PUBLIC NOTICE

The Boston Redevelopment Authority ("BRA") d/b/a the Boston Planning & Development Agency ("BPDA") hereby gives notice pursuant to Article 80A-2 and 80B-5 of the Boston Zoning Code ("Code") that a Project Notification Form ("PNF") for Large Project review was filed by National Development (the "Proponent") on October 30, 2020 for the development of an approximately 351,500 square foot mixed-use building containing approximately 325 residential rental units, approximately 17,000 square feet of retail/restaurant space and 153 parking spaces (the "Project"). As proposed, the Project conforms to all zoning requirements and 43 affordable units will be built on-site.

The Project will be located on an approximately 66,600 square foot site consisting of two properties known as the Midtown Hotel 220 Huntington Avenue and 1 Cumberland Avenue (collectively, the "Project Site"), bounded by Huntington Avenue to the northwest, Cumberland Street to the northeast, Public Alley #404 to the southeast and the five-story mixed-use building located at 236 Huntington Avenue to the southwest. The Project Site is located in the Huntington Avenue/Prudential Center Zoning District and is directly across Huntington Avenue from the Christian Science Center plaza, with the Saint Botolph neighborhood directly to the south and the Back Bay neighborhood to the north.

The Proponent is seeking the issuance of a Scoping Determination by the BPDA pursuant to Section 80B-5. The BPDA in the Scoping Determination for such PNF may waive further review pursuant to Section 80B-5.3(d), if, after reviewing public comments, the BPDA finds that such PNF adequately describes the Project's impacts.

The PNF may be obtained from the BPDA website- www.bostonplans.org Public comments on the PNF, including the comments of public agencies, should be submitted in writing to Nupoor Monani, BPDA, at the address stated above or via email at nupoor.monani@boston.gov, within 30 days of the publication of this notice.

BOSTON REDEVELOPMENT AUTHORITY
d/b/a BOSTON PLANNING & DEVELOPMENT AGENCY

Teresa Polhemus, Executive Director/Secretary

PROJECT NOTIFICATION FORM

220 Huntington Avenue

Submitted to:
Boston Planning and Development Agency
One City Hall Square
Boston, MA 02201

Submitted by:
National Development
2130 Washington Street
Newton Lower Falls, MA 02462

Prepared by:
Epsilon Associates, Inc.
3 Mill & Main Place, Suite 250
Maynard, MA 01754

In Association with:
CBT Architects
IBI Group, Inc.
Howard Stein Hudson
The Green Engineer, Inc.
Vanderweil Engineers
Sanborn, Head & Associates
Nitsch Engineering
Nutter McClennen & Fish, LLP

October 30, 2020

Epsilon
ASSOCIATES INC.

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Chapter 1

General Information and Project Description

1.0 GENERAL INFORMATION AND PROJECT DESCRIPTION

1.1 Introduction

National Development (the Proponent) proposes the redevelopment of an approximately 66,660 square foot (sf) site consisting of two properties known as the Midtown Hotel 220 Huntington Avenue and 1 Cumberland Street (collectively the Project Site). The Project Site will be developed into a ten-story, approximately 351,500 square foot (sf) mixed-use building containing approximately 325 residential rental units, approximately 17,000 square feet of retail/restaurant space, 11,500 square feet of amenity space, 153 parking spaces and covered bike storage for approximately 325 bicycles (the Project). See Figure 1-1 for an aerial locus map of the Project Site.

The Project will make improvements to the Huntington Avenue/Prudential Center Zoning District by replacing aging low-scale buildings with quality transit-oriented housing at a scale and density that fulfills the original Christian Science Center Master Plan and is complementary to the Saint Botolph neighborhood directly to the south and the Back Bay neighborhood to the north. The Project will include new residential units, active ground floor uses and an enhanced street life and improvements to the crosswalks at the intersection of Huntington Avenue and Cumberland Street. See Figure 1-2 for a Project rendering from Huntington Avenue.

This Expanded Project Notification Form (PNF) is being submitted to the Boston Redevelopment Authority (BRA) doing business as Boston Planning & Development Agency (the BPDA) to initiate review of the Project under Article 80B, Large Project Review, of the Boston Zoning Code.

Data Source: Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services

220 Huntington Avenue Boston, Massachusetts

Epsilon ASSOCIATES INC.

Figure 1-1

Aerial Locus

Figure 1-2

Corner of Huntington Avenue and Cumberland Street

1.2 Project Identification and Team

Name /Location:	220 Huntington Avenue
Proponent:	Midtown Tenant LLC c/o National Development 2310 Washington Street Newton Lower Falls, MA 02462 (617) 527-9800 Ted Tye Samantha Randel
Architect:	CBT Architects 110 Canal Street Boston, MA 02144 (617) 262-4354 Robert Hagan Adam Cuomo
Landscape Architect:	IBI Group, Inc. 21 Custom House Street, 3rd Floor Boston, MA 02110 (617) 896-2500 Chris Jones Carl Frushour
Legal Counsel:	Nutter McClennen & Fish, LLP Seaport West 155 Seaport Boulevard Boston, MA 02210 (617) 439-2000 Mary Marshall

Permitting Consultant:	Epsilon Associates, Inc. 3 Mill & Main Place, Suite 250 Maynard, MA 01754 (978) 897-7100 Cindy Schlessinger Fiona Vardy
	RG Lathrop Consulting LLC 67 Saint Botolph Street Boston, MA 02116 (617) 784-3629 Randi Lathrop
Transportation and Parking Consultant:	Howard Stein Hudson 11 Beacon Street, Suite 1010 Boston, MA 02108 (617) 482-7080 Guy Busa Ian McKinnon
Civil Engineer:	Nitsch Engineering 2 Center Plaza, Suite 430 Boston, MA 02108 (617) 338-0063 Gary Pease Christopher Hodney Ryan Gordon
MEP:	Vanderweil Engineers 274 Summer Street Boston, MA 02210 (617) 423-7423 Alex Vanderweil Paul Van Kauwenberg
Sustainability Consultant:	The Green Engineer, Inc. 23 Bradford Street, 1st Floor Concord, MA 01742 (978) 369-8978 Sarah Michelman Matthew Smith

Geotechnical Consultant:	Sanborn, Head & Associates 98 North Washington Street, Suite 101 Boston, MA 02114 (857) 327-9730 Stan Sadkowski
Construction Management	Cranshaw Construction 2310 Washington Street Newton Lower Falls, MA 02462 (617) 965-7300 Tom Burke

1.3 Project Site

The approximately 66,660 sf (1.53-acre) Project Site is comprised of two adjacent parcels with frontage on Huntington Avenue in the Saint Botolph neighborhood of Boston. The Project Site is generally bounded by Huntington Avenue to the northwest, Cumberland Street to the northeast, Public Alley #404 to the southeast and the five-story mixed-use building located at 236 Huntington Avenue to the southwest. The Project Site is located in the Huntington Avenue/Prudential Center Zoning District and is directly across Huntington Avenue from the Christian Science Center plaza, with the Saint Botolph neighborhood directly to the south and the Back Bay neighborhood to the north. The Project Site currently includes two existing buildings: the two-story Midtown Hotel (220 Huntington Avenue), and a four-story residential building located at 1 Cumberland Street. The Midtown Hotel, a two-story structure, includes 159 hotel rooms and a single level of below grade parking. The ground floor is mostly defined by a continuous brick retaining wall and raised planter bed along Huntington Avenue, incongruous with the wide sidewalks and vibrant and permeable ground level presence along other blocks of Huntington Avenue. The second structure, at 1 Cumberland Street, is a four story brick row house containing seven rental residential units, which fronts on to Cumberland Street. Both structures will be removed from the Project Site in order to enable the dynamic redevelopment of the Project Site. The existing Project Site conditions are presented in Figures 1-3 and 1-4. A key to the area photographs is included in Figure 1-4. Area photographs are included in Figures 1-5 to 1-7. A site survey is included in Appendix A.

1.4 Area Context

The area includes many of Boston's prominent institutions dedicated to fine arts, architecture, music, theatre, and education, including the Christian Science Center, Boston Symphony Orchestra, New England Conservatory of Music, Northeastern University, the Wentworth Institute of Technology, Boston University School of Medicine, Massachusetts College of Art and Design, and the Museum of Fine Arts.

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Figure 1-3
Existing Site Conditions

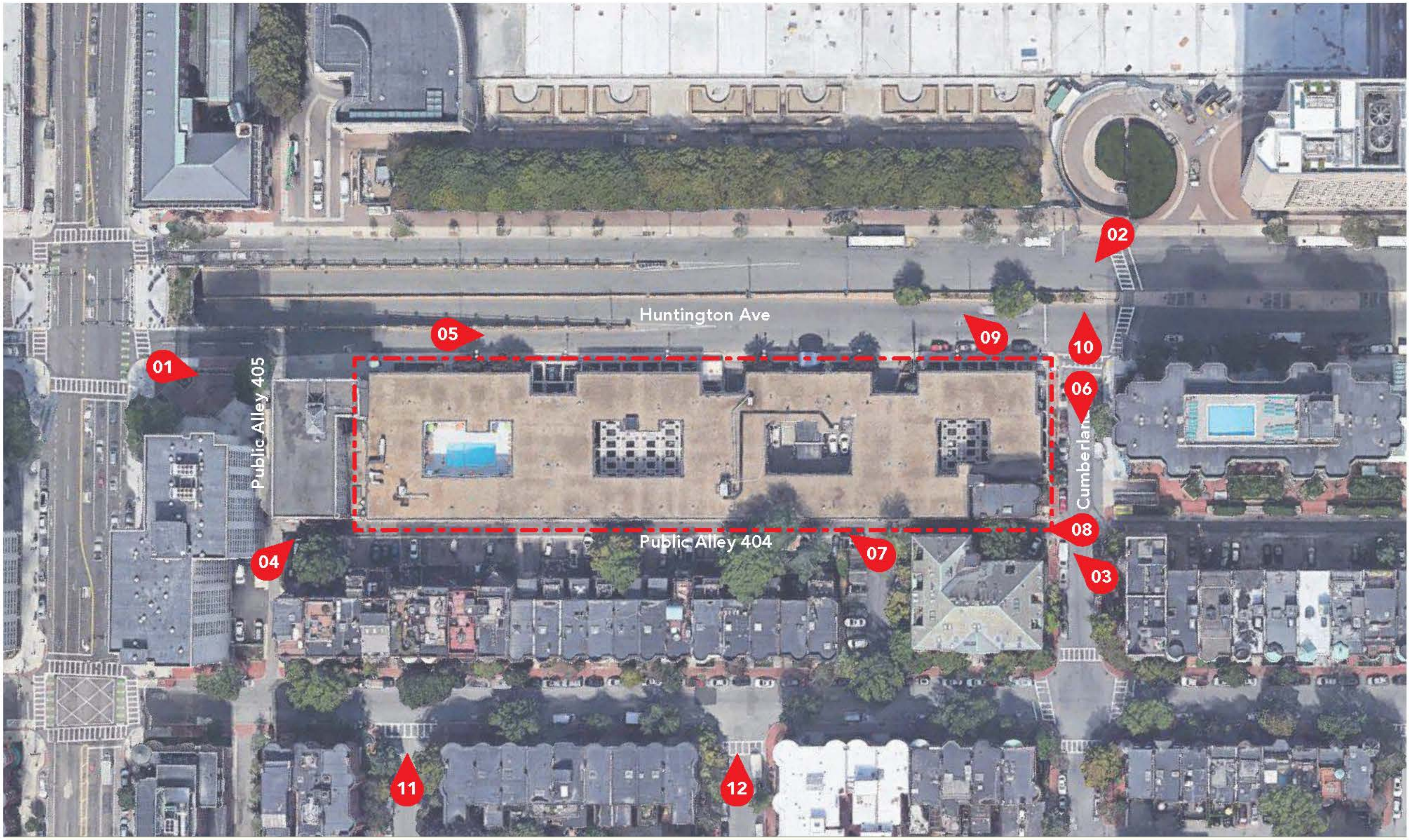

Figure 1-4

Area Photographs Location Key

01

02

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04

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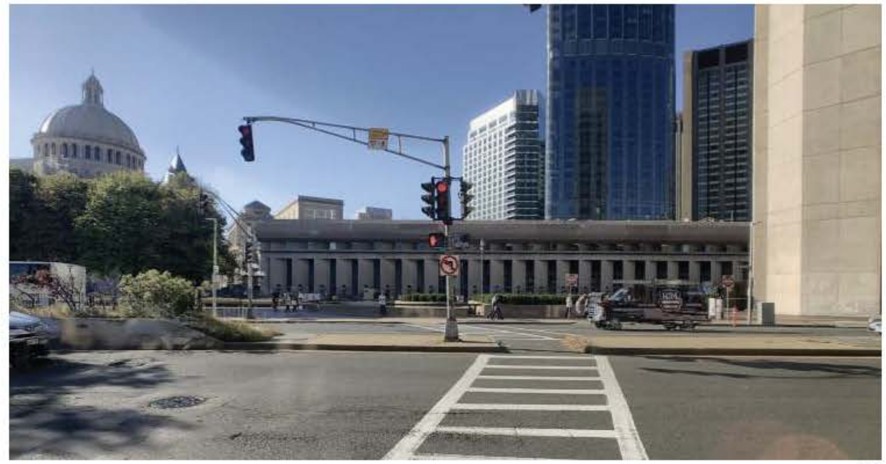

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The Project Site is well served by public transportation as it is located in close proximity to both the Symphony and Prudential stations of the Green Line and is approximately a quarter mile from the Orange Line's Massachusetts Avenue station. The Project is also well connected to regional public transportation through the Back Bay Commuter Rail/Orange Line station, located approximately a half mile from the Project Site. The area is also served by multiple bus routes in the vicinity of the Project Site which serve points throughout Boston and the neighboring cities and towns.

1.5 Project Description

1.5.1 Proposed Project

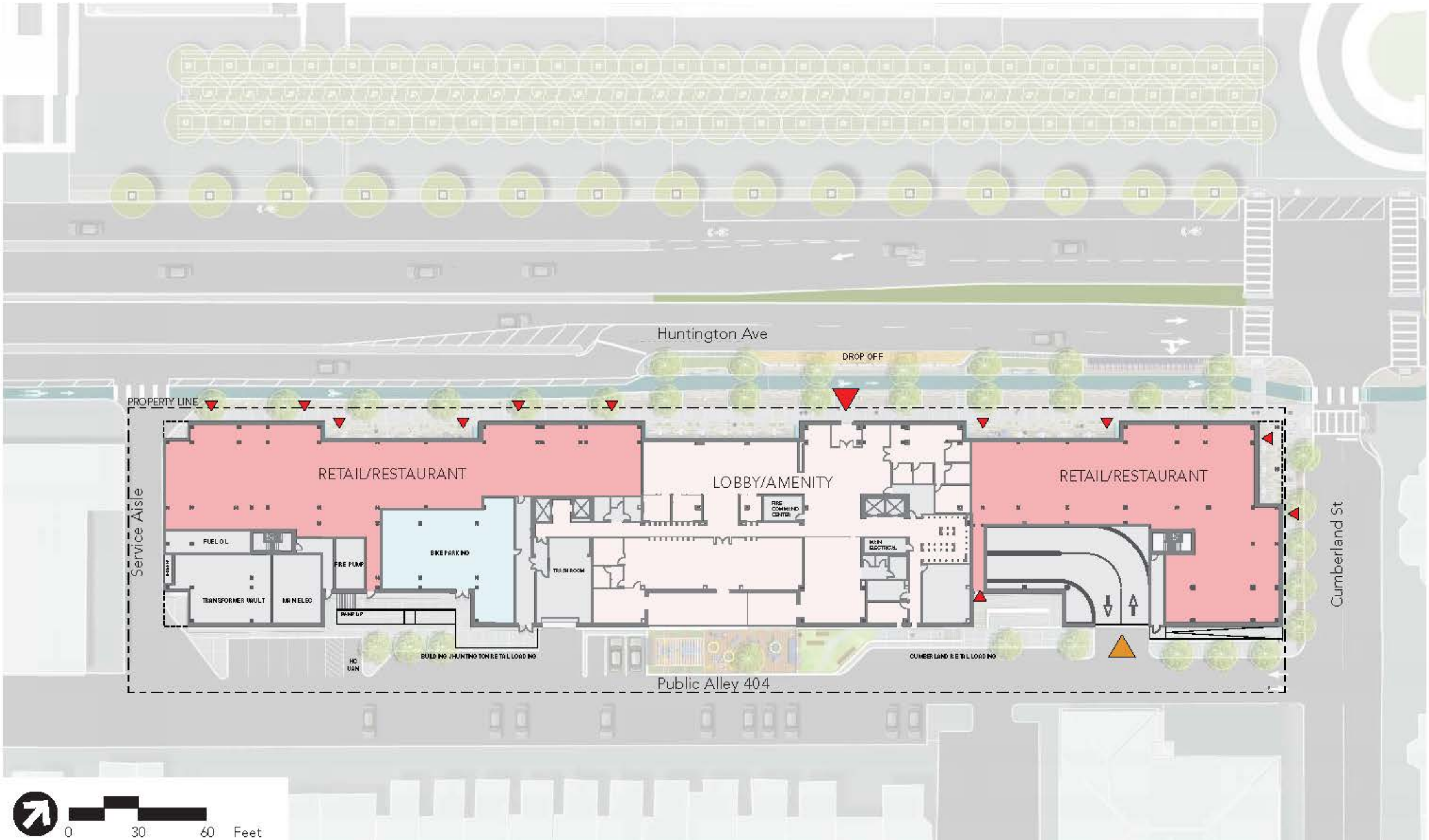
As described above, the Project will make improvements to the Huntington Avenue/Prudential Center Zoning District by replacing aging low-scale buildings with quality transit-oriented housing at a scale and density that complements the existing and established neighborhood, fulfilling the original Christian Science Center Master Plan in a manner which is sensitive and responsive to the adjacent Saint Botolph neighborhood.

The Project involves demolition of the two existing structures and the construction of a new as-of-right residential building with ground level retail and one level of below grade parking, expanding the sidewalk and public realm and extending the continuity of the streetwall condition along Huntington Avenue.

The new residential building will be a 10 story, 351,500 sf mid-rise structure that is approximately 115' high, with a below grade parking garage totaling approximately 60,000 sf. The building use is predominantly residential apartments at approximately 323,000 sf along with roughly 11,500 sf of associated residential amenities. The ground floor will consist of a residential lobby, approximately 17,000 sf of retail/restaurant space, two service/loading areas, and associated mechanical and back-of-house spaces (see Figure 1-8).

The new building will include approximately 325 residential units with a mix of unit types. The units will vary in size from studio apartments up to family-sized three-bedroom units. A market analysis will be conducted during final design phases to assist in confirming the unit types and sizes.

As part of the overall redevelopment of the Project Site, the ground floor program, public realm, and streetscape will be significantly enhanced. The existing garage entries on Huntington Avenue will be removed allowing for a continuous pedestrian zone fronting the Project along Huntington Avenue (see Figure 1-9). Ground level storefronts that work with the rhythm of the building facades are proposed for the retail spaces, and a new residential entry on Huntington Avenue will punctuate and further enhance the pedestrian experience. A cohesive building signage program



Primary Building Entry

Parking Entry

Secondary Building Entry

Figure 1-9

Open Space/Landscape Plan

will also be designed and incorporated into the ground floor experience, while loading for the Project will remain at the rear of the building along Public Alley 404. The intersection of Huntington Avenue and Cumberland Street, the building's most prominent corner, will be anchored by neighborhood-scale retail. Floor plans and sections are included in Appendix B.

The Project will aid in the revitalization of the Neighborhood by including:

- A ground floor with new retail/restaurant use(s) and a residential lobby that will activate Huntington Avenue and enliven the neighborhood by adding new local residents and promoting enhanced street life;
- The addition of new housing stock to assist in Mayor Walsh's goal of adding 53,000 housing units by 2030 (Housing a Changing City: Boston 2030);
- Proposed improvements to the sidewalks on Huntington Avenue and Cumberland Street, incorporating Boston Complete Street strategies where widths allow;
- Proposed expansion of the Public Alley 404's width to allow for better daylight space between buildings and allow for more enjoyable outdoor spaces;
- Proposed new service alley between the Project and 236 Huntington Avenue which will facilitate proper access to loading and service areas; and
- Improvements to the carriage road connection along Huntington Avenue and the Huntington Avenue/Cumberland Street intersection and crosswalks that will create safer movements for vehicles, bicycles, and pedestrians alike.

Table 1-1 Project Program

Use	GFA[1]	Quantity
Residential Residential Amenity Retail/Restaurant	323,000 sf 11,500 sf 17,000 sf	325 Units
Parking	60,000 sf	153 Spaces
Project Total	**351,500 sf**	**325 Residential Units** **153 Parking Spaces** **325 Bike Storage Spaces**

1 All areas are provided as Gross Floor Area as defined by the Boston Zoning Code. Below grade parking is not included in GFA

1.5.2 Evolution of Design

The Project Site is currently owned by The First Church of Christ, Scientist and its affiliated entities ("Church"). The Church selected National Development as the designated developer of the Project Site, and they entered into a long-term ground lease to enable development of the Project Site in March of 2020.

The Project has evolved with a number of iterations prior to landing on the current design strategy and approach. It was initially contemplated to include the demolition of 236 Huntington Avenue for the development of a high-rise tower at the primary intersection of Huntington Avenue and Cumberland Street with a low-scale building running the length of Huntington Avenue. After listening to thoughts and comments provided by its neighbors and carefully considering the role of the Project Site within the Christian Science Center Master Plan, a mid-rise as-of-right scheme was developed which provides a more deferential height, massing, and articulation. The design of the Project as it has evolved no longer includes the demolition of 236 Huntington Avenue and better reflects the bold and simple aesthetic of the structures that compose the edges of the Christian Science Center Plaza, while also providing an approach to the public realm that acknowledges a 21st century urban condition.

1.6 Public Benefits

The Project will provide many public benefits for the surrounding neighborhood and the City of Boston.

Public Realm Improvements

As previously described, the Project will include improvements to the crosswalks and intersection at Huntington Avenue and Cumberland Street which will enhance the pedestrian and bike experience along the Project Site perimeter. Proposed improvements to the sidewalks include incorporating Boston Complete Street strategies where widths allow (see Figure 1-9).

As part of the anticipated Project-related mitigation and access improvements, and based on initial conversations with BTD, and a preliminary feasibility study, the Project would reconfigure the existing signalized intersection of Huntington Avenue and Cumberland Street. The modifications would include opening up the median to improve network connectivity. Specifically, intersection changes would allow northbound left-turns from Cumberland Street to Huntington Avenue and southwest-bound left-turns from Huntington Avenue to Cumberland Street.

The proposed expansion of the width of Public Alley 404 provides better daylight space between buildings and allows for more enjoyable outdoor spaces.

Street Activation

Retail/restaurant storefronts and entrances, including the residential lobby entrance along Huntington Avenue, have been carefully considered and positioned to provide convenient access as well as potential seating and dining zones for residents and visitors to enjoy the active streetscape and views toward the Christian Science Center Plaza.

As described above, to further extend and link the neighborhoods, the sidewalks surrounding the Project Site will be improved by incorporating strategies outlined in Boston Complete Streets program, including new street trees where sidewalk widths allow and new street lighting.

Additional Housing

The addition of new housing stock will assist in Mayor Walsh's challenge of adding 53,000 housing units by 2030 (Housing a Changing City: Boston 2030).

Affordable Housing

The Project will comply with the City's Inclusionary Housing Policy, in that 13% of the units (42 units) at the Project will be affordable units. The affordable units will comprise a mix of studio, one- and two-bedroom units.

Sustainable Design/Green Building

Energy conservation and other sustainable design measures are an integral component of the Project. The Proponent is committed to complying with Article 37 of the Zoning Code by building a LEED certifiable project with a target of the Silver level, incorporating sustainable design features such as low-flow high-efficiency plumbing fixtures and LED lighting technology.

Increased Employment

The Project will result in the creation of approximately 500 construction jobs.

New Property Tax

The Project will generate new property tax revenues to the City of Boston through significantly increased property values.

1.7 Zoning and Regulatory Controls

Pursuant to Boston Zoning Map 1D, the Project Site is located in its entirety within the Huntington Avenue Boulevard Area of the Huntington Avenue/Prudential Center Zoning District, the zoning controls for which are set forth in Article 41 of the Boston Zoning Code and Enabling Act (the "Code"). The Project Site is also located within the Groundwater Conservation Overlay District (GCOD) and the Restricted Parking Overlay District (RPOD). The Project as designed will comply with the dimensional and use requirements set forth in Article 41 and in accordance with the requirements of Article 80B Large Project Review and will require only a conditional use permit in accordance with the provisions of the GCOD from the Zoning Board of Appeal.

1.8 Legal Information

1.8.1 Legal Judgements Adverse to the Proposed Project

There are no legal judgments or actions pending concerning the Project.

1.8.2 History of Tax Arrears

There is no history of tax arrears on property owned in Boston by the Proponent.

1.8.3 Site Controls/Public Easements

As described above, the Church selected National Development as the designated developer of the Project Site, and they have entered into a long-term ground lease to enable development of the Site. There are no public easements encumbering 220 Huntington Avenue.

1.9 Public Participation

As part of its planning efforts, the Proponent has contacted nearby residents and representatives of numerous neighborhood groups, elected officials, and public agencies. The formal community outreach process begins with the filing of this PNF.

The Proponent continues to be committed to a comprehensive and effective community outreach process and will continue to engage the community to ensure public input on the Project. The Proponent looks forward to working with the BPDA and city agencies, local elected officials, neighbors, and others as the design and review processes move forward.

1.10 Anticipated Permits and Approvals

Table 1-2 represents a preliminary list of permits and approvals from governmental agencies that are expected to be required for the Project, based on currently available information. It is possible that only some of these permits or actions will be required, or that additional permits or actions will be required.

Table 1-2 Anticipated Permits and Approvals

Agency	Permit, Review or Approval
Local	
Boston Civic Design Commission	Design Review in accordance with Article 28 of the Code
Boston Employment Commission	Compliance with the Boston Residents Jobs Policy
Boston Fire Department	Approval of Fire Safety Equipment; Fuel Oil Storage Permit (if required)
Boston Inspectional Services Department	Building Permit; Other construction-related permits; Certificates of Occupancy
Boston Landmarks Commission	Article 85 Demolition Delay
Boston Planning & Development Agency	Review under Article 80, including Large Project Review, as required pursuant to Article 80B of the Code; Affordable Rental Housing Agreement and Restriction; Cooperation Agreement; Other permits as may be identified
Boston Pubic Improvement Commission	Specific Repairs; Groundwater Recharge Wells License; Pedestrian Easement; Canopy or Projection License (if required); Earth Retention (if required)
Boston Public Works Department	Curb Cut Permit(s); Sidewalk Occupancy Management Agreement
Boston Transportation Department	Transportation Access Plan Agreement; Construction Management Plan
Boston Water and Sewer Commission	Site Plan Review Approval; Site Plan for Cut and Cap
Interagency Green Building Committee	Article 37 Review
Public Improvement Commission	Streetscape Improvements; Specific Repair Plan
State	
Massachusetts Department of Environmental Protection	Fossil Fuel Utilization permit (if required); Notice(s) of Demolition and Construction including permission for asbestos abatement (if required)
Massachusetts Bay Transit Authority	MBTA Approval, License Agreement and/or consent (if required given the proximity of MBTA infrastructure to the Project Site)
Massachusetts Water Resources Authority	Temporary Construction Dewatering Permit
Federal	
Environmental Protection Agency	Coverage under NPDES Construction General Permit; NPDES Remediation General Permit, if required
Federal Aviation Administration	Determination of No Hazard to Air Navigation for building and construction equipment, including cranes (if required)

1.11 Schedule

It is anticipated that construction will commence in the third quarter of 2021 and will be completed at the beginning of 2024.

Chapter 2

Transportation

2.0 TRANSPORTATION

2.1 Overview

The transportation study adheres to the Boston Transportation Department (BTD) Transportation Access Plan Guidelines and Boston Planning and Development Agency Article 80 Large Project Review process. The study includes an evaluation of the existing conditions, future conditions with and without the Project, loading and delivery services, transit services, pedestrian and bicycle activity, transportation demand management (TDM) strategies for the Project and construction-period impacts. None of the study intersections are expected to experience a change in level of service from the No-Build Condition to Build Condition, indicating that the Project will have no substantial impact on area traffic operations.

2.1.1 Project Description

As previously described, the Project Site is located near the intersection of Huntington Avenue and Massachusetts Avenue in the Huntington Avenue/Prudential Center Zoning District and is directly across Huntington Avenue from the Christian Science Center plaza, with the Saint Botolph neighborhood directly to the south and the Back Bay neighborhood to the north. The Project Site is occupied by an existing 159-room hotel at 220 Huntington Avenue and a seven-unit, low rise multifamily housing building at 1 Cumberland Street.

The Project includes a ten-story building with 325 residential units, approximately 17,000 square feet of retail/restaurant space and 153 parking spaces. The Project will open access to a new alley to the west of the building for delivery circulation as well as make use of the existing Public Alley 404 behind the building for most vehicle access needs. The intersection of Huntington Avenue at Cumberland Street will also be modified to improve network connectivity and site access. Table 2-1 summarizes the development program.

Table 2-1 Project Development Program

Land Use	Existing Site	Proposed Project
Hotel	159 rooms	0
Residential	7 units	325 units
Retail/Restaurant	0	17,000 sf
Amenity	0	11,500 sf
Parking	100 spaces	153 spaces

2.1.2 Transportation Summary

Residential developments generate far fewer trips per square foot than comparably sized office or retail developments and do not produce a large proportion of daily trips during commuter travel periods, thereby minimizing the Project's impacts during peak hours. Additionally, the convenience of the nearby MBTA Green Line Stations at Prudential and Symphony and the Orange Line Station at Massachusetts Avenue will encourage transit travel to and from the Project Site by Project residents. None of the study intersections are expected to experience a change in level of service from the No-Build Condition to Build Condition, indicating that the Project will have no substantial impact on area traffic operations.

Key transportation characteristics of the Project and analysis results include:

- During the a.m. peak hour, the Project will generate four fewer entering vehicle trips and nine new exiting vehicle trips and during the p.m. peak hour, the Project will generate 28 new entering trips and nine new exiting trips. Vehicle trips include automobiles, taxicabs, and transportation network company services such as Uber and Lyft.
- The Project will provide approximately 153 parking spaces for residents. The parking ratio will be approximately 0.47 spaces/residential unit. It is expected that many residents will not own an automobile and will instead rely on car sharing services, taxicabs, or Uber/Lyft, for trips requiring a vehicle.
- The Proponent will construct new sidewalks adjacent to the Project Site in accordance with Boston Complete Streets guidelines and requirements of the Americans with Disabilities Act and Massachusetts Architectural Access Board (ADA/AAB) to the extent feasible.
- In accordance with the City of Boston Bicycle Guidelines, and to encourage bicycling as an alternative mode of transportation, the Proponent will provide secure bicycle storage capacity for residents and employees. Residential bicycle storage capacity will be provided at a ratio of one per residential unit.
- The Project will have an off-street loading area off of Public Alley 404. Residential move-in/move-out and retail loading activity will occur at the two loading bays and be managed by an on-site transportation coordinator and subject to City regulation.
- The Proponent is committed to implementing Transportation Demand Management (TDM) measures to reduce residents' dependence on automobiles. TDM measures to be undertaken by the Proponent include: promoting transit services in residential marketing materials, providing secure bicycle storage, joining the local Transportation Management Association, and designating an on-site transportation coordinator.

- A Transportation Access Plan Agreement will be entered into between the Proponent and BTD and will set forth the specific TDM measures and agreements between the Proponent and the City of Boston.

2.1.3 Methodology

This transportation study and its supporting analyses were conducted in accordance with BTD and MassDOT guidelines, as described below.

- The Existing Condition analysis includes an inventory of the existing transportation conditions such as transit services, pedestrian circulation, bicycle facilities, traffic characteristics, parking, curb usage, loading, and site conditions. Existing counts of vehicles, bicycles, and pedestrians were collected at the study area intersections. A traffic data collection effort forms the basis for the transportation analysis conducted as part of this evaluation.
- The future transportation conditions analyses evaluate potential transportation impacts associated with the Project. The long-term transportation impacts are evaluated for the year 2027, based on a seven-year horizon from the year of the filing of this traffic study.
  - The No-Build (2027) Condition analysis includes general background traffic growth, traffic growth associated with specific developments (not including this Project), and transportation improvements that are planned near the Project Site.
  - The Build (2027) Condition analysis includes the No-Build condition plus the net change in traffic volume due to the Project. Expected roadway, parking, transit, pedestrian, and bicycle accommodations, as well as loading facilities associated with the Project, are identified.
- The final sections of the transportation study identify the transportation demand management measures to minimize automobile usage and Project-related impacts and outline the requirements of the Transportation Access Plan Agreement (TAPA) and Construction Management Plan (CMP).

2.1.4 Study Area

The study area, shown in Figure 2-1, consists of the following five intersections in the vicinity of the Project Site:

- Huntington Avenue at Massachusetts Avenue (signalized);
- Massachusetts Avenue at Saint Botolph Street (signalized);
- Huntington Avenue at Belvidere Street and West Newton Street (signalized);
- Huntington Avenue at Cumberland Street (unsignalized); and
- Cumberland Street at Saint Botolph Street (unsignalized).

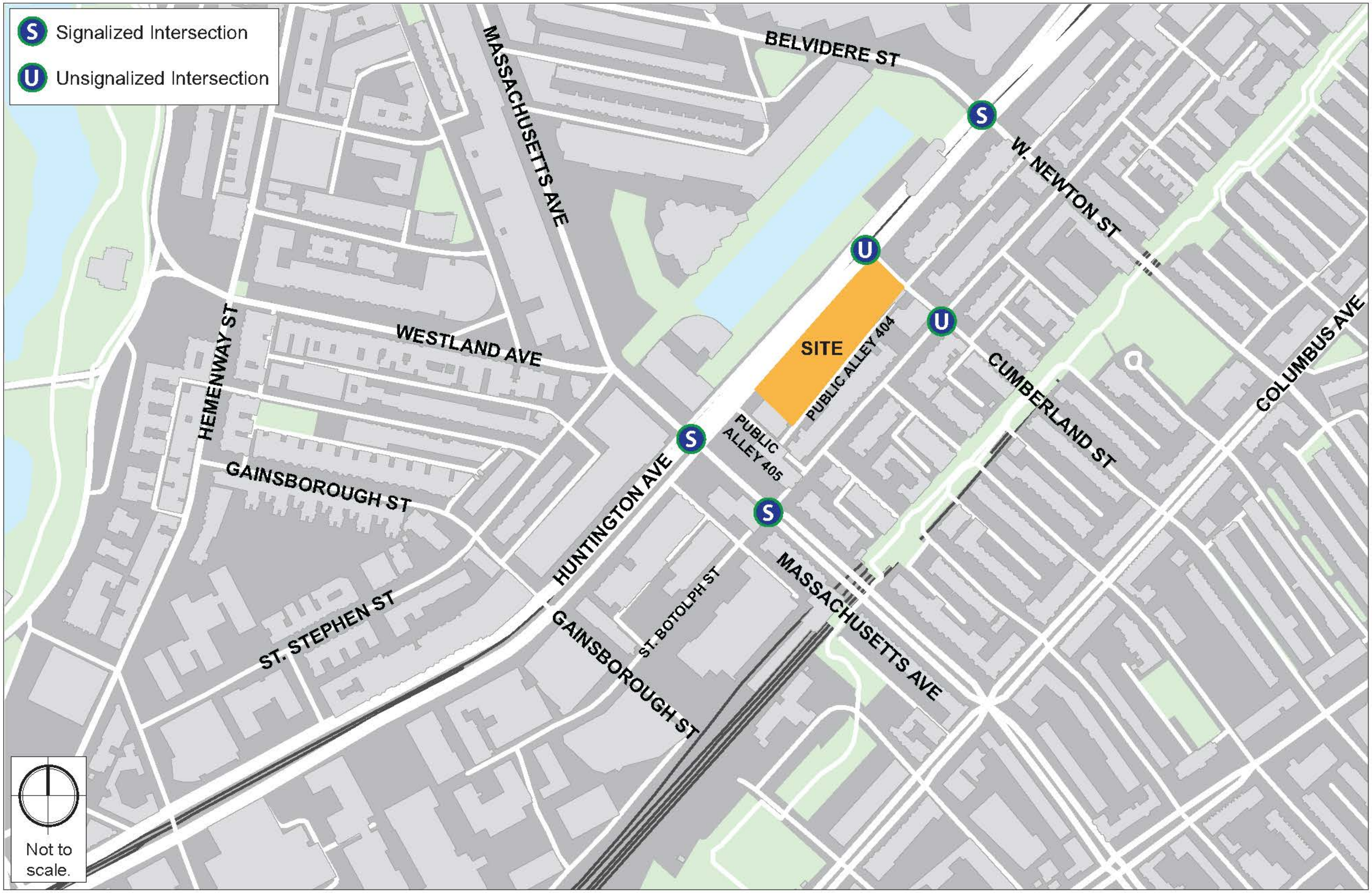


Figure 2-1
Study Area

2.2 Existing Condition

This section includes descriptions of existing study area roadway geometry, intersection geometry and traffic control, parking supply and curb use, public transportation services, car-sharing services, bicycle-sharing services, peak-hour volumes for vehicles, bicycles, and pedestrians, and intersection traffic operations.

2.2.1 Existing Roadway Conditions

The Project Site is generally bounded by Huntington Avenue to the northwest, Cumberland Street to the northeast, Public Alley #404 to the southeast and the five-story mixed-use building located at 236 Huntington Avenue to the southwest. Access to the study area and the Project Site includes the following roadways, which are categorized according to the Massachusetts Department of Transportation (MassDOT) Office of Transportation Planning functional classifications:

Massachusetts Avenue is a two-way, four lane roadway classified as an urban principal arterial under BTD jurisdiction and runs generally north-south. It extends as far north as Lexington, MA and to Columbia Road in Boston for its southern extent. Within the study area, sidewalks are provided on both sides of the roadway and on-street parking is allowed on select blocks. Painted bicycle lanes are also provided along both sides of Massachusetts Avenue in the vicinity of the Project Site. Along the roadway varying bicycle facilities exist such as bicycle lanes, protected/buffered bicycle lanes, sidewalk level cycle tracks, and sharrows.

Huntington Avenue is classified as an urban principal arterial under BTD jurisdiction that runs in an east-west direction between Washington Street to the west and Dartmouth Street to the east. In the Project vicinity, Huntington Avenue is a two-way roadway with two to four lanes in either direction.

In front of the Project Site, it has two lanes in either direction that continue down an underpass below the intersection with Massachusetts Avenue. On-street parking is provided on the southern side of the road and tour bus curb space is provided on the northern side of the road. Sidewalks are provided on both sides of the roadway. Sharrows are provided on Huntington Avenue in both directions, east of Massachusetts Avenue.

Saint Botolph Street is a two-way, two lane roadway located to the southeast of the Project Site. Saint Botolph Street generally runs in an east-west direction between Northeastern University to the west and Copley Place to the east. Saint Botolph Street is classified as a local roadway under BTD jurisdiction. On-street parking and sidewalks are provided on both sides of the road.

Belvidere Street is classified as an urban minor arterial under BTD jurisdiction. It runs east-west between Massachusetts Avenue to the west and Huntington Avenue to the east. It is a two-way, two lane road between Huntington Avenue and Dalton Street, then it becomes a one-way, one lane road going west between Dalton Street and Massachusetts Avenue. There is a bicycle lane on both sides of the road. Sidewalks and on-street parking are provided on both sides of the road.

West Newton Street is classified as an urban minor arterial road under BTD jurisdiction that runs between Huntington Avenue to the north and Washington Street to the south. This road is a two-way with two lanes within the study area, but one-way at other sections. On-street parking and sidewalks are provided on both sides of the road.

Cumberland Street is a two-way, two lane roadway classified as local under BTD jurisdiction. It runs east-west between Huntington Avenue to the north and ends at the Southwest Corridor to the south. It borders the northeast side of the proposed Project Site. On-street parking is provided on both sides of the road along with sidewalks.

Public Alley 404 is a two-way, single lane alley which only allows for one direction of travel at a time. The alley runs between Cumberland Street to the northeast and Public Alley 405 to the southwest. It is classified as a local road under BTD jurisdiction. No on-street parking is provided, however resident only parking exists behind the curb along the southeast side of the road. A sidewalk is provided on the northwest side of the road.

Public Alley 405 is a two-way, single lane alley which only allows for one direction of travel at a time. The alley runs between Huntington Avenue to the northwest and Saint Botolph Street to the southeast. It is classified as a local road under BTD jurisdiction. On-street parking is not provided. Sidewalks are provided on both sides of the road.

2.2.2 Existing Intersection Conditions

Existing conditions at the study area intersections are described below.

Huntington Avenue at Belvidere Street and West Newton Street is a signalized four-way intersection. The Huntington Avenue eastbound approach has an exclusive left-turn lane with about 200-feet of storage, a through lane, a through/right-turn lane, and adjacent on-street parking. The Huntington Avenue westbound approach has an exclusive left-turn lane with about 200-feet of storage, two through lanes, and an exclusive right-turn lane. The Belvidere Street southbound approach has an exclusive left-turn lane with about 160-feet of storage, a through lane, and an exclusive right-turn only lane. The West Newton Street northbound approach has a single left-turn/through/right-turn lane. Parking is only permitted on the eastbound approach on the south side of the street. Crosswalks are provided across all approach. ADA accessible ramps are provided on the West Newton Street approach. All other crossings have what appear to be ADA accessible ramps. Pedestrian signal heads are provided on all crossings.

Huntington Avenue at Cumberland Street is a T-intersection with a signalized pedestrian crossing. The Huntington Avenue eastbound approach consists of two through lanes and a shared through/right-turn lane. A fourth lane, adjacent to the curb, operates as a through and turns into on-street parking right at the approach with Cumberland Street. The Huntington Avenue westbound approach consists of three through lanes and a fourth lane that is used by tour buses as a waiting area. The Cumberland Street northbound approach consists of a shared left-turn/through/right-turn lane. On-street parking is allowed on either side of the Cumberland

Street approach. Crosswalks and ADA accessible ramps are provided across the Huntington Avenue westbound approach and the Cumberland Street approach. Pedestrian signal equipment is only provided across the Huntington Avenue westbound approach.

Cumberland Street at Saint Botolph Street is an unsignalized four-way intersection. All approaches have a general left-turn/through/right-turn lane. It is stop-controlled on all approaches. Crosswalks, ADA accessible ramps, and on-street parking are provided on all approaches.

Huntington Avenue at Christian Science Plaza Garage Entrance/Exit is a driveway that provides access to an underground garage that serves the Christian Science Plaza and a few surrounding buildings. Vehicles exiting the garage at this point will turn onto Huntington Avenue or Falmouth Street. Other access points include an entrance/exit under the building at 1 Dalton Street and an exit on Huntington Avenue across from Cumberland Street.

Huntington Avenue at Massachusetts Avenue is a six-legged signalized intersection with four approaches. The Huntington Avenue eastbound approach consists of a shared left-turn/through lane and a shared through/right-turn lane. The Huntington Avenue westbound approach consists of a shared left-turn/through lane and an exclusive right-turn lane. The Massachusetts Avenue northbound approach has an exclusive left-turn lane with 110-feet of storage, a through lane, a shared through/right-turn lane, and a bicycle lane. The Massachusetts Avenue southbound approach has a shared left-turn/through lane, a shared through/right-turn lane, and a bicycle lane. Along Huntington Avenue there is an approximately 50-foot wide median that consists of a short bridge overpass along Massachusetts Avenue which allows vehicles to travel through on Huntington. Sharrows are provided on Huntington Avenue eastbound. Parking is not permitted on any of the approaches. Crosswalks, wheelchair ramps, and pedestrian signal equipment are provided across all approaches of the intersection.

Massachusetts Avenue at Saint Botolph Street is a four-legged intersection with four approaches located east of the Project Site. The Saint Botolph Street eastbound and westbound approaches both consist of a single travel lane. The Massachusetts Avenue southbound approach consist of a left-turn only lane, a through lane, a through/right-turn lane, and bicycle lane. The Massachusetts Avenue northbound approach consists of a shared left-turn/through lane, a through/right-turn lane, and a bicycle lane. Residential permit parking is provided along all approaches to the intersection. Crosswalks, wheelchair ramps, and pedestrian signal equipment are provided across all approaches of the intersection.

Massachusetts Avenue at Westland Avenue/St. Stephen Street/Falmouth Street is a five-leg signalized intersection with four approaches. The Westland Avenue approach has an exclusive through only lane, an approximately 165 foot shared through/right-turn storage lane, and a bicycle lane. The Falmouth Street approach has a general left-turn/through/right-turn lane. The Massachusetts Avenue southbound approach has two through lane, a through/right-turn lane, and a protected bicycle lane. The Massachusetts Avenue northbound approach has a through/right-turn lane, a through lane, a left-turn only lane with approximately 130 feet of storage, and a bicycle lane. St. Stephan Street is a one-way road therefore it does not have vehicles entering the intersection. There is some on-street parking on either side of St. Stephen Street, however on all other approaches there is no on-street parking. Crosswalks, wheelchair ramps, and pedestrian signal equipment are provided across all approaches of the intersection.

2.2.3 Existing Parking

An inventory of the existing on-street and off-street parking in the vicinity of the Project was documented during the Fall of 2019 and is shown in Figure 2-2.

On-street parking surrounding the Project Site primarily consists of resident only parking, metered parking, tour bus waiting areas, valet parking, and partially restricted areas during select hours. The Project Site currently has an underground garage with approximately 100 parking spaces. Five public parking garages are within a quarter mile radius of the Project.

2.2.4 Car Sharing Services

Car sharing enables easy access to short-term vehicular transportation. Vehicles are rented on an hourly or daily basis, and all vehicle costs (gas, maintenance, insurance, and parking) are included in the rental fee. Vehicles are checked out for a specific time period and returned to their designated location. Vehicles are parked in local garages and lots with some locations having several cars available. Car-sharing services give users the ability to complete trips that might otherwise be an inconvenience via other modes without the need for private vehicle ownership. This may include long distance travel, trips that require transferring/carrying a lot of goods or equipment, and trips to places where public transportation is limited or does not exist.

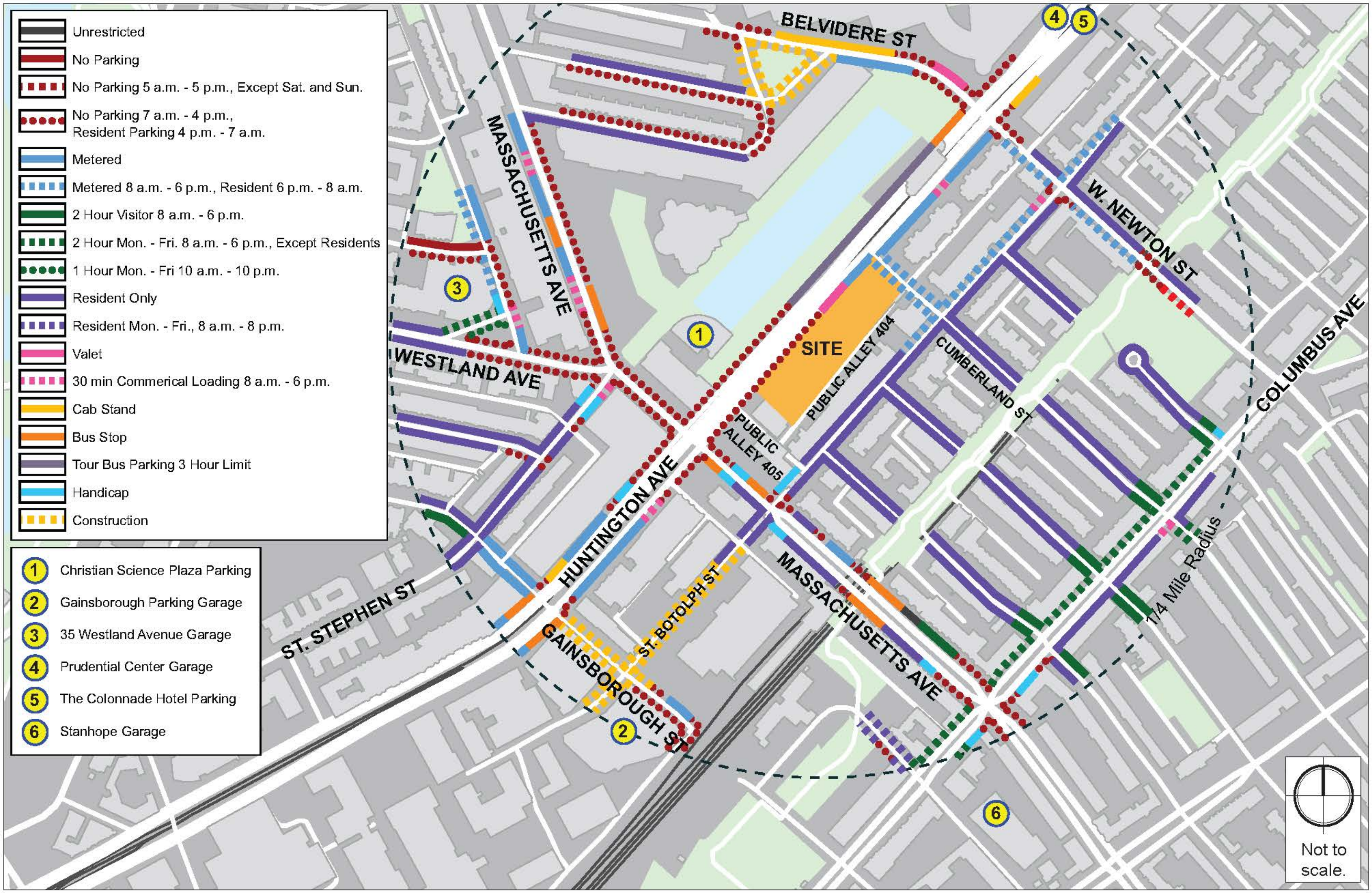
Zipcar is the primary company in the Boston car sharing market that has dedicated parking spots. Five Zipcar locations are within a quarter-mile radius (a five-minute walk) of the Project Site, with one on Huntington Street. Other car sharing companies are also emerging, such as Getaround and Turo. The vehicles available through Getaround and Turo are generally personal vehicles belonging to residents in the neighborhood, therefore the available inventory may vary. The nearby car sharing locations are shown in Figure 2-3.

2.2.5 Existing Traffic Data

Turning Movement Counts (TMCs) and vehicle classification counts were conducted during the weekday a.m. (7:00 – 9:00 a.m.) and weekday p.m. (4:00 – 6:00 p.m.) peak periods during two data collection effort.

Traffic volume data were collected on Tuesday, November 19, 2019 at:

- Huntington Avenue at Belvidere Street and West Newton Street;
- Cumberland Street at Saint Botolph Street;
- Huntington Avenue at Massachusetts Avenue; and
- Massachusetts Avenue at Saint Botolph Street.



220 Huntington Avenue Boston, Massachusetts

Figure 2-2

On-Street Parking Regulations and Off-Street Garages

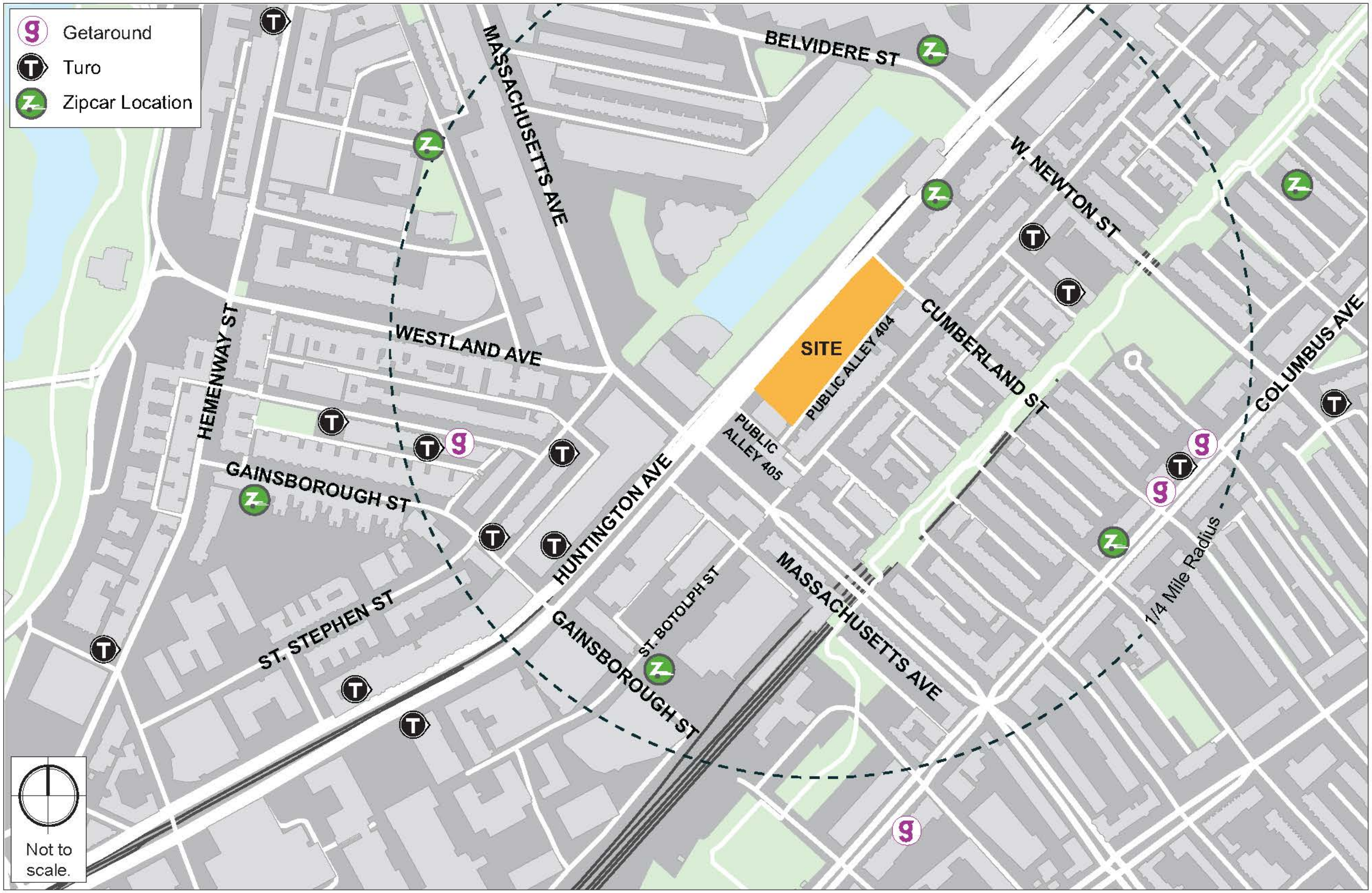


Figure 2-3
Car Sharing Locations

Counts at Huntington Avenue at Cumberland Street were collected for a longer duration from 6am-6pm on Wednesday August 7, 2019.

The traffic classification counts included car, heavy vehicle, pedestrian, and bicycle movements. The detailed traffic counts for the study area intersections are provided in Appendix C.

To account for seasonal variation in traffic volumes throughout the year, data provided by MassDOT was reviewed. The most recent (2019) MassDOT Weekday Seasonal Factors were used to determine the need for seasonal adjustments to the November and August 2019 TMCs. The seasonal adjustment factor for roadways similar to the study area (U3 and U7) in the month of August is 0.91. For roadways collected in the month of November, the factor is 0.97 for urban principal arterials (U3) and 0.99 for minor arterials and local roads (U4 and U7). These factors indicate that average month traffic volumes are less than the traffic volumes that were collected. Therefore, the traffic counts were not adjusted downward to reflect average month conditions to provide a conservatively high analysis consistent with the peak season traffic volumes. The MassDOT 2019 Weekday Seasonal Factors table is provided in Appendix C.

2.2.6 Existing Vehicular Traffic Volumes

The existing traffic volumes that were collected in November and August 2019 were used to develop the Existing Condition traffic volumes. The volumes were balanced where necessary across the roadway network within the study area.

The Existing Condition weekday a.m. peak hour and weekday p.m. peak hour traffic volumes are shown in Figures 2-4 and Figure 2-5, respectively.

2.2.7 Existing Bicycle Volumes and Accommodations

Within the study area, bicycle lanes are marked along Massachusetts Avenue on both sides of the roadway and share-the-road arrows (sharrows) are provided on Huntington Avenue west of Massachusetts Avenue. Along Westland Avenue and Belvidere Avenue there are also bicycle lanes on both sides of the road. Since none of these facilities are protected or buffered within the study area, these streets would be considered intermediate to advanced routes suitable for experienced riders or those with some on-road experience.

Bicycle counts, presented in Figure 2-6, were conducted concurrently with the vehicular TMCs. Based on the counts, bicycle activity in the area was generally high along Massachusetts Avenue and moderate along Huntington Avenue during the data collection period.

The Project Site is also located in proximity to several bicycle sharing stations provided by BLUEbikes (formerly Hubway). BLUEbikes is the Boston area's largest bicycle sharing service, which was launched in 2011 and currently consists of more than 3,400 shared bicycles at more than 190 stations throughout Boston, Brookline, Cambridge, and Somerville. As shown in Figure 2-7, there are four BLUEbike stations located within a quarter mile (approximately five-minute walk) of the Project Site.

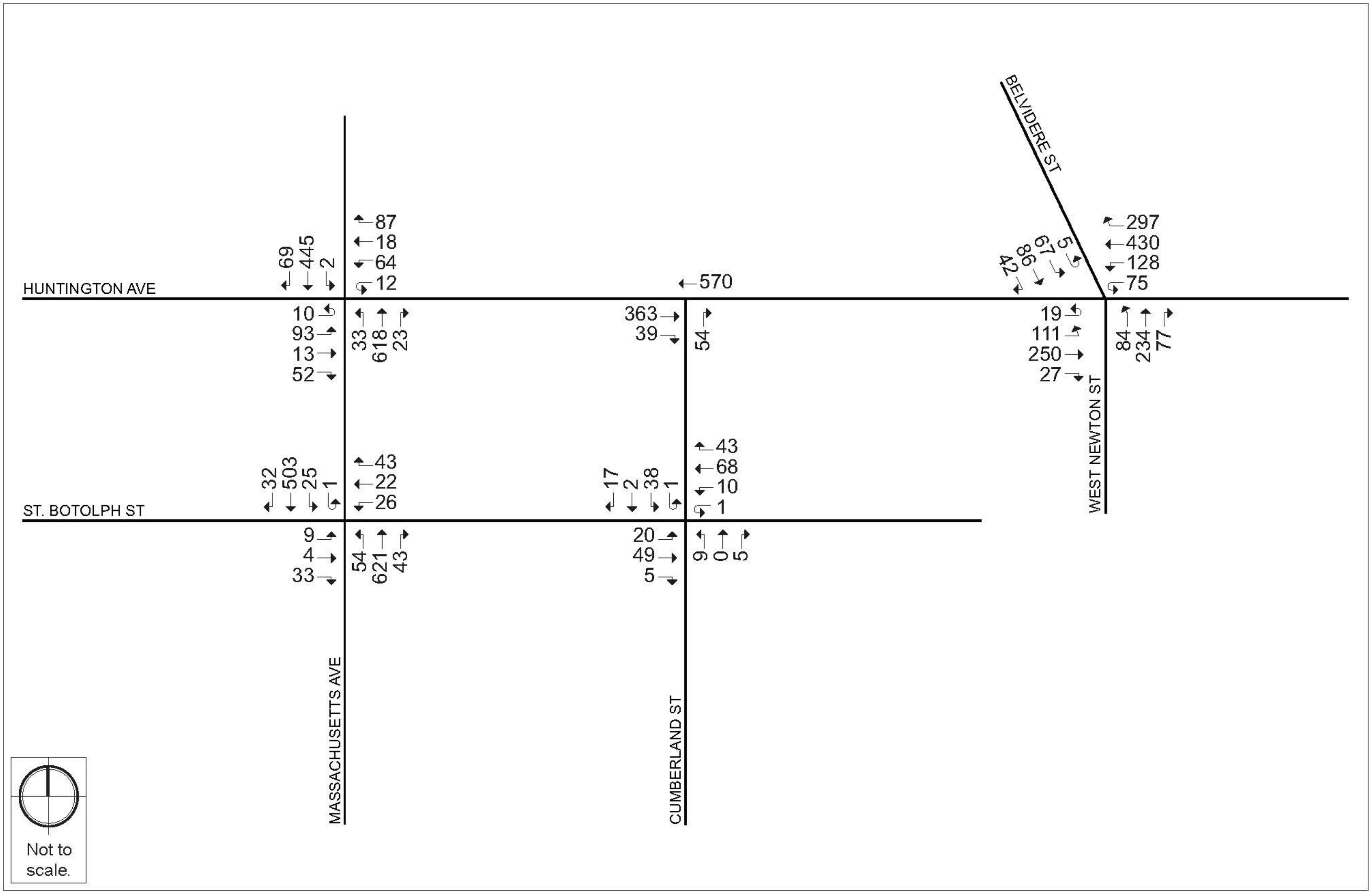


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Figure 2-4

Existing Condition Traffic Volumes, Weekday a.m. Peak Hour

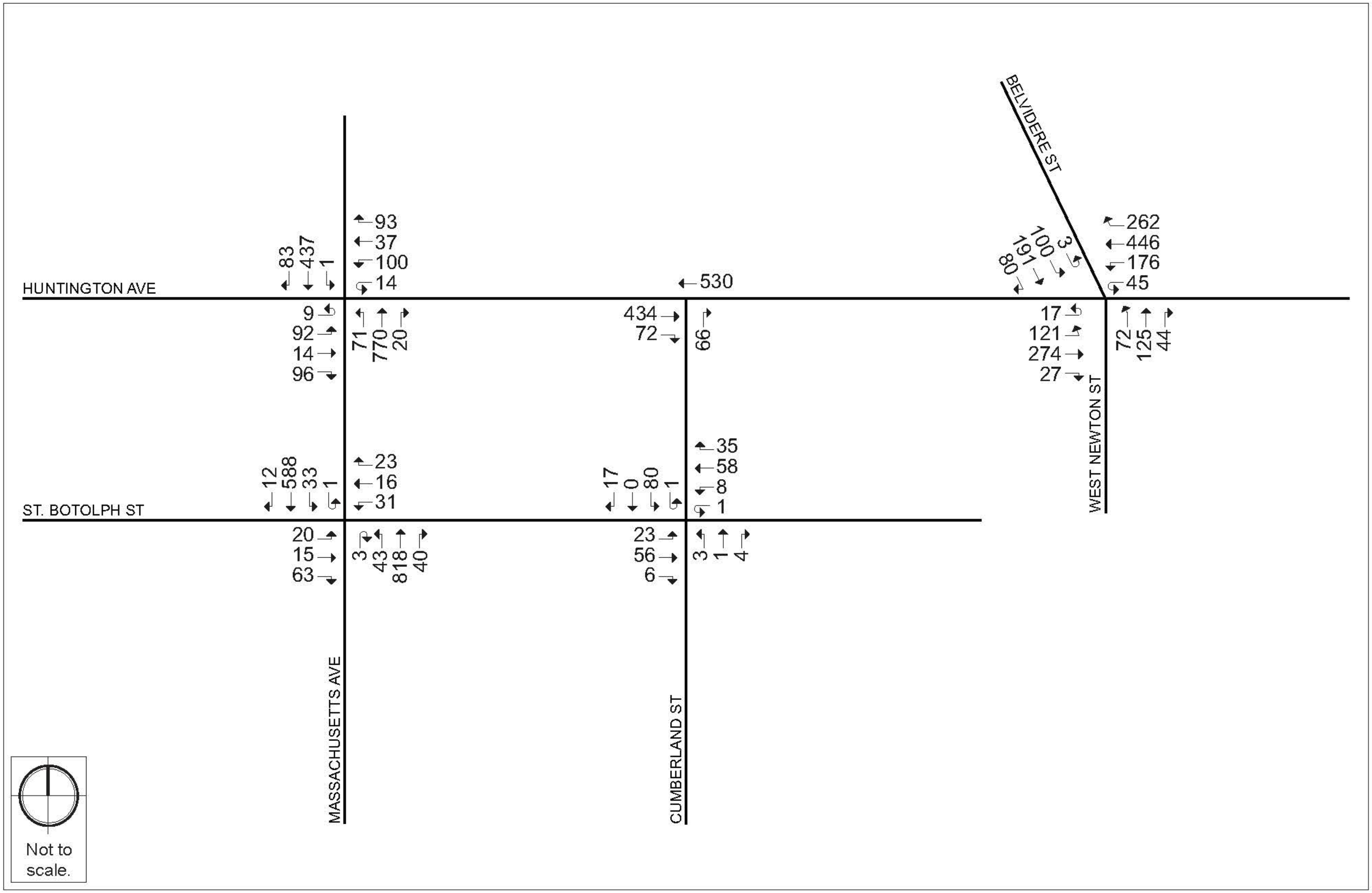

Figure 2-5

Existing Condition Traffic Volumes, Weekday p.m. Peak Hour

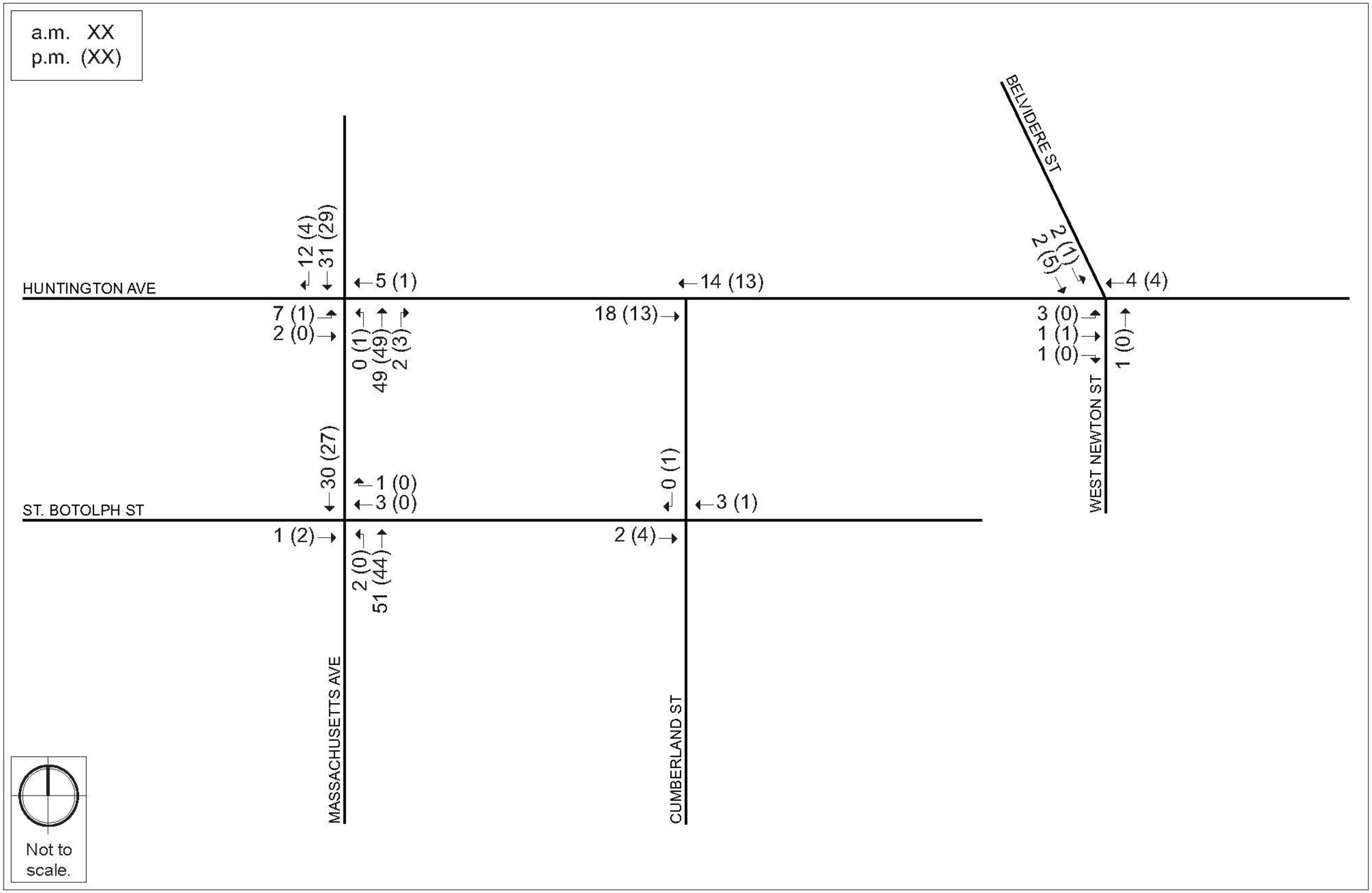

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Figure 2-6

Existing Condition Bicycle Volumes, Weekday a.m. and p.m. Peak Hours

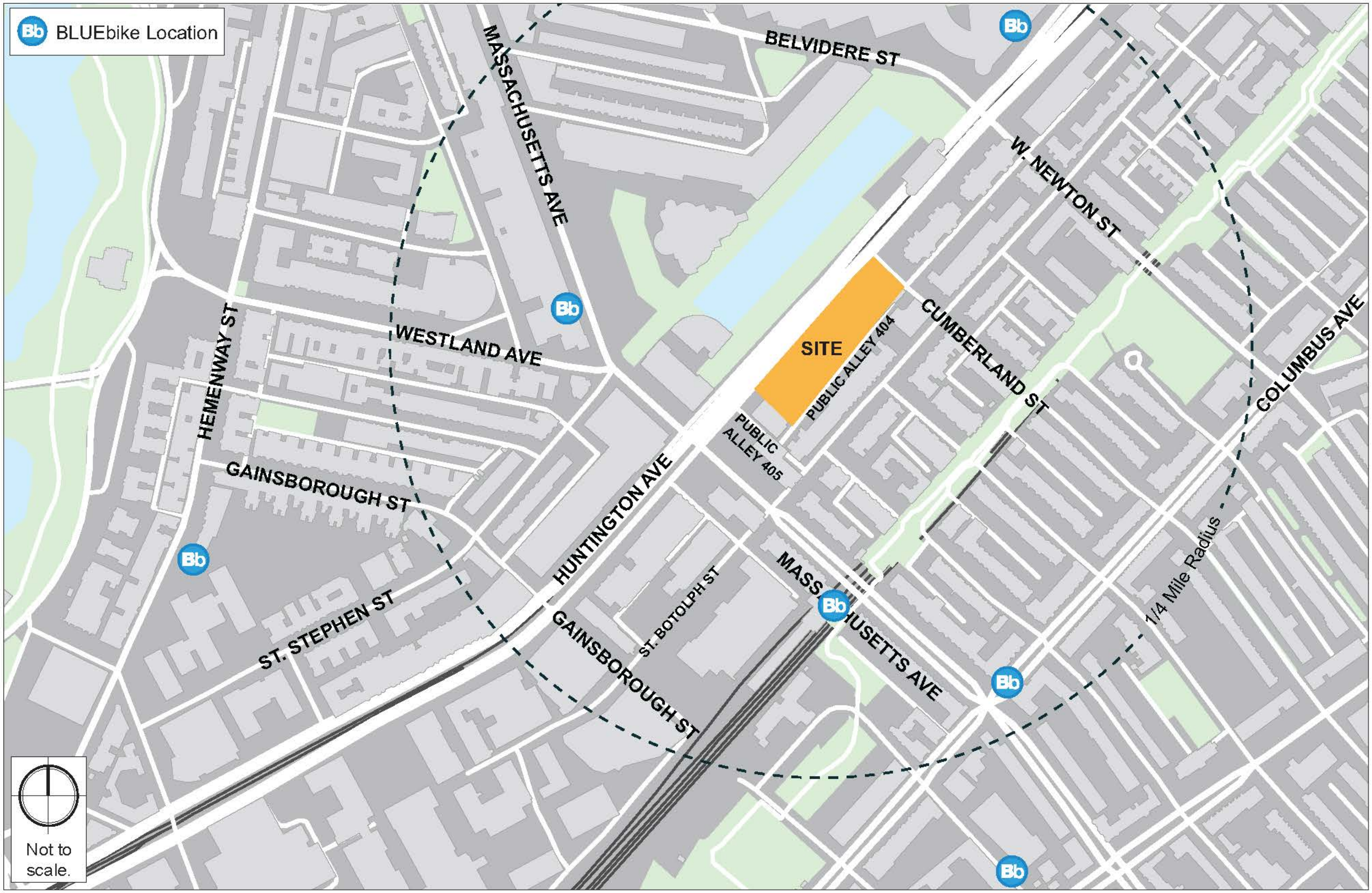

Figure 2-7
Bicycle Sharing Locations

2.2.8 Existing Pedestrian Volumes and Accommodations

Sidewalks are provided along all the roadways within the proposed study area and pedestrian signal equipment at all signalized intersections. Crosswalks and ramps are provided at all intersections across all approaches except for the eastbound approach at the intersection of Huntington Avenue at Cumberland Street. The Project will include improvements to the crosswalks and intersection at Huntington Avenue and Cumberland Street.

To determine the amount of pedestrian activity within the study area, pedestrian counts were conducted concurrently with the TMCs at the study area intersections and are presented in Figure 2-8. Pedestrian activity is very high in the study area and shows that walking is a popular means of travel during the a.m. and p.m. peak hours.

2.2.9 Existing Public Transportation Services

The Project Site is well served by public transportation options including very proximate rapid transit service. The Massachusetts Bay Transportation Authority's (MBTA) Green Line runs right under Huntington Avenue with two stations within a quarter mile radius (a five-minute walk) of the Project Site: Symphony Station and Prudential Station. The Massachusetts Avenue Station on the MBTA Orange Line is also within a quarter mile from the Project Site. Slightly further away and outside the quarter mile radius is the Northeastern University Station. Additionally, the MBTA operates three bus routes (1,39, and 170) within a quarter mile of the Project Site. Route 55 stops within a quarter mile of the Project Site in the outbound direction and within a half mile in the inbound direction. Route 43 stops within a half mile of the Project Site in the outbound and inbound directions. The nearby public transit services are shown in Figure 2-9 and summarized in Table 2-2.

Table 2-2 Existing Public Transportation Service Summary

Transit Service	Description	Peak-Hour Headway (minutes)[1]
Rapid Transit Routes		
Orange Line	Forest Hills – Oak Grove	6
Green Line	Branch E: Lechmere – Heath Street	6-7
Bus Routes		
1	Harvard Square Station – Dudley Square Station	8-11
39	Forest Hills Station – Back Bay Station	7-9
43	Ruggles Station – Park Street Station	20-30
55	Jersey Street and Queensberry Street – Park St Station	17-30
170	Waltham Center – Dudley Station	25 (a.m.) 60 (p.m.)

[1] Headway is the scheduled time between trains or buses. Headways are approximate.
Source: www.mbta.com, February 2020.

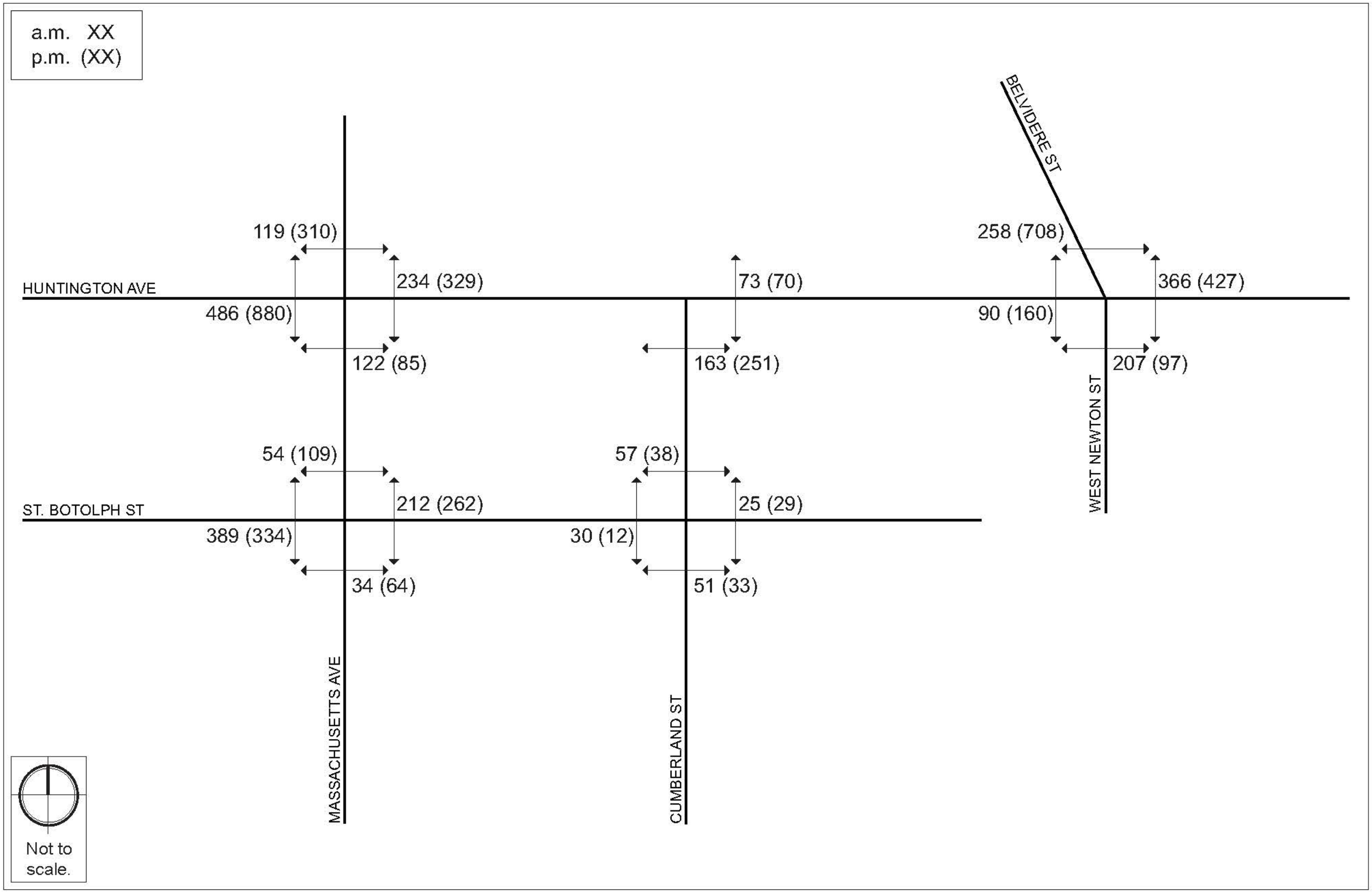

Figure 2-8

Existing Condition Pedestrian Volumes, Weekday a.m. and p.m. Peak Hours

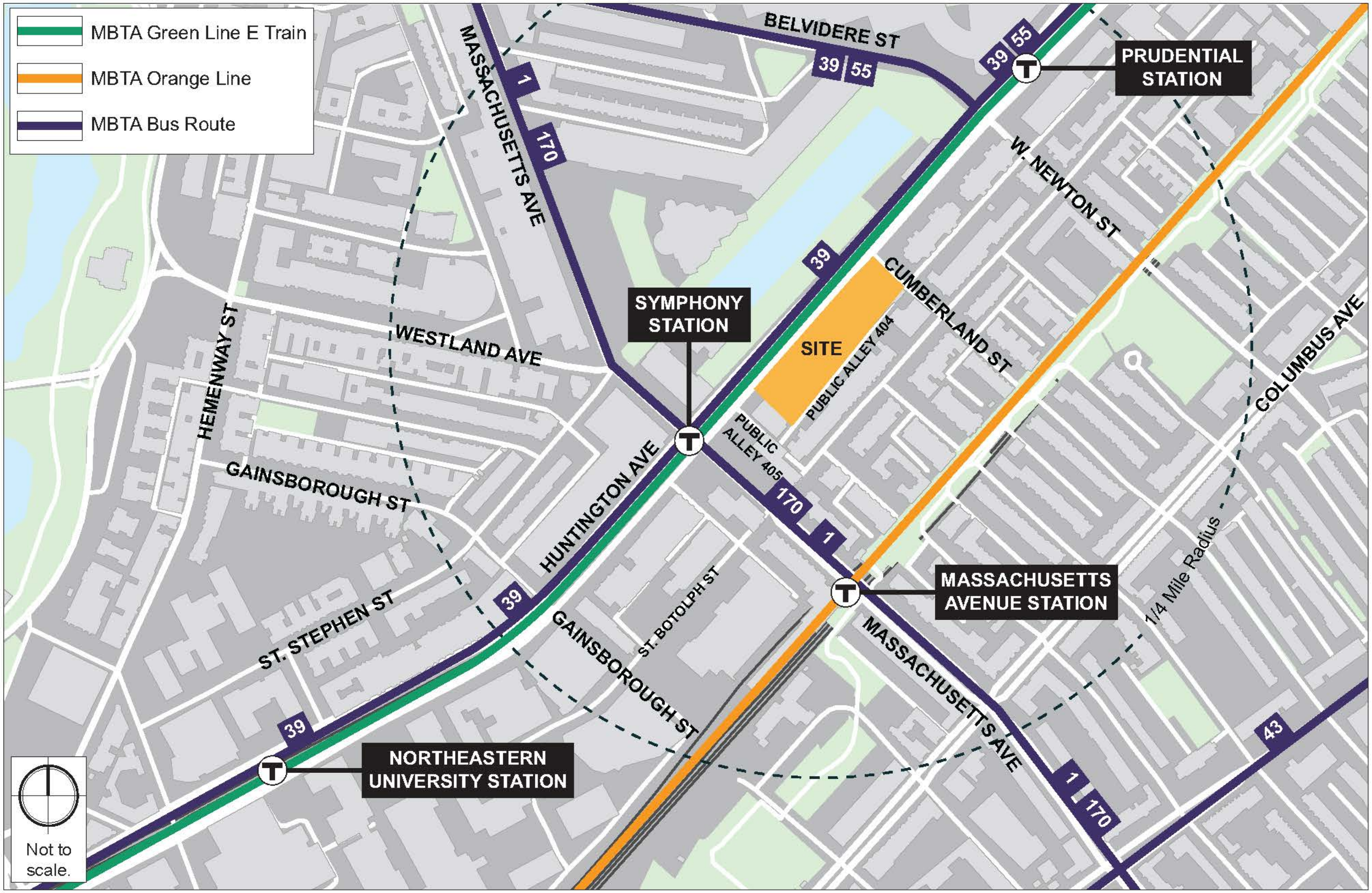

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Figure 2-9
Public Transportation

2.2.10 Existing Transit Ridership

To determine the existing ridership, the peak load point along each route was identified. Rail flow data from Spring 2018 was used to serve as the baseline for the rail transit analyses, which shows average boarding, alighting, and exit loads at each station in 15-minute increments. Automated passenger count (APC) data from Fall 2019 was used to serve as the baseline for the bus transit analysis, which shows average boarding, alighting, and exit loads at a stop for each bus trip. Of the existing transit services in the area, only the closest and frequently operating rail and bus lines within a quarter mile of the Project Site were analyzed. Route 170, which does not have frequent service throughout the day, and Route 55, which does not stop within a quarter mile of the Project Site in the outbound direction, are not expected to be impacted by users of the Project Site and therefore were not analyzed. The Existing Condition maximum hourly passenger loads are shown in Table 2-3 for the Orange Line and Green Line and in Table 2-4 for Bus Routes 1 and 39.

Table 2-3 Existing Condition Orange and Green Line, Maximum Hourly Passenger Load

Time of Day	Orange Line				Green Line (Branch E)			
	North of Mass. Ave		South of Mass. Ave		East of Symphony		West of Symphony	
	Northbound	Southbound	Northbound	Southbound	Eastbound	Westbound	Eastbound	Westbound
5 - 6 am	436	1,103	414	296	399	766	26	90
6 - 7 am	2,624	3,616	2,656	1,122	1,283	2,011	130	304
7 - 8 am	4,031	5,943	3,991	1,538	3,506	3,858	358	496
8 - 9 am	5,709	7,439	5,257	1,398	4,686	4,901	535	464
9 - 10 am	2,793	3,678	2,684	955	2,650	2,926	308	342
10 - 11 am	1,608	2,066	1,514	783	1,662	1,919	222	253
11 - 12 pm	1,535	1,751	1,334	884	1,704	1,728	282	228
12 - 1 pm	1,629	1,738	1,283	1,120	1,873	1,903	304	267
1 - 2 pm	1,823	1,835	1,363	1,290	2,020	2,014	322	282
2 - 3 pm	2,475	2,192	1,963	1,709	2,636	2,162	550	292
3 - 4 pm	3,684	2,777	1,968	2,291	3,467	2,679	693	310
4 - 5 pm	5,312	3,809	2,193	3,246	4,638	3,337	726	398
5 - 6 pm	6,947	5,122	2,138	4,521	5,365	5,078	709	611
6 - 7 pm	4,180	3,020	1,329	2,845	3,850	3,810	517	410
7 - 8 pm	2,356	1,876	838	1,785	2,499	2,164	261	284
8 - 9 pm	1,731	1,464	650	1,430	1,952	1,453	206	237
9 - 10 pm	1,488	1,264	473	1,257	1,988	1,189	156	203
10 - 11 pm	1,549	1,021	414	1,038	2,074	995	100	162
11 - 12 am	1,126	753	216	768	1,307	638	86	92
12 - 1 a.m.	322	238	70	243	443	237	18	34

Table 2-4 Existing Condition Bus Routes 1 and 39, Maximum Hourly Passenger Load

Time of Day	North of Nearby Bus Stop*				South of Nearby Bus Stop*			
	Inbound		Outbound		Inbound		Outbound	
	1	39	1	39	1	39	1	39
5 - 6 am	43	58	89	13	48	169	94	24
6 - 7 am	134	107	160	67	197	414	139	108
7 - 8 am	296	120	329	129	342	392	226	166
8 - 9 am	357	137	372	132	306	440	221	161
9 - 10 am	233	74	195	54	198	261	134	87
10 - 11 am	125	72	154	30	120	195	149	79
11 - 12 pm	137	59	155	42	150	136	156	107
12 - 1 pm	150	58	130	41	159	133	126	112
1 - 2 pm	142	78	170	49	152	158	169	143
2 - 3 pm	185	75	189	58	180	122	195	251
3 - 4 pm	262	92	224	57	225	157	241	254
4 - 5 pm	352	137	366	81	248	203	341	371
5 - 6 pm	343	77	328	118	217	127	236	416
6 - 7 pm	249	58	235	81	147	97	132	259
7 - 8 pm	179	36	203	75	111	61	108	257
8 - 9 pm	128	25	130	50	98	44	55	165
9 - 10 pm	137	17	124	34	107	33	46	125
10 - 11 pm	78	18	112	30	69	43	38	123
11 - 12 am	69	13	42	23	63	21	28	87
12 - 1 am	22	5	26	10	20	8	13	32
1 - 2 am	4	-	4	3	3	-	2	4

* Nearby Stops:

Bus #1 - Massachusetts Ave @ Huntington Ave (Inbound) and Massachusetts Ave @ Saint Botolph St (Outbound).
Bus #39 - Huntington Ave @ Prudential Station (Inbound) and Huntington Ave @ Belvidere St (Outbound).

2.3. No-Build Condition

The "No-Build (2027) Condition" reflects a future scenario that incorporates anticipated traffic volume changes associated with background traffic growth independent of any specific project, traffic associated with other planned specific developments, and planned infrastructure improvements that will affect travel patterns throughout the study area. These infrastructure improvements include roadway, public transportation, pedestrian facility, and bicycle facility improvements.

2.3.1 Background Traffic Growth

The methodology to account for general future background traffic growth is to evaluate how traffic volumes may be affected by changes in demographics, smaller scale development projects, or projects unforeseen at this time. Based on a review of recent and historic traffic data collected and to account for any additional unforeseen traffic growth, a traffic growth rate of one-half percent (0.5%) per year, compounded annually through the horizon year, was used.

2.3.2 Specific Development Traffic Growth

Traffic volumes associated with larger, known development projects can affect traffic patterns throughout the study area within the future analysis time horizon. Key background development which have board approval the Boston Planning and Development Agency (BPDA) or are currently under construction were identified and are shown in Figure 2-10. Traffic volumes associated with the following projects were directly incorporated into the future conditions traffic volumes:

- **Parcel 12** – This project is a combined land and air rights parcel that passes over the Massachusetts Turnpike (I-90). The project will consist of 429,000 sf of office space, 55,000 sf of retail/residential space, up to 150,000 sf to be use as either a hotel or residential units, and approximately 150 parking spaces. The project will also feature approximately 28,000 sf of open space made up of a civic plaza and elevated public park. The project has been approved by the BPDA Board.

- **1000 Boylston Street** – The proposed project will consist of a single condominium tower with approximately 108 units with greenspace and outdoor amenities on the roof. The project will include 45,500 sf of retail and restaurant space and two stories of the structure will house approximately 175 parking spaces. The project has been approved by the BPDA Board.

- **252-264 Huntington Avenue** – This project includes a new building which will be both the expansion of an existing facility and the addition of residential space. The first and second floor of the new building will be a 14,000 sf expansion of the existing Huntington Theatre on the site as well as include 7,500 sf of ground floor retail/restaurant space. Above that there will be a residential tower with 426 residential units. The project will also have a below-grade garage with 114 parking spaces. The project has been approved by the BPDA Board.

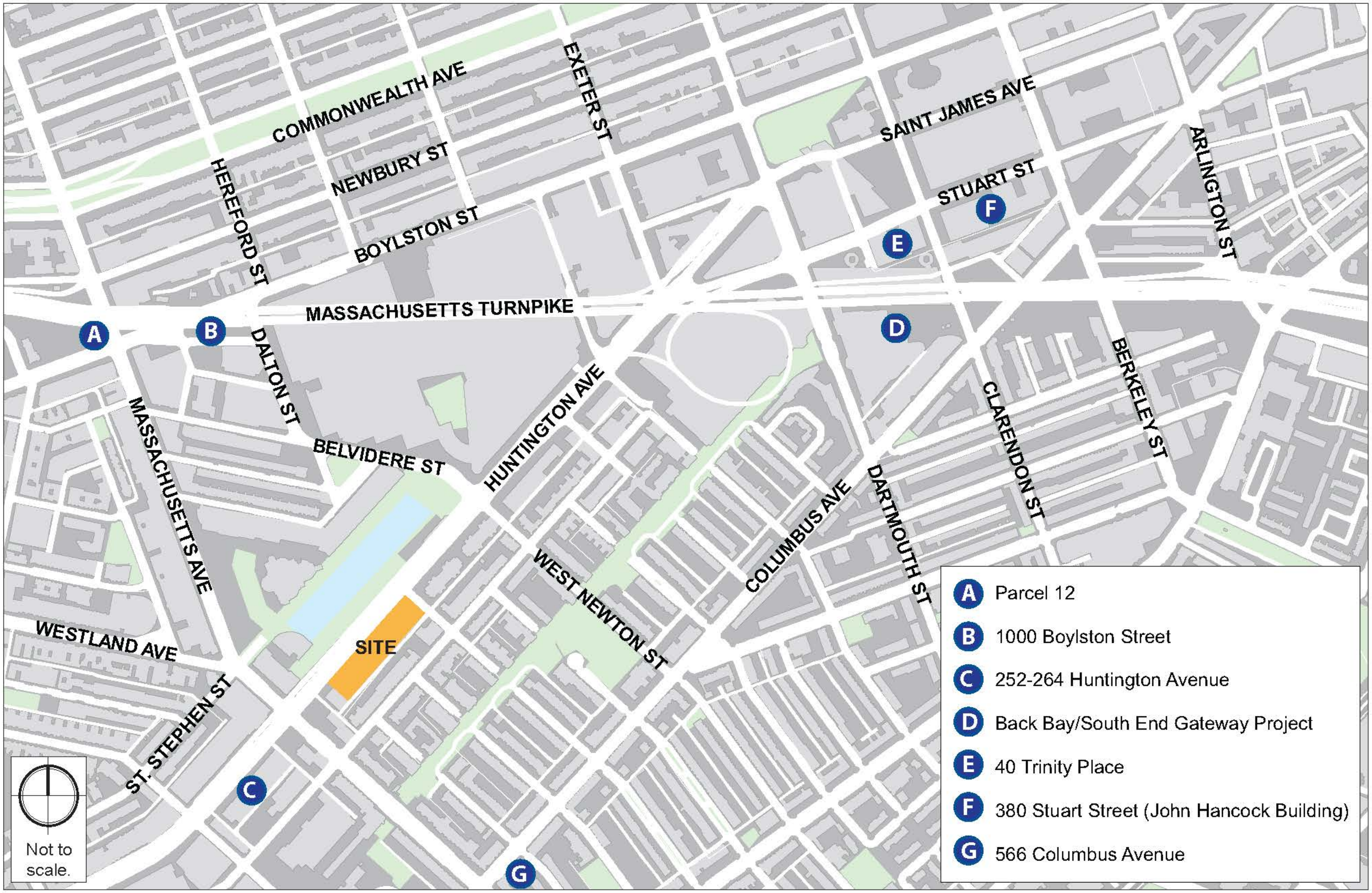

Figure 2-10
Background Projects

- **Back Bay/South End Gateway Project** – This project will be a transit-oriented redevelopment as the site is located on active transportation infrastructure at Back Bay Station. The new mixed-use buildings will consist of 592,000 sf of office space, 62,000 sf of retail and restaurant space, and approximately 600 residential units. In addition to the land development, the project is pre-paying rent for their lease to the land so that the MBTA may make improvements to the Back Bay Station. The project has been approved by the BPDA Board.

- **40 Trinity Place** – This project will be a 31-story building comprised of 154 hotel guest rooms with amenities, approximately 146 condo units, and 11,300 sf of restaurant and lounge space. The project does not propose any new parking spaces, but instead uses 126 spaces at two off-site garages. This project is currently under construction.

- **380 Stuart Street** – This project will include construction of approximately 615,000 sf of office space, and 10,000 sf of ground floor retail/safe space. The new development will serve the growing John Hancock business. The project will also include 175 below-grade parking spaces. The project has been approved by the BPDA Board.

- **566 Columbus Avenue** – The project will include the redevelopment of an existing site into a six-story building, 87,900 sf building. The building will consist of 2,300 sf of office space, 2,700 sf of retail and exhibition space, and 66 homeownership units. There will also be a below-grade garage with 42 parking spaces. The project has been approved by the BPDA Board.

Traffic volumes for several smaller or more remote projects, listed below, are reflected in the general background traffic growth.

- **72 Burbank Street** – This project includes a new 20,629 sf residential building on an existing surface parking lot. The proposed development is a six-story building with 32 compact living rental units. The project has been approved by the BPDA Board.

- **Northampton Street Residences** – This project includes redevelopment of an existing surface parking lot into a 5 1/2 story residential building with 47 affordable housing units. The building will contain a mix of rental and homeownership units. The project has been approved by the BPDA Board.

