5 Transportation

This chapter provides an assessment of the Project's transportation characteristics. The chapter includes evaluations of existing conditions and projected future conditions without and with the proposed Project (i.e., No-Build and Build conditions, respectively). Transportation improvements and mitigation measures are identified to address existing transportation problems in the area in addition to minimizing potential impacts of the Project. In addition to physical multi-modal transportation infrastructure improvements, the mitigation package includes a robust Transportation Demand Management (TDM) plan designed to reduce single-occupant vehicle (SOV) travel and encourage use of alternative transportation modes. The Proponent will commit to these improvements through the execution of a Transportation Access Plan Agreement (TAPA) with the City of Boston.

5.1 Key Findings

The key findings of the transportation analysis include the following:

- The Proponent seeks to obtain a Phase 1 waiver in order to start construction on the first phase of construction while the Full Build Master Plan continues through the MEPA regulatory review process: This transportation analysis has been completed for both Phase 1 and the Full Build Master Plan (inclusive of Phase 1).
- The Phase 1 Project is expected to generate approximately 702 net new daily vehicle trips, with approximately 58 and 82 net new vehicle trips occurring in the morning and evening peak hours, respectively;
- The Full Build Master Plan is expected to generate approximately 5,006 net new daily vehicle trips, with approximately 382 and 533 net new vehicle trips occurring in the morning and evening peak hours, respectively. This level of vehicle trip generation will phase in gradually over the 8-10 year development period and reflects the Project's location in an existing urban environment;

- The Charlestown neighborhood is served by a number of public transportation services, including MBTA Bus, Orange Line, and Ferry service, as well as shuttle buses associated with local institutions;
- At this time, there are two parking options envisioned for off-street parking. Both would result in up to 1,379 off-street parking spaces, with Option A providing all spaces on-site and Option B providing up to 244 spaces off-site underneath the Tobin Bridge.
- As currently envisioned, at full build out the Project will provide approximately 326 on-street spaces within the Project site, an increase of 154 from the existing on-street parking capacity. Approximately 86 off-street parking spaces and 62 on-street spaces will be constructed for Phase 1.
- The Project will provide ample bicycle parking, both short-term and long-term, for residents, employees and visitors to the Project;
- Extensive roadway and sidewalk improvements provided by the Project will significantly enhance the pedestrian environment and promote multi-modal access;
- The Project will incorporate a robust program of TDM strategies to take full advantage of its multiple mobility options and its synergy with the surrounding vibrant mixed-use neighborhoods;
- Roadway mitigation is being proposed at three study area intersections. Updated pavement markings are being proposed at Bunker Hill Street at Polk Street/Green Street (#5), and at Vine Street at Chelsea Street (#9). Signalization is being considered at the intersection of Bunker Hill Street at Medford Street/Main Street (#10); and
- Potential transit enhancements including improvements to MBTA bus service and possible opportunities for shuttle service would enhance transit service for residents and the wider Charlestown neighborhood.

5.2 Project Overview

The location of the Project is shown in Figure 5.1 in the context of the local and regional roadway network supporting the neighborhood. The Project comprises the rebuilding of an approximately 28.3-acre area in the city's Charlestown neighborhood to create a new mixed-income housing development. The existing 1,100 affordable housing units will ultimately be replaced by a mix of 2,699 affordable and market rate units with 100 affordable units to be built off-site through an initiative of the BHA and the City. The Project is supported by approximately 62,500 square feet of street-level local retail and community uses. The Project will predominantly maintain the existing street grid and establish new connections to existing streets across Bunker Hill Street, creating an enhanced public realm.

The Project will be constructed on a rolling basis in multiple phases over an approximately 8- to 10-year period (see Figure 1.7, Phasing Plan). For the purposes of this DEIR-NPC/DPIR, the

Project was broken down into two Phases. Phase 1 proposes the demolition of 111 existing affordable units and construction of 158 affordable units plus 200 market rate units. The Full Build Master Plan includes the demolition of a further 999 affordable units and construction of 856 affordable units plus 1,489 market rate units. Residents of existing units will be temporarily relocated to facilitate demolition of existing units and construction of new units. Therefore, each phase will involve the elimination and addition of residential units and supporting parking, yielding a net change in travel demand (trip generation) reflecting the mix of unit types for each phase.

TABLE 5.1 PROJECT PHASING PLAN SUMMARY

	Phase 1	Additional Master Plan	Total Full Build Master Plan
New Affordable Units	158	856	1,010
New Market Rate Units	200	1,489	1,689
Total	358	2,341	2,699
Demo	111	989	1,100
Net New	**247**	**1,342**	**1,589**

Source: Stantec

The proposed site plans for Phase 1 and the Full Build Master Plan are presented in Figures 5.2 and 5.3, respectively.

5.3 Phase 1 Impacts

Because Phase 1 of the Project includes demolition of 111 existing affordable residential units, the net increase in total residential units is limited to a total of 247 residential units comprising 200 market rate units and 47 affordable units. Transportation analysis was performed for Phase 1 using the same methodology described in this chapter for the Full Build Master Pan. The detailed Phase 1 analysis is presented in Appendix C.

The Phase 1 Project is expected to generate a net increase of approximately 702 new daily vehicle trips, with approximately 58 and 82 net new vehicle trips being made in the morning and evening peak hours, respectively. This level of new vehicle trips, equivalent to about one new vehicle trip every 45 – 60 seconds during the peak hours, is expected to have minimal impact on the roadway network. Any impact will be dissipated in all directions over the local roadway network, resulting in no changes in level of service (LOS) grades at study intersections and insignificant increases in delay or queuing.

Similarly, the Phase 1 Project is projected to generate limited increases in transit trips. A net increase of approximately 476 new daily transit trips is expected, with approximately 40 and 55 new transit trips occurring during the morning and evening peak hours, respectively. Again, with fewer than one new transit trip per minute during the peak periods, the Phase 1 Project is

expected to have insignificant impacts to existing transit services. Approximately 63 podium parking spaces will be provided in Building F during Phase 1, along with approximately 23 surface parking spaces in a lot at the intersection of Decatur Street and Moulton Street for a total of approximately 86 off-street parking spaces. The Phase 1 project will provide 62 on-street parking spaces.

5.4 Study Methodology

The analysis presented in this chapter provides a detailed description of the Project's transportation characteristics and evaluates any potential impacts to transportation infrastructure. It is consistent with the Boston Transportation Department (BTD) Transportation Access Plans Guidelines as well as to EOEA Guidelines.

5.5 Analysis Conditions

The transportation analysis considers five analysis scenarios as follows:

- **2019 Existing Condition**
- **2026 No-Build Condition** - This condition assumes no changes to the Project Site, but accounts for planned transportation improvements and background growth associated with increased regional growth and specific planned development projects.
- **2026 Phase 1 Build Condition** - This condition assumes the same 2026 No-Build conditions background growth and infrastructure changes but includes the expected Project-related traffic if only the first phase of the Project is constructed. The Phase 1 analysis is presented in Appendix C and the results of the analysis are summarized in section 5.3.
- **2026 Full Build Master Plan Condition** - This condition assumes the same 2026 No-Build conditions background growth and infrastructure changes but includes all of the expected Project-related traffic (including Phase 1).
- **2026 Full Build Master Plan with Mitigation Condition** - This condition assumes the same 2026 Master Plan Build conditions but includes the proposed Project's infrastructure improvements and mitigation program once the Project is fully constructed.

All analysis conditions include an assessment of the morning and evening commuter peak hours. They include multi-modal evaluations of transit, pedestrian and bicycle in addition to the roadway and traffic analysis.

5.6 Study Area

The study area is defined in the BPDA Scoping Determination and MEPA Certificate on the ENF/PNF and is presented in Figure 5.4. The following eleven study intersections are included:

1. Existing Transportation Conditions Medford Street at Polk Street
2. Medford Street at Monument Street
3. Medford Street at Chelsea Street
4. Bunker Hill Street at School Street/Mystic Street
5. Bunker Hill Street at Polk Street/Green Street
6. Bunker Hill Street at Monument Street
7. Bunker Hill Street at Vine Street/Tufts Street
8. Vine Street at Moulton Street
9. Vine Street at Chelsea Street
10. Bunker Hill Street at Medford Street/Main Street
11. Main Street/Warren Street at Austin Street/Green Street

5.7 Existing Transportation Conditions

This section describes existing transportation conditions, including an overview of roadway conditions, transit operations, pedestrian and bicycle facilities, and general site conditions. A discussion of the existing on- and off-street parking supply is also provided.

5.7.1. Roadway Network

The Project Site is located proximate to the regional roadway system, which includes Interstate 93, Rutherford Avenue (Route 99), and U.S. Route 1 (including the Tobin Bridge crossing of the Mystic River). The Charlestown neighborhood has three regional roadway gateways: Travelers from the south enter through City Square; Sullivan Square serves as the gateway to travelers from the north and west; and the Gilmore Bridge provides a direct connection between Charlestown and Cambridge.

The Charlestown neighborhood is served by a well-defined internal network of major streets. Main Street, Bunker Hill Street, Chelsea Street, and Medford Street are all important city streets, and collectively they serve as the backbone of the neighborhood. From these four streets, access into the individual smaller communities is provided.

Medford Street and Bunker Hill Street directly abut the Site to the north and south, respectively. Several cross streets connect Medford Street and Bunker Hill Street, including Polk, Monument, Tufts, Corey and Decatur Streets. Walford Way, O'Reilly Way, and Samuel Morse Way provide important east-west connectivity within the internal Site roadway network.

5.7.2. Study Area Intersections

The 11 study area intersections are described below.

1. Medford Street at Polk Street

Medford Street and Polk Street intersect to form a three legged unsignalized intersection. As Polk Street is a one-way roadway away from Medford Street, there is no traffic control at this intersection. Both streets provide one general purpose lane with adjacent parking. Curb-extensions are provided at the end of Polk Street, and crosswalks are present across all approaches. Sidewalks are present along both sides of Medford and Polk Streets. The Charlestown High School is located on the northwest corner of this intersection, while the Charlestown Community Center is on the north side of the intersection. The Project site is located to the east/south of the intersection.

2. Medford Street at Monument Street

Medford Street and Monument Street intersect to form a three legged unsignalized intersection. Medford Street is the major street traveling in the east-west direction. Both approaches on Medford Street consist of a single general-purpose lane with adjacent on-street parking. Monument Street from the south also consist of one general-purpose lane, adjacent parking, and is under implied stop control, as no stop sign or stop bar is present. Sidewalks are present along both sides of Medford and Monument Streets, and crosswalks are provided across both streets (only on the west side of Medford Street). The Project site abuts both sides of Monument Street, and the Charlestown Community Center and housing are located on the north side of Medford Street.

3. Medford Street at Chelsea Street

Medford Street crosses under Route 1 to intersect Chelsea Street and form a three-legged unsignalized intersection. Chelsea Street consists of two general-purpose lanes in each direction. Medford Street, under stop-control, has one general-purpose lane with adjacent on-street parking. Sidewalks are available along all approaches and a crosswalk is present across Medford Street. Land use in the vicinity of this intersection consists of parking under the Route 1 overpass, and the Charlestown Navy Yard to its east.

4. Bunker Hill Street at School Street/Mystic Street

School Street/Mystic Street intersect Bunker Hill Street to form a slightly off-set four legged unsignalized intersection. Both School Street and Mystic Street are one-way roadways away from Bunker Hill Street, therefore there is no traffic control at this intersection. All streets provide one general purpose lane with adjacent parking. Curb-extensions are provided at the end of Mystic Street, and crosswalks are present across all approaches. Sidewalks are present along both sides of all streets as well. A mix of residential and commercial uses are present in the vicinity of the intersection.

5. Bunker Hill Street at Polk Street/Green Street

Polk Street/Green Street intersect Bunker Hill Street to form a slightly off-set four legged unsignalized intersection. Both School Street and Mystic Street are one-way roadways towards Bunker Hill Street and are both under stop control. All streets provide one general purpose lane with adjacent parking. Curb-extensions are provided at the end of Polk Street, and crosswalks are present across all approaches except to the north of Bunker Hill Street. Sidewalks are present along both sides of all streets. A mix of first floor retail commercial space and residential units are present in the vicinity of the intersection. The Project site is located at the southeast corner.

6. Bunker Hill Street at Monument Street

Monument Street intersects Bunker Hill Street to form a four legged unsignalized intersection. Monument Street is a two-way roadway to the north and a one-way roadway towards Bunker Hill Street to the south and is under stop control. All streets provide one general purpose lane with adjacent parking. Crosswalks are present across all approaches and sidewalks are present along both sides of all streets. A mix of first floor retail commercial space and residential units are present in the vicinity of the intersection. The Project site is located to the north of the intersection.

7. Bunker Hill Street/Vine Street at Bunker Hill Street/Tufts Street

Bunker Hill Street turns to the southeast at this location and becomes Vine Street between Bunker Hill Street and Chelsea Street. The major street approaches at this intersection are Bunker Hill to the west and Vine to the east. Bunker Hill Street to the south and Tufts Street to the north are one-way roadways away from the intersection. A pedestrian signal is present at this location to serve the Harvard-Kent Elementary School located at the southwest corner of this location.

All streets provide one general purpose lane with adjacent parking. Crosswalks are present across all approaches, and sidewalks are present along both sides of all streets. Aside from the Elementary School, land uses at this location include Hayes Square, St. Catherine's Rectorate and an administrative building.

