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Transportation

VHB, on behalf of CDNV, has prepared a detailed Traffic Impact and Access Study for the proposed 5 Middlesex Avenue mixed-use redevelopment (the “Project”). The Project will be developed within a combined 9.38-acre site bounded by Mystic Avenue, Foley Street, Grand Union Boulevard, and Revolution Drive (the “Site”). As discussed in detail in Chapter 1, the development program will include a mixture of residential, commercial, and retail uses.

The proposed redevelopment will be undertaken over an extended period of time, with the initial development consisting of 329 residential units with 4,140 square feet (sf) ground floor retail space to be located within Block 23 at the northwest corner of Grand Union Boulevard and Revolution Drive.

The Study quantifies existing and projected future traffic conditions with and without the Project. Based on the analysis of the future traffic conditions, the proposed Project is not expected to have a significant impact on the study area locations.

5.1 Project Description

As discussed in Chapter 1, the CDNV development proposal for the Project Site involves the redevelopment of approximately 9.38 acres of land within the Assembly Square District of Somerville, Massachusetts. In total, approximately 1.45-million sf of mixed development (including the existing office building on the property) will be provided on the Project Site.

The Project is based on three key principles that are consistent with the City’s longstanding goals for the Assembly Square Mixed Use District (the “District”):

- Create a balanced mixed-use program;
- Pedestrian & transit-oriented planning and design; and
- Focus development around new pedestrian-oriented public places.

A summary of the uses and associated building areas evaluated as part of the Transportation Analysis is provided in Table 5-1. The building areas shown in Table 5-1 represent the total building areas for each block, including both leasable area, and “back-of-house” supporting space such as lobbies, mechanical rooms, etc.

Table 5-1 Development Program

Analysis Condition	Residential	Office ^a	Research & Development ^a	Retail/ Restaurant space ^b	Fire Station
Initial development					
Block 24 (existing)*	0 units	137,000 sf	0 sf	25,000 sf	0 sf
<u>Block 23</u>	<u>329 units</u>	<u>0 sf</u>	<u>0 sf</u>	<u>4,140 sf</u>	<u>0 sf</u>
Subtotal	329 units	137,000 sf	0 sf	29,140 sf	0 sf
Subsequent development					
Block 21	0 units	373,500 sf	272,500 sf	20,000 sf	16,000 sf
Block 24	0 units	25,000 sf	0 sf	-25,000 sf	0 sf
Block 25 ^c	160 units	0 sf	0 sf	3,000 sf	0 sf
<u>Block 26</u>	<u>0 units</u>	<u>77,000 sf</u>	<u>63,000 sf</u>	<u>0 sf</u>	<u>0 sf</u>
Subtotal	489 units	475,500 sf	335,500 sf	-2,000 sf	0 sf
Total Full Build-out	489 units	612,500 sf	335,500 sf	27,140 sf	16,000 sf
a	A total of 948,000 sf of building space will be devoted to office or research and development space. The exact breakdown for between these two uses is based on current development plans, but may change over time based on market conditions and tenant needs.				
b	Block 24 currently contains a health club facility oriented towards existing Assembly Square workers and visitors. While there are no plans for this use to vacate the site, it was assumed that this 25,000 sf could be converted to office space under future conditions so as to consider a "worst-case" analysis.				
c	The traffic analysis was based on an original development program including 167 units for Block 25. As this total has been reduced, the subsequent trip generation estimates for the 489-unit residential component are conservatively high as the analysis was based on 496 units.				

The following sections provide a general summary of the planned development within each of the blocks making up the overall Project Site.

Block 21

Block 21 is located in the northwest corner of the Site, bordered by Middlesex Avenue to the west, Foley Street to the north, and the proposed "Road K" to the east. In total, 646,000 sf of office/research and development space will be provided within this parcel, with 373,500 sf assumed to be devoted to office, and the remaining 272,500 sf used as laboratory space. Ground floor retail/restaurant space also will be provided oriented towards Foley Street and Road K, including 17,000 sf of retail space and 3,000 sf of restaurant space. Block 21 also will include a new fire station serving the Assembly Square district. This amenity will be located at the northwest corner of the building adjacent to the Foley Street/Middlesex Avenue intersection. Block 21 also will feature parking for 1,352 vehicles, including one sub-grade level within the parking garage.

Block 23

The initial development of the Project will occur within Block 23. This new building will be bound by Grand Union Boulevard to the east, Road K to the west, and Road L and Revolution Drive to the north and south, respectively. A total of 329 residential units are proposed within Block 23, along with 4,140 sf of street-level restaurant use. The parking needs for this parcel will be accommodated by 197 structured parking spaces.

Block 24

The existing Block 24 building currently contains 162,000 sf of space mostly oriented towards general office uses. However, this building also includes a 25,000 sf Assembly Sports Club fitness club. It is expected that this facility will remain in place as part of the initial Site redevelopment, and likely also as part of the long-term use of the Site. However, to provide for a “worst-case” analysis in terms of peak-hour office traffic generation, the transportation analysis was conducted assuming that this area potentially could be converted to office space at some point in the future. Under that scenario, the entirety of the 162,000-sf building would be used as office space. The parking needs for this block will be satisfied by the 1,352-space parking garage within Block 21.

Block 25

Block 25 is located in the center of the Site, just south of Block 21 and west of and adjacent to Road K. This building will include 187,000 sf of building space mostly devoted to the proposed 160 residential units. The building also will include 3,000 sf of ground-floor retail space. A single level of underground parking including 110 spaces also will be provided within Block 25 for this development.

Block 26

Block 26 will be located at the northeast corner of the Mystic Avenue/Revolution Drive intersection and also will have frontage on the newly created Road K. The planned development within this block will include 140,000 sf of commercial space. For the purpose of this analysis, it is assumed that 77,000 sf of that area will be used for office, with the remaining 63,000 sf used for research and development space. Parking for this block will be provided within the Block 21 garage, along with an additional 36 surface parking spaces provided between Block 24 and Block 26.

5.2 Transportation Analysis Methodology

VHB prepared the traffic assessment in three stages. The first stage involved an assessment of existing traffic conditions within the Project study area including an inventory of existing roadway geometry; observations of traffic flow, including daily and peak period traffic counts; and a review of vehicular crash data.

The second stage of the study established the framework for evaluating the transportation impacts of the proposed Project. Specific travel demand forecasts for the Project were assessed along with future traffic demands on the study area

roadways due to projected background traffic growth and other proposed area developments that may occur independent of the proposed development. The year 2024, a seven-year time horizon, was selected as the design year for analysis for the preparation of this traffic impact and access assessment in accordance with the standard industry practices in Massachusetts.

The third and final stage of the study discusses possible measures to improve existing and future traffic operations in the area and offsetting the traffic-related impacts associated with the development of the proposed Project.

As part of this evaluation, VHB considered traffic conditions under the following the following conditions:

- › **2017 Existing conditions** - This scenario considers the existing roadway infrastructure and currently observed traffic volumes.
- › **2024 No-Build conditions** – The 2017 observed volumes will be adjusted using an annual growth factor to reflect anticipated future regional traffic growth. Site-specific traffic generated by other definitively-known development projects that could impact traffic conditions within the study area also will be added. Traffic generated by these projects was obtained from available project traffic studies, or estimated as part of this evaluation. The roadway infrastructure analyzed includes mitigation planned by other projects and/or municipal or state undertakings that are planned to be completed within the analysis horizon.
- › **2024 Full Project Build conditions** - This scenario involves adding the additional Project-Site-generated traffic being added to the 2024 No-Build volumes.

The capacity analyses will be conducted using the methodology presented in the 2010 Highway Capacity Manual or other approved procedures using Synchro™ software.

5.3 Study Area

Based on VHB's knowledge of the area transportation network and the operational characteristics of the Project, the following intersections and their approach roadways were included in the assessment. The following study area intersections were included in the study area for this assessment:

Somerville

- › Middlesex Avenue at Foley Street
- › Mystic Avenue (Route 38) at Middlesex Avenue
- › Mystic Avenue (Route 38) at Revolution Drive
- › Grand Union Boulevard at Foley Street
- › Grand Union Boulevard at Revolution Drive
- › Foley Street at Site Driveway

- › Foley Street at K-Mart Driveway / Driveway
- › Revolution Drive at Site Driveway / Home Depot Driveway
- › Fellsway (Route 28) at Grand Union Boulevard
- › Fellsway (Route 28) at Middlesex Avenue
- › Mystic Avenue (Route 38) at Wheatland Street / Bailey Road
- › Fellsway (Route 28) SB at Bailey Road (Route 38) / I-93 Southbound On-Ramp
- › Fellsway / McGrath Highway (Route 28) SB at Mystic Avenue (Route 38)
- › Mystic Avenue (Route 38) at McGrath Highway (Route 28) NB Off-Ramp
- › I-93 Southbound On-Ramp at Mystic Avenue U-Turn
- › McGrath Highway (Route 28) at Broadway
- › McGrath Highway (Route 28) at Pearl Street
- › Mystic Avenue (Route 38) at I-93 Southbound Off-Ramp U-Turn
- › Mystic Avenue (Route 38) at Grand Union Boulevard / Lombardi Way
- › Lombardi Way at I-93 Southbound Off-Ramp
- › Broadway at Lombardi Way / Mt. Vernon Street

Medford

- › Wellington Circle East
- › Wellington Circle West
- › Wellington Circle North
- › Fellsway (Route 28) at Riverside Avenue

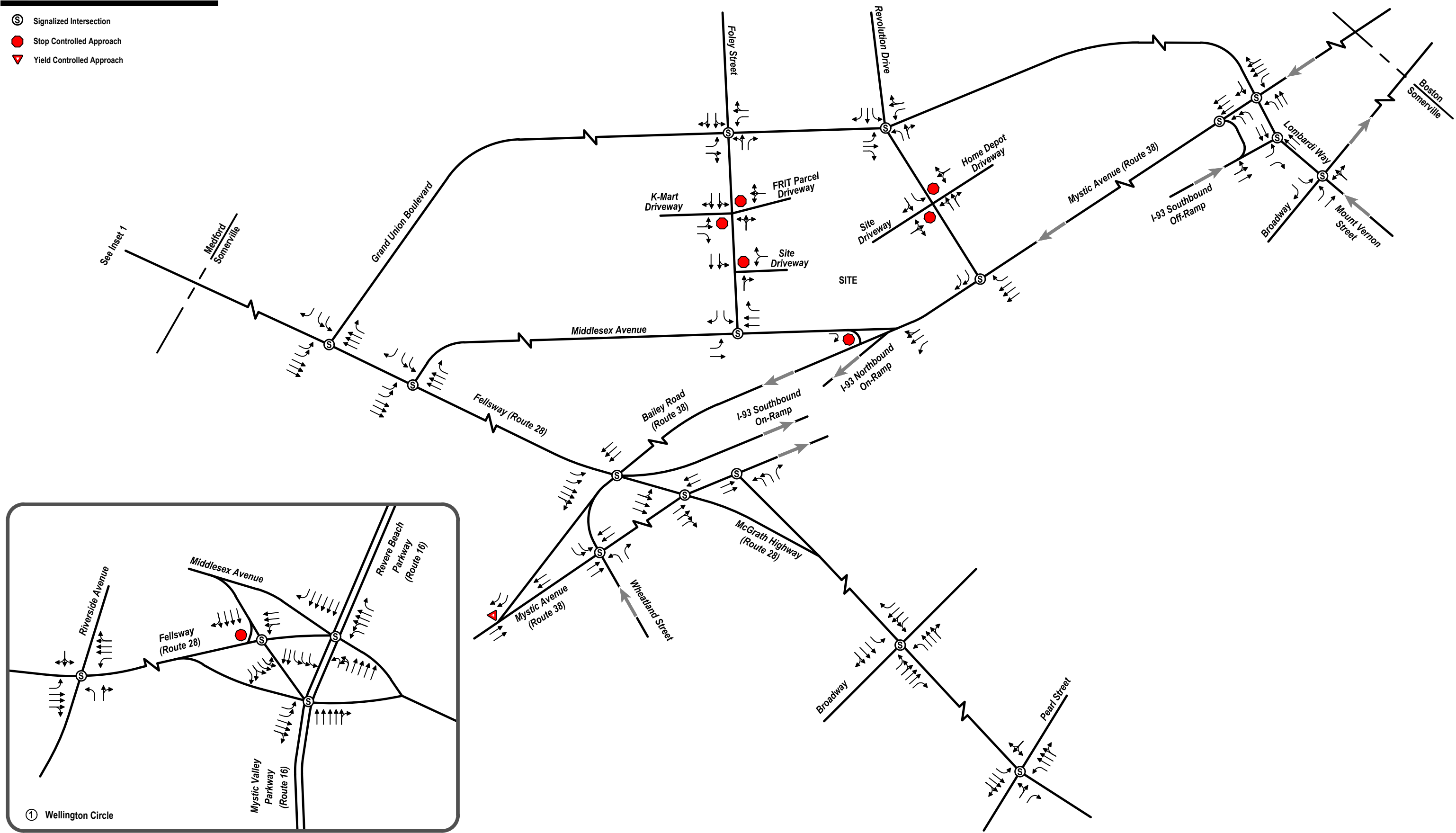
The study area intersections listed above are highlighted in Figure 5-1, and the observed intersection geometry and travel-lane use area shown in Figure 5-2.

Roadway and Intersection Geometry

Descriptions of the study area roadways and intersections are provided below, including descriptions of the existing lane configurations, traffic control at the study intersections, the roadway jurisdiction in this area, and existing pedestrian and bicycle infrastructure.



Figure 5.1



Not to Scale



Study Area Intersections
Lane Geometry and Traffic Control
5 Middlesex Avenue
Somerville, Massachusetts

Figure 5.2

Study Area Roadways

Middlesex Avenue

Middlesex Avenue runs between Fellsway (Route 28) and Mystic Avenue (Route 38). It is classified as an urban minor arterial roadway and is under local City of Somerville jurisdiction. Middlesex Avenue runs in a generally north/south direction and consists of two travel lanes in the northbound direction and one travel lane in the southbound direction between Mystic Avenue (Route 38) and Foley Street and one travel lane in each direction between Foley Street and Fellsway (Route 28). Exclusive turn lanes are provided at all major intersections. The posted speed limit on the roadway is 30 mph. On-street parking is provided on both sides of the roadway between Foley Street and Fellsway (Route 28), and on the southbound side of the roadway from Foley Street to Mystic Avenue (Route 38). Sidewalks are provided along both sides of the roadway and crosswalks are provided at major intersections. Sharrows are provided along the entire roadway in both directions. Land use along Middlesex Avenue is mainly commercial

Mystic Avenue (Route 38)

Mystic Avenue (Route 38) runs between Grand Union Boulevard and Wheatland Street within the study area. Mystic Avenue (Route 38) within the study area consists of two different segments separated by I-93: a two-way segment from Wheatland Street to the I-93 Southbound On-Ramp and a one-way segment northwest-bound from Grand Union Boulevard to the I-93 Northbound On-Ramp. The one-way segment of Mystic Avenue (Route 38) transitions into Bailey Road and connects to the other segment of Mystic Avenue (Route 38). The roadway is classified as an urban minor arterial roadway and is under mostly MassDOT jurisdiction within the study area. Mystic Avenue (Route 38) runs in a northwest/southeast direction. Mystic Avenue (Route 38) northwest-bound consists of three travel lanes from Grand Union Boulevard to Middlesex Avenue. At Middlesex Avenue, the left-lane diverges onto the I-93 Northbound On-Ramp and the remaining two lanes continue straight onto Bailey Road. Mystic Avenue (Route 38) southeast-bound consists of two travel lanes between Wheatland Street and the McGrath Highway Northbound Off-Ramp. Exclusive turn lanes are provided at major intersections. There is no posted speed limit within the study area. Sidewalks are provided along the west side of Mystic Avenue (Route 38) southeast-bound between Wheatland Street and the I-93 Southbound On-Ramp and both sides of Mystic Avenue (Route 38) northwest-bound for most of the roadway. Crosswalks are provided at major intersections. MBTA bus routes 92 and 95 travel along Mystic Avenue (Route 38) with route 92 traveling on the roadway between Grand Union Boulevard and Revolution Drive. Land use along Mystic Avenue (Route 38) is a mixture of commercial and residential.

Grand Union Boulevard

Grand Union Boulevard runs from Fellsway (Route 28) to Mystic Avenue (Route 38). It is classified as an urban collector roadway and is under local City of Somerville

jurisdiction. Grand Union Boulevard runs in a generally north/south direction and consists of one travel lane from Mystic Avenue (Route 38) to Great River Road and two travel lanes from Great River Road to Fellsway (Route 28). Exclusive turn lanes are located at major intersections. There is no posted speed limit within the study area. On-street parking is provided on both sides from Revolution Drive to Great River Road. Sidewalks are provided along both sides of the roadway and crosswalks are provided at major intersections. Bike lanes are provided in both directions from Mystic Avenue (Route 38) to Great River Road. MBTA bus routes 90 and 92 run along Grand Union Boulevard. Land use along Grand Union Boulevard is mainly commercial.

Fellsway (Route 28)

Fellsway (Route 28) runs from Riverside Avenue to Mystic Avenue (Route 38) within the study area. South of Mystic Avenue, Route 28 continues through the study area as McGrath Highway. Fellsway (Route 28) is classified as an urban principal arterial roadway and is mostly under Department of Conservation and Recreation jurisdiction, except for the bridge over the Mystic River and the segment between Puritan Road and Mystic Avenue (Route 38), which is under MassDOT jurisdiction. Fellsway (Route 28) runs in a generally north/south direction and consists of three travel lanes for most of the roadway, except for the northbound direction between Wellington Circle and McDonald Road, which is two lanes in order to accommodate on-street parking. The northbound and southbound travel lanes are separated by an approximately 8-35-foot-wide median for most of the roadway through the study area. Exclusive turn lanes are located at major intersections. The posted speed limit on the roadway is 35 mph. Sidewalks are provided along both sides of the roadway and crosswalks are provided at major intersections. MBTA bus routes 100, 108, 134, and 710 travel on Fellsway (Route 28) from Revere Beach Parkway to Riverside Avenue. Bus route 90 travels on Fellsway (Route 28) from Grand Union boulevard to Revere Beach Parkway. Land use along Fellsway (Route 28) is a mixture of commercial, residential, and recreational.

McGrath Highway (Route 28)

McGrath Highway (Route 28) runs from Mystic Avenue (Route 38) to Pearl Street within the study area. North of Mystic Avenue (Route 38), Route 28 continues through the study area as Fellsway. McGrath Highway (Route 28) is classified as an urban principal arterial roadway and is under MassDOT jurisdiction. McGrath Highway (Route 28) runs in a generally north/south direction and consists of three travel lanes for most of the roadway. The northbound and southbound travel lanes are separated by a 4-8-foot-wide median for most of the roadway through the study area. Exclusive turn lanes are located at major intersections. The posted speed limit at Pearl Street for the southbound lanes is 25 mph. Sidewalks are provided along both sides and crosswalks are provided at major intersections. An overhead pedestrian walkway is provided across McGrath Highway (Route 28) at Otis Street. Land use is a mixture of commercial, residential, and recreational.

Study Area Intersections

Middlesex Avenue at Foley Street

Middlesex Avenue and Foley Street form a three-way signalized intersection. Middlesex Avenue runs north/south and Foley Street intersects from the east. The Middlesex Avenue northbound approach consists of two through lanes and an exclusive right-turn lane, while the southbound approach consists of one through lane and an exclusive left-turn lane. The Foley Street westbound approach consists of an exclusive left-turn lane and exclusive right-turn lane. Sidewalks are provided on both sides of all approaches. Crosswalks are provided across the Foley Street westbound approach and Middlesex Avenue southbound approach. On-street parking is provided on the west side on Middlesex Avenue and the south side of Foley Street. A bike lane is located on the Foley Street eastbound approach. Sharrows are provided on all approaches. Land use around the intersection is commercial.

Mystic Avenue (Route 38) at Middlesex Avenue

Mystic Avenue (Route 38) and Middlesex Avenue form a three-way unsignalized intersection. Mystic Avenue (Route 38) runs one-way northwestbound and Middlesex Avenue intersects from the north. The approaching lanes and the departing lanes on Middlesex Avenue are divided by a center island approximately 290 feet across with southbound Middlesex Avenue traffic entering Mystic Avenue (Route 38) via a U-turn slip lane. The Mystic Avenue (Route 38) approach consists of three travel lanes. The left lane on Mystic Avenue separates approximately 150 feet past the departing lane of Middlesex Avenue to connect with I-93 Northbound On-Ramp. The Middlesex Avenue departing roadway consist of two travel lanes and the approaching roadway onto Mystic Avenue (Route 38) consists of one travel lane. Sidewalks are provided on the east side of Mystic Avenue (Route 38) and Middlesex Avenue and through the center island that separates the Middlesex Avenue approaching and departing lanes. A crosswalk is provided across the Middlesex Avenue departing lanes. A bus stop for MBTA route 95 is located approximately 90 feet prior to the Middlesex Avenue departing roadway on Mystic Avenue (Route 38). Land use around the intersection is mostly commercial.

Mystic Avenue (Route 38) at Revolution Drive

Mystic Avenue (Route 38) and Revolution Drive form a three-way signalized intersection. Mystic Avenue (Route 38) runs one-way northwestbound and Revolution Drive intersects from the north. The Mystic Avenue northwestbound approach consists of three through lanes and an exclusive right-turn lane. The Revolution Drive approaching and departing roadways are separated by a median approximately 50 feet wide. The Revolution Drive approaching roadway consists of two exclusive right-turn lanes and the departing roadway consists of two travel lanes. Sidewalks are provided along the northeast side of Mystic Avenue (Route 38), both sides of Revolution Drive, and across the median separating the approaching

and departing roadways on Revolution Drive. Crosswalks are provided across the approaching and departing roadways of Revolution Drive. Land use around the intersection is mostly commercial.