Additionally, the Christian Science Garage is expected to close their west exit which will shift some exiting volume to the drum exit near the intersection of Huntington Avenue and Cumberland Street.

2.3.3 Proposed Infrastructure and Transit Improvements

The following two projects were identified within the study area regarding improvements to transit.

- **Symphony Station Improvements**. Symphony Station serves the Green Line Branch E and the proposed improvements will help with safety and accessibility at the station. Improvements include raised platforms, new elevators, accessible bathrooms, better wayfinding, and new lighting. These improvements are not expected to increase capacity.

- **Green Line Track Updates**. Sections of track along the Green Line Branch E as well as the rest of the Green Line were replaced. Select intersections were also improved with new rubber panels to enhance the crossing experience for pedestrians and bicycles. Improving tracks that had reached their service life means that rail cars will no longer have to travel slowly within certain areas. These improvements are expected to improve travel times and reliability, but have no known capacity impacts.

- **Train Car Upgrades**. As part of their long-term transit improvements, the MBTA plans to gradually replace train cars with new higher capacity cars as well as add more cars to increase the fleet size on the orange and green lines. The Orange Line fleet change is already in progress and will include replacing 120 cars and add 32 new cars. The increase in future rail capacity due to the new cars was the only improvement taken into consideration for the future transit analysis.

2.3.4 No-Build (2027) Traffic Volumes

The one-half percent per year annual growth rate, compounded annually, was applied to the Existing Condition traffic volumes, then the traffic volumes associated with the background development projects listed above were added to develop the No-Build (2027) Condition traffic volumes. The No-Build (2027) weekday a.m. peak hour and p.m. peak hour traffic volumes are shown on Figure 2-11 and Figure 2-12, respectively.

2.3.5 No-Build (2027) Transit Ridership

Transit ridership growth rates were obtained from the Central Transportation Planning Staff (CTPS) Long Range Transportation Plan (LRTP), which reflects the 2040 statewide transportation projections. The existing ridership was grown by a general background growth rate of 0.75% for the bus ridership and 1% for the rail ridership. The background growth was used to develop the No-Build (2027) Condition maximum hourly passenger load to represent a baseline for the future without the Project. The No-Build (2027) Condition maximum hourly passenger loads are shown in Table 2-5 and Table 2-6 for the rail lines and bus routes, respectively.

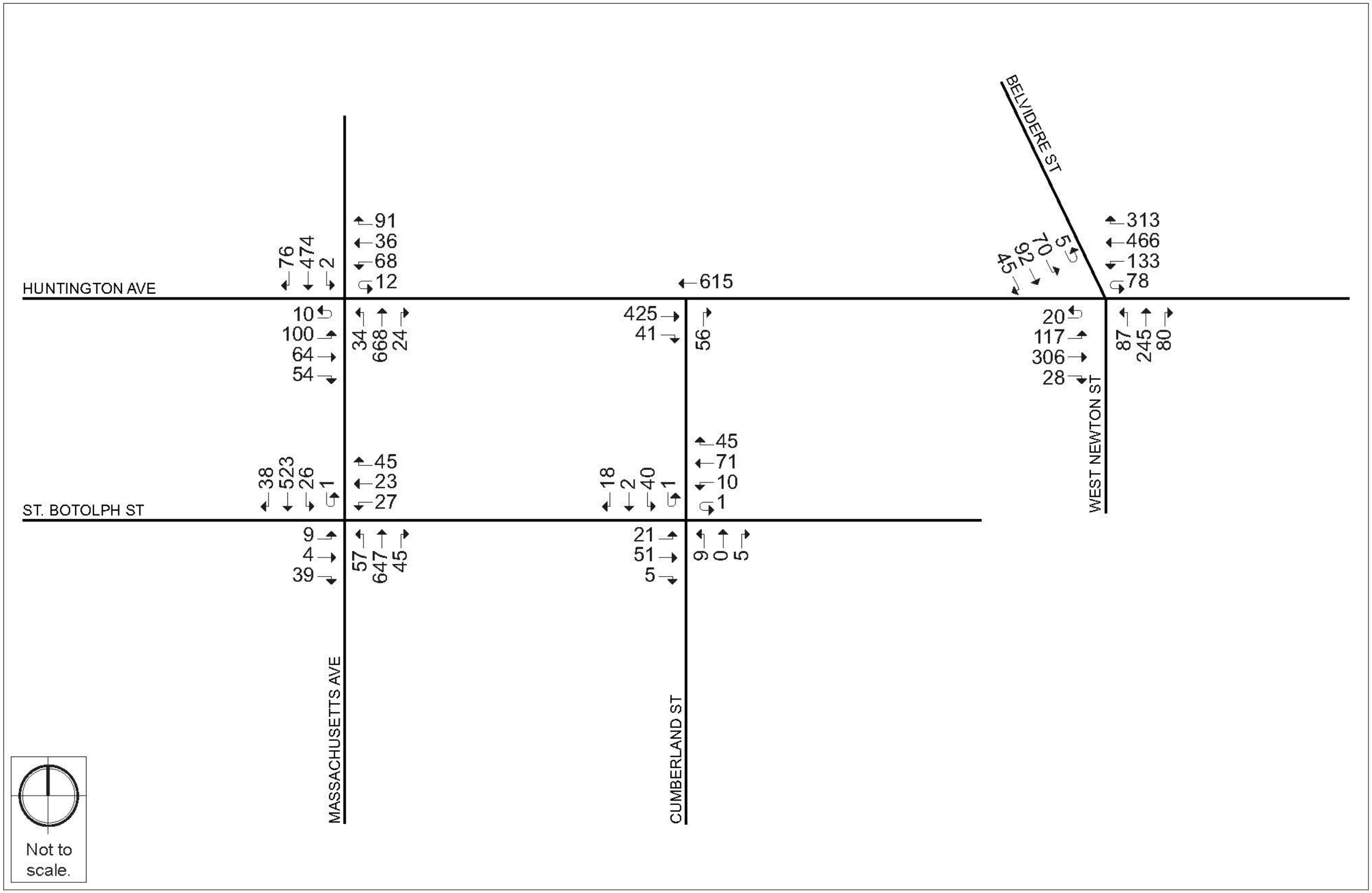

Figure 2-11

No-Build (2027) Condition Traffic Volumes, Weekday a.m. Peak Hour

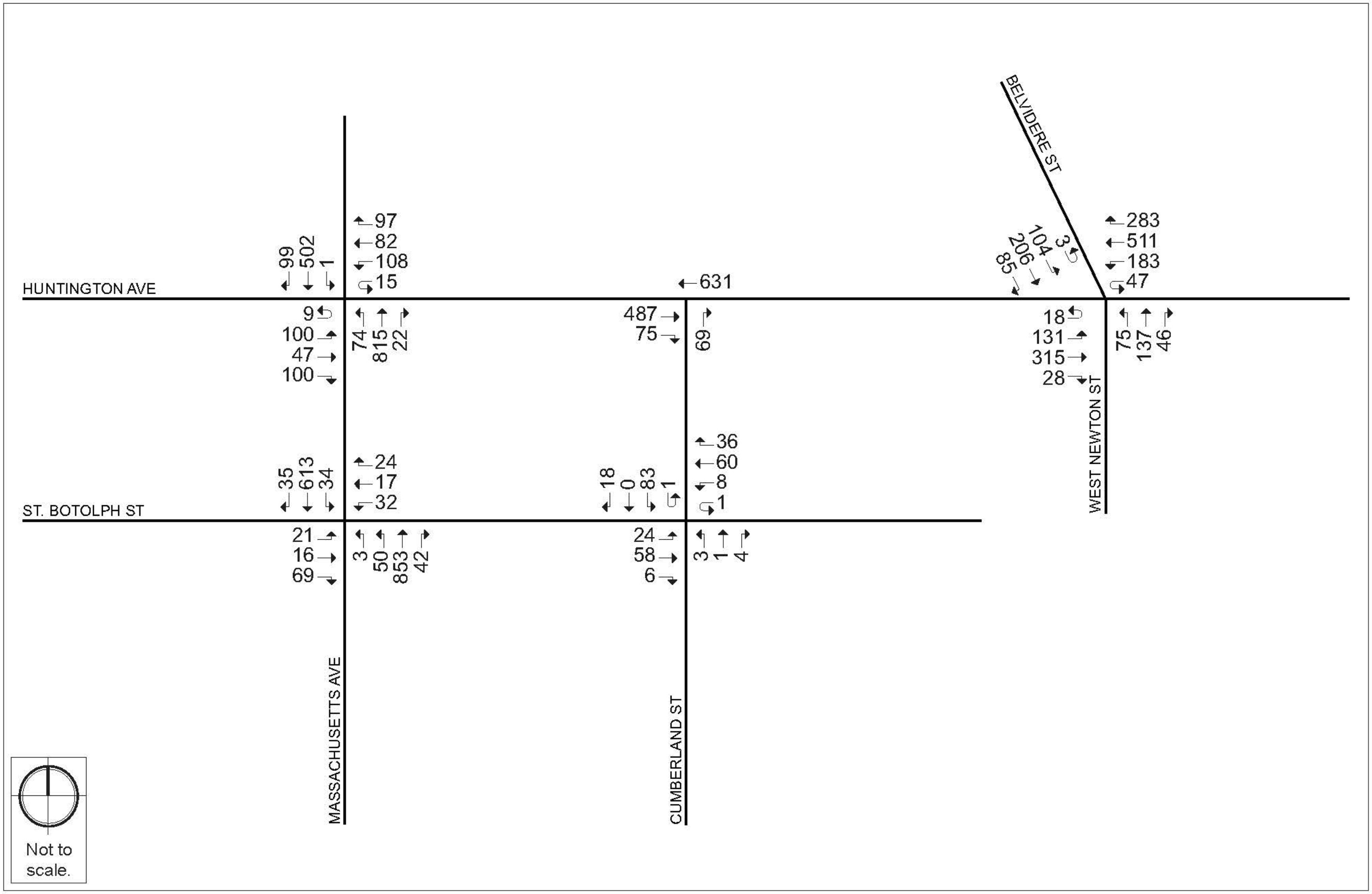

Figure 2-12

No-Build (2027) Condition Traffic Volumes, Weekday p.m. Peak Hour

Table 2-5 No-Build (2027) Condition Orange and Green Line, Maximum Hourly Passenger Load

Time of Day	Orange Line				Green Line (Branch E)			
	North of Mass. Ave		South of Mass. Ave		East of Symphony		West of Symphony	
	North-bound	South-bound	North-bound	South-bound	East-bound	West-bound	East-bound	West-bound
5 - 6 am	467	1,183	444	317	428	821	28	96
6 - 7 am	2,813	3,877	2,848	1,203	1,376	2,156	139	326
7 - 8 am	4,322	6,372	4,279	1,649	3,759	4,136	384	532
8 - 9 am	6,121	7,976	5,636	1,499	5,024	5,255	574	497
9 - 10 am	2,994	3,943	2,878	1,024	2,841	3,137	330	367
10 - 11 am	1,724	2,215	1,623	839	1,782	2,057	238	271
11 - 12 pm	1,646	1,877	1,430	948	1,827	1,853	302	244
12 - 1 pm	1,747	1,863	1,376	1,201	2,008	2,040	326	286
1 - 2 pm	1,955	1,967	1,461	1,383	2,166	2,159	345	302
2 - 3 pm	2,654	2,350	2,105	1,832	2,826	2,318	590	313
3 - 4 pm	3,950	2,977	2,110	2,456	3,717	2,872	743	332
4 - 5 pm	5,695	4,084	2,351	3,480	4,973	3,578	778	427
5 - 6 pm	7,448	5,491	2,292	4,847	5,752	5,444	760	655
6 - 7 pm	4,482	3,238	1,425	3,050	4,128	4,085	554	440
7 - 8 pm	2,526	2,011	898	1,914	2,679	2,320	280	304
8 - 9 pm	1,856	1,570	697	1,533	2,093	1,558	221	254
9 - 10 pm	1,595	1,355	507	1,348	2,131	1,275	167	218
10 - 11 pm	1,661	1,095	444	1,113	2,224	1,067	107	174
11 - 12 am	1,207	807	232	823	1,401	684	92	99
12 - 1 a.m.	345	255	75	261	475	254	19	36

Table 2-6 No-Build (2027) Condition Bus Routes 1 and 39, Maximum Hourly Passenger Load

Time of Day	North of Nearby Bus Stop*				South of Nearby Bus Stop*			
	Inbound		Outbound		Inbound		Outbound	
	1	39	1	39	1	39	1	39
5 - 6 am	45	61	94	13	50	178	99	25
6 - 7 am	141	113	169	71	207	436	147	114
7 - 8 am	311	126	347	135	360	413	238	174
8 - 9 am	376	145	392	139	322	463	232	169
9 - 10 am	245	78	205	57	209	275	141	92
10 - 11 am	132	76	162	32	127	205	157	83
11 - 12 pm	144	62	164	44	158	143	164	113
12 - 1 pm	158	61	137	44	167	140	133	118
1 - 2 pm	149	82	179	52	160	166	178	151
2 - 3 pm	195	79	199	61	189	128	205	265
3 - 4 pm	276	97	236	60	237	166	254	267
4 - 5 pm	371	145	385	85	261	214	359	391
5 - 6 pm	361	81	346	125	229	134	248	438
6 - 7 pm	262	61	248	86	155	102	140	272
7 - 8 pm	188	38	213	79	117	64	113	270
8 - 9 pm	135	27	137	52	104	46	58	174
9 - 10 pm	144	17	130	36	112	35	49	132
10 - 11 pm	82	19	118	31	72	45	40	129
11 - 12 am	72	14	44	24	66	22	30	91
12 - 1 am	23	5	27	10	21	9	14	33
1 - 2 am	4	-	4	3	4	-	2	5

* Nearby Stops:

Bus #1 - Massachusetts Ave @ Huntington Ave (Inbound) and Massachusetts Ave @ Saint Botolph St (Outbound).
Bus #39 - Huntington Ave @ Prudential Station (Inbound) and Huntington Ave @ Belvidere St (Outbound).

2.4 Build Condition

2.4.1 Site Access and Vehicle Circulation

The ground floor site plan is shown in Figure 2-13. The existing Project Site has two curb-cuts on Huntington Avenue that allow vehicles to access the existing underground garage. Vehicles enter via the northeast curb-cut and exit via the more southern one. Under the Build Condition, both curb-cuts will be removed, and garage access will be moved to the back of the building on Public Alley 404. The two-way garage access ramp will be located at the eastern most corner of the Project Site. Public Alley 404 currently is two-way and will remain two-way under the Build Condition. Vehicles exiting the garage will however be required to only exit left from the garage before turning onto Cumberland Street. This will be established through signage.

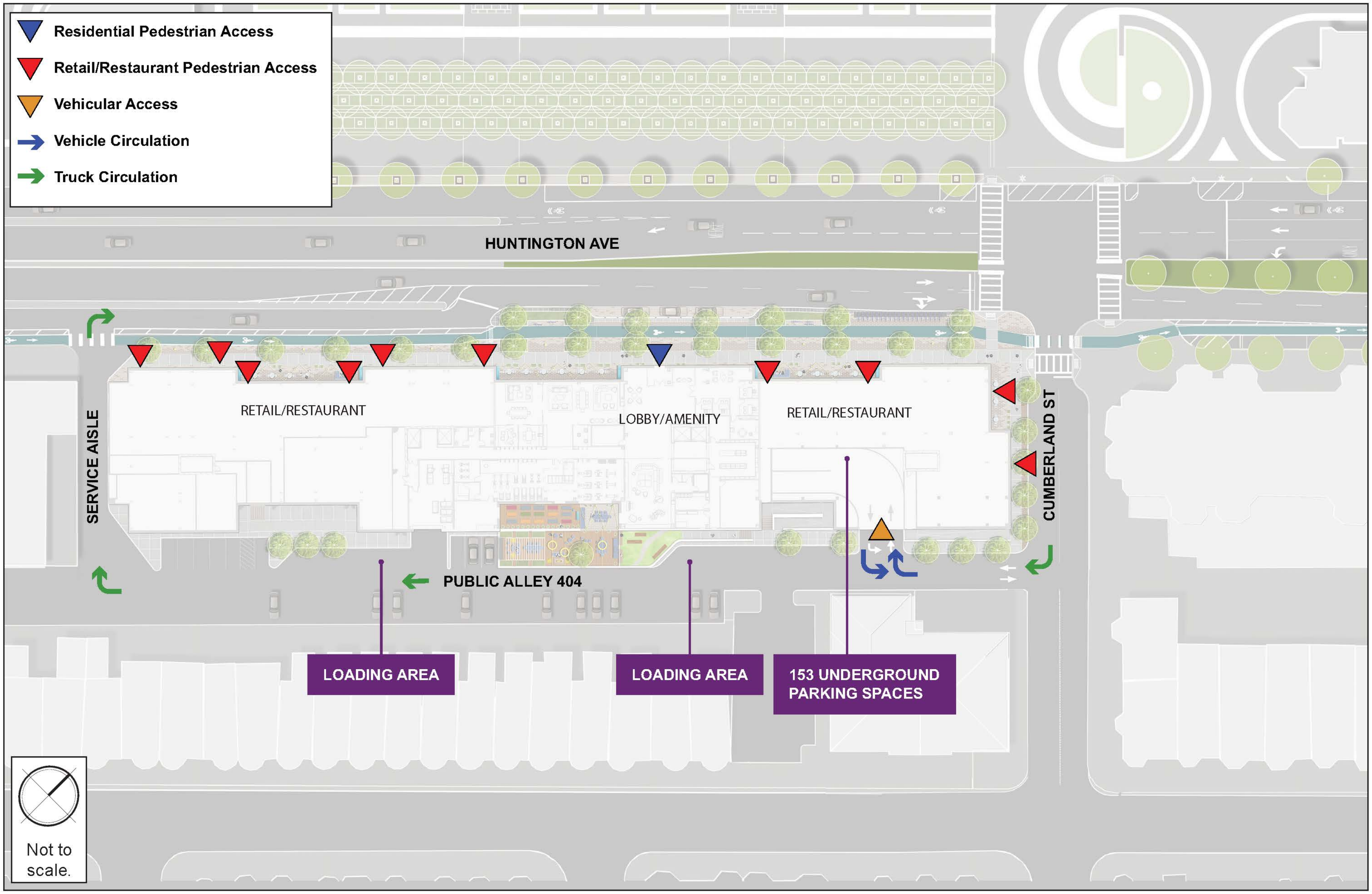

Figure 2-13

Site Plan

Larger vehicles used for loading and deliveries will also access the building via Public Alley 404, however they will enter from Cumberland Street and exit via a new private road along the southwest side of the Project. The new access road will be called “Service Driveway” running between Public Alley 404 and Huntington Avenue. Given that Huntington Avenue is separated by a median in this area, these service vehicles will turn right onto Huntington Avenue from Service Driveway.

A drop-off/pick-up area for approximately four vehicles will be located on Huntington Avenue just south of Cumberland Street. This may serve taxicabs or transportation network company (TNC) vehicles, such as Uber and Lyft. Behind the building along Public Alley 404 there will also be nine perpendicular parking spaces that will serve building operations.

The primary pedestrian entrances to the residential lobby as well as the retail spaces will be located on Huntington Avenue as shown on the site plan.

2.4.1.1 Intersection and Phasing Modifications

As part of the anticipated Project-related mitigation, and based on initial conversations with BTD, and a preliminary feasibility study, the Project would reconfigure the existing signalized intersection of Huntington Avenue and Cumberland Street. The modifications would include opening the median to improve network connectivity. This will allow westbound vehicles to directly turn left from Huntington Avenue to Cumberland Street. Additionally, vehicles coming from Cumberland Street would now be allowed to also turn left onto Huntington Avenue. A crosswalk will also be added across the northeast approach of the intersection.

For the phasing, the current signal at Huntington Avenue/Cumberland Street operates with two phases, one for the Huntington Avenue movements and one for Cumberland Street. Under the proposed phasing, the westbound approach would have a new leading protected phase to allow for left turns to be followed by the same phases as the existing condition.

2.4.2 Project Parking

Parking goals have been developed by BTD for new large developments throughout the City based on neighborhood and land use. For Back Bay, residential space call for a maximum of 1.0 parking spaces per dwelling unit and non-residential space calls for a maximum of 0.4 spaces per 1,000 square feet. These maximums would result in six spaces for the ground floor retail/restaurant uses and 325 spaces for residential use. The Project is planning to provide 153 parking spaces which results in a parking ratio of 0.47 spaces per dwelling unit, which meets the current BTD parking maximums.

2.4.3 *Loading and Service Accommodations*

All loading/delivery/trash pickup activity will take place in Public Alley 404 behind the proposed building. There will be two loading zones in the form of pull off areas instead of docks along the building. The loading areas will serve the ground floor businesses that are closer to each side of the building, respectively. Move-in/move-out activity will take place in the below grade garage.

2.4.4 *Bicycle Accommodations*

Under BTD Bike Parking Guidelines, projects subject to a Transportation Access Plan Agreement (TAPA) must provide secure bicycle parking for residents and employees, as well as short-term bicycle racks for visitors. Based on the guidelines, the Project will provide a minimum of 325 secure/covered bicycle parking spaces for residents (one per unit) and six secure/covered bicycle parking spaces for retail/restaurant employees and customers (0.3 per 1,000 square feet of retail development). An additional 69 bicycle parking spaces will be provided (0.2 per residential unit and one per 5,000 square feet of retail) for public use either via outdoor bicycle racks or other means around the site to the extent there is sufficient demand and space on the site. These will be accessible to visitors and for use as short term parking. All bicycle parking is anticipated to be installed based on January 2020 BTD Bike Parking Guidelines.

BTD guidelines also require that new developments going through the Article 80 Project Review process located in areas with high anticipated bicycle ridership, such as Back Bay, install a new BLUEbike station. For a residential building of this nature, the Proponent will commit to installing one new 19-dock BLUEbike station near the Project Site on Huntington Avenue.

The Project is also proposing a new protected bicycle lane along the southwest side of Huntington Avenue. It would be buffered with flex posts where the cross-section width is limited from Massachusetts Avenue up to where the underpass lanes are at-grade again. From that point to Cumberland Street the facility would be curb protected and finally return to sharrow markings just north of Cumberland Street. In the southwest direction of Huntington Avenue there would be sharrow markings only.

2.4.5 *Trip Generation Methodology*

To estimate the number of trips expected to be generated by the proposed Project, data published by the Institute of Transportation Engineers (ITE) in the *Trip Generation Manual*[1] were used. ITE provides trip rates to estimate the total number of unadjusted vehicular trips associated with a project. In an urban setting well-served by transit, adjustments are necessary to account for other travel mode shares such as walking, bicycling, and transit. For this Project, the following Land Use Codes (LUCs) were used:

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1 Trip Generation Manual, 10th Edition; Institute of Transportation Engineers; Washington, D.C.; 2017.

Land Use Code 221 – Multifamily Housing (Mid-Rise). Mid-rise multifamily housing includes apartments, townhouses, and condominiums located within the same building with at least three other dwelling units and that have between three and 10 levels (floors). Calculations of the number of trips uses ITE's average rate per unit.

Land Use Code 931 – Quality Restaurant. This land use consists of high quality, full-service eating establishments with a typical duration of stay of at least one hour. Quality restaurants generally do not serve breakfast; some do not serve lunch; all serve dinner. This type of restaurant often requests and sometimes requires reservations and is generally not part of a chain. Calculations of the number of trips use ITE's average rate per 1,000 square feet. While the ground floor space is expected to be a mix of retail and restaurant space, to provide a more conservative estimate, ITE rates for LUC 931 were used for all 17,000 sf.

The Project also includes approximately 11,500 sf of amenity space. However, because this space is not a land use that produces its own trips but rather a facility used by the residential land use, activity associated with it will be minimal and has not been incorporated in the trip generation.

2.4.6 Travel Mode Share

BTD provides vehicle, transit, and walking mode share rates for different areas of Boston. The Project is in the Traffic Analysis Zone Area 4 – Back Bay. The unadjusted vehicular trips were converted to person-trips by using vehicle occupancy rates published by the Federal Highway Administration (FHWA)[2]. The person-trips were then distributed to different modes according to the mode shares shown in Table 2-7.

Table 2-7 Travel Mode Shares

Land Use		Walk/Bicycle Share	Transit Share	Vehicle Share	Vehicle Occupancy Rate
Daily					
Multifamily Housing (Mid-Rise)	In	57%	19%	24%	1.18
	Out	57%	19%	24%	1.18
Retail/Restaurant	In	55%	16%	29%	1.82
	Out	55%	16%	29%	1.82
a.m. Peak Hour					
Multifamily Housing (Mid-Rise)	In	59%	22%	19%	1.18
	Out	64%	15%	21%	1.18
Retail/Restaurant	In	57%	19%	24%	1.82
	Out	61%	13%	26%	1.82

2 Summary of Travel Trends: 2017 National Household Travel Survey; FHWA; Washington, D.C.; July 2018.

Table 2-7 Travel Mode Shares (Continued)

Land Use		Walk/Bicycle Share	Transit Share	Vehicle Share	Vehicle Occupancy Rate
p.m. Peak Hour					
Multifamily Housing (Mid-Rise)	In	64%	15%	21%	1.18
	Out	59%	22%	19%	1.18
Retail/Restaurant	In	61%	13%	26%	1.82
	Out	57%	19%	24%	1.82

2.4.7 Existing Trip Generation

When assessing a site with existing, active land uses, it is standard practice to estimate existing trips and subtract those trips from the projected new future trips. The result of this process yields "net new" trips that become the basis for the traffic analysis.

The existing Project Site generates trips associated with the existing 159-room key hotel and seven-unit multifamily housing. The study team estimated the existing site trips by using LUC 310 – Hotel and LUC 220 – Multifamily Housing Low-Rise). The trips associated with the existing land uses are provided in Appendix C.

2.4.8 Project Trip Generation

The travel mode share percentages shown in Table 2-7 were applied to the number of person trips to develop walk/bicycle, transit, and vehicle trip generation estimates for the Project. Vehicle trips include automobiles, taxicabs, and transportation network company (TNC) services, such as Uber and Lyft. The trip generation for the Project by travel mode is shown in Table 2-8. The detailed trip generation information is provided in Appendix C.

Table 2-8 Project Trip Generation

Land Use/Direction		Walk/Bicycle Trips	Transit Trips	Vehicle Trips		
				Private	Taxicab/ TNC	Total Vehicle Trips
Daily						
Residential LUC 221 – 325 Rooms	In	595	198	202	11	213
	Out	595	198	202	11	213
	Total	**1,190**	**396**	**404**	**22**	**426**
Retail/ Restaurant LUC 8931 – 17,000 sf	In	863	251	196	19	215
	Out	863	251	196	19	215
	Total	**1,726**	**502**	**392**	**38**	**430**
Total	In	1,458	449	398	30	428
	Out	1,458	449	398	30	428
	Total	**2,916**	**898**	**796**	**60**	**856**

Table 2-8 Project Trip Generation (Continued)

Land Use/Direction		Walk/Bicycle Trips	Transit Trips	Vehicle Trips Private	Vehicle Trips Taxicab/ TNC	Total Vehicle Trips
a.m. Peak Hour						
Residential LUC 221 – 325 Rooms	In	20	8	6	0	6
	Out	66	15	18	1	19
	Total	**86**	**23**	**24**	**1**	**25**
Retail/ Restaurant LUC 8931 – 17,000 sf	In	8	3	2	0	2
	Out	8	2	1	0	1
	Total	**16**	**5**	**3**	**0**	**3**
Total	In	28	11	8	0	8
	Out	74	17	19	1	20
	Total	**102**	**28**	**27**	**1**	**28**
p.m. Peak Hour						
Residential LUC 221 – 325 Rooms	In	66	15	18	1	19
	Out	38	15	10	1	11
	Total	**104**	**30**	**28**	**2**	**30**
Retail/ Restaurant LUC 8931 – 17,000 sf	In	120	25	22	3	25
	Out	55	19	10	1	11
	Total	**175**	**44**	**32**	**4**	**36**
Total	In	186	40	40	4	44
	Out	93	34	20	2	22
	Total	**279**	**74**	**60**	**6**	**66**

As shown in Table 2-8, The Project is expected to generate 2,916 pedestrian/bicycle trips, 898 transit trips, and 856 vehicle trips throughout the day. During the a.m. peak hour, 102 pedestrian/bicycle trips (28 in and 74 out), 28 transit trips (11 in and 17 out), and 28 vehicle trips (8 in and 20 out) are expected. During the p.m. peak hour, the Project will generate approximately 279 pedestrian/bicycle trips (186 in and 93 out), 74 transit trips (40 in and 34 out), and 66 vehicle trips (44 in and 22 out).

The net vehicle trip generation for the Project was determined by adjusting the Project-generated vehicle trips to account for the removal of the trips associated with the existing uses on the Project Site. The net vehicle trip generation for the Project during the weekday a.m. and p.m. peak hours is shown in Table 2-9.

Table 2-9 Net Vehicle Trip Generation

Time Period/Direction		Project-Generated Vehicle Trips	Existing Vehicle Trips (removed)	Net New Vehicle Trips
Daily	In	428	229	+199
	Out	428	229	+199
	Total	**856**	**458**	**+398**
a.m. Peak Hour	In	8	12	-4
	Out	20	11	+9
	Total	**28**	**23**	**+5**
p.m. Peak Hour	In	44	16	+28
	Out	22	13	+9
	Total	**66**	**29**	**+37**

As shown in Table 2-9, The Project will add five vehicle trips (4 less entering and 9 more exiting) during the a.m. peak hour and 37 vehicle trips (28 entering and 9 exiting) during the p.m. peak hour. The impact to vehicular traffic based on the small amount of new peak hour vehicle trips is expected to be negligible.

2.4.9 Vehicle Trip Distribution

The trip distribution identifies the various travel paths for vehicles associated with the Project. Trip distribution patterns for the Project were based on BTD's origin-destination data for Area 4 and trip distribution patterns presented in traffic studies for nearby projects. The trip distribution patterns for the Project are illustrated in Figure 2-14.

2.4.10 Build (2027) Traffic Volumes

The net trip generation associated with the removal of the existing site trips and the addition of the Project-generated vehicle trips were distributed throughout the study area according to the trip distribution patterns. The Project-generated trips at the study area intersections are shown for the weekday a.m. peak hour and the weekday p.m. peak hour in Figure 2-15 and Figure 2-16, respectively. In addition to the new trips, the Project is opening the median on Huntington Avenue at the Cumberland Street intersection which will introduce new northbound and westbound left-turn movements. This will likely allow for some change in travel patterns. A portion of the northbound right-turn volume was shifted to left-turns and some of the U-turns at the adjacent intersections are expected to decline with the additional movements available at Cumberland Street.

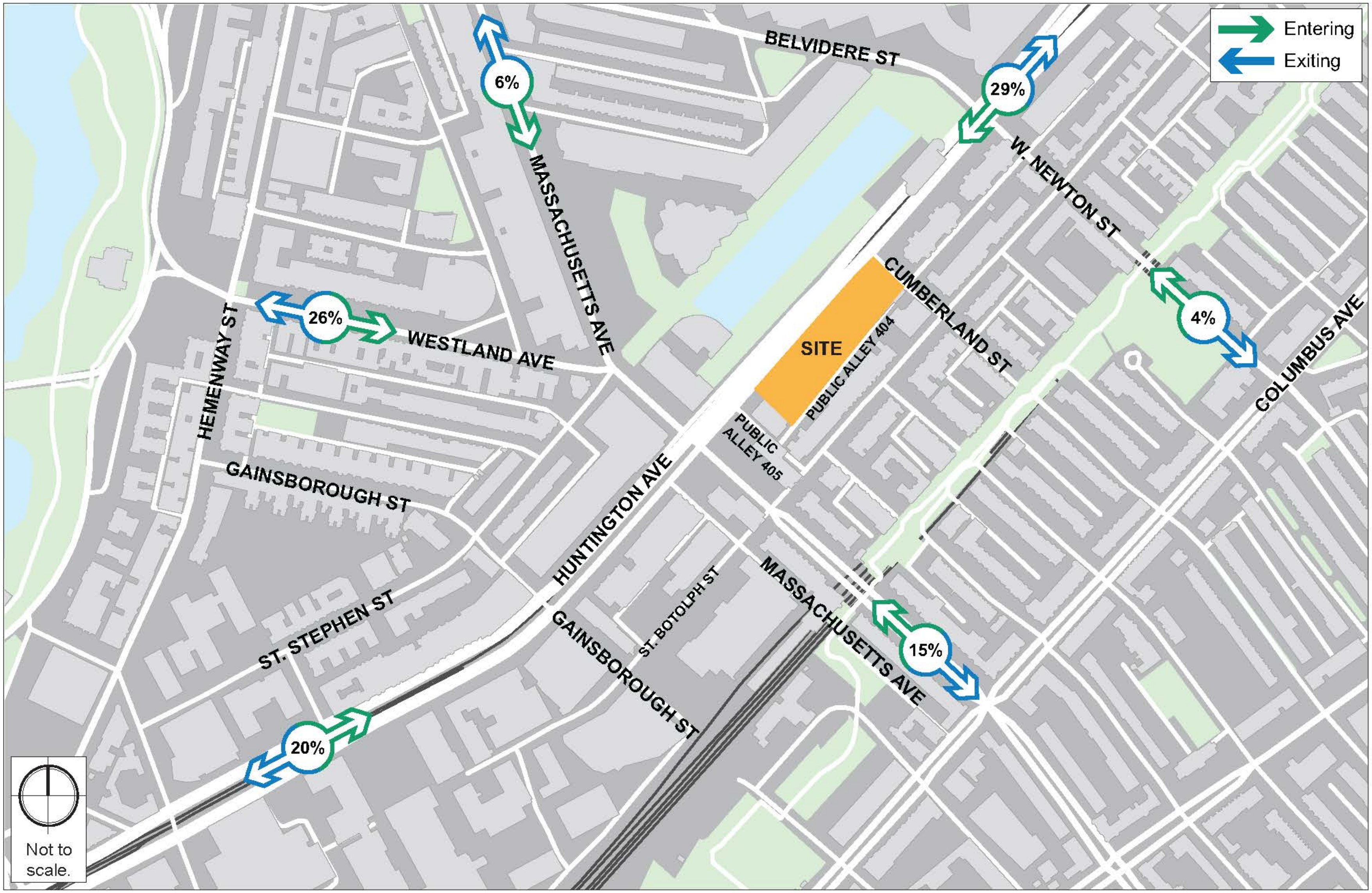

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Figure 2-14
Trip Distribution

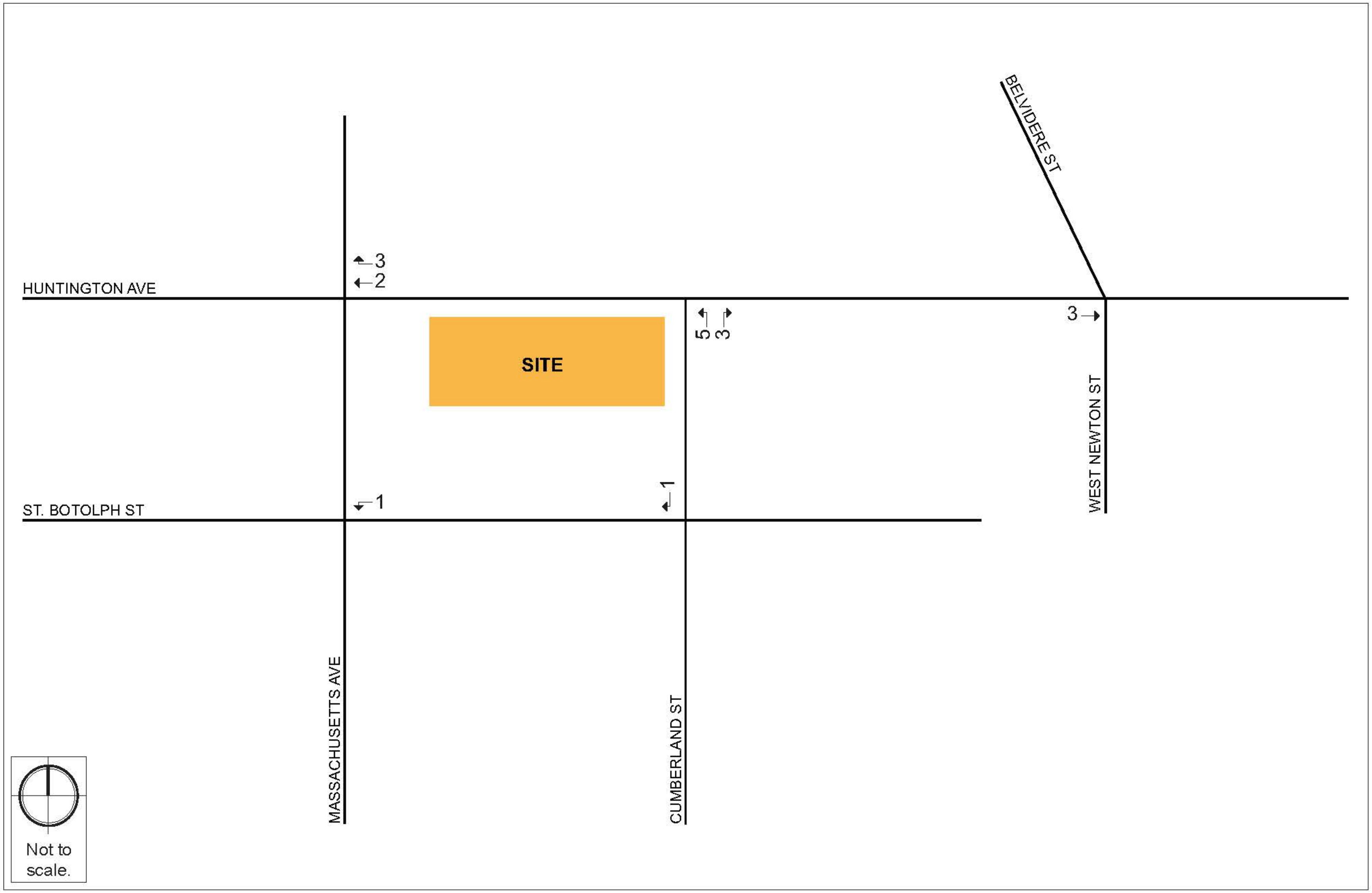

Figure 2-15

Project-generated Vehicle Trips, Weekday a.m. Peak Hour

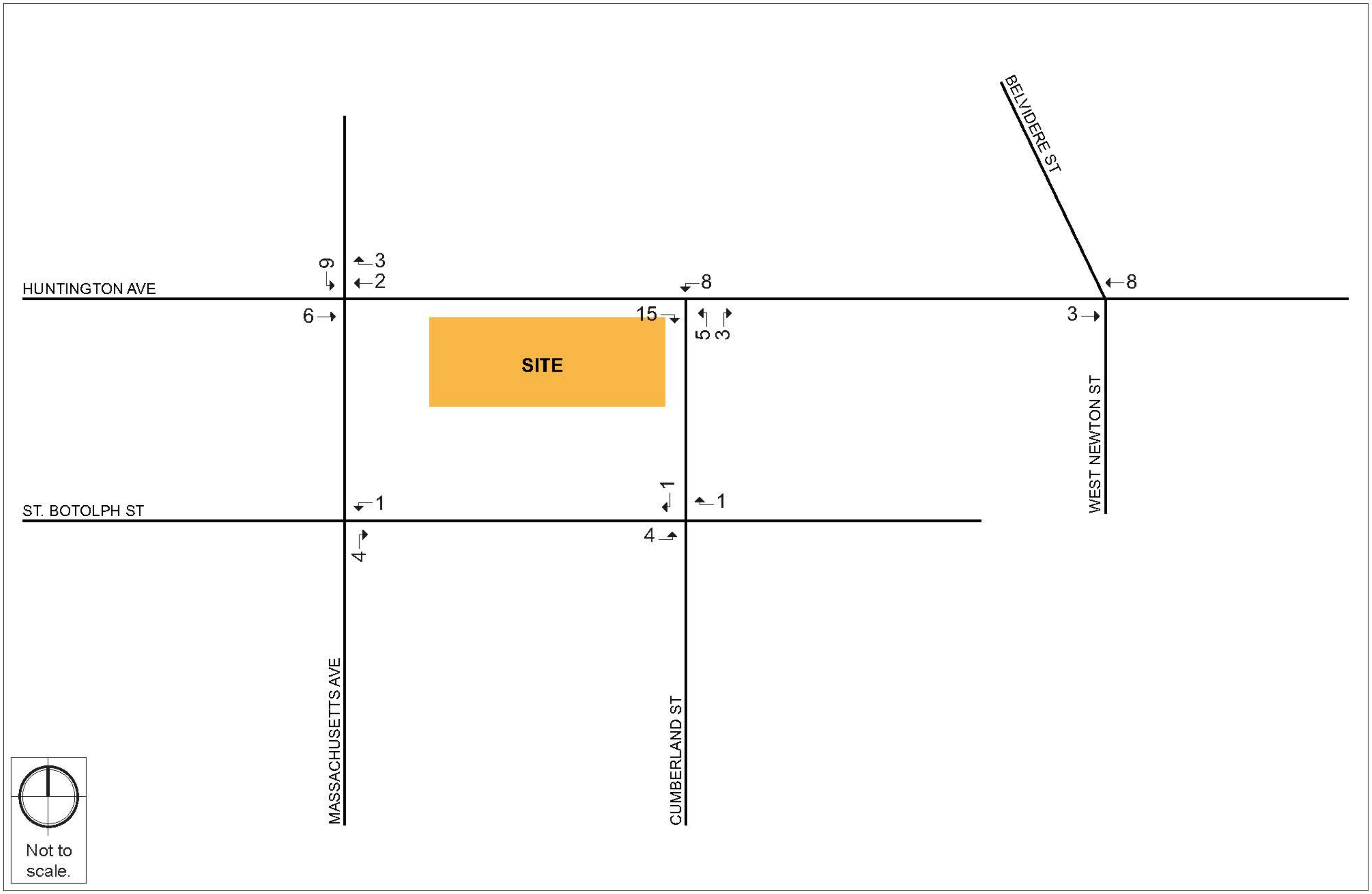

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Figure 2-16
Project-generated Vehicle Trips, Weekday p.m. Peak Hour

The Project-generated vehicle trips were added to the No-Build (2027) Condition vehicular traffic volumes and volumes adjustments made for the new intersection movements to produce the Build (2027) Condition vehicular traffic volumes. The Build (2027) Condition a.m. and p.m. peak hour traffic volumes are shown in Figure 2-17 and Figure 2-18, respectively.

2.4.11 Net New Transit Trip Generation

The Project's transit impact is measured by the new transit trips generated by the Project compared to the existing uses. The net new transit trips are shown in Table 2-10.

Table 2-10 Daily Net New Transit Trips

Land Use		Existing Transit Trips	Proposed Transit Trips	Net New Transit Trips
Daily	In	200	449	**249**
	Out	200	449	**249**
	Total	400	898	**498**
Weekday a.m. Peak Hour	In	15	11	**-4**
	Out	7	17	**10**
	Total	22	28	**6**
Weekday a.m. Peak Hour	In	12	40	**28**
	Out	16	34	**18**
	Total	28	74	**46**

2.4.12 Transit Trip Distribution

The transit trips were distributed to the Orange Line, Green Line (Branch E), and Bus Routes 1 and 39. Serving the closest stops or stations to the Project Site. The existing ridership was used to determine the transit trip distribution patterns for the Project. The distribution patterns are shown in Table 2-11.

Table 2-11 Transit Trip Distribution

MBTA Service	Direction	Alighting	Boarding
Orange Line	Northbound	23%	43%
	Southbound	47%	22%
Green Line (Branch E)	Eastbound	3%	21%
	Westbound	19%	3%
Bus Route 1	Inbound	0%	4%
	Outbound	3%	0%
Bus Route 39	Inbound	1%	4%
	Outbound	3%	2%

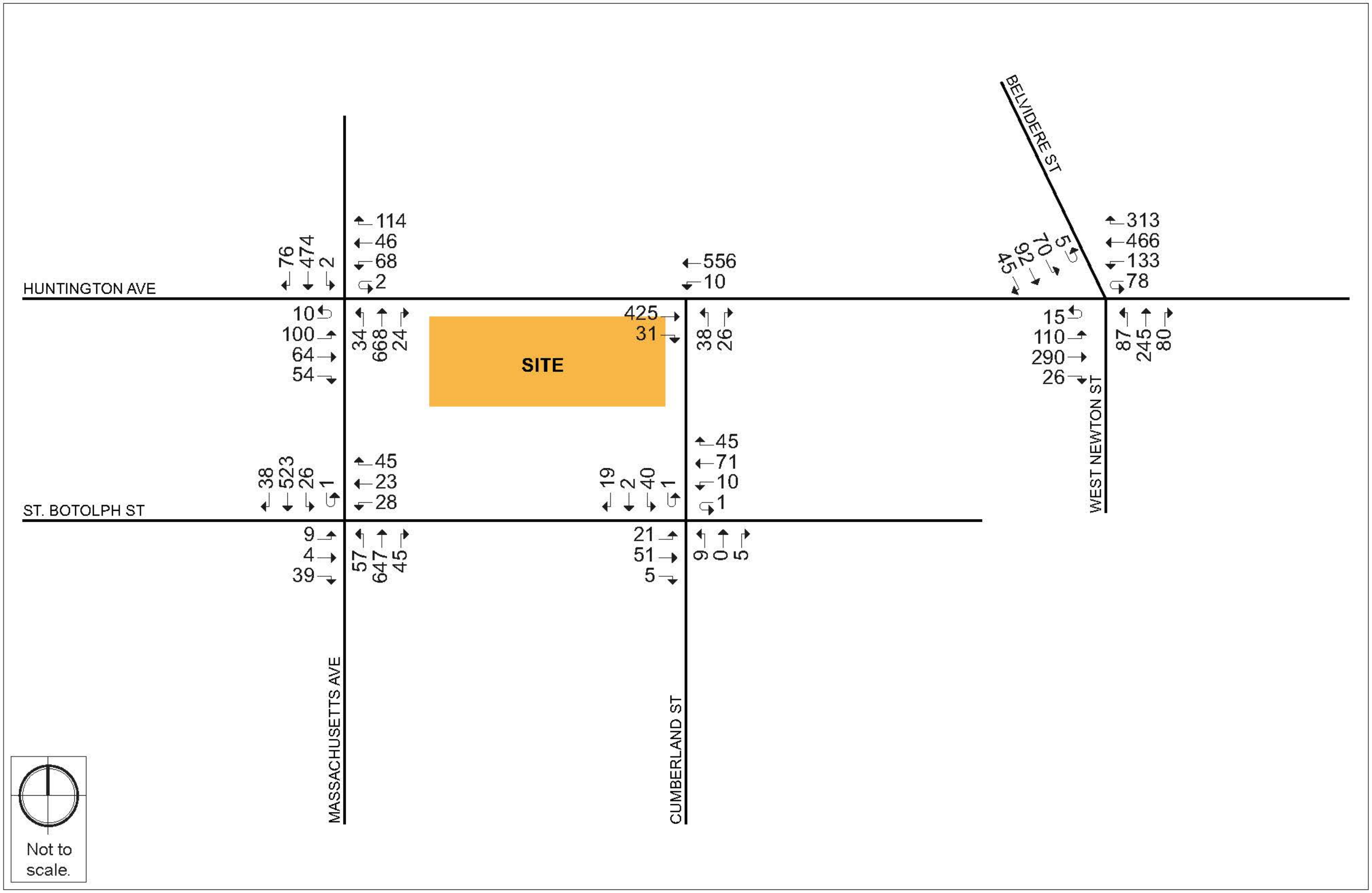

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Figure 2-17

Build (2027) Condition Traffic Volumes, Weekday a.m. Peak Hour

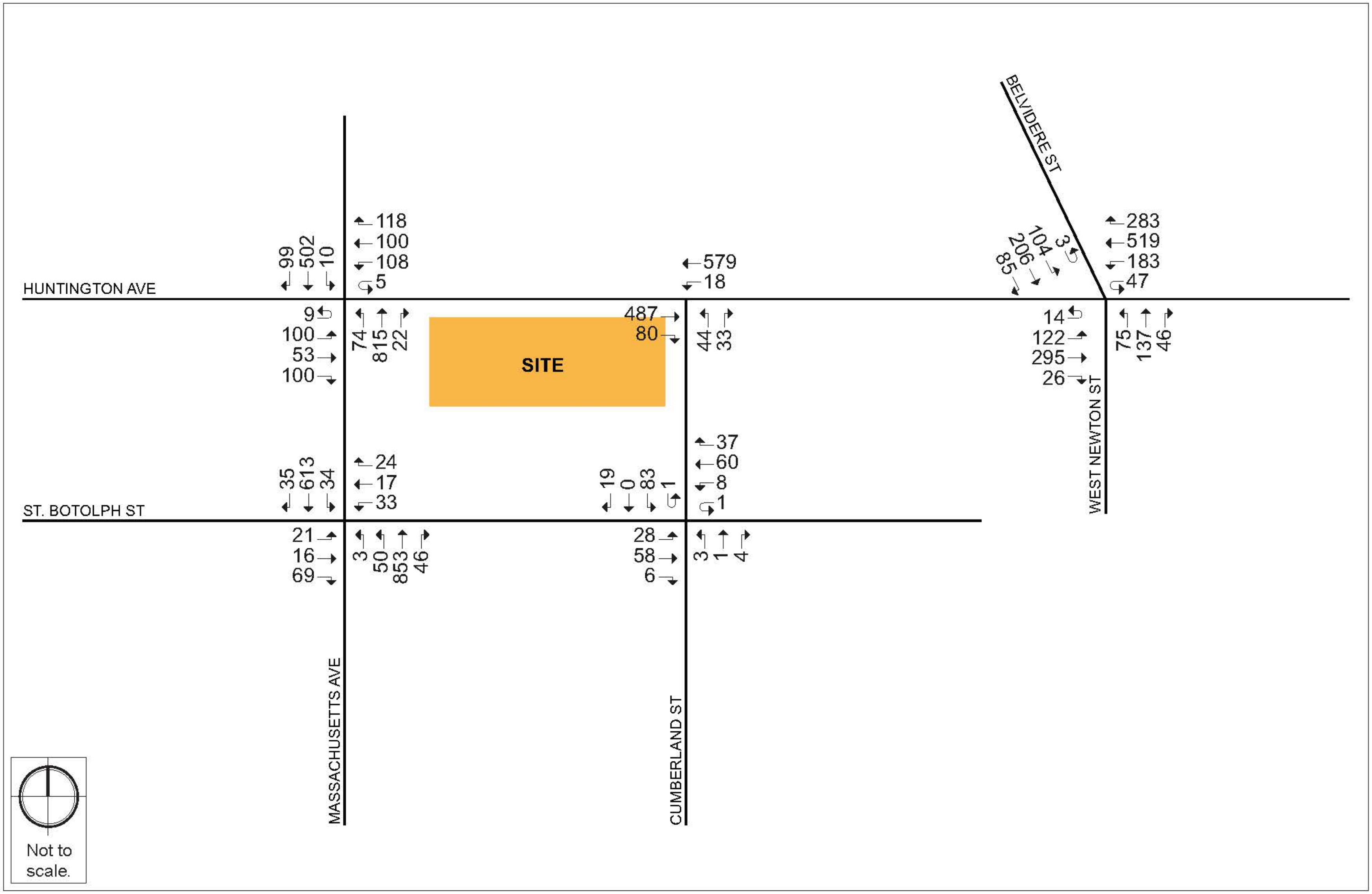

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Figure 2-18

Build (2027) Condition Traffic Volumes, Weekday p.m. Peak Hour

The Project's expected daily transit trips were distributed throughout the day using the ITE Generation Manual's Hourly Distribution charts for each land use. The net new transit trips were then distributed to the MBTA service as shown in Table 2-11. The net new passenger loads by direction are shown in Table 2-12 and Table 2-13 for the rail and bus services, respectively.

Table 2-12 Net New Hourly Passenger Trips, Orange Line and Green Line

Time of Day	Orange Line at Massachusetts Avenue				Green Line (Branch E) at Symphony Station			
	Northbound		Southbound		Eastbound		Westbound	
	Alighting	Boarding	Alighting	Boarding	Alighting	Boarding	Alighting	Boarding
5 - 6 am	1	-2	2	-	-	-	1	-
6 - 7 am	2	1	3	1	-	1	1	-
7 - 8 am	-	5	-4	3	-	2	-	-
8 - 9 am	-	5	-4	3	-	2	-	-
9 - 10 am	-	3	2	2	-	1	-	-
10 - 11 am	3	4	5	2	-	1	2	-
11 - 12 pm	7	9	14	4	1	4	6	1
12 - 1 pm	7	14	15	7	1	6	6	1
1 - 2 pm	3	10	8	5	1	5	3	1
2 - 3 pm	3	3	6	1	-	1	2	-
3 - 4 pm	1	2	3	-	-	-	1	-
4 - 5 pm	7	8	13	4	1	4	5	-
5 - 6 pm	7	8	13	4	1	4	5	-
6 - 7 pm	6	16	12	7	1	7	5	1
7 - 8 pm	6	11	12	6	1	5	5	1
8 - 9 pm	4	10	7	5	1	5	3	1
9 - 10 pm	2	5	4	2	-	2	2	-
10 - 11 pm	-	3	2	1	-	1	-	-
11 - 12 am	-	1	-	1	-	1	-	-
12 - 1 a.m.	-	-	2	-	-	-	-	-

Table 2-13 Net New Hourly Passenger Trips, Bus Routes 1 and 39

Time of Day	Route 1				Route 39			
	Inbound		Outbound		Inbound		Outbound	
	Alighting	Boarding	Alighting	Boarding	Alighting	Boarding	Alighting	Boarding
5 - 6 am	-	-	-	-	-	-	-	-
6 - 7 am	-	-	-	-	-	-	-	-
7 - 8 am	-	-	-	-	-	-	-	-
8 - 9 am	-	-	-	-	-	-	-	-
9 - 10 am	-	-	-	-	-	-	-	-
10 - 11 am	-	-	-	-	-	-	-	-
11 - 12 pm	-	1	1	-	-	1	1	-
12 - 1 pm	-	1	1	1	-	1	1	-
1 - 2 pm	-	1	1	-	-	1	1	-
2 - 3 pm	-	-	-	-	-	-	-	-
3 - 4 pm	-	-	-	-	-	-	-	-
4 - 5 pm	-	1	1	-	-	1	1	-
5 - 6 pm	-	1	1	-	-	1	1	-
6 - 7 pm	-	1	1	1	-	1	1	-
7 - 8 pm	-	1	1	1	-	1	1	-
8 - 9 pm	-	1	-	1	-	1	-	-
9 - 10 pm	-	-	-	-	-	-	-	-
10 - 11 pm	-	-	-	-	-	-	-	-
11 - 12 am	-	-	-	-	-	-	-	-
12 - 1 a.m.	-	-	-	-	-	-	-	-

2.4.13 Build (2027) Transit Ridership

The net new transit trips from the Project as outlined in the Table 2-12 and Table 2-13 are then added to the No-Build (2027) Condition maximum hourly passenger load to develop the Build (2027) Condition maximum hourly passenger load. The Build (2027) Condition maximum hourly passenger load are shown in Table 2-14 and Table 2-15 for the rail lines and bus routes, respectively.

Table 2-14 Build (2027) Condition Orange and Green Line, Maximum Hourly Passenger Load

Time of Day	Orange Line				Green Line (Branch E)			
	North of Mass. Ave		South of Mass. Ave		East of Symphony		West of Symphony	
	North-bound	South-bound	North-bound	South-bound	East-bound	West-bound	East-bound	West-bound
5 - 6 am	465	1,185	445	317	428	822	28	96
6 - 7 am	2,814	3,880	2,850	1,204	1,377	2,157	139	326
7 - 8 am	4,327	6,368	4,279	1,652	3,761	4,136	384	532
8 - 9 am	6,126	7,972	5,636	1,502	5,026	5,255	574	497
9 - 10 am	2,997	3,945	2,878	1,026	2,842	3,137	330	367
10 - 11 am	1,728	2,220	1,626	841	1,783	2,059	238	271
11 - 12 pm	1,655	1,891	1,437	952	1,831	1,859	303	245
12 - 1 pm	1,761	1,878	1,383	1,208	2,014	2,046	327	287
1 - 2 pm	1,965	1,975	1,464	1,388	2,171	2,162	346	303
2 - 3 pm	2,657	2,356	2,108	1,833	2,827	2,320	590	313
3 - 4 pm	3,952	2,980	2,111	2,456	3,717	2,873	743	332
4 - 5 pm	5,703	4,097	2,358	3,484	4,977	3,583	779	427
5 - 6 pm	7,456	5,504	2,299	4,851	5,756	5,449	761	655
6 - 7 pm	4,498	3,250	1,431	3,057	4,135	4,090	555	441
7 - 8 pm	2,537	2,023	904	1,920	2,684	2,325	281	305
8 - 9 pm	1,866	1,577	701	1,538	2,098	1,561	222	255
9 - 10 pm	1,600	1,359	509	1,350	2,133	1,277	167	218
10 - 11 pm	1,664	1,097	444	1,114	2,225	1,067	107	174
11 - 12 am	1,208	807	232	824	1,402	684	92	99
12 - 1 a.m.	345	257	75	261	475	254	19	36

Table 2-15 Build (2027) Condition Bus Routes 1 and 39, Maximum Hourly Passenger Load

Time of Day	North of Nearby Bus Stop*				South of Nearby Bus Stop*			
	Inbound		Outbound		Inbound		Outbound	
	1	39	1	39	1	39	1	39
5 - 6 am	45	61	94	13	50	178	99	25
6 - 7 am	141	113	169	71	207	436	147	114
7 - 8 am	311	126	347	135	360	413	238	174
8 - 9 am	376	145	392	139	322	463	232	169
9 - 10 am	245	78	205	57	209	275	141	92
10 - 11 am	132	76	162	32	127	205	157	83
11 - 12 pm	144	63	164	45	159	143	165	113
12 - 1 pm	158	62	138	45	168	140	134	118
1 - 2 pm	149	83	179	53	161	166	179	151
2 - 3 pm	195	79	199	61	189	128	205	265
3 - 4 pm	276	97	236	60	237	166	254	267
4 - 5 pm	371	146	385	86	262	214	360	391
5 - 6 pm	361	82	346	126	230	134	249	438
6 - 7 pm	262	62	249	87	156	102	141	272
7 - 8 pm	188	39	214	80	118	64	114	270
8 - 9 pm	135	28	138	52	105	46	58	174
9 - 10 pm	144	17	130	36	112	35	49	132
10 - 11 pm	82	19	118	31	72	45	40	129
11 - 12 am	72	14	44	24	66	22	30	91
12 - 1 am	23	5	27	10	21	9	14	33
1 - 2 am	4	-	4	3	4	-	2	5

* Nearby Stops:

Bus #1 - Massachusetts Ave @ Huntington Ave (Inbound) and Massachusetts Ave @ Saint Botolph St (Outbound).
Bus #39 - Huntington Ave @ Prudential Station (Inbound) and Huntington Ave @ Belvidere St (Outbound).

2.5 Traffic Capacity Analysis

The criterion for evaluating traffic operations is level of service (LOS), which is determined by assessing average delay experienced by vehicles at intersections and along intersection approaches. Trafficware's Synchro (version 10) software package was used to calculate average delay and associated LOS at the study area intersections. This software is based on the traffic operational analysis methodology of the most recent Transportation Research Board Highway Capacity Manual (HCM).

LOS designations are based on average delay per vehicle for all vehicles entering an intersection. Table 2-16 displays the intersection LOS criteria. LOS A indicates the most favorable condition, with minimum traffic delay, while LOS F represents the worst condition, with significant traffic delay.

LOS D or better is typically considered desirable during the peak hours of traffic in urban and suburban settings. However, LOS E or F is often typical for a stop-controlled minor street that intersects a major roadway and does not necessarily indicate that the operations at the intersection are poor or failing.

Table 2-16 Vehicle Level of Service Criteria

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

Source: 2000 Highway Capacity Manual, Transportation Research Board.

In addition to delay and LOS, the operational capacity and vehicular queues are calculated and used to further quantify traffic operations at intersections. The following describes these other calculated measures.

The volume-to-capacity ratio (v/c ratio) is a measure of congestion at an intersection approach. A v/c ratio below one indicates that the intersection approach has adequate capacity to process the arriving traffic volumes over the course of an hour. A v/c ratio of one or greater indicates that the traffic volume on the intersection approach exceeds capacity.

The 50th percentile queue length, measured in feet, represents the maximum queue length during a cycle of the traffic signal with typical (or median) entering traffic volumes.

The 95th percentile queue length, measured in feet, denotes the farthest extent of the vehicle queue (to the last stopped vehicle) upstream from the stop line. This maximum queue occurs five percent, or less, of the time during the peak hour, and typically does not develop during off-peak hours. Since volumes fluctuate throughout the hour, the 95th percentile queue represents what can be considered a "worst case" condition. Queues at an intersection are generally below the 95th percentile length throughout most of the peak hour. It is also unlikely that 95th percentile queues for each approach to an intersection occur simultaneously.

Table 2-17 and Table 2-18 present, respectively, the a.m. and p.m. peak hour capacity analysis for the study area intersections under each analysis condition: Existing Condition, No-Build (2027) Condition, and the Build (2027) Condition. The detailed analysis sheets are provided in Appendix C. The sections below present results for each condition.

2.5.1 Existing Condition

As shown under the Existing Condition in Table 2-17 and Table 2-18, a majority of the study area intersections and approaches operate at acceptable levels of service (LOS D or better) except for the following movements:

- Massachusetts Avenue/Huntington Avenue
  - All eastbound movements and westbound left/through movements operate at LOS E during the a.m. and p.m. peak hours.
  - The westbound right and northbound through/right movements operate at LOS E during the a.m. peak hour and LOS F during the p.m. peak hour.
  - The northbound left movement operates at LOS F during the a.m. and p.m. peak hours.
- Huntington Avenue/West Newton Street/Belvidere Street
  - The eastbound and westbound left movements operate at LOS F during the a.m. peak hour and LOS E during the p.m. peak hour.
  - The northbound movements operate at LOS E during the a.m. and p.m. peak hours.
  - The southbound left movement operates at LOS E during the p.m. peak hour.

2.5.2 No-Build (2027) Condition

Under the No-Build (2027) Condition all study area intersections and approaches continue to operate at the same levels of service as the Existing Condition, except for:

- The southbound movements at the intersection of Massachusetts Avenue/Huntington Avenue are anticipated to have additional delay resulting in a change from LOS D to LOS E during the a.m. and p.m. peak hours.

2.5.3 Build (2027) Condition

All intersections continue to operate at the same overall LOS as under the No-Build (2027) Condition, except for:

The intersection of Huntington Avenue/West Newton Street/Belvidere Street improves from LOS E to LOS D for the overall intersection and from LOS F to LOS E for the eastbound and westbound left movements during the a.m. peak hour. These improvements are likely attributed to the U-turn vehicles and the West Newton Street left turn vehicles that were shifted to the Cumberland Street intersection.

Table 2-17 Capacity Analysis Summary, Weekday a.m. Peak Hour

Intersection/Movement	Existing Condition			Queues (ft)		No-Build (2027) Condition			Queues (ft)		Build (2027) Condition			Queues (ft)	
	LOS	Delay (s)	V/C Ratio	50th	95th	LOS	Delay (s)	V/C Ratio	50th	95th	LOS	Delay (s)	V/C Ratio	50th	95th
Signalized Intersections															
Massachusetts Avenue/Huntington Avenue	**E**	**55.8**	-	-	-	**E**	**64.0**	-	-	-	**E**	**63.3**	-	-	-
Huntington Ave EB left/thru | thru/right	E	60.2	0.63	74	113	E	70.5	0.80	102	#163	E	70.5	0.80	102	#163
Huntington Ave WB left/thru	E	58.3	0.53	81	131	E	65.5	0.66	102	16	E	65.2	0.66	101	160
Huntington Ave WB right	E	63.4	0.59	76	126	E	64.5	0.61	80	1312	E	75.6	0.75	100	#177
Massachusetts Ave NB left	F	85.5	0.34	30	m53	F	85.0	0.35	31	m53	F	85.0	0.35	31	m53
Massachusetts Ave NB thru | thru/right	E	55.6	0.52	276	340	E	65.3	0.56	307	366	E	62.8	0.57	312	366
Massachusetts Ave SB left/thru | thru/right	D	50.9	0.73	172	244	E	58.0	0.80	191	#316	E	56.4	0.81	191	#316
Massachusetts Avenue/Saint Botolph Street	**C**	**22.9**	-	-	-	**C**	**24.1**	-	-	-	**C**	**24.1**	-	-	-
Saint Botolph St EB left/thru/right	D	42.8	0.21	35	71	D	43.3	0.23	39	77	D	43.3	0.23	39	77
Saint Botolph St WB left/thru/right	D	50.0	0.48	86	118	D	51.0	0.50	91	123	D	51.5	0.50	92	124
Massachusetts Ave NB left/thru | thru/right	B	16.1	0.54	175	230	B	17.3	0.57	187	246	B	17.3	0.57	187	246
Massachusetts Ave SB left	B	19.3	0.10	15	m26	B	19.6	0.11	16	m24	B	19.5	0.11	16	m23
Massachusetts Ave SB thru | thru/right	C	24.6	0.32	185	243	C	25.7	0.34	195	255	C	25.7	0.34	198	255
Huntington Ave/West Newton St/Belvidere St	**D**	**52.1**	-	-	-	**E**	**55.4**	-	-	-	**D**	**48.9**	-	-	-
Huntington Ave EB left	F	80.2	0.81	99	#197	F	82.5	0.83	105	#212	E	75.7	0.78	93	#185
Huntington Ave EB thru | thru/right	D	38.4	0.43	96	141	D	41.1	0.54	120	169	D	39.0	0.47	112	160
Huntington Ave WB left	F	83.9	0.89	149	#301	F	94.9	0.94	~160	#315	E	75.2	0.84	154	#315
Huntington Ave WB thru | thru	D	40.3	0.54	151	206	D	43.3	0.63	166	224	D	39.4	0.54	165	224
Huntington Ave WB right	D	42.1	0.83	104	#238	D	49.3	0.88	114	#276	D	42.5	0.84	113	#276
West Newton St NB left/thru/right	E	69.6	0.95	273	#467	E	71.7	0.96	291	#496	E	63.8	0.91	247	#398
Belvidere St SB left	D	54.1	0.45	51	99	D	53.4	0.44	53	102	D	53.4	0.44	53	102
Belvidere St SB thru	B	16.6	0.11	34	63	B	16.3	0.11	37	67	B	17.4	0.12	38	67
Belvidere St SB right	A	0.2	0.07	0	0	A	0.2	0.07	0	0	A	0.3	0.08	0	0
Huntington Avenue/Cumberland Street	**A**	**5.1**	-	-	-	**A**	**5.3**	-	-	-	**B**	**10.9**	-	-	-
Huntington Ave EB thru | thru/right	A	5.4	0.19	42	61	A	5.6	0.22	50	72	A	9.6	0.25	59	122
Huntington Ave WB left	Movement does not exist.										D	38.8	0.07	6	22
Huntington Ave WB thru | thru | thru (thru | thru under Build)	A	5.5	0.18	45	60	A	5.6	0.19	49	65	A	8.0	0.28	78	107
Cumberland St NB right (left/right under Build)	A	0.5	0.13	0	0	A	0.5	0.14	0	0	C	25.4	0.34	56	85

Table 2-17 Capacity Analysis Summary, Weekday a.m. Peak Hour (Continued)

Intersection/Movement	Existing Condition					No-Build (2027) Condition					Build (2027) Condition				
	LOS	Delay (s)	V/C Ratio	Queues (ft) 50th	Queues (ft) 95th	LOS	Delay (s)	V/C Ratio	Queues (ft) 50th	Queues (ft) 95th	LOS	Delay (s)	V/C Ratio	Queues (ft) 50th	Queues (ft) 95th
Unsignalized Intersection															
Saint Botolph Street/Cumberland Street	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Saint Botolph St EB left/thru/right	A	8.1	0.14	-	13	A	8.2	0.14	-	13	A	8.3	0.15	-	13
Saint Botolph St WB left/thru/right	A	7.9	0.16	-	15	A	8.0	0.17	-	15	A	8.2	0.23	-	23
Cumberland St NB left/thru/right	A	7.6	0.03	-	3	A	7.7	0.03	-	3	A	7.8	0.03	-	3
Cumberland St SB left/thru/right	A	10	0.12	-	10	B	10.1	0.12	-	10	B	10.2	0.13	-	10

Grey Shading indicates LOS E or F under the Existing Condition or a change from LOS D or better in a previous condition to LOS E or F.
Black Shading indicates an improvement from LOS E or F.

~ 50th percentile volume exceeds capacity. Queue shown is the maximum after two cycles.
# 95th percentile volume exceeds capacity. Queue shown is the maximum after two cycles.
m Volumes for 95th percentile queue is metered by upstream signal

Table 2-18 Capacity Analysis Summary, Weekday p.m. Peak Hour

Intersection/Movement	Existing Condition					No-Build (2027) Condition					Build (2027) Condition				
	LOS	Delay (s)	V/C Ratio	Queues (ft) 50th	Queues (ft) 95th	LOS	Delay (s)	V/C Ratio	Queues (ft) 50th	Queues (ft) 95th	LOS	Delay (s)	V/C Ratio	Queues (ft) 50th	Queues (ft) 95th
Signalized Intersections															
Massachusetts Avenue/Huntington Avenue	**E**	**71.2**	-	-	-	**F**	**90.6**	-	-	-	**F**	**96.9**	-	-	-
Huntington Ave EB left/thru | thru/right	E	76.0	0.85	106	#144	F	102.2	1.00	132	#190	F	106.2	1.02	~137	#195
Huntington Ave WB left/thru	E	71.5	0.76	129	#225	F	109.4	1.00	183	#336	F	114.6	1.02	~200	#351
Huntington Ave WB right	F	96.9	0.84	81	#177	F	98.4	0.85	84	#185	F	140.2	1.04	~111	#232
Massachusetts Ave NB left	F	90.5	0.57	55	m95	F	90.9	0.58	58	m93	F	90.9	0.58	58	m93
Massachusetts Ave NB thru | thru/right	F	85.2	0.58	320	387	F	101.0	0.62	342	410	F	100.9	0.62	342	410
Massachusetts Ave SB left/thru | thru/right	D	42.3	0.73	146	177	E	64.5	0.93	184	#377	E	73.7	0.96	294	#388
Massachusetts Avenue/Saint Botolph Street	**C**	**24.3**	-	-	-	**C**	**30.3**	-	-	-	**C**	**30.8**	-	-	-
Saint Botolph St EB left/thru/right	D	50.0	0.45	82	129	D	51.7	0.50	90	140	D	51.7	0.50	90	140
Saint Botolph St WB left/thru/right	D	47.0	0.36	59	97	D	47.8	0.38	62	101	D	48.0	0.38	62	101
Massachusetts Ave NB left/thru | thru/right	B	18.3	0.59	224	287	D	26.0	0.63	245	314	D	26.9	0.64	247	317
Massachusetts Ave SB left	C	20.8	0.16	22	m29	C	20.7	0.17	24	m25	C	20.5	0.17	24	m24
Massachusetts Ave SB thru | thru/right	C	25.6	0.35	216	m267	C	30.7	0.39	238	m252	C	30.9	0.39	238	m244
Huntington Ave/West Newton St/Belvidere St	**D**	**45.7**	-	-	-	**D**	**48.8**	-	-	-	**D**	**44.3**	-	-	-
Huntington Ave EB left	E	64.0	0.71	104	167	E	65.0	0.74	112	180	E	63.7	0.71	102	165
Huntington Ave EB thru | thru/right	C	34.4	0.36	102	147	D	36.2	0.43	120	168	D	33.6	0.37	105	157
Huntington Ave WB left	E	71.3	0.84	157	#273	E	73.	0.86	165	#289	E	69.5	0.84	162	#289
Huntington Ave WB thru | thru	C	34.8	0.44	146	209	D	37.02	0.54	173	241	C	33.8	0.48	162	245
Huntington Ave WB right	D	38.7	0.82	48	#193	D	53.8	0.91	76	#245	D	46.6	0.88	63	#233
West Newton St NB left/thru/right	E	71.9	0.91	180	#305	E	75.9	0.93	195	#334	E	60.4	0.82	164	237
Belvidere St SB left	E	77.3	0.77	90	#142	E	78.1	0.78	94	#151	E	78.6	0.78	94	#151
Belvidere St SB thru	C	24.2	0.33	112	148	C	24.0	0.35	122	159	C	26.4	0.37	133	159
Belvidere St SB right	A	4.7	0.20	0	22	A	5.3	0.21	2	25	A	5.5	0.22	2	25
Huntington Avenue/Cumberland Street	**A**	**5.1**	-	-	-	**A**	**5.3**	-	-	-	**B**	**11.5**	-	-	-
Huntington Ave EB thru | thru/right	A	5.4	0.22	51	72	A	5.6	0.24	59	82	B	11.5	0.31	72	145
Huntington Ave WB left	Movement does not exist.										D	39.7	0.12	10	32
Huntington Ave WB thru | thru | thru (thru | thru under Build)	A	5.4	0.15	40	54	A	5.5	0.18	46	61	A	7.9	0.27	78	107
Cumberland St NB right (left/right under Build)	A	0.7	0.16	0	0	A	1.8	0.18	0	3	C	23.9	0.32	51	90

Table 2-18 Capacity Analysis Summary, Weekday p.m. Peak Hour (Continued)

Intersection/Movement	Existing Condition					No-Build (2027) Condition					Build (2027) Condition				
	LOS	Delay (s)	V/C Ratio	Queues (ft) 50th	Queues (ft) 95th	LOS	Delay (s)	V/C Ratio	Queues (ft) 50th	Queues (ft) 95th	LOS	Delay (s)	V/C Ratio	Queues (ft) 50th	Queues (ft) 95th
Unsignalized Intersection															
Saint Botolph Street/Cumberland Street	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Saint Botolph St EB left/thru/right	A	8.2	0.13	-	10	A	8.2	0.13	-	13	A	8.4	0.14	-	13
Saint Botolph St WB left/thru/right	A	8.1	0.19	-	18	A	8.2	0.20	-	18	A	8.6	0.20	-	28
Cumberland St NB left/thru/right	A	7.5	0.02	-	3	A	7.6	0.02	-	3	A	7.7	0.02	-	3
Cumberland St SB left/thru/right	A	8.4	0.16	-	15	A	8.5	0.17	-	15	A	8.7	0.17	-	15

Grey Shading indicates LOS E or F under the Existing Condition or a change from LOS D or better in a previous condition to LOS E or F.
Black Shading indicates an improvement from LOS E or F.
~ 50th percentile volume exceeds capacity. Queue shown is the maximum after two cycles.
# 95th percentile volume exceeds capacity. Queue shown is the maximum after two cycles.
m Volumes for 95th percentile queue is metered by upstream signal

2.6 Transit Capacity Analysis

The new transit trips generated by the Project are expected to use the Orange Line, Green Line, or the MBTA Bus Route 1 and/or Route 39. The associated transit capacity evaluation is focused on the routes that serve the Project.

2.6.1 Transit Analysis Methodology

The volume to capacity ratio (V/C) is the primary measurement to determine the impact to transit service from the Project. The V/C ratio is a measurement of the number of passengers divided by the planning capacity. A V/C ratio of 1.0 or higher means the transit line is at capacity and any additional passengers either cannot fit or will cause delays to service as passengers try to crowd onto the train or bus. To calculate the V/C, ridership and capacity were determined for the Existing Condition to evaluate how the transit service operates today. Then, similar to the process of projecting vehicular traffic, the future ridership and capacity was developed both for the No-Build (2027) Condition, without the Project, and the Build (2027) Condition, with the Project.

The MBTA defines their capacity standard as the planning capacity, which is the number of passengers that can comfortably fit on a train or bus. As defined in the MBTA's *Service and Delivery Policy*, the planning capacity of an Orange Line train, which has six train cars, is 141 passengers per train car, for a total of 846 passengers per train. The planning capacity of a Green Line train, which has two train cars on average, is 100 passengers per train car, for a total of 200 passengers per train. The Orange Line and Green Line were estimated based on a 50% increase in capacity in the future conditions. The planning capacity for a bus is calculated as 140 percent of the seated capacity on the bus. A standard 40-foot MBTA bus has 39 seats; therefore, the planning capacity is 54 passengers per bus.

2.6.2 Transit Analysis Results

The Orange Line, Green Line (Branch E), Bus Route 1, and Route 39 volume to capacity ratios are displayed for the Existing Condition, No-Build (2027) Condition, and Build (2027) Condition, in Table 2-19, Table 2-20, Table 2-21, and Table 2-22, respectively. It should be noted that the data reflects average conditions during each hour. Individual trains or buses may have higher loads and exceed capacity within the same hour. Graphs of the maximum load and capacity for each route are included in the Appendix C.

Table 2-19 MBTA Orange Line Volume to Capacity Summary

Time of Day	Existing Capacity (Passengers)	Existing Condition				Future Capacity (Passengers)	No-Build (2027) Condition				Build (2027) Condition			
		North of Mass. Ave		South of Mass. Ave			North of Mass. Ave		South of Mass. Ave		North of Mass. Ave		South of Mass. Ave	
		Northbound	Southbound	Northbound	Southbound		Northbound	Southbound	Northbound	Southbound	Northbound	Southbound	Northbound	Southbound
5 - 6 am	11,280	0.04	0.10	0.04	0.03	16,920	0.03	0.07	0.03	0.02	0.03	0.07	0.03	0.02
6 - 7 am	14,100	0.19	0.26	0.19	0.08	21,150	0.13	0.18	0.13	0.06	0.13	0.18	0.13	0.06
7 - 8 am	16,920	0.24	0.35	0.24	0.09	25,380	0.17	0.25	0.17	0.06	0.17	0.25	0.17	0.07
8 - 9 am	16,920	0.34	0.44	0.31	0.08	25,380	0.24	0.31	0.22	0.06	0.24	0.31	0.22	0.06
9 - 10 am	10,152	0.28	0.36	0.26	0.09	15,228	0.20	0.26	0.19	0.07	0.20	0.26	0.19	0.07
10 - 11 am	10,152	0.16	0.20	0.15	0.08	15,228	0.11	0.15	0.11	0.06	0.11	0.15	0.11	0.06
11 - 12 pm	10,152	0.15	0.17	0.13	0.09	15,228	0.11	0.12	0.09	0.06	0.11	0.12	0.09	0.06
12 - 1 pm	10,152	0.16	0.17	0.13	0.11	15,228	0.11	0.12	0.09	0.08	0.12	0.12	0.09	0.08
1 - 2 pm	10,152	0.18	0.18	0.13	0.13	15,228	0.13	0.13	0.10	0.09	0.13	0.13	0.10	0.09
2 - 3 pm	10,152	0.24	0.22	0.19	0.17	15,228	0.17	0.15	0.14	0.12	0.17	0.15	0.14	0.12
3 - 4 pm	13,536	0.27	0.21	0.15	0.17	20,304	0.19	0.15	0.10	0.12	0.19	0.15	0.10	0.12
4 - 5 pm	16,920	0.31	0.23	0.13	0.19	25,380	0.22	0.16	0.09	0.14	0.22	0.16	0.09	0.14
5 - 6 pm	16,920	0.41	0.30	0.13	0.27	25,380	0.29	0.22	0.09	0.19	0.29	0.22	0.09	0.19
6 - 7 pm	14,100	0.30	0.21	0.09	0.20	21,150	0.21	0.15	0.07	0.14	0.21	0.15	0.07	0.14
7 - 8 pm	11,280	0.21	0.17	0.07	0.16	16,920	0.15	0.12	0.05	0.11	0.15	0.12	0.05	0.11
8 - 9 pm	11,280	0.15	0.13	0.06	0.13	16,920	0.11	0.09	0.04	0.09	0.11	0.09	0.04	0.09
9 - 10 pm	11,280	0.13	0.11	0.04	0.11	16,920	0.09	0.08	0.03	0.08	0.09	0.08	0.03	0.08
10 - 11 pm	11,280	0.14	0.09	0.04	0.09	16,920	0.10	0.06	0.03	0.07	0.10	0.06	0.03	0.07
11 - 12 am	11,280	0.10	0.07	0.02	0.07	16,920	0.07	0.05	0.01	0.05	0.07	0.05	0.01	0.05
12 - 1 a.m.	11,280	0.03	0.02	0.01	0.02	16,920	0.02	0.02	0.00	0.02	0.02	0.02	0.00	0.02

Table 2-20 MBTA Green Line (Branch E) Volume to Capacity Summary

Time of Day	Existing Capacity (Passengers)	Existing Condition				Future Capacity (Passengers)	No-Build (2027) Condition				Build (2027) Condition			
		East of Symphony		West of Symphony			East of Symphony		West of Symphony		East of Symphony		West of Symphony	
		Eastbound	Westbound	Eastbound	Westbound		Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound
5 - 6 am	3,000	0.13	0.26	0.01	0.03	4,500	0.10	0.18	0.01	0.02	0.10	0.18	0.01	0.02
6 - 7 am	3,500	0.37	0.57	0.04	0.09	5,250	0.26	0.41	0.03	0.06	0.26	0.41	0.03	0.06
7 - 8 am	4,000	0.88	0.96	0.09	0.12	6,000	0.63	0.69	0.06	0.09	0.63	0.69	0.06	0.09
8 - 9 am	4,000	1.17	1.23	0.13	0.12	6,000	0.84	0.88	0.10	0.08	0.84	0.88	0.10	0.08
9 - 10 am	2,667	0.99	1.10	0.12	0.13	4,000	0.71	0.78	0.08	0.09	0.71	0.78	0.08	0.09
10 - 11 am	2,667	0.62	0.72	0.08	0.09	4,000	0.45	0.51	0.06	0.07	0.45	0.51	0.06	0.07
11 - 12 pm	2,667	0.64	0.65	0.11	0.09	4,000	0.46	0.46	0.08	0.06	0.46	0.46	0.08	0.06
12 - 1 pm	2,667	0.70	0.71	0.11	0.10	4,000	0.50	0.51	0.08	0.07	0.50	0.51	0.08	0.07
1 - 2 pm	2,667	0.76	0.76	0.12	0.11	4,000	0.54	0.54	0.09	0.08	0.54	0.54	0.09	0.08
2 - 3 pm	2,667	0.99	0.81	0.21	0.11	4,000	0.71	0.58	0.15	0.08	0.71	0.58	0.15	0.08
3 - 4 pm	3,333	1.04	0.80	0.21	0.09	5,000	0.74	0.57	0.15	0.07	0.74	0.57	0.15	0.07
4 - 5 pm	4,000	1.16	0.83	0.18	0.10	6,000	0.83	0.60	0.13	0.07	0.83	0.60	0.13	0.07
5 - 6 pm	4,000	1.34	1.27	0.18	0.15	6,000	0.96	0.91	0.13	0.11	0.96	0.91	0.13	0.11
6 - 7 pm	3,500	1.10	1.09	0.15	0.12	5,250	0.79	0.78	0.11	0.08	0.79	0.78	0.11	0.08
7 - 8 pm	3,000	0.83	0.72	0.09	0.09	4,500	0.60	0.52	0.06	0.07	0.60	0.52	0.06	0.07
8 - 9 pm	3,000	0.65	0.48	0.07	0.08	4,500	0.47	0.35	0.05	0.06	0.47	0.35	0.05	0.06
9 - 10 pm	3,000	0.66	0.40	0.05	0.07	4,500	0.47	0.28	0.04	0.05	0.47	0.28	0.04	0.05
10 - 11 pm	3,000	0.69	0.33	0.03	0.05	4,500	0.49	0.24	0.02	0.04	0.49	0.24	0.02	0.04
11 - 12 am	3,000	0.44	0.21	0.03	0.03	4,500	0.31	0.15	0.02	0.02	0.31	0.15	0.02	0.02
12 - 1 a.m.	3,000	0.15	0.08	0.01	0.01	4,500	0.11	0.06	0.00	0.01	0.11	0.06	0.00	0.01

Grey Shading indicates volume to capacity ratio that is greater than 1.00.

Table 2-21 Bus Route 1, Maximum Hourly Volume to Capacity Summary

Time of Day	Capacity (Passengers)		Existing Condition				No-Build (2027) Condition				Build (2027) Condition			
			North of Nearby Stop		South of Nearby Stop		North of Nearby Stop		South of Nearby Stop		North of Nearby Stop		South of Nearby Stop	
	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound
5 - 6 am	216	324	0.20	0.28	0.22	0.29	0.21	0.29	0.23	0.31	0.21	0.29	0.23	0.31
6 - 7 am	378	432	0.35	0.37	0.52	0.32	0.37	0.39	0.55	0.34	0.37	0.39	0.55	0.34
7 - 8 am	432	432	0.68	0.76	0.79	0.52	0.72	0.80	0.83	0.55	0.72	0.80	0.83	0.55
8 - 9 am	432	432	0.83	0.86	0.71	0.51	0.87	0.91	0.75	0.54	0.87	0.91	0.75	0.54
9 - 10 am	432	324	0.54	0.60	0.46	0.41	0.57	0.63	0.48	0.44	0.57	0.63	0.48	0.44
10 - 11 am	270	324	0.46	0.48	0.45	0.46	0.49	0.50	0.47	0.49	0.49	0.50	0.47	0.49
11 - 12 pm	324	324	0.42	0.48	0.46	0.48	0.45	0.51	0.49	0.51	0.45	0.51	0.49	0.51
12 - 1 pm	324	270	0.46	0.48	0.49	0.47	0.49	0.51	0.52	0.49	0.49	0.51	0.52	0.50
1 - 2 pm	270	324	0.52	0.52	0.56	0.52	0.55	0.55	0.59	0.55	0.55	0.55	0.60	0.55
2 - 3 pm	324	378	0.57	0.50	0.55	0.52	0.60	0.53	0.58	0.54	0.60	0.53	0.58	0.54
3 - 4 pm	378	378	0.69	0.59	0.59	0.64	0.73	0.62	0.63	0.67	0.73	0.62	0.63	0.67
4 - 5 pm	432	486	0.81	0.75	0.57	0.70	0.86	0.79	0.60	0.74	0.86	0.79	0.61	0.74
5 - 6 pm	432	432	0.79	0.76	0.50	0.55	0.84	0.80	0.53	0.57	0.84	0.80	0.53	0.58
6 - 7 pm	432	378	0.58	0.62	0.34	0.35	0.61	0.66	0.36	0.37	0.61	0.66	0.36	0.37
7 - 8 pm	432	378	0.41	0.54	0.26	0.28	0.44	0.56	0.27	0.30	0.44	0.57	0.27	0.30
8 - 9 pm	324	270	0.40	0.48	0.30	0.21	0.42	0.51	0.32	0.22	0.42	0.51	0.32	0.22
9 - 10 pm	324	270	0.42	0.46	0.33	0.17	0.44	0.48	0.35	0.18	0.44	0.48	0.35	0.18
10 - 11 pm	216	270	0.36	0.41	0.32	0.14	0.38	0.44	0.34	0.15	0.38	0.44	0.34	0.15
11 - 12 am	270	216	0.25	0.19	0.23	0.13	0.27	0.20	0.25	0.14	0.27	0.20	0.25	0.14
12 - 1 a.m.	216	216	0.10	0.12	0.09	0.06	0.11	0.13	0.10	0.07	0.11	0.13	0.10	0.07

* Nearby Stops: Bus #1 - Massachusetts Ave @ Huntington Ave (Inbound) and Massachusetts Ave @ Saint Botolph St (Outbound).

Table 2-22 Bus Route 39, Maximum Hourly Volume to Capacity Summary

Time of Day	Capacity (Passengers)		Existing Condition				No-Build (2027) Condition				Build (2027) Condition			
			North of Nearby Stop		South of Nearby Stop		North of Nearby Stop		South of Nearby Stop		North of Nearby Stop		South of Nearby Stop	
	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound
5 - 6 am	324	162	0.18	0.08	0.52	0.15	0.19	0.08	0.55	0.15	0.19	0.08	0.55	0.15
6 - 7 am	540	324	0.20	0.21	0.77	0.33	0.21	0.22	0.81	0.35	0.21	0.22	0.81	0.35
7 - 8 am	432	432	0.28	0.30	0.91	0.38	0.29	0.31	0.96	0.40	0.29	0.31	0.96	0.40
8 - 9 am	486	486	0.28	0.27	0.90	0.33	0.30	0.29	0.95	0.35	0.30	0.29	0.95	0.35
9 - 10 am	324	378	0.23	0.14	0.81	0.23	0.24	0.15	0.85	0.24	0.24	0.15	0.85	0.24
10 - 11 am	270	216	0.27	0.14	0.72	0.36	0.28	0.15	0.76	0.38	0.28	0.15	0.76	0.38
11 - 12 pm	216	270	0.27	0.15	0.63	0.40	0.29	0.16	0.66	0.42	0.29	0.17	0.66	0.42
12 - 1 pm	216	216	0.27	0.19	0.61	0.52	0.28	0.20	0.65	0.55	0.29	0.21	0.65	0.55
1 - 2 pm	270	216	0.29	0.23	0.58	0.66	0.30	0.24	0.61	0.70	0.31	0.24	0.61	0.70
2 - 3 pm	216	378	0.35	0.15	0.56	0.66	0.36	0.16	0.59	0.70	0.36	0.16	0.59	0.70
3 - 4 pm	270	216	0.34	0.27	0.58	1.17	0.36	0.28	0.61	1.24	0.36	0.28	0.61	1.24
4 - 5 pm	378	324	0.36	0.25	0.54	1.15	0.38	0.26	0.57	1.21	0.39	0.27	0.57	1.21
5 - 6 pm	324	378	0.24	0.31	0.39	1.10	0.25	0.33	0.41	1.16	0.25	0.33	0.41	1.16
6 - 7 pm	324	324	0.18	0.25	0.30	0.80	0.19	0.26	0.31	0.84	0.19	0.27	0.31	0.84
7 - 8 pm	270	324	0.13	0.23	0.22	0.79	0.14	0.24	0.24	0.83	0.14	0.25	0.24	0.83
8 - 9 pm	270	270	0.09	0.18	0.16	0.61	0.10	0.19	0.17	0.64	0.10	0.19	0.17	0.64
9 - 10 pm	216	216	0.08	0.16	0.15	0.58	0.08	0.16	0.16	0.61	0.08	0.16	0.16	0.61
10 - 11 pm	324	270	0.05	0.11	0.13	0.45	0.06	0.12	0.14	0.48	0.06	0.12	0.14	0.48
11 - 12 am	270	324	0.05	0.07	0.08	0.27	0.05	0.07	0.08	0.28	0.05	0.07	0.08	0.28
12 - 1 a.m.	162	216	0.03	0.04	0.05	0.15	0.03	0.05	0.05	0.15	0.03	0.05	0.05	0.15

* Nearby Stops: Bus #39 - Huntington Ave @ Prudential Station (Inbound) and Huntington Ave @ Belvidere St (Outbound).
* Grey Shading indicates volume to capacity ratio that is greater than 1.00

Based on future improvements laid out in the MBTA Focus 40 plan, one principal goal is to increase capacity of train cars on the Green Line and Orange Line through the replacement of car types and by adding more trains. As shown in Table 2-19 and Table 2-20, the expected increase in rail capacity is expected to be able to accommodate the future rail demand due to background growth and permitted projects. In addition, Tables 2-21 and 2-22 show that the buses in the area can mostly accommodate the expected additional future demand except for Bus Route 39 in the p.m. between 3 – 6 p.m. for the outbound direction South of the Project. The capacity for this direction during the evening peak hours is already exceeded in the Existing Condition, slightly increases in the No-Build, however, shows no increase in the Build Condition with the added trips from the Project.

2.7 Transportation Mitigation Measures

The Proponent will work with the City of Boston to create a Project that efficiently serves vehicle trips, improves the pedestrian environment, and encourages transit and bicycle use at the Project Site. The Proponent will also bring abutting sidewalks and pedestrian ramps to the City of Boston standards in accordance with the Boston Complete Streets design guidelines. This will include the reconstruction and widening of the sidewalks where possible, the installation of new, accessible ramps, improvements to street lighting where necessary, planting of street trees, and providing bicycle storage racks surrounding the Project Site, where appropriate.

The Proponent will make improvements to the existing signalized intersection of Huntington Avenue at Cumberland Street to bring improved access and pedestrian safety to the area. These improvements will allow new vehicle turning movements that were previously unavailable, specifically the Huntington Avenue westbound left turn into Cumberland Street and the Cumberland Street northbound left turn to Huntington Avenue westbound. These traffic control changes will allow more direct access to and from the Saint Botolph Street neighborhood and the Project Site. The new intersection will introduce another pedestrian crosswalk across the Huntington Avenue eastbound approach and the pedestrian realm will improve with shorter and safer crossings.

The Proponent is responsible for preparing the Transportation Access Plan Agreement (TAPA), a formal legal agreement between the Proponent and the BTD. The TAPA formalizes the findings of the transportation study, mitigation commitments, elements of access and physical design, travel demand management measures, and any other responsibilities that are agreed to by both the Proponent and the BTD. Because the TAPA must incorporate the results of the technical analysis, it must be executed after these other processes have been completed. The proposed measures listed above and any additional transportation improvements to be undertaken as part of this Project will be defined and documented in the TAPA.

2.8 Travel Demand Management

The Proponent is committed to implementing Transportation Demand Management (TDM) measures to minimize automobile usage and Project related traffic impacts. TDM will be facilitated by the nature and location of the proposed Project. The Proponent will work with the City to develop a TDM program appropriate to the Proposed Project and consistent with its level of impact. The Proponent is prepared to take advantage of good transit access in marketing the Project to future residents and office tenants by working with them to implement the following TDM measures to encourage the use of non-vehicular modes of travel.

TDM measures will be described and evaluated in further detail in the TAPA. The TDM measures for the Project may include, but are not limited, to the following:

- **Limited Parking**: The Project will have approximately 153 parking spaces for residents. With approximately 325 residential units, the resulting parking ratio is anticipated to be approximately 0.47 spaces per unit.
  - Parking will be provided at market rate, unbundled from any residential rental agreements. This allows residents who do not drive to not subsidize parking for others and it reveals the cost of parking, so residents must actively make the decision to pay extra for parking.
- **Vehicle Sharing Program**: The Proponent will explore the feasibility of providing spaces in the garage for a car sharing service such as Zipcar for residents and the public.
- **Public Transportation**: The Proponent will provide orientation packets to new residents and tenants containing information on available alternative modes of transportation. This may including information on public transportation routes/schedules, nearby vehicle sharing and bicycle sharing locations, and walking opportunities. The new commercial tenant leases will contain language to encourage tenants to promote public transportation and encourage subsidizing employee use of public transit.
  - The Proponent will encourage the commercial tenants to participate in MBTA's Perq program, which would provide employees with subsidized monthly transit passes.
  - The Proponent will encourage tenants to provide on-line registration for the RideSource ride-matching program.
  - The Proponent may install real time displays at transit stops that show arrival and departure times for different routes/lines to that stop.
- **Bicycle Accommodations:**
  - The Proponent will provide secure/covered bicycle storage spaces for residents and employees as well as external racks for visitors throughout the Project Site near the building entrances;
  - The Proponent will install a new bikeshare station on Huntington Avenue
  - Commercial tenants may be encouraged to subsidize bicycle share memberships;
  - The Proponent may provide a bike repair station in the bike room to be used by tenants for quick repairs and bicycle maintenance.