8. Vine Street at Moulton Street

Moulton Street and Vine Street form a four-way unsignalized intersection. Vine Street is the major street, and Moulton Street is under implied stop control, as no stop signs or stop bars are present. All streets provide one general purpose lane with adjacent parking. Crosswalks are present across all approaches and sidewalks are present along both sides of all streets. A mix of open space and commercial uses are present in the vicinity of this intersection, including a St. Catherine's church and Hayes Square.

9. Vine Street at Chelsea Street

Vine Street crosses under Route 1 to intersect Chelsea Street and form a three-legged unsignalized intersection. Chelsea Street consists of two general-purpose lanes in each direction. Vine Street, under stop-control, has one general-purpose lane with adjacent on-street parking. Sidewalks are available along all approaches, but no crosswalks are present. Land use in the vicinity of this intersection consists of parking under the Route 1 overpass, and the Charlestown Navy Yard.

10. Bunker Hill Street at Medford Street/Main Street

Main Street turns to the south at this location consisting of, consequently, the eastbound and northbound approaches of this intersection. Medford Street intersects this location from the north with Bunker Hill Street intersecting it from the east. The major street approaches at this intersection are Main Street to the west and Bunker Hill Street to the east. Medford Street and Main Street to the south are under stop control.

All streets provide one general purpose lane with adjacent parking, except for Main Street to the west of the intersection where no parking is present. Crosswalks are present across all approaches, and sidewalks are present along both sides of all streets. Bike lanes are also provided along both sides of Main Street both to the south and to the west of the intersection. Land uses at this location include the Engine 32 Ladder 9 Boston Fire Department, Gardens for Charlestown, the Charlestown Working Theater as well as commercial and residential uses.

11. Main Street/Warren Street at Austin Street/Green Street

Main Street/Warren Street/Austin Street/Green Street intersect to form a four-legged signalized intersection. The Main Street eastbound approach consists of one general purpose lane with adjacent parking; it also has a bike lane that continues through the intersection. East of the intersection, Main Street becomes a one-way street traveling eastbound parallel to Warren Street. The Warren Street (Dexter Row) westbound approach also consists of one general purpose lane with adjacent parking and a bike lane. The Austin Street northbound approach consists of a channelized right-turn lane (under stop control) and a wide general-purpose lane that although unstripped can accommodate left-turning and through movement vehicles in separate lanes. On-street parking is provided on the west side of the street. Green Street is a one-way street away from the intersection; it consists of a general-purpose lane with parking on the east side of the roadway. Crosswalks are present across all approaches, and sidewalks are present on both sides of all streets. Land use in the vicinity of this intersection include the Bunker Hill Mall Shopping Center, the public library, the Boys & Girls Club, and other commercial and recreational uses.

5.7.3. Existing Traffic Volumes

Daily traffic volumes were established by automatic traffic recorder (ATR) counts at three locations in October 2019. The daily traffic information obtained from the ATR data is summarized in Table 5.2.

TABLE 5.2 EXISTING TRAFFIC VOLUME SUMMARY

Location	Daily[a]	Weekday Morning			Weekday Evening		
		Volume[b]	K Factor[c]	Dir. Dist.[d]	Volume	K Factor	Dir. Dist.
Medford Street west of Decatur Street	4,663	358	0.08	69% EB	318	0.07	50% EB/WB
Chelsea Street south of Medford Street	9,497	583	0.06	51% SB	617	0.06	69% SB
Bunker Hill Street west of Tufts Street	5,781	484	0.08	63% EB	472	0.08	50% EB/WB

a daily traffic expressed in vehicles per day
b peak hour volumes expressed in vehicles per day
c percent of daily traffic that occurs during the peak hour
d directional distribution of peak hour traffic

As shown in Table 5.2, Medford Street west of Decatur Street carries approximately 4,700 vehicles on a typical weekday with the peak hours accounting for 8 percent (morning peak hour) and 7 percent (evening peak hour) of the weekday daily traffic flow. Traffic along Medford Street is heavier in the eastbound direction during the morning peak hour and split evenly east and westbound in the evening peak hour.

Chelsea Street south of Medford Street carries the greatest traffic volume in the study area, with approximately 9,500 vehicles on a typical weekday, and morning and evening peak hours each accounting for 6 percent of the daily traffic flow. Traffic along Chelsea Street is heavier in the southbound direction during both the morning and evening peak hours.

Bunker Hill Street west of Tufts Street carries approximately 5,800 vehicles on a typical weekday with morning and evening peak hours each accounting for 8 percent of the weekday daily traffic flow. Traffic along Bunker Hill Street is heavier in the eastbound direction during the morning peak hour and split evenly east and westbound in the evening peak hour.

Turning movement counts (TMCs) were conducted at all study intersections during a typical weekday morning between 7:00 AM and 9:00 AM and weekday evening between 4:00 PM and 6:00 PM in October 2019. The intersection TMCs were used to establish traffic networks for the 2019 Existing Condition. From turning movement counts, the study area's traffic peak hours were determined to be 8:00 AM to 9:00 AM and 4:45 PM to 5:45 PM. Existing Condition

weekday peak hour traffic volumes are shown in Figures 5.5 and 5.6 for the morning and evening peak hours, respectively.

5.7.4. Public Transportation

The Charlestown neighborhood is served by several public transportation services, as shown in Figure 5.7. Their service and operations characteristics are described in further detail below.

MBTA Orange Line

The MBTA Orange Line provides service from the Forest Hills Station in Jamaica Plain, Boston to the Oak Grove Station in Malden, running every six minutes during the weekday peak periods. The closest station is Community College (approximately 0.5 miles) south of the site.

The Orange Line connects with the Blue Line at State Street, the Green Line at the North Station and Hay Market Station and via a tunnel at Downtown Crossing, the Red Line at Downtown Crossing, and to the Silver Line at Downtown Crossing, Chinatown and Tufts Medical Center. The Orange Line also provides connections to the commuter rail at North Station (Fitchburg, Lowell, Haverhill, and Newburyport/Rockport lines) and at Back Bay (Worcester, Needham, Providence, and Fairmont lines).

Based on the latest Rapid Transit schedule (effective September 1, 2019) posted on the MBTA's website, the hours of operation for the Orange line are weekday and Saturdays from 5:16 AM until 12:30 AM, and Sundays from 6:00 AM until 12:30 AM.

MBTA Bus Service

Two local MBTA bus routes provide neighborhood connections to regionally important locations.

- **Route 92** operates between Sullivan Square and Devonshire Street at Milk Street via Main/Warren Street in Charlestown. This route connects to the Orange Line at Haymarket and Sullivan Square stations. The stops closes to the Project Site are Warren Street at Church Street and Warren Street at Winthrop Street. Based on the bus schedules effective September 1, 2019, Route 92 operates from 5:05 AM until 10:28 PM on weekdays with 18-minute headways during peak hours and from 5:33 AM until 9:29 PM on Saturdays. Route 92 does not run on Sundays.
- **Route 93** also operates between Sullivan Square and Devonshire Street at Milk Street, but travels along Bunker Hill Street in Charlestown. This route also connects to the Orange Line at Haymarket and Sullivan Square stations. Three stops serve the Site directly: Bunker Hill at Vine Street, Bunker Hill at Ferrin Street, and Bunker Hill at Concord Street. Based on the bus schedules effective September 1, 2019, Route 93 operates from 4:50 AM to 1:18 AM on weekdays with 8-minute headways during peak hours, from 4:52 AM to 1:35 AM on Saturdays, and from 5:35 AM until 12:25 AM on Sundays.

Water Transportation

The Inner Harbor Ferry, operated by Boston Harbor Cruises, operates between the Charlestown Navy Yard and Long Wharf (F4) connecting Charleston to Downtown Boston. Service runs from 6:30 AM until 8:15 PM on weekdays with 15-minute headways during peak hours, and from 10:00 AM to 6:15 PM during the weekends. This service runs year-round except during severe weather. The Charlestown Navy Yard Ferry Terminal is between 0.3 and 0.8 miles from the Project site (between the closest and farthest buildings).

Table 5.3 summarizes the available public transportation options within the study area

TABLE 5.3 MBTA PUBLIC TRANSPORTATION SERVICE SUMMARY

Transit Service	Origin-Destination	Major Stops	Nearest Stop to Project Site	Peak Hour Headway (mins)	Hours of Service
MBTA Orange Line	Oak Grove – Forest Hills	North Station (Green Line) State Street (Blue Line) Downtown Crossing (Red Line) Back Bay (Commuter Rail)	Community College	6	Weekday: 5:16 AM–12:30 AM Saturday: 5:16 AM–12:30 AM Sunday: 6:00 AM– 2:30 AM
MBTA Bus Route 92	Sullivan Square Station – Downtown Boston	Sullivan Square City Square Haymarket Station	Main Street at Harvard Street or Warren Street at Church Street	18	Weekday: 5:05 AM–10:28 PM Saturday: 5:33 AM–9:29 PM Sunday: No Service
MBTA Bus Route 93	Sullivan Square Station – Downtown Boston	Bunker Hill Monument City Square Charlestown Navy Yard Haymarket Station	Along Bunker Hill Street (adjacent to Site)	8	Weekday: 4:50 AM–1:18 AM Saturday: 4:52 AM–1:35 AM Sunday: 5:35 AM–12:25 AM
MBTA Commuter Ferry F4	Boston Long Wharf – Charlestown Navy Yard	Long Wharf Charlestown Navy Yard	Charlestown Navy Yard	15	Weekday: 6:30 AM–8:15 PM Saturday: 10:00 AM–6:15 PM Sunday: 10:00 AM–6:15 PM

Sources: Bus and Subway Schedules Effective September 1, 2019; Ferry Schedule Effective July 1, 2019

Private Shuttles

Partners HealthCare provides a free shuttle service to its employees, patients, and visitors. Three routes are provided to the Charlestown Navy Yard:

- **MGH Main Campus to Charlestown Navy Yard** - This route provides stops at MGH Main Campus, North Station, One Constitution Center and the Charlestown Navy Yard. On

weekdays, service starts at 5:30 AM and ends at 1:30 AM. The shuttle runs approximately every 15 minutes until 7:15 PM, and every 30 minutes thereafter.

- **Spaulding Express** - This route provides a direct route between Spaulding Rehabilitation Hospital and North Station. On weekdays, the shuttle operates between 6:00 AM and 9:00 AM with 10-minute headways and between 3:00 PM and 6:00 PM with 10-minute headways. During the weekends, service starts at 5:30 AM and ends at 9:00 AM with 10-minute headways.
- **MGH Main Campus to Charlestown (Bunker Hill Health Center)** - This route connects the MGH Main Campus to the Bunker Hill Health Center (73 High Street). The shuttle operates on weekdays, between 9:00 AM and 11:00 AM, with 45-minute headways and between 1:15 PM and 4:00 PM with approximately 1.5-hour headways.

Bunker Hill Community College also provides a free shuttle service for its students, faculty and staff connecting its Charlestown Campus to its Chelsea Campus. The shuttle runs between 7:30 AM and 10:30 PM on weekdays, and between 8:00 AM and 3:00 PM on weekends. Headways vary throughout the day from approximately 30 minutes to one hour.

5.7.5. Pedestrian Environment

Charlestown is a pedestrian friendly neighborhood with good connections to transit and local neighborhood destinations as well as the Charlestown Navy yard. Sidewalks are provided throughout the study area and crosswalks are present at all the study area intersections; at the majority of them, crosswalks are provided across all approaches. The Project will enhance the pedestrian environment within and around the Project site. Peak hour pedestrian counts are presented in Figures 5.8 and 5.9 for the morning and evening peak hours, respectively.

The Freedom Trail also travels through Charlestown. It crosses to Charlestown via the Washington Street bridge, proceeds along Chelsea Street through City Square to the USS Constitution at the Charlestown Navy Yard. Another branch goes to the Bunker Hill Monument via Main Street and Winthrop Street or Constitution Road and Adams Street (from the USS Constitution) to Monument Square.

5.7.6. Bicycle Accommodations

Existing peak hour bicycle counts at study intersections are presented in Figures 5.10 and 5.11 for the morning and evening peak hours, respectively.

The existing bicycle infrastructure in the immediate vicinity of the Project site is limited with no dedicated on-street bike lanes or sharrow (shared lane) striping. However, there is a Bluebikes station located in front of St. Catherine's church at Hayes Square. At the time of this filing, the station has been removed for the winter and the number of docks usually present is unknown.

Nine additional Bluebikes stations are present in Charlestown, all of which are in operation during the winter:

- Medford Street at Charlestown BCYF (19 docks – less than 500 feet from Site)
- Main Street at Baldwin Street (19 docks – 0.7 miles from Site)
- Edwards Playground – Main Street at Eden Street (19 docks – 0.5 miles from Site)
- Main Street at Austin Street (11 docks – 0.4 miles from Site)
- Main Street at Thompson Square (15 docks – 0.4 miles from Site)
- Bunker Hill Community College (23 docks – 0.6 miles from Site)
- Warren Street at Chelsea Street (23 docks – 0.4 miles from Site)
- Charlestown Navy Yard (23 docks – 0.2 miles from Site)
- Spaulding Rehabilitation Hospital – Charlestown Navy Yard (19 docks – 0.2 miles from Site)

The locations of existing Bluebikes stations and Zipcar car-sharing locations are presented in Figure 5.12.

5.7.7. Crashes

An analysis of crashes at study intersections was conducted. Crash data contained in the MassDOT Crash Portal are typically under-reported in Boston due to an inconsistency in the reporting format used by the Boston Police Department. For a better representation of roadway safety in the study area, data from the City of Boston Vision Zero database for the most recent three-year period available (2016 to 2018) were obtained. The database provides records of incidents where the Emergency Medical Services (EMS) attended the location. As the data likely exclude many damage-only crashes, they do not represent the total number of crashes. However, they provide a "heat map" of crashes potentially involving injuries or fatalities and are therefore a better measure of crash history than the MassDOT Crash Data Portal. A summary of the Vision Zero data is presented in Table 5.4.