Grand Union Boulevard at Foley Street

Grand Union Boulevard and Foley Street form a four-way signalized intersection. Grand Union Boulevard runs north/south and Foley Street runs east/west. The Grand Union Boulevard northbound and southbound approaches consist of a shared through/right-turn lane and an exclusive left-turn lane. The Foley Street eastbound approach consists of a shared through/left-turn lane and an exclusive right-turn lane, while the westbound approach consists of two general purpose lanes. The intersection was signalized in Fall 2017. Sidewalks are provided along both sides of all approaches. Crosswalks are provided across all approaches. On-street parking is provided on both sides of Grand Union Boulevard. MBTA bus stops for routes 90 and 92 are located approximately 100 feet south of Foley Street on either side of Grand Union Boulevard. Bike lanes are provided on both sides of Grand Union Boulevard and sharrows are provided on Foley Street. Land use around the intersection is mostly commercial.

Grand Union Boulevard at Revolution Drive

Grand Union Boulevard and Revolution Drive form a four-way signalized intersection. Grand Union Boulevard runs north/south and Revolution Drive runs east/west. The Grand Union Boulevard northbound approach consists of an exclusive left-turn lane and a shared through/right-turn lane, while the southbound approach consists of an exclusive left-turn lane, a through lane, and an exclusive right-turn lane. The Revolution Drive eastbound approach consists of an exclusive left-turn lane and a shared through/right-turn lane, while the westbound approach consists of a shared through/left-turn lane, a through lane, and a channelized right-turn lane. Sidewalks are provided along both sides of all approaches. Crosswalks are provided across all approaches. Bike lanes are provided on both sides of Grand Union Boulevard and on the Revolution Drive eastbound approach. Sharrows are provided on all approaches. Land use around the intersection is mostly commercial.

Foley Street at Site Driveway

Foley Street and the Site Driveway form a three-way unsignalized intersection. Foley Street runs east/west and the Site Driveway intersects from the south. The Foley Street eastbound approach consists of one travel lane and the westbound approach consists of two travel lanes. The Site Driveway northbound approach consists of one general purpose lane and is under stop control. Sidewalks are provided on both sides of Foley Street. On-street parking is provided on the south side of Foley Street. A bike lane is provided on the north side of Foley Street. Sharrows are provided on the south side of Foley Street. Land use around the intersection is mostly commercial.

Foley Street at K-Mart Driveway / Driveway

Foley Street and two parking lot driveways form a four-way unsignalized intersection. Foley Street runs east/west and the driveways intersect from the north and the south. The driveway to the north provides access to the parking lot for K-Mart and Assembly Square Marketplace and the driveway to the south provides access to a small parking lot for the Assembly Row leasing office. The Foley Street eastbound approach consists of one travel lane and the westbound approach consists of two travel lanes. The northbound driveway consists of one general purpose lane, while the southbound driveway consists of an exclusive right-turn lane and a through lane. The southbound driveway is under stop control and the northbound driveway is unsigned but operates under stop control. Sidewalks are provided along both sides of Foley Street and the west side of the southbound driveway. On-street parking is provided on the south side of Foley Street eastbound approach. A bike lane is provided on the north side of Foley Street. Sharrows are provided on the south side of Foley Street. Land use around the intersection is mostly commercial.

Revolution Drive at Site Driveway / Home Depot Driveway

Revolution Drive and two parking lot driveways form a four-way unsignalized intersection. The driveway to the north provides access to site and the driveway to the south provides access to the parking lot for Home Depot. Revolution Drive runs northeast/southwest and the driveways intersect from the northwest and southeast. The Revolution Drive northeast-bound approach consists of two travel lane, while the southwest-bound approach consists of one travel lane and an exclusive left-turn lane. The northwest-bound and southeast-bound driveways consist of one general purpose lane. Sidewalks are provided along both sides of Revolution Drive. Sharrows are provided on Revolution Drive. Land use around the intersection is mostly commercial.

Fellsway (Route 28) at Grand Union Boulevard

Fellsway (Route 28) and Grand Union Boulevard form a three-way signalized intersection. Fellsway (Route 28) runs north/south and Grand Union Boulevard intersects from the east. The Fellsway (Route 28) northbound approach consists of three through lanes and a channelized right-turn lane, and the southbound approach consists of three through lanes and two channelized left-turn lanes. The Grand Union Boulevard westbound approach consists of two exclusive left-turn lanes and a channelized right-turn lane. Sidewalks are provided on both sides of all approaches. Crosswalks are provided across the Grand Union Boulevard approach and the Fellsway (Route 28) southbound approach. Land use around the intersection is a mixture of commercial, residential, and recreational.

Fellsway (Route 28) at Middlesex Avenue

Fellsway (Route 28) and Middlesex Avenue form a three-way signalized intersection. Fellsway (Route 28) runs north/south and Middlesex Avenue approaches from the

east. The Fellsway (Route 28) northbound approach consists of three through lanes and a channelized right-turn lane, and the southbound approach consists of three through lanes and two channelized left-turn lanes. The Middlesex Avenue westbound approach consists of two exclusive left-turn lanes and a channelized right-turn lane. Sidewalks are provided on both sides of all approaches. Crosswalks are provided across the Middlesex Avenue approach and the Fellsway (Route 28) southbound approach. Land use around the intersection is a mixture of commercial and residential.

Mystic Avenue (Route 38) at Wheatland Street / Bailey Road

Mystic Avenue (Route 38), Wheatland Street, and Bailey Road form a four-way signalized intersection. It is part of the larger Route 28 / Route 38 / I-93 interchange. Mystic Avenue (Route 38) runs northwest/southeast, Wheatland Street approaches from the southwest, and Bailey Road approaches from the northeast. The Mystic Avenue (Route 38) northwest-bound and southeast-bound approaches consist of two general purpose lanes. The Wheatland Street northeast-bound approach consists of one general purpose lane, and the Bailey Road southwest-bound approach consists of two general purpose lanes. Bailey Road and Wheatland Street are both one-way approaching the intersection. Sidewalks are provided on both sides of all approaches, except the southeast side of the Bailey Road southwest-bound approach. Crosswalks are provided across the Mystic Avenue (Route 38) southeast-bound approach and the Bailey Road southwest-bound approach. On-street parking is provided on both sides of the Wheatland street northeast-bound approach. An MBTA bus stop for route 95 is located west of Wheatland Street on the southwest corner of the Mystic Avenue (Route 38) southeast-bound approach. Land use around the intersection is a mixture of commercial and residential.

Fellsway (Route 28) SB at Bailey Road (Route 38) / I-93 Southbound On-Ramp

Fellsway (Route 28) Southbound, Bailey Road, and the I-93 Southbound On-Ramp form a five-way signalized intersection. It is part of the larger Route 28 / Route 38 / I-93 interchange. Fellsway (Route 28) is one-way running southbound, Bailey Road is one-way running west, and I-93 Southbound On-Ramp is one-way running southeast departing the intersection. Northbound traffic on Fellsway (Route 28) travels through a tunnel below the intersection. The Fellsway (Route 28) southbound approach consists of two channelized left-turn lanes onto the I-93 Southbound On-Ramp, three through lanes, and a channelized right-turn lane. The Bailey Road westbound approach consists of two travel lanes. Sidewalks are provided on all corners. Crosswalks are provided across all approaches except across the Fellsway (Route 28) southbound travel lanes south of the intersection. Land use around the intersections is a mixture of commercial and residential.

Fellsway / McGrath Highway (Route 28) SB at Mystic Avenue (Route 38)

Mystic Avenue (Route 38) and Fellsway / McGrath Highway (Route 28) Southbound form a four-way signalized intersection. It is part of the larger Route 28 / Route 38 /

I-93 interchange. Fellsway (Route 28) Southbound is one-way approaching the intersection from the north and McGrath Highway (Route 28) Southbound is one-way departing the intersection to the south. Northbound traffic on Fellsway / McGrath Highway (Route 28) travels through a tunnel below the intersection. Mystic Avenue (Route 38) runs east/west with an approximately 20-foot-wide median. The Fellsway (Route 28) southbound approach consists of three general purpose lanes. The Mystic Avenue (Route 38) eastbound approach consists of a through lane, a shared through-right-turn lane, and an exclusive right-turn lane. The Mystic Avenue (Route 38) westbound approach consists of two through lanes and right-turns are prohibited. Sidewalks are provided on the east side of Fellsway (Route 28) southbound approach, west side of the McGrath Highway southern departing lanes, the south side of Mystic Avenue (Route 38) west of the intersection, and in the median of Mystic Avenue (Route 38) east of the intersection. Crosswalks are provided across the Mystic Avenue (Route 38) westbound approach, the approaching lanes of the Mystic Avenue westbound approach, and across Fellsway / McGrath Highway (Route 28) through the center of the intersection connecting to sidewalks in the median of Mystic Avenue (Route 38). Land use around the intersection is a mixture of commercial and recreational.

Mystic Avenue (Route 38) at McGrath Highway (Route 28) NB Off-Ramp

Mystic Avenue (Route 38) and the McGrath Highway (Route 28) Northbound Off-Ramp form a three-way signalized intersection. It is part of the larger Route 28 / Route 38 / I-93 interchange. Mystic Avenue (Route 38) is two-way west of the McGrath Highway Northbound Off-Ramp with an approximately 20-foot-wide median and one-way departing the intersection east of the McGrath Highway Northbound Off-Ramp. The McGrath Highway (Route 28) northbound approach consists of two left-turn lanes and a channelized right-turn lane. The Mystic Avenue (Route 38) eastbound approach consists of two through lanes. Sidewalks are provided on the south side of Mystic Avenue (Route 38) east of the intersection, in the median of Mystic Avenue (Route 38) west of the intersection, and on the east side of the McGrath Highway (Route 28) northbound channelized right-turn. Crosswalks are provided across the McGrath Highway (Route 28) northbound approach and the approaching roadway of the Mystic Avenue (Route 38) eastbound approach. Land use around the intersection is mostly commercial and recreational.

I-93 Southbound On-Ramp at Mystic Avenue U-Turn

The Mystic Avenue U-Turn intersects the I-93 Southbound On-Ramp from the north to form a three-way signalized intersection. It is part of the larger Route 28 / Route 38 / I-93 interchange. The I-93 Southbound On-Ramp is one-way running southeast-bound and the Mystic Avenue U-Turn is one-way running southbound. The I-93 Southbound On-Ramp southeast-bound approach consist of two through lanes and the Mystic Avenue U-Turn southbound approach consists of two left-turn lanes. There are no pedestrian facilities provided at this intersection.

It should be noted that the Mystic Avenue U-Turn was recently constructed and opened for traffic in the late Fall of 2017. Existing traffic counts were conducted prior to the opening of the roadway (as described in detail later in this report) and therefore the traffic counts did not include the intersection of the I-93 Southbound On-Ramp at Mystic Avenue U-Turn.

McGrath Highway (Route 28) at Broadway

McGrath Highway (Route 28) and Broadway form a four-way signalized intersection. McGrath Highway (Route 28) runs north/south and Broadway runs east/west. All approaches have medians separating the approaching and departing traffic. The McGrath Highway (Route 28) northbound and southbound approaches each consist of an exclusive left-turn lane, two through lanes, and a shared through/right-turn lane. The Broadway eastbound approach consists of an exclusive left-turn lane, a shared through/left-turn lane, two through lanes, and an exclusive right-turn lane. The Broadway westbound approach consists of an exclusive left-turn lane, a shared through/left-turn lane, a through lane, and a channelized right-turn lane. Sidewalks are provided on both sides of all approaches. Crosswalks are provided across all approaches. A MBTA bus stop for routes 89, 89/93, and 101 is located to the west of the intersection on the Broadway eastbound approach. Land use around the intersection is a mixture of commercial, residential, and recreational.

McGrath Highway (Route 28) at Pearl Street

McGrath Highway (Route 28) and Pearl Street form a four-way signalized intersection. McGrath Highway (Route 28) runs north/south and Pearl Street runs east/west. A median separated the approaching and departing traffic on McGrath Highway (Route 28). The McGrath Highway (Route 28) northbound and southbound approaches have an exclusive left-turn lane, two through lanes, and a shared through/right-turn lane. The Pearl Street eastbound approach consists of an exclusive right-turn lane and a shared through/left-turn lane, and the westbound approach has one general purpose lane. Sidewalks are provided on both sides of all approaches, except for the west side of McGrath Highway north of the intersection, and crosswalks are provided across all approaches. On-street parking is provided on both sides of the Pearl Street westbound approach. MBTA bus stops for route 80 are located on the south corner of the Pearl Street eastbound approach and the north corner of the Pearl street westbound approach. Sharrows are provided on Pearl Street. Land use around the intersection is commercial and residential.

Mystic Avenue (Route 38) at I-93 Southbound Off-Ramp U-Turn

Mystic Avenue (Route 38) and the I-93 Southbound Off-Ramp U-Turn form a three-way signalized intersection. Mystic Avenue (Route 38) is one-way westbound and the I-93 Southbound Off-Ramp U-Turn intersects from the south. The Mystic Avenue (Route 38) westbound approach consists of three through lanes and the U-Turn northbound approach consists of two left-turn lanes. Sidewalks are provided on

both sides of all approaches and no crosswalks are provided. Land use around the intersection is mostly industrial.

Mystic Avenue (Route 38) at Grand Union Boulevard / Lombardi Way

Mystic Avenue (Route 38), Grand Union Boulevard, and Lombardi Way form a four-way signalized intersection. Mystic Avenue (Route 38) is one-way running northwest-bound, Grand Union Boulevard intersects from the north, and Lombardi Way intersects from the south. The Mystic Avenue (Route 38) northwest-bound approach consists of an exclusive left-turn, two through lanes, and a shared through/right-turn lane. The Grand Union Boulevard southbound approach consists of one general purpose lane, and the Lombardi Way northbound approach consists of two through lanes and an exclusive left-turn lane. Sidewalks are provided on both sides of all approaches, except the west side of the Lombardi Way approach and the southwest side of the Mystic Avenue (Route 38) northwest-bound approach. Crosswalks are provided across the Mystic Avenue (Route 38) northwest-bound approach and the Grand Union Boulevard southbound approach. Sharrows are provided on Mystic Avenue and Lombardi Way. Land use around the intersections is mostly industrial.

Lombardi Way at I-93 Southbound Off-Ramp

Lombardi Way and the I-93 Southbound Off-Ramp form a three-way signalized intersection. Lombardi Way runs north/south and I-93 SB Off-Ramp intersects from the northwest. The Lombardi Way northbound and southbound approaches consist of two through lanes. The I-93 Southbound Off-Ramp consists of an exclusive left-turn lane and an exclusive right-turn lane. A Sidewalk is provided on the east side of Lombardi Way and no crosswalks are provided. Sharrows are provided on Lombardi Way in both directions. Land use around the intersection is mostly industrial.

Broadway at Lombardi Way / Mt. Vernon Street

Broadway, Lombardi Way, and Mt. Vernon Street form a four-way signalized intersection. Broadway runs east/west, Lombardi Way intersects from the north, and Mt. Vernon Street intersects from the south. The Broadway eastbound approach consists of an exclusive left-turn lane and a through lane, while the westbound approach is one-way departing the intersection. The Lombardi Way southbound approach consists of an exclusive left-turn lane and an exclusive right-turn lane. The Mt. Vernon northbound approach is one-way approaching the intersection and consists of one general purpose lane. Sidewalks are provided on both sides of all approaches, except the west side of the Lombardi Way southbound approach and the north side of Broadway east of the intersection. Crosswalks are provided across all approaches. On-street parking is provided on the west side of the Mt. Vernon Street northbound approach, both sides of the Broadway eastbound approach, and the south side of the Broadway westbound approach. An MBTA bus stop for routes 89, 90, 92, 93, and 101 is located just east of the intersection on the south side of Broadway. Bike lanes are provided on both sides of the Broadway eastbound

approach and departing the intersection on the Broadway westbound approach. Sharrows are provided on Lombardi Way. Land use around the intersection is mostly commercial and residential.

Wellington Circle East – *Medford*

Wellington Circle East is a five-way signalized intersection and consists of Fellsway (Route 28) running one-way northbound, Revere Beach Parkway (Route 16) intersecting from the east, Mystic Valley Parkway (Route 16) intersecting from the west, and Middlesex Avenue intersecting from the northeast and running one-way departing the intersection. It is part of the larger Route 16 / Route 28 intersection. The Fellsway (Route 28) northbound approach consists of an exclusive left-turn lane, a shared through/left-turn lane, a through lane, a shared through/slight-right-turn lane, and a channelized right-turn lane. The Mystic Valley Parkway (Route 16) eastbound approach consists of two channelized left-turn lanes and four through lanes. The Revere Beach Parkway (Route 16) westbound approach consists of a channelized right-turn lane and five through lanes. Sidewalks are provided on both sides of Revere Beach Parkway and Mystic Valley Parkway (Route 16), the east side of Fellsway (Route 28) south of the intersection, and the east side of Middlesex Avenue. Crosswalks are provided across the Revere Beach Parkway (Route 16) westbound approach and the Fellsway (Route 28) north- and southbound approaches. Land use around the intersection is a mixture of commercial and residential.

Wellington Circle West– *Medford*

Wellington Circle West is a five-way signalized intersection and consists of Fellsway (Route 28) running one-way southbound, Mystic Valley Parkway (Route 16) running east/west, and Middlesex Avenue intersecting from the northeast and running one-way approaching the intersection. It is part of the larger Route 16 / Route 28 intersection. The Fellsway (Route 28) southbound approach consists of two exclusive left-turn lanes, three through lanes, and a channelized right-turn lane. The Mystic Valley Parkway (Route 16) eastbound approach consists of five through lanes and a channelized right-turn lane, while the westbound approach consists of three channelized left-turn lanes and two through lanes. The Middlesex Avenue southwestbound approach consists of two exclusive left-turn lanes, a shared through/left-turn lane, and a through lane. Sidewalks are provided on both sides of Mystic Valley Parkway (Route 16), the west side of Fellsway (Route 28), and the northwest side of Middlesex Avenue. Crosswalks are provided across the Mystic Valley Parkway (Route 16) eastbound approach, the Fellsway (Route 28) northbound and southbound approaches, and the Middlesex Avenue southwest-bound approach. Land use around the intersection is a mixture of commercial and recreational.

Wellington Circle North– Medford

Wellington Circle North is a four-way signalized intersection and consists of Fellsway (Route 28) running one-way northbound and Middlesex Avenue running one-way southwest-bound. It is part of the larger Route 16 / Route 28 intersection. The Fellsway (Route 28) northbound approach consists of three through lanes. The Middlesex Avenue southwest-bound approach consists of four through lanes and a channelized right-turn lane. Sidewalks are provided on the east side of Fellsway (Route 28) north of the intersection and the northwest side of Middlesex Avenue. Crosswalks are provided across the Fellsway (Route 28) southbound approach and the Middlesex Avenue southwest-bound channelized right-turn lane. Land use around the intersection is a mixture of commercial and residential.

Fellsway (Route 28) at Riverside Avenue – Medford

Fellsway (Route 28) and Riverside Avenue form a four-way signalized intersection. Fellsway (Route 28) runs north/south and Riverside Avenue runs east/west. The Fellsway (Route 28) northbound and southbound approaches consist of an exclusive left-turn lane, two through lanes, and a shared through/right-turn lane. The Riverside Avenue eastbound approach consists of two general purpose lanes, while the westbound approach consists of one general purpose lane. Sidewalks are provided along both sides of all approaches and crosswalks are provided across all approaches. MBTA bus stops for routes 134 and 710 are located on both sides of Riverside Avenue just to the west of the intersection. An MBTA bus stop for route 108 is located just to the east of the intersection on the north side of the Riverside Avenue westbound approach and an MBTA bus stop for routes 100 and 108 is located just to the south of the intersection on the east side of the Fellsway (Route 28) northbound approach. Land use around the intersection is a mixture of residential and commercial.

5.4 Study Area Traffic Volumes

Traffic volumes for a portion of the study area roadways and intersections were collected by VHB in October 2017. Traffic volumes for the remaining study area roadways and intersections were collected in January 2017 as part of the Transportation Impact and Access study (TIAS) for another nearby development project¹. Peak-period turning movement and classification (TMC) counts were collected at the study area intersections on a typical weekday from 7:00 to 9:00 AM and 4:00 to 6:00 PM, and on a typical Saturday from 11:00 AM to 2:00 PM. These time periods were selected so that the combined peak periods for the roadway and Project Site activity would be evaluated.

The weekday morning peak period was observed to generally occur from 7:15 AM to 8:15 AM, with the weekday evening peak period generally occurring from 4:45 PM to

¹ Assembly's Edge, PUD-PMP, Transportation Impact and Access Study, Design Consultants Inc., (Somerville, Massachusetts) September 2017.

5:45 PM, and the Saturday midday peak period observed to occur from 12:00 PM to 1:00 PM.

In addition, VHB conducted automatic traffic (ATR) counts for a continuous 72-hour period, including a typical weekday and Saturday in October 2017. These counts were conducted on Grand Union Boulevard south of Foley Street and on Middlesex Avenue Northbound, north of Mystic Avenue. January 2017 daily traffic volumes on Foley Street and Middlesex Avenue also were obtained from the recent study noted above. The observed traffic volumes are summarized in Table 5-2.