- **Transportation Coordinator**: The Proponent will designate a transportation coordinator to oversee transportation issues, including parking, service/loading and deliveries, and move-in/move-out activity, as well as raise awareness of public transportation, bicycling, and walking opportunities.

- **Transportation Management Association**: The Proponent will join and participate in a local Transportation Management Association on behalf of the tenants and residents.

- **Travel Information Displays**: The Proponent will explore the feasibility of providing a display with real time information on travel alternatives for residents and/or tenants in building lobby spaces including information such as distance and time to certain destinations or transit stops.

- **Land Use related:**

  - The Proponent may provide in unit laundry machines for residential use.

  - The Proponent will provide a designated area to facilitate delivery services on Public Ally 404 at the two loading areas.

  - The Proponent will explore providing personal/family assistance storage facilities for residential use. These may include making shared collapsible shopping carts available to residents or providing a secure storage room for larger personal items like strollers, athletic gear, or cargo bicycles.

The Proponent and BTD will enter into a Transportation Access Plan Agreement. The TAPA will codify the specific measures and agreements between the Proponent and the City of Boston.

2.8.1 Electric Vehicles

The Project will follow the City of Boston's electric vehicle (EV) guidelines and provide 25 percent EV charging stations and 75 percent EV-ready spaces within the Project's parking areas. The specifics of the EV charging stations will be determined in the TAPA. Providing EV infrastructure in new developments will support the use of more environmentally friendly vehicles that can help reduce greenhouse gas emissions.

2.9 Evaluation of Short-Term Construction Impacts

The Proponent will also produce a Construction Management Plan (CMP) for review and approval by BTD. Most construction activities will be accommodated within the current Project Site boundaries. Details of the overall construction schedule, staging, working hours, worker transportation and parking, number of construction workers and vehicles, and routes will be addressed in detail in the CMP in accordance with the City's transportation maintenance plan requirements.

To minimize transportation impacts during the construction period, the following measures will be considered for the Construction Management Plan:

- Limited construction worker parking on-site;
- Encouragement of worker carpooling;
- Consideration of a subsidy for MBTA passes for full-time employees; and
- Providing secure spaces on-site for workers supplies and tools so they do not have to be brought to the Site each day.

The Construction Management Plan to be executed with the City prior to commencement of construction and will document all committed measures.

Chapter 3

Environmental Review Component

3.0 ENVIRONMENTAL REVIEW COMPONENT

3.1 Wind

Rowan Williams Davies & Irwin Inc. (RWDI) was retained to prepare a qualitative assessment of the pedestrian wind impacts by the 220 Huntington Avenue Project.

Current (No Build) and proposed (Build) wind conditions are anticipated to be in compliance with the effective gust criterion and dangerous winds are not anticipated in either the No Build or Build condition.

Existing wind conditions in the surrounding area are not expected to be significantly impacted by this Project as the size of the Project is expected to limit impacts to areas close to the Project Site.

On an annual basis, the mean wind speeds around the existing site are likely comfortable for standing. With the introduction of the Project (Build Condition), wind speeds along the perimeter of the building will increase. Even with this increase most of the perimeter sidewalks are expected to remain appropriate for the intended use (i.e. walking). Ten of the 14 locations studied are expected to have pedestrian level wind conditions comfortable for walking or better. The exception is near the east and west ends of the building where uncomfortable winds are expected, however with appropriate mitigation, wind speed conditions are expected to improve.

3.1.1 Building Site and Project Site Information

The Project Site is located on the southeast side of Huntington Avenue between Cumberland Street and an existing building at 236 Huntington Avenue (see Figures 3.1-1 and 3.1-2). The Christian Science Center is located across the street on the northwest side of Huntington Avenue. Downtown Boston is approximately one mile to the northeast while Logan International Airport is approximately three miles to the northeast.

The Project features a ten-story residential building with retail/restaurant on the ground floor. Key pedestrian areas on and around the site include the perimeter sidewalks, primary building entrances, and ground level amenity spaces.

3.1.2 Methodology

Predicting wind speeds and occurrence frequencies involves the combined assessment of building geometry, orientation, position and height of surrounding buildings, upstream terrain and the local wind climate.

Over the years, RWDI has conducted thousands of wind-tunnel model studies on pedestrian wind conditions around buildings, yielding a broad knowledge base. In some situations, this knowledge and experience, together with literature information, allow for a reliable, consistent and efficient desktop estimation of pedestrian wind conditions without wind-tunnel testing.

Figure 3.1-1

Aerial View of the Project Site and Surroundings

220 Huntington Avenue Boston, Massachusetts

Figure 3.1-2
Proposed Building Massing

This approach provides a screening-level estimation of potential wind conditions and offers conceptual wind control measures for improved wind comfort, where necessary.

RWDI's assessment is based on the following:

- Use of RWDI's proprietary 3D software (*WindEstimator*[2]) for providing a screening-level numerical estimation of potential wind conditions around generalized building forms;
- A review of the regional long-term meteorological data from Boston Logan International Airport;
- Wind-tunnel studies and desktop assessments undertaken by RWDI for similar and nearby projects in the Boston area; and,
- RWDI's engineering judgement and knowledge of wind flows around buildings[1,2,3].

3.1.3 Wind Data

Wind statistics at Boston-Logan International Airport between 1995 and 2018, inclusive, were analyzed for the spring (March to May), summer (June to August), fall (September to November) and winter (December to February) seasons.

Figure 3.1-3 graphically depicts the distributions of wind frequency and directionality for the four seasons and for the annual period. When all winds are considered (regardless of speed), winds from the northwest and southwest quadrants are predominant. Northeasterly winds are also frequent, especially in the spring. Strong winds with mean speeds greater than 20 mph (red bands in the images) are prevalent from the northwesterly directions throughout the year, while the southwesterly and northeasterly winds are also frequent.

Winds from the northwest, west, southwest and northeast directions are considered most relevant to the current study, although winds from other directions were also considered in the assessment.

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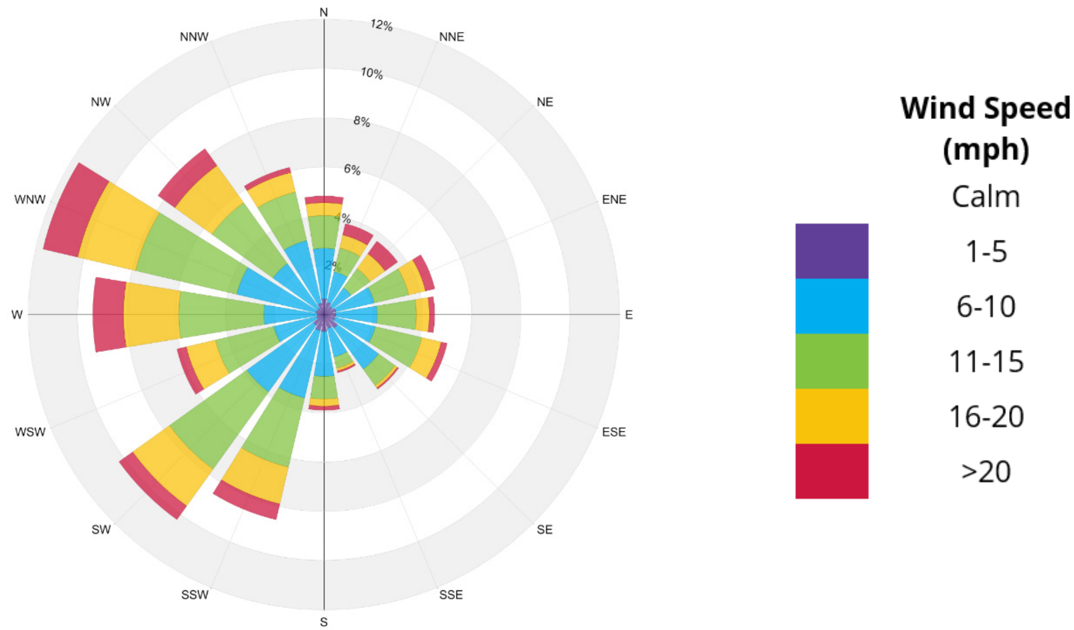
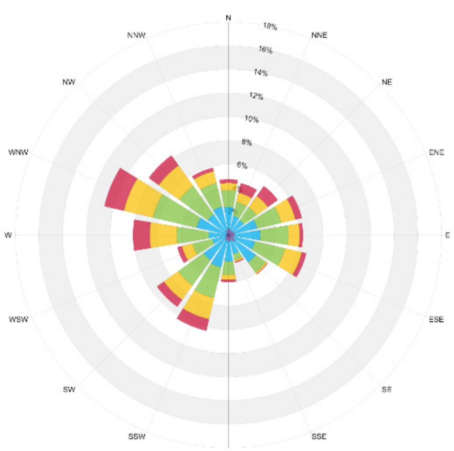
1 H. Wu and F. Kriksic (2012). "Designing for Pedestrian Comfort in Response to Local Climate", Journal of Wind Engineering and Industrial Aerodynamics, vol.104-106, pp.397-407.

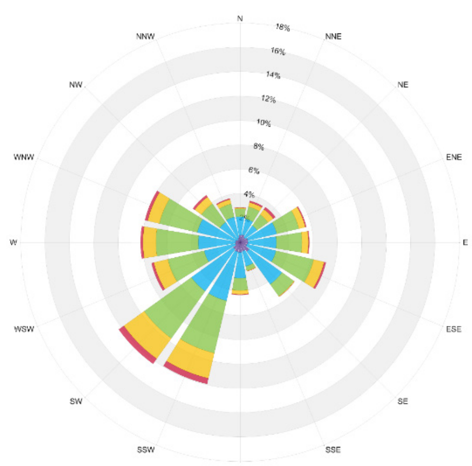
2 H. Wu, C.J. Williams, H.A. Baker and W.F. Waechter (2004), "Knowledge-based Desk-Top Analysis of Pedestrian Wind Conditions", ASCE Structure Congress 2004, Nashville, Tennessee.

3 C.J. Williams, H. Wu, W.F. Waechter and H.A. Baker (1999), "Experience with Remedial Solutions to Control Pedestrian Wind Problems", 10th International Conference on Wind Engineering, Copenhagen, Denmark.

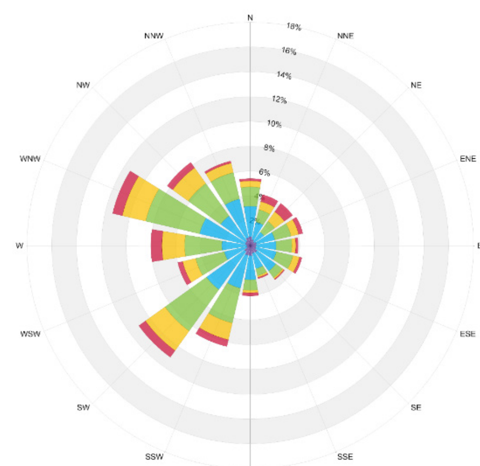




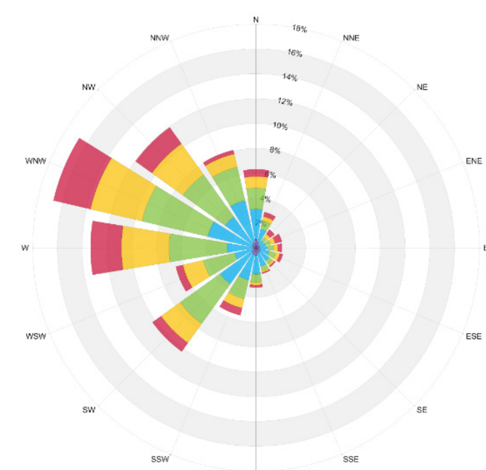
Spring
(March - May)



Summer
(June - August)



Fall
(September - November)



Winter
(December - February)

Figure 3.1-3

Directional Distribution of Winds Approaching Boston Logan International Airport (1995 – 2018)

3.1.4 Criteria

The BPDA has adopted two standards for assessing the relative wind comfort of pedestrians. First, the BPDA 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. This criterion is hereby referred to as the "effective gust criterion".

The second set of criteria used by the BPDA to determine the acceptability of specific locations is based on the work of Melbourne[4]. 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. They are as follows:

Table 3.1-1 BPDA Mean Wind Criteria*

Comfort Category	Mean Wind Speed (mph)
Dangerous	>27
Uncomfortable for Walking	>19 and ≤27
Comfortable for Walking	>15 and ≤19
Comfortable for Standing	12 and ≤15
Comfortable for Sitting	≤12

**Applicable to the hourly mean speed exceeded 1% of the time.*

Pedestrians on sidewalks and parking lots will be active and wind speeds comfortable for walking are appropriate. Lower wind speeds comfortable for standing are desired for building entrances and bus stops where people are apt to linger. For any outdoor amenity space, low wind speeds comfortable for sitting are desired in the summer, when it is typically in use.

The wind climate found in a typical location in Boston is generally comfortable for the pedestrian use of sidewalks and thoroughfares and meets the BPDA effective gust criterion of 31 mph at most areas, while windier conditions may be expected near the corners of taller buildings exposed to the prevailing winds. Without any mitigation measures, this wind climate is likely to be frequently unsuitable for more passive activities such as sitting.

Discussions related to pedestrian wind comfort and safety are based on the annual wind climate. 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.

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4 Melbourne, W.H., 1978, "Criteria for Environmental Wind Conditions", Journal of Industrial Aerodynamics, 3(1978) 241-249.

3.1.5 Results

3.1.5.1 Wind Flows around Buildings

In the discussion of wind conditions on and around the Project, reference may be made to the following generalized wind flows (see Figure 3.1-4). If these building / wind combinations occur for prevailing winds, there is a greater potential for increased wind activity and uncomfortable conditions.

Design details such as deep canopies close to ground level; wind screens / tall trees with dense landscaping; etc. (Figure 3.1-5) can help reduce wind speeds. The choice and effectiveness of these measures depends on the exposure and orientation of the site with respect to the prevailing wind directions and the size and massing of the proposed buildings.

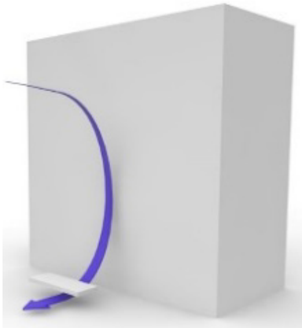
3.1.5.2 No Build – Wind Conditions

Given the relatively low heights of the existing buildings on and immediately adjacent to the site, as well as their distance from taller existing buildings, it is anticipated that the current wind conditions (No Build) to be in compliance with the effective gust criterion. On an annual basis, the mean wind speeds around the existing site are most likely to be considered comfortable for standing.

3.1.5.3 Build – Wind Conditions

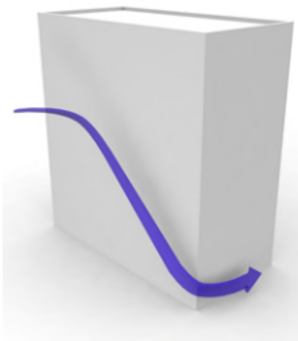
Due to the size of the Project and the exposure of the site, it is expected that strong winds primarily from the northwest and northeast will be intercepted by the massing and directed toward ground level. This is expected to cause an increase in wind speeds adjacent to the Project.

With the Project, it is anticipated that wind conditions with the Project (Build) will be in compliance with the effective gust criterion. Ten of the 14 locations studied are expected to have pedestrian level wind conditions comfortable for walking or better. Wind flow accelerations may increase around corners at both the east and west ends of the building potentially causing uncomfortable conditions. As noted above, even with this increase in mean wind speeds, neither an exceedance of the effective gust criterion nor any dangerous wind conditions are anticipated. The predicted ground level wind comfort conditions are presented in Figure 3.1-6. Discussions of these potential wind conditions are provided in the following sections.



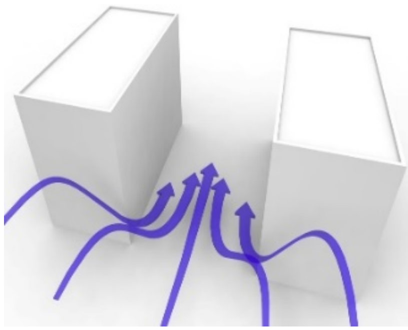
Downwashing

Tall buildings tend to intercept the stronger winds at higher elevations and redirect them to the ground level. This is often the main cause for wind accelerations around large buildings at the pedestrian level.



Corner Acceleration

Winds approach at an oblique angle to a tall façade and are deflected down causing a localized increase in the wind activity or corner acceleration around the exposed building corner(s) at pedestrian level.



Channeling

When two buildings are situated side by side, wind flow tends to accelerate through the space between the buildings due to channeling effect caused by the narrow gap.

Figure 3.1-4

Generalized Wind Flows

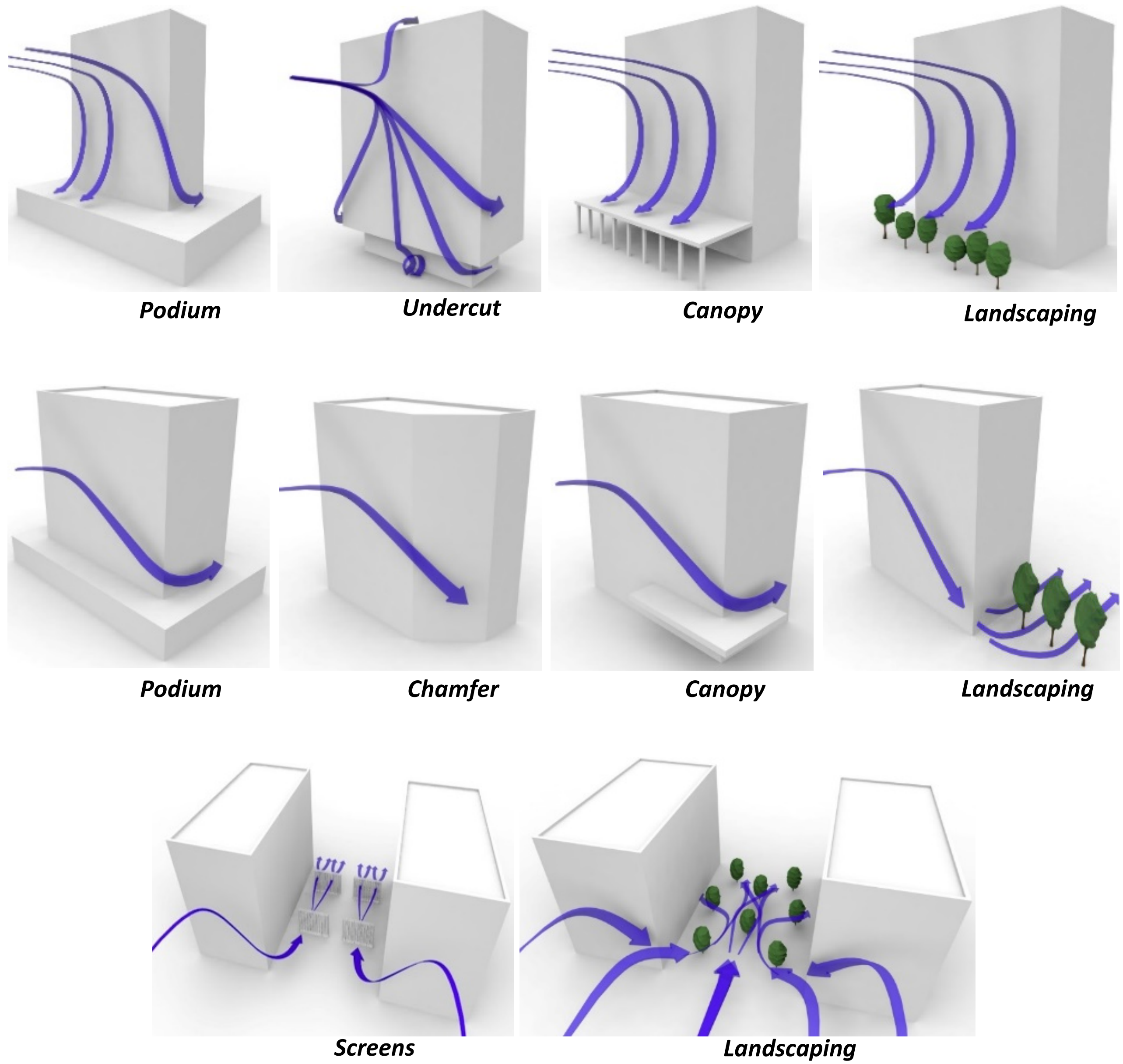


Figure 3.1-5

Examples of Wind Control Measures

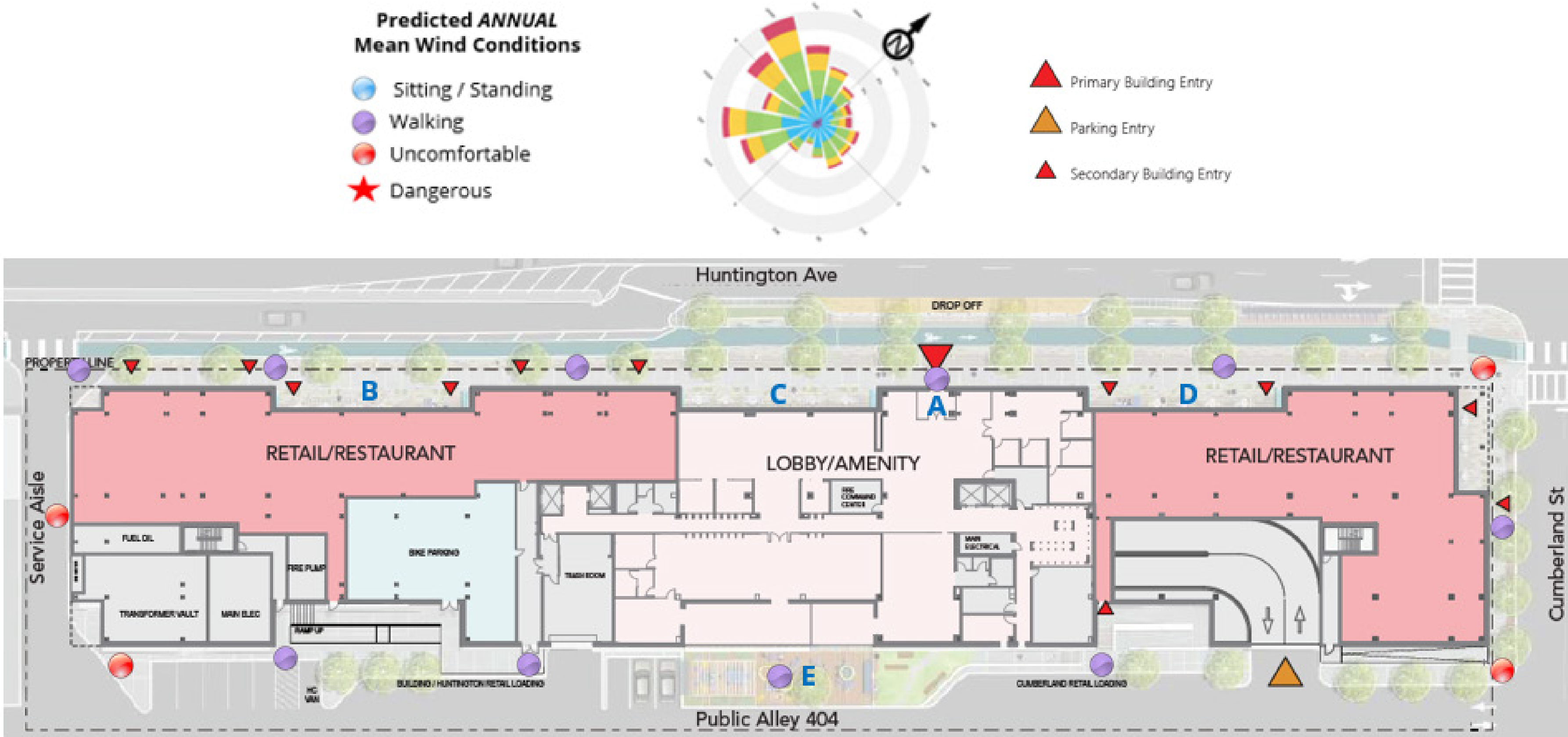


Figure 3.1-6

Predicted Annual Wind Comfort Conditions (Ground Level)

3.1.5.4 Offsite

Existing wind conditions in the surrounding area are not expected to be significantly impacted by this Project as the size of the Project is expected to limit impacts to areas close to the Project Site.

3.1.5.5 Perimeter Sidewalks

With the introduction of the Project (Build Condition), wind speeds along the Huntington Avenue sidewalk are expected to increase, and for the most part, remain appropriate for the intended use (i.e., comfortable for walking on an annual basis) as indicated in Figure 3.1-6. Even with the increase in local wind speeds, neither dangerous winds nor an exceedance of the effective gust criterion are anticipated.

Along Cumberland Street uncomfortable wind conditions are expected due to corner accelerations (see Figure 3.1-4) by winds from the northwest and northeast. Although this level of wind activity is not uncommon in the area, the potential addition of coniferous / marcescent trees closer to the corners and/or a canopy wrapping around the corners as indicated in Figure 3.1-5 may be considered to improve wind conditions.

The proposed service aisle at the southwest end of the property will be subjected to corner accelerations and northwesterly winds channeling (see Figure 3.1-4) between the two buildings. These conditions may cause uncomfortable winds, although this area is not a pedestrian active area and does not include sidewalks.

3.1.5.6 Building Entrances

The main residential entrance off Huntington Avenue (location A in Figure 3.1-6) will be exposed to northwesterly winds downwashing off the northwest façade of the building (see Figures 3.1-4 and 3.1-5). As a result, this entrance is expected to be comfortable for walking. Incorporating an overhead canopy over the entrance area and and/or providing screening (architectural or landscaping) on both sides of the entrance may be considered.

Similarly, the secondary and retail entrances marked with red triangles in Figure 3.1-6 will also be exposed to the prevailing comfortable for walking conditions along the sidewalks.

3.1.5.7 Grade-level Amenity Spaces

Amenity spaces along Huntington Avenue (indicated as locations B, C, and D in Figure 3.1-6) should be comfortable for walking. These result from northwesterly winds downwashing from the façade above as per Figure 3.1-4. With appropriate mitigation, wind speeds are expected to be comfortable for sitting.

The amenity space along Public Alley 404 (Location E in Figure 3.1-6) will be exposed to northeasterly and southwesterly downwashing winds thus causing conditions comfortable for walking.

3.1.6 Summary

As described above, current (No Build) and proposed (Build) wind conditions are anticipated to be in compliance with the effective gust criterion and dangerous winds are not anticipated in either the No Build or Build condition.

Existing wind conditions in the surrounding area are not expected to be significantly impacted by this Project as the size of the Project is expected to limit impacts to areas close to the Project Site.

With the introduction of the Project (Build Condition), wind speeds along the perimeter of the building will slightly increase. Even with this increase most of the perimeter sidewalks are expected to remain appropriate for the intended use (i.e. walking).

3.2 Shadow

3.2.1 Introduction and Methodology

As typically required by the BPDA, a shadow impact analysis was conducted to investigate shadow impacts from the Project during three periods (9:00 a.m., 12:00 noon, and 3:00 p.m.) during the vernal equinox (March 21), summer solstice (June 21), autumnal equinox (September 21), and winter solstice (December 21). In addition, shadow studies were conducted for the 6:00 p.m. period during the summer solstice and autumnal equinox.

The shadow analysis presents the existing shadow and new shadow that would be created by the Project, illustrating the incremental impact of the Project. The analysis focuses on nearby open spaces, sidewalks, and bus stops adjacent to and in the vicinity of the Project Site. It should be noted that the shadow graphics do not account for existing or proposed trees. Shadows have been determined using the applicable Altitude and Azimuth data for Boston. Figures showing net new shadow from the Project are provided in Figures 3.2-1 to 3.2-14.

New shadow will primarily be limited to the Project Site's immediate surroundings. The as-of-right building's design was developed to mitigate shadow impacts to the greatest extent possible in a dense urban environment. No new shadows will be cast on bus stops in the Project vicinity. During 10 of the 14 time periods studied, there are no net new shadows on any public open space. Minimal new shadow will be cast onto a portion of the surrounding open space along the Christian Science Plaza and Reflecting Pool during only four of the time periods studied.

3.2.2 Vernal Equinox (March 21)

At 9:00 a.m. during the vernal equinox, no new shadow will be cast onto nearby bus stops. New shadow will be cast northwest onto Huntington Avenue, its western sidewalk, and open space along the Christian Science Plaza and Reflecting Pool.

At 12:00 p.m., no new shadow will be cast onto nearby bus stops or open space. New shadow will be cast north and west onto Huntington Avenue and its sidewalks and north onto a small portion of Cumberland Street.

At 3:00 p.m., no new shadow will be cast onto nearby bus stops or open space. New shadow will be limited to a portion of Cumberland Street and its northern sidewalk, northeast of the Project Site.

3.2.3 Summer Solstice (June 21)

At 9:00 a.m. during the summer solstice, no new shadow will be cast onto nearby bus stops or open space. New shadow will be cast north and west onto Huntington Avenue and its sidewalks.

At 12:00 p.m., no new shadow will be cast onto nearby bus stops or open space. Minimal new shadow will be cast west onto a minor portion of Huntington Avenue and its eastern sidewalk adjacent to the Project Site.

At 3:00 p.m., no new shadow will be cast onto nearby bus stops or open space. Minimal new shadow will be cast northeast onto a small portion of Cumberland Street and its northern sidewalk.

At 6:00 p.m., no new shadow will be cast onto nearby bus stops or open space. New shadow will be cast onto a small portion of Cumberland Street and its northern sidewalk and across portions of Saint Botolph Street and its sidewalks. As described above, the as-of-right building’s design was developed to mitigate shadow impacts to the greatest extent possible in a dense urban environment.

3.2.4 Autumnal Equinox (September 21)

At 9:00 a.m., during the autumnal equinox, no new shadow will be cast onto nearby bus stops. New shadow will be cast west onto Huntington Avenue and its western sidewalk as well as open space on the Christian Science Plaza and along the Reflecting Pool.

At 12:00 p.m., no new shadow will be cast onto nearby bus stops or open space. New shadow will be cast north and west onto Huntington Avenue and its sidewalk, and north onto a portion of Cumberland Street.

At 3:00 p.m., no new shadow will be cast onto nearby bus stops or open space. Minimal new shadow will be cast northwest onto a small portion of Cumberland Street and its northern sidewalk.

At 6:00 p.m., no new shadow will be cast onto nearby bus stops and open spaces or the surrounding neighborhood.

3.2.5 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 in urban areas to elongate and be cast onto large portions of the surrounding area.

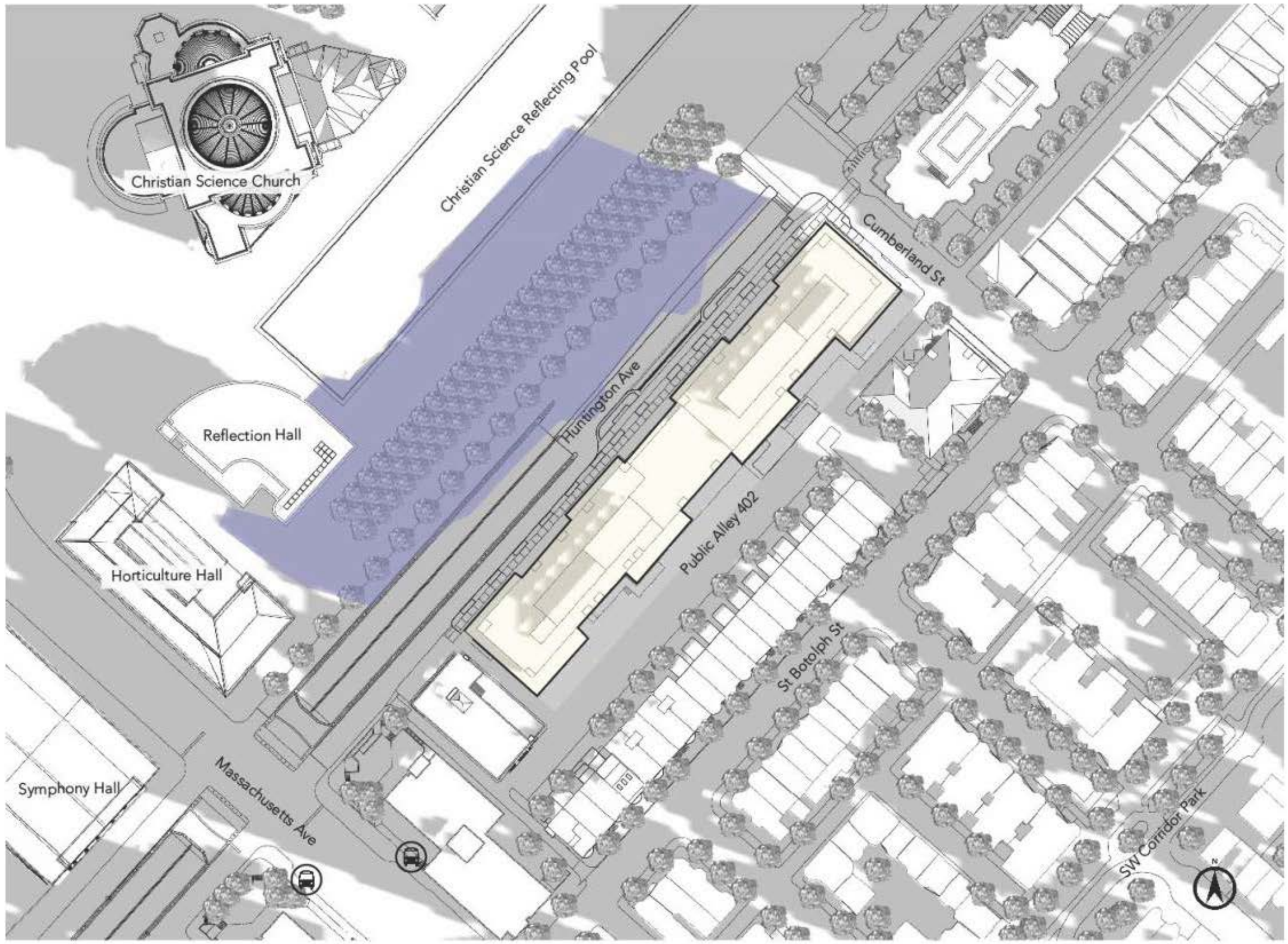
At 9:00 a.m., during the winter solstice, no new shadow will be cast onto nearby bus stops. New shadow will be cast northwest across the Christian Science Plaza and Reflecting Pool.

At 12:00 p.m., no new shadow will be cast onto nearby bus stops. New shadow will be cast onto Huntington Avenue and its sidewalk and across Cumberland Street and its sidewalks. Shadows will be cast on a portion of the Christian Science Plaza.

At 3:00 p.m., no new shadow will be cast onto nearby bus stops, open spaces or the surrounding neighborhood.

3.2.6 Conclusions

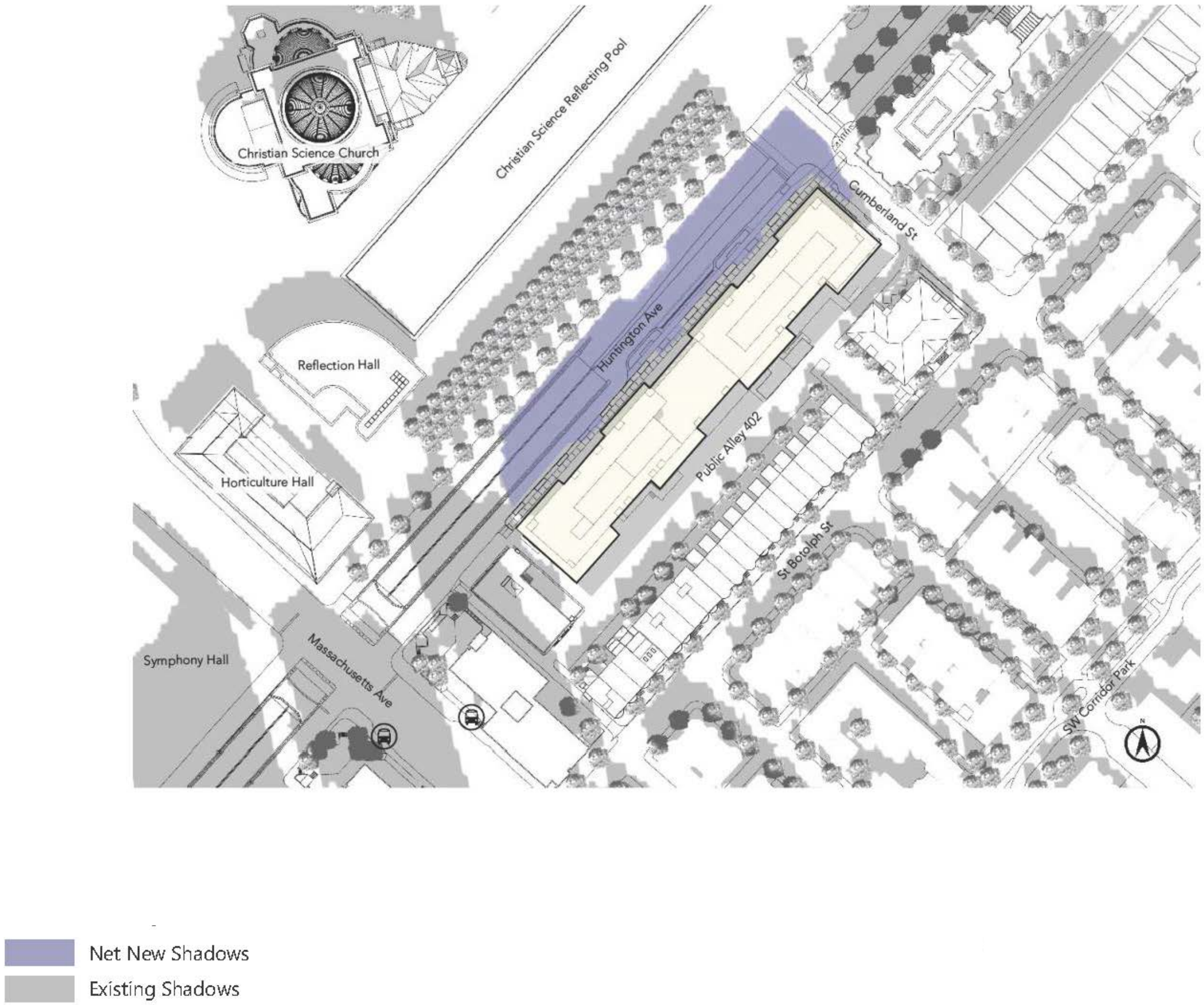
Fourteen periods were studied to determine the extent of net new shadow cast by the Project. No new shadows will be cast on bus stops in the Project vicinity. New shadow will primarily be limited to the Project Site's immediate surroundings. Minimal new shadow will be cast onto a portion of the surrounding open space along the Christian Science Plaza. As described above, the as-of-right building's design was developed to mitigate shadow impacts to the greatest extent possible in a dense urban environment.



Net New Shadows
Existing Shadows

Figure 3.2-1

Shadow Study: March 21, 9:00 a.m.

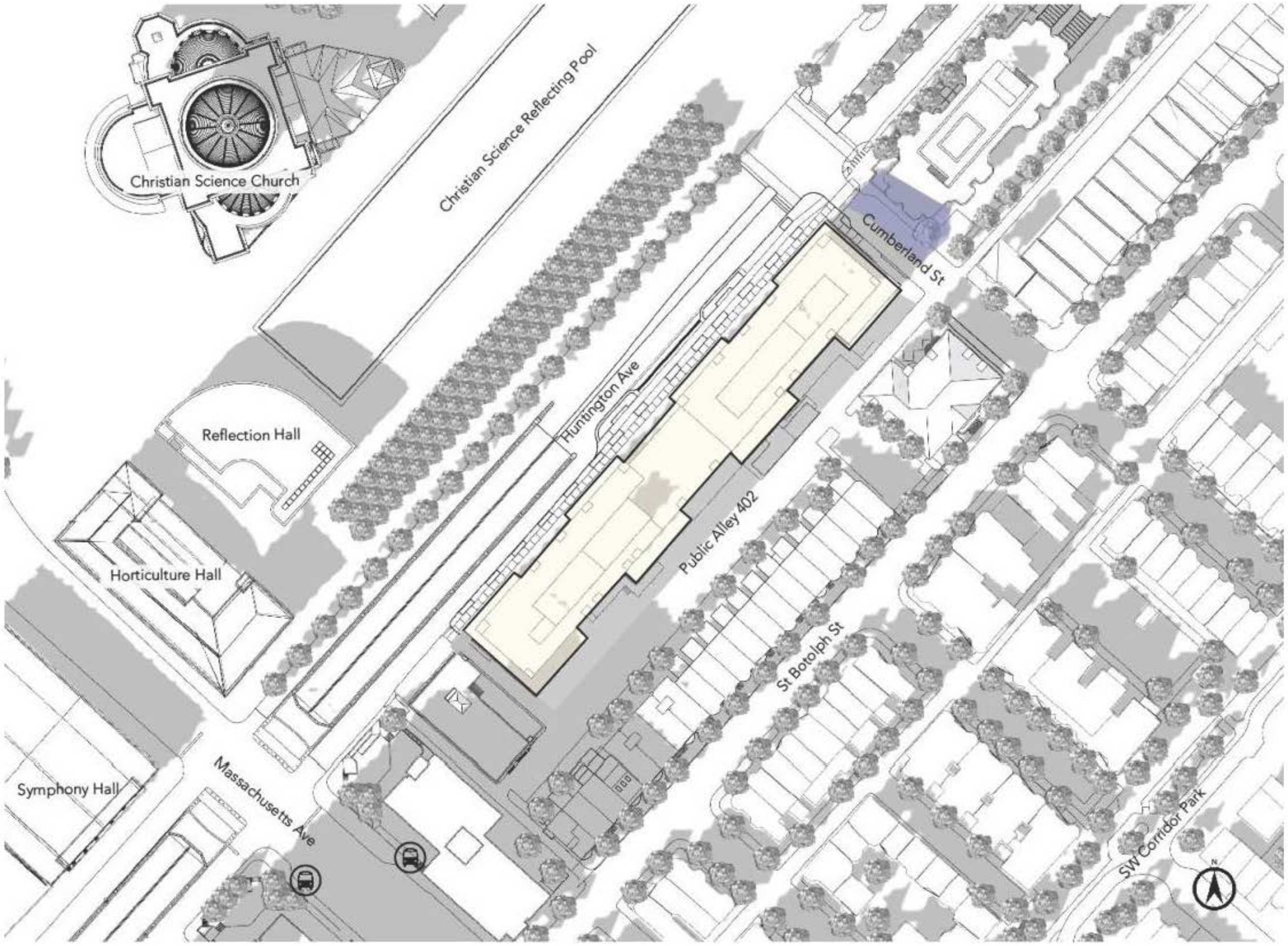


220 Huntington Avenue Boston, Massachusetts

cbt

Figure 3.2-2

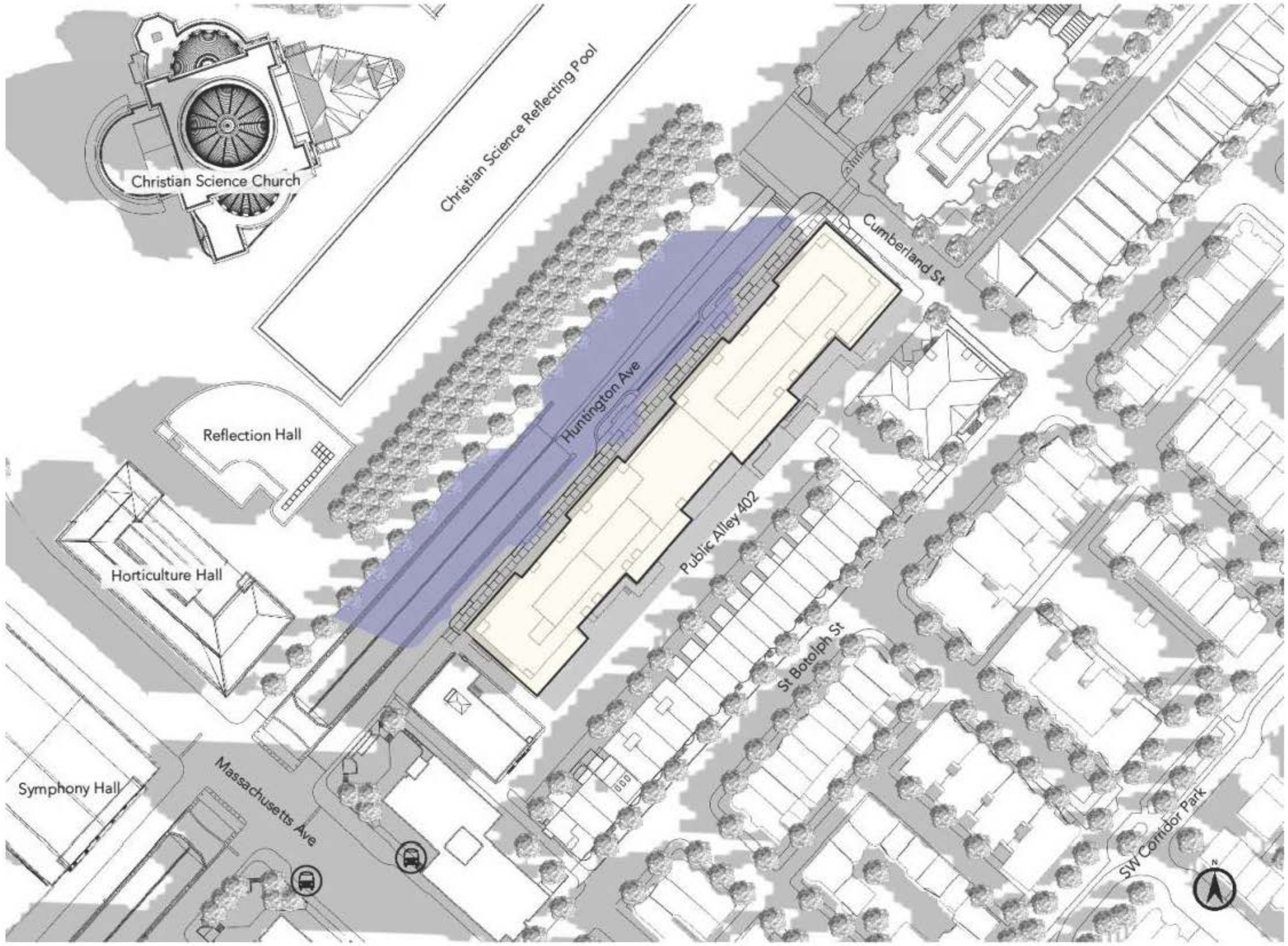
Shadow Study: March 21, 12:00 p.m.



Net New Shadows
Existing Shadows

cbt

Figure 3.2-3
Shadow Study: March 21, 3:00 p.m.



Net New Shadows

Existing Shadows

Figure 3.2-4

Shadow Study: June 21, 9:00 a.m.

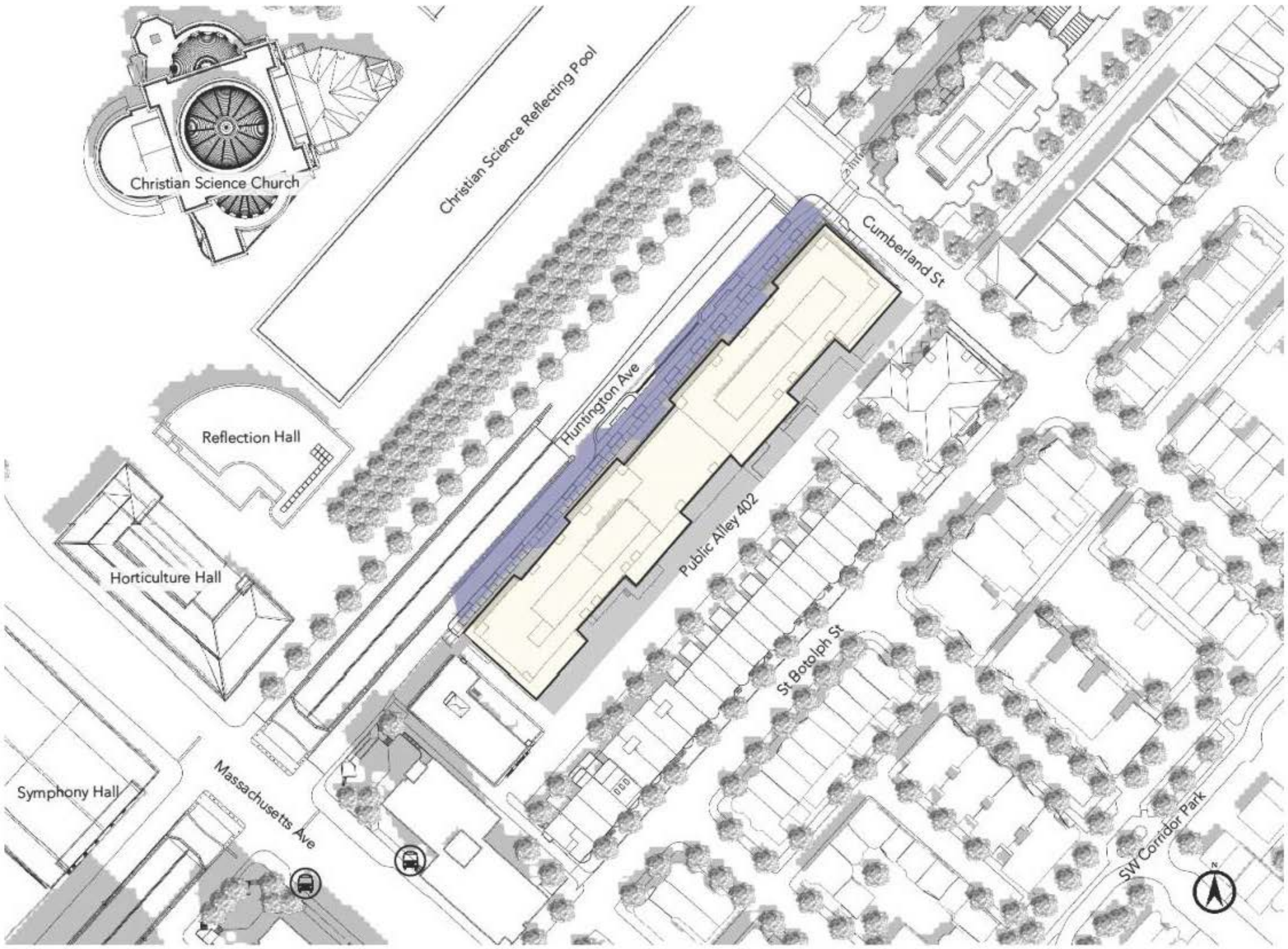


Figure 3.2-5

Shadow Study: June 21, 12:00 p.m.

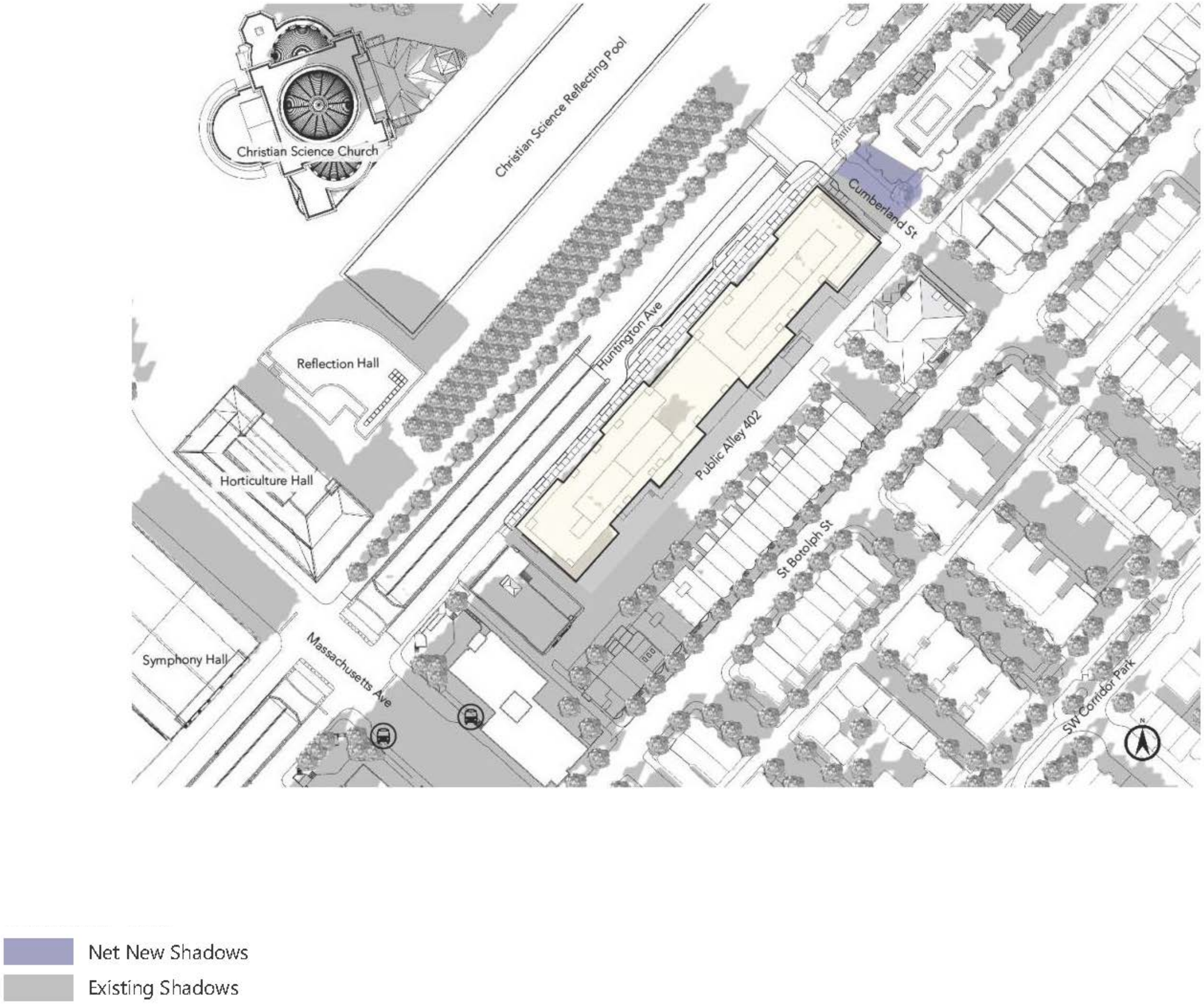


Figure 3.2-6

Shadow Study: June 21, 3:00 p.m.

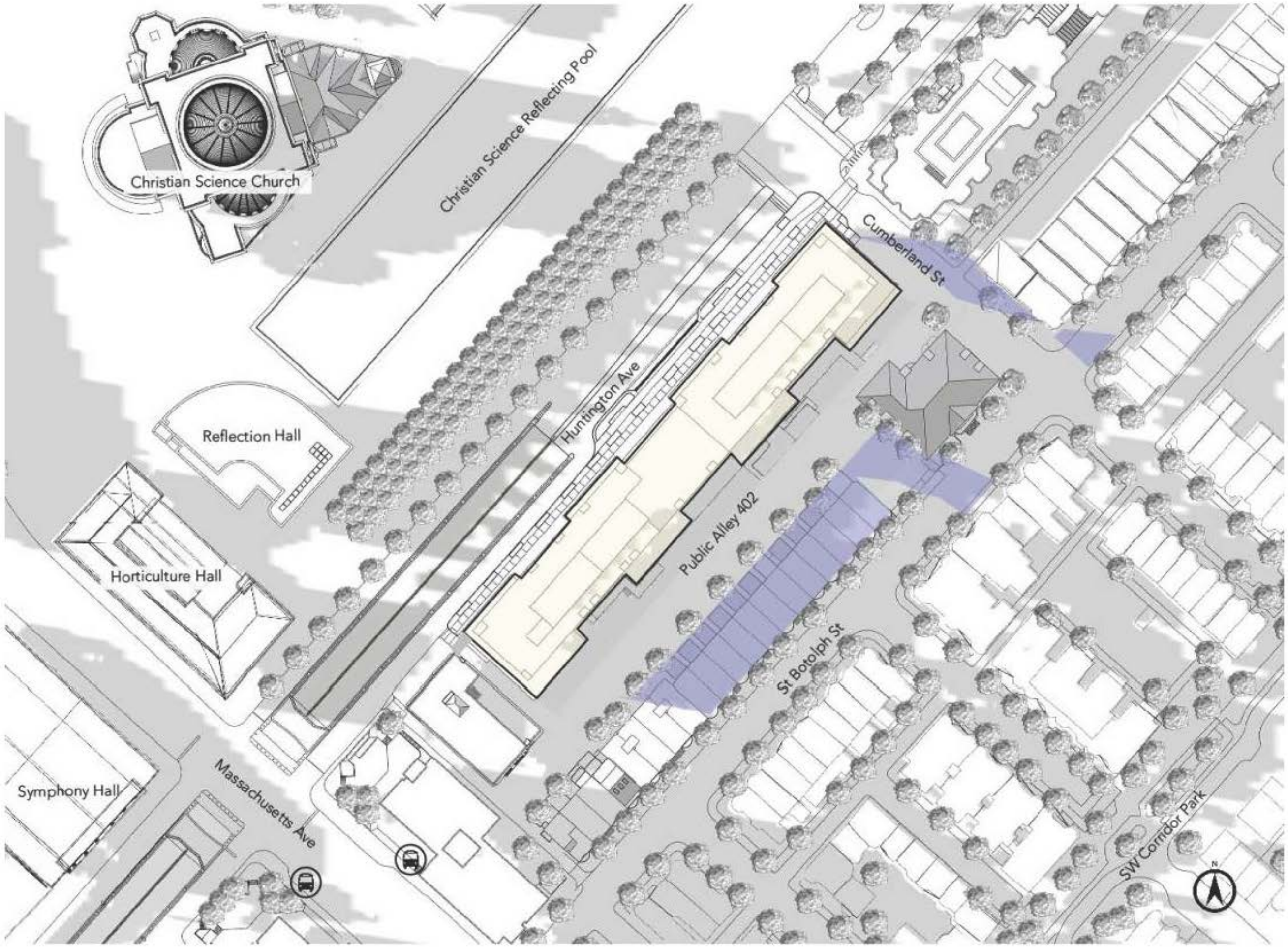


Figure 3.2-7

Shadow Study: June 21, 6:00 p.m.

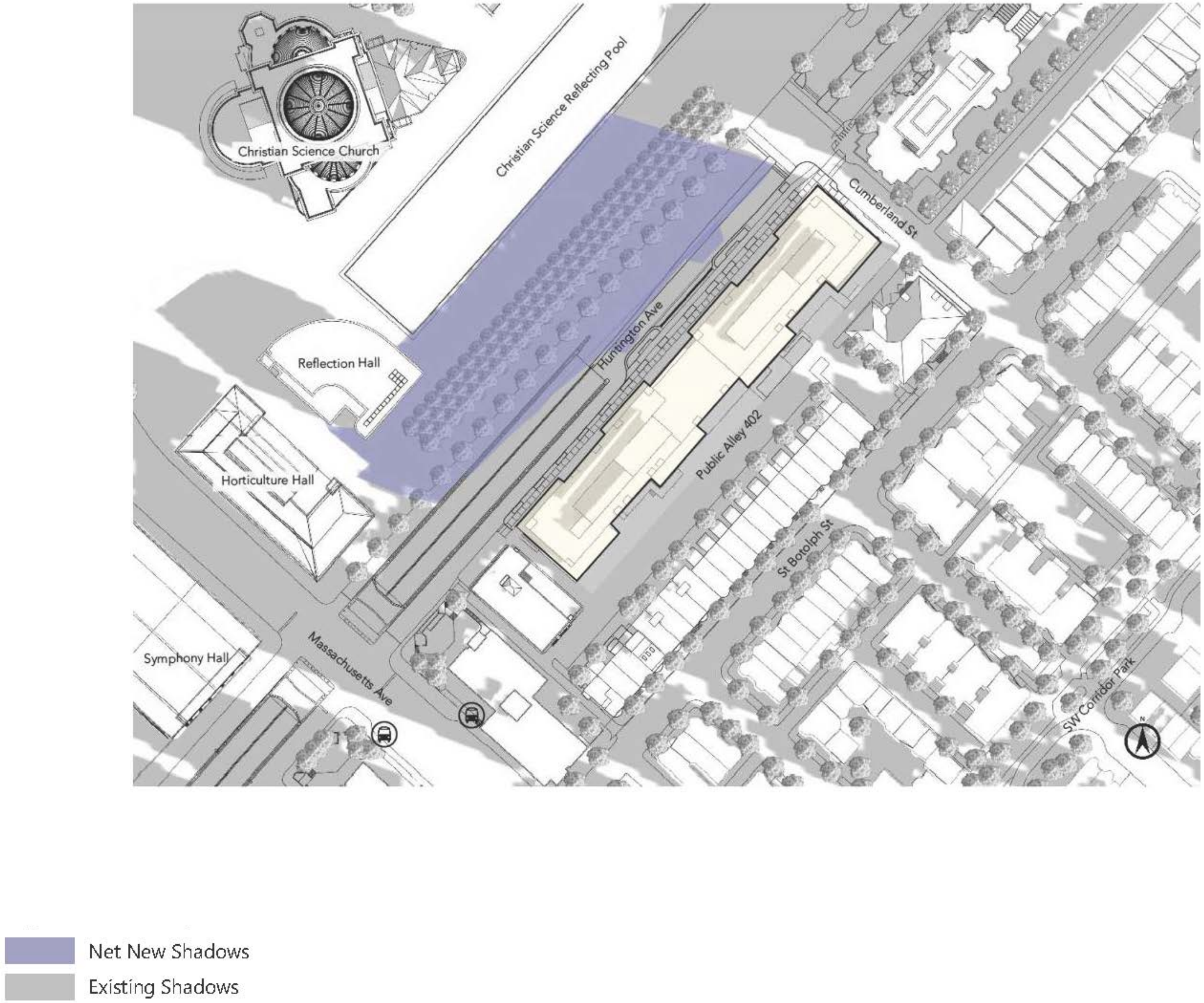
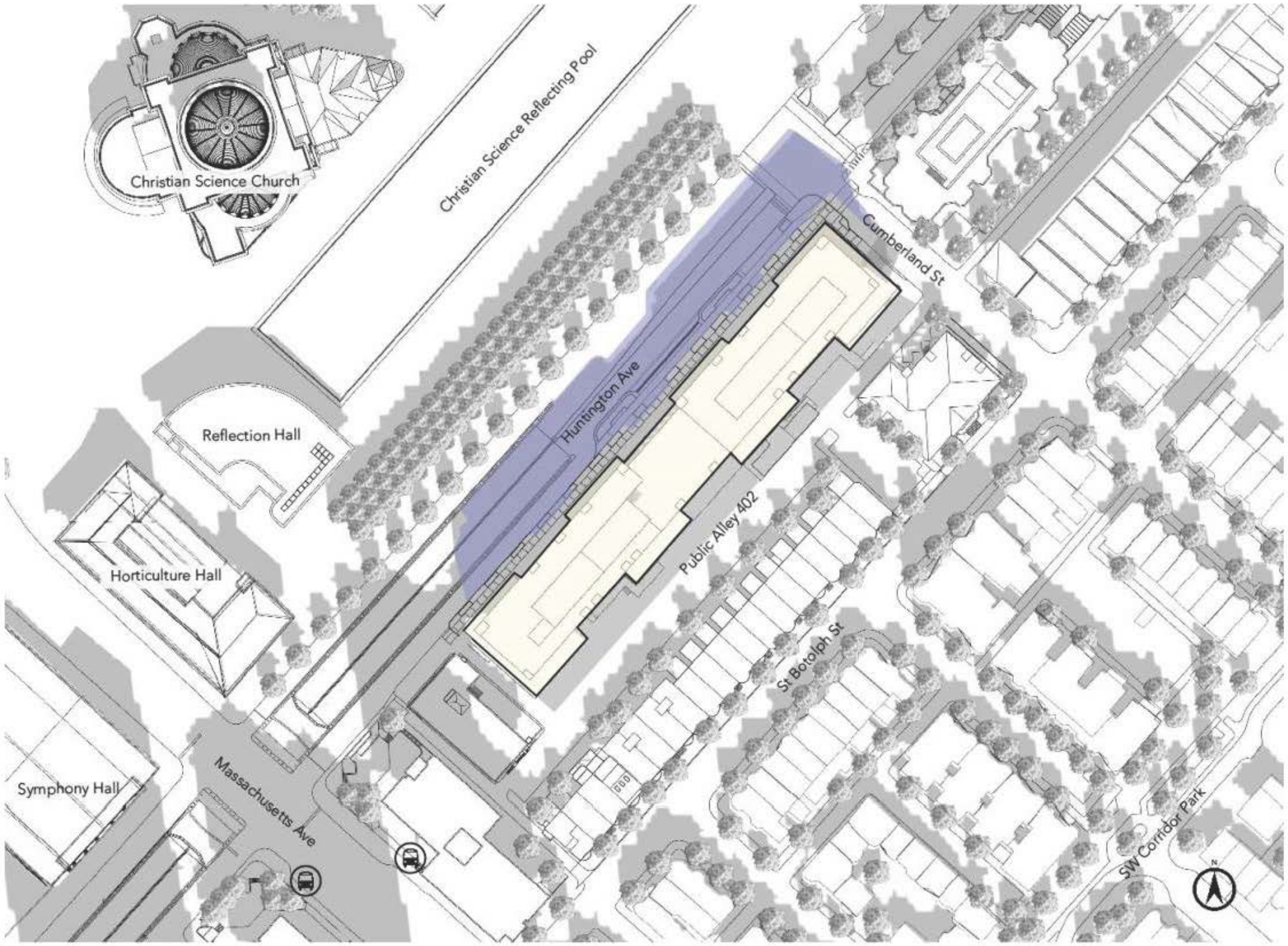


Figure 3.2-8

Shadow Study: September 21, 9:00 a.m.

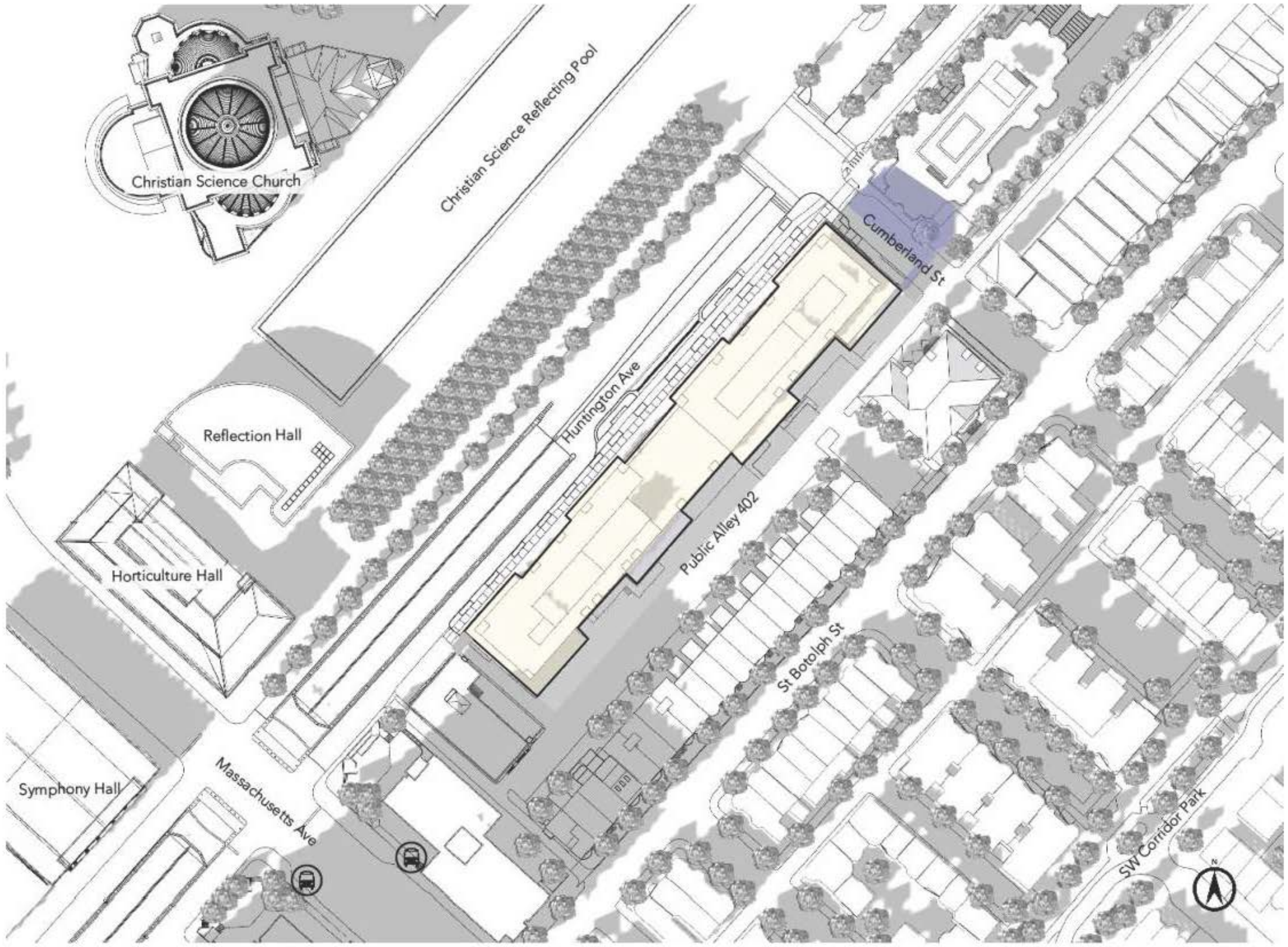


Net New Shadows

Existing Shadows

Figure 3.2-9

Shadow Study: September 21, 12:00 p.m.

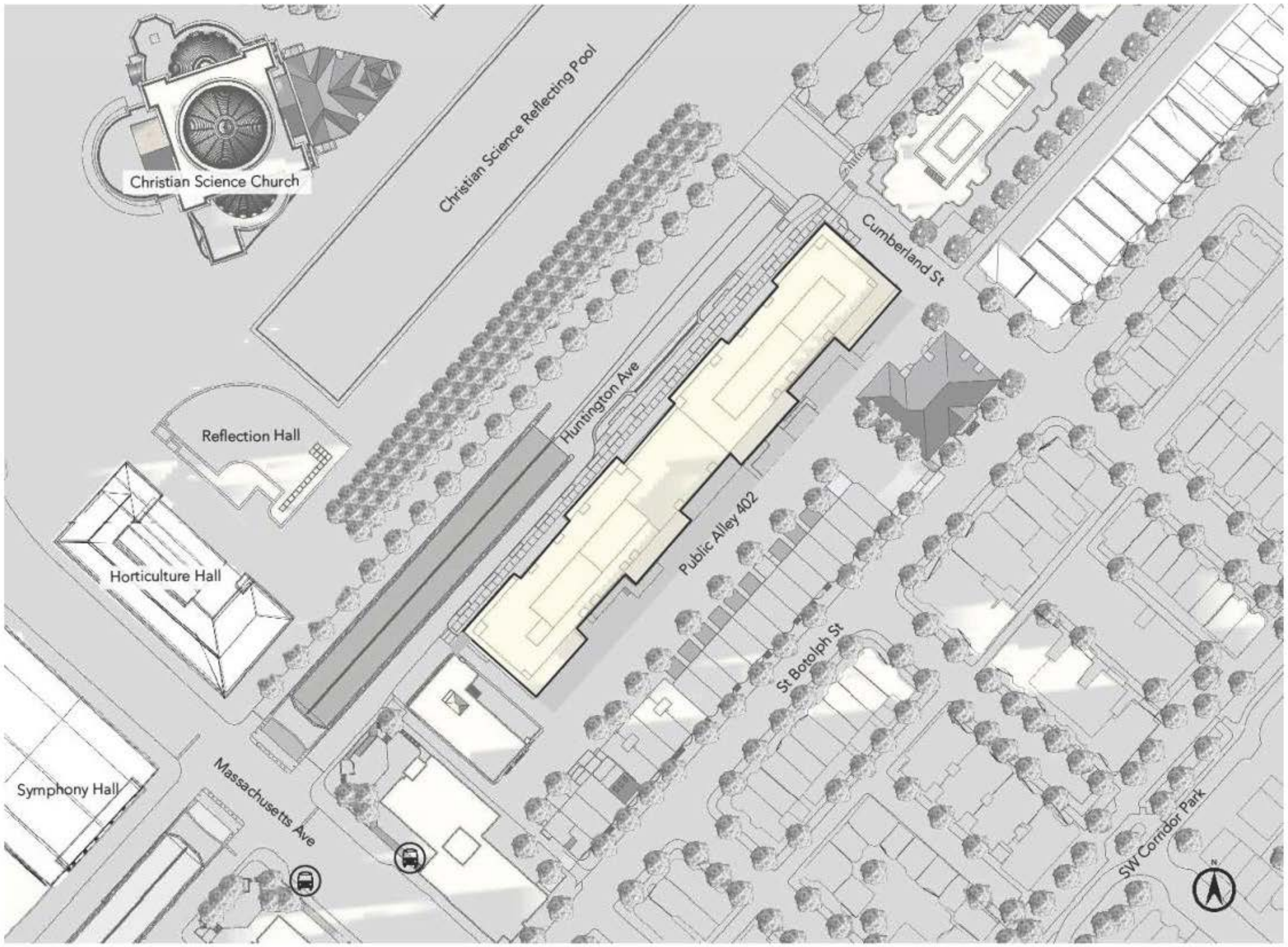


Net New Shadows

Existing Shadows

Figure 3.2-10

Shadow Study: September 21, 3:00 p.m.

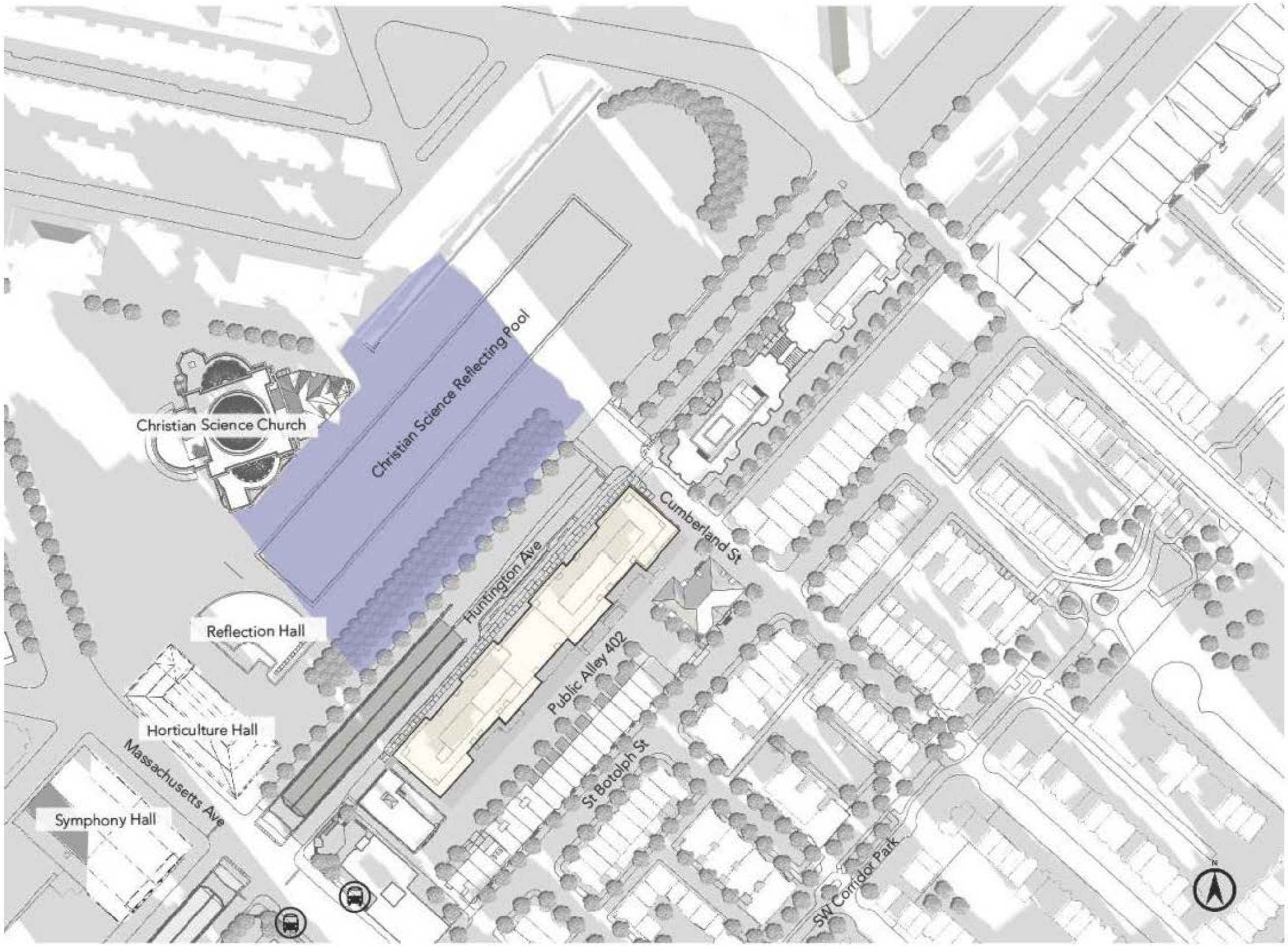


Net New Shadows

Existing Shadows

Figure 3.2-11

Shadow Study: September 21, 6:00 p.m.

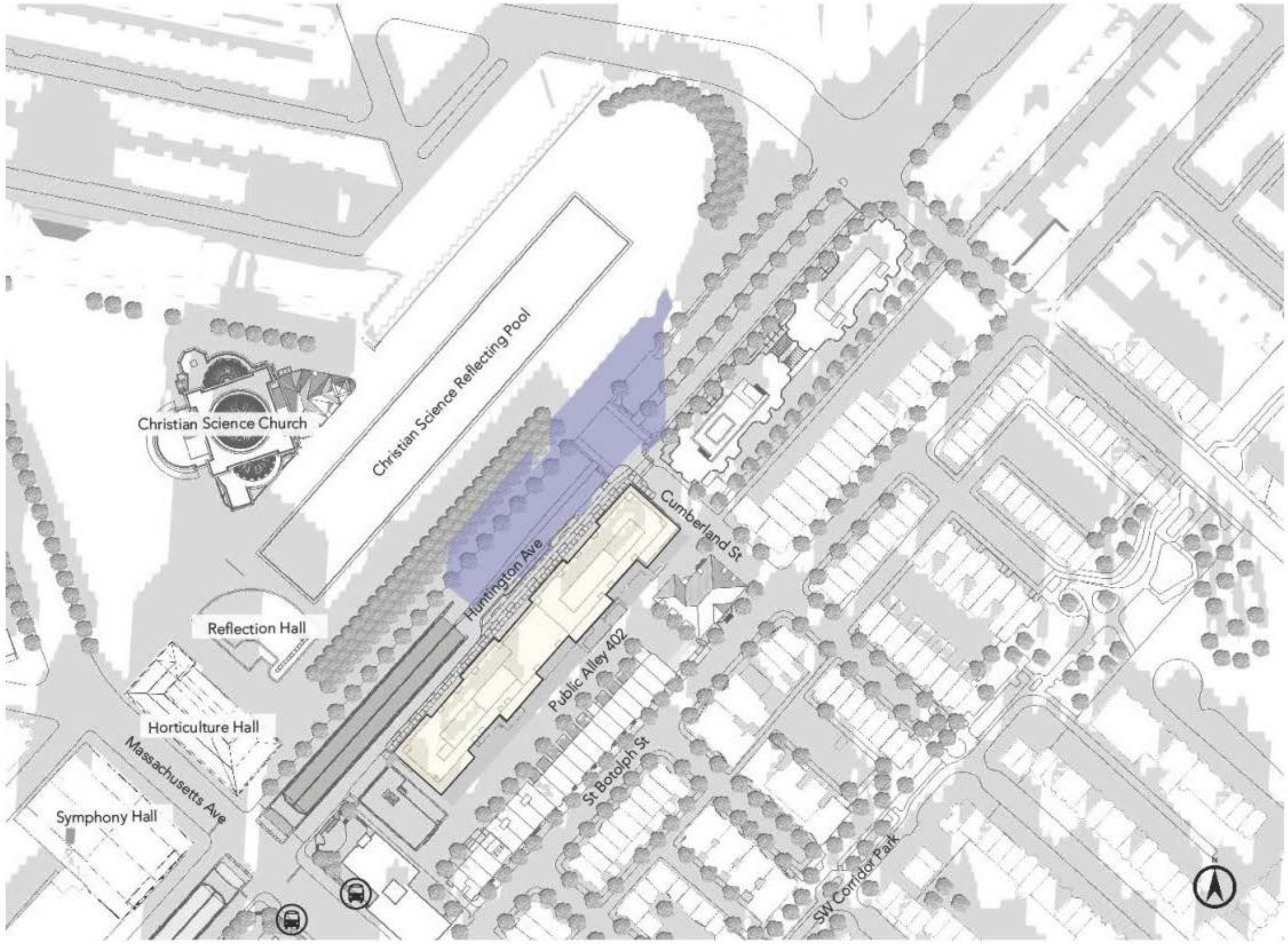


Net New Shadows

Existing Shadows

Figure 3.2-12

Shadow Study: December 21, 9:00 a.m.

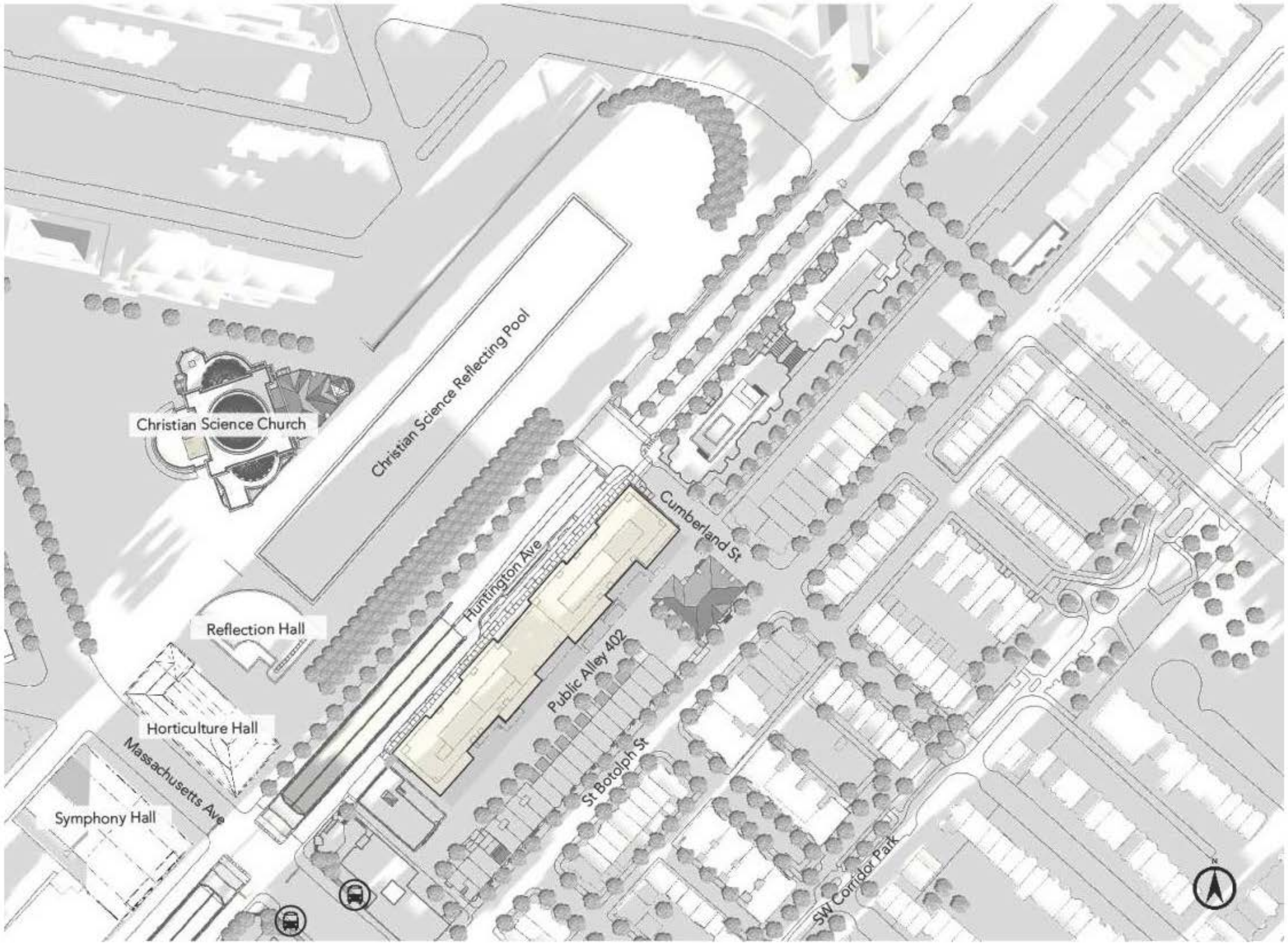


Net New Shadows

Existing Shadows

Figure 3.2-13

Shadow Study: December: 21, 12:00 p.m.



Net New Shadows
Existing Shadows

Figure 3.2-14
Shadow Study: December 21, 3:00 p.m.

3.3 Daylight

The daylight analysis was performed using the Boston Redevelopment Authority Daylight Analysis (BRADA) computer program[5]. 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 percent 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.

The analysis compares three conditions for the Project Site: Existing Condition; Proposed Condition, and the context of the area.

Two viewpoints were chosen to evaluate daylight obstruction for the Existing, Proposed and As-of-right conditions: one from Huntington Avenue (Viewpoint 1) and one from Cumberland Street (Viewpoint 2). Three area context points were considered to provide a basis of comparison to existing conditions in the surrounding area. The viewpoints were taken from the following locations and are shown on Figure 3.3-1:

- **Viewpoint 1:** View from Huntington Avenue facing southeast toward the Project Site.
- **Viewpoint 2:** View from Cumberland Street facing southwest toward the Project Site.
- **Area Context Viewpoint (AC1):** View from Huntington Avenue facing southeast toward 150 Huntington Avenue.
- **Area Context Viewpoint (AC2):** View from Massachusetts Avenue facing south toward 333 Massachusetts Avenue.
- **Area Context Viewpoint (AC3):** View from Massachusetts Avenue facing north toward 300 Massachusetts Avenue.

3.3.1 Results

Results for each viewpoint are described in Table 3.3-1. Figures 3.3-2 through 3.3-5 illustrate the BRADA results for each analysis and are located at the end of this section.

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[5] Method developed by Harvey Bryan and Susan Stuebing, computer program developed by Ronald Fergle, Massachusetts Institute of Technology, Cambridge, MA, September 1984.

G:\Projects2\MA\Boston\5377\MXD\Viewpoint_200930.mxd

Data Source: Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services

220 Huntington Avenue Boston, Massachusetts

Epsilon ASSOCIATES INC.

Figure 3.3-1

Viewpoint and Area Context Locations

Table 3.3-1 Daylight Obstruction Values

Viewpoint Locations		Existing Conditions	Proposed Conditions
Viewpoint 1	View from Huntington Avenue facing southeast toward the Project Site	27.7%	68.4%
Viewpoint 2	View from Cumberland Street facing southwest toward the Project Site	52.4%	74.4%
Area Context Points			
AC1	View from Huntington Avenue facing southeast toward 150 Huntington Avenue	67.9%	N/A
AC2	View from Massachusetts Avenue facing southwest toward 333 Massachusetts Avenue	78.8%	N/A
AC3	View from Massachusetts Avenue facing northeast toward 300 Massachusetts Avenue	57.4%	N/A

Huntington Avenue

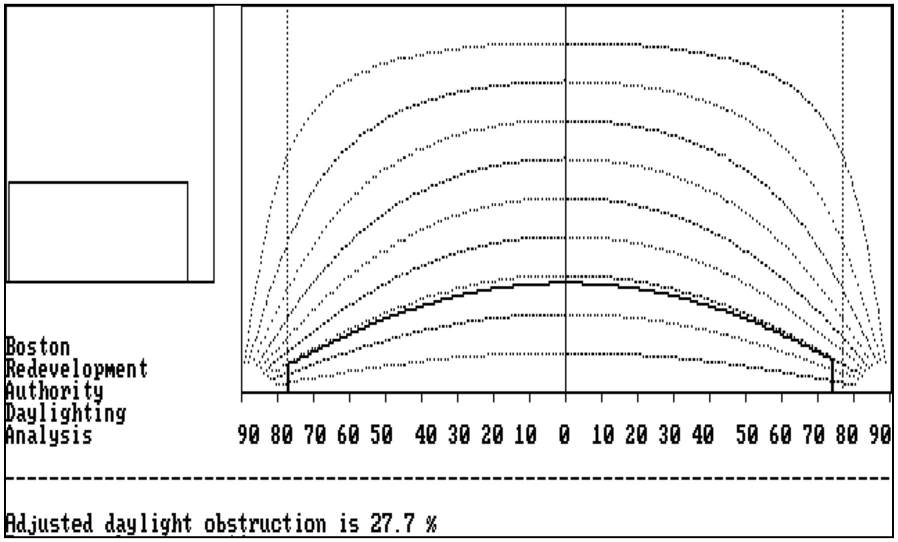
Huntington Avenue runs along the northwestern edge of the Project Site. Viewpoint 1 was taken from the center of Huntington Avenue looking southeast toward the Project Site. The development of the Project will result in the daylight obstruction value at this viewpoint of 68.4%. While this is an increase over Existing Conditions, since the Project Site currently includes a two-story building, this daylight obstruction value is similar to the Area Context values and to a typical urban area.

Cumberland Street

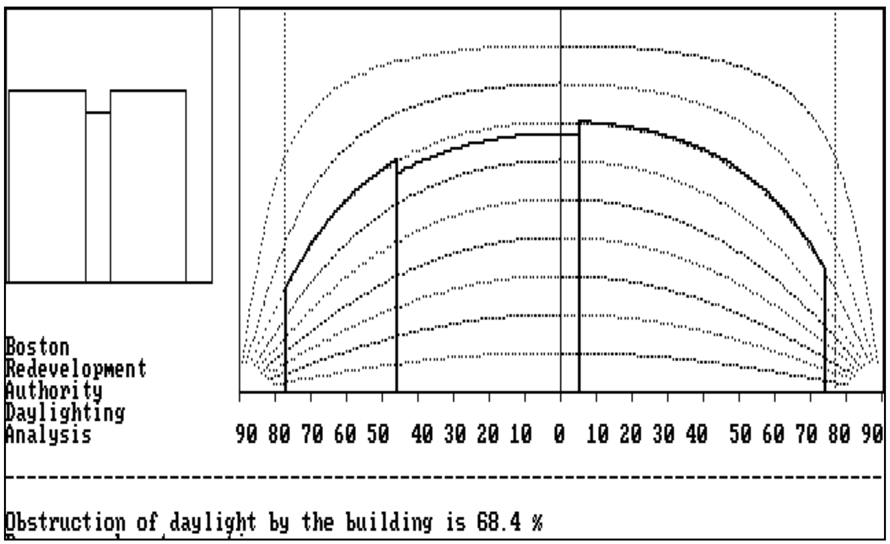
Cumberland Street runs along the northeastern edge of the Project Site. Viewpoint 2 was taken from the center of Cumberland Street looking southwest toward the Project Site. The development of the Project will result in an increase in the daylight obstruction value at this viewpoint of 74.4%. While this is an increase over Existing Conditions, this daylight obstruction value is similar to the Area Context values and to a typical urban area.

Area Context Views

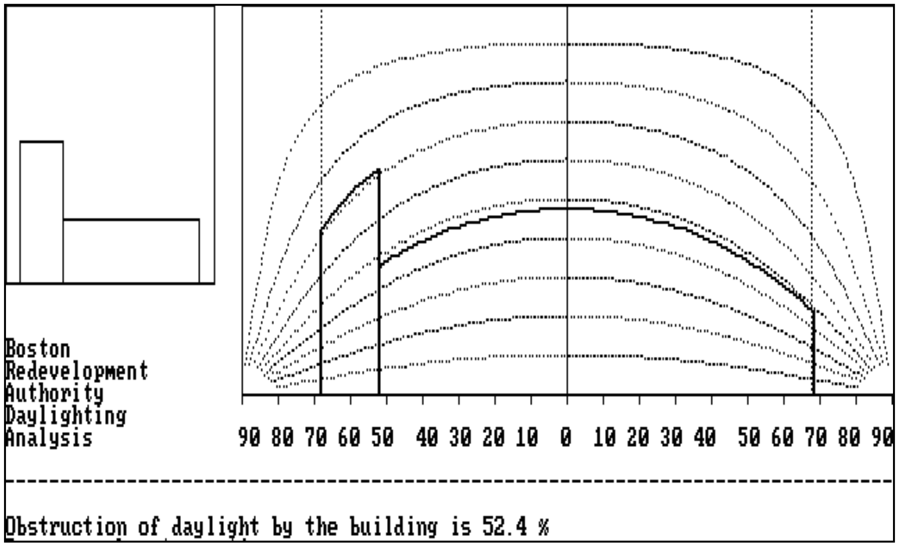
The area around the Project Site is developed with mid- and high-rise buildings. To provide a larger context for comparison of daylight conditions, obstruction values were calculated for three Area Context Viewpoints described above and shown in Figures 3.3-4 to 3.3-5. The daylight obstruction values ranged from 57.4% for AC3 to 67.9% for AC1. Daylight obstruction values for the Project are similar to the buildings in the Project vicinity, including the Area Context values.