TABLE 5.4 BOSTON VISION ZERO CRASH SUMMARY

	Medford Street at Polk Street	Medford Street at Monument Street	Medford Street at Chelsea Street	Bunker Hill Street at School/ Mystic St.	Bunker Hill Street at Polk/ Green St.	Bunker Hill St. at Monument Street	Bunker Hill/Vine St. at Tufts Street	Vine Street at Moulton Street	Vine Street at Chelsea Street	Main/ Bunker Hill St. at Medford St.	Main/ Warren St. at Austin/ Green St.
Signalized	No	No	No	No	No	No	Yes	No	No	No	Yes
MassDOT Average Crash Rate	0.52	0.52	0.52	0.52	0.52	0.52	0.71	0.52	0.52	0.52	0.71
Calculated Crash Rate	0.00	0.17	0.21	0.13	0.00	0.13	0.00	0.00	0.00	0.36	0.43
Exceeds Average?	No	No	No	No	No	No	No	No	No	No	No
Year											
2016	0	1	0	0	0	0	0	0	0	1	3
2017	0	0	0	1	0	1	0	0	0	3	3
2018	0	0	2	0	0	0	0	0	0	2	0
Total	0	1	2	1	0	1	0	0	0	6	6
Time of Year											
January – March	0	0	0	0	0	0	0	0	0	1	1
April – June	0	0	1	1	0	0	0	0	0	3	2
July – September	0	1	0	0	0	0	0	0	0	1	1
October – December	0	0	1	0	0	1	0	0	0	1	2
Non-Motorist Crash Type											
Pedestrian	0	0	1	0	0	1	0	0	0	0	2
Bicyclist	0	1	0	0	0	0	0	0	0	0	0
Fatalities	0	0	0	0	0	0	0	0	0	0	0

Sources: Boston Vision Zero Crash Records Jan. 1st, 2016 – Dec. 31st, 2018.

As shown in Table 5.4, review of the Vision Zero data indicates that none of the intersections in the study area exceed the average crash rate or have a crash resulting in a fatality. However, four of the study area intersections had at least one crash occur during the three-year period 2016-2018 that involved a bicyclist or pedestrian. These locations are as follows:

- Medford Street at Monument Street (one crash involving cyclist)
- Medford Street at Chelsea Street (one crash involving pedestrian)
- Bunker Hill Street at Monument Street (one involving pedestrian)
- Main/Warren Street at Austin/Green Street (two crashes involving pedestrians)

Highway Safety Improvement Program (HSIP)

Typically, the MassDOT's Highway Safety Improvement Program (HSIP) database should also be reviewed when calculating the crash rate at any given facility. This review was performed, although its validity should be borne in mind in light of the previous comments regarding the completeness of the MassDOT data base.

An HSIP-eligible cluster is one which the total number of "equivalent property damage only" crashes in the area is within the top 5% of all clusters in that region. Being HSIP-eligible makes the location eligible for FHWA and MassDOT funds to address the identified safety issues at these locations. It also suggests that the location experiences safety-related issues that potentially involve personal injury that are far above normal rates for comparable locations.

None of the study area intersections are located in a HSIP Crash Cluster as determined by the MassDOT data base.

5.7.8. Parking

Currently, the Project site is supported by 280 off-street parking spaces which are reserved for existing residents of the BHA Charlestown Housing Development which equivalent to a ratio of approximately 0.25 spaces per unit. In addition, there are approximately 233 on-street parking spaces within the Site, of which 79 are located on private streets and are not open to Charlestown resident permit parking ("RPP"). The balance of the on-street parking is 164 RPP spaces, which are primarily used by existing residents. There are 142 spaces along the perimeter streets, which are generally shared by the neighborhood. Figure 5.13 shows off-street and on-street parking facilities, as well as curb regulations within one quarter mile of the Project Site.

5.8 No-Build Transportation Conditions

This section describes projection of traffic volumes over a period of 7 years for the 2026 Full Build Master Plan conditions year. As previously mentioned, the 2026 No-Build conditions assumes that the proposed Project is not built.

Background Growth

Traffic growth on area roadways is a function of the expected land development, economic activity, and changes in demographics. A frequently used procedure is to estimate an annual percentage increase and apply that increase to study area traffic volumes. In addition to regional background growth, traffic associated with new major development that would be expected to affect the study area is included in the No-Build condition projections.

Consistent with DEIR/DPIR analyses for other recent projects and after, a rate of 0.25 percent per year for seven years was applied. Discussions with BTD indicated that a 0.25 percent per-year background growth would be appropriate for the study area. In addition, traffic projections for the following specific planned projects are included.

- **The Chain Forge Hotel** – A proposed 230-room hotel located in the Charlestown Navy Hard with 200 parking spaces. This project is currently BPDA Board Approved.
- **The Ropewalk** – A proposed residential project that includes 97 residential units, 6,300 SF of community space, and 86 parking spaces. This project is currently under construction.
- **Hood Master Plan** – A proposed Master Plan project for the former Hood Plant which includes approximately 1.4 million SF of office, 92,000 SF of retail, 157,000 SF of residential, and 86,000 SF of hotel. This Project is currently BPDA Board Approved.
- **32 Cambridge Street** – A residential project that includes 171 residential units, 2,500 SF of retail, and 114 parking spaces. This Project was recently completed in August 2019.
- **Charlestown Battalion Armory** – A residential project that includes 42 residential units. This Project was recently completed in August 2019.

Peak Hour No-Build Auto Traffic Volumes

The 2019 Existing Condition traffic volumes were adjusted and projected to the 2026 No-Build Conditions based on the previous assumptions. The projected 2026 No-Build traffic turning volumes at all study intersections for the morning and evening peak hours are presented in Figures 5.14 and 5.15, respectively.

Future Roadway Conditions

In assessing future traffic conditions, proposed roadway improvements within the study area were considered. Based on conversations with BTD, a number of roadway improvement projects are proposed for the area. These projects will not have a direct effect on the study

area intersections but have the potential to improve the overall circulation of traffic traveling to and from Charlestown.

Rutherford Avenue/Sullivan Square Design Project

The goal of this project is to redesign Rutherford Avenue from Sullivan Square to City Square. This project will improve pedestrian connections and safety to MBTA transit stations and the community, decrease traffic congestion, protect Main Street from cut-through traffic, create public and open space, provide opportunities for appropriate development, provide bicycle connections, and provide a designated bus rapid transit (BRT) lane. Currently, the project is at 25% preliminary design with a public hearing scheduled in February/March of 2020. The project is anticipated to be advertised for construction in March 2021 and will last approximately three years and cost approximately $150M.

North Washington Street Bridge Project

This project will replace the existing North Washington Street Bridge (also known as the Charlestown Bridge). The new bridge will be a complete street with two vehicle lanes in each direction, one inbound dedicated bus lane, separated cycle tracks in each direction, sidewalks on both sides including a wide scenic overlook and seating area. Construction is underway as of August 2018 and will continue into Spring 2023.

Bunker Hill Street

The City of Boston, in its 5-year action plan presented in the 2013 "Boston Bike Network Plan", identified Bunker Hill Street as a roadway in need of exclusive bike lanes. As of the time of this filing, no specific project has been identified and no timeline has been provided on when Bunker Hill Street will be reconstructed to include a bicycle facility.

5.9 2026 Full Build Master Plan Transportation Conditions

The 2026 Full Build Master Plan Conditions traffic volumes for the study area roadways were developed by estimating Project-generated vehicle traffic volumes, distributing these volumes by direction, and assigning them to the study area intersections. The traffic volumes expected to be generated by the proposed Project were added to the 2026 No Build conditions traffic volumes to create the 2026 Full Build Master Plan Conditions traffic volume networks. The following sections describe the procedures used to develop the 2026 Full Build Master Plan Conditions traffic volume networks.

5.9.1. Project Generated Trips

Project-generated trips were calculated using methodologies outlined in the Institute of Transportation Engineers (ITE) Trip Generation Handbook, 3rd Edition and using 10th Edition ITE

trip generation rates. The appropriate trip generation methodology for each Project element, by building, is shown in Table 5.5.

TABLE 5.5 ITE LAND USE CODES

Building	Land Use Code	Program
Building A	LUC 221 - Multi-family Housing	166 units
Building B	LUC 221 - Multi-family Housing	116 units
Building C	LUC 221 - Multi-family Housing	63 units
Building D-1	LUC 221 - Multi-family Housing	75 units
Building D-2	LUC 221 - Multi-family Housing	29 units
Building E-1	LUC 221 - Multi-family Housing	136 units
Building E-2	LUC 221 - Multi-family Housing	60 units
Building F	LUC 221 - Multi-family Housing	163 units
Building G	LUC 221 - Multi-family Housing	69 units
	LUC 252 – Senior Adult Housing	72 units
Building H	LUC 221 - Multi-family Housing	86 units
Building I	LUC 221 - Multi-family Housing	104 units
Building J	LUC 221 - Multi-family Housing	75 units
Building L	LUC 221 - Multi-family Housing	85 units
Building M	LUC 221 - Multi-family Housing	84 units
Building N	LUC 221 - Multi-family Housing	143 units
Building O	LUC 221 - Multi-family Housing	73 units
Total Residential		**2,699 units**
Less Existing Residential Eliminated		**1,100 units**
Total Net New Residential		**1,599 units**
Total Retail	**LUC 820 – Shopping Center**	**62,500 SF**

ITE Trips - Unadjusted

The first step in determining the trip generation for the Project is to develop its total unadjusted trips. To estimate these trips, trip generation rates published by the Institute of Transportation Engineers (ITE)[1] were utilized. As previously mentioned, the Project consists mainly of residential trips with supporting retail and community spaces.

The ITE unadjusted trip rates are largely based upon non-urban data and do not represent the actual vehicle trips expected to be generated by the Project. Subsequently, the number of Project trips generated by each transportation mode needs to be determined by applying mode share characteristics for this location in Charlestown to derive adjusted Project trips by mode.

Table 5.6 shows the ITE Unadjusted daily vehicle trips for the Full Build Master Plan.

[1] Trip Generation; Tenth Edition; Institute of Transportation Engineers; Washington, DC; September, 2017.

TABLE 5.6 ITE UNADJUSTED DAILY VEHICLE TRIPS

Land Use	ITE Unadjusted Daily Vehicle Trips		
	Entering	Exiting	Total
Existing	2,997	2,977	5,994
Gross Full Build Master Plan			
Residential	6,609	6,609	13,218
Retail	1,321	1,321	2,642
Sub-total Full Build	7,930	7,930	15,860
Net New	4,933	4,933	9,866

Mode Share and Vehicle Occupancy

To account for all modes of transportation, mode shares for residential were established from U.S. Census Bureau American Community Survey (ACS) 2013-2017 five-year estimates. Retail mode shares were based on the BTD Access Boston 2000-2010 mode splits and adjusted to account for the type of community retail that is envisioned for this project. The project is not expected to include significant destination retail as the street-level retail will support the residents of the neighborhood. The mode shares and average vehicle occupancies for the Project are presented in Tables 5.7 and 5.8, respectively.

TABLE 5.7 MODE SHARES

Mode	Residential[1]	Retail[2]
Vehicle	47%	20%
Transit	30%	27%
Walk	13%	48%
Bike	4%	5%
Other	6%	0%

Source: [1] 2013-2017 American Community Survey Data
[2] Boston Transportation Department Mode Splits for District 11

TABLE 5.8 VEHICLE OCCUPANCY RATES (VOR)

Land Use	National VOR	Local VOR
Residential		
Daily	1.18[1]	1.06[3]
Morning Peak	1.56[2]	
Evening Peak	1.70[2]	
Retail	1.82[1]	1.82[1]

Source: [1] Based on 2017 National Household Transportation Survey (NHTS)
[2] Based on ITE Trip Generation Manual
[3] Based on 2013-2017 American Community Survey Data

Adjusted Project Trips

To convert the unadjusted ITE Project trips to actual numbers of expected Project trips by mode, the local mode shares and vehicle occupancy ratios for each land use were applied to the unadjusted ITE trips.

Table 5.9 shows the 2026 Full Build Master Plan net new project trips by mode of transportation.

TABLE 5.9 ADJUSTED NET NEW PROJECT TRIPS BY MODE

		Vehicle			Transit			Walk/Bike		
		Daily	**AM Peak**	**PM Peak**	**Daily**	**AM Peak**	**PM Peak**	**Daily**	**AM Peak**	**PM Peak**
Residential	Entering	2,239	97	313	1,518	221	351	858	121	199
	Exiting	2,239	272	202	1,518	325	284	858	180	158
	Total	**4,478**	**369**	**515**	**3,036**	**546**	**635**	**1,716**	**301**	**357**
Retail	Entering	264	8	11	649	20	81	1,274	40	160
	Exiting	264	5	7	649	12	50	1,274	24	98
	Total	**528**	**13**	**18**	**1,298**	**32**	**131**	**2,548**	**64**	**258**
Total	Entering	2,503	105	324	2,167	241	432	2,132	161	359
	Exiting	2,503	277	209	2,167	337	334	2,134	204	256
	Total	**5,006**	**382**	**533**	**4,334**	**578**	**766**	**4,264**	**365**	**615**

5.9.2. Trip Distribution

The directional distribution of the vehicular traffic approaching and departing the site is a function of the land use, population densities, the location of employment, existing travel patterns, competing uses, and the efficiency of the existing roadway system.