TABLE 5-2 OBSERVED TRAFFIC VOLUME SUMMARY

Location	Weekday							Saturday			
	<u>Daily</u> ^a	<u>Morning Peak Hour</u>			<u>Evening Peak Hour</u>			<u>Daily</u>	<u>Midday Peak Hour</u>		
	Vol.	Vol. ^b	K Factor ^c	Dir. Dist. ^d	Vol.	K Factor	Dir. Dist.	Vol.	Vol.	K Factor	Dir. Dist.
Grand Union Boulevard South of Foley Street ^e	10,200	795	7.8%	SB 84%	780	7.7%	NB 70%	9,000	730	8.1%	NB 59%
Middlesex Avenue (Northbound) North of Mystic Avenue ^e	3,400	150	4.4%	NB 100%	345	10.3%	NB 100%	2,700	265	9.6%	NB 100%
Foley Street East of Middlesex Avenue ^f	6,400	460	7.2%	EB 83%	440	6.9%	WB 53%	6,500	665	10.2%	EB 62%
Middlesex Avenue North of Foley Street ^f	8,800	560	6.4%	SB 70%	685	7.8%	NB 72%	8,000	785	9.9%	NB 50%

a average daily traffic volume expressed in vehicles per day.

b peak hour volume expressed in vehicles per hour.

c percent of traffic occurs during the peak hour.

d directional distribution of peak hour traffic.

e Source: VHB; based on automatic recorder counts conducted in October 2017.

f Source: Assembly's Edge TIAS; based on automatic recorder counts conducted in January 2017.

Note: Peak hours do not necessarily coincide with the peak hours of turning movement counts.

As shown in Table 5-2 Grand Union Boulevard south of Foley Street carries approximately 10,200 vehicles on a typical weekday with the peak hours accounting for 7.8 percent (morning peak hour) and 7.7 percent (evening peak hour) of the weekday daily traffic flow. On a typical Saturday, Grand Union Boulevard south of Foley Street carries approximately 9,000 vehicles with the midday peak hour

accounting for 8.1 percent of the Saturday daily traffic flow. Traffic flow along Grand Union Boulevard is heavier in the southbound direction during the weekday morning peak hour and heavier in the northbound direction during the weekday evening and Saturday midday peak hours.

Middlesex Avenue north of Mystic Avenue carries approximately 3,400 vehicles on a typical weekday with the peak hours accounting for 4.4 percent (morning peak hour) and 10.3 percent (evening peak hour) of the weekday daily traffic flow. On a typical Saturday, Middlesex Avenue north of Mystic Avenue carries approximately 2,700 vehicles with the midday peak hour accounting for 9.6 percent of the Saturday daily traffic flow. It should be noted that the traffic counts were conducted on Middlesex Avenue northbound lanes only, between Mystic Avenue and the Middlesex Avenue southbound slip lane.

Foley Street east of Middlesex Avenue carries approximately 6,400 vehicles on a typical weekday with the peak hours accounting for 7.2 percent (morning peak hour) and 6.9 percent (evening peak hour) of the weekday daily traffic flow. On a typical Saturday, Foley Street east of Middlesex Avenue carries approximately 6,500 vehicles with the midday peak hour accounting for 10.2 percent of the Saturday daily traffic flow. Traffic flow along Foley Street is heavier in the eastbound direction during the weekday morning and Saturday midday peak hours and heavier in the westbound direction during the weekday evening peak hour.

Middlesex Avenue north of Foley Street carries approximately 8,800 vehicles on a typical weekday with the peak hours accounting for 6.4 percent (morning peak hour) and 7.8 percent (evening peak hour) of the weekday daily traffic flow. On a typical Saturday, Middlesex Avenue north of Foley Street carries approximately 8,000 vehicles with the midday peak hour accounting for 9.9 percent of the Saturday daily traffic flow. Traffic flow along Middlesex Avenue is heavier in the southbound direction during the weekday morning peak hour and heavier in the northbound direction during the weekday evening and Saturday midday peak hours.

The daily ATR data and peak-period TMC data are included in the Appendix to this document.

Seasonality of Count Data

The traffic data collected for the study area was obtained during the months of January and October 2017. To quantify the seasonal variation of traffic volumes in the area, historic traffic data available from MassDOT were reviewed. Monthly hourly traffic volumes for 2015 were reviewed at MassDOT permanent counting station 8495 located on I-93 in Somerville. Based on the review, traffic volumes in October are slightly higher than average month conditions and traffic volumes in January are slightly lower than average month conditions. To present a conservative analysis, the observed October traffic volumes have not been adjusted downward while the observed January traffic volumes have been adjusted upward. To be consistent with the Assembly's Edge TIAS, the January traffic volumes were increased by 1.48-

percent, the same adjustment rate used in that traffic study. The seasonal adjustment factors are included in the Appendix to this document.

The resulting 2017 Existing Conditions weekday morning, weekday evening, and Saturday midday peak hour traffic volumes are shown in Figures 5.3, 5.4, and 5.4, respectively.

5.4.1 Public Transportation

The study area is currently served by five MBTA bus routes within 0.5 miles of the Project Site, as shown in Figure 5.6. The area is serviced by MBTA Bus Routes 89, 90, 92, 95, and 101. MBTA Bus Routes 90, 92, and 95 directly serve the site with stops on Mystic Avenue and Grand Union Boulevard. In addition, the site is served by the Orange Line of the MBTA with Assembly Station located less than 1000 feet east of the site. Descriptions of each transit service is provided below and detailed maps and schedules can be found in the Appendix to this document.

- › Bus Route 89 travels between Sullivan Square and Davis Square or Clarendon Hill via Broadway. The nearest stop to the Site is approximately 0.5 miles away at the intersection of Broadway and Lombardi Way / Mt. Vernon Street. During peak periods, Bus Route 89 has a frequency of approximately 7-15 minutes.
- › Bus Route 90 travels between Wellington Station and Davis Square via Assembly Square Mall, Sullivan Square, and Highland Avenue. The nearest stop to the Site is on Grand Union Boulevard adjacent to the Site, at Foley Street. During peak periods, Bus Route 90 has a frequency of approximately 40-50 minutes.
- › Bus Route 92 travels between Assembly Square Mall and Downtown Boston via Sullivan Square and Haymarket. The nearest stop to the Site is on Grand Union Boulevard adjacent to the Site, at Foley Street. On weekday, Bus Route 92 terminates at Sullivan Square before 9:30 AM and after 4:00 PM, therefore not providing service to the Site during peak periods.
- › Bus Route 95 travels between Sullivan Square and West Medford via Mystic Avenue and Medford Square. The nearest stop to the Site is on Mystic Avenue (Route 38) adjacent to the Site, at Middlesex Avenue. During peak periods, Bus Route 95 has a frequency of approximately 25-40 minutes.
- › Bus Route 101 travels between Sullivan Square and Malden Center via Broadway and Medford Square. The nearest stop to the Site is approximately 0.5 miles away at the intersection of Broadway and Lombardi Way / Mt. Vernon Street. During peak periods, Bus Route 89 has a frequency of approximately 5-20 minutes.

Assembly Square Orange Line Station

Assembly Station on the Orange Line of the MBTA is approximately 800 feet east of the site via Revolution Drive or Foley Street. The Orange Line travels from Oak Grove

in the north to Forest Hills in the south and serves the cities of Malden, Medford, and Somerville, as well as the Boston neighborhoods of Charlestown, Downtown, Chinatown, Back Bay, South End, Roxbury, and Jamaica Plain. The Orange Line runs approximately every six minutes during peak periods. The Assembly Square Station on the Orange Line opened in 2014.

Additional transit service is available within the study area beyond the 0.5 miles range discussed above. Additional stops on the Orange Line are located at Sullivan Square Station (located approximately 0.6 miles south of the Site) and Wellington (located approximately 1 mile north of the Site). Both Sullivan Square Station and Wellington Station are local transit hubs and provide connections to several additional MBTA bus routes as well.

Ⓢ Signalized Intersection
neg = Negligible

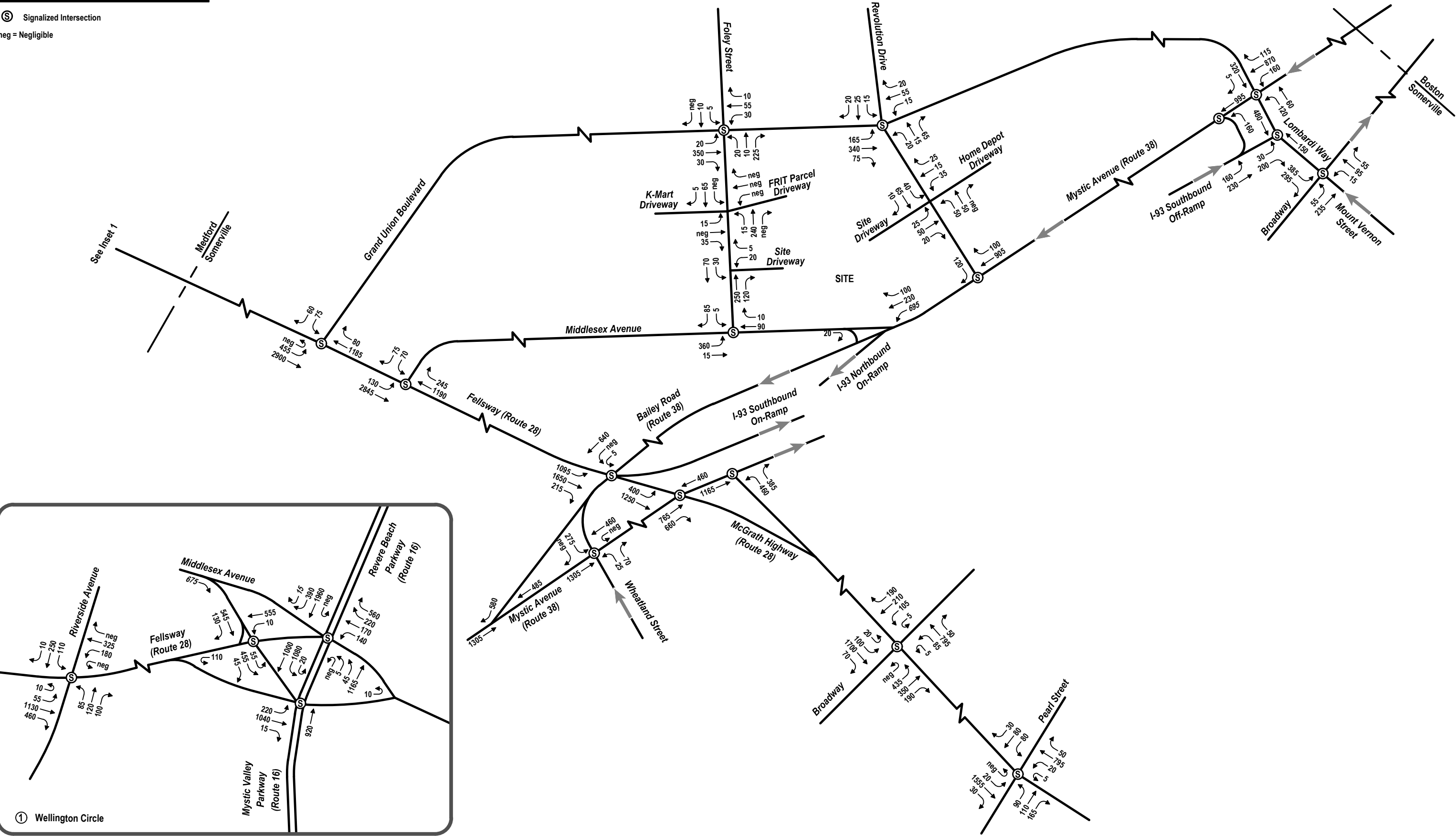
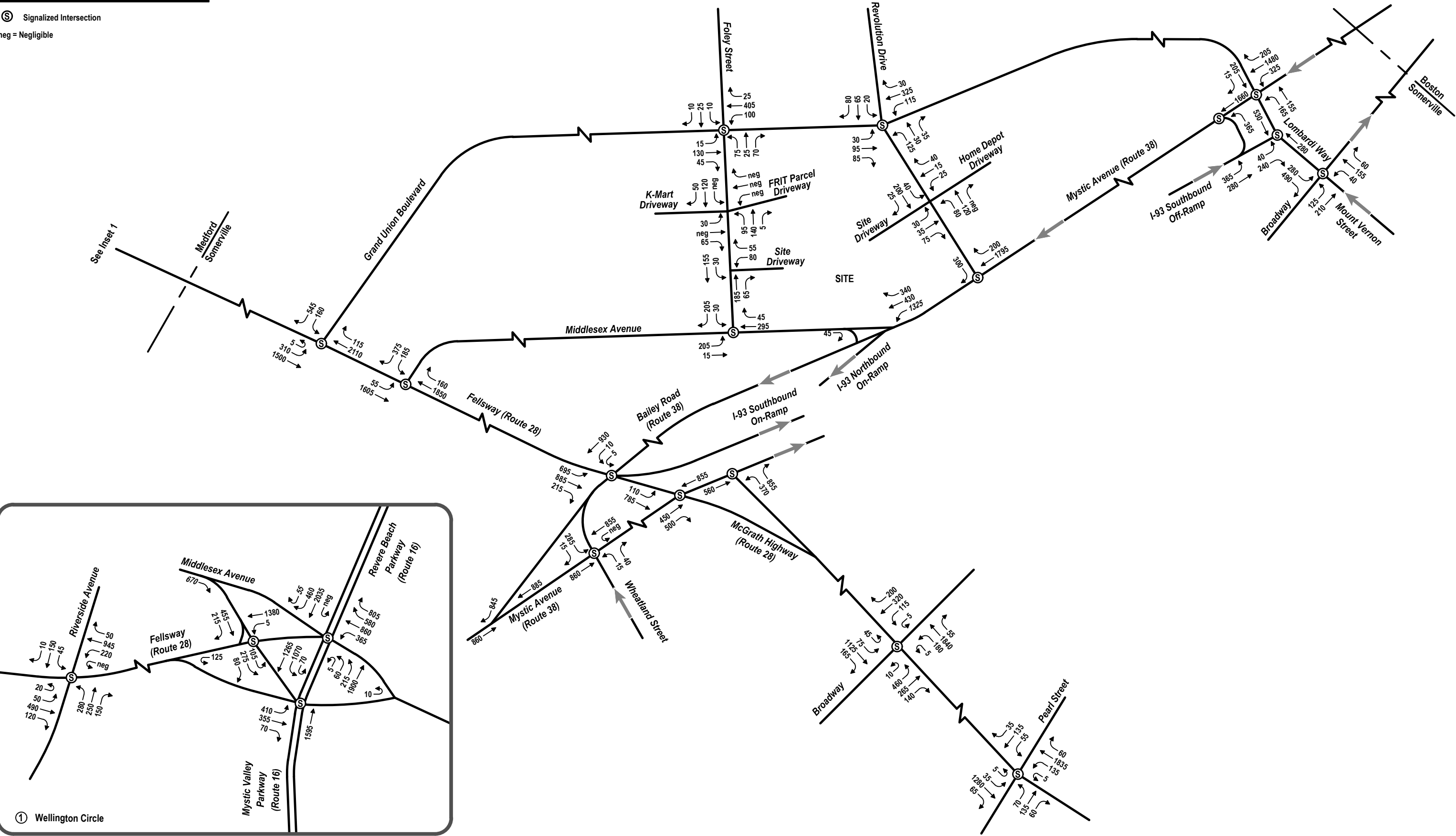


Figure 5.3
2017 Existing Conditions
Weekday Morning Peak Hour Traffic Volumes
5 Middlesex Avenue
Somerville, Massachusetts



Not to Scale

Ⓢ Signalized Intersection
neg = Negligible



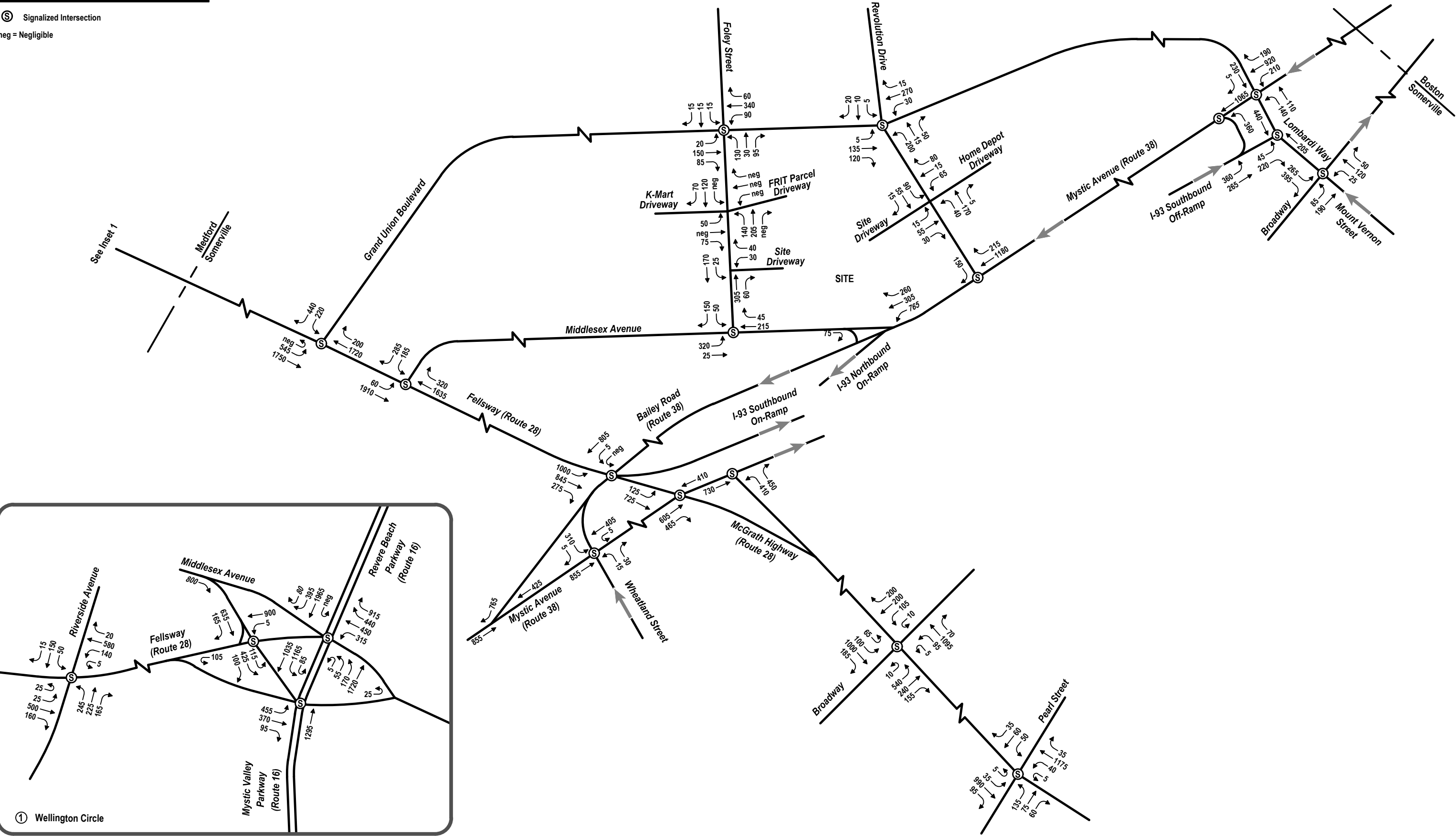
Not to Scale



2017 Existing Conditions
Weekday Evening Peak Hour Traffic Volumes
5 Middlesex Avenue
Somerville, Massachusetts

Figure 5.4

Ⓢ Signalized Intersection
neg = Negligible

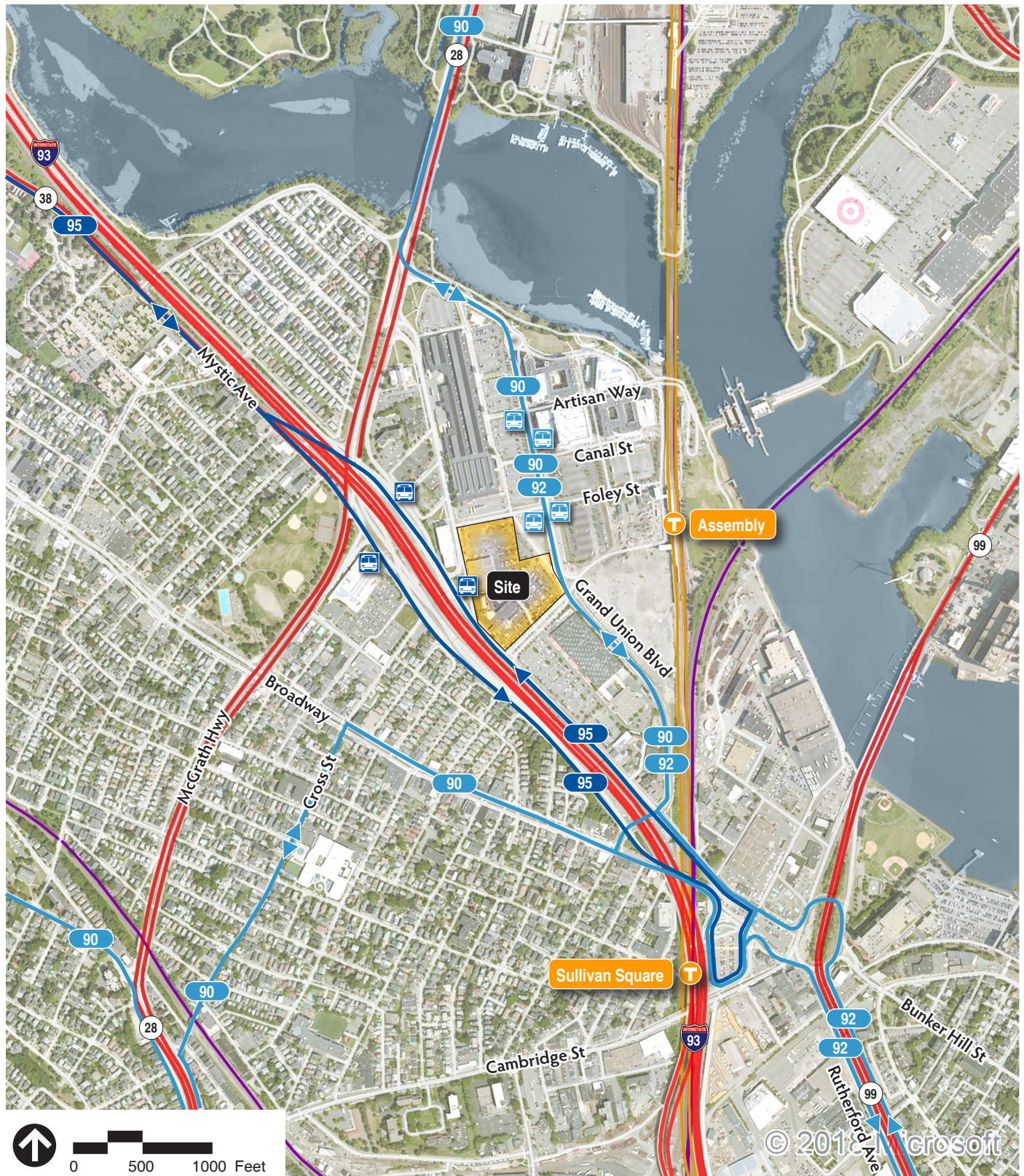


Not to Scale



2017 Existing Conditions
Saturday Midday Peak Hour Traffic Volumes
5 Middlesex Avenue
Somerville, Massachusetts

Figure 5.5



Source: Bing Aerial, MassGIS



Figure 5-6
Public Transit

XMBLY
Somerville, Massachusetts

5.4.2 Vehicle Crash Analysis

A detailed crash analysis was conducted to identify potential vehicle accident trends and/or roadway deficiencies in the traffic study area. The most current vehicle accident data for the traffic study area intersections were obtained from MassDOT for the years 2011 to 2015. The MassDOT database is comprised of crash data from the Massachusetts Registry of Motor Vehicles (RMV) Division primarily for use in traffic studies and safety evaluations. Data files are provided for an entire city or town for an entire year, though it is possible that some crash records may be omitted either due to individual crashes not being reported, or the city crash records not being provided in a compatible format for RMV use. A summary of the study intersections vehicle accident history based on the available RMV data is presented in Table 5-2 and the detailed crash data is provided in the Appendix to this study.