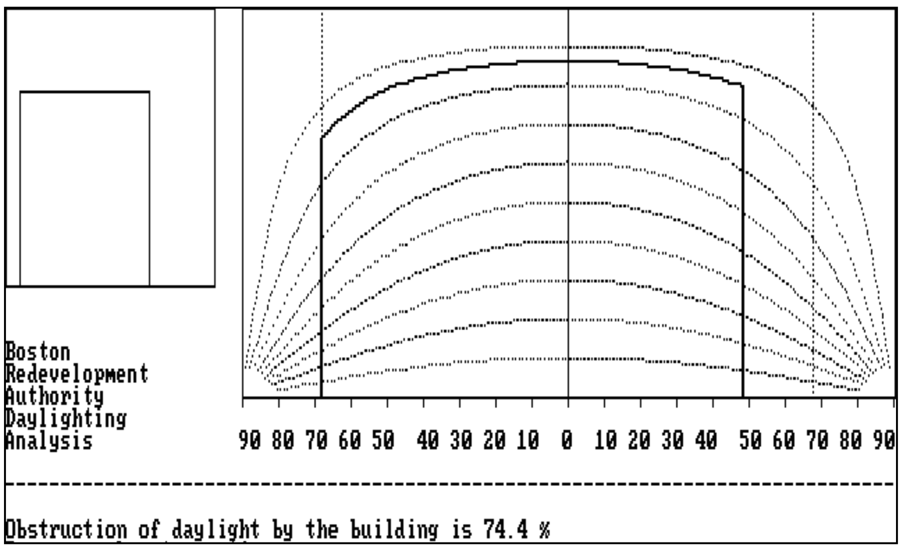
Viewpoint 1 (Existing): View from Huntington Avenue facing southeast toward the Project Site



Viewpoint 1 (Proposed): View from Huntington Avenue facing southeast toward the Project Site

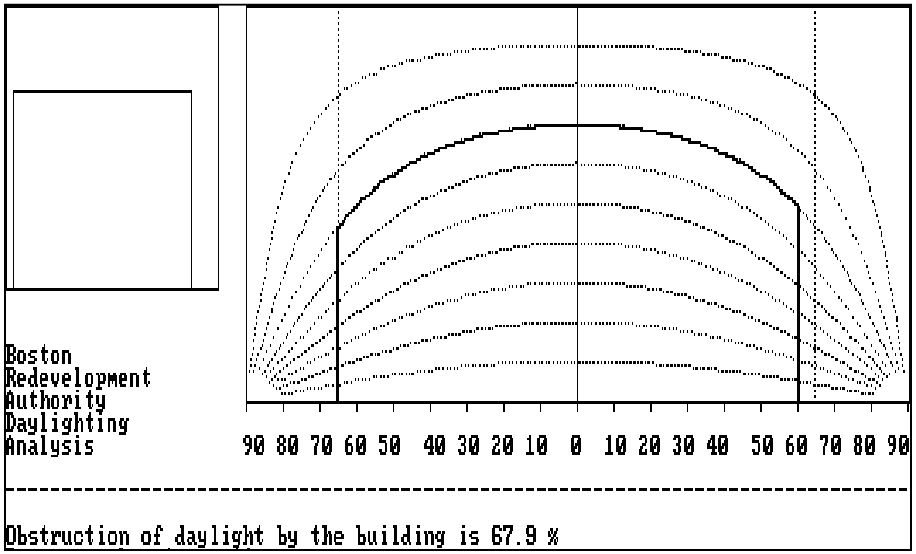


Viewpoint 2 (Existing): View from Cumberland Street facing southwest toward the Project Site

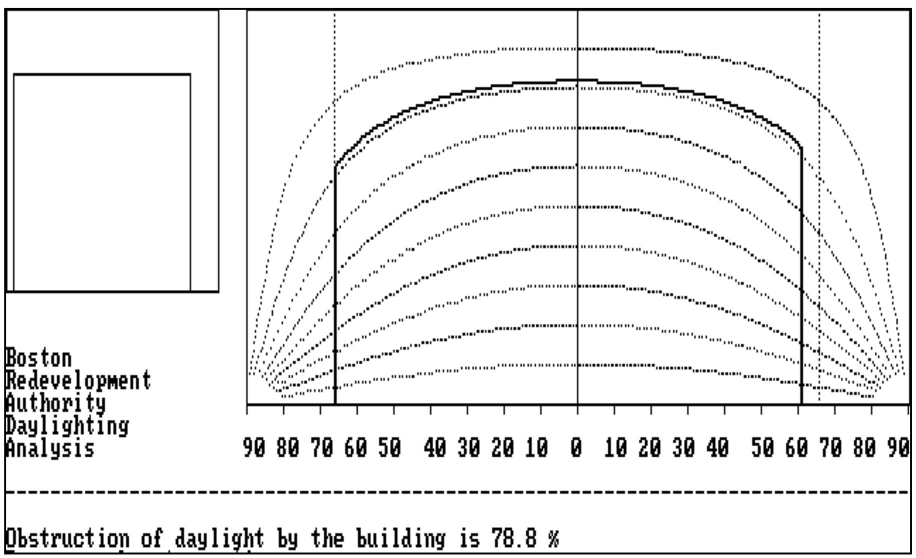


Viewpoint 2 (Proposed): View from Cumberland Street facing southwest toward the Project Site

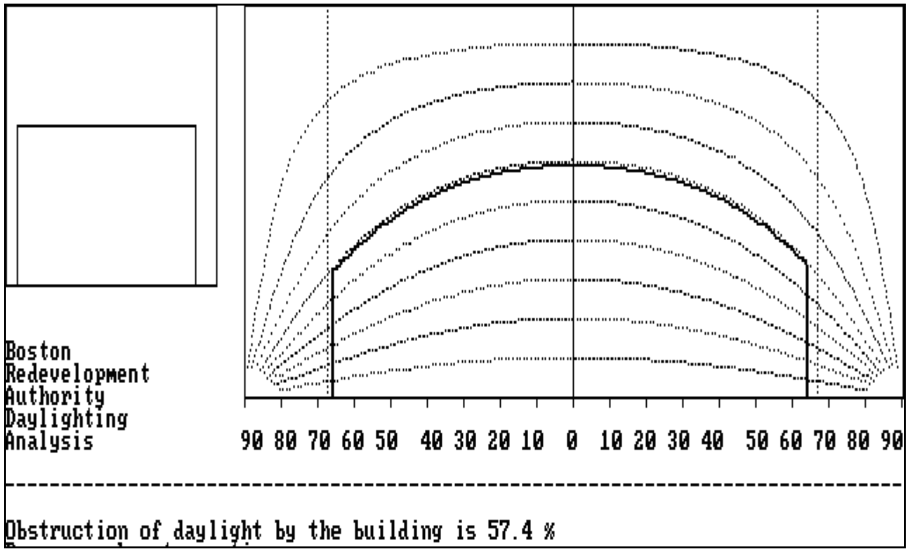
Figure 3.3-3
Existing and Proposed Conditions



AC1: View from Huntington Avenue facing southeast toward 150 Huntington Avenue



AC2: View from Massachusetts Avenue facing southwest toward 333 Massachusetts Avenue



AC3: View from Massachusetts Avenue facing northeast toward 300 Massachusetts Avenue

3.3.2 Conclusion

The daylight analysis conducted for the Project describes existing and proposed daylight obstruction conditions at the Project Site and the surrounding area. Results of the BRADA analysis indicate that while development of the Project will result in increased daylight obstruction over existing conditions, the resulting conditions will be similar to the daylight obstruction values within the surrounding area and typical of densely built urban areas.

3.4 Solar Glare

It is anticipated that the Project will not include the use of reflective glass or other reflective materials on the building façades that would result in adverse impacts from reflected solar glare from the Project.

3.5 Air Quality

An air quality analysis has been conducted to determine the impact of pollutant emissions from stationary and mobile sources generated by the Project. New stationary sources will be reviewed by the Massachusetts Department of Environmental Protection (MassDEP) during permitting under the Environmental Results Program (ERP), if required.

3.5.1 National Ambient Air Quality Standards and Background Concentrations

Background air quality concentrations and federal air quality standards were utilized to conduct the microscale analysis included below. Federal National Ambient Air Quality Standards (NAAQS) were developed by the U.S. Environmental Protection Agency (EPA) to protect the human health against adverse health effects with a margin of safety. The modeling methodologies were developed in accordance with the latest MassDEP modeling policies and Federal modeling guidelines.[6] The following sections outline the NAAQS standards and detail the sources of background air quality data.

3.5.1.1 National Ambient Air Quality Standards

The 1970 Clean Air Act was enacted by the U.S. Congress to protect the health and welfare of the public from the adverse effects of air pollution. As required by the Clean Air Act, EPA promulgated NAAQS for the following criteria pollutants: nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter (PM) (PM10 and PM2.5), carbon monoxide (CO), ozone (O_3), and lead (Pb).[7] The NAAQS are listed in Table 3.5-1. The Commonwealth recently promulgated amendments to the Massachusetts Ambient Air Quality Standards (MAAQS) to be identical to NAAQS.[8].

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[6] 40 CFR 51 Appendix W, Guideline on Air Quality Models, 70 FR 68228, Nov. 9, 2005

[7] 40 CFR 50, National Primary and Secondary Ambient Air Quality Standards, Nov. 25, 1971.

[8] 310 CMR 6.04, June 14, 2019

NAAQS specify concentration levels for various averaging times and include both "primary" and "secondary" standards. Primary standards are intended to protect human health, whereas secondary standards are intended to protect public welfare from any known or anticipated adverse effects associated with the presence of air pollutants, such as damage to vegetation. The more stringent of the primary or secondary standards were applied when comparing to the modeling results for this Project.

The NAAQS also reflect various durations of exposure. The non-probabilistic short-term periods (24 hours or less) refer to exposure levels not to be exceeded more than once a year. Long-term periods refer to limits that cannot be exceeded for exposure averaged over three months or longer.

Table 3.5-1 National (NAAQS) and Massachusetts (MAAQS) Ambient Air Quality Standards

Pollutant	Averaging Period	NAAQS/MAAQS ($\mu g/m^3$) Primary	Secondary
NO_2	Annual [1]	100	Same
	1-hour [2]	188	None
SO_2	3-hour [3]	None	1,300
	1-hour [4]	196	None
PM2.5	Annual [1]	12	15
	24-hour [5]	35	Same
PM10	24-hour [3]	150	Same
CO	8-hour [3]	10,000	Same
	1-hour [3]	40,000	Same
Ozone	8-hour [6]	147	Same
Pb	3-month [1]	1.5	Same

Source: http://www.epa.gov/ttn/naaqs/criteria.html and 310 CMR 6.04
[1] Not to be exceeded.
[2] 98th percentile of one-hour daily maximum concentrations, averaged over three years.
[3] Not to be exceeded more than once per year.
[4] 99th percentile of one-hour daily maximum concentrations, averaged over three years.
[5] 98th percentile, averaged over three years.
[6] Annual fourth-highest daily maximum eight-hour concentration, averaged over three years.

3.5.1.2 Background Concentrations

To estimate background pollutant levels representative of the area, the most recent air quality monitor data reported by the MassDEP in their Annual Air Quality Reports was obtained for 2015 to 2017. The three-hour SO_2 values are no longer reported in the annual reports. Data for this pollutant and averaging time combination was obtained from the EPA's AirData website.

The Clean Air Act allows for one exceedance per year of the CO and SO_2 short-term NAAQS. The highest second-high accounts for the one exceedance. Annual NAAQS are never to be exceeded. The 24-hour PM10 standard is not to be exceeded more than once per year on average over three years. To attain the 24-hour PM2.5 standard, the three-year average of the 98th percentile of 24-hour concentrations must not exceed 35 $\mu g/m^3$. For annual PM2.5 averages, the average of the highest yearly observations was used as the background concentration. To attain the one-hour NO_2 standard, the three-year average of the 98th percentile of the maximum daily one-hour concentrations must not exceed 188 µg/m³.

Background concentrations were determined from the closest available monitoring stations to the proposed development. All pollutants are not monitored at every station, so data from multiple locations are necessary. The closest monitor is at Kenmore Square (1.25 miles northwest of the Project Site), which monitors all pollutants regulated by the NAAQS except CO. The monitored CO values at Harrison Avenue are presented. A summary of the background air quality concentrations is presented in Table 3.5-2. MassDEP provided the values to be used.

Table 3.5-2 Observed Ambient Air Quality Concentrations and Selected Background Levels

Pollutant	Averaging Period	Form	Background Concentration (µg/m³)	NAAQS	Percent of NAAQS
SO_2 (1)(6)	1-Hour (5)	99th %	8.9	196.0	5%
	3-Hour	H2H	10.0	1300.0	1%
PM-10	24-Hour	H2H	30.0	150.0	20%
PM-2.5	24-Hour (5)	98th %	15.1	35.0	43%
	Annual (5)	H	6.9	12.0	58%
NO_2 (3)	1-Hour (5)	98th %	86.5	188.0	46%
	Annual	H	47.5	100.0	47%
CO (2)	1-Hour	H2H	2750.4	40000.0	7%
	8-Hour	H2H	1439.4	10000.0	14%
Ozone (4)	8-Hour	H4H	135.4	147.0	92%
Lead (7)	Rolling 3-Month	H	0.017	0.15	12%

Notes:
From MassDEP Air Quality Monitor reports or EPA's AirData Website
(1) SO_2 reported ppb. Converted to µg/m³ using factor of 1 ppm = 2.62 µg/m³.
(2) CO reported in ppm. Converted to µg/m³ using factor of 1 ppm = 1146 µg/m³.
(3) NO_2 reported in ppb. Converted to µg/m³ using factor of 1 ppm = 1.88 µg/m³.
(4) O_3 reported in ppm. Converted to µg/m³ using factor of 1 ppm = 1963 µg/m³.
(5) Background level is the average concentration of the three years.
(6) The 24-hour and Annual standards were revoked by EPA on June 22, 2010, Federal Register 75-119, p. 35520.
(7) Lead is not reported at any site in Massachusetts in 2017 or 2018.

Air quality in the vicinity of the Project Site is generally good, with all local background concentrations found to be well below the NAAQS.

3.5.2 Microscale Analysis

Mobile sources of air pollution include gasoline, diesel, and natural gas fueled vehicles. Emissions from mobile sources have continually decreased as engine technologies and efficiency have been improved.

Mobile sources of air pollution include emissions from vehicle traffic associated with the Project.

A "microscale" analysis is typically requested to be completed for any intersection where (1) Project traffic would impact intersections or roadway links currently operating at LOS D, E, or F, or would cause LOS to decline to D, E, or F; (2) Project traffic would increase traffic volumes on nearby roadways by 10% or more (unless the increase in traffic volume is less than 100 vehicles per hour); or, (3) the Project will generate 3,000 or more new average daily trips on roadways providing access to a single location. The microscale analysis involves modeling of CO emissions from vehicles idling at and traveling through signaled intersections. Predicted ambient concentrations of CO for the Build and No-Build cases are compared with federal (and state) ambient air quality standards for CO.

For this Project, the transportation analysis shows that Project traffic affects one intersection either currently operating at LOS D or worse, or projected to operate at LOS D or worse for future cases. Therefore, a microscale analysis is required.

3.5.2.1 Methodology

The microscale analysis involves modeling of carbon monoxide (CO) emissions from vehicles idling at and traveling through signaled intersections. Predicted ambient concentrations of CO for the Build and No-Build cases are compared with federal (and state) ambient air quality standards for CO.

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. The NAAQS 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 current 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 analysis for the Project followed the procedure outlined in U.S. EPA's intersection modeling guidance.[9]

The microscale analysis has been conducted using the latest versions of EPA's MOVES and CAL3QHC programs to estimate CO concentrations at sidewalk receptor locations.

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9 U.S. EPA, Guideline for Modeling Carbon Monoxide from Roadway Intersections; EPA-454/R-92-005, November 1992.

Baseline (2019) and future year (2027) emission factor data calculated from the MOVES model, along with traffic data, were input into the CAL3QHC program to determine CO concentrations due to traffic flowing through the selected intersection.

Existing background values of CO at the nearest monitor location at Harrison Avenue were obtained from MassDEP. CAL3QHC results were then added to background CO values of 2.4 ppm (one-hour) and 1.3 ppm (eight-hour), as provided by MassDEP, to determine total air quality impacts due to the Project. These values were compared to the NAAQS for CO of 35 ppm (one-hour) and 9 ppm (eight-hour).

The modeling methodology was developed in accordance with the latest MassDEP modeling policies and Federal modeling guidelines.[10]

3.5.2.2 Intersection Selection

Two signalized intersections included in the traffic study meet the conditions typically used to determine the need for a microscale analysis (see Chapter 2). The traffic volumes and LOS calculations provided in Chapter 2 form the basis of evaluating the traffic data versus the microscale thresholds. The intersections found to meet the criteria are the intersection of Massachusetts Avenue and Huntington Avenue and the intersection of Huntington Avenue and West Newton Street/Belvidere Street.

Microscale modeling was performed for the intersection based on the aforementioned methodology. The 2019 Existing conditions and the 2027 No-Build, and Build conditions were each evaluated for both morning (a.m.) and afternoon (p.m.) peak.

The CAL3QHC model's queueing algorithm is not designed for unsignalized intersections. Therefore, analysis of intersections where no signal exists was not performed.

3.5.2.3 Emissions Calculations (MOVES)

The EPA MOVES computer program was used to estimate motor vehicle emission factors on the roadway network. Emission factors calculated by the MOVES 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 county specific vehicle age registration distribution, fleet mix, meteorology, and other inputs. The inputs for MOVES for the existing (2019) and build year (2027) are provided by MassDEP.

[10] 40 CFR 51 Appendix W, Guideline on Air Quality Models, 70 FR 68228, Nov. 9, 2005

All link types for the modeled intersections were input into MOVES. Idle emission factors are obtained from factors for a link average speed of 0 miles per hour (mph). Moving emissions are calculated based on speeds at which free-flowing vehicles travel through the intersection as stated in traffic modeling (SYNCHRO) reports. A speed of 25 mph is used for all free-flow traffic. Speeds of 10 and 15 mph were used for right (and U-turns, if necessary) and left turns, respectively. Roadway emissions factors were obtained from MOVES using EPA guidance.[11]

Winter CO emission factors are typically higher than summer. Therefore, January weekday emission factors were conservatively used in the microscale analysis. The emission factors are presented in Table 3.5-3.

Table 3.5-3 MOVES Carbon Monoxide Emission Factors

Carbon Monoxide Only		2019	2027
Free Flow	25 mph	2.992	1.430
Right Turns	10 mph	4.667	2.205
Left Turns	15 mph	4.021	1.947
Queues	Idle	10.463	2.435

Notes: Winter CO emission factors are higher than summer and are conservatively used
Urban Unrestricted Roadway type used

3.5.2.4 Receptors & Meteorology Inputs

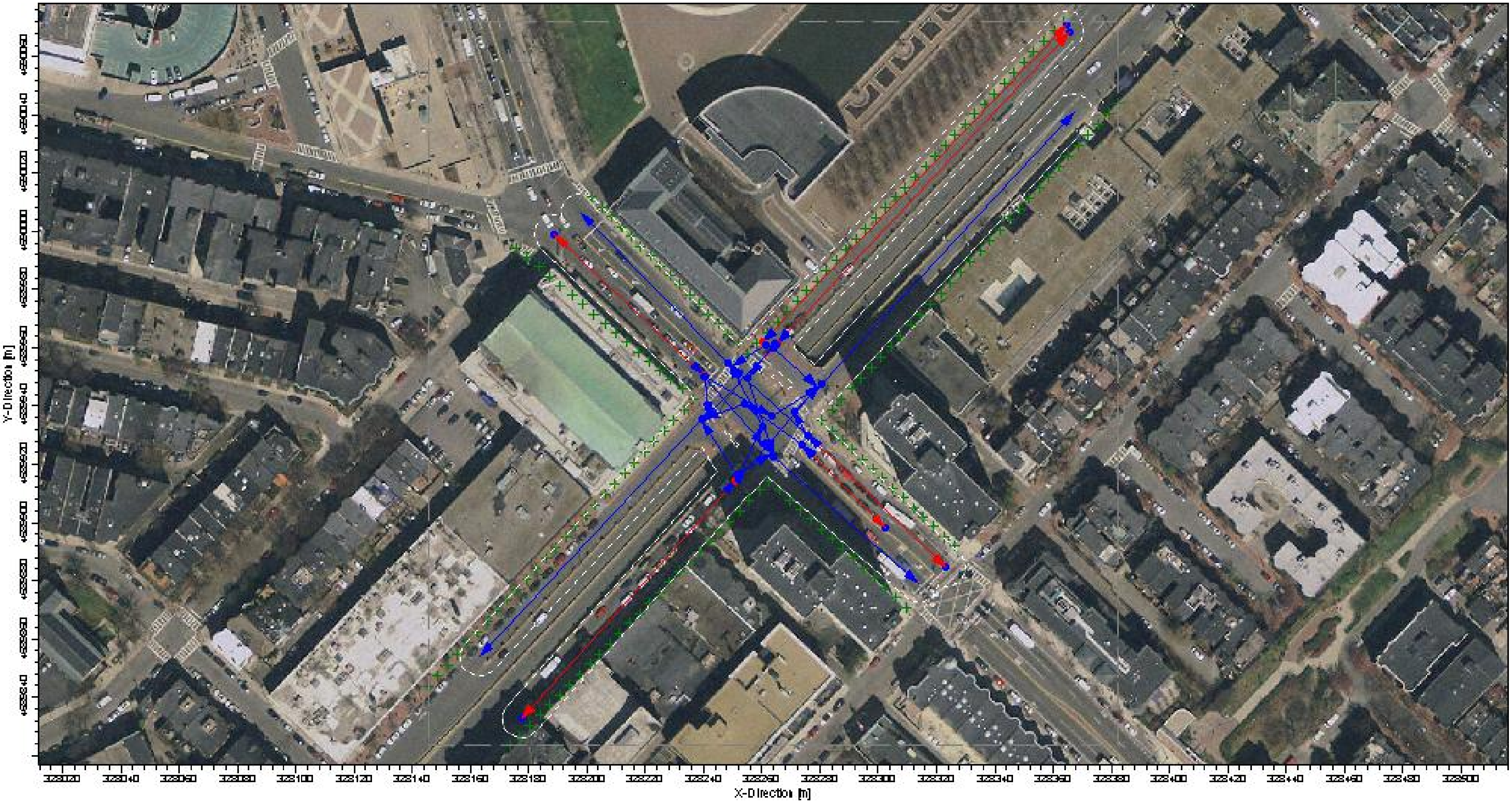
A set of receptors was placed in the vicinity of the modeled intersection. Receptors extended approximately 300 feet on the sidewalks along the roadways approaching the intersection. The roadway links and receptor locations of the modeled intersections are presented in Figure 3.5-1 and 3.5-2.

For the CAL3QHC model, limited meteorological inputs are required. Following EPA guidance[12], a wind speed of one meter per second, stability class D (4), and a mixing height of 1,000 meters were used. To account for the intersection geometry, wind directions from 0° to 350°, every 10° were selected. A surface roughness length of 321 centimeters was selected.[13]

[11] U.S. EPA, 2010. Using MOVES in Project-Level Carbon Monoxide Analyses. EPA-420-B-10-041

[12] U.S. EPA, Guideline for Modeling Carbon Monoxide from Roadway Intersections. EPA-454/R-92-005, November 1992.

[13] 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.

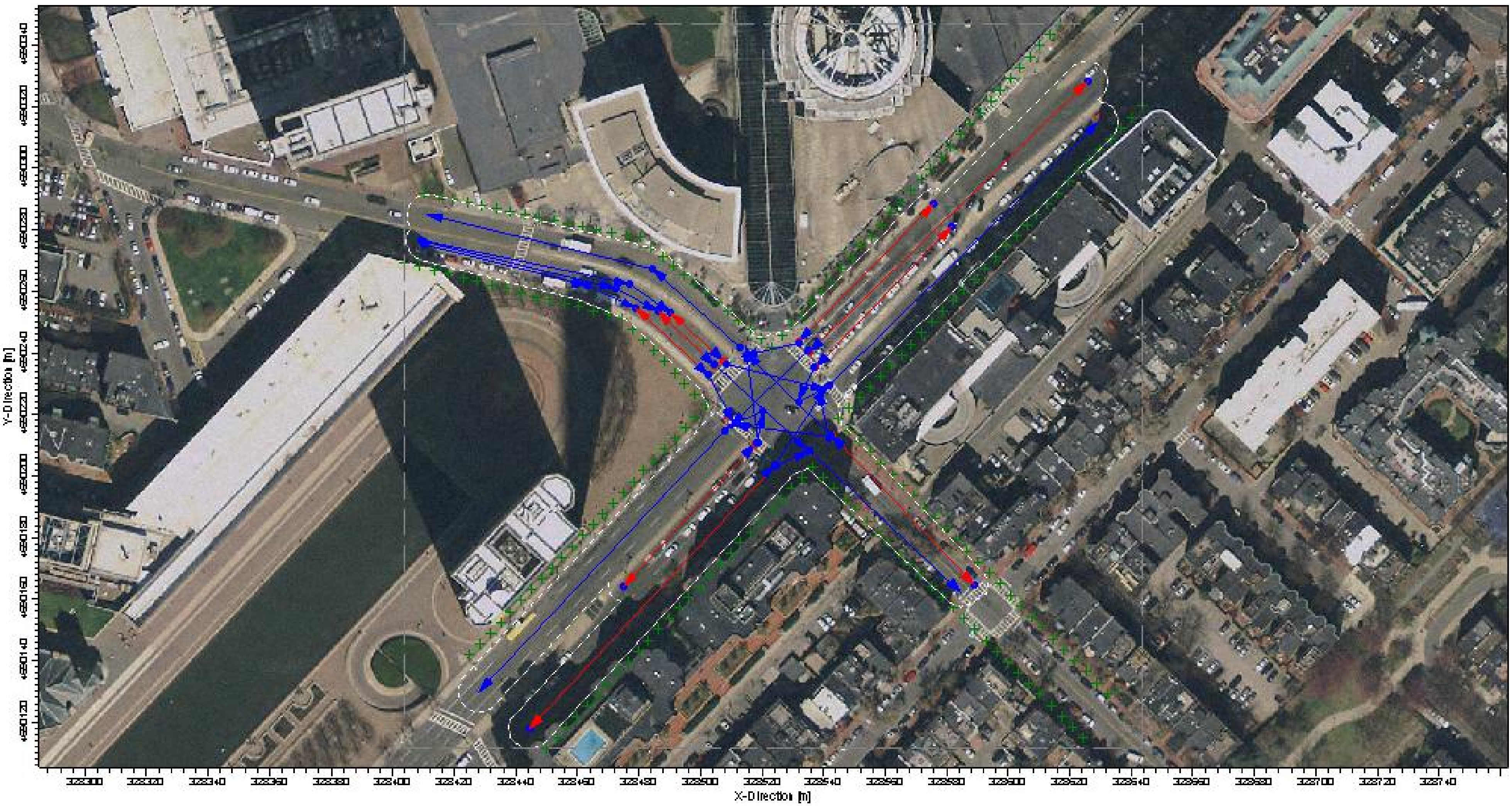


220 Huntington Avenue   Boston, MA

Epsilon
ASSOCIATES INC.

Figure 3.5-1

Intersection of Huntington Avenue and Massachusetts Avenue



220 Huntington Avenue   Boston, MA

Epsilon ASSOCIATES INC.

Figure 3.5-2

Intersection of Huntington Avenue, Belvidere Street and W. Newton Street

3.5.2.5 Impact Calculations (CAL3QHC)

The CAL3QHC model predicts one-hour concentrations using queue-links at signalized intersections, worst-case meteorological conditions, and traffic input data. The one-hour concentrations were scaled by a factor of 0.9 to estimate eight-hour concentrations.[14] The CAL3QHC methodology was based on EPA CO modeling guidance. Signal timings were provided directly from the traffic modeling outputs.

For use in the microscale analysis, background concentrations of CO in ppm were required. The corresponding maximum background concentrations in ppm were 2750.4 μg/m^3 (2.4 ppm) for one-hour and 1439.4 μg/m^3 (1.3 ppm) for eight-hour CO.

3.5.2.6 Microscale Results

Results of the maximum one-hour predicted CO concentrations from CAL3QHC are provided in Tables 3.5-4 through 3.5-6 for the 2019 and 2027 scenarios. Eight-hour average concentrations are calculated by multiplying the maximum one-hour concentrations by a factor of 0.9.[15]

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 the intersection as they are predicted during the simultaneous occurrence of "defined" worst case meteorology. The highest one-hour traffic-related concentration predicted in the area of the Project for the modeled conditions (0.3 ppm) plus background (2.4 ppm) is 2.7 ppm. The highest eight-hour traffic-related concentration predicted in the area of the Project for the modeled conditions (0.3 ppm) plus background (1.3 ppm) is 1.6 ppm. Both maximum concentrations occur under Existing Conditions.

Under the future No-Build, and Build conditions, the highest one-hour traffic-related concentration predicted in the area of the Project for the modeled conditions (0.1 ppm) plus background (2.4 ppm) is 2.5 ppm. The highest eight-hour traffic-related concentration predicted in the area of the Project for the modeled conditions (0.1 ppm) plus background (1.3 ppm) is 1.4 ppm.

All concentrations are well below the one-hour NAAQS of 35 ppm and the eight-hour NAAQS of 9 ppm.

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14 U.S. EPA, AERSCREEN User's Guide; EPA-454/B-11-001, March 2011.

15 U.S. EPA, AERSCREEN User's Guide; EPA-454/B-11-001, March 2011.

3.5.2.7 Microscale Conclusions

Results of the microscale analysis show that all predicted CO concentrations are well below one-hour and eight-hour NAAQS. Therefore, it can be concluded that there are no anticipated adverse air quality impacts resulting from increased traffic related to the Project.

Existing impacts are often higher than future impacts for a number of reasons:

- the evolution of alternatively-fueled low-emission vehicles into the general roadway fleet (hybrids, electrics, CNG vehicles);
- the emission rates of traditional fossil-fueled vehicles continue to improve; and
- the increase in traffic volume with (or even without) the proposed Project is not large enough to overcome the benefits of a lower emitting vehicle fleet.

Table 3.5-4 Summary of Microscale Modeling Analysis (Existing 2019)

Intersection	Peak	CAL3QHC Modeled CO Impacts (ppm)	Monitored Background Concentration (ppm)	Total CO Impacts (ppm)	NAAQS (ppm)
1-Hour					
Huntington Avenue and Massachusetts Avenue	AM	0.3	2.4	2.7	35
	PM	0.3	2.4	2.7	35
Huntington Avenue and W. Newton Street/Belvidere Street	AM	0.3	2.4	2.7	35
	PM	0.3	2.4	2.7	35
8-Hour					
Congress Street, A Street, and Thomson Place	AM	0.3	1.3	1.6	9
	PM	0.3	1.3	1.6	9
Congress Street, Boston Wharf Road, and West Service Road	AM	0.3	1.3	1.6	9
	PM	0.3	1.3	1.6	9

Notes: CAL3QHC eight-hour impacts were conservatively obtained by multiplying one-hour impacts by a screening factor of 0.9.

Table 3.5-5 Summary of Microscale Modeling Analysis (No-Build 2027)

Intersection	Peak	CAL3QHC Modeled CO Impacts (ppm)	Monitored Background Concentration (ppm)	Total CO Impacts (ppm)	NAAQS (ppm)
1-Hour					
Huntington Avenue and Massachusetts Avenue	AM	0.1	2.4	2.5	35
	PM	0.1	2.4	2.5	35
Huntington Avenue and W. Newton Street/Belvidere Street	AM	0.1	2.4	2.5	35
	PM	0.1	2.4	2.5	35
8-Hour					
Congress Street, A Street, and Thomson Place	AM	0.1	1.3	1.4	9
	PM	0.1	1.3	1.4	9
Congress Street, Boston Wharf Road, and West Service Road	AM	0.1	1.3	1.4	9
	PM	0.1	1.3	1.4	9
Notes: CAL3QHC eight-hour impacts were conservatively obtained by multiplying one-hour impacts by a screening factor of 0.9.					

Table 3.5-6 Summary of Microscale Modeling Analysis (Build 2027)

Intersection	Peak	CAL3QHC Modeled CO Impacts (ppm)	Monitored Background Concentration (ppm)	Total CO Impacts (ppm)	NAAQS (ppm)
1-Hour					
Huntington Avenue and Massachusetts Avenue	AM	0.1	2.4	2.5	35
	PM	0.1	2.4	2.5	35
Huntington Avenue and W. Newton Street/Belvidere Street	AM	0.1	2.4	2.5	35
	PM	0.1	2.4	2.5	35
8-Hour					
Congress Street, A Street, and Thomson Place	AM	0.1	1.3	1.4	9
	PM	0.1	1.3	1.4	9
Congress Street, Boston Wharf Road, and West Service Road	AM	0.1	1.3	1.4	9
	PM	0.1	1.3	1.4	9
Notes: CAL3QHC eight-hour impacts were conservatively obtained by multiplying one-hour impacts by a screening factor of 0.9.					

3.5.4 Stationary Sources of Air Pollution

3.5.4.1 Permitting

Stationary sources of air pollution are typically units that combust fuel. In this case, these sources consist of heating and hot water units and emergency electrical generators. Cooling towers, although not a combustion source, are a source of particulate emissions.

It is expected that the majority of stationary sources (boilers, engines, etc.) may be subject to MassDEP's ERP. The Proponent will complete the required applications and submittals for the equipment, as necessary.

3.6 Stormwater/Water Quality

Section 7.4 includes information on stormwater impacts.

3.7 Flood Hazard Zones/Wetlands

The Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) for the Project Site located in the City of Boston – Community Panels 25025C0079J and 25025C0077J indicate the FEMA Flood Zone Designations for the Project Site. The map shows the Project is located in a Zone X Area determined to be outside of the 0.2% annual chance floodplain.

Only a very small portion of the Project Site at the corner of Cumberland Street and Public Alley #404 is located in BPDA Sea Level Rise – Flood Hazard Area, with a Base Flood Elevation of 18.0 feet BCB. Building storm drainage systems will be provided with emergency overflow systems in case of flooding. Proposed Site elevations are based on surrounding public way sidewalk/alley elevations. The Project Site is highest in elevation along Huntington Avenue and Cumberland Street (Elevation 16.7-18.3 Boston City Base (BCB)). Building entrances and the ground level will be raised to the Huntington Avenue/Cumberland Street elevation. Doors along Public Alley #404 will be elevated compared to the elevation of the alley. Public Alley #404 ranges from its lowest point mid-way at Elevation 12 BCB up to Elevation 16 BCB near Cumberland Street. Building entrances will be outside of BPDA Sea Level Rise Area.

The Project Site does not contain wetlands.

3.8 Geotechnical/Groundwater

Subsurface explorations have been advanced across the Project Site for geotechnical purposes. Explorations have been advanced to depths ranging from 167 feet to 182 feet below the existing garage slab at approximately El. 13.5 feet. Elevations are referenced from the BCB.

3.8.1 Subsurface Conditions

Based on the subsurface explorations advanced at the Project Site, the subsurface profile consists of the following – referenced from the existing garage level down:

- Approximately 13 feet of historic (urban) fill consisting of sand with various amounts of gravel and silt, and varying amounts of brick, ash and cinders, and wood;
- Approximately 5 to 7 feet of organic silt with varying amounts of organic material;
- Approximately 17 feet of natural deposits of sand and gravel with varying amounts of silt;
- Approximately 119 to 122 feet of silty clay (Boston Blue Clay) with varying amounts of sand;
- Approximately 1 to 5 feet of glacial till overlying weathered bedrock consisting of Cambridge Argillite.

3.8.2 Groundwater

Stabilized groundwater level measurements were collected by Sanborn Head between May 5 and 20, 2019. The depth to groundwater measured by Sanborn Head ranged from approximately El. 7.8 to 8.1 feet.

A historical review of the groundwater information provided by the Boston Groundwater Trust (BGWT) indicates the groundwater generally fluctuates between approximately El. 5.1 and 9.5 feet., which is generally consistent with the data collected by Sanborn Head.

3.8.3 Demolition Waste

The existing building will be razed, and the building materials removed from the Project Site. Hazardous Building Materials (HBM), if present, will be identified, segregated, and disposed of in accordance with local, state and Federal regulations.

Prior to or during construction, excess soil generated from site excavations will be pre-characterized to support off-site where on-site re-use is infeasible. Soil and groundwater (if encountered) will be managed in accordance with applicable local, State and Federal regulations.

3.8.4 Geotechnical Construction Impacts

Excess soil is expected to be generated during construction which will require off-site disposal. The volume of soil to be disposed off-site is expected to be limited to the soil displaced by excavation for the additional level of parking (approximately 13 feet below existing grade), spread footing foundations, and excess soils generated from site-related utilities. Excess soil will be managed and properly disposed off-site in accordance with the MCP and other applicable regulations.

Construction solid wastes related to geotechnical work generated by the Project are expected to be limited to demolition and excavations.

Dewatering will be required to maintain the stability of the bottom of the excavation and create a workably dry area for which to construction foundations and move equipment. During construction. The Contractor will submit a Notice of Intent (NOI) for a National Pollutant Discharge Elimination System (NPDES) Remediation General Permit (RGP) to the United States Environmental Protection Agency (USEPA) to allow for the discharge of dewatering effluent to a municipal storm drain after treatment. It is anticipated that dewatering may be performed inside the shoring system by pumping from filtered sumps installed below the bottom of the excavation; however, the actual method for controlling groundwater will be determined by the Contractor.

The Project Site lies within the City of Boston's Groundwater Conservation Overlay District (GCOD), which will help inform the management of groundwater. The Project will be designed such that groundwater levels will not be altered outside the property limits.

The design will incorporate storage and recharge of stormwater. Stormwater will be recharged around the perimeter of the Project Site using recharge wells in the post-construction condition.

Programs will be implemented during construction for monitoring dust and vibrations, as appropriate.

3.9 Operational Solid and Hazardous Wastes

The Project will generate solid waste typical of residential, retail, and restaurant uses. Solid waste is expected to include wastepaper, cardboard, glass and plastic bottles and food. Recyclable materials will be recycled through a program implemented by building management. Per the requirements for LEED Certifiability the Project will meet the LEED Prerequisite for Storage & Collection of Recyclables. Those requirements state that the Project will put a recycling program in place for mixed paper, corrugated cardboard, glass, plastics, and metals as well as a sufficient space to collect those recyclables. In addition, a new LEED v4 requirement states that the Project will collect and properly dispose of two of the following waste streams – batteries, mercury-containing lamps and electronic waste.

The Project will generate approximately 516 tons of solid waste per year.

With the exception of household hazardous wastes typical of residential and retail developments (e.g. cleaning fluids and paint), the Project will not involve the generation, use, transportation, storage, release, or disposal of potentially hazardous materials.

3.10 Noise

3.10.1 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 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 or more 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 3-decibel increase (53 dB), which is equal to doubling in sound energy, but not equal to a doubling in decibel quantity (100 dB). Thus, every 3-dB change in sound level represents a doubling or halving of sound energy. The human ear does not perceive changes in the sound pressure level as equal changes in loudness. Scientific research demonstrates that the following general relationships hold between sound level and human perception for two sound levels with the same or very similar frequency characteristics[16]:

- 3 dBA increase or decrease results in a change in sound that is just perceptible to the average person;
- 5 dBA increase or decrease is described as a clearly noticeable change in sound level; and
- 10 dBA increase or decrease is described as twice or half as loud.

Another mathematical property of decibels is that if one source of noise is at least 10 dB louder than another source, then the total sound level is simply the sound level of the higher-level source. For example, a sound source at 60 dB plus another sound source at 47 dB is equal to 60 dB.

A sound level meter (SLM) that is used to measure sound is a standardized instrument.[17] It contains "weighting networks" (e.g., A-, C-, Z-weightings) to adjust the frequency response of the instrument. Frequencies, reported in Hertz (Hz), are detailed characterizations of sounds, often addressed in musical terms as "pitch" or "tone". The most commonly used weighting network is the A-weighting because it most closely approximates how the human ear responds to sound at various frequencies. The A-weighting network is the accepted scale used for community sound level measurements; therefore, sounds are frequently reported as detected with a sound level meter using this weighting. A-weighted sound levels emphasize middle frequency sounds (i.e., middle pitched – around 1,000 Hz), and de-emphasize low and high frequency sounds. These sound levels are reported in decibels designated as "dBA". Z-weighted sound levels are measured

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16 Bies, David, and Colin Hansen. 2009. *Engineering Noise Control: Theory and Practice*, 4th Edition. New York: Taylor and Francis.

17 *American National Standard Specification for Sound Level Meters*, ANSI S1.4-1983 (R2006), published by the Standards Secretariat of the Acoustical Society of America, Melville, NY.

sound levels without any weighting curve and are otherwise referred to as “unweighted”. C-weighted sound levels do not emphasize middle frequency sounds to the same degree as A-weighted and are typically used to approximate the sensitivity of the human ear with respect to very loud sound sources (i.e., over 100 decibels) or when low frequency sounds transfers are a concern. These sound levels are reported in decibels designated as “dBC”.

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 the sound levels observed during a measurement period. Exceedance levels are designated L_n, where n can have a value between 0 and 100 in terms of percentage. Several sound level metrics that are reported in community sound monitoring are described below.

- L_{10} is the sound level 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 sounds like those from passing motor vehicles.

- L_{50} is the sound level exceeded 50 percent of the time. It is the median level observed during the measurement period. The L_{50} is affected by occasional louder sounds like those from passing motor vehicles; however, it is often found comparable to the equivalent sound level under relatively steady sound level conditions.

- L_{90} is the sound level 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 sound sources.

- 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 typically 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 loud sounds if there are fluctuating sound levels. The L_{eq} is sometimes also referred to as the average sound level or L_{ave}.

In the design of noise controls, which do not function quite like the human ear, it is important to understand the frequency spectrum of the noise source of interest. The spectra of noises are usually stated in terms of octave-band sound pressure levels, in dB, with the frequency bands being those established by standard (American National Standards Institute [ANSI] S1.11-2004 (R2009)).

3.10.2 Noise Regulations and Criteria

The City of Boston has both a noise ordinance and noise regulations. Chapter 16 §26 of the Boston Municipal Code sets the general standard for noise that is unreasonable or excessive: louder than 50 dB between the hours of 11:00 p.m. and 7:00 a.m., or louder than 70 dB at all other hours. The Boston Air Pollution Control Commission (BAPCC) has adopted regulations based on the City's ordinance - "Regulations for the Control of Noise in the City of Boston", which distinguish among residential, business, and industrial districts in the City. In particular, BAPCC Regulation 2 is applicable to the sounds from the Project.

Table 3.10-1 below presents the "Zoning District Noise Standards" contained in Regulation 2.5 of the BAPCC "Regulations for the Control of Noise in the City of Boston," adopted December 17, 1976. These maximum allowable sound pressure levels apply at the property line of the receiving property. The "Residential Zoning District" limits apply to any lot located within a residential zoning district or to any residential use located in another zone except an Industrial Zoning District, according to Regulation 2.2. Similarly, per Regulation 2.3, business limits apply to any lot located within a business zoning district not in residential or institutional use.

Table 3.10-1 City Noise Standards, Maximum Allowable Sound Pressure Levels

Octave-band Center	Residential Zoning District		Residential Industrial Zoning District		Business Zoning District	Industrial Zoning District
Frequency (Hz)	**Daytime (dB)**	**All Other Times (dB)**	**Daytime (dB)**	**All Other Times (dB)**	**Anytime (dB)**	**Anytime (dB)**
32	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:

1. Noise standards from Regulation 2.5 "Zoning District Noise Standards", City of Boston Air Pollution Control Commission, "Regulations for the Control of Noise in the City of Boston", adopted December 17, 1976.
2. All standards apply at the property line of the receiving property.
3. dB and dBA based on a reference pressure of 20 micropascals.
4. Daytime refers to the period between 7:00 a.m. and 6:00 p.m. daily, except Sunday.

3.10.3 Future Conditions

While the details of the mechanical equipment associated with the Project have not yet been precisely determined, steady operational noise from stationary sources will primarily involve heating, cooling and ventilation equipment for the building. Anticipated rooftop equipment includes a cooling tower, exhaust fans, energy recovery units, and an emergency generator. Intake and exhaust louvers for the parking garage fans will be located along the facades of the building with precise dimensions and locations still to be determined. Sound levels will be considered as the mechanical equipment and its specific location as well as exhaust locations are definitively determined.

Most of the proposed mechanical equipment with the potential to impact existing sound levels will be located on the roof of the 10 story Project. It is anticipated that the height of the mechanical equipment will mitigate potential noise impacts from the mechanical equipment. Exhaust and intake fans located along the building facades will be designed to mitigate sound levels at the nearby residences. The emergency generator, located on the building roof, will be tested periodically during the day when ambient sound levels are higher in order to mitigate sound level impacts. During the final design phase of the Project, mechanical equipment and noise controls will be specified to meet the applicable broadband limit and the corresponding octave-band limits of the City Noise Standards. Reasonable efforts will be made, if necessary, to minimize noise impacts from the Project using routinely employed methods of noise control, including:

- Selection of "low-noise" equipment models;
- Fitting of inlet and discharge vents with duct silencers;
- Installation of screening barriers to provide shielding where appropriate;
- Use of sound-attenuating enclosures, acoustical blankets, or both on continuously operating equipment with outdoor exposure; and
- Siting of noisy equipment at locations that protect sensitive receptors by shielding or with increased distance.

The Project, with appropriate noise control, is not expected to result in any adverse noise impacts to the surrounding area. Short-term, intermittent increases in noise levels will occur during Project construction. However, every reasonable effort will be made to minimize the noise impacts and ensure that the Project complies with the requirements of the City of Boston noise ordinance as described above.

Construction period noise impacts and mitigation are discussed below in Section 3.11.9.

3.11 Construction Impacts

3.11.1 Introduction

A Construction Management Plan (CMP) in compliance with the City's Construction Management Program will be submitted to BTD once final plans are developed and the construction schedule is fixed. The construction contractor will be required to comply with the details and conditions of the approved CMP.

Proper pre-planning with the City and neighborhood 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. The CMP will include routing plans for trucking and deliveries, plans for the protection of existing utilities, and control of noise and dust.

During the construction phase of the Project, the Proponent will provide the name, telephone number and address of a contact person to communicate with on issues related to the construction.

The Proponent intends to follow the guidelines of the City of Boston and MassDEP which direct the evaluation and mitigation of construction impacts.

3.11.2 Construction Methodology / Public Safety

Construction methodologies that ensure public safety and protect nearby tenants will be employed. Techniques such as barricades and signage will be used. Construction management and scheduling will minimize impacts on the surrounding environment and will include plans for construction worker commuting and parking, routing plans for trucking and deliveries, and the control of noise and dust.

As the design of the Project progresses, the Proponent will meet with BTD to discuss the specific location of barricades, the need for lane closures, pedestrian walkways and truck queuing areas. Secure fencing, signage and covered walkways may be employed to ensure the safety and efficiency of all pedestrian and vehicular traffic flows. In addition, sidewalk areas and walkways near construction activities will be well marked and lighted to protect pedestrians and ensure their safety. Public safety for pedestrians on abutting sidewalks will also include covered pedestrian walkways when appropriate. If required by BTD and the Boston Police Department, police details will be provided to facilitate traffic flow. These measures will be incorporated into the CMP which will be submitted to BTD for approval prior to the commencement of construction work.

3.11.3 Construction Schedule

Typical construction hours will be from 7:00 a.m. to 6:00 p.m., Monday through Friday, with most shifts ordinarily ending at 3:30 p.m. No substantial sound-generating activity will occur before 7:00 a.m. If longer hours, additional shifts, or Saturday work is required, the construction manager will place a work permit request to the proper City of Boston department(s) in advance. It is noted that some activities such as finishing activities could run beyond 6:00 p.m. to ensure the structural integrity of the finished product; for example, certain concrete components must be completed in a single pour, and placement of concrete cannot be interrupted.

3.11.4 Construction Staging / Access

Access to the Project Site and construction staging areas will be provided in the CMP.

Although specific construction and staging details have not been finalized, the Proponent and its construction manager will work to ensure that staging areas will be located to minimize impacts to pedestrian and vehicular flow. Secure fencing and barricades will be used to isolate construction areas from pedestrian traffic adjacent to the Project Site. Construction procedures will be designed to meet all Occupational Safety and Health Administration (OSHA) safety standards for specific site construction activities.

3.11.5 Construction Mitigation

The Proponent will follow City and MassDEP guidelines which will direct the evaluation and mitigation of construction impacts.

A CMP will be submitted to BTD for review and approval prior to issuance of a Building Permit. The CMP will include detailed information on specific construction mitigation measures and construction methodologies to minimize impacts to abutters and the local community. The CMP will also define truck routes which will help in minimizing the impact of trucks on City and neighborhood streets.

"Don't Dump - Drains to Charles River" plaques will be installed at storm drains that are replaced or installed as part of the Project.

3.11.6 Construction Employment and Worker Transportation

As required by the ordinance, the Proponent will make reasonable good-faith efforts to have at least 51% of the total employee work hours be for Boston residents, at least 40% of total employee work hours be for minorities and at least 12% of the total employee work hours be for women.

To reduce vehicle trips to and from the construction site, minimal construction worker parking will be available at the site, and all workers will be strongly encouraged to use public transportation and ridesharing options. The general contractors will work aggressively to ensure that construction workers are well informed of the public transportation options serving the area. Space on-site will be made available for workers' supplies and tools so they do not have to be brought to the Project Site each day.

3.11.7 Construction Truck Routes and Deliveries

Truck traffic will vary throughout the construction period, depending on the activity. The construction team will manage deliveries to the site during morning and afternoon peak hours in a manner that minimizes disruption to traffic flow on adjacent streets. Construction truck routes to and from the site for contractor personnel, supplies, materials, and removal of excavations required for the development will be coordinated with BTD. Traffic logistics and routing will be planned to minimize community impacts. Truck access during construction will be determined by BTD as part of the CMP. These routes will be mandated as a part of all subcontractors' contracts for the Project. The construction team will provide subcontractors and vendors with Construction Vehicle & Delivery Truck Route Brochures in advance of construction activity.

"No Idling" signs will be included at the loading, delivery, pick-up and drop-off areas.

3.11.8 Construction Air Quality

Short-term air quality impacts from fugitive dust may be expected during demolition, excavation and the early phases of construction. Plans for controlling fugitive dust during demolition, excavation and construction include mechanical street sweeping, wetting portions of the site during periods of high wind, and careful removal of debris by covered trucks.

The construction contract will provide for a number of strictly enforced measures to be used by contractors to reduce potential emissions and minimize impacts. These measures are expected to include:

- Using wetting agents on areas of exposed soil on a scheduled basis;
- Using covered trucks;
- Minimizing spoils on the construction site;
- Monitoring of actual construction practices to ensure that unnecessary transfers and mechanical disturbances of loose materials are minimized;
- Minimizing storage of debris on site; and
- Periodic street and sidewalk cleaning with water to minimize dust accumulations.

3.11.9 Construction Noise

The Proponent is committed to mitigating noise impacts from the construction of the Project. Increased community sound levels, however, are an inherent consequence of construction activities.

Construction work will comply with the requirements of the City of Boston Noise Ordinance. Every reasonable effort will be made to minimize the noise impact of construction activities.

Mitigation measures are expected to include:

- Instituting a proactive program to ensure compliance with the City of Boston noise limitation policy;
- 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;
- Selecting the quietest of alternative items of equipment where feasible;
- Scheduling equipment operations to keep average noise levels low, to synchronize the 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.

3.11.10 Construction Waste

The Proponent will take an active role with regard to the reprocessing and recycling of construction waste. The disposal contract will include specific requirements that will ensure that construction procedures allow for the necessary segregation, reprocessing, reuse and recycling of materials when possible. For those materials that cannot be recycled, solid waste will be transported in covered trucks to an approved solid waste facility, per MassDEP Regulations for Solid Waste Facilities, 310 CMR 16.00. This requirement will be specified in the disposal contract. 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.

3.11.11 Protection of Utilities

Existing public and private infrastructure located within the public right-of-way will be protected during construction. The installation of proposed utilities within the public way will be in accordance with the MWRA, BWSC, Boston Public Works, Dig Safe, and the governing utility company requirements. All necessary permits will be obtained before the commencement of the specific utility installation.

Specific methods for constructing proposed utilities where they are near to, or connect with, existing water, sewer and drain facilities will be reviewed by BWSC as part of its Site Plan Review process.

3.12 Rodent Control

A rodent extermination certificate will be filed with the building permit application to the City. Rodent inspection monitoring and treatment will be carried out before, during, and at the completion of all construction work for the Project, in compliance with the City's requirements. Rodent extermination prior to work commencement will consist of treatment of areas throughout the Project Site.

3.13 Wildlife Habitat

The Project Site is currently developed within a fully developed urban area and, as such, the Project will not impact wildlife habitats as designated on the National Heritage and Endangered Species Priority Habitats of Rare Species and Estimated Habitats of Rare Wildlife maps.

Chapter 4

Sustainable Design and Climate Resiliency

4.0 SUSTAINABLE DESIGN AND CLIMATE RESILIENCY

4.1 Sustainable Design and Green Buildings

Article 37 of the Boston Zoning Code requires the provision of a LEED scorecard to demonstrate that a project is "LEED certifiable", demonstrating that the project meets the minimum requirements to achieve a LEED Certified level (all LEED prerequisites and achieve at least 40 points). This documentation is reviewed by the Boston Interagency Green Building Committee (IGBC), which is responsible for advising the BPDA on a proposed project's compliance with the provisions of this article. As the Project design advances, all credits that have been targeted and any credits identified as "Maybe" will continue to be evaluated to determine if they could be achievable.

As demonstrated by the draft LEED-NC Scorecard, the Project anticipates a total of 52 'Yes' points with a goal of being LEED Silver certifiable and an additional 27 'Maybe' points are currently being targeted for the Project.

This narrative describes credits known to be achievable by the Project, based on the current design and those to be considered/evaluated further as design advances.

Integrative Process (IP)

The credit requires the team to identify and use opportunities to achieve synergies across disciplines and energy-related and water-related building systems. Preliminary energy modeling and water budgeting will be completed during schematic design and design use targets will be set. These analyses will inform the owner's project requirements (OPR), basis of design (BOD), design documents, and construction documents.

Location and Transportation (LT)

This category encourages project teams to take advantage of the infrastructure elements in existing communities that provide environmental and human health benefits. The location of the Project in the Huntington Avenue/Prudential Center Zoning district on a previously developed parcel provides the opportunity to earn many of the credits in this category.

- **Sensitive Land Protection**: The Project is located on land that is previously developed and therefore meets the credit requirements.

- **High Priority Site**: The Project is located in a Qualified Census Tract and therefore achieves 1 point for meeting the credit requirements for Option 2: Priority Designation.

- **Surrounding Density and Diverse Uses**: The Project is located within a neighborhood with an average density greater than 35,000 square feet per acre and is located within 1/2-mile walking distance of eight diverse uses and therefore achieves five total points by meeting the credit requirements for both Option 1 and Option 2.

- **Access to Quality Transit (LEEDv4.1)**: The Project is within walking distance (less than 1/4 mile) of multiple Green Line branches, the Orange Line, and numerous bus stops that provide enough rides per day to achieve all five points, in accordance with the credit requirements.

- **Bicycle Facilities (LEEDv4.1)**: The City of Boston roadways have a 25 mph speed limit. The Project is located adjacent to a qualifying bicycle network. The Project will provide showers and secure, covered bicycle storage for regular building residents and occupants as well as short term bicycle storage for building visitors.

- **Reduced Parking Footprint (LEEDv4.1)**: The Project's designed parking capacity exceeds the credit requirement for a 30% reduction below the base ratios recommended by the ITE Planning Handbook and therefore complies with this credit. The Project also exceeds the exemplary performance threshold of 60% reduction, qualifying for an additional point applied under the Innovation category.

- **Electric Vehicles (LEEDv4.1):** The Project will provide EV charging stations for a minimum of 2% of the parking provided on site and will comply with this credit.

Sustainable Sites (SS)

The Proponent and Project team have considered the features of the Project Site and the surrounding context to create a building that is sustainable and environmentally sensitive. At this stage in the Project development, the Proponent is evaluating numerous measures to protect and control uplight and trespass of exterior lighting, and implement a robust rainwater management strategy on-site.

- **Prerequisite – Construction Activity Pollution Prevention**: The Project-specific construction documents will include erosion and sedimentation control guidance for onsite implementation by the Construction Manager, (CM). The CM is required to implement a compliant erosion and sedimentation control plan that meets local requirements and the 2012 U.S. Environmental Protection Agency (EPA) Construction General Permit or local equivalent.

- **Site Assessment**: A site assessment of key attributes will be completed and documented during early design to evaluate sustainable options and inform related decisions about site design.

- **Rainwater Management (LEEDv4.1)**: The Project will contain an extensive stormwater management system to capture one and one quarter inch of surface runoff for recharge on-site. Achievement of this credit is contingent on the final design and stormwater boundary for the Project.

- **Heat Island Reduction**: The team is studying the options for specifying an SRI-compliant roof and hardscapes for Option 1. Achievement of Option 1 for this credit is contingent on the final design. The Project is locating more than 75% of the parking capacity underground, which complies with Option 2 for one point.

- **Light Pollution Reduction**: The Project will evaluate the use of compliant exterior and Project Site light fixtures and if the light trespass from the Project Site can be minimized. Achievement of this credit is contingent on the final design.

Water Efficiency (WE)

In order to improve on-site water efficiency and reduce the burden on municipal water supply and wastewater systems, the Project will reduce potable water use for both sewage conveyance and irrigation needs. Both whole-building and end-use water metering will be installed in the Project, and low flow and high efficiency plumbing fixtures will be used to reduce the amount of potable water used throughout the building. Exterior vegetation will be comprised of regionally appropriate, drought tolerant, indigenous plants.

Preliminary water balance calculations indicate that the selection of low-flow, high-efficiency fixtures, WaterSense appliances reduces the potable water demand for the Project over 30% compared to a code baseline.

- **Prerequisite/Credit: Outdoor Water Use Reduction**: Both points can be achieved if no permanent irrigation is required. Reducing the Project's landscape water requirement by at least 30% from the calculated baseline for the Project Site's peak watering month meets the prerequisite; the design is not expected to require permanent irrigation on the Project Site, achieving both points.

- **Prerequisite/Credit: Indoor Water Use Reduction**: Through the specification of low-flow high-efficiency plumbing fixtures, the Project will exceed the required 20 percent annual potable water use reduction and will target an annual potable water reduction of 30 percent for two points.

- **Prerequisite/Credit: Water Metering**: Permanent meters for building and associated grounds must be installed and the data shared with USGBC for a minimum of five years. The credit will be earned by installing meters for two or more subsystems; this is being pursued and the systems to be sub-metered will be finalized and confirmed as design progresses.

Energy and Atmosphere (EA)

The building systems shall be designed to optimize energy performance and reduce energy consumption through high efficiency building systems. The Project team will engage a building commissioning agent to ensure the proper installation and operation of systems.

No chlorofluorocarbon (CFC) based refrigerants will be used in order to avoid ozone depletion in the atmosphere. The Project team will explore the feasibility of onsite alternative energy technologies, including a rooftop-mounted photovoltaic (PV) array.

- **Prerequisite/Credit: Fundamental and Enhanced Commissioning and Verificatio**n: The Project team will engage a Commissioning Agent (CxA) to review the proposed design and ultimately confirm the building systems are installed and function as intended and desired. The Project is pursuing Enhanced Commissioning (three points) and Building Envelope Commissioning (2 points), which will be documented as part of the Construction application.

- **Prerequisite/Credit: Energy Performance**: As design progresses, the design team will continue to use whole building energy modeling to document the annual energy use and cost savings. The Project intends to employ the approved Alternative Compliance Path (EApc95) for this credit, allowing the Project to evaluate the performance of the Project using the GHG Emissions reduction and Source Energy savings in addition to the cost savings metric. Early energy analysis results indicate an estimated annual energy cost savings of 16.2%, source energy savings of 20%, and a 25.3% reduction of GHG emissions for the Project when compared to a baseline building performance as calculated using the rating method in Appendix G of ANSI/ASHRAE/ IESNA Standard 90.1-2013, with Massachusetts code amendments. Using EApc95, the Project demonstrates a savings of 22.7% against ASHRAE 90.1-2013, and a savings of 26% (11 points) against ASHRAE 90.1-2010 after code equivalency is calculated. As the Project is still in early phases of design, the Project team has listed eight points as “yes” and the remaining three points as “maybe” points pending further development of the design’s performance.

- **Prerequisite: Building-Level Energy Metering**: Permanent meters for buildings must be installed and the data shared with USGBC for a minimum of five years. Building-level energy metering will be provided as part of the Project.

- **Prerequisite: Fundamental Refrigerant Management**: As per the prerequisite requirements, the specifications for refrigerants used in the building HVAC & R systems will not permit the use of CFC based refrigerants.

Materials and Resources (MR)

This category focuses on minimizing the embodied energy and other impacts associated with the extraction, processing, transport, maintenance, and disposal of building materials. The requirements are designed to support a life-cycle approach that improves performance and promotes resource efficiency. Each requirement identifies a specific action that fits into the larger context of a life-cycle approach to embodied impact reduction.

- **Prerequisite: Storage and Collection of Recyclables:** Recyclables will be collected throughout the building and designated storage for collected recyclables will be provided in the Project. The recyclables will be collected by a contracted waste management company on a regular basis. Additionally, safe collection, storage, and disposal of batteries and e-waste will be incorporated into the Project design.

- **Prerequisite/Credit: Construction and Demolition Waste Management (LEEDv4.1)**: A Construction Waste Management Plan (CWMP) must be submitted for the prerequisite. The CM will endeavor to divert as much demolition debris and construction waste from area landfills as possible with a minimum diversion rate of 75% overall, using at least three separate material waste streams. The LEED credit will be confirmed based on performance during the construction process.

- **Building Product Disclosure and Optimization – Environmental Product Declarations (LEEDv4.1)**: The Project building must use at least 20 different permanently installed products sourced from at least five different manufacturers with EPD documentation. This credit will be documented within the Construction Application.

- **Building Product Disclosure and Optimization – Material Ingredients (LEEDv4.1)**: The Project building must use at least 20 different permanently installed products sourced from at least five different manufacturers that use approved programs to demonstrate the chemical inventory of the product to at least 0.1%. This credit will be documented within the Construction Application.

Indoor Environmental Quality (IEQ)

The comfort and well-being of the building occupants will be paramount in regard to air quality, access to light, and thermal comfort. An indoor air quality management plan will be implemented during construction to enhance the well-being of construction workers and to promote a better indoor environment for building occupants. Low-emitting materials will be employed throughout the building to reduce the quantity of indoor air contaminants and promote the comfort and well-being of installers and building occupants.

Quality views will be provided for occupants. Design strategies will focus on occupant comfort, controllability, and well-being.

- **Prerequisite - Minimum Indoor Air Quality Performance:** The Project mechanical systems are designed to meet or exceed the requirements of ASHRAE Standard 62.1-2010 sections 4 through 7. Outdoor air intake flow will be monitored.

- **Prerequisite - Environmental Tobacco Smoke Control**: The Project building will be smoke-free and smoking will be prohibited within 25 feet of building entrances, openings, and air intakes. Signage will be posted as required.

- **Enhanced Indoor Air Quality Strategies**: The design team will aim to minimize and control the entry of pollutants into the building and to contain chemical use areas. Entryway systems, isolation and exhaust of chemical use areas, and MERV 13 filtration on all outdoor intakes will be provided, in compliance with Option 1 (1 point). Achievement of this credit will be documented based on the final design.

- **Low-Emitting Materials (LEEDv4.1)**: This credit now includes requirements for product manufacturing as well as project teams. It covers VOC emissions in the indoor air and the VOC content of materials, as well as the testing methods by which indoor VOC emissions are determined. Different materials must meet different requirements to be considered compliant for this credit. The building interior and exterior are organized in eight categories, each with different thresholds of compliance. The building interior is defined as everything within the waterproofing membrane. The building exterior is defined as everything outside and inclusive of the primary and secondary weatherproofing system, such as waterproofing membranes and air- and water-resistive barrier materials. One point is currently targeted to be achieved, which will require meeting the thresholds of compliance for two of the eight product categories. Categories currently being targeted for compliance are: Flooring and Composite Wood.

- **Construction Indoor Air Quality Management Plan**: The CM will be required to develop and implement a compliant Indoor Air Quality Management Plan for the construction and pre-occupancy phases of the Project to meet/exceed the recommended Control Measures of the SMACNA IAQ Guidelines for Occupied buildings Under Construction 2nd Edition 2007, ANSI/SMACNA 008-2008 (Chapter 3). Other credit requirements include protecting absorptive materials, providing proper filtration media, and prohibiting the use of tobacco products inside and within 25 feet of the building entrances during construction.

- **Thermal Comfort**: The Project will be designed to meet ASHRAE 55 requirements. Additionally, the Project will include thermal controls for 100% of multi-occupant spaces and 50% of individual occupant spaces. Achievement of this will be documented based on the final design.

- **Interior Lighting**: The Project will provide multi-level lighting controls for 100% of multi-occupant spaces and 90% of individual occupant spaces. Achievement of this credit will be documented based on the final design.

- **Quality Views**: A direct line of sight to the outdoors via vision glazing must be provided for 75% of all regularly occupied floor area; a clear image must be provided of the exterior. Achievement of this credit will be documented based on the final design.

Innovation and Design (IN)

The Project is currently exploring numerous innovative approaches to design and maintenance and qualifies for exemplary performance points for base credits listed above. Strategies being explored include: purchasing lighting with low mercury content, green housekeeping and pest management programs, and LEED pilot credits for site design and building material research.

- **Exemplary Performance – Reduced Parking Footprint**: The Project's designed parking capacity exceeds the exemplary performance threshold of 60% reduction for the base credit, qualifying for an exemplary performance point.

- **Innovation – Purchasing, Lamps:** The Project will be designed with 100% LED lighting technology that exceeds the efficiency of their mercury-containing counterparts. This will eliminate the use of mercury-containing lamps within the Project, reducing the exposure hazards of building occupants and staff.

- **Innovation – O+M Starter Kit**: Green Cleaning Policy and Integrated Pest Management: The Project will develop and implement a Green Cleaning Policy to be utilized within the building that complies with the specific requirements under LEED-EB:O+M Rating System. Additionally, the Project will develop and implement an Integrated Pest Management Program that will emphasize low-impact pest control methods that reduce potential exposure of occupants to harmful pesticides on the Project Site.

- **Pilot Credit – Integrated Analysis of Building Materials**: The Project will specify and install at least three permanently installed products within the building that have a documented qualitative analysis of the potential health, safety, and environmental impacts of the product in five stages of the products life cycle. Qualitative analysis will meet the requirements of this Pilot Credit.

- **Pilot Credit – Walkable Project Site**: The site design will incorporate numerous strategies to improve the walkability and safety for pedestrians on-site, paying specific attention to street tree spacing, bike lanes, curb cuts, and envelope design that activates and addresses the exterior at the ground level.

- **LEED Accredited Professional**: The design team for the Project includes several LEED Accredited Professionals (AP). Therefore, this credit will be achieved.

Regional Priority (RP)

Regional Priority Credits (RPCs) are established LEED credits designated by the USGBC to have priority for a particular area of the country. When a project team achieves one of the designated RPCs, an additional credit is awarded to the project for up to four total points.

Applicable Regional Priority Credits (RPC) for the Project include:

- High Priority Site (2 points threshold)
- Rainwater Management (2 points threshold)
- Indoor Water Use Reduction (40% - 4 points threshold)
- Optimize Energy Performance (20% - 8 points threshold)
- Renewable Energy Production (5% - 2 points threshold)
- Building Life Cycle Impact Reduction (2 points threshold)

The Project is currently anticipating one point as 'Yes' for the Optimize Energy Performance Regional Priority credit. Achievement of this credit and any additional credits will be confirmed during the design process.

4.2 Climate Change Resilience

4.2.1 Introduction

Climate change conditions considered by the Project team include higher maximum and mean temperatures, more frequent and longer extreme heat events, more frequent and longer droughts, more severe freezing rain and heavy rainfall events, and increased wind gusts.

A copy of the completed Climate Resiliency Checklist is included in Appendix D. Given the preliminary level of design, the responses are also preliminary and will be updated as the Project design progresses.

4.2.2 Extreme Heat Events

The Climate Ready Boston report predicts that in Boston, there may be between 25 to 90 days with temperatures over 90 degrees by 2070, compared to an average of 11 days per year over 90 degrees between 1971 and 2000. The Project design will include measures to adapt to these conditions, such as a high-efficiency building envelope with self-shading, low solar heat gain coefficient (SHGC) windows and high R values. The ventilation cooling load will be reduced with heat recovery. The cooling towers on the roof will reject heat from the building and will be oversized for design conditions. Therefore, future capacity can be added without redesigning the building systems. Additionally, the Project will install planters and vegetation in various locations on both the ground level and 10th floor terrace, accompanied by high solar reflectance index (SRI) hardscape areas to reduce heat absorption by hardscape areas. Ground level trees and vegetation will reduce direct sunlight exposure to hardscape and portions of the adjacent street surfaces.

4.2.3 Rain Events

As a result of climate change, the Northeast is expected to experience more frequent and intense storms. To mitigate this, the Proponent will take measures to minimize stormwater runoff and protect the Project's mechanical equipment, as necessary. The existing Project Site is nearly entirely impervious and the Project will reduce the amount of impervious area on the Project Site, which will reduce stormwater runoff on the Project Site. The Project will be designed to reduce the existing peak rates and volumes of stormwater runoff from the Project Site, and promote runoff recharge to the greatest extent practicable.

4.2.4 Sea Level Rise

Only a very small portion of the Project Site at the corner of Cumberland Street and Public Alley #404 is located in BPDA Sea Level Rise – Flood Hazard Area, with a Base Flood Elevation of 18.0 ft BCB.

Building storm drainage systems will be provided with emergency overflow systems in case of flooding. Proposed site elevations are based on surrounding public way sidewalk/alley elevations. The site is highest in elevation along Huntington Avenue and Cumberland Street (Elevation 16.7-18.3 BCB). Building entrances and ground level will be raised to Huntington Avenue/Cumberland Street elevation. Doors along Public Alley #404 will be elevated compared to the elevation of the alley. Public Alley #404 ranges from its lowest point mid-way at Elevation 12 BCB up to Elevation 16 BCB near Cumberland Street. Building Entrances will be outside of BPDA Sea Level Rise Area.

4.2.5 Drought Conditions

Although more intense rainstorms are predicted, extended periods of drought are also predicted due to climate change. Under the high emissions scenario, the occurrence of droughts lasting one to three months could go up by as much as 75% over existing conditions by the end of the century. To minimize the Project's susceptibility to drought conditions, the landscape design is anticipated to incorporate native and adaptive plant materials and high efficiency irrigation systems will be installed. Aeration fixtures and appliances will be chosen for water conservation qualities, thereby conserving potable water supplies.

4.3 Zero Carbon Building Assessment

The Boston Zoning Article 37 Interagency Green Building Committee (IGBC) recently released the 'Zero Carbon Building Assessment' (Carbon Neutral Building Assessment) in alignment with the City of Boston's stated goals to be carbon neutral by 2050. As part of the Zoning Code Article 37 Green Buildings and Climate Resiliency Requirements, the IGBC now requests that the project team submit a project-specific Zero Carbon/Zero Energy Building Analysis. The Zero Carbon Building Assessment for the Project is included in Appendix E.

LEED v4 BD+C: New Construction

Project Checklist

Project Name: **220 Huntington Avenue**
Address: **220 Huntington Avenue**
Date: **October 2020**

Y	?+	?-	N		Integrative Process	1
1	0	0	0	Credit 1	Integrative Process	1

Y	?+	?-	N		Location and Transportation	16
15	0	1	0			
x	x	x	x	Credit 1	LEED for Neighborhood Development Location	16
1				Credit 2	Sensitive Land Protection	1
1		1		Credit 3	High Priority Site	2
5				Credit 4	Surrounding Density and Diverse Uses	5
5				Credit 5	Access to Quality Transit	5
1				Credit 6	Bicycle Facilities	1
1				Credit 7	Reduced Parking Footprint	1
1				Credit 8	Green Vehicles	1

Y	?+	?-	N		Sustainable Sites	10
2	3	3	2			
Y				Prereq 1	Construction Activity Pollution Prevention	Required
1				Credit 1	Site Assessment	1
		1	1	Credit 2	Site Development - Protect or Restore Habitat	2
			1	Credit 3	Open Space	1
	1	2		Credit 4	Rainwater Management	3
1	1			Credit 5	Heat Island Reduction	2
	1			Credit 6	Light Pollution Reduction	1

Y	?+	?-	N		Water Efficiency	11
5	1	2	3			
Y				Prereq 1	Outdoor Water Use Reduction	Required
Y				Prereq 2	Indoor Water Use Reduction	Required
Y				Prereq 3	Building-Level Water Metering	Required
2				Credit 1	Outdoor Water Use Reduction	2
2	1	1	2	Credit 2	Indoor Water Use Reduction	6
		1	1	Credit 3	Cooling Tower Water Use	2
1				Credit 4	Water Metering	1

Y	?+	?-	N		Energy and Atmosphere	33
13	6	1	13			
Y				Prereq 1	Fundamental Commissioning and Verification	Required
Y				Prereq 2	Minimum Energy Performance	Required
Y				Prereq 3	Building-Level Energy Metering	Required
Y				Prereq 4	Fundamental Refrigerant Management	Required
5			1	Credit 1	Enhanced Commissioning	6
8	3		7	Credit 2	Optimize Energy Performance	18
			1	Credit 3	Advanced Energy Metering	1
			2	Credit 4	Demand Response	2
		1	2	Credit 5	Renewable Energy Production	3
	1			Credit 6	Enhanced Refrigerant Management	1
	2			Credit 7	Green Power and Carbon Offsets	2

Y	?+	?-	N		Materials and Resources	13
4	0	2	7			
Y				Prereq 1	Storage and Collection of Recyclables	Required
Y				Prereq 2	Construction and Demolition Waste Management Planning	Required
		1	4	Credit 1	Building Life-Cycle Impact Reduction	5
1			1	Credit 2	Building Product Disclosure and Optimization - EPD	2
		1	1	Credit 3	Building Product Disclosure and Optimization - Sourcing of Raw Materials	2
1			1	Credit 4	Building Product Disclosure and Optimization - Material Ingredients	2
2				Credit 5	Construction and Demolition Waste Management	2

Y	?+	?-	N		Indoor Environmental Quality	16
6	2	2	6			
Y				Prereq 1	Minimum Indoor Air Quality Performance	Required
Y				Prereq 2	Environmental Tobacco Smoke Control	Required
1	1			Credit 1	Enhanced Indoor Air Quality Strategies	2
1		1	1	Credit 2	Low-Emitting Materials	3
1				Credit 3	Construction Indoor Air Quality Management Plan	1
	1	1		Credit 4	IAQ Assessment	2
1				Credit 5	Thermal Comfort	1
1			1	Credit 5	Interior Lighting	2
			3	Credit 5	Daylight	3
1				Credit 5	Quality Views	1
			1	Credit 5	Acoustic Performance	1

Y	?+	?-	N		Innovation	6
5	1	0	0			
1				Credit 1	Innovation Credit: EP LTc7, Reduced Parking Footprint	1
	1			Credit 2	Innovation Credit: EP for SSc5, Heat Island Reduction	1
1				Credit 3	Innovation Credit: Purchasing - Lamps	1
1				Credit 4	Innovation Credit: EBOM Starter Kit (Green Cleaning and IPM Plan)	1
1				Credit 5	Pilot Credit: Integrative Analysis of Bldg Materials	1
1				Credit 6	LEED Accredited Professional	1

Y	?+	?-	N		Regional Priority (earn up to 4 points)	4
1	0	3	0			
1				Credit 1	EAc2 Optimize Energy Performance (20%/8 pts)	1
		1		Credit 2	WEc2 Indoor Water use Reduction (40%/4 points)	1
		1		Credit 3	LTc3 High Priority Site (2 points)	1
		1		Credit 4	SSc4 Rainwater Management (2 pts)	1

Y	?+	?-	N	TOTALS	Possible Points:	110
52	13	14	31			

Certified: 40 to 49 points, **Silver:** 50 to 59 points, **Gold:** 60 to 79 points, **Platinum:** 80 to 110

Chapter 5

Urban Design

5.0 URBAN DESIGN

This Section addresses the urban design approach for the Project, including significant public realm improvements and consistency with planning initiatives for the neighborhood. The Project will revitalize the intersection of Huntington Avenue and Cumberland Street by supplanting the existing low-scale uses of the Project Site with high-quality residential and retail uses and acting as the natural continuation of the original Christian Science Center Master Plan. The existing neighborhood's character is defined by its continuous midrise building façades and storefronts, which serve as edges to the Christian Science Center Plaza and to the Prudential Center. The Project will expand that character, reinforcing the urban fabric of the neighborhood while being mindful and respectful for the adjacent Saint Botolph Neighborhood.

5.1 Area Context

The immediate area is defined by a 12-story mid-rise residential building to the east and a zero lot line condition abutting a five story mixed use building to the west. The Site is primarily defined by its direct frontage onto the Christian Science Center Plaza to the north and its prominence as the southern edge of the Christian Science Center Master Plan. The Project Site opens towards the plaza along Huntington Avenue in a similar manner as the frontage at the Church Park Apartments along Massachusetts Avenue. The Christian Science Center Plaza offers dramatic views of the Project Site as well as providing extended views from the Project Site toward the north. On the South, the Project Site is bordered by a rear alley that separates the Project from the four- and five-story brick row houses that make up the fabric of the Saint Botolph neighborhood.

5.2 Public Realm Improvements

The Project includes significant improvements to the surrounding public realm and will contribute to the neighborhood as a vibrant beacon to the Prudential Center area from Massachusetts Avenue/Northeastern University and from the Saint Botolph neighborhood. The residential use will further assist in bridging these urban areas.

As described previously, improvements to the public realm include upgrades to streets, sidewalks, bike paths, and the overall pedestrian experience. Upgrades to the crosswalks and street intersection at Huntington Avenue and Cumberland Streets will enhance pedestrian and bike safety along the Project Site perimeter. Street improvements to the carriage road connection along Huntington Avenue and to the left-hand turn lane onto Cumberland Street will make the street intersections and movements safer for vehicles, bicycles, and pedestrians alike. A proposed expansion of the width of Public Alley 404 will allow more access to light and air as well as the potential for more enjoyable outdoor spaces, and a proposed new service alley between the Project and 236 Huntington Avenue will allow for improved access to loading and service areas, further improving the quality of life along the more primary streets abutting the Project Site.

To extend and link the neighborhoods surrounding the Project Site, the sidewalks around the Project Site will be improved by incorporating strategies outlined in Boston Complete Streets program, including new street trees and new street lighting where sidewalk widths allow (see Figure 5-1).

Retail/restaurant storefronts and entrances, including the residential lobby entrance along Huntington Avenue, have been carefully considered and positioned to provide convenient access as well as potential seating and dining zones for residents and visitors to enjoy the active streetscape and views toward the Christian Science Center Plaza. The presence of residential, retail and restaurant activity throughout the day will enhance neighborhood safety, and the incorporation of designated zones for the seating and outdoor dining will ensure that these activities do not impede pedestrian activity. The retail storefronts will have a strong corner presence at the Huntington Avenue and Cumberland Street intersection, which will further enhance and enliven the urban thoroughfare. The entrances will create a sense of place by linking the retail spaces along Huntington Avenue across from the Prudential Center with Massachusetts Avenue intersection and Northeastern University. Please see Figures 5-2 and 5-3.

5.3 Building Massing

The Project, at the southern edge of the Christian Science Center Master Plan, is contemplated as a bold, textured, simple form that reinforces the edge of the Christian Science Center Plaza and is in keeping with the original intent of Pei Cobb Freed & Partners' 1970's master plan of the plaza. The Project's facades will utilize the same material palette as the Christian Science Center, providing scale and visual interest through repetition of light and shadow (see Figure 5-4). The mid-rise portions of the building will run along the length of Huntington Avenue with a series of lower scale elements which align in height with the adjacent building at 236 Huntington Avenue. Please see Figures 5-5 to 5-7.

These elements address the required zoning setbacks while also providing rhythm and visual relief along the length of the building. The proposed height generally aligns with the adjacent mid-rise apartment building across Cumberland Street, acting as a continuation of the streetwall condition which further reinforces its contribution to the original master plan. Figures 5-8 to 5-9 show the Project's relationship to Cumberland Street.

This break also provides an element of visual relief at the condition where the building meets the sky (see Figures 5-10 to 5-11). Figures 5-12 to 5-14 provide additional elevations of the building.

cbt

Figure 5-1

Open Space/Landscape Plan

Figure 5-2

Eye-level perspective along Huntington Avenue looking Southeast

Figure 5-3

Eye-level perspective along Huntington Avenue looking Southeast

Figure 5-4

Façade of Huntington Avenue

cbt

Figure 5-5

Corner of Huntington Avenue and Public Alley 405

Figure 5-6

Corner of Huntington Avenue and Public Alley 405

Figure 5-7

Corner of Huntington Avenue and Cumberland Street

Figure 5-8

Corner of Cumberland Street and Public Alley 404

Figure 5-9

Corner of Cumberland Street and Saint Botolph Street

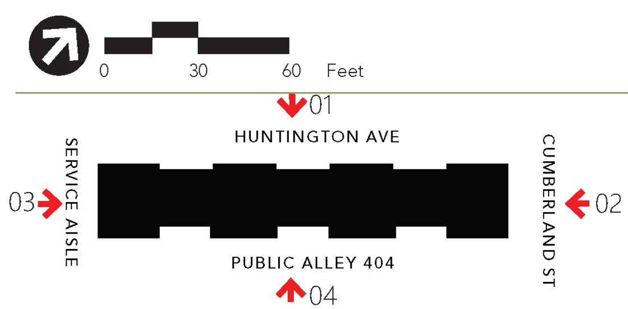
cbt

Figure 5-10

Aerial View of Huntington Avenue Facade

cbt

Figure 5-11
Aerial View of Public Alley 404 Facade



220 Huntington Avenue Boston, Massachusetts

cbt

Figure 5-12

North Elevation

02

03

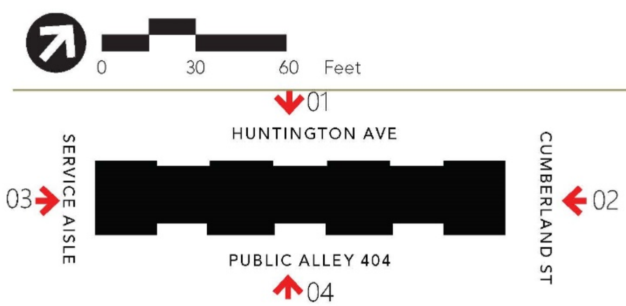
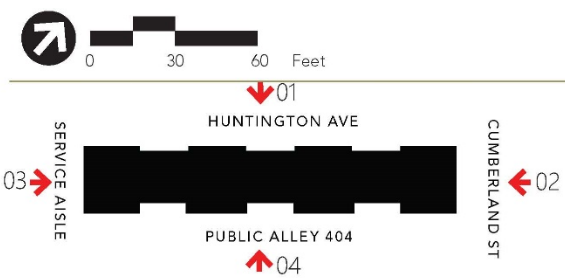


Figure 5-13

East and West Elevations

04



220 Huntington Avenue   Boston, Massachusetts

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Figure 5-14

South Elevation

Chapter 6

Historic and Archeological Resources

6.0 HISTORIC AND ARCHAEOLOGICAL RESOURCES

This section describes the historic and archaeological resources within and in the vicinity of the Project Site.

6.1 Project Site

The Project Site consists of two adjacent parcels of land totaling approximately 1.5 acres in the Huntington Avenue/Prudential Center Zoning district and is directly across Huntington Avenue from the Christian Science Center plaza, with the Saint Botolph neighborhood directly to the south and the Back Bay neighborhood to the north. The Project Site is bounded by Huntington Avenue to the northwest, Cumberland Street to the northeast, Public Alley #404 to the southeast, and the five-story mixed use property at 236 Huntington Avenue to the southwest.

The Project Site was originally located within the Back Bay, the area was infilled by a series of projects over a period of 150 years resulting in the infill of the marsh which formerly separated Boston and Brookline. Huntington Avenue was extended from Boylston Street to today's Gainsborough Street in 1875, and by 1890 Huntington Avenue was built out as far west as today's Massachusetts Avenue.

The late 19th and early 20th century the area saw the steady westward movement of institutions, including the First Church of Christ Scientist, which constructed its original building in 1894 north of the intersection of Huntington Avenue and Massachusetts Avenue. Other institutions historically located in the vicinity include the Boston Symphony Orchestra, the Massachusetts Horticultural Society, Jewett Repertory Theatre, New England Conservatory, and the Museum of Fine Arts Boston. The Project Site is located directly south of the Christian Science Center Plaza, and the surrounding area continues to include many of Boston's prominent institutions dedicated to fine arts, architecture, music, theatre, and education.

6.1.1 Historic Resources within the Project Site

There are no properties listed in the State or National Registers of Historic Places on the Project Site. The Project Site includes two existing buildings: the Midtown Hotel (220 Huntington Avenue) and a residential building at 1 Cumberland Street. Both structures are proposed to be removed from the Project Site. The property at 1 Cumberland Street is included in the Massachusetts Historical Commission's (MHC) Inventory of Historic and Archaeological Assets of the Commonwealth ("the Inventory"). The building is incorrectly identified as having historic designations in the Inventory. The property is not listed in the State or National Registers of Historic Places. The property is also outside the boundary of the locally designated Saint Botolph Area Architectural Conservation District.

The two-story on raised basement Midtown Hotel occupies nearly the entire block bound by Huntington Avenue, Cumberland Street, and Public Alleys #404 and 405. The concrete and white brick building, originally called the Midtown Motor Inn, was constructed in 1960-1961. The

Midtown Hotel replaced several buildings previously on the Project Site dating to the 1880s and 1890s including a number of row houses, club houses, and the Hotel Minerva. Since its construction, the building has continuously functioned as a hotel with meeting and function rooms, a restaurant and ground-level parking. The hotel was designed by Samuel Glaser Associates, a Boston architecture firm established by Samuel Glaser (1902-1983) in 1930.

The property at 1 Cumberland Street is a four-story red brick and brownstone building constructed in 1888 as a multi-family residential building. The building was constructed with elements of the Queen Anne and Richardsonian Romanesque styles to the designs of Boston architect Alonzo Shaw Drisko (1829-1914). The building has undergone a series of alterations throughout its history including an increase in the number of apartments from four to seven and replacement of original windows. By 1890 the building was attached to a row house fronting Huntington Avenue, demolished for the construction of the Midtown Hotel. A tall brick stairtower was later added at the north elevation connecting the building with the Midtown Hotel.

6.1.2 Historic Resources in the Vicinity of the Project Site

Historic resources in the vicinity of the Project Site include several resources listed in the State and National Registers of Historic Places. Table 6-1 lists the State and National Register-listed properties and historic districts located within a quarter-mile radius of the Project Site. Figure 6-1 depicts the locations of these properties and historic districts.

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Data Source: Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services

220 Huntington Avenue   Boston, Massachusetts

Epsilon ASSOCIATES INC.

Figure 6-1

Historic Resource Map

Table 6-1 State and National Register-Listed Properties and Historic Districts

Map No	Historic Resource	Address	Designation
A	South End Historic District	Bound by Massachusetts and Harrison Ave, East and West Brookline, Tremont, Upton, Malden and Union Park Sts, Shawmut Ave, Dwight and Berkeley Sts	NRDIS
B	South End Landmark District	Roughly bound by Camden St, Harrison Ave, East Berkeley St and Tremont St	LHD
C	Saint Botolph Street Area	Roughly bound by Harcourt St, Penn Central Railroad, alley north of Massachusetts Ave and alley east of Huntington Ave	LHD
D	Christian Science Center Complex	Bound by Huntington Ave, Horticultural Hall, Massachusetts Ave, Clearway, Dalton and Belvidere St	LL
1	The Riviera	270 Huntington Ave	NRIND
2	Horticultural Hall	300 Massachusetts Ave	NRIND, PR
3	Boston Young Men's Christian Association Building	312-320 Huntington Ave	NRIND
4	New England Conservatory of Music- Jordan Hall	290 Huntington Ave	NHL, NRIND, PR
5	Symphony Hall	301 Massachusetts Ave	NHL, NRIND, PR
6	Fannie M. Blanchard Lodging House	16 Greenwich Pk	LHD, NRDIS, PR
7	Samuel J. Tuttle – Patrick J. Grasby House	556 Columbus Ave	LHD, NRDIS, PR
8	Leroy Jackson House	24 Claremont Pk	LHD, NRDIS, PR
9	Street Clock	333 Massachusetts Ave	LL

Designation Legend:

LHD	Local Historic District Property
LL	Local Landmark
NHL	National Historic Landmark
NRDIS	National Register Historic District
NRIND	National Register Individual Property
PR	Preservation Restriction

6.1.3 Archaeological Resources within the Project Site

A review of the MHC's online archaeological base maps conducted on June 8, 2020 revealed no known recorded archaeological sites within the Project Site. Previous ground disturbance activities and other improvements have likely limited the potential for the Project Site to yield significant archaeological resources.

6.2 Impacts to Historic Resources

Potential urban design, shadow, and wind impacts of the new construction on nearby historic resources were considered and are summarized below.

6.2.1 Demolition of Existing Buildings

The Midtown Hotel at 220 Huntington Avenue (1960-1961) and the residential property at 1 Cumberland Street (1888) will be demolished. Because the Project will involve the demolition of structures 50 years or older, the demolition of the structures on the Project Site are subject to review by the Boston Landmarks Commission (BLC) under Article 85 (Demolition Delay Review) of the Boston Zoning Code. The Project Proponent and team members have met with the BLC staff. At the appropriate time the Proponent will file the required Article 85 application with the BLC to initiate the review.

6.2.2 Urban Design

The Project Site is prominently located on Huntington Avenue with direct frontage onto the Christian Science Center Plaza. The new ten-story building will replace aging low-scale buildings with high-quality new construction designed to be a beacon at the southern edge of the Christian Science Center Plaza. The building will feature approximately 17,000 square feet of ground level retail/restaurant space. The upper floors will contain 325 residential rental units. Below grade parking will be located under the building.

The proposed building is complementary in height and design to the existing neighborhood character and will reinforce and enhance the Huntington Avenue streetscape. The immediate area is defined by a 12-story mid-rise residential building to the east and a five-story mixed use building to the west. The Project Site is primarily defined by its frontage onto the Christian Science Plaza to the north. As designed, the exterior of the building will use the same material palette as the Christian Science Center, with visual interest provided through repetition of light and shadow. The bold and simple aesthetic reflects the structures that compose the edges of the Christian Science Center Plaza. The building will feature continuous mid-rise portions along Huntington Avenue approximately aligning with the mid-rise apartment building to the east across Cumberland Street, with a series of lower five-story sections which align with the adjacent building to the west. The proposed height acts as a continuation of the street wall condition which further reinforces the building's contribution to the original Christian Science master plan.

Ground level storefronts along Huntington Avenue will replace the existing brick enclosure wall and garage entries at street level, activating the public realm and reinforcing the urban fabric of the neighborhood. The Project will also include improvements to the Huntington Avenue and Cumberland Street intersection and adjacent sidewalks to improve the pedestrian and bike experience at the site perimeter.

6.2.3 Shadow Impacts

Shadow impact analyses were conducted to investigate shadow impacts from the Project during three periods (9:00 a.m., 12:00 noon, and 3:00 p.m.) during the vernal equinox (March 21), summer solstice (June 21), autumnal equinox (September 21), and winter solstice (December 21). In addition, shadow studies were conducted for the 6:00 p.m. period during the summer solstice and autumnal equinox.

As discussed in Section 3.2, the shadow analysis for the Project demonstrates that net new shadow will primarily be limited to the Project Site's immediate surroundings. Minimal new shadow will be cast onto a portion of the surrounding open space along the Christian Science Plaza and the Reflecting Pool and south and east onto abutting properties. The as-of-right building's design was developed to mitigate shadow impacts to the greatest extent possible in a dense urban environment. The results of these shadow studies are included in Section 3.2 and shown in Figures 3.2-1 to 3.2-14.

6.2.4 Wind Impacts

Pedestrian wind safety and comfort studies demonstrate that the Project will exert no significant wind impacts to surrounding historic resources, including within the Christian Science Center Plaza.

As discussed in Section 3.1, the wind analysis for the Project demonstrates that increases in wind speeds will be limited to areas close to the Project site and conditions are predicted to remain suitable for a pedestrian environment. The results of these wind studies are included in Section 3.1 and shown in Figures 3.1 to 3.3.

Chapter 7

Infrastructure

7.0 INFRASTRUCTURE

7.1 Infrastructure Systems

This section outlines the existing utilities surrounding the Project Site, the connections required to provide service to the Project and any impacts on the existing utility systems that may result from the construction of the Project. The following utility systems are discussed:

- Sewer;
- Domestic water;
- Fire protection;
- Drainage;
- Natural gas;
- Electricity; and
- Telecommunications.

The Project includes the demolition of an existing two-story hotel with one-level of underground parking (220 Huntington Avenue) and a four-story brick apartment building (1 Cumberland Street) and the construction of a new ten-story residential building with retail/restaurant space and underground parking. The approximately 1.5-acre Project Site is comprised of two adjacent parcels located in the Huntington Avenue/Prudential Center Zoning District and is directly across Huntington Avenue from the Christian Science Center plaza, with the Saint Botolph neighborhood directly to the south and the Back Bay neighborhood to the north. The Project Site is generally bounded by Huntington Avenue to the northwest, Cumberland Street to the northeast, Public Alley #404 to the southeast and the five-story mixed-use building located at 236 Huntington Avenue to the southwest.

The existing infrastructure systems included in this section are those owned by the Boston Water and Sewer Commission (BWSC), Massachusetts Water Resources Authority (MWRA) and private utility companies. The area included in the analyses are of the proposed building and the portions of Huntington Avenue, Cumberland Street and Public Alley #404 adjacent to the Project Site. The Project is well-served by existing infrastructure systems and based on initial investigations it is expected that existing infrastructure systems are adequately sized to accept the demand associated with the development and operation of the Project. The Project team will work with the utility companies who own and manage the infrastructure discussed herein to ensure sufficient infrastructure capacity and minimize impacts due to the Project.

7.2 Wastewater Infrastructure

7.2.1 Existing Sewer System

The BWSC owns and maintains the sewer system that services the City of Boston. The BWSC sewer system connects to the MWRA interceptors for conveyance, treatment, and disposal through the MWRA Deer Island Wastewater Treatment Plant.

Public Alley #404

There is an existing 10-inch BWSC sanitary sewer main in Public Alley #404 which flows northeasterly to the 24-inch combined sewer main in Cumberland Street.

Cumberland Street

There is an 18-inch combined sewer main in Cumberland Street. There are conflicting record plans showing this main may be a 24-inch pipe. To be conservative, the capacity calculations in Table 7-1 assume the smaller, 18-inch pipe. This pipe flows northwesterly to a 21-inch combined sewer main in Huntington Avenue just north of the Project Site.