The Project trip distribution is based on the origin-destination U.S. Census Bureau American Community Survey (ACS) 2013-2017 five-year estimates for census tract 403 of Suffolk County, Massachusetts. Table 5.10 summarizes Project trip distributions, and Figure 5.16 presents the Project trip distributions as assigned to the primary roadways serving the study area.

TABLE 5.10 PROJECT TRIP DISTRIBUTION

Trip Assignment	Distribution
I-93 North	23.2%
I-93 South	15.4%
I-90 West	10.9%
Storrow Drive	6.8%
Washington Bridge	16.8%
Route 99	0.9%
Route 1	6.8%

Trip Assignment	Distribution
Cambridge Street	4.2%
Gilmore Bridge	10.5%
Local	4.4%
Total	100%

Trip Assignment

The assignment of site-generated traffic to specific travel routes was based on observed traffic flow conditions on available routes. It is assumed that most motorists will seek the fastest and most direct routes to and from the site, although in some situations Project trips are split between alternative routes.

As shown on the Site Plan (Figure 5.3), the driveways for the parking garages are located on Medford Street, Corey Street, Tufts Street, Moulton Street, and Polk Street. Table 5.11 shows the parking garage assignments for each building.

TABLE 5.11 PROJECT TRIP GARAGE ASSIGNMENTS[1]

Parking Garage Location	Parking Spaces	Assigned Buildings
Building A	52 spaces	A
Building H	102 spaces	H
Building I	58 spaces	B, I
Parking Garage	320 spaces	B, C, D, J
Building L	47 spaces	L
Building E	92 spaces	E
Building O	400 spaces	G, N, O
Building F	86 spaces	F, M

[1] As the site plan continues to be refined, the locations and exact number of parking spaces may change. However, such minor changes are not expected to significantly change the assignment of project trips to study area intersections.

The net new Project generated auto trips were assigned to the roadway network as described above. These trips were added to the 2026 No-Build conditions to provide the 2026 Full-Build conditions networks. Figures 5.17 and 5.18 present the Full-Build Master Plan peak hour networks for the morning and evening peak hours, respectively.

5.9.3. Traffic Operations Analysis

The evaluation criteria used to analyze area intersections in this traffic study are based on the 2010 Highway Capacity Manual [HCM] 2, as follows:

▼

[2] Highway Capacity Manual; Transportation Research Board; 2010.

- **Level of service (LOS)** is the term used to denote the different operating conditions which occur on a given roadway segment under various traffic volume loads. It is a qualitative measure of a number of factors including roadway geometrics, speed, travel delay and freedom to maneuver. Level of service provides an index to the operational qualities of a roadway segment or an intersection. Level-of-service designations range from A to F, with LOS A representing the least congested operating conditions and LOS F representing the most congested conditions.
- **Delay** is a complex measure that depends upon a number of variables such as quality of signal progression, cycle length, allocation of green time, and volume-to-capacity (v/c) ratio. Of all the factors cited, v/c ratios have the least effect on delay. Thus, for any given v/c ratio, a range of delay values [and, therefore, levels of service] may result. Conversely, for a given level of service, the v/c ratio may lie anywhere within a broad range. Comparison of intersection capacity results therefore requires that in addition to the LOS, the other measures of effectiveness [MOEs] also be considered.

The level-of-service designations, which are based on delay, are reported differently for signalized and unsignalized intersections. For signalized intersections, the analysis considers the operation of all traffic entering the intersection and the LOS designation is for overall conditions at the intersection. For unsignalized intersections, the analysis assumes that traffic on the mainline is not affected by traffic on the side streets. Thus, the LOS designation is for the critical movement exiting the side street and is typically the left turn out of the side street or site driveway.

Signalized Intersection Capacity Analyses

Tables 5.12 and 5.13 present a summary of the capacity analyses for the signalized intersections in the study area for the morning and evening peak hours, respectively. The capacity analyses worksheets are included in Appendix C.

During the morning peak hour, both signalized intersections operate at an overall LOS C or better for all three scenarios. At the intersection of Main Street/Warren Street at Austin Street/Green Street, the Main Street eastbound approach goes from LOS C to LOS D with an increase in delay of 9.1 seconds, and the Austin Street northbound approach goes from LOS C to LOS D with an increase in delay of 3.1 seconds.

During the evening peak hour, the intersection of Bunker Hill Street at Vine Street/Tufts Street operates at LOS A under all scenarios and the intersection of Main Street/Warren Street at Austin Street/Green Street operates at LOS C during the existing and no-build scenarios but is reduced to LOS D under the build condition with an increase in delay of 18 seconds. This change in LOS is due to an increase in delay for the Austin Street northbound approach which operates at LOS E under the no-build conditions and would operate at LOS F during the build scenario with a 49.3 second increase in delay.

TABLE 5.12 SIGNALIZED INTERSECTION VEHICLE LEVEL OF SERVICE – AM PEAK HOUR

Intersection		Movement	2016 Existing Conditions					2023 No-Build Conditions					2023 Build Conditions				
			V/C[1]	Delay[2]	LOS[3]	50th Queue[4]	95th Queue[5]	V/C[1]	Delay[2]	LOS[3]	50th Queue[4]	95th Queue[5]	V/C[1]	Delay[2]	LOS[3]	50th Queue[4]	95th Queue[5]
7	Bunker Hill Street at Vine Street/Tufts Street	Bunker Hill EB L/T/R	0.32	3.0	A	0	130	0.33	3.1	A	0	135	0.37	3.3	A	0	156
		Vine St WB L/T/R	0.27	2.8	A	0	87	0.29	2.8	A	0	91	0.33	3.1	A	0	107
		Overall	**0.28**	**2.9**	**A**	**-**	**-**	**0.29**	**3.0**	**A**	**-**	**-**	**0.33**	**3.2**	**A**	**-**	**-**
11	Main Street/ Warren Street at Austin Street/ Green Street	Main St EB L/T/R	0.84	29.3	C	251	#455	0.85	30.7	C	258	#466	0.93	39.8	D	~327	#520
		Main St WB L/T/R	0.67	22.7	C	123	177	0.69	23.8	C	128	183	0.72	25.7	C	130	#193
		Austin St NB L/T	0.66	33.6	C	140	192	0.67	34.1	C	143	196	0.74	37.2	D	160	#233
		Austin St NB R	0.14	0.2	A	0	0	0.14	0.2	A	0	0	0.14	0.2	A	0	0
		Overall	**0.69**	**24.7**	**C**	**-**	**-**	**0.70**	**25.6**	**C**			**0.76**	**30.9**	**C**	**-**	

1 Volume to Capacity Ratio
2 delay in seconds
3 level of service
4 50th percentile queue (reported in feet)
5 95th percentile queue (reported in feet)
~ Volume exceeds capacity, queue is theoretically infinite
# 95th percentile volume exceeds capacity, queue may be longer
m Volume for 95th percentile queue is metered by upstream signal

TABLE 5.13 SIGNALIZED INTERSECTION VEHICLE LEVEL OF SERVICE – PM PEAK HOUR

Intersection		Movement	2016 Existing Conditions					2023 No-Build Conditions					2023 Build Conditions				
			V/C[1]	Delay[2]	LOS[3]	50th Queue[4]	95th Queue[5]	V/C[1]	Delay[2]	LOS[3]	50th Queue[4]	95th Queue[5]	V/C[1]	Delay[2]	LOS[3]	50th Queue[4]	95th Queue[5]
7	Bunker Hill Street at Vine Street/Tufts Street	Bunker Hill EB L/T/R	0.26	3.8	A	53	729	0.27	3.9	A	55	96	0.38	4.7	A	85	141
		Vine St WB L/T/R	0.30	4.1	A	66	121	0.31	4.2	A	68	113	0.38	4.7	A	90	146
		Overall	**0.25**	**4.0**	**A**	-	-	**0.26**	**4.1**	**A**	-	-	**0.32**	**4.7**	**A**	-	-
11	Main Street/ Warren Street at Austin Street/ Green Street	Main St EB L/T/R	0.61	18.8	B	156	229	0.62	19.1	B	160	233	0.68	21.0	C	182	264
		Main St WB L/T/R	0.47	15.9	B	98	172	0.48	16.1	B	101	177	0.49	16.4	B	102	180
		Austin St NB L/T	0.90	53.5	D	~193	#365	0.92	55.9	E	~208	#374	1.11	105.2	F	~290	#467
		Austin St NB R	0.21	0.4	A	0	0	0.21	0.4	A	0	0	0.21	0.4	A	0	0
		Overall	**0.64**	**24.6**	**C**	-	-	**0.65**	**25.4**	**C**	-	-	**0.74**	**43.4**	**D**	-	-

1 Volume to Capacity Ratio
2 delay in seconds
3 level of service
4 50th percentile queue (reported in feet)
5 95th percentile queue (reported in feet)
~ Volume exceeds capacity, queue is theoretically infinite
# 95th percentile volume exceeds capacity, queue may be longer
m Volume for 95th percentile queue is metered by upstream signal

Unsignalized Intersection Capacity Analyses

Table 5.14 presents a summary of the capacity analyses for the unsignalized intersections during the morning and evening peak hours. The capacity analyses worksheets are included in Appendix C. The analytical methodologies typically used for the analysis of unsignalized intersections use conservative analysis parameters, such as high critical gaps.[3] Actual field observations indicate that drivers on minor streets generally accept smaller gaps in traffic than those used in the analysis procedures and therefore experience less delay than reported by the analysis software. Consequently, the analysis results tend to overstate the actual delays experienced in the field. For this reason, the results of the unsignalized intersection analyses should be considered highly conservative.

During the morning peak hour, intersections #5 and #10 operate at or LOS F under all three study scenarios. Intersection #9 operates at LOS C during the existing and no-build scenarios and would operate at LOS F during the build scenario due to the impacts of project generated trips.

During the evening peak hour, intersection #9 operates at LOS C during the existing and no-build scenarios and would operate at LOS F during the build scenario due to the impacts of project generated trips. Intersection #10 operates at LOS F during all three study scenarios.

Adjustments to some of the unsignalized study area intersections is discussed in the subsequent mitigation section of this chapter.

[3] 'critical gap' is defined as the minimum time, in seconds, between successive major-stream vehicles, in which a minor-street vehicle can make a maneuver

TABLE 5.14 UNSIGNALIZED INTERSECTION VEHICLE LEVEL OF SERVICE

	Intersection	Morning Peak Hour									Evening Peak Hour								
		2016 Existing			2023 No-Build			2023 Build			2016 Existing			2023 No-Build			2023 Build		
		V/C[1]	Delay[2]	LOS[3]	V/C[1]	Delay[2]	LOS[3]	V/C[1]	Delay[2]	LOS[3]	V/C[1]	Delay[2]	LOS[3]	V/C[1]	Delay[2]	LOS[3]	V/C[1]	Delay[2]	LOS[3]
1	**Medford Street at Polk Street – No Control**																		
2	**Medford Street at Monument Street**																		
	Moulton St NB	0.12	11.7	B	0.13	11.9	B	0.18	13.3	B	0.11	11.1	B	0.12	11.3	B	0.23	13.4	B
3	**Medford Street at Chelsea Street**																		
	Chelsea Street EB	0.44	14.7	B	0.51	16.8	C	0.68	22.3	C	0.35	15.0	B	0.42	17.2	C	0.64	24.3	C
4	**Bunker Hill at School Street/Mystic Street – No Control**																		
	Bunker Hill Street at Polk Street/Green Street																		
5	Green St NB	0.74	54.8	F	0.80	64.9	F	>1.00	>120	F	0.43	19.7	C	0.45	20.9	C	0.74	38.2	E
	Polk St SB	0.87	75.5	F	0.92	89.0	F	>1.00	>120	F	0.36	17.5	C	0.38	18.2	C	0.55	26.1	D
	Bunker Hill Street at Monument Street																		
6	Monument St NB	0.07	19.7	C	0.07	20.4	C	0.09	24.2	C	0.03	15.8	C	0.04	16.3	C	0.05	20.6	C
	Monument St SB	0.34	18.5	C	0.36	19.6	C	0.53	26.0	D	0.19	15.7	C	0.21	16.3	C	0.35	21.5	D
	Vine Street at Moulton Street																		
8	Moulton St NB	0.05	14.2	B	0.05	14.5	B	0.06	16.5	C	0.04	13.8	B	0.04	14.1	B	0.05	17.6	C
	Moulton St SB	0.05	12.2	B	0.05	12.4	B	0.28	17.3	C	0.03	12.0	B	0.03	12.2	B	0.18	17.9	C
	Vine Street at Chelsea Street																		
9	Vine St EB	0.43	17.7	C	0.50	20.6	C	0.73	37.1	E	0.30	17.9	C	0.38	21.8	C	0.73	56.5	F
	Bunker Hill Street at Medford Street/Main Street																		
10	Main St NB	>1.00	>120	F	>1.00	>120	F	>1.00	>120	F	>1.00	>120	F	>1.00	>120	F	>1.00	>120	F
	Medford St SB	0.86	54.2	F	0.96	76.8	F	>1.00	>120	F	0.48	15.7	C	0.51	16.7	C	0.61	20.6	C

1 Volume to Capacity Ratio, 2 Delay in seconds, 3 Level of service

Proposed Roadway Mitigation

In order to address existing traffic deficiencies and mitigate potential impacts of the Project on the neighboring roadway network, several improvements are being considered and will be further reviewed in collaboration with the BTD and BPDA. Table 5.15 presents the Build Mitigated vehicular level of service results compared to the Build Un-mitigated level of service results for intersections #5 and #9. Table 5.16 shows the build mitigated level of service results for intersection #10.:

- **#5 Bunker Hill Street at Polk Street/Green Street** – Currently, both Polk Street and Green Street provide one general purpose lane on each approach. A potential improvement on Polk Street is to stripe the approach as a right-turn only lane and a left-turn only lane in order to meet the increased demand for these turns. Another potential improvement is to also stripe the Green Street approach as a right-turn only lane and a left-turn only lane. Adding the extra lane on Green Street would involve the removal of at least two on-street parking spaces. As shown in Table 5.15, even though LOS F would prevail during the morning peak hour, the improvement would reduce the intersection delay significantly. In the evening peak hour the operations would improve to LOS C, with associated reductions in delay.
- **#9 Vine Street at Chelsea Street** – Currently Vine Street provides a general-purpose approach. A potential improvement to this intersection is to stripe the approach as a right-turn only lane and a left-turn only lane for a short distance to the west (50 feet should be sufficient). As shown in Table 5.15, the intersection would improve top LOS C during both peak hours.
- **#10 Bunker Hill Street at Medford Street/Main Street** – Currently this unsignalized intersection performs at LOS F during both peak times under all three study scenarios. A potential improvement to this intersection is to signalize it and adding exclusive left turn lanes on the Bunker Hill Street eastbound approach and on the Main Street northbound approach. At this time, widening of the intersection is not expected, as the additional lanes could likely fit within the existing curb-to-curb width. Other factors, such as a signal warrant analysis, bicycle and pedestrian accommodations, signal timing design, drainage, safety, as well as the general desire by BTD to signalize this particular intersection, need to be considered in order to determine if signalization at this intersection is appropriate. As shown in Table 5.15, signalization of the intersection would result in an overall LOS C during both peak hours, with satisfactory levels of service for all approaches.

