm		
Protected Phases		1		4	1 4			3			3	
Permitted Phases	1			1			3		3	3		
Actuated Green, G (s)	18.4	18.4		20.4	26.4			48.0	48.0		48.0	
Effective Green, g (s)	20.4	20.4		24.4	28.4			50.0	50.0		50.0	
Actuated g/C Ratio	0.20	0.20		0.24	0.28			0.50	0.50		0.50	
Clearance Time (s)	6.0	6.0		6.0				6.0	6.0		6.0	
Vehicle Extension (s)	3.0	3.0		3.0				3.0	3.0		3.0	
Lane Grp Cap (vph)	64	589		119	816			1493	703		1480	
v/s Ratio Prot		0.22		c0.10	0.17						0.28	
v/s Ratio Perm	c0.74			0.49				c0.35	0.21			
v/c Ratio	3.66	1.09		2.37	0.59			0.70	0.42		0.57	
Uniform Delay, d1	39.8	39.8		37.6	30.8			19.2	15.8		17.4	
Progression Factor	1.00	1.00		0.72	0.73			1.00	1.00		1.00	
Incremental Delay, d2	1232.8	63.9		635.2	2.4			2.7	1.9		1.6	
Delay (s)	1272.6	103.7		662.4	24.9			22.0	17.7		19.0	
Level of Service	F	F		F	C			C	B		B	
Approach Delay (s)		416.0			258.4			20.4			19.0	
Approach LOS		F			F			C			B	

Intersection Summary			
HCM Average Control Delay	148.5	HCM Level of Service	F
HCM Volume to Capacity ratio	1.60		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	25.6
Intersection Capacity Utilization	90.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	120	420	505	770	660	279	1381
v/c Ratio	2.26	0.65	1.59	0.66	0.75	0.38	1.13
Control Delay	648.2	47.8	302.1	25.0	38.4	4.5	103.5
Queue Delay	0.0	0.0	0.0	4.1	0.0	0.0	0.0
Total Delay	648.2	47.8	302.1	29.0	38.4	4.5	103.5
Queue Length 50th (ft)	~151	156	~447	298	240	0	~698
Queue Length 95th (ft)	#275	214	m#655	244	322	56	#795
Internal Link Dist (ft)		849		14	255		366
Turn Bay Length (ft)						300	
Base Capacity (vph)	53	643	317	1164	879	739	1223
Starvation Cap Reductn	0	0	0	306	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	2.26	0.65	1.59	0.90	0.75	0.38	1.13

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	10	10	10	11	11	11	10	10	10
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			0.95	1.00		0.95	
Frt	1.00	1.00		1.00	1.00			1.00	0.85		1.00	
Flt Protected	0.95	1.00		0.95	1.00			1.00	1.00		1.00	
Satd. Flow (prot)	1510	2854		1486	2969			3137	1405		2990	
Flt Permitted	0.15	1.00		0.33	1.00			0.74	1.00		1.00	
Satd. Flow (perm)	243	2854		516	2969			2329	1405		2990	
Volume (vph)	116	401	7	490	740	7	13	607	262	0	1168	33
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.94	0.94	0.94	0.87	0.87	0.87
Adj. Flow (vph)	120	413	7	505	763	7	14	646	279	0	1343	38
RTOR Reduction (vph)	0	0	0	0	1	0	0	0	165	0	1	0
Lane Group Flow (vph)	120	420	0	505	769	0	0	660	114	0	1380	0
Heavy Vehicles (%)	4%	4%	4%	2%	2%	2%	0%	0%	0%	1%	1%	1%
Parking (#/hr)		1	1									
Turn Type	Perm			D.P+P			Perm		Perm	Perm		
Protected Phases		1		4	1 4			3			3	
Permitted Phases	1			1			3		3	3		
Actuated Green, G (s)	24.2	24.2		38.2	44.2			47.0	47.0		47.0	
Effective Green, g (s)	26.2	26.2		42.2	46.2			49.0	49.0		49.0	
Actuated g/C Ratio	0.22	0.22		0.35	0.38			0.41	0.41		0.41	
Clearance Time (s)	6.0	6.0		6.0				6.0	6.0		6.0	
Vehicle Extension (s)	3.0	3.0		3.0				3.0	3.0		3.0	
Lane Grp Cap (vph)	53	623		311	1143			951	574		1221	
v/s Ratio Prot		0.15		c0.22	0.26						c0.46	
v/s Ratio Perm	c0.49			0.35				0.28	0.08			
v/c Ratio	2.26	0.67		1.62	0.67			0.69	0.20		1.13	
Uniform Delay, d1	46.9	43.0		35.1	30.6			29.3	22.9		35.5	
Progression Factor	1.00	1.00		0.86	0.75			1.00	1.00		1.00	
Incremental Delay, d2	624.3	5.8		291.5	2.4			4.2	0.8		69.3	
Delay (s)	671.2	48.7		321.5	25.3			33.5	23.6		104.8	
Level of Service	F	D		F	C			C	C		F	
Approach Delay (s)		187.1			142.7			30.6			104.8	
Approach LOS		F			F			C			F	

Intersection Summary			
HCM Average Control Delay	110.4	HCM Level of Service	F
HCM Volume to Capacity ratio	1.54		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	28.8
Intersection Capacity Utilization	89.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Trip Generation

Mass Mental Hospital

Trip Generation Estimate
DPIR/DEIR Analysis
VHB,Inc.
August 2009

Phase 1 Trip Generation

	Size	Trip Rate	Unadjusted Vehicle Trips	VOR	Person Trips	Transit Share	Walk/Other Share	Vehicle Share	Local VOR	Transit Trips	Walk/Other Trips	Vehicle Trips
Daily Hospital		17.57	439		703					141	232	206
In	24.99	8.79	220	1.6	351	20%	33%	47%	1.6	70	116	103
Out	ksf	8.79	220	1.6	351	20%	33%	47%	1.6	70	116	103
Daily Nursing Home		2.37	111		134					67	15	43
In	47	1.19	56	1.2	67	50%	11%	39%	1.2	33	7	22
Out	beds	1.19	56	1.2	67	50%	11%	39%	1.2	33	7	22
Daily Office		11.01	438		526					263	58	171
In	39.8	5.51	219	1.2	263	50%	11%	39%	1.2	131	29	85
Out	ksf	5.51	219	1.2	263	50%	11%	39%	1.2	131	29	85
Total Daily			**989**		**1,362**					**470**	**304**	**421**
In			**494**		**681**					**235**	**152**	**210**
Out			**494**		**681**					**235**	**152**	**210**
AM Clinical/Hospital		1.20	30		48					15	12	13
In	24.99	0.80	20	1.6	32	31%	26%	43%	1.6	10	8	9
Out	ksf	0.40	10	1.6	16	31%	26%	43%	1.6	5	4	4
AM Nursing Home		0.17	8		10					5	1	3
in	47	0.12	6	1.2	7	50%	11%	39%	1.2	3	1	2
out	beds	0.05	2	1.2	3	50%	11%	39%	1.2	1	0	1
AM Office		1.55	62		74					37	8	24
In	39.8	1.36	54	1.2	65	50%	11%	39%	1.2	33	7	21
Out	ksf	0.19	7	1.2	9	50%	11%	39%	1.2	4	1	3
Total AM Peak Hour			**100**		**132**					**57**	**22**	**40**
In			**80**		**104**					**46**	**16**	**32**
Out			**20**		**28**					**11**	**5**	**8**
PM Clinical/Hospital		1.18	29		47					15	12	13
In	24.99	0.39	10	1.6	16	31%	26%	43%	1.6	5	4	4
Out	ksf	0.79	20	1.6	32	31%	26%	43%	1.6	10	8	8
PM Nursing Home		0.22	10		12					6	1	4
In	47	0.07	3	1.2	4	50%	11%	39%	1.2	2	0	1
Out	beds	0.15	7	1.2	8	50%	11%	39%	1.2	4	1	3
PM Office		1.49	59		71					36	8	23
In	39.8	0.25	10	1.2	12	50%	11%	39%	1.2	6	1	4
Out	ksf	1.24	49	1.2	59	50%	11%	39%	1.2	30	6	19
Total PM Peak Hour			**99**		**131**					**56**	**21**	**40**
In			**23**		**32**					**13**	**6**	**9**
Out			**76**		**99**					**43**	**16**	**30**

ITE 7th Edition Land Use Codes:
LUC 710 - Office
LUC 760 - Research & Development
LUC 610 - Hospital
LUC 220 - Apartments
LUC 620 - Nursing Home
Mode Split: BTD Zone 5 for All Purpose. BWH mode share for employee only trips

Mass Mental Hospital
Trip Generation Estimate
DPIR/DEIR Analysis
VHB,Inc.
August 2009

Full Build Trip Generation

	Size	Trip Rate	Unadjusted Vehicle Trips	VOR	Person Trips	Transit Share	Walk/Other Share	Vehicle Share	Local VOR	Transit Trips	Walk/Other Trips	Vehicle Trips
Daily Residential		6.72	1109		1,331					200	519	510
In	165	3.36	554	1.2	665	15%	39%	46%	1.2	100	259	255
Out	units	3.36	554	1.2	665	15%	39%	46%	1.2	100	259	255
Daily R& D		8.11	1241		1489					744	164	484
In	152.960	4.06	620	1.2	744	50%	11%	39%	1.2	372	82	242
Out	ksf	4.06	620	1.2	744	50%	11%	39%	1.2	372	82	242
Daily Hospital		17.57	3,408		5453					1091	1800	1602
In	193.990	8.79	1,704	1.6	2727	20%	33%	47%	1.6	545	900	801
Out	ksf	8.79	1,704	1.6	2727	20%	33%	47%	1.6	545	900	801
Daily Nursing Home		2.37	111		134					67	15	43
In	47	1.19	56	1.2	67	50%	11%	39%	1.2	33	7	22
Out	beds	1.19	56	1.2	67	50%	11%	39%	1.2	33	7	22
Daily Office		11.01	843		1012					506	111	329
In	76.6	5.51	421	1.2	506	50%	11%	39%	1.2	253	56	164
Out	ksf	5.51	421	1.2	506	50%	11%	39%	1.2	253	56	164
Total Daily			**6,712**		**9,418**					**2,607**	**2,608**	**2,968**
In			**3,356**		**4,709**					**1,304**	**1,304**	**1,484**
Out			**3,356**		**4,709**					**1,304**	**1,304**	**1,484**
AM Residential		0.51	84		101					17	46	31
In	165	0.10	17	1.2	20	17%	46%	37%	1.2	3	9	6
Out	units	0.41	67	1.2	81	17%	46%	37%	1.2	14	37	25
AM R&D		1.24	190		228					114	25	74
In	153.0	1.03	157	1.2	189	50%	11%	39%	1.2	94	21	61
Out	ksf	0.21	32	1.2	39	50%	11%	39%	1.2	19	4	13
AM Clinical/Hospital		1.20	233		372					115	97	100
In	193.990	0.80	156	1.6	250	31%	26%	43%	1.6	77	65	67
Out	ksf	0.40	77	1.6	123	31%	26%	43%	1.6	38	32	33
AM Nursing Home		0.17	8		10					5	1	3
in	47	0.12	6	1.2	7	50%	11%	39%	1.2	3	1	2
out	beds	0.05	2	1.2	3	50%	11%	39%	1.2	1	0	1
AM Office		1.55	119		142					71	16	46
In	76.6	1.36	104	1.2	125	50%	11%	39%	1.2	63	14	41
Out	ksf	0.19	14	1.2	17	50%	11%	39%	1.2	9	2	6
Total AM Peak Hour			**633**		**853**					**322**	**185**	**255**
In			**440**		**591**					**241**	**109**	**178**
Out			**193**		**262**					**81**	**76**	**77**
PM Residential		0.62	102		123					21	56	38
In	165	0.40	66	1.2	80	17%	46%	37%	1.2	14	37	25
Out	units	0.22	36	1.2	43	17%	46%	37%	1.2	7	20	13
PM R&D		1.08	165		198					99	22	64
In	153.0	0.16	25	1.2	30	50%	11%	39%	1.2	15	3	10
Out	ksf	0.92	140	1.2	169	50%	11%	39%	1.2	84	19	55
PM Clinical/Hospital		1.18	229		366					114	95	98
In	193.990	0.39	76	1.6	121	31%	26%	43%	1.6	37	31	32
Out	ksf	0.79	153	1.6	245	31%	26%	43%	1.6	76	64	66
PM Nursing Home		0.22	10		12					6	1	4
In	47	0.07	3	1.2	4	50%	11%	39%	1.2	2	0	1
Out	beds	0.15	7	1.2	8	50%	11%	39%	1.2	4	1	3
PM Office		1.49	114		137					68	15	44
In	76.6	0.25	19	1.2	23	50%	11%	39%	1.2	12	3	8
Out	ksf	1.24	95	1.2	114	50%	11%	39%	1.2	57	12	37
Total PM Peak Hour			**621**		**837**					**308**	**190**	**249**
In			**190**		**258**					**80**	**74**	**76**
Out			**431**		**579**					**229**	**116**	**174**

ITE 7th Edition Land Use Codes:
LUC 710 - Office
LUC 760 - Research & Development
LUC 610 - Hospital
LUC 220 - Apartments
LUC 620 - Nursing Home
Mode Split: BTD Zone 5 for All Purpose. BWH mode share for employee only trips

Brigham and Women's Garage Rates

Security and Parking
Parking Options
Shuttles
Contact Us

Security and Parking

Font Size A A A Send Print

Parking Options

Patient Self-Park

Location	Hours	Rates	
45 Francis Street Ambulatory Services Building Garage	Monday - Friday 6:00 AM - midnight	0-1 Hours 1-2 Hours 2-3 Hours 3-4 Hours 4-5 Hours 5-6 Hours 6-24 Hours	$ 6.00 $ 7.00 $ 8.00 $ 9.00 $11.00 $13.00 $21.00
Monday - Friday 5:00 PM - midnight Weekends and holidays 8:00 AM - midnight		Flat fee of $6.00	

Note: The ASB Garage is restricted to patients weekdays from 6:00 AM - 5:00 PM.

Patient Valet Parking

15 & 45 Francis Streets	75 Francis Street	Rates	
15 Francis Street Monday - Friday 7:00 AM - 6:00 PM 45 Francis Street Monday - Friday 6:00 AM - 6:00 PM	Open 24 hours a day, 7 days a week	0 - 1 Hours 1 - 2 Hours 2 - 3 Hours 3 - 4 Hours 4 - 5 Hours 5 - 6 Hours 6 - 24 Hours	$ 6.00 $ 8.00 $ 9.00 $11.00 $12.00 $13.00 $17.00

Visitor Parking

Ambulatory Services Building Garage 45 Francis Street	Open to vistors evenings and weekends only Monday - Friday 5:00 PM - midnight Weekends and holidays 8:00 AM - midnight	Flat fee of $6.00
Servicenter Garage Corner of Francis Street and Brookline Avenue	Open 24 hours a day, 7 days a week	Hourly rates apply

For questions or concerns regarding the BWH Parking Program, please call the parking office: (617) 732-5877.

Send Feedback to: Robert Chicarello at rchicarello@partners.org
This page was last modified on 9/15/2008

Crash / Accident Analysis

MassHighway

CRASH RATE WORKSHEET

CITY/TOWN : Boston

COUNT DATE :

DISTRICT :

UNSIGNALIZED :

SIGNALIZED : X

MHD USE ONLY

Source #

~ INTERSECTION DATA ~

MAJOR STREET : Huntington

MINOR STREET(S) : Longwood

RIN #

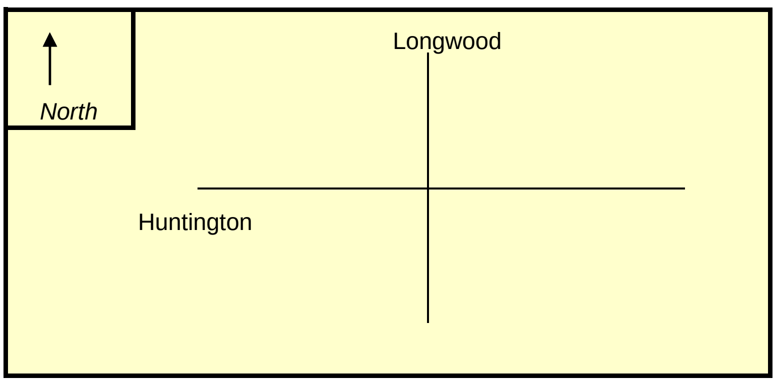
RIN #

RIN #

RIN #

RIN #

INTERSECTION DIAGRAM (Label Approaches)



INTERSECTION REF #

Peak Hour Volumes

APPROACH :	1	2	3	4	5	6
DIRECTION :	SB	WB	NB	EB		
VOLUMES (PM) :	386	917	136	643		

" K " FACTOR : .09

APPROACH ADT : 23133.333

ADT = TOTAL VOL/"K" FACT.

TOTAL # OF ACCIDENTS : 17

OF YEARS : 3

AVERAGE # OF ACCIDENTS (**A**) : 6

CRASH RATE CALCULATION : 0.67

$$\text{RATE} = \frac{(A * 1{,}000{,}000)}{(ADT * 365)}$$

Source (optional):

Comments:

last updated: 11/06/01

MassHighway

CRASH RATE WORKSHEET

CITY/TOWN : Boston

COUNT DATE :

DISTRICT :

UNSIGNALIZED :

SIGNALIZED : X

MHD USE ONLY

Source #

~ INTERSECTION DATA ~

MAJOR STREET : Longwood

MINOR STREET(S) : Binney

RIN #

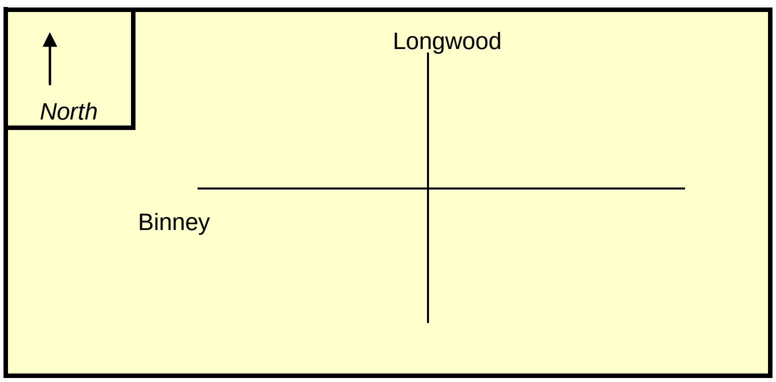
RIN #

RIN #

RIN #

RIN #

INTERSECTION DIAGRAM
(Label Approaches)



INTERSECTION REF #

Peak Hour Volumes

APPROACH :	**1**	**2**	**3**	**4**	**5**	**6**
DIRECTION :	SB	WB	NB	EB		
VOLUMES (PM) :	337	233	527	143		

" K " FACTOR : .09

APPROACH ADT : 13777.778

ADT = TOTAL VOL/"K" FACT.

TOTAL # OF ACCIDENTS : 8

OF YEARS : 3

AVERAGE # OF ACCIDENTS (**A**) : 3

CRASH RATE CALCULATION : 0.53

$$\text{RATE} = \frac{(A * 1{,}000{,}000)}{(ADT * 365)}$$

Source (optional):

Comments:

last updated: 11/06/01

MassHighway

CRASH RATE WORKSHEET

CITY/TOWN : Boston

COUNT DATE :

DISTRICT :

UNSIGNALIZED :

SIGNALIZED : X

MHD USE ONLY

Source #

~ INTERSECTION DATA ~

MAJOR STREET : Riverway

MINOR STREET(S) : Longwood

RIN #

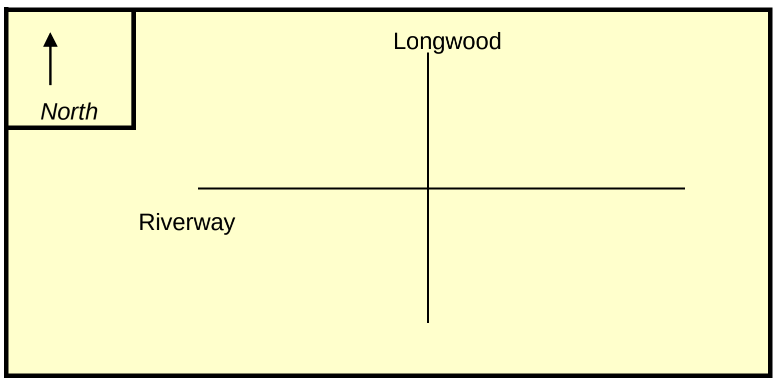
RIN #

RIN #

RIN #

RIN #

INTERSECTION DIAGRAM
(Label Approaches)



INTERSECTION REF #

Peak Hour Volumes

APPROACH :	**1**	**2**	**3**	**4**	**5**	**6**
DIRECTION :	SB	WB	NB	EB		
VOLUMES (PM) :	419	1128	410	706		

" K " FACTOR : .09

APPROACH ADT : 29588.889

ADT = TOTAL VOL/"K" FACT.

TOTAL # OF ACCIDENTS : 18

OF YEARS : 3

AVERAGE # OF ACCIDENTS (**A**) : 6

CRASH RATE CALCULATION : 0.56

$$\text{RATE} = \frac{(A * 1{,}000{,}000)}{(ADT * 365)}$$

Source (optional):

Comments:

MassHighway

CRASH RATE WORKSHEET

CITY/TOWN : Boston

COUNT DATE :

DISTRICT :

UNSIGNALIZED :

SIGNALIZED : X

MHD USE ONLY

Source #

~ INTERSECTION DATA ~

MAJOR STREET : Brookline

MINOR STREET(S) : Longwood

RIN #

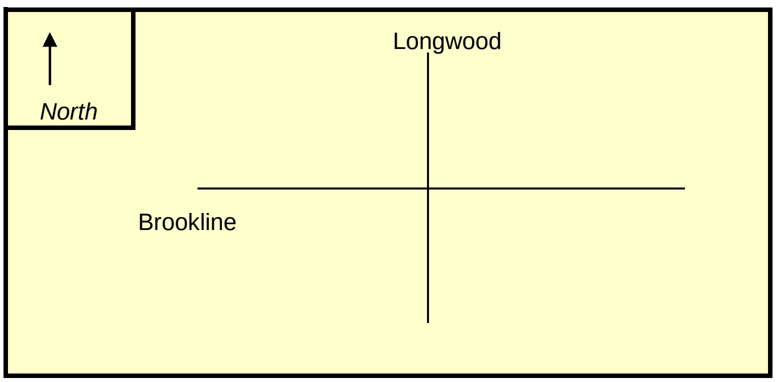
RIN #

RIN #

RIN #

RIN #

INTERSECTION DIAGRAM
(Label Approaches)



INTERSECTION REF #

Peak Hour Volumes

APPROACH :	**1**	**2**	**3**	**4**	**5**	**6**
DIRECTION :	SB	WB	NB	EB		
VOLUMES (PM) :	196	770	653	670		

" K " FACTOR : .09

APPROACH ADT : 25433.333

ADT = TOTAL VOL/"K" FACT.

TOTAL # OF ACCIDENTS : 28

OF YEARS : 3

AVERAGE # OF ACCIDENTS (**A**) : 9

CRASH RATE CALCULATION : 1.01

$$RATE = \frac{(A * 1,000,000)}{(ADT * 365)}$$

Source (optional):

Comments:

MassHighway

CRASH RATE WORKSHEET

CITY/TOWN : Boston

COUNT DATE :

DISTRICT :

UNSIGNALIZED :

SIGNALIZED : X

MHD USE ONLY

Source #

~ INTERSECTION DATA ~

MAJOR STREET : Brookline

MINOR STREET(S) : Francis

RIN #

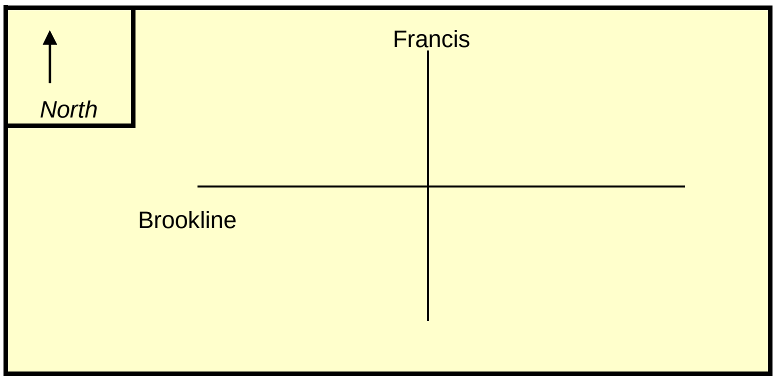
RIN #

RIN #

RIN #

RIN #

INTERSECTION DIAGRAM (Label Approaches)



INTERSECTION REF #

Peak Hour Volumes

APPROACH :	**1**	**2**	**3**	**4**	**5**	**6**
DIRECTION :	SB	WB	NB	EB		
VOLUMES (PM) :	147	913	519	596		

" K " FACTOR : .09

APPROACH ADT : 24166.667 **ADT** = TOTAL VOL/"K" FACT.

TOTAL # OF ACCIDENTS : 17

OF YEARS : 3

AVERAGE # OF ACCIDENTS (**A**) : 6

CRASH RATE CALCULATION : 0.64

RATE = $\frac{(A * 1,000,000)}{(ADT * 365)}$

Source (optional):

Comments:

last updated: 11/06/01

MassHighway

CRASH RATE WORKSHEET

CITY/TOWN : Boston

COUNT DATE :

DISTRICT :

UNSIGNALIZED :

SIGNALIZED : X

MHD USE ONLY

Source #

~ INTERSECTION DATA ~

MAJOR STREET : Brookline

MINOR STREET(S) : Fenwood

RIN #

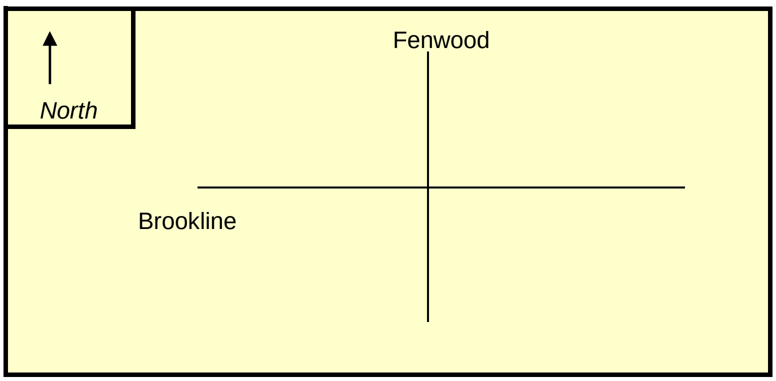
RIN #

RIN #

RIN #

RIN #

INTERSECTION DIAGRAM (Label Approaches)



INTERSECTION REF #

Peak Hour Volumes

APPROACH :	**1**	**2**	**3**	**4**	**5**	**6**
DIRECTION :	SB	WB	NB	EB		
VOLUMES (PM) :		1024	51	573		

" K " FACTOR : .09

APPROACH ADT : 18311.111 **ADT** = TOTAL VOL/"K" FACT.

TOTAL # OF ACCIDENTS : 1

OF YEARS : 3

AVERAGE # OF ACCIDENTS (**A**) : 0

CRASH RATE CALCULATION : 0.05

$$RATE = \frac{(A * 1,000,000)}{(ADT * 365)}$$

Source (optional):

Comments:

last updated: 11/06/01

MassHighway

CRASH RATE WORKSHEET

CITY/TOWN : Boston

COUNT DATE :

DISTRICT :

UNSIGNALIZED :

SIGNALIZED : X

MHD USE ONLY

Source #

~ INTERSECTION DATA ~

MAJOR STREET : Brookline

MINOR STREET(S) : Riverway

RIN #

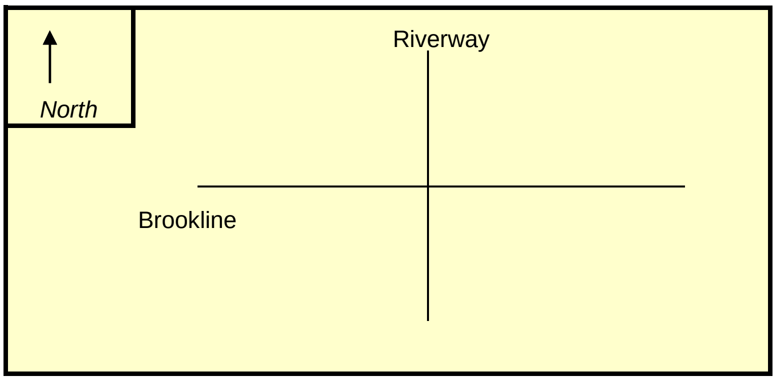
RIN #

RIN #

RIN #

RIN #

INTERSECTION DIAGRAM
(Label Approaches)



INTERSECTION REF #

Peak Hour Volumes

APPROACH :	**1**	**2**	**3**	**4**	**5**	**6**
DIRECTION :	SB	WB	NB	EB		
VOLUMES (PM) :	1135	1025	813	464		

" K " FACTOR : .09

APPROACH ADT : 38188.889

ADT = TOTAL VOL/"K" FACT.

TOTAL # OF ACCIDENTS : 46

OF YEARS : 3

AVERAGE # OF ACCIDENTS (**A**) : 15

CRASH RATE CALCULATION : 1.10

$$\text{RATE} = \frac{(A * 1{,}000{,}000)}{(ADT * 365)}$$

Source (optional):

Comments:

last updated: 11/06/01

MassHighway

CRASH RATE WORKSHEET

CITY/TOWN : Boston

COUNT DATE :

DISTRICT :

UNSIGNALIZED : X

SIGNALIZED :

MHD USE ONLY

Source #

~ INTERSECTION DATA ~

MAJOR STREET : Riverway

MINOR STREET(S) : Vining

RIN #

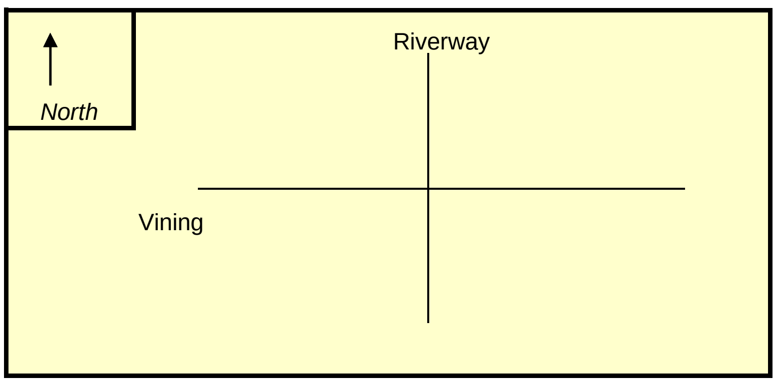
RIN #

RIN #

RIN #

RIN #

INTERSECTION
DIAGRAM
(Label Approaches)



INTERSECTION REF #

Peak Hour Volumes

APPROACH :	**1**	**2**	**3**	**4**	**5**	**6**
DIRECTION :	SB	WB	NB	EB		
VOLUMES (PM) :	1511		858			

" K " FACTOR : .09

APPROACH ADT : 26322.222

ADT = TOTAL VOL/"K" FACT.

TOTAL # OF ACCIDENTS : 1

OF YEARS : 3

AVERAGE # OF ACCIDENTS (**A**) : 0

CRASH RATE CALCULATION : 0.03

RATE = $\frac{(A * 1{,}000{,}000)}{(ADT * 365)}$

Source (optional):

Comments:

MassHighway

CRASH RATE WORKSHEET

CITY/TOWN : Boston

COUNT DATE :

MHD USE ONLY

DISTRICT :

UNSIGNALIZED : X

SIGNALIZED :

Source #

~ INTERSECTION DATA ~

MAJOR STREET : Francis

RIN #

MINOR STREET(S) : Binney

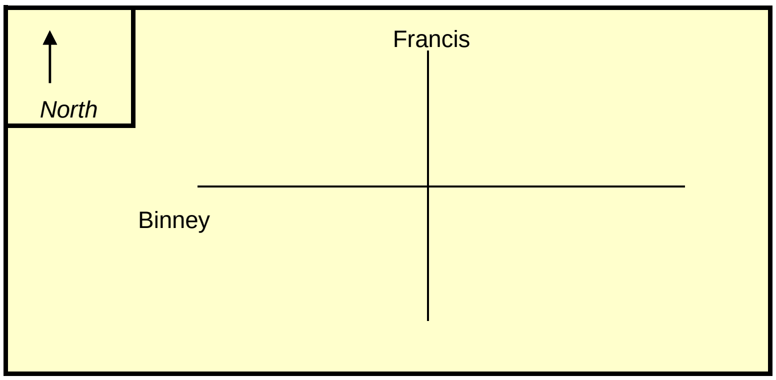
RIN #

RIN #

RIN #

RIN #

INTERSECTION DIAGRAM (Label Approaches)



INTERSECTION REF #

Peak Hour Volumes

APPROACH :	**1**	**2**	**3**	**4**	**5**	**6**
DIRECTION :	SB	WB	NB	EB		
VOLUMES (PM) :	337	223	306	99		

" K " FACTOR : .09

APPROACH ADT : 10722.222

ADT = TOTAL VOL/"K" FACT.

TOTAL # OF ACCIDENTS : 2

OF YEARS : 3

AVERAGE # OF ACCIDENTS (**A**) : 1

CRASH RATE CALCULATION : 0.17

RATE = $\frac{(A * 1{,}000{,}000)}{(ADT * 365)}$

Source (optional):

Comments:

MassHighway

CRASH RATE WORKSHEET

MHD USE ONLY

CITY/TOWN : Boston

COUNT DATE :

DISTRICT :

UNSIGNALIZED :

SIGNALIZED : X

Source #

~ INTERSECTION DATA ~

MAJOR STREET : Francis

MINOR STREET(S) : Vining

RIN #

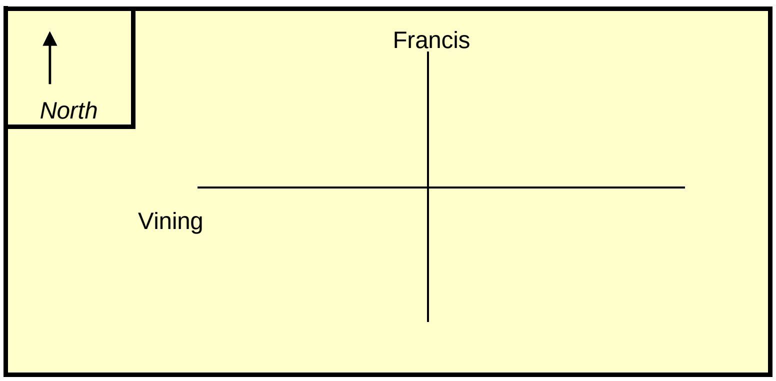
RIN #

RIN #

RIN #

RIN #

INTERSECTION DIAGRAM (Label Approaches)



INTERSECTION REF #

Peak Hour Volumes

APPROACH :	**1**	**2**	**3**	**4**	**5**	**6**
DIRECTION :	SB	WB	NB	EB		
VOLUMES (PM) :	335	0	282	176		

" K " FACTOR : .09

APPROACH ADT : 8811.1111

ADT = TOTAL VOL/"K" FACT.

TOTAL # OF ACCIDENTS : 1

OF YEARS : 3

AVERAGE # OF ACCIDENTS (**A**) : 0

CRASH RATE CALCULATION : 0.10

$$RATE = \frac{(A * 1{,}000{,}000)}{(ADT * 365)}$$

Source (optional):

Comments:

last updated: 11/06/01

MassHighway

CRASH RATE WORKSHEET

CITY/TOWN : Boston

COUNT DATE :

DISTRICT :

UNSIGNALIZED : X

SIGNALIZED :

MHD USE ONLY

Source #

~ INTERSECTION DATA ~

MAJOR STREET : Francis

MINOR STREET(S) : St Albans

RIN #

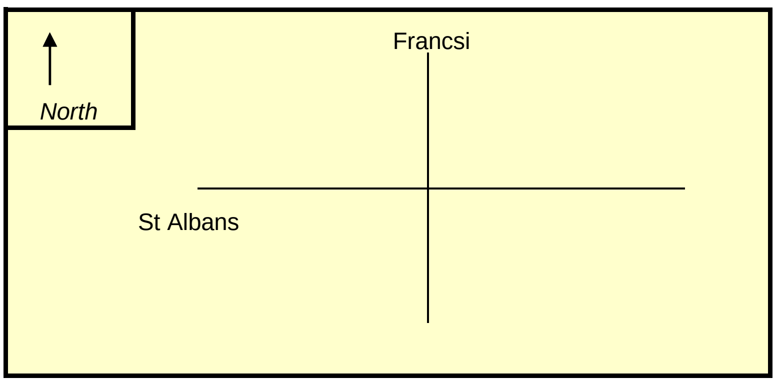
RIN #

RIN #

RIN #

RIN #

INTERSECTION DIAGRAM (Label Approaches)



INTERSECTION REF #

Peak Hour Volumes

APPROACH :	1	2	3	4	5	6
DIRECTION :	SB	WB	NB	EB		
VOLUMES (PM) :	211	106	270	75		

" K " FACTOR : .09

APPROACH ADT : 7355.5556

ADT = TOTAL VOL/"K" FACT.