Crash rates are calculated based on the number of accidents at an intersection and the volume of traffic traveling through that intersection on a daily basis. Rates that exceed MassDOT's average for accidents at intersections in the district in which the town or city is located could indicate safety or geometric issues for a particular intersection. For our study area, the calculated crash rates were compared to MassDOT's District 4 average, as Somerville and Medford are located in District 4. In District 4, the average crash rate is 0.73 for signalized intersections and 0.56 for unsignalized intersections. These rates imply that, on average, 0.73 accidents occurred per million vehicles entering signalized intersections throughout District 4, and 0.56 accidents occurred per million vehicles entering unsignalized intersections in District 4. It should be noted that the location for some accidents cannot be precisely determined from the database. These locations typically involve interchange intersections. Additionally, some accidents may have occurred but were either not reported or not included in the database, and therefore not considered.

The following tables present the number of crashes, crash characteristics, as well as the crash rate for each of the study area intersections. Table 5-3 presents the crash data for the study area intersections. It should be noted that the intersection of I-93 Southbound On-Ramp at Mystic Avenue U-Turn was constructed in Fall 2017 and therefore is not included in the vehicular crash summary. Detailed crash data is provided in the Appendix to this document.

Table 5-3 Vehicular Crash Summary (2011-2015)

	Middlesex Avenue at Foley Street	Mystic Avenue at Middlesex Avenue	Mystic Avenue at Revolution Drive	Grand Union Boulevard at Foley Street	Grand Union Boulevard at Revolution Drive	Foley Street at Site Driveway	Foley Street at K- Mart Driveway / Driveway	Revolution Drive at Site Driveway / Home Depot Parking Lot	Fellsway at Grand Union Boulevard	Fellsway at Middlesex Avenue
Signalized?	Yes	No	Yes	No	Yes	No	No	No	Yes	Yes
MassDOT Average Crash Rate	0.73	0.56	0.73	0.56	0.73	0.56	0.56	0.56	0.73	0.73
Calculated Crash Rate	0.47	0.38	0.04	0.28	0.26	0.00	0.20	0.07	0.30	0.26
Exceeds Average?	No	No	No	No	No	No	No	No	No	No
Year										
2011	0	1	0	0	1	0	0	1	4	2
2012	0	2	0	0	0	0	2	0	6	5
2013	1	2	2	0	1	0	0	0	7	7
2014	3	1	0	2	2	0	0	0	6	7
<u>2015</u>	<u>3</u>	<u>0</u>	<u>0</u>	<u>3</u>	<u>1</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>4</u>	<u>1</u>
Total	7	6	2	5	5	0	2	1	27	22
Collision Type										
Angle	4	1	0	4	3	0	0	1	3	4
Head-on	1	1	1	0	0	0	0	0	0	1
Rear-end	1	2	1	0	1	0	1	0	20	12
Rear-to-rear	0	0	0	0	0	0	0	0	0	0
Sideswipe, opposite direction	0	0	0	0	0	0	0	0	0	0
Sideswipe, same direction	0	0	0	0	0	0	0	0	1	1
Single Vehicle Crash	1	2	0	0	1	0	1	0	3	4
Not reported	0	0	0	1	0	0	0	0	0	0
Severity										
Fatal Injury	0	0	0	0	0	0	0	0	0	0
Non-Fatal Injury	1	1	1	1	1	0	1	0	7	7
Property Damage Only	3	5	1	4	4	0	1	1	20	13
Not Reported	3	0	0	0	0	0	0	0	0	2
Time of day										
Weekday ,7:00 AM - 9:00 AM	0	0	0	0	0	0	1	1	1	1
Weekday, 4:00 – 6:00 PM	0	0	0	0	0	0	0	0	2	2
Saturday 11:00 AM – 2:00 PM	2	2	0	0	0	0	0	0	2	2
Weekday, other time	3	2	1	2	5	0	1	0	15	12
Weekend, other time	2	2	1	3	0	0	0	0	7	5
Pavement Conditions										
Dry	6	5	0	4	4	0	1	1	24	19
Wet	1	1	2	0	1	0	0	0	1	1
Snow	0	0	0	0	0	0	0	0	2	2
Ice	0	0	0	0	0	0	0	0	0	0
Slush	0	0	0	0	0	0	0	0	0	0
Not reported	0	0	0	1	0	0	1	0	0	0
Non-Motorist (Bike, Pedestrian)	0	0	0	0	1	0	1	0	1	2

Source: Crash data was obtained from MassDOT Crash Portal, accessed October 2017.

Table 5-3 Crash Summary (2011-2015) (Cont.)

	Mystic Avenue at Wheatland Street / Bailey Road	Fellsway SB at Bailey Road and I-93 SB On- Ramp	Fellsway / McGrath Highway SB at Mystic Avenue	Mystic Avenue at McGrath Highway NB Off-Ramp	McGrath Highway at Broadway	McGrath Highway at Pearl Street	Mystic Avenue at I-93 SB Off-Ramp U-turn	Mystic Avenue at Grand Union Boulevard / Lombardi Way	Lombardi Way at I-93 SB Off-Ramp	Broadway at Lombardi Way / Mt. Vernon Street
Signalized?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MassDOT Average Crash Rate	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73
Calculated Crash Rate	0.27	0.57	2.21	0.31	0.67	0.44	0.02	0.32	0.10	0.57
Exceeds Average?	No	No	Yes	No	No	No	No	No	No	No
Year										
2011	0	9	18	1	10	2	1	2	1	0
2012	1	6	43	0	11	7	0	3	1	4
2013	4	4	27	1	16	11	0	4	1	5
2014	3	7	21	3	15	10	0	3	0	3
2015	<u>3</u>	<u>5</u>	<u>9</u>	<u>6</u>	<u>15</u>	<u>5</u>	<u>0</u>	<u>4</u>	<u>0</u>	<u>3</u>
Total	11	31	118	11	67	35	1	16	3	15
Collision Type										
Angle	4	13	65	0	13	9	0	7	2	8
Head-on	0	1	6	0	0	1	0	1	0	0
Rear-end	4	7	36	6	38	11	1	6	0	1
Rear-to-rear	0	0	0	1	0	1	0	0	0	0
Sideswipe, opposite direction	0	1	3	2	0	2	0	0	0	0
Sideswipe, same direction	2	2	6	1	5	5	0	0	0	0
Single Vehicle Crash	1	7	2	1	9	5	0	2	0	4
Not reported	0	0	0	0	2	1	0	0	1	2
Severity										
Fatal Injury	0	1	0	0	0	0	0	0	0	0
Non-Fatal Injury	2	11	45	4	26	12	1	5	1	8
Property Damage Only	8	17	67	7	39	21	0	9	2	6
Not Reported	1	2	6	0	2	2	0	2	0	1
Time of day										
Weekday ,7:00 AM - 9:00 AM	0	2	4	0	7	3	0	4	1	3
Weekday, 4:00 – 6:00 PM	0	2	10	0	6	1	0	2	0	0
Saturday 11:00 AM – 2:00 PM	0	0	2	0	0	2	0	1	0	0
Weekday, other time	7	20	72	7	44	24	1	8	2	9
Weekend, other time	4	7	30	4	10	5	0	1	0	3
Pavement Conditions										
Dry	9	21	95	8	50	25	1	11	2	11
Wet	2	8	23	2	14	6	0	4	0	2
Snow	0	1	0	0	3	2	0	0	0	0
Ice	0	0	0	0	0	0	0	0	0	0
Slush	0	1	0	1	0	0	0	0	0	1
Not reported	0	0	0	0	0	2	0	1	1	1
Non-Motorist (Bike, Pedestrian)	0	2	2	0	7	3	0	1	0	4

Source: Crash data was obtained from MassDOT Crash Portal, accessed October 2017.

Table 5-3 Crash Summary (2011 – 2015) (Cont.)

	Wellington Circle East	Wellington Circle West	Wellington Circle North	Fellsbury at Riverside Avenue
Signalized?	Yes	Yes	Yes	Yes
MassDOT Average Crash Rate	0.73	0.73	0.73	0.73
Calculated Crash Rate	0.80	1.28	0.81	0.59
Exceeds Average?	Yes	Yes	Yes	No
Year				
2011	12	20	2	3
2012	24	36	6	4
2013	22	33	4	11
2014	23	21	6	5
<u>2015</u>	<u>37</u>	<u>29</u>	<u>12</u>	<u>10</u>
Total	118	139	30	33
Collision Type				
Angle	38	54	16	12
Head-on	2	2	0	1
Rear-end	43	37	4	10
Rear-to-rear	0	0	0	1
Sideswipe, opposite direction	3	3	1	2
Sideswipe, same direction	22	41	8	3
Single Vehicle Crash	7	2	1	4
Not reported / Invalid	3	0	0	0
Severity				
Fatal Injury	0	0	0	0
Non-Fatal Injury	28	27	8	13
Property Damage Only	88	108	19	18
Not Reported	2	4	3	2
Time of day				
Weekday, 7:00 AM - 9:00 AM	6	9	3	0
Weekday, 4:00 - 6:00 PM	10	11	4	2
Saturday 11:00 AM - 2:00 PM	2	5	3	2
Weekday, other time	68	78	12	22
Weekend, other time	32	36	8	7
Pavement Conditions				
Dry	99	124	27	24
Wet	15	13	3	8
Snow	3	2	0	1
Ice	0	0	0	0
Slush	0	0	0	0
Other	1	0	0	0
Non-Motorist (Bike, Pedestrian)	6	2	0	4

Source: Crash data was obtained from MassDOT Crash Portal, accessed October 2017.

As shown in Table 5-3, review of the accident data indicates that one of the Somerville study area intersections is above the district crash rate averages: the intersection of Fellsway / McGrath Highway (Route 28) SB at Mystic Avenue (Route 38), which had 118 reported crashes over the five-year period. As shown in

The majority of crashes throughout the study area were angle crashes and rear-end crashes occurring on dry pavement resulting in property damage only. It should be noted that one fatal accident was indicated in the study area at the intersection of Fellsway / McGrath Highway (Route 28) SB at Mystic Avenue (Route 38). In addition, approximately half of the study area intersections had at least one crash occurred during the five-year period that involved a bicyclist or a pedestrian. The intersections of McGrath Highway (Route 28) at Broadway and Wellington Circle East both had over five reported crashes that involved a bicyclist or a pedestrian over the five-year period.

Highway Safety Improvement Program

In addition to calculating the crash rate, study area intersections should also be reviewed in the MassDOT's Highway Safety Improvement Program (HSIP) database. An HSIP-eligible cluster is one in which the total number of "equivalent property damage only"² 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.

As part of this effort, VHB reviewed this database and found that two the following intersections are listed under the following HSIP-eligible clusters:

2012-2014 HSIP Cluster

- › Fellsway (Route 28) SB at Bailey Road (Route 38) / I-93 Southbound On-Ramp
- › Fellsway / McGrath Highway (Route 28) SB at Mystic Avenue (Route 38)
- › McGrath Highway (Route 28) at Broadway
- › McGrath Highway (Route 28) at Pearl Street
- › Wellington Circle East
- › Wellington Circle West
- › Wellington Circle North
- › Fellsway (Route 28) at Riverside Street

2005-2014 HSIP Pedestrian Cluster

- › McGrath Highway (Route 28) at Broadway

Top 200 Intersection Cluster (2012-2014)

² Equivalent property damage only" is a method of combining the number of crashes with the severity of the crashes based on a weighted scale. Crashes involving property damage only are reported at a minimal level of importance, while collisions involving personal injury (or fatalities) are weighted more heavily.

- › Fellsway / McGrath Highway (Route 28) SB at Mystic Avenue (Route 38)
- › McGrath Highway (Route 28) at Broadway
- › Wellington Circle East
- › Wellington Circle West
- › Wellington Circle North

While multiple locations have been identified as being HSIP locations, several of these study area intersections have been subject to Roadway Safety Audits (RSA) conducted by MassDOT. Specifically, a RSA was conducted (dated February 1, 2017) to evaluate conditions at the Route 28/Mystic Avenue interchange, and Route 28 at Broadway in Somerville. Prior to that effort, the Route 28/Mystic Avenue interchange also was studied as part of a September 30, 2015 RSA. Finally, the three Wellington Circle locations in Medford listed above were evaluated as part of a March 10, 2016 RSA.

5.5 Future Conditions

Traffic volumes in the study area were projected to a seven-year traffic-planning horizon. Independent of the Project, volumes on the roadway network under the future No-Build conditions were assumed to include existing traffic and new traffic resulting from background traffic growth. Under the Build condition, Project generated traffic volumes were added to the No-Build volumes to reflect the Build conditions within the Project study area.

5.5.1 2024 No-Build Conditions

Traffic growth on area roadways is a function of the expected land development, economic activity, and changes in local and regional demographics. A frequently used procedure is to estimate the historical annual percentage increase in traffic volumes and apply that increase to the study-area traffic volumes. An alternative procedure involves the estimation of traffic generated by specific planned major developments that would be expected to affect traffic volumes on the study area roadways. For the purpose of this assessment, both methods were utilized to present a conservative assessment.

Historic Traffic Growth

Historic traffic data in the vicinity of the project Site was reviewed to determine an appropriate growth rate. Previous traffic studies conducted in the City of Somerville and historic count data was reviewed. Based on this research, a growth rate of 1.0-percent was determined to be appropriate for this study.

Site Specific Growth

In addition to accounting for background growth, the traffic associated with other planned/approved developments near the Site was also considered. Based on a

review of recent traffic studies conducted in the area and discussions with the City of Somerville, there are three planned/approved developments within the vicinity of the study area that were considered as part of the background development.

- › **Assembly Edge** – The project includes the construction of two buildings containing approximately 215 residential units, 9,515 SF of retail, and 180 hotel rooms on Middlesex Avenue between McGrath Highway and Kensington Avenue. The site currently consists of a one-story Dunkin Donuts and adjacent Caribbean restaurant.
- › **Assembly Row (Full Build Out)** – To the east of the project Site is Assembly Row, a large, multi-phased, mixed-use development owned by Federal Realty Investment Trust. Once fully built-out, Assembly Row will consist of approximately 1,843 residential units, 170 hotel rooms, 2,801,333 SF of office, 527,024 SF of retail, a 12-screen cinema, and a 50,000 SF health club. Full build-out of the project site is expected to take 10-15 years total with several phases already completed or under construction. As of 2017, approximately 448 residential units, 1,248,183 SF of office, 347,524 SF of retail, a 12-screen cinema, and a 50,000 SF health club has been completed and tenanted in Blocks 1-4, 10 and 11 (Partners Healthcare). An additional 509 residential units, 57,000 SF of retail, and 155 hotel rooms are under construction as of 2017 in Blocks 5A and 6. The remaining development is expected to be located in Blocks 5B, 7, 8, and 9 and has yet to commence construction. The entirety of Assembly Row is expected to be opened and operational by 2024. The traffic expected to be generated by the phases that were not yet completed and operational at the time of the existing traffic counts in 2017 have been identified and included in the No-Build and Build condition analyses.
- › **Wynn Casino** – The project includes the construction of an approximately 2.6 million square foot casino located on Horizon Way off Lower Broadway (Route 99) in Everett. The project will include a 500-room luxury hotel, gaming area, retail space, food and beverage outlets, convention and meeting spaces, a spa and gym, and nightclub.

Projected traffic volumes expected to be generated by these projects were obtained from the published traffic studies submitted as part of the permitting processes. The projected Site-generated traffic tracings are included in the Appendix to this document.

Roadway Improvements

In assessing future traffic conditions, proposed roadway improvements within the study area were considered. Based on research by VHB and discussions with the City of Somerville, the following projects may affect traffic volumes within the seven-year horizon:

- › **Mystic Avenue U-Turn** – As part of the Assembly Row mixed-use development described above, several mitigation measures were agreed

upon to try and alleviated traffic congestion and improve local connectivity. One such mitigation measure is a new U-Turn connection from Mystic Avenue (Route 38 Northbound) to the I-93 Southbound On-Ramp. This connection now provides an additional access point to I-93 southbound and is expected to reduce the number of vehicles using Fellsway (Route 28) southbound to access I-93 southbound. Within the Assembly Square area, the new connection is expected to reduce the amount of traffic turning left onto Fellsway (Route 28) from Grand Union Boulevard and Middlesex Avenue to reach I-93 southbound and instead will increase the amount of traffic turning right onto Mystic Avenue (Route 38) from Middlesex Avenue and Revolution Drive.

A new actuated signal has been installed at the location where the U-Turn intersects the I-93 Southbound On-Ramp. Two lanes are provided on each approach to the new signalized intersection. The signal uses the same signal plan and is operated by the same signal controller as the intersections of Route 28 at Route 38. The new U-Turn opened for traffic in late Fall 2017, after existing traffic counts were conducted. Therefore, volumes for the No-Build and Build conditions were adjusted to reflect the new traffic pattern that will be in place under those conditions.

- › **Route I-93/Route 28/Mystic Avenue interchange** – Following recent roadway safety audits at this location, MassDOT is now undertaking the design of planned improvements at this location. These measures are currently in the early conceptual stage but are expected to focus primarily on pedestrian and bicycle enhancements. As there currently are no known changes planned to the overall operation of the interchange for automobile traffic, the future conditions analysis did not incorporate any planned operational changes.
- › **Mystic River Footbridge** – In the initial design stage is a 780-foot bridge across the Mystic River to link the Wynn Casino, which is currently under construction, with Assembly Square and the Orange Line. The footbridge will be open to pedestrians and bicyclists only and will connect recreational paths on both sides of the Mystic River. A second bridge will be required over the Orange Line train tracks to complete the connection between Assembly Square and the Wynn Casino. It should be noted that this project is currently unfunded and therefore is mentioned for reference purpose only. No credit was taken for potential vehicle trip reductions.

The roadway improvement projects listed above were incorporated into the No-Build and Build conditions traffic analyses.

Public Transportation Improvements

In addition to planned roadway improvement projects in the vicinity of the project Site, planned public transportation improvement projects were reviewed as well. Based on research by VHB, it was determined that one public transportation project is planned in the area; the extension of the MBTA's Green Line.