TABLE 5.15 UNSIGNALIZED BUILD AND BUILD MITIGATED VEHICULAR LEVEL OF SERVICE – MORNING AND EVENING PEAK HOURS

Intersection		Morning Peak Hour						Evening Peak Hour					
		2023 Build			2023 Build Mitigated			2023 Build			2023 Build Mitigated		
		V/C[1]	Delay[2]	LOS[3]	V/C[1]	Delay[2]	LOS[3]	V/C[1]	Delay[2]	LOS[3]	V/C[1]	Delay[2]	LOS[3]
	Bunker Hill Street at Polk/Green Street												
5	Green St NB	>1.00	>120	F	0.84	66.4	F	0.74	38.2	E	0.42	19.4	C
	Polk St SB	>1.00	>120	F	0.82	52.8	F	0.55	26.1	D	0.28	17.3	C
	Vine Street at Chelsea Street												
9	Vine St EB	0.73	37.1	E	0.47	21.3	C	0.73	56.5	F	0.55	34.8	D

1 Volume to Capacity Ratio, 2 Delay in seconds, 3 Level of service

TABLE 5.16 INTERSECTION #10 BUILD MITIGATED VEHICULAR LEVEL OF SERVICE – MORNING AND EVENING PEAK HOURS

Intersection		**Movement**	**2023 Build Mitigated – AM Peak**					**2023 Build Mitigated – PM Peak**				
			V/C[1]	**Delay[2]**	**LOS[3]**	**50th Queue[4]**	**95th Queue[5]**	**V/C[1]**	**Delay[2]**	**LOS[3]**	**50th Queue[4]**	**95th Queue[5]**
10	**Bunker Hill Street at Medford Street/ Main Street**	Bunker Hill St EB L	0.63	15.3	B	92	146	0.27	9.1	A	28	70
		Bunker Hill St EB T/R	0.66	28.5	C	186	300	0.80	29.7	C	188	353
		Bunker Hill St WB L/T/R	0.49	23.8	C	137	206	0.49	20.3	C	106	194
		Main St NB L	0.75	40.2	D	69	#146	0.55	27.1	C	56	111
		Main St NB T/R	0.14	30.6	C	18	54	0.15	30.5	C	9	47
		Medford St L/T/R	0.48	37.3	D	45	143	0.34	31.8	C	11	93
		Overall	**0.69**	**28.0**	**C**	**-**	**-**	**0.58**	**25.9**	**C**	**-**	**-**

1 Volume to Capacity Ratio
2 delay in seconds
3 level of service
4 50th percentile queue (reported in feet)
5 95th percentile queue (reported in feet)
95th percentile volume exceeds capacity, queue may be longer

5.9.4. Transit Operations

As previously discussed, several public transit alternatives are available to the Project. Existing, No-Build and Build ridership have been developed based on MBTA data, projections and expected transit trip generation for the Project.

The person-transit trips presented in Section 5.7.1 were assigned to the Orange Line, Bus, and Ferry services. The assignment percentages shown in Table 5.17 are based on the travel patterns of the census tracts 402, 403, and 408.01.

TABLE 5.17 TRANSIT TRIP ASSIGNMENT

Transit Mode	Project Trip Assignment
Orange Line	42%
Bus	50%
Ferry	8%
Total	**100%**

Orange Line Analysis

Existing ridership was based on load profiles available for the Fall 2017. Future background growth for 2026 No-Build was based on MBTA data incorporated in analyses of other recent project relying significantly on subway access, including 115 Winthrop Square and the Back Bay/South End Gateway. Existing and projected 2026 No-Build and Build ridership for each line at the Community College station are presented in Table 5.18.

TABLE 5.18 EXISTING AND PROJECTED SUBWAY RIDERSHIP BY LINE AND DIRECTION

Direction	Enter/Exit Station	Morning Peak Hour				Evening Peak Hour			
		Existing	No-Build	Project Trips	Build	Existing	No-Build	Project Trips	Build
Forest Hills (Southbound)	Load Entering	6,667	7,298	83 alighting	7,381	1,848	2,009	50 alighting	2,059
	Load Exiting	6,664	7,295	117 boarding	7,412	2,153	2,341	39 boarding	2,380
Oak Grove (Northbound)	Load Entering	1,713	1,875	17 alighting	1,892	6,279	6,826	130 alighting	6,956
	Load Exiting	1,212	1,327	24 boarding	1,351	6,006	6,529	100 boarding	6,629

Existing capacities for the Orange Line is based on vehicle load standards from the MBTA's Service Delivery Policy and Crush Capacity manual and data from the MBTA Blue Book, 14th edition. Policy and Crush Capacity are defined by the MBTA as follows:

- **Policy Capacity** refers to the load standards of passenger per car volume defined by the MBTA's Service Delivery Policy which states the standards "establish the average maximum number of passengers allowed per vehicle to provide a safe and comfortable ride." Each

vehicle type in the MBTA fleet has a defined "policy capacity" and is published in the MBTA Blue Book;

- **Crush Capacity** refers to the higher load capacity of a vehicle and is calculated by adding the number of seated passengers plus 1.5 square feet per standing passenger (two square feet on buses). The MBTA Blue Book publishes the "crush capacity" for each vehicle type in the MBTA fleet.

The existing policy and crush capacities for the Orange Line is 131 passengers per car and 224 passengers per car, respectively. With a six-minute headway, six cars per train, and a peak hour on-time performance of 0.90 (for the month of November 2019), the existing policy and crush capacities for the morning and evening peak hours are 7,074 passengers per hour and 12,096 passengers per hour, respectively.

By 2026, the MBTA will have added new train cars that will reduce the headways to 4.5 minutes instead of 6. Therefore, the future (no-build and build) policy and crush capacities for the morning and evening peak hours are 9,432 passengers per hour and 16,128 passengers per hour, respectively.

With the addition of the Project generated Orange Line trips, the analysis shows there is negligible impact on all Orange Line loads entering and exiting Community College Station during the peak hours. During the busiest peak times, morning outbound and evening inbound, the Project adds fewer than four passengers per peak hour train. As shown in Table 5.18 the Project will add 117 transit trips to the morning outbound volume, equating to approximately 3.25 passengers per train car. For the evening inbound peak hour, 130 Project trips will be using the Orange Line, equating to 3.61 passengers per train car.

MBTA Bus Analysis

As previously described, the Project is estimated to add approximately 50% percent of its transit trips to Routes 92 and 93. While more bus riders are expected to use the Route 92 bus due to it's proximity to the Project site, some are expected to use the Route 93 bus, particularly during the peak periods when commuting trips are often combined with other trip purposes closer to the Route 92, such as school/daycare drop-off/pick-up, retail, coffee shops and services such as dry-cleaning.

The 289 bus trips in the AM peak hour (121 in, 168 out) and 383 bus trips in the PM peak hour (216 in, 167 out) are assigned to the routes based on existing ridership patterns. Table 5.19 below shows the assignment of MBTA Bus Trip by route and direction.

TABLE 5.19 PROJECT GENERATED BUS TRIPS BY LINE

Route	Direction	Morning Peak Hour			Evening Peak Hour		
		Trip Out (Boardings)	Trips In (Alightings)	Total Trips	Trip Out (Boardings)	Trips In (Alightings)	Total Trips
Route 92	Inbound	26	18	44	7	8	15
	Outbound	15	11	26	34	44	78
	Total	**41**	**29**	**70**	**41**	**52**	**93**
Route 93	Inbound	72	52	124	34	44	78
	Outbound	55	40	95	92	119	211
	Total	**127**	**92**	**219**	**126**	**163**	**289**

MBTA Bus Route 92

Based on the FY2018 Bus Route Trip Stop Composite Day, there are three or four inbound and three or four outbound buses servicing the area during the peak hours. If bus service continues to operate under similar schedules and routes in the future, the Project will add up to 7 - 9 passengers to each bus in the AM Peak hour in the peak direction, and up to 11 - 14 passengers to each bus during the PM peak hour in the peak direction. However, as Project bus riders also alight at the stop while the new riders are boarding, the net increase in passengers on the bus is significantly lower. As shown in Table 5.20 below, the net addition of Project riders is well within the MBTA On-Time Performance (OTP) capacity of the route.

MBTA Bus Route 93

Based on the FY2018 Bus Route Trip Stop Composite Day, there are approximately seven or eight inbound and seven or eight outbound buses servicing the area during the peak hours. If bus service continues to operate under similar schedules and routes in the future, the Project will add up to 9 - 10 passengers to each bus in the AM Peak hour in the peak direction, and up to 15 - 17 during the PM Peak Hour, in the peak direction. However, as Project bus riders also alight at the stop while the new riders are boarding, the net increase in passengers on the bus is significantly lower. As shown in Table 5.20 below, the net addition of Project riders is well within the MBTA OTP capacity of the route.

Table 5.20 shows the existing and projected ridership within the vicinity of the Project for each of the MBTA Bus Routes studied based on the net change in passenger numbers at each bus stop.

TABLE 5.20 EXISTING AND PROJECTED BUS RIDERSHIP BY LINE AND DIRECTION

Route	Morning Peak Hour					Evening Peak Hour				
	Existing[1]	No-Build	Project Generated Trips	Build	Capacity	Existing	No-Build	Project Generated Trips	Build	Capacity
92 Inbound	78	82	26 boarding/ 18 alighting	90	162	11	12	7 boarding/ 8 alighting	11	216
92 Outbound	60	63	15 boarding/ 11 alighting	67	162	61	64	34 boarding/ 44 alighting	54	216
93 Inbound	196	205	72 boarding/ 52 alighting	225	378	55	58	34 boarding/ 44 alighting	48	378
93 Outbound	208	218	55 boarding/ 40 alighting	233	378	173	181	92 boarding/ 119 alighting	154	378

[1] Load Exiting the Nearest Stop,
[2] Background growth rate = 0.68 percent (source: L Street Station Redevelopment Transit Analysis),
[3] Capacity = 54 passengers per bus X # of buses per peak hour

It should be noted that the riderships presented in Table 5.20 are for each entire peak hour, and are based MBTA On-Time Performance (OTP) capacities that assume the maintenance of scheduled headways. In practice, due to delays in headways and bunching of buses, riders often experience longer delays and crush capacity conditions rather than the average target conditions for the entire peak hour indicated Table 5.50.

MBTA Ferry Analysis

The project is estimated to generate approximately 48 (20 in, 28 out) ferry trips during the morning peak hour and approximately 64 (36 in, 28 out) ferry trips during the evening peak hour. During each peak hour there are four inbound and four outbound ferries, therefore each ferry will carry up to approximately nine new passengers. The capacity of each boat is 149 or 190 passengers.

Potential Transit Enhancements

It should be noted that the MBTA is in the process of updating the fleet of Orange Line cars and designing significant upgrades to the signal system. In combination with the new signal system, the new rolling stock will decrease the headways from 6.0 minutes to 4.5 minutes, increasing the future capacity and reliability of the line, as described above. These in-process improvements will significantly improve the commuter experience on the Orange Line, enabling more commuters to choose the Outbound direction on the 93 bus to Sullivan Square and balance new demand in the Inbound direction.

The Proponent has identified several transit enhancements that could address potential impacts on transit service and infrastructure resulting from the Project's new density at full build out. These improvements would not only be beneficial for the Bunker Hill Project, but

would also enhance transit service for the wider Charlestown neighborhood. Potential enhancements include the following:

1. MBTA Bus Service

While the #92 and #93 MBTA Bus routes provide direct connections to Downtown Boston at Haymarket, they are subject to the constraints of traffic congestion and both the frequency and maintenance of service. As such, although they pass through the heart of the community, they do not provide a level of service equivalent to the Orange line subway service, and require a second-seat ride to destinations beyond Haymarket.

The Proponent is committed to working with the BPDA/BTD and the MBTA to advance improvements in bus service, consistent with the MBTA's Better Bus Project and BTD's prioritization of bus service and infrastructure in the context of Complete Streets.