TOTAL # OF ACCIDENTS : 2

OF YEARS : 3

AVERAGE # OF ACCIDENTS (**A**) : 1

CRASH RATE CALCULATION : 0.25

$$RATE = \frac{(A * 1{,}000{,}000)}{(ADT * 365)}$$

Source (optional):

Comments:

MassHighway

CRASH RATE WORKSHEET

CITY/TOWN : Boston

COUNT DATE :

DISTRICT :

UNSIGNALIZED :

SIGNALIZED : X

MHD USE ONLY

Source #

~ INTERSECTION DATA ~

MAJOR STREET : Huntington

MINOR STREET(S) : Francis

RIN #

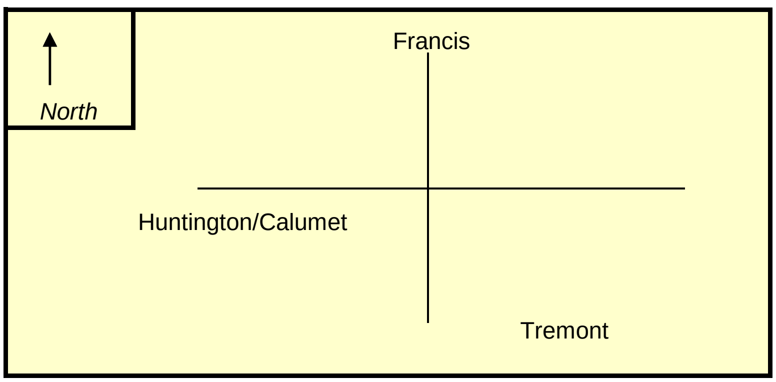
RIN #

RIN #

RIN #

RIN #

INTERSECTION DIAGRAM
(Label Approaches)



INTERSECTION REF #

Peak Hour Volumes

APPROACH :	**1**	**2**	**3**	**4**	**5**	**6**
DIRECTION :	SB	WB	NB	EB		
VOLUMES (PM) :	334	873	358	703		

" K " FACTOR : .09

APPROACH ADT : 25200

ADT = TOTAL VOL/"K" FACT.

TOTAL # OF ACCIDENTS : 35

OF YEARS : 3

AVERAGE # OF ACCIDENTS (**A**) : 12

CRASH RATE CALCULATION : 1.27

$$\text{RATE} = \frac{(A * 1{,}000{,}000)}{(ADT * 365)}$$

Source (optional):

Comments:

last updated: 11/06/01

MassHighway

CRASH RATE WORKSHEET

CITY/TOWN : Boston

COUNT DATE :

DISTRICT :

UNSIGNALIZED :

SIGNALIZED : X

MHD USE ONLY

Source #

~ INTERSECTION DATA ~

MAJOR STREET : Fenwood

MINOR STREET(S) : Vining

RIN #

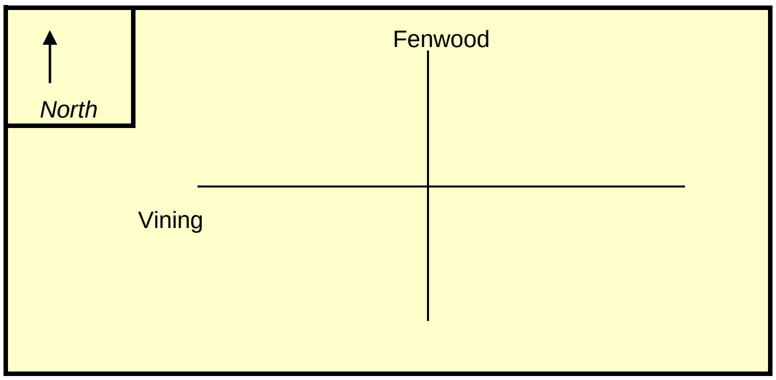
RIN #

RIN #

RIN #

RIN #

INTERSECTION DIAGRAM (Label Approaches)



INTERSECTION REF #

Peak Hour Volumes

APPROACH :	**1**	**2**	**3**	**4**	**5**	**6**
DIRECTION :	SB	WB	NB	EB		
VOLUMES (PM) :	104	82	62	249		

" K " FACTOR : .09

APPROACH ADT : 5522.2222

ADT = TOTAL VOL/"K" FACT.

TOTAL # OF ACCIDENTS : 1

OF YEARS : 3

AVERAGE # OF ACCIDENTS (**A**) : 0

CRASH RATE CALCULATION : 0.17

$$\text{RATE} = \frac{(A * 1{,}000{,}000)}{(ADT * 365)}$$

Source (optional):

Comments:

last updated: 11/06/01

MassHighway

CRASH RATE WORKSHEET

CITY/TOWN : Boston | COUNT DATE :

DISTRICT : | UNSIGNALIZED : | SIGNALIZED : X

MHD USE ONLY

Source #

~ INTERSECTION DATA ~

MAJOR STREET : Huntington

MINOR STREET(S) : Fenwood

RIN #

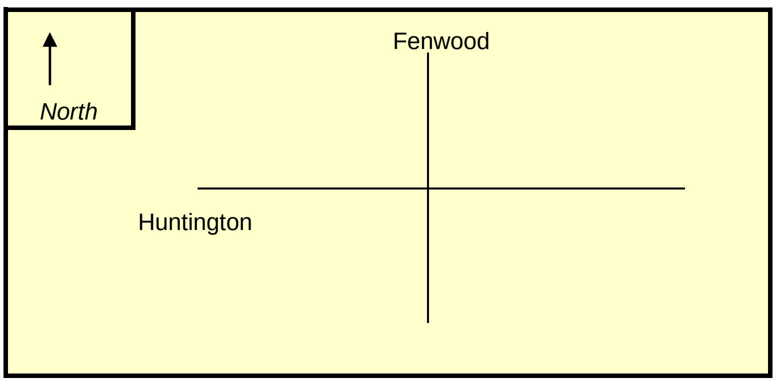
RIN #

RIN #

RIN #

RIN #

INTERSECTION DIAGRAM
(Label Approaches)



INTERSECTION REF #

Peak Hour Volumes

APPROACH :	1	2	3	4	5	6
DIRECTION :	SB	WB	NB	EB		
VOLUMES (PM) :	0	898	0	607		

" K " FACTOR : .09 | APPROACH ADT : 16722.222 | **ADT** = TOTAL VOL/"K" FACT.

TOTAL # OF ACCIDENTS : 1 | # OF YEARS : 3 | AVERAGE # OF ACCIDENTS (**A**) : 0

CRASH RATE CALCULATION : 0.05

$$\text{RATE} = \frac{(A * 1{,}000{,}000)}{(ADT * 365)}$$

Source (optional):

Comments:

MassHighway

CRASH RATE WORKSHEET

CITY/TOWN : Boston

COUNT DATE :

DISTRICT :

UNSIGNALIZED :

SIGNALIZED : X

MHD USE ONLY

Source #

~ INTERSECTION DATA ~

MAJOR STREET : Huntington

MINOR STREET(S) : St Albans

RIN #

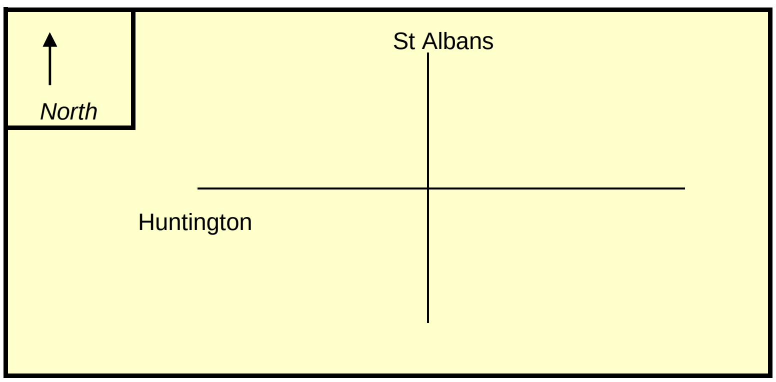
RIN #

RIN #

RIN #

RIN #

INTERSECTION DIAGRAM
(Label Approaches)



INTERSECTION REF #

Peak Hour Volumes

APPROACH :	1	2	3	4	5	6
DIRECTION :	SB	WB	NB	EB		
VOLUMES (PM) :	200	845	26	585		

" K " FACTOR : .09

APPROACH ADT : 18400

ADT = TOTAL VOL/"K" FACT.

TOTAL # OF ACCIDENTS : 10

OF YEARS : 3

AVERAGE # OF ACCIDENTS (**A**) : 3

CRASH RATE CALCULATION : 0.50

$$RATE = \frac{(A * 1,000,000)}{(ADT * 365)}$$

Source (optional):

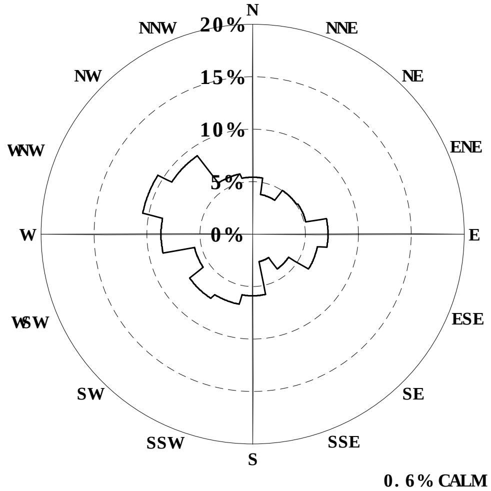
Comments:

last updated: 11/06/01

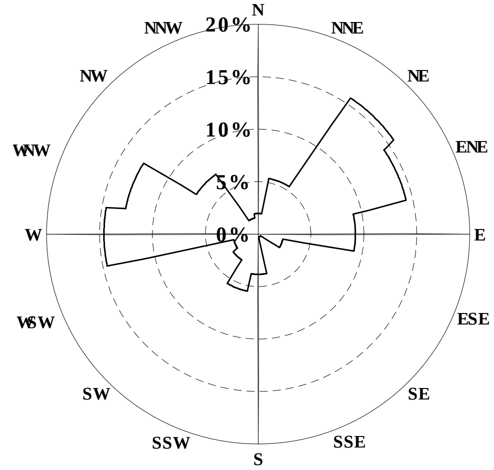
Appendix D

Wind

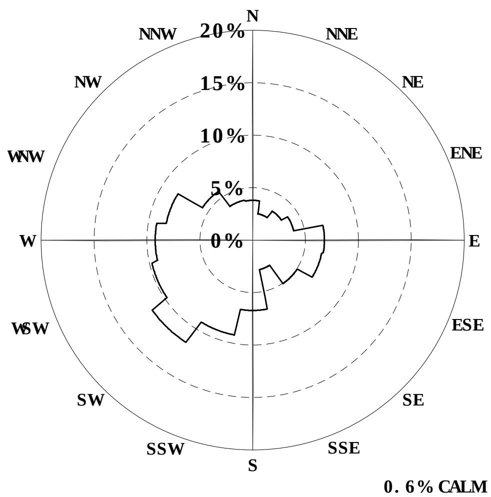
FIGURES



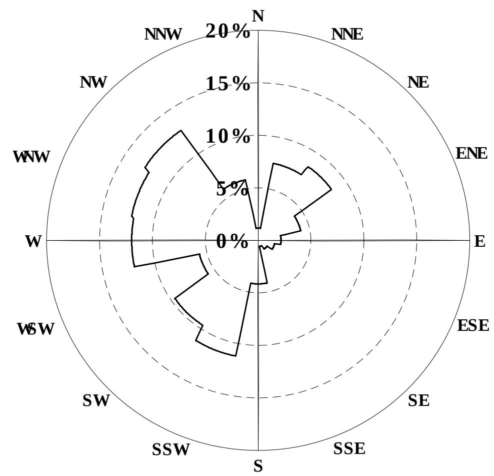
ALL SPRING WINDS



STRONG SPRING WINDS

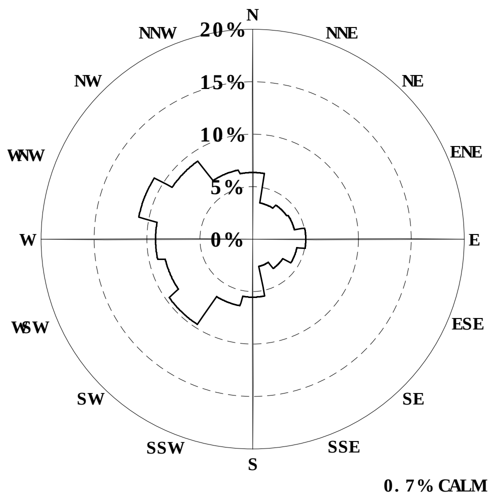


ALL SUMMER WINDS

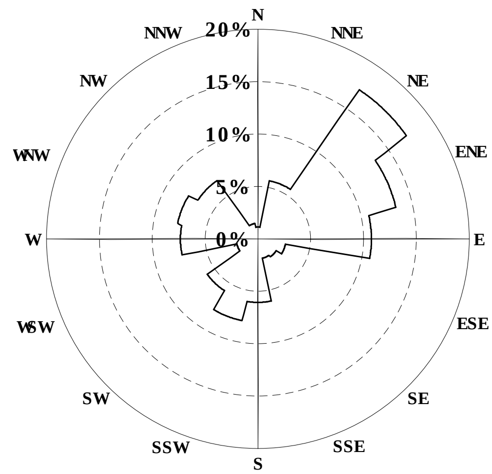


STRONG SUMMER WINDS

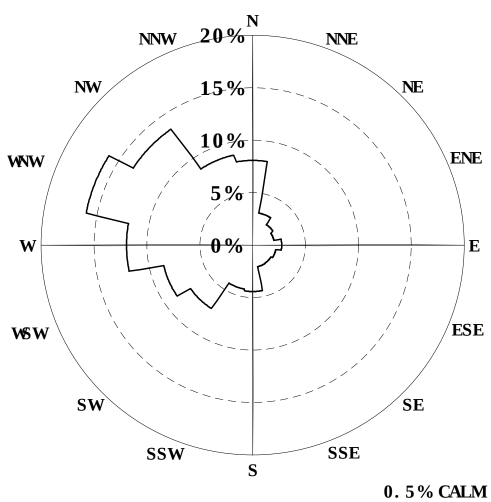
Directional Distribution (%) of Winds (Blowing From) **Boston-Logan International Airport, Massachusetts (1945 - 1998)** Massachusetts Mental Health Center - Boston, Massachusetts Project #0941016	Figure No. **2a** Date: September 1, 2009	RWDI



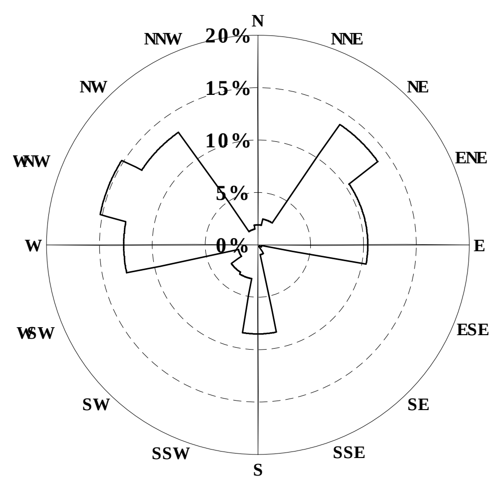
ALL FALL WINDS



STRONG FALL WINDS

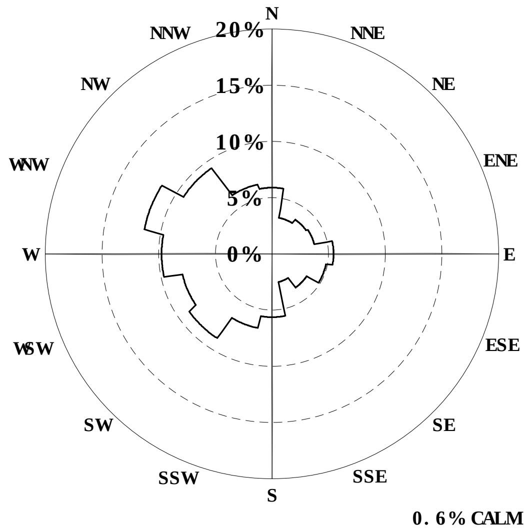


ALL WINTER WINDS

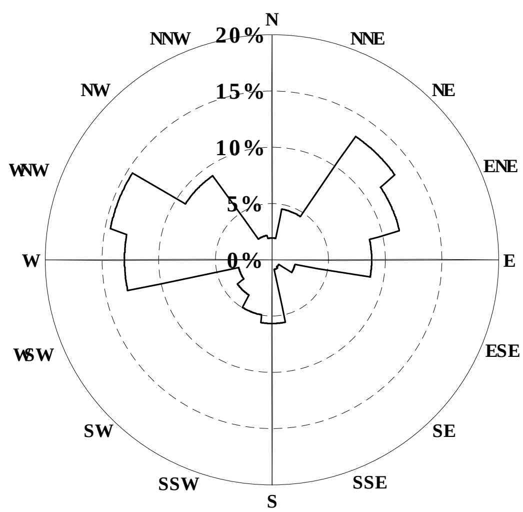


STRONG WINTER WINDS

Directional Distribution (%) of Winds (Blowing From) **Boston-Logan International Airport, Massachusetts (1945 - 1998)** Massachusetts Mental Health Center - Boston, Massachusetts Project #0941016	Figure No. **2b** Date: September 1, 2009	RWDI



ALL ANNUAL WINDS



STRONG ANNUAL WINDS

Directional Distribution (%) of Winds (Blowing From) **Boston-Logan International Airport, Massachusetts (1945 - 1998)** Massachusetts Mental Health Center - Boston, Massachusetts Project #0941016	Figure No. **2c** Date: September 1, 2009	RWDI

TABLES

Table 2: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
1	A	Spring	15		Standing	22		Acceptable
		Summer	11		Sitting	16		Acceptable
		Fall	13		Standing	20		Acceptable
		Winter	16		Walking	23		Acceptable
		Annual	14		Standing	21		Acceptable
	B	Spring	13	-12%	Standing	18	-17%	Acceptable
		Summer	9	-17%	Sitting	14	-12%	Acceptable
		Fall	12		Sitting	17	-14%	Acceptable
		Winter	14	-12%	Standing	20	-12%	Acceptable
		Annual	13		Standing	18	-13%	Acceptable
2	A	Spring	13		Standing	19		Acceptable
		Summer	10		Sitting	15		Acceptable
		Fall	12		Sitting	18		Acceptable
		Winter	14		Standing	21		Acceptable
		Annual	13		Standing	19		Acceptable
	B	Spring	15	+15%	Standing	21	+11%	Acceptable
		Summer	11	+10%	Sitting	16		Acceptable
		Fall	14	+17%	Standing	19		Acceptable
		Winter	17	+21%	Walking	23	+10%	Acceptable
		Annual	15	+15%	Standing	21	+11%	Acceptable
3	A	Spring	11		Sitting	17		Acceptable
		Summer	9		Sitting	13		Acceptable
		Fall	10		Sitting	16		Acceptable
		Winter	12		Sitting	18		Acceptable
		Annual	11		Sitting	16		Acceptable
	B	Spring	15	+36%	Standing	20	+18%	Acceptable
		Summer	11	+22%	Sitting	15	+15%	Acceptable
		Fall	14	+40%	Standing	18	+13%	Acceptable
		Winter	16	+33%	Walking	21	+17%	Acceptable
		Annual	15	+36%	Standing	19	+19%	Acceptable
4	A	Spring	13		Standing	20		Acceptable
		Summer	10		Sitting	15		Acceptable
		Fall	12		Sitting	18		Acceptable
		Winter	15		Standing	21		Acceptable
		Annual	13		Standing	19		Acceptable
	B	Spring	16	+23%	Walking	22	+10%	Acceptable
		Summer	12	+20%	Sitting	17	+13%	Acceptable
		Fall	15	+25%	Standing	20	+11%	Acceptable
		Winter	18	+20%	Walking	24	+14%	Acceptable
		Annual	16	+23%	Walking	22	+16%	Acceptable

Notes: 1) Wind speeds are for a 1% probability of exceedance, and
2) %Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations
A - No Build
B - Full Build

Mean Wind Speed Criteria

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

Effective Gust Criteria

Acceptable:	≤ 31 mph
Unacceptable:	> 31 mph

Table 2: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			Mean Wind Speed			Effective Gust Wind Speed		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
5	A	Spring	11		Sitting	17		Acceptable
		Summer	8		Sitting	12		Acceptable
		Fall	10		Sitting	15		Acceptable
		Winter	12		Sitting	18		Acceptable
		Annual	11		Sitting	16		Acceptable
	B	Spring	14	+27%	Standing	18		Acceptable
		Summer	11	+38%	Sitting	14	+17%	Acceptable
		Fall	13	+30%	Standing	17	+13%	Acceptable
		Winter	15	+25%	Standing	20	+11%	Acceptable
		Annual	14	+27%	Standing	18	+13%	Acceptable
6	A	Spring	9		Sitting	15		Acceptable
		Summer	7		Sitting	12		Acceptable
		Fall	9		Sitting	14		Acceptable
		Winter	10		Sitting	16		Acceptable
		Annual	9		Sitting	15		Acceptable
	B	Spring	8	-10%	Sitting	14		Acceptable
		Summer	7		Sitting	12		Acceptable
		Fall	8	-10%	Sitting	14		Acceptable
		Winter	9		Sitting	16		Acceptable
		Annual	8	-10%	Sitting	14		Acceptable
7	A	Spring	10		Sitting	16		Acceptable
		Summer	8		Sitting	13		Acceptable
		Fall	9		Sitting	15		Acceptable
		Winter	10		Sitting	17		Acceptable
		Annual	10		Sitting	15		Acceptable
	B	Spring	9		Sitting	15		Acceptable
		Summer	7	-12%	Sitting	12		Acceptable
		Fall	9		Sitting	14		Acceptable
		Winter	10		Sitting	16		Acceptable
		Annual	9		Sitting	15		Acceptable
8	A	Spring	18		Walking	26		Acceptable
		Summer	13		Standing	22		Acceptable
		Fall	16		Walking	25		Acceptable
		Winter	19		Walking	28		Acceptable
		Annual	18		Walking	26		Acceptable
	B	Spring	19		Walking	25		Acceptable
		Summer	15	+15%	Standing	19	-13%	Acceptable
		Fall	18	+13%	Walking	23		Acceptable
		Winter	21	+11%	Uncomfortable	27		Acceptable
		Annual	19		Walking	25		Acceptable

Notes: 1) Wind speeds are for a 1% probability of exceedance, and
2) %Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

<u>Configurations</u>
A - No Build
B - Full Build

<u>Mean Wind Speed Criteria</u>

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

<u>Effective Gust Criteria</u>

Acceptable:	≤ 31 mph
Unacceptable:	> 31 mph

Table 2: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
9	A	Spring	13		Standing	21		Acceptable
		Summer	10		Sitting	16		Acceptable
		Fall	13		Standing	20		Acceptable
		Winter	15		Standing	23		Acceptable
		Annual	13		Standing	21		Acceptable
	B	Spring	21	+62%	Uncomfortable	27	+29%	Acceptable
		Summer	16	+60%	Walking	21	+31%	Acceptable
		Fall	19	+46%	Walking	25	+25%	Acceptable
		Winter	23	+52%	Uncomfortable	30	+30%	Acceptable
		Annual	21	+62%	Uncomfortable	27	+29%	Acceptable
10	A	Spring	11		Sitting	18		Acceptable
		Summer	8		Sitting	14		Acceptable
		Fall	10		Sitting	17		Acceptable
		Winter	12		Sitting	20		Acceptable
		Annual	11		Sitting	18		Acceptable
	B	Spring	17	+55%	Walking	23	+28%	Acceptable
		Summer	13	+63%	Standing	18	+29%	Acceptable
		Fall	15	+50%	Standing	21	+24%	Acceptable
		Winter	18	+50%	Walking	24	+20%	Acceptable
		Annual	16	+45%	Walking	22	+22%	Acceptable
11	A	Spring	17		Walking	25		Acceptable
		Summer	13		Standing	18		Acceptable
		Fall	16		Walking	23		Acceptable
		Winter	19		Walking	27		Acceptable
		Annual	17		Walking	24		Acceptable
	B	Spring	16		Walking	22	-11%	Acceptable
		Summer	13		Standing	18		Acceptable
		Fall	14	-12%	Standing	20	-12%	Acceptable
		Winter	16	-15%	Walking	23	-14%	Acceptable
		Annual	15	-11%	Standing	21	-12%	Acceptable
12	A	Spring	20		Uncomfortable	27		Acceptable
		Summer	16		Walking	21		Acceptable
		Fall	19		Walking	25		Acceptable
		Winter	22		Uncomfortable	29		Acceptable
		Annual	20		Uncomfortable	27		Acceptable
	B	Spring	15	-24%	Standing	21	-21%	Acceptable
		Summer	12	-24%	Sitting	17	-18%	Acceptable
		Fall	14	-25%	Standing	20	-19%	Acceptable
		Winter	17	-22%	Walking	22	-23%	Acceptable
		Annual	15	-24%	Standing	20	-25%	Acceptable

Notes: 1) Wind speeds are for a 1% probability of exceedance, and
2) %Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations
A - No Build
B - Full Build

Mean Wind Speed Criteria

Comfortable for Sitting:	$\leq$ 12 mph
Comfortable for Standing:	> 12 and $\leq$ 15 mph
Comfortable for Walking:	> 15 and $\leq$ 19 mph
Uncomfortable for Walking:	> 19 and $\leq$ 27 mph
Dangerous Conditions:	> 27 mph

Effective Gust Criteria

Acceptable:	$\leq$ 31 mph
Unacceptable:	> 31 mph

Table 2: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			Mean Wind Speed			Effective Gust Wind Speed		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
13	A	Spring	28		Dangerous	36		Unacceptable
		Summer	22		Uncomfortable	28		Acceptable
		Fall	27		Uncomfortable	34		Unacceptable
		Winter	31		Dangerous	39		Unacceptable
		Annual	28		Dangerous	36		Unacceptable
	B	Spring	21	-24%	Uncomfortable	28	-21%	Acceptable
		Summer	16	-26%	Walking	22	-20%	Acceptable
		Fall	20	-25%	Uncomfortable	26	-23%	Acceptable
		Winter	23	-25%	Uncomfortable	31	-20%	Acceptable
		Annual	21	-24%	Uncomfortable	28	-21%	Acceptable
14	A	Spring	28		Dangerous	35		Unacceptable
		Summer	22		Uncomfortable	28		Acceptable
		Fall	26		Uncomfortable	33		Unacceptable
		Winter	31		Dangerous	39		Unacceptable
		Annual	28		Dangerous	35		Unacceptable
	B	Spring	20	-28%	Uncomfortable	29	-16%	Acceptable
		Summer	15	-31%	Standing	21	-24%	Acceptable
		Fall	18	-30%	Walking	27	-17%	Acceptable
		Winter	22	-28%	Uncomfortable	31	-20%	Acceptable
		Annual	20	-28%	Uncomfortable	28	-19%	Acceptable
15	A	Spring	19		Walking	26		Acceptable
		Summer	15		Standing	21		Acceptable
		Fall	18		Walking	25		Acceptable
		Winter	20		Uncomfortable	28		Acceptable
		Annual	18		Walking	26		Acceptable
	B	Spring	15	-20%	Standing	23	-11%	Acceptable
		Summer	11	-26%	Sitting	17	-18%	Acceptable
		Fall	14	-21%	Standing	21	-15%	Acceptable
		Winter	17	-14%	Walking	25	-10%	Acceptable
		Annual	15	-16%	Standing	23	-11%	Acceptable
16	A	Spring	13		Standing	19		Acceptable
		Summer	10		Sitting	15		Acceptable
		Fall	12		Sitting	18		Acceptable
		Winter	14		Standing	21		Acceptable
		Annual	13		Standing	19		Acceptable
	B	Spring	15	+15%	Standing	23	+21%	Acceptable
		Summer	11	+10%	Sitting	18	+20%	Acceptable
		Fall	14	+17%	Standing	22	+22%	Acceptable
		Winter	15		Standing	24	+14%	Acceptable
		Annual	14		Standing	22	+16%	Acceptable

Notes: 1) Wind speeds are for a 1% probability of exceedance, and
2) %Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations
A - No Build
B - Full Build

Mean Wind Speed Criteria

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

Effective Gust Criteria

Acceptable:	≤ 31 mph
Unacceptable:	> 31 mph

Table 2: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			Mean Wind Speed			Effective Gust Wind Speed		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
17	A	Spring	12		Sitting	18		Acceptable
		Summer	9		Sitting	14		Acceptable
		Fall	11		Sitting	17		Acceptable
		Winter	13		Standing	19		Acceptable
		Annual	12		Sitting	18		Acceptable
	B	Spring	16	+33%	Walking	25	+39%	Acceptable
		Summer	12	+33%	Sitting	18	+29%	Acceptable
		Fall	15	+36%	Standing	23	+35%	Acceptable
		Winter	18	+38%	Walking	28	+47%	Acceptable
		Annual	16	+33%	Walking	25	+39%	Acceptable
18	A	Spring	11		Sitting	17		Acceptable
		Summer	9		Sitting	14		Acceptable
		Fall	11		Sitting	16		Acceptable
		Winter	12		Sitting	18		Acceptable
		Annual	11		Sitting	17		Acceptable
	B	Spring	23	+109%	Uncomfortable	30	+76%	Acceptable
		Summer	18	+100%	Walking	24	+71%	Acceptable
		Fall	21	+91%	Uncomfortable	28	+75%	Acceptable
		Winter	25	+108%	Uncomfortable	33	+83%	Unacceptable
		Annual	22	+100%	Uncomfortable	30	+76%	Acceptable
19	A	Spring	DATA NOT AVAILABLE					
		Summer	DATA NOT AVAILABLE					
		Fall	DATA NOT AVAILABLE					
		Winter	DATA NOT AVAILABLE					
		Annual	DATA NOT AVAILABLE					
	B	Spring	19		Walking	26		Acceptable
		Summer	16		Walking	21		Acceptable
		Fall	18		Walking	25		Acceptable
		Winter	22		Uncomfortable	29		Acceptable
		Annual	19		Walking	26		Acceptable
20	A	Spring	DATA NOT AVAILABLE					
		Summer	DATA NOT AVAILABLE					
		Fall	DATA NOT AVAILABLE					
		Winter	DATA NOT AVAILABLE					
		Annual	DATA NOT AVAILABLE					
	B	Spring	24		Uncomfortable	34		Unacceptable
		Summer	21		Uncomfortable	28		Acceptable
		Fall	23		Uncomfortable	32		Unacceptable
		Winter	27		Uncomfortable	38		Unacceptable
		Annual	24		Uncomfortable	34		Unacceptable

Notes: 1) Wind speeds are for a 1% probability of exceedance, and
2) %Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations
A - No Build
B - Full Build

Mean Wind Speed Criteria

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

Effective Gust Criteria

Acceptable:	≤ 31 mph
Unacceptable:	> 31 mph

Table 2: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			Mean Wind Speed			Effective Gust Wind Speed		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
21	A	Spring	DATA NOT AVAILABLE					
		Summer	DATA NOT AVAILABLE					
		Fall	DATA NOT AVAILABLE					
		Winter	DATA NOT AVAILABLE					
		Annual	DATA NOT AVAILABLE					
	B	Spring	14		Standing	22		Acceptable
		Summer	11		Sitting	19		Acceptable
		Fall	13		Standing	21		Acceptable
		Winter	15		Standing	24		Acceptable
		Annual	14		Standing	22		Acceptable
22	A	Spring	DATA NOT AVAILABLE					
		Summer	DATA NOT AVAILABLE					
		Fall	DATA NOT AVAILABLE					
		Winter	DATA NOT AVAILABLE					
		Annual	DATA NOT AVAILABLE					
	B	Spring	24		Uncomfortable	34		Unacceptable
		Summer	21		Uncomfortable	28		Acceptable
		Fall	23		Uncomfortable	32		Unacceptable
		Winter	27		Uncomfortable	38		Unacceptable
		Annual	24		Uncomfortable	34		Unacceptable
23	A	Spring	DATA NOT AVAILABLE					
		Summer	DATA NOT AVAILABLE					
		Fall	DATA NOT AVAILABLE					
		Winter	DATA NOT AVAILABLE					
		Annual	DATA NOT AVAILABLE					
	B	Spring	13		Standing	22		Acceptable
		Summer	11		Sitting	18		Acceptable
		Fall	13		Standing	21		Acceptable
		Winter	14		Standing	23		Acceptable
		Annual	13		Standing	22		Acceptable
24	A	Spring	15		Standing	22		Acceptable
		Summer	12		Sitting	18		Acceptable
		Fall	14		Standing	21		Acceptable
		Winter	16		Walking	23		Acceptable
		Annual	15		Standing	22		Acceptable
	B	Spring	17	+13%	Walking	26	+18%	Acceptable
		Summer	14	+17%	Standing	23	+28%	Acceptable
		Fall	16	+14%	Walking	25	+19%	Acceptable
		Winter	18	+13%	Walking	29	+26%	Acceptable
		Annual	16		Walking	26	+18%	Acceptable

Notes: 1) Wind speeds are for a 1% probability of exceedance, and
2) %Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

<u>Configurations</u>
A - No Build
B - Full Build

<u>Mean Wind Speed Criteria</u>

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

<u>Effective Gust Criteria</u>

Acceptable:	≤ 31 mph
Unacceptable:	> 31 mph

Table 2: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			Mean Wind Speed			Effective Gust Wind Speed		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
25	A	Spring	14		Standing	21		Acceptable
		Summer	10		Sitting	15		Acceptable
		Fall	13		Standing	19		Acceptable
		Winter	16		Walking	23		Acceptable
		Annual	14		Standing	21		Acceptable
	B	Spring	27	+93%	Uncomfortable	36	+71%	Unacceptable
		Summer	20	+100%	Uncomfortable	27	+80%	Acceptable
		Fall	25	+92%	Uncomfortable	33	+74%	Unacceptable
		Winter	30	+88%	Dangerous	39	+70%	Unacceptable
		Annual	27	+93%	Uncomfortable	36	+71%	Unacceptable
26	A	Spring	DATA NOT AVAILABLE					
		Summer	DATA NOT AVAILABLE					
		Fall	DATA NOT AVAILABLE					
		Winter	DATA NOT AVAILABLE					
		Annual	DATA NOT AVAILABLE					
	B	Spring	17		Walking	25		Acceptable
		Summer	13		Standing	18		Acceptable
		Fall	16		Walking	24		Acceptable
		Winter	19		Walking	28		Acceptable
		Annual	17		Walking	25		Acceptable
27	A	Spring	13		Standing	20		Acceptable
		Summer	11		Sitting	16		Acceptable
		Fall	12		Sitting	19		Acceptable
		Winter	14		Standing	21		Acceptable
		Annual	12		Sitting	19		Acceptable
	B	Spring	18	+38%	Walking	24	+20%	Acceptable
		Summer	15	+36%	Standing	20	+25%	Acceptable
		Fall	16	+33%	Walking	22	+16%	Acceptable
		Winter	18	+29%	Walking	25	+19%	Acceptable
		Annual	16	+33%	Walking	23	+21%	Acceptable
28	A	Spring	17		Walking	24		Acceptable
		Summer	14		Standing	19		Acceptable
		Fall	16		Walking	22		Acceptable
		Winter	18		Walking	25		Acceptable
		Annual	17		Walking	23		Acceptable
	B	Spring	21	+24%	Uncomfortable	28	+17%	Acceptable
		Summer	17	+21%	Walking	23	+21%	Acceptable
		Fall	18	+13%	Walking	25	+14%	Acceptable
		Winter	20	+11%	Uncomfortable	28	+12%	Acceptable
		Annual	19	+12%	Walking	25		Acceptable

Notes: 1) Wind speeds are for a 1% probability of exceedance, and
2) %Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations
A - No Build
B - Full Build

Mean Wind Speed Criteria

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

Effective Gust Criteria

Acceptable:	≤ 31 mph
Unacceptable:	> 31 mph

Table 2: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			Mean Wind Speed			Effective Gust Wind Speed		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
29	A	Spring	18		Walking	25		Acceptable
		Summer	16		Walking	22		Acceptable
		Fall	18		Walking	24		Acceptable
		Winter	20		Uncomfortable	28		Acceptable
		Annual	18		Walking	25		Acceptable
	B	Spring	18		Walking	26		Acceptable
		Summer	15		Standing	21		Acceptable
		Fall	16	-10%	Walking	23		Acceptable
		Winter	18		Walking	26		Acceptable
		Annual	17		Walking	24		Acceptable
30	A	Spring	21		Uncomfortable	28		Acceptable
		Summer	18		Walking	25		Acceptable
		Fall	20		Uncomfortable	27		Acceptable
		Winter	23		Uncomfortable	31		Acceptable
		Annual	21		Uncomfortable	28		Acceptable
	B	Spring	16	-23%	Walking	23	-17%	Acceptable
		Summer	12	-32%	Sitting	18	-27%	Acceptable
		Fall	15	-24%	Standing	21	-21%	Acceptable
		Winter	17	-25%	Walking	24	-22%	Acceptable
		Annual	15	-28%	Standing	22	-20%	Acceptable
31	A	Spring	10		Sitting	17		Acceptable
		Summer	8		Sitting	14		Acceptable
		Fall	10		Sitting	16		Acceptable
		Winter	11		Sitting	18		Acceptable
		Annual	10		Sitting	16		Acceptable
	B	Spring	11	+10%	Sitting	18		Acceptable
		Summer	9	+13%	Sitting	14		Acceptable
		Fall	11	+10%	Sitting	17		Acceptable
		Winter	12		Sitting	19		Acceptable
		Annual	11	+10%	Sitting	17		Acceptable
32	A	Spring	16		Walking	22		Acceptable
		Summer	12		Sitting	16		Acceptable
		Fall	15		Standing	20		Acceptable
		Winter	18		Walking	23		Acceptable
		Annual	16		Walking	21		Acceptable
	B	Spring	12	-24%	Sitting	17	-22%	Acceptable
		Summer	10	-16%	Sitting	13	-18%	Acceptable
		Fall	12	-19%	Sitting	16	-19%	Acceptable
		Winter	13	-27%	Standing	18	-21%	Acceptable
		Annual	12	-24%	Sitting	17	-18%	Acceptable

Notes: 1) Wind speeds are for a 1% probability of exceedance, and
2) %Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations
A - No Build
B - Full Build

Mean Wind Speed Criteria

Comfortable for Sitting:	$\leq$ 12 mph
Comfortable for Standing:	> 12 and $\leq$ 15 mph
Comfortable for Walking:	> 15 and $\leq$ 19 mph
Uncomfortable for Walking:	> 19 and $\leq$ 27 mph
Dangerous Conditions:	> 27 mph