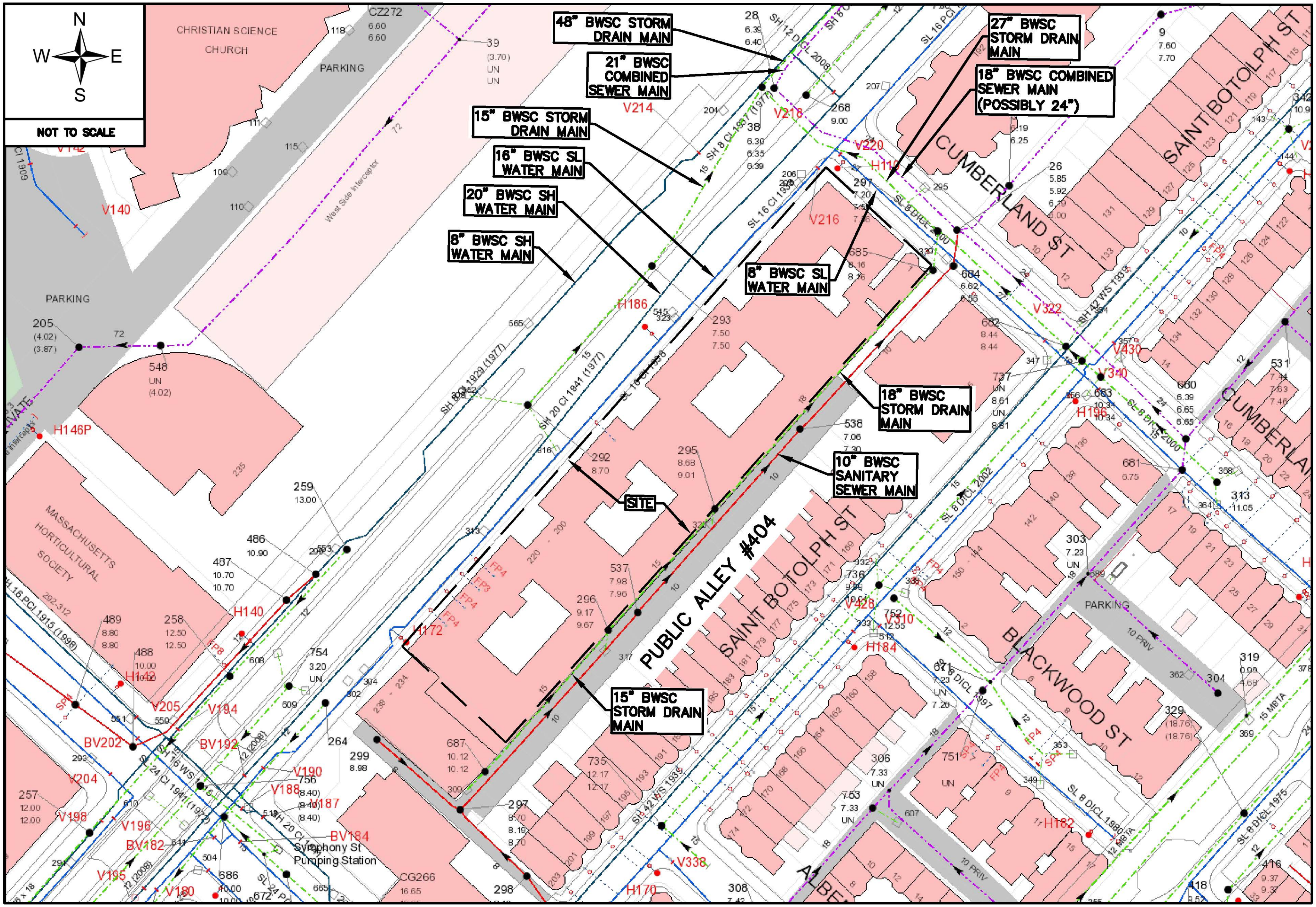
From Cumberland Street, the 18-inch combined sewer main flows easterly in Huntington Avenue to Belvidere Street, where it turns and flows north, increasing to a 24-inch combined sewer main, and then increases to a 27-inch combined sewer main. The 27-inch combined sewer main in Belvidere Street connects to the West Side Interceptor in Dalton Street and is ultimately directed to the MWRA's Deer Island Wastewater Treatment Plan. During times of high flows, the combined sewer main discharges to the Charles River via the combined sewer outfall. The existing BWSC sewer system is shown in Figure 7-1.

Record plans indicate that there are existing building sewer services that connect to the 10-in BWSC sewer main in Public Alley #404.

7.2.2 Wastewater Generation

The Project Site's existing and proposed sewage generation rates were estimated using Massachusetts Department of Environmental Protection 310 CMR 15.00 values based on the existing and proposed programs. 310 CMR 15.00 lists typical sewage generation values by building use and are conservative values for estimating the sewage flows from new construction. The 310 CMR 15.00 values are used to evaluate the approximate increase in sewer flows due to the Project. The estimated sewage flows are shown in Table 7-1.

The existing hotel has 159 rooms and the existing four-story apartment building has eight bedrooms. The estimated existing sewage flow is 18,370 gallons per day (gpd.)



220 Huntington Avenue Boston, Massachusetts

Nitsch Engineering

Figure 7-1

Existing BWSC Systems

The Project will consist of a new building with 445 bedrooms in 325 units as well as approximately 17,000 square feet of retail/restaurant space. The estimated proposed sewage flows are 58,855 gpd, or an increase of 40,485, gpd compared to the existing condition. This Project will result in a net increase in flows of greater than 15,000 gpd, and will therefore be required to contribute an Inflow and Infiltration (I/I) fee to BWSC. The sewer flows indicated in this document will be modified as the Project progresses. This fee will be finalized during the BWSC site plan review process based on the building program at that time. The Project will comply with the BWSC 4:1 I/I mitigation program.

Table 7-1 Proposed Project Wastewater Generation *

Use	Size/Unit	310 CMR Value (gpd/unit)	Total Flow (gpd)
Existing Building (using average 310 CMR values)			
Hotel	159 rooms	110/ bedroom	17,490
Residential (1 Cumberland)	8 bedrooms	110/bedroom	880
		Total Existing Sewer Flows	18,370
Proposed Building (using average 310 CMR values)			
Residential	445 bedrooms	110/bedroom	48,950
Restaurant/Retail*	17,000 square feet approximately 283 seats	35/seat	9,905
*Although the retail/restaurant space is anticipated to be 17,000 square feet, the breakdown of retail and restaurant has not been definitively determined. To be conservative for purposes of the analysis, the entire 17,000 sf has been analyzed as restaurant use because restaurant use is a higher sewage generator than retail use.			
		Total Proposed Sewer Flows	58,855

Increase in Sewer Flows (gpd):	40,485

7.2.3 Sewage Capacity and Impacts

The Project's impact on the existing BWSC system in Public Alley #404 was analyzed. The existing sewer system capacity calculations are presented in Table 7-2.

Table 7-2 Sewer Hydraulic Capacity Analysis

Manhole (BWSC Number)[1]	Distance	Invert Elevation (Up)	Invert Elevation (Down)	Slope (%)	Diameter (inches)	Manning's Number	Flow Capacity (cfs)[2]	Flow Capacity (MGD)
Public Alley #404								
297 to 537	211	8.19	7.98	0.1%	10	0.013	0.69	0.45
537 to 538	196	7.96	7.30	0.3%	10	0.013	1.27	0.82
538 to 684	194	7.06	6.62	0.2%	10	0.013	1.04	0.67
684 to 26	18	6.56	6.00	3.1%	10	0.013	3.86	2.50
						Minimum Flow Analyzed	0.69	0.45
Cumberland Street								
26 to 28	192	5.85	5.65	0.1%[3]	18[4]	0.013	3.39	2.19
						Minimum Flow Analyzed	3.39	2.19

Note: 1. Manhole numbers taken from BWSC Sewer System GIS Map.
2. Flow calculations based on Manning Equation.
3. Conservative slope of 0.1 assumed for sections where records indicate it is flowing backwards.
4. Conflicting record plans indicate the pipe is either 18-inch or 24-inch. 18-inch was used to be conservative.

Table 7-2 indicates the flow (hydraulic) capacity of the 10-inch sewer main in Public Alley #404 and the 18-inch combined sewer main in Cumberland Street. The minimum hydraulic flow capacity is 0.45 million gallons per day (MGD) or 0.69 cubic feet per second (cfs) for the 10-inch main in Public Alley #404 and 3.39 MGD or 2.19 cfs for the 18-inch combined sewer main in Cumberland Street.

Based on an average daily flow estimate for the Project of 58,855 gpd or 0.058 MGD, an increase of 40,485 gpd or 0.040 MGD from the existing building, and with a factor of safety of 10 (total estimate = 0.058 MGD x 10 = 0.58 MGD), no capacity problems are expected. Design of the sanitary sewer connections will be coordinated with BWSC during the permitting phase and will not negatively impact the capacity of any of the sewer mains in the adjacent roadways.

7.2.4 Proposed Conditions

The Proponent will coordinate with the BWSC on the design and capacity of the proposed connections to the sewer system. The Project is expected to generate an increase in wastewater flows of approximately 40,485 gpd. Approval for the increase in sanitary flow will come from BWSC.

The Project will require new building sewer services. The new sewer services for the Project will connect to the existing BWSC sewer main in Public Alley #404. The existing building sewer services will be cut and capped at the main and abandoned or removed as required.

Improvements and connections to BWSC infrastructure will be reviewed as part of the BWSC's Site Plan Review process for the Project. This process will include a comprehensive design review of the proposed service connections, an assessment of Project demands and system capacity, and the establishment of service accounts.

7.3 Water Infrastructure

7.3.1 Existing Water System

Water for the Project will be provided by BWSC. BWSC is supplied water by the MWRA system.

There are six water systems within the City of Boston, and these provide service to portions of the City based on ground surface elevation. The six systems are the southern low (SL), southern high (SH), southern extra high (SEH), northern low (NL), northern high (NH), and high-pressure fire service. Water mains are labeled by their system, pipe size, year installed, pipe material, and year cement lined (CL), if applicable. There are existing BWSC water mains adjacent to the Project Site:

- 8-inch cement lined ductile iron SL water main installed in 2000 (SL 8 DICL 2000) in Cumberland Street;
- 16-inch cast iron SL water main installed in 1938 (SL 16 CI 1938) in Huntington Avenue;
- 20-inch cast iron SH water main installed in 1941, and relined in 1977, in Huntington Avenue; and
- 8-inch cast iron SH water main installed in 1929, and relined in 1977, in Huntington Avenue.

The existing BWSC water system is shown in Figure 7-1.

Record Drawings indicates that the existing motel building has water services that connect to the 16-inch SL water main in Huntington Avenue. The existing four-story apartment building has a water service that connects to the 8-inch SL water main in Cumberland Street.

7.3.2 Anticipated Water Consumption

The Project's water demand estimate for the domestic services is based on the Project's estimated sewage generation, described in the previous section. A conservative factor of 1.1 (10%) is applied to the estimated average daily sewage flows calculated with 310 CMR 15.00 values, as shown in Table 7-1, to account for consumption, system losses, and other usages to estimate an average daily water demand. The Project's estimated existing domestic water demand is approximately 20,207 gpd. The Project's estimated domestic water demand is approximately 64,741 gpd, or an increase of approximately 44,534 gpd compared to the existing condition. The water for the Project will be supplied by the BWSC systems in Huntington Avenue and/or Cumberland Street.

7.3.3 Existing Water Capacity

BWSC record flow test data containing actual flow and pressure for hydrants within the vicinity of the Project Site was requested by the Proponent. Hydrant flow data was available. The hydrant flow data is shown in Table 7-3.

Table 7-3 Existing Hydrant Flow Data

Flow Hydrant Number	Date of Test	Static Pressure (psi)	Residual Pressure (psi)	Total Flow (gpm)
H110 (SL 8 DICL 2000)	02/04/2020	76	72	2,004
H142 (SH 16 PCI 1915 (1998)	02/04/2020	108	104	2,456
H112 (SL 12 DICL 1977 in St. Stephen Street)	11/25/2019	76	72	2,004
H136 SL 16 CI 1941 (1977)	08/27/2019	73	71	1,418

As the design progresses, if necessary, the Proponent will request hydrant flows be conducted by BWSC adjacent to the Project, as hydrant flow test data must be less than one-year old when used for design. Water capacity problems are not anticipated within the system as a result of the Project's construction.

7.3.4 Proposed Water Improvements

The proposed Project will require new domestic water and fire protection services. The domestic water and fire protection services will connect to the existing BWSC water mains in Huntington Avenue and/or Cumberland Street. The water services for the existing building will be cut and capped at the mains.

The proposed Project's impact to the existing water system will be reviewed as part of the BWSC's Site Plan Review process.

The domestic water and fire protection service connections required for the Project will meet the applicable City and State codes and standards, including cross-connection backflow prevention. Compliance with the standards for the domestic water system service connection will be reviewed as part of BWSC's Site Plan Review Process. This review will include sizing of domestic water and fire protection services, calculation of meter sizing, backflow prevention design, and location of hydrants and siamese connections that conform to BWSC and Boston Fire Department requirements.

Efforts to reduce water consumption will be made. Aeration fixtures and appliances will be chosen for water conservation qualities. In public areas, sensor operated faucets and toilets will be installed.

New water services will be installed in accordance with the latest local, state, and federal codes and standards. Backflow preventers will be installed at both domestic and fire protection service connections. New meters will be installed with Meter Transmitter Units (MTU's) as part of the BWSC's Automatic Meter Reading (AMR) system.

7.4 Storm Drainage Infrastructure

7.4.1 Existing Storm Drainage System

There are existing BWSC storm drain mains in Huntington Avenue, Cumberland Street, and Public Alley #404 adjacent to the Project Site.

Public Alley #404

There is a 15-inch BWSC storm drain main in Cumberland Street which flows northeasterly, increases to an 18-inch BWSC storm drain main and connects to a 27-inch BWSC storm drain main in Cumberland Street.

Cumberland Street

There is a 27-inch BWSC storm drain main in Cumberland Street which flows northwesterly and connects to the BWSC 48-inch storm drain main in Huntington Avenue.

Huntington Avenue

There is a 15-inch BWSC storm drain main in Huntington Avenue which flows northeasterly and increases to a 48-inch BWSC storm drain main which flows northeasterly.

The 48-inch BWSC storm drain main in Huntington Avenue continues flowing east to Belvidere Street, where it turns and flows north, increasing to a 54-inch storm drain main. The 54-inch storm drain main connects to the West Side Interceptor in Dalton Street and is ultimately directed to the MWRA's Deer Island Wastewater Treatment Plan via the West Side Interceptor. During times of high flows, the West Side Interceptor discharges to the Charles River via the combined sewer outfall.

The existing BWSC Storm Drainage System is shown in Figure 7-1.

The existing Project Site is comprised of building roof with paved walkways and landscape planter beds above the underground garage and is nearly 100% impervious. Stormwater runoff from the existing hotel building appears to be collected and directed to the BWSC 15-inch and 18-inch storm drain mains in Public Alley #404. Stormwater runoff from the existing four-story apartment building appears to sheet flow to Cumberland Street and/or Public Alley #404. Stormwater runoff from the surrounding City of Boston sidewalks sheet flow to the catch basins in the roadways.

The Project Site is not located in a FEMA Floodplain. Only a very small portion of the Project Site at the corner of Cumberland Street and Public Alley #404 is located in BPDA Sea Level Rise – Flood Hazard Area, with a Base Flood Elevation of 18.0 feet BCB.

7.4.2 Proposed Drainage Improvements

The Project Site will be comprised of building roof and paved areas. The Project will evaluate methods to incorporate landscape and permeable areas to reduce impervious area. The Project will be designed to meet or reduce stormwater runoff peak rates and volumes of stormwater runoff from the Project Site compared to the existing condition.

The BPDA oversees the Smart Utility Policy for Article 80 Development Review. Since the Project is above the threshold criteria of having at or above 100,00 square feet of floor area, the Project is required through the use of Green Infrastructure to retain, on site, a volume of runoff equal to 1.25-inches of rainfall across the portion of impervious area on Project Site.

The Project will promote runoff recharge to minimize the loss of annual stormwater recharge to groundwater. The Project Site is located in the Boston GCOD, Article 32 of the Boston Zoning Code. Article 32 requires that 1-inch of stormwater over the entire impervious area of the Project Site be recharged into the ground. The stormwater management system for the new building will be designed to capture, store, and infiltrate 1.25-inches of runoff over the impervious Project Site area to recharge groundwater, meeting BWSC and BPDA requirements.

The Project's design will include a private closed drainage system that will be adequately sized for the Project Site's expected stormwater flows. The proposed Project Site will be mostly building roof, and due to space constraints, runoff will be directed to interior stormwater storage tanks designed to hold 1.25-inches of the impervious Project Site area. From the storage tanks, runoff will be directed to groundwater recharge wells around the exterior of the building, designed to infiltrate the 1.25-inch volume within 72-hours. Overflow connections to the BWSC storm drain mains from the groundwater recharge wells and the storage tanks will be provided for larger storm events.

The Project will evaluate ways to incorporate green infrastructure into the Project, such as permeable pavers or street trees in the furnishing zones of the adjacent sidewalks.

Improvements to the BWSC infrastructure will be reviewed as part of the BWSC's Site Plan Review Process. The process will include a comprehensive design review of the proposed service connections, and assessment of Project demands and system capacity.

All necessary dewatering will be conducted in accordance with applicable MWRA and BWSC discharge permits. Once construction is complete, the Project will be in compliance with local and state stormwater management policies, as described below.

7.4.3 Water Quality Impacts

The Project will not affect the water quality of nearby water bodies. Erosion and sediment control measures will be implemented during construction to minimize the transport of Project Site soils to off-site areas and BWSC storm drain systems. During construction, existing catch basins will be protected with filter fabric, straw bales and/or crushed stone, to provide for sediment removal from runoff. These controls will be inspected and maintained throughout the construction phase until the areas of disturbance have been stabilized through the placement of pavement or structure.

The existing Project Site does not provide treatment of stormwater prior to discharge to the BWSC systems. The Project Site will be designed to treat stormwater by capturing runoff on the building roof and directing it to the groundwater recharge wells. The proposed stormwater design will improve water quality by reducing Total Suspended Solids and phosphorus.

As described above, the Project will comply with Article 80 by capturing within a suitably designed system a volume of rainfall on the Project Site equivalent to no less than 1.25 inches across that portion of the surface area of the lot to be occupied by the Project. The Project will result in no negative impact on groundwater levels within the Project Site or adjacent lots, subject to the terms of any (i) dewatering permit or (ii) cooperation agreement entered into by the Proponent and the BPDA, to the extent that such agreement provides standards for groundwater protection during construction.

7.4.4 DEP Stormwater Management Policy Standards

In March 1997, Massachusetts Department of Environmental Protection (MassDEP) adopted a new Stormwater Management Policy to address non-point source pollution. In 1997, MassDEP published the Massachusetts Stormwater Handbook as guidance on the Stormwater Policy, which was revised in February 2008. The Policy prescribes specific stormwater management standards for development projects, including urban pollutant removal criteria for projects that may impact environmental resource areas. Compliance is achieved through the implementation of Best Management Practices (BMPs) in the stormwater management design. The Policy is administered locally pursuant to MGL Ch. 131, s. 40.

A description of the Project's anticipated compliance with the Standards is outlined below:

Standard #1: No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

Compliance: The proposed design will comply with this Standard. The design does not propose new stormwater conveyances and no new untreated stormwater will be directly discharged to, nor will erosion be caused to wetlands or waters of the Commonwealth as a result of stormwater discharges related to the Project.

Standard #2: Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR 10.04.

Compliance: The proposed design will comply with this Standard to the maximum extent practicable. The existing peak discharge rate will be met or will be met or decreased as a result of the improvements associated with the Project.

Standard #3: Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.

Compliance: The Project will comply with this standard to the maximum extent practicable.

Standard #4: Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This Standard is met when:

a) Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;

b) Structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and

c) Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.

Compliance: The proposed design will comply with this standard. Within the Project Site, there will be mostly roof and paved areas. Runoff from paved areas that would contribute unwanted sediments or pollutants to the existing storm drain system will be collected by deep sump, hooded catch basins and conveyed through stormwater systems designed to improve runoff quality before discharging into the BWSC system.

Standard #5: For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable.

If through source control and/or pollution prevention all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt, and stormwater runoff, the Proponent shall use the specific structural stormwater BMPs determined by the Department to be suitable for such uses as provided in the Massachusetts

Stormwater Handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53 and the regulations promulgated thereunder at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.

Compliance: The proposed design will comply with this standard.

Standard #6: Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply, and stormwater discharges near or to any other critical area, require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook. A discharge is near a critical area if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters and Special Resource Waters shall be removed and set back from the receiving water or wetland and receive the highest and best practical method of treatment. A "storm water discharge" as defined in 314 CMR 3.04(2)(a)1 or (b) to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to a Zone I or Zone A are prohibited unless essential to the operation of a public water supply.

Compliance: The Project will comply with this Standard. The Project will not discharge untreated stormwater to a sensitive area or any other area.

Standard #7: A redevelopment Project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment Project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.

Compliance: The Project is a redevelopment. A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural stormwater best management practice requirements of Standards 4, 5, and 6. A redevelopment project must comply with all other requirements of the Stormwater Management Standards and improve existing conditions.

Standard #8: A plan to control construction-related impacts including erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.

Compliance: The Project will comply with this Standard. Sedimentation and erosion controls will be incorporated as part of the design of these projects and employed during construction.

Standard #9: A long-term operation and maintenance (O&M) plan shall be developed and implemented to ensure that stormwater management systems function as designed.

Compliance: The Project will comply with this Standard. An O&M Plan including long-term BMP operation requirements will be prepared for the Project and will assure proper maintenance and functioning of the stormwater management system.

Standard #10: All illicit discharges to the stormwater management system are prohibited.

Compliance: The Project will comply with this Standard. There will be no illicit connections associated with the Project.

7.5 Electrical Systems

Eversource owns the electrical system in the vicinity of the Project Site in Huntington Avenue, Cumberland Street and Public Alley #404 where the existing building services connect. The Proponent will work with Eversource Energy to confirm adequate system capacity as the design is finalized.

7.6 Telecommunications Systems

The Proponent will select private telecommunications companies to provide telephone, cable, and data services. There are several potential candidates with substantial Boston networks capable of providing service. There appears to be existing telecommunications services in Huntington Avenue and Cumberland Street where the existing buildings services connect. Upon selection of a provider or providers, the Proponent will coordinate service connection locations and obtain appropriate approvals.

7.7 Natural Gas System

National Grid owns and maintains the existing gas mains adjacent to the Project Site. There are existing gas mains in Huntington Avenue and Cumberland Street. The existing hotel building has gas services connecting to the main in Huntington Avenue. A gas service for the new building would also connect to the main in Huntington Avenue.

The Proponent will coordinate with National Grid to determine project demands, confirm adequate system capacity and, and establish connection points and requirements.

7.8 Smart Utilities

The BPDA adopted the "Smart Utility Policy for Article 80 Development Review - 2018." The following section summarizes the approach to addressing the City of Boston's Smart Utilities Policy for the Project. The Project has evaluated the applicability and ability to integrate Smart Utility Standards into the new building. The Project Site Utilities Plan is provided as Appendix F.

Green Infrastructure

For all projects at or above 100,000 square feet of floor area, the BPDA, in consultation with the Boston Water and Sewer Commission (BWSC) recommends the use of Green Infrastructure to retain, on site, a volume of runoff equal to 1.25 inches of rainfall times the total impervious area. As described above, the Project will be designed to infiltrate 1.25 inches of storm water runoff from the impervious areas of the Project into the ground to the greatest extent possible. For City of Boston sidewalks, the Project will evaluate the opportunity to add permeable pavers and street trees to reduce impervious area and reduce stormwater runoff.

Adaptive Signal Technologies

The Project proposes as potential mitigation to reconfigure the existing signalized intersection of Huntington Avenue and Cumberland Street to improve network connectivity. As part of upgrading the signalized intersection, the signal system would be interconnected with the City of Boston Traffic Management Center and linked together with any Adaptive Signal System that may be in operation directly proximate to the Project. Other Smart Signal technologies as defined by the policy may include traffic monitoring and detection cameras, pavement or loop sensors and video counting equipment to allow for real-time traffic management.

Streetlight Installation

Huntington Avenue, Cumberland Street and Public Alley #404 sidewalks contain streetlights owned and maintained by the City of Boston Public Works Department (PWD) Street Lighting Division. Streetlight locations will be evaluated as part of the Project for potential relocations or opportunities to keep streetlights in place. New composite pullboxes and street lighting conduit will be installed as required for the Project. Shadow conduit for future fiber optic service will be evaluated as part of the Project. The Proponent will coordinate required improvements to the existing streetlight system with the Public Works Department.

7.9 Utility Protection During Construction

Existing public and private infrastructure located within any public or private rights-of-way shall be protected during construction. The installation of proposed utilities within public ways will be in accordance with the BWSC, Boston Public Works Department, Dig-Safe Program, and applicable utility company requirements.

Specific methods for construction of proposed utilities where they are near or within existing BWSC water, sewer, and drain facilities will be reviewed by the BWSC as part of the Site Plan Review Process. The necessary permits will be obtained before the commencement of work.

The Proponent will continue to work and coordinate with the BWSC and the utility companies to ensure safe and coordinated operations in connection with the Project.

7.10 Conservation of Resources

The State Building Code requires the use of water-conserving fixtures. Water conservation measures such as low-flow toilets and restricted flow faucets will help reduce the domestic water demand on the existing distribution system. The installation of sensor-operated sinks with water conserving aerators and sensor-operated toilets in all non-residential restrooms will be incorporated into the design plans for the Project.

Chapter 8

Coordination with other Governmental Agencies

8.0 COORDINATION WITH OTHER GOVERNMENTAL AGENCIES

8.1 Architectural Access Board Requirements

The Project will obtain the appropriate approvals as required from the Massachusetts Architectural Access Board and the standards of the Americans with Disabilities Act. An Accessibility Checklist and related plans is included in Appendix G.

8.2 Massachusetts Environmental Policy Act (MEPA)

A project is subject to the Massachusetts Environmental Policy Act (MEPA) review when the following two conditions are met: (1) a project is subject to MEPA jurisdiction, and (2) a MEPA review threshold is exceeded. MEPA jurisdiction is not anticipated at this time.

8.3 Massachusetts Historical Commission Review

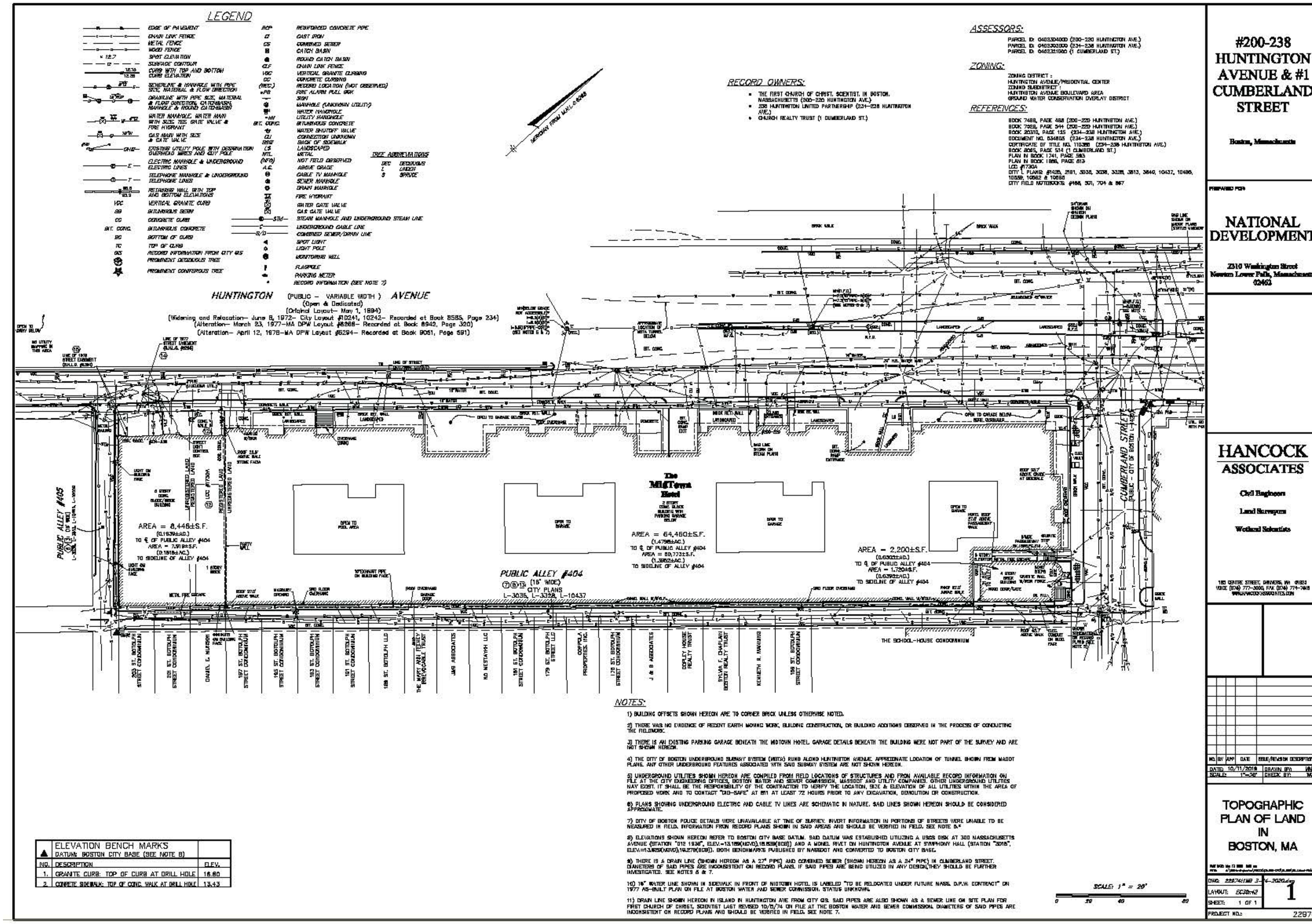
State permits or other state approvals triggering State Register Review (950 CMR 71.00) are not anticipated. In addition, no federal funding, licenses, permits and/or approvals triggering review under Section 106 of the National Historic Preservation Act are anticipated.

8.4 Boston Landmarks Commission Review

The proposed demolition of the existing buildings is subject to BLC's review in accordance with Article 85 of the Boston Zoning Code (Demolition Delay). At the appropriate time, the Proponent will file the required Article 85 application with the BLC. The Proponent will work closely with the BLC staff to fulfill the requirements of the Article 85 review process.

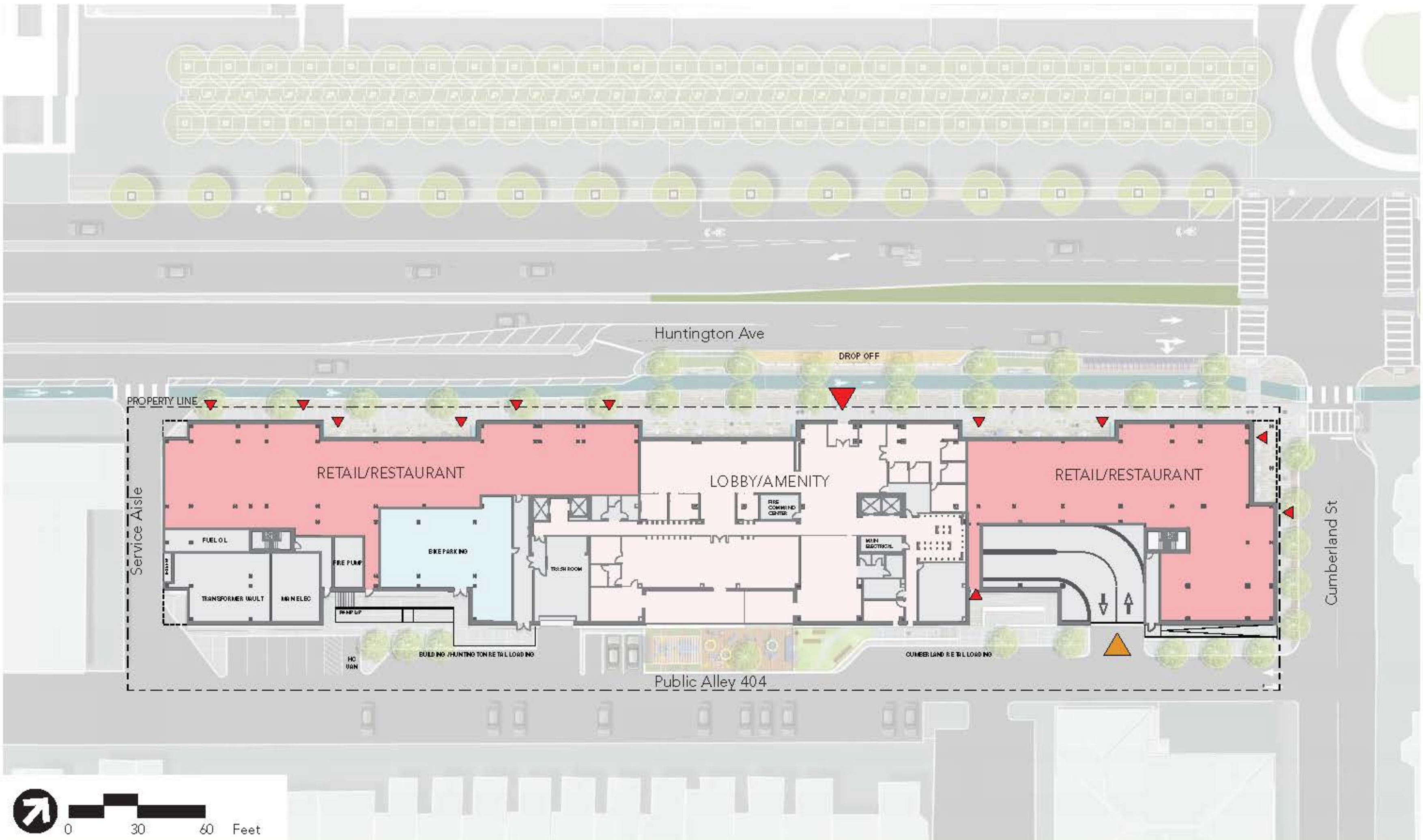
Appendix A

Site Survey


#200-238 HUNTINGTON AVENUE & #1 CUMBERLAND STREET
Boston, Massachusetts
PREPARED FOR
NATIONAL DEVELOPMENT
2310 Washington Street
Newton Lower Falls, Massachusetts 02462
HANCOCK ASSOCIATES
Civil Engineers
Land Surveyors
Wetland Scientists
TOPOGRAPHIC PLAN OF LAND IN BOSTON, MA
LEGEND
ASSESSORS:
ZONING:
RECORD OWNERS:
REFERENCES:
HUNTINGTON (PUBLIC – VARIABLE WIDTH) AVENUE
PUBLIC ALLEY #404
PUBLIC ALLEY #405
CUMBERLAND STREET
THE SCHOOL-HOUSE CONDOMINIUM
ELEVATION BENCH MARKS
DATUM: BOSTON CITY BASE (SEE NOTE 8)
NO. DESCRIPTION ELEV.
1. GRANITE CURB: TOP OF CURB AT DRILL HOLE 16.60
2. CONCRETE SIDEWALK: TOP OF CONC. WALK AT DRILL HOLE 13.43
SCALE: 1" = 20'
NOTES:
1) BUILDING OFFSETS SHOWN HEREON ARE TO CORNER BRICK UNLESS OTHERWISE NOTED.
2) THERE WAS NO EVIDENCE OF RECENT EARTH MOVING WORK, BUILDING CONSTRUCTION, OR BUILDING ADDITIONS OBSERVED IN THE PROCESS OF CONDUCTING THE FIELDWORK.
3) THERE IS AN EXISTING PARKING GARAGE BENEATH THE MIDTOWN HOTEL. GARAGE DETAILS BENEATH THE BUILDING WERE NOT PART OF THE SURVEY AND ARE NOT SHOWN HEREON.
4) THE CITY OF BOSTON UNDERGROUND SUBWAY SYSTEM (MBTA) RUNS ALONG HUNTINGTON AVENUE. APPROXIMATE LOCATION OF TUNNEL SHOWN FROM MADOT PLANS. ANY OTHER UNDERGROUND FEATURES ASSOCIATED WITH SAID SUBWAY SYSTEM ARE NOT SHOWN HEREON.
5) UNDERGROUND UTILITIES SHOWN HEREON ARE COMPILED FROM FIELD LOCATIONS OF STRUCTURES AND FROM AVAILABLE RECORD INFORMATION ON FILE AT THE CITY ENGINEERING OFFICES, BOSTON WATER AND SEWER COMMISSION, MASSDOT AND UTILITY COMPANIES. OTHER UNDERGROUND UTILITIES MAY EXIST. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE LOCATION, SIZE & ELEVATION OF ALL UTILITIES WITHIN THE AREA OF PROPOSED WORK AND TO CONTACT "DIG-SAFE" AT 811 AT LEAST 72 HOURS PRIOR TO ANY EXCAVATION, DEMOLITION OR CONSTRUCTION.
6) PLANS SHOWING UNDERGROUND ELECTRIC AND CABLE TV LINES ARE SCHEMATIC IN NATURE. SAID LINES SHOWN HEREON SHOULD BE CONSIDERED APPROXIMATE.
7) CITY OF BOSTON POLICE DETAILS WERE UNAVAILABLE AT TIME OF SURVEY. INVERT INFORMATION IN PORTIONS OF STREETS WERE UNABLE TO BE MEASURED IN FIELD. INFORMATION FROM RECORD PLANS SHOWN IN SAID AREAS AND SHOULD BE VERIFIED IN FIELD. SEE NOTE 5.
8) ELEVATIONS SHOWN HEREON REFER TO BOSTON CITY BASE DATUM. SAID DATUM WAS ESTABLISHED UTILIZING A USGS DISK AT 300 MASSACHUSETTS AVENUE (STATION "012 1936", ELEV.=13.189(NGVD),18.839(BCB)) AND A MONEL RIVET ON HUNTINGTON AVENUE AT SYMPHONY HALL (STATION "3016", ELEV.=13.629(NGVD),19.279(BCB)). BOTH BENCHMARKS PUBLISHED BY MASSDOT AND CONVERTED TO BOSTON CITY BASE.
9) THERE IS A DRAIN LINE (SHOWN HEREON AS A 27" PIPE) AND COMBINED SEWER (SHOWN HEREON AS A 24" PIPE) IN CUMBERLAND STREET. DIAMETERS OF SAID PIPES ARE INCONSISTENT ON RECORD PLANS. IF SAID PIPES ARE BEING UTILIZED IN ANY DESIGN, THEY SHOULD BE FURTHER INVESTIGATED. SEE NOTES 5 & 7.
10) 16" WATER LINE SHOWN IN SIDEWALK IN FRONT OF MIDTOWN HOTEL IS LABELED "TO BE RELOCATED UNDER FUTURE MASS. D.P.W. CONTRACT" ON 1977 AS-BUILT PLAN ON FILE AT BOSTON WATER AND SEWER COMMISSION. STATUS UNKNOWN.
11) DRAIN LINE SHOWN HEREON IN ISLAND IN HUNTINGTON AVE FROM CITY GIS. SAID PIPES ARE ALSO SHOWN AS A SEWER LINE ON SITE PLAN FOR FIRST CHURCH OF CHRIST, SCIENTIST LAST REVISED 10/5/74 ON FILE AT THE BOSTON WATER AND SEWER COMMISSION. DIAMETERS OF SAID PIPES ARE INCONSISTENT ON RECORD PLANS AND SHOULD BE VERIFIED IN FIELD. SEE NOTE 7.
PROJECT NO.: 22974

Appendix B

Floor Plans and Sections



Primary Building Entry

Parking Entry

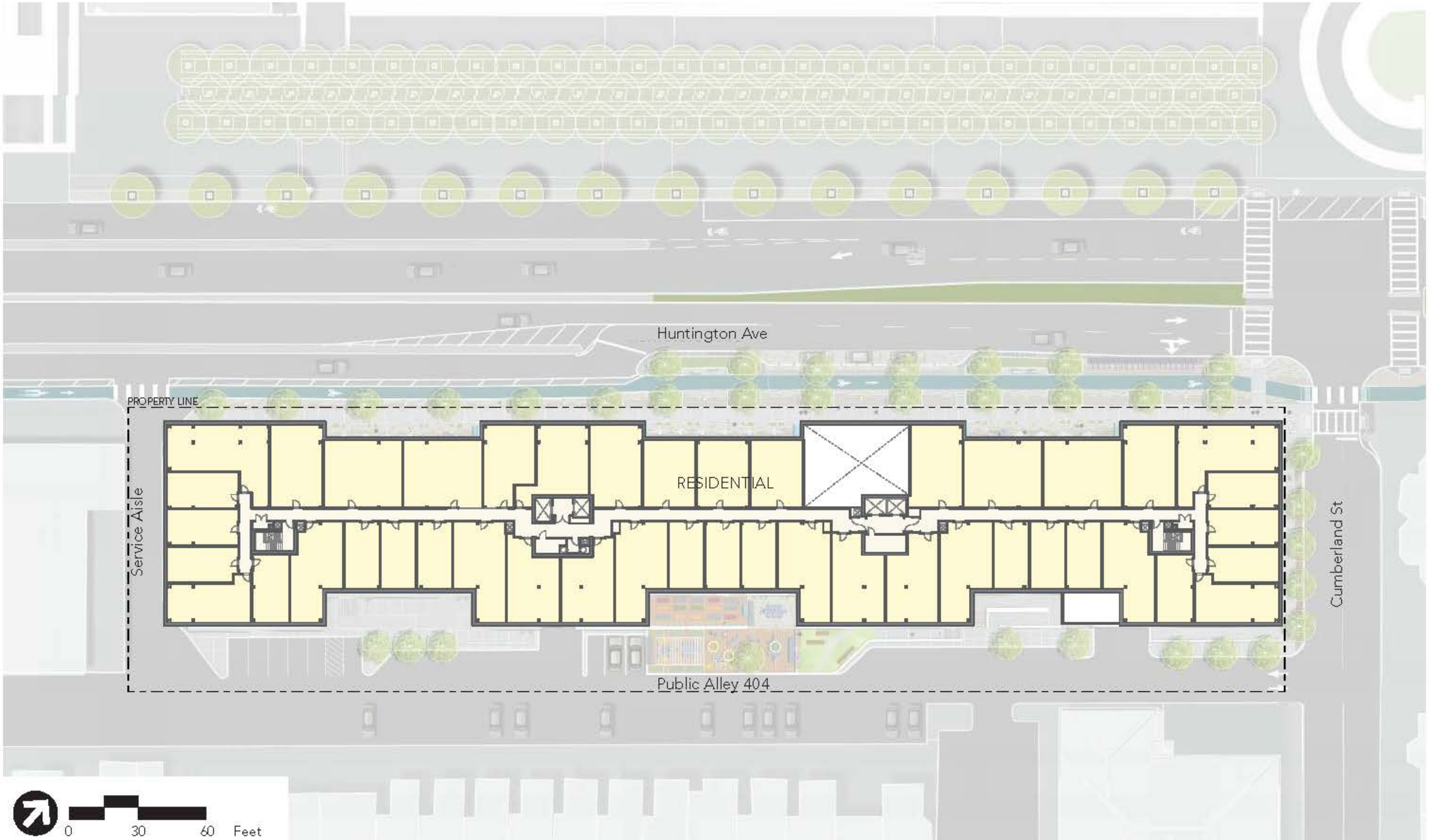
Secondary Building Entry

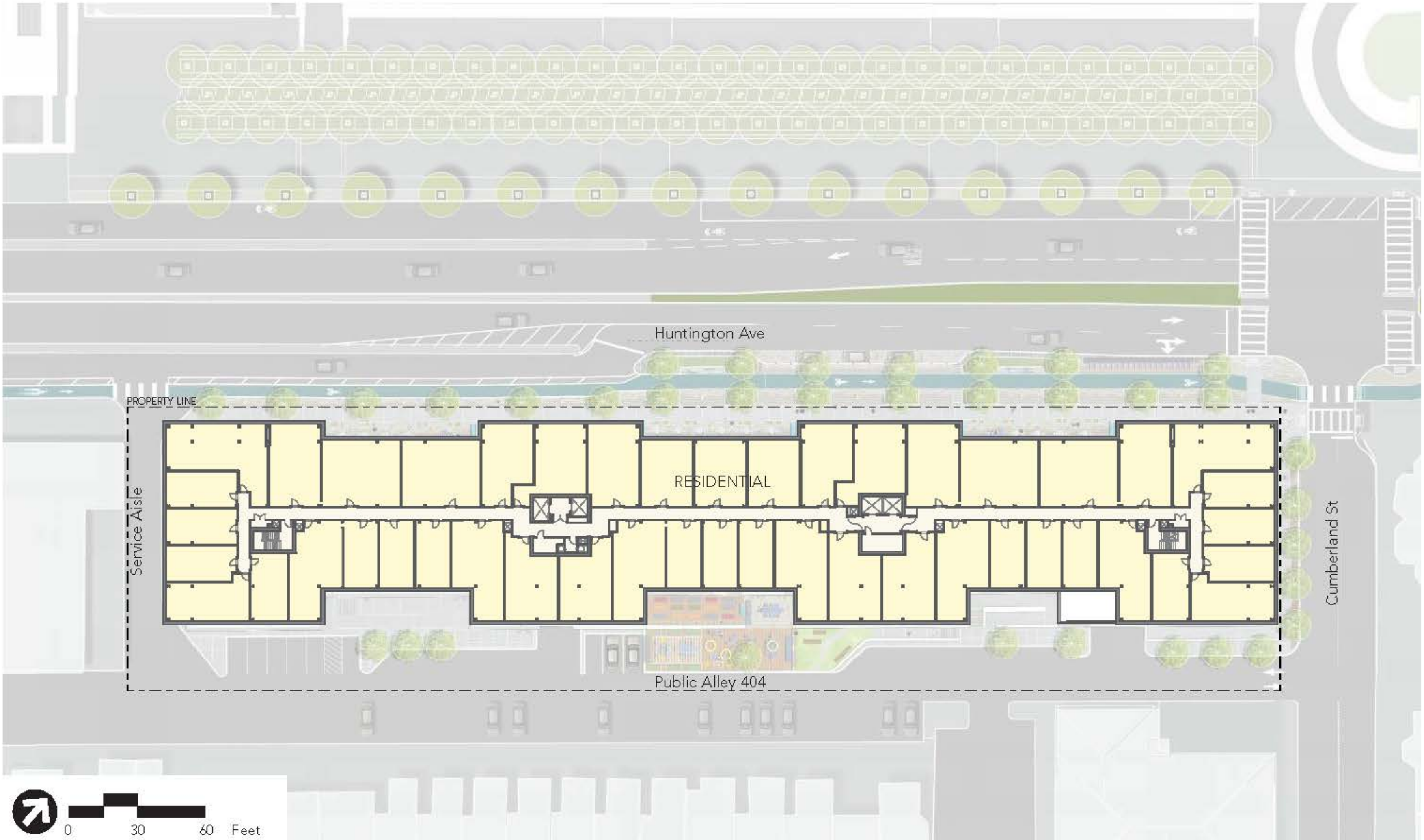
5

220 Huntington Avenue   Boston, Massachusetts

cbt

Ground Floor Plan

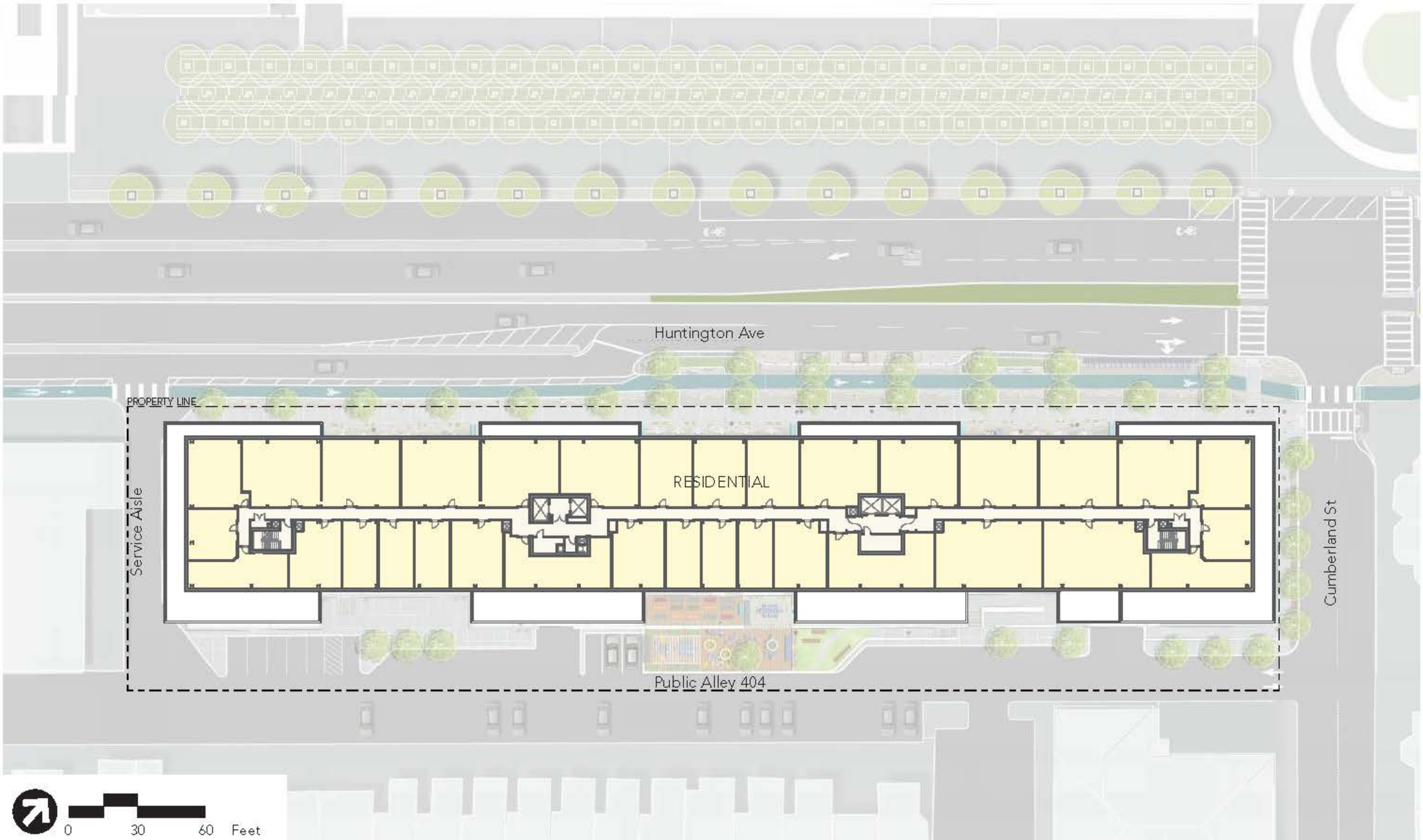

Huntington Ave
PROPERTY LINE
RESIDENTIAL
Service Aisle
Cumberland St
Public Alley 404
0
30
60
Feet

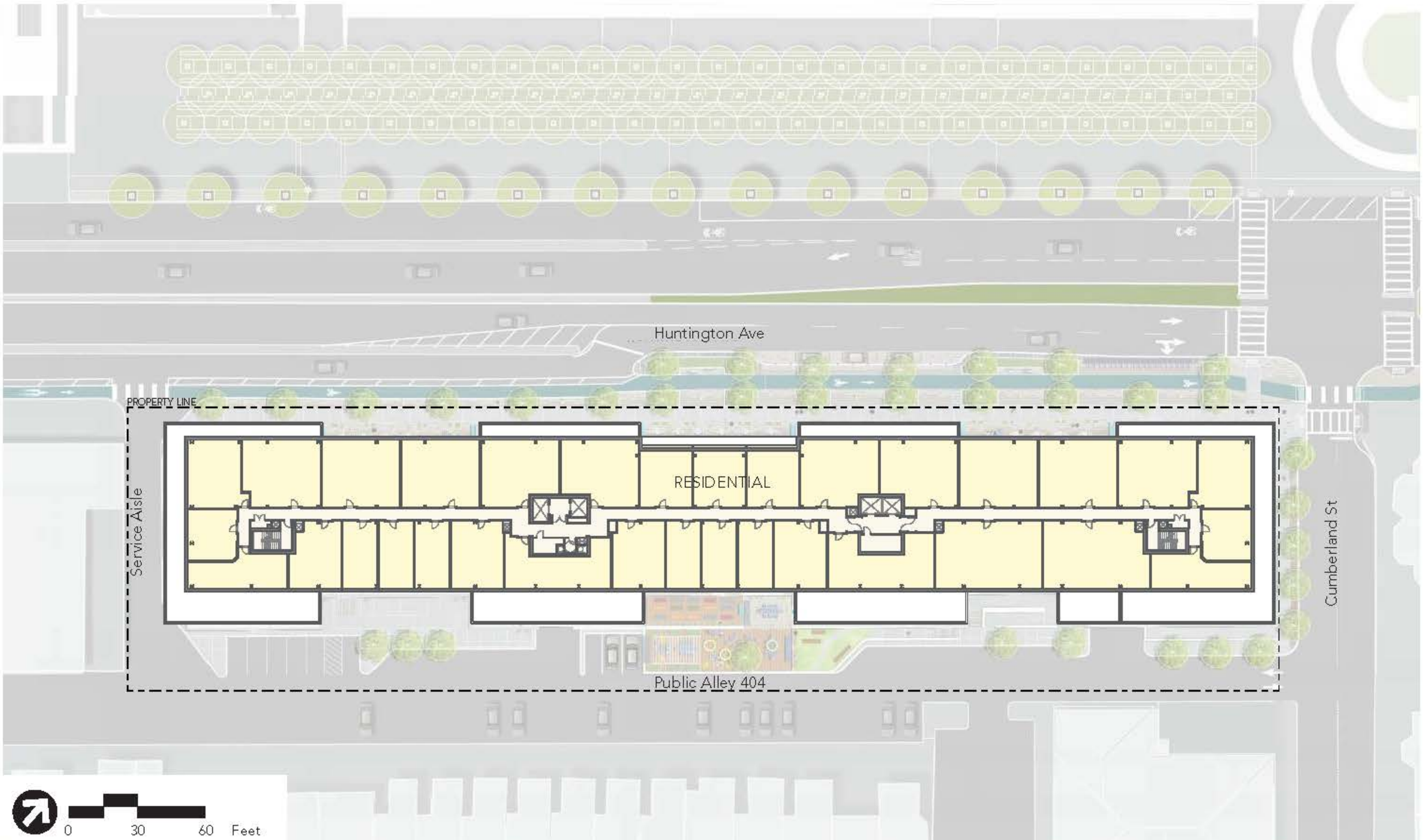


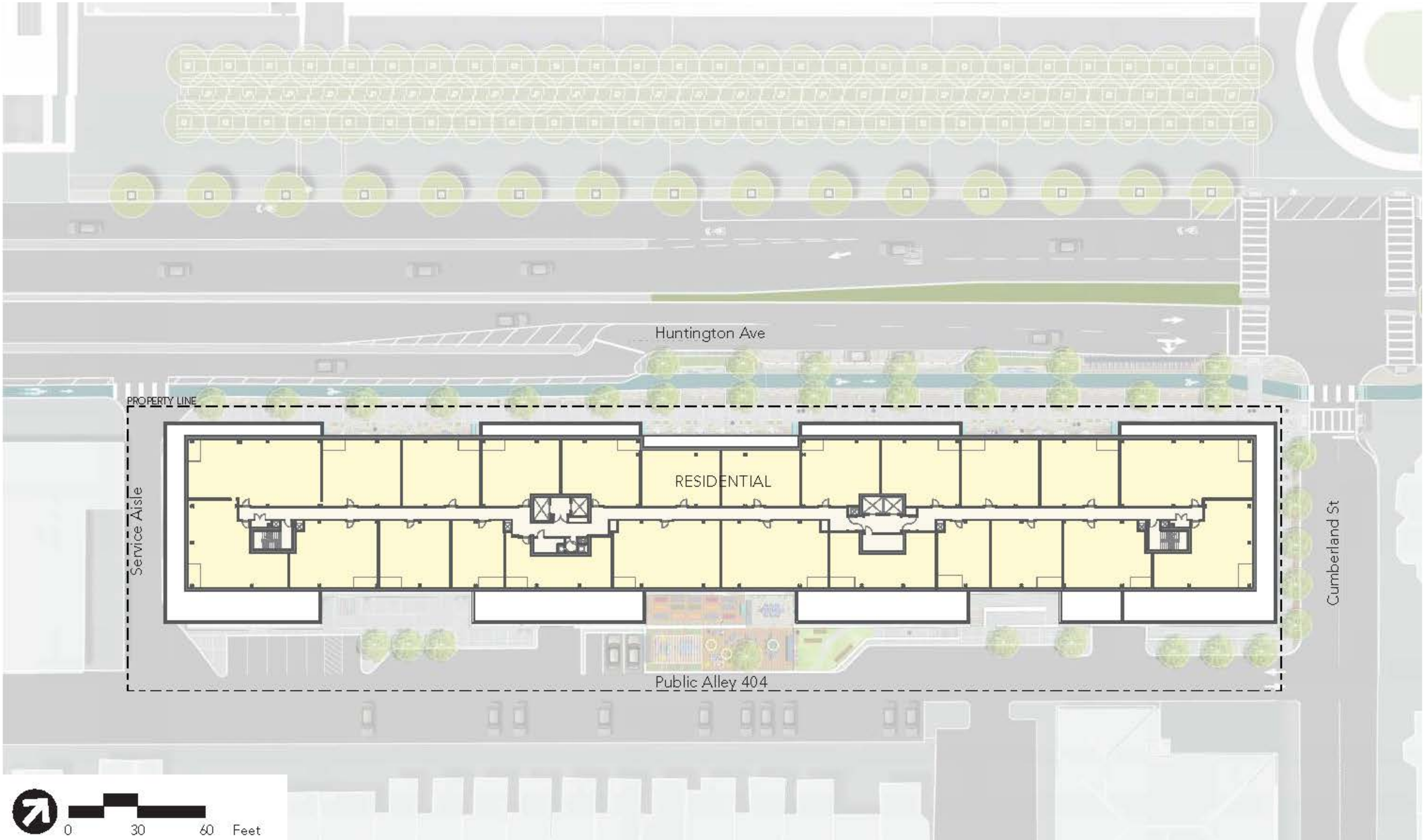
220 Huntington Avenue Boston, Massachusetts

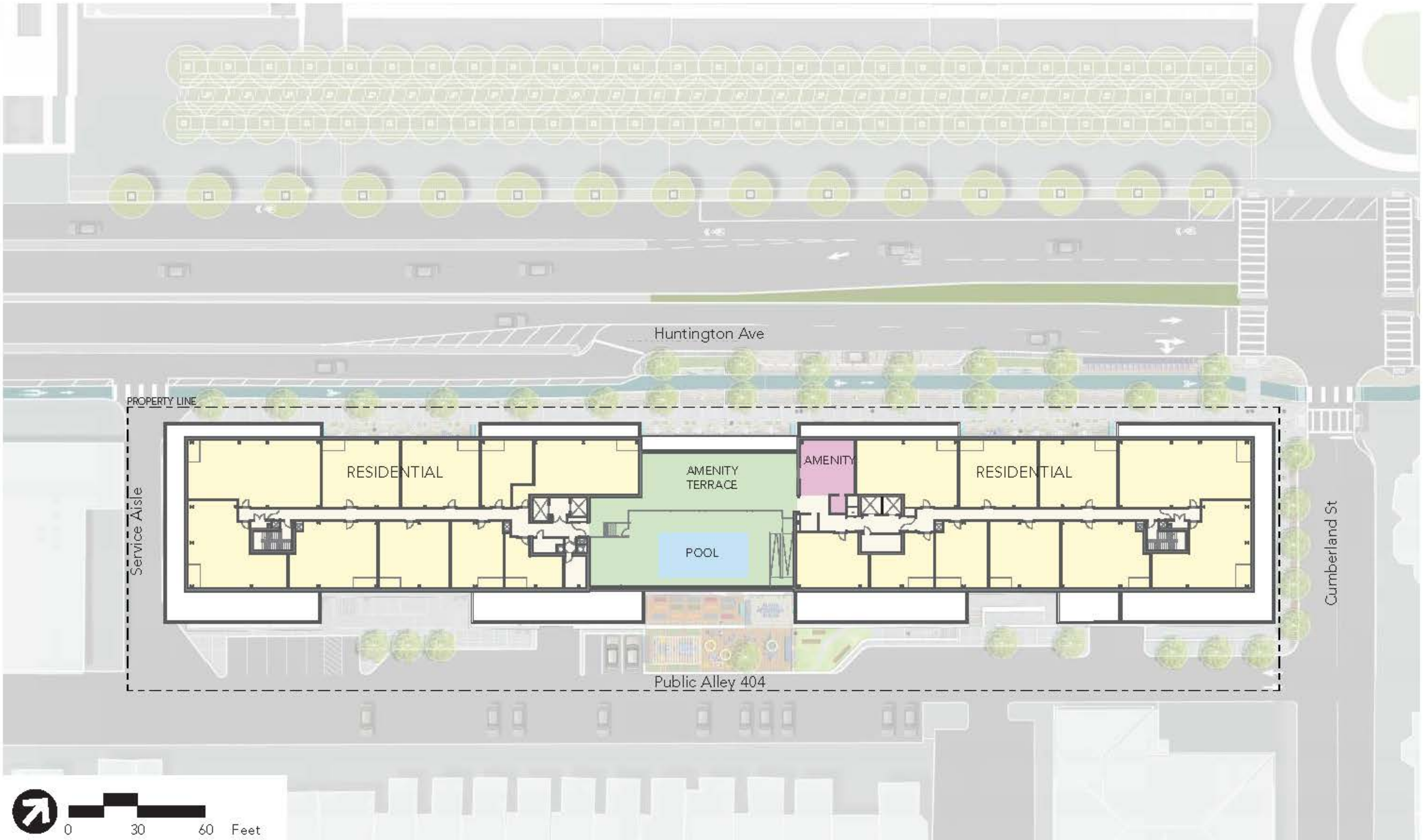
cbt

Third - Fifth Floor Plan

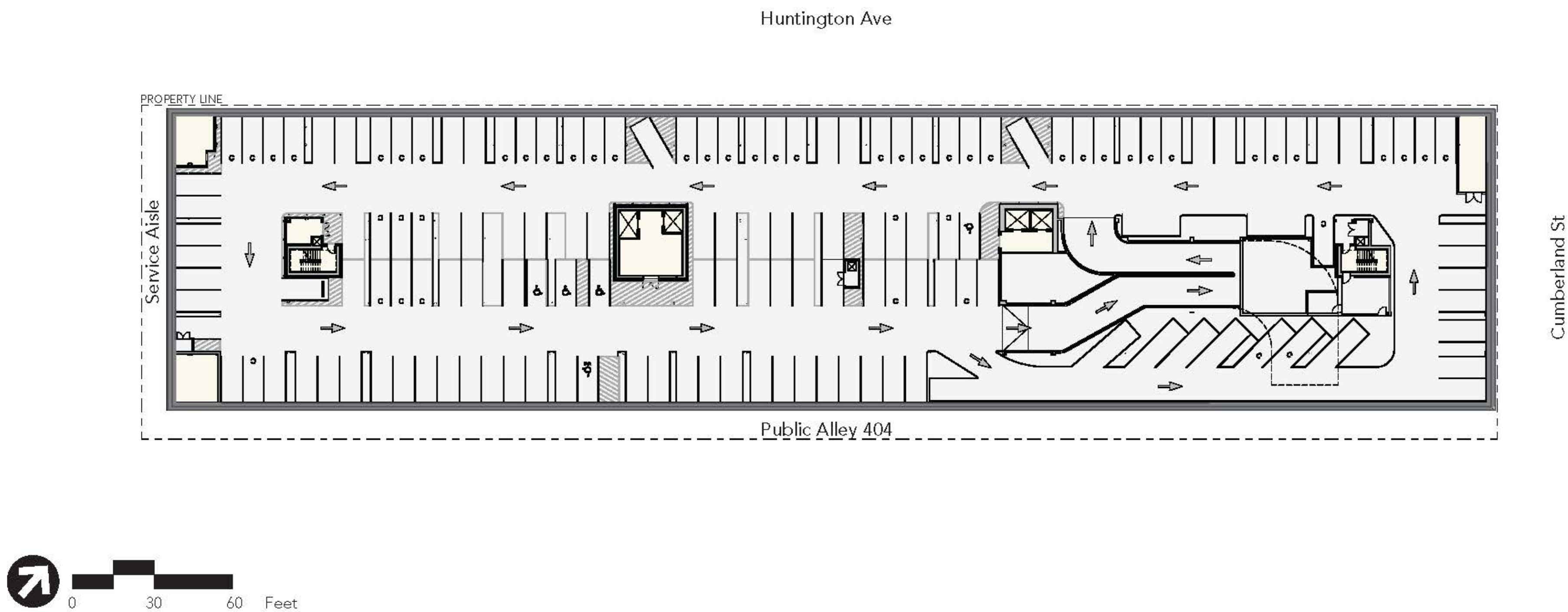

Huntington Ave
PROPERTY LINE
RESIDENTIAL
Service Aisle
Cumberland St
Public Alley 404
0
30
60
Feet


Huntington Ave
PROPERTY LINE
Service Aisle
RESIDENTIAL
Cumberland St
Public Alley 404
0
30
60
Feet

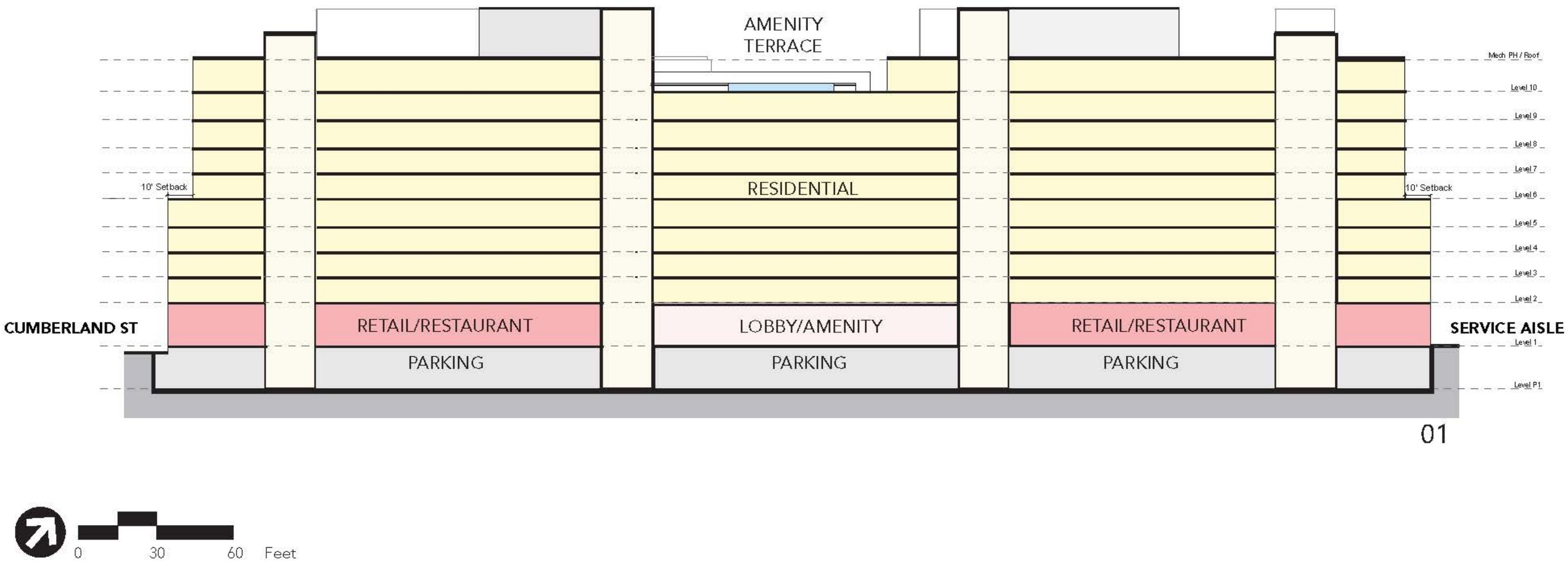

Huntington Ave
PROPERTY LINE
RESIDENTIAL
Service Aisle
Cumberland St
Public Alley 404
0
30
60
Feet



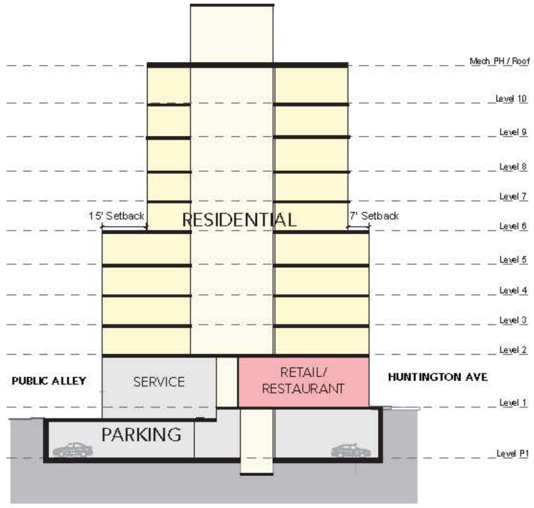
Huntington Ave
PROPERTY LINE
Service Aisle
RESIDENTIAL
AMENITY TERRACE
POOL
AMENITY
RESIDENTIAL
Cumberland St
Public Alley 404
0
30
60
Feet



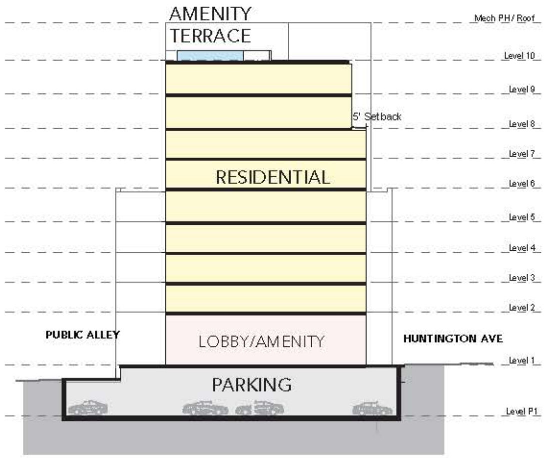
Huntington Ave
PROPERTY LINE
Service Aisle
Cumberland St
Public Alley 404
0
30
60
Feet


AMENITY TERRACE
RESIDENTIAL
Mech PH / Roof
Level 10
Level 9
Level 8
Level 7
10' Setback
10' Setback
Level 6
Level 5
Level 4
Level 3
Level 2
CUMBERLAND ST
RETAIL/RESTAURANT
LOBBY/AMENITY
RETAIL/RESTAURANT
SERVICE AISLE
Level 1
PARKING
PARKING
PARKING
Level P1
01
0
30
60
Feet

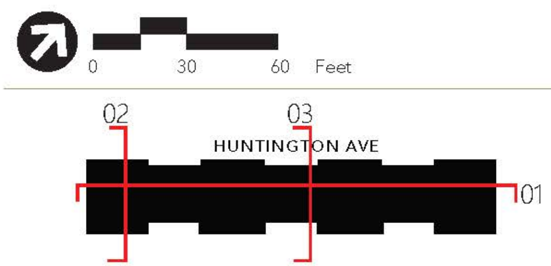

02
03
HUNTINGTON AVE
01


Mech PH / Roof
Level 10
Level 9
Level 8
Level 7
Level 6
Level 5
Level 4
Level 3
Level 2
Level 1
Level P1
15' Setback
7' Setback
RESIDENTIAL
PUBLIC ALLEY
SERVICE
RETAIL/
RESTAURANT
HUNTINGTON AVE
PARKING

02


AMENITY
TERRACE
Mech PH / Roof
Level 10
Level 9
Level 8
Level 7
Level 6
Level 5
Level 4
Level 3
Level 2
Level 1
Level P1
5' Setback
RESIDENTIAL
PUBLIC ALLEY
LOBBY/AMENITY
HUNTINGTON AVE
PARKING

03


0
30
60
Feet
02
03
HUNTINGTON AVE
01

Appendix C

Transportation

Client:	Vannesa Kello
Project #:	505_057_HSH
BTD #:	Location 2
Location:	Back Bay, Boston, MA
Street 1:	Mass Avenue
Street 2:	Huntington Avenue
Count Date:	11/19/2019
Day of Week:	Tuesday
Weather:	Rain, 40°F

BOSTON TRAFFIC DATA
PO BOX 1723, Framingham, MA 01701
Office: 978-746-1259
DataRequest@BostonTrafficData.com
www.BostonTrafficData.com

PASSENGER CARS & HEAVY VEHICLES COMBINED

	Mass Avenue Northbound				Mass Avenue Southbound				Huntington Avenue Eastbound				Huntington Avenue Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
7:00 AM	0	8	121	4	0	1	89	20	0	18	5	11	0	14	8	20
7:15 AM	0	9	133	2	0	1	95	12	1	23	1	8	1	10	6	22
7:30 AM	0	6	132	8	0	1	104	14	1	16	1	11	1	11	3	11
7:45 AM	0	2	146	5	0	1	115	9	3	20	2	19	2	18	4	24
8:00 AM	0	5	138	8	0	1	120	20	4	25	2	10	3	12	2	21
8:15 AM	0	13	158	7	0	0	113	16	1	17	3	16	1	13	7	25
8:30 AM	0	9	145	7	0	0	100	19	2	26	2	17	5	21	1	26
8:45 AM	0	6	177	1	0	1	112	14	3	25	6	9	3	18	8	15

	Mass Avenue Northbound				Mass Avenue Southbound				Huntington Avenue Eastbound				Huntington Avenue Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
4:00 PM	0	12	170	6	0	0	108	20	1	21	7	21	1	22	9	16
4:15 PM	0	11	192	9	0	2	126	14	1	16	4	15	2	23	7	21
4:30 PM	0	24	180	3	0	0	101	23	2	18	3	28	2	20	12	25
4:45 PM	0	16	192	7	0	0	103	17	2	41	2	21	3	29	8	23
5:00 PM	0	16	196	5	0	1	108	20	2	16	6	25	5	30	8	26
5:15 PM	0	15	202	5	0	0	125	23	3	17	3	22	4	21	9	19
5:30 PM	0	22	163	6	0	0	109	18	1	16	6	19	3	28	12	13
5:45 PM	0	17	174	3	0	0	96	30	9	23	7	24	0	30	14	12

AM PEAK HOUR 8:00 AM to 9:00 AM	Mass Avenue Northbound				Mass Avenue Southbound				Huntington Avenue Eastbound				Huntington Avenue Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**33**	**618**	**23**	**0**	**2**	**445**	**69**	**10**	**93**	**13**	**52**	**12**	**64**	**18**	**87**
PHF	**0.92**				**0.91**				**0.89**				**0.85**			
HV %	**0.0%**	**15.2%**	**8.9%**	**17.4%**	**0.0%**	**0.0%**	**12.8%**	**7.2%**	**10.0%**	**7.5%**	**7.7%**	**9.6%**	**0.0%**	**4.7%**	**27.8%**	**14.9%**

PM PEAK HOUR 4:30 PM to 5:30 PM	Mass Avenue Northbound				Mass Avenue Southbound				Huntington Avenue Eastbound				Huntington Avenue Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**71**	**770**	**20**	**0**	**1**	**437**	**83**	**9**	**92**	**14**	**96**	**14**	**100**	**37**	**93**
PHF	**0.97**				**0.88**				**0.80**				**0.88**			
HV %	**0.0%**	**1.4%**	**2.6%**	**0.0%**	**0.0%**	**0.0%**	**6.4%**	**2.4%**	**0.0%**	**4.3%**	**14.3%**	**5.2%**	**21.4%**	**3.0%**	**0.0%**	**0.0%**

Client:	Vannesa Kello
Project #:	505_057_HSH
BTD #:	Location 2
Location:	Back Bay, Boston, MA
Street 1:	Mass Avenue
Street 2:	Huntington Avenue
Count Date:	11/19/2019
Day of Week:	Tuesday
Weather:	Rain, 40°F

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HEAVY VEHICLES

	Mass Avenue Northbound				Mass Avenue Southbound				Huntington Avenue Eastbound				Huntington Avenue Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
7:00 AM	0	2	15	1	0	0	6	0	0	2	2	2	0	2	3	2
7:15 AM	0	1	18	1	0	0	12	0	1	2	0	0	0	4	2	3
7:30 AM	0	0	16	1	0	0	13	0	0	2	1	1	0	2	0	0
7:45 AM	0	1	20	2	0	0	15	0	0	1	1	0	1	4	0	0
8:00 AM	0	0	13	2	0	0	14	3	0	1	0	1	0	1	1	6
8:15 AM	0	3	16	1	0	0	12	1	0	4	0	2	0	1	1	2
8:30 AM	0	2	11	1	0	0	15	0	0	1	1	1	0	1	1	2
8:45 AM	0	0	15	0	0	0	16	1	1	1	0	1	0	0	2	3

	Mass Avenue Northbound				Mass Avenue Southbound				Huntington Avenue Eastbound				Huntington Avenue Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
4:00 PM	0	1	5	0	0	0	6	2	0	0	0	2	0	2	0	0
4:15 PM	0	0	3	1	0	0	7	0	0	0	0	0	1	1	0	0
4:30 PM	0	1	5	0	0	0	6	0	0	0	1	2	0	1	0	0
4:45 PM	0	0	5	0	0	0	8	1	0	2	1	1	0	0	0	0
5:00 PM	0	0	6	0	0	0	8	1	0	1	0	1	2	2	0	0
5:15 PM	0	0	4	0	0	0	6	0	0	1	0	1	1	0	0	0
5:30 PM	0	0	6	0	0	0	9	0	0	1	0	0	0	1	0	0
5:45 PM	0	0	4	0	0	0	4	0	0	0	0	1	0	0	0	1

AM PEAK HOUR 7:15 AM to 8:15 AM	Mass Avenue Northbound				Mass Avenue Southbound				Huntington Avenue Eastbound				Huntington Avenue Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**2**	**67**	**6**	**0**	**0**	**54**	**3**	**1**	**6**	**2**	**2**	**1**	**11**	**3**	**9**
PHF	**0.82**				**0.84**				**0.69**				**0.67**			

PM PEAK HOUR 4:45 PM to 5:45 PM	Mass Avenue Northbound				Mass Avenue Southbound				Huntington Avenue Eastbound				Huntington Avenue Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**0**	**21**	**0**	**0**	**0**	**31**	**2**	**0**	**5**	**1**	**3**	**3**	**3**	**0**	**0**
PHF	**0.88**				**0.92**				**0.56**				**0.38**			

Client:	Vannesa Kello
Project #:	505_057_HSH
BTD #:	Location 2
Location:	Back Bay, Boston, MA
Street 1:	Mass Avenue
Street 2:	Huntington Avenue
Count Date:	11/19/2019
Day of Week:	Tuesday
Weather:	Rain, 40°F

BOSTON
TRAFFIC DATA

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PEDESTRIANS & BICYCLES

	Mass Avenue Northbound					Mass Avenue Southbound					Huntington Avenue Eastbound					Huntington Avenue Westbound				
Start Time	Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED	
7:00 AM	0	4	0	12		0	4	0	5		0	2	0	53		0	1	0	22	
7:15 AM	0	6	0	11		0	1	2	12		0	0	0	74		0	0	0	33	
7:30 AM	0	7	0	16		0	6	0	18		0	0	0	87		1	1	0	43	
7:45 AM	1	6	0	83		0	9	0	14		1	0	0	102		0	0	0	48	
8:00 AM	0	6	0	29		0	4	2	19		1	0	0	85		0	0	0	33	
8:15 AM	0	10	1	38		0	5	2	22		0	0	0	137		0	2	0	49	
8:30 AM	0	15	1	29		0	12	4	34		1	0	0	126		0	2	0	81	
8:45 AM	0	18	0	26		0	10	4	44		5	2	0	138		0	1	0	71	

	Mass Avenue Northbound					Mass Avenue Southbound					Huntington Avenue Eastbound					Huntington Avenue Westbound				
Start Time	Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED	
4:00 PM	0	7	0	38		0	7	1	42		0	2	0	153		0	0	0	102	
4:15 PM	0	12	0	37		0	2	1	68		1	1	0	182		0	1	0	71	
4:30 PM	0	12	0	26		0	8	0	62		0	0	0	199		0	0	0	88	
4:45 PM	0	10	2	16		0	4	0	58		0	0	0	211		0	0	0	46	
5:00 PM	1	11	0	26		0	9	2	84		1	0	0	193		0	1	0	105	
5:15 PM	0	16	1	17		0	8	2	106		0	0	0	277		0	0	0	90	
5:30 PM	0	10	0	17		0	11	3	96		0	0	0	250		0	1	1	113	
5:45 PM	0	7	0	15		0	12	3	54		0	0	0	237		0	1	0	112	

AM PEAK HOUR[1] 8:00 AM to 9:00 AM	Mass Avenue Northbound					Mass Avenue Southbound					Huntington Avenue Eastbound					Huntington Avenue Westbound				
	Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED	
	0	49	2	122		0	31	12	119		7	2	0	486		0	5	0	234	

PM PEAK HOUR[1] 4:30 PM to 5:30 PM	Mass Avenue Northbound					Mass Avenue Southbound					Huntington Avenue Eastbound					Huntington Avenue Westbound				
	Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED	
	1	49	3	85		0	29	4	310		1	0	0	880		0	1	0	329	

[1] *Peak hours corresponds to vehicular peak hours.*

Client:	Vannesa Kello
Project #:	505_057_HSH
BTD #:	Location 3
Location:	Back Bay, Boston, MA
Street 1:	Mass Avenue
Street 2:	St. Botolph Street
Count Date:	11/19/2019
Day of Week:	Tuesday
Weather:	Rain, 40°F

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PASSENGER CARS & HEAVY VEHICLES COMBINED

	Mass Avenue Northbound				Mass Avenue Southbound				St. Botolph Street Eastbound				St. Botolph Street Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
7:00 AM	0	13	125	12	0	1	112	1	0	2	1	11	0	10	1	6
7:15 AM	0	18	139	13	0	3	108	2	0	0	1	7	0	3	3	5
7:30 AM	1	6	141	13	0	1	123	2	0	1	1	3	0	6	7	4
7:45 AM	1	15	148	10	0	3	145	4	0	0	0	1	0	5	2	5
8:00 AM	0	14	134	13	0	7	128	7	0	1	3	9	0	6	9	16
8:15 AM	0	18	167	7	0	5	130	7	0	3	1	6	0	7	8	8
8:30 AM	0	11	148	11	0	7	124	7	0	3	0	9	0	6	3	10
8:45 AM	0	11	172	12	1	6	121	11	0	2	0	9	0	7	2	9

	Mass Avenue Northbound				Mass Avenue Southbound				St. Botolph Street Eastbound				St. Botolph Street Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
4:00 PM	0	6	175	6	0	9	139	3	0	9	1	13	0	10	4	4
4:15 PM	0	20	200	12	0	12	146	6	0	7	5	18	0	11	1	5
4:30 PM	0	9	193	6	0	8	137	4	0	10	3	17	0	5	4	4
4:45 PM	3	10	205	10	0	9	142	2	0	2	4	19	0	7	5	8
5:00 PM	0	14	207	9	0	10	150	3	0	4	3	11	0	11	5	6
5:15 PM	0	10	213	15	0	6	159	3	0	4	5	16	0	8	2	5
5:30 PM	2	12	180	12	0	5	141	10	0	5	5	12	0	5	5	6
5:45 PM	0	16	184	9	0	11	135	4	0	3	4	15	0	7	3	7

AM PEAK HOUR 8:00 AM to 9:00 AM	Mass Avenue Northbound				Mass Avenue Southbound				St. Botolph Street Eastbound				St. Botolph Street Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**54**	**621**	**43**	**1**	**25**	**503**	**32**	**0**	**9**	**4**	**33**	**0**	**26**	**22**	**43**
PHF	**0.92**				**0.99**				**0.88**				**0.73**			
HV %	**0.0%**	**3.7%**	**10.0%**	**4.7%**	**0.0%**	**8.0%**	**12.1%**	**9.4%**	**0.0%**	**11.1%**	**25.0%**	**3.0%**	**0.0%**	**7.7%**	**4.5%**	**0.0%**

PM PEAK HOUR 4:30 PM to 5:30 PM	Mass Avenue Northbound				Mass Avenue Southbound				St. Botolph Street Eastbound				St. Botolph Street Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	3	**43**	**818**	**40**	**0**	**33**	**588**	**12**	**0**	**20**	**15**	**63**	**0**	**31**	**16**	**23**
PHF	**0.95**				**0.94**				**0.82**				**0.80**			
HV %	**0.0%**	**0.0%**	**2.6%**	**0.0%**	**0.0%**	**6.1%**	**6.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**6.3%**	**0.0%**

Client:	Vannesa Kello
Project #:	505_057_HSH
BTD #:	Location 3
Location:	Back Bay, Boston, MA
Street 1:	Mass Avenue
Street 2:	St. Botolph Street
Count Date:	11/19/2019
Day of Week:	Tuesday
Weather:	Rain, 40°F

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HEAVY VEHICLES

	Mass Avenue Northbound				Mass Avenue Southbound				St. Botolph Street Eastbound				St. Botolph Street Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
7:00 AM	0	0	18	0	0	0	10	0	0	0	0	0	0	1	0	0
7:15 AM	0	2	21	2	0	0	16	0	0	0	0	0	0	0	0	0
7:30 AM	0	1	15	1	0	0	17	0	0	0	0	0	0	0	0	1
7:45 AM	0	1	22	0	0	0	18	1	0	0	0	0	0	2	0	2
8:00 AM	0	0	14	2	0	0	15	1	0	0	0	0	0	0	1	0
8:15 AM	0	0	20	0	0	0	15	0	0	0	1	0	0	0	0	0
8:30 AM	0	0	13	0	0	1	14	2	0	1	0	1	0	2	0	0
8:45 AM	0	2	15	0	0	1	17	0	0	0	0	0	0	0	0	0

	Mass Avenue Northbound				Mass Avenue Southbound				St. Botolph Street Eastbound				St. Botolph Street Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
4:00 PM	0	0	7	0	0	0	9	1	0	0	0	1	0	1	0	0
4:15 PM	0	0	3	0	0	0	8	0	0	0	0	0	0	0	0	0
4:30 PM	0	0	6	0	0	0	9	0	0	0	0	0	0	0	0	0
4:45 PM	0	0	5	0	0	0	10	0	0	0	0	0	0	0	1	0
5:00 PM	0	0	6	0	0	2	9	0	0	0	0	0	0	0	0	0
5:15 PM	0	0	4	0	0	0	7	0	0	0	0	0	0	0	0	0
5:30 PM	0	0	7	0	0	0	11	0	0	0	0	0	0	0	1	0
5:45 PM	0	0	3	0	0	0	4	0	0	0	0	0	0	0	0	0

AM PEAK HOUR 7:15 AM to 8:15 AM	Mass Avenue Northbound				Mass Avenue Southbound				St. Botolph Street Eastbound				St. Botolph Street Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**4**	**72**	**5**	**0**	**0**	**66**	**2**	**0**	**0**	**0**	**0**	**0**	**2**	**1**	**3**
PHF	**0.81**				**0.89**				**0.00**				**0.38**			

PM PEAK HOUR 4:45 PM to 5:45 PM	Mass Avenue Northbound				Mass Avenue Southbound				St. Botolph Street Eastbound				St. Botolph Street Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**0**	**22**	**0**	**0**	**2**	**37**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**
PHF	**0.79**				**0.89**				**0.00**				**0.50**			

Client: Vannesa Kello
Project #: 505_057_HSH
BTD #: Location 3
Location: Back Bay, Boston, MA
Street 1: Mass Avenue
Street 2: St. Botolph Street
Count Date: 11/19/2019
Day of Week: Tuesday
Weather: Rain, 40°F

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PEDESTRIANS & BICYCLES

	Mass Avenue Northbound					Mass Avenue Southbound					St. Botolph Street Eastbound					St. Botolph Street Westbound				
Start Time	Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED	
7:00 AM	0	3	0	1		0	3	0	5		0	0	0	32		0	0	0	16	
7:15 AM	0	7	0	6		0	1	0	1		0	1	0	39		0	0	0	25	
7:30 AM	0	6	0	10		0	5	0	7		0	0	0	88		0	0	0	44	
7:45 AM	0	7	0	5		0	8	0	6		0	0	0	106		0	0	0	38	
8:00 AM	1	6	0	6		0	4	0	10		0	0	0	85		0	1	1	46	
8:15 AM	0	11	0	7		0	5	0	19		0	0	0	108		0	1	0	46	
8:30 AM	1	14	0	11		0	11	0	15		0	1	0	84		0	1	0	57	
8:45 AM	0	20	0	10		0	10	0	10		0	0	0	112		0	0	0	63	

	Mass Avenue Northbound					Mass Avenue Southbound					St. Botolph Street Eastbound					St. Botolph Street Westbound				
Start Time	Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED	
4:00 PM	0	8	0	19		0	6	0	14		0	1	0	122		0	1	0	62	
4:15 PM	0	10	0	20		0	2	0	15		0	0	0	66		0	0	0	58	
4:30 PM	0	11	0	18		0	7	0	18		0	0	0	67		0	0	0	70	
4:45 PM	0	11	0	8		0	4	0	22		0	1	0	62		0	0	0	59	
5:00 PM	0	8	0	16		0	8	0	43		0	0	0	85		0	0	0	66	
5:15 PM	0	14	0	22		0	8	0	26		0	1	0	120		0	0	0	67	
5:30 PM	0	9	0	30		0	10	0	34		0	0	0	128		0	0	0	85	
5:45 PM	0	6	0	14		0	11	0	18		0	0	0	125		0	0	0	69	

AM PEAK HOUR[1] 8:00 AM to 9:00 AM	Mass Avenue Northbound					Mass Avenue Southbound					St. Botolph Street Eastbound					St. Botolph Street Westbound				
	Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED	
	2	51	0	34		0	30	0	54		0	1	0	389		0	3	1	212	

PM PEAK HOUR[1] 4:30 PM to 5:30 PM	Mass Avenue Northbound					Mass Avenue Southbound					St. Botolph Street Eastbound					St. Botolph Street Westbound				
	Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED	
	0	44	0	64		0	27	0	109		0	2	0	334		0	0	0	262	

[1] *Peak hours corresponds to vehicular peak hours.*

Client:	Vannesa Kello
Project #:	505_057_HSH
BTD #:	Location 4
Location:	Back Bay, Boston, MA
Street 1:	Cumberland Street
Street 2:	St. Botolph Street
Count Date:	11/19/2019
Day of Week:	Tuesday
Weather:	Rain, 40°F

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PASSENGER CARS & HEAVY VEHICLES COMBINED

	Cumberland Street Northbound				Cumberland Street Southbound				St. Botolph Street Eastbound				St. Botolph Street Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
7:00 AM	0	1	2	0	0	11	0	4	0	4	13	0	0	2	8	8
7:15 AM	0	0	0	1	0	9	0	1	0	4	12	0	0	0	17	8
7:30 AM	0	0	0	3	0	21	0	3	0	2	7	0	0	0	13	15
7:45 AM	0	0	0	1	0	8	0	0	0	5	5	2	0	2	13	7
8:00 AM	0	2	0	0	0	11	1	4	0	9	17	2	1	1	21	13
8:15 AM	0	1	0	5	0	5	0	7	0	3	7	1	0	6	14	12
8:30 AM	0	3	0	0	1	12	0	4	0	3	9	2	0	1	12	10
8:45 AM	0	3	0	0	0	10	1	2	0	5	16	0	0	2	21	8

	Cumberland Street Northbound				Cumberland Street Southbound				St. Botolph Street Eastbound				St. Botolph Street Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
4:00 PM	0	2	0	1	1	17	0	3	0	6	12	1	1	3	12	10
4:15 PM	0	1	0	0	0	20	0	2	0	9	15	2	0	4	23	14
4:30 PM	0	0	0	0	0	18	0	6	0	5	9	2	0	1	14	5
4:45 PM	0	0	1	3	0	25	0	6	0	3	20	1	0	0	9	6
5:00 PM	0	0	0	1	0	21	1	5	0	4	16	0	0	1	12	3
5:15 PM	0	0	0	0	1	17	0	2	0	4	24	0	1	0	17	7
5:30 PM	0	0	1	0	0	17	0	4	0	7	13	2	2	2	12	9
5:45 PM	0	1	0	0	0	20	0	3	0	6	22	0	1	1	12	9

AM PEAK HOUR 8:00 AM to 9:00 AM	Cumberland Street Northbound				Cumberland Street Southbound				St. Botolph Street Eastbound				St. Botolph Street Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**9**	**0**	**5**	**1**	**38**	**2**	**17**	**0**	**20**	**49**	**5**	**1**	**10**	**68**	**43**
PHF	**0.58**				**0.85**				**0.66**				**0.85**			
HV %	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**100.0%**	**2.6%**	**0.0%**	**5.9%**	**0.0%**	**5.0%**	**6.1%**	**0.0%**	**0.0%**	**0.0%**	**2.9%**	**0.0%**

PM PEAK HOUR 4:00 PM to 5:00 PM	Cumberland Street Northbound				Cumberland Street Southbound				St. Botolph Street Eastbound				St. Botolph Street Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**3**	**1**	**4**	**1**	**80**	**0**	**17**	**0**	**23**	**56**	**6**	**1**	**8**	**58**	**35**
PHF	**0.50**				**0.79**				**0.82**				**0.62**			
HV %	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**4.3%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**5.2%**	**0.0%**

Client:	Vannesa Kello
Project #:	505_057_HSH
BTD #:	Location 4
Location:	Back Bay, Boston, MA
Street 1:	Cumberland Street
Street 2:	St. Botolph Street
Count Date:	11/19/2019
Day of Week:	Tuesday
Weather:	Rain, 40°F

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HEAVY VEHICLES

	Cumberland Street Northbound				Cumberland Street Southbound				St. Botolph Street Eastbound				St. Botolph Street Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
7:15 AM	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0
7:30 AM	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
7:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0
8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
8:15 AM	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0
8:30 AM	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0
8:45 AM	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0

	Cumberland Street Northbound				Cumberland Street Southbound				St. Botolph Street Eastbound				St. Botolph Street Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
4:15 PM	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0
4:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
5:00 PM	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0
5:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

AM PEAK HOUR 7:45 AM to 8:45 AM	Cumberland Street Northbound				Cumberland Street Southbound				St. Botolph Street Eastbound				St. Botolph Street Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**0**	**1**	**2**	**0**	**0**	**0**	**5**	**0**
PHF	**0.00**				**0.25**				**0.38**				**0.42**			

PM PEAK HOUR 4:15 PM to 5:15 PM	Cumberland Street Northbound				Cumberland Street Southbound				St. Botolph Street Eastbound				St. Botolph Street Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**2**	**1**	**0**	**0**	**0**	**2**	**0**
PHF	**0.00**				**0.25**				**0.38**				**0.50**			

Client:	Vannesa Kello
Project #:	505_057_HSH
BTD #:	Location 4
Location:	Back Bay, Boston, MA
Street 1:	Cumberland Street
Street 2:	St. Botolph Street
Count Date:	11/19/2019
Day of Week:	Tuesday
Weather:	Rain, 40°F

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PEDESTRIANS & BICYCLES

	Cumberland Street Northbound					Cumberland Street Southbound					St. Botolph Street Eastbound					St. Botolph Street Westbound				
Start Time	Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED	
7:00 AM	0	0	0	8		0	0	0	4		0	0	0	6		0	0	0	0	
7:15 AM	0	0	0	9		0	0	0	4		0	1	0	5		0	0	0	3	
7:30 AM	0	0	0	5		0	0	0	5		0	0	0	2		0	0	0	3	
7:45 AM	0	0	0	16		0	0	0	6		0	0	0	2		0	0	0	1	
8:00 AM	0	0	0	8		0	0	0	9		0	0	0	9		0	1	0	3	
8:15 AM	0	0	0	14		0	0	0	20		0	0	0	15		0	0	0	10	
8:30 AM	0	0	0	13		0	0	0	17		0	1	0	4		0	1	0	5	
8:45 AM	0	0	0	16		0	0	0	11		0	1	0	2		0	1	0	7	

	Cumberland Street Northbound					Cumberland Street Southbound					St. Botolph Street Eastbound					St. Botolph Street Westbound				
Start Time	Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED	
4:00 PM	0	0	0	6		0	0	1	11		0	2	0	4		0	0	0	9	
4:15 PM	0	0	0	12		0	0	0	4		0	0	0	1		0	1	0	13	
4:30 PM	0	0	0	6		0	0	0	14		0	0	0	2		0	0	0	2	
4:45 PM	0	0	0	9		0	0	0	9		0	2	0	5		0	0	0	5	
5:00 PM	0	0	0	6		0	0	0	15		0	1	0	4		0	0	0	8	
5:15 PM	0	0	0	10		0	0	0	16		0	1	0	2		0	0	0	3	
5:30 PM	0	0	0	14		0	0	0	11		0	0	0	5		0	0	0	3	
5:45 PM	0	0	0	16		1	0	0	12		0	1	0	6		0	0	0	1	

AM PEAK HOUR[1]	Cumberland Street Northbound					Cumberland Street Southbound					St. Botolph Street Eastbound					St. Botolph Street Westbound				
8:00 AM to 9:00 AM	Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED	
	0	0	0	51		0	0	0	57		0	2	0	30		0	3	0	25	

PM PEAK HOUR[1]	Cumberland Street Northbound					Cumberland Street Southbound					St. Botolph Street Eastbound					St. Botolph Street Westbound				
4:00 PM to 5:00 PM	Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED	
	0	0	0	33		0	0	1	38		0	4	0	12		0	1	0	29	

[1] *Peak hours corresponds to vehicular peak hours.*

Client:	Vannesa Kello
Project #:	505_057_HSH
BTD #:	Location 5
Location:	Back Bay, Boston, MA
Street 1:	Huntington Avenue
Street 2:	Belvidere Street/West Newton Street
Count Date:	11/19/2019
Day of Week:	Tuesday
Weather:	Rain, 40°F

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PASSENGER CARS & HEAVY VEHICLES COMBINED

	West Newton Street Northbound				Belvidere Street Southbound				Huntington Avenue Eastbound				Huntington Avenue Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
7:00 AM	0	27	35	16	0	14	18	6	6	16	49	4	10	22	79	62
7:15 AM	0	34	58	15	3	10	20	5	1	29	40	3	4	40	102	65
7:30 AM	0	30	86	13	3	18	15	13	2	22	38	4	10	29	97	96
7:45 AM	0	25	54	14	0	9	12	19	1	28	54	6	19	27	116	83
8:00 AM	0	13	63	21	3	14	20	10	4	26	57	6	13	37	111	79
8:15 AM	0	25	54	18	1	25	16	11	7	24	55	8	18	38	98	77
8:30 AM	0	22	56	20	1	16	26	9	6	34	62	6	23	23	109	73
8:45 AM	0	24	61	18	0	12	24	12	2	27	76	7	21	30	112	68

	West Newton Street Northbound				Belvidere Street Southbound				Huntington Avenue Eastbound				Huntington Avenue Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
4:00 PM	0	14	20	13	1	12	36	20	6	21	85	13	7	47	82	57
4:15 PM	0	11	28	9	1	14	33	14	3	17	67	6	16	43	130	51
4:30 PM	0	10	29	15	1	27	42	15	2	16	66	10	24	40	127	77
4:45 PM	0	14	31	8	1	26	45	12	2	24	61	6	11	36	97	58
5:00 PM	0	22	21	9	2	33	65	18	5	14	69	7	11	45	111	74
5:15 PM	0	17	32	12	0	18	41	20	5	33	62	6	6	50	102	65
5:30 PM	0	17	31	11	1	24	54	24	3	31	75	9	10	47	105	60
5:45 PM	0	16	41	12	0	25	31	18	4	43	68	5	18	34	128	63

AM PEAK HOUR 8:00 AM to 9:00 AM	West Newton Street Northbound				Belvidere Street Southbound				Huntington Avenue Eastbound				Huntington Avenue Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**84**	**234**	**77**	**5**	**67**	**86**	**42**	**19**	**111**	**250**	**27**	**75**	**128**	**430**	**297**
PHF	**0.96**				**0.94**				**0.91**				**0.97**			
HV %	**0.0%**	**2.4%**	**2.1%**	**5.2%**	**0.0%**	**7.5%**	**2.3%**	**7.1%**	**21.1%**	**13.5%**	**7.2%**	**7.4%**	**1.3%**	**5.5%**	**8.6%**	**13.8%**

PM PEAK HOUR 5:00 PM to 6:00 PM	West Newton Street Northbound				Belvidere Street Southbound				Huntington Avenue Eastbound				Huntington Avenue Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**72**	**125**	**44**	**3**	**100**	**191**	**80**	**17**	**121**	**274**	**27**	**45**	**176**	**446**	**262**
PHF	**0.87**				**0.79**				**0.91**				**0.96**			
HV %	**0.0%**	**1.4%**	**1.6%**	**2.3%**	**0.0%**	**4.0%**	**0.5%**	**0.0%**	**0.0%**	**8.3%**	**2.9%**	**3.7%**	**0.0%**	**0.6%**	**2.9%**	**4.6%**

Client: Vannesa Kello
Project #: 505_057_HSH
BTD #: Location 5
Location: Back Bay, Boston, MA
Street 1: Huntington Avenue
Street 2: Belvidere Street/West Newton Street
Count Date: 11/19/2019
Day of Week: Tuesday
Weather: Rain, 40°F

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HEAVY VEHICLES

	West Newton Street Northbound				Belvidere Street Southbound				Huntington Avenue Eastbound				Huntington Avenue Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
7:00 AM	0	2	0	0	0	0	0	0	1	3	7	1	2	1	8	7
7:15 AM	0	3	1	2	0	0	0	0	0	2	3	1	0	1	12	6
7:30 AM	0	0	0	1	0	3	2	0	0	3	1	1	0	1	5	5
7:45 AM	0	1	1	2	0	1	0	1	0	4	6	0	0	1	6	8
8:00 AM	0	0	0	2	0	0	0	0	1	4	8	0	0	0	13	10
8:15 AM	0	2	1	0	0	3	1	0	1	4	3	1	0	3	8	14
8:30 AM	0	0	1	2	0	1	0	3	2	3	4	0	0	1	5	10
8:45 AM	0	0	3	0	0	1	1	0	0	4	3	1	1	3	11	7

	West Newton Street Northbound				Belvidere Street Southbound				Huntington Avenue Eastbound				Huntington Avenue Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
4:00 PM	0	0	0	1	0	1	0	1	0	0	2	0	1	0	2	4
4:15 PM	0	0	1	0	0	1	0	0	0	3	4	2	0	0	7	3
4:30 PM	0	0	1	1	0	3	1	0	0	2	1	2	0	0	5	5
4:45 PM	0	0	0	0	0	0	0	0	0	3	4	1	0	0	4	5
5:00 PM	0	0	1	0	0	2	0	0	0	2	5	1	0	1	1	4
5:15 PM	0	0	1	1	0	1	1	0	0	3	1	0	0	0	6	2
5:30 PM	0	1	0	0	0	0	0	0	0	2	1	0	0	0	5	2
5:45 PM	0	0	0	0	0	1	0	0	0	3	1	0	0	0	1	4

AM PEAK HOUR 8:00 AM to 9:00 AM	West Newton Street Northbound				Belvidere Street Southbound				Huntington Avenue Eastbound				Huntington Avenue Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**2**	**5**	**4**	**0**	**5**	**2**	**3**	**4**	**15**	**18**	**2**	**1**	**7**	**37**	**41**
PHF	**0.92**				**0.63**				**0.75**				**0.86**			

PM PEAK HOUR 4:15 PM to 5:15 PM	West Newton Street Northbound				Belvidere Street Southbound				Huntington Avenue Eastbound				Huntington Avenue Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**0**	**3**	**1**	**0**	**6**	**1**	**0**	**0**	**10**	**14**	**6**	**0**	**1**	**17**	**17**
PHF	**0.50**				**0.44**				**0.83**				**0.88**			

Client:	Vannesa Kello
Project #:	505_057_HSH
BTD #:	Location 5
Location:	Back Bay, Boston, MA
Street 1:	Huntington Avenue
Street 2:	Belvidere Street/West Newton Street
Count Date:	11/19/2019
Day of Week:	Tuesday
Weather:	Rain, 40°F

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PEDESTRIANS & BICYCLES

	West Newton Street Northbound					Belvidere Street Southbound					Huntington Avenue Eastbound					Huntington Avenue Westbound				
Start Time	Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED	
7:00 AM	0	0	0	13		0	0	0	15		0	1	0	8		0	0	0	15	
7:15 AM	0	0	0	9		0	0	0	48		0	0	0	14		0	0	0	45	
7:30 AM	0	0	0	17		0	0	0	28		1	0	0	12		0	1	0	69	
7:45 AM	0	0	0	26		0	1	0	34		0	0	0	17		0	0	1	65	
8:00 AM	0	0	0	34		1	0	0	50		1	0	0	18		0	1	0	54	
8:15 AM	0	0	0	65		0	0	0	54		1	1	0	17		0	1	0	90	
8:30 AM	0	0	0	42		0	0	0	62		1	0	0	26		0	1	0	96	
8:45 AM	1	0	0	66		1	2	0	92		0	0	1	29		0	1	0	126	

	West Newton Street Northbound					Belvidere Street Southbound					Huntington Avenue Eastbound					Huntington Avenue Westbound				
Start Time	Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED	
4:00 PM	0	0	0	37		0	2	0	87		0	1	0	33		0	0	0	102	
4:15 PM	0	0	0	16		0	0	0	95		0	0	0	26		0	2	0	76	
4:30 PM	0	0	0	18		0	1	1	107		0	0	0	21		0	0	0	72	
4:45 PM	0	0	0	21		0	3	0	104		0	0	0	30		0	0	0	67	
5:00 PM	0	0	0	22		0	0	0	146		0	0	0	32		0	1	0	62	
5:15 PM	0	0	0	21		1	2	0	261		0	1	0	51		0	0	0	114	
5:30 PM	0	0	0	24		0	2	0	157		0	0	0	41		0	2	0	123	
5:45 PM	0	0	0	30		0	1	0	144		0	0	0	36		0	1	0	128	

AM PEAK HOUR[1] 8:00 AM to 9:00 AM	West Newton Street Northbound					Belvidere Street Southbound					Huntington Avenue Eastbound					Huntington Avenue Westbound				
	Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED	
	1	0	0	207		2	2	0	258		3	1	1	90		0	4	0	366	

PM PEAK HOUR[1] 5:00 PM to 6:00 PM	West Newton Street Northbound					Belvidere Street Southbound					Huntington Avenue Eastbound					Huntington Avenue Westbound				
	Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED		Left	Thru	Right	PED	
	0	0	0	97		1	5	0	708		0	1	0	160		0	4	0	427	

[1] Peak hours corresponds to vehicular peak hours.