Beginning in 2020, the MBTA will be undertaking a comprehensive network redesign of its bus system informed by a pending 2020 Multiyear Investment Strategy and enabled by potential new funding. At present, there are many mismatches between the amount of service provided on individual routes and ridership levels. In general, due to its financial constraints, the MBTA has attempted to meet, but not go beyond, the minimum Standard Delivery Policy (SDP) standards on its higher ridership routes. At the same time, and mostly for historical reasons, other routes provide more service than is needed to meet demand and as required by the SDP. This indicates that there are opportunities to shift service from underutilized routes to overcrowded routes.

Community complaints have been expressed regarding service and overcrowding on the Route 93 bus, and there are a number of ways that the service might be improved in an effort to accomplish the goals of Bus Rapid Transit (BRT). These include the following:

- **Improved Peak Period Headways** - Overcrowding on the bus routes may result from inadequate frequency of service and difficulty in maintaining headways due to congestion and infrastructure deficiencies. Adding additional buses to reduce headways can address overcrowding issues as well as reducing wait-times for users at bus stops. However, it may be necessary for the MBTA to purchase (and store and maintain) additional buses to provide if sufficient buses are not already available or cannot be repurposed from underutilized routes. A potential approach would be to run a pilot study to test how increased service would benefit the route.
- **Alternate Bus Routes** - It is possible that alternate routing of the 93 bus could reduce the impact of congestion while keeping the route proximate to the Project. Medford Street (currently used as a snow route) would be a potential alternate route that has stops adjacent to the Bunker Hill Project. If increased frequency is introduced, the route could be alternated between the two corridors during peak periods. Again, such a change could be tested as a pilot study

- **Dedicated Bus Lanes** - The right-of-way constraints in the Bunker Hill Street corridor are a limiting factor in allocating parts of the cross section to dedicated use by buses throughout the corridor. However, there may be opportunities to provide bus lanes on certain sections, depending on whether on-street parking or curbside uses need to be maintained and accommodating the needs of bicycles and pedestrians. It should be noted that the 92 and 93 bus routes will of course benefit from the bus lane that will be incorporated in the new North Washington Street bridge.
- **Peak Period Bus Lanes** - A simple alternative to full-time dedicated bus lanes is the introduction of bus lanes that are restricted to use by buses only during peak period. This can be accomplished more easily by eliminating curbside uses such as parking during the peak period, which is then restored for the remainder of the day outside peak periods. This approach lends itself well to peak period – peak direction application to accommodate inbound buses during the morning peak and outbound buses during the evening peak.
- **Bus Priority Signalization** -This approach may not be beneficial in the Bunker Hill Street corridor as the intersections are currently un-signalized, however it may be beneficial to consider such signalization at the Chelsea Street intersection with Rutherford Avenue.
- **In-Lane Bus Stops** - This design for bus stops involves the extension of the curb out to the edge of the travel lane to eliminate the need for the bus to pull over into the stop. It has the benefit of making it easier for boarding and alighting passengers, as well as providing an expanded waiting area with better visibility. While the bus will stop following through-traffic during its dwell-time at the stop, in practice this disruption frequently occurs because many buses do not pull over to traditional bus stops and partially block the travel lane in any event. It is also partially off-set by a reduction in dwell time because the boarding and alighting for passengers is reduced.
- **Bus Stop Amenities** - In addition to providing bus shelters and seating, a real-time transit display is a helpful and convenient amenity at bus stops.
- **Complementary Pedestrian Accommodations** - Pedestrian (and bicycle) accommodations are an important supporting component to bus service. These include pedestrian movement along the street corridor as well as crossing the street. Ideally, bus stops should be located downstream of intersections and/or crosswalks so that passengers alighting from the bus will generally walk to the back of the bus to cross the street and therefore avoid being obscured from car drivers view when emerging at the front of the bus.

2. Shuttle Service

As described in Section 5.7.4, Partners Healthcare operates several shuttle routes for employees, patients and visitors to and from Charlestown. Routes between the main MGH campus and the Charlestown Navy Yard and an express shuttle between Spaulding Rehabilitation Hospital and North Station operate every 10-15 minutes during rush hour with primary utilization as commuter access to Partners' facilities in Charlestown. These

routes run along Chelsea Street past the eastern edge of the Project site. Additionally, Partners Healthcare operates a route for employees, patients and visitors between the MGH main campus and the New Health Center on Tufts Street – a location in the heart of the Project – several times a day during off-peak hours. The Proponent will collaborate with Partners Healthcare to explore potential opportunities to leverage existing capacity in these shuttle routes (a commuter from Charlestown to North Station or MGH would be a reverse-commute for these shuttles). There may be opportunities to incorporate or expand the existing shuttle services to serve the Bunker Hill Project and other parts of the neighborhood. It is expected that these shuttle bus services will benefit from the new bus priority lane on the new North Washington Street bridge, making it easier to maintain headways and reduce travel time.

Another opportunity to improve transit connectivity would be service between Charlestown and major employment and educational opportunities in East Cambridge, Kendal Square (with Red line connection), MIT and University Park. Ridership for such a shuttle route may not make it viable on its own. However, the EZ Ride shuttle operated by the Charles River Transportation Management Association (TMA) already provides service in this corridor connecting it to North Station via Monsignor O'Brien Highway and Cambridge Crossing. There may be opportunities to connect with or expand this service to cross into Charlestown via the Gilmore Bridge; reaching Main Street or even the Navy Yard could be beneficial not only to Charlestown residents and the Project, but also to the corporate sponsors of the EZ Ride.

The Proponent has explored the feasibility of shuttle service connecting the Bunker Hill Project with the Community College Orange Line station, a connection that is not currently served by transit. The Project site is an approximately 20-minute walk to this station, with the last 500 feet passing parking lots and crossing Rutherford Ave. This walk is particularly unpleasant during inclement weather. With convenient and frequent bus service on the 93 between the Project and Sullivan Square – the outbound direction runs every 7-8 minutes during rush hour with significant excess capacity – a limited shuttle between the site and the Community College Station is unlikely to be a convenient alternative, despite arriving one Orange Line stop closer to downtown. In fact, since a private shuttle providing this connection is likely to be caught in rush hour traffic, it is unlikely to be capable of providing more than two to three trips per hour, providing a marginally more convenient service for a limited number of individuals per day. Before adding another vehicle, the Proponent supports working with existing service to increase utilization of existing capacity and will charge the Project's transportation coordinator with promoting these opportunities.

An important consideration in implementing any shuttle service, including the above opportunities, is the mechanism by which they are initiated, managed and funded. Often

the demand by individual projects or entities is insufficient to make them viable, at least with a frequency that is sufficient to make the service attractive for users. In other parts of the Metropolitan area this obstacle is often overcome by collaboration between stakeholders to accomplish an economy of scale to warrant and support service. Such collaboration is typically accomplished through a Transportation Management Association (TMA) which manages the shuttles and through which stakeholders fund the service. The Charles River TMA, the Seaport TMA and MASCO (Medical Academic and Scientific Community Organization) in the Longwood area are good examples of TMAs that manage shuttle service for their members.

Although the A Better City (ABC) is the corresponding TMA in Downtown Boston, it does not operate shuttles and its purview does not encompass Charlestown. This suggests that there is an opportunity for the formation of a TMA in Charlestown which could be the enabling entity for shuttle services such as those discussed above in relation to the Bunker Hill Projects. As discussed in Section 5.10, an important component of the Transportation Demand Management (TDM) plan for the Project is the Proponent's commitment to joining a TMA to facilitate access by Project residents and employees to other TDM programs and alternative transportation opportunities.

5.9.5. Pedestrian Analysis

Pedestrian level-of-service (PLOS) at intersections was analyzed using the methodology outlined in the 2000 HCM. The PLOS criteria are presented in Table 5.21.

TABLE 5.21 SIGNALIZED PEDESTRIAN LEVEL OF SERVICE

Level of Service	Pedestrian Delay (sec/p)		Likelihood of Risk-Taking or Noncompliance
	Signalized	Unsignalized	
PLOS A	< 10	< 5	Low
PLOS B	≥ 10 – 20	≥ 5 – 10	
PLOS C	> 20 – 30	> 10 – 20	Moderate
PLOS D	> 30 – 40	> 20 – 30	
PLOS E	> 40 – 60	> 30 – 45	High
PLOS F	> 60	> 45	Very High

PLOS at signalized intersections is dictated by the portion of the signal cycle dedicated to the pedestrian crossing. Accordingly, increasing pedestrian volumes does not alter PLOS at signalized intersections, and if walk times and cycle lengths do not change PLOS will remain the same under any condition. Table 5.22 presents the PLOS at each signalized intersection crosswalks for morning and evening peak hours.

TABLE 5.22 SIGNALIZED PEDESTRIAN LEVEL OF SERVICE

Intersection	AM PLOS	PM PLOS
7. Bunker Hill St./ Vine St./Tufts St.		
West Crosswalk (Bunker Hill St.)	C	C
East Crosswalk (Vine St.)	C	C
South Crosswalk (Bunker Hill St.)	C	C
North Crosswalk (Tufts St.)	C	C
11. Main St./Warren St./Austin St./Green St.		
West Crosswalk (Main St.)	B	B
East Crosswalk (Main St./Warren St.)	B	B
South Crosswalk (Austin St.)	B	B
North Crosswalk (Austin St.)	B	B

All crosswalks at signalized intersections currently operate at PLOS C or better. As noted previously, the PLOS is determined by the traffic signal phasing and timing, which remain unchanged under No-Build and Build conditions and are therefore not impacted by Project trips.

Unsignalized Pedestrian Level of Service (PLOS)

For unsignalized intersections, the PLOS is calculated using the crosswalk length and the conflicting vehicular flow rates for the morning and evening peak hours. Table 5.23 presents the PLOS for each unsignalized intersection crosswalk for the morning and evening peak hours.

TABLE 5.23 UNSIGNALIZED PEDESTRIAN LEVEL OF SERVICE (PLOS)

Intersection	Crosswalk	AM Peak Hour			PM Peak Hour		
		Exiting	No-Build	Build	Exiting	No-Build	Build
1. Medford St at Polk St	East	D	D	E	C	D	E
	South	A	A	A	A	A	A
	West	E	E	F	D	E	E
2. Medford St at Monument St	South	A	A	B	A	A	B
	West	D	D	E	C	D	E
3. Medford St at Chelsea St	West	E	E	F	E	E	F
4. Bunker Hill at School St/Mystic St	North	A	A	A	A	A	A
	East	F	F	F	F	F	F
	South	A	A	A	A	A	A
	West	E	E	F	E	E	F
5. Bunker Hill at Polk St/Green St	North	A	A	A	A	A	A
	South	A	A	A	A	A	B
	West	D	F	F	E	F	F
6. Bunker Hill St at Monument St	North	A	A	B	A	A	A
	East	E	E	F	E	E	F
	South	A	A	A	A	A	A

Intersection	Crosswalk	AM Peak Hour			PM Peak Hour		
		Exiting	No-Build	Build	Exiting	No-Build	Build
	West	E	F	F	E	E	F
8. Vine St at Moulton St	North	A	A	A	A	A	A
	East	B	D	D	B	C	D
	South	A	A	A	A	A	A
	West	D	D	E	D	D	E
9. Vine St at Chelsea St	West	C	D	D	C	C	E
10. Bunker Hill St at Medford St/Main St	North	F	F	F	F	F	F
	East	F	F	F	F	F	F
	South	F	F	F	F	F	F
	West	F	F	F	F	F	F

As shown, all crosswalks at unsignalized intersections currently operate at LOS D or better except the following intersection:

- (1) Medford Street at Polk Street – West crosswalk (morning peak hour)
- (3) Medford Street at Chelsea Street – West crosswalk (both peak hours)
- (4) Bunker Hill at School Street – Mystic Street – East and West crosswalk (both peak hours)
- (5) Bunker Hill Street at Polk Street/Green Street – West crosswalk (evening peak hour)
- (6) Bunker Hill Street at Monument Street – East and West crosswalk (both peak hours)
- (10) Bunker Hill Street at Medford Street/Main Street – all crosswalks (both peak hours)

It should be noted that the analysis methodology for pedestrian LOS at un-signalized crosswalks is very conservative, as it is based on gaps in traffic flow and does not take into account the law requiring drivers to yield to pedestrians in the crosswalk. However, regardless of the pedestrian LOS, improvements to certain pedestrian crossings in the study area would improve the pedestrian experience. The Proponent will work with the BTD to explore opportunities for improvements such as better signage, warning devices in the roadway, improvement of sight-lines etc.

5.9.6. Vehicle Parking

Parking Supply and Ratios

As currently envisioned, at full build out the Project will provide approximately 326 on-street spaces on internal streets and an additional 156 on-street spaces on perimeter streets, for a total 482 on-street spaces site-wide. The new on-street parking spaces will be public and open to visitors and residents of the entire neighborhood with resident permit parking stickers or visitor passes and will increase the current count of RPP spaces on internal and perimeter streets by 154.

Additionally, the Project will provide up to 1,379 off-street parking spaces for residents. Because the area underneath the Tobin Bridge has not yet been secured by the Proponent, at the time of this filing, two options are envisioned to provide this amount of off-street parking:

- **Option A** – All parking on-site in podium and surface lots as well as two structured garages; and
- **Option B** – Parking provided on-site in podium and surface lots and two structured garages, and off-site underneath the Tobin Bridge. The parking area underneath the Tobin Bridge is envisioned to be resident permit parking for the Charlestown neighborhood, which, when combined with the net new internal and perimeter on-street spaces, would increase the RPP spaces in total by 400. While this option would shift 244 spaces from project-controlled to RPP, the Proponent prefers this approach to reduce structured parking cost and increase parking capacity for the broader community. Table 5.24 below shows the proposed parking options under consideration for this project.