Effective Gust Criteria

Acceptable:	$\leq$ 31 mph
Unacceptable:	> 31 mph

Table 2: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
33	A	Spring	14		Standing	20		Acceptable
		Summer	10		Sitting	15		Acceptable
		Fall	13		Standing	18		Acceptable
		Winter	15		Standing	21		Acceptable
		Annual	13		Standing	19		Acceptable
	B	Spring	11	-20%	Sitting	17	-14%	Acceptable
		Summer	8	-19%	Sitting	13	-12%	Acceptable
		Fall	10	-22%	Sitting	15	-16%	Acceptable
		Winter	11	-26%	Sitting	17	-18%	Acceptable
		Annual	10	-22%	Sitting	16	-15%	Acceptable
34	A	Spring	11		Sitting	17		Acceptable
		Summer	9		Sitting	14		Acceptable
		Fall	10		Sitting	15		Acceptable
		Winter	11		Sitting	17		Acceptable
		Annual	10		Sitting	16		Acceptable
	B	Spring	11		Sitting	18		Acceptable
		Summer	8	-10%	Sitting	13		Acceptable
		Fall	10		Sitting	17	+13%	Acceptable
		Winter	11		Sitting	19	+12%	Acceptable
		Annual	10		Sitting	17		Acceptable
35	A	Spring	15		Standing	22		Acceptable
		Summer	13		Standing	18		Acceptable
		Fall	14		Standing	20		Acceptable
		Winter	15		Standing	22		Acceptable
		Annual	14		Standing	21		Acceptable
	B	Spring	14		Standing	22		Acceptable
		Summer	10	-22%	Sitting	16	-10%	Acceptable
		Fall	13		Standing	21		Acceptable
		Winter	15		Standing	25	+14%	Acceptable
		Annual	14		Standing	22		Acceptable
36	A	Spring	17		Walking	24		Acceptable
		Summer	13		Standing	18		Acceptable
		Fall	16		Walking	22		Acceptable
		Winter	19		Walking	26		Acceptable
		Annual	17		Walking	24		Acceptable
	B	Spring	13	-23%	Standing	21	-12%	Acceptable
		Summer	9	-30%	Sitting	15	-16%	Acceptable
		Fall	12	-24%	Sitting	19	-13%	Acceptable
		Winter	14	-25%	Standing	22	-14%	Acceptable
		Annual	13	-23%	Standing	20	-16%	Acceptable

Notes: 1) Wind speeds are for a 1% probability of exceedance, and
2) %Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations
A - No Build
B - Full Build

Mean Wind Speed Criteria
Comfortable for Sitting: ≤ 12 mph
Comfortable for Standing: > 12 and ≤ 15 mph
Comfortable for Walking: > 15 and ≤ 19 mph
Uncomfortable for Walking: > 19 and ≤ 27 mph
Dangerous Conditions: > 27 mph

Effective Gust Criteria
Acceptable: ≤ 31 mph
Unacceptable: > 31 mph

Table 2: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			Mean Wind Speed			Effective Gust Wind Speed		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
37	A	Spring	12		Sitting	18		Acceptable
		Summer	9		Sitting	14		Acceptable
		Fall	12		Sitting	17		Acceptable
		Winter	14		Standing	20		Acceptable
		Annual	12		Sitting	18		Acceptable
	B	Spring	24	+100%	Uncomfortable	34	+89%	Unacceptable
		Summer	17	+89%	Walking	24	+71%	Acceptable
		Fall	22	+83%	Uncomfortable	31	+82%	Acceptable
		Winter	27	+93%	Uncomfortable	38	+90%	Unacceptable
		Annual	24	+100%	Uncomfortable	34	+89%	Unacceptable
38	A	Spring	13		Standing	19		Acceptable
		Summer	10		Sitting	14		Acceptable
		Fall	12		Sitting	18		Acceptable
		Winter	15		Standing	22		Acceptable
		Annual	13		Standing	19		Acceptable
	B	Spring	22	+69%	Uncomfortable	31	+63%	Acceptable
		Summer	17	+70%	Walking	25	+79%	Acceptable
		Fall	21	+75%	Uncomfortable	29	+61%	Acceptable
		Winter	25	+67%	Uncomfortable	35	+58%	Unacceptable
		Annual	22	+69%	Uncomfortable	31	+63%	Acceptable
39	A	Spring	15		Standing	21		Acceptable
		Summer	11		Sitting	15		Acceptable
		Fall	13		Standing	19		Acceptable
		Winter	16		Walking	23		Acceptable
		Annual	14		Standing	21		Acceptable
	B	Spring	23	+52%	Uncomfortable	31	+48%	Acceptable
		Summer	20	+82%	Uncomfortable	26	+73%	Acceptable
		Fall	22	+69%	Uncomfortable	29	+52%	Acceptable
		Winter	25	+56%	Uncomfortable	34	+48%	Unacceptable
		Annual	23	+64%	Uncomfortable	31	+48%	Acceptable
40	A	Spring	14		Standing	20		Acceptable
		Summer	10		Sitting	15		Acceptable
		Fall	13		Standing	19		Acceptable
		Winter	15		Standing	22		Acceptable
		Annual	14		Standing	20		Acceptable
	B	Spring	21	+50%	Uncomfortable	29	+45%	Acceptable
		Summer	18	+80%	Walking	25	+67%	Acceptable
		Fall	20	+54%	Uncomfortable	28	+47%	Acceptable
		Winter	23	+52%	Uncomfortable	32	+45%	Unacceptable
		Annual	21	+50%	Uncomfortable	29	+45%	Acceptable

Notes: 1) Wind speeds are for a 1% probability of exceedance, and
2) %Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations	Mean Wind Speed Criteria		Effective Gust Criteria	
A - No Build	Comfortable for Sitting:	≤ 12 mph	Acceptable:	≤ 31 mph
B - Full Build	Comfortable for Standing:	> 12 and ≤ 15 mph	Unacceptable:	> 31 mph
	Comfortable for Walking:	> 15 and ≤ 19 mph		
	Uncomfortable for Walking:	> 19 and ≤ 27 mph		
	Dangerous Conditions:	> 27 mph		

Table 2: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			Mean Wind Speed			Effective Gust Wind Speed		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
41	A	Spring	13		Standing	19		Acceptable
		Summer	11		Sitting	16		Acceptable
		Fall	12		Sitting	18		Acceptable
		Winter	14		Standing	20		Acceptable
		Annual	13		Standing	18		Acceptable
	B	Spring	11	-14%	Sitting	18		Acceptable
		Summer	9	-17%	Sitting	15		Acceptable
		Fall	10	-16%	Sitting	16	-10%	Acceptable
		Winter	11	-20%	Sitting	19		Acceptable
		Annual	10	-22%	Sitting	17		Acceptable
42	A	Spring	15		Standing	23		Acceptable
		Summer	12		Sitting	18		Acceptable
		Fall	14		Standing	21		Acceptable
		Winter	16		Walking	24		Acceptable
		Annual	15		Standing	22		Acceptable
	B	Spring	15		Standing	22		Acceptable
		Summer	11		Sitting	16	-10%	Acceptable
		Fall	13		Standing	20		Acceptable
		Winter	17		Walking	25		Acceptable
		Annual	15		Standing	22		Acceptable
43	A	Spring	12		Sitting	19		Acceptable
		Summer	9		Sitting	15		Acceptable
		Fall	11		Sitting	18		Acceptable
		Winter	13		Standing	20		Acceptable
		Annual	12		Sitting	18		Acceptable
	B	Spring	9	-24%	Sitting	17	-10%	Acceptable
		Summer	7	-21%	Sitting	13	-12%	Acceptable
		Fall	8	-26%	Sitting	16	-10%	Acceptable
		Winter	10	-22%	Sitting	19		Acceptable
		Annual	9	-24%	Sitting	17		Acceptable
44	A	Spring	DATA NOT AVAILABLE					
		Summer	DATA NOT AVAILABLE					
		Fall	DATA NOT AVAILABLE					
		Winter	DATA NOT AVAILABLE					
		Annual	DATA NOT AVAILABLE					
	B	Spring	12		Sitting	20		Acceptable
		Summer	9		Sitting	15		Acceptable
		Fall	11		Sitting	18		Acceptable
		Winter	13		Standing	22		Acceptable
		Annual	12		Sitting	20		Acceptable

Notes: 1) Wind speeds are for a 1% probability of exceedance, and
2) %Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations
A - No Build
B - Full Build

Mean Wind Speed Criteria
Comfortable for Sitting: ≤ 12 mph
Comfortable for Standing: > 12 and ≤ 15 mph
Comfortable for Walking: > 15 and ≤ 19 mph
Uncomfortable for Walking: > 19 and ≤ 27 mph
Dangerous Conditions: > 27 mph

Effective Gust Criteria
Acceptable: ≤ 31 mph
Unacceptable: > 31 mph

Table 2: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
45	A	Spring	21		Uncomfortable	28		Acceptable
		Summer	17		Walking	22		Acceptable
		Fall	19		Walking	26		Acceptable
		Winter	23		Uncomfortable	31		Acceptable
		Annual	21		Uncomfortable	28		Acceptable
	B	Spring	18	-13%	Walking	29		Acceptable
		Summer	13	-23%	Standing	21		Acceptable
		Fall	17	-10%	Walking	26		Acceptable
		Winter	20	-12%	Uncomfortable	32		Unacceptable
		Annual	18	-13%	Walking	28		Acceptable
46	A	Spring	16		Walking	22		Acceptable
		Summer	12		Sitting	17		Acceptable
		Fall	15		Standing	20		Acceptable
		Winter	17		Walking	23		Acceptable
		Annual	16		Walking	22		Acceptable
	B	Spring	21	+31%	Uncomfortable	32	+45%	Unacceptable
		Summer	15	+25%	Standing	23	+35%	Acceptable
		Fall	19	+27%	Walking	29	+45%	Acceptable
		Winter	24	+41%	Uncomfortable	35	+52%	Unacceptable
		Annual	21	+31%	Uncomfortable	31	+41%	Acceptable
47	A	Spring	14		Standing	20		Acceptable
		Summer	11		Sitting	16		Acceptable
		Fall	13		Standing	19		Acceptable
		Winter	14		Standing	21		Acceptable
		Annual	13		Standing	20		Acceptable
	B	Spring	21	+50%	Uncomfortable	30	+50%	Acceptable
		Summer	15	+36%	Standing	21	+31%	Acceptable
		Fall	19	+46%	Walking	27	+42%	Acceptable
		Winter	23	+64%	Uncomfortable	33	+57%	Unacceptable
		Annual	21	+62%	Uncomfortable	29	+45%	Acceptable
48	A	Spring	24		Uncomfortable	30		Acceptable
		Summer	17		Walking	22		Acceptable
		Fall	22		Uncomfortable	27		Acceptable
		Winter	26		Uncomfortable	33		Unacceptable
		Annual	23		Uncomfortable	29		Acceptable
	B	Spring	24		Uncomfortable	29		Acceptable
		Summer	18		Walking	23		Acceptable
		Fall	22		Uncomfortable	28		Acceptable
		Winter	26		Uncomfortable	32		Unacceptable
		Annual	24		Uncomfortable	29		Acceptable

Notes: 1) Wind speeds are for a 1% probability of exceedance, and
2) %Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations	Mean Wind Speed Criteria		Effective Gust Criteria	
A - No Build	Comfortable for Sitting:	≤ 12 mph	Acceptable:	≤ 31 mph
B - Full Build	Comfortable for Standing:	> 12 and ≤ 15 mph	Unacceptable:	> 31 mph
	Comfortable for Walking:	> 15 and ≤ 19 mph		
	Uncomfortable for Walking:	> 19 and ≤ 27 mph		
	Dangerous Conditions:	> 27 mph		

Table 2: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
49	A	Spring	18		Walking	26		Acceptable
		Summer	13		Standing	19		Acceptable
		Fall	16		Walking	24		Acceptable
		Winter	19		Walking	28		Acceptable
		Annual	17		Walking	25		Acceptable
	B	Spring	16	-10%	Walking	24		Acceptable
		Summer	12		Sitting	18		Acceptable
		Fall	15		Standing	22		Acceptable
		Winter	17	-10%	Walking	25	-10%	Acceptable
		Annual	16		Walking	23		Acceptable
50	A	Spring	18		Walking	26		Acceptable
		Summer	14		Standing	21		Acceptable
		Fall	16		Walking	24		Acceptable
		Winter	18		Walking	26		Acceptable
		Annual	17		Walking	24		Acceptable
	B	Spring	16	-10%	Walking	24		Acceptable
		Summer	13		Standing	20		Acceptable
		Fall	15		Standing	22		Acceptable
		Winter	17		Walking	25		Acceptable
		Annual	16		Walking	23		Acceptable
51	A	Spring	20		Uncomfortable	28		Acceptable
		Summer	16		Walking	22		Acceptable
		Fall	18		Walking	26		Acceptable
		Winter	21		Uncomfortable	29		Acceptable
		Annual	19		Walking	27		Acceptable
	B	Spring	18		Walking	26		Acceptable
		Summer	15		Standing	21		Acceptable
		Fall	17		Walking	23	-11%	Acceptable
		Winter	19		Walking	27		Acceptable
		Annual	17	-10%	Walking	24	-10%	Acceptable
52	A	Spring	27		Uncomfortable	35		Unacceptable
		Summer	21		Uncomfortable	27		Acceptable
		Fall	25		Uncomfortable	33		Unacceptable
		Winter	30		Dangerous	39		Unacceptable
		Annual	27		Uncomfortable	35		Unacceptable
	B	Spring	26		Uncomfortable	34		Unacceptable
		Summer	19		Walking	25		Acceptable
		Fall	24		Uncomfortable	31		Acceptable
		Winter	29		Dangerous	37		Unacceptable
		Annual	26		Uncomfortable	33		Unacceptable

Notes: 1) Wind speeds are for a 1% probability of exceedance, and
2) %Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

<u>Configurations</u>
A - No Build
B - Full Build

<u>Mean Wind Speed Criteria</u>

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

<u>Effective Gust Criteria</u>

Acceptable:	≤ 31 mph
Unacceptable:	> 31 mph

Table 2: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
53	A	Spring	16		Walking	24		Acceptable
		Summer	13		Standing	19		Acceptable
		Fall	14		Standing	22		Acceptable
		Winter	16		Walking	26		Acceptable
		Annual	15		Standing	23		Acceptable
	B	Spring	18	+13%	Walking	26		Acceptable
		Summer	15	+15%	Standing		21+11%	Acceptable
		Fall	16	+14%	Walking	24		Acceptable
		Winter	19	+19%	Walking	27		Acceptable
		Annual	17	+13%	Walking	25		Acceptable
54	A	Spring	13		Standing	21		Acceptable
		Summer	10		Sitting	16		Acceptable
		Fall	12		Sitting	19		Acceptable
		Winter	14		Standing	22		Acceptable
		Annual	13		Standing	20		Acceptable
	B	Spring	19	+46%	Walking	26	+24%	Acceptable
		Summer	14	+40%	Standing	19	+19%	Acceptable
		Fall	17	+42%	Walking	24	+26%	Acceptable
		Winter	20	+43%	Uncomfortable	28	+27%	Acceptable
		Annual	18	+38%	Walking	25	+25%	Acceptable
55	A	Spring	17		Walking	25		Acceptable
		Summer	13		Standing	19		Acceptable
		Fall	16		Walking	24		Acceptable
		Winter	18		Walking	27		Acceptable
		Annual	17		Walking	25		Acceptable
	B	Spring	24	+41%	Uncomfortable	31	+24%	Acceptable
		Summer	18	+38%	Walking	23	+21%	Acceptable
		Fall	23	+44%	Uncomfortable	29	+21%	Acceptable
		Winter	27	+50%	Uncomfortable	34	+26%	Unacceptable
		Annual	24	+41%	Uncomfortable	31	+24%	Acceptable
56	A	Spring	15		Standing	24		Acceptable
		Summer	12		Sitting	19		Acceptable
		Fall	14		Standing	22		Acceptable
		Winter	17		Walking	26		Acceptable
		Annual	15		Standing	23		Acceptable
	B	Spring	21	+40%	Uncomfortable	29	+21%	Acceptable
		Summer	16	+33%	Walking	22	+16%	Acceptable
		Fall	20	+43%	Uncomfortable	27	+23%	Acceptable
		Winter	24	+41%	Uncomfortable	32	+23%	Unacceptable
		Annual	21	+40%	Uncomfortable	29	+26%	Acceptable

Notes: 1) Wind speeds are for a 1% probability of exceedance, and
2) %Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations
A - No Build
B - Full Build

Mean Wind Speed Criteria

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

Effective Gust Criteria

Acceptable:	≤ 31 mph
Unacceptable:	> 31 mph

Table 2: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
57	A	Spring	21		Uncomfortable	29		Acceptable
		Summer	17		Walking	23		Acceptable
		Fall	20		Uncomfortable	27		Acceptable
		Winter	23		Uncomfortable	31		Acceptable
		Annual	21		Uncomfortable	28		Acceptable
	B	Spring	22		Uncomfortable	29		Acceptable
		Summer	17		Walking	23		Acceptable
		Fall	20		Uncomfortable	27		Acceptable
		Winter	23		Uncomfortable	31		Acceptable
		Annual	21		Uncomfortable	28		Acceptable
58	A	Spring	20		Uncomfortable	28		Acceptable
		Summer	15		Standing	21		Acceptable
		Fall	18		Walking	25		Acceptable
		Winter	22		Uncomfortable	31		Acceptable
		Annual	19		Walking	27		Acceptable
	B	Spring	21		Uncomfortable	29		Acceptable
		Summer	15		Standing	21		Acceptable
		Fall	18		Walking	26		Acceptable
		Winter	23		Uncomfortable	32		Unacceptable
		Annual	20		Uncomfortable	28		Acceptable
59	A	Spring	22		Uncomfortable	32		Unacceptable
		Summer	19		Walking	26		Acceptable
		Fall	21		Uncomfortable	30		Acceptable
		Winter	25		Uncomfortable	35		Unacceptable
		Annual	22		Uncomfortable	31		Acceptable
	B	Spring	19	-13%	Walking	28	-12%	Acceptable
		Summer	16	-15%	Walking	23	-11%	Acceptable
		Fall	18	-13%	Walking	27		Acceptable
		Winter	22	-11%	Uncomfortable	32		Unacceptable
		Annual	19	-13%	Walking	28		Acceptable
60	A	Spring	19		Walking	27		Acceptable
		Summer	16		Walking	23		Acceptable
		Fall	18		Walking	25		Acceptable
		Winter	19		Walking	27		Acceptable
		Annual	18		Walking	25		Acceptable
	B	Spring	16	-15%	Walking	24	-10%	Acceptable
		Summer	14	-12%	Standing	21		Acceptable
		Fall	15	-16%	Standing	22	-11%	Acceptable
		Winter	16	-15%	Walking	24	-10%	Acceptable
		Annual	15	-16%	Standing	22	-11%	Acceptable

Notes: 1) Wind speeds are for a 1% probability of exceedance, and
2) %Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

<u>Configurations</u>
A - No Build
B - Full Build

<u>Mean Wind Speed Criteria</u>

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

<u>Effective Gust Criteria</u>

Acceptable:	≤ 31 mph
Unacceptable:	> 31 mph

Table 2: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
61	A	Spring	17		Walking	24		Acceptable
		Summer	14		Standing	20		Acceptable
		Fall	16		Walking	23		Acceptable
		Winter	18		Walking	25		Acceptable
		Annual	17		Walking	23		Acceptable
	B	Spring	15	-11%	Standing	22		Acceptable
		Summer	12	-13%	Sitting	18		Acceptable
		Fall	14	-12%	Standing	21		Acceptable
		Winter	16	-10%	Walking	23		Acceptable
		Annual	15	-11%	Standing	21		Acceptable
62	A	Spring	17		Walking	23		Acceptable
		Summer	13		Standing	18		Acceptable
		Fall	16		Walking	22		Acceptable
		Winter	18		Walking	25		Acceptable
		Annual	16		Walking	23		Acceptable
	B	Spring	14	-17%	Standing	21		Acceptable
		Summer	12		Sitting	17		Acceptable
		Fall	13	-18%	Standing	19	-13%	Acceptable
		Winter	15	-16%	Standing	22	-11%	Acceptable
		Annual	14	-12%	Standing	20	-12%	Acceptable
63	A	Spring	17		Walking	24		Acceptable
		Summer	13		Standing	18		Acceptable
		Fall	16		Walking	22		Acceptable
		Winter	19		Walking	26		Acceptable
		Annual	17		Walking	23		Acceptable
	B	Spring	15	-11%	Standing	22		Acceptable
		Summer	12		Sitting	17		Acceptable
		Fall	14	-12%	Standing	20		Acceptable
		Winter	16	-15%	Walking	23	-11%	Acceptable
		Annual	15	-11%	Standing	21		Acceptable
64	A	Spring	18		Walking	25		Acceptable
		Summer	14		Standing	19		Acceptable
		Fall	17		Walking	23		Acceptable
		Winter	20		Uncomfortable	27		Acceptable
		Annual	18		Walking	24		Acceptable
	B	Spring	17		Walking	24		Acceptable
		Summer	14		Standing	19		Acceptable
		Fall	16		Walking	22		Acceptable
		Winter	18		Walking	25		Acceptable
		Annual	17		Walking	23		Acceptable

Notes: 1) Wind speeds are for a 1% probability of exceedance, and
2) %Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations
A - No Build
B - Full Build

Mean Wind Speed Criteria

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

Effective Gust Criteria

Acceptable:	≤ 31 mph
Unacceptable:	> 31 mph

Table 2: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			Mean Wind Speed			Effective Gust Wind Speed		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
65	A	Spring	18		Walking	24		Acceptable
		Summer	13		Standing	18		Acceptable
		Fall	17		Walking	22		Acceptable
		Winter	20		Uncomfortable	26		Acceptable
		Annual	18		Walking	24		Acceptable
	B	Spring	16	-10%	Walking	23		Acceptable
		Summer	13		Standing	18		Acceptable
		Fall	15	-11%	Standing	21		Acceptable
		Winter	18		Walking	24		Acceptable
		Annual	16	-10%	Walking	22		Acceptable
66	A	Spring	15		Standing	22		Acceptable
		Summer	13		Standing	18		Acceptable
		Fall	14		Standing	20		Acceptable
		Winter	16		Walking	23		Acceptable
		Annual	15		Standing	21		Acceptable
	B	Spring	17	+13%	Walking	26	+18%	Acceptable
		Summer	12		Sitting	19		Acceptable
		Fall	15		Standing	24	+20%	Acceptable
		Winter	18	+13%	Walking	28	+22%	Acceptable
		Annual	17	+13%	Walking	25	+19%	Acceptable
67	A	Spring	15		Standing	22		Acceptable
		Summer	12		Sitting	17		Acceptable
		Fall	14		Standing	20		Acceptable
		Winter	16		Walking	23		Acceptable
		Annual	15		Standing	21		Acceptable
	B	Spring	17	+13%	Walking	26	+18%	Acceptable
		Summer	14	+17%	Standing	21	+24%	Acceptable
		Fall	16	+14%	Walking	24	+20%	Acceptable
		Winter	18	+13%	Walking	28	+22%	Acceptable
		Annual	16		Walking	25	+19%	Acceptable
68	A	Spring	16		Walking	22		Acceptable
		Summer	12		Sitting	17		Acceptable
		Fall	14		Standing	20		Acceptable
		Winter	17		Walking	24		Acceptable
		Annual	15		Standing	22		Acceptable
	B	Spring	18	+13%	Walking	26	+18%	Acceptable
		Summer	15	+25%	Standing	22	+29%	Acceptable
		Fall	17	+21%	Walking	25	+25%	Acceptable
		Winter	19	+12%	Walking	28	+17%	Acceptable
		Annual	17	+13%	Walking	26	+18%	Acceptable

Notes: 1) Wind speeds are for a 1% probability of exceedance, and
2) %Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations
A - No Build
B - Full Build

Mean Wind Speed Criteria

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

Effective Gust Criteria

Acceptable:	≤ 31 mph
Unacceptable:	> 31 mph

Table 2: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			Mean Wind Speed			Effective Gust Wind Speed		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
69	A	Spring	14		Standing	21		Acceptable
		Summer	11		Sitting	16		Acceptable
		Fall	13		Standing	20		Acceptable
		Winter	16		Walking	23		Acceptable
		Annual	14		Standing	21		Acceptable
	B	Spring	18	+29%	Walking	26	+24%	Acceptable
		Summer	15	+36%	Standing	22	+38%	Acceptable
		Fall	17	+31%	Walking	25	+25%	Acceptable
		Winter	19	+19%	Walking	28	+22%	Acceptable
		Annual	18	+29%	Walking	25	+19%	Acceptable
70	A	Spring	17		Walking	23		Acceptable
		Summer	12		Sitting	17		Acceptable
		Fall	15		Standing	21		Acceptable
		Winter	18		Walking	25		Acceptable
		Annual	17		Walking	23		Acceptable
	B	Spring	16		Walking	23		Acceptable
		Summer	12		Sitting	17		Acceptable
		Fall	15		Standing	21		Acceptable
		Winter	17		Walking	25		Acceptable
		Annual	16		Walking	22		Acceptable
71	A	Spring	13		Standing	21		Acceptable
		Summer	12		Sitting	18		Acceptable
		Fall	12		Sitting	18		Acceptable
		Winter	12		Sitting	20		Acceptable
		Annual	12		Sitting	19		Acceptable
	B	Spring	15	+15%	Standing	23	+10%	Acceptable
		Summer	13		Standing	20	+11%	Acceptable
		Fall	14	+17%	Standing	21	+17%	Acceptable
		Winter	15	+25%	Standing	23	+15%	Acceptable
		Annual	14	+17%	Standing	22	+16%	Acceptable
72	A	Spring	19		Walking	27		Acceptable
		Summer	17		Walking	23		Acceptable
		Fall	18		Walking	24		Acceptable
		Winter	19		Walking	27		Acceptable
		Annual	18		Walking	25		Acceptable
	B	Spring	20		Uncomfortable	27		Acceptable
		Summer	17		Walking	23		Acceptable
		Fall	18		Walking	25		Acceptable
		Winter	18		Walking	27		Acceptable
		Annual	18		Walking	25		Acceptable

Notes: 1) Wind speeds are for a 1% probability of exceedance, and
2) %Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations	Mean Wind Speed Criteria		Effective Gust Criteria	
A - No Build	Comfortable for Sitting:	≤ 12 mph	Acceptable:	≤ 31 mph
B - Full Build	Comfortable for Standing:	> 12 and ≤ 15 mph	Unacceptable:	> 31 mph
	Comfortable for Walking:	> 15 and ≤ 19 mph		
	Uncomfortable for Walking:	> 19 and ≤ 27 mph		
	Dangerous Conditions:	> 27 mph		

Table 2: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
73	A	Spring	16		Walking	24		Acceptable
		Summer	13		Standing	19		Acceptable
		Fall	14		Standing	22		Acceptable
		Winter	16		Walking	25		Acceptable
		Annual	15		Standing	23		Acceptable
	B	Spring	23	+44%	Uncomfortable	33	+38%	Unacceptable
		Summer	20	+54%	Uncomfortable	28	+47%	Acceptable
		Fall	22	+57%	Uncomfortable	31	+41%	Acceptable
		Winter	24	+50%	Uncomfortable	36	+44%	Unacceptable
		Annual	22	+47%	Uncomfortable	32	+39%	Unacceptable
74	A	Spring	12		Sitting	20		Acceptable
		Summer	10		Sitting	16		Acceptable
		Fall	11		Sitting	18		Acceptable
		Winter	13		Standing	21		Acceptable
		Annual	12		Sitting	19		Acceptable
	B	Spring	12		Sitting	19		Acceptable
		Summer	9		Sitting	15		Acceptable
		Fall	11		Sitting	18		Acceptable
		Winter	13		Standing	21		Acceptable
		Annual	12		Sitting	19		Acceptable
75	A	Spring	18		Walking	26		Acceptable
		Summer	14		Standing	21		Acceptable
		Fall	17		Walking	25		Acceptable
		Winter	21		Uncomfortable	30		Acceptable
		Annual	18		Walking	26		Acceptable
	B	Spring	20	+11%	Uncomfortable	29	+12%	Acceptable
		Summer	15		Standing	21		Acceptable
		Fall	18		Walking	27		Acceptable
		Winter	23	+10%	Uncomfortable	32		Unacceptable
		Annual	20	+11%	Uncomfortable	29	+12%	Acceptable
76	A	Spring	15		Standing	22		Acceptable
		Summer	11		Sitting	16		Acceptable
		Fall	14		Standing	21		Acceptable
		Winter	17		Walking	24		Acceptable
		Annual	15		Standing	22		Acceptable
	B	Spring	14		Standing	21		Acceptable
		Summer	11		Sitting	16		Acceptable
		Fall	13		Standing	20		Acceptable
		Winter	15	-11%	Standing	23		Acceptable
		Annual	14		Standing	21		Acceptable

Notes: 1) Wind speeds are for a 1% probability of exceedance, and
2) %Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations	Mean Wind Speed Criteria		Effective Gust Criteria	
A - No Build	Comfortable for Sitting:	$\leq$ 12 mph	Acceptable:	$\leq$ 31 mph
B - Full Build	Comfortable for Standing:	> 12 and $\leq$ 15 mph	Unacceptable:	> 31 mph
	Comfortable for Walking:	> 15 and $\leq$ 19 mph		
	Uncomfortable for Walking:	> 19 and $\leq$ 27 mph		
	Dangerous Conditions:	> 27 mph		

Table 2: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
77	A	Spring	14		Standing	22		Acceptable
		Summer	10		Sitting	16		Acceptable
		Fall	13		Standing	21		Acceptable
		Winter	16		Walking	25		Acceptable
		Annual	14		Standing	22		Acceptable
	B	Spring	18	+29%	Walking	24		Acceptable
		Summer	14	+40%	Standing	19	+19%	Acceptable
		Fall	17	+31%	Walking	23	+10%	Acceptable
		Winter	20	+25%	Uncomfortable	26		Acceptable
		Annual	18	+29%	Walking	24		Acceptable
78	A	Spring	24		Uncomfortable	33		Unacceptable
		Summer	18		Walking	24		Acceptable
		Fall	22		Uncomfortable	31		Acceptable
		Winter	27		Uncomfortable	37		Unacceptable
		Annual	24		Uncomfortable	33		Unacceptable
	B	Spring	17	-28%	Walking	24	-26%	Acceptable
		Summer	13	-27%	Standing	19	-20%	Acceptable
		Fall	15	-31%	Standing	23	-25%	Acceptable
		Winter	18	-32%	Walking	27	-26%	Acceptable
		Annual	16	-32%	Walking	24	-26%	Acceptable
79	A	Spring	22		Uncomfortable	31		Acceptable
		Summer	16		Walking	23		Acceptable
		Fall	21		Uncomfortable	29		Acceptable
		Winter	25		Uncomfortable	34		Unacceptable
		Annual	22		Uncomfortable	31		Acceptable
	B	Spring	24		Uncomfortable	34	+10%	Unacceptable
		Summer	18	+13%	Walking	24		Acceptable
		Fall	22		Uncomfortable	30		Acceptable
		Winter	27		Uncomfortable	37		Unacceptable
		Annual	24		Uncomfortable	33		Unacceptable
80	A	Spring	18		Walking	26		Acceptable
		Summer	13		Standing	20		Acceptable
		Fall	17		Walking	25		Acceptable
		Winter	19		Walking	29		Acceptable
		Annual	18		Walking	26		Acceptable
	B	Spring	16	-10%	Walking	23	-11%	Acceptable
		Summer	12		Sitting	17	-14%	Acceptable
		Fall	15	-11%	Standing	21	-15%	Acceptable
		Winter	18		Walking	25	-13%	Acceptable
		Annual	16	-10%	Walking	22	-14%	Acceptable

Notes: 1) Wind speeds are for a 1% probability of exceedance, and
2) %Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

<u>Configurations</u>
A - No Build
B - Full Build

<u>Mean Wind Speed Criteria</u>

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

<u>Effective Gust Criteria</u>

Acceptable:	≤ 31 mph
Unacceptable:	> 31 mph

Table 2: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			Mean Wind Speed			Effective Gust Wind Speed		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
81	A	Spring	16		Walking	24		Acceptable
		Summer	12		Sitting	18		Acceptable
		Fall	15		Standing	23		Acceptable
		Winter	17		Walking	27		Acceptable
		Annual	16		Walking	24		Acceptable
	B	Spring	11	-30%	Sitting	18	-24%	Acceptable
		Summer	8	-32%	Sitting	14	-21%	Acceptable
		Fall	10	-32%	Sitting	16	-29%	Acceptable
		Winter	12	-28%	Sitting	19	-29%	Acceptable
		Annual	11	-30%	Sitting	17	-28%	Acceptable
82	A	Spring	16		Walking	26		Acceptable
		Summer	12		Sitting	20		Acceptable
		Fall	15		Standing	24		Acceptable
		Winter	18		Walking	28		Acceptable
		Annual	16		Walking	26		Acceptable
	B	Spring	14	-12%	Standing	21	-18%	Acceptable
		Summer	10	-16%	Sitting	16	-19%	Acceptable
		Fall	13	-12%	Standing	19	-20%	Acceptable
		Winter	15	-16%	Standing	23	-17%	Acceptable
		Annual	13	-18%	Standing	21	-18%	Acceptable
83	A	Spring	20		Uncomfortable	32		Unacceptable
		Summer	14		Standing	23		Acceptable
		Fall	18		Walking	29		Acceptable
		Winter	22		Uncomfortable	35		Unacceptable
		Annual	20		Uncomfortable	31		Acceptable
	B	Spring	17	-14%	Walking	27	-15%	Acceptable
		Summer	13		Standing	21		Acceptable
		Fall	16	-10%	Walking	25	-13%	Acceptable
		Winter	19	-13%	Walking	30	-13%	Acceptable
		Annual	17	-14%	Walking	27	-12%	Acceptable
84	A	Spring	17		Walking	27		Acceptable
		Summer	14		Standing	21		Acceptable
		Fall	16		Walking	25		Acceptable
		Winter	19		Walking	29		Acceptable
		Annual	17		Walking	26		Acceptable
	B	Spring	12	-28%	Sitting	18	-32%	Acceptable
		Summer	9	-35%	Sitting	14	-32%	Acceptable
		Fall	11	-30%	Sitting	18	-27%	Acceptable
		Winter	12	-36%	Sitting	20	-30%	Acceptable
		Annual	11	-34%	Sitting	18	-30%	Acceptable

Notes: 1) Wind speeds are for a 1% probability of exceedance, and
2) %Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

<u>Configurations</u>
A - No Build
B - Full Build

<u>Mean Wind Speed Criteria</u>

Comfortable for Sitting:	$\leq$ 12 mph
Comfortable for Standing:	> 12 and $\leq$ 15 mph
Comfortable for Walking:	> 15 and $\leq$ 19 mph
Uncomfortable for Walking:	> 19 and $\leq$ 27 mph
Dangerous Conditions:	> 27 mph

<u>Effective Gust Criteria</u>

Acceptable:	$\leq$ 31 mph
Unacceptable:	> 31 mph

Table 2: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			Mean Wind Speed			Effective Gust Wind Speed		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
85	A	Spring	15		Standing	21		Acceptable
		Summer	11		Sitting	17		Acceptable
		Fall	14		Standing	20		Acceptable
		Winter	17		Walking	23		Acceptable
		Annual	15		Standing	21		Acceptable
	B	Spring	21	+40%	Uncomfortable	29	+38%	Acceptable
		Summer	17	+55%	Walking	24	+41%	Acceptable
		Fall	20	+43%	Uncomfortable	28	+40%	Acceptable
		Winter	23	+35%	Uncomfortable	33	+43%	Unacceptable
		Annual	21	+40%	Uncomfortable	29	+38%	Acceptable
86	A	Spring	13		Standing	21		Acceptable
		Summer	10		Sitting	16		Acceptable
		Fall	12		Sitting	19		Acceptable
		Winter	15		Standing	23		Acceptable
		Annual	13		Standing	21		Acceptable
	B	Spring	29	+123%	Dangerous	38	+81%	Unacceptable
		Summer	24	+140%	Uncomfortable	31	+94%	Acceptable
		Fall	27	+125%	Uncomfortable	35	+84%	Unacceptable
		Winter	32	+113%	Dangerous	42	+83%	Unacceptable
		Annual	29	+123%	Dangerous	38	+81%	Unacceptable
87	A	Spring	19		Walking	28		Acceptable
		Summer	14		Standing	21		Acceptable
		Fall	17		Walking	26		Acceptable
		Winter	20		Uncomfortable	31		Acceptable
		Annual	18		Walking	28		Acceptable
	B	Spring	17	-10%	Walking	25	-10%	Acceptable
		Summer	13		Standing	19		Acceptable
		Fall	16		Walking	23	-11%	Acceptable
		Winter	18		Walking	27	-12%	Acceptable
		Annual	16	-10%	Walking	25	-10%	Acceptable
88	A	Spring	9		Sitting	15		Acceptable
		Summer	8		Sitting	12		Acceptable
		Fall	8		Sitting	14		Acceptable
		Winter	10		Sitting	16		Acceptable
		Annual	9		Sitting	15		Acceptable
	B	Spring	12	+33%	Sitting	20	+33%	Acceptable
		Summer	11	+38%	Sitting	17	+42%	Acceptable
		Fall	12	+50%	Sitting	19	+36%	Acceptable
		Winter	13	+30%	Standing	22	+38%	Acceptable
		Annual	12	+33%	Sitting	20	+33%	Acceptable

Notes: 1) Wind speeds are for a 1% probability of exceedance, and
2) %Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations
A - No Build
B - Full Build