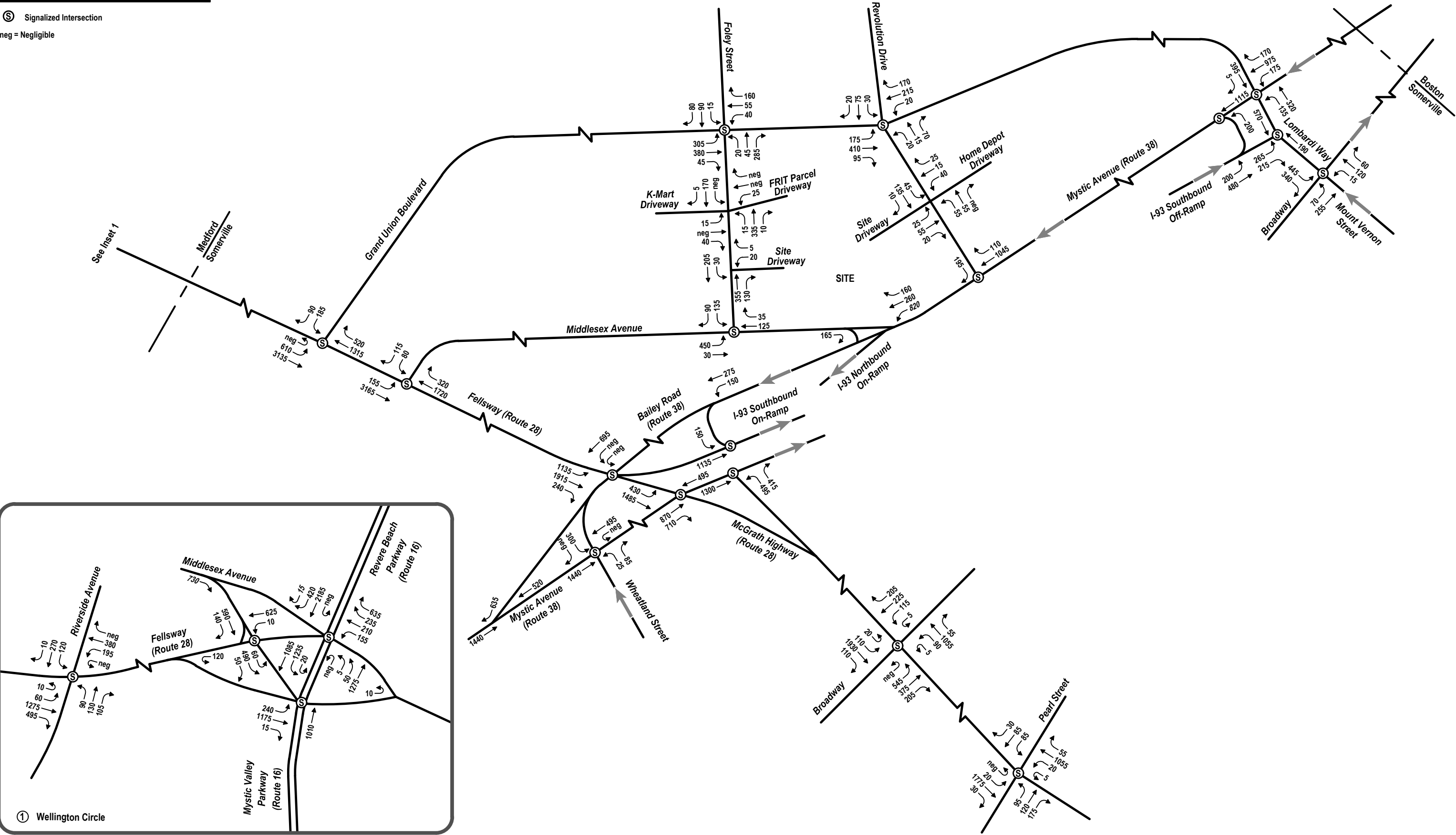
- › **Green Line Extension** – In early 2017, the Federal Transit Administration granted final approvals for the 4.3-mile extension of the MBTA's Green Line light rail from its current terminus at Lechmere Station in Cambridge into Somerville and Medford. The extension will have two branches: a 0.9-mile southerly branch that will terminate near Somerville's Union Square, and a 3.4-mile northerly branch that will parallel the Lowell Line of the commuter rail through Somerville and will terminate at College Avenue in Medford. The Green Line extension is expected to be completed in 2021 and will include seven new stations (including a rebuilt Lechmere Station). The nearest stations to the project Site will be East Somerville Station and Gilman Square Station, both approximately one-mile south/ southwest of the project Site.

It should be noted that the Green Line extension project is mentioned for reference purposes only and is not factored into the future traffic analyses.

No-Build Traffic Volumes

The 2024 No-Build traffic volumes were developed by applying the 1.0 percent annual growth rate over the seven-year study horizon to the 2017 Existing Conditions traffic volumes and adding the traffic volumes associated with the site-specific background projects noted previously. Figures 5.7, 5.8, and 5.9 show the respective 2024 No-Build peak hour traffic volumes.

Ⓢ Signalized Intersection
neg = Negligible



① Wellington Circle



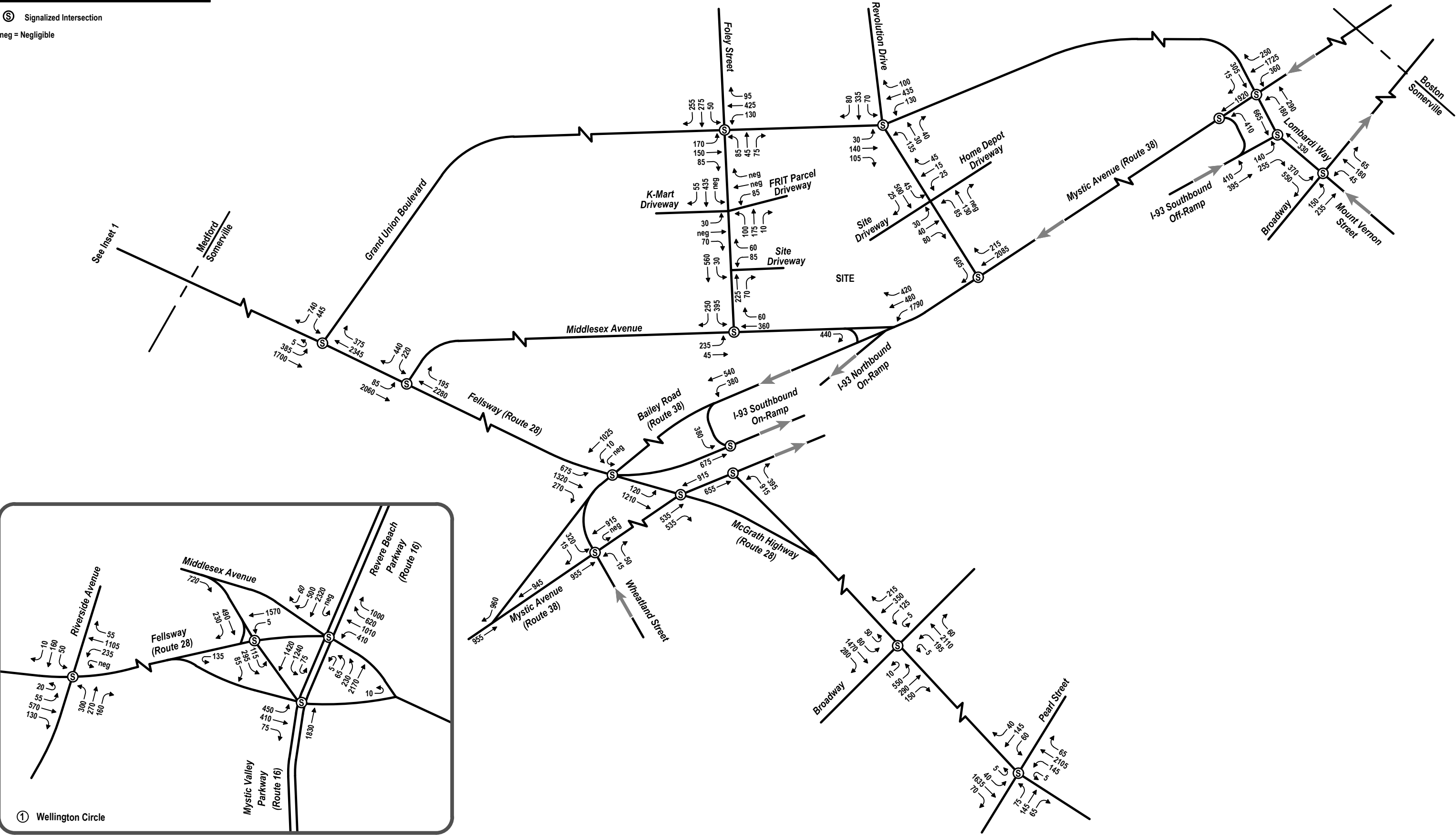
Not to Scale



Figure 5.7
2024 No Build Conditions
Weekday Morning Peak Hour Traffic Volumes
5 Middlesex Avenue
Somerville, Massachusetts

Ⓢ Signalized Intersection

neg = Negligible



① Wellington Circle

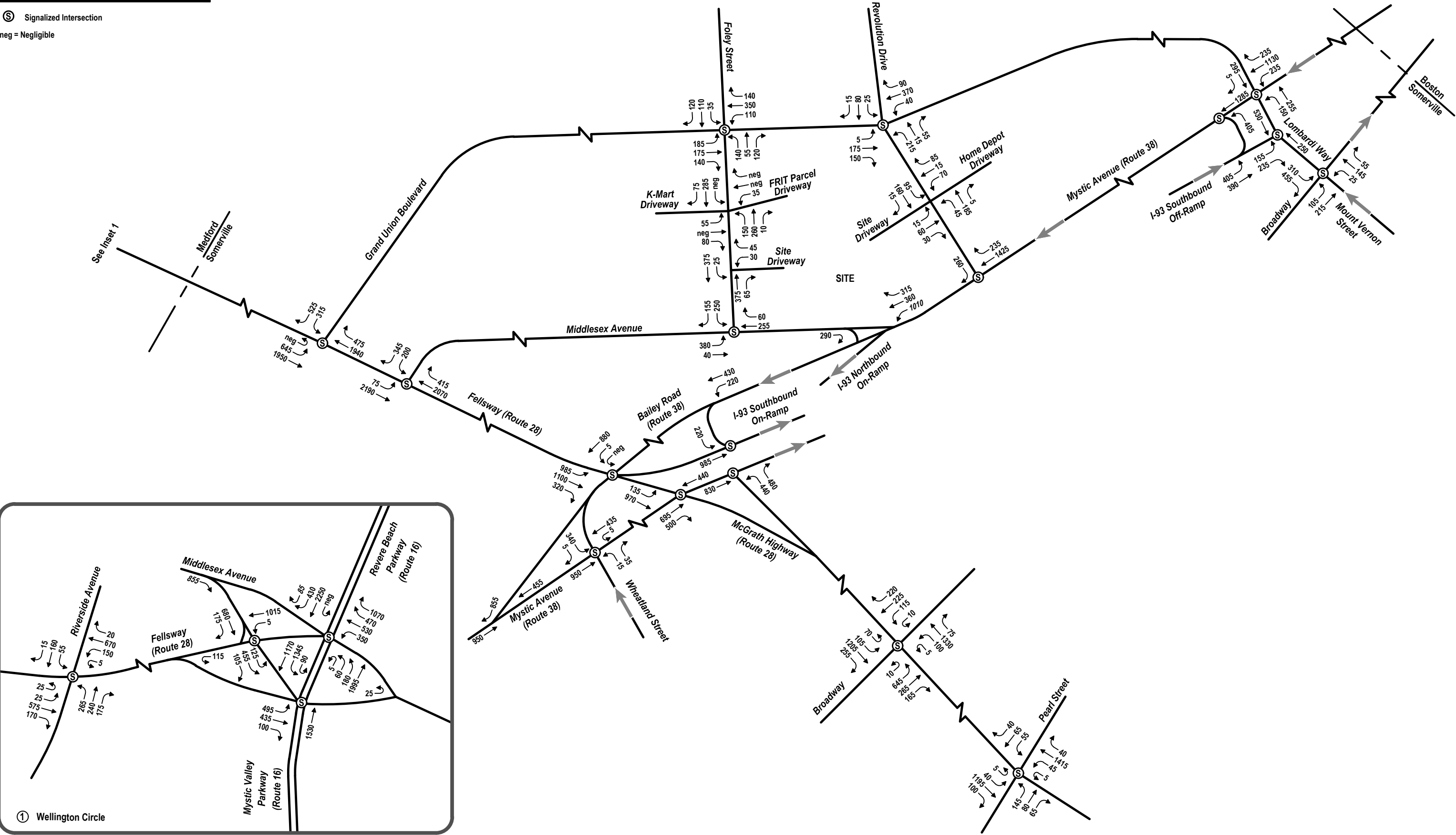


Not to Scale



Figure 5.8
2024 No Build Conditions
Weekday Evening Peak Hour Traffic Volumes
5 Middlesex Avenue
Somerville, Massachusetts

Ⓢ Signalized Intersection
neg = Negligible



Not to Scale



Figure 5.9
2024 No Build Conditions
Saturday Midday Peak Hour Traffic Volumes
5 Middlesex Avenue
Somerville, Massachusetts

5.5.2 Trip Generation

The Project is comprised of office/lab, residential, and retail use being developed over time as shown in Table 5-1. The rate at which any development generates traffic is dependent upon a number of factors such as size, location, and concentration of surrounding developments. The Trip Generation Manual³ published by the Institute of Transportation Engineers (ITE) categorizes these land uses and provides weekday daily, weekday morning, weekday evening, Saturday daily and midday peak hour unadjusted vehicle trip generation estimates for each use. For the proposed development, the trip generation estimates for the planned uses were projected using Land Use Code (LUC) 221 (Mid-Rise Residential), LUC 710 (General Office Building), LUC 760 (Research & Development Center) and LUC 820 (Shopping Center). The resulting overall Project trip generation was compared to that associated with the existing uses on the Site, with the additional traffic compared that to condition being added to the study area roadway network.

Table 5-4 summarizes the Project-related trip projections for the existing uses within the Project Site.

³ Trip Generation Manual (10th Edition), Institute of Transportation Engineers, Washington D.C., 2017.

Table 5-4 Existing Site Trip Generation

	Existing Office¹ (137,000 sf)	Existing Health Club² (25,000 sf)	Existing Block 24 (162,000 sf)	
			Total Unadjusted Trips (162,000 sf)	Total Net Vehicle Trips (162,000 sf)
Weekday Daily				
Enter	720	538	1,258	668
Exit	<u>720</u>	<u>538</u>	<u>1,258</u>	<u>669</u>
Total	1,440	1,076	2516	1,337
Weekday Morning				
Enter	134	17	151	73
Exit	<u>22</u>	<u>16</u>	<u>38</u>	<u>15</u>
Total	156	33	189	88
Weekday Evening				
Enter	25	49	74	37
Exit	<u>129</u>	<u>37</u>	<u>166</u>	<u>82</u>
Total	154	86	240	119
Saturday Daily				
Enter	151	339	490	265
Exit	<u>151</u>	<u>339</u>	<u>490</u>	<u>264</u>
Total	302	678	980	529
Saturday Midday				
Enter	39	39	78	41
Exit	<u>33</u>	<u>41</u>	<u>74</u>	<u>39</u>
Total	72	80	152	80

1 Source: Trip Generation Manual, 10th Edition; Institute of Transportation Engineers (ITE); Washington, D.C. (2017). Land use code 710 (General Office Building).

2 Ibid. Land use code 492 (Health/Fitness Club).

As shown in Table 5-4, the existing trip generation for Block 24 is lower than that which would be found in a more isolated suburban site. This is due to the availability of public transportation, shared trips with other nearby uses within the Assembly Square district, and the inherent benefits of being located within an area with bicycle and pedestrian accommodations. The details of these assumed mode splits are discussed in greater detail later in this section. With the proposed Project and continued ongoing development of the surrounding area the trend away from single-occupant automobile travel to and from the Project Site should continue.

Following the documentation of the existing Block 24 trip generation as shown in Table 5-4, trip generation was estimated for the full redevelopment of the Project Site. The methodology used and results of this analysis are discussed in detail in the following sections.

Proposed Project-Generated Traffic

The proposed transit-oriented development will consist of a mixture of office/lab, residential, and supporting retail/restaurant/active uses. As noted above, traffic associated with the office/lab space was estimated using ITE LUC 710 (General Office Building) and LUC 760 (Research & Development Center) trip generation data. Residential trip generation was estimated using ITE LUC 221 (Mid-Rise Residential). The retail uses are expected to be small, service-oriented businesses. While exact tenants have not yet been secured, these are not expected to be large destination-retail uses. Instead, potential uses will include small eating establishments, coffee shops, or gallery uses. While these clearly do not fit the description of a transitional ITE "Shopping Center", retail traffic was estimated using this land use code (LUC 820), which results in an overly conservative analysis. The Project will also include a new 16,000 sf fire station to be located within Block 21. Traffic generation for emergency/municipal facilities such as this is typically associated mostly with personnel traffic, and vehicles leaving on calls, which occur randomly. As most staff will be arriving and departing the Site outside of the critical peak hours being evaluated, it is not necessary to quantify the trip generation, which should be nominal at most, for this use. The overall unadjusted vehicle trip estimates for the Project are presented in Table 5-5 and trip generation worksheets are included in the Appendix.

Table 5-5 Project Trip Generation – Unadjusted Vehicle Trips

	Office ^a	R&D ^b	Residential ^c	Retail/ Restaurant ^d	Total Unadjusted Vehicle Trips
Weekday Daily					
Enter	3,078	1,878	1,351	512	6,819
Exit	<u>3,078</u>	<u>1,878</u>	<u>1,351</u>	<u>512</u>	6,307
Total	6,156	3,756	2,702	1,024	13,638
Weekday Morning					
Enter	518	105	43	16	682
Exit	<u>84</u>	<u>35</u>	<u>122</u>	<u>10</u>	251
Total	602	140	165	26	933
Weekday Evening					
Enter	102	25	126	50	303
Exit	<u>535</u>	<u>139</u>	<u>80</u>	<u>54</u>	808
Total	637	164	206	104	1,111
Saturday Daily					
Enter	677	317	962	626	2,582
Exit	<u>677</u>	<u>317</u>	<u>962</u>	<u>626</u>	2,582
Total	1,354	634	1,924	1,252	5,164
Saturday Midday					
Enter	75	40	105	64	284
Exit	<u>149</u>	<u>40</u>	<u>110</u>	<u>59</u>	358
Total	324	80	215	123	742

a Based on ITE LUC 710 (General Office Building), assumes 612,500 sf of office space.

b Based on ITE LUC 760 (Research & Development Center), assumes 333,500 sf of R&D space.

c Based on ITE LUC 221 (Mid-Rise Residential), based on 496 units (since reduced to 489 units).

d Based on ITE LUC 820 (Shopping Center), assumes 20,000 sf of retail space and 7,140 sf of restaurant space.

The values shown in Table 5-5 are the base unadjusted vehicle-trip estimates prior to the necessary adjustments for internal Assembly Square trip sharing, mode-splits, and other factors. The details of how these subsequent adjustments were made by each step are discussed in the following sections.

Person Trips

The unadjusted vehicle trips calculated using the ITE data were subsequently converted into person trips by applying national data⁴ for vehicle-occupancy rates

⁴ Summary of Travel Trends – National Household Travel Survey; USDOT Federal Highway Administration (Washington, DC), 2017.

for a variety of uses. This was done so that the national ITE-based data also would be converted to person trips using national data for consistency.

Internal Capture Trips

As described in the ITE Trip Generation Handbook "because of the complementary nature of these land uses, some trips are made among the on-site uses. This capture of trips internal to the site has the net effect of reducing vehicle trip generation between the overall development site and the external street system (compared to the total number of trips generated by comparable land uses developed individually on stand-alone sites)...an internal capture rate can generally be defined as the percentage of total person trips generated by a site that are made entirely within the site. The trip origin, destination, and travel path are all within the site."

Based on the methodology outlined in the ITE Trip Generation Handbook, internal capture rates were applied to the gross person trips. The resulting peak-hour person trip estimates for the Project and are presented in Table 5-6 and worksheets are included in the Appendix.

Table 5-6 Project Peak-Hour Person Trips

	Office ^a	R&D ^a	Residential ^a	Retail ^a	Total Person Trips
Weekday Morning					
Enter	585	119	48	28	780
<u>Exit</u>	<u>95</u>	<u>40</u>	<u>137</u>	<u>17</u>	<u>289</u>
Total	680	159	185	45	1,069
Weekday Evening					
Enter	115	28	142	88	373
<u>Exit</u>	<u>605</u>	<u>157</u>	<u>91</u>	<u>96</u>	<u>949</u>
Total	720	185	233	184	1,322
Saturday Midday					
Enter	198	45	119	113	475
<u>Exit</u>	<u>169</u>	<u>45</u>	<u>124</u>	<u>104</u>	<u>442</u>
Total	367	90	243	217	917

^a Person trip generation estimate with internal capture credits applied.

Mode Share

The mode shares used for this evaluated were developed considering multiple sources. These include a traffic study⁵ for a prior development proposal on the Project Site, and data from the Notice of Project Change (NPC)⁶ prepared for the

⁵ The Office and Research Center + The Residences at Assembly (Chapter 3 – Transportation) Design Consultants, Inc. (Somerville, Massachusetts), September 30, 2016.

⁶ Assembly Row Revised Program for Partners Healthcare Site – Notice of Project Change; VHB, Watertown, Massachusetts (May 15, 2014).

Partner's office development within Assembly Square. Mode shares presented as part of the nearby North Point development also were considered due to the similarities in some components of that project. The resulting anticipated mode splits are presented in Table 5-7.

Table 5-7 Mode Share

Use	Vehicle	Transit	Bike/Walk
Office/Research & Development	54%	36%	10%
Residential	43%	47%	10%
Retail/Restaurant	80%	10%	10%

Source: Based on hybrid of mode shares used in Partners Health Care Study PNF (2014), Certified NorthPoint TIS (with data from Kendall Square K2 City of Cambridge, "Hotel Parking and Transportation Demand Management Reports – City of Cambridge", Assembly Edge PUD-PMP (2017), US Census data, and Boston Transportation Department data for Zone 11 (Sullivan Square).

The mode shares discussed above were applied to the net-new person trips to generate the adjusted Project trips by mode. The local average vehicle occupancy, based on US Census data for each primary use then was applied to the vehicle mode to reflect the number of vehicle trips generated by the Site.

Pass-By Trips

While the ITE rates provide estimates for all the traffic associated with each land use, not all of the traffic generated by the Project will be new to the area roadways. For example, a portion of the vehicle-trips generated by the retail land use will likely be drawn from the traffic volume roadways adjacent to the Project Site. For example, someone traveling on South Street may choose to deviate from their original travel path to visit the site retail, before heading back to continue to their final destination. For this evaluation, ITE pass-by rates for LUC 820 (Shopping Center) were utilized for the retail trip generation, and applied to existing trips on South Street. Specifically, 34- and 26-percent of the Site trip generation was assumed to be drawn from the surrounding roadway network during the weekday evening and Saturday midday peak hours, respectively. For all other time periods studied, a 25-percent pass-by rate was assumed.

Project-Generated Trips

The mode share and local average vehicle occupancy were applied to the person trips to estimate net new trips by mode, and then the pass-by adjustments noted above were applied to the vehicle trips generated by the retail portion of the Site. Tables 5-8 and 5-9 summarize the net new trips by mode and net new vehicle trips by use, respectively. Detailed trip generation worksheets are provided in the Appendix.