TABLE 5.24 PROJECT OFF-STREET PARKING PLAN SUMMARY

Parking Location	Option A	Option B
Podium Parking		
Building A	52	52
Building H	102	102
Building I	58	58
Building L	47	47
Building E	92	92
Building F	63	63
Building N	62	62
Total Podium Parking	**476**	**476**
Surface Parking		
Total Surface Parking at Decatur/Moulton Lot	**23**	**23**
Structured Parking Garage		
Block L	400	400
Block O	480	236
Total Garage Spaces	**880**	**636**
Under the Tobin Bridge		
Total Parking Under the Tobin Bridge	**0**	**244**
Total	**1,379**	**1,379**
Parking Ratio*	0.51	0.51

*off-street spaces/unit

Electric Vehicle Parking

The Project will comply with the City of Boston's currently effective electric vehicle (EV) parking policy, which requires that 25 percent of parking spaces are electric vehicle supply equipment (EVSE) installed, and the remaining 75 percent of parking spaces are "EV Ready" for future installation, to the maximum extent practicable.

5.9.7. Bicycle Parking

The Project will be informed by the City of Boston's currently effective off-street bicycle parking guidelines for multi-unit residential and retail buildings and will provide a variety of bicycle options for residents and visitors to the Project Site. Short-term, outdoor bicycle parking will be provided in the public realm in the vicinity of the Project Site. Long-term covered and secure bicycle parking will be provided for residents, visitors and employees of the Project.

The Proponent will work with BTD to determine appropriate numbers of long- and short-term bicycle parking and will commit to providing additional spaces in response to actual demand if those numbers are fully utilized. As presented in Table 1-1 in Section 1, it is currently anticipated that up to 2,700 long-term bike parking spaces will be provided to support the full-build Master Plan Project, along with a minimum of 120 short-term spaces.

5.9.8. Loading, Service, and Deliveries

Curbside accommodations along the Project site are provided for residential drop-off and short-term loading. Loading docks and trash compactors will be provided in each building. On-street and off-street loading locations are shown in the Site Plan in Figures 5.2 and 5.3.

5.10 Transportation Demand Management

The Project will incorporate a robust program of TDM strategies to take full advantage of multiple mobility options. The goal will be to develop a broad set of alternatives for residents of the Site so they will not be highly dependent on their personal vehicles. As the Project planning moves forward, actions that will promote these alternatives will be identified.

As discussed in Section 5.9.4, the Proponent has identified a range of potential transit enhancements that could address potential impacts on transit service and infrastructure resulting from the Project's new density at full build out. These improvements would not only be beneficial for the Bunker Hill Project, but would also enhance transit service for the wider Charlestown neighborhood. Potential enhancements include potential shuttle service expansion opportunities as well as opportunities for enhancement of MBTA bus service.

As noted above, the Site will be designed with generous and attractive sidewalks, ADA-compliant ramps and improved pedestrian crossings to encourage people to walk to their destinations. Bike accommodations are being carefully considered in the design of the development's street system.

An important component of the TDM plan will be the incorporation of appropriate bicycle accommodations throughout the Site, including secure bike parking for residents of the Project. The proponent will follow BTD guidelines to encourage the use of bicycles. The proponent will also incorporate car sharing services within the development.

There is increasing attention on the water transportation options available to people traveling between Charlestown and downtown. The City Council has expressed interest in exploring an expansion of the current ferry service to extend beyond one destination in Downtown (Long Wharf). An analysis of service improvements to East Boston and the Seaport District may soon be underway. Such improvements would significantly improve mobility opportunities for residents of the Charlestown neighborhood.

Below is a list of TDM measures that will apply to both the residential and commercial Project components:

- Join a Transportation Management Association (TMA) established for the Charlestown Area;
- Designate a Transportation Coordinator to oversee all transportation related operational matters at each Project component, including vehicular operations, servicing and loading, parking and implementation of the TDM Plan. The Transportation Coordinator will act as the contact and liaison for the City, local Transportation Management Association (if/when it's established) and tenants/residents of the Project;
- Post and make available transit maps, schedules and other information relevant to commuting residential building lobbies;
- Assign Car Sharing spaces in garages, subject to demand;
- Install electric vehicle charging stations for up to 25% of parking capacity and EV-ready parking for balance of parking capacity;
- Provide long-term covered secure, and short-term public realm bicycle spaces (number of spaces to be determined based on demand and in collaboration with BTD).
- Provide an on-site "Fix-it" bike station;
- Charge for residential parking separately from rental fees.
- Add other project components to decrease convenience trips such as: dry cleaning valet, grocery delivery cold storage, package lockers, etc.

5.11 Construction Management

The Proponent will develop a detailed evaluation of potential short-term, construction-related transportation impacts including construction vehicle traffic, parking supply and demand, and pedestrian access. A detailed Construction Management Plan (CMP) will be developed and submitted to the BTD for their approval. These plans will detail construction vehicle routing and staging and maintenance of sufficient pedestrian and bicycle routes in and around the area.

To minimize impacts to the abutters and the local community, the Proponent will consider all available measures during construction activities, including specific construction mitigation

measures, construction materials access, and staging area plans. The potential need for street use along roadways adjacent to the Project site is not known at this time.

Contractors will be encouraged to devise access plans for their personnel that deter automobile use (such as providing transit subsidies and onsite lockers).

During the construction period, pedestrian activity adjacent to the Project site may be impacted by sidewalk closures. A variety of measures will be considered and implemented to protect the safety of pedestrians. Temporary walkways, appropriate lighting, and new directional and informational signage to direct pedestrians around the construction site will be provided. After construction is complete, finished pedestrian sidewalks will be permanently reconstructed to meet ADA standards around the new facilities. Any damage as a result of construction vehicles or otherwise will be repaired per City standards.

5.12 Transportation Access Plan Agreement (TAPA)

The Proponent will enter into a Transportation Access Plan Agreement (TAPA) with the BTD which will formalize and document all transportation mitigation and TDM commitments to be made in connection with the Project. The TAPA will assign TDM implementation to the appropriate responsible entity.

Specific mitigation measures have not been discussed with the City at this time. Upon the City's review of this transportation analysis and assessment of Project impacts, TDM commitments will be discussed and agreed upon for the Project. A TAPA will be executed for the Project in advance of its building permit issuance.

Chapter from Final Environmental Impact Report dated 7-31-20

2

Traffic and Transportation

This chapter provides additional information related to transportation as requested in the EEA Secretary's Certificate on the DEIR, including updates related to mitigation commitments, off-site parking, bicycle and pedestrian facilities, and a revised transit analysis.

2.1 Updated Transportation Mitigation Commitments

The Project proposes certain physical and operational transportation improvements to mitigate the transportation related Project impacts and work towards meeting the goals of the City for the area.

Potential mitigation measures include the following:

- **Bunker Hill Street at Polk Street/Green Street** – Currently, both Polk Street and Green Street provide one general purpose lane on each approach. A proposed improvement on Polk Street is to stripe the approach as a right-turn only lane and a left-turn only lane in order to meet the increased demand for these turns. Another proposed improvement is to also stripe the Green Street approach as a right-turn only lane and a left-turn only lane.
- **Vine Street at Chelsea Street** – Currently, Vine Street provides a general-purpose approach. The proposed improvement to this intersection is to stripe the approach as a right-turn only lane and a left-turn only lane for a short distance to the west (50 feet should be sufficient).
- **Bunker Hill Street at Medford Street/Main Street** – Currently, this unsignalized intersection performs at LOS F during both peak times under all three study scenarios. The proposed improvement to this intersection is to signalize it and adding exclusive left turn lanes on the Bunker Hill Street eastbound approach and on the Main Street northbound approach. At this time, widening of the intersection is not expected, as the additional lanes are unlikely to fit within the existing curb-to-curb width. Other factors, such as a signal warrant analysis, bicycle and pedestrian accommodations, signal timing design, drainage, safety, as well as the general inclination of BTD to signalize this particular intersection, need to be considered in order to determine if signalization at this intersection is appropriate.

- **Bicycle Facilities** – An existing BlueBikes station proximate to Phase 1 will be expanded if utilization rates demonstrate sufficient demand. One BlueBike station will be installed on-site in a highly visible location near the publicly accessible open space programmed along Bunker Hill Street between Lexington and Monument Streets during the phase in which this area is redeveloped. Should utilization rates demonstrate sufficient demand to warrant an additional BlueBikes station in a later phase. Final station locations will be defined in coordination with City's BlueBike coordinator and will depend on availability of appropriate sun exposure, as stations are solar powered.
- **Bike/Ped Improvements** – The Site will be designed with generous and attractive sidewalks, ADA compliant ramps and improved pedestrian crossings to encourage people to walk to their destinations. Bike accommodations are being carefully considered along Medford Street, Bunker Hill Street, Concord Street, and Tufts Street in the design of the development's street system.
- **Infrastructure Improvement** – The Proponent will work with TNCs (ride hail companies) to create pick-up/drop-off zones using geofencing.
- **Safety** – the Proponent will work with BTD to establish specific safety improvements that align with the City's Vision Zero plan.
- **Transit/Shuttle Bus** – Study the feasibility of a coordinated/consolidated shuttle service with area stakeholders. Explore shuttle pilot studies in consultation with BPDA.
- **Transit/Bus** – Explore bus rapid transit improvements along Medford Street and Bunker Hill Street, including bus-only lanes, peak period bus lanes, bus priority signalization, in-lane bus stops, bus shelters, and other bus stop amenities.
- **Transit/Bus** – Explore and test enhancements to the #92 and #93 MBTA Bus routes as a pilot study, including improved peak period headways and alternate bus routes.
- **Transit/Ferry** – Participate in an MBTA ferry route enhancement study.
- **Transportation Demand Management Strategies** – Implement TDM strategies listed in Section 2.1.1 below.

As traffic mitigation strategies are being further developed and refined, the Proponent will consult directly with Massport and the Boston Autoport to ensure traffic impacts to the Autoport are considered. Additionally, the Proponent has been in discussions with the Boston Transportation Department and the BPDA regarding roadway mitigation. The Proponent coordinated with BTD and the BPDA on April 29, 2020 and June 29, 2020, and discussions are ongoing.

As the Project has been designed to be completed in phases, the implementation of the mitigation measures described above are proposed to be appropriately phased. The transportation improvements to be implemented in association with each phase are summarized in Chapter 6.

2.1.1 Transportation Demand Management

The Project will incorporate a robust program of TDM strategies to take full advantage of multiple mobility options within the Charlestown neighborhood. The goal will be to develop

a broad set of alternatives for residents of the Site so they will not be highly dependent on their personal vehicles.

An important component of the TDM plan will be joining a Transportation Management Association (TMA). Although the A Better City (ABC) is the corresponding TMA, it is not active in Charlestown. The Proponent will work with and join, as appropriate, the ABC TMA and will reach out to other area stakeholders to assist the TMA establish a more active presence in the Charlestown neighborhood. As of the time of the FEIR filing, the Proponent has reached out to Partners Healthcare and will engage with Hood Park, The Flatley Company and other area stakeholders in order to discuss potential area shuttle consolidations and services. Discussions with the area stakeholders and the City of Boston are ongoing.

Below is a list of TDM measures that will apply to both the residential and commercial Project components:

- Join A Better City (ABC) Transportation Management Association (TMA);
- Designate a Transportation Coordinator to oversee all transportation related operational matters at each Project component, including vehicular operations, servicing and loading, parking and implementation of the TDM Plan. The Transportation Coordinator will act as the contact and liaison for the City, local Transportation Management Association (if/when it's active in the area) and tenants/residents of the Project;
- Post and make available transit maps, schedules and other information relevant to commuting residential building lobbies;
- Offer a new resident orientation packet with a free one-month transit pass for the first month of a new lease;
- Offer additional transit incentives, such as offering rewards for using alternative modes of transportation;
- Establish a monitoring program as part of the TAPA with the City of Boston. The monitoring program is expected to include employee and resident surveys, collection of traffic counts, and parking garage counts and occupancies. The monitoring program will quantify the progress made towards reducing Vehicle Miles Traveled (VMT) and carbon dioxide emissions;
- Join the Bluebikes corporate partnership;
- Offer a one-time Bluebikes and/or Zipcar credit at the start of a new lease;
- Assign parking spaces in the garage for car sharing companies (such as Zipcar), subject to demand;
- Install electric vehicle charging stations for up to 25% of parking capacity and EV-ready parking for balance of parking capacity;
- Provide long-term covered secure, and short-term public realm bicycle spaces;
- Provide on-site air pumps and bike tools;
- Charge for residential parking separately from rental fees.

› Add other project components to decrease convenience trips such as: dry cleaning valet, grocery delivery cold storage, package lockers, etc.

2.1.2 Transportation Access Plan Agreement

The Proponent will enter into a Transportation Access Plan Agreement (TAPA) with the BTD which will formalize and document all transportation mitigation and TDM commitments to be made in connection with the Project. The TAPA will assign TDM implementation to the appropriate responsible entity for each planned phase of construction.

Specific mitigation measures have not been established with the City at this time. Upon the City's review of the transportation analysis and assessment of Project impacts presented in the DEIR-NPC/DPIR, TDM commitments will be discussed and agreed upon for the Project. A TAPA will be executed for the Project in advance of its building permit issuance.