Mean Wind Speed Criteria
Comfortable for Sitting: ≤ 12 mph
Comfortable for Standing: > 12 and ≤ 15 mph
Comfortable for Walking: > 15 and ≤ 19 mph
Uncomfortable for Walking: > 19 and ≤ 27 mph
Dangerous Conditions: > 27 mph

Effective Gust Criteria
Acceptable: ≤ 31 mph
Unacceptable: > 31 mph

Table 2: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			**Mean Wind Speed**			**Effective Gust Wind Speed**		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
89	A	Spring	13		Standing	20		Acceptable
		Summer	11		Sitting	16		Acceptable
		Fall	12		Sitting	19		Acceptable
		Winter	14		Standing	22		Acceptable
		Annual	13		Standing	20		Acceptable
	B	Spring	13		Standing	20		Acceptable
		Summer	10		Sitting	15		Acceptable
		Fall	12		Sitting	19		Acceptable
		Winter	15		Standing	22		Acceptable
		Annual	13		Standing	20		Acceptable
90	A	Spring	31		Dangerous	39		Unacceptable
		Summer	23		Uncomfortable	29		Acceptable
		Fall	28		Dangerous	36		Unacceptable
		Winter	34		Dangerous	43		Unacceptable
		Annual	30		Dangerous	39		Unacceptable
	B	Spring	26	-15%	Uncomfortable	35		Unacceptable
		Summer	19	-16%	Walking	25	-13%	Acceptable
		Fall	24	-13%	Uncomfortable	31	-13%	Acceptable
		Winter	29	-14%	Dangerous	39		Unacceptable
		Annual	26	-12%	Uncomfortable	34	-12%	Unacceptable
91	A	Spring	13		Standing	22		Acceptable
		Summer	10		Sitting	16		Acceptable
		Fall	12		Sitting	21		Acceptable
		Winter	15		Standing	25		Acceptable
		Annual	13		Standing	22		Acceptable
	B	Spring	16	+23%	Walking	25	+14%	Acceptable
		Summer	11	+10%	Sitting	18	+13%	Acceptable
		Fall	14	+17%	Standing	23	+10%	Acceptable
		Winter	17	+13%	Walking	28	+12%	Acceptable
		Annual	15	+15%	Standing	25	+14%	Acceptable
92	A	Spring	15		Standing	23		Acceptable
		Summer	13		Standing	19		Acceptable
		Fall	13		Standing	20		Acceptable
		Winter	14		Standing	22		Acceptable
		Annual	14		Standing	21		Acceptable
	B	Spring	16		Walking	24		Acceptable
		Summer	13		Standing	20		Acceptable
		Fall	14		Standing	21		Acceptable
		Winter	15		Standing	24		Acceptable
		Annual	14		Standing	22		Acceptable

Notes: 1) Wind speeds are for a 1% probability of exceedance, and
2) %Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations
A - No Build
B - Full Build

Mean Wind Speed Criteria
Comfortable for Sitting: $\leq$ 12 mph
Comfortable for Standing: > 12 and $\leq$ 15 mph
Comfortable for Walking: > 15 and $\leq$ 19 mph
Uncomfortable for Walking: > 19 and $\leq$ 27 mph
Dangerous Conditions: > 27 mph

Effective Gust Criteria
Acceptable: $\leq$ 31 mph
Unacceptable: > 31 mph

Table 2: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			Mean Wind Speed			Effective Gust Wind Speed		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
93	A	Spring	18		Walking	26		Acceptable
		Summer	13		Standing	19		Acceptable
		Fall	16		Walking	24		Acceptable
		Winter	19		Walking	28		Acceptable
		Annual	17		Walking	25		Acceptable
	B	Spring	18		Walking	25		Acceptable
		Summer	14		Standing	19		Acceptable
		Fall	17		Walking	24		Acceptable
		Winter	19		Walking	27		Acceptable
		Annual	18		Walking	25		Acceptable
94	A	Spring	11		Sitting	18		Acceptable
		Summer	9		Sitting	14		Acceptable
		Fall	11		Sitting	17		Acceptable
		Winter	13		Standing	19		Acceptable
		Annual	11		Sitting	18		Acceptable
	B	Spring	8	-26%	Sitting	15	-16%	Acceptable
		Summer	7	-21%	Sitting	12	-13%	Acceptable
		Fall	8	-26%	Sitting	13	-23%	Acceptable
		Winter	9	-30%	Sitting	15	-20%	Acceptable
		Annual	8	-26%	Sitting	14	-21%	Acceptable
95	A	Spring	24		Uncomfortable	31		Acceptable
		Summer	19		Walking	25		Acceptable
		Fall	23		Uncomfortable	30		Acceptable
		Winter	27		Uncomfortable	35		Unacceptable
		Annual	24		Uncomfortable	31		Acceptable
	B	Spring	19	-20%	Walking	26	-15%	Acceptable
		Summer	14	-25%	Standing	19	-23%	Acceptable
		Fall	18	-21%	Walking	24	-19%	Acceptable
		Winter	21	-21%	Uncomfortable	28	-19%	Acceptable
		Annual	19	-20%	Walking	26	-15%	Acceptable
96	A	Spring	19		Walking	26		Acceptable
		Summer	15		Standing	20		Acceptable
		Fall	18		Walking	24		Acceptable
		Winter	21		Uncomfortable	28		Acceptable
		Annual	19		Walking	26		Acceptable
	B	Spring	22	+16%	Uncomfortable	31	+19%	Acceptable
		Summer	18	+20%	Walking	25	+25%	Acceptable
		Fall	21	+17%	Uncomfortable	29	+21%	Acceptable
		Winter	24	+14%	Uncomfortable	33	+18%	Unacceptable
		Annual	21	+11%	Uncomfortable	30	+15%	Acceptable

Notes: 1) Wind speeds are for a 1% probability of exceedance, and
2) %Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations
A - No Build
B - Full Build

Mean Wind Speed Criteria

Comfortable for Sitting:	$\leq$ 12 mph
Comfortable for Standing:	> 12 and $\leq$ 15 mph
Comfortable for Walking:	> 15 and $\leq$ 19 mph
Uncomfortable for Walking:	> 19 and $\leq$ 27 mph
Dangerous Conditions:	> 27 mph

Effective Gust Criteria

Acceptable:	$\leq$ 31 mph
Unacceptable:	> 31 mph

Table 2: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			Mean Wind Speed			Effective Gust Wind Speed		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
97	A	Spring	14		Standing	21		Acceptable
		Summer	11		Sitting	17		Acceptable
		Fall	13		Standing	20		Acceptable
		Winter	15		Standing	24		Acceptable
		Annual	13		Standing	21		Acceptable
	B	Spring	18	+29%	Walking	26	+24%	Acceptable
		Summer	14	+27%	Standing	21	+24%	Acceptable
		Fall	17	+31%	Walking	24	+20%	Acceptable
		Winter	20	+33%	Uncomfortable	29	+21%	Acceptable
		Annual	18	+38%	Walking	26	+24%	Acceptable
98	A	Spring	19		Walking	27		Acceptable
		Summer	14		Standing	20		Acceptable
		Fall	18		Walking	25		Acceptable
		Winter	21		Uncomfortable	30		Acceptable
		Annual	19		Walking	27		Acceptable
	B	Spring	19		Walking	27		Acceptable
		Summer	15		Standing	21		Acceptable
		Fall	18		Walking	25		Acceptable
		Winter	22		Uncomfortable	30		Acceptable
		Annual	19		Walking	27		Acceptable
99	A	Spring	20		Uncomfortable	28		Acceptable
		Summer	14		Standing	20		Acceptable
		Fall	18		Walking	26		Acceptable
		Winter	22		Uncomfortable	31		Acceptable
		Annual	20		Uncomfortable	28		Acceptable
	B	Spring	22	+10%	Uncomfortable	31	+11%	Acceptable
		Summer	17	+21%	Walking	23	+15%	Acceptable
		Fall	21	+17%	Uncomfortable	28		Acceptable
		Winter	25	+14%	Uncomfortable	34	+10%	Unacceptable
		Annual	22	+10%	Uncomfortable	30		Acceptable
100	A	Spring	28		Dangerous	37		Unacceptable
		Summer	22		Uncomfortable	28		Acceptable
		Fall	26		Uncomfortable	35		Unacceptable
		Winter	32		Dangerous	41		Unacceptable
		Annual	28		Dangerous	37		Unacceptable
	B	Spring	19	-31%	Walking	27	-26%	Acceptable
		Summer	16	-26%	Walking	21	-24%	Acceptable
		Fall	17	-34%	Walking	24	-30%	Acceptable
		Winter	20	-37%	Uncomfortable	28	-31%	Acceptable
		Annual	18	-35%	Walking	26	-29%	Acceptable

Notes: 1) Wind speeds are for a 1% probability of exceedance, and
2) %Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations
A - No Build
B - Full Build

Mean Wind Speed Criteria

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

Effective Gust Criteria

Acceptable:	≤ 31 mph
Unacceptable:	> 31 mph

Table 2: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			Mean Wind Speed			Effective Gust Wind Speed		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
101	A	Spring	21		Uncomfortable	29		Acceptable
		Summer	16		Walking	22		Acceptable
		Fall	20		Uncomfortable	27		Acceptable
		Winter	24		Uncomfortable	32		Unacceptable
		Annual	21		Uncomfortable	29		Acceptable
	B	Spring	18	-13%	Walking	26		Acceptable
		Summer	15		Standing	21		Acceptable
		Fall	17	-14%	Walking	24	-10%	Acceptable
		Winter	19	-20%	Walking	26	-18%	Acceptable
		Annual	18	-13%	Walking	25	-13%	Acceptable
102	A	Spring	21		Uncomfortable	28		Acceptable
		Summer	17		Walking	23		Acceptable
		Fall	20		Uncomfortable	26		Acceptable
		Winter	23		Uncomfortable	31		Acceptable
		Annual	21		Uncomfortable	28		Acceptable
	B	Spring	16	-23%	Walking	23	-17%	Acceptable
		Summer	12	-28%	Sitting	17	-25%	Acceptable
		Fall	15	-24%	Standing	21	-18%	Acceptable
		Winter	18	-21%	Walking	25	-18%	Acceptable
		Annual	16	-23%	Walking	23	-17%	Acceptable
103	A	Spring	21		Uncomfortable	29		Acceptable
		Summer	18		Walking	24		Acceptable
		Fall	20		Uncomfortable	28		Acceptable
		Winter	24		Uncomfortable	33		Unacceptable
		Annual	21		Uncomfortable	29		Acceptable
	B	Spring	11	-47%	Sitting	18	-37%	Acceptable
		Summer	9	-49%	Sitting	15	-37%	Acceptable
		Fall	10	-49%	Sitting	17	-38%	Acceptable
		Winter	12	-49%	Sitting	18	-44%	Acceptable
		Annual	11	-47%	Sitting	17	-40%	Acceptable
104	A	Spring	18		Walking	26		Acceptable
		Summer	15		Standing	22		Acceptable
		Fall	17		Walking	24		Acceptable
		Winter	19		Walking	28		Acceptable
		Annual	17		Walking	25		Acceptable
	B	Spring	9	-49%	Sitting	15	-41%	Acceptable
		Summer	7	-52%	Sitting	12	-44%	Acceptable
		Fall	8	-52%	Sitting	14	-41%	Acceptable
		Winter	10	-46%	Sitting	16	-42%	Acceptable
		Annual	9	-46%	Sitting	15	-39%	Acceptable

Notes: 1) Wind speeds are for a 1% probability of exceedance, and
2) %Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations
A - No Build
B - Full Build

Mean Wind Speed Criteria

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

Effective Gust Criteria

Acceptable:	≤ 31 mph
Unacceptable:	> 31 mph

Table 2: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			Mean Wind Speed			Effective Gust Wind Speed		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
105	A	Spring	18		Walking	25		Acceptable
		Summer	15		Standing	21		Acceptable
		Fall	17		Walking	23		Acceptable
		Winter	20		Uncomfortable	27		Acceptable
		Annual	18		Walking	25		Acceptable
	B	Spring	12	-32%	Sitting	19	-23%	Acceptable
		Summer	9	-39%	Sitting	14	-32%	Acceptable
		Fall	11	-34%	Sitting	18	-21%	Acceptable
		Winter	13	-34%	Standing	21	-21%	Acceptable
		Annual	12	-32%	Sitting	19	-23%	Acceptable
106	A	Spring	16		Walking	23		Acceptable
		Summer	15		Standing	20		Acceptable
		Fall	16		Walking	22		Acceptable
		Winter	18		Walking	26		Acceptable
		Annual	16		Walking	23		Acceptable
	B	Spring	8	-49%	Sitting	14	-38%	Acceptable
		Summer	6	-58%	Sitting	11	-44%	Acceptable
		Fall	8	-49%	Sitting	13	-40%	Acceptable
		Winter	8	-55%	Sitting	15	-41%	Acceptable
		Annual	8	-49%	Sitting	14	-38%	Acceptable
107	A	Spring	15		Standing	22		Acceptable
		Summer	13		Standing	19		Acceptable
		Fall	15		Standing	21		Acceptable
		Winter	17		Walking	24		Acceptable
		Annual	15		Standing	21		Acceptable
	B	Spring	8	-46%	Sitting	13	-40%	Acceptable
		Summer	6	-52%	Sitting	11	-41%	Acceptable
		Fall	7	-52%	Sitting	12	-42%	Acceptable
		Winter	8	-52%	Sitting	13	-45%	Acceptable
		Annual	7	-52%	Sitting	13	-37%	Acceptable
108	A	Spring	11		Sitting	17		Acceptable
		Summer	8		Sitting	13		Acceptable
		Fall	11		Sitting	16		Acceptable
		Winter	12		Sitting	18		Acceptable
		Annual	11		Sitting	17		Acceptable
	B	Spring	14	+27%	Standing	21	+24%	Acceptable
		Summer	10	+25%	Sitting	15	+15%	Acceptable
		Fall	13	+18%	Standing	19	+19%	Acceptable
		Winter	15	+25%	Standing	23	+28%	Acceptable
		Annual	13	+18%	Standing	21	+24%	Acceptable

Notes: 1) Wind speeds are for a 1% probability of exceedance, and
2) %Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations
A - No Build
B - Full Build

Mean Wind Speed Criteria

Comfortable for Sitting:	≤ 12 mph
Comfortable for Standing:	> 12 and ≤ 15 mph
Comfortable for Walking:	> 15 and ≤ 19 mph
Uncomfortable for Walking:	> 19 and ≤ 27 mph
Dangerous Conditions:	> 27 mph

Effective Gust Criteria

Acceptable:	≤ 31 mph
Unacceptable:	> 31 mph

Table 2: Pedestrian Wind Comfort and Safety Categories - Multiple Seasons

BRA Criteria			Mean Wind Speed			Effective Gust Wind Speed		
Loc.	Config.	Season	Speed(mph)	%Change	RATING	Speed(mph)	%Change	RATING
109	A	Spring	9		Sitting	15		Acceptable
		Summer	7		Sitting	12		Acceptable
		Fall	8		Sitting	13		Acceptable
		Winter	9		Sitting	15		Acceptable
		Annual	8		Sitting	13		Acceptable
	B	Spring	9		Sitting	15		Acceptable
		Summer	7		Sitting	12		Acceptable
		Fall	8		Sitting	13		Acceptable
		Winter	9		Sitting	15		Acceptable
		Annual	8		Sitting	13		Acceptable

Notes: 1) Wind speeds are for a 1% probability of exceedance, and
2) %Change is based on comparison with Configuration A and only those that are greater than 10% are listed.

Configurations
A - No Build
B - Full Build

Mean Wind Speed Criteria
Comfortable for Sitting: $\leq$ 12 mph
Comfortable for Standing: > 12 and $\leq$ 15 mph
Comfortable for Walking: > 15 and $\leq$ 19 mph
Uncomfortable for Walking: > 19 and $\leq$ 27 mph
Dangerous Conditions: > 27 mph

Effective Gust Criteria
Acceptable: $\leq$ 31 mph
Unacceptable: > 31 mph

Appendix E

Air Quality

APPENDIX E AIR QUALITY

Introduction

The Air Quality Appendix E to the MMHC DEIR/DPIR provides modeling assumptions and backup for results presented in Section 4.6 of the report. Included within this documentation is a brief description of the methodology employed along with pertinent calculations and data used in the emissions and dispersion calculations supporting the mesoscale, microscale and stationary source air quality analyses.

Motor Vehicle Emissions

The EPA MOBILE6.2 computer program generated motor vehicle emissions used in the garage stationary source analysis along with the mobile source CAL3QHC modeling and mesoscale analysis. The 2021 model input parameters were provided by MassDEP via e-mail from Marc Bennett on August 13, 2009. All other years were provided at an earlier date. Emission rates were derived for 2009, 2016, and 2021 for speed limits of 2.5, 10, 15, and 30 mph for use in the mesoscale and microscale analyses. The 10 mph rate was used to estimate parking garage emissions.

CAL3QHC

For the intersections studied, the CAL3QHC model was applied to calculate CO concentrations at sensitive receptor locations using emission rates derived in MOBILE6.2. The intersection's queue links and free flow links were input to the model along with sensitive receptors at all locations nearby each intersection. The meteorological assumptions input into the model were a 1.0 meter per second wind speed, Pasquill-Gifford Class D stability combined with a mixing height of 1000 meters. For each direction, the full range of wind directions at 10 degree intervals was examined. In addition, a surface roughness (z_0) of 175 cm was used. Idle emission rates for queue links were based on 2.5 mph emission rates derived in MOBILE6.2 and converted from grams per mile to grams per hour. Emission rates for speeds of 10, 15, and 30 mph were used for free flow links and turn movements.

AERMOD

The EPA AERMOD model was used to calculate air quality impacts due to the parking garage vents, heating combustion boilers, emergency generators, and cooling towers. For non-combustion sources, ambient temperature releases were assumed; otherwise temperatures from the exhaust gas were used. Urban dispersion coefficients were used. Building downwash was accounted for in the modeling based on the building heights and projected widths of the buildings. The maximum modeled impacts from the garage vents and the stack sources were conservatively added to monitored background values for comparison to the NAAQS.

Stationary Source Emissions

Emissions for the heating combustion units were calculated using the latest DEP emission limits for boilers based on the Boiler Environmental Results Program (ERP). Emissions for the emergency generators and cooling towers were obtained from vendor information for a similar size unit. The resulting hourly emission rate in pounds per hour were converted to grams per second and input to the AERMOD model. For the NAAQS analysis, a similar approach was conducted for SO_2, NOx, PM-10, and PM-2.5. The emergency generator emissions were calculated based on a g/bhp-hr emission factor provided by vendor information for typical size units.

All assumptions and data used in the stationary source emissions and stack parameter calculations are provided herein.

Boiler, Cooling Tower, Emergency Generator and Garage Exhaust Vent Emissions Calculations

MMHC - Calculation of Modeling Emission Rates

Heating Boilers							
Building Name	B&W Bldg	Res. Bldg.	Res. Bldg.	Fenwood Inn	Binney Bldg		
Project Phase	Final	Final	Final	Mid	Mid		
Designation	BWBOIL1-3	RESBOIL1-4	RESBOIL5-6	FENBOIL1-2	BINBOIL1-2		
Model	N/A	N/A	N/A	AERCO MLX	AERCO BMK		
Qty.	3	4	2	2	2		
Heat Input (MMBTU/hr) (ea)	20.9	0.6	1.0	0.757	1.5	Emission rates	
Boiler Emission Rates						lb/MMBTU	
Short Term							
NOx (g/s ea.)	0.0923	0.0026	0.0044	0.0033	0.0066	0.035	ERP limits
CO (g/s ea.)	0.2110	0.0060	0.0101	0.0076	0.0151	0.080	ERP limits
VOC (g/s ea.)	0.0791	0.0023	0.0038	0.0029	0.0057	0.030	ERP limits
PM-10/PM-2.5 (g/s ea.)	0.0264	0.0008	0.0013	0.0010	0.0019	0.010	ERP limits Assume PM10=PM2.5
SO2 (g/s ea.)	0.0016	0.00005	0.0001	0.0001	0.0001	0.0006	AP42 Table 1.4-2
Long Term (assume 15% annual capacity factor)							
NOx (g/s ea.)	0.0138	0.0004	0.0007	0.0005	0.0010		
CO (g/s ea.)	0.0317	0.0009	0.0015	0.0011	0.0023		
VOC (g/s ea.)	0.0119	0.0003	0.0006	0.0004	0.0009		
PM-10/PM-2.5 (g/s ea.)	0.0040	0.0001	0.0002	0.0001	0.0003		
SO2 (g/s ea.)	0.0002	0.00001	0.00001	0.00001	0.00002		
Stack Parameters (each unit)							
Gas Exit Temp (°F)	*225*	*170*	*170*	*225*	*225*		
Exhaust air (CFM)	11279.81	297.29	495.48	407.82	808.11		
Gas Exit Velocity (fps)	*31.65*	*25.23*	*23.66*	*34.62*	*68.59*		
Primary Building Height (ft)	204.00	168.00	168.00	78.00	118.00		
Stack Height (ft) (above roofline)	10.00	3.00	3.00	10.00	10.00		
Stack Height (ft)	*214.00*	*171.00*	*171.00*	*88.00*	*128.00*		
Stack Diameter (ft)	*2.75*	*0.5*	*0.6667*	*0.5*	*0.5*		

Cooling Towers				
Building Name	B&W Bldg	Res. Bldg.	Fenwood Inn	Binney Bldg
Project Phase	Final	Final	Mid	Mid
# of CTs	4	2	NONE	NONE
Designation	BWCT1-4	RESCT1-2		
Make	Marley	N/A		
Model	N/A	N/A		
Cooling Tower Rate (tons each)	700	90		
Cooling Tower Specs (per tower)				
Cooling Tower Exhaust Flow (cfm)	280000	36000		
Cooling Tower Exhaust Flow (kg/s)	147.3	18.9		
Cooling Tower Exhaust Temp (°F)	*75*	*75*		
Cooling Tower Stack Diameter (ft)	*12.5*	*4*		
Cooling Tower Stack Velocity (fps)	*38.03*	*47.75*		
Tower Overall Dimensions (width, length, height of stack exit) (ft)	22x14x22	12x5x9		
CT Stack Height (ft) (above roofline)	22	9		
Primary Building Height (ft)	*240.00*	*168.00*		
CT Stack Height (ft)	262.00	177.00		
Number of cells (per tower)	1	1		
Cooling Tower Drift				
Drift Rate (% of circ water)	0.001	0.001		
Circulating Water Rate (gph)	126,000	16,200		
Circulating Water Rate (gpm)	2,100	270		
TDS+TSS concentration in drift (mg/L)	1,500	1,500		
PM emission rate in drift (lb/hr)	0.016	0.002		
PM emission rate in drift (g/s)	0.00199	0.00026		

Emergency Engines					
Building Name	B&W Bldg	B&W Bldg	Res. Bldg.	Fenwood Inn	Binney Bldg
Project Phase	Final	Final	Final	Mid	Mid
Number	1	1	1	NONE	1
Generator Designation	BWGEN1	BWGEN2	RESGEN		BINGEN
Generator Size (kW)	500	2500	300		300
Make	Cummins	CAT	Cummins		CAT
Model	DFEK	3516C-HD TA	GFEB CC		C9
Fuel type	Diesel	Diesel	Nat. Gas		Diesel
100% load fuel consumption	34.7	173.3	4200		22.7
100% load fuel consumption units	gph	gph	cfh		gph
Heat Input (MMBTU/hr)	4.7539	23.7421	4.368		3.1099
Horsepower (hp)	732	3604	475		480.1
Emission Factors					
NOx (g/BHP-hr)	4.85	5.05	2.0		4.02
CO (g/BHP-hr)	0.31	0.41	4.0		0.26
VOC (g/BHP-hr)	0.11	0.1	1.0		0.06
PM10/PM2.5 (g/BHP-hr)	0.05	0.036	9.50E-03		0.075
SO2 (lb/mmBTU)	0.001515	0.001515	5.88E-04		0.29
HAPs (lb/mmBTU)	0.00149198	0.00149198	0.032		0.004
Emission Rates					
Short Term					
NOx (g/s)	0.986	5.056	0.264		0.536
CO (g/s)	0.063	0.410	0.528		0.035
VOC (g/s)	0.022	0.100	0.132		0.008
PM10/PM2.5 (g/s)	0.010	0.036	0.001		0.010
SO2 (g/s)	0.001	0.004	0.0003		0.114
HAPs (g/s)	0.001	0.004	0.018		0.001
Long Term (300 hr/yr)					
NOx (g/s)	0.03377	0.17314	0.00904		0.01836
CO (g/s)	0.00216	0.01406	0.01807		0.00119
VOC (g/s)	0.00077	0.00343	0.00452		0.00027
PM10/PM2.5 (g/s)	0.00035	0.00123	0.00004		0.00034
SO2 (g/s)	0.00003	0.00013	0.00001		0.00389
HAPs (g/s)	0.00003	0.00015	0.00061		0.00005
Stack Parameters					
Exhaust Temperature (°F)	900	921.9	1350		931.1
Total Exhaust Flow (ACFM)	3625	19048.8	3380		2461.4
Flange Diameter (in)	5	12	5		7
Maximum Backpressure (in. H2O)	41	26.9	27.19		23.7
Maximum velocity (fpm)	20044.78	16366.45	18831.45		15413.22
Flow area required (sq ft)	0.18	1.16	0.18		0.16
Number of exhausts (typ. 1 or 2)	2	2	2		1
Selected silencer diameter (in)	6	18	6		8
Actual silencer opening area (sq ft)(ea.)	0.196	1.767	0.196		0.349
Actual velocity (fpm) (ea.)	9230.987	5389.708	8607.099		7051.392
Actual velocity (fps) (ea.)	153.850	89.828	143.452		117.523
Single Stack Effective Diameter (ft)	0.707	2.121	0.707		0.667
Single Stack Effective Velocity (fps)	153.850	89.828	143.452		117.523
Primary Building Height (ft)	240.00	240.00	168.00		118.00
Stack Height (ft) (10' above roofline)	*250.00*	*250.00*	*178.00*		*128.00*

Garage Exhaust Vents

	B&W Bldg 406 spaces under bldg.	
total spaces	406	
Residential spaces	0	
Retail/commercial spaces	406	
# vehicles entering garage/hr	304.5	assume peak turnover of 75% of total spaces
Levels	4	
Number of vents	2	
Stack Exhaust Flow (acfm)	140000	50% of total air (280K cfm)will be vented (A. Santoro)
Stack Exhaust Temperature (°F)	*70*	Assumed underground temp remains consistent
outlet area per vent (sqft)	50	Assumed largest available from vendor data (A. Santoro)
effective diameter (ft)	*7.97885*	Vents are covered Louvers. Thus model as BETA capped release in ISC-AERMOD View
Stack Velocity (fps)	*8773.19896*	
Stack Velocity (fpm)	526391.93767	
Stack height (ft)	*33*	roof height + 1 ft
Garage Distance Traveled (ft)	516	
Hourly garage mileage (VMT)	29.758	

Total Emissions

	Per Vent Emission Rates		2021 Emission Factors M6.2 g/mile
Composite VOC (g/s):	0.00140	Composite VOC (g/mile):	0.339
Composite CO (g/s):	0.04614	Composite CO (g/mile):	11.163
Composite NOX (g/s):	0.00084	Composite NOX (g/mile):	0.202
Total PM2.5 (g/s):	0.00005	Total PM2.5 (g/mile):	0.011
Total PM10 (g/s):	0.00010	Total PM10 (g/mile):	0.025
SO2 (g/s):	0.00003	SO2 (g/mile):	0.008

Example Emissions Assumption.

Example Emissions Assumption.

The 406-space garage is a 4 levels underground. It is assumed that the garage is on average 75% full. It's also assumed that a vehicle travels down the garage ramp, and makes 3 turns to traverse a level with each turn the length of the building. It is assumed that the vehicles travel halfway, on average, into the garage at any time. Some travel through all 4 levels. Some find parking on the uppermost level. In this case, the per level distance is approximately 516 feet, or 1032 feet for the distance down to the midpoint levels. It is assumed that all vehicles for this garage are for commercial purposes (workers, patients, visitors, etc) and that there's 50% turnover during a daily hour.

Using this assumption, a total VMT of 29.76 miles is traveled (516 feet/level x 4 levels x 304.5 cars / 5,280 feet per mile / 2 (halfway) / 2 (turnover)).

Emission factor is assumed to be weighted average of 10 mph LDGV, LDGT<6000gvw, LDDV, and MC. Higher of summer/winter values.

Since traffic in/out of garage will not be at peak hour for all 24 hrs per day, the following factors were assumed to account for fluctuating usage

Hour	Factor	Hour	Factor	Hour	Factor
1 AM to 5 AM	0.25	9 AM to 4 PM	0.50	8 PM to 12 AM	0.25
6 AM to 8 AM	1.00	6 PM to 7 PM	1.00		

MMHC - Calculation of Modeling Emission Rates

summer 2021 10 mph

Vehicle Type:	LDGV	LDGT12	LDGT34	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
GVWR:		<6000	>6000	(All)						
	------	------	------	------	------	------	------	------	------	------
VMT Distribution:	0.2603	0.4379	0.1722		0.037	0.0003	0.0016	0.0869	0.0036	1
Fuel Economy (mpg):	24.1	18.5	14.2	17	9.9	32.4	18.3	7.3	50	16
Composite Emission	Factors (g/ mi):									
Composite VOC :	0.324	0.31	0.357	0.323	0.478	0.295	0.202	0.54	5.03	0.365
Composite CO :	4.34	4.39	4.58	4.45	13.4	1.941	0.718	0.945	36.49	4.556
Composite NOX :	0.209	0.191	0.265	0.212	0.26	0.432	0.134	1.432	1	0.322
Composite CO2 :	368	479.4	624.5	520.4	893.5	314.1	555.3	1396.6	177.4	569.37
2.5 Total PM:	0.0112	0.0113	0.0113	0.0113	0.0185	0.0374	0.0195	0.0428	0.0207	0.0143
Total PM:	0.0247	0.0247	0.0248	0.0247	0.0331	0.0532	0.0337	0.0712	0.0372	0.0292
SO2:	0.0065	0.0087	0.0115	0.0095	0.0163	0.0029	0.0052	0.013	0.0033	0.0092

Winter 2021 10 mph

Vehicle Type:	LDGV	LDGT12	LDGT34	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
GVWR:		<6000	>6000	(All)						
	------	------	------	------	------	------	------	------	------	------
VMT Distribution:	0.2606	0.4386	0.1722		0.0366	0.0003	0.0017	0.0863	0.0036	1
Fuel Economy (mpg):	24.1	18.5	14.2	17	9.9	32.4	18.3	7.3	50	16
Composite Emission	Factors (g/ mi):									
Composite VOC :	0.279	0.287	0.364	0.309	0.51	0.29	0.207	0.544	4.47	0.344
Composite CO :	12	10.49	10.4	10.47	17.15	1.911	0.722	0.984	33.28	10.356
Composite NOX :	0.178	0.207	0.294	0.231	0.296	0.429	0.141	1.511	1.38	0.334
Composite CO2 :	368	479.4	624.5	520.3	893.4	314.1	555.5	1397.3	177.4	568.71
2.5 Total PM:	0.0112	0.0113	0.0113	0.0113	0.0187	0.0373	0.0198	0.0437	0.0207	0.0144
Total PM:	0.0247	0.0247	0.0248	0.0247	0.0333	0.0532	0.034	0.0722	0.0372	0.0292
SO2:	0.0065	0.0087	0.0115	0.0095	0.0163	0.0029	0.0052	0.013	0.0033	0.0092

Summer garage vehicles :	LDGV	LDGT12	LDDV	MC	SUM
actual fraction	0.2603	0.4379	0.0003	0.0036	0.7021
garage fraction	0.3707	0.6237	0.0004	0.0051	1
					Composite EF
Composite VOC :	0.324	0.31	0.295	5.03	0.339
Composite CO :	4.34	4.39	1.941	36.49	4.535
Composite NOX :	0.209	0.191	0.432	1.00	0.202
Composite CO2 :	368	479.4	314.1	177.4	436.480
Total PM2.5:	0.0112	0.0113	0.0374	0.0207	0.011
Total PM10:	0.0247	0.0247	0.0532	0.0372	0.025
SO2:	0.0065	0.0087	0.0029	0.0033	0.008

Winter garage vehicles :	LDGV	LDGT12	LDDV	MC	SUM
actual fraction	0.2606	0.4386	0.0003	0.0036	0.7031
garage fraction	0.3706	0.6238	0.0004	0.0051	1
					Composite EF
Composite VOC :	0.279	0.287	0.29	4.47	0.305
Composite CO :	12	10.49	1.911	33.28	11.163
Composite NOX :	0.178	0.207	0.429	1.38	0.202
Composite CO2 :	368	479.4	314.1	177.4	436.493
Total PM2.5:	0.0112	0.0113	0.0373	0.0207	0.011
Total PM10:	0.0247	0.0247	0.0532	0.0372	0.025
SO2:	0.0065	0.0087	0.0029	0.0033	0.008

Emissions Summary

Roads

	VOC lbs/day	VOC tons/yr	NOx lbs/day	NOx tons/yr	CO2 lbs/day	CO2 tons/yr
2009 Existing	60.0	7.8	141.3	18.4	61891.9	8045.9
2016 No-Build	30.1	3.9	48.3	6.3	67430.4	8765.9
2016 Build	30.2	3.9	48.5	6.3	67585.8	8786.2
delta	0.1	0.0	0.1	0.0	155.4	20.2
2021 No-Build	24.5	3.2	29.7	3.9	69713.1	9062.7
2021 Build	25.2	3.3	30.5	4.0	71765.1	9329.5
delta	0.7	0.1	0.9	0.1	2052.0	266.8

Intersections

	VOC lbs/day	VOC tons/yr	NOx lbs/day	NOx tons/yr	CO2 lbs/day	CO2 tons/yr
2009 Existing	19.6	2.5	14.0	1.8	3353.8	436.0
2016 No-Build	11.4	1.5	5.1	0.7	3902.9	507.4
2016 Build	11.5	1.5	5.1	0.7	3932.6	511.2
delta	0.1	0.0	0.0	0.0	29.7	3.9
2021 No-Build	10.5	1.4	3.3	0.4	4120.5	535.7
2021 Build	11.0	1.4	3.4	0.4	4334.4	563.5
delta	0.5	0.1	0.2	0.0	213.9	27.8

Total

Pollutant	VOC lbs/day	VOC tons/yr	NOx lbs/day	NOx tons/yr	CO2 lbs/day	CO2 tons/yr
2009 Existing	79.6	10.3	155.4	20.2	65245.7	8481.9
2016 No-Build	41.4	5.4	53.5	6.9	71333.3	9273.3
2016 Build	41.6	5.4	53.6	7.0	71518.3	9297.4
Difference	0.2	0.0	0.2	0.0	185.1	24.1
Difference (%)	0.38%	0.38%	0.28%	0.28%	0.26%	0.26%
2021 No-Build	35.0	4.6	32.9	4.3	73833.6	9598.4
2021 Build	36.3	4.7	34.0	4.4	76099.5	9892.9
Difference	1.3	0.2	1.0	0.1	2265.9	294.6
Difference (%)	3.62%	3.62%	3.17%	3.17%	3.07%	3.07%

GHG Summary

	Case 1	Case 2	Case 3
	2021	2021	2021
	Build (base) - No Build	Build (preferred) - No Build	Build ("Stretch") - No Build
Net VMT, miles/day	1,637	1,637	1637
Roadway GHG, tpy	267	267	267
Net Delay, hrs/day	68	68	68
Intersection GHG, tpy	28	28	28
Net GHG Emissions, tpy	295	295	295
Percent Change	---	---	0%

MA Mental Health Center

Mesoscale Analysis

				AM Peak Hour Volume[1]							PM Peak Hour Volume[1]						
Link Number	Roadway Segment	Link Distance (miles)	Average Speed Limit (mph)	Existing (2009)	Midterm No Build (2016)	Midterm Build (2016)	Net Project Traffic	No Build (2021)	Build (2021)	Net Project Traffic	Existing (2009)	Midterm No Build (2016)	Midterm Build (2016)	Net Project Traffic	No Build (2021)	Build (2021)	Net Project Traffic
1	Riverway - Longwood to Brookline	0.29	30	1,803	1,864	1,866	2	1,909	1,917	8	1,841	1,904	1,908	4	1,948	1,968	20
2	Riverway - Brookline to Vining	0.05	30	2,246	2,410	2,411	1	2,475	2,482	7	2,324	2,474	2,475	1	2,539	2,551	12
3	Riverway - Vining Southward	0.25	30	2,409	2,580	2,586	6	2,645	2,678	33	2,369	2,519	2,522	3	2,583	2,603	20
4	Brookline Ave - West of Riverway	0.25	30	1,188	1,269	1,274	5	1,294	1,341	47	1,131	1,234	1,221	-13	1,262	1,310	48
5	Brookline Ave - Riverway to Fenwood	0.02	30	1,622	1,789	1,795	6	1,832	1,885	53	1,598	1,793	1,781	-12	1,839	1,899	60
6	Brookline Ave - Fenwood to Francis	0.05	30	1,601	1,775	1,779	4	1,823	1,857	34	1,620	1,800	1,811	11	1,846	1,912	66
7	Brookline Ave - Francis to Longwood	0.17	30	1,574	1,724	1,733	9	1,779	1,820	41	1,583	1,781	1,789	8	1,834	1,878	44
8	Brookline Ave - East of Longwood	0.25	30	1,832	2,026	2,033	7	2,080	2,121	41	1,600	1,793	1,798	5	1,835	1,874	39
9	Binney St - Fenwood to Francis	0.04	30	250	228	200	-28	199	234	35	182	180	180	0	173	223	50
10	Binney St - Francis to Longwood	0.17	30	350	385	366	-19	379	402	23	366	421	393	-28	412	441	29
11	Binney St - East of Longwood	0.07	30	355	379	379	0	388	393	5	304	323	323	0	331	332	1
12	Vining St - private way to Mission Park Garage	0.01	30	527	524	524	0	537	571	34	226	202	202	0	207	248	41
13	Vining St - private way to Fenwood	0.04	30	532	522	566	44	535	732	197	306	281	327	46	288	498	210
14	Vining St - Fenwood to Francis	0.05	30	346	356	356	0	351	416	65	258	230	240	10	228	306	78
15	Vining St - Francis to Brigham Garage	0.01	30	125	217	90	-127	114	114	0	127	132	113	-19	125	125	0
16	St Albans St - South of Huntington (Mission St)	0.08	30	28	28	28	0	30	30	0	26	27	27	0	27	27	0
17	St Albans St - Huntington to Fenwood	0.09	30	265	272	276	4	279	293	14	260	266	272	6	273	296	23
18	St Albans St - Fenwood to Francis	0.05	30	147	151	156	5	154	181	27	133	135	139	4	137	160	23
19	St Albans St - Francis to Brigham Driveway	0.01	30	65	56	56	0	66	66	0	106	107	107	0	125	125	0
20	Huntington Ave - West of St Albans	0.25	30	1,434	1,509	1,519	10	1,558	1,575	17	1,565	1,641	1,647	6	1,684	1,708	24
21	Huntington Ave - St Albans to Fenwood	0.08	30	1,276	1,354	1,355	1	1,393	1,396	3	1,452	1,526	1,526	0	1,567	1,568	1
22	Huntington Ave - Fenwood to Francis/Tremont/Calumet	0.05	30	1,305	1,388	1,391	3	1,424	1,445	21	1,497	1,574	1,574	0	1,617	1,627	10
23	Huntington Ave - Francis/Tremont/Calumet to Longwood	0.27	30	1,226	1,311	1,326	15	1,374	1,453	79	1,516	1,606	1,613	7	1,676	1,734	58
24	Huntington Ave - East of Longwood	0.25	30	1,419	1,536	1,552	16	1,597	1,682	85	1,603	1,727	1,735	8	1,794	1,863	69
25	private way - Riverway to Vining St	0.08	30	136	141	182	41	144	309	165	70	61	108	47	62	237	175
26	private way - South of Vining St	0.02	30	12	12	12	0	12	12	0	6	6	6	0	6	6	0
27	Fenwood Rd - Brookline to Binney	0.07	30	206	224	215	-9	213	244	31	93	102	80	-22	77	101	24
28	Fenwood Rd - Binney to Vining	0.05	30	318	295	301	6	293	360	67	232	235	241	6	231	305	74
29	Fenwood Rd - Vining to St. Albans	0.09	30	246	261	275	14	267	332	65	196	210	222	12	213	270	57
30	Fenwood Rd - St Albans to Huntington	0.07	30	47	52	56	4	50	74	24	62	65	65	0	67	78	11
31	Francis St - North of Brookline	0.06	30	247	257	259	2	261	271	10	261	271	277	6	274	295	21
32	Francis St - Brookline to Binney	0.07	30	743	774	774	0	804	868	64	756	803	818	15	830	931	101
33	Francis St - Binney to Vining	0.05	30	697	655	763	108	805	847	42	641	674	682	8	715	776	61
34	Francis St - Vining to St Albans	0.10	30	489	639	535	-104	565	599	34	493	562	567	5	600	628	28
35	Francis St - St Albans to Huntington	0.08	30	596	607	619	12	658	719	61	604	604	613	9	670	720	50
36	Calumet St - South of Huntington	0.13	30	140	145	145	0	149	149	0	238	246	246	0	253	253	0
37	Tremont St - South of Huntington	0.20	30	769	803	803	0	823	826	3	792	836	834	-2	857	860	3
38	Longwood Ave - North of Riverway	0.10	30	964	1,021	1,023	2	1,050	1,064	14	1,152	1,217	1,220	3	1,250	1,275	25
39	Longwood Ave - Riverway to Brookline	0.17	30	514	559	561	2	578	590	12	606	707	710	3	728	750	22
40	Longwood Ave - Brookline to Binney	0.08	30	959	1,052	1,052	0	1,075	1,087	12	991	1,080	1,081	1	1,104	1,121	17
41	Longwood Ave - Binney to Huntington	0.34	30	669	757	754	-3	771	777	6	913	1,004	1,003	-1	1,023	1,034	11
42	Longwood Ave - South of Huntington	0.04	30	414	438	438	0	450	450	0	454	480	480	0	491	491	0
43							0			0				0			0
44							0			0				0			0
45							0			0				0			0
46							0			0				0			0
47							0			0				0			0
48							0			0				0			0
49							0			0				0			0
50							0			0				0			0
							0			0				0			0
							0			0				0			0

Notes

1. Where link volumes are unbalanced between intersections, the higher volume was used to provide a conservative analysis.