Table 5-8 Project-Generated Peak-Hour Trips by Mode

	Bike/Walk	Transit	Vehicle^a
Weekday Morning			
Enter	77	274	343
<u>Exit</u>	<u>27</u>	<u>109</u>	<u>109</u>
Total	104	383	452
Weekday Evening			
Enter	32	109	132
<u>Exit</u>	<u>89</u>	<u>314</u>	<u>401</u>
Total	121	423	533
Saturday Midday			
Enter	41	135	181
<u>Exit</u>	<u>39</u>	<u>131</u>	<u>163</u>
Total	80	266	344

a Total development vehicle trips (including pass-by trips associated with the retail portion).

As shown in Table 5-8, the Project is expected to generate between 344 and 533 total vehicle trips during the peak hours studied (including trips generated by the existing Site uses). The breakdown of these trips by use are summarized below in Table 5-9.

Table 5-9 Project-Generated Peak-Hour Vehicle Trips by Use ^a

	Office	R&D	Residential	Retail	Pass-By ^b	Total Trips	-Existing Trips	=Total Net Vehicle Trips
Weekday Morning								
Enter	265	54	16	6	2	343	73	270
Exit	<u>41</u>	<u>17</u>	<u>46</u>	<u>3</u>	<u>2</u>	<u>109</u>	<u>15</u>	<u>94</u>
Total	306	71	62	9	4	452	88	364
Weekday Evening								
Enter	50	12	38	21	11	132	37	95
Exit	<u>272</u>	<u>71</u>	<u>27</u>	<u>20</u>	<u>11</u>	<u>401</u>	<u>82</u>	<u>319</u>
Total	322	83	65	41	22	533	119	414
Saturday Midday								
Enter	88	20	31	32	10	181	41	140
Exit	<u>73</u>	<u>19</u>	<u>37</u>	<u>24</u>	<u>10</u>	<u>163</u>	<u>39</u>	<u>124</u>
Total	161	39	68	56	20	344	80	264

a New vehicle trips with internal capture credits applied.

b Pass-by credits of 25%, 34%, and 26% applied to weekday morning, weekday evening, and Saturday midday peak hour retail trip generation, respectively.

As shown in Tables 5-9, the Project is expected to generate a total 452, 533, and 344 vehicle trips during the respective weekday morning, weekday evening, and Saturday midday peak hours. However, these totals include traffic already being generated by the Site under existing conditions (as shown in Table 5-4). After considering this existing traffic generation, the Project will result in an additional 364, 414, and 264 vehicle trips compared to existing conditions during the weekday morning, weekday evening, and Saturday midday peak hours, respectively. This additional traffic was assigned to the study area roadways and intersections based on trip distribution patterns developed as discussed in the following section.

5.6 Trip Distribution and Assignment

The directional distribution of traffic approaching and departing the Project is a function of several variables. These include the population densities, shopping opportunities, competing uses, existing travel patterns, and the efficiency of the roadways leading to the site.

Due to the varying trip characteristics of the Project uses – residential, office, and retail/restaurant/active use – each use is expected to experience a different distribution pattern. Thus, regional trip distribution percentages were calculated separately for each of the Project's uses. The more localized trip distribution (i.e., within each study intersection) was developed based on the location of uses within the Site.

The residential and office trip distribution patterns were determined using journey-to-work census data for the City of Somerville. The trip distribution for the retail

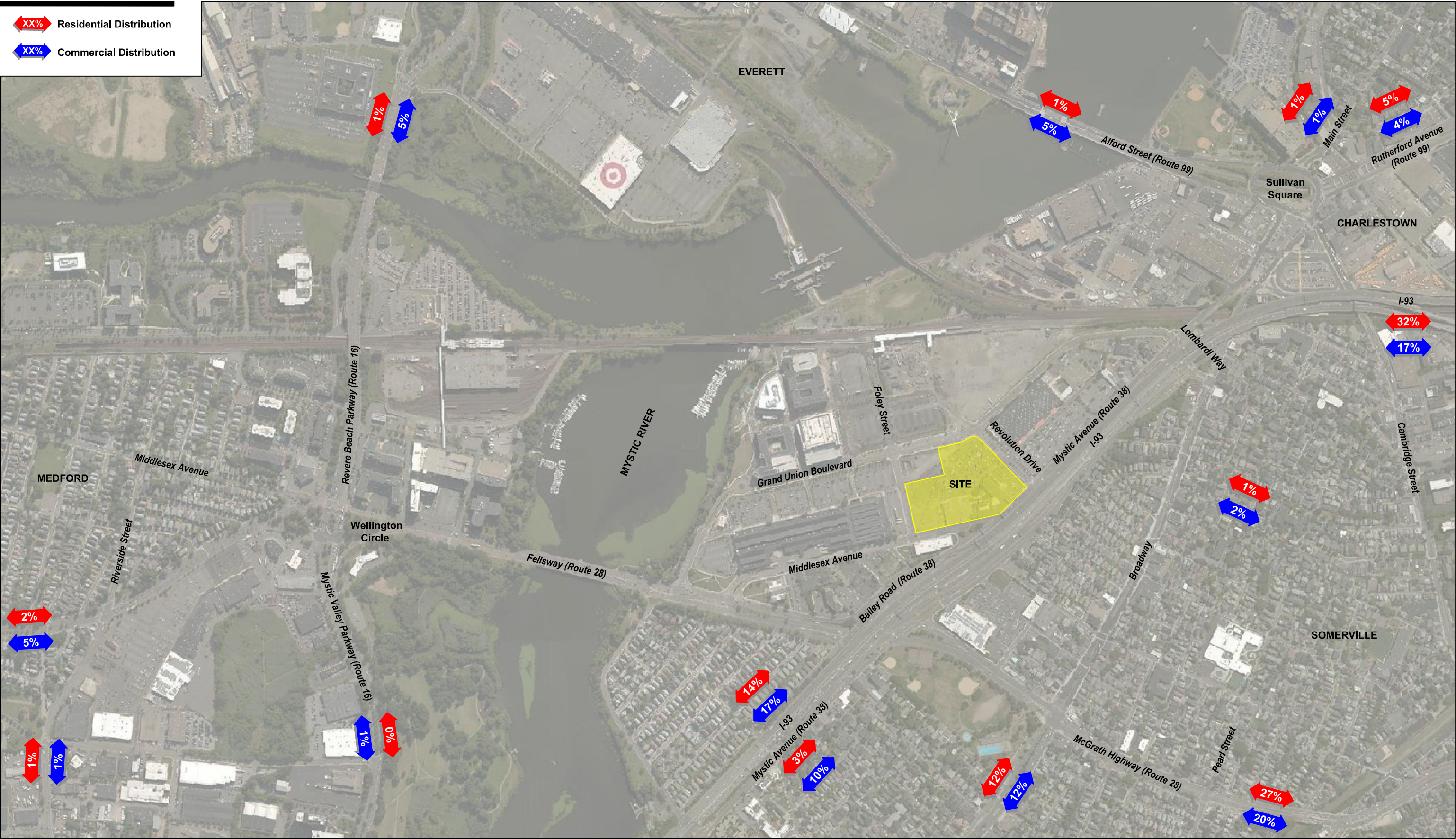
component was developed based on a previously-established gravity model utilizing the census data for communities included in the market trade area. Based on the distribution of population within the projected market trade area, arrival and departure patterns for project-related traffic were estimated and adjusted, if appropriate, based on known local factors such as locations of competing opportunities. The assignment of site-generated traffic to specific travel routes was based on observed traffic flow conditions on available routes, and the assumption that most motorists will seek the fastest and most direct routes to and from the site.

Table 5-10 summarizes the resulting trip distribution patterns for the Project. The individual trip distribution patterns for the commercial (office/research & development, and retail/restaurant space) and residential uses are shown in Figure 5.10.

Table 5-10 Vehicle Trip Distribution Summary

Route	Direction	Office/ Research & Development	Residential	Retail/ Restaurant
I-93	north	25%	11%	25%
I-93	south	21%	28%	21%
Route 28	northwest	6%	3%	6%
Route 28	southeast	14%	14%	14%
Route 16	west	1%	1%	1%
Route 16	east	7%	1%	7%
Broadway	northwest	8%	11%	8%
Medford Street	northwest	6%	22%	6%
Mystic Avenue	north	4%	3%	4%
Mystic Avenue	south	5%	3%	5%
<u>Local Roadways</u>	--	<u>3%</u>	<u>3%</u>	<u>3%</u>
Total	--	100%	100%	100%

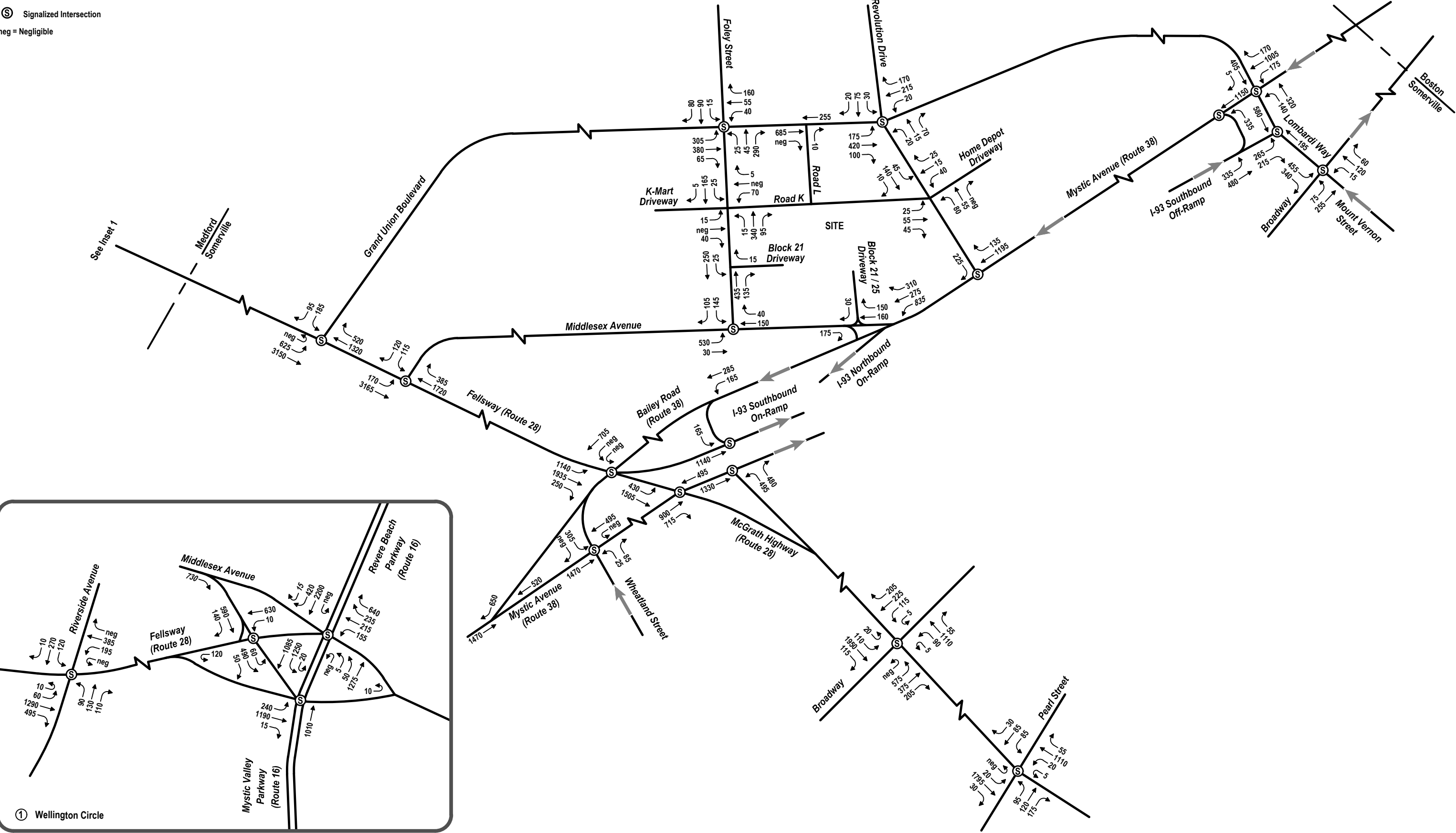
The future 2024 Build traffic volumes were developed by adding the additional Project-generated traffic volumes (as compared to existing conditions) to the 2024 No-Build conditions peak-hour traffic volumes. Figures 5.11, 5.12, and 5.13 show the resulting 2024 Build Conditions weekday morning, weekday evening, and Saturday midday peak hour traffic volumes, respectively.



Trip Distribution
5 Middlesex Avenue
Somerville, Massachusetts

Figure 5.10

Ⓢ Signalized Intersection
neg = Negligible



Not to Scale

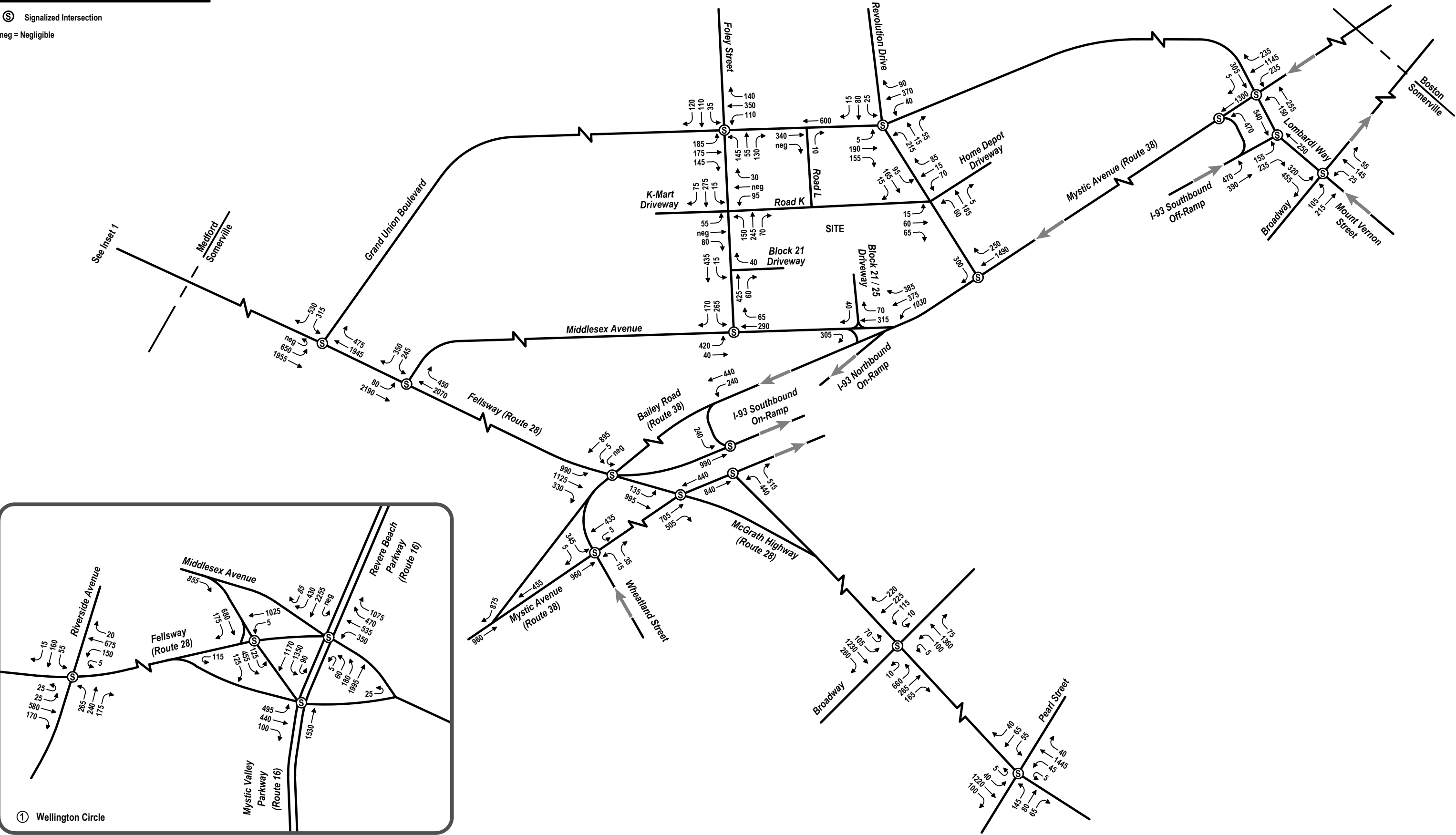


2024 Build Conditions
Weekday Morning Peak Hour Traffic Volumes
5 Middlesex Avenue
Somerville, Massachusetts

Figure 5.11

Figure 5.12

Ⓢ Signalized Intersection
neg = Negligible



2024 Build Conditions
Saturday Midday Peak Hour Traffic Volumes
5 Middlesex Avenue
Somerville, Massachusetts

Figure 5.13



Not to Scale

5.7 Parking Demand and Supply

Evaluating the adequacy of a development's parking supply normally involves comparing the expected demand to the proposed supply. Estimating the parking demand associated with each individual use within a transit-oriented mixed-use development also requires the evaluation of transit, walking, biking, and internal trip sharing. The resulting parking demand then can be compared to the proposed parking supply. With this approach there is an underlying assumption that there are no limitations to parking availability and that anyone wishing to park can freely do so. If the availability of parking is not restricted to some degree, then a site will not truly function as a transit-oriented development. Instead, it only will be a project that happens to have nearby public transportation available as one possible travel option.

As part of the proposed Site design, the amount and specific location of parking supply was carefully evaluated. This was done to help ensure that sufficient parking would be available for the normal operation of the Site, while not providing excessive parking which might reduce incentive for using other means of travel. The resulting parking supply satisfies the parking requirements specified in the City of Somerville Zoning Bylaws, and also meets the functional needs of the development.

The following section summarizes the parking supply proposed for the Project Site.

Proposed Parking Supply

Parking for the Site primarily will be accommodated through structured parking, along with limited surface parking (only 36 spaces) and on-street parking. The street parking is likely to be used primarily by visitors to retail/restaurant uses within the Site. In total, 36 on-street spaces will be provided along Road K. These spaces will be provided along both sides of the roadway to help serve the individual businesses while helping to create a vibrant street environment. There also is existing metered parking on Grand Union Boulevard and Foley Street adjacent to the Site. These spaces currently have a two-hour time limit Monday through Saturday from 8 AM to 8 PM, with \$0.25 pricing per 15 minutes. It is expected that the new Road K parking will follow a similar structure, but the details of the on-street parking will be coordinated with the City of Somerville.

The 36-surface parking spaces will be located in a single parking lot at the southerly end of the Site between Blocks 24 and 26. A single full-access driveway will be provided on Road K serving this lot.

As noted above, the overwhelming majority of parking provided will be in structured garages within Blocks 21, 23, and 25. Block 21 will be the main parking supply for the proposed Site commercial development, with approximately 1,352 spaces being provided in a multi-level garage. A full-access driveway to this garage will be provided on Road K, and a driveway restricted to entering and exiting right turns will be provided on Middlesex Avenue between Blocks 21 and 24. Block 21 also will have a driveway on Foley Street just east of its signalized intersection with Middlesex

Avenue. Due to its proximity to this location, exiting left-turns from the garage will be restricted through signage.

The residential uses within the Site also will have their own garages. Specifically, Block 23, containing 329 residential units with roughly 4,140 sf of supporting ground-floor commercial space, will have structured parking containing 197 parking spaces. The access drive for the garage will be located on Road L midway between Road K and Grand Union Boulevard. Likewise, Block 25, containing approximately 160 units, will have its own parking garage containing approximately 110 parking spaces.

The parking facilities within each Project building will be controlled through gating, ticketing, reader cards or other means. This will help ensure that the parking is strictly used by the Project, and not for parking for the MBTA or other nearby developments. The ability of this proposed parking supply to accommodate the anticipated Project parking demand is discussed in the following section.

Parking Demand

The potential parking demand for the Project was estimated based on standard ITE⁷ parking generation data for office, residential, and retail uses. Even considering the varying peak periods, shared parking, and other factors, the average calculated parking demand for the Project likely will slightly exceed the proposed supply. This proposed parking supply is being appropriately limited to help promote travel to the site other means besides automobile. The following sections discuss how the office/research & development, residential, and retail/restaurant demand effectively will be managed to help reduce the Project parking needs.

Time-of-Day Considerations

As with any office-/residential oriented development, the peak period for the parking demand will occur midday on a weekday. While the Project includes a retail/restaurant component, only 27,140 sf of building space is proposed for those uses, which are expected to be heavily oriented to shared business with Site residents and workers.

Public Transportation/Biking/Walking

The parking needs for the Project will be lessened due to the nearby availability of public bus service and the MBTA Assembly Square Orange Line Station. Amenities associated with the Project also will promote bicycle and pedestrian travel. With the Project being continuously developed over a several-year period there should continue to be less reliance by Site workers and residents on private automobile ownership. This ongoing trend is the result of increased transit usage, and recently improved accommodations for bicycle and pedestrian travel throughout the Assembly Square District. Alternate means of travel, such as taxi, private ride services

7 Parking Generation, 4th Edition, Institute of Transportation Engineers, Washington, D.C., 2010.

(Uber, Lyft, and others) should continue to reduce the parking needs for this area. There also will be extensive internal trip-sharing between the various uses within the Project Site. As an example, some residents of the Project Site may choose to walk to the various on-site retail uses that will be available. Similarly, some office/research & development workers could actually choose to live in one of the Site's residential units. Accordingly, there would not be any additional parking activity associated with that type of activity.

Shared Parking

A shared-parking approach will be utilized to help minimize the amount of parking spaces required. Due to the varying peak times for the office/lab and residential uses, there are opportunities for parking spaces to be shared between residents and workers.