Client:	Vannesa Kello
Project #:	425_C44_HSH
BTD #:	Location 1
Location:	Boston, MA
Street 1:	Huntington Avenue
Street 2:	Cumberland St/North Garage Drive
Count Date:	8/7/2019
Day of Week:	Wednesday
Weather:	Sun, Clouds & Rain, 80°F

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PASSENGER CARS & HEAVY VEHICLES COMBINED

	Cumberland Street Northbound				North Garage Driveway Southbound				Huntington Avenue Eastbound				Huntington Avenue Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
6:00 AM	0	0	0	4	0	0	0	0	0	0	34	2	0	0	92	0
6:15 AM	0	0	0	6	0	0	0	0	0	0	43	3	0	0	94	0
6:30 AM	0	0	0	8	0	0	0	0	0	0	52	4	0	0	97	0
6:45 AM	0	0	0	10	0	0	0	1	0	0	63	6	0	0	102	0
7:00 AM	0	0	0	9	0	0	0	1	0	0	74	6	0	0	107	0
7:15 AM	0	0	0	10	0	0	0	2	0	0	61	8	0	0	116	0
7:30 AM	0	0	0	11	0	0	0	0	0	0	57	11	0	0	114	0
7:45 AM	0	0	0	9	0	0	0	0	0	0	70	9	0	0	112	0
8:00 AM	0	0	0	8	0	0	0	1	0	0	84	8	0	0	127	0
8:15 AM	0	0	0	10	0	0	0	1	0	0	91	12	0	0	138	0
8:30 AM	0	0	0	11	0	0	0	3	0	0	99	14	0	0	132	0
8:45 AM	0	0	0	12	0	0	0	2	0	0	97	11	0	0	125	0
9:00 AM	0	0	0	11	0	0	0	2	0	0	98	9	0	0	132	0
9:15 AM	0	0	0	13	0	0	0	4	0	0	93	10	0	0	139	0
9:30 AM	0	0	0	18	0	0	0	2	0	0	87	11	0	0	142	0
9:45 AM	0	0	0	12	0	0	0	0	0	0	85	9	0	0	157	0
10:00 AM	0	0	0	8	0	0	0	1	0	0	84	6	0	0	145	0
10:15 AM	0	0	0	7	0	0	0	2	0	0	69	7	0	0	134	0
10:30 AM	0	0	0	5	0	0	0	2	0	0	56	8	0	0	131	0
10:45 AM	0	0	0	6	0	0	0	3	0	0	72	9	0	0	128	0
11:00 AM	0	0	0	5	0	0	0	3	0	0	89	11	0	0	124	0
11:15 AM	0	0	0	7	0	0	0	4	0	0	91	13	0	0	119	0
11:30 AM	0	0	0	10	0	0	0	3	0	0	94	16	0	0	122	0
11:45 AM	0	0	0	7	0	0	0	4	0	0	89	13	0	0	130	0
12:00 PM	0	0	0	7	0	0	0	4	0	0	86	11	0	0	127	0
12:15 PM	0	0	0	8	0	0	0	5	0	0	84	10	0	0	132	0
12:30 PM	0	0	0	9	0	0	0	4	0	0	83	8	0	0	135	0
12:45 PM	0	0	0	10	0	0	0	3	0	0	82	10	0	0	126	0
1:00 PM	0	0	0	11	0	0	0	3	0	0	81	14	0	0	119	0
1:15 PM	0	0	0	12	0	0	0	2	0	0	84	12	0	0	114	0
1:30 PM	0	0	0	13	0	0	0	2	0	0	88	11	0	0	125	0
1:45 PM	0	0	0	15	0	0	0	3	0	0	97	13	0	0	132	0
2:00 PM	0	0	0	18	0	0	0	3	0	0	106	15	0	0	142	0
2:15 PM	0	0	0	17	0	0	0	5	0	0	95	15	0	0	149	0
2:30 PM	0	0	0	16	0	0	0	4	0	0	84	16	0	0	146	0
2:45 PM	0	0	0	15	0	0	0	4	0	0	86	18	0	0	142	0
3:00 PM	0	0	0	12	0	0	0	3	0	0	89	21	0	0	134	0
3:15 PM	0	0	0	11	0	0	0	4	0	0	93	24	0	0	139	0
3:30 PM	0	0	0	10	0	0	0	3	0	0	97	27	0	0	131	0
3:45 PM	0	0	0	10	0	0	0	3	0	0	101	23	0	0	122	0
4:00 PM	0	0	0	9	0	0	0	2	0	0	104	19	0	0	115	0
4:15 PM	0	0	0	11	0	0	0	2	0	0	116	15	0	0	102	0
4:30 PM	0	0	0	13	0	0	0	1	0	0	129	11	0	0	112	0
4:45 PM	0	0	0	15	0	0	0	2	0	0	118	13	0	0	124	0
5:00 PM	0	0	0	14	0	0	0	1	0	0	108	16	0	0	130	0
5:15 PM	0	0	0	17	0	0	0	1	0	0	105	19	0	0	135	0
5:30 PM	0	0	0	20	0	0	0	2	0	0	103	24	0	0	141	0
5:45 PM	0	0	0	16	0	0	0	1	0	0	98	20	0	0	136	0

AM PEAK HOUR 9:00 AM to 10:00 AM	Cumberland Street Northbound				North Garage Driveway Southbound				Huntington Avenue Eastbound				Huntington Avenue Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**0**	**0**	**54**	**0**	**0**	**0**	**8**	**0**	**0**	**363**	**39**	**0**	**0**	**570**	**0**
PHF	**0.75**				**0.50**				**0.94**				**0.91**			
HV %	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**12.5%**	**0.0%**	**0.0%**	**12.1%**	**0.0%**	**0.0%**	**0.0%**	**6.8%**	**0.0%**

MID PEAK HOUR 11:30 AM to 12:30 PM	Cumberland Street Northbound				North Garage Driveway Southbound				Huntington Avenue Eastbound				Huntington Avenue Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**0**	**0**	**32**	**0**	**0**	**0**	**16**	**0**	**0**	**353**	**50**	**0**	**0**	**511**	**0**
PHF	**0.80**				**0.80**				**0.92**				**0.97**			
HV %	**0.0%**	**0.0%**	**0.0%**	**3.1%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**7.9%**	**0.0%**	**0.0%**	**0.0%**	**5.9%**	**0.0%**

PM PEAK HOUR 4:45 PM to 5:45 PM	Cumberland Street Northbound				North Garage Driveway Southbound				Huntington Avenue Eastbound				Huntington Avenue Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**0**	**0**	**66**	**0**	**0**	**0**	**6**	**0**	**0**	**434**	**72**	**0**	**0**	**530**	**0**
PHF	**0.83**				**0.75**				**0.97**				**0.94**			
HV %	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**3.7%**	**0.0%**	**0.0%**	**0.0%**	**3.0%**	**0.0%**

Client: Vannesa Kello
Project #: 425_C44_HSH
BTD #: Location 1
Location: Boston, MA
Street 1: Huntington Avenue
Street 2: Cumberland St/North Garage Drive
Count Date: 8/7/2019
Day of Week: Wednesday
Weather: Sun, Clouds & Rain, 80°F

BOSTON TRAFFIC DATA
PO BOX 1723, Framingham, MA 01701
Office: 978-746-1259
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HEAVY VEHICLES

	Cumberland Street Northbound				North Garage Driveway Southbound				Huntington Avenue Eastbound				Huntington Avenue Westbound			
Start Time	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
6:00 AM	0	0	0	1	0	0	0	0	0	0	2	0	0	0	3	0
6:15 AM	0	0	0	0	0	0	0	0	0	0	3	0	0	0	5	0
6:30 AM	0	0	0	1	0	0	0	0	0	0	4	0	0	0	4	0
6:45 AM	0	0	0	0	0	0	0	0	0	0	6	0	0	0	5	0
7:00 AM	0	0	0	0	0	0	0	0	0	0	5	0	0	0	4	0
7:15 AM	0	0	0	0	0	0	0	0	0	0	7	0	0	0	6	0
7:30 AM	0	0	0	0	0	0	0	0	0	0	10	0	0	0	8	0
7:45 AM	0	0	0	0	0	0	0	0	0	0	11	0	0	0	10	0
8:00 AM	0	0	0	0	0	0	0	0	0	0	9	0	0	0	8	0
8:15 AM	0	0	0	0	0	0	0	0	0	0	12	0	0	0	10	0
8:30 AM	0	0	0	0	0	0	0	0	0	0	14	0	0	0	12	0
8:45 AM	0	0	0	0	0	0	0	0	0	0	13	0	0	0	8	0
9:00 AM	0	0	0	0	0	0	0	0	0	0	11	0	0	0	10	0
9:15 AM	0	0	0	0	0	0	0	1	0	0	10	0	0	0	11	0
9:30 AM	0	0	0	0	0	0	0	0	0	0	12	0	0	0	10	0
9:45 AM	0	0	0	0	0	0	0	0	0	0	11	0	0	0	8	0
10:00 AM	0	0	0	0	0	0	0	0	0	0	9	0	0	0	9	0
10:15 AM	0	0	0	0	0	0	0	0	0	0	10	0	0	0	8	0
10:30 AM	0	0	0	0	0	0	0	0	0	0	8	0	0	0	7	0
10:45 AM	0	0	0	0	0	0	0	0	0	0	9	0	0	0	9	0
11:00 AM	0	0	0	0	0	0	0	0	0	0	10	0	0	0	8	0
11:15 AM	0	0	0	0	0	0	0	0	0	0	8	0	0	0	10	0
11:30 AM	0	0	0	1	0	0	0	0	0	0	7	0	0	0	9	0
11:45 AM	0	0	0	0	0	0	0	0	0	0	9	0	0	0	7	0
12:00 PM	0	0	0	0	0	0	0	0	0	0	7	0	0	0	8	0
12:15 PM	0	0	0	0	0	0	0	0	0	0	5	0	0	0	6	0
12:30 PM	0	0	0	0	0	0	0	0	0	0	6	0	0	0	5	0
12:45 PM	0	0	0	0	0	0	0	0	0	0	7	0	0	0	7	0
1:00 PM	0	0	0	0	0	0	0	0	0	0	8	0	0	0	6	0
1:15 PM	0	0	0	0	0	0	0	0	0	0	5	0	0	0	6	0
1:30 PM	0	0	0	0	0	0	0	0	0	0	7	1	0	0	5	0
1:45 PM	0	0	0	0	0	0	0	0	0	0	8	0	0	0	4	0
2:00 PM	0	0	0	0	0	0	0	0	0	0	6	0	0	0	5	0
2:15 PM	0	0	0	0	0	0	0	0	0	0	7	0	0	0	6	0
2:30 PM	0	0	0	0	0	0	0	0	0	0	6	0	0	0	7	0
2:45 PM	0	0	0	0	0	0	0	0	0	0	7	0	0	0	5	0
3:00 PM	0	0	0	0	0	0	0	0	0	0	5	0	0	0	6	0
3:15 PM	0	0	0	0	0	0	0	0	0	0	4	0	0	0	5	0
3:30 PM	0	0	0	0	0	0	0	0	0	0	6	0	0	0	7	0
3:45 PM	0	0	0	0	0	0	0	0	0	0	5	0	0	0	5	0
4:00 PM	0	0	0	0	0	0	0	0	0	0	4	0	0	0	6	0
4:15 PM	0	0	0	0	0	0	0	0	0	0	5	0	0	0	5	0
4:30 PM	0	0	0	0	0	0	0	0	0	0	3	0	0	0	4	0
4:45 PM	0	0	0	0	0	0	0	0	0	0	4	0	0	0	5	0
5:00 PM	0	0	0	0	0	0	0	0	0	0	3	0	0	0	4	0
5:15 PM	0	0	0	0	0	0	0	0	0	0	4	0	0	0	3	0
5:30 PM	0	0	0	0	0	0	0	0	0	0	5	0	0	0	4	0
5:45 PM	0	0	0	0	0	0	0	0	0	0	4	0	0	0	5	0

AM PEAK HOUR 8:15 AM to 9:15 AM	Cumberland Street Northbound				North Garage Driveway Southbound				Huntington Avenue Eastbound				Huntington Avenue Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**50**	**0**	**0**	**0**	**40**	**0**
PHF	**0.00**				**0.00**				**0.89**				**0.83**			

MID PEAK HOUR 10:45 AM to 11:45 AM	Cumberland Street Northbound				North Garage Driveway Southbound				Huntington Avenue Eastbound				Huntington Avenue Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**34**	**0**	**0**	**0**	**36**	**0**
PHF	**0.25**				**0.00**				**0.85**				**0.90**			

PM PEAK HOUR 2:00 PM to 3:00 PM	Cumberland Street Northbound				North Garage Driveway Southbound				Huntington Avenue Eastbound				Huntington Avenue Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**26**	**0**	**0**	**0**	**23**	**0**
PHF	**0.00**				**0.00**				**0.93**				**0.82**			

Client:	Vannesa Kello
Project #:	425_C44_HSH
BTD #:	Location 1
Location:	Boston, MA
Street 1:	Huntington Avenue
Street 2:	Cumberland St/North Garage Drive
Count Date:	8/7/2019
Day of Week:	Wednesday
Weather:	Sun, Clouds & Rain, 80°F

BOSTON TRAFFIC DATA
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PEDESTRIANS & BICYCLES

	Cumberland Street Northbound				North Garage Driveway Southbound				Huntington Avenue Eastbound				Huntington Avenue Westbound			
Start Time	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
6:00 AM	0	0	0	10	0	0	0	8	0	2	0	0	0	1	0	9
6:15 AM	0	0	0	9	0	0	0	11	0	2	0	0	0	2	0	6
6:30 AM	0	0	0	12	0	0	0	10	0	3	0	0	0	3	0	8
6:45 AM	0	0	0	10	0	0	0	12	0	4	0	0	0	2	0	7
7:00 AM	0	0	0	14	0	0	0	14	0	3	0	0	0	4	0	9
7:15 AM	0	0	0	20	0	0	0	15	0	2	0	0	0	3	0	17
7:30 AM	0	0	0	26	0	0	0	12	0	2	0	0	0	2	0	12
7:45 AM	0	0	0	32	0	0	0	13	0	3	0	0	0	3	0	14
8:00 AM	0	0	0	28	0	0	0	17	0	3	0	0	0	2	0	13
8:15 AM	0	0	0	36	0	0	0	24	0	4	0	0	0	5	0	19
8:30 AM	0	0	0	39	0	0	0	28	0	4	0	0	0	3	0	15
8:45 AM	0	0	0	58	0	0	0	35	0	5	1	0	0	4	0	17
9:00 AM	0	0	0	30	0	0	0	29	0	6	0	0	0	3	0	20
9:15 AM	0	0	0	53	0	0	0	24	0	5	0	0	0	4	0	13
9:30 AM	0	0	0	34	0	0	0	18	0	4	0	0	0	3	0	24
9:45 AM	0	0	0	46	0	0	0	10	0	3	0	0	0	4	0	16
10:00 AM	0	0	0	36	0	0	0	12	0	4	0	0	0	3	0	18
10:15 AM	0	0	0	27	0	0	0	14	0	3	0	0	0	3	0	21
10:30 AM	0	0	0	28	0	0	0	17	0	3	0	0	0	2	0	22
10:45 AM	0	0	0	32	0	0	0	22	0	2	0	0	0	5	0	19
11:00 AM	0	0	0	30	0	0	0	21	0	4	0	0	0	4	0	20
11:15 AM	0	0	0	43	0	0	0	20	0	3	0	0	0	3	0	21
11:30 AM	0	0	0	38	0	0	0	25	0	2	0	0	0	3	0	27
11:45 AM	0	0	0	34	0	0	0	28	0	4	0	0	0	4	0	25
12:00 PM	0	0	0	36	0	0	0	31	0	3	0	0	0	2	0	28
12:15 PM	0	0	0	43	0	0	0	34	0	2	0	0	0	2	0	27
12:30 PM	0	0	0	32	0	0	0	37	0	5	0	0	0	5	0	23
12:45 PM	0	0	0	33	0	0	0	35	0	4	0	0	0	3	0	18
1:00 PM	0	0	0	35	0	0	0	38	0	3	0	0	0	4	0	12
1:15 PM	0	0	0	21	0	0	0	40	0	2	0	0	0	3	0	9
1:30 PM	0	0	0	42	0	0	0	36	0	3	0	0	0	2	0	14
1:45 PM	0	0	0	40	0	0	0	33	0	4	0	0	0	3	0	15
2:00 PM	0	0	0	38	0	0	0	31	0	4	0	0	0	3	0	19
2:15 PM	0	0	0	23	0	0	0	24	0	3	0	0	0	2	0	11
2:30 PM	0	0	0	35	0	0	0	27	0	2	0	0	0	4	0	18
2:45 PM	0	0	0	37	0	0	0	30	0	4	0	0	0	3	0	19
3:00 PM	0	0	0	40	0	0	0	37	0	3	0	0	0	2	0	22
3:15 PM	0	0	0	29	0	0	0	46	0	3	0	0	0	2	0	17
3:30 PM	0	0	0	32	0	0	0	42	0	4	1	0	0	3	0	19
3:45 PM	0	0	0	36	0	0	0	36	0	2	0	0	0	5	0	16
4:00 PM	0	0	0	32	0	0	0	32	0	5	0	0	0	4	0	17
4:15 PM	0	0	0	35	0	0	0	26	0	4	0	0	0	3	0	18
4:30 PM	0	0	0	38	0	0	0	30	0	3	0	0	0	5	0	20
4:45 PM	0	0	0	49	0	0	0	45	0	5	0	0	0	4	0	18
5:00 PM	0	0	0	65	0	0	0	51	0	3	0	0	0	2	0	16
5:15 PM	0	0	0	73	0	0	0	62	0	2	0	0	0	3	0	19
5:30 PM	0	0	0	64	0	0	0	53	0	3	0	0	0	4	0	17
5:45 PM	0	0	0	55	0	0	0	50	0	2	0	0	0	3	0	20

AM PEAK HOUR	Cumberland Street Northbound				North Garage Driveway Southbound				Huntington Avenue Eastbound				Huntington Avenue Westbound			
9:00 AM to	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
10:00 AM	0	0	0	163	0	0	0	81	0	18	0	0	0	14	0	73

MID PEAK HOUR	Cumberland Street Northbound				North Garage Driveway Southbound				Huntington Avenue Eastbound				Huntington Avenue Westbound			
11:30 AM to	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
12:30 PM	0	0	0	151	0	0	0	118	0	11	0	0	0	11	0	107

PM PEAK HOUR	Cumberland Street Northbound				North Garage Driveway Southbound				Huntington Avenue Eastbound				Huntington Avenue Westbound			
4:45 PM to	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
5:45 PM	0	0	0	251	0	0	0	211	0	13	0	0	0	13	0	70

NOTE: Peak hour summaries here correspond to peak hours identified for passenger car and heavy vehicles combined.

Massachusetts Highway Department
Statewide Traffic Data Collection
2019 Weekday Seasonal Factors

Factor Group	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Axle Factor
R1	1.22	1.14	1.12	1.06	1.00	0.96	0.87	0.85	0.96	0.99	1.04	1.12	0.85
R2	0.95	0.96	0.98	0.97	0.97	0.93	0.97	0.94	0.96	0.90	0.92	0.93	0.96
R3	1.15	1.06	1.07	1.00	0.89	0.88	0.89	0.89	0.95	0.92	1.02	1.01	0.97
R4-R7	1.09	1.09	1.11	1.02	0.96	0.92	0.89	0.89	0.99	0.98	1.09	1.13	0.98
U1-Boston	1.03	1.01	0.98	0.94	0.94	0.92	0.95	0.93	0.94	0.94	0.97	1.04	0.96
U1-Essex	1.09	1.06	1.03	0.99	0.94	0.90	0.88	0.86	0.93	0.94	0.99	1.06	0.93
U1-Southeast	1.06	1.05	1.01	0.97	0.95	0.93	0.93	0.90	0.94	0.94	0.98	1.04	0.98
U1-West	1.19	1.14	1.09	0.95	0.92	0.89	0.89	0.86	0.91	0.95	0.97	1.07	0.84
U1-Worcester	1.02	1.04	0.97	0.94	0.93	0.91	0.95	0.91	0.93	0.92	0.95	1.10	0.88
U2	1.01	1.00	0.94	0.93	0.91	0.89	0.93	0.90	0.90	0.91	0.94	1.02	0.99
U3	1.06	1.03	0.98	0.94	0.93	0.91	0.95	0.91	0.92	0.93	0.97	1.00	0.98
U4-U7	1.01	1.00	0.95	0.92	0.88	0.86	0.92	0.91	0.92	0.94	0.99	1.04	0.99
Rec - East	1.04	1.16	1.12	0.98	0.92	0.88	0.77	0.81	0.94	1.02	1.08	1.12	0.99
Rec - West	1.30	1.23	1.32	1.18	0.95	0.82	0.70	0.69	0.97	0.96	1.16	1.15	0.98

Round off:
0-999 = 10
>1000 = 100

U = Urban
R = Rural

1 - Interstate
2 - Freeway and Expressway
3 - Other Principal Arterial
4 - Minor Arterial
5 - Major Collector
6 - Minor Collector
7 - Local Road and Street

Recreational - East Group - Cape Cod (all towns) including the town of Plymouth south of Route 3A (stations 7014,7079,7080,7090,7091,7092,7093,7094,7095,7096,7097,7108 and 7178), Martha's Vineyard and Nantucket.

Recreational - West Group - Continuous Stations 2 and 189 including stations 1066,1067,1083,1084,1085,1086,1087,1088,1089,1090,1091,1092,1093,1094,1095,1096,1097,1098,1099,1100,1101,1102,1103,1104,1105,1106,1107,1108,1113,1114,1116,2196,2197 and 2198.

9/23/2020

220 Huntington Avenue (Midtown Hotel Redvelopment)

Existing Trip Generation

HOWARD STEIN HUDSON

25-Feb-2020

XXX Means Columns U, X, and AA do not sum to Column R; hard code adjustements are needed

XX HARD CODED TO BALANCE (Manually change formatting)

Land Use	Size	Category	Directional Split	Average Trip Rate	Unadjusted Vehicle Trips	Assumed National Vehicle Occupancy Rate[1]	Unadjusted Person-Trips	Primary Person Trips	Transit Share[3]	Transit Person-Trips	Walk/Bike/ Other Share[3]	Walk/ Bike/ Other Trips	Auto Share[3]	Auto Person-Trips	% Taxi[4]	Private Auto Person-Trips	Taxi Person-Trips	Assumed Local Auto Occupancy Rate[5]	Assumed Local Auto Occupancy Rate for Taxis[6]	Total Adjusted Private Auto Trips	Total Adjusted Taxi Trips	Total Adjusted Auto (Private + Taxi) Trips
Daily Peak Hour																						
Multifamily Housing (Low Rise)[7]	7	Total		7.320	52	1.18	**62**	**62**	19%	**12**	57%	**36**	24%	**14**	5%	14	0	1.18	1.13	**12**	**0**	**12**
	units	In	50%	3.660	26	1.18	**31**	**31**	19%	**6**	57%	**18**	24%	**7**	5%	7	0	1.18	1.13	**6**	**0**	**6**
		Out	50%	3.660	26	1.18	**31**	**31**	19%	**6**	57%	**18**	24%	**7**	5%	7	0	1.18	1.13	**6**	**0**	**6**
Hotel[10]	159	Total		8.360	1,330	1.82	**2,420**	**2,420**	16%	**388**	55%	**1,330**	29%	**702**	30%	492	210	1.82	1.20	**270**	**176**	**446**
	rooms	In	50%	4.180	665	1.82	**1,210**	**1,210**	16%	**194**	55%	**665**	29%	**351**	30%	246	105	1.82	1.20	**135**	**88**	**223**
		Out	50%	4.180	665	1.82	**1,210**	**1,210**	16%	**194**	55%	**665**	29%	**351**	30%	246	105	1.82	1.20	**135**	**88**	**223**
Total		Total			**1,382**		**2,482**	**2,482**		**400**		**1,366**		**716**		**506**	**210**			**282**	**176**	**458**
		In			**691**		**1,241**	**1,241**		**200**		**683**		**358**		**253**	**105**			**141**	**88**	**229**
		Out			**691**		**1,241**	**1,241**		**200**		**683**		**358**		**253**	**105**			**141**	**88**	**229**
AM Peak Hour																						
Multifamily Housing (Low Rise)[7]	7	Total		0.460	3	1.18	**3**	**3**		**0**		**2**		**1**	5%	1	0	1.18	1.13	**1**	**0**	**1**
	units	In	23%	0.106	1	1.18	**1**	**1**	22%	**0**	59%	**1**	19%	**0**	5%	0	0	1.18	1.13	**0**	**0**	**0**
		Out	77%	0.354	2	1.18	**2**	**2**	15%	**0**	64%	**1**	21%	**1**	5%	1	0	1.18	1.13	**1**	**0**	**1**
Hotel[10]	159	Total		0.47	75	1.82	**136**	**136**		**22**		**80**		**34**	30%	24	11	1.82	1.20	**13**	**9**	**22**
	rooms	In	59%	0.277	44	1.82	**80**	**80**	19%	**15**	57%	**46**	24%	**19**	30%	13	6	1.82	1.20	**7**	**5**	**12**
		Out	41%	0.193	31	1.82	**56**	**56**	13%	**7**	61%	**34**	26%	**15**	30%	11	5	1.82	1.20	**6**	**4**	**10**
Total		Total			**78**		**139**	**139**		**22**		**82**		**35**		**25**	**11**			**14**	**9**	**23**
		In			**45**		**81**	**81**		**15**		**47**		**19**		**13**	**6**			**7**	**5**	**12**
		Out			**33**		**58**	**58**		**7**		**35**		**16**		**12**	**5**			**7**	**4**	**11**
PM Peak Hour																						
Multifamily Housing (Low Rise)[7]	7	Total		0.560	3	1.18	**3**	**3**		**0**		**2**		**1**	5%	1	0	1.18	1.13	**1**	**0**	**1**
	units	In	63%	0.353	2	1.18	**2**	**2**	15%	**0**	64%	**1**	21%	**1**	5%	1	0	1.18	1.13	**1**	**0**	**1**
		Out	37%	0.207	1	1.18	**1**	**1**	22%	**0**	59%	**1**	19%	**0**	5%	0	0	1.18	1.13	**0**	**0**	**0**
Hotel[10]	159	Total		0.60	96	1.82	**175**	**175**		**28**		**103**		**44**	30%	31	13	1.82	1.20	**17**	**11**	**28**
	rooms	In	51%	0.306	49	1.82	**89**	**89**	13%	**12**	61%	**54**	26%	**23**	30%	16	7	1.82	1.20	**9**	**6**	**15**
		Out	49%	0.294	47	1.82	**86**	**86**	19%	**16**	57%	**49**	24%	**21**	30%	15	6	1.82	1.20	**8**	**5**	**13**
Total		Total			**99**		**178**	**178**		**28**		**105**		**45**		**32**	**13**			**18**	**11**	**29**
		In			**51**		**91**	**91**		**12**		**55**		**24**		**17**	**7**			**10**	**6**	**16**
		Out			**48**		**87**	**87**		**16**		**50**		**21**		**15**	**6**			**8**	**5**	**13**

1. 2009 National vehicle occupancy rates - 1.13:home to work; 1.84: family/personal business; 1.78: shopping; 2.2 social/recreational
2. Based on ITE Trip Generation Handbook, 3rd Edition method
3. Mode shares based on peak-hour BTD Data for Area 1
4. Vehicle Trips = 70% Private Auto and 30% Taxi. Taxi trip rate based on CTPS Taxi activity rates for Hotel lane use, as adopted by Central Artery/Tunnel Project
5. Local vehicle occupancy rates based on 2009 National vehicle occupancy rates
6. For taxi cabs, 1.2 passengers per cab. (2.2 minus 1 driver equals 1.2)
7. ITE Trip Generation Manual, 10th Edition, LUC 220 (Multifamily Housing Low-Rise (1-2 floors), average rate
8. ITE Trip Generation Manual, 10th Edition, LUC 710 (General Office Building), average rate
9. ITE Trip Generation Manual, 10th Edition, LUC 712 (Small Office Building), average rate
10. ITE Trip Generation Manual, 10th Edition, LUC 925 (Drinking Place), average rate
11. ITE Trip Generation Manual, 10th Edition, LUC 930 (Fast Casual Restaurant), average rate

220 Huntington Avenue (Midtown Hotel Redvelopment)
Trip Generation Assessment

HOWARD STEIN HUDSON
25-Aug-2020

XXX Means Columns U, X, and AA do not sum to Column R; hard code adjustments are needed
XX HARD CODED TO BALANCE (Manually change formatting)

Land Use	Size	Category	Directional Split	Average Trip Rate	Unadjusted Vehicle Trips	Assumed National Vehicle Occupancy Rate[1]	Unadjusted Person-Trips	Primary Person Trips	Transit Share[3]	Transit Person-Trips	Walk/Bike/ Other Share[3]	Walk/ Bike/ Other Trips	Auto Share[3]	Auto Person-Trips	% Taxi[4]	Private Auto Person-Trips	Taxi Person-Trips	Assumed Local Auto Occupancy Rate[5]	Assumed Local Auto Occupancy Rate for Taxis[6]	Total Adjusted Private Auto Trips	Total Adjusted Taxi Trips	Total Adjusted Auto (Private + Taxi) Trips
Daily Peak Hour																						
Multifamily Housing (Mid Rise)[8]	325	Total		5.440	1,768	1.18	**2,086**	**2,086**	19%	**396**	57%	**1,190**	24%	**500**	5%	476	26	1.18	1.20	**404**	**22**	**426**
	units	In	50%	2.720	884	1.18	**1,043**	**1,043**	19%	**198**	57%	**595**	24%	**250**	5%	238	13	1.18	1.20	**202**	**11**	**213**
		Out	50%	2.720	884	1.18	**1,043**	**1,043**	19%	**198**	57%	**595**	24%	**250**	5%	238	13	1.18	1.20	**202**	**11**	**213**
Quality Restaurant[15]	17	Total		83.840	1,426	2.20	**3,138**	**3,138**	16%	**502**	55%	**1,726**	29%	**910**	5%	864	46	2.20	1.20	**392**	**38**	**430**
	KSF	In	50%	41.920	713	2.20	**1,569**	**1,569**	16%	**251**	55%	**863**	29%	**455**	5%	432	23	2.20	1.20	**196**	**19**	**215**
		Out	50%	41.920	713	2.20	**1,569**	**1,569**	16%	**251**	55%	**863**	29%	**455**	5%	432	23	2.20	1.20	**196**	**19**	**215**
Total		Total			**3,194**		**5,224**	**5,224**		**898**		**2,916**		**1,410**		**1,340**	**72**			**796**	**60**	**856**
		In			**1,597**		**2,612**	**2,612**		**449**		**1,458**		**705**		**670**	**36**			**398**	**30**	**428**
		Out			**1,597**		**2,612**	**2,612**		**449**		**1,458**		**705**		**670**	**36**			**398**	**30**	**428**
AM Peak Hour																						
Multifamily Housing (Mid Rise)[8]	325	Total		0.360	117	1.18	**138**	**138**		**23**		**86**		**29**	5%	28	1	1.18	1.20	**24**	**1**	**25**
	units	In	26%	0.094	30	1.18	**35**	**35**	22%	**8**	59%	**20**	19%	**7**	5%	7	0	1.18	1.20	**6**	**0**	**6**
		Out	74%	0.266	87	1.18	**103**	**103**	15%	**15**	64%	**66**	21%	**22**	5%	21	1	1.18	1.20	**18**	**1**	**19**
Quality Restaurant[15]	17	Total		0.73	13	2.20	**28**	**28**		**5**		**16**		**7**	5%	7	0	2.20	1.20	**3**	**0**	**3**
	KSF	In	55%	0.402	7	2.20	**15**	**15**	19%	**3**	57%	**8**	24%	**4**	5%	4	0	2.20	1.20	**2**	**0**	**2**
		Out	45%	0.329	6	2.20	**13**	**13**	13%	**2**	61%	**8**	26%	**3**	5%	3	0	2.20	1.20	**1**	**0**	**1**
Total		Total			**130**		**166**	**166**		**28**		**102**		**36**		**35**	**1**			**27**	**1**	**28**
		In			**37**		**50**	**50**		**11**		**28**		**11**		**11**	**0**			**8**	**0**	**8**
		Out			**93**		**116**	**116**		**17**		**74**		**25**		**24**	**1**			**19**	**1**	**20**
PM Peak Hour																						
Multifamily Housing (Mid Rise)[8]	325	Total		0.440	143	1.18	**169**	**169**		**30**		**104**		**35**	5%	33	2	1.18	1.20	**28**	**2**	**30**
	units	In	61%	0.268	87	1.18	**103**	**103**	15%	**15**	64%	**66**	21%	**22**	5%	21	1	1.18	1.20	**18**	**1**	**19**
		Out	39%	0.172	56	1.18	**66**	**66**	22%	**15**	59%	**38**	19%	**13**	5%	12	1	1.18	1.20	**10**	**1**	**11**
Quality Restaurant[15]	17	Total		7.80	133	2.20	**293**	**293**		**44**		**175**		**74**	5%	70	4	2.20	1.20	**32**	**4**	**36**
	KSF	In	67%	5.226	89	2.20	**196**	**196**	13%	**25**	61%	**120**	26%	**51**	5%	48	3	2.20	1.20	**22**	**3**	**25**
		Out	33%	2.574	44	2.20	**97**	**97**	19%	**19**	57%	**55**	24%	**23**	5%	22	1	2.20	1.20	**10**	**1**	**11**
Total		Total			**276**		**462**	**462**		**74**		**279**		**109**		**103**	**6**			**60**	**6**	**66**
		In			**176**		**299**	**299**		**40**		**186**		**73**		**69**	**4**			**40**	**4**	**44**
		Out			**100**		**163**	**163**		**34**		**93**		**36**		**34**	**2**			**20**	**2**	**22**

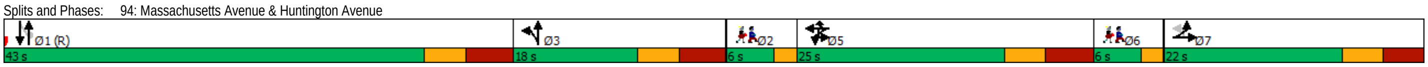
1. 2009 National vehicle occupancy rates - 1.13:home to work; 1.84: family/personal business; 1.78: shopping; 2.2 social/recreational
2. Based on ITE Trip Generation Handbook, 3rd Edition method
3. Mode shares based on peak-hour BTD Data for Area 4
4. Vehicle Trips = 70% Private Auto and 30% Taxi. Taxi trip rate based on CTPS Taxi activity rates for Hotel lane use, as adopted by Central Artery/Tunnel Project
5. Local vehicle occupancy rates based on 2009 National vehicle occupancy rates
6. For taxi cabs, 1.2 passengers per cab. (2.2 minus 1 driver equals 1.2)
7. ITE Trip Generation Manual, 10th Edition, LUC 220 (Multifamily Housing Low-Rise (1-2 floors), average rate
8. ITE Trip Generation Manual, 10th Edition, LUC 221 (Multifamily Housing Mid-Rise (3-10 floors)), average rate
9. ITE Trip Generation Manual, 10th Edition, LUC 222 (Multifamily Housing High-Rise (11+ Floors)), average rate
10. ITE Trip Generation Manual, 10th Edition, LUC 310 (Hotel), average rate
11. ITE Trip Generation Manual, 10th Edition, LUC 710 (General Office Building), average rate
12. ITE Trip Generation Manual, 10th Edition, LUC 760 (Research & Development Center), average rate
13. ITE Trip Generation Manual, 10th Edition, LUC 820 (Shopping Center), average rate
14. ITE Trip Generation Manual, 10th Edition, LUC 850 (Supermarket), average rate
15. ITE Trip Generation Manual, 10th Edition, LUC 931 (Quality Restaurant), average rate
16. ITE Trip Generation Manual, 10th Edition, LUC 932 (High-Turnover (Sit-Down) Restaurant), average rate

Lane Group	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Ø2	Ø6
Lane Configurations																
Traffic Volume (vph)	10	93	13	52	12	64	18	87	33	618	23	2	445	69		
Future Volume (vph)	10	93	13	52	12	64	18	87	33	618	23	2	445	69		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900		
Storage Length (ft)		0		0		0		0	100		0	0		0		
Storage Lanes		0		0		0		1	1		0	0		0		
Taper Length (ft)		50				50			80			50				
Lane Util. Factor	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95		
Ped Bike Factor			0.78				0.81		0.61	0.99			0.88			
Frt			0.954					0.850		0.995			0.980			
Flt Protected			0.970				0.961		0.950							
Satd. Flow (prot)	0	0	2500	0	0	0	1511	1264	1413	2917	0	0	2513	0		
Flt Permitted			0.970				0.961		0.950				0.953			
Satd. Flow (perm)	0	0	2149	0	0	0	1226	1264	867	2917	0	0	2394	0		
Right Turn on Red				No				No			No			No		
Satd. Flow (RTOR)																
Link Speed (mph)			25				25			25			25			
Link Distance (ft)			408				165			334			296			
Travel Time (s)			11.1				4.5			9.1			8.1			
Confl. Peds. (#/hr)		119		122		122		119	486		234	234		486		
Confl. Bikes (#/hr)				2				5			49			31		
Peak Hour Factor	0.89	0.89	0.89	0.89	0.85	0.85	0.85	0.85	0.92	0.92	0.92	0.91	0.91	0.91		
Heavy Vehicles (%)	10%	8%	8%	10%	0%	5%	28%	15%	15%	9%	17%	0%	13%	7%		
Adj. Flow (vph)	11	104	15	58	14	75	21	102	36	672	25	2	489	76		
Shared Lane Traffic (%)																
Lane Group Flow (vph)	0	0	188	0	0	0	110	102	36	697	0	0	567	0		
Turn Type	Perm	Split	NA		Split	Split	NA	Prot	Prot	NA		Perm	NA			
Protected Phases		7	7		5	5	5	5	3	1 3			1		2	6
Permitted Phases	7											1				
Detector Phase	7	7	7		5	5	5	5	3	1 3		1	1			
Switch Phase																
Minimum Initial (s)	8.0	8.0	8.0		8.0	8.0	8.0	8.0	8.0			10.0	10.0		1.0	1.0
Minimum Split (s)	21.0	21.0	21.0		23.5	23.5	23.5	23.5	15.5			20.5	20.5		6.0	6.0
Total Split (s)	22.0	22.0	22.0		25.0	25.0	25.0	25.0	18.0			43.0	43.0		6.0	6.0
Total Split (%)	18.3%	18.3%	18.3%		20.8%	20.8%	20.8%	20.8%	15.0%			35.8%	35.8%		5%	5%
Maximum Green (s)	15.0	15.0	15.0		17.5	17.5	17.5	17.5	10.5			35.5	35.5		4.0	4.0
Yellow Time (s)	3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5			3.5	3.5		2.0	2.0
All-Red Time (s)	3.5	3.5	3.5		4.0	4.0	4.0	4.0	4.0			4.0	4.0		0.0	0.0
Lost Time Adjust (s)			0.0				0.0	0.0	0.0				0.0			
Total Lost Time (s)			7.0				7.5	7.5	7.5				7.5			
Lead/Lag					Lag	Lag	Lag	Lag	Lag			Lead	Lead		Lead	
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes			Yes	Yes		Yes	
Vehicle Extension (s)	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0			2.0	2.0		2.0	2.0
Recall Mode	Ped	Ped	Ped		Ped	Ped	Ped	Ped	Ped			C-Max	C-Max		Ped	Ped
Walk Time (s)	4.0	4.0	4.0		4.0	4.0	4.0	4.0	1.0			7.0	7.0		4.0	4.0
Flash Dont Walk (s)	10.0	10.0	10.0		12.0	12.0	12.0	12.0	6.0			6.0	6.0		0.0	0.0
Pedestrian Calls (#/hr)	122	122	122		119	119	119	119	234			500	500		119	122
Act Effct Green (s)			14.4				16.4	16.4	8.9	55.2			38.7			
Actuated g/C Ratio			0.12				0.14	0.14	0.07	0.46			0.32			
v/c Ratio			0.63				0.53	0.59	0.34	0.52			0.73			
Control Delay			60.2				58.3	63.4	85.5	47.4			46.6			
Queue Delay			0.0				0.0	0.0	0.0	8.2			4.2			
Total Delay			60.2				58.3	63.4	85.5	55.6			50.9			
LOS			E				E	E	F	E			D			
Approach Delay			60.2				60.7			57.1			50.9			
Approach LOS			E				E			E			D			
90th %ile Green (s)	15.0	15.0	15.0		17.5	17.5	17.5	17.5	10.5			35.5	35.5		4.0	4.0
90th %ile Term Code	Max	Max	Max		Max	Max	Max	Max	Max			Coord	Coord		Max	Max
70th %ile Green (s)	15.0	15.0	15.0		16.7	16.7	16.7	16.7	9.8			37.0	37.0		4.0	4.0
70th %ile Term Code	Max	Max	Max		Gap	Gap	Gap	Gap	Gap			Coord	Coord		Max	Max
50th %ile Green (s)	14.0	14.0	14.0		16.0	16.0	16.0	16.0	8.4			40.1	40.1		4.0	4.0
50th %ile Term Code	Ped	Ped	Ped		Ped	Ped	Ped	Ped	Gap			Coord	Coord		Max	Max
30th %ile Green (s)	14.0	14.0	14.0		16.0	16.0	16.0	16.0	8.0			40.5	40.5		4.0	4.0
30th %ile Term Code	Ped	Ped	Ped		Ped	Ped	Ped	Ped	Min			Coord	Coord		Max	Max
10th %ile Green (s)	14.0	14.0	14.0		16.0	16.0	16.0	16.0	8.0			40.5	40.5		4.0	4.0
10th %ile Term Code	Ped	Ped	Ped		Ped	Ped	Ped	Ped	Min			Coord	Coord		Max	Max
Stops (vph)			156				86	81	33	601			371			
Fuel Used(gal)			3				2	2	1	10			8			
CO Emissions (g/hr)			226				110	109	56	721			533			
NOx Emissions (g/hr)			44				21	21	11	140			104			
VOC Emissions (g/hr)			52				26	25	13	167			124			
Dilemma Vehicles (#)			0				0	0	0	0			0			
Queue Length 50th (ft)			74				81	76	30	276			172			
Queue Length 95th (ft)			113				131	126	m53	340			244			
Internal Link Dist (ft)			328				85			254			216			
Turn Bay Length (ft)									100							
Base Capacity (vph)			312				220	184	123	1378			772			
Starvation Cap Reductn			0				0	0	0	636			135			
Spillback Cap Reductn			0				0	0	0	199			0			
Storage Cap Reductn			0				0	0	0	0			0			
Reduced v/c Ratio			0.60				0.50	0.55	0.29	0.94			0.89			

Intersection Summary

Area Type: CBD
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 3 (3%), Referenced to phase 1:NBSB, Start of Green
Natural Cycle: 105
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.73
Intersection Signal Delay: 55.8 Intersection LOS: E
Intersection Capacity Utilization 63.4% ICU Level of Service B
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 94: Massachusetts Avenue & Huntington Avenue

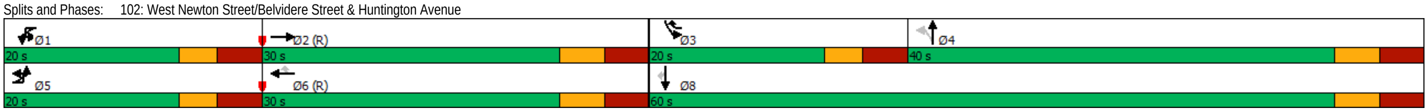


Lane Group	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations														
Traffic Volume (vph)	19	111	250	27	75	128	430	297	84	234	77	72	86	42
Future Volume (vph)	19	111	250	27	75	128	430	297	84	234	77	72	86	42
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)		200		0		200		0	0		0	0		0
Storage Lanes		1		0		1		1	0		0	1		1
Taper Length (ft)		50				50			50			50		
Lane Util. Factor	0.95	1.00	0.95	0.95	0.95	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.70	0.95			0.66		0.44		0.90		0.79		0.83
Frt			0.985					0.850		0.974				0.850
Flt Protected		0.950				0.950				0.989		0.950		
Satd. Flow (prot)	0	1569	3150	0	0	1733	3312	1417	0	1655	0	1671	1863	1509
Flt Permitted		0.950				0.950				0.901		0.950		
Satd. Flow (perm)	0	1103	3150	0	0	1143	3312	623	0	1464	0	1325	1863	1259
Right Turn on Red				Yes				Yes			Yes			Yes
Satd. Flow (RTOR)			9					104		11				104
Link Speed (mph)			25				25			25			25	
Link Distance (ft)			523				395			275			284	
Travel Time (s)			14.3				10.8			7.5			7.7	
Confl. Peds. (#/hr)		258		207		207		258	90		366	366		90
Confl. Bikes (#/hr)				1				4						2
Peak Hour Factor	0.91	0.91	0.91	0.91	0.97	0.97	0.97	0.97	0.96	0.96	0.96	0.94	0.94	0.94
Heavy Vehicles (%)	21%	14%	7%	7%	1%	6%	9%	14%	2%	2%	5%	8%	2%	7%
Adj. Flow (vph)	21	122	275	30	77	132	443	306	88	244	80	77	91	45
Shared Lane Traffic (%)														
Lane Group Flow (vph)	0	143	305	0	0	209	443	306	0	412	0	77	91	45
Turn Type	Prot	Prot	NA		Prot	Prot	NA	pm+ov	Perm	NA		Prot	NA	Perm
Protected Phases	5	5	2		1	1	6	3		4		3	8	
Permitted Phases								6	4					8
Detector Phase	5	5	2		1	1	6	3	4	4		3	8	8
Switch Phase														
Minimum Initial (s)	8.0	8.0	8.0		8.0	8.0	8.0	8.0	8.0	8.0		8.0	8.0	8.0
Minimum Split (s)	14.5	14.5	26.0		14.5	14.5	26.0	14.5	26.0	26.0		14.5	26.0	26.0
Total Split (s)	20.0	20.0	30.0		20.0	20.0	30.0	20.0	40.0	40.0		20.0	60.0	60.0
Total Split (%)	18.2%	18.2%	27.3%		18.2%	18.2%	27.3%	18.2%	36.4%	36.4%		18.2%	54.5%	54.5%
Maximum Green (s)	13.5	13.5	23.0		13.5	13.5	23.0	13.5	33.0	33.0		13.5	53.0	53.0
Yellow Time (s)	3.0	3.0	3.5		3.0	3.0	3.5	3.0	3.5	3.5		3.0	3.5	3.5
All-Red Time (s)	3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5
Lost Time Adjust (s)		0.0	0.0			0.0	0.0	0.0		0.0		0.0	0.0	0.0
Total Lost Time (s)		6.5	7.0			6.5	7.0	6.5		7.0		6.5	7.0	7.0
Lead/Lag	Lead	Lead	Lag		Lead	Lead	Lag	Lead	Lag	Lag		Lead		
Lead-Lag Optimize?	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes		Yes		
Vehicle Extension (s)	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0
Recall Mode	None	None	C-Max		None	None	C-Max	None	None	None		None	None	None
Walk Time (s)			7.0				7.0		12.0	12.0			12.0	12.0
Flash Dont Walk (s)			12.0				12.0		7.0	7.0			7.0	7.0
Pedestrian Calls (#/hr)			207				258		366	366			90	90
Act Effct Green (s)		12.4	24.5			15.0	27.1	39.0		32.1		11.3	50.0	50.0
Actuated g/C Ratio		0.11	0.22			0.14	0.25	0.35		0.29		0.10	0.45	0.45
v/c Ratio		0.81	0.43			0.89	0.54	0.83		0.95		0.45	0.11	0.07
Control Delay		80.2	38.4			83.9	40.3	42.1		69.6		54.1	16.6	0.2
Queue Delay		0.0	0.0			0.0	0.0	0.0		0.0		0.0	0.0	0.0
Total Delay		80.2	38.4			83.9	40.3	42.1		69.6		54.1	16.6	0.2
LOS		F	D			F	D	D		E		D	B	A
Approach Delay			51.8				50.4			69.6			26.7	
Approach LOS			D				D			E			C	
90th %ile Green (s)	13.5	13.5	23.0		13.5	13.5	23.0	13.5	33.0	33.0		13.5	53.0	53.0
90th %ile Term Code	Max	Max	Coord		Max	Max	Coord	Max	Max	Max		Max	Hold	Hold
70th %ile Green (s)	13.5	13.5	23.0		13.5	13.5	23.0	13.5	33.0	33.0		13.5	53.0	53.0
70th %ile Term Code	Max	Max	Coord		Max	Max	Coord	Max	Max	Max		Max	Hold	Hold
50th %ile Green (s)	13.5	13.5	23.0		13.5	13.5	23.0	13.0	33.5	33.5		13.0	53.0	53.0
50th %ile Term Code	Max	Max	Coord		Max	Max	Coord	Gap	Max	Max		Gap	Hold	Hold
30th %ile Green (s)	12.5	12.5	23.0		17.6	17.6	28.1	8.7	33.7	33.7		8.7	48.9	48.9
30th %ile Term Code	Gap	Gap	Coord		Max	Max	Coord	Gap	Gap	Gap		Gap	Hold	Hold
10th %ile Green (s)	8.9	8.9	30.7		16.8	16.8	38.6	8.0	27.5	27.5		8.0	42.0	42.0
10th %ile Term Code	Gap	Gap	Coord		Gap	Gap	Coord	Min	Gap	Gap		Min	Hold	Hold
Stops (vph)		118	229			168	370	206		338		65	46	0
Fuel Used(gal)		3	4			5	6	4		8		1	1	0
CO Emissions (g/hr)		221	300			335	447	303		548		85	47	7
NOx Emissions (g/hr)		43	58			65	87	59		107		17	9	1
VOC Emissions (g/hr)		51	70			78	104	70		127		20	11	2
Dilemma Vehicles (#)		0	0			0	0	0		0		0	0	0
Queue Length 50th (ft)		99	96			149	151	104		273		51	34	0
Queue Length 95th (ft)		#197	141			#301	206	#238		#467		99	63	0
Internal Link Dist (ft)			443				315			195			204	
Turn Bay Length (ft)		200				200								
Base Capacity (vph)		192	709			235	817	395		449		205	897	660
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		0.74	0.43			0.89	0.54	0.77		0.92		0.38	0.10	0.07

Intersection Summary

Area Type: Other
Cycle Length: 110
Actuated Cycle Length: 110
Offset: 48 (44%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.95
Intersection Signal Delay: 52.1 Intersection LOS: D
Intersection Capacity Utilization 84.8% ICU Level of Service E
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 102: West Newton Street/Belvidere Street & Huntington Avenue



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Ø2	Ø6
Lane Configurations														
Traffic Volume (vph)	9	4	33	26	22	43	54	621	43	26	503	32		
Future Volume (vph)	9	4	33	26	22	43	54	621	43	26	503	32		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900		
Storage Length (ft)	0		0	0		0	100		0	50		0		
Storage Lanes	0		0	0		0	0		0	1		0		
Taper Length (ft)	50			50			50			80				
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	1.00	0.95	0.95		
Ped Bike Factor		0.94			0.94			0.95		0.87	0.96			
Frt		0.903			0.936			0.991			0.991			
Flt Protected		0.991			0.986			0.996		0.950				
Satd. Flow (prot)	0	1371	0	0	1461	0	0	2838	0	1504	2769	0		
Flt Permitted		0.944			0.902			0.857		0.314				
Satd. Flow (perm)	0	1291	0	0	1318	0	0	2393	0	433	2769	0		
Right Turn on Red			No			No			No			Yes		
Satd. Flow (RTOR)											8			
Link Speed (mph)		25			25			25			25			
Link Distance (ft)		438			762			341			334			
Travel Time (s)		11.9			20.8			9.3			9.1			
Confl. Peds. (#/hr)	54		34	34		54	389		212	212		389		
Confl. Bikes (#/hr)			1			3			51			30		
Peak Hour Factor	0.88	0.88	0.88	0.73	0.73	0.73	0.92	0.92	0.92	0.99	0.99	0.99		
Heavy Vehicles (%)	11%	25%	3%	8%	4%	0%	4%	10%	5%	8%	12%	9%		
Adj. Flow (vph)	10	5	38	36	30	59	59	675	47	26	508	32		
Shared Lane Traffic (%)														
Lane Group Flow (vph)	0	53	0	0	125	0	0	781	0	26	540	0		
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA			
Protected Phases		5			5			1			1		2	6
Permitted Phases	5			5			1			1				
Detector Phase	5	5		5	5		1	1		1	1			
Switch Phase														
Minimum Initial (s)	8.0	8.0		8.0	8.0		10.0	10.0		10.0	10.0		1.0	1.0
Minimum Split (s)	29.5	29.5		29.5	29.5		25.5	25.5		25.5	25.5		6.0	6.0
Total Split (s)	38.0	38.0		38.0	38.0		70.0	70.0		70.0	70.0		6.0	6.0
Total Split (%)	31.7%	31.7%		31.7%	31.7%		58.3%	58.3%		58.3%	58.3%		5%	5%
Maximum Green (s)	32.5	32.5		32.5	32.5		64.5	64.5		64.5	64.5		4.0	4.0
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5		2.0	2.0
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0		0.0	0.0
Lost Time Adjust (s)		0.0			0.0			0.0		0.0	0.0			
Total Lost Time (s)		5.5			5.5			5.5		5.5	5.5			
Lead/Lag	Lag	Lag		Lag	Lag		Lag	Lag		Lag	Lag		Lead	Lead
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0
Recall Mode	Ped	Ped		Ped	Ped		C-Max	C-Max		C-Max	C-Max		Ped	Ped
Walk Time (s)	7.0	7.0		7.0	7.0		10.0	10.0		10.0	10.0		4.0	4.0
Flash Dont Walk (s)	17.0	17.0		17.0	17.0		10.0	10.0		10.0	10.0		0.0	0.0
Pedestrian Calls (#/hr)	88	88		88	88		500	500		500	500		500	88
Act Effct Green (s)		24.0			24.0			72.5		72.5	72.5			
Actuated g/C Ratio		0.20			0.20			0.60		0.60	0.60			
v/c Ratio		0.21			0.48			0.54		0.10	0.32			
Control Delay		42.6			49.4			15.7		19.3	23.2			
Queue Delay		0.2			0.6			0.4		0.0	1.5			
Total Delay		42.8			50.0			16.1		19.3	24.6			
LOS		D			D			B		B	C			
Approach Delay		42.8			50.0			16.1			24.4			
Approach LOS		D			D			B			C			
90th %ile Green (s)	24.0	24.0		24.0	24.0		72.5	72.5		72.5	72.5		4.5	4.0
90th %ile Term Code	Ped	Ped		Ped	Ped		Coord	Coord		Coord	Coord		Gap	Max
70th %ile Green (s)	24.0	24.0		24.0	24.0		72.5	72.5		72.5	72.5		4.5	4.0
70th %ile Term Code	Ped	Ped		Ped	Ped		Coord	Coord		Coord	Coord		Gap	Max
50th %ile Green (s)	24.0	24.0		24.0	24.0		72.5	72.5		72.5	72.5		4.5	4.0
50th %ile Term Code	Ped	Ped		Ped	Ped		Coord	Coord		Coord	Coord		Gap	Max
30th %ile Green (s)	24.0	24.0		24.0	24.0		72.5	72.5		72.5	72.5		4.5	4.0
30th %ile Term Code	Ped	Ped		Ped	Ped		Coord	Coord		Coord	Coord		Gap	Max
10th %ile Green (s)	24.0	24.0		24.0	24.0		72.5	72.5		72.5	72.5		4.5	4.0
10th %ile Term Code	Ped	Ped		Ped	Ped		Coord	Coord		Coord	Coord		Gap	Max
Stops (vph)		39			79			406		23	433			
Fuel Used(gal)		1			2			6		0	6			
CO Emissions (g/hr)		51			126			415		18	399			
NOx Emissions (g/hr)		10			25			81		4	78			
VOC Emissions (g/hr)		12			29			96		4	92			
Dilemma Vehicles (#)		0			0			0		0	0			
Queue Length 50th (ft)		35			86			175		15	185			
Queue Length 95th (ft)		71			118			230		m26	243			
Internal Link Dist (ft)		358			682			261			254			
Turn Bay Length (ft)										50				
Base Capacity (vph)		349			356			1445		261	1676			
Starvation Cap Reductn		0			0			0		0	907			
Spillback Cap Reductn		69			70			230		0	0			
Storage Cap Reductn		0			0			0		0	0			
Reduced v/c Ratio		0.19			0.44			0.64		0.10	0.70			

Intersection Summary

Area Type: CBD
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 53 (44%), Referenced to phase 1:NBSB, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.54
Intersection Signal Delay: 22.9 Intersection LOS: C
Intersection Capacity Utilization 73.7% ICU Level of Service D
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 134: Massachusetts Avenue & St. Botolph Street

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	363	39	0	570	0	54
Future Volume (vph)	363	39	0	570	0	54
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.95	0.95	1.00	0.91	1.00	1.00
Ped Bike Factor	0.99					
Frt	0.986					0.865
Flt Protected						
Satd. Flow (prot)	3164	0	0	4848	0	1644
Flt Permitted						
Satd. Flow (perm)	3164	0	0	4848	0	1644
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)	25					259
Link Speed (mph)	25			25	25	
Link Distance (ft)	598			523	321	
Travel Time (s)	16.3			14.3	8.8	
Confl. Peds. (#/hr)		163				73
Confl. Bikes (#/hr)		18				
Peak Hour Factor	0.94	0.94	0.91	0.91	0.75	0.75
Heavy Vehicles (%)	12%	0%	0%	7%	0%	0%
Adj. Flow (vph)	386	41	0	626	0	72
Shared Lane Traffic (%)						
Lane Group Flow (vph)	427	0	0	626	0	72
Turn Type	NA			NA		Prot
Protected Phases	1			1		3
Permitted Phases						
Detector Phase	1			1		3
Switch Phase						
Minimum Initial (s)	8.0			8.0		8.0
Minimum Split (s)	12.0			12.0		27.0
Total Split (s)	62.0			62.0		28.0
Total Split (%)	68.9%			68.9%		31.1%
Maximum Green (s)	58.0			58.0		24.0
Yellow Time (s)	3.0			3.0		3.0
All-Red Time (s)	1.0			1.0		1.0
Lost Time Adjust (s)	0.0			0.0		0.0
Total Lost Time (s)	4.0			4.0		4.0
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	2.0			2.0		2.0
Recall Mode	C-Max			C-Max		None
Walk Time (s)						15.0
Flash Dont Walk (s)						8.0
Pedestrian Calls (#/hr)						73
Act Effct Green (s)	65.2			65.2		20.0
Actuated g/C Ratio	0.72			0.72		0.22
v/c Ratio	0.19			0.18		0.13
Control Delay	5.4			5.5		0.5
Queue Delay	0.0			0.0		0.0
Total Delay	5.4			5.5		0.5
LOS	A			A		A
Approach Delay	5.4			5.5	0.5	
Approach LOS	A			A	A	
90th %ile Green (s)	59.0			59.0		23.0
90th %ile Term Code	Coord			Coord		Ped
70th %ile Green (s)	59.0			59.0		23.0
70th %ile Term Code	Coord			Coord		Ped
50th %ile Green (s)	59.0			59.0		23.0
50th %ile Term Code	Coord			Coord		Ped
30th %ile Green (s)	59.0			59.0		23.0
30th %ile Term Code	Coord			Coord		Ped
10th %ile Green (s)	86.0			86.0		0.0
10th %ile Term Code	Coord			Coord		Skip
Stops (vph)	123			179		0
Fuel Used(gal)	3			4		0
CO Emissions (g/hr)	206			270		11
NOx Emissions (g/hr)	40			53		2
VOC Emissions (g/hr)	48			63		2
Dilemma Vehicles (#)	0			0		0
Queue Length 50th (ft)	42			45		0
Queue Length 95th (ft)	61			60		0
Internal Link Dist (ft)	518			443	241	
Turn Bay Length (ft)						
Base Capacity (vph)	2298			3512		628
Starvation Cap Reductn	0			0		0
Spillback Cap Reductn	0			0		0
Storage Cap Reductn	0			0		0
Reduced v/c Ratio	0.19			0.18		0.11

Intersection Summary
Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 70 (78%), Referenced to phase 1:EBWB, Start of Green
Natural Cycle: 40
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.19
Intersection Signal Delay: 5.1 Intersection LOS: A
Intersection Capacity Utilization 36.9% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 4001: Cumberland Street & Huntington Avenue

Intersection	
Intersection Delay, s/veh	8.4
Intersection LOS	A

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Lane Configurations														
Traffic Vol, veh/h	20	49	5	1	10	68	43	9	0	5	1	38	2	17
Future Vol, veh/h	20	49	5	1	10	68	43	9	0	5	1	38	2	17
Peak Hour Factor	0.66	0.66	0.66	0.85	0.85	0.85	0.85	0.58	0.58	0.58	0.85	0.85	0.85	0.85
Heavy Vehicles, %	5	6	0	0	0	3	0	0	0	0	100	3	0	6
Mvmt Flow	30	74	8	1	12	80	51	16	0	9	1	45	2	20
Number of Lanes	0	1	0	0	0	1	0	0	1	0	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.1	7.9	7.6	10
HCM LOS	A	A	A	A

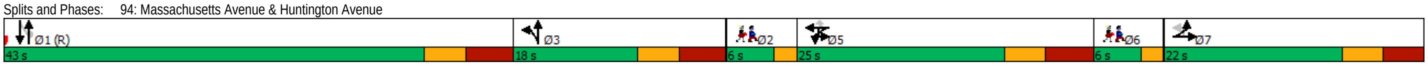
Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	64%	27%	8%	67%
Vol Thru, %	0%	66%	56%	4%
Vol Right, %	36%	7%	36%	30%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	14	74	122	58
LT Vol	9	20	10	39
Through Vol	0	49	69	2
RT Vol	5	5	43	17
Lane Flow Rate	24	112	144	68
Geometry Grp	1	1	1	1
Degree of Util (X)	0.03	0.138	0.163	0.116
Departure Headway (Hd)	4.479	4.418	4.1	6.145
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	800	814	878	585
Service Time	2.502	2.429	2.11	4.167
HCM Lane V/C Ratio	0.03	0.138	0.164	0.116
HCM Control Delay	7.6	8.1	7.9	10
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.1	0.5	0.6	0.4

Lane Group	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Ø2	Ø6
Lane Configurations																
Traffic Volume (vph)	9	92	14	96	14	100	37	93	71	770	20	1	437	83		
Future Volume (vph)	9	92	14	96	14	100	37	93	71	770	20	1	437	83		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900		
Storage Length (ft)		0		0		0		0	100		0	0		0		
Storage Lanes		0		0		0		1	1		0	0		0		
Taper Length (ft)		50				50			80			50				
Lane Util. Factor	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95		
Ped Bike Factor			0.77				0.89	0.61	0.60	0.99			0.86			
Frt			0.932					0.850		0.996			0.976			
Flt Protected			0.977				0.964		0.950							
Satd. Flow (prot)	0	0	2526	0	0	0	1586	1454	1608	3109	0	0	2577	0		
Flt Permitted			0.977				0.964		0.950				0.954			
Satd. Flow (perm)	0	0	2165	0	0	0	1404	891	972	3109	0	0	2458	0		
Right Turn on Red				No				No			No			No		
Satd. Flow (RTOR)																
Link Speed (mph)			25				25			25			25			
Link Distance (ft)			408				165			334			296			
Travel Time (s)			11.1				4.5			9.1			8.1			
Confl. Peds. (#/hr)		310		85		85		310	880		329	329		880		
Confl. Bikes (#/hr)				2				5			49			31		
Peak Hour Factor	0.80	0.80	0.80	0.80	0.88	0.88	0.88	0.88	0.97	0.97	0.97	0.88	0.88	0.88		
Heavy Vehicles (%)	0%	4%	14%	5%	21%	3%	0%	0%	1%	3%	0%	0%	6%	2%		
Adj. Flow (vph)	11	115	18	120	16	114	42	106	73	794	21	1	497	94		
Shared Lane Traffic (%)																
Lane Group Flow (vph)	0	0	264	0	0	0	172	106	73	815	0	0	592	0		
Turn Type	Perm	Split	NA		Split	Split	NA	Perm	Prot	NA		Perm	NA			
Protected Phases		7	7		5	5	5		3	1 3			1		2	6
Permitted Phases	7							5				1				
Detector Phase	7	7	7		5	5	5	5	3	1 3		1	1			
Switch Phase																
Minimum Initial (s)	8.0	8.0	8.0		8.0	8.0	8.0	8.0	8.0			10.0	10.0		1.0	1.0
Minimum Split (s)	21.0	21.0	21.0		23.5	23.5	23.5	23.5	15.5			20.5	20.5		6.0	6.0
Total Split (s)	22.0	22.0	22.0		25.0	25.0	25.0	25.0	18.0			43.0	43.0		6.0	6.0
Total Split (%)	18.3%	18.3%	18.3%		20.8%	20.8%	20.8%	20.8%	15.0%			35.8%	35.8%		5%	5%
Maximum Green (s)	15.0	15.0	15.0		17.5	17.5	17.5	17.5	10.5			35.5	35.5		4.0	4.0
Yellow Time (s)	3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5			3.5	3.5		2.0	2.0
All-Red Time (s)	3.5	3.5	3.5		4.0	4.0	4.0	4.0	4.0			4.0	4.0		0.0	0.0
Lost Time Adjust (s)			0.0				0.0	0.0	0.0				0.0			
Total Lost Time (s)			7.0				7.5	7.5	7.5				7.5			
Lead/Lag					Lag	Lag	Lag	Lag	Lag			Lead	Lead		Lead	
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes			Yes	Yes		Yes	
Vehicle Extension (s)	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0			2.0	2.0		2.0	2.0
Recall Mode	Ped	Ped	Ped		Ped	Ped	Ped	Ped	Ped			C-Max	C-Max		Ped	Ped
Walk Time (s)	4.0	4.0	4.0		4.0	4.0	4.0	4.0	1.0			7.0	7.0		4.0	4.0
Flash Dont Walk (s)	10.0	10.0	10.0		12.0	12.0	12.0	12.0	6.0			6.0	6.0		0.0	0.0
Pedestrian Calls (#/hr)	85	85	85		310	310	310	310	329			500	500		310	85
Act Effct Green (s)			14.8				17.1	17.1	9.7	54.1			36.9			
Actuated g/C Ratio			0.12				0.14	0.14	0.08	0.45			0.31			
v/c Ratio			0.85				0.76	0.84	0.57	0.58			0.78			
Control Delay			76.0				71.5	96.9	90.5	48.5			42.3			
Queue Delay			0.0				0.0	0.0	0.0	36.7			0.5			
Total Delay			76.0				71.5	96.9	90.5	85.2			42.8			
LOS			E				E	F	F	F			D			
Approach Delay			76.0				81.2			85.6			42.8			
Approach LOS			E				F			F			D			
90th %ile Green (s)	15.0	15.0	15.0		17.5	17.5	17.5	17.5	10.5			35.5	35.5		4.0	4.0
90th %ile Term Code	Max	Max	Max		Max	Max	Max	Max	Max			Coord	Coord		Max	Max
70th %ile Green (s)	15.0	15.0	15.0		17.5	17.5	17.5	17.5	10.5			35.5	35.5		4.0	4.0
70th %ile Term Code	Max	Max	Max		Max	Max	Max	Max	Max			Coord	Coord		Max	Max
50th %ile Green (s)	15.0	15.0	15.0		17.5	17.5	17.5	17.5	10.5			35.5	35.5		4.0	4.0
50th %ile Term Code	Max	Max	Max		Max	Max	Max	Max	Max			Coord	Coord		Max	Max
30th %ile Green (s)	15.0	15.0	15.0		17.0	17.0	17.0	17.0	8.9			37.6	37.6		4.0	4.0
30th %ile Term Code	Max	Max	Max		Gap	Gap	Gap	Gap	Gap			Coord	Coord		Max	Max
10th %ile Green (s)	14.0	14.0	14.0		16.0	16.0	16.0	16.0	8.0			40.5	40.5		4.0	4.0
10th %ile Term Code	Ped	Ped	Ped		Ped	Ped	Ped	Ped	Min			Coord	Coord		Max	Max
Stops (vph)			192				137	81	66	723			372			
Fuel Used(gal)			5				3	2	2	13			7			
CO Emissions (g/hr)			331				205	159	123	897			506			
NOx Emissions (g/hr)			64				40	31	24	175			98			
VOC Emissions (g/hr)			77				48	37	29	208			117			
Dilemma Vehicles (#)			0				0	0	0	0			0			
Queue Length 50th (ft)			106				129	81	55	320			146			
Queue Length 95th (ft)			#144				#225	#177	m95	387			177			
Internal Link Dist (ft)			328				85			254			216			
Turn Bay Length (ft)									100							
Base Capacity (vph)			315				231	129	140	1423			756			
Starvation Cap Reductn			0				0	0	0	656			22			
Spillback Cap Reductn			0				0	0	0	20			18			
Storage Cap Reductn			0				0	0	0	0			0			
Reduced v/c Ratio			0.84				0.74	0.82	0.52	1.06			0.81			

Intersection Summary

Area Type: CBD
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 21 (18%), Referenced to phase 1:NBSB, Start of Green
Natural Cycle: 105
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.85
Intersection Signal Delay: 71.2 — Intersection LOS: E
Intersection Capacity Utilization 77.5% — ICU Level of Service D
Analysis Period (min) 15
\# 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.

Splits and Phases: 94: Massachusetts Avenue & Huntington Avenue

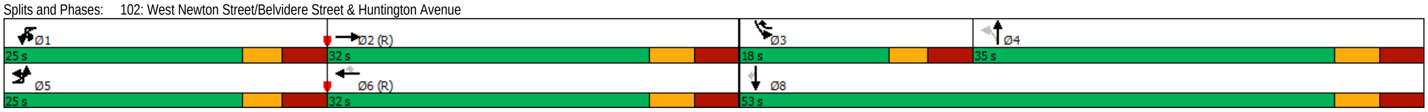


Lane Group	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰	↑↱			↰	↑↑	↱		✥		↰	↑	↱
Traffic Volume (vph)	17	121	274	27	45	176	446	262	72	125	44	103	191	80
Future Volume (vph)	17	121	274	27	45	176	446	262	72	125	44	103	191	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)		200		0		200		0	0		0	0		0
Storage Lanes		1		0		1		1	0		0	1		1
Taper Length (ft)		50				50			50			50		
Lane Util. Factor	0.95	1.00	0.95	0.95	0.95	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.58	0.97			0.82		0.19		0.87		0.74		0.72
Frt			0.986					0.850		0.975				0.850
Flt Protected		0.950				0.950				0.985		0.950		
Satd. Flow (prot)	0	1687	3360	0	0	1791	3505	1538	0	1665	0	1736	1900	1615
Flt Permitted		0.950				0.950				0.812		0.950		
Satd. Flow (perm)	0	971	3360	0	0	1473	3505	285	0	1291	0	1277	1900	1155
Right Turn on Red				Yes				Yes			Yes			Yes
Satd. Flow (RTOR)			9					159		10				104
Link Speed (mph)			25				25			25			25	
Link Distance (ft)			523				395			275			284	
Travel Time (s)			14.3				10.8			7.5			7.7	
Confl. Peds. (#/hr)		708		97		97		708	160		427	427		160
Confl. Bikes (#/hr)				1				4						2
Peak Hour Factor	0.91	0.91	0.91	0.91	0.96	0.96	0.96	0.96	0.87	0.87	0.87	0.79	0.79	0.79
Heavy Vehicles (%)	0%	8%	3%	4%	0%	1%	3%	5%	1%	2%	2%	4%	0%	0%
Adj. Flow (vph)	19	133	301	30	47	183	465	273	83	144	51	130	242	101
Shared Lane Traffic (%)														
Lane Group Flow (vph)	0	152	331	0	0	230	465	273	0	278	0	130	242	101
Turn Type	Prot	Prot	NA		Prot	Prot	NA	pm+ov	Perm	NA		Prot	NA	Perm
Protected Phases	5	5	2		1	1	6	3		4		3	8	
Permitted Phases								6	4					8
Detector Phase	5	5	2		1	1	6	3	4	4		3	8	8
Switch Phase														
Minimum Initial (s)	8.0	8.0	8.0		8.0	8.0	8.0	8.0	8.0	8.0		8.0	8.0	8.0
Minimum Split (s)	14.5	14.5	26.0		14.5	14.5	26.0	14.5	26.0	26.0		14.5	26.0	26.0
Total Split (s)	25.0	25.0	32.0		25.0	25.0	32.0	18.0	35.0	35.0		18.0	53.0	53.0
Total Split (%)	22.7%	22.7%	29.1%		22.7%	22.7%	29.1%	16.4%	31.8%	31.8%		16.4%	48.2%	48.2%
Maximum Green (s)	18.5	18.5	25.0		18.5	18.5	25.0	11.5	28.0	28.0		11.5	46.0	46.0
Yellow Time (s)	3.0	3.0	3.5		3.0	3.0	3.5	3.0	3.5	3.5		3.0	3.5	3.5
All-Red Time (s)	3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5
Lost Time Adjust (s)		0.0	0.0			0.0	0.0	0.0		0.0		0.0	0.0	0.0
Total Lost Time (s)		6.5	7.0			6.5	7.0	6.5		7.0		6.5	7.0	7.0
Lead/Lag	Lead	Lead	Lag		Lead	Lead	Lag	Lead	Lag	Lag		Lead		
Lead-Lag Optimize?	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes		Yes		
Vehicle Extension (s)	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0
Recall Mode	None	None	C-Max		None	None	C-Max	None	None	None		None	None	None
Walk Time (s)			7.0				7.0		12.0	12.0			12.0	12.0
Flash Dont Walk (s)			12.0				12.0		7.0	7.0			7.0	7.0
Pedestrian Calls (#/hr)			97				500		427	427			160	160
Act Effct Green (s)		13.9	30.0			16.8	32.9	44.1		25.5		10.7	42.7	42.7
Actuated g/C Ratio		0.13	0.27			0.15	0.30	0.40		0.23		0.10	0.39	0.39
v/c Ratio		0.71	0.36			0.84	0.44	0.82		0.91		0.77	0.33	0.20
Control Delay		64.0	34.4			71.3	34.8	38.7		71.9		77.3	24.2	4.7
Queue Delay		0.0	0.0			0.0	0.0	0.0		0.0		0.0	0.0	0.0
Total Delay		64.0	34.4			71.3	34.8	38.7		71.9		77.3	24.2	4.7
LOS		E	C			E	C	D		E		E	C	A
Approach Delay			43.7				44.5			71.9			34.6	
Approach LOS			D				D			E			C	
90th %ile Green (s)	18.5	18.5	25.0		18.5	18.5	25.0	11.5	28.0	28.0		11.5	46.0	46.0
90th %ile Term Code	Max	Max	Coord		Max	Max	Coord	Max	Max	Max		Max	Hold	Hold
70th %ile Green (s)	16.6	16.6	25.0		18.5	18.5	26.9	11.5	28.0	28.0		11.5	46.0	46.0
70th %ile Term Code	Gap	Gap	Coord		Max	Max	Coord	Max	Max	Max		Max	Hold	Hold
50th %ile Green (s)	14.2	14.2	25.0		18.5	18.5	29.3	11.5	28.0	28.0		11.5	46.0	46.0
50th %ile Term Code	Gap	Gap	Coord		Max	Max	Coord	Max	Max	Max		Max	Hold	Hold
30th %ile Green (s)	11.9	11.9	31.2		16.2	16.2	35.5	11.0	24.6	24.6		11.0	42.1	42.1
30th %ile Term Code	Gap	Gap	Coord		Gap	Gap	Coord	Gap	Gap	Gap		Gap	Hold	Hold
10th %ile Green (s)	8.4	8.4	43.7		12.3	12.3	47.6	8.0	19.0	19.0		8.0	33.5	33.5
10th %ile Term Code	Gap	Gap	Coord		Gap	Gap	Coord	Min	Ped	Ped		Min	Hold	Hold
Stops (vph)		130	235			203	360	92		212		94	128	10
Fuel Used(gal)		3	4			5	6	3		5		2	2	0
CO Emissions (g/hr)		203	304			331	422	231		344		156	132	22
NOx Emissions (g/hr)		40	59			64	82	45		67		30	26	4
VOC Emissions (g/hr)		47	70			77	98	53		80		36	31	5
Dilemma Vehicles (#)		0	0			0	0	0		0		0	0	0
Queue Length 50th (ft)		104	102			157	146	48		180		90	112	0
Queue Length 95th (ft)		167	147			#273	209	#193		#305		#142	148	22
Internal Link Dist (ft)			443				315			195			204	
Turn Bay Length (ft)		200				200								
Base Capacity (vph)		283	922			301	1047	341		336		181	794	543
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		0.54	0.36			0.76	0.44	0.80		0.83		0.72	0.30	0.19

Intersection Summary

Area Type: Other
Cycle Length: 110
Actuated Cycle Length: 110
Offset: 54 (49%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.91
Intersection Signal Delay: 45.7 Intersection LOS: D
Intersection Capacity Utilization 82.6% ICU Level of Service E
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 102: West Newton Street/Belvidere Street & Huntington Avenue



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Ø2	Ø6
Lane Configurations														
Traffic Volume (vph)	20	15	63	31	16	23	46	818	40	33	588	12		
Future Volume (vph)	20	15	63	31	16	23	46	818	40	33	588	12		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900		
Storage Length (ft)	0		0	0		0	100		0	50		0		
Storage Lanes	0		0	0		0	0		0	1		0		
Taper Length (ft)	50			50			50			80				
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	1.00	0.95	0.95		
Ped Bike Factor		0.91			0.91			0.96		0.91	0.99			
Frt		0.913			0.956			0.993			0.997			
Flt Protected		0.990			0.978			0.997		0.950				
Satd. Flow (prot)	0	1439	0	0	1487	0	0	3051	0	1533	3021	0		
Flt Permitted		0.929			0.840			0.879		0.248				
Satd. Flow (perm)	0	1313	0	0	1235	0	0	2662	0	364	3021	0		
Right Turn on Red			No			No			No			Yes		
Satd. Flow (RTOR)											3			
Link Speed (mph)		25			25			25			25			
Link Distance (ft)		438			762			341			334			
Travel Time (s)		11.9			20.8			9.3			9.1			
Confl. Peds. (#/hr)	109		64	64		109	334		262	262		334		
Confl. Bikes (#/hr)			1			3			51			30		
Peak Hour Factor	0.82	0.82	0.82	0.80	0.80	0.80	0.95	0.95	0.95	0.94	0.94	0.94		
Heavy Vehicles (%)	0%	0%	0%	0%	6%	0%	0%	3%	0%	6%	6%	0%		
Adj. Flow (vph)	24	18	77	39	20	29	48	861	42	35	626	13		
Shared Lane Traffic (%)														
Lane Group Flow (vph)	0	119	0	0	88	0	0	951	0	35	639	0		
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA			
Protected Phases		5			5			1			1		2	6
Permitted Phases	5			5			1			1				
Detector Phase	5	5		5	5		1	1		1	1			
Switch Phase														
Minimum Initial (s)	8.0	8.0		8.0	8.0		10.0	10.0		10.0	10.0		1.0	1.0
Minimum Split (s)	29.5	29.5		29.5	29.5		25.5	25.5		25.5	25.5		6.0	6.0
Total Split (s)	38.0	38.0		38.0	38.0		70.0	70.0		70.0	70.0		6.0	6.0
Total Split (%)	31.7%	31.7%		31.7%	31.7%		58.3%	58.3%		58.3%	58.3%		5%	5%
Maximum Green (s)	32.5	32.5		32.5	32.5		64.5	64.5		64.5	64.5		4.0	4.0
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5		2.0	2.0
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0		0.0	0.0
Lost Time Adjust (s)		0.0			0.0			0.0		0.0	0.0			
Total Lost Time (s)		5.5			5.5			5.5		5.5	5.5			
Lead/Lag	Lag	Lag		Lag	Lag		Lag	Lag		Lag	Lag		Lead	Lead
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0
Recall Mode	Ped	Ped		Ped	Ped		C-Max	C-Max		C-Max	C-Max		Ped	Ped
Walk Time (s)	7.0	7.0		7.0	7.0		10.0	10.0		10.0	10.0		4.0	4.0
Flash Dont Walk (s)	17.0	17.0		17.0	17.0		10.0	10.0		10.0	10.0		0.0	0.0
Pedestrian Calls (#/hr)	173	173		173	173		500	500		500	500		500	173
Act Effct Green (s)		24.0			24.0			72.5		72.5	72.5			
Actuated g/C Ratio		0.20			0.20			0.60		0.60	0.60			
v/c Ratio		0.45			0.36			0.59		0.16	0.35			
Control Delay		48.7			46.2			16.5		20.8	22.5			
Queue Delay		1.3			0.8			1.8		0.0	3.1			
Total Delay		50.0			47.0			18.3		20.8	25.6			
LOS		D			D			B		C	C			
Approach Delay		50.0			47.0			18.3			25.3			
Approach LOS		D			D			B			C			
90th %ile Green (s)	24.0	24.0		24.0	24.0		72.5	72.5		72.5	72.5		4.5	4.0
90th %ile Term Code	Ped	Ped		Ped	Ped		Coord	Coord		Coord	Coord		Gap	Max
70th %ile Green (s)	24.0	24.0		24.0	24.0		72.5	72.5		72.5	72.5		4.5	4.0
70th %ile Term Code	Ped	Ped		Ped	Ped		Coord	Coord		Coord	Coord		Gap	Max
50th %ile Green (s)	24.0	24.0		24.0	24.0		72.5	72.5		72.5	72.5		4.5	4.0
50th %ile Term Code	Ped	Ped		Ped	Ped		Coord	Coord		Coord	Coord		Gap	Max
30th %ile Green (s)	24.0	24.0		24.0	24.0		72.5	72.5		72.5	72.5		4.5	4.0
30th %ile Term Code	Ped	Ped		Ped	Ped		Coord	Coord		Coord	Coord		Gap	Max
10th %ile Green (s)	24.0	24.0		24.0	24.0		72.5	72.5		72.5	72.5		4.5	4.0
10th %ile Term Code	Ped	Ped		Ped	Ped		Coord	Coord		Coord	Coord		Gap	Max
Stops (vph)		86			60			535		26	496			
Fuel Used(gal)		2			1			8		0	6			
CO Emissions (g/hr)		117			94			539		23	445			
NOx Emissions (g/hr)		23			18			105		5	87			
VOC Emissions (g/hr)		27			22			125		5	103			
Dilemma Vehicles (#)		0			0			0		0	0			
Queue Length 50th (ft)		82			59			224		22	216			
Queue Length 95th (ft)		129			97			287		m29	m267			
Internal Link Dist (ft)		358			682			261			254			
Turn Bay Length (ft)										50				
Base Capacity (vph)		355			334			1608		219	1826			
Starvation Cap Reductn		0			0			0		0	1056			
Spillback Cap Reductn		109			102			463		0	0			
Storage Cap Reductn		0			0			0		0	0			
Reduced v/c Ratio		0.48			0.38			0.83		0.16	0.83			

Intersection Summary

Area Type: CBD
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 69 (58%), Referenced to phase 1:NBSB, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.59
Intersection Signal Delay: 24.3 Intersection LOS: C
Intersection Capacity Utilization 80.8% ICU Level of Service D
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 134: Massachusetts Avenue & St. Botolph Street

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	434	72	0	530	0	66
Future Volume (vph)	434	72	0	530	0	66
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.95	0.95	1.00	0.91	1.00	1.00
Ped Bike Factor	0.97					
Frt	0.979					0.865
Flt Protected						
Satd. Flow (prot)	3311	0	0	5036	0	1644
Flt Permitted						
Satd. Flow (perm)	3311	0	0	5036	0	1644
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)	42					158
Link Speed (mph)	25			25	25	
Link Distance (ft)	598			523	321	
Travel Time (s)	16.3			14.3	8.8	
Confl. Peds. (#/hr)		251				70
Confl. Bikes (#/hr)		18				
Peak Hour Factor	0.97	0.97	0.94	0.94	0.83	0.83
Heavy Vehicles (%)	4%	0%	0%	3%	0%	0%
Adj. Flow (vph)	447	74	0	564	0	80
Shared Lane Traffic (%)						
Lane Group Flow (vph)	521	0	0	564	0	80
Turn Type	NA			NA		Prot
Protected Phases	1			1		3
Permitted Phases						
Detector Phase	1			1		3
Switch Phase						
Minimum Initial (s)	8.0			8.0		8.0
Minimum Split (s)	12.0			12.0		27.0
Total Split (s)	62.0			62.0		28.0
Total Split (%)	68.9%			68.9%		31.1%
Maximum Green (s)	58.0			58.0		24.0
Yellow Time (s)	3.0			3.0		3.0
All-Red Time (s)	1.0			1.0		1.0
Lost Time Adjust (s)	0.0			0.0		0.0
Total Lost Time (s)	4.0			4.0		4.0
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	2.0			2.0		2.0
Recall Mode	C-Max			C-Max		None
Walk Time (s)						15.0
Flash Dont Walk (s)						8.0
Pedestrian Calls (#/hr)						70
Act Effct Green (s)	65.2			65.2		20.0
Actuated g/C Ratio	0.72			0.72		0.22
v/c Ratio	0.22			0.15		0.16
Control Delay	5.4			5.4		0.7
Queue Delay	0.0			0.0		0.0
Total Delay	5.4			5.4		0.7
LOS	A			A		A
Approach Delay	5.4			5.4	0.7	
Approach LOS	A			A	A	
90th %ile Green (s)	59.0			59.0		23.0
90th %ile Term Code	Coord			Coord		Ped
70th %ile Green (s)	59.0			59.0		23.0
70th %ile Term Code	Coord			Coord		Ped
50th %ile Green (s)	59.0			59.0		23.0
50th %ile Term Code	Coord			Coord		Ped
30th %ile Green (s)	59.0			59.0		23.0
30th %ile Term Code	Coord			Coord		Ped
10th %ile Green (s)	86.0			86.0		0.0
10th %ile Term Code	Coord			Coord		Skip
Stops (vph)	153			165		0
Fuel Used(gal)	4			4		0
CO Emissions (g/hr)	259			250		13
NOx Emissions (g/hr)	50			49		3
VOC Emissions (g/hr)	60			58		3
Dilemma Vehicles (#)	0			0		0
Queue Length 50th (ft)	51			40		0
Queue Length 95th (ft)	72			54		0
Internal Link Dist (ft)	518			443	241	
Turn Bay Length (ft)						
Base Capacity (vph)	2410			3648		554
Starvation Cap Reductn	0			0		0
Spillback Cap Reductn	0			0		0
Storage Cap Reductn	0			0		0
Reduced v/c Ratio	0.22			0.15		0.14

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 66 (73%), Referenced to phase 1:EBWB, Start of Green
Natural Cycle: 40
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.22
Intersection Signal Delay: 5.1 Intersection LOS: A
Intersection Capacity Utilization 40.3% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 4001: Cumberland Street & Huntington Avenue

Intersection	
Intersection Delay, s/veh	8.2
Intersection LOS	A

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Lane Configurations														
Traffic Vol, veh/h	23	56	6	1	8	58	35	3	1	4	1	80	0	17
Future Vol, veh/h	23	56	6	1	8	58	35	3	1	4	1	80	0	17
Peak Hour Factor	0.82	0.82	0.82	0.62	0.62	0.62	0.62	0.50	0.50	0.50	0.79	0.79	0.79	0.79
Heavy Vehicles, %	4	0	0	0	0	5	0	0	0	0	0	0	0	0
Mvmt Flow	28	68	7	2	13	94	56	6	2	8	1	101	0	22
Number of Lanes	0	1	0	0	0	1	0	0	1	0	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.2	8.1	7.5	8.4
HCM LOS	A	A	A	A

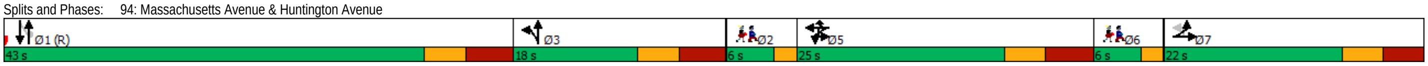
Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	38%	27%	8%	82%
Vol Thru, %	12%	66%	57%	0%
Vol Right, %	50%	7%	35%	18%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	8	85	102	98
LT Vol	3	23	8	81
Through Vol	1	56	59	0
RT Vol	4	6	35	17
Lane Flow Rate	16	104	165	124
Geometry Grp	1	1	1	1
Degree of Util (X)	0.02	0.129	0.19	0.157
Departure Headway (Hd)	4.415	4.483	4.156	4.569
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	811	802	865	786
Service Time	2.438	2.498	2.17	2.588
HCM Lane V/C Ratio	0.02	0.13	0.191	0.158
HCM Control Delay	7.5	8.2	8.1	8.4
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.1	0.4	0.7	0.6

Lane Group	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Ø2	Ø6
Lane Configurations																
Traffic Volume (vph)	10	100	64	54	12	68	36	91	34	668	24	2	474	76		
Future Volume (vph)	10	100	64	54	12	68	36	91	34	668	24	2	474	76		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900		
Storage Length (ft)		0		0		0		0	100		0	0		0		
Storage Lanes		0		0		0		1	1		0	0		0		
Taper Length (ft)		50				50			80			50				
Lane Util. Factor	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95		
Ped Bike Factor			0.83				0.85		0.63	0.99			0.88			
Frt			0.964					0.850		0.995			0.979			
Flt Protected			0.977				0.967		0.950							
Satd. Flow (prot)	0	0	2610	0	0	0	1482	1264	1413	2919	0	0	2500	0		
Flt Permitted			0.977				0.967		0.950				0.953			
Satd. Flow (perm)	0	0	2332	0	0	0	1265	1264	897	2919	0	0	2382	0		
Right Turn on Red				No				No			No			No		
Satd. Flow (RTOR)																
Link Speed (mph)			25				25			25			25			
Link Distance (ft)			408				165			334			296			
Travel Time (s)			11.1				4.5			9.1			8.1			
Confl. Peds. (#/hr)		119		122		122		119	486		234	234		486		
Confl. Bikes (#/hr)				2				5			49			31		
Peak Hour Factor	0.89	0.89	0.89	0.89	0.85	0.85	0.85	0.85	0.92	0.92	0.92	0.91	0.91	0.91		
Heavy Vehicles (%)	10%	8%	8%	10%	0%	5%	28%	15%	15%	9%	17%	0%	13%	7%		
Adj. Flow (vph)	11	112	72	61	14	80	42	107	37	726	26	2	521	84		
Shared Lane Traffic (%)																
Lane Group Flow (vph)	0	0	256	0	0	0	136	107	37	752	0	0	607	0		
Turn Type	Perm	Split	NA		Split	Split	NA	Prot	Prot	NA		Perm	NA			
Protected Phases		7	7		5	5	5	5	3	1 3			1		2	6
Permitted Phases	7											1				
Detector Phase	7	7	7		5	5	5	5	3	1 3		1	1			
Switch Phase																
Minimum Initial (s)	8.0	8.0	8.0		8.0	8.0	8.0	8.0	8.0			10.0	10.0		1.0	1.0
Minimum Split (s)	21.0	21.0	21.0		23.5	23.5	23.5	23.5	15.5			20.5	20.5		6.0	6.0
Total Split (s)	22.0	22.0	22.0		25.0	25.0	25.0	25.0	18.0			43.0	43.0		6.0	6.0
Total Split (%)	18.3%	18.3%	18.3%		20.8%	20.8%	20.8%	20.8%	15.0%			35.8%	35.8%		5%	5%
Maximum Green (s)	15.0	15.0	15.0		17.5	17.5	17.5	17.5	10.5			35.5	35.5		4.0	4.0
Yellow Time (s)	3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5			3.5	3.5		2.0	2.0
All-Red Time (s)	3.5	3.5	3.5		4.0	4.0	4.0	4.0	4.0			4.0	4.0		0.0	0.0
Lost Time Adjust (s)			0.0				0.0	0.0	0.0				0.0			
Total Lost Time (s)			7.0				7.5	7.5	7.5				7.5			
Lead/Lag					Lag	Lag	Lag	Lag	Lag			Lead	Lead		Lead	
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes			Yes	Yes		Yes	
Vehicle Extension (s)	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0			2.0	2.0		2.0	2.0
Recall Mode	Ped	Ped	Ped		Ped	Ped	Ped	Ped	Ped			C-Max	C-Max		Ped	Ped
Walk Time (s)	4.0	4.0	4.0		4.0	4.0	4.0	4.0	1.0			7.0	7.0		4.0	4.0
Flash Dont Walk (s)	10.0	10.0	10.0		12.0	12.0	12.0	12.0	6.0			6.0	6.0		0.0	0.0
Pedestrian Calls (#/hr)	122	122	122		119	119	119	119	234			500	500		119	122
Act Effct Green (s)			14.7				16.6	16.6	9.0	54.7			38.2			
Actuated g/C Ratio			0.12				0.14	0.14	0.08	0.46			0.32			
v/c Ratio			0.80				0.66	0.61	0.35	0.56			0.80			
Control Delay			70.5				65.5	64.5	85.0	48.4			50.6			
Queue Delay			0.0				0.0	0.0	0.0	16.9			7.3			
Total Delay			70.5				65.5	64.5	85.0	65.3			58.0			
LOS			E				E	E	F	E			E			
Approach Delay			70.5				65.0			66.2			58.0			
Approach LOS			E				E			E			E			
90th %ile Green (s)	15.0	15.0	15.0		17.5	17.5	17.5	17.5	10.5			35.5	35.5		4.0	4.0
90th %ile Term Code	Max	Max	Max		Max	Max	Max	Max	Max			Coord	Coord		Max	Max
70th %ile Green (s)	15.0	15.0	15.0		17.5	17.5	17.5	17.5	9.9			36.1	36.1		4.0	4.0
70th %ile Term Code	Max	Max	Max		Max	Max	Max	Max	Gap			Coord	Coord		Max	Max
50th %ile Green (s)	15.0	15.0	15.0		16.0	16.0	16.0	16.0	8.5			39.0	39.0		4.0	4.0
50th %ile Term Code	Max	Max	Max		Ped	Ped	Ped	Ped	Gap			Coord	Coord		Max	Max
30th %ile Green (s)	14.4	14.4	14.4		16.0	16.0	16.0	16.0	8.0			40.1	40.1		4.0	4.0
30th %ile Term Code	Gap	Gap	Gap		Ped	Ped	Ped	Ped	Min			Coord	Coord		Max	Max
10th %ile Green (s)	14.0	14.0	14.0		16.0	16.0	16.0	16.0	8.0			40.5	40.5		4.0	4.0
10th %ile Term Code	Ped	Ped	Ped		Ped	Ped	Ped	Ped	Min			Coord	Coord		Max	Max
Stops (vph)			210				108	86	33	652			401			
Fuel Used(gal)			5				2	2	1	11			9			
CO Emissions (g/hr)			341				148	116	57	790			603			
NOx Emissions (g/hr)			66				29	22	11	154			117			
VOC Emissions (g/hr)			79				34	27	13	183			140			
Dilemma Vehicles (#)			0				0	0	0	0			0			
Queue Length 50th (ft)			102				102	80	31	307			191			
Queue Length 95th (ft)			#163				160	132	m53	366			#316			
Internal Link Dist (ft)			328				85			254			216			
Turn Bay Length (ft)									100							
Base Capacity (vph)			326				216	184	123	1368			758			
Starvation Cap Reductn			0				0	0	0	614			115			
Spillback Cap Reductn			0				0	0	0	200			3			
Storage Cap Reductn			0				0	0	0	0			0			
Reduced v/c Ratio			0.79				0.63	0.58	0.30	1.00			0.94			

Intersection Summary

Area Type: CBD
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 3 (3%), Referenced to phase 1:NBSB, Start of Green
Natural Cycle: 105
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.80
Intersection Signal Delay: 64.0 Intersection LOS: E
Intersection Capacity Utilization 65.0% ICU Level of Service C
Analysis Period (min) 15
\# 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.