MA Mental Health Center

Mesoscale Analysis

					Daily Traffic Volume						
Link Number	Roadway Segment	Link Distance (miles)	Average Speed Limit (mph)	K-factor	Existing (2009)	Midterm No Build (2016)	Midterm Build (2016)	Net Project Traffic	No Build (2021)	Build (2021)	Net Project Traffic
1	Riverway - Longwood to Brookline	0.29	30	10.0%	18,410	19,040	19,080	40	19,480	19,680	200
2	Riverway - Brookline to Vining	0.05	30	10.0%	23,240	24,740	24,750	10	25,390	25,510	120
3	Riverway - Vining Southward	0.25	30	10.0%	24,090	25,800	25,860	60	26,450	26,780	330
4	Brookline Ave - West of Riverway	0.25	30	10.0%	11,880	12,690	12,740	50	12,940	13,410	480
5	Brookline Ave - Riverway to Fenwood	0.02	30	10.0%	16,220	17,930	17,950	60	18,390	18,990	600
6	Brookline Ave - Fenwood to Francis	0.05	30	10.0%	16,200	18,000	18,110	110	18,460	19,120	660
7	Brookline Ave - Francis to Longwood	0.17	30	10.0%	15,830	17,810	17,890	90	18,340	18,780	440
8	Brookline Ave - East of Longwood	0.25	30	10.0%	18,320	20,260	20,330	70	20,800	21,210	410
9	Binney St - Fenwood to Francis	0.04	30	10.0%	2,500	2,280	2,000	0	1,990	2,340	500
10	Binney St - Francis to Longwood	0.17	30	10.0%	3,660	4,210	3,930	-190	4,120	4,410	290
11	Binney St - East of Longwood	0.07	30	10.0%	3,550	3,790	3,790	0	3,880	3,930	50
12	Vining St - private way to Mission Park Garage	0.01	30	10.0%	5,270	5,240	5,240	0	5,370	5,710	410
13	Vining St - private way to Fenwood	0.04	30	10.0%	5,320	5,220	5,660	460	5,350	7,320	2,100
14	Vining St - Fenwood to Francis	0.05	30	10.0%	3,460	3,560	3,560	100	3,510	4,160	780
15	Vining St - Francis to Brigham Garage	0.01	30	10.0%	1,270	2,170	1,130	-190	1,250	1,250	0
16	St Albans St - South of Huntington (Mission St)	0.08	30	10.0%	280	280	280	0	300	300	0
17	St Albans St - Huntington to Fenwood	0.09	30	10.0%	2,650	2,720	2,760	60	2,790	2,960	230
18	St Albans St - Fenwood to Francis	0.05	30	10.0%	1,470	1,510	1,560	50	1,540	1,810	270
19	St Albans St - Francis to Brigham Driveway	0.01	30	10.0%	1,060	1,070	1,070	0	1,250	1,250	0
20	Huntington Ave - West of St Albans	0.25	30	10.0%	15,650	16,410	16,470	100	16,840	17,080	240
21	Huntington Ave - St Albans to Fenwood	0.08	30	10.0%	14,520	15,260	15,260	10	15,670	15,680	30
22	Huntington Ave - Fenwood to Francis/Tremont/Calumet	0.05	30	10.0%	14,970	15,740	15,740	30	16,170	16,270	210
23	Huntington Ave - Francis/Tremont/Calumet to Longwood	0.27	30	10.0%	15,160	16,060	16,130	150	16,760	17,340	790
24	Huntington Ave - East of Longwood	0.25	30	10.0%	16,030	17,270	17,350	160	17,940	18,630	850
25	private way - Riverway to Vining St	0.08	30	10.0%	1,360	1,410	1,820	470	1,440	3,090	1,750
26	private way - South of Vining St	0.02	30	10.0%	120	120	120	0	120	120	0
27	Fenwood Rd - Brookline to Binney	0.07	30	10.0%	2,060	2,240	2,150	-90	2,130	2,440	310
28	Fenwood Rd - Binney to Vining	0.05	30	10.0%	3,180	2,950	3,010	60	2,930	3,600	740
29	Fenwood Rd - Vining to St. Albans	0.09	30	10.0%	2,460	2,610	2,750	140	2,670	3,320	650
30	Fenwood Rd - St Albans to Huntington	0.07	30	10.0%	620	650	650	40	670	780	240
31	Francis St - North of Brookline	0.06	30	10.0%	2,610	2,710	2,770	60	2,740	2,950	210
32	Francis St - Brookline to Binney	0.07	30	10.0%	7,560	8,030	8,180	150	8,300	9,310	1,010
33	Francis St - Binney to Vining	0.05	30	10.0%	6,970	6,740	7,630	1,080	8,050	8,470	610
34	Francis St - Vining to St Albans	0.10	30	10.0%	4,930	6,390	5,670	50	6,000	6,280	340
35	Francis St - St Albans to Huntington	0.08	30	10.0%	6,040	6,070	6,190	120	6,700	7,200	610
36	Calumet St - South of Huntington	0.13	30	10.0%	2,380	2,460	2,460	0	2,530	2,530	0
37	Tremont St - South of Huntington	0.20	30	10.0%	7,920	8,360	8,340	0	8,570	8,600	30
38	Longwood Ave - North of Riverway	0.10	30	10.0%	11,520	12,170	12,200	30	12,500	12,750	250
39	Longwood Ave - Riverway to Brookline	0.17	30	10.0%	6,060	7,070	7,100	30	7,280	7,500	220
40	Longwood Ave - Brookline to Binney	0.08	30	10.0%	9,910	10,800	10,810	10	11,040	11,210	170
41	Longwood Ave - Binney to Huntington	0.34	30	10.0%	9,130	10,040	10,030	-10	10,230	10,340	110
42	Longwood Ave - South of Huntington	0.04	30	10.0%	4,540	4,800	4,800	0	4,910	4,910	0
43				10.0%	0	0	0	0	0	0	0
44				10.0%	0	0	0	0	0	0	0
45				10.0%	0	0	0	0	0	0	0
46				10.0%	0	0	0	0	0	0	0
47				10.0%	0	0	0	0	0	0	0
48				10.0%	0	0	0	0	0	0	0
49				10.0%	0	0	0	0	0	0	0
50				10.0%	0	0	0	0	0	0	0
				10.0%	0	0	0	0	0	0	0
				10.0%	0	0	0	0	0	0	0

Notes
1. Where link volumes are unbalanced between intersections, the higher volume was used to provide a cor

MA Mental Health Center

Mesoscale Analysis
2009 Existing Case

	Link	Daily Average Volumes	Miles Per Link	Miles Traveled	Vehicle Speed (mph)	MOBILE6 vehicle class	MOBILE6 VOC (g/mile)	lbs/day	tons/year	MOBILE6 NOX (g/mile)	lbs/day	tons/year	MOBILE6 CO2 (g/mile)	lbs/day	tons/year
1	Riverway - Longwood to Brookline	18,410	0.29	5338.9	30	Composite	0.540	6.356	0.826	1.271	14.960	1.945	556.650	6551.949	851.753
2	Riverway - Brookline to Vining	23,240	0.05	1162.0	30	Composite	0.540	1.383	0.180	1.271	3.256	0.423	556.650	1426.018	185.382
3	Riverway - Vining Southward	24,090	0.25	6022.5	30	Composite	0.540	7.170	0.932	1.271	16.876	2.194	556.650	7390.870	960.813
4	Brookline Ave - West of Riverway	11,880	0.25	2970.0	30	Composite	0.540	3.536	0.460	1.271	8.322	1.082	556.650	3644.812	473.826
5	Brookline Ave - Riverway to Fenwood	16,220	0.02	324.4	30	Composite	0.540	0.386	0.050	1.271	0.909	0.118	556.650	398.107	51.754
6	Brookline Ave - Fenwood to Francis	16,200	0.05	810.0	30	Composite	0.540	0.964	0.125	1.271	2.270	0.295	556.650	994.040	129.225
7	Brookline Ave - Francis to Longwood	15,830	0.17	2691.1	30	Composite	0.540	3.204	0.416	1.271	7.541	0.980	556.650	3302.544	429.331
8	Brookline Ave - East of Longwood	18,320	0.25	4580.0	30	Composite	0.540	5.453	0.709	1.271	12.834	1.668	556.650	5620.620	730.681
9	Binney St - Fenwood to Francis	2,500	0.04	100.0	30	Composite	0.540	0.119	0.015	1.271	0.280	0.036	556.650	122.721	15.954
10	Binney St - Francis to Longwood	3,660	0.17	622.2	30	Composite	0.540	0.741	0.096	1.271	1.743	0.227	556.650	763.570	99.264
11	Binney St - East of Longwood	3,550	0.07	248.5	30	Composite	0.540	0.296	0.038	1.271	0.696	0.091	556.650	304.962	39.645
12	Vining St - private way to Mission Park Garage	5,270	0.01	52.7	30	Composite	0.540	0.063	0.008	1.271	0.148	0.019	556.650	64.674	8.408
13	Vining St - private way to Fenwood	5,320	0.04	212.8	30	Composite	0.540	0.253	0.033	1.271	0.596	0.078	556.650	261.150	33.950
14	Vining St - Fenwood to Francis	3,460	0.05	173.0	30	Composite	0.540	0.206	0.027	1.271	0.485	0.063	556.650	212.307	27.600
15	Vining St - Francis to Brigham Garage	1,270	0.01	12.7	30	Composite	0.540	0.015	0.002	1.271	0.036	0.005	556.650	15.586	2.026
16	St Albans St - South of Huntington (Mission St)	280	0.08	22.4	30	Composite	0.540	0.027	0.003	1.271	0.063	0.008	556.650	27.489	3.574
17	St Albans St - Huntington to Fenwood	2,650	0.09	238.5	30	Composite	0.540	0.284	0.037	1.271	0.668	0.087	556.650	292.689	38.050
18	St Albans St - Fenwood to Francis	1,470	0.05	73.5	30	Composite	0.540	0.088	0.011	1.271	0.206	0.027	556.650	90.200	11.726
19	St Albans St - Francis to Brigham Driveway	1,060	0.01	10.6	30	Composite	0.540	0.013	0.002	1.271	0.030	0.004	556.650	13.008	1.691
20	Huntington Ave - West of St Albans	15,650	0.25	3912.5	30	Composite	0.540	4.658	0.606	1.271	10.963	1.425	556.650	4801.458	624.189
21	Huntington Ave - St Albans to Fenwood	14,520	0.08	1161.6	30	Composite	0.540	1.383	0.180	1.271	3.255	0.423	556.650	1425.527	185.318
22	Huntington Ave - Fenwood to Francis/Tremont/Calumet	14,970	0.05	748.5	30	Composite	0.540	0.891	0.116	1.271	2.097	0.273	556.650	918.566	119.414
23	Huntington Ave - Francis/Tremont/Calumet to Longwood	15,160	0.27	4093.2	30	Composite	0.540	4.873	0.633	1.271	11.470	1.491	556.650	5023.214	653.018
24	Huntington Ave - East of Longwood	16,030	0.25	4007.5	30	Composite	0.540	4.771	0.620	1.271	11.229	1.460	556.650	4918.042	639.346
25	private way - Riverway to Vining St	1,360	0.08	108.8	30	Composite	0.540	0.130	0.017	1.271	0.305	0.040	556.650	133.520	17.358
26	private way - South of Vining St	120	0.02	2.4	30	Composite	0.540	0.003	0.000	1.271	0.007	0.001	556.650	2.945	0.383
27	Fenwood Rd - Brookline to Binney	2,060	0.07	144.2	30	Composite	0.540	0.172	0.022	1.271	0.404	0.053	556.650	176.964	23.005
28	Fenwood Rd - Binney to Vining	3,180	0.05	159.0	30	Composite	0.540	0.189	0.025	1.271	0.446	0.058	556.650	195.126	25.366
29	Fenwood Rd - Vining to St. Albans	2,460	0.09	221.4	30	Composite	0.540	0.264	0.034	1.271	0.620	0.081	556.650	271.704	35.322
30	Fenwood Rd - St Albans to Huntington	620	0.07	43.4	30	Composite	0.540	0.052	0.007	1.271	0.122	0.016	556.650	53.261	6.924
31	Francis St - North of Brookline	2,610	0.06	156.6	30	Composite	0.540	0.186	0.024	1.271	0.439	0.057	556.650	192.181	24.984
32	Francis St - Brookline to Binney	7,560	0.07	529.2	30	Composite	0.540	0.630	0.082	1.271	1.483	0.193	556.650	649.439	84.427
33	Francis St - Binney to Vining	6,970	0.05	348.5	30	Composite	0.540	0.415	0.054	1.271	0.977	0.127	556.650	427.683	55.599
34	Francis St - Vining to St Albans	4,930	0.10	493.0	30	Composite	0.540	0.587	0.076	1.271	1.381	0.180	556.650	605.014	78.652
35	Francis St - St Albans to Huntington	6,040	0.08	483.2	30	Composite	0.540	0.575	0.075	1.271	1.354	0.176	556.650	592.988	77.088
36	Calumet St - South of Huntington	2,380	0.13	309.4	30	Composite	0.540	0.368	0.048	1.271	0.867	0.113	556.650	379.699	49.361
37	Tremont St - South of Huntington	7,920	0.20	1584.0	30	Composite	0.540	1.886	0.245	1.271	4.439	0.577	556.650	1943.900	252.707
38	Longwood Ave - North of Riverway	11,520	0.10	1152.0	30	Composite	0.540	1.371	0.178	1.271	3.228	0.420	556.650	1413.745	183.787
39	Longwood Ave - Riverway to Brookline	6,060	0.17	1030.2	30	Composite	0.540	1.226	0.159	1.271	2.887	0.375	556.650	1264.271	164.355
40	Longwood Ave - Brookline to Binney	9,910	0.08	792.8	30	Composite	0.540	0.944	0.123	1.271	2.221	0.289	556.650	972.932	126.481
41	Longwood Ave - Binney to Huntington	9,130	0.34	3104.2	30	Composite	0.540	3.696	0.480	1.271	8.698	1.131	556.650	3809.504	495.236
42	Longwood Ave - South of Huntington	4,540	0.04	181.6	30	Composite	0.540	0.216	0.028	1.271	0.509	0.066	556.650	222.861	28.972
43	0	0	0.00	0.0	30	Composite	0.540	0.000	0.000	1.271	0.000	0.000	556.650	0.000	0.000
44	0	0	0.00	0.0	30	Composite	0.540	0.000	0.000	1.271	0.000	0.000	556.650	0.000	0.000
45	0	0	0.00	0.0	30	Composite	0.540	0.000	0.000	1.271	0.000	0.000	556.650	0.000	0.000
46	0	0	0.00	0.0	30	Composite	0.540	0.000	0.000	1.271	0.000	0.000	556.650	0.000	0.000
47	0	0	0.00	0.0	30	Composite	0.540	0.000	0.000	1.271	0.000	0.000	556.650	0.000	0.000
48	0	0	0.00	0.0	30	Composite	0.540	0.000	0.000	1.271	0.000	0.000	556.650	0.000	0.000
49	0	0	0.00	0.0	30	Composite	0.540	0.000	0.000	1.271	0.000	0.000	556.650	0.000	0.000
50	0	0	0.00	0.0	30	Composite	0.540	0.000	0.000	1.271	0.000	0.000	556.650	0.000	0.000
	Total	340380.000	4.650	50433.000				60.041	7.805		141.318	18.371		61891.861	8045.942

Notes: Daily to annual factor (5 days/week * 52 weeks per year / 365 days per year) = 71%

MA Mental Health Center

Mesoscale Analysis
2016 Mid Term No Build Case

	Link	Daily Average Volumes	Miles Per Link	Miles Traveled	Vehicle Speed (mph)	MOBILE6 vehicle class	MOBILE6 VOC (g/mile)	lbs/day	tons/year	MOBILE6 NOX (g/mile)	lbs/day	tons/year	MOBILE6 CO2 (g/mile)	lbs/day	tons/year
1	Riverway - Longwood to Brookline	19,040	0.29	5521.6	30	Composite	0.252	3.068	0.399	0.405	4.930	0.641	564.840	6875.858	893.862
2	Riverway - Brookline to Vining	24,740	0.05	1237.0	30	Composite	0.252	0.687	0.089	0.405	1.104	0.144	564.840	1540.393	200.251
3	Riverway - Vining Southward	25,800	0.25	6450.0	30	Composite	0.252	3.583	0.466	0.405	5.759	0.749	564.840	8031.963	1044.155
4	Brookline Ave - West of Riverway	12,690	0.25	3172.5	30	Composite	0.252	1.763	0.229	0.405	2.833	0.368	564.840	3950.605	513.579
5	Brookline Ave - Riverway to Fenwood	17,930	0.02	358.6	30	Composite	0.252	0.199	0.026	0.405	0.320	0.042	564.840	446.552	58.052
6	Brookline Ave - Fenwood to Francis	18,000	0.05	900.0	30	Composite	0.252	0.500	0.065	0.405	0.804	0.104	564.840	1120.739	145.696
7	Brookline Ave - Francis to Longwood	17,810	0.17	3027.7	30	Composite	0.252	1.682	0.219	0.405	2.703	0.351	564.840	3770.291	490.138
8	Brookline Ave - East of Longwood	20,260	0.25	5065.0	30	Composite	0.252	2.814	0.366	0.405	4.522	0.588	564.840	6307.270	819.945
9	Binney St - Fenwood to Francis	2,280	0.04	91.2	30	Composite	0.252	0.051	0.007	0.405	0.081	0.011	564.840	113.568	14.764
10	Binney St - Francis to Longwood	4,210	0.17	715.7	30	Composite	0.252	0.398	0.052	0.405	0.639	0.083	564.840	891.237	115.861
11	Binney St - East of Longwood	3,790	0.07	265.3	30	Composite	0.252	0.147	0.019	0.405	0.237	0.031	564.840	330.369	42.948
12	Vining St - private way to Mission Park Garage	5,240	0.01	52.4	30	Composite	0.252	0.029	0.004	0.405	0.047	0.006	564.840	65.252	8.483
13	Vining St - private way to Fenwood	5,220	0.04	208.8	30	Composite	0.252	0.116	0.015	0.405	0.186	0.024	564.840	260.011	33.801
14	Vining St - Fenwood to Francis	3,560	0.05	178.0	30	Composite	0.252	0.099	0.013	0.405	0.159	0.021	564.840	221.657	28.815
15	Vining St - Francis to Brigham Garage	2,170	0.01	21.7	30	Composite	0.252	0.012	0.002	0.405	0.019	0.003	564.840	27.022	3.513
16	St Albans St - South of Huntington (Mission St)	280	0.08	22.4	30	Composite	0.252	0.012	0.002	0.405	0.020	0.003	564.840	27.894	3.626
17	St Albans St - Huntington to Fenwood	2,720	0.09	244.8	30	Composite	0.252	0.136	0.018	0.405	0.219	0.028	564.840	304.841	39.629
18	St Albans St - Fenwood to Francis	1,510	0.05	75.5	30	Composite	0.252	0.042	0.005	0.405	0.067	0.009	564.840	94.018	12.222
19	St Albans St - Francis to Brigham Driveway	1,070	0.01	10.7	30	Composite	0.252	0.006	0.001	0.405	0.010	0.001	564.840	13.324	1.732
20	Huntington Ave - West of St Albans	16,410	0.25	4102.5	30	Composite	0.252	2.279	0.296	0.405	3.663	0.476	564.840	5108.702	664.131
21	Huntington Ave - St Albans to Fenwood	15,260	0.08	1220.8	30	Composite	0.252	0.678	0.088	0.405	1.090	0.142	564.840	1520.220	197.629
22	Huntington Ave - Fenwood to Francis/Tremont/Calumet	15,740	0.05	787.0	30	Composite	0.252	0.437	0.057	0.405	0.703	0.091	564.840	980.024	127.403
23	Huntington Ave - Francis/Tremont/Calumet to Longwood	16,060	0.27	4336.2	30	Composite	0.252	2.409	0.313	0.405	3.872	0.503	564.840	5399.720	701.964
24	Huntington Ave - East of Longwood	17,270	0.25	4317.5	30	Composite	0.252	2.399	0.312	0.405	3.855	0.501	564.840	5376.434	698.936
25	private way - Riverway to Vining St	1,410	0.08	112.8	30	Composite	0.252	0.063	0.008	0.405	0.101	0.013	564.840	140.466	18.261
26	private way - South of Vining St	120	0.02	2.4	30	Composite	0.252	0.001	0.000	0.405	0.002	0.000	564.840	2.989	0.389
27	Fenwood Rd - Brookline to Binney	2,240	0.07	156.8	30	Composite	0.252	0.087	0.011	0.405	0.140	0.018	564.840	195.258	25.383
28	Fenwood Rd - Binney to Vining	2,950	0.05	147.5	30	Composite	0.252	0.082	0.011	0.405	0.132	0.017	564.840	183.677	23.878
29	Fenwood Rd - Vining to St. Albans	2,610	0.09	234.9	30	Composite	0.252	0.131	0.017	0.405	0.210	0.027	564.840	292.513	38.027
30	Fenwood Rd - St Albans to Huntington	650	0.07	45.5	30	Composite	0.252	0.025	0.003	0.405	0.041	0.005	564.840	56.660	7.366
31	Francis St - North of Brookline	2,710	0.06	162.6	30	Composite	0.252	0.090	0.012	0.405	0.145	0.019	564.840	202.480	26.322
32	Francis St - Brookline to Binney	8,030	0.07	562.1	30	Composite	0.252	0.312	0.041	0.405	0.502	0.065	564.840	699.964	90.995
33	Francis St - Binney to Vining	6,740	0.05	337.0	30	Composite	0.252	0.187	0.024	0.405	0.301	0.039	564.840	419.654	54.555
34	Francis St - Vining to St Albans	6,390	0.10	639.0	30	Composite	0.252	0.355	0.046	0.405	0.571	0.074	564.840	795.725	103.444
35	Francis St - St Albans to Huntington	6,070	0.08	485.6	30	Composite	0.252	0.270	0.035	0.405	0.434	0.056	564.840	604.701	78.611
36	Calumet St - South of Huntington	2,460	0.13	319.8	30	Composite	0.252	0.178	0.023	0.405	0.286	0.037	564.840	398.236	51.771
37	Tremont St - South of Huntington	8,360	0.20	1672.0	30	Composite	0.252	0.929	0.121	0.405	1.493	0.194	564.840	2082.084	270.671
38	Longwood Ave - North of Riverway	12,170	0.10	1217.0	30	Composite	0.252	0.676	0.088	0.405	1.087	0.141	564.840	1515.488	197.013
39	Longwood Ave - Riverway to Brookline	7,070	0.17	1201.9	30	Composite	0.252	0.668	0.087	0.405	1.073	0.140	564.840	1496.685	194.569
40	Longwood Ave - Brookline to Binney	10,800	0.08	864.0	30	Composite	0.252	0.480	0.062	0.405	0.771	0.100	564.840	1075.909	139.868
41	Longwood Ave - Binney to Huntington	10,040	0.34	3413.6	30	Composite	0.252	1.896	0.247	0.405	3.048	0.396	564.840	4250.838	552.609
42	Longwood Ave - South of Huntington	4,800	0.04	192.0	30	Composite	0.252	0.107	0.014	0.405	0.171	0.022	564.840	239.091	31.082
43	0	0	0.00	0.0	0	Composite	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
44	0	0	0.00	0.0	0	Composite	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
45	0	0	0.00	0.0	0	Composite	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
46	0	0	0.00	0.0	0	Composite	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
47	0	0	0.00	0.0	0	Composite	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
48	0	0	0.00	0.0	0	Composite	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
49	0	0	0.00	0.0	0	Composite	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
50	0	0	0.00	0.0	0	Composite	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Total	364680.000	4.650	54149.400				30.084	3.911		48.349	6.285		67430.382	8765.950

Notes: Daily to annual factor (5 days/week * 52 weeks per year / 365 days per year) = 71%

MA Mental Health Center

Mesoscale Analysis
2016 Mid Term Build Case

	Link	Daily Average Volumes	Miles Per Link	Miles Traveled	Vehicle Speed (mph)	MOBILE6 vehicle class	MOBILE6 VOC (g/mile)	lbs/day	tons/year	MOBILE6 NOX (g/mile)	lbs/day	tons/year	MOBILE6 CO2 (g/mile)	lbs/day	tons/year
1	Riverway - Longwood to Brookline	19,080	0.29	5533.2	30	Composite	0.252	3.074	0.400	0.405	4.940	0.642	564.840	6890.303	895.739
2	Riverway - Brookline to Vining	24,750	0.05	1237.5	30	Composite	0.252	0.688	0.089	0.405	1.105	0.144	564.840	1541.016	200.332
3	Riverway - Vining Southward	25,860	0.25	6465.0	30	Composite	0.252	3.592	0.467	0.405	5.772	0.750	564.840	8050.642	1046.583
4	Brookline Ave - West of Riverway	12,740	0.25	3185.0	30	Composite	0.252	1.769	0.230	0.405	2.844	0.370	564.840	3966.171	515.602
5	Brookline Ave - Riverway to Fenwood	17,950	0.02	359.0	30	Composite	0.252	0.199	0.026	0.405	0.321	0.042	564.840	447.050	58.117
6	Brookline Ave - Fenwood to Francis	18,110	0.05	905.5	30	Composite	0.252	0.503	0.065	0.405	0.808	0.105	564.840	1127.588	146.586
7	Brookline Ave - Francis to Longwood	17,890	0.17	3041.3	30	Composite	0.252	1.690	0.220	0.405	2.716	0.353	564.840	3787.226	492.339
8	Brookline Ave - East of Longwood	20,330	0.25	5082.5	30	Composite	0.252	2.824	0.367	0.405	4.538	0.590	564.840	6329.062	822.778
9	Binney St - Fenwood to Francis	2,000	0.04	80.0	30	Composite	0.252	0.044	0.006	0.405	0.071	0.009	564.840	99.621	12.951
10	Binney St - Francis to Longwood	3,930	0.17	668.1	30	Composite	0.252	0.371	0.048	0.405	0.597	0.078	564.840	831.962	108.155
11	Binney St - East of Longwood	3,790	0.07	265.3	30	Composite	0.252	0.147	0.019	0.405	0.237	0.031	564.840	330.369	42.948
12	Vining St - private way to Mission Park Garage	5,240	0.01	52.4	30	Composite	0.252	0.029	0.004	0.405	0.047	0.006	564.840	65.252	8.483
13	Vining St - private way to Fenwood	5,660	0.04	226.4	30	Composite	0.252	0.126	0.016	0.405	0.202	0.026	564.840	281.928	36.651
14	Vining St - Fenwood to Francis	3,560	0.05	178.0	30	Composite	0.252	0.099	0.013	0.405	0.159	0.021	564.840	221.657	28.815
15	Vining St - Francis to Brigham Garage	1,130	0.01	11.3	30	Composite	0.252	0.006	0.001	0.405	0.010	0.001	564.840	14.072	1.829
16	St Albans St - South of Huntington (Mission St)	280	0.08	22.4	30	Composite	0.252	0.012	0.002	0.405	0.020	0.003	564.840	27.894	3.626
17	St Albans St - Huntington to Fenwood	2,760	0.09	248.4	30	Composite	0.252	0.138	0.018	0.405	0.222	0.029	564.840	309.324	40.212
18	St Albans St - Fenwood to Francis	1,560	0.05	78.0	30	Composite	0.252	0.043	0.006	0.405	0.070	0.009	564.840	97.131	12.627
19	St Albans St - Francis to Brigham Driveway	1,070	0.01	10.7	30	Composite	0.252	0.006	0.001	0.405	0.010	0.001	564.840	13.324	1.732
20	Huntington Ave - West of St Albans	16,470	0.25	4117.5	30	Composite	0.252	2.288	0.297	0.405	3.676	0.478	564.840	5127.381	666.560
21	Huntington Ave - St Albans to Fenwood	15,260	0.08	1220.8	30	Composite	0.252	0.678	0.088	0.405	1.090	0.142	564.840	1520.220	197.629
22	Huntington Ave - Fenwood to Francis/Tremont/Calumet	15,740	0.05	787.0	30	Composite	0.252	0.437	0.057	0.405	0.703	0.091	564.840	980.024	127.403
23	Huntington Ave - Francis/Tremont/Calumet to Longwood	16,130	0.27	4355.1	30	Composite	0.252	2.420	0.315	0.405	3.889	0.506	564.840	5423.256	705.023
24	Huntington Ave - East of Longwood	17,350	0.25	4337.5	30	Composite	0.252	2.410	0.313	0.405	3.873	0.503	564.840	5401.339	702.174
25	private way - Riverway to Vining St	1,820	0.08	145.6	30	Composite	0.252	0.081	0.011	0.405	0.130	0.017	564.840	181.311	23.570
26	private way - South of Vining St	120	0.02	2.4	30	Composite	0.252	0.001	0.000	0.405	0.002	0.000	564.840	2.989	0.389
27	Fenwood Rd - Brookline to Binney	2,150	0.07	150.5	30	Composite	0.252	0.084	0.011	0.405	0.134	0.017	564.840	187.412	24.364
28	Fenwood Rd - Binney to Vining	3,010	0.05	150.5	30	Composite	0.252	0.084	0.011	0.405	0.134	0.017	564.840	187.412	24.364
29	Fenwood Rd - Vining to St. Albans	2,750	0.09	247.5	30	Composite	0.252	0.138	0.018	0.405	0.221	0.029	564.840	308.203	40.066
30	Fenwood Rd - St Albans to Huntington	650	0.07	45.5	30	Composite	0.252	0.025	0.003	0.405	0.041	0.005	564.840	56.660	7.366
31	Francis St - North of Brookline	2,770	0.06	166.2	30	Composite	0.252	0.092	0.012	0.405	0.148	0.019	564.840	206.963	26.905
32	Francis St - Brookline to Binney	8,180	0.07	572.6	30	Composite	0.252	0.318	0.041	0.405	0.511	0.066	564.840	713.039	92.695
33	Francis St - Binney to Vining	7,630	0.05	381.5	30	Composite	0.252	0.212	0.028	0.405	0.341	0.044	564.840	475.069	61.759
34	Francis St - Vining to St Albans	5,670	0.10	567.0	30	Composite	0.252	0.315	0.041	0.405	0.506	0.066	564.840	706.066	91.789
35	Francis St - St Albans to Huntington	6,190	0.08	495.2	30	Composite	0.252	0.275	0.036	0.405	0.442	0.057	564.840	616.655	80.165
36	Calumet St - South of Huntington	2,460	0.13	319.8	30	Composite	0.252	0.178	0.023	0.405	0.286	0.037	564.840	398.236	51.771
37	Tremont St - South of Huntington	8,340	0.20	1668.0	30	Composite	0.252	0.927	0.120	0.405	1.489	0.194	564.840	2077.103	270.023
38	Longwood Ave - North of Riverway	12,200	0.10	1220.0	30	Composite	0.252	0.678	0.088	0.405	1.089	0.142	564.840	1519.224	197.499
39	Longwood Ave - Riverway to Brookline	7,100	0.17	1207.0	30	Composite	0.252	0.671	0.087	0.405	1.078	0.140	564.840	1503.036	195.395
40	Longwood Ave - Brookline to Binney	10,810	0.08	864.8	30	Composite	0.252	0.480	0.062	0.405	0.772	0.100	564.840	1076.906	139.998
41	Longwood Ave - Binney to Huntington	10,030	0.34	3410.2	30	Composite	0.252	1.895	0.246	0.405	3.045	0.396	564.840	4246.605	552.059
42	Longwood Ave - South of Huntington	4,800	0.04	192.0	30	Composite	0.252	0.107	0.014	0.405	0.171	0.022	564.840	239.091	31.082
43	0	0	0.00	0.0	0	Composite	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
44	0	0	0.00	0.0	0	Composite	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
45	0	0	0.00	0.0	0	Composite	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
46	0	0	0.00	0.0	0	Composite	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
47	0	0	0.00	0.0	0	Composite	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
48	0	0	0.00	0.0	0	Composite	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
49	0	0	0.00	0.0	0	Composite	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
50	0	0	0.00	0.0	0	Composite	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Total	365320.000	4.650	54274.200				30.153	3.920		48.460	6.300		67585.791	8786.153

Notes: Daily to annual factor (5 days/week * 52 weeks per year / 365 days per year) = 71%