The peak residential parking demand should occur outside of normal office working hours. Due to these offsetting peak times, there should be ample opportunity for shared parking between the residential and office uses. For example, other garages serving mixed-uses in the Boston area offer "reverse-commute" parking passes. Under this program, residents have access to certain parking spaces within a garage provided that they arrive after 4 PM and depart before 9 AM on weekdays. This allows nearby office workers to use these same parking spaces with the reverse time-restriction. The exact time periods for these restrictions can be determined as office tenants are identified.

Similarly, on a less formal basis, some of the office parking spaces can have signage noting that they are restricted to office use from 7 AM to 5 PM (or other similar time periods) with these spaces being reserved for other uses after that time. That alternate use likely would be by retail or restaurant patrons arriving during the early evening hours. These types of shared-parking activity are preferable to providing excessive parking for the office and residential uses separately without any consideration for these types of sharing opportunities within the Project Site. The excess of parking would discourage alternate means of transportation such as MBTA bus or train services, biking, taxi, or other ride services.

Most of the Project retail space will consist of small shops, restaurants, or cafes within each of the blocks where retail/restaurant space is proposed. Given the mixed-use nature of the Site, and the surrounding Assembly Square area, ample shared activity is expected with nearby uses. Therefore, a considerable amount of customer traffic should be in the form of residents or office/lab workers already on-site as opposed to destination retail traffic.

5.8 Site Access Plan

The Project site is bound by existing roadways around its perimeter, which will allow for multiple options for entering and exiting the overall Project site. The Project also will include the construction of a new "Road K" traveling in a north/south direction through the center of the Site. This roadway will be intersected at its midpoint by

Road L, which will continue to the east to its terminus with Grand Union Boulevard. Road K will intersect Foley Street opposite the K-Mart Driveway on the opposite side of the roadway, and this location will continue to function as a full-access unsignalized intersection. Road K will continue to the south through the Site where it will intersect Revolution Drive opposite the existing Home Depot driveway. To enhance access at this location, a new eastbound left-turn lane will be constructed within the existing roadway median to accommodate entering left-turns into the Project Site. This intersection will continue to operate at as a full-access four-way, unsignalized intersection.

To avoid traffic conflicts on Grand Union Boulevard, turning movements to and from Road L will be limited to right-turns only. Road L will provide access and egress for the residential 197-space parking garage within Block 23, and Site residents also may use Road K to travel to and from the garage. Road K also will provide access and egress to the Block 21 commercial parking garage and the 36-space Block 26 parking lot. The access driveway for the Block 21 garage has been located roughly 120 feet to the south of Foley Street. In doing so, it is expected that the majority of traffic to and from the garage will be oriented to the northerly segment of Road K as opposed to the remaining 680 feet of roadway to the south. The presence of on-street parking and traffic-calming features should help discourage use of this roadway by non-Site traffic. By providing this internal Site roadway, conflicts on the surrounding roadways will be minimized. A new driveway will be provided on Foley Street for the Block 21 driveway, but exiting left-turns will be restricted from that location.

A new driveway also will be provided on Middlesex Avenue, but it will be limited to entering and exiting right-turns only due to the existing landscaped island opposite the site which limits Middlesex Avenue to one-way, northbound travel only in this area. To help provide adequate sight lines looking from this driveway towards northbound Middlesex Avenue traffic, the easterly curblane of this roadway will be modified slightly. Specifically, as shown in Figure 5.14, the existing edge of road will be shifted by up to 26 feet to the west. Traffic heading northbound on Mystic Avenue still will be able to freely turn right onto Middlesex Avenue, but exiting Site traffic will be able to see these oncoming vehicles for a greater distance. With this change, there also will be additional green space provided along the Site's Middlesex Avenue frontage which should provide for improved conditions for pedestrians in this area.

Finally, the proposed 16,000 SF City of Somerville fire station will have its own driveway on Middlesex Avenue at the northwest corner of Block 21. The Proponent is committed to working with the City to help provide appropriate measures to help ensure timely, safe, and efficient access and egress to this new amenity.

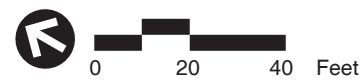
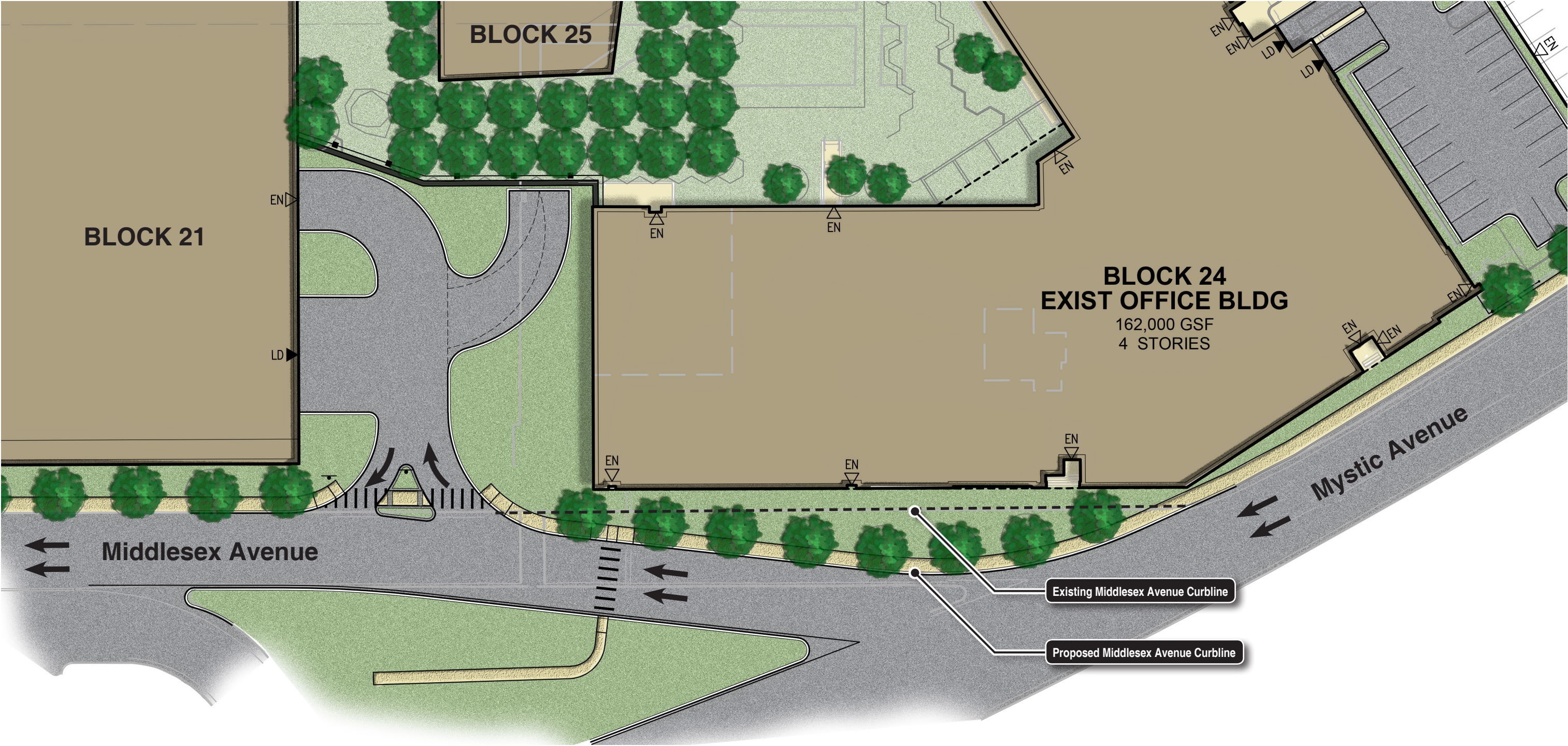


Figure 5.14
Proposed Middlesex Avenue Curb
Realignment
XMBLY
Somerville, Massachusetts

5.9 Traffic Operations Analysis

Measuring existing traffic volumes and projecting future traffic volumes quantifies traffic flow within the study area. To assess quality flow, roadway capacity analyses were conducted with respect to Existing and projected No-Build and Build traffic volume conditions. Capacity analyses provide an indication of how well the roadway facilities serve the traffic demands placed upon them. Roadway operating conditions are classified by calculated levels of service.

Level-of-Service Criteria

The evaluation criteria used to analyze area intersections in this traffic study are based on the 2010 Highway Capacity Manual (HCM)⁸. The term 'Level of Service' (LOS) is used to denote the different operating conditions that occur on a given roadway segment under various traffic volume loads. It is a qualitative measure that considers a number of factors including roadway geometry, speed, travel delay and freedom to maneuver. LOS provides an index to the operational qualities of a roadway segment or an intersection. LOS designations range from A to F, with LOS A representing the best operating conditions and LOS F representing the worst operating conditions.

In addition to LOS, two other measures of effectiveness (MOEs) are typically used to quantify the traffic operations at intersections; volume-to-capacity ratio (v/c) and delay (expressed in seconds per vehicle). For example, an existing v/c ratio of 0.9 for an intersection indicates that the intersection is operating at 90 percent of its available capacity. A delay of 15 seconds for a particular vehicular movement or approach indicates that vehicles on the movement or approach will experience an average additional travel time of 15 seconds. For a given LOS letter designation there may be a wide range of values for both v/c ratios and delay. Comparison of intersection capacity results therefore requires that, in addition to the LOS, the other MOEs should also be considered.

The LOS 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, however, 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, which is generally the left turn out of the side street or site driveway. Table 9 shows the LOS criteria for both signalized intersections and unsignalized intersections.

It should be noted that the analytical methodologies typically used for the analysis of unsignalized intersections use conservative analysis parameters, such as long critical gaps. Actual field observations indicate that drivers on minor streets generally

8 Highway Capacity Manual; Transportation Research Board (Washington, D.C.), 2010.

accept shorter gaps in traffic than those used in the analysis procedures and therefore experience less delay than reported by the analysis software. The analysis methodologies also do not fully take into account the beneficial grouping effects caused by nearby signalized intersections. The net effect of these analysis procedures is the over-estimation of calculated delays at unsignalized intersections in the study area. Cautious judgment should therefore be exercised when interpreting the capacity analysis results at unsignalized intersections. The level-of-service criteria for signalized and unsignalized intersections are summarized in Table 5-11.

Table 5-11 Level of Service Criteria

Level of Service	Delay – Signalized Intersection	Delay – Unsignalized Intersection
A	0 to 10 seconds	0 to 10 seconds
B	10 to 20 seconds	10 to 15 seconds
C	20 to 35 seconds	15 to 25 seconds
D	35 to 55 seconds	25 to 35 seconds
E	55 to 80 seconds	35 to 50 seconds
F	Greater than 80 seconds	Greater than 50 seconds

Source: 2010 Highway Capacity Manual.

Signalized Intersection Capacity Analysis

Capacity analyses conducted by VHB for the signalized intersections are summarized in Table 5-12. The capacity analyses were conducted for the 2017 Existing, 2024 No-Build, and 2024 Build conditions.

Table 5-12 Signalized Intersection Capacity Analysis

Location / Movement	2017 Existing Conditions					2024 No-Build Conditions					2024 Build Conditions				
	v/c ^a	Del ^b	LOS ^c	50 Q ^d	95 Q ^e	v/c	Del	LOS	50 Q	95 Q	v/c	Del	LOS	50 Q	95 Q
Middlesex Avenue at Foley Street															
<i>Weekday Morning</i>															
WB L	0.02	30	C	1	12	0.52	37	D	47	142	0.54	38	D	58	153
WB R	0.13	4	A	0	24	0.11	3	A	0	22	0.13	3	A	0	24
NB R	0.17	25	C	14	42	0.23	33	C	22	70	0.29	34	C	31	83
NB T	0.03	6	A	0	5	0.07	5	A	0	13	0.08	5	A	0	14
SB L	0.54	12	B	39	187	0.66	17	B	75	309	0.76	21	C	102	#417
SB T	0.01	9	A	1	13	0.03	11	B	4	26	0.03	11	B	4	26
Overall		13	B				20	C				23	C		
<i>Weekday Evening</i>															
WB L	0.17	28	C	9	37	0.83	46	D	225	#479	0.93	61	E	~301	#569
WB R	0.32	4	A	0	19	0.28	3	A	0	42	0.32	3	A	0	47
NB R	0.40	22	C	34	112	0.60	34	C	103	158	0.68	36	D	137	204
NB T	0.08	4	A	0	10	0.08	3	A	0	11	0.09	3	A	2	14
SB L	0.43	12	B	21	106	0.59	23	C	95	153	0.69	25	C	110	171
SB T	0.02	10	A	1	14	0.06	15	B	16	37	0.06	15	B	16	36
Overall		13	B				28	C				33	C		
<i>Saturday Midday</i>															
WB L	0.24	31	C	15	58	0.58	34	C	90	#286	0.61	39	D	158	#329
WB R	0.21	3	A	0	26	0.17	3	A	0	30	0.19	3	A	0	32
NB R	0.34	25	C	29	93	0.47	34	C	54	128	0.57	39	D	92	147
NB T	0.09	4	A	0	12	0.09	3	A	0	15	0.10	3	A	0	16
SB L	0.54	13	B	35	174	0.65	19	B	90	255	0.78	27	C	196	287
SB T	0.03	10	A	2	20	0.05	13	B	7	33	0.05	14	B	14	32
Overall		15	B				23	C				28	C		
Mystic Avenue (Route 38) at Revolution Drive															
<i>Weekday Morning</i>															
WB R	0.28	13	B	10	30	0.38	15	B	18	49	0.43	17	B	23	64
NB T	0.33	5	A	30	54	0.46	6	A	42	76	0.50	7	A	54	99
NB R	0.09	1	A	0	0	0.11	1	A	0	0	0.13	1	A	0	0
Overall		6	A				7	A				8	A		
<i>Weekday Evening</i>															
WB R	0.62	26	C	70	101	0.86	36	D	149	#241	0.95	48	D	182	#302
NB T	0.63	9	A	128	209	0.77	13	B	249	311	0.80	14	B	257	320
NB R	0.13	0	A	0	0	0.15	0	A	0	0	0.16	0	A	0	0
Overall		11	B				17	B				21	C		
<i>Saturday Midday</i>															
WB R	0.34	17	B	16	45	0.51	22	C	36	91	0.55	23	C	46	103
NB T	0.39	5	A	46	83	0.54	7	A	76	136	0.57	8	A	88	155
NB R	0.19	1	A	0	0	0.21	1	A	0	0	0.22	1	A	0	0
Overall		6	A				8	A				9	A		

a Volume to capacity ratio.

b Average total delay, in seconds per vehicle.

c Level-of-service.

d 50th percentile queue, in feet.

e 95th percentile queue, 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 5-12 Signalized Intersection Capacity Analysis (continued)

Location / Movement	2017 Existing Conditions					2024 No-Build Conditions					2024 Build Conditions				
	v/c ^a	Del ^b	LOS ^c	50 Q ^d	95 Q ^e	v/c	Del	LOS	50 Q	95 Q	v/c	Del	LOS	50 Q	95 Q
Grand Union Boulevard at Foley Street															
<i>Weekday Morning</i>															
EB L/T	0.29	50	C	20	5	0.48	52	D	44	85	0.52	55	E	47	90
EB R	0.64	13	B	0	62	0.62	10	A	0	64	0.63	10	A	0	64
WB L/T/R	0.16	42	C	8	13	0.64	33	C	36	71	0.64	33	C	36	71
NB L	0.08	7	A	8	13	0.11	18	B	4	m34	0.11	18	B	4	m34
NB T/R	0.08	8	A	15	22	0.41	19	B	0	113	0.41	19	B	0	113
SB L	0.03	10	B	6	17	0.51	16	B	112	192	0.51	16	B	112	192
SB T/R	0.46	19	B	208	285	0.54	24	C	216	358	0.57	25	C	230	379
Overall		18	B				21	C				22	C		
<i>Weekday Evening</i>															
EB L/T	0.64	52	D	63	106	0.93	98	F	~97	#214	1.16	>120	F	~128	#251
EB R	0.21	7	A	0	27	0.14	6	A	0	29	0.19	5	A	0	34
WB L/T/R	0.14	27	C	12	23	0.67	26	C	123	#197	0.68	26	C	123	#206
NB L	0.19	9	A	21	m43	0.42	10	A	28	m31	0.42	10	B	28	m31
NB T/R	0.50	17	B	97	#427	>1.20	>120	F	~375	m#415	>1.20	>120	F	~375	m#415
SB L	0.05	16	B	6	18	0.87	60	E	71	#171	0.87	60	E	71	#171
SB T/R	0.30	24	C	87	142	0.55	31	C	111	188	0.56	31	C	113	192
Overall		21	C				64	E				69	E		
<i>Saturday Midday</i>															
EB L/T	0.85	73	E	111	#213	0.94	89	F	~154	#301	0.94	87	F	~162	#310
EB R	0.23	6	A	0	34	0.23	5	A	0	39	0.24	5	A	0	40
WB L/T/R	0.13	25	C	11	23	0.41	21	C	46	87	0.40	21	C	46	87
NB L	0.19	17	B	36	68	0.32	19	B	45	80	0.33	19	B	45	80
NB T/R	0.51	25	C	195	357	0.94	61	E	~343	#563	0.97	66	E	~343	#563
SB L	0.05	16	B	7	21	0.83	50	D	80	#206	0.83	50	D	79	#205
SB T/R	0.35	25	C	109	186	0.57	30	C	165	267	0.59	31	C	168	272
Overall		30	C				44	D				45	D		

- a Volume to capacity ratio.
b Average total delay, in seconds per vehicle.
c Level-of-service.
d 50th percentile queue, in feet.
e 95th percentile queue, 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 5-12 Signalized Intersection Capacity Analysis (continued)

Location / Movement	2017 Existing Conditions					2024 No-Build Conditions					2024 Build Conditions				
	v/c ^a	Del ^b	LOS ^c	50 Q ^d	95 Q ^e	v/c	Del	LOS	50 Q	95 Q	v/c	Del	LOS	50 Q	95 Q
Grand Union Boulevard at Revolution Drive															
<i>Weekday Morning</i>															
EB L	0.24	49	D	14	37	0.23	49	D	13	39	0.23	49	D	13	39
EB T/R	0.52	25	C	10	56	0.49	24	C	10	59	0.49	24	C	10	59
WB L	0.27	52	D	14	28	0.37	56	E	20	#57	0.37	56	E	20	#57
WB T	0.28	49	D	23	39	0.57	61	E	50	#123	0.57	61	E	50	#123
WB R	0.02	0	A	0	0	0.01	0	A	0	0	0.01	0	A	0	0
NB L	0.03	13	B	5	17	0.04	12	B	7	18	0.04	12	B	7	18
NB T/R	0.10	20	B	35	70	0.53	25	C	238	334	0.53	25	C	238	334
SB L	0.25	9	A	65	58	0.36	9	A	49	59	0.36	9	A	52	65
SB T	0.36	12	B	140	131	0.39	11	B	121	151	0.40	11	B	132	168
SB R	0.09	11	B	29	36	0.11	10	A	26	43	0.11	11	B	29	49
Overall	16	B				20	B				20	B			
<i>Weekday Evening</i>															
EB L	0.79	66	E	76	#157	0.80	71	E	~112	#230	0.80	71	E	~112	#230
EB T/R	0.26	21	C	17	54	0.15	18	B	16	55	0.15	18	B	16	55
WB L	0.13	34	C	12	31	0.21	33	C	39	81	0.21	33	C	39	81
WB T	0.30	36	D	41	72	0.67	42	D	~246	#416	0.67	42	D	~246	#416
WB R	0.06	0	A	0	0	0.06	0	A	0	0	0.06	0	A	0	0
NB L	0.20	23	C	63	m88	0.33	25	C	61	m94	0.35	26	C	61	m94
NB T/R	0.47	34	C	237	m264	1.04	86	F	~436	m#500	1.04	86	F	~436	m#498
SB L	0.08	30	C	16	38	0.16	29	C	14	m26	0.16	27	C	14	m26
SB T	0.15	41	D	58	110	0.36	43	D	85	m142	0.44	43	D	107	m174
SB R	0.16	42	D	52	103	0.32	43	D	63	m113	0.34	42	D	65	m117
Overall	34	C				54	D				54	D			
<i>Saturday Midday</i>															
EB L	0.71	55	D	175	246	0.77	63	E	167	#36	0.77	63	E	167	#366
EB T/R	0.18	14	B	11	44	0.18	16	B	9	55	0.18	16	B	9	55
WB L	0.02	35	D	4	14	0.09	40	D	16	47	0.09	40	D	16	47
WB T	0.03	36	D	8	21	0.20	41	D	53	111	0.20	41	D	53	111
WB R	0.02	0	A	0	0	0.01	0	A	0	0	0.01	0	A	0	0
NB L	0.05	17	B	9	34	0.07	14	B	12	36	0.07	14	B	12	36
NB T/R	0.34	21	C	108	280	0.50	22	C	181	443	0.50	22	C	181	443
SB L	0.01	18	B	2	11	0.01	15	B	1	9	0.01	15	B	1	9
SB T	0.17	23	C	57	139	0.21	22	C	73	157	0.23	22	C	81	169
SB R	0.18	23	C	50	129	0.22	22	C	63	140	0.22	22	C	65	144
Overall	29	C				30	C				30	C			

a Volume to capacity ratio.

b Average total delay, in seconds per vehicle.

c Level-of-service.

d 50th percentile queue, in feet.

e 95th percentile queue, 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 5-12 Signalized Intersection Capacity Analysis (continued)