Splits and Phases: 94: Massachusetts Avenue & Huntington Avenue



Lane Group	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations														
Traffic Volume (vph)	20	117	306	28	78	133	466	313	87	245	80	75	92	45
Future Volume (vph)	20	117	306	28	78	133	466	313	87	245	80	75	92	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)		200		0		200		0	0		0	0		0
Storage Lanes		1		0		1		1	0		0	1		1
Taper Length (ft)		50				50			50			50		
Lane Util. Factor	0.95	1.00	0.95	0.95	0.95	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.72	0.96			0.69		0.44		0.90		0.80		0.83
Frt			0.987					0.850		0.974				0.850
Flt Protected		0.950				0.950				0.990		0.950		
Satd. Flow (prot)	0	1569	3181	0	0	1733	3312	1417	0	1658	0	1671	1863	1509
Flt Permitted		0.950				0.950				0.900		0.950		
Satd. Flow (perm)	0	1127	3181	0	0	1192	3312	623	0	1463	0	1333	1863	1259
Right Turn on Red				Yes				Yes			Yes			Yes
Satd. Flow (RTOR)			8					104		11				104
Link Speed (mph)			25				25			25			25	
Link Distance (ft)			523				395			275			284	
Travel Time (s)			14.3				10.8			7.5			7.7	
Confl. Peds. (#/hr)		258		207		207		258	90		366	366		90
Confl. Bikes (#/hr)				1				4						2
Peak Hour Factor	0.91	0.91	0.91	0.91	0.97	0.97	0.97	0.97	0.96	0.96	0.96	0.94	0.94	0.94
Heavy Vehicles (%)	21%	14%	7%	7%	1%	6%	9%	14%	2%	2%	5%	8%	2%	7%
Adj. Flow (vph)	22	129	336	31	80	137	480	323	91	255	83	80	98	48
Shared Lane Traffic (%)														
Lane Group Flow (vph)	0	151	367	0	0	217	480	323	0	429	0	80	98	48
Turn Type	Prot	Prot	NA		Prot	Prot	NA	pm+ov	Perm	NA		Prot	NA	Perm
Protected Phases	5	5	2		1	1	6	3		4		3	8	
Permitted Phases								6	4					8
Detector Phase	5	5	2		1	1	6	3	4	4		3	8	8
Switch Phase														
Minimum Initial (s)	8.0	8.0	8.0		8.0	8.0	8.0	8.0	8.0	8.0		8.0	8.0	8.0
Minimum Split (s)	14.5	14.5	26.0		14.5	14.5	26.0	14.5	26.0	26.0		14.5	26.0	26.0
Total Split (s)	20.0	20.0	30.0		20.0	20.0	30.0	20.0	40.0	40.0		20.0	60.0	60.0
Total Split (%)	18.2%	18.2%	27.3%		18.2%	18.2%	27.3%	18.2%	36.4%	36.4%		18.2%	54.5%	54.5%
Maximum Green (s)	13.5	13.5	23.0		13.5	13.5	23.0	13.5	33.0	33.0		13.5	53.0	53.0
Yellow Time (s)	3.0	3.0	3.5		3.0	3.0	3.5	3.0	3.5	3.5		3.0	3.5	3.5
All-Red Time (s)	3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5
Lost Time Adjust (s)		0.0	0.0			0.0	0.0	0.0		0.0		0.0	0.0	0.0
Total Lost Time (s)		6.5	7.0			6.5	7.0	6.5		7.0		6.5	7.0	7.0
Lead/Lag	Lead	Lead	Lag		Lead	Lead	Lag	Lead	Lag	Lag		Lead		
Lead-Lag Optimize?	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes		Yes		
Vehicle Extension (s)	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0
Recall Mode	None	None	C-Max		None	None	C-Max	None	None	None		None	None	None
Walk Time (s)			7.0				7.0		12.0	12.0			12.0	12.0
Flash Dont Walk (s)			12.0				12.0		7.0	7.0			7.0	7.0
Pedestrian Calls (#/hr)			207				258		366	366			90	90
Act Effct Green (s)		12.7	23.4			14.7	25.3	37.7		33.0		11.9	51.4	51.4
Actuated g/C Ratio		0.12	0.21			0.13	0.23	0.34		0.30		0.11	0.47	0.47
v/c Ratio		0.83	0.54			0.94	0.63	0.88		0.96		0.44	0.11	0.07
Control Delay		82.5	41.1			94.9	43.3	49.3		71.7		53.4	16.3	0.2
Queue Delay		0.0	0.0			0.0	0.0	0.0		0.0		0.0	0.0	0.0
Total Delay		82.5	41.1			94.9	43.3	49.3		71.7		53.4	16.3	0.2
LOS		F	D			F	D	D		E		D	B	A
Approach Delay			53.2				56.2			71.7			26.0	
Approach LOS			D				E			E			C	
90th %ile Green (s)	13.5	13.5	23.0		13.5	13.5	23.0	13.5	33.0	33.0		13.5	53.0	53.0
90th %ile Term Code	Max	Max	Coord		Max	Max	Coord	Max	Max	Max		Max	Hold	Hold
70th %ile Green (s)	13.5	13.5	23.0		13.5	13.5	23.0	13.5	33.0	33.0		13.5	53.0	53.0
70th %ile Term Code	Max	Max	Coord		Max	Max	Coord	Max	Max	Max		Max	Hold	Hold
50th %ile Green (s)	13.5	13.5	23.0		13.5	13.5	23.0	13.5	33.0	33.0		13.5	53.0	53.0
50th %ile Term Code	Max	Max	Coord		Max	Max	Coord	Max	Max	Max		Max	Hold	Hold
30th %ile Green (s)	13.4	13.4	23.0		13.5	13.5	23.1	11.0	35.5	35.5		11.0	53.0	53.0
30th %ile Term Code	Gap	Gap	Coord		Max	Max	Coord	Gap	Max	Max		Gap	Hold	Hold
10th %ile Green (s)	9.7	9.7	25.0		19.3	19.3	34.6	8.0	30.7	30.7		8.0	45.2	45.2
10th %ile Term Code	Gap	Gap	Coord		Gap	Gap	Coord	Min	Gap	Gap		Min	Hold	Hold
Stops (vph)		122	285			173	415	233		347		68	50	0
Fuel Used(gal)		3	5			5	7	5		8		1	1	0
CO Emissions (g/hr)		236	376			379	508	356		581		88	50	8
NOx Emissions (g/hr)		46	73			74	99	69		113		17	10	2
VOC Emissions (g/hr)		55	87			88	118	82		135		20	12	2
Dilemma Vehicles (#)		0	0			0	0	0		0		0	0	0
Queue Length 50th (ft)		105	120			~160	166	114		291		53	37	0
Queue Length 95th (ft)		#212	169			#315	224	#276		#496		102	67	0
Internal Link Dist (ft)			443				315			195			204	
Turn Bay Length (ft)		200				200								
Base Capacity (vph)		192	683			230	762	387		453		205	897	660
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		0.79	0.54			0.94	0.63	0.83		0.95		0.39	0.11	0.07

Intersection Summary

Area Type: Other

Cycle Length: 110

Actuated Cycle Length: 110

Offset: 48 (44%), Referenced to phase 2:EBT and 6:WBT, Start of Green

Natural Cycle: 85

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.96

Intersection Signal Delay: 55.4 Intersection LOS: E

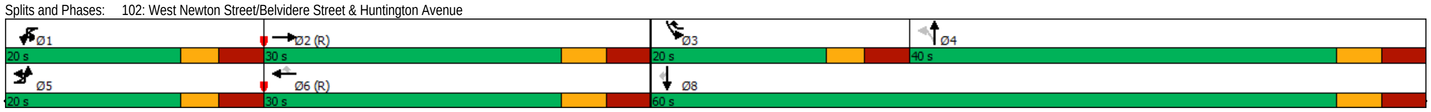
Intersection Capacity Utilization 86.1% ICU Level of Service E

Analysis Period (min) 15

~ 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.

Splits and Phases: 102: West Newton Street/Belvidere Street & Huntington Avenue



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Ø2	Ø6
Lane Configurations		↰↑↱			↰↑↱			↰↑↑↱		↰	↑↑↱			
Traffic Volume (vph)	9	4	39	27	23	45	57	647	45	27	523	38		
Future Volume (vph)	9	4	39	27	23	45	57	647	45	27	523	38		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900		
Storage Length (ft)	0		0	0		0	100		0	50		0		
Storage Lanes	0		0	0		0	0		0	1		0		
Taper Length (ft)	50			50			50			80				
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	1.00	0.95	0.95		
Ped Bike Factor		0.94			0.94			0.95		0.88	0.96			
Frt		0.899			0.936			0.991			0.990			
Flt Protected		0.992			0.986			0.996		0.950				
Satd. Flow (prot)	0	1369	0	0	1461	0	0	2838	0	1504	2752	0		
Flt Permitted		0.948			0.901			0.850		0.300				
Satd. Flow (perm)	0	1295	0	0	1318	0	0	2376	0	418	2752	0		
Right Turn on Red			No			No			No			Yes		
Satd. Flow (RTOR)											9			
Link Speed (mph)		25			25			25			25			
Link Distance (ft)		438			762			341			334			
Travel Time (s)		11.9			20.8			9.3			9.1			
Confl. Peds. (#/hr)	54		34	34		54	389		212	212		389		
Confl. Bikes (#/hr)			1			3			51			30		
Peak Hour Factor	0.88	0.88	0.88	0.73	0.73	0.73	0.92	0.92	0.92	0.99	0.99	0.99		
Heavy Vehicles (%)	11%	25%	3%	8%	4%	0%	4%	10%	5%	8%	12%	9%		
Adj. Flow (vph)	10	5	44	37	32	62	62	703	49	27	528	38		
Shared Lane Traffic (%)														
Lane Group Flow (vph)	0	59	0	0	131	0	0	814	0	27	566	0		
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA			
Protected Phases		5			5			1			1		2	6
Permitted Phases	5			5			1			1				
Detector Phase	5	5		5	5		1	1		1	1			
Switch Phase														
Minimum Initial (s)	8.0	8.0		8.0	8.0		10.0	10.0		10.0	10.0		1.0	1.0
Minimum Split (s)	29.5	29.5		29.5	29.5		25.5	25.5		25.5	25.5		6.0	6.0
Total Split (s)	38.0	38.0		38.0	38.0		70.0	70.0		70.0	70.0		6.0	6.0
Total Split (%)	31.7%	31.7%		31.7%	31.7%		58.3%	58.3%		58.3%	58.3%		5%	5%
Maximum Green (s)	32.5	32.5		32.5	32.5		64.5	64.5		64.5	64.5		4.0	4.0
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5		2.0	2.0
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0		0.0	0.0
Lost Time Adjust (s)		0.0			0.0			0.0		0.0	0.0			
Total Lost Time (s)		5.5			5.5			5.5		5.5	5.5			
Lead/Lag	Lag	Lag		Lag	Lag		Lag	Lag		Lag	Lag		Lead	Lead
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0
Recall Mode	Ped	Ped		Ped	Ped		C-Max	C-Max		C-Max	C-Max		Ped	Ped
Walk Time (s)	7.0	7.0		7.0	7.0		10.0	10.0		10.0	10.0		4.0	4.0
Flash Dont Walk (s)	17.0	17.0		17.0	17.0		10.0	10.0		10.0	10.0		0.0	0.0
Pedestrian Calls (#/hr)	88	88		88	88		500	500		500	500		500	88
Act Effct Green (s)		24.0			24.0			72.5		72.5	72.5			
Actuated g/C Ratio		0.20			0.20			0.60		0.60	0.60			
v/c Ratio		0.23			0.50			0.57		0.11	0.34			
Control Delay		43.0			50.1			16.2		19.6	23.6			
Queue Delay		0.2			0.8			1.1		0.0	2.1			
Total Delay		43.3			51.0			17.3		19.6	25.7			
LOS		D			D			B		B	C			
Approach Delay		43.3			51.0			17.3			25.4			
Approach LOS		D			D			B			C			
90th %ile Green (s)	24.0	24.0		24.0	24.0		72.5	72.5		72.5	72.5		4.5	4.0
90th %ile Term Code	Ped	Ped		Ped	Ped		Coord	Coord		Coord	Coord		Gap	Max
70th %ile Green (s)	24.0	24.0		24.0	24.0		72.5	72.5		72.5	72.5		4.5	4.0
70th %ile Term Code	Ped	Ped		Ped	Ped		Coord	Coord		Coord	Coord		Gap	Max
50th %ile Green (s)	24.0	24.0		24.0	24.0		72.5	72.5		72.5	72.5		4.5	4.0
50th %ile Term Code	Ped	Ped		Ped	Ped		Coord	Coord		Coord	Coord		Gap	Max
30th %ile Green (s)	24.0	24.0		24.0	24.0		72.5	72.5		72.5	72.5		4.5	4.0
30th %ile Term Code	Ped	Ped		Ped	Ped		Coord	Coord		Coord	Coord		Gap	Max
10th %ile Green (s)	24.0	24.0		24.0	24.0		72.5	72.5		72.5	72.5		4.5	4.0
10th %ile Term Code	Ped	Ped		Ped	Ped		Coord	Coord		Coord	Coord		Gap	Max
Stops (vph)		43			84			433		24	460			
Fuel Used(gal)		1			2			6		0	6			
CO Emissions (g/hr)		57			135			441		19	423			
NOx Emissions (g/hr)		11			26			86		4	82			
VOC Emissions (g/hr)		13			31			102		4	98			
Dilemma Vehicles (#)		0			0			0		0	0			
Queue Length 50th (ft)		39			91			187		16	195			
Queue Length 95th (ft)		77			123			246		m24	255			
Internal Link Dist (ft)		358			682			261			254			
Turn Bay Length (ft)										50				
Base Capacity (vph)		350			356			1435		252	1666			
Starvation Cap Reductn		0			0			0		0	925			
Spillback Cap Reductn		76			78			362		0	0			
Storage Cap Reductn		0			0			0		0	0			
Reduced v/c Ratio		0.22			0.47			0.76		0.11	0.76			

Intersection Summary

Area Type: CBD
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 53 (44%), Referenced to phase 1:NBSB, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.57
Intersection Signal Delay: 24.1 Intersection LOS: C
Intersection Capacity Utilization 75.6% ICU Level of Service D
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 134: Massachusetts Avenue & St. Botolph Street

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	425	41	0	612	0	56
Future Volume (vph)	425	41	0	612	0	56
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.95	0.95	1.00	0.91	1.00	1.00
Ped Bike Factor	0.99					
Frt	0.987					0.865
Flt Protected						
Satd. Flow (prot)	3168	0	0	4848	0	1644
Flt Permitted						
Satd. Flow (perm)	3168	0	0	4848	0	1644
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)	23					225
Link Speed (mph)	25			25	25	
Link Distance (ft)	598			523	321	
Travel Time (s)	16.3			14.3	8.8	
Confl. Peds. (#/hr)		163				73
Confl. Bikes (#/hr)		18				
Peak Hour Factor	0.94	0.94	0.91	0.91	0.75	0.75
Heavy Vehicles (%)	12%	0%	0%	7%	0%	0%
Adj. Flow (vph)	452	44	0	673	0	75
Shared Lane Traffic (%)						
Lane Group Flow (vph)	496	0	0	673	0	75
Turn Type	NA			NA		Prot
Protected Phases	1			1		3
Permitted Phases						
Detector Phase	1			1		3
Switch Phase						
Minimum Initial (s)	8.0			8.0		8.0
Minimum Split (s)	12.0			12.0		27.0
Total Split (s)	62.0			62.0		28.0
Total Split (%)	68.9%			68.9%		31.1%
Maximum Green (s)	58.0			58.0		24.0
Yellow Time (s)	3.0			3.0		3.0
All-Red Time (s)	1.0			1.0		1.0
Lost Time Adjust (s)	0.0			0.0		0.0
Total Lost Time (s)	4.0			4.0		4.0
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	2.0			2.0		2.0
Recall Mode	C-Max			C-Max		None
Walk Time (s)						15.0
Flash Dont Walk (s)						8.0
Pedestrian Calls (#/hr)						73
Act Effct Green (s)	65.2			65.2		20.0
Actuated g/C Ratio	0.72			0.72		0.22
v/c Ratio	0.22			0.19		0.14
Control Delay	5.6			5.6		0.5
Queue Delay	0.0			0.0		0.0
Total Delay	5.6			5.6		0.5
LOS	A			A		A
Approach Delay	5.6			5.6	0.5	
Approach LOS	A			A	A	
90th %ile Green (s)	59.0			59.0		23.0
90th %ile Term Code	Coord			Coord		Ped
70th %ile Green (s)	59.0			59.0		23.0
70th %ile Term Code	Coord			Coord		Ped
50th %ile Green (s)	59.0			59.0		23.0
50th %ile Term Code	Coord			Coord		Ped
30th %ile Green (s)	59.0			59.0		23.0
30th %ile Term Code	Coord			Coord		Ped
10th %ile Green (s)	86.0			86.0		0.0
10th %ile Term Code	Coord			Coord		Skip
Stops (vph)	148			195		0
Fuel Used(gal)	3			4		0
CO Emissions (g/hr)	243			291		11
NOx Emissions (g/hr)	47			57		2
VOC Emissions (g/hr)	56			67		3
Dilemma Vehicles (#)	0			0		0
Queue Length 50th (ft)	50			49		0
Queue Length 95th (ft)	72			65		0
Internal Link Dist (ft)	518			443	241	
Turn Bay Length (ft)						
Base Capacity (vph)	2301			3512		603
Starvation Cap Reductn	0			0		0
Spillback Cap Reductn	0			0		0
Storage Cap Reductn	0			0		0
Reduced v/c Ratio	0.22			0.19		0.12

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 70 (78%), Referenced to phase 1:EBWB, Start of Green
Natural Cycle: 40
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.22
Intersection Signal Delay: 5.3 Intersection LOS: A
Intersection Capacity Utilization 38.6% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 4001: Cumberland Street & Huntington Avenue

Intersection	
Intersection Delay, s/veh	8.5
Intersection LOS	A

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Lane Configurations														
Traffic Vol, veh/h	21	51	5	1	10	71	45	9	0	5	1	40	2	18
Future Vol, veh/h	21	51	5	1	10	71	45	9	0	5	1	40	2	18
Peak Hour Factor	0.66	0.66	0.66	0.85	0.85	0.85	0.85	0.58	0.58	0.58	0.85	0.85	0.85	0.85
Heavy Vehicles, %	5	6	0	0	0	3	0	0	0	0	100	3	0	6
Mvmt Flow	32	77	8	1	12	84	53	16	0	9	1	47	2	21
Number of Lanes	0	1	0	0	0	1	0	0	1	0	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.2	8	7.7	10.1
HCM LOS	A	A	A	B

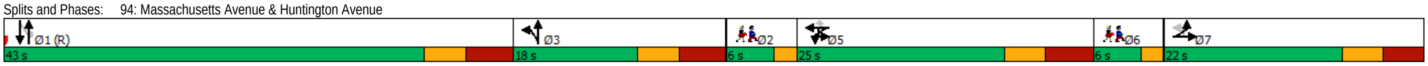
Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	64%	27%	8%	67%
Vol Thru, %	0%	66%	56%	3%
Vol Right, %	36%	6%	36%	30%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	14	77	127	61
LT Vol	9	21	10	41
Through Vol	0	51	72	2
RT Vol	5	5	45	18
Lane Flow Rate	24	117	149	72
Geometry Grp	1	1	1	1
Degree of Util (X)	0.03	0.144	0.171	0.123
Departure Headway (Hd)	4.51	4.438	4.116	6.169
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	794	810	874	583
Service Time	2.536	2.453	2.128	4.193
HCM Lane V/C Ratio	0.03	0.144	0.17	0.123
HCM Control Delay	7.7	8.2	8	10.1
HCM Lane LOS	A	A	A	B
HCM 95th-tile Q	0.1	0.5	0.6	0.4

Lane Group	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Ø2	Ø6
Lane Configurations			4Tb				4	r	7	Tb			4Tb			
Traffic Volume (vph)	9	100	47	100	15	108	82	97	74	815	22	1	502	99		
Future Volume (vph)	9	100	47	100	15	108	82	97	74	815	22	1	502	99		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900		
Storage Length (ft)		0		0		0		0	100		0	0		0		
Storage Lanes		0		0		0		1	1		0	0		0		
Taper Length (ft)		50				50			80			50				
Lane Util. Factor	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95		
Ped Bike Factor			0.80				0.92	0.61	0.65	0.99			0.85			
Frt			0.941					0.850		0.996			0.975			
Flt Protected			0.979				0.971		0.950							
Satd. Flow (prot)	0	0	2569	0	0	0	1610	1454	1608	3108	0	0	2557	0		
Flt Permitted			0.979				0.971		0.950				0.954			
Satd. Flow (perm)	0	0	2270	0	0	0	1475	891	1049	3108	0	0	2440	0		
Right Turn on Red				No				No			No			No		
Satd. Flow (RTOR)																
Link Speed (mph)			25				25			25			25			
Link Distance (ft)			408				165			334			296			
Travel Time (s)			11.1				4.5			9.1			8.1			
Confl. Peds. (#/hr)		310		85		85		310	880		329	329		880		
Confl. Bikes (#/hr)				2				5			49			31		
Peak Hour Factor	0.80	0.80	0.80	0.80	0.88	0.88	0.88	0.88	0.97	0.97	0.97	0.88	0.88	0.88		
Heavy Vehicles (%)	0%	4%	14%	5%	21%	3%	0%	0%	1%	3%	0%	0%	6%	2%		
Adj. Flow (vph)	11	125	59	125	17	123	93	110	76	840	23	1	570	113		
Shared Lane Traffic (%)																
Lane Group Flow (vph)	0	0	320	0	0	0	233	110	76	863	0	0	684	0		
Turn Type	Perm	Split	NA		Split	Split	NA	Perm	Prot	NA		Perm	NA			
Protected Phases		7	7		5	5	5		3	1 3			1		2	6
Permitted Phases	7							5				1				
Detector Phase	7	7	7		5	5	5	5	3	1 3		1	1			
Switch Phase																
Minimum Initial (s)	8.0	8.0	8.0		8.0	8.0	8.0	8.0	8.0			10.0	10.0		1.0	1.0
Minimum Split (s)	21.0	21.0	21.0		23.5	23.5	23.5	23.5	15.5			20.5	20.5		6.0	6.0
Total Split (s)	22.0	22.0	22.0		25.0	25.0	25.0	25.0	18.0			43.0	43.0		6.0	6.0
Total Split (%)	18.3%	18.3%	18.3%		20.8%	20.8%	20.8%	20.8%	15.0%			35.8%	35.8%		5%	5%
Maximum Green (s)	15.0	15.0	15.0		17.5	17.5	17.5	17.5	10.5			35.5	35.5		4.0	4.0
Yellow Time (s)	3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5			3.5	3.5		2.0	2.0
All-Red Time (s)	3.5	3.5	3.5		4.0	4.0	4.0	4.0	4.0			4.0	4.0		0.0	0.0
Lost Time Adjust (s)			0.0				0.0	0.0	0.0				0.0			
Total Lost Time (s)			7.0				7.5	7.5	7.5				7.5			
Lead/Lag					Lag	Lag	Lag	Lag	Lag			Lead	Lead		Lead	
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes			Yes	Yes		Yes	
Vehicle Extension (s)	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0			2.0	2.0		2.0	2.0
Recall Mode	Ped	Ped	Ped		Ped	Ped	Ped	Ped	Ped			C-Max	C-Max		Ped	Ped
Walk Time (s)	4.0	4.0	4.0		4.0	4.0	4.0	4.0	1.0			7.0	7.0		4.0	4.0
Flash Dont Walk (s)	10.0	10.0	10.0		12.0	12.0	12.0	12.0	6.0			6.0	6.0		0.0	0.0
Pedestrian Calls (#/hr)	85	85	85		310	310	310	310	329			500	500		310	85
Act Effct Green (s)			15.0				17.5	17.5	9.7	53.5			36.3			
Actuated g/C Ratio			0.12				0.15	0.15	0.08	0.45			0.30			
v/c Ratio			1.00				1.00	0.85	0.58	0.62			0.93			
Control Delay			102.2				109.4	98.4	90.9	49.7			58.6			
Queue Delay			0.0				0.0	0.0	0.0	51.2			5.8			
Total Delay			102.2				109.4	98.4	90.9	101.0			64.5			
LOS			F				F	F	F	F			E			
Approach Delay			102.2				105.9			100.1			64.5			
Approach LOS			F				F			F			E			
90th %ile Green (s)	15.0	15.0	15.0		17.5	17.5	17.5	17.5	10.5			35.5	35.5		4.0	4.0
90th %ile Term Code	Max	Max	Max		Max	Max	Max	Max	Max			Coord	Coord		Max	Max
70th %ile Green (s)	15.0	15.0	15.0		17.5	17.5	17.5	17.5	10.5			35.5	35.5		4.0	4.0
70th %ile Term Code	Max	Max	Max		Max	Max	Max	Max	Max			Coord	Coord		Max	Max
50th %ile Green (s)	15.0	15.0	15.0		17.5	17.5	17.5	17.5	10.5			35.5	35.5		4.0	4.0
50th %ile Term Code	Max	Max	Max		Max	Max	Max	Max	Max			Coord	Coord		Max	Max
30th %ile Green (s)	15.0	15.0	15.0		17.5	17.5	17.5	17.5	9.2			36.8	36.8		4.0	4.0
30th %ile Term Code	Max	Max	Max		Max	Max	Max	Max	Gap			Coord	Coord		Max	Max
10th %ile Green (s)	15.0	15.0	15.0		17.5	17.5	17.5	17.5	8.0			38.0	38.0		4.0	4.0
10th %ile Term Code	Max	Max	Max		Max	Max	Max	Max	Min			Coord	Coord		Max	Max
Stops (vph)			224				177	83	70	772			474			
Fuel Used(gal)			7				6	2	2	14			11			
CO Emissions (g/hr)			495				387	168	129	966			736			
NOx Emissions (g/hr)			96				75	33	25	188			143			
VOC Emissions (g/hr)			115				90	39	30	224			170			
Dilemma Vehicles (#)			0				0	0	0	0			0			
Queue Length 50th (ft)			132				183	84	58	342			184			
Queue Length 95th (ft)			#190				#336	#185	m93	410			#377			
Internal Link Dist (ft)			328				85			254			216			
Turn Bay Length (ft)									100							
Base Capacity (vph)			321				234	129	140	1405			737			
Starvation Cap Reductn			0				0	0	0	652			18			
Spillback Cap Reductn			0				0	0	0	31			35			
Storage Cap Reductn			0				0	0	0	0			0			
Reduced v/c Ratio			1.00				1.00	0.85	0.54	1.15			0.97			

Intersection Summary

Area Type: CBD
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 21 (18%), Referenced to phase 1:NBSB, Start of Green
Natural Cycle: 105
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.00
Intersection Signal Delay: 90.6 Intersection LOS: F
Intersection Capacity Utilization 96.5% ICU Level of Service F
Analysis Period (min) 15
\# 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.

Splits and Phases: 94: Massachusetts Avenue & Huntington Avenue

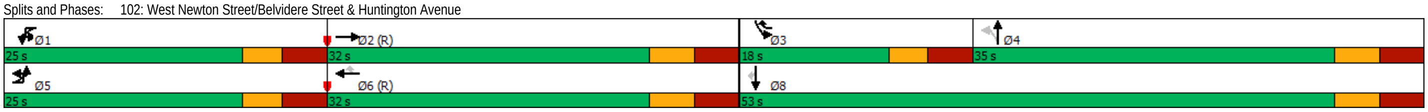


Lane Group	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations														
Traffic Volume (vph)	18	131	315	28	47	183	511	283	75	137	46	107	206	85
Future Volume (vph)	18	131	315	28	47	183	511	283	75	137	46	107	206	85
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)		200		0		200		0	0		0	0		0
Storage Lanes		1		0		1		1	0		0	1		1
Taper Length (ft)		50				50			50			50		
Lane Util. Factor	0.95	1.00	0.95	0.95	0.95	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.61	0.98			0.83		0.19		0.88		0.74		0.72
Frt			0.988					0.850		0.976				0.850
Flt Protected		0.950				0.950				0.986		0.950		
Satd. Flow (prot)	0	1687	3376	0	0	1791	3505	1538	0	1671	0	1736	1900	1615
Flt Permitted		0.950				0.950				0.810		0.950		
Satd. Flow (perm)	0	1034	3376	0	0	1493	3505	285	0	1296	0	1289	1900	1155
Right Turn on Red				Yes				Yes			Yes			Yes
Satd. Flow (RTOR)			8					146		10				104
Link Speed (mph)			25				25			25			25	
Link Distance (ft)			523				395			275			284	
Travel Time (s)			14.3				10.8			7.5			7.7	
Confl. Peds. (#/hr)		708		97		97		708	160		427	427		160
Confl. Bikes (#/hr)				1				4						2
Peak Hour Factor	0.91	0.91	0.91	0.91	0.96	0.96	0.96	0.96	0.87	0.87	0.87	0.79	0.79	0.79
Heavy Vehicles (%)	0%	8%	3%	4%	0%	1%	3%	5%	1%	2%	2%	4%	0%	0%
Adj. Flow (vph)	20	144	346	31	49	191	532	295	86	157	53	135	261	108
Shared Lane Traffic (%)														
Lane Group Flow (vph)	0	164	377	0	0	240	532	295	0	296	0	135	261	108
Turn Type	Prot	Prot	NA		Prot	Prot	NA	pm+ov	Perm	NA		Prot	NA	Perm
Protected Phases	5	5	2		1	1	6	3		4		3	8	
Permitted Phases								6	4					8
Detector Phase	5	5	2		1	1	6	3	4	4		3	8	8
Switch Phase														
Minimum Initial (s)	8.0	8.0	8.0		8.0	8.0	8.0	8.0	8.0	8.0		8.0	8.0	8.0
Minimum Split (s)	14.5	14.5	26.0		14.5	14.5	26.0	14.5	26.0	26.0		14.5	26.0	26.0
Total Split (s)	25.0	25.0	32.0		25.0	25.0	32.0	18.0	35.0	35.0		18.0	53.0	53.0
Total Split (%)	22.7%	22.7%	29.1%		22.7%	22.7%	29.1%	16.4%	31.8%	31.8%		16.4%	48.2%	48.2%
Maximum Green (s)	18.5	18.5	25.0		18.5	18.5	25.0	11.5	28.0	28.0		11.5	46.0	46.0
Yellow Time (s)	3.0	3.0	3.5		3.0	3.0	3.5	3.0	3.5	3.5		3.0	3.5	3.5
All-Red Time (s)	3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5
Lost Time Adjust (s)		0.0	0.0			0.0	0.0	0.0		0.0		0.0	0.0	0.0
Total Lost Time (s)		6.5	7.0			6.5	7.0	6.5		7.0		6.5	7.0	7.0
Lead/Lag	Lead	Lead	Lag		Lead	Lead	Lag	Lead	Lag	Lag		Lead		
Lead-Lag Optimize?	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes		Yes		
Vehicle Extension (s)	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0
Recall Mode	None	None	C-Max		None	None	C-Max	None	None	None		None	None	None
Walk Time (s)			7.0				7.0		12.0	12.0			12.0	12.0
Flash Dont Walk (s)			12.0				12.0		7.0	7.0			7.0	7.0
Pedestrian Calls (#/hr)			97				500		427	427			160	160
Act Effct Green (s)		14.5	28.6			17.1	31.2	42.7		26.3		11.0	43.8	43.8
Actuated g/C Ratio		0.13	0.26			0.16	0.28	0.39		0.24		0.10	0.40	0.40
v/c Ratio		0.74	0.43			0.86	0.54	0.91		0.93		0.78	0.35	0.21
Control Delay		65.0	36.2			73.9	37.2	53.8		75.9		78.1	24.0	5.3
Queue Delay		0.0	0.0			0.0	0.0	0.0		0.0		0.0	0.0	0.0
Total Delay		65.0	36.2			73.9	37.2	53.8		75.9		78.1	24.0	5.3
LOS		E	D			E	D	D		E		E	C	A
Approach Delay			44.9				50.1			75.9			34.5	
Approach LOS			D				D			E			C	
90th %ile Green (s)	18.5	18.5	25.0		18.5	18.5	25.0	11.5	28.0	28.0		11.5	46.0	46.0
90th %ile Term Code	Max	Max	Coord		Max	Max	Coord	Max	Max	Max		Max	Hold	Hold
70th %ile Green (s)	17.4	17.4	25.0		18.5	18.5	26.1	11.5	28.0	28.0		11.5	46.0	46.0
70th %ile Term Code	Gap	Gap	Coord		Max	Max	Coord	Max	Max	Max		Max	Hold	Hold
50th %ile Green (s)	15.0	15.0	25.0		18.5	18.5	28.5	11.5	28.0	28.0		11.5	46.0	46.0
50th %ile Term Code	Gap	Gap	Coord		Max	Max	Coord	Max	Max	Max		Max	Hold	Hold
30th %ile Green (s)	12.6	12.6	27.7		16.9	16.9	32.0	11.5	26.9	26.9		11.5	44.9	44.9
30th %ile Term Code	Gap	Gap	Coord		Gap	Gap	Coord	Max	Gap	Gap		Max	Hold	Hold
10th %ile Green (s)	9.0	9.0	40.5		12.9	12.9	44.4	8.8	20.8	20.8		8.8	36.1	36.1
10th %ile Term Code	Gap	Gap	Coord		Gap	Gap	Coord	Gap	Gap	Gap		Gap	Hold	Hold
Stops (vph)		139	277			210	429	103		222		97	138	11
Fuel Used(gal)		3	5			5	7	4		5		2	2	0
CO Emissions (g/hr)		222	358			352	506	311		380		163	142	24
NOx Emissions (g/hr)		43	70			69	98	60		74		32	28	5
VOC Emissions (g/hr)		51	83			82	117	72		88		38	33	5
Dilemma Vehicles (#)		0	0			0	0	0		0		0	0	0
Queue Length 50th (ft)		112	120			165	173	76		195		94	122	2
Queue Length 95th (ft)		180	168			#289	241	#245		#334		#151	159	25
Internal Link Dist (ft)			443				315			195			204	
Turn Bay Length (ft)		200				200								
Base Capacity (vph)		283	885			301	994	331		337		181	794	543
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		0.58	0.43			0.80	0.54	0.89		0.88		0.75	0.33	0.20

Intersection Summary

Area Type: Other
Cycle Length: 110
Actuated Cycle Length: 110
Offset: 54 (49%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.93
Intersection Signal Delay: 48.8 Intersection LOS: D
Intersection Capacity Utilization 83.1% ICU Level of Service E
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 102: West Newton Street/Belvidere Street & Huntington Avenue



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Ø2	Ø6
Lane Configurations														
Traffic Volume (vph)	21	16	69	32	17	24	53	853	42	34	613	35		
Future Volume (vph)	21	16	69	32	17	24	53	853	42	34	613	35		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900		
Storage Length (ft)	0		0	0		0	100		0	50		0		
Storage Lanes	0		0	0		0	0		0	1		0		
Taper Length (ft)	50			50			50			80				
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	1.00	0.95	0.95		
Ped Bike Factor		0.91			0.91			0.96		0.92	0.97			
Frt		0.913			0.955			0.993			0.992			
Flt Protected		0.990			0.978			0.997		0.950				
Satd. Flow (prot)	0	1439	0	0	1485	0	0	3052	0	1533	2949	0		
Flt Permitted		0.928			0.824			0.859		0.231				
Satd. Flow (perm)	0	1312	0	0	1212	0	0	2603	0	343	2949	0		
Right Turn on Red			No			No			No			Yes		
Satd. Flow (RTOR)											7			
Link Speed (mph)		25			25			25			25			
Link Distance (ft)		438			762			341			334			
Travel Time (s)		11.9			20.8			9.3			9.1			
Confl. Peds. (#/hr)	109		64	64		109	334		262	262		334		
Confl. Bikes (#/hr)			1			3			51			30		
Peak Hour Factor	0.82	0.82	0.82	0.80	0.80	0.80	0.95	0.95	0.95	0.94	0.94	0.94		
Heavy Vehicles (%)	0%	0%	0%	0%	6%	0%	0%	3%	0%	6%	6%	0%		
Adj. Flow (vph)	26	20	84	40	21	30	56	898	44	36	652	37		
Shared Lane Traffic (%)														
Lane Group Flow (vph)	0	130	0	0	91	0	0	998	0	36	689	0		
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA			
Protected Phases		5			5			1			1		2	6
Permitted Phases	5			5			1			1				
Detector Phase	5	5		5	5		1	1		1	1			
Switch Phase														
Minimum Initial (s)	8.0	8.0		8.0	8.0		10.0	10.0		10.0	10.0		1.0	1.0
Minimum Split (s)	29.5	29.5		29.5	29.5		25.5	25.5		25.5	25.5		6.0	6.0
Total Split (s)	38.0	38.0		38.0	38.0		70.0	70.0		70.0	70.0		6.0	6.0
Total Split (%)	31.7%	31.7%		31.7%	31.7%		58.3%	58.3%		58.3%	58.3%		5%	5%
Maximum Green (s)	32.5	32.5		32.5	32.5		64.5	64.5		64.5	64.5		4.0	4.0
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5		2.0	2.0
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0		0.0	0.0
Lost Time Adjust (s)		0.0			0.0			0.0		0.0	0.0			
Total Lost Time (s)		5.5			5.5			5.5		5.5	5.5			
Lead/Lag	Lag	Lag		Lag	Lag		Lag	Lag		Lag	Lag		Lead	Lead
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0
Recall Mode	Ped	Ped		Ped	Ped		C-Max	C-Max		C-Max	C-Max		Ped	Ped
Walk Time (s)	7.0	7.0		7.0	7.0		10.0	10.0		10.0	10.0		4.0	4.0
Flash Dont Walk (s)	17.0	17.0		17.0	17.0		10.0	10.0		10.0	10.0		0.0	0.0
Pedestrian Calls (#/hr)	173	173		173	173		500	500		500	500		500	173
Act Effct Green (s)		24.0			24.0			72.5		72.5	72.5			
Actuated g/C Ratio		0.20			0.20			0.60		0.60	0.60			
v/c Ratio		0.50			0.38			0.63		0.17	0.39			
Control Delay		50.1			46.8			17.6		20.7	22.9			
Queue Delay		1.6			0.9			8.4		0.0	7.8			
Total Delay		51.7			47.8			26.0		20.7	30.7			
LOS		D			D			C		C	C			
Approach Delay		51.7			47.8			26.0			30.2			
Approach LOS		D			D			C			C			
90th %ile Green (s)	24.0	24.0		24.0	24.0		72.5	72.5		72.5	72.5		4.5	4.0
90th %ile Term Code	Ped	Ped		Ped	Ped		Coord	Coord		Coord	Coord		Gap	Max
70th %ile Green (s)	24.0	24.0		24.0	24.0		72.5	72.5		72.5	72.5		4.5	4.0
70th %ile Term Code	Ped	Ped		Ped	Ped		Coord	Coord		Coord	Coord		Gap	Max
50th %ile Green (s)	24.0	24.0		24.0	24.0		72.5	72.5		72.5	72.5		4.5	4.0
50th %ile Term Code	Ped	Ped		Ped	Ped		Coord	Coord		Coord	Coord		Gap	Max
30th %ile Green (s)	24.0	24.0		24.0	24.0		72.5	72.5		72.5	72.5		4.5	4.0
30th %ile Term Code	Ped	Ped		Ped	Ped		Coord	Coord		Coord	Coord		Gap	Max
10th %ile Green (s)	24.0	24.0		24.0	24.0		72.5	72.5		72.5	72.5		4.5	4.0
10th %ile Term Code	Ped	Ped		Ped	Ped		Coord	Coord		Coord	Coord		Gap	Max
Stops (vph)		94			62			585		27	548			
Fuel Used(gal)		2			1			8		0	7			
CO Emissions (g/hr)		129			98			586		24	487			
NOx Emissions (g/hr)		25			19			114		5	95			
VOC Emissions (g/hr)		30			23			136		6	113			
Dilemma Vehicles (#)		0			0			0		0	0			
Queue Length 50th (ft)		90			62			245		24	238			
Queue Length 95th (ft)		140			101			314		m25	m252			
Internal Link Dist (ft)		358			682			261			254			
Turn Bay Length (ft)										50				
Base Capacity (vph)		355			328			1572		207	1784			
Starvation Cap Reductn		0			0			0		0	1045			
Spillback Cap Reductn		109			101			537		0	0			
Storage Cap Reductn		0			0			0		0	0			
Reduced v/c Ratio		0.53			0.40			0.96		0.17	0.93			

Intersection Summary

Area Type: CBD
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 69 (58%), Referenced to phase 1:NBSB, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.63
Intersection Signal Delay: 30.3 Intersection LOS: C
Intersection Capacity Utilization 84.1% ICU Level of Service E
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 134: Massachusetts Avenue & St. Botolph Street

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↱			↑↑↑		↱
Traffic Volume (vph)	487	75	0	631	0	69
Future Volume (vph)	487	75	0	631	0	69
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12
Grade (%)	0%			0%	0%	
Storage Length (ft)		0	0		0	0
Storage Lanes		0	0		0	1
Taper Length (ft)			50		50	
Lane Util. Factor	0.95	0.95	1.00	0.91	1.00	1.00
Ped Bike Factor	0.97					
Frt	0.980					0.865
Flt Protected						
Satd. Flow (prot)	3320	0	0	5036	0	1644
Flt Permitted						
Satd. Flow (perm)	3320	0	0	5036	0	1644
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)	38					140
Link Speed (mph)	25			25	25	
Link Distance (ft)	598			523	321	
Travel Time (s)	16.3			14.3	8.8	
Confl. Peds. (#/hr)		251				70
Confl. Bikes (#/hr)		18				
Peak Hour Factor	0.97	0.97	0.94	0.94	0.83	0.83
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	4%	0%	0%	3%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%			0%	0%	
Adj. Flow (vph)	502	77	0	671	0	83
Shared Lane Traffic (%)						
Lane Group Flow (vph)	579	0	0	671	0	83
Turn Type	NA			NA		Prot
Protected Phases	1			1		3
Permitted Phases						
Detector Phase	1			1		3
Switch Phase						
Minimum Initial (s)	8.0			8.0		8.0
Minimum Split (s)	12.0			12.0		27.0
Total Split (s)	62.0			62.0		28.0
Total Split (%)	68.9%			68.9%		31.1%
Maximum Green (s)	58.0			58.0		24.0
Yellow Time (s)	3.0			3.0		3.0
All-Red Time (s)	1.0			1.0		1.0
Lost Time Adjust (s)	0.0			0.0		0.0
Total Lost Time (s)	4.0			4.0		4.0
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	2.0			2.0		2.0
Minimum Gap (s)	2.0			2.0		2.0
Time Before Reduce (s)	0.0			0.0		0.0
Time To Reduce (s)	0.0			0.0		0.0
Recall Mode	C-Max			C-Max		None
Walk Time (s)						15.0
Flash Dont Walk (s)						8.0
Pedestrian Calls (#/hr)						70
Act Effct Green (s)	65.2			65.2		20.0
Actuated g/C Ratio	0.72			0.72		0.22
v/c Ratio	0.24			0.18		0.18
Control Delay	5.6			5.5		1.8
Queue Delay	0.0			0.0		0.0
Total Delay	5.6			5.5		1.8
LOS	A			A		A
Approach Delay	5.6			5.5	1.8	
Approach LOS	A			A	A	
90th %ile Green (s)	59.0			59.0		23.0
90th %ile Term Code	Coord			Coord		Ped
70th %ile Green (s)	59.0			59.0		23.0
70th %ile Term Code	Coord			Coord		Ped
50th %ile Green (s)	59.0			59.0		23.0
50th %ile Term Code	Coord			Coord		Ped
30th %ile Green (s)	59.0			59.0		23.0
30th %ile Term Code	Coord			Coord		Ped
10th %ile Green (s)	86.0			86.0		0.0
10th %ile Term Code	Coord			Coord		Skip
Queue Length 50th (ft)	59			49		0
Queue Length 95th (ft)	82			64		3
Internal Link Dist (ft)	518			443	241	
Turn Bay Length (ft)						
Base Capacity (vph)	2415			3648		541
Starvation Cap Reductn	0			0		0
Spillback Cap Reductn	0			0		0
Storage Cap Reductn	0			0		0
Reduced v/c Ratio	0.24			0.18		0.15

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 66 (73%), Referenced to phase 1:EBWB, Start of Green
Natural Cycle: 40
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.24
Intersection Signal Delay: 5.3 Intersection LOS: A
Intersection Capacity Utilization 41.8% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 4001: Cumberland Street & Huntington Avenue

Intersection	
Intersection Delay, s/veh	8.3
Intersection LOS	A

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Lane Configurations														
Traffic Vol, veh/h	24	58	6	1	8	60	36	3	1	4	1	83	0	18
Future Vol, veh/h	24	58	6	1	8	60	36	3	1	4	1	83	0	18
Peak Hour Factor	0.82	0.82	0.82	0.62	0.62	0.62	0.62	0.50	0.50	0.50	0.79	0.79	0.79	0.79
Heavy Vehicles, %	4	0	0	0	0	5	0	0	0	0	0	0	0	0
Mvmt Flow	29	71	7	2	13	97	58	6	2	8	1	105	0	23
Number of Lanes	0	1	0	0	0	1	0	0	1	0	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.2	8.2	7.6	8.5
HCM LOS	A	A	A	A

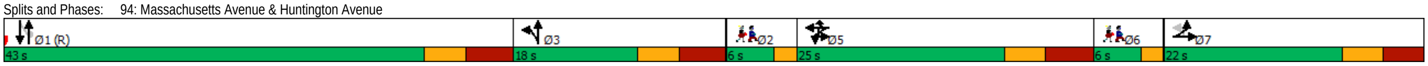
Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	38%	27%	8%	82%
Vol Thru, %	12%	66%	58%	0%
Vol Right, %	50%	7%	35%	18%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	8	88	105	102
LT Vol	3	24	8	84
Through Vol	1	58	61	0
RT Vol	4	6	36	18
Lane Flow Rate	16	107	169	129
Geometry Grp	1	1	1	1
Degree of Util (X)	0.02	0.134	0.196	0.165
Departure Headway (Hd)	4.442	4.502	4.172	4.587
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	806	797	862	784
Service Time	2.467	2.522	2.19	2.606
HCM Lane V/C Ratio	0.02	0.134	0.196	0.165
HCM Control Delay	7.6	8.2	8.2	8.5
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.1	0.5	0.7	0.6

Lane Group	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Ø2	Ø6
Lane Configurations			↰↑↱				↰↑	↱	↰	↑↱			↰↑↱			
Traffic Volume (vph)	10	100	64	54	2	68	46	114	34	668	24	2	474	76		
Future Volume (vph)	10	100	64	54	2	68	46	114	34	668	24	2	474	76		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900		
Storage Length (ft)		0		0		0		0	100		0	0		0		
Storage Lanes		0		0		0		1	1		0	0		0		
Taper Length (ft)		50				50			80			50				
Lane Util. Factor	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95		
Ped Bike Factor			0.83				0.87		0.63	0.99			0.88			
Frt			0.964					0.850		0.995			0.979			
Flt Protected			0.977				0.971		0.950							
Satd. Flow (prot)	0	0	2610	0	0	0	1456	1264	1413	2919	0	0	2500	0		
Flt Permitted			0.977				0.971		0.950				0.953			
Satd. Flow (perm)	0	0	2332	0	0	0	1270	1264	897	2919	0	0	2382	0		
Right Turn on Red				No				No			No			No		
Satd. Flow (RTOR)																
Link Speed (mph)			25				25			25			25			
Link Distance (ft)			408				165			334			296			
Travel Time (s)			11.1				4.5			9.1			8.1			
Confl. Peds. (#/hr)		119		122		122		119	486		234	234		486		
Confl. Bikes (#/hr)				2				5			49			31		
Peak Hour Factor	0.89	0.89	0.89	0.89	0.85	0.85	0.85	0.85	0.92	0.92	0.92	0.91	0.91	0.91		
Heavy Vehicles (%)	10%	8%	8%	10%	0%	5%	28%	15%	15%	9%	17%	0%	13%	7%		
Adj. Flow (vph)	11	112	72	61	2	80	54	134	37	726	26	2	521	84		
Shared Lane Traffic (%)																
Lane Group Flow (vph)	0	0	256	0	0	0	136	134	37	752	0	0	607	0		
Turn Type	Perm	Split	NA		Split	Split	NA	Prot	Prot	NA		Perm	NA			
Protected Phases		7	7		5	5	5	5	3	1 3			1		2	6
Permitted Phases	7											1				
Detector Phase	7	7	7		5	5	5	5	3	1 3		1	1			
Switch Phase																
Minimum Initial (s)	8.0	8.0	8.0		8.0	8.0	8.0	8.0	8.0			10.0	10.0		1.0	1.0
Minimum Split (s)	21.0	21.0	21.0		23.5	23.5	23.5	23.5	15.5			20.5	20.5		6.0	6.0
Total Split (s)	22.0	22.0	22.0		25.0	25.0	25.0	25.0	18.0			43.0	43.0		6.0	6.0
Total Split (%)	18.3%	18.3%	18.3%		20.8%	20.8%	20.8%	20.8%	15.0%			35.8%	35.8%		5%	5%
Maximum Green (s)	15.0	15.0	15.0		17.5	17.5	17.5	17.5	10.5			35.5	35.5		4.0	4.0
Yellow Time (s)	3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5			3.5	3.5		2.0	2.0
All-Red Time (s)	3.5	3.5	3.5		4.0	4.0	4.0	4.0	4.0			4.0	4.0		0.0	0.0
Lost Time Adjust (s)			0.0				0.0	0.0	0.0				0.0			
Total Lost Time (s)			7.0				7.5	7.5	7.5				7.5			
Lead/Lag					Lag	Lag	Lag	Lag	Lag			Lead	Lead		Lead	
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes			Yes	Yes		Yes	
Vehicle Extension (s)	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0			2.0	2.0		2.0	2.0
Recall Mode	Ped	Ped	Ped		Ped	Ped	Ped	Ped	Ped			C-Max	C-Max		Ped	Ped
Walk Time (s)	4.0	4.0	4.0		4.0	4.0	4.0	4.0	1.0			7.0	7.0		4.0	4.0
Flash Dont Walk (s)	10.0	10.0	10.0		12.0	12.0	12.0	12.0	6.0			6.0	6.0		0.0	0.0
Pedestrian Calls (#/hr)	122	122	122		119	119	119	119	234			500	500		119	122
Act Effct Green (s)			14.7				16.9	16.9	9.0	54.4			37.9			
Actuated g/C Ratio			0.12				0.14	0.14	0.08	0.45			0.32			
v/c Ratio			0.80				0.66	0.75	0.35	0.57			0.81			
Control Delay			70.5				65.2	75.6	85.0	48.8			51.0			
Queue Delay			0.0				0.0	0.0	0.0	14.0			5.4			
Total Delay			70.5				65.2	75.6	85.0	62.8			56.4			
LOS			E				E	E	F	E			E			
Approach Delay			70.5				70.4			63.8			56.4			
Approach LOS			E				E			E			E			
90th %ile Green (s)	15.0	15.0	15.0		17.5	17.5	17.5	17.5	10.5			35.5	35.5		4.0	4.0
90th %ile Term Code	Max	Max	Max		Max	Max	Max	Max	Max			Coord	Coord		Max	Max
70th %ile Green (s)	15.0	15.0	15.0		17.5	17.5	17.5	17.5	9.9			36.1	36.1		4.0	4.0
70th %ile Term Code	Max	Max	Max		Max	Max	Max	Max	Gap			Coord	Coord		Max	Max
50th %ile Green (s)	15.0	15.0	15.0		17.5	17.5	17.5	17.5	8.5			37.5	37.5		4.0	4.0
50th %ile Term Code	Max	Max	Max		Max	Max	Max	Max	Gap			Coord	Coord		Max	Max
30th %ile Green (s)	14.4	14.4	14.4		16.0	16.0	16.0	16.0	8.0			40.1	40.1		4.0	4.0
30th %ile Term Code	Gap	Gap	Gap		Ped	Ped	Ped	Ped	Min			Coord	Coord		Max	Max
10th %ile Green (s)	14.0	14.0	14.0		16.0	16.0	16.0	16.0	8.0			40.5	40.5		4.0	4.0
10th %ile Term Code	Ped	Ped	Ped		Ped	Ped	Ped	Ped	Min			Coord	Coord		Max	Max
Stops (vph)			210				107	103	33	654			401			
Fuel Used(gal)			5				2	2	1	11			9			
CO Emissions (g/hr)			341				148	162	57	793			606			
NOx Emissions (g/hr)			66				29	31	11	154			118			
VOC Emissions (g/hr)			79				34	37	13	184			140			
Dilemma Vehicles (#)			0				0	0	0	0			0			
Queue Length 50th (ft)			102				101	100	31	312			191			
Queue Length 95th (ft)			#163				160	#177	m53	366			#316			
Internal Link Dist (ft)			328				85			254			216			
Turn Bay Length (ft)									100							
Base Capacity (vph)			326				212	184	123	1360			752			
Starvation Cap Reductn			0				0	0	0	596			97			
Spillback Cap Reductn			0				0	0	0	179			3			
Storage Cap Reductn			0				0	0	0	0			0			
Reduced v/c Ratio			0.79				0.64	0.73	0.30	0.98			0.93			

Intersection Summary

Area Type: CBD
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 3 (3%), Referenced to phase 1:NBSB, Start of Green
Natural Cycle: 105
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.81
Intersection Signal Delay: 63.3 Intersection LOS: E
Intersection Capacity Utilization 66.0% ICU Level of Service C
Analysis Period (min) 15
\# 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.

Splits and Phases: 94: Massachusetts Avenue & Huntington Avenue

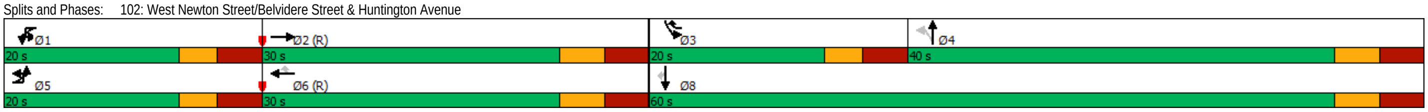


Lane Group	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations														
Traffic Volume (vph)	15	110	288	28	78	133	466	313	43	245	80	75	92	45
Future Volume (vph)	15	110	288	28	78	133	466	313	43	245	80	75	92	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)		200		0		200		0	0		0	0		0
Storage Lanes		1		0		1		1	0		0	1		1
Taper Length (ft)		50				50			50			50		
Lane Util. Factor	0.95	1.00	0.95	0.95	0.95	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.72	0.95			0.68		0.44		0.90		0.78		0.83
Frt			0.987					0.850		0.971				0.850
Flt Protected		0.950				0.950				0.994		0.950		
Satd. Flow (prot)	0	1572	3172	0	0	1733	3312	1417	0	1643	0	1671	1863	1509
Flt Permitted		0.950				0.950				0.948		0.950		
Satd. Flow (perm)	0	1129	3172	0	0	1177	3312	623	0	1541	0	1311	1863	1259
Right Turn on Red				Yes				Yes			Yes			Yes
Satd. Flow (RTOR)			8					104		13				104
Link Speed (mph)			25				25			25			25	
Link Distance (ft)			523				395			275			284	
Travel Time (s)			14.3				10.8			7.5			7.7	
Confl. Peds. (#/hr)		258		207		207		258	90		366	366		90
Confl. Bikes (#/hr)				1				4						2
Peak Hour Factor	0.91	0.91	0.91	0.91	0.97	0.97	0.97	0.97	0.96	0.96	0.96	0.94	0.94	0.94
Heavy Vehicles (%)	21%	14%	7%	7%	1%	6%	9%	14%	2%	2%	5%	8%	2%	7%
Adj. Flow (vph)	16	121	316	31	80	137	480	323	45	255	83	80	98	48
Shared Lane Traffic (%)														
Lane Group Flow (vph)	0	137	347	0	0	217	480	323	0	383	0	80	98	48
Turn Type	Prot	Prot	NA		Prot	Prot	NA	pm+ov	Perm	NA		Prot	NA	Perm
Protected Phases	5	5	2		1	1	6	3		4		3	8	
Permitted Phases								6	4					8
Detector Phase	5	5	2		1	1	6	3	4	4		3	8	8
Switch Phase														
Minimum Initial (s)	8.0	8.0	8.0		8.0	8.0	8.0	8.0	8.0	8.0		8.0	8.0	8.0
Minimum Split (s)	14.5	14.5	26.0		14.5	14.5	26.0	14.5	26.0	26.0		14.5	26.0	26.0
Total Split (s)	20.0	20.0	30.0		20.0	20.0	30.0	20.0	40.0	40.0		20.0	60.0	60.0
Total Split (%)	18.2%	18.2%	27.3%		18.2%	18.2%	27.3%	18.2%	36.4%	36.4%		18.2%	54.5%	54.5%
Maximum Green (s)	13.5	13.5	23.0		13.5	13.5	23.0	13.5	33.0	33.0		13.5	53.0	53.0
Yellow Time (s)	3.0	3.0	3.5		3.0	3.0	3.5	3.0	3.5	3.5		3.0	3.5	3.5
All-Red Time (s)	3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5
Lost Time Adjust (s)		0.0	0.0			0.0	0.0	0.0		0.0		0.0	0.0	0.0
Total Lost Time (s)		6.5	7.0			6.5	7.0	6.5		7.0		6.5	7.0	7.0
Lead/Lag	Lead	Lead	Lag		Lead	Lead	Lag	Lead	Lag	Lag		Lead		
Lead-Lag Optimize?	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes		Yes		
Vehicle Extension (s)	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0
Recall Mode	None	None	C-Max		None	None	C-Max	None	None	None		None	None	None
Walk Time (s)			7.0				7.0		12.0	12.0			12.0	12.0
Flash Dont Walk (s)			12.0				12.0		7.0	7.0			7.0	7.0
Pedestrian Calls (#/hr)			207				258		366	366			90	90
Act Effct Green (s)		12.4	25.4			16.3	29.3	41.7		29.4		11.9	47.8	47.8
Actuated g/C Ratio		0.11	0.23			0.15	0.27	0.38		0.27		0.11	0.43	0.43
v/c Ratio		0.78	0.47			0.84	0.54	0.84		0.91		0.44	0.12	0.08
Control Delay		75.7	39.0			75.2	39.4	42.5		63.8		53.4	17.4	0.3
Queue Delay		0.0	0.0			0.0	0.0	0.0		0.0		0.0	0.0	0.0
Total Delay		75.7	39.0			75.2	39.4	42.5		63.8		53.4	17.4	0.3
LOS		E	D			E	D	D		E		D	B	A
Approach Delay			49.4				48.0			63.8			26.5	
Approach LOS			D				D			E			C	
90th %ile Green (s)	13.5	13.5	23.0		13.5	13.5	23.0	13.5	33.0	33.0		13.5	53.0	53.0
90th %ile Term Code	Max	Max	Coord		Max	Max	Coord	Max	Max	Max		Max	Hold	Hold
70th %ile Green (s)	13.5	13.5	23.0		13.5	13.5	23.0	13.5	33.0	33.0		13.5	53.0	53.0
70th %ile Term Code	Max	Max	Coord		Max	Max	Coord	Max	Max	Max		Max	Hold	Hold
50th %ile Green (s)	14.4	14.4	23.0		14.8	14.8	23.4	13.5	31.7	31.7		13.5	51.7	51.7
50th %ile Term Code	Gap	Gap	Coord		Max	Max	Coord	Max	Gap	Gap		Max	Hold	Hold
30th %ile Green (s)	12.0	12.0	23.8		20.5	20.5	32.3	11.0	27.7	27.7		11.0	45.2	45.2
30th %ile Term Code	Gap	Gap	Coord		Gap	Gap	Coord	Gap	Gap	Gap		Gap	Hold	Hold
10th %ile Green (s)	8.5	8.5	34.0		19.3	19.3	44.8	8.0	21.7	21.7		8.0	36.2	36.2
10th %ile Term Code	Gap	Gap	Coord		Gap	Gap	Coord	Min	Gap	Gap		Min	Hold	Hold
Stops (vph)		114	263			169	398	221		326		68	51	0
Fuel Used(gal)		3	5			5	7	5		7		1	1	0
CO Emissions (g/hr)		204	345			319	478	322		482		88	52	8
NOx Emissions (g/hr)		40	67			62	93	63		94		17	10	2
VOC Emissions (g/hr)		47	80			74	111	75		112		20	12	2
Dilemma Vehicles (#)		0	0			0	0	0		0		0	0	0
Queue Length 50th (ft)		93	112			154	165	113		247		53	38	0
Queue Length 95th (ft)		#185	160			#315	224	#276		#398		102	67	0
Internal Link Dist (ft)			443				315			195			204	
Turn Bay Length (ft)		200				200								
Base Capacity (vph)		195	737			257	882	405		471		205	897	660
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		0.70	0.47			0.84	0.54	0.80		0.81		0.39	0.11	0.07

Intersection Summary

Area Type: Other
Cycle Length: 110
Actuated Cycle Length: 110
Offset: 48 (44%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.91
Intersection Signal Delay: 48.9 — Intersection LOS: D
Intersection Capacity Utilization 83.3% — ICU Level of Service E
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 102: West Newton Street/Belvidere Street & Huntington Avenue



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Ø2	Ø6
Lane Configurations		↰↑↱			↰↑↱			↰↑↑↱		↰	↑↑↱			
Traffic Volume (vph)	9	4	39	28	23	45	57	647	45	27	523	38		
Future Volume (vph)	9	4	39	28	23	45	57	647	45	27	523	38		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900		
Storage Length (ft)	0		0	0		0	100		0	50		0		
Storage Lanes	0		0	0		0	0		0	1		0		
Taper Length (ft)	50			50			50			80				
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	1.00	0.95	0.95		
Ped Bike Factor		0.94			0.94			0.95		0.88	0.96			
Frt		0.899			0.937			0.991			0.990			
Flt Protected		0.992			0.986			0.996		0.950				
Satd. Flow (prot)	0	1369	0	0	1463	0	0	2838	0	1504	2752	0		
Flt Permitted		0.948			0.898			0.850		0.300				
Satd. Flow (perm)	0	1295	0	0	1314	0	0	2376	0	418	2752	0		
Right Turn on Red			No			No			No			Yes		
Satd. Flow (RTOR)											9			
Link Speed (mph)		25			25			25			25			
Link Distance (ft)		438			762			341			334			
Travel Time (s)		11.9			20.8			9.3			9.1			
Confl. Peds. (#/hr)	54		34	34		54	389		212	212		389		
Confl. Bikes (#/hr)			1			3			51			30		
Peak Hour Factor	0.88	0.88	0.88	0.73	0.73	0.73	0.92	0.92	0.92	0.99	0.99	0.99		
Heavy Vehicles (%)	11%	25%	3%	8%	4%	0%	4%	10%	5%	8%	12%	9%		
Adj. Flow (vph)	10	5	44	38	32	62	62	703	49	27	528	38		
Shared Lane Traffic (%)														
Lane Group Flow (vph)	0	59	0	0	132	0	0	814	0	27	566	0		
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA			
Protected Phases		5			5			1			1		2	6
Permitted Phases	5			5			1			1				
Detector Phase	5	5		5	5		1	1		1	1			
Switch Phase														
Minimum Initial (s)	8.0	8.0		8.0	8.0		10.0	10.0		10.0	10.0		1.0	1.0
Minimum Split (s)	29.5	29.5		29.5	29.5		25.5	25.5		25.5	25.5		6.0	6.0
Total Split (s)	38.0	38.0		38.0	38.0		70.0	70.0		70.0	70.0		6.0	6.0
Total Split (%)	31.7%	31.7%		31.7%	31.7%		58.3%	58.3%		58.3%	58.3%		5%	5%
Maximum Green (s)	32.5	32.5		32.5	32.5		64.5	64.5		64.5	64.5		4.0	4.0
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5		2.0	2.0
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0		0.0	0.0
Lost Time Adjust (s)		0.0			0.0			0.0		0.0	0.0			
Total Lost Time (s)		5.5			5.5			5.5		5.5	5.5			
Lead/Lag	Lag	Lag		Lag	Lag		Lag	Lag		Lag	Lag		Lead	Lead
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0
Recall Mode	Ped	Ped		Ped	Ped		C-Max	C-Max		C-Max	C-Max		Ped	Ped
Walk Time (s)	7.0	7.0		7.0	7.0		10.0	10.0		10.0	10.0		4.0	4.0
Flash Dont Walk (s)	17.0	17.0		17.0	17.0		10.0	10.0		10.0	10.0		0.0	0.0
Pedestrian Calls (#/hr)	88	88		88	88		500	500		500	500		500	88
Act Effct Green (s)		24.0			24.0			72.5		72.5	72.5			
Actuated g/C Ratio		0.20			0.20			0.60		0.60	0.60			
v/c Ratio		0.23			0.50			0.57		0.11	0.34			
Control Delay		43.0			50.4			16.2		19.5	23.6			
Queue Delay		0.3			1.1			1.1		0.0	2.1			
Total Delay		43.3			51.5			17.3		19.5	25.7			
LOS		D			D			B		B	C			
Approach Delay		43.3			51.5			17.3			25.4			
Approach LOS		D			D			B			C			
90th %ile Green (s)	24.0	24.0		24.0	24.0		72.5	72.5		72.5	72.5		4.5	4.0
90th %ile Term Code	Ped	Ped		Ped	Ped		Coord	Coord		Coord	Coord		Gap	Max
70th %ile Green (s)	24.0	24.0		24.0	24.0		72.5	72.5		72.5	72.5		4.5	4.0
70th %ile Term Code	Ped	Ped		Ped	Ped		Coord	Coord		Coord	Coord		Gap	Max
50th %ile Green (s)	24.0	24.0		24.0	24.0		72.5	72.5		72.5	72.5		4.5	4.0
50th %ile Term Code	Ped	Ped		Ped	Ped		Coord	Coord		Coord	Coord		Gap	Max
30th %ile Green (s)	24.0	24.0		24.0	24.0		72.5	72.5		72.5	72.5		4.5	4.0
30th %ile Term Code	Ped	Ped		Ped	Ped		Coord	Coord		Coord	Coord		Gap	Max
10th %ile Green (s)	24.0	24.0		24.0	24.0		72.5	72.5		72.5	72.5		4.5	4.0
10th %ile Term Code	Ped	Ped		Ped	Ped		Coord	Coord		Coord	Coord		Gap	Max
Stops (vph)		43			84			433		24	462			
Fuel Used(gal)		1			2			6		0	6			
CO Emissions (g/hr)		57			135			441		19	423			
NOx Emissions (g/hr)		11			26			86		4	82			
VOC Emissions (g/hr)		13			31			102		4	98			
Dilemma Vehicles (#)		0			0			0		0	0			
Queue Length 50th (ft)		39			92			187		16	198			
Queue Length 95th (ft)		77			124			246		m23	255			
Internal Link Dist (ft)		358			682			261			254			
Turn Bay Length (ft)										50				
Base Capacity (vph)		350			355			1435		252	1666			
Starvation Cap Reductn		0			0			0		0	925			
Spillback Cap Reductn		88			90			362		0	0			
Storage Cap Reductn		0			0			0		0	0			
Reduced v/c Ratio		0.23			0.50			0.76		0.11	0.76			

Intersection Summary

Area Type: CBD
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 53 (44%), Referenced to phase 1:NBSB, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.57
Intersection Signal Delay: 24.1 Intersection LOS: C
Intersection Capacity Utilization 75.6% ICU Level of Service D
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 134: Massachusetts Avenue & St. Botolph Street

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	425	31	10	553	82	26
Future Volume (vph)	425	31	10	553	82	26
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.95	0.95	1.00	0.95	1.00	1.00
Ped Bike Factor	0.96				0.98	
Frt	0.990				0.967	
Flt Protected			0.950		0.964	
Satd. Flow (prot)	3100	0	1805	3374	1733	0
Flt Permitted			0.950		0.964	
Satd. Flow (perm)	3100	0	1805	3374	1733	0
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)	11				18	
Link Speed (mph)	25			25	25	
Link Distance (ft)	598			523	321	
Travel Time (s)	16.3			14.3	8.8	
Confl. Peds. (#/hr)		163				73
Confl. Bikes (#/hr)		18				
Peak Hour Factor	0.94	0.94	0.91	0.91	0.75	0.75
Heavy Vehicles (%)	12%	0%	0%	7%	0%	0%
Adj. Flow (vph)	452	33	11	608	109	35
Shared Lane Traffic (%)						
Lane Group Flow (vph)	485	0	11	608	144	0
Turn Type	NA		Prot	NA	Prot	
Protected Phases	6		5	2	4	
Permitted Phases						
Detector Phase	6		5	2	4	
Switch Phase						
Minimum Initial (s)	8.0		8.0	8.0	8.0	
Minimum Split (s)	19.0		13.0	13.0	30.0	
Total Split (s)	45.0		15.0	60.0	30.0	
Total Split (%)	50.0%		16.7%	66.7%	33.3%	
Maximum Green (s)	40.0		10.0	55.0	25.0	
Yellow Time (s)	3.0		3.0	3.0	3.0	
All-Red Time (s)	2.0		2.0	2.0	2.0	
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	
Total Lost Time (s)	5.0		5.0	5.0	5.0	
Lead/Lag	Lag		Lead			
Lead-Lag Optimize?	Yes		Yes			
Vehicle Extension (s)	2.0		2.0	2.0	2.0	
Recall Mode	C-Max		None	C-Max	None	
Walk Time (s)	7.0				7.0	
Flash Dont Walk (s)	7.0				18.0	
Pedestrian Calls (#/hr)	73				73	
Act Effct Green (s)	55.8		8.0	58.4	21.6	
Actuated g/C Ratio	0.62		0.09	0.65	0.24	
v/c Ratio	0.25		0.07	0.28	0.34	
Control Delay	9.6		38.8	8.0	25.4	
Queue Delay	0.0		0.0	0.0	0.0	
Total Delay	9.6		38.8	8.0	25.4	
LOS	A		D	A	C	
Approach Delay	9.6			8.5	25.4	
Approach LOS	A			A	C	
90th %ile Green (s)	42.0		8.0	55.0	25.0	
90th %ile Term Code	Coord		Min	Coord	Ped	
70th %ile Green (s)	55.0		0.0	55.0	25.0	
70th %ile Term Code	Coord		Skip	Coord	Ped	
50th %ile Green (s)	55.0		0.0	55.0	25.0	
50th %ile Term Code	Coord		Skip	Coord	Ped	
30th %ile Green (s)	55.0		0.0	55.0	25.0	
30th %ile Term Code	Coord		Skip	Coord	Ped	
10th %ile Green (s)	72.0		0.0	72.0	8.0	
10th %ile Term Code	Coord		Skip	Coord	Min	
Stops (vph)	202		12	228	74	
Fuel Used(gal)	4		0	4	1	
CO Emissions (g/hr)	279		12	296	79	
NOx Emissions (g/hr)	54		2	58	15	
VOC Emissions (g/hr)	65		3	69	18	
Dilemma Vehicles (#)	0		0	0	0	
Queue Length 50th (ft)	59		6	78	56	
Queue Length 95th (ft)	122		22	107	85	
Internal Link Dist (ft)	518			443	241	
Turn Bay Length (ft)						
Base Capacity (vph)	1926		200	2189	494	
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	0.25		0.06	0.28	0.29	

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:WBT and 6:EBT, Start of Green
Natural Cycle: 65
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.34
Intersection Signal Delay: 10.9 Intersection LOS: B
Intersection Capacity Utilization 43.3% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 4001: Cumberland Street & Huntington Avenue

Intersection	
Intersection Delay, s/veh	8.6
Intersection LOS	A

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Lane Configurations														
Traffic Vol, veh/h	21	51	5	1	10	71	89	9	0	5	1	40	2	19
Future Vol, veh/h	21	51	5	1	10	71	89	9	0	5	1	40	2	19
Peak Hour Factor	0.66	0.66	0.66	0.85	0.85	0.85	0.85	0.58	0.58	0.58	0.85	0.85	0.85	0.85
Heavy Vehicles, %	5	6	0	0	0	3	0	0	0	0	100	3	0	6
Mvmt Flow	32	77	8	1	12	84	105	16	0	9	1	47	2	22
Number of Lanes	0	1	0	0	0	1	0	0	1	0	0	0	1	0
Approach	EB			WB				NB			SB			
Opposing Approach	WB			EB				SB			NB			
Opposing Lanes	1			1				1			1			
Conflicting Approach Left	SB			NB				EB			WB			
Conflicting Lanes Left	1			1				1			1			
Conflicting Approach Right	NB			SB				WB			EB			
Conflicting Lanes Right	1			1				1			1			
HCM Control Delay	8.3			8.2				7.8			10.2			
HCM LOS	A			A				A			B			

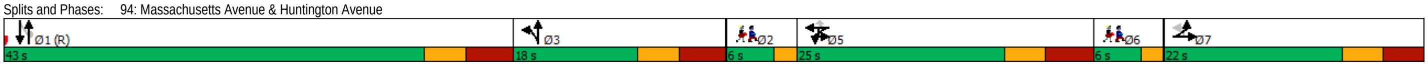
Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	64%	27%	6%	66%
Vol Thru, %	0%	66%	42%	3%
Vol Right, %	36%	6%	52%	31%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	14	77	171	62
LT Vol	9	21	10	41
Through Vol	0	51	71	2
RT Vol	5	5	90	19
Lane Flow Rate	24	117	201	73
Geometry Grp	1	1	1	1
Degree of Util (X)	0.031	0.146	0.225	0.127
Departure Headway (Hd)	4.615	4.495	4.022	6.26
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	775	799	895	573
Service Time	2.648	2.512	2.036	4.291
HCM Lane V/C Ratio	0.031	0.146	0.225	0.127
HCM Control Delay	7.8	8.3	8.2	10.2
HCM Lane LOS	A	A	A	B
HCM 95th-tile Q	0.1	0.5	0.9	0.4

Lane Group	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Ø2	Ø6
Lane Configurations			↰↑↱				↰	↱	↰	↑↱			↰↑↱			
Traffic Volume (vph)	9	100	53	100	5	108	100	118	74	815	22	10	502	99		
Future Volume (vph)	9	100	53	100	5	108	100	118	74	815	22	10	502	99		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900		
Storage Length (ft)		0		0		0		0	100		0	0		0		
Storage Lanes		0		0		0		1	1		0	0		0		
Taper Length (ft)		50				50			80			50				
Lane Util. Factor	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95		
Ped Bike Factor			0.81				0.93	0.61	0.66	0.99			0.85			
Frt			0.943					0.850		0.996			0.976			
Flt Protected			0.980				0.974		0.950				0.999			
Satd. Flow (prot)	0	0	2579	0	0	0	1632	1454	1608	3108	0	0	2566	0		
Flt Permitted			0.980				0.974		0.950				0.932			
Satd. Flow (perm)	0	0	2288	0	0	0	1512	891	1056	3108	0	0	2394	0		
Right Turn on Red				No				No			No			No		
Satd. Flow (RTOR)																
Link Speed (mph)			25				25			25			25			
Link Distance (ft)			408				165			334			296			
Travel Time (s)			11.1				4.5			9.1			8.1			
Confl. Peds. (#/hr)		310		85		85		310	880		329	329		880		
Confl. Bikes (#/hr)				2				5			49			31		
Peak Hour Factor	0.80	0.80	0.80	0.80	0.88	0.88	0.88	0.88	0.97	0.97	0.97	0.88	0.88	0.88		
Heavy Vehicles (%)	0%	4%	14%	5%	21%	3%	0%	0%	1%	3%	0%	0%	6%	2%		
Adj. Flow (vph)	11	125	66	125	6	123	114	134	76	840	23	11	570	113		
Shared Lane Traffic (%)																
Lane Group Flow (vph)	0	0	327	0	0	0	243	134	76	863	0	0	694	0		
Turn Type	Perm	Split	NA		Split	Split	NA	Perm	Prot	NA		Perm	NA			
Protected Phases		7	7		5	5	5		3	1 3			1		2	6
Permitted Phases	7							5				1				
Detector Phase	7	7	7		5	5	5	5	3	1 3		1	1			
Switch Phase																
Minimum Initial (s)	8.0	8.0	8.0		8.0	8.0	8.0	8.0	8.0			10.0	10.0		1.0	1.0
Minimum Split (s)	21.0	21.0	21.0		23.5	23.5	23.5	23.5	15.5			20.5	20.5		6.0	6.0
Total Split (s)	22.0	22.0	22.0		25.0	25.0	25.0	25.0	18.0			43.0	43.0		6.0	6.0
Total Split (%)	18.3%	18.3%	18.3%		20.8%	20.8%	20.8%	20.8%	15.0%			35.8%	35.8%		5%	5%
Maximum Green (s)	15.0	15.0	15.0		17.5	17.5	17.5	17.5	10.5			35.5	35.5		4.0	4.0
Yellow Time (s)	3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5			3.5	3.5		2.0	2.0
All-Red Time (s)	3.5	3.5	3.5		4.0	4.0	4.0	4.0	4.0			4.0	4.0		0.0	0.0
Lost Time Adjust (s)			0.0				0.0	0.0	0.0				0.0			
Total Lost Time (s)			7.0				7.5	7.5	7.5				7.5			
Lead/Lag					Lag	Lag	Lag	Lag	Lag			Lead	Lead		Lead	
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes			Yes	Yes		Yes	
Vehicle Extension (s)	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0			2.0	2.0		2.0	2.0
Recall Mode	Ped	Ped	Ped		Ped	Ped	Ped	Ped	Ped			C-Max	C-Max		Ped	Ped
Walk Time (s)	4.0	4.0	4.0		4.0	4.0	4.0	4.0	1.0			7.0	7.0		4.0	4.0
Flash Dont Walk (s)	10.0	10.0	10.0		12.0	12.0	12.0	12.0	6.0			6.0	6.0		0.0	0.0
Pedestrian Calls (#/hr)	85	85	85		310	310	310	310	329			500	500		310	85
Act Effct Green (s)			15.0				17.5	17.5	9.7	53.5			36.3			
Actuated g/C Ratio			0.12				0.15	0.15	0.08	0.45			0.30			
v/c Ratio			1.02				1.02	1.04	0.58	0.62			0.96			
Control Delay			106.2				114.6	140.2	90.6	49.7			63.8			
Queue Delay			0.0				0.0	0.0	0.0	51.2			9.9			
Total Delay			106.2				114.6	140.2	90.6	100.9			73.7			
LOS			F				F	F	F	F			E			
Approach Delay			106.2				123.7			100.1			73.7			
Approach LOS			F				F			F			E			
90th %ile Green (s)	15.0	15.0	15.0		17.5	17.5	17.5	17.5	10.5			35.5	35.5		4.0	4.0
90th %ile Term Code	Max	Max	Max		Max	Max	Max	Max	Max			Coord	Coord		Max	Max
70th %ile Green (s)	15.0	15.0	15.0		17.5	17.5	17.5	17.5	10.5			35.5	35.5		4.0	4.0
70th %ile Term Code	Max	Max	Max		Max	Max	Max	Max	Max			Coord	Coord		Max	Max
50th %ile Green (s)	15.0	15.0	15.0		17.5	17.5	17.5	17.5	10.5			35.5	35.5		4.0	4.0
50th %ile Term Code	Max	Max	Max		Max	Max	Max	Max	Max			Coord	Coord		Max	Max
30th %ile Green (s)	15.0	15.0	15.0		17.5	17.5	17.5	17.5	9.2			36.8	36.8		4.0	4.0
30th %ile Term Code	Max	Max	Max		Max	Max	Max	Max	Gap			Coord	Coord		Max	Max
10th %ile Green (s)	15.0	15.0	15.0		17.5	17.5	17.5	17.5	8.0			38.0	38.0		4.0	4.0
10th %ile Term Code	Max	Max	Max		Max	Max	Max	Max	Min			Coord	Coord		Max	Max
Stops (vph)			228				181	95	70	772			496			
Fuel Used(gal)			7				6	4	2	14			11			
CO Emissions (g/hr)			521				419	273	129	966			796			
NOx Emissions (g/hr)			101				81	53	25	188			155			
VOC Emissions (g/hr)			121				97	63	30	224			184			
Dilemma Vehicles (#)			0				0	0	0	0			0			
Queue Length 50th (ft)			~137				~200	~111	58	342			294			
Queue Length 95th (ft)			#195				#351	#232	m93	410			#388			
Internal Link Dist (ft)			328				85			254			216			
Turn Bay Length (ft)									100							
Base Capacity (vph)			322				238	129	140	1405			723			
Starvation Cap Reductn			0				0	0	0	653			11			
Spillback Cap Reductn			0				0	0	0	35			35			
Storage Cap Reductn			0				0	0	0	0			0			
Reduced v/c Ratio			1.02				1.02	1.04	0.54	1.15			1.01			

Intersection Summary

Area Type: CBD
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 21 (18%), Referenced to phase 1:NBSB, Start of Green
Natural Cycle: 115
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.04
Intersection Signal Delay: 96.9 Intersection LOS: F
Intersection Capacity Utilization 96.8% ICU Level of Service F
Analysis Period (min) 15
~ 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.