MA Mental Health Center

Mesoscale Analysis
2021 No Build Case

	Link	Daily Average Volumes	Miles Per Link	Miles Traveled	Vehicle Speed (mph)	MOBILE6 vehicle class	MOBILE6 VOC (g/mile)	lbs/day	tons/year	MOBILE6 NOX (g/mile)	lbs/day	tons/year	MOBILE6 CO2 (g/mile)	lbs/day	tons/year
1	Riverway - Longwood to Brookline	19,480	0.29	5649.2	30	Composite	0.200	2.491	0.324	0.242	3.014	0.392	568.710	7082.953	920.784
2	Riverway - Brookline to Vining	25,390	0.05	1269.5	30	Composite	0.200	0.560	0.073	0.242	0.677	0.088	568.710	1591.696	206.920
3	Riverway - Vining Southward	26,450	0.25	6612.5	30	Composite	0.200	2.916	0.379	0.242	3.528	0.459	568.710	8290.736	1077.796
4	Brookline Ave - West of Riverway	12,940	0.25	3235.0	30	Composite	0.200	1.426	0.185	0.242	1.726	0.224	568.710	4056.035	527.285
5	Brookline Ave - Riverway to Fenwood	18,390	0.02	367.8	30	Composite	0.200	0.162	0.021	0.242	0.196	0.026	568.710	461.147	59.949
6	Brookline Ave - Fenwood to Francis	18,460	0.05	923.0	30	Composite	0.200	0.407	0.053	0.242	0.492	0.064	568.710	1157.255	150.443
7	Brookline Ave - Francis to Longwood	18,340	0.17	3117.8	30	Composite	0.200	1.375	0.179	0.242	1.663	0.216	568.710	3909.090	508.182
8	Brookline Ave - East of Longwood	20,800	0.25	5200.0	30	Composite	0.200	2.293	0.298	0.242	2.774	0.361	568.710	6519.747	847.567
9	Binney St - Fenwood to Francis	1,990	0.04	79.6	30	Composite	0.200	0.035	0.005	0.242	0.042	0.006	568.710	99.802	12.974
10	Binney St - Francis to Longwood	4,120	0.17	700.4	30	Composite	0.200	0.309	0.040	0.242	0.374	0.049	568.710	878.160	114.161
11	Binney St - East of Longwood	3,880	0.07	271.6	30	Composite	0.200	0.120	0.016	0.242	0.145	0.019	568.710	340.531	44.269
12	Vining St - private way to Mission Park Garage	5,370	0.01	53.7	30	Composite	0.200	0.024	0.003	0.242	0.029	0.004	568.710	67.329	8.753
13	Vining St - private way to Fenwood	5,350	0.04	214.0	30	Composite	0.200	0.094	0.012	0.242	0.114	0.015	568.710	268.313	34.881
14	Vining St - Fenwood to Francis	3,510	0.05	175.5	30	Composite	0.200	0.077	0.010	0.242	0.094	0.012	568.710	220.041	28.605
15	Vining St - Francis to Brigham Garage	1,250	0.01	12.5	30	Composite	0.200	0.006	0.001	0.242	0.007	0.001	568.710	15.672	2.037
16	St Albans St - South of Huntington (Mission St)	300	0.08	24.0	30	Composite	0.200	0.011	0.001	0.242	0.013	0.002	568.710	30.091	3.912
17	St Albans St - Huntington to Fenwood	2,790	0.09	251.1	30	Composite	0.200	0.111	0.014	0.242	0.134	0.017	568.710	314.829	40.928
18	St Albans St - Fenwood to Francis	1,540	0.05	77.0	30	Composite	0.200	0.034	0.004	0.242	0.041	0.005	568.710	96.542	12.551
19	St Albans St - Francis to Brigham Driveway	1,250	0.01	12.5	30	Composite	0.200	0.006	0.001	0.242	0.007	0.001	568.710	15.672	2.037
20	Huntington Ave - West of St Albans	16,840	0.25	4210.0	30	Composite	0.200	1.856	0.241	0.242	2.246	0.292	568.710	5278.487	686.203
21	Huntington Ave - St Albans to Fenwood	15,670	0.08	1253.6	30	Composite	0.200	0.553	0.072	0.242	0.669	0.087	568.710	1571.761	204.329
22	Huntington Ave - Fenwood to Francis/Tremont/Calumet	16,170	0.05	808.5	30	Composite	0.200	0.356	0.046	0.242	0.431	0.056	568.710	1013.695	131.780
23	Huntington Ave - Francis/Tremont/Calumet to Longwood	16,760	0.27	4525.2	30	Composite	0.200	1.995	0.259	0.242	2.414	0.314	568.710	5673.684	737.579
24	Huntington Ave - East of Longwood	17,940	0.25	4485.0	30	Composite	0.200	1.978	0.257	0.242	2.393	0.311	568.710	5623.282	731.027
25	private way - Riverway to Vining St	1,440	0.08	115.2	30	Composite	0.200	0.051	0.007	0.242	0.061	0.008	568.710	144.437	18.777
26	private way - South of Vining St	120	0.02	2.4	30	Composite	0.200	0.001	0.000	0.242	0.001	0.000	568.710	3.009	0.391
27	Fenwood Rd - Brookline to Binney	2,130	0.07	149.1	30	Composite	0.200	0.066	0.009	0.242	0.080	0.010	568.710	186.941	24.302
28	Fenwood Rd - Binney to Vining	2,930	0.05	146.5	30	Composite	0.200	0.065	0.008	0.242	0.078	0.010	568.710	183.681	23.879
29	Fenwood Rd - Vining to St. Albans	2,670	0.09	240.3	30	Composite	0.200	0.106	0.014	0.242	0.128	0.017	568.710	301.288	39.167
30	Fenwood Rd - St Albans to Huntington	670	0.07	46.9	30	Composite	0.200	0.021	0.003	0.242	0.025	0.003	568.710	58.803	7.644
31	Francis St - North of Brookline	2,740	0.06	164.4	30	Composite	0.200	0.072	0.009	0.242	0.088	0.011	568.710	206.124	26.796
32	Francis St - Brookline to Binney	8,300	0.07	581.0	30	Composite	0.200	0.256	0.033	0.242	0.310	0.040	568.710	728.456	94.699
33	Francis St - Binney to Vining	8,050	0.05	402.5	30	Composite	0.200	0.177	0.023	0.242	0.215	0.028	568.710	504.653	65.605
34	Francis St - Vining to St Albans	6,000	0.10	600.0	30	Composite	0.200	0.265	0.034	0.242	0.320	0.042	568.710	752.278	97.796
35	Francis St - St Albans to Huntington	6,700	0.08	536.0	30	Composite	0.200	0.236	0.031	0.242	0.286	0.037	568.710	672.035	87.365
36	Calumet St - South of Huntington	2,530	0.13	328.9	30	Composite	0.200	0.145	0.019	0.242	0.175	0.023	568.710	412.374	53.609
37	Tremont St - South of Huntington	8,570	0.20	1714.0	30	Composite	0.200	0.756	0.098	0.242	0.914	0.119	568.710	2149.009	279.371
38	Longwood Ave - North of Riverway	12,500	0.10	1250.0	30	Composite	0.200	0.551	0.072	0.242	0.667	0.087	568.710	1567.247	203.742
39	Longwood Ave - Riverway to Brookline	7,280	0.17	1237.6	30	Composite	0.200	0.546	0.071	0.242	0.660	0.086	568.710	1551.700	201.721
40	Longwood Ave - Brookline to Binney	11,040	0.08	883.2	30	Composite	0.200	0.389	0.051	0.242	0.471	0.061	568.710	1107.354	143.956
41	Longwood Ave - Binney to Huntington	10,230	0.34	3478.2	30	Composite	0.200	1.534	0.199	0.242	1.856	0.241	568.710	4360.958	566.925
42	Longwood Ave - South of Huntington	4,910	0.04	196.4	30	Composite	0.200	0.087	0.011	0.242	0.105	0.014	568.710	246.246	32.012
43	0	0	0.00	0.0	0	Composite	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
44	0	0	0.00	0.0	0	Composite	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
45	0	0	0.00	0.0	0	Composite	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
46	0	0	0.00	0.0	0	Composite	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
47	0	0	0.00	0.0	0	Composite	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
48	0	0	0.00	0.0	0	Composite	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
49	0	0	0.00	0.0	0	Composite	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
50	0	0	0.00	0.0	0	Composite	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Total	373790.000	4.650	55601.600				24.516	3.187		29.665	3.856		69713.146	9062.709

Notes: Daily to annual factor (5 days/week * 52 weeks per year / 365 days per year) = 71%

MA Mental Health Center

Mesoscale Analysis
2021 Build Case

	Link	Daily Average Volumes	Miles Per Link	Miles Traveled	Vehicle Speed (mph)	MOBILE6 vehicle class	MOBILE6 VOC (g/mile)	lbs/day	tons/year	MOBILE6 NOX (g/mile)	lbs/day	tons/year	MOBILE6 CO2 (g/mile)	lbs/day	tons/year
1	Riverway - Longwood to Brookline	19,680	0.29	5707.2	30	Composite	0.200	2.516	0.327	0.242	3.045	0.396	568.710	7155.673	930.237
2	Riverway - Brookline to Vining	25,510	0.05	1275.5	30	Composite	0.200	0.562	0.073	0.242	0.681	0.088	568.710	1599.219	207.898
3	Riverway - Vining Southward	26,780	0.25	6695.0	30	Composite	0.200	2.952	0.384	0.242	3.572	0.464	568.710	8394.174	1091.243
4	Brookline Ave - West of Riverway	13,410	0.25	3352.5	30	Composite	0.200	1.478	0.192	0.242	1.789	0.233	568.710	4203.356	546.436
5	Brookline Ave - Riverway to Fenwood	18,990	0.02	379.8	30	Composite	0.200	0.167	0.022	0.242	0.203	0.026	568.710	476.192	61.905
6	Brookline Ave - Fenwood to Francis	19,120	0.05	956.0	30	Composite	0.200	0.422	0.055	0.242	0.510	0.066	568.710	1198.630	155.822
7	Brookline Ave - Francis to Longwood	18,780	0.17	3192.6	30	Composite	0.200	1.408	0.183	0.242	1.703	0.221	568.710	4002.874	520.374
8	Brookline Ave - East of Longwood	21,210	0.25	5302.5	30	Composite	0.200	2.338	0.304	0.242	2.829	0.368	568.710	6648.261	864.274
9	Binney St - Fenwood to Francis	2,340	0.04	93.6	30	Composite	0.200	0.041	0.005	0.242	0.050	0.006	568.710	117.355	15.256
10	Binney St - Francis to Longwood	4,410	0.17	749.7	30	Composite	0.200	0.331	0.043	0.242	0.400	0.052	568.710	939.972	122.196
11	Binney St - East of Longwood	3,930	0.07	275.1	30	Composite	0.200	0.121	0.016	0.242	0.147	0.019	568.710	344.920	44.840
12	Vining St - private way to Mission Park Garage	5,710	0.01	57.1	30	Composite	0.200	0.025	0.003	0.242	0.030	0.004	568.710	71.592	9.307
13	Vining St - private way to Fenwood	7,320	0.04	292.8	30	Composite	0.200	0.129	0.017	0.242	0.156	0.020	568.710	367.112	47.725
14	Vining St - Fenwood to Francis	4,160	0.05	208.0	30	Composite	0.200	0.092	0.012	0.242	0.111	0.014	568.710	260.790	33.903
15	Vining St - Francis to Brigham Garage	1,250	0.01	12.5	30	Composite	0.200	0.006	0.001	0.242	0.007	0.001	568.710	15.672	2.037
16	St Albans St - South of Huntington (Mission St)	300	0.08	24.0	30	Composite	0.200	0.011	0.001	0.242	0.013	0.002	568.710	30.091	3.912
17	St Albans St - Huntington to Fenwood	2,960	0.09	266.4	30	Composite	0.200	0.117	0.015	0.242	0.142	0.018	568.710	334.012	43.422
18	St Albans St - Fenwood to Francis	1,810	0.05	90.5	30	Composite	0.200	0.040	0.005	0.242	0.048	0.006	568.710	113.469	14.751
19	St Albans St - Francis to Brigham Driveway	1,250	0.01	12.5	30	Composite	0.200	0.006	0.001	0.242	0.007	0.001	568.710	15.672	2.037
20	Huntington Ave - West of St Albans	17,080	0.25	4270.0	30	Composite	0.200	1.883	0.245	0.242	2.278	0.296	568.710	5353.715	695.983
21	Huntington Ave - St Albans to Fenwood	15,680	0.08	1254.4	30	Composite	0.200	0.553	0.072	0.242	0.669	0.087	568.710	1572.764	204.459
22	Huntington Ave - Fenwood to Francis/Tremont/Calumet	16,270	0.05	813.5	30	Composite	0.200	0.359	0.047	0.242	0.434	0.056	568.710	1019.964	132.595
23	Huntington Ave - Francis/Tremont/Calumet to Longwood	17,340	0.27	4681.8	30	Composite	0.200	2.064	0.268	0.242	2.498	0.325	568.710	5870.029	763.104
24	Huntington Ave - East of Longwood	18,630	0.25	4657.5	30	Composite	0.200	2.054	0.267	0.242	2.485	0.323	568.710	5839.562	759.143
25	private way - Riverway to Vining St	3,090	0.08	247.2	30	Composite	0.200	0.109	0.014	0.242	0.132	0.017	568.710	309.939	40.292
26	private way - South of Vining St	120	0.02	2.4	30	Composite	0.200	0.001	0.000	0.242	0.001	0.000	568.710	3.009	0.391
27	Fenwood Rd - Brookline to Binney	2,440	0.07	170.8	30	Composite	0.200	0.075	0.010	0.242	0.091	0.012	568.710	214.149	27.839
28	Fenwood Rd - Binney to Vining	3,600	0.05	180.0	30	Composite	0.200	0.079	0.010	0.242	0.096	0.012	568.710	225.684	29.339
29	Fenwood Rd - Vining to St. Albans	3,320	0.09	298.8	30	Composite	0.200	0.132	0.017	0.242	0.159	0.021	568.710	374.635	48.703
30	Fenwood Rd - St Albans to Huntington	780	0.07	54.6	30	Composite	0.200	0.024	0.003	0.242	0.029	0.004	568.710	68.457	8.899
31	Francis St - North of Brookline	2,950	0.06	177.0	30	Composite	0.200	0.078	0.010	0.242	0.094	0.012	568.710	221.922	28.850
32	Francis St - Brookline to Binney	9,310	0.07	651.7	30	Composite	0.200	0.287	0.037	0.242	0.348	0.045	568.710	817.100	106.223
33	Francis St - Binney to Vining	8,470	0.05	423.5	30	Composite	0.200	0.187	0.024	0.242	0.226	0.029	568.710	530.983	69.028
34	Francis St - Vining to St Albans	6,280	0.10	628.0	30	Composite	0.200	0.277	0.036	0.242	0.335	0.044	568.710	787.385	102.360
35	Francis St - St Albans to Huntington	7,200	0.08	576.0	30	Composite	0.200	0.254	0.033	0.242	0.307	0.040	568.710	722.187	93.884
36	Calumet St - South of Huntington	2,530	0.13	328.9	30	Composite	0.200	0.145	0.019	0.242	0.175	0.023	568.710	412.374	53.609
37	Tremont St - South of Huntington	8,600	0.20	1720.0	30	Composite	0.200	0.758	0.099	0.242	0.918	0.119	568.710	2156.532	280.349
38	Longwood Ave - North of Riverway	12,750	0.10	1275.0	30	Composite	0.200	0.562	0.073	0.242	0.680	0.088	568.710	1598.592	207.817
39	Longwood Ave - Riverway to Brookline	7,500	0.17	1275.0	30	Composite	0.200	0.562	0.073	0.242	0.680	0.088	568.710	1598.592	207.817
40	Longwood Ave - Brookline to Binney	11,210	0.08	896.8	30	Composite	0.200	0.395	0.051	0.242	0.478	0.062	568.710	1124.406	146.173
41	Longwood Ave - Binney to Huntington	10,340	0.34	3515.6	30	Composite	0.200	1.550	0.202	0.242	1.876	0.244	568.710	4407.850	573.021
42	Longwood Ave - South of Huntington	4,910	0.04	196.4	30	Composite	0.200	0.087	0.011	0.242	0.105	0.014	568.710	246.246	32.012
43	0	0	0.00	0.0	0	Composite	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
44	0	0	0.00	0.0	0	Composite	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
45	0	0	0.00	0.0	0	Composite	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
46	0	0	0.00	0.0	0	Composite	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
47	0	0	0.00	0.0	0	Composite	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
48	0	0	0.00	0.0	0	Composite	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
49	0	0	0.00	0.0	0	Composite	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
50	0	0	0.00	0.0	0	Composite	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Total	389320.000	4.650	57238.200				25.238	3.281		30.538	3.970		71765.111	9329.464

Notes: Daily to annual factor (5 days/week * 52 weeks per year / 365 days per year) = 71%

Intersection	2009 AM Peak LOS	2009 AM Peak Delay (Sec)	2009 AM Peak Traffic Volume	2009 PM Peak LOS	2009 PM Peak Delay (Sec)	2009 PM Peak Traffic Volume
Brookline @ Francis	E	55.4	2153	F	80.0	2075
Brookline @ Riverway	F	80.0	3357	F	80.0	3347
Vining @ Francis	C	33.7	872	B	19.6	793
Francis @ Huntington	F	80.0	2044	F	80.0	2268
Fenwood @ Huntington	A	0.1	1329	A	0.1	1505
St. Albans @ Huntington	B	10.7	1508	B	11.2	1656
Huntington @ Longwood	E	55.2	1908	E	69.3	2091
Binney @ Longwood	C	31.1	1255	C	34.5	1240
Brookline @ Longwood	F	80.0	2478	D	43.0	2290
Riverway @ Longwood	D	38.5	2416	F	80.0	2663
Fenwood @ Brookline (unsignalized)	A	4.4	1678	A	4.4	1648
Vining @ private way (unsignalized)	B	10.1	604	A	7.8	291
Binney @ Francis (unsignalized)	C	22.6	1058	C	22.1	965
Binney @ Fenwood (unsignalized)	A	5.5	421	A	5.1	253
Fenwood @ Vining (unsignalized)	B	11.5	776	A	9.2	497
St. Albans @ Francis (unsignalized)	C	23.7	664	B	12.6	662
St. Albans @ Fenwood (unsignalized)	B	9.5	340	B	8.3	314

LOS for unsignalized intersections were assumed
to be the simple average of all approaches.

	Mid-Term (2016) No-Build AM Peak			Mid-Term (2016) No-Build PM Peak			Mid-Term (2016) Phase 1 Build AM Peak				Mid-Term (2016) Phase 1 Build PM Peak			
Intersection	LOS	Delay (Sec)	Traffic Volume	LOS	Delay (Sec)	Traffic Volume	LOS	Delay (Sec)	Traffic Volume	No-Build to Build Volume % Increase	LOS	Delay (Sec)	Traffic Volume	No-Build to Build Volume % Increase
Brookline @ Francis	F	80.0	2344	F	80.0	2276	F	80.0	2359	1%	F	80.0	2298	1%
Brookline @ Riverway	F	80.0	3684	F	80.0	3690	F	80.0	3690	0%	F	80.0	3678	0%
Vining @ Francis	E	69.2	1055	B	17.7	831	F	80.0	928	-12%	B	18.4	833	0%
Francis @ Huntington	F	80.0	2151	F	80.0	2372	F	80.0	2166	1%	F	80.0	2379	0%
Fenwood @ Huntington	A	0.2	1413	A	0.1	1581	A	0.2	1417	0%	A	0.1	1581	0%
St. Albans @ Huntington	B	10.8	1591	B	11.6	1735	B	11.0	1595	0%	B	11.8	1741	0%
Huntington @ Longwood	D	41.6	2093	D	50.6	2254	D	41.5	2109	1%	D	51.2	2263	0%
Binney @ Longwood	C	34.5	1404	D	35.2	1373	C	34.0	1402	0%	D	35.0	1372	0%
Brookline @ Longwood	F	80.0	2792	E	77.8	2568	F	80.0	2801	0%	F	80.0	2577	0%
Riverway @ Longwood	D	47.8	2521	F	80.0	2777	D	48.5	2525	0%	F	80.0	2784	0%
Fenwood @ Brookline (unsignalized)	A	4.7	1863	A	4.6	1832	A	4.7	1869	0%	A	4.6	1842	1%
Vining @ private way (unsignalized)	A	10.1	600	A	7.7	257	A	10.5	644	7%	A	7.9	304	18%
Binney @ Francis (unsignalized)	C	22.7	1067	C	22.1	1017	C	22.8	1108	4%	C	22.1	1009	-1%
Binney @ Fenwood (unsignalized)	A	5.2	409	A	5.2	258	A	5.3	375	-8%	A	5.7	241	-7%
Fenwood @ Vining (unsignalized)	B	11.6	709	A	9.0	479	B	12.3	743	5%	A	9.3	515	8%
St. Albans @ Francis (unsignalized)	C	23.9	669	B	11.5	680	C	23.9	681	2%	B	11.7	689	1%
St. Albans @ Fenwood (unsignalized)	B	9.9	355	B	8.6	326	B	10.0	369	4%	B	8.7	337	3%

LOS for unsignalized intersections were assumed
to be the simple average of all approaches.

	(2021) No-Build AM Peak			(2021) No-Build PM Peak			(2021) Full Build AM Peak				(2021) Full Build PM Peak			
Intersection	LOS	Delay (Sec)	Traffic Volume	LOS	Delay (Sec)	Traffic Volume	LOS	Delay (Sec)	Traffic Volume	No-Build to Build Volume % Increase	LOS	Delay (Sec)	Traffic Volume	No-Build to Build Volume % Increase
Brookline @ Francis	F	80.0	2415	F	80.0	2339	F	80.0	2494	3%	F	80.0	2456	5%
Brookline @ Riverway	F	80.0	3775	F	80.0	3784	F	80.0	3829	1%	F	80.0	3844	2%
Vining @ Francis	F	80.0	980	B	17.2	869	F	80.0	1051	7%	C	22.1	953	10%
Francis @ Huntington	F	80.0	2423	F	80.0	2464	F	80.0	2319	-4%	F	80.0	2525	2%
Fenwood @ Huntington	A	0.2	1451	A	0.1	1624	A	0.2	1475	2%	A	0.1	1635	1%
St. Albans @ Huntington	B	11.7	1636	B	12.0	1780	B	11.9	1653	1%	B	12.9	1804	1%
Huntington @ Longwood	D	44.2	2169	E	56.3	2335	D	48.5	2254	4%	E	65.4	2404	3%
Binney @ Longwood	C	34.9	1431	D	35.7	1398	D	37.0	1454	2%	D	36.4	1427	2%
Brookline @ Longwood	F	80.0	2871	F	80.0	2633	F	80.0	2924	2%	F	80.0	2694	2%
Riverway @ Longwood	D	54.3	2586	F	80.0	2845	E	57.9	2608	1%	F	80.0	2890	2%
Fenwood @ Brookline (unsignalized)	A	4.8	1909	A	4.6	1877	A	5.0	1968	3%	A	4.8	1952	4%
Vining @ private way (unsignalized)	B	10.3	614	A	7.7	263	B	12.9	812	32%	A	9.1	476	81%
Binney @ Francis (unsignalized)	C	22.8	1152	C	22.1	1041	C	22.8	1234	7%	C	22.2	1156	11%
Binney @ Fenwood (unsignalized)	A	5.3	369	A	5.9	231	A	5.6	436	18%	A	5.6	305	32%
Fenwood @ Vining (unsignalized)	B	12.0	718	A	9.0	481	C	19.5	915	27%	B	11.4	690	43%
St. Albans @ Francis (unsignalized)	C	24.1	731	B	13.5	750	C	24.1	792	8%	B	14.9	800	7%
St. Albans @ Fenwood (unsignalized)	B	10.0	362	B	8.6	334	B	11.3	427	18%	B	9.4	391	17%

LOS for unsignalized intersections were assumed
to be the simple average of all approaches.

K Factor	10%	factors peak hour vehicle volumes to daily volumes
Peak hr delay to daily Factor (8hr/day)	33%	Factors peak hour delay to daily delay
Daily delay to annual Factor (5 days/wk, 52 wk/yr)	71%	factors peak daily delay to annual delay

Intersection	Average Delay time (s)	Traffic Volume (adt)	Idle MOBILE6 VOC (g/hr)	VOC (lb/day)	VOC (tpy)	Idle MOBILE6 NOX (g/hr)	NOX (lb/day)	NOX (tpy)	Idle MOBILE6 CO2 (g/hr)	CO2 (lb/day)	CO2 (tpy)
Brookline @ Francis	67.70	21530	8.115	2.41	0.31	5.828	1.73	0.225	1391.625	414.06	53.828
Brookline @ Riverway	80.00	33570	8.115	4.45	0.58	5.828	3.19	0.415	1391.625	762.92	99.179
Vining @ Francis	26.65	8720	8.115	0.38	0.05	5.828	0.28	0.036	1391.625	66.02	8.582
Francis @ Huntington	80.00	22680	8.115	3.01	0.39	5.828	2.16	0.281	1391.625	515.43	67.006
Fenwood @ Huntington	0.10	15050	8.115	0.00	0.00	5.828	0.00	0.000	1391.625	0.43	0.056
St. Albans @ Huntington	10.95	16560	8.115	0.30	0.04	5.828	0.22	0.028	1391.625	51.51	6.697
Huntington @ Longwood	62.25	20910	8.115	2.16	0.28	5.828	1.55	0.201	1391.625	369.77	48.070
Binney @ Longwood	32.80	12550	8.115	0.68	0.09	5.828	0.49	0.064	1391.625	116.94	15.202
Brookline @ Longwood	61.50	24780	8.115	2.52	0.33	5.828	1.81	0.236	1391.625	432.92	56.280
Riverway @ Longwood	59.25	26630	8.115	2.61	0.34	5.828	1.88	0.244	1391.625	448.22	58.269
Fenwood @ Brookline (unsignalized)	4.40	16780	8.115	0.12	0.02	5.828	0.09	0.011	1391.625	20.97	2.727
Vining @ private way (unsignalized)	8.95	6040	8.115	0.09	0.01	5.828	0.06	0.008	1391.625	15.36	1.996
Binney @ Francis (unsignalized)	22.38	10580	8.115	0.39	0.05	5.828	0.28	0.037	1391.625	67.26	8.744
Binney @ Fenwood (unsignalized)	5.28	4210	8.115	0.04	0.00	5.828	0.03	0.003	1391.625	6.32	0.821
Fenwood @ Vining (unsignalized)	10.34	7760	8.115	0.13	0.02	5.828	0.10	0.012	1391.625	22.79	2.962
St. Albans @ Francis (unsignalized)	18.18	6640	8.115	0.20	0.03	5.828	0.14	0.019	1391.625	34.29	4.458
St. Albans @ Fenwood (unsignalized)	8.93	3400	8.115	0.05	0.01	5.828	0.04	0.005	1391.625	8.62	1.121
Totals	hrs	1093.156		19.56	2.54		14.04	1.83		3353.83	436.00

K Factor	10%	factors peak hour vehicle volumes to daily volumes
Peak hr delay to daily Factor (8hr/day)	33%	Factors peak hour delay to daily delay
Daily delay to annual Factor (5 days/wk, 52 wk/yr)	71%	factors peak daily delay to annual delay

Intersection	Average Delay time (s)	Traffic Volume (adt)	Idle MOBILE6 VOC (g/hr)	VOC (lb/day)	VOC (tpy)	Idle MOBILE6 NOX (g/hr)	NOX (lb/day)	NOX (tpy)	Idle MOBILE6 CO2 (g/hr)	CO2 (lb/day)	CO2 (tpy)
Brookline @ Francis	80.00	23440	4.12	1.58	0.21	1.850	0.71	0.092	1414.950	541.63	70.412
Brookline @ Riverway	80.00	36900	4.12	2.48	0.32	1.850	1.11	0.145	1414.950	852.65	110.844
Vining @ Francis	43.45	10550	4.12	0.39	0.05	1.850	0.17	0.023	1414.950	132.40	17.212
Francis @ Huntington	80.00	23720	4.12	1.60	0.21	1.850	0.72	0.093	1414.950	548.10	71.253
Fenwood @ Huntington	0.15	15810	4.12	0.00	0.00	1.850	0.00	0.000	1414.950	0.68	0.089
St. Albans @ Huntington	11.20	17350	4.12	0.16	0.02	1.850	0.07	0.010	1414.950	56.13	7.297
Huntington @ Longwood	46.10	22540	4.12	0.87	0.11	1.850	0.39	0.051	1414.950	300.13	39.017
Binney @ Longwood	34.85	14040	4.12	0.41	0.05	1.850	0.18	0.024	1414.950	141.33	18.372
Brookline @ Longwood	78.90	27920	4.12	1.85	0.24	1.850	0.83	0.108	1414.950	636.28	82.716
Riverway @ Longwood	63.90	27770	4.12	1.49	0.19	1.850	0.67	0.087	1414.950	512.54	66.631
Fenwood @ Brookline (unsignalized)	4.65	18630	4.12	0.07	0.01	1.850	0.03	0.004	1414.950	25.02	3.253
Vining @ private way (unsignalized)	8.89	6000	4.12	0.04	0.01	1.850	0.02	0.003	1414.950	15.40	2.002
Binney @ Francis (unsignalized)	22.43	10670	4.12	0.20	0.03	1.850	0.09	0.012	1414.950	69.13	8.987
Binney @ Fenwood (unsignalized)	5.20	4090	4.12	0.02	0.00	1.850	0.01	0.001	1414.950	6.14	0.799
Fenwood @ Vining (unsignalized)	10.33	7090	4.12	0.06	0.01	1.850	0.03	0.004	1414.950	21.14	2.749
St. Albans @ Francis (unsignalized)	17.70	6800	4.12	0.10	0.01	1.850	0.05	0.006	1414.950	34.76	4.519
St. Albans @ Fenwood (unsignalized)	9.20	3550	4.12	0.03	0.00	1.850	0.01	0.002	1414.950	9.43	1.226
Totals	hrs	1251.152		11.36	1.48		5.10	0.66		3902.90	507.38

MidTerm (2016) Build

K Factor	10%	factors peak hour vehicle volumes to daily volumes
Peak hr delay to daily Factor (8hr/day)	33%	Factors peak hour delay to daily delay
Daily delay to annual Factor (5 days/wk, 52 wk/yr)	71%	factors peak daily delay to annual delay

Intersection	Average Delay time (s)	Traffic Volume (adt)	Idle MOBILE6 VOC (g/hr)	VOC (lb/day)	VOC (tpy)	Idle MOBILE6 NOX (g/hr)	NOX (lb/day)	NOX (tpy)	Idle MOBILE6 CO2 (g/hr)	CO2 (lb/day)	CO2 (tpy)
Brookline @ Francis	80.00	23590	4.12	1.59	0.21	1.850	0.71	0.093	1414.950	545.09	70.862
Brookline @ Riverway	80.00	36900	4.12	2.48	0.32	1.850	1.11	0.145	1414.950	852.65	110.844
Vining @ Francis	49.20	9280	4.12	0.38	0.05	1.850	0.17	0.022	1414.950	131.88	17.144
Francis @ Huntington	80.00	23790	4.12	1.60	0.21	1.850	0.72	0.093	1414.950	549.72	71.463
Fenwood @ Huntington	0.15	15810	4.12	0.00	0.00	1.850	0.00	0.000	1414.950	0.68	0.089
St. Albans @ Huntington	11.40	17410	4.12	0.17	0.02	1.850	0.07	0.010	1414.950	57.33	7.452
Huntington @ Longwood	46.35	22630	4.12	0.88	0.11	1.850	0.40	0.051	1414.950	302.96	39.385
Binney @ Longwood	34.50	14020	4.12	0.41	0.05	1.850	0.18	0.024	1414.950	139.71	18.162
Brookline @ Longwood	80.00	28010	4.12	1.88	0.24	1.850	0.85	0.110	1414.950	647.23	84.140
Riverway @ Longwood	64.25	27840	4.12	1.50	0.20	1.850	0.68	0.088	1414.950	516.65	67.164
Fenwood @ Brookline (unsignalized)	4.67	18690	4.12	0.07	0.01	1.850	0.03	0.004	1414.950	25.19	3.275
Vining @ private way (unsignalized)	9.20	6440	4.12	0.05	0.01	1.850	0.02	0.003	1414.950	17.11	2.225
Binney @ Francis (unsignalized)	22.48	11080	4.12	0.21	0.03	1.850	0.09	0.012	1414.950	71.94	9.353
Binney @ Fenwood (unsignalized)	5.53	3750	4.12	0.02	0.00	1.850	0.01	0.001	1414.950	5.99	0.779
Fenwood @ Vining (unsignalized)	10.79	7430	4.12	0.07	0.01	1.850	0.03	0.004	1414.950	23.15	3.010
St. Albans @ Francis (unsignalized)	17.76	6890	4.12	0.10	0.01	1.850	0.05	0.006	1414.950	35.34	4.595
St. Albans @ Fenwood (unsignalized)	9.31	3690	4.12	0.03	0.00	1.850	0.01	0.002	1414.950	9.93	1.290
Totals	hrs	1260.658		11.45	1.49		5.14	0.67		3932.56	511.23

Future (2021) No Build

K Factor 10% factors peak hour vehicle volumes to daily volumes
Peak hr delay to daily Factor (8hr/day) 33% Factors peak hour delay to daily delay
Daily delay to annual Factor (5 days/wk, 52 wk/yr) 71% factors peak daily delay to annual delay

Intersection	Average Delay time (s)	Traffic Volume (adt)	Idle MOBILE6 VOC (g/hr)	VOC (lb/day)	VOC (tpy)	Idle MOBILE6 NOX (g/hr)	NOX (lb/day)	NOX (tpy)	Idle MOBILE6 CO2 (g/hr)	CO2 (lb/day)	CO2 (tpy)
Brookline @ Francis	80.00	24150	3.625	1.43	0.19	1.130	0.45	0.058	1423.425	561.38	72.979
Brookline @ Riverway	80.00	37840	3.625	2.24	0.29	1.130	0.70	0.091	1423.425	879.61	114.349
Vining @ Francis	48.60	9800	3.625	0.35	0.05	1.130	0.11	0.014	1423.425	138.39	17.991
Francis @ Huntington	80.00	24640	3.625	1.46	0.19	1.130	0.45	0.059	1423.425	572.77	74.460
Fenwood @ Huntington	0.15	16240	3.625	0.00	0.00	1.130	0.00	0.000	1423.425	0.71	0.092
St. Albans @ Huntington	11.85	17800	3.625	0.16	0.02	1.130	0.05	0.006	1423.425	61.29	7.968
Huntington @ Longwood	50.25	23350	3.625	0.87	0.11	1.130	0.27	0.035	1423.425	340.93	44.321
Binney @ Longwood	35.30	14310	3.625	0.37	0.05	1.130	0.12	0.015	1423.425	146.78	19.081
Brookline @ Longwood	80.00	28710	3.625	1.70	0.22	1.130	0.53	0.069	1423.425	667.38	86.759
Riverway @ Longwood	67.15	28450	3.625	1.41	0.18	1.130	0.44	0.057	1423.425	555.11	72.164
Fenwood @ Brookline (unsignalized)	4.73	19090	3.625	0.07	0.01	1.130	0.02	0.003	1423.425	26.26	3.413
Vining @ private way (unsignalized)	9.00	6140	3.625	0.04	0.01	1.130	0.01	0.002	1423.425	16.06	2.087
Binney @ Francis (unsignalized)	22.46	11520	3.625	0.19	0.02	1.130	0.06	0.008	1423.425	75.18	9.774
Binney @ Fenwood (unsignalized)	5.60	3690	3.625	0.02	0.00	1.130	0.00	0.001	1423.425	6.00	0.781
Fenwood @ Vining (unsignalized)	10.51	7180	3.625	0.06	0.01	1.130	0.02	0.002	1423.425	21.93	2.851
St. Albans @ Francis (unsignalized)	18.79	7500	3.625	0.10	0.01	1.130	0.03	0.004	1423.425	40.95	5.323
St. Albans @ Fenwood (unsignalized)	9.28	3620	3.625	0.02	0.00	1.130	0.01	0.001	1423.425	9.76	1.268
Totals	hrs	1313.032		10.49	1.36		3.27	0.43		4120.47	535.66

Future (2021) Build

K Factor	10%	factors peak hour vehicle volumes to daily volumes
Peak hr delay to daily Factor (8hr/day)	33%	Factors peak hour delay to daily delay
Daily delay to annual Factor (5 days/wk, 52 wk/yr)	71%	factors peak daily delay to annual delay

Intersection	Average Delay time (s)	Traffic Volume (adt)	Idle MOBILE6 VOC (g/hr)	VOC (lb/day)	VOC (tpy)	Idle MOBILE6 NOX (g/hr)	NOX (lb/day)	NOX (tpy)	Idle MOBILE6 CO2 (g/hr)	CO2 (lb/day)	CO2 (tpy)
Brookline @ Francis	80.00	24940	3.625	1.48	0.19	1.130	0.46	0.060	1423.425	579.74	75.366
Brookline @ Riverway	80.00	38440	3.625	2.28	0.30	1.130	0.71	0.092	1423.425	893.55	116.162
Vining @ Francis	51.05	10510	3.625	0.40	0.05	1.130	0.12	0.016	1423.425	155.90	20.267
Francis @ Huntington	80.00	25250	3.625	1.49	0.19	1.130	0.47	0.061	1423.425	586.95	76.303
Fenwood @ Huntington	0.15	16350	3.625	0.00	0.00	1.130	0.00	0.000	1423.425	0.71	0.093
St. Albans @ Huntington	12.40	18040	3.625	0.17	0.02	1.130	0.05	0.007	1423.425	65.00	8.450
Huntington @ Longwood	56.95	24040	3.625	1.01	0.13	1.130	0.32	0.041	1423.425	397.81	51.715
Binney @ Longwood	36.70	14540	3.625	0.39	0.05	1.130	0.12	0.016	1423.425	155.05	20.157
Brookline @ Longwood	80.00	29240	3.625	1.73	0.23	1.130	0.54	0.070	1423.425	679.70	88.360
Riverway @ Longwood	68.95	28900	3.625	1.47	0.19	1.130	0.46	0.060	1423.425	579.00	75.270
Fenwood @ Brookline (unsignalized)	4.90	19680	3.625	0.07	0.01	1.130	0.02	0.003	1423.425	28.02	3.643
Vining @ private way (unsignalized)	10.96	8120	3.625	0.07	0.01	1.130	0.02	0.003	1423.425	25.87	3.362
Binney @ Francis (unsignalized)	22.53	12340	3.625	0.21	0.03	1.130	0.06	0.008	1423.425	80.78	10.502
Binney @ Fenwood (unsignalized)	5.62	4360	3.625	0.02	0.00	1.130	0.01	0.001	1423.425	7.12	0.925
Fenwood @ Vining (unsignalized)	15.43	9150	3.625	0.10	0.01	1.130	0.03	0.004	1423.425	41.01	5.331
St. Albans @ Francis (unsignalized)	19.50	8000	3.625	0.12	0.02	1.130	0.04	0.005	1423.425	45.33	5.893
St. Albans @ Fenwood (unsignalized)	10.36	4270	3.625	0.03	0.00	1.130	0.01	0.001	1423.425	12.86	1.671
Totals	hrs	1381.202		11.04	1.43		3.44	0.45		4334.39	563.47

MMHC - Calculation of Microscale Modeling Emission Rates
Summary of MOBILE6.2 Output

Carbon Monoxide Only

Queues	Idle
Free Flow	30 mph
Right Turns	10 mph
Left Turns	15 mph

Summer	**2009**	**2016**	**2021**	**Units**
Idle	38.4875	28.0525	25.16	g/hr
2.5 mph	15.395	11.221	10.064	g/mile
10 mph	6.748	5.073	4.556	g/mile
15 mph	5.727	4.268	3.846	g/mile
30 mph	4.755	3.48	3.114	g/mile

Winter	**2009**	**2016**	**2021**	**Units**
Idle	87.7775	44.38	46.1325	g/hr
2.5 mph	35.111	17.752	18.453	g/mile
10 mph	17.5	9.677	10.356	g/mile
15 mph	15.504	8.711	9.406	g/mile
30 mph	13.601	7.786	8.508	g/mile

Due to excessive size AERMOD, CAL3QHC, and MOBILE6.2 input and output files are available on digital media upon request.