2.2 Off-Site Parking

Chapter 5 of the DEIR (Section 5.9.6) presented a flexible parking program with two distinct alternatives for providing up to 1,379 off-street parking spaces. Option A provides all spaces on-site and Option B provides up to 244 of the proposed spaces off-site underneath the Tobin Bridge. The Proponent is anticipating comments from City agencies and the public related to the proposed parking strategies. Feedback from these entities is helpful to better understand how local priorities can be incorporated as design progresses. The Proponent will then reach out to MassDOT to explore mechanisms for gaining access to the space under the Tobin Bridge. Stand-alone parking structures on the Site are not anticipated to be built until Phases 5 and 9. Until that time all off-street parking can be accommodated within building podiums and temporary surface parking lots. As advanced design approaches for those phases, the Proponent will re-assess parking needs to determine how best to accommodate off-street parking, including potentially utilizing the area under the Tobin Bridge. Chapter 6 of this FEIR includes a Draft Section 61 Finding for MassDOT in the event that a State Agency Action is warranted, whether it be an access permit, ground lease, land transfer, or other action. If necessary, the Proponent will submit additional information to MEPA before phase 9 to support the appropriate MassDOT action.

2.3 Bicycle and Pedestrian Facilities

The Project will be informed by the City of Boston's currently effective off-street bicycle parking guidelines for multi-unit residential and retail buildings and will provide a variety of bicycle options for residents and visitors to the Project Site. Short-term, outdoor bicycle parking will be provided in the public realm in the vicinity of the Project Site. Long-term covered and secure bicycle parking will be provided for residents, visitors and employees of the Project.

Table 2-1 provides the currently anticipated number of long-term and short-term bike parking spaces, and the Bikeshare contribution that will be provided to support the full-build Master Plan Project.

TABLE 2-1 BICYCLE PARKING PROGRAM

Use	Program	Long-Term Bike Parking		Short-Term Bike Parking	
		Rate	Number	Rate	Number
Residential	2,699 units	1 per unit	2,699 spaces	1 per 20 units	135 spaces
Retail	70,000 SF	1 per 3,000 SF	24 spaces	1 per 5,000 SF	14 spaces
Total			**2,723 spaces**		**149 spaces**

Additionally, in accordance to the Bike Parking Guidelines, the Project will provide 1 shower and 12 on-site lockers for retail employees in Building E. BlueBikes accommodations are discussed above.

The Site will be designed with generous and attractive sidewalks, ADA compliant ramps and improved pedestrian crossings to encourage people to walk to their destinations. Bike accommodations are being carefully considered in the design of the development's street system.

2.4 Transit Analysis and Mitigation

An updated transit analysis and potential mitigation are described below.

2.4.1 Updated Transit Analysis

Existing ridership was based on load profiles available for the Fall 2017. Future background growth for 2026 No-Build was based on MBTA data incorporated in analyses of other recent projects relying significantly on subway access, including 115 Winthrop Square and the Back Bay/South End Gateway project. Table 2-2 shows the existing and projected subway ridership by line and direction.

TABLE 2-2 EXISTING AND PROJECTED SUBWAY RIDERSHIP BY LINE AND DIRECTION

Direction	Enter/Exit Station	Morning Peak Hour				Evening Peak Hour			
		Existing	No-Build	Project Trips	Build	Existing	No-Build	Project Trips	Build
Forest Hills (Southbound)	Load Entering	6,667	7,298	83 alighting	7,381	1,848	2,009	50 alighting	2,059
	Load Exiting	6,664	7,295	117 boarding	7,412	2,153	2,341	39 boarding	2,380
Oak Grove (Northbound)	Load Entering	1,713	1,875	17 alighting	1,892	6,279	6,826	130 alighting	6,956
	Load Exiting	1,212	1,327	24 boarding	1,351	6,006	6,529	100 boarding	6,629

Existing capacities for the Orange Line are based on vehicle load standards from the MBTA's Service Delivery Policy and Crush Capacity manual and data from the MBTA Blue Book, 14th edition. Policy and Crush Capacity are defined by the MBTA as follows:

- Policy Capacity refers to the load standards of passenger per car volume defined by the MBTA's Service Delivery Policy which states the standards "establish the average maximum number of passengers allowed per vehicle to provide a safe and comfortable ride." Each vehicle type in the MBTA fleet has a defined "policy capacity" and is published in the MBTA Blue Book;
- Crush Capacity refers to the higher load capacity of a vehicle and is calculated by adding the number of seated passengers plus 1.5 square feet per standing passenger (two square feet on buses). The MBTA Blue Book publishes the "crush capacity" for each vehicle type in the MBTA fleet.

The existing policy and crush capacities for the Orange Line is 131 passengers per car and 224 passengers per car, respectively. With a six-minute headway, six cars per train, and a peak hour on-time performance of 0.90 (for the month of November 2019), the existing policy and crush capacities for the morning and evening peak hours are 7,074 passengers per hour and 12,096 passengers per hour, respectively.

In the DEIR, it was assumed that by 2026, the MBTA will have added new train cars that will reduce the headways to 4.5 minutes instead of 6. Therefore, the future (no-build and build) policy and crush capacities for the morning and evening peak hours were 9,432 passengers per hour and 16,128 passengers per hour, respectively. However, since the Orange Line expansion is not guaranteed at this time, it is expected that the existing policy and crush capacities will remain at 7,074 passengers per hours and 12,096 passengers per hour, respectively.

With the addition of the Project generated Orange Line trips, the analysis shows there is negligible impact on all Orange Line loads entering and exiting Community College Station during the peak hours. During the busiest peak times, morning outbound and evening inbound, the Project adds fewer than four passengers per peak hour train. The Project will add 117 transit trips to the morning outbound volume, equating to approximately 3.25 passengers per train car. For the evening inbound peak hour, 130 Project trips will be using the Orange Line, equating to 3.61 passengers per train car.

2.4.2 Potential Transit Enhancements

The Proponent has identified several transit enhancements that could address potential impacts on transit service and infrastructure resulting from the Project's new density at full build out. These improvements would not only be beneficial for the Bunker Hill Project but would also enhance transit service for the wider Charlestown neighborhood. Potential enhancements include the following:

2.4.2.1 MBTA Bus Service

While the #92 and #93 MBTA Bus routes provide direct connections to Downtown Boston at Haymarket, they are subject to the constraints of traffic congestion and both the frequency and maintenance of service. As such, although they pass through the heart of the community, they do not provide a level of service equivalent to the Orange line subway service and require a second-seat ride to destinations beyond Haymarket.

The Proponent is committed to working with the BPDA/BTD and the MBTA to advance improvements in bus service, consistent with the MBTA's Better Bus Project and BTD's prioritization of bus service and infrastructure in the context of Complete Streets.

Community complaints have been expressed regarding service and overcrowding on the #93 MBTA Bus route, and there are a number of ways that the service might be improved in an effort to accomplish the goals of Bus Rapid Transit (BRT). These include the following:

- **Improved Peak Period Headways** - Overcrowding on the bus routes may result from inadequate frequency of service and difficulty in maintaining headways due to congestion and infrastructure deficiencies. Adding additional buses to reduce headways can address overcrowding issues as well as reducing wait-times for users at bus stops. However, it may be necessary for the MBTA to purchase (and store and maintain) additional buses to provide if sufficient buses are not already available or cannot be repurposed from underutilized routes. A potential approach would be to run a pilot study to test how increased service would benefit the route.
- **Alternate Bus Routes** - It is possible that alternate routing of the #93 MBTA Bus route could reduce the impact of congestion while keeping the route proximate to the Project. Medford Street (currently used as a snow route) would be a potential alternate route that has stops adjacent to the Bunker Hill Project. If increased frequency is introduced, the route could be alternated between the two corridors during peak periods. Again, such a change could be tested as a pilot study.
- **Dedicated Bus Lanes** - The right-of-way constraints in the Bunker Hill Street corridor are a limiting factor in allocating parts of the cross section to dedicated use by buses throughout the corridor. However, there may be opportunities to provide bus lanes on certain sections, depending on whether on-street parking or curbside uses need to be maintained and accommodating the needs of bicycles and pedestrians. It should be noted that the #92 and #93 MBTA Bus routes will of course benefit from the bus lane that will be incorporated in the new North Washington Street bridge.
- **Peak Period Bus Lanes** - A simple alternative to full-time dedicated bus lanes is the introduction of bus lanes that are restricted to use by buses only during peak period. This can be accomplished more easily by eliminating curbside uses such as parking during the peak period, which is then restored for the remainder of the day outside peak periods. This approach lends itself well to peak period – peak direction application to accommodate inbound buses during the morning peak and outbound buses during the evening peak.
- **Bus Priority Signalization** -This approach may not be beneficial in the Bunker Hill Street corridor as the intersections are currently un-signalized, however it may be beneficial to consider such signalization at the Chelsea Street intersection with Rutherford Avenue.
- **In-Lane Bus Stops** - This design for bus stops involves the extension of the curb out to the edge of the travel lane to eliminate the need for the bus to pull over into the stop. It has the benefit of making it easier for boarding and alighting passengers, as well as providing an expanded waiting area with better visibility. While the bus will stop following through-traffic during its dwell-time at the stop, in practice this disruption frequently occurs because many buses do not pull over to traditional bus stops and partially block

the travel lane in any event. It is also partially off-set by a reduction in dwell time because the boarding and alighting for passengers is reduced.

- **Bus Stop Amenities** - In addition to providing bus shelters and seating, a real-time transit display is a helpful and convenient amenity at bus stops.
- **Complementary Pedestrian Accommodations** - Pedestrian (and bicycle) accommodations are an important supporting component to bus service. These include pedestrian movement along the street corridor as well as crossing the street. Ideally, bus stops should be located downstream of intersections and/or crosswalks so that passengers alighting from the bus will generally walk to the back of the bus to cross the street and therefore avoid being obscured from car drivers view when emerging at the front of the bus.

2.4.2.2 Shuttle Service

Partners Healthcare operates several shuttle routes for employees, patients and visitors to and from Charlestown. Routes between the main MGH campus and the Charlestown Navy Yard and an express shuttle between Spaulding Rehabilitation Hospital and North Station operate every 10-15 minutes during rush hour with primary utilization as commuter access to Partners' facilities in Charlestown. These routes run along Chelsea Street past the eastern edge of the Project site. Additionally, Partners Healthcare operates a route for employees, patients and visitors between the MGH main campus and the New Health Center on Tufts Street – a location in the heart of the Project – several times a day during off-peak hours. The Proponent will collaborate with Partners Healthcare to explore potential opportunities to leverage existing capacity in these shuttle routes (a commuter from Charlestown to North Station or MGH would be a reverse-commute for these shuttles). There may be opportunities to incorporate or expand the existing shuttle services to serve the Bunker Hill Project and other parts of the neighborhood. It is expected that these shuttle bus services will benefit from the new bus priority lane on the new North Washington Street bridge, making it easier to maintain headways and reduce travel time.

Another opportunity to improve transit connectivity would be service between Charlestown and major employment and educational opportunities in East Cambridge, Kendall Square (with Red line connection), MIT and University Park. Ridership for such a shuttle route may not make it viable on its own. However, the EZ Ride shuttle operated by the Charles River Transportation Management Association (TMA) already provides service in this corridor connecting it to North Station via Monsignor O'Brien Highway and Cambridge Crossing. There may be opportunities to connect with or expand this service to cross into Charlestown via the Gilmore Bridge; reaching Main Street or even the Navy Yard could be beneficial not only to Charlestown residents and the Project, but also to the corporate sponsors of the EZ Ride.

The Proponent has explored the feasibility of shuttle service connecting the Bunker Hill Project with the Community College Orange Line station, a connection that is not currently served by transit. The Project site is an approximately 20-minute walk to this station, with the last 500 feet passing parking lots and crossing Rutherford Ave. This walk is particularly unpleasant during inclement weather. With convenient and frequent bus service on the #93 MBTA Bus route between the Project and Sullivan Square – the outbound direction runs

every 7-8 minutes during rush hour with significant excess capacity – a limited shuttle between the site and the Community College Station is unlikely to be a convenient alternative, despite arriving one Orange Line stop closer to downtown. In fact, since a private shuttle providing this connection is likely to be caught in rush hour traffic, it is unlikely to be capable of providing more than two to three trips per hour, providing a marginally more convenient service for a limited number of individuals per day. Before adding another vehicle, the Proponent supports working with existing service to increase utilization of existing capacity and will charge the Project's transportation coordinator with promoting these opportunities.

An important consideration in implementing any shuttle service, including the above opportunities, is the mechanism by which they are initiated, managed and funded. Often the demand by individual projects or entities is insufficient to make them viable, at least with a frequency that is sufficient to make the service attractive for users. In other parts of the Metropolitan area this obstacle is often overcome by collaboration between stakeholders to accomplish an economy of scale to warrant and support service. Such collaboration is typically accomplished through a Transportation Management Association (TMA) which manages the shuttles and through which stakeholders fund the service. The Charles River TMA, the Seaport TMA and MASCO (Medical Academic and Scientific Community Organization) in the Longwood area are good examples of TMAs that manage shuttle service for their members.

Although the A Better City (ABC) is the corresponding TMA in Downtown Boston, it does not operate shuttles in Charlestown. As discussed in this Chapter, an important component of the Transportation Demand Management (TDM) plan for the Project is the Proponent's commitment to joining and/or coordinating with corporate partners in Charlestown to establish a TMA to facilitate access by Project residents and employees to other TDM programs and alternative transportation opportunities.

Once the Project reaches the later phases of construction, where the residential density can potentially support the need for a shuttle during the peak commuting hours, the Proponent will study the feasibility of a coordinated/consolidated shuttle service with area stakeholders.