Splits and Phases: 94: Massachusetts Avenue & Huntington Avenue

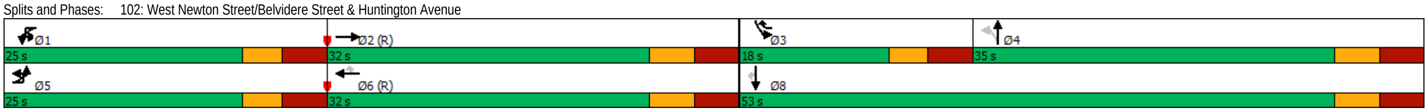


Lane Group	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations														
Traffic Volume (vph)	14	122	293	28	47	183	519	283	37	137	46	107	206	85
Future Volume (vph)	14	122	293	28	47	183	519	283	37	137	46	107	206	85
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)		200		0		200		0	0		0	0		0
Storage Lanes		1		0		1		1	0		0	1		1
Taper Length (ft)		50				50			50			50		
Lane Util. Factor	0.95	1.00	0.95	0.95	0.95	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.62	0.97			0.83		0.19		0.89		0.73		0.72
Frt			0.987					0.850		0.972				0.850
Flt Protected		0.950				0.950				0.992		0.950		
Satd. Flow (prot)	0	1684	3366	0	0	1791	3505	1538	0	1651	0	1736	1900	1615
Flt Permitted		0.950				0.950				0.886		0.950		
Satd. Flow (perm)	0	1041	3366	0	0	1483	3505	285	0	1426	0	1261	1900	1155
Right Turn on Red				Yes				Yes			Yes			Yes
Satd. Flow (RTOR)			8					158		12				104
Link Speed (mph)			25				25			25			25	
Link Distance (ft)			523				395			275			284	
Travel Time (s)			14.3				10.8			7.5			7.7	
Confl. Peds. (#/hr)		708		97		97		708	160		427	427		160
Confl. Bikes (#/hr)				1				4						2
Peak Hour Factor	0.91	0.91	0.91	0.91	0.96	0.96	0.96	0.96	0.87	0.87	0.87	0.79	0.79	0.79
Heavy Vehicles (%)	0%	8%	3%	4%	0%	1%	3%	5%	1%	2%	2%	4%	0%	0%
Adj. Flow (vph)	15	134	322	31	49	191	541	295	43	157	53	135	261	108
Shared Lane Traffic (%)														
Lane Group Flow (vph)	0	149	353	0	0	240	541	295	0	253	0	135	261	108
Turn Type	Prot	Prot	NA		Prot	Prot	NA	pm+ov	Perm	NA		Prot	NA	Perm
Protected Phases	5	5	2		1	1	6	3		4		3	8	
Permitted Phases								6	4					8
Detector Phase	5	5	2		1	1	6	3	4	4		3	8	8
Switch Phase														
Minimum Initial (s)	8.0	8.0	8.0		8.0	8.0	8.0	8.0	8.0	8.0		8.0	8.0	8.0
Minimum Split (s)	14.5	14.5	26.0		14.5	14.5	26.0	14.5	26.0	26.0		14.5	26.0	26.0
Total Split (s)	25.0	25.0	32.0		25.0	25.0	32.0	18.0	35.0	35.0		18.0	53.0	53.0
Total Split (%)	22.7%	22.7%	29.1%		22.7%	22.7%	29.1%	16.4%	31.8%	31.8%		16.4%	48.2%	48.2%
Maximum Green (s)	18.5	18.5	25.0		18.5	18.5	25.0	11.5	28.0	28.0		11.5	46.0	46.0
Yellow Time (s)	3.0	3.0	3.5		3.0	3.0	3.5	3.0	3.5	3.5		3.0	3.5	3.5
All-Red Time (s)	3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5
Lost Time Adjust (s)		0.0	0.0			0.0	0.0	0.0		0.0		0.0	0.0	0.0
Total Lost Time (s)		6.5	7.0			6.5	7.0	6.5		7.0		6.5	7.0	7.0
Lead/Lag	Lead	Lead	Lag		Lead	Lead	Lag	Lead	Lag	Lag		Lead		
Lead-Lag Optimize?	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes		Yes		
Vehicle Extension (s)	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0
Recall Mode	None	None	C-Max		None	None	C-Max	None	None	None		None	None	None
Walk Time (s)			7.0				7.0		12.0	12.0			12.0	12.0
Flash Dont Walk (s)			12.0				12.0		7.0	7.0			7.0	7.0
Pedestrian Calls (#/hr)			97				500		427	427			160	160
Act Effct Green (s)		13.8	31.4			17.6	35.2	46.6		23.1		10.9	40.5	40.5
Actuated g/C Ratio		0.13	0.29			0.16	0.32	0.42		0.21		0.10	0.37	0.37
v/c Ratio		0.71	0.37			0.84	0.48	0.88		0.82		0.78	0.37	0.22
Control Delay		63.7	33.6			69.5	33.8	46.6		60.4		78.6	26.4	5.5
Queue Delay		0.0	0.0			0.0	0.0	0.0		0.0		0.0	0.0	0.0
Total Delay		63.7	33.6			69.5	33.8	46.6		60.4		78.6	26.4	5.5
LOS		E	C			E	C	D		E		E	C	A
Approach Delay			42.5				45.3			60.4			35.9	
Approach LOS			D				D			E			D	
90th %ile Green (s)	18.5	18.5	25.0		18.5	18.5	25.0	11.5	28.0	28.0		11.5	46.0	46.0
90th %ile Term Code	Max	Max	Coord		Max	Max	Coord	Max	Max	Max		Max	Hold	Hold
70th %ile Green (s)	16.4	16.4	25.0		20.0	20.0	28.6	11.5	26.5	26.5		11.5	44.5	44.5
70th %ile Term Code	Gap	Gap	Coord		Max	Max	Coord	Max	Gap	Gap		Max	Hold	Hold
50th %ile Green (s)	14.1	14.1	28.9		19.7	19.7	34.5	11.5	22.9	22.9		11.5	40.9	40.9
50th %ile Term Code	Gap	Gap	Coord		Gap	Gap	Coord	Max	Gap	Gap		Max	Hold	Hold
30th %ile Green (s)	11.7	11.7	35.5		16.9	16.9	40.7	11.5	19.1	19.1		11.5	37.1	37.1
30th %ile Term Code	Gap	Gap	Coord		Gap	Gap	Coord	Max	Gap	Gap		Max	Hold	Hold
10th %ile Green (s)	8.2	8.2	42.6		12.9	12.9	47.3	8.5	19.0	19.0		8.5	34.0	34.0
10th %ile Term Code	Gap	Gap	Coord		Gap	Gap	Coord	Gap	Ped	Ped		Gap	Hold	Hold
Stops (vph)		128	249			207	416	91		198		97	144	11
Fuel Used(gal)		3	5			5	7	4		4		2	2	0
CO Emissions (g/hr)		200	320			337	483	279		278		164	151	24
NOx Emissions (g/hr)		39	62			66	94	54		54		32	29	5
VOC Emissions (g/hr)		46	74			78	112	65		64		38	35	6
Dilemma Vehicles (#)		0	0			0	0	0		0		0	0	0
Queue Length 50th (ft)		102	105			162	162	63		164		94	133	2
Queue Length 95th (ft)		165	157			#289	245	#233		237		#151	159	25
Internal Link Dist (ft)			443				315			195			204	
Turn Bay Length (ft)		200				200								
Base Capacity (vph)		283	966			310	1122	343		371		181	794	543
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		0.53	0.37			0.77	0.48	0.86		0.68		0.75	0.33	0.20

Intersection Summary

Area Type: Other
Cycle Length: 110
Actuated Cycle Length: 110
Offset: 54 (49%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.88
Intersection Signal Delay: 44.3 Intersection LOS: D
Intersection Capacity Utilization 83.1% ICU Level of Service E
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 102: West Newton Street/Belvidere Street & Huntington Avenue



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Ø2	Ø6
Lane Configurations														
Traffic Volume (vph)	21	16	69	33	17	24	53	853	46	34	613	35		
Future Volume (vph)	21	16	69	33	17	24	53	853	46	34	613	35		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900		
Storage Length (ft)	0		0	0		0	100		0	50		0		
Storage Lanes	0		0	0		0	0		0	1		0		
Taper Length (ft)	50			50			50			80				
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	1.00	0.95	0.95		
Ped Bike Factor		0.91			0.91			0.96		0.92	0.97			
Frt		0.913			0.956			0.993			0.992			
Flt Protected		0.990			0.978			0.997		0.950				
Satd. Flow (prot)	0	1439	0	0	1488	0	0	3045	0	1533	2949	0		
Flt Permitted		0.928			0.818			0.859		0.230				
Satd. Flow (perm)	0	1312	0	0	1205	0	0	2597	0	342	2949	0		
Right Turn on Red			No			No			No			Yes		
Satd. Flow (RTOR)											7			
Link Speed (mph)		25			25			25			25			
Link Distance (ft)		438			762			341			334			
Travel Time (s)		11.9			20.8			9.3			9.1			
Confl. Peds. (#/hr)	109		64	64		109	334		262	262		334		
Confl. Bikes (#/hr)			1			3			51			30		
Peak Hour Factor	0.82	0.82	0.82	0.80	0.80	0.80	0.95	0.95	0.95	0.94	0.94	0.94		
Heavy Vehicles (%)	0%	0%	0%	0%	6%	0%	0%	3%	0%	6%	6%	0%		
Adj. Flow (vph)	26	20	84	41	21	30	56	898	48	36	652	37		
Shared Lane Traffic (%)														
Lane Group Flow (vph)	0	130	0	0	92	0	0	1002	0	36	689	0		
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA			
Protected Phases		5			5			1			1		2	6
Permitted Phases	5			5			1			1				
Detector Phase	5	5		5	5		1	1		1	1			
Switch Phase														
Minimum Initial (s)	8.0	8.0		8.0	8.0		10.0	10.0		10.0	10.0		1.0	1.0
Minimum Split (s)	29.5	29.5		29.5	29.5		25.5	25.5		25.5	25.5		6.0	6.0
Total Split (s)	38.0	38.0		38.0	38.0		70.0	70.0		70.0	70.0		6.0	6.0
Total Split (%)	31.7%	31.7%		31.7%	31.7%		58.3%	58.3%		58.3%	58.3%		5%	5%
Maximum Green (s)	32.5	32.5		32.5	32.5		64.5	64.5		64.5	64.5		4.0	4.0
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5		2.0	2.0
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0		0.0	0.0
Lost Time Adjust (s)		0.0			0.0			0.0		0.0	0.0			
Total Lost Time (s)		5.5			5.5			5.5		5.5	5.5			
Lead/Lag	Lag	Lag		Lag	Lag		Lag	Lag		Lag	Lag		Lead	Lead
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0
Recall Mode	Ped	Ped		Ped	Ped		C-Max	C-Max		C-Max	C-Max		Ped	Ped
Walk Time (s)	7.0	7.0		7.0	7.0		10.0	10.0		10.0	10.0		4.0	4.0
Flash Dont Walk (s)	17.0	17.0		17.0	17.0		10.0	10.0		10.0	10.0		0.0	0.0
Pedestrian Calls (#/hr)	173	173		173	173		500	500		500	500		500	173
Act Effct Green (s)		24.0			24.0			72.5		72.5	72.5			
Actuated g/C Ratio		0.20			0.20			0.60		0.60	0.60			
v/c Ratio		0.50			0.38			0.64		0.17	0.39			
Control Delay		50.1			47.0			17.7		20.5	22.7			
Queue Delay		1.6			1.0			9.2		0.0	8.1			
Total Delay		51.7			48.0			26.9		20.5	30.9			
LOS		D			D			C		C	C			
Approach Delay		51.7			48.0			26.9			30.4			
Approach LOS		D			D			C			C			
90th %ile Green (s)	24.0	24.0		24.0	24.0		72.5	72.5		72.5	72.5		4.5	4.0
90th %ile Term Code	Ped	Ped		Ped	Ped		Coord	Coord		Coord	Coord		Gap	Max
70th %ile Green (s)	24.0	24.0		24.0	24.0		72.5	72.5		72.5	72.5		4.5	4.0
70th %ile Term Code	Ped	Ped		Ped	Ped		Coord	Coord		Coord	Coord		Gap	Max
50th %ile Green (s)	24.0	24.0		24.0	24.0		72.5	72.5		72.5	72.5		4.5	4.0
50th %ile Term Code	Ped	Ped		Ped	Ped		Coord	Coord		Coord	Coord		Gap	Max
30th %ile Green (s)	24.0	24.0		24.0	24.0		72.5	72.5		72.5	72.5		4.5	4.0
30th %ile Term Code	Ped	Ped		Ped	Ped		Coord	Coord		Coord	Coord		Gap	Max
10th %ile Green (s)	24.0	24.0		24.0	24.0		72.5	72.5		72.5	72.5		4.5	4.0
10th %ile Term Code	Ped	Ped		Ped	Ped		Coord	Coord		Coord	Coord		Gap	Max
Stops (vph)		94			63			590		27	549			
Fuel Used(gal)		2			1			8		0	7			
CO Emissions (g/hr)		129			100			591		24	486			
NOx Emissions (g/hr)		25			19			115		5	95			
VOC Emissions (g/hr)		30			23			137		6	113			
Dilemma Vehicles (#)		0			0			0		0	0			
Queue Length 50th (ft)		90			62			247		24	238			
Queue Length 95th (ft)		140			101			317		m24	m244			
Internal Link Dist (ft)		358			682			261			254			
Turn Bay Length (ft)										50				
Base Capacity (vph)		355			326			1569		206	1784			
Starvation Cap Reductn		0			0			0		0	1048			
Spillback Cap Reductn		109			100			536		0	0			
Storage Cap Reductn		0			0			0		0	0			
Reduced v/c Ratio		0.53			0.41			0.97		0.17	0.94			

Intersection Summary

Area Type: CBD
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 69 (58%), Referenced to phase 1:NBSB, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.64
Intersection Signal Delay: 30.8 Intersection LOS: C
Intersection Capacity Utilization 84.2% ICU Level of Service E
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 134: Massachusetts Avenue & St. Botolph Street

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	487	80	18	579	81	34
Future Volume (vph)	487	80	18	579	81	34
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12
Grade (%)	0%			0%	0%	
Storage Length (ft)		0	0		0	0
Storage Lanes		0	1		1	0
Taper Length (ft)			50		50	
Lane Util. Factor	0.95	0.95	1.00	0.95	1.00	1.00
Ped Bike Factor	0.92				0.97	
Frt	0.979				0.960	
Flt Protected			0.950		0.966	
Satd. Flow (prot)	3140	0	1805	3505	1717	0
Flt Permitted			0.950		0.966	
Satd. Flow (perm)	3140	0	1805	3505	1717	0
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)	26				23	
Link Speed (mph)	25			25	25	
Link Distance (ft)	598			523	321	
Travel Time (s)	16.3			14.3	8.8	
Confl. Peds. (#/hr)		251				70
Confl. Bikes (#/hr)		18				
Peak Hour Factor	0.97	0.97	0.94	0.94	0.83	0.83
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	4%	0%	0%	3%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%			0%	0%	
Adj. Flow (vph)	502	82	19	616	98	41
Shared Lane Traffic (%)						
Lane Group Flow (vph)	584	0	19	616	139	0
Turn Type	NA		Prot	NA	Prot	
Protected Phases	6		5	2	4	
Permitted Phases						
Detector Phase	6		5	2	4	
Switch Phase						
Minimum Initial (s)	8.0		8.0	8.0	8.0	
Minimum Split (s)	19.0		13.0	13.0	30.0	
Total Split (s)	45.0		15.0	60.0	30.0	
Total Split (%)	50.0%		16.7%	66.7%	33.3%	
Maximum Green (s)	40.0		10.0	55.0	25.0	
Yellow Time (s)	3.0		3.0	3.0	3.0	
All-Red Time (s)	2.0		2.0	2.0	2.0	
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	
Total Lost Time (s)	5.0		5.0	5.0	5.0	
Lead/Lag	Lag		Lead			
Lead-Lag Optimize?	Yes		Yes			
Vehicle Extension (s)	2.0		2.0	2.0	2.0	
Minimum Gap (s)	2.0		2.0	2.0	2.0	
Time Before Reduce (s)	0.0		0.0	0.0	0.0	
Time To Reduce (s)	0.0		0.0	0.0	0.0	
Recall Mode	C-Max		None	C-Max	None	
Walk Time (s)	7.0				7.0	
Flash Dont Walk (s)	7.0				18.0	
Pedestrian Calls (#/hr)	70				70	
Act Effct Green (s)	53.2		8.0	58.4	21.6	
Actuated g/C Ratio	0.59		0.09	0.65	0.24	
v/c Ratio	0.31		0.12	0.27	0.32	
Control Delay	11.5		39.7	7.9	23.9	
Queue Delay	0.0		0.0	0.0	0.0	
Total Delay	11.5		39.7	7.9	23.9	
LOS	B		D	A	C	
Approach Delay	11.5			8.8	23.9	
Approach LOS	B			A	C	
90th %ile Green (s)	42.0		8.0	55.0	25.0	
90th %ile Term Code	Coord		Min	Coord	Ped	
70th %ile Green (s)	42.0		8.0	55.0	25.0	
70th %ile Term Code	Coord		Min	Coord	Ped	
50th %ile Green (s)	55.0		0.0	55.0	25.0	
50th %ile Term Code	Coord		Skip	Coord	Ped	
30th %ile Green (s)	55.0		0.0	55.0	25.0	
30th %ile Term Code	Coord		Skip	Coord	Ped	
10th %ile Green (s)	72.0		0.0	72.0	8.0	
10th %ile Term Code	Coord		Skip	Coord	Min	
Queue Length 50th (ft)	72		10	78	51	
Queue Length 95th (ft)	145		32	107	90	
Internal Link Dist (ft)	518			443	241	
Turn Bay Length (ft)						
Base Capacity (vph)	1867		200	2274	493	
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	0.31		0.10	0.27	0.28	

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:WBT and 6:EBT, Start of Green
Natural Cycle: 65
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.32
Intersection Signal Delay: 11.5 Intersection LOS: B
Intersection Capacity Utilization 45.1% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 4001: Cumberland Street & Huntington Avenue

Intersection	
Intersection Delay, s/veh	8.6
Intersection LOS	A

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Lane Configurations														
Traffic Vol, veh/h	28	58	6	1	8	60	75	3	1	4	1	83	0	19
Future Vol, veh/h	28	58	6	1	8	60	75	3	1	4	1	83	0	19
Peak Hour Factor	0.82	0.82	0.82	0.62	0.62	0.62	0.62	0.50	0.50	0.50	0.79	0.79	0.79	0.79
Heavy Vehicles, %	4	0	0	0	0	5	0	0	0	0	0	0	0	0
Mvmt Flow	34	71	7	2	13	97	121	6	2	8	1	105	0	24
Number of Lanes	0	1	0	0	0	1	0	0	1	0	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.4	8.6	7.7	8.7
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	38%	30%	6%	81%
Vol Thru, %	12%	63%	42%	0%
Vol Right, %	50%	7%	52%	19%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	8	92	144	103
LT Vol	3	28	8	84
Through Vol	1	58	60	0
RT Vol	4	6	76	19
Lane Flow Rate	16	112	232	130
Geometry Grp	1	1	1	1
Degree of Util (X)	0.02	0.143	0.263	0.171
Departure Headway (Hd)	4.588	4.581	4.08	4.715
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	779	783	883	761
Service Time	2.622	2.604	2.098	2.742
HCM Lane V/C Ratio	0.021	0.143	0.263	0.171
HCM Control Delay	7.7	8.4	8.6	8.7
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.1	0.5	1.1	0.6

Appendix D

Climate Resiliency Checklist

Boston Planning & Development Agency
Climate Resiliency Report Summary

Submitted: 10/29/2020 16:42:17

A.1 - Project Information

Project Name:	220 Huntington Avenue			
Project Address:	220 Huntington Avenue			
Filing Type:	Initial (PNF, EPNF, NPC or other substantial filing)			
Filing Contact:	Fiona Vardy	Epsilon Associates, Inc.	fvardy@epsilonassociates.com	978-461-6243
Is MEPA approval required?	No	MEPA date:		

A.2 - Project Team

Owner / Developer:	National Development
Architect:	CBT Architects
Engineer:	Vanderweil Engineers
Sustainability / LEED:	The Green Engineer
Permitting:	Epsilon Associates, Inc.
Construction Management:	Cranshaw Construction

A.3 - Project Description and Design Conditions

List the principal Building Uses:	Multi-family Residential (apartments)
List the First Floor Uses:	Residential lobby, retail, residential amenities, and back of house mechanical
List any Critical Site Infrastructure and or Building Uses:	N/A

Site and Building:

Site Area (SF):	66660	Building Area (SF):	351500
Building Height (Ft):	115	Building Height (Stories):	10
Existing Site Elevation – Low (Ft BCB):	12.0	Existing Site Elevation – High (Ft BCB):	18.25
Proposed Site Elevation – Low (Ft BCB):	12.0	Proposed Site Elevation – High (Ft BCB):	18.25
Proposed First Floor Elevation (Ft BCB):	18.25	Below grade spaces/levels (#):	1

Article 37 Green Building:

LEED Version - Rating System:	LEED NC v4	LEED Certification:	Yes
Proposed LEED rating:	Silver	Proposed LEED point score (Pts.):	52

Building Envelope:

When reporting R values, differentiate between R discontinuous and R continuous. For example, use "R13" to show R13 discontinuous and use R10c.i. to show R10 continuous. When reporting U value, report total assembly U value including supports and structural elements.

Roof:	R30c.i.	Exposed Floor :	R30
Foundation Wall:	R10c.i.	Slab Edge (at or below grade):	R10c.i.

Vertical Above-grade Assemblies (%'s are of total vertical area and together should total 100%):

Area of Opaque Curtain Wall & Spandrel Assembly:	12	Wall & Spandrel Assembly Value:	U 0.12
Area of Framed & Insulated / Standard Wall:	55	Wall Value:	R26
Area of Vision Window:	32	Window Glazing Assembly Value:	U 0.4 weighted avg.
		Window Glazing SHGC:	0.3
Area of Doors:	1	Door Assembly Value :	U 0.77

Energy Loads and Performance

For this filing – describe how energy loads & performance were determined	Energy modeling in eQuest, with DOE2.3		
Annual Electric (kWh):	2168875	Peak Electric (kW):	575
Annual Heating (MMbtu/hr):	4360	Peak Heating (MMbtu):	2.3
Annual Cooling (Tons/hr):	NA	Peak Cooling (Tons):	
Energy Use - Below ASHRAE 90.1 - 2013 (%):	30	Have the local utilities reviewed the building energy performance?:	No
Energy Use - Below Mass. Code (%):	28.3	Energy Use Intensity (kBtu/SF):	32

Back-up / Emergency Power System

Electrical Generation Output (kW):	500	Number of Power Units:	1
System Type (kW):	Standby	Fuel Source:	Diesel

Emergency and Critical System Loads (in the event of a service interruption)

Electric (kW):	350	Heating (MMbtu/hr):	170
		Cooling (Tons/hr):	20

B – Greenhouse Gas Reduction and Net Zero / Net Positive Carbon Building Performance

Reducing greenhouse gas emissions is critical to avoiding more extreme climate change conditions. To achieve the City's goal of carbon-neutrality by 2050 the performance of new buildings will need to progressively improve to carbon net zero and net positive.

B.1 – GHG Emissions - Design Conditions

For this filing - Annual Building GHG Emissions (Tons): 786

For this filing - describe how building energy performance has been integrated into project planning, design, and engineering and any supporting analysis or modeling:

The Proponent and Project team have identified building energy performance as a primary focus for this building. The team is utilizing energy modeling and analysis to assist with design and to inform the building's potential energy intensity and GHG emissions.

Describe building specific passive energy efficiency measures including orientation, massing, building envelop, and systems:

The orientation and massing are largely fixed due to the site conditions. The envelope provides window shading due to inset windows. The envelope insulation exceeds code requirements. Heat recovery is used from the exhaust air.

Describe building specific active energy efficiency measures including high performance equipment, controls, fixtures, and systems:

The design uses high efficiency water-source heat pumps. Ventilation air is provided separately through high efficiency DOAS units. Condensing boilers provide heat to the condenser loop. Low-flow fixtures and Energy Star appliances are used extensively.

Describe building specific load reduction strategies including on-site renewable energy, clean energy, and storage systems:

On-site renewable is not feasible because the roof is used for mechanical equipment and amenity areas. The water-source heat pump configuration is able to recover heat from one part of the building to another when there is simultaneous heating and cooling. The use of natural gas for heating is reduced significantly from the code baseline (46%).

Describe any area or district scale emission reduction strategies including renewable energy, central energy plants, distributed energy systems, and smart grid infrastructure:

Not applicable.

Describe any energy efficiency assistance or support provided or to be provided to the project:

The Proponent is in the process of involving the utility companies during early design to further discuss opportunities that are available.

B.2 - GHG Reduction - Adaptation Strategies

Describe how the building and its systems will evolve to further reduce GHG emissions and achieve annual carbon net zero and net positive performance (e.g. added efficiency measures, renewable energy, energy storage, etc.) and the timeline for meeting that goal (by 2050):

> The building will be able to evolve to meet carbon net zero in the future by purchasing off-site renewable energy and offsets. The systems can be changed to all-electric in the future by replacing the central boilers and gas water heaters with electric options.

C - Extreme Heat Events

Annual average temperature in Boston increased by about 2˚F in the past hundred years and will continue to rise due to climate change. By the end of the century, the average annual temperature could be 56° (compared to 46° now) and the number of days above 90° (currently about 10 a year) could rise to 90.

C.1 – Extreme Heat - Design Conditions

Temperature Range - Low (Deg.):	3	Temperature Range - High (Deg.):	96
Annual Heating Degree Days:	95	Annual Cooling Degree Days	126

What Extreme Heat Event characteristics will be / have been used for project planning

Days - Above 90° (#):	90	Days - Above 100° (#):	33
Number of Heatwaves / Year (#):	2	Average Duration of Heatwave (Days):	3

Describe all building and site measures to reduce heat-island effect at the site and in the surrounding area:

> The Project will install planters and vegetation in various locations on both the ground level and 10th floor terrace, accompanied by high SRI hardscape areas to reduce heat absorption by hardscape areas. Ground level trees and vegetation will reduce direct sunlight exposure to hardscape and portions of the adjacent street surfaces.

C.2 - Extreme Heat – Adaptation Strategies

Describe how the building and its systems will be adapted to efficiently manage future higher average temperatures, higher extreme temperatures, additional annual heatwaves, and longer heatwaves:

> The Project design will include measures to adapt to these conditions, such as a high-efficiency building envelope with self-shading, low solar heat gain coefficient (SHGC) windows and high R values. The ventilation cooling load is reduced with heat recovery. The cooling towers on the roof will reject heat from the building and will be oversized for design conditions. Therefore, future capacity can be added without redesigning the building systems. Additionally, the Project will install planters and vegetation in various locations on both the ground level and 10th floor terrace, accompanied by high solar reflectance index (SRI) hardscape areas to reduce heat absorption by hardscape areas. Ground level trees and vegetation will reduce direct sunlight exposure to hardscape and portions of the adjacent street surfaces.

Describe all mechanical and non-mechanical strategies that will support building functionality and use during extended interruptions of utility services and infrastructure including proposed and future adaptations:

Non-mechanical strategies are currently under consideration by the Project team. Building functionality and life safety needs will be provided by an emergency generator, which includes power to fire protection systems, emergency lighting, domestic water booster systems, low voltage systems, bathroom exhausts. The building will include a high performance building envelope with operable windows.

D - Extreme Precipitation Events

From 1958 to 2010, there was a 70 percent increase in the amount of precipitation that fell on the days with the heaviest precipitation. Currently, the 10-Year, 24-Hour Design Storm precipitation level is 5.25”. There is a significant probability that this will increase to at least 6” by the end of the century. Additionally, fewer, larger storms are likely to be accompanied by more frequent droughts.

D.1 – Extreme Precipitation - Design Conditions

What is the project design precipitation level? (In. / 24 Hours)	6.0

Describe all building and site measures for reducing storm water run-off:

The stormwater management system will be designed to store runoff and promote groundwater recharge. Runoff will be collected at the building roof and directed to interior storage tanks sized for 1.25” over the site area. From the tanks, runoff will be directed to groundwater recharge wells around the perimeter of the building designed to drain the tanks within 72-hours. For storms greater than 1.25”, overflow connections from both the wells and the storage tanks will connect to the BWSC storm drain mains in Public Alley #404 and/or Cumberland Street.
Behind the building, areas within Public Alley #404 will be collected by catch basins, as is done in the existing condition.

The proposed site will be designed to meet the existing rates of runoff and volume of stormwater compared to the existing condition for the 2-, 10-, 25-, and 100-year storms. The future 10-year, 24-hour design storm (6-inch) will be evaluated to ensure the system is adequately sized for future events. The existing site does not provide stormwater storage or recharge.

Opportunities to reduce impervious areas will be evaluated as the design progresses (such as permeable pavers and/or street trees or other landscape areas) to help reduce stormwater runoff from the site.

D.2 - Extreme Precipitation - Adaptation Strategies

Describe how site and building systems will be adapted to efficiently accommodate future more significant rain events (e.g. rainwater harvesting, on-site storm water retention, bio swales, green roofs):

Retention system is designed to hold a volume equal to 1.25 inches over the site area. This system will be designed to accommodate the potential for future outlet connections to adapt to additional reuse strategies.

E – Sea Level Rise and Storms

Under any plausible greenhouse gas emissions scenario, the sea level in Boston will continue to rise throughout the century. This will increase the number of buildings in Boston susceptible to coastal flooding and the likely frequency of flooding for those already in the floodplain.

Is any portion of the site in a FEMA Special Flood Hazard Area?	No	What Zone:	
What is the current FEMA SFHA Zone Base Flood Elevation for the site (Ft BCB)?			
Is any portion of the site in the BPDA Sea Level Rise Flood Hazard Area (see SLR-FHA online map)?	Yes		

If you answered YES to either of the above questions, please complete the following questions.
Otherwise you have completed the questionnaire; thank you!

E.1 – Sea Level Rise and Storms – Design Conditions

Proposed projects should identify immediate and future adaptation strategies for managing the flooding scenario represented by the Sea Level Rise Flood Hazard Area (SLR-FHA), which includes 3.2’ of sea level rise above 2013 tide levels, an additional 2.5” to account for subsidence, and the 1% Annual Chance Flood. After using the SLR-FHA to identify a project’s Sea Level Rise Base Flood Elevation, proponents should calculate the Sea Level Rise Design Flood Elevation by adding 12” of freeboard for buildings, and 24” of freeboard for critical facilities and infrastructure and any ground floor residential units.

What is the Sea Level Rise - Base Flood Elevation for the site (Ft BCB)?	18.0		
What is the Sea Level Rise - Design Flood Elevation for the site (Ft BCB)?	20.0	First Floor Elevation (Ft BCB):	18.25
What are the Site Elevations at Building (Ft BCB)?	18.25	What is the Accessible Route Elevation (Ft BCB)?	18.25

Describe site design strategies for adapting to sea level rise including building access during flood events, elevated site areas, hard and soft barriers, wave / velocity breaks, storm water systems, utility services, etc.:

Only a very small portion of the Project Site at the corner of Cumberland Street and Public Alley #404 is located in BPDA Sea Level Rise – Flood Hazard Area, with a Base Flood Elevation of 18.0 ft BCB.
Building storm drainage systems will be provided with emergency overflow systems in case of flooding. Proposed site elevations are based on surrounding public way sidewalk/alley elevations. The Project Site is highest in elevation along Huntington Avenue and Cumberland Street (Elevation 16.7-18.3 BCB). Building entrances and ground level will be raised to Huntington Avenue/Cumberland Street elevation. Doors along Public Alley #404 will be elevated compared to the elevation of the alley. Public Alley #404 ranges from its lowest point mid-way at Elevation 12 BCB up to Elevation 16 BCB near Cumberland Street. Building Entrances will be outside of BPDA Sea Level Rise Area.

Describe how the proposed Building Design Flood Elevation will be achieved including dry / wet flood proofing, critical systems protection, utility service protection, temporary flood barriers, waste and drain water back flow prevention, etc.:

Temporary flood barriers will be used, where needed. Main electrical room, fire pump room, fuel oil storage, and main tel/data room are all located at Level 1. Equipment will be elevated or temporary flood barriers installed in front of these rooms during flood events. Incoming water service room, water booster pump, and gas booster are currently located in basement level. Central mechanical, plumbing domestic water heating systems and emergency electrical systems are located in the mechanical penthouse at the roof level.

Utility connections will be provided with waterproof connections at foundation walls, and gravity drainage systems will be provided with backwater valves.

Describe how occupants might shelter in place during a flooding event including any emergency power, water, and waste water provisions and the expected availability of any such measures:

The emergency generator will be installed on the roof, and will provide life safety protection for the building during an event. Main electrical room, fire pump room, fuel oil storage, and main tel/data room are all located at Level 1. These rooms are not above design flood elevation, but equipment will be elevated or temporary flood barriers installed in front of these rooms during flood events to provide normal power, tel/data and fire protection. Incoming water service room, water booster pump are currently located in basement level. Central mechanical, plumbing domestic water heating systems and emergency electrical systems are located in the mechanical penthouse at the roof level.

Describe any strategies that would support rapid recovery after a weather event:

The emergency generator, being on the roof, will keep life safety systems functioning during an event to allow quicker recovery.

E.2 – Sea Level Rise and Storms – Adaptation Strategies

Describe future site design and or infrastructure adaptation strategies for responding to sea level rise including future elevating of site areas and access routes, barriers, wave / velocity breaks, storm water systems, utility services, etc.:

-Raising site is limited by surrounding roadway elevations.
-Doors facing alley at Elevation 17.5 (higher than alley low point of Elevation 12.0). -Avoid critical accessible routes along back alley.
-Backwater valves on sewer and drain overflow services.

-Removable flood barriers at building entrance and garage entrance (up to Elevation 20.0) or adjusted for future projected flood elevations.

Describe future building adaptation strategies for raising the Sea Level Rise Design Flood Elevation and further protecting critical systems, including permanent and temporary measures:

Removable flood barriers at building entrance and garage entrance (up to Elevation 20.0) or adjusted for future projected flood elevations.

Thank you for completing the Boston Climate Change Checklist!

For questions or comments about this checklist or Climate Change best practices, please contact:
John.Dalzell@boston.gov

Appendix E

Zero Carbon Building Assessment

The Green Engineer
Sustainable Design Consulting

www.greenengineer.com

220 Huntington

Boston, MA

Zero Carbon Building Assessment for the City of Boston

Prepared For:

National Development
2310 Washington Street
Newton Lower Falls, MA 02462

Prepared By:

The Green Engineer, Inc.
23 Bradford Street, 1st Floor
Concord MA 01742
978.369.8978

July 22nd, 2020

Executive Summary

The Project includes the construction of an approximately 351,500 GSF, ten-story residential building. The Project consists of a basement level with covered parking, a ground level with retail and amenity spaces, and nine stories of multifamily residential apartments. The Project is in the schematic design phase. The Project intends to be certified under LEED-NC v4 and meet the Article 37 requirements by assessing low and net-zero carbon options early in the design process.

The basis of design for the building systems is water source heat pumps, supported by a condenser water loop with condensing boilers and cooling towers. The retail spaces will be fit out by the future tenants. Plumbing fixtures with low flush and flow rates will be specified to minimize the demand for potable water for sewage conveyance and process uses. The roof area is largely consumed by mechanical equipment and amenity areas, thus a zero-carbon solution would require using off-site renewable resources or credits.

The Project team has focused heavily on developing the most efficient envelope possible. As a result, the baseline has been compared to the enhanced envelope that is the basis of design, and a super-insulated envelope intended to represent a passive house-style design approach has been studied.

The Green Engineer (TGE) performed a building energy analysis comparing the design to the stretch code baseline and a zero-carbon ready all-electric building. The baseline references ASHRAE 90.1-2013, Appendix G, with MA amendments. The proposed case was developed based on the SD drawing set from 3/6/2020. Where not yet specified, efficiencies and other assumptions for the design case were based on conversations with the design team in addition to high efficiency equipment meeting ASHRAE 90.1-2013 and industry best-practices. The baseline includes three efficiency measures required by the Massachusetts Amendments to the energy code (C406.1): Reduced air-infiltration, Provision of a dedicated outdoor air system, and 10% improvement over ASHRAE 90.1-2013 HVAC system efficiency.

Preliminary results indicate the basis of design outperforms the stretch code baseline by **21.1%** on a site energy basis. The zero-carbon ready electric building outperforms the code baseline by **29.8%** on a site energy basis.

I. Low Energy Building

A. Energy Conservation Measures

The following ECM's have been identified for the proposed case:

- Increased wall and roof insulation
- High performance glazing system
- Reduced infiltration
- Significantly reduced interior lighting through the use of high efficiency LED fixtures
- Low flow plumbing fixtures and high efficiency water heater
- Energy star appliances
- Dedicated outdoor air system with heat recovery
- Condensing boilers
- High efficiency water-source heat pumps

The following further ECM's have been identified for the zero-carbon ready case:

- All-electric air-source VRF heat pumps
- Increased envelope performance – super-insulated, passive house-style envelope
- Hybrid heat pump/electric resistance water heaters

B. Energy Analysis Inputs

220 Huntington					
Building Type: Mixed-Use Residential					
INPUT SUMMARY					
Building Component	**Baseline - ASHRAE 90.1 2013 w. MA Amendments**	**WSHPs with Enhanced Envelope**	**WSHPs with Super-Insulated Envelope**	**VRV with Enhanced Envelope (All-Electric)**	**VRV with Super-Insulated Envelope (All-Electric)**
Gross Square Foot	Residential: 323,000 sf Residentail Amenity: 11,500 sf Retail/Restaurant: 17,000 Parking: 60,000 sf				
Space description	Residential M-Sun: 24/7 Office and Amenity: M-F: 8a-5p; Sat/Sun/Hol: Closed Retail M-F: 8a-7p; Sat: 10a-5p; Sun/Hol: Closed				
Temperature Setpoints	Cooling: 75 F Heating: 70 F				
EXTERIOR ENVELOPE					
Roof Assembly	R 30 c.i. above deck	R 30 c.i. above deck	R 60 c.i. above deck	R 30 c.i. above deck	R 60 c.i. above deck
Wall Assembly	U-0.055 (R-13 Batt + R-10 c.i.)	R-26 Wall R-15 Spandrel R-10 Louvers	R-40 Effective	R-26 Wall R-15 Spandrel R-10 Louvers	R-40 Effective
Level 1 Floor	U-0.038 (R-30)	U-0.038 (R-30)	U-0.025 (R-40)	U-0.038 (R-30)	U-0.025 (R-40)
Wall-to-Window Ratio	24%	32%	32%	32%	32%
Windows and Glazing Description	Metal Framing (Fixed): U-0.42 SHGC: 0.4	Metal Framing: U-0.41 SHGC: 0.4	Metal Framing: U-0.20 SHGC: 0.35	Metal Framing: U-0.41 SHGC: 0.4	Metal Framing: U-0.20 SHGC: 0.35
Infiltration[1]	0.25 cfm/sf at 75 Pa With third-party testing	0.25 cfm/sf at 75 Pa With third-party testing	0.20 cfm/sf at 75 Pa With third-party testing	0.25 cfm/sf at 75 Pa With third-party testing	0.20 cfm/sf at 75 Pa With third-party testing
LIGHTING					
Automatic Lighting Shutoff	As per ASHRAE 90.1 2010 mandatory requirements	Identical to Baseline			
LPD (W/SF)	Residential core: 0.55 W/sf Residential units: 0.55 W/sf Retail: 0.86 W/sf Parking: 0.15 W/sf	Residential core: 0.55 W/sf Residential units: 0.55 W/sf Retail: 0.86 W/sf Parking: 0.10 W/sf			
Daylight Dimming Controls	As per ASHRAE 90.1 2010 mandatory requirements	Identical to Baseline			
Exterior Lighting	5 kW estimated load	Identical to Baseline			
HVAC SYSTEM AND CONTROLS					
HVAC System Description[2]	Residential, core and amenity: System #1 - PTAC (AC-HW) with DOAS (DX-Furnace) Retail: System #3 - PSZ AC (DX-Furnace)	Residential, core and amenity: Water-source HP with boiler DOAS (DX-Furnace) Retail: System #3 - PSZ AC (DX-Furnace)		Residential, core and amenity: Air-source VRF DOAS (DX-HP) Retail: System #4 - PSZ HP (DX)	
Heating Source[3]	Residential: Natural draft boilers, 88% Et DOAS: Furnace, 88% Et Retail: Furnace, 88% Et	Residential: Heat pump loop with condensing boilers, 4.7 COP, 92% Et DOAS: Furnace, 88% Et Retail: Furnace, 88% Et		Residential: VRF air-source heat pumps, 3.6 COP DOAS: Air source heat pump, 3.5 COP Retail: Air source heat pumps 3.5 COP	
Cooling Source[3]	Residential: PTAC, 13.1 EER DOAS: DX, 11.9 EER Retail: DX, 11.9 EER	Residential: WS-HP, 14.3 EER DOAS: DX, 12.2 EER Retail: DX, 11.9 EER		Residential: VRF, 12.1 SEER DOAS: HP, 10.2 EER Retail: HP, 10.2 EER	
Outdoor Air Design Min Ventilation	ASHRAE 62.1 Minimum	Identical to Baseline			
Exhaust Air Recovery	Yes, 50% effectiveness	Yes, 75% effectiveness			
Supply Air Temperature	Ventilation air: 70 F	Identical to Baseline			
Economizer	Residential: N/A Retail: Yes, Dry bulb high temperature: 70F	Residential: N/A Retail: Yes, Dry bulb high temperature: 70F			
Demand Control Ventilaiton	Where required by code	Identical to Baseline			

INPUT SUMMARY					
Building Component	**Baseline - ASHRAE 90.1 2013 w. MA Amendments**	**WSHPs with Enhanced Envelope**	**WSHPs with Super-Insulated Envelope**	**VRV with Enhanced Envelope (All-Electric)**	**VRV with Super-Insulated Envelope (All-Electric)**
SERVICE HOT WATER					
DHW System Type	Natural gas storage water heaters 3 qty. 225 gallon	Natural gas storage water heaters 3 qty. 225 gallon		Hybrid heat pump/electric resistance storage water heaters	
Equipment Efficiency & Temp Controls	0.80 EF; 120F Supply	0.94 EF; 120F Supply		2.5 EF; 120F Supply	
DHW Flow	Lav: 2.2 gpm Kitchen sink: 2.2 gpm Shower: 2.5 gpm Standard appliances	Lav: 1.5 gpm Kitchen sink: 1.5 gpm Shower: 1.75 gpm Energy Star appliances			
MISCELLANEOUS					
Equipment Loads (W/SF)	Residential Units: 0.6 W/sf Office: 1.0 W/sf MER: 2.5 W/sf Retail: 0.5 W/sf	Residential Units: Reduction for Energy Star appliances Office, MER, Retail: Identical to baseline			
Escalators and Elevator:	40 hp x 4	Identical to Baseline			
Notes: Additional Efficiency Options Included in Baseline Model.					
1. Additional Efficiency Package Option-1 (per C406.1): Reduced air-infiltration.					
2. Additional Efficiency Package Option-2 (per C406.1): Provision of a dedicated outdoor air system.					
3. Additional Efficiency Package Option-3 (per C406.1): 10% improvement over ASHRAE 90.1 2013 HVAC system efficiency.					

Table 1: Table of Inputs

II. Renewable and Clean Energy Sources and Storage

A. On-site Renewable and Clean Energy Systems

On-site photovoltaic (PV) system:
After a preliminary study and analysis, the Proponent and Project team have determined that it is not feasible to incorporate a rooftop-mounted photovoltaic (PV) array into the proposed Project. The rooftop area for the Project is under high demand for building equipment and amenity space to serve residents. At this stage of design, it has been determined that there will not be enough contiguous free space to allow for significant PV installation.

B. Off-site Renewable and Clean Energy Sources and Credits

Off-site wind project:
To accomplish net-zero carbon status, it is recommended the Project consider entering into a contract with a power provider to supply 100% of the electricity used from renewable, through the purchase of Renewable Energy Certificates (RECs) that help to fund a renewable energy facility. Since the net-zero carbon design option incorporates an all-electric building system design, 100% of the energy being used by the building would be sourced from renewable energy sources.

III. Annual Net Performance Calculation

Simulation Results

Figure 1 provides a comparison of Energy Use Intensity by end-use of the proposed design (hybrid water-source heat pump) against the code baseline and the zero-carbon ready building (All-Electric). In addition, the baseline has been compared to the enhanced envelope that is the basis of design, and a super-insulated envelope intended to represent a passive house-style design approach.

Tables 2 and 3 provide a detailed load comparison of the baseline, proposed, and zero-carbon ready conditions, with resulting building energy performance, overall site energy performance, and greenhouse gas emissions reductions indicated. LEED v4 BD+C requires new construction buildings to exceed the baseline by at least 5% to demonstrate Minimum Energy Performance prerequisite compliance. The number of LEED points has not been directly assessed but is estimated based on the performance compared to the code baseline.

The results show a source energy use intensity (EUI) of 69 kBtu/sf for the proposed case and 68 kBtu/sf for the zero-carbon ready case. It is recommended that the 69 kBtu/sf source EUI number be adopted as the design target EUI. This is a 20.2% reduction over the code baseline source EUI of 87 kBtu/sf.

This study uses electricity and natural gas emissions factors as reported by the Energy Star Portfolio Manager Technical Reference on Greenhouse Gas Emissions, revised August 2018. A single nationwide conversion factor is cited for natural gas while the electric conversion factor is specific to the New England (NEWE) electric grid. These are the only conversion factors currently recognized by USGBC for documenting building energy performance on a greenhouse gas emissions basis.

74.94 kG-CO2e/MBTU - Electric Site Energy Conversion Factor
53.11 kG-CO2e/MBTU - Gas Site Energy Conversion Factor

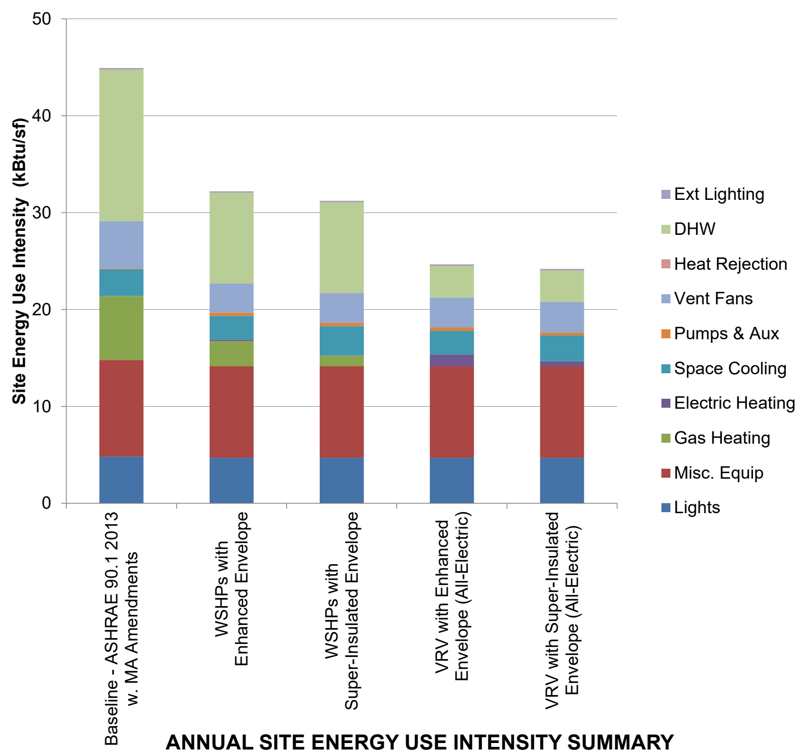


Figure 1: Site EUI Performance by End-Use

Site Energy Use Savings (MMBtu/Yr)					
Description	**Baseline - ASHRAE 90.1 2013 w. MA Amendments**	**WSHPs with Enhanced Envelope**	**WSHPs with Super-Insulated Envelope**	**VRV with Enhanced Envelope (All-Electric)**	**VRV with Super-Insulated Envelope (All-Electric)**
Lights	1,762	1,716	1,716	1,716	1,716
Misc. Equip	3,643	3,451	3,451	3,451	3,451
Gas Heating	2,408	947	401	0	0
Electric Heating	0	56	3	436	195
Space Cooling	1,009	896	1,113	900	967
Pumps & Aux	32	126	124	130	112
Vent Fans	1,775	1,095	1,118	1,126	1,150
Heat Rejection	0	7	8	0	0
DHW	5,718	3,413	3,413	1,189	1,189
Ext Lighting	55	55	55	55	55
Total	**16,402**	**11,760**	**11,401**	**9,003**	**8,834**
% Savings	-	**28.3%**	**30.5%**	**45.1%**	**46.1%**
Site EUI	**45**	**32**	**31**	**25**	**24**
Source EUI	**87**	**69**	**69**	**69**	**68**

Table 2: Designed Savings over Baseline

Energy Use, GHG Reduction and Cost Summary						
Description		**Baseline - ASHRAE 90.1 2013 w. MA Amendments**	**WSHPs with Enhanced Envelope**	**WSHPs with Super-Insulated Envelope**	**VRV with Enhanced Envelope (All-Electric)**	**VRV with Super-Insulated Envelope (All-Electric)**
Annual Site Energy Summary						
Electricity	kWh	2,425,410	2,168,875	2,223,652	2,638,687	2,638,687
Natural Gas	MMBtu	8,126	4,360	3,814	-	-
Total Site Energy use	MMBtu	16,402	11,760	11,401	9,003	8,834
Total Site EUI	kBtu/sf	45	32	31	25	24
Annual Energy Cost Reduction						
Electricity	$/year	$443,850	$396,904	$406,928	$482,880	$482,880
Natural Gas	$/year	$82,560	$44,293	$38,746	$0	$0
Total Energy Cost	$/year	**$526,410**	**$441,197**	**$445,674**	**$482,880**	**$482,880**
Site Energy Cost Savings (%)			**16.2%**	**15.3%**	**8.3%**	**8.3%**
Annual Source Energy Reduction						
Total Source Energy use	MMBtu	31,703,700	25,298,035	25,248,160	25,208,960	24,736,320
Total Source EUI	kBtu/sf	87	69	69	69	68
Source Energy Savings (%)			**20.2%**	**20.4%**	**20.5%**	**22.0%**
Green House Gas (GHG) Reduction						
Total GHG Emissions	MTCO2e	1,051.4	785.8	770.8	674.3	674.3
GHG Reduction(%)			**25.3%**	**26.7%**	**35.9%**	**35.9%**
EApc95 Compliance Path (Average of Source and GHG Savings %)			**22.7%**	**23.5%**	**28.2%**	**28.9%**
Estimated LEED Points			**11**	**11**	**13**	**13**

Table 3: Performance Metrics Summary

IV. First Costs and Life Cycle Cost Assessment

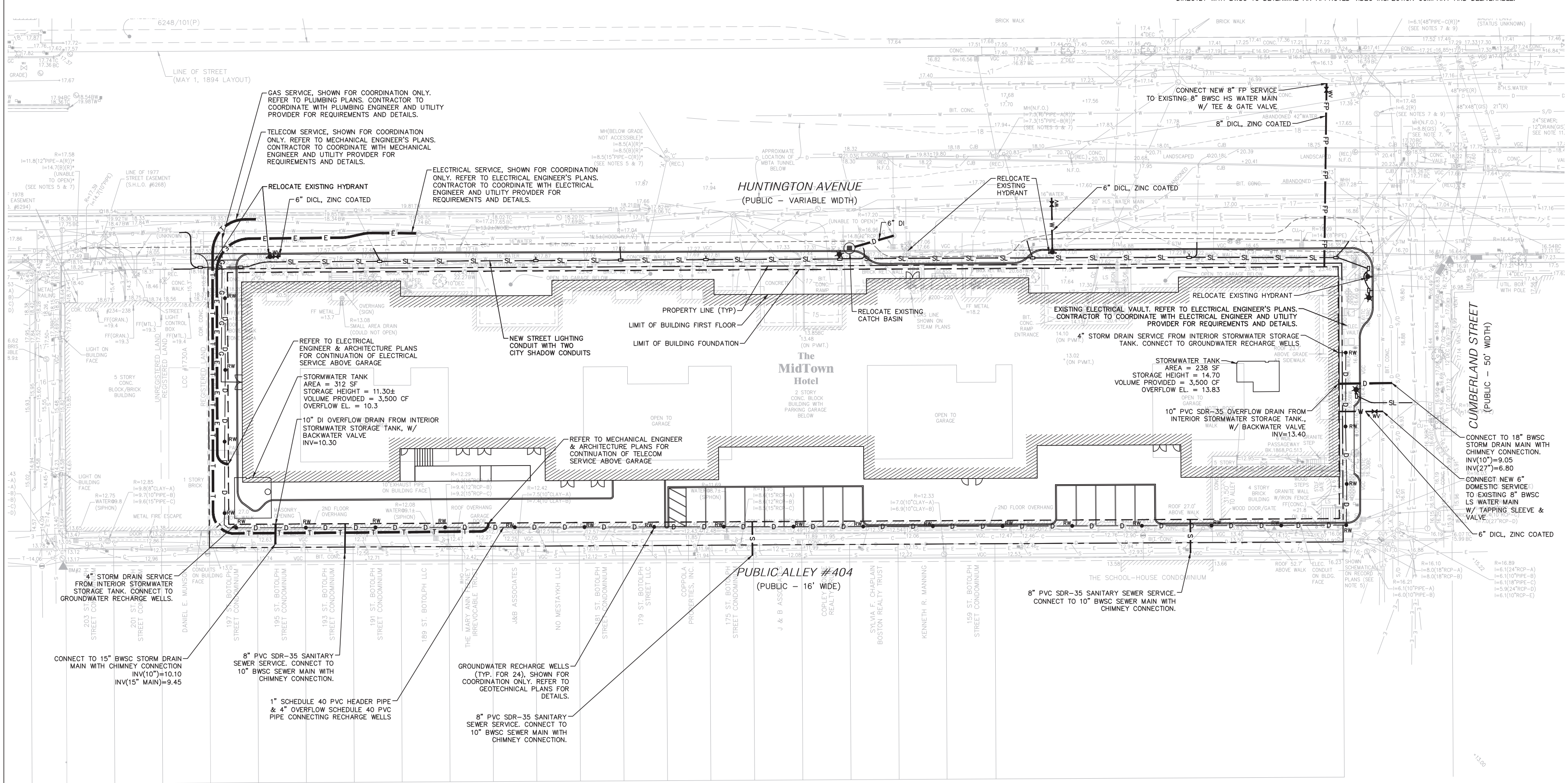
The building has an anticipated site EUI of approximately 32 kBtu/sf and will rely on off-site renewable energy or credits. The zero-carbon ready, all-electric option has an anticipated site EUI of approximately 24 kBtu/sf, eliminating fossil fuel consumption, and relying on 100% off-site renewable electricity and electricity offsets. The building will include a high performance envelope, high efficiency LED light fixtures, high efficiency heat pump units, and optimized HVAC controls. For the zero-carbon ready option, renewable energy will be sourced from off-site renewables. The cost data for construction of each option is not available at this time. Any cost premium for the zero-carbon ready option would be partially offset by utility incentives and reduced operating costs due to lower utility bills.

Appendix F

Site Utilities Plan

BWSC & CONTRACTOR NOTES:

1. THE ESTIMATED SANITARY SEWAGE DISCHARGE IS 49,885 GALLONS PER DAY (GPD). THIS ESTIMATE IS BASED ON 310 C.M.R. 15.000 THE STATE ENVIRONMENTAL CODE, TITLE 5: STANDARD REQUIREMENTS FOR THE SITING, CONSTRUCTION, INSPECTION, UPGRADE AND EXPANSION OF ON-SITE SEWAGE TREATMENT AND DISPOSAL SYSTEMS AND FOR THE TRANSPORT AND DISPOSAL OF SEPTAGE.
2. THE ESTIMATED DAILY WATER USE IS 54,874 [110% SEWAGE NUMBER ABOVE] GPD BASED ON THE ESTIMATED SANITARY SEWAGE DISCHARGE WITH A 10% PEAKING FACTOR. THE PEAK DOMESTIC FLOW BASED ON FIXTURE COUNTS IS APPROXIMATELY XX GPM [FROM MEP].
3. TWO XXXX" COMPOUND WATER METERS WILL BE EITHER NEPTUNE OR ELSTER AMCO COMPOUND TYPE METERS. THE METERS MUST BE PURCHASED BY THE CONTRACTOR. A METER TRANSMITTER UNIT (MTU) SHALL BE SUPPLIED BY THE COMMISSION AT THE OWNER'S EXPENSE. A FEE OF $325/MTU WILL BE PAID TO THE COMMISSION AT THE TIME OF FILING THE GENERAL SERVICE APPLICATION.
4. BACKWATER VALVES SHALL BE PROVIDED BY THE PLUMBER AT ALL GRAVITY SANITARY SEWER AND STORM DRAIN CONNECTIONS FOR ANY FIXTURE LOCATED AT AN ELEVATION BELOW THE TOP OF THE SEWER OR DRAIN MANHOLE.
5. THE CONTRACTOR SHALL NOTIFY THE BWSC CROSS-CONNECTION DEPARTMENT AT 617-989-7283 ONCE BACKWATER VALVES ARE INSTALLED FOR BWSC INSPECTION.
6. DYE TESTING SHALL BE PERFORMED ON NEW STORM DRAIN AND SANITARY SEWER CONNECTIONS AFTER INSTALLATION IS COMPLETE. DYE TESTS SHALL BE WITNESSED BY THE BWSC.
7. A PREREQUISITE FOR FILING A GENERAL SERVICE APPLICATION WITH THE BWSC FOR NEW CONSTRUCTION IS THE ROUGH CONSTRUCTION SIGN-OFF DOCUMENT FROM THE CITY OF BOSTON'S INSPECTIONAL SERVICES DEPARTMENT.
8. AN AS-BUILT PLAN (AUTOCAD 2016 OR EARLIER RELEASE) SHALL BE PROVIDED BY THE CONTRACTOR AND ENDORSED BY A CIVIL ENGINEER OR PROFESSIONAL LAND SURVEYOR SHOWING THE LOCATION, DEPTH, AND INVERT OF EVERY BEND, FITTING, VALVE, CLEANOUT AND ANCHOR. THE AS-BUILT DRAWING SHALL BE SUBMITTED TO THE BOSTON AND WATER SEWER COMMISSION FOR REVIEW AND APPROVAL.
9. WATER SHUT DOWN SHALL BE COORDINATED WITH BWSC WATER OPERATIONS, (617) 989-7276, 24 HOURS NOTICE REQUIRED.
10. PROVIDE "DON'T DUMP" PLAQUES AT ALL CATCH BASIN AND DRAIN INLET LOCATIONS. "DON'T DUMP" PLAQUES TO BE PURCHASED FROM BWSC.
11. THE CONTRACTOR SHALL PURCHASE THE NEW HYDRANT(S) FROM THE BWSC. THE CONTRACTOR SHALL PURCHASE THE HYDRANT(S) FROM THE COMMISSION WHEN FILING THE GENERAL SERVICE APPLICATION.
12. EXISTING WATER METER(S) TO BE REMOVED OR REPLACED SHALL BE RETURNED TO BWSC.
13. THE CONTRACTOR SHALL VIDEO INSPECT THE EXISTING XXX" BWSC XXXX MAIN IN XXX STREET PRIOR TO CONSTRUCTION AND AFTER CONSTRUCTION IS COMPLETE AND SUBMIT TO BWSC AND NITSCH ENGINEERING FOR REVIEW. THE INSPECTION SOFTWARE SHALL BE CAPABLE OF EXPORTING DIGITAL INSPECTION LOG DATA INTO AN MSACCESS DATABASE IN THE PIPELINE ASSESSMENT AND CERTIFICATION PROGRAM (PACP) STANDARD EXCHANGE FORMAT. THE INSPECTION SOFTWARE CODING SYSTEM SHALL BE PACP CERTIFIED (LATEST EDITION) AS PER THE NATIONAL ASSOCIATION OF SEWER SERVICE COMPANIES (NASSCO). THE SOFTWARE SHALL BE EQUIPPED WITH ALL MODULES NECESSARY FOR PACP INSPECTIONS AND SCORING. THE CONTRACTOR SHALL COORDINATE DIRECTLY WITH BWSC TO DETERMINE AN APPROVED VIDEO INSPECTION COMPANY AND DELIVERABLE.



REVISIONS

#	DATE	DESCRIPTION

220 Huntington Ave Boston, MA

cbt 617 262 4354 cbtarchitects.com
110 canal street boston, ma 02114

Nitsch Engineering

NOT FOR CONSTRUCTION

SCHEMATIC DESIGN
3/6/2020

SITE UTILITY PLAN

SCALE	PROJECT #	DATE ISSUED
AS NOTED	196002.02	3.6.2020

C100

Appendix G

Accessibility Checklist

ARTICLE 80 – ACCESSIBILITY CHECKLIST

A Requirement of the Boston Planning & Development Agency (BPDA) Article 80 Development Review Process

The Mayor's Commission for Persons with Disabilities works to reduce architectural barriers that impact accessibility in Boston's built environment. This Checklist is intended to ensure that accessibility is planned at the beginning of projects, rather than after a design is completed. It aims to ensure that projects not only meet minimum MAAB/ADA requirements, but that they create a built environment which provides equitable experiences for all people, regardless of age or ability.

All BPDA Small or Large Project Review, including Institutional Master Plan modifications, must complete this Checklist to provide specific detail and data on accessibility. An updated Checklist is required if any project plans change significantly.

For more information on compliance requirements, best practices, and creating ideal designs for accessibility throughout Boston's built environment, proponents are strongly encouraged to meet with Disability Commission staff prior to filing.

Accessibility Analysis Information Sources:

1. Age-Friendly Design Guidelines - Design features that allow residents to Age in Place https://www.enterprisecommunity.org/download?fid=6623&nid=3496
2. Americans with Disabilities Act – 2010 ADA Standards for Accessible Design http://www.ada.gov/2010ADAstandards_index.htm
3. Massachusetts Architectural Access Board 521 CMR http://www.mass.gov/eopss/consumer-prot-and-bus-lic/license-type/aab/aab-rules-and-regulations-pdf.html
4. Massachusetts State Building Code 780 CMR http://www.mass.gov/eopss/consumer-prot-and-bus-lic/license-type/csl/building-codebbrs.html
5. Massachusetts Office of Disability – Disabled Parking Regulations http://www.mass.gov/anf/docs/mod/hp-parking-regulations-summary-mod.pdf
6. MBTA Fixed Route Accessible Transit Stations http://www.mbta.com/riding_the_t/accessible_services/
7. City of Boston – Complete Street Guidelines http://bostoncompletestreets.org/
8. City of Boston – Mayor's Commission for Persons with Disabilities http://www.boston.gov/disability
9. City of Boston – Public Works Sidewalk Reconstruction Policy http://www.cityofboston.gov/images_documents/sidewalk%20policy%200114_tcm3-41668.pdf
10. City of Boston – Public Improvement Commission Sidewalk Café Policy http://www.cityofboston.gov/images_documents/Sidewalk_cafes_tcm3-1845.pdf
11. International Symbol of Accessibility (ISA) https://www.access-board.gov/guidelines-and-standards/buildings-and-sites/about-the-ada-standards/guide-to-the-ada-standards/guidance-on-the-isa
12. LEED – Pilot Credits for Social Equity and Inclusion https://www.usgbc.org/articles/social-equity-pilot-credits-added-leed-nd-and-leed-om

Glossary of Terms:

1. ***Accessible Route*** – A continuous and unobstructed path of travel that meets or exceeds the dimensional requirements set forth by MAAB 521 CMR: Section 20
2. ***Accessible Guestrooms*** – Guestrooms with additional floor space, that meet or exceed the dimensional requirements set forth by MAAB 521 CMR: Section 8.4
3. ***Age-Friendly*** **–** Implementing structures, settings and polices that allow people to age with dignity and respect in their homes and communities
4. ***Housing – Group 1 Units*** **–** Residential Units that contain features which can be modified without structural change to meet the specific functional needs of an occupant with a disability, per MAAB 521 CMR: Section 9.3
5. ***Housing – Group 2 Units*** **–** Residential units with additional floor space that meet or exceed the dimensional and inclusionary requirements set forth by MAAB 521 CMR: Section 9.4
6. ***Ideal Design for Accessibility*** **–** Design which meets, as well as exceeds, compliance with AAB/ADA building code requirements
7. ***Inclusionary Development Policy (IDP)*** – Program run by the BPDA that preserves access to affordable housing opportunities in the City. For more information visit: http://www.bostonplans.org/housing/overview
8. ***Public Improvement Commission (PIC)*** – The regulatory body in charge of managing the public right of way in Boston. For more information visit: https://www.boston.gov/pic
9. ***Social Equity LEED Credit*** **–** Pilot LEED credit for projects that engage neighborhood residents and provide community benefits, particularly for persons with disabilities
10. ***Visitability*** – A structure that is designed intentionally with no architectural barriers in its common spaces (entrances, doors openings, hallways, bathrooms), thereby allowing persons with disabilities who have functional limitations to visit

Today's Date:	**Your Name and Title:**
1. Project Information:	

If this is a multi-phased or multi-building project, fill out a separate Checklist for each phase/building.

Project Name:	220 Huntington Avenue			
Project Address(es):	220 Huntington Avenue			
Total Number of Phases/Buildings:	1			
Primary Contact: **(ND to verify)** (Name / Title / Company / Email / Phone):	Sam Randel Vice President, Development National Development 617-599-5050			
Owner / Developer:	National Development			
Architect:	CBT Architects			
Civil Engineer:	Nitsch Engineering			
Landscape Architect:	IBI Group, Inc.			
Code Consultant:	Code Red Consultants			
Accessibility Consultant (*If you have one*):	Code Red Consultants			
What stage is the project on the date this checklist is being filled out?	SPRA / **PNF** / Expanded PNF Submitted	Draft / Final Project Impact Report Submitted	BPDA Board Approved or other: __________	

2. Building Classification and Description:
This section identifies preliminary construction information about the project including size and uses.

What are the dimensions of the project? See below:				
Site Area:	*Approx. 66,660 SF*	Building Area:	*Approx.351,500 SF*	
First Floor Elevation:	17.5–18.25 Ft BCB	Any below-grade space	*Yes*	
What is the construction classification?	**New Construction**	Renovation	Addition	Change of Use
Do you anticipate filing any variances with the MAAB (Massachusetts Architectural Access Board) due to non-compliance with 521 CMR?	**YES**			
If yes, is the reason for your MAAB variance: (1) technical infeasibility, **OR** (2) excessive and unreasonable cost without substantial benefit for persons with disabilities? Have you met with an accessibility consultant or Disability Commission to try to achieve compliance rather than applying for a variance? Explain:	**(1)** a. Electrical receptacles at inside corners of kitchens. b. Electrical receptacles at perimeter glazing. c. Kitchen sink depth.			

<table>
<tr><td rowspan="3">What are principal building uses?
(using IBC definitions, select all appropriate that apply):</td><td>Residential – One - Three Unit</td><td>Residential - Multi-unit, Four+</td><td>Institutional</td><td>Educational</td></tr>
<tr><td>Business</td><td>Mercantile</td><td>Factory</td><td>Hospitality</td></tr>
<tr><td>Laboratory / Medical</td><td>Storage, Utility and Other</td><td colspan="2">Other: Amenity spaces and Ground Floor Retail</td></tr>
<tr><td>List street-level uses of the building:</td><td colspan="4">Residential Amenity, Retail, Restaurant and Back of House</td></tr>
<tr><td colspan="5">3. Accessibility of Existing Infrastructure:
This section explores the proximity to accessible transit lines and institutions. Identify how the area surrounding the development is accessible for people with mobility impairments, and analyze the existing condition of the accessible routes to these sites through sidewalk and pedestrian ramp reports.</td></tr>
<tr><td>Provide a description of the neighborhood where this development is located and its identifying topographical characteristics:</td><td colspan="4">The Project Site is located in the Huntington Avenue/Prudential Center Zoning District and is directly across Huntington Avenue from the Christian Science Center plaza with the Saint Botolph neighborhood directly to the south and the Back Bay neighborhood to the north. It is bounded by Huntington Avenue to the northwest (partially in front of the Massachusetts Avenue underpass), Cumberland Street to the northeast, and Public Alley #404 to the southeast. Huntington Avenue is separated by a raised concrete median. The Project Site is one block away from the Greenhouse Apartments, the Prudential Center, and the Colonnade Hotel.</td></tr>
<tr><td>List the surrounding accessible MBTA transit lines and their proximity to development site, including commuter rail, subway stations, and bus stops:</td><td colspan="4">Commuter Rail – Back Bay Station (0.56 miles)
Green Line – Prudential Station (0.17 miles)
Orange Line – Massachusetts Ave. Station (0.20 miles)
Bus Stop – Massachusetts Ave @ Huntington Ave (0.10 miles)</td></tr>
<tr><td>List surrounding institutions and their proximity: hospitals, public housing, elderly and disabled housing, educational facilities, others:</td><td colspan="4">Boston Medical Center (0.90 miles)
Boston Housing Authority – Northampton St. (0.9 miles)
New England Conservatory of Music (0.2 miles)
Northeastern University (0.4 miles)
Wentworth Institute of Technology (0.9 miles)
Massachusetts College of Art and Design Museum of Fine Arts (1.0 mile)</td></tr>
<tr><td>List surrounding government buildings and their proximity: libraries, community centers, recreational facilities, and related facilities:</td><td colspan="4">US Post Office (0.30 miles)
Boston Public Library – Central Library (0.52 miles)
Boston Public Library – South End Branch (0.50 miles)
YMCA (0.28 miles)
Blackstone Community Center (0.75 miles)
Boston Symphony Orchestra (0.2 miles)
Museum of Fine Arts (0.7)</td></tr>
<tr><td colspan="5">4. Surrounding Site Conditions – Existing:
This section identifies current condition of the sidewalks and pedestrian ramps at the development site.</td></tr>
<tr><td>Is the development site within a formally recognized historic district? If yes, which one?</td><td colspan="4">NO</td></tr>
<tr><td>Are there existing sidewalks and pedestrian ramps at the development site? If yes, list</td><td colspan="4">Yes, there are existing sidewalks on Huntington Avenue and Cumberland Street.</td></tr>
</table>

the existing sidewalk and pedestrian ramp slopes, dimensions, materials, and physical condition:	**Huntington Avenue** Longitudinal Slopes: Between 0.0-1.0%. Cross Slopes: Between 2.7-4.0% Dimensions: 0.5' curb + 6.5' sidewalk to property line Materials: granite curb, cement concrete sidewalk Physical Condition: Varies. Street light poles, hydrants, and driveway entrance curb create pinch points (3.5' minimum clear width). **Cumberland Street** Longitudinal Slope: Between 0.2-1.0% Cross Slopes: Between 2.5-5.5% Dimensions: 0.5' curb + 7.5' sidewalk to property line Materials: Mostly Brick; Cement concrete at Huntington Ave intersection. Physical Condition: Varies. Street light poles, hydrants and street light control box create pinch points (4.0' minimum clear width) Notes: There is a sidewalk electrical vault with brick cover. There is a pedestrian ramp at the corner of Huntington Avenue and Cumberland Street with a tactile panel. Public Alley #404 has a 2.5' wide cement concrete between the building and paved alley which contains street light poles; not an accessible path.
Are the sidewalks and pedestrian ramps existing-to-remain? ***If yes,*** have they been verified as ADA/MAAB compliant (with yellow composite detectable warnings, cast in concrete)? ***If yes,*** provide description and photos. If ***no,*** explain plans for compliance:	**NO**
5. Surrounding Site Conditions – Proposed *This section identifies the proposed condition of the sidewalks and pedestrian ramps around the development site. Ideal sidewalk width contributes to lively pedestrian activity, allowing people to walk side by side and pass each other comfortably walking alone, in pairs, or using a wheelchair or walker.*	
Are the proposed sidewalks consistent with Boston Complete Streets? ***If yes***, choose which Street Type was applied: Downtown Commercial, Downtown Mixed-use, Neighborhood Main, Connector, Residential, Industrial, Shared Street, Parkway, or Boulevard. Explain:	**YES** Huntington Avenue: Boulevard Cumberland Street: Neighborhood Residential Pedestrian Easement will be required.
What are the total dimensions and slopes of the proposed sidewalks? List the widths of each proposed zone: Frontage, Pedestrian and Furnishing Zone:	**Frontage:** Huntington Ave: 1.5' - +/-10' (retail nooks) Cumberland Street: Approx 12" - 12' (at retail nooks) **Pedestrian:** Huntington Ave: 6.5' Cumberland Street: 6.5'-9' **Furnishing:** Huntington Ave: Varies: approx. 4' to +/-6'

	Cumberland Street: N/A
List the proposed materials for each Zone. Will the proposed materials be on private property or will the proposed materials be on the City of Boston pedestrian right-of-way?	**Frontage:** Unit paver **Pedestrian:** Boston city standard concrete **Furnishing:** permeable paver
Will sidewalk cafes or other furnishings be programmed for the pedestrian right-of-way? ***If yes,*** what are the proposed dimensions of the sidewalk café or furnishings and what will the remaining right-of-way clearance be?	**YES** Huntington Avenue: Bike racks, street lights, potential pedestrian level lighting, blue bikes will be programmed for the pedestrian right-of-way and located in furnishing zones. Furnishing zones dimensions varies from 4.' to +/-6'. The clearance from the pedestrian right-of-way is 2.5'. Cumberland Street: No sidewalk cafes or other furnishings will be programmed for pedestrian R.O.W. The clearance from the pedestrian right-of-way is 6'.
If the pedestrian right-of-way is on private property, will the proponent seek a pedestrian easement with the Public Improvement Commission (PIC)?	**YES** A portion of the pedestrian right-of-way will be within the private property. Pedestrian easements will be required.
Will any portion of this project be going through the Public Improvement Commission (PIC)? ***If yes,*** identify PIC actions and provide details:	**YES** Specific Repairs Groundwater Recharge Wells License Pedestrian Easements Canopy or Projection License (possible) Earth Retention (possible)
6. Building Entrances, Vertical Connections, Accessible Routes, and Common Areas: *The primary objective in ideal accessible design is to build smooth, level, continuous routes and vertical connections that are integrated with standard routes, not relocated to alternate areas. This creates universal access to all entrances and spaces, and creates equity for persons of all ages and abilities by allowing for "aging in place" and "visitability" (visiting neighbors).*	
Are all of the building entrances accessible? Describe the accessibility of each building entrance: flush condition, stairs, ramp, lift, elevator, or other. If all of the building entrances are ***not accessible,*** explain:	**YES** Building entrances to have flush conditions.
Are all building entrances well-marked with signage, lighting, and protection from weather?	**YES**

Are all vertical connections located within the site (interior and exterior) integrated and accessible? Describe each vertical connection (interior and exterior): stairs, ramp, lift, elevator, or other. If all the vertical connections are ***not integrated and accessible,*** explain:	**YES** Spaces within the building are accessible by interior elevators and accessible corridors.
Are all common spaces in the development located on an accessible route? Describe:	**YES** Common spaces within the building are accessible by interior elevators and accessible corridors.
Are all of the common spaces accessible for persons with mobility impairments? (Examples: community rooms, laundry areas, outdoor spaces, garages, decks/roof decks):	**YES** Common spaces within the building are accessible by interior elevators and accessible corridors.
What built-in features are provided in common public spaces? (Examples: built-in furnishings such as tables, seating; countertop heights, outdoor grills and benches). Are these accessible? Do benches and seats have armrests? Describe:	It is early to determine the specific built-in features, but amenity spaces will incorporate accessibility as required in MAAB.
If this project is subject to Large Project Review/Institutional Master Plan, describe the accessible routes way-finding / signage package:	This will be developed as the Project moves into the design process.
7. Accessible Housing Units (If applicable) – Residential Group 1, Group 2, and Hospitality Guestrooms *In order to create accessible housing and hospitality rooms, this section addresses the number of accessible units that are proposed for barrier-free housing and hotel rooms in this development.*	
What is the total number of proposed housing units or hotel rooms for this development?	325 residential units
If a residential development, how many units are for sale? How many are for rent? What is the breakdown of market value units vs. IDP (Inclusionary Development Policy) units?	325 Residential rental units. 13% of the units (42) will be IDP units. All IDP units will be rental.
If a residential development, will all units be constructed as MAAB Group 1* units, which have blocking and other built-in	**YES**

infrastructure that makes them adaptable for access modifications in the future? *(*this is required in all new construction)*:	
If a residential development, how many fully built-out ADA (MAAB Group 2) units will there be? (*requirement is 5%*):	17 Units will be MAAB Group-2
If a residential development, how many units will be built-out as ADA/MAAB sensory units? (*requirement is 2%):*	Seven Units will be MAAB sensory units.
If a residential development, how many of the fully built-out ADA (MAAB Group 2) units will also be IDP units? ***If none***, explain:	Two of the Group 2 units will be IDP units and an additional one will be a MAAB sensory unit.
If a hospitality development, how many of the accessible units will feature a wheel-in shower? Will accessibility features and equipment be built in or provided (built-in bench, tub seat, etc.)? ***If yes,*** provide details and location of equipment:	N/A
Do the proposed housing and hotel units that are standard, non-ADA units (MAAB Group 1) have any architectural barriers that would prevent entry or use of the space by persons with mobility impairments? (Example: stairs or thresholds within units, step up to balcony, etc.). ***If yes,*** explain:	**NO**
8. Accessible Parking: *See Massachusetts Architectural Access Board Rules and Regulations 521 CMR Section 23.00 regarding accessible parking requirements and the Massachusetts Office of Disability Disabled Parking Regulations*.	
What is the total number of parking spaces provided at the development site? Will these be in a parking lot or garage? Will they be mechanically stacked? Explain:	153 total parking spaces located at the development site. The parking spaces will be located at the P1 level and along Public Alley 404. They will be a combination of standard spaces and mechanically stacked.
How many of these parking spaces will be designated as Accessible Parking Spaces? How many will be "Van Accessible" spaces with an 8 foot access aisle? Describe:	5 accessible parking spaces and 1 van accessible space provided (6 total).
Will visitor parking be provided? If ***yes,*** where will the accessible visitor parking be located?	**NO** There is surrounding street/metered parking available.

Has a drop-off area been identified? ***If yes,*** where is it located, and is it wheelchair accessible?	**YES NO** It is located on Huntington Avenue in front of the building main entrance. It is wheelchair accessible.
9. Community Impact: *Accessibility and inclusion extend past required compliance with building codes to providing an overall development that allows full and equal participation of persons with disabilities and older adults.*	
Has the proponent looked into either of the two new LEED Credit Pilots for (1) Inclusion, or (2) Social Equity – with a proposal that could increase inclusion of persons with disabilities? ***If yes,*** describe:	NO As the Project is in very early stages of design, the Proponent and project team have not discussed these credits at this stage of the Project; it will be a point of discussion as the Project progresses.
These new LEED Pilot Credits may be awarded for filling out this checklist and evaluating ways to add features to your design that will increase equity for persons with disabilities. Have you looked at this list to assess the feasibility of adding any of these features?	**YES**
Is this project providing funding or improvements to the surrounding neighborhood or to adjacent MBTA Station infrastructure? (Examples: adding street trees, building or refurbishing parks, adding an additional MBTA elevator or funding other accessibility improvements or other community initiatives)? ***If yes,*** describe:	**YES** Adding street trees along Huntington Avenue providing bike racks, a bike share station, and extending bike lanes.
Will any public transportation infrastructure be affected by this development, during and/or post-construction (Examples: are any bus stops being removed or relocated)? ***If yes***, has the proponent coordinated with the MBTA for mitigation? Explain:	**NO** No public transportation infrastructure will be impacted by any stage of the Project
During construction, will any on-street accessible parking spaces be impacted (during and/or post-construction)? **If yes,** what is the plan for relocating the spaces?	**NO** No accessible parking spaces will be impacted by the Project
Has the proponent reviewed these plans with the City of Boston Disability Commission Architectural Access staff? ***If***	**The Project team has met with the City of Boston Disability Commission and the Project plans were reviewed.**

no, will you be setting up a meeting before filing?	

10. Attachments

Include a list of all documents you are submitting with this Checklist – drawings, diagrams, photos, or any other materials that describe the accessible and inclusive elements of this project.

Provide a diagram of the accessible routes to and from the accessible parking lot/garage and drop-off areas to the development entry locations, including route distances.
Provide a diagram of the accessible route connections through the site, including distances.
Provide a diagram the accessible route to any roof decks or outdoor space (if applicable).
Provide a plan and diagram of the accessible Group 2 units, including locations and route from accessible entry.
Provide any additional drawings, diagrams, photos, or any other material that describes the inclusive and accessible elements of this project. • Ground Floor Plan • Tenth Floor Plan • Garage Plan

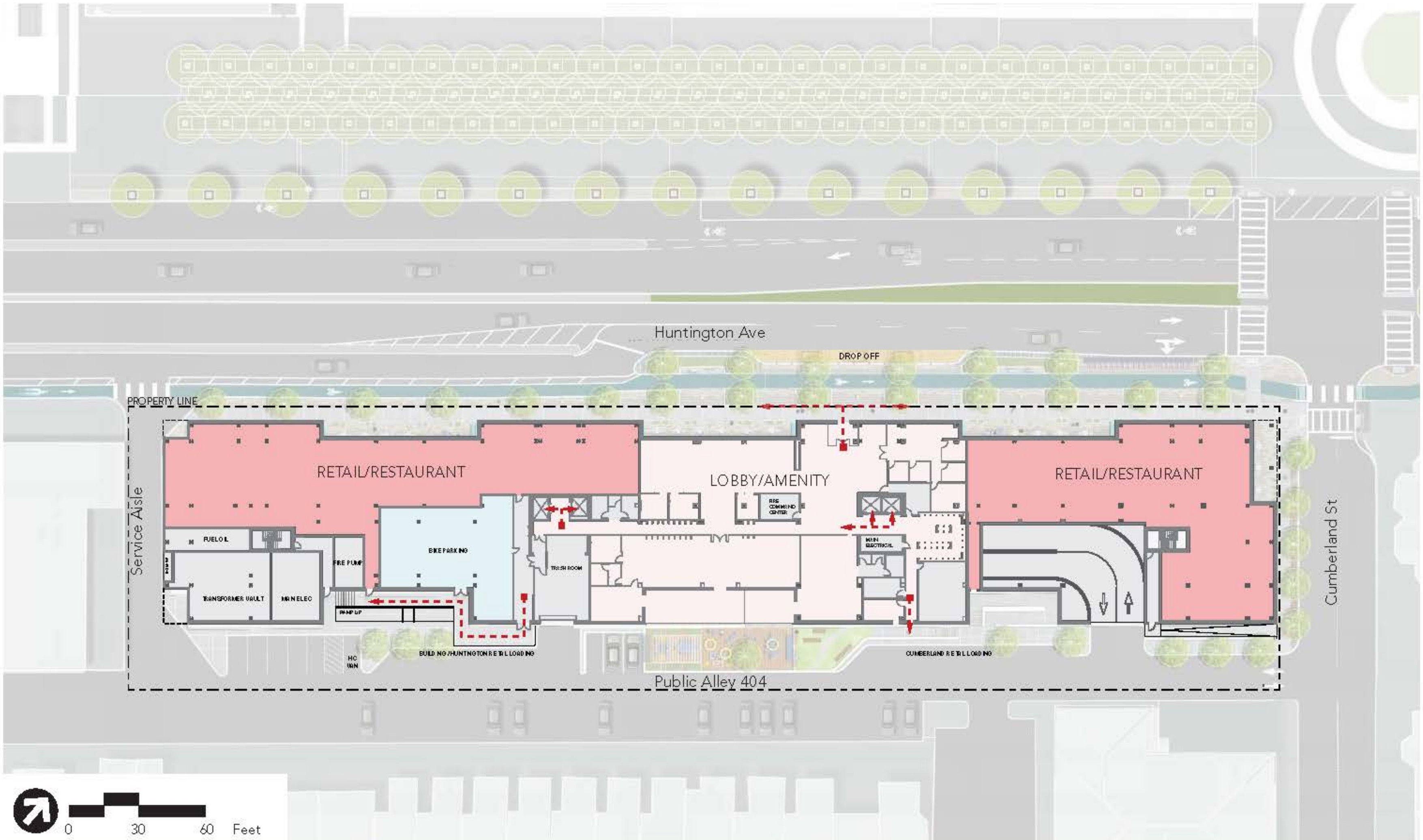
This completes the Article 80 Accessibility Checklist required for your project. Prior to and during the review process, Commission staff are able to provide technical assistance and design review, in order to ensure that all buildings, sidewalks, parks, and open spaces are welcoming and usable to Boston's diverse residents and visitors, including those with physical, sensory, and other disabilities.

For questions about this checklist, or for more information on best practices for improving accessibility and inclusion, visit www.boston.gov/disability, or contact our Architectural Access staff at:

ADA@boston.gov | patricia.mendez@boston.gov | sarah.leung@boston.gov |
617-635-3682 (phone) | 617-635-2726 (fax) | 617-635-2541 (tty)

The Mayor's Commission for Persons with Disabilities
Boston City Hall, One City Hall Square, Room 967, Boston MA 02201

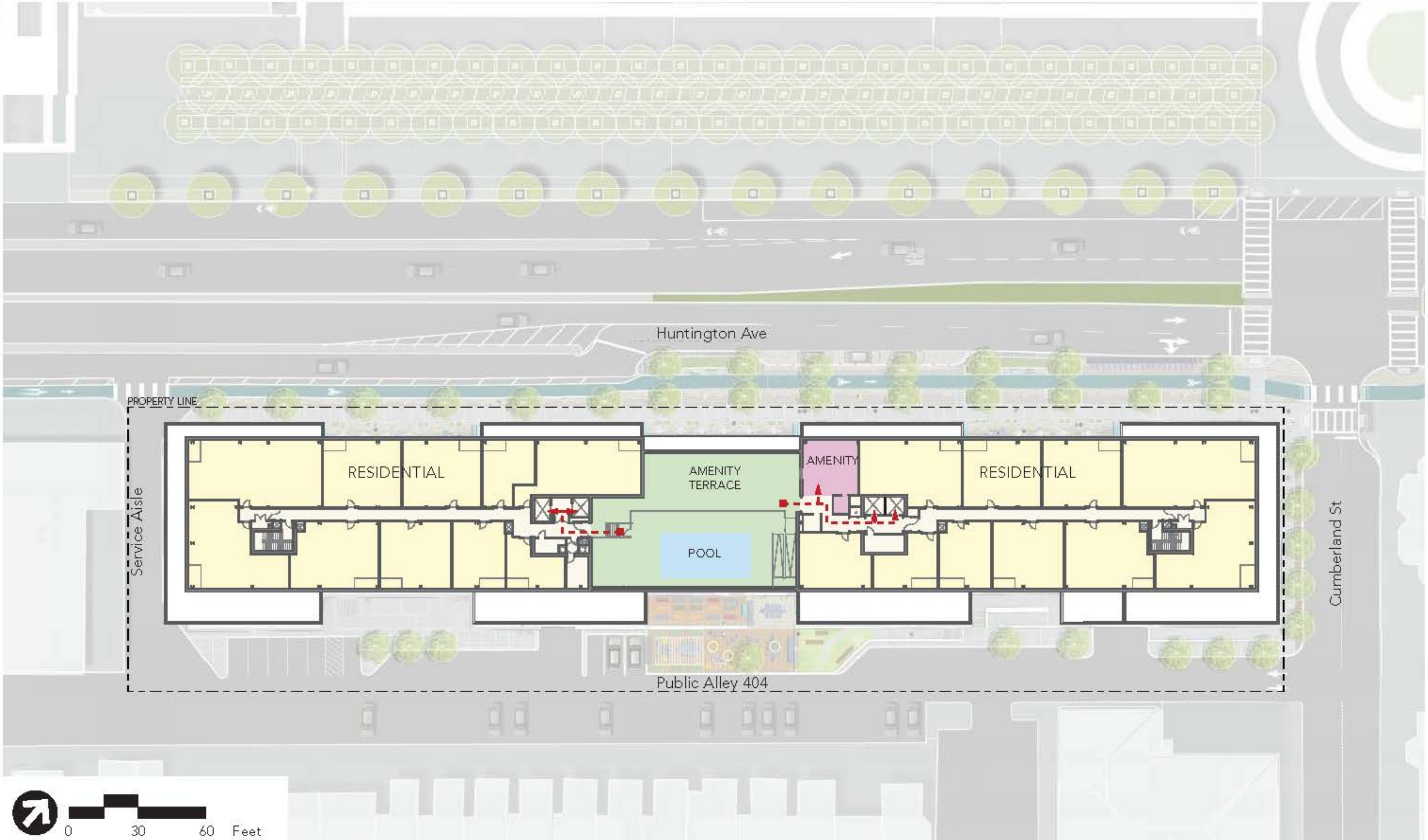
Updated: October, 2019



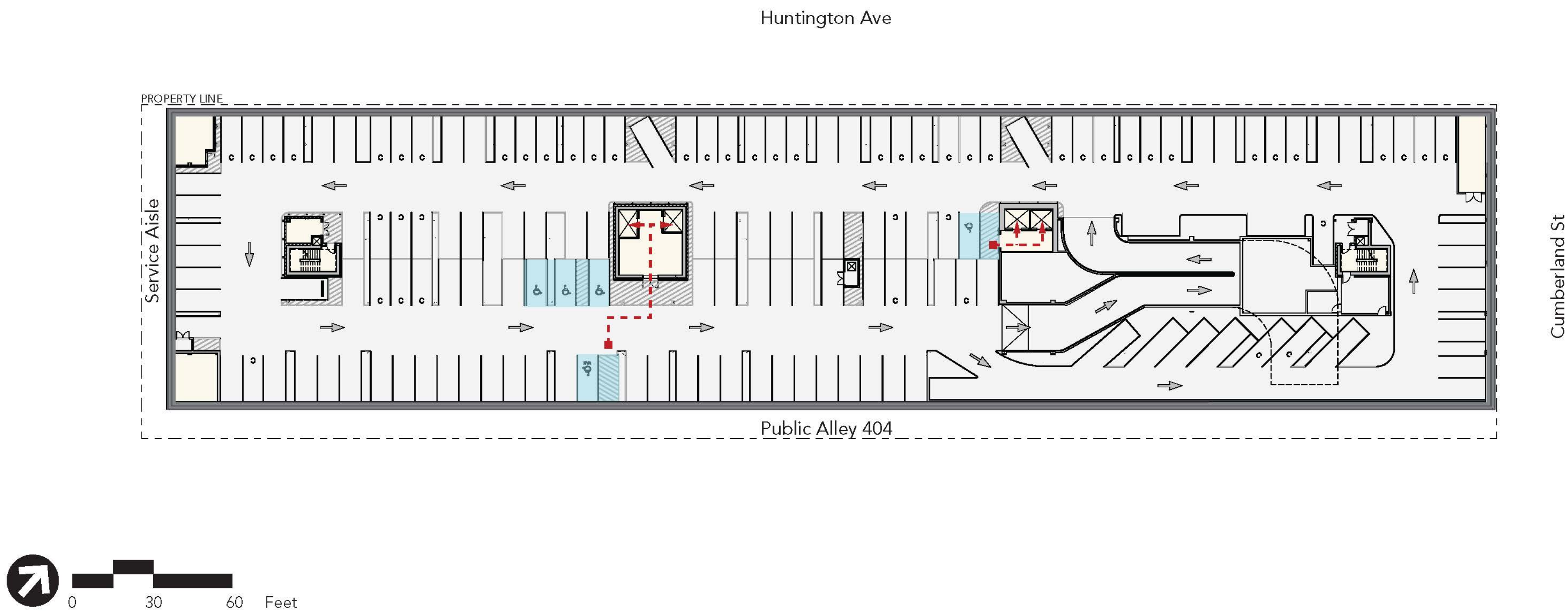
220 Huntington Avenue Boston, Massachusetts

cbt

Ground Floor Plan



Huntington Ave
PROPERTY LINE
RESIDENTIAL
AMENITY TERRACE
POOL
AMENITY
RESIDENTIAL
Service Aisle
Cumberland St
Public Alley 404
0
30
60
Feet


Huntington Ave
PROPERTY LINE
Service Aisle
Cumberland St
Public Alley 404
0
30
60
Feet

Appendix H

Broadband Ready Buildings Questionnaire

Form Publisher Template

10/30/2020

This is a simple template document automatically generated by Form Publisher.
Feel free to personalize it like any other Google Spreadsheet.

FormPublisher

Questions list:	
Project Name::	220 Huntington Avenue
Project Address Primary: :	220 Huntington Avenue
Project Address Additional: :	
Project Contact (name / Title / Company / email / phone): :	Sam Randel / Vice President, Development / srandel@natdev.com / 617-599-5050
Expected completion date:	2024
Owner / Developer:	National Development
Architect:	CBT Architects
Engineer (building systems)::	Nitsch Engineering
Permitting::	Epsilon Associates, Inc.
Construction Management:	Cranshaw Construction
Number of Points of Entry:	Unknown
Locations of Points of Entry:	Unknown
Quantity and size of conduits:	Unknown
Location where conduits connect (e.g. building-owned manhole, carrier-specific manhole or stubbed at property line) :	Unknown
Other information/comments:	
Do you plan to conduct a utility site assessment to identify where cabling is located within the street? This information can be helpful in determining the locations of POEs and telco rooms. Please enter 'unknown' if these decisions have not yet been made or you are presently unsure.:	Unknown
Number of risers:	Unknown
Distance between risers (if more than one):	Unknown
Dimensions of riser closets:	Unknown
Riser or conduit will reach to top floor :	Unknown
Number and size of conduits or sleeves within each riser:	Unknown
Proximity to other utilities (e.g. electrical, heating):	Unknown
Other information/comments:	
What is the size of the telecom room?:	Unknown
Describe the electrical capacity of the telecom room (i.e. # and size of electrical circuits):	Unknown
Will the telecom room be located in an area of the building containing one or more load bearing walls?:	Unknown

Will the telecom room be climate controlled? :	Unknown			
If the building is within a flood-prone geographic area, will the telecom equipment will be located above the floodplain?:				
Will the telecom room be located on a floor where water or other liquid storage is present?:	Unknown			
Will the telecom room contain a flood drain?:	Unknown			
Will the telecom room be single use (telecom only) or shared with other utilities?:	Unknown			
Other information/comments:				
Will building/developer supply common inside wiring to all floors of the building? :	Unknown			
If yes, what transmission medium (e.g. coax, fiber)? Please enter ‘unknown’ if these decisions have not yet been made or you are presently unsure.:	Unknown			
Is the building/developer providing wiring within each unit? :	Unknown			
If yes, what transmission medium (e.g. coax, fiber)? Please enter ‘unknown’ if these decisions have not yet been made or you are presently unsure.:	Unknown			
Will the building conduct any RF benchmark testing to assess cellular coverage?:	Unknown			
Will the building allocate any floor space for future in-building wireless solutions (DAS/small cell/booster equipment)?:	Unknown			
Will the building be providing an in-building solution (DAS/ Small cell/ booster)? :	Unknown			
If so, are you partnering with a carrier, neutral host provider, or self-installing?:				
Will you allow cellular providers to place equipment on the roof?:	Unknown			
Will you allow broadband providers (fixed wireless) to install equipment on the roof? :	Unknown			
Will you allow broadband providers (fixed wireless) to install equipment on the roof? :	Unknown			
Date contacted:				
Does Comcast intend to serve the building?:	Unknown			
Transmission Medium:	Unknown			
If no or unknown, why?:				
Date contacted:				
Does RCN intend to serve the building?:	Unknown			
Transmission Medium:	Unknown			
If no or unknown, why?:				
Date contacted:				

Does Verizon intend to serve the building?:	Unknown			
Transmission Medium:	Unknown			
If no or unknown, why?:				
Date contacted:				
Does netBlazr intend to serve the building?:	Unknown			
Transmission Medium:	Unknown			
If no or unknown, why?:				
Date contacted:				
Does WebPass intend to serve the building?:				
Transmission Medium:	Unknown			
If no or unknown, why?:				
Date contacted:				
Does Starry intend to serve the building?:	Unknown			
Transmission Medium:	Unknown			
If no or unknown, why?:				
Do you plan to abstain from exclusivity agreements with broadband and cable providers? :	Unknown			
Do you plan to make public to tenants and prospective tenants the list of broadband/cable providers who serve the building?:	Unknown			