Appendix F

LEED Checklists and Narratives

LEED Checklist

Partial Hospital/Fenwood Inn

APPENDIX F LEED CHECKLISTS AND NARRATIVES

F.1 Partial Hospital / Fenwood Inn

The Project team will prioritize the following credits from the LEED building rating system in order to achieve a level Certifiable for the Partial Hospital / Fenwood Inn. Each credit will be evaluated by the Project team on an on-going basis through the design and construction phases of the Project.

Sustainable Sites (SS)

SS P1 Construction Activity Pollution Prevention - An erosion and sedimentation control plan for all construction activities will be created and implemented that will employ strategies such as temporary and permanent seeding, mulching, silt fencing, sediment traps and sediment basins.

SS C1 Site Selection - The location of the Partial Hospital/Fenwood Inn avoids development of an environmentally sensitive site and reduces environmental impacts by using a previously developed urban site.

SS C2 Development Density & Community Connectivity - The site of the Partial Hospital/Fenwood Inn is located on a previously developed site in an existing urban area that meets the density requirements of Option 1 requiring a minimum density of 60,000 sf per acre net.

SS C4.1 Alternative Transportation, Public Transportation Access - The location of the Partial Hospital/Fenwood Inn leverages the local public transportation access and meets requirements for this credit to be within a 1/2 mile of an existing subway stop.

SS C4.2 Alternative Transportation, Bicycle Storage & Changing Rooms - The design of the Partial Hospital/Fenwood Inn intends to include secure bike racks or storage within 200 yards of the building entrance for at least 5% of the building users, and provide shower and changing facilities for 0.5% of the full-time equivalent (FTE) occupants in the building.

SS C6.1 Stormwater Design—Quantity Control - The Partial Hospital / Fenwood Inn design intends to satisfy this credit through Option 2 by reducing the existing rate and quantity of stormwater discharge by at least 25%.

SS C6.2 Stormwater Design—Quality Control – The Partial Hospital / Fenwood Inn design will include a stormwater management plan to capture and treat the stormwater runoff from 90% of the average annual rainfall.

SS C7.1 Heat Island Effect, Non-Roof – The Partial Hospital / Fenwood Inn design intends to satisfy this credit through Option 1 by creating a site plan that combines materials of SRI > 29, shade, and/or open-grid pavers for at least 50% of site hardscape.

Water Efficiency (WE)

WE C1.1 & WE C1.2 Water Efficient Landscaping, No Potable Use or No Irrigation - The Partial Hospital / Fenwood Inn design intends to eliminate the use of potable water, or other natural surface or subsurface water resources, for landscape irrigation.

WE C3.1 Water Use Reduction by 20% - The Partial Hospital / Fenwood Inn design will incorporate low flow fixtures.

Energy & Atmosphere (EA)

EA P1 Fundamental Commissioning of the Building Energy Systems - The Partial Hospital / Fenwood Inn design intends to follow the requirements for fundamental commissioning as described by this prerequisite.

EA P2 Minimum Energy Performance - The Partial Hospital / Fenwood Inn design intends to establish a minimum level of energy performance by complying with the specified provisions of ASHRAE/IESNA Standard 90.1-2004 and will be demonstrated by the computer simulation model used for EA Credit 1.

EA P3 Fundamental Refrigerant Management - The Partial Hospital / Fenwood Inn will use zero CFC-based refrigerants in the new base building HVAC&R systems.

EA C1 Optimize Energy Performance - The Partial Hospital / Fenwood Inn design intends to optimize energy performance by conducting whole building energy simulations, Option 1, and improve the buildings performance by at least 21% over the baseline building performance rating.

EA C3 Enhanced Commissioning - It is the intent of the Proponent to implement the additional commissioning activities as outlined in this credit.

Materials & Resources (MR)

MR P1 Storage & Collection of Recyclables - The Partial Hospital / Fenwood Inn design intends to provide an easily accessible area that serves the entire building and is dedicated to the collection and storage of non-hazardous materials for recycling, including paper, corrugated cardboard, glass, plastics and metals, at a minimum.

MR C2.1 Construction Waste Management, Divert 50% from Disposal - The Proponent intends to recycle and/or salvage at least 50% of non-hazardous construction and demolition debris through the implementation of a construction waste management plan.

MR C2.2 Construction Waste Management—75% Recycled or Salvaged - The Proponent intends to recycle and/or salvage an additional 25% beyond MR C2.1 (75% total) of non-hazardous construction and demolition debris through the implementation of a construction waste management plan.

MRC4.1 Recycled Content, 10% (post-consumer + 1/2 pre-consumer) - The Proponent intends to document the recycled content of all building materials and maintain or exceed the required recycled content for this credit. This credit will generally be achieved through the use of recycled structural steel.

MR C7 Certified Wood - The Proponent intends to use a minimum of 50% of wood-based materials and products that are FSC-certified.

Indoor Environmental Quality (EQ)

EQ P1 Minimum IAQ Performance - The *Proponent* intends to design the ventilation systems to meet the minimum outdoor air ventilation rates specified by this credit.

EQ P2 Environmental Tobacco Smoke (ETS) Control - The Proponent intends to minimize exposure to ETS through Option 1, to prohibit smoking in the building and locate any exterior designated smoking areas at least 25 feet from entries, air intakes, and operable windows.

EQ C3.1 Construction IAQ Management Plan, During Construction - The Proponent intends to develop and implement an IAQ Management Plan for the construction phase of the building as follows: during construction meet or exceed the recommended control measures, protect stored on-site or installed absorptive materials from moisture damage, and if permanently installed air handlers are used during construction, filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 shall be used at each return air grille and replaced immediately prior to occupancy.

EQ C4.1 Low-Emitting Materials, Adhesives & Sealants - It is the intent of the Proponent that all interior adhesives and sealants will meet the requirements of their respective reference standard listed under this credit for Volatile Organic Compound (VOC) limit.

EQ C4.2 Low-Emitting Materials, Paints & Coatings - It is the intent of the Proponent that all interior paints and coatings will meet the VOC limits indicated by the reference standards listed under this credit.

EQ C4.3 Low-Emitting Materials, Carpet Systems - It is the intent of the Proponent that all carpet systems will be selected to meet the requirements of the reference standards listed under this credit.

EQ C4.4 Low-Emitting Materials, Composite Wood & Agrifiber Products - It is the intent of the Proponent that all composite wood and agrifiber products and other materials listed under this credit that are used in the interior of the building will contain no added urea-formaldehyde resins.

EQ C5 Indoor Chemical & Pollutant Source Control - The Proponent intends to minimize building occupant exposure to potentially hazardous particulates and chemical pollutants by designing pollutant control measures at building entries and ventilating regularly occupied spaces as required by the credit.

EQ C6.1 Controllability of Systems, Lighting - The design intends to provide a high level of lighting system control by integrating lighting systems controllability into the overall lighting design while managing the overall energy use of the building. This includes both schemes for individual lighting controls and controllability of multi-occupant spaces to allow adjustments to be made to meet group needs and preferences.

EQ C8.2 Daylight & Views, Views for 90% of Spaces - The Proponent intends to design the spaces and locate vision glazing to provide a direct line of sight to the outdoor environment for 90% of the regularly occupied spaces.

Innovation & Design Process (ID)

ID C1.1 innovation in Design: Implement Green Building Education and/or Education Outreach program – The strategy to achieve this credit is still being studied.

ID C1.2 Innovation in Design: Exemplary Commuter Choice - The building location along with a transportation management plan may demonstrate a quantifiable reduction in personal automobile use through multiple alternative options.

ID C1.3 Innovation in Design: Exemplary Development Density – The strategy to achieve this credit is still being studied.

ID C2 LEED® Accredited Professional - It is the intent of the Proponent to maintain a LEED Accredited Professional as an active participant in the project to assist in integrating the requirements of LEED and streamlining the application and certification process.

Mass Mental Health Center Redevelopment

Fenwood Inn/Partial Hospital

Issued for DEIR/DPIR
9/25/2009

LEED-NC Proiect Checklist for *LEED CERTIFIED*

Boston, MA

Yes	?	No			
7		7	**Sustainable Sites**		**14** Points
Y			Prereq 1	**Construction Activity Pollution Prevention**	Required
1			Credit 1	**Site Selection**	1
1			Credit 2	**Development Density & Community Connectivity**	1
		1	Credit 3	**Brownfield Redevelopment**	1
1			Credit 4.1	**Alternative Transportation**, Public Transportation Access	1
1			Credit 4.2	**Alternative Transportation**, Bicycle Storage & Changing Rooms	1
		1	Credit 4.3	**Alternative Transportation**, Low-Emitting and Fuel-Efficient Vehicles	1
		1	Credit 4.4	**Alternative Transportation**, Parking Capacity	1
		1	Credit 5.1	**Site Development,** Protect of Restore Habitat	1
		1	Credit 5.2	**Site Development,** Maximize Open Space	1
1			Credit 6.1	**Stormwater Design,** Quantity Control	1
1			Credit 6.2	**Stormwater Design,** Quality Control	1
1			Credit 7.1	**Heat Island Effect,** Non-Roof	1
		1	Credit 7.2	**Heat Island Effect,** Roof	1
		1	Credit 8	**Light Pollution Reduction**	1

Yes	?	No			
3		2	**Water Efficiency**		**5** Points
1			Credit 1.1	**Water Efficient Landscaping**, Reduce by 50%	1
1			Credit 1.2	**Water Efficient Landscaping**, No Potable Use or No Irrigation	1
		1	Credit 2	**Innovative Wastewater Technologies**	1
1			Credit 3.1	**Water Use Reduction**, 20% Reduction	1
		1	Credit 3.2	**Water Use Reduction**, 30% Reduction	1

Yes	?	No			
4		13	**Energy & Atmosphere**		**17** Points
Y			Prereq 1	**Fundamental Commissioning of the Building Energy Systems**	Required
Y			Prereq 2	**Minimum Energy Performance**	Required
Y			Prereq 3	**Fundamental Refrigerant Management**	Required
3		7	Credit 1	**Optimize Energy Performance**	1 to 10
		3	Credit 2	**On-Site Renewable Energy**	1 to 3
1			Credit 3	**Enhanced Commissioning**	1
		1	Credit 4	**Enhanced Refrigerant Management**	1
		1	Credit 5	**Measurement & Verification**	1
		1	Credit 6	**Green Power**	1

Yes	?	No			
4		9	**Materials & Resources**		**13** Points
Y			Prereq 1	**Storage & Collection of Recyclables**	Required
		1	Credit 1.1	**Building Reuse**, Maintain 75% of Existing Walls, Floors & Roof	1
		1	Credit 1.2	**Building Reuse**, Maintain 100% of Existing Walls, Floors & Roof	1
		1	Credit 1.3	**Building Reuse**, Maintain 50% of Interior Non-Structural Elements	1
1			Credit 2.1	**Construction Waste Management**, Divert 50% from Disposal	1
1			Credit 2.2	**Construction Waste Management**, Divert 75% from Disposal	1
		1	Credit 3.1	**Materials Reuse**, 5%	1
		1	Credit 3.2	**Materials Reuse**,10%	1
1			Credit 4.1	**Recycled Content**, 10% (post-consumer + ½ pre-consumer)	1
		1	Credit 4.2	**Recycled Content**, 20% (post-consumer + ½ pre-consumer)	1
		1	Credit 5.1	**Regional Materials**, 10% Extracted, Processed & Manufactured Region	1
		1	Credit 5.2	**Regional Materials**, 20% Extracted, Processed & Manufactured Region	1
		1	Credit 6	**Rapidly Renewable Materials**	1
1			Credit 7	**Certified Wood**	1

Yes	?	No			
8		7	**Indoor Environmental Quality**		**15** Points
Y			Prereq 1	**Minimum IAQ Performance**	Required
Y			Prereq 2	**Environmental Tobacco Smoke** (ETS) **Control**	Required
		1	Credit 1	**Outdoor Air Delivery Monitoring**	1
		1	Credit 2	**Increased Ventilation**	1
1			Credit 3.1	**Construction IAQ Management Plan**, During Construction	1
		1	Credit 3.2	**Construction IAQ Management Plan**, Before Occupancy	1
1			Credit 4.1	**Low-Emitting Materials**, Adhesives & Sealants	1
1			Credit 4.2	**Low-Emitting Materials**, Paints & Coatings	1
1			Credit 4.3	**Low-Emitting Materials**, Carpet Systems	1
1			Credit 4.4	**Low-Emitting Materials**, Composite Wood & Agrifiber Products	1
1			Credit 5	**Indoor Chemical & Pollutant Source Control**	1
1			Credit 6.1	**Controllability of Systems**, Lighting	1
		1	Credit 6.2	**Controllability of Systems**, Thermal Comfort	1
		1	Credit 7.1	**Thermal Comfort**, Design	1
		1	Credit 7.2	**Thermal Comfort**, Verification	1
		1	Credit 8.1	**Daylight & Views**, Daylight 75% of Spaces	1
1			Credit 8.2	**Daylight & Views**, Views for 90% of Spaces	1

Yes	?	No			
4		1	**Innovation & Design Process**		**5** Points
1			Credit 1.1	**Innovation in Design**: Green Bldg Education/Education Outreach	1
1			Credit 1.2	**Innovation in Design**: Exemplary Commuter Choice	1
1			Credit 1.3	**Innovation in Design**: Exemplary Development Density	1
		1	Credit 1.4	**Innovation in Design**: TBD	1
1			Credit 2	**LEED® Accredited Professional**	1

Yes	?	No		
30		39	**Project Totals** **(pre-certification estimates)**	**69** Points

Certified 26-32 points **Silver** 33-38 points **Gold** 39-51 points **Platinum** 52-69 points

LEED Checklist

Binney Street Building

F.2 Binney Street Building

The Project team will prioritize the following credits from the LEED building rating system in order to be LEED Silver Certified for the Binney Street Building. Each credit will be evaluated by the Project team on an on-going basis through all of the design and construction phases of the Project.

Sustainable Sites (SS)

SS P1 Construction Activity Pollution Prevention - An erosion and sedimentation control plan for all construction activities will be created and implemented that will employ strategies such as temporary and permanent seeding, mulching, silt fencing, sediment traps and sediment basins.

SS C1 Site Selection - The building's location avoids development of an environmentally sensitive site and causing increased environmental impact by utilizing a previously developed urban site.

SS C2 Development Density & Community Connectivity - The building is located on a previously developed site in an existing urban area that meets the density requirements of Option 1 requiring a minimum density of 60,000 sf per acre net.

SS C4.1 Alternative Transportation, Public Transportation Access - The building location utilizes the required public transportation access requirements for this credit by being within 1/2 mile of an existing subway stop.

SS C4.2 Alternative Transportation, Bicycle Storage & Changing Rooms - The design intends to include secure bike racks or storage for at least 5% of the building users and provide shower and changing facilities for 0.5% of the full-time equivalent occupants in the building.

SS C6.1 Stormwater Design, Quantity Control - The design intends to satisfy this credit through Option 2 by reducing the existing rate and quantity of stormwater discharge by at least 25%.

SS C6.2 Stormwater Design, Quality Control - The design intends to implement a stormwater management plan that identifies strategies to capture and treat the stormwater runoff from 90% of the average annual rainfall.

SS C7.1 Heat Island Effect, Non-Roof - The design intends to meet this credit through Option 1 creating a site plan that combines materials of SRI>29, shade, and/or open-grid pavers for at least 50% of the site's hardscape.

SS C7.2 Heat Island Effect, Roof – The design intends to meet this credit through Option 3 by installing a combination of high albedo roof surfaces, such as white PVC roofing, and vegetated roof surfaces.

Water Efficiency (WE)

WE C1.1 & WE C1.2 Water Efficient Landscaping, No Potable Use or No Irrigation - The Binney Street Building's design intends to eliminate the use of potable water, or other natural surface or subsurface water resources, for landscape irrigation.

WE C3.1 Water Use Reduction by 20% - The design intends to include low flow fixtures to reduce water use.

Energy & Atmosphere (EA)

EA P1 Fundamental Commissioning of the Building Energy Systems - The Proponent intends to follow the requirements for fundamental commissioning as described by this prerequisite.

EA P2 Minimum Energy Performance - The Proponent intends to establish a minimum level of energy performance by complying with the specified provisions of ASHRAE/IESNA Standard 90.1-2004 and will be demonstrated by the computer simulation model used for EA C1.

EA P3 Fundamental Refrigerant Management - It is the intent of the design to use zero CFC-based refrigerants in the new base building HVAC&R systems.

EA C1 Optimize Energy Performance - The design intends to optimize energy performance by conducting whole building energy simulations, Option 1, and improve the buildings performance by at least 21% over the baseline building performance rating.

EA C3 Enhanced Commissioning - It is the intent of the Proponent to implement the additional commissioning activities as outlined in this credit.

EA C4 Enhanced Refrigerant Management - The design of the base building HVAC&R equipment intends to minimize the emission of compounds that contribute to ozone depletion and global warming as stated by this credit.

Materials & Resources (MR)

MR P1 Storage & Collection of Recyclables - The design intends to provide an easily accessible area that serves the entire building and is dedicated to the collection and storage of non-hazardous materials for recycling, including paper, corrugated cardboard, plastics and metals at a minimum.

MR C2.1 Construction Waste Management, Divert 50% from Disposal - The Proponent intends to recycle and/or salvage at least 50% of non-hazardous construction and demolition debris through the implementation of a construction waste management plan.

MR C2.2 Construction Waste Management, Divert 75% from Disposal - The Proponent intends to recycle and/or salvage an additional 25% beyond MR C2.1 (75% total) of non-hazardous construction and demolition debris through the implementation of a construction waste management plan.

MR C4.1 Recycled Content, 10% (post-consumer + ½ pre-consumer) - The Proponent intends to document the recycled content of all building materials and maintain or exceed the required recycled content for this credit. This credit will generally be achieved through the use of recycled structural steel.

MR C7 Certified Wood - It is the intent of the design to use a minimum of 50% of wood-based materials and products that are FSC-Certified.

Indoor Environmental Quality (EQ)

EQ P1 Minimum IAQ Performance - The Proponent intends to design the ventilation systems to meet the minimum outdoor air ventilation rates specified by this credit.

EQ P2 Environmental Tobacco Smoke (ETS) Control - The Proponent intends to minimize exposure to ETS through Option 1, to prohibit smoking in the building and locate any exterior designated smoking areas at least 25 feet from entries, air intakes, and operable windows.

EQ C1 Outdoor Air Delivery Monitoring - The Proponent will consider permanent monitoring systems with feedback as part of the ventilation system to monitor carbon dioxide concentrations in densely occupied spaces and measure outdoor air flow rates to non-densely occupied spaces as specified in this credit.

EQ C3.1 Construction IAQ Management Plan, During Construction - The Proponent intends to develop and implement an Indoor Air Quality Management Plan for the construction and pre-occupancy phases of the building as follows: during construction meet or exceed the recommended control measures, protect stored on-site or installed absorptive materials from moisture damage, and if permanently installed air handlers are used during construction, filtration media with a MERV of 8 shall be used at each return air grille and replaced immediately prior to occupancy.

EQ C4.1 Low-Emitting Materials, Adhesives & Sealants - It is the intent of the Proponent that all interior adhesives and sealants will meet the requirements of their respective reference standard listed under this credit for VOC limit.

EQ C4.2 Low-Emitting Materials, Paints & Coatings - It is the intent of the Proponent that all interior paints and coatings will meet the VOC limits indicated by the reference standards listed under this credit.

EQ C4.3 Low-Emitting Materials, Carpet Systems - It is the intent of the Proponent that all carpet systems will be selected to meet the requirements of the reference standards listed under this credit.

EQ C4.4 Low-Emitting Materials—Composite Wood & Agrifiber Products – It is the intent of the Proponent to specify wood and agrifiber products that contain no added urea-formaldehyde resins and specify laminating adhesives for assemblies that contain no added urea-formaldehyde resins.

EQ C5 Indoor Chemical & Pollutant Source Control - The design intends to minimize building occupant exposure to potentially hazardous particulates and chemical pollutants by designing pollutant control measures at building entries and ventilating regularly occupied spaces as required by the credit.

EQ C6.1 Controllability of Systems, Lighting – The design intends to provide individual lighting controls for 90% of the building occupants and will include fixtures such as occupancy sensors.

Innovation & Design Process (ID)

ID C1.1 Innovation in Design: Implement Green Building Education and/or Education Outreach program - The Proponent intends to create a plan that reduces auto use through multiple transportation alternatives.

ID C1.2 Innovation in Design: Exemplary Commuter Choice - The building location along with a transportation management plan may demonstrate a quantifiable reduction in personal automobile use through multiple alternative options.

ID C1.3 Innovation in Design: Exemplary Development Density - The strategy to achieve this credit is still being studied.

ID C1.4 Innovation or Exemplary Performance - The strategy to achieve this credit is still being studied.

ID C2 LEED® Accredited Professional - It is the intent of the Proponent Project to maintain a LEED Accredited Professional as an active participant in the Project to assist in integrating the requirements of LEED and streamlining the application and certification process.

Mass Mental Health Center Redevelopment

Binney Street Building

Issued for DEIR/DPIR
9/10/2009

LEED-NC Project Checklist for *LEED SILVER*

Boston, MA

Yes	?	No				
8		6		**Sustainable Sites**		**14** Points
Y			Prereq 1	**Construction Activity Pollution Prevention**		Required
1			Credit 1	**Site Selection**		1
1			Credit 2	**Development Density & Community Connectivity**		1
		1	Credit 3	**Brownfield Redevelopment**		1
1			Credit 4.1	**Alternative Transportation**, Public Transportation Access		1
1			Credit 4.2	**Alternative Transportation**, Bicycle Storage & Changing Rooms		1
		1	Credit 4.3	**Alternative Transportation**, Low-Emitting and Fuel-Efficient Vehicles		1
		1	Credit 4.4	**Alternative Transportation**, Parking Capacity		1
		1	Credit 5.1	**Site Development,** Protect of Restore Habitat		1
		1	Credit 5.2	**Site Development,** Maximize Open Space		1
1			Credit 6.1	**Stormwater Design,** Quantity Control		1
1			Credit 6.2	**Stormwater Design,** Quality Control		1
1			Credit 7.1	**Heat Island Effect,** Non-Roof		1
1			Credit 7.2	**Heat Island Effect,** Roof		1
		1	Credit 8	**Light Pollution Reduction**		1

Yes	?	No				
3		2		**Water Efficiency**		**5** Points
1			Credit 1.1	**Water Efficient Landscaping**, Reduce by 50%		1
1			Credit 1.2	**Water Efficient Landscaping**, No Potable Use or No Irrigation		1
		1	Credit 2	**Innovative Wastewater Technologies**		1
1			Credit 3.1	**Water Use Reduction**, 20% Reduction		1
		1	Credit 3.2	**Water Use Reduction**, 30% Reduction		1

Yes	?	No				
5		12		**Energy & Atmosphere**		**17** Points
Y			Prereq 1	**Fundamental Commissioning of the Building Energy Systems**		Required
Y			Prereq 2	**Minimum Energy Performance**		Required
Y			Prereq 3	**Fundamental Refrigerant Management**		Required
3		7	Credit 1	**Optimize Energy Performance**		1 to 10
		3	Credit 2	**On-Site Renewable Energy**		1 to 3
1			Credit 3	**Enhanced Commissioning**		1
1			Credit 4	**Enhanced Refrigerant Management**		1
		1	Credit 5	**Measurement & Verification**		1
		1	Credit 6	**Green Power**		1

Continue…

Yes	?	No			
4		9	**Materials & Resources**		**13** Points
Y			Prereq 1	**Storage & Collection of Recyclables**	Required
		1	Credit 1.1	**Building Reuse**, Maintain 75% of Existing Walls, Floors & Roof	1
		1	Credit 1.2	**Building Reuse**, Maintain 100% of Existing Walls, Floors & Roof	1
		1	Credit 1.3	**Building Reuse**, Maintain 50% of Interior Non-Structural Elements	1
1			Credit 2.1	**Construction Waste Management**, Divert 50% from Disposal	1
1			Credit 2.2	**Construction Waste Management**, Divert 75% from Disposal	1
		1	Credit 3.1	**Materials Reuse**, 5%	1
		1	Credit 3.2	**Materials Reuse**,10%	1
1			Credit 4.1	**Recycled Content**, 10% (post-consumer + ½ pre-consumer)	1
		1	Credit 4.2	**Recycled Content**, 20% (post-consumer + ½ pre-consumer)	1
		1	Credit 5.1	**Regional Materials**, 10% Extracted, Processed & Manufactured Region	1
		1	Credit 5.2	**Regional Materials**, 20% Extracted, Processed & Manufactured Region	1
		1	Credit 6	**Rapidly Renewable Materials**	1
1			Credit 7	**Certified Wood**	1

Yes	?	No			
8		7	**Indoor Environmental Quality**		**15** Points
Y			Prereq 1	**Minimum IAQ Performance**	Required
Y			Prereq 2	**Environmental Tobacco Smoke** (ETS) **Control**	Required
1			Credit 1	**Outdoor Air Delivery Monitoring**	1
		1	Credit 2	**Increased Ventilation**	1
1			Credit 3.1	**Construction IAQ Management Plan**, During Construction	1
		1	Credit 3.2	**Construction IAQ Management Plan**, Before Occupancy	1
1			Credit 4.1	**Low-Emitting Materials**, Adhesives & Sealants	1
1			Credit 4.2	**Low-Emitting Materials**, Paints & Coatings	1
1			Credit 4.3	**Low-Emitting Materials**, Carpet Systems	1
1			Credit 4.4	**Low-Emitting Materials**, Composite Wood & Agrifiber Products	1
1			Credit 5	**Indoor Chemical & Pollutant Source Control**	1
1			Credit 6.1	**Controllability of Systems**, Lighting	1
		1	Credit 6.2	**Controllability of Systems**, Thermal Comfort	1
		1	Credit 7.1	**Thermal Comfort**, Design	1
		1	Credit 7.2	**Thermal Comfort**, Verification	1
		1	Credit 8.1	**Daylight & Views**, Daylight 75% of Spaces	1
		1	Credit 8.2	**Daylight & Views**, Views for 90% of Spaces	1

Yes	?	No			
5			**Innovation & Design Process**		**5** Points
1			Credit 1.1	**Innovation in Design**: Green Bldg Education/Education Outreach	1
1			Credit 1.2	**Innovation in Design**: Exemplary Commuter Choice	1
1			Credit 1.3	**Innovation in Design**: Exemplary Development Density	1
1			Credit 1.4	**Innovation in Design**: TBD	1
1			Credit 2	**LEED® Accredited Professional**	1

Yes	?	No		
33		36	**Project Totals** **(pre-certification estimates)**	**69** Points

Certified 26-32 points **Silver** 33-38 points **Gold** 39-51 points **Platinum** 52-69 points

LEED Checklist

Brigham and Women's Hospital Building

F.3 Brigham and Women's Building

The Project team will prioritize the following credits from the LEED building rating system in order to achieve LEED Silver Certified for this building. Each credit will be evaluated by the Project team on an on-going basis through all of the design and construction phases of the Project.

Sustainable Sites (SS)

SS P1 Construction Activity Pollution Prevention - An erosion and sedimentation control plan for all construction activities will be created and implemented.

SS C1 Site Selection - The building location avoids development of an environmentally sensitive site and causing increased environmental impact by utilizing a previously developed urban site.

SS C2 Development Density & Community Connectivity - The building is located on a previously developed site in an existing urban area that meets the density requirements of Option 1 requiring a minimum density of 60,000 sf per acre net.

SS C4.1 Alternative Transportation, Public Transportation Access - The building location utilizes the required public transportation access requirements for this credit by being within 1/2 mile of an existing subway stop.

SS C4.2 Alternative Transportation, Bicycle Storage & Changing Rooms - The design intends to include secure bike racks or storage for at least 5% of the building users and provide shower and changing facilities for 0.5% of the FTE occupants in the building.

SS C6.1 Stormwater Design, Quantity Control - The design intends to implement strategies consistent with Option 2 and reduce the pre-development rate and quantity of stormwater discharge by at least 25%.

SS C6.2 Stormwater Design, Quality Control - The design intends to implement a stormwater management plan that identifies strategies to capture and treat the stormwater runoff from 90% of the average annual rainfall.

SS C7.1 Heat Island Effect, Non-Roof - The design intends to meet this credit through Option 2 by placing more than 50% of the parking spaces below ground and within the footprint of the Brigham and Women's Building.

SS C7.2 Heat Island Effect, Roof - The design intends to meet this credit through Option 3 by installing a combination of vegetated roof surfaces and high albedo roof surfaces such as white PVC roofing.

Water Efficiency (WE)

WE C1.1 Water Efficient Landscaping, Reduce by 50% - The requirements of this credit will be met with credit WE C1.2 below.

WE C1.2 Water Efficient Landscaping, No Potable Use or No Irrigation - The design intends to eliminate the use of potable water, or other natural surface or subsurface water resources for landscape irrigation.

WE C2 Innovative Wastewater Technologies - The design intends to meet this credit through Option 1 and reduce potable water use for building sewage conveyance by 50% through the use of water-conserving fixtures or non-potable water.

WE C3.1 Water Use Reduction, 20% Reduction - It is the intent of the design to use 20% less water than the minimum fixture performance requirements specified for water closets, urinals, lavatory faucets, showers, and kitchen sinks.

Energy & Atmosphere (EA)

EA P1 Fundamental Commissioning of the Building Energy Systems - The Proponent intends to follow the requirements for fundamental commissioning as described by this prerequisite.

EA P2 Minimum Energy Performance - The Proponent intends to establish a minimum level of energy performance by complying with the specified provisions of ASHRAE/IESNA Standard 90.1-2004 and will be demonstrated by the computer simulation model used for EA Credit 1.

EA P3 Fundamental Refrigerant Management - It is the intent of the design to use zero CFC-based refrigerants in the new base building HVAC&R systems.

EA C1 Optimize Energy Performance - The design intends to optimize energy performance by conducting whole building energy simulations, Option 1, and improve the buildings performance by at least 17.5% over the baseline building performance rating.

EA C3 Enhanced Commissioning - It is the intent of the Proponent to implement the additional commissioning activities as outlined in this credit.

EA C4 Enhanced refrigerant Management - It is the intent of the design to follow Option 2 and select refrigerants and HVAC&R that comply with the referenced formula.

EA C5 Measurement & Verification - The Proponent intends to implement a Measurement & Verification Plan as specified by this credit for a period of no less than one year from the point of occupancy.

Materials & Resources (MR)

MR P1 Storage & Collection of Recyclables - The design intends to provide an easily accessible area that serves the entire building and is dedicated to the collection and storage of non-hazardous materials for recycling, including paper, corrugated cardboard, plastics and metals at a minimum.

MR C2.1 and MR C2.2 - Construction Waste Management, Divert 75% from Disposal - The Proponent intends to recycle and/or salvage at least 50% of non-hazardous construction and demolition debris through the implementation of a construction waste management plan.

MR C4.1 Recycled Content, 10% (post-consumer + ½ pre-consumer) - The Proponent intends to document the recycled content of all building materials and maintain or exceed the required recycled content for this credit.

MR C7 Certified Wood - It is the intent of the design to use a minimum of 50% of wood-based materials and products that are FSC-certified.

Indoor Environmental Quality (EQ)

EQ P1 Minimum IAQ Performance - The Proponent intends to design the ventilation systems to meet the minimum outdoor air ventilation rates specified by this credit.

EQ P2 Environmental Tobacco Smoke (ETS) Control - The Proponent intends to minimize exposure to Environmental Tobacco Smoke through option 1, to prohibit smoking in the building and locate any exterior designated smoking areas at least 25 feet from entries, air intakes, and operable windows.

EQ C1 Outdoor Air Delivery Monitoring - The Proponent will consider permanent monitoring systems with feedback as part of the ventilation system to monitor carbon dioxide concentrations in densely occupied spaces and measure outdoor air flow rates to non-densely occupied spaces as specified in this credit.

EQ C2 Increased Ventilation - The design intends to increase breathing zone outdoor air ventilation rates to all occupied spaces by at least 30% above the minimum rates required by the referenced standard for this credit.

EQ C3.1 Construction IAQ Management Plan, During Construction - The Proponent intends to develop and implement an IAQ Management Plan for the construction and pre-occupancy phases of the building as follows: during construction, meet or exceed the recommended control measures, protect stored on-site or installed absorptive materials from moisture damage, and filtration media with a MERV of 8 shall be used at each return air grille and replaced immediately prior to occupancy if permanently installed air handlers are used during construction.

EQ C4.1 Low-Emitting Materials, Adhesives & Sealants - It is the intent of the Proponent that all interior adhesives and sealants will meet the requirements of their respective reference standard listed under this credit for VOC limit.

EQ C4.2 Low-Emitting Materials, Paints & Coatings - It is the intent of the Proponent that all interior paints and coatings will meet the VOC limits indicated by the reference standards listed under this credit.

EQ C4.3 Low-Emitting Materials, Carpet Systems - It is the intent of the Proponent that all carpet systems will be selected to meet the requirements of the reference standards listed under this credit.

EQ C4.4 Low-Emitting Materials, Composite Wood & Agrifiber Products - It is the intent of the Proponent that all composite wood and agrifiber products and other materials listed under this credit that are used on the interior of the building will contain no added urea-formaldehyde resins.

EQ C5 Indoor Chemical & Pollutant Source Control - The design intends to minimize building occupant exposure to potentially hazardous particulates and chemical pollutants by designing pollutant control measures at building entries and ventilating regularly occupied spaces as required by the credit.

EQ C6.1 Controllability of Systems, Lighting - The design intends to provide a high level of lighting system control by integrating lighting systems controllability into the overall lighting design while managing the overall energy use of the building. This includes both schemes for individual lighting controls and controllability of multi-occupant spaces to allow adjustments to be made to meet group needs and preferences.

EQ C7.2 Thermal Comfort, Verification - It is the intent of the Proponent to implement a thermal comfort survey of the building occupants within six to eighteen months after occupancy. If more than 20% of occupants are dissatisfied with thermal comfort, the Proponent will develop a plan for corrective action.

EQ C8.1 Daylight & Views, Daylight 75% of Spaces - It is the intent of the design to provide daylight and views to at least 75% of the regularly occupied areas of the building as required under this credit through the design, location, and specification of glazing systems.

Innovation & Design Process (ID)

ID C1.1 Innovation in Design: Implement Green Building Education and/or Education Outreach program - The strategy to achieve this credit is still being studied.

ID C1.2 Innovation in Design: Exemplary Commuter Choice - The building location along with a transportation management plan may demonstrate a quantifiable reduction in personal automobile use through multiple alternative options.

ID C1.3 Innovation in Design: Exemplary Development Density - The strategy to achieve this credit is still being studied.

ID C2 LEED® Accredited Professional - It is the intent of the Proponent to maintain a LEED Accredited Professional as an active participant in the Project to assist in integrating the requirements of LEED and streamlining the application and certification process.

Mass Mental Health Center Redevelopment

BWH Building

LEED-NC Project Checklist for *LEED SILVER*
Boston, MA

Issued for DEIR/DPIR
9/25/2009

Yes	?	No			
8		6		**Sustainable Sites**	**14** Points
Y			Prereq 1	**Construction Activity Pollution Prevention**	Required
1			Credit 1	**Site Selection**	1
1			Credit 2	**Development Density & Community Connectivity**	1
		1	Credit 3	**Brownfield Redevelopment**	1
1			Credit 4.1	**Alternative Transportation**, Public Transportation Access	1
1			Credit 4.2	**Alternative Transportation**, Bicycle Storage & Changing Rooms	1
		1	Credit 4.3	**Alternative Transportation**, Low-Emitting and Fuel-Efficient Vehicles	1
		1	Credit 4.4	**Alternative Transportation**, Parking Capacity	1
		1	Credit 5.1	**Site Development,** Protect of Restore Habitat	1
		1	Credit 5.2	**Site Development,** Maximize Open Space	1
1			Credit 6.1	**Stormwater Design,** Quantity Control	1
1			Credit 6.2	**Stormwater Design,** Quality Control	1
1			Credit 7.1	**Heat Island Effect,** Non-Roof	1
1			Credit 7.2	**Heat Island Effect,** Roof	1
		1	Credit 8	**Light Pollution Reduction**	1

Yes	?	No			
4		1		**Water Efficiency**	**5** Points
1			Credit 1.1	**Water Efficient Landscaping**, Reduce by 50%	1
1			Credit 1.2	**Water Efficient Landscaping**, No Potable Use or No Irrigation	1
1			Credit 2	**Innovative Wastewater Technologies**	1
1			Credit 3.1	**Water Use Reduction**, 20% Reduction	1
		1	Credit 3.2	**Water Use Reduction**, 30% Reduction	1

Yes	?	No			
6		11		**Energy & Atmosphere**	**17** Points
Y			Prereq 1	**Fundamental Commissioning of the Building Energy Systems**	Required
Y			Prereq 2	**Minimum Energy Performance**	Required
Y			Prereq 3	**Fundamental Refrigerant Management**	Required
3		7	Credit 1	**Optimize Energy Performance**	1 to 10
		3	Credit 2	**On-Site Renewable Energy**	1 to 3
1			Credit 3	**Enhanced Commissioning**	1
1			Credit 4	**Enhanced Refrigerant Management**	1
1			Credit 5	**Measurement & Verification**	1
		1	Credit 6	**Green Power**	1

Continue…

Yes	?	No			
4		9	**Materials & Resources**		**13** Points
Y			Prereq 1	**Storage & Collection of Recyclables**	Required
		1	Credit 1.1	**Building Reuse**, Maintain 75% of Existing Walls, Floors & Roof	1
		1	Credit 1.2	**Building Reuse**, Maintain 100% of Existing Walls, Floors & Roof	1
		1	Credit 1.3	**Building Reuse**, Maintain 50% of Interior Non-Structural Elements	1
1			Credit 2.1	**Construction Waste Management**, Divert 50% from Disposal	1
1			Credit 2.2	**Construction Waste Management**, Divert 75% from Disposal	1
		1	Credit 3.1	**Materials Reuse**, 5%	1
		1	Credit 3.2	**Materials Reuse**,10%	1
1			Credit 4.1	**Recycled Content**, 10% (post-consumer + ½ pre-consumer)	1
		1	Credit 4.2	**Recycled Content**, 20% (post-consumer + ½ pre-consumer)	1
		1	Credit 5.1	**Regional Materials**, 10% Extracted, Processed & Manufactured Region	1
		1	Credit 5.2	**Regional Materials**, 20% Extracted, Processed & Manufactured Region	1
		1	Credit 6	**Rapidly Renewable Materials**	1
1			Credit 7	**Certified Wood**	1

Yes	?	No			
11		4	**Indoor Environmental Quality**		**15** Points
Y			Prereq 1	**Minimum IAQ Performance**	Required
Y			Prereq 2	**Environmental Tobacco Smoke** (ETS) **Control**	Required
1			Credit 1	**Outdoor Air Delivery Monitoring**	1
1			Credit 2	**Increased Ventilation**	1
1			Credit 3.1	**Construction IAQ Management Plan**, During Construction	1
		1	Credit 3.2	**Construction IAQ Management Plan**, Before Occupancy	1
1			Credit 4.1	**Low-Emitting Materials**, Adhesives & Sealants	1
1			Credit 4.2	**Low-Emitting Materials**, Paints & Coatings	1
1			Credit 4.3	**Low-Emitting Materials**, Carpet Systems	1
1			Credit 4.4	**Low-Emitting Materials**, Composite Wood & Agrifiber Products	1
1			Credit 5	**Indoor Chemical & Pollutant Source Control**	1
1			Credit 6.1	**Controllability of Systems**, Lighting	1
		1	Credit 6.2	**Controllability of Systems**, Thermal Comfort	1
		1	Credit 7.1	**Thermal Comfort**, Design	1
1			Credit 7.2	**Thermal Comfort**, Verification	1
1			Credit 8.1	**Daylight & Views**, Daylight 75% of Spaces	1
		1	Credit 8.2	**Daylight & Views**, Views for 90% of Spaces	1

Yes	?	No			
4		1	**Innovation & Design Process**		**5** Points
1			Credit 1.1	**Innovation in Design**: Green Bldg Education/Education Outreach	1
1			Credit 1.2	**Innovation in Design**: Exemplary Commuter Choice	1
1			Credit 1.3	**Innovation in Design**: Exemplary Development Density	1
		1	Credit 1.4	**Innovation in Design**: TBD	1
1			Credit 2	**LEED® Accredited Professional**	1

Yes	?	No		
37		32	**Project Totals** **(pre-certification estimates)**	**69** Points

Certified 26-32 points **Silver** 33-38 points **Gold** 39-51 points **Platinum** 52-69 points

LEED Checklist

Residential Building

F.4 Residential Building

The Residential Building is still in the early stage of design. At this time, the Project team will prioritize the following credits from the LEED rating system in order to achieve a level Certifiable with the possibility of being LEED Silver Certifiable. Each credit will be evaluated by the Project team on an on-going basis through the design and construction phases of the Project.

Sustainable Sites (SS)

SS P1 Construction Activity Pollution Prevention - An Erosion and Sedimentation Control Plan will be developed as part of the PNF process which will employ strategies such as temporary and permanent seeding, mulching, silt fencing, sediment traps and sediment basins.

SS C1 Site Selection - The MMHC Site doesn't trigger any of the criteria required to achieve this credit, therefore eligible for this credit.

SS C2 Development Density & Community Connectivity - The MMHC Site is considered an Urban Site and therefore is eligible for this credit.

SS C4.1 Alternative Transportation, Public Transportation Access - The MMHC Site is within ½ of the Longwood Medical Area T-stop on the Green D-line, therefore eligible for this credit.

SS C4.2 Alternative Transportation, Bicycle Storage & Changing Rooms - The residents of The MMHC Site will be provided with a minimum of 21 (15%) bicycle storage racks.

SS C4.4 Alternative Transportation, Parking Capacity - The Residential Building at the MMHC Site has no new parking spaces and therefore complies with this point requirement.

SS C6.1 Stormwater Design, Quantity Control - The MMHC Site is covered by more than 50% impervious surfaces. Therefore, it is the Proponent's intent to recharge the groundwater to the levels specified above.

SS C7.1 Heat Island Effect, Non-Roof - The Residential Building at the MMHC Site will use a combination of high-reflective hardscaping and shading methods for a minimum of 50% of the site's hardscape.

SS C7.2 Heat Island Effect, Roof - The Residential Building's roof is considered a low-slope roof and will have a minimum SRI of 78.

Water Efficiency (WE)

WE C1.1 Water Efficient Landscaping, Reduce by 50%, Potential Technologies & Strategies - The project will have a landscape architect design the landscape with native or adapted plants to reduce irrigation requirements.

WE C3.1 Water Use Reduction, 20% Reduction, Potential Technologies & Strategies **-** The project will incorporate high-efficiency fixtures in all residential units and use occupant sensors at the common area restrooms to reduce the potable water demand.

Energy and Atmosphere (EA)

EA P1 Fundamental Commissioning of the Building Energy Systems - Commissioned Systems - The Proponent will engage and obtain a commissioning report from an independent agency per the required criteria; therefore, the building will meet this prerequisite.

EA P2 Minimum Energy Performance **-** The building envelope, HVAC, lighting, and other systems will meet or exceed the above referenced criteria, therefore meeting the intent of this prerequisite.

EA P3 Fundamental Refrigerant Management **-** The Residential Building will not have any HVAC equipment that uses CFC refrigerants, thus meeting the intent of this required prerequisite.

EA C5 Measurement & Verification (M&V) - The Proponent will develop an M&V Plan to evaluate building energy system performance for a minimum of one-year; therefore, the building is eligible for this credit.

Materials and Resources (MR)

MR P1 Storage & Collection of Recyclables **-** The Residential Building at the MMHC Site has been designed to incorporate recycling within the building, including but not limited to the paper, corrugated cardboard, glass, plastics and metals. Thus the building meets the intent of this prerequisite.

MR C2.1 Construction Waste Management, Divert 50% from Disposal **-** The Propenent and its contractor have committed to divert 50% of construction waste at the Residential Building project.

MR C4.1 Recycled Content, **10% (post-consumer + 1/2 pre-consumer)** **-** The Proponent and its construction contractors have agreed to establish a project goal for recycled content materials and identify material suppliers that can achieve this goal. During construction, the construction contractor will ensure that the specified recycled content materials are installed.

Indoor Environmental Quality (EQ)

EQ P1 Minimum IAQ Performance - The building's HVAC system will meet or exceed the minimum outdoor air ventilation rates as described in the ASHRAE standard.

EQ P2 Environmental Tobacco Smoke (ETS) Control - The building will be a smoke free facility, therefore complying with the intent of this prerequisite.

EQ C3.1 Construction IAQ Management Plan, *During Construction* - The Proponent will adopt an IAQ management plan to protect the HVAC system during construction; therefore, the building is eligible for this credit.

EQ C4.1 Low-Emitting Materials, Adhesives & Sealants - The construction documents for the Residential Building will specify low-VOC materials as required, thus the building will be eligible for this credit.

EQ C4.2 Low-Emitting Materials, Paints & Coatings - The construction documents will specify low-VOC paints and coatings to comply with the intent of this credit.

EQ C4.3 Low-Emitting Materials, Carpet Systems - Construction documents will clearly specify requirements for product testing and/or certification, thus the building is eligible for this credit.

EQ C4.4 Low-Emitting Materials, Composite Wood & Agrifiber Products - The construction documents for the Residential Building will specify wood and agrifiber products that contain no added urea-formaldehyde resins.

EQ C5 Indoor Chemical & Pollutant Source Control - The residential entrances have been designed to employ the use of a walk-off grate at the main entrance and will exhaust laundry areas as described above.

EQ C6.1 Controllability of Systems, Lighting - The occupants of the Residential Building will have full individual lighting control within their units; therefore, the building is eligible for this credit.

EQ C6.2 Controllability of Systems, Thermal Comfort - The occupants of the Residential Building will have more than 50% control of their thermal comfort; therefore, the building is eligible for this credit.

EQ C7.1 Thermal Comfort, Design - The Residential Building will have HVAC systems and building envelope designed to meet the above referenced AHRAE standards. Thus, the building meets the intent of this credit.

EQ C7.2 Thermal Comfort, **Verification -** The Proponent has agreed to implement a thermal comfort survey within the allotted time and will develop a corrective action plan if needed, as required.

EQ C8.1 Daylight and Views, **Daylight 75% of Spaces -** The Residential Building will be designed to allow daylight into 75% of the occupied spaces and will be verified via one of the two possible options related to this credit. Therefore, the building is in compliance with these credit requirements.

Innovation & Design Process (ID)

ID C1.1 Innovation in Design, "Live Green" - The Proponent has committed to developing and maintaining a sustainable bulletin board to help residents "Live Green."

ID C2 LEED Accredited Professional - At least one member of The Architectural Team, Inc. will be a LEED Accredited Professional.

Boston Green Building Credits (Article 37) (BG)

BG Pa-c Construction Air Pollution Control Plan - The Proponent and its construction contractor will incorporate the above requirements into the construction contract language.

BG C3 Groundwater Recharge - The MMHC Site is located outside of Article 32 associated areas. The project will provide measures that result in on-site infiltration of rainwater; therefore the building will be eligible for this credit.

BG C4 Modern Mobility - The Proponent has agreed to all of the prerequisites associated to residential buildings. The project will comply with the above prerequisites and the TDM options as follows:

(a) Provide a fifty percent (50%) subsidy for monthly T pass purchases, one for each dwelling unit for the tenants first full year of occupancy.

(d) Price and allow the purchase of deeded parking spaces separately from dwelling units. Parking spaces required by zoning may only be purchased and used by building tenants/unit owners.

(f) On site ATM, dry cleaning drop-off/pick-up & other amenities that reduce short car trips.

LEED-NC

LEED-NC Version 2.2 Project Checklist
with Boston Green Building Credits

RTH - Residential
Boston, MA

Yes	?	No			
8	1	5	**Sustainable Sites**		14 Points
Y			Prereq 1	**Construction Activity Pollution Prevention**	Required
1			Credit 1	**Site Selection**	1
1			Credit 2	**Development Density & Community Connectivity**	1
		1	Credit 3	**Brownfield Redevelopment**	1
1			Credit 4.1	**Alternative Transportation**, Public Transportation Access	1
1			Credit 4.2	**Alternative Transportation**, Bicycle Storage & Changing Rooms	1
		1	Credit 4.3	**Alternative Transportation**, Low-Emitting and Fuel-Efficient Vehicles	1
1			Credit 4.4	**Alternative Transportation**, Parking Capacity	1
		1	Credit 5.1	**Site Development,** Protect of Restore Habitat	1
		1	Credit 5.2	**Site Development,** Maximize Open Space	1
1			Credit 6.1	**Stormwater Design,** Quantity Control	1
	1		Credit 6.2	**Stormwater Design,** Quality Control	1
1			Credit 7.1	**Heat Island Effect,** Non-Roof	1
1			Credit 7.2	**Heat Island Effect,** Roof	1
		1	Credit 8	**Light Pollution Reduction**	1

Yes	?	No			
2	1	2	**Water Efficiency**		5 Points
1			Credit 1.1	**Water Efficient Landscaping**, Reduce by 50%	1
	1		Credit 1.2	**Water Efficient Landscaping**, No Potable Use or No Irrigation	1
		1	Credit 2	**Innovative Wastewater Technologies**	1
1			Credit 3.1	**Water Use Reduction**, 20% Reduction	1
		1	Credit 3.2	**Water Use Reduction**, 30% Reduction	1

Yes	?	No			
1	3	2	**Energy & Atmosphere**		17 Points
Y			Prereq 1	**Fundamental Commissioning of the Building Energy Systems**	Required
Y			Prereq 2	**Minimum Energy Performance**	Required
Y			Prereq 3	**Fundamental Refrigerant Management**	Required
	1		Credit 1	**Optimize Energy Performance**	1 to 10
		1	Credit 2	**On-Site Renewable Energy**	1 to 3
	1		Credit 3	**Enhanced Commissioning**	1
		1	Credit 4	**Enhanced Refrigerant Management**	1
1			Credit 5	**Measurement & Verification**	1
	1		Credit 6	**Green Power**	1

Yes ? No

2	2	9	Materials & Resources		13 Points
Y			Prereq 1	**Storage & Collection of Recyclables**	Required
		1	Credit 1.1	**Building Reuse**, Maintain 75% of Existing Walls, Floors & Roof	1
		1	Credit 1.2	**Building Reuse**, Maintain 100% of Existing Walls, Floors & Roof	1
		1	Credit 1.3	**Building Reuse**, Maintain 50% of Interior Non-Structural Elements	1
1			Credit 2.1	**Construction Waste Management**, Divert 50% from Disposal	1
		1	Credit 2.2	**Construction Waste Management**, Divert 75% from Disposal	1
		1	Credit 3.1	**Materials Reuse**, 5%	1
		1	Credit 3.2	**Materials Reuse**,10%	1
1			Credit 4.1	**Recycled Content**, 10% (post-consumer + ½ pre-consumer)	1
		1	Credit 4.2	**Recycled Content**, 20% (post-consumer + ½ pre-consumer)	1
	1		Credit 5.1	**Regional Materials**, 10% Extracted, Processed & Manufactured Regio	1
		1	Credit 5.2	**Regional Materials**, 20% Extracted, Processed & Manufactured Regio	1
		1	Credit 6	**Rapidly Renewable Materials**	1
	1		Credit 7	**Certified Wood**	1
Yes	?	No			

11	4		Indoor Environmental Quality		15 Points
Y			Prereq 1	**Minimum IAQ Performance**	Required
Y			Prereq 2	**Environmental Tobacco Smoke** (ETS) **Control**	Required
	1		Credit 1	**Outdoor Air Delivery Monitoring**	1
	1		Credit 2	**Increased Ventilation**	1
1			Credit 3.1	**Construction IAQ Management Plan**, During Construction	1
	1		Credit 3.2	**Construction IAQ Management Plan**, Before Occupancy	1
1			Credit 4.1	**Low-Emitting Materials**, Adhesives & Sealants	1
1			Credit 4.2	**Low-Emitting Materials**, Paints & Coatings	1
1			Credit 4.3	**Low-Emitting Materials**, Carpet Systems	1
1			Credit 4.4	**Low-Emitting Materials**, Composite Wood & Agrifiber Products	1
1			Credit 5	**Indoor Chemical & Pollutant Source Control**	1
1			Credit 6.1	**Controllability of Systems**, Lighting	1
1			Credit 6.2	**Controllability of Systems**, Thermal Comfort	1
1			Credit 7.1	**Thermal Comfort**, Design	1
1			Credit 7.2	**Thermal Comfort**, Verification	1
1			Credit 8.1	**Daylight & Views**, Daylight 75% of Spaces	1
	1		Credit 8.2	**Daylight & Views**, Views for 90% of Spaces	1
Yes	?	No			

2		3	Innovation & Design Process		5 Points
1			Credit 1.1	**Innovation in Design**: Provide Specific Title	1
		1	Credit 1.2	**Innovation in Design**: Provide Specific Title	1
		1	Credit 1.3	**Innovation in Design**: Provide Specific Title	1
		1	Credit 1.4	**Innovation in Design**: Provide Specific Title	1
1			Credit 2	**LEED® Accredited Professional**	1
Yes	?	No			

Yes	?	No			Points
2		2	**Boston Green Building Credits**		**4** Points
Y			Prereq 1	**Construction Air Pollution Control Plan**	Required
Y			Prereq 2	**Outdoor Construction Management Plan**	Required
Y			Prereq 3	**Pest Management Plan**	Required
		1	Credit 1	**Modern Grid**	1
		1	Credit 2	**Historic Preservation**	1
1			Credit 3	**Groundwater Recharge**	1
1			Credit 4	**Modern Mobility**	1

Yes	?	No		
28	11	23	**Project Totals** (pre-certification estimates)	**69** Points

Certified 26-32 points **Silver** 33-38 points **Gold** 39-51 points **Platinum** 52-69 points

Appendix G

Greenhouse Gas Analysis

G.1 – Sample Operating Manual Table of Contents

G.2 – MEP Systems Concept Descriptions

G.3 – GHP Estimated Performance

G.1
Sample Operating Manual Table of Contents

(Sample from a complex Project)

Northeastern University's International Village

Operators Manual

September 14, 2009

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

G.2
HVAC Systems Concept Descriptions

Binney St. Building and Partial Hospital/Fenwood Inn

Complete new heating, ventilation, air-conditioning, and exhaust systems shall be provided for the building. Primary heating shall be provided via hot water boiler equipment fed by natural gas. Electric heating water pumps will deliver hot water for space heating.

Primary cooling shall be provided by DX air cooled condensing units associated with the air handlers. Air distribution shall be variable air volume with terminal reheat coils supplied by two (2) rooftop mounted air handlers.

Exhaust systems shall be provided for toilet, general, and specialized exhausts. Automatic control systems shall be supported by a direct digital control-based building automation system.

Brigham & Women's Building

Outside Air

Multiple, roof mounted 100% outside air units will deliver air that is 95% filtered, humidified, heated and cooled to 55-degrees F that will meet the outside air requirements of the:

- The once through variable air volume controlled Laboratory ventilation requirements
- The once through variable air volume controlled Vivarium ventilation requirements
- The Outside air requirements of the on-floor located variable air volume controlled, recirculating air handling systems that will serve the clinical and other non-laboratory floors.

Exhaust Air

- All outside air supplied to the building will be exhausted using variable air volume, high dilution fan systems located on the roof.

Energy Recovery

- Where applicable, the energy in the air exhausted from the once through air handling systems defined above will be recaptured using energy recovery or heat recovery systems.

Cooling

- Chilled water will be generated on site through the use of three (3) high efficiency (fraction of a kW per ton) water-cooled, electrically driven, variable speed, variable primary water flow chillers.

- Free cooling through the use of a water to water heat exchanger or water to refrigerant heat exchanger will be provided to eliminate the need to operate the chillers compressors under certain outside air conditions.

- Multiple variable speed induced draft cooling towers will reject the heat from the chiller plant to atmosphere.

- Chilled water will be supplied to the 100% outside VAV air handling units, the on floor VAV recirculating air handling units, the fan coils to be used in the laboratory equipment areas to remove the heat from such equipment.

- Pumps associated with the chilled water will be variable flow

- Pumps associated with the cooling towers may be constant flow or variable flow pending technology and PHS standards at the time of design.

Heating hot Water

- Hot water will be generated by three (3) on site gas fired; flexible tube water boilers equipped with low NOX, high turn down burners.

- Hot water will be delivered to heating coils in the outside air handling units, heating coils in the variable air volume boxes, perimeter radiation and other heating elements.

- Pumps associated with the boiler primary loop will be constant flow

- Pumps associated with AHU's and terminal equipment will be variable flow.

Domestic Hot Water

- Boiler water from the above plant will be supplied to multiple stainless steel brazed flat plate heat exchangers.

Humidification and Sterilization

- High pressure steam from the adjacent Shapiro Building will be supplied for humidification and instrument sterilization.

Vehicle Parking Space Ventilation

- A carbon monoxide sensor controlled variable air volume supply and exhaust air system will be installed to limit carbon monoxide levels in vehicle parking and travel areas to DPH and LEED standards in effect at the time of design.

Building Automation

- A direct digital control based automation systems will be provided to control all energy using elements including those in the electrical and plumbing systems.

Residential Building

The upper eight floors (condominiums) shall be served by a heat pump system complete with central boilers for supplemental heating and a cooling tower for supplemental cooling.

The remaining seven floors and one basement level will contain the a small building management office, mechanical space, common spaces and six floors of apartments for rent. These floors will be served by a two pipe fan coil system complete with central boilers providing the required heating load and an air cooled chiller system to provide the required cooling load.

All of the common corridor areas will be served by roof top units. These roof top units will provide cooling by the use of electric DX cooling and provide the heating requirements by the use of indirect gas-fired furnaces.

The central indirect gas-fired domestic water heating system will provide all of the domestic hot water requirements for the building.

G.3
CHP Estimated Performance

Brigham and Women's Building Cogeneration Estimate

	Value	Units	
Engine size	925	kW	Wakesha engine
Engine capacity factor	99%		
Heat rate	11,220	Btu/kWh	
Parasitic load	2%		
Waste heat	8,032	Btu/kWh	
Heat recovery efficiency	67%		
Heat recoverable	5,401	Btu/kWh	
Heat utilization factor	100%		
Heat utilization	5,401	Btu/kWh	

Annual Energy			Associated CO_2 Reduction (tpy)
Power generation, net	7,861,531	kWh	(3,176)
Fuel use	88,206	MMBtu	513
Heating plant credit	42,457	MMBtu	(247)
		Net	(2,910)

	MMBtu/yr	
Fuel use	88,206	
as electricity	26,824	30%
utilized heat	42,457	48%
	Overall efficiency	79%

Residential Building Cogeneration Estimate

From CogenGreen.com, EcoGen 30						
electricity	30	kW				
recovered heat	67	kW	0.229	MMBtu/hr		
fuel	105	kW LHV	117	kW HHV	398	scfh
waste heat recovery	77%					

	Value	Units	
Engine size	30	kW	
Engine capacity factor	75%		
Heat rate	13,256	Btu/kWh	HHV
Parasitic load	2%		
Waste heat	10,109	Btu/kWh	
Heat recovery efficiency	75%		
Heat recoverable	7,620	Btu/kWh	
Heat utilization factor	95%		
Heat utilization	7,239	Btu/kWh	

Annual Energy				Associated CO_2 Reduction (tpy)
Power generation, net	193,158	kWh		(78)
Fuel use	2,560	MMBtu		149
Heating plant credit	1,398	MMBtu		(81)
			Net	(10)

	MMBtu/yr	
Fuel use	2,560	
as electricity	659	26%
utilized heat	1,398	55%
	Overall efficiency	80%

Appendix H

2003 Memorandum of Agreement

MEMORANDUM OF AGREEMENT
BETWEEN
THE MASSACHUSETTS DEPARTMENT OF MENTAL HEALTH,
THE MASSACHUSETTS DIVISION OF CAPITAL ASSET MANAGEMENT AND
THE MASSACHUSETTS HISTORICAL COMMISSION

WHEREAS, the Asset Management Board has authorized the Massachusetts Department of Mental Health (DMH) with the assistance of the Massachusetts Division of Capital Asset Management and Maintenance (DCAM) to enter into a competitive disposition process to dispose of the approximately 2.87-acre Massachusetts Mental Health Center (MMHC) site located on three parcels of land at the intersection of Brookline Avenue, Fenwood Road, and the Riverway in Boston , MA (Site) by means of a long-term ground lease of ninety-five (95) years; and

WHEREAS, there are five structures on the Site that contain approximately 188,907 square feet and were built in 1912, 1954 and 1957; and

WHEREAS, in exchange for the long-term lease, the ground lessee will be obligated to develop for DMH, in either new construction and/or renovated space, a redeveloped MMHC facility of approximately 50,000 square feet, a hospital / Fenwood Inn of approximately 20,000 square feet, and parking for approximately 50 cars; and

WHEREAS, in exchange for the construction of these state facilities and additional consideration as appropriate, the ground lessee will have the right to develop the remainder of the Site for private development of such uses that are compatible with the DMH facilities and the medical, educational, institutional and residential uses in the Longwood Medical Area, subject to all federal, state and local permits and approvals; and

WHEREAS, with the exception of the Vining Street parcel which is located across Vining Street from the main portion of the Site and contains a 21,126 square foot structure, the Site is listed in the State and National Registers of Historic Places; and

WHEREAS, the listing in the National Register of Historic Places identifies the Main Building (1912), the Power Plant (1912), and cast iron picket fence as contributing structures and the Research Building (1954) and Therapeutic Building (1957) as noncontributing structures; and

WHEREAS, there are other historic properties in the vicinity including but not limited to the Olmsted Park System Historic District, the Mission Hill Triangle Historic District, the Massachusetts School of Art, the Timothy Hoxie House, the Isabella Stuart Gardner Museum, and numerous properties included in MHC's Inventory of Historic and Archeological Assets of the Commonwealth, which, due to their proximity to the Site, may be affected by development on the Site; and

WHEREAS, DMH and DCAM are preparing to issue a Request for Proposals (RFP) for the lease and redevelopment of the Site; and

WHEREAS, the transfer by lease of the Site constitutes a project undertaken by a State agency pursuant to 950 CMR 71.03 and is a project for which DMH and DCAM have sought the comments of the Massachusetts Historical Commission (MHC) pursuant to M.G.L. Chapter 9, Section 26-27C, as amended by Chapter 254 of the Acts of 1988 (950 CMR 71.00); and

WHEREAS, MHC has determined that the proposed project will have an adverse effect on the historic property pursuant to 950 CMR 71.05(e) through the lease of a State Register property; and

WHEREAS; no feasible or prudent alternative exists to eliminate the adverse effect of the proposed lease; and

WHEREAS, MHC has determined to accept the adverse effect of the lease of the Site in consideration of the mitigation alternatives described herein; and

WHEREAS, MHC, DMH and DCAM agree, and the Boston Landmarks Commission (BLC) hereby concurs, that the project shall be undertaken and implemented in accordance with the following stipulations to mitigate the effect of the lease of the Site in compliance with M.G.L. Chapter 9, Section 27C.

STIPULATIONS

DMH and DCAM shall ensure that the following measures are carried out in coordination with MHC and BLC, as set forth below:

I. Redevelopment of the Massachusetts Mental Health Center

A. DMH and DCAM are encouraged to include historic preservation in any redevelopment process. Options for redevelopment of the Site which incorporate historic preservation should take into account the following principles of reuse planning:

1. Preservation of the character-defining features of the contributing buildings and structures on the Site should be encouraged where feasible.

2. If it is determined that it is not feasible to preserve all of the character-defining features of the contributing buildings and structures on the Site, the feasibility of preserving character-defining features of portions of the contributing buildings and structures will be examined and encouraged where feasible.

3. Rehabilitation of contributing buildings and structures on the Site should be consistent with recommended approaches in the Secretary of the Interior's Standards for Rehabilitation of Historic Properties, (hereinafter "Standards").

II. Marketing Plan and Request for Proposals

A. Notwithstanding any provisions of this MOA, DCAM has full marketing authority for the Site and will make all final marketing decisions. DMH and DCAM will consult with MHC and BLC on developing a marketing plan for the Site which shall include the following elements:

1. An advertising plan and schedule for publicizing the availability of the RFP.

2. An initial distribution list for notice of availability of the RFP which will include any contacts offered by MHC and BLC.

3. A schedule for receiving and reviewing submissions in response to the RFP.

B. DCAM will provide a draft marketing plan to MHC and BLC. MHC and the BLC will have fourteen (14) days to review and comment on the draft marketing plan. If MHC or BLC does not find the draft marketing plan acceptable, DCAM will make reasonable efforts exercised in good faith to accommodate the concerns of MHC and BLC and will submit a final marketing plan. Before implementation, MHC and BLC will have seven (7) days to review and comment on the portions of the final marketing plan which address issues of historic preservation. In the event MHC and BLC do not provide initial comments on the draft marketing plan within 14 days or comments on the final marketing plan within 7 days, the plan shall be deemed acceptable to MHC and BLC. It is understood that the content of the marketing plan shall not require approval of MHC or BLC.

C. Concurrent with the development of a marketing plan, DCAM will prepare the RFP for the disposition of the Site. DMH and DCAM will consult with MHC and BLC on developing the RFP which shall include the following elements:

1. An appendix to the RFP prepared by MHC for submission to DCAM on or before twenty-one (21) days from written notice from DCAM that explains what MHC regards as the significance and the character-defining elements of the contributing buildings and structures and information concerning potential tax benefits. DCAM will have the right to reasonably approve such appendix within seven (7) days of submission and prior to its inclusion in the RFP. If DCAM and MHC cannot agree on the appendix, DCAM shall amend the appendix if necessary to state that it contains MHC's opinions only and then at DCAM's discretion proceed with the RFP.

2. A photograph and parcel map of the Site.

3. Reference to the points listed under I.A. of this MOA. The RFP as a whole will make a good faith effort to generate interest in the preservation of what MHC has defined as the historic character of the Site.

D. DCAM will provide a confidential draft RFP to MHC and BLC. MHC and BLC will have fourteen (14) days to review and comment on those portions of the draft RFP which address issues of historic preservation. Before issuance of the final RFP, MHC and BLC will have seven (7) days to review and comment on the portions of the final RFP which address issues of historic preservation. In the event MHC and BLC do not provide initial comments on the draft RFP within 14 days or comments on the final RFP within 7 days, the RFP shall be deemed acceptable to MHC and BLC. It is understood that the content of the RFP shall not require approval of MHC or BLC. It is further understood that MHC and BLC will not share any portion of the RFP with anyone prior to the time the RFP is made publicly available by DCAM.

E. The marketing effort shall be continued for no less than three months from the date of the issuance of the RFP. Issuance shall occur when the notice of availability of the RFP is published in the Central Register.

F. DCAM and DMH will schedule a Bidder's Conference for prospective developers to occur at the midpoint of the marketing effort during which MHC and BLC will have the opportunity to present information and to answer questions from prospective developers.

G. Once proposals from developers are received by DCAM in response to the RFP, MHC and BLC shall be afforded the opportunity to comment on the proposals and to provide these comments in writing to DCAM prior to any interviews which DCAM and DMH may conduct with any of the developers. If, after a consultation period of no more than thirty (30) days with MHC and BLC regarding the applicability of the Standards to the proposals and taking into consideration MHC and BLC comments during any interviews which DCAM and DMH may conduct with any of the developers during the RFP marketing period, DCAM and DMH, in their sole determination, have received no proposals that are feasible and acceptable that provide for rehabilitation or new construction in conformance with the recommended approaches in the Standards, they will convey their conclusions to MHC and BLC.

1. For all buildings and structures for which there is no preservation proposal that is feasible and acceptable to DCAM and DMH, then DCAM or DMH or any lessee of the Site or any other person may proceed, subject to any other applicable reviews and permits, with demolition of buildings and structures or rehabilitation or new construction that does not conform to the Standards following completion of photographic recordation and documentation as stipulated in Section V.

III. New Construction

A. DCAM shall encourage new buildings and structures that are sympathetic or compatible to what MHC has determined to be character-defining attributes of the contributing buildings and structures on the Site.

IV. Exempted Activities

A. The following construction activities are unlikely to affect what MHC regards as the character-defining attributes of the Site and are exempted from further review by MHC, including comments in any environmental review process:

1. Resurfacing, maintenance, repair or improvement of existing parking lots, roads and driveways.

2. Repair, replacement or improvements to infrastructure, i.e. heating and electrical systems, sewer, water, ventilation systems or plumbing.

3. Maintenance work such as painting, repair or replacement of substantially in-kind architectural elements.

4. All interior work.

5. Demolition or alteration of non-contributing structures.

6. New construction on the Vining Street parcel of the Site.

7. New construction on the main Site that is consistent with the design guidelines set forth in Section III.

V. Photographic Recordation and Documentation

A. Prior to demolition of any contributing building or structure, substantial new construction or other major change to the Site, DCAM and DMH shall require that the buildings and structures on the Site are documented by photographs and narratives in accordance with a "recordation plan" that satisfies all of the following:

1. Provides for documentation of the historical processes that shaped the organization, design and history of the MMHC. (The nomination of the MMHC to the National Register by MHC is sufficient documentation.)

2. Contains photographs and documentation of the character-defining attributes.

3. Is reviewed and commented upon by MHC.

4. Provides that copies of the resulting documentation are made available to MHC and BLC.

VI. Historic Rehabilitation Tax Credits

A. In order to ensure that rehabilitation of buildings and structures that MHC believes contribute to the historical significance of the Site can qualify for applicable tax credits, DMH and DCAM shall encourage any designated ground lessee to consult with MHC and the National Park Service for the purpose of meeting tax credit standards in any work to be completed.

VII. Modifications

Any party to this MOA may request that it be amended or modified whereupon the parties will consult in accordance with 950 CMR 71 to consider such amendment or modification.

Executed on this 26th day of June, 2003.

Department of Mental Health (DMH)

By: [signature] MD
Title: acting commissioner

Division of Capital Asset Management and Maintenance (DCAM)

By: [signature]
Title: Commissioner

Massachusetts Historical Commission (MHC)

By: [signature]
Title: Executive Director

Boston Landmarks Commission (BLC)

By: [signature]
Title: EXECUTIVE DIRECTOR

Appendix I

Circulation List

APPENDIX I CIRCULATION LIST

Federal Agencies

U.S. Environmental Protection Agency
Region 1, JFK Federal Building
Attn: Environmental Reviewer
1 Congress Street
Boston, MA 02114-2023

Federal Aviation Administration
New England Region, Airports Division
12 New England Executive Park
Burlington, MA 01803

State and Regional Agencies

Secretary Ian A. Bowles (2 copies)
Executive Office of Environmental Affairs
Attn: MEPA Office
100 Cambridge Street, Suite 900
Boston, MA 02114

Department of Environmental Protection
Attn: Commissioner's Office/MEPA Coordinator
One Winter Street
Boston, MA 02108

Department of Environmental Protection
Northeast Regional Office
Attn: MEPA Coordinator
205B Lowell Street
Wilmington, MA 01887

Massachusetts Aeronautics Commission
Attn: MEPA Coordinator
10 Park Plaza, Room 3510
Boston, MA 02116

Massachusetts Historical Commission
The MA Archives Building
220 Morrissey Boulevard
Boston, MA 02125

Department of Conservation and Recreation
Division of Urban Parks
Attn: MEPA Coordinator
251 Causeway Street, Suite 600
Boston, MA 02114

Massachusetts Water Resource Authority
Attn: MEPA Coordinator
100 First Avenue
Charlestown Navy Yard
Boston, MA 02129

Division of Energy Resources
Attn: MEPA Coordinator
100 Cambridge Street, 10th Floor
Boston, MA 02114

Division of Capital Asset Management
Attn: Carol Meeker
One Ashburton Place
15th Floor
Boston, MA 02108

Department of Mental Health
Attn: Cliff Robinson
Central Office
25 Staniford Street
Boston, MA 02114

Department of Public Safety
Attn: MEPA Reviewer
One Ashburton Place
Room 1301
Boston, MA 02108

Local Agencies/Representatives

Boston Redevelopment Authority
Attn: John Palmieri, Director
One City Hall Plaza, 9th Floor
Boston, MA 02201

Boston City Council
Attn: Michael P. Ross, President
One City Hall Plaza, 5th Floor
Boston, MA 02201

Boston Conservation Commission
Boston Environment Department
One City Hall Plaza
Room 805
Boston, MA 02201

Boston Landmarks Commission
One City Hall Plaza
Room 805
Boston, MA 02201

Boston Public Health Commission
Attn: Dr. Barbara Ferrer, Executive Director
1010 Massachusetts Avenue
Boston, MA 02118

Boston Water & Sewer Commission
Attn: MEPA Reviewer
980 Harrison Avenue
Boston, MA 02119

Boston Transportation Department
Attn: Charlotte Fleetwood
One City Hall Plaza
Room 721
Boston, MA 02201

Boston Parks Department
Attn: Brian McLaughlin
1010 Massachusetts Avenue, 3rd Floor
Boston, MA 02118

Boston Groundwater Trust
234 Clarendon Street, Third Floor
Boston, MA 02116

Board of Selectmen
Town of Brookline
Attn: Nancy Daly, Chair
Brookline Town Hall
333 Washington Street
Brookline, MA 02445

Libraries

Boston Public Library
Parker Hill Branch
1497 Tremont Street
Roxbury, MA 02120

The Public Library of Brookline
361 Washington Street
Brookline, MA 02445

Community

Charles River Watershed Association
190 Park Road
Weston, MA 02493

Children's Hospital Boston
Attn: Charles Weinstein
300 Longwood Avenue
Boston, MA 02115

Fenway Community Development Corporation
Attn: Lisa Soli / Mark Laderman
73 Hemenway Street
Boston, MA 02115

Friends of Historic Mission Hill
81 Lawn Street
Roxbury, MA 02120

Friends of the Muddy River
107 Queensberry Street #2
Boston, MA 02215

Medical Academic and Scientific Community Organization, Inc
375 Longwood Avenue
Boston, MA 02215-5328

The Mission Hill Health Movement
1534 Tremont Street
Roxbury, MA 02215

Mission Hill Neighborhood Housing Services
One Brigham Circle
1620 Tremont Street
M Level
Mission Hill, MA 02120