Location / Movement		2017 Existing Conditions					2024 No-Build Conditions					2024 Build Conditions				
		v/c ^a	Del ^b	LOS ^c	50 Q ^d	95 Q ^e	v/c	Del	LOS	50 Q	95 Q	v/c	Del	LOS	50 Q	95 Q
Fellsway (Route 28) at Grand Union Boulevard																
Weekday Morning																
WB L	0.10	35	D	25	46	0.24	37	D	64	97	0.24	37	D	64	97	
WB R	0.04	0	A	0	0	0.06	0	A	0	0	0.07	0	A	0	0	
NB T	0.79	13	B	47	98	0.86	22	C	115	m103	0.86	22	C	116	m104	
NB R	0.06	0	A	0	m0	0.37	3	A	27	m0	0.37	3	A	26	m0	
SB L	0.58	43	D	173	230	0.77	49	D	247	317	0.79	50	D	254	325	
SB T	0.97	32	C	781	#902	1.04	75	E	~1049	#1127	1.05	75	E	~1058	#1136	
Overall		27	C				52	D				52	D			
Weekday Evening																
WB L	0.22	37	D	62	85	0.55	42	D	169	223	0.55	42	D	169	223	
WB R	0.42	1	A	0	0	0.51	1	A	0	0	0.52	1	A	0	0	
NB T	>1.20	>120	F	~817	m#716	>1.20	>120	F	~965	m#594	>1.20	>120	F	~974	m#603	
NB R	0.08	0	A	0	m0	0.26	0	A	0	m0	0.26	0	A	0	m0	
SB L	0.37	39	D	106	149	0.49	41	D	145	196	0.50	41	D	147	198	
SB T	0.46	12	B	205	238	0.56	13	B	271	311	0.56	13	B	273	312	
Overall		87	F				105	F				107	F			
Saturday Middy																
WB L	0.28	37	D	78	115	0.39	39	D	113	158	0.39	39	D	113	158	
WB R	0.31	1	A	0	0	0.36	1	A	0	0	0.36	1	A	0	0	
NB T	1.04	48	D	~183	m#526	>1.20	>120	F	~712	m#159	>1.20	>120	F	~715	m#161	
NB R	0.13	0	A	0	m0	0.33	1	A	0	m0	0.33	1	A	0	m0	
SB L	0.66	45	D	204	267	0.82	51	D	264	337	0.82	52	D	268	340	
SB T	0.56	13	B	267	306	0.65	14	B	342	390	0.65	15	B	343	391	
Overall		28	C				57	E				58	E			
Fellsway (Route 28) at Middlesex Avenue																
Weekday Morning																
WB L	0.10	35	D	23	44	0.11	35	D	26	48	0.16	36	D	39	65	
WB R	0.06	0	A	0	0	0.09	0	A	0	0	0.09	0	A	0	0	
NB T	0.79	40	D	334	392	1.13	102	F	~613	#709	1.13	102	F	~613	#709	
NB R	0.17	0	A	0	0	0.22	0	A	0	0	0.27	0	A	0	0	
SB L	0.16	47	D	43	m46	0.20	46	D	53	m53	0.22	46	D	59	m58	
SB T	0.94	10	B	106	m139	1.05	51	D	~1053	m#187	1.05	51	D	~1053	m#182	
Overall		19	B				63	E				62	E			
Weekday Evening																
WB L	0.24	37	D	66	98	0.28	37	D	77	113	0.42	40	D	122	168	
WB R	0.27	0	A	0	0	0.30	1	A	0	0	0.31	1	A	0	0	
NB T	1.13	103	F	~632	#729	>1.20	>120	F	~957	#1049	>1.20	>120	F	~957	#1049	
NB R	0.10	0	A	0	0	0.13	0	A	0	0	0.15	0	A	0	0	
SB L	0.06	30	C	12	26	0.11	33	C	24	45	0.11	33	C	25	48	
SB T	0.50	6	A	90	100	0.68	11	B	184	197	0.68	11	B	184	197	
Overall		50	D				109	F				107	F			
Saturday Middy																
WB L	0.24	37	D	64	97	0.25	37	D	69	104	0.31	38	D	86	125	
WB R	0.20	0	A	0	0	0.24	0	A	0	0	0.24	0	A	0	0	
NB T	0.99	98	F	479	#597	>1.20	>120	F	~823	#916	>1.20	>120	F	~823	#916	
NB R	0.21	0	A	0	0	0.28	0	A	0	0	0.31	1	A	0	0	
SB L	0.07	35	C	15	m30	0.10	39	D	22	m38	0.10	39	D	23	m40	
SB T	0.61	7	A	113	123	0.73	9	A	150	160	0.73	9	A	150	159	
Overall		41	D				76	E				75	E			
a	Volume to capacity ratio.					d	50th percentile queue, in feet.									
b	Average total delay, in seconds per vehicle.					e	95th percentile queue, in feet.									
c	Level-of-service.					~	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 5-12 Signalized Intersection Capacity Analysis (continued)

Location / Movement	2017 Existing Conditions					2024 No-Build Conditions					2024 Build Conditions				
	v/c ^a	Del ^b	LOS ^c	50 Q ^d	95 Q ^e	v/c	Del	LOS	50 Q	95 Q	v/c	Del	LOS	50 Q	95 Q
Mystic Avenue (Route 38) at Wheatland Street / Bailey Road															
<i>Weekday Morning</i>															
EB T	0.79	28	C	461	558	0.86	32	C	537	648	0.88	33	C	558	674
WB T	0.26	1	A	1	1	0.29	0	A	0	0	0.29	0	A	0	0
NB L/R	0.05	26	C	14	35	0.04	26	C	14	35	0.04	26	C	14	35
SB L/R	0.26	39	D	101	m136	0.28	40	D	111	m132	0.28	40	D	112	m134
Overall		23	C				25	C				26	C		
<i>Weekday Evening</i>															
EB T	0.51	20	C	241	299	0.57	21	C	278	343	0.57	21	C	281	345
WB T	0.47	1	A	1	1	0.54	1	A	0	0	0.54	1	A	0	0
NB L/R	0.03	26	C	11	23	0.03	26	C	8	24	0.03	26	C	8	24
SB L/R	0.28	39	D	119	148	0.28	40	D	124	m158	0.30	40	D	128	m160
Overall		15	B				15	B				15	B		
<i>Saturday Midday</i>															
EB T	0.49	20	B	226	281	0.75	36	D	363	446	0.76	36	D	367	452
WB T	0.26	1	A	2	0	0.37	1	A	5	4	0.37	1	A	5	4
NB L/R	0.03	26	C	11	23	0.02	16	B	6	19	0.02	16	B	6	19
SB L/R	0.28	37	D	112	150	0.22	28	C	120	158	0.23	28	C	121	159
Overall		18	B				25	C				25	C		
Fellsway (Route 28) SB at Bailey Road (Route 38) / I-93 Southbound On-Ramp															
<i>Weekday Morning</i>															
WB T	0.25	17	B	102	128	0.30	17	B	118	146	0.30	17	B	120	148
SB L	0.99	75	E	463	#616	1.04	88	F	~530	#665	1.04	90	F	~535	#669
SB T/R	1.15	111	F	~668	#765	>1.20	>120	F	~872	#967	>1.20	>120	F	~890	#985
Overall		84	F				>120	F				>120	F		
<i>Weekday Evening</i>															
WB T	0.38	18	B	167	201	0.42	19	B	190	226	0.44	19	B	197	234
SB L	0.62	35	C	245	310	0.61	35	C	240	304	0.62	35	D	246	311
SB T/R	0.67	34	C	270	323	0.98	55	D	472	#589	1.04	70	E	~554	#653
Overall		29	C				39	D				47	D		
<i>Saturday Midday</i>															
WB T	0.32	17	B	135	165	0.49	29	C	205	247	0.49	29	C	209	252
SB L	0.89	47	D	397	#502	0.65	26	C	312	284	0.66	26	C	314	387
SB T/R	0.68	33	C	269	322	0.66	25	C	313	365	0.67	25	C	325	379
Overall		34	C				26	C				27	C		

a Volume to capacity ratio.

b Average total delay, in seconds per vehicle.

c Level-of-service.

d 50th percentile queue, in feet.

e 95th percentile queue, 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 5-12 Signalized Intersection Capacity Analysis (continued)

Location / Movement	2017 Existing Conditions					2024 No-Build Conditions					2024 Build Conditions				
	v/c ^a	Del ^b	LOS ^c	50 Q ^d	95 Q ^e	v/c	Del	LOS	50 Q	95 Q	v/c	Del	LOS	50 Q	95 Q
Fellsway / McGrath Highway (Route 28) SB at Mystic Avenue (Route 38)															
<i>Weekday Morning</i>															
EB T/R	0.62	64	E	120	153	0.72	65	E	141	203	0.73	66	E	145	210
EB R	0.62	13	B	87	m129	0.71	16	B	104	m165	0.73	17	B	107	m165
WB T	0.27	2	A	5	7	0.29	1	A	0	0	0.29	1	A	0	0
SB L/T	1.02	57	E	~112	m87	1.18	101	F	~675	m84	1.20	107	F	~687	m83
Overall		46	D				68	E				71	E		
<i>Weekday Evening</i>															
EB T/R	0.39	13	B	94	117	0.47	16	B	118	141	0.49	16	B	123	146
EB R	0.39	12	B	73	107	0.47	13	B	87	123	0.48	13	B	91	127
WB T	0.48	2	A	5	6	0.54	3	A	0	m0	0.54	3	A	0	m0
SB L/T	0.55	8	A	34	38	0.80	14	B	73	m84	0.84	16	B	87	m84
Overall		8	A				11	B				12	B		
<i>Saturday Midday</i>															
EB T/R	0.47	21	C	120	144	0.69	52	D	134	188	0.70	61	E	136	192
EB R	0.46	13	B	85	123	0.67	21	C	92	159	0.69	22	C	95	167
WB T	0.25	1	A	1	1	0.35	2	A	0	m4	0.35	2	A	0	m4
SB L/T	0.50	7	A	27	30	0.49	5	A	26	29	0.51	5	A	27	30
Overall		11	B				21	C				23	C		
Mystic Avenue (Route 38) at McGrath Highway (Route 28) NB Off-Ramp															
<i>Weekday Morning</i>															
EB T	0.64	72	E	382	m412	0.71	73	E	444	m456	0.73	74	E	458	m470
NB T	0.44	35	C	150	199	0.52	37	D	178	232	0.52	37	D	178	232
NB R	0.25	0	A	0	0	0.29	1	A	0	0	0.33	1	A	0	0
Overall		51	D				51	D				51	D		
<i>Weekday Evening</i>															
EB T	0.31	24	C	190	243	0.36	33	C	245	303	0.36	35	D	247	m306
NB T	0.82	46	D	318	397	0.97	63	E	391	#528	0.97	63	E	391	#528
NB R	0.24	0	A	0	0	0.27	0	A	0	0	0.28	1	A	0	0
Overall		29	C				41	D				41	D		
<i>Saturday Midday</i>															
EB T	0.41	34	C	275	342	0.37	32	C	313	387	0.37	35	C	317	393
NB T	0.42	35	C	141	189	0.80	59	E	186	#267	0.80	59	E	186	#267
NB R	0.31	1	A	0	0	0.33	1	A	0	0	0.36	1	A	0	0
Overall		25	C				30	C				31	C		
I-93 Southbound On-Ramp at Mystic Avenue U-Turn															
<i>Weekday Morning</i>															
EB T						1.00	28	C	120	m115	1.00	29	C	~120	m115
SB R						0.09	13	B	28	46	0.10	14	B	31	51
Overall							26	C				27	C		
<i>Weekday Evening</i>															
EB T						0.59	8	A	25	30	0.61	8	A	25	30
SB R						0.22	11	B	57	86	0.25	12	B	69	101
Overall							9	A				9	A		
<i>Saturday Midday</i>															
EB T						0.64	6	A	36	41	0.64	6	A	36	42
SB R						0.17	13	B	32	60	0.19	15	B	39	68
Overall							7	A				8	A		

a Volume to capacity ratio.

b Average total delay, in seconds per vehicle.

c Level-of-service.

95th percentile volume exceeds capacity, queue may be longer.

m Volume for 95th percentile queue is metered by upstream signal.

d 50th percentile queue, in feet.

e 95th percentile queue, in feet.

~ Volume exceeds capacity, queue is theoretically infinite.

Table 5-12 Signalized Intersection Capacity Analysis (continued)

Location / Movement	2017 Existing Conditions					2024 No-Build Conditions					2024 Build Conditions				
	v/c ^a	Del ^b	LOS ^c	50 Q ^d	95 Q ^e	v/c	Del	LOS	50 Q	95 Q	v/c	Del	LOS	50 Q	95 Q
McGrath Highway (Route 28) at Broadway															
<i>Weekday Morning</i>															
EB L	0.70	50	D	152	284	0.80	57	E	230	#436	0.81	58	E	245	#472
EB L/T	0.58	39	D	128	197	0.61	41	D	172	249	0.60	40	D	177	255
EB R	0.64	48	D	113	216	0.63	48	D	142	257	0.61	47	D	142	257
WB L	0.53	56	E	69	148	0.61	62	E	91	168	0.61	63	E	91	168
WB L/T	0.56	50	D	78	137	0.64	55	E	101	155	0.65	56	E	101	155
WB R	0.13	0	A	0	0	0.15	0	A	0	0	0.15	0	A	0	0
NB L	0.54	58	E	59	127	0.60	64	E	74	139	0.60	65	E	74	139
NB T/R	0.61	36	D	180	284	0.87	48	D	310	#468	0.93	53	D	331	#506
SB L	0.63	58	E	82	164	0.67	64	E	101	176	0.68	65	E	101	176
SB T/R	>1.20	>120	F	~594	#865	>1.20	>120	F	~841	#1036	>1.20	>120	F	~857	#1080
Overall		89	F				>120	F				>120	F		
<i>Weekday Evening</i>															
EB L	0.79	61	E	216	#366	0.87	70	E	276	#488	0.87	71	E	283	#503
EB L/T	0.54	43	D	144	202	0.57	45	D	173	232	0.57	45	D	174	234
EB R	0.53	48	D	104	189	0.52	49	D	116	201	0.51	49	D	116	201
WB L	0.49	55	D	87	160	0.51	56	E	106	178	0.51	56	E	106	178
WB L/T	0.72	57	E	141	204	0.75	60	E	173	231	0.76	60	E	173	231
WB R	0.14	0	A	0	0	0.15	0	A	0	0	0.15	0	A	0	0
NB L	0.75	69	E	142	240	0.82	76	E	172	#308	0.83	77	E	172	#308
NB T/R	>1.20	>120	F	~704	#953	>1.20	>120	F	~1015	#1269	>1.20	>120	F	~1029	#1283
SB L	0.64	67	E	92	164	0.69	71	E	113	185	0.69	71	E	113	185
SB T/R	0.98	63	E	~394	#571	>1.20	>120	F	~805	#967	>1.20	>120	F	~857	#1020
Overall		94	F				>120	F				>120	F		
<i>Saturday MIDDAY</i>															
EB L	0.80	59	E	227	#411	0.89	69	E	303	#566	0.91	72	E	312	#584
EB L/T	0.49	39	D	131	188	0.52	40	D	163	227	0.53	40	D	165	231
EB R	0.48	43	D	101	186	0.48	44	D	115	205	0.48	44	D	115	205
WB L	0.59	63	E	87	159	0.64	66	E	98	174	0.64	66	E	98	174
WB L/T	0.59	55	D	92	141	0.65	58	E	104	156	0.65	58	E	104	156
WB R	0.14	0	A	0	0	0.16	0	A	0	0	0.16	0	A	0	0
NB L	0.60	65	E	77	141	0.64	68	E	84	150	0.64	68	E	84	150
NB T/R	0.90	50	D	330	#485	1.16	>120	F	~506	#678	1.19	>120	F	~525	#698
SB L	0.74	66	E	134	220	0.77	70	E	140	232	0.77	70	E	140	232
SB T/R	0.84	42	D	336	#477	1.06	79	E	~471	#669	1.08	87	F	~490	#690
Overall		46	D				79	E				85	F		

a Volume to capacity ratio.

b Average total delay, in seconds per vehicle.

c Level-of-service.

d 50th percentile queue, in feet.

e 95th percentile queue, 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 5-12 Signalized Intersection Capacity Analysis (continued)

Location / Movement	2017 Existing Conditions					2024 No-Build Conditions					2024 Build Conditions				
	v/c ^a	Del ^b	LOS ^c	50 Q ^d	95 Q ^e	v/c	Del	LOS	50 Q	95 Q	v/c	Del	LOS	50 Q	95 Q
McGrath Highway (Route 28) at Pearl Street															
<i>Weekday Morning</i>															
EB R	1.02	112	F	~231	#341	0.99	106	F	~199	#365	0.99	106	F	~199	#365
EB L/T	0.53	41	D	134	182	0.52	41	D	122	194	0.52	41	D	122	194
WB L/T/R	>1.20	>120	F	~265	#382	>1.20	>120	F	~230	#394	>1.20	>120	F	~230	#394
NB L	0.17	19	B	11	27	0.18	20	B	11	28	0.18	20	B	11	28
NB T/R	0.42	24	C	165	242	0.55	27	C	279	332	0.58	28	C	298	354
SB L	0.07	18	B	9	23	0.10	18	B	9	24	0.11	18	B	9	24
SB T/R	0.87	39	D	431	511	0.97	50	D	~601	#707	0.98	51	D	~614	#719
Overall		58	E				57	E				57	E		
<i>Weekday Evening</i>															
EB R	0.94	90	F	~230	#372	1.03	113	F	~235	#400	1.08	>120	F	~237	#402
EB L/T	0.15	31	C	41	76	0.16	32	C	42	81	0.17	32	C	42	81
WB L/T/R	>1.20	>120	F	~309	#422	>1.20	>120	F	~298	#475	>1.20	>120	F	~303	#479
NB L	0.67	38	D	62	#158	0.76	48	D	79	#203	0.78	50	D	80	#207
NB T/R	0.83	33	C	545	#684	1.02	55	E	~829	#947	1.00	52	D	~842	#960
SB L	0.24	20	B	18	39	0.28	20	C	20	42	0.28	20	C	20	42
SB T/R	0.78	34	C	396	450	0.90	39	D	536	#657	0.90	40	D	~603	#700
Overall		45	D				60	E				61	E		
<i>Saturday Midday</i>															
EB R	0.68	46	D	91	#346	0.75	54	D	107	#397	0.76	55	D	109	#397
EB L/T	0.13	25	C	15	74	0.13	27	C	20	81	0.13	28	C	20	81
WB L/T/R	0.40	36	D	45	#183	0.55	43	D	67	#252	0.55	44	D	68	#253
NB L	0.20	17	B	9	41	0.25	17	B	10	46	0.25	17	B	10	46
NB T/R	0.66	26	C	159	349	0.74	27	C	221	479	0.75	27	C	228	493
SB L	0.18	17	B	8	38	0.23	17	B	9	42	0.23	17	B	9	42
SB T/R	0.68	27	C	143	317	0.72	28	C	189	414	0.73	28	C	194	425
Overall		28	C				29	C				30	C		
Mystic Avenue (Route 38) at I-93 Southbound Off-Ramp U-Turn															
<i>Weekday Morning</i>															
WB T	0.39	4	A	35	35	0.42	4	A	26	61	0.44	5	A	27	63
NB L	0.19	25	C	39	62	0.22	25	C	47	75	0.37	27	C	82	121
Overall		7	A				7	A				10	A		
<i>Weekday Evening</i>															
WB T	0.55	10	B	90	m87	0.66	32	C	146	m73	0.68	37	D	149	m70
NB L	0.49	32	C	96	124	0.48	29	C	105	147	0.51	29	C	115	161
Overall		14	B				31	C				35	D		
<i>Saturday Midday</i>															
WB T	0.34	5	A	41	80	0.46	8	A	71	m86	0.48	9	A	73	m84
NB L	0.52	32	C	109	123	0.44	27	C	105	119	0.49	26	C	122	134
Overall		12	B				13	B				13	B		

a Volume to capacity ratio.

b Average total delay, in seconds per vehicle.

c Level-of-service.

d 50th percentile queue, in feet.

e 95th percentile queue, 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 5-12 Signalized Intersection Capacity Analysis (continued)

Location / Movement	2017 Existing Conditions					2024 No-Build Conditions					2024 Build Conditions				
	v/c ^a	Del ^b	LOS ^c	50 Q ^d	95 Q ^e	v/c	Del	LOS	50 Q	95 Q	v/c	Del	LOS	50 Q	95 Q
Mystic Avenue (Route 38) at Grand Union Boulevard / Lombardi Way															
<i>Weekday Morning</i>															
WB L	0.30	24	C	78	130	0.33	25	C	82	140	0.34	25	C	82	140
WB T/R	0.65	27	C	200	244	0.77	30	C	229	286	0.80	31	C	238	296
NB L	0.33	21	C	30	80	0.33	14	B	15	58	0.34	15	B	17	60
NB T	0.04	10	A	7	22	0.19	9	A	18	60	0.19	9	A	20	61
SB L/T/R	0.85	48	D	221	264	0.84	47	D	225	#374	0.85	47	D	232	#388
Overall		30	C				28	C				29	C		
<i>Weekday Evening</i>															
WB L	0.59	30	C	174	269	0.69	34	C	192	296	0.69	34	C	192	296
WB T/R	1.07	81	F	~465	#563	>1.20	>120	F	~589	#686	>1.20	>120	F	~593	#691
NB L	0.29	17	B	50	119	0.33	19	B	40	127	0.35	20	C	40	127
NB T	0.09	12	B	24	57	0.16	11	B	34	97	0.16	11	B	34	97
SB L/T/R	0.63	45	D	149	198	0.70	50	D	199	284	0.76	54	D	218	314
Overall		63	E				>120	F				>120	F		
<i>Saturday Midday</i>															
WB L	0.31	23	C	86	172	0.44	29	C	122	198	0.45	29	C	122	198
WB T/R	0.59	24	C	183	275	0.90	39	D	~377	#432	0.93	42	D	~345	#440
NB L	0.31	22	C	69	66	0.28	13	B	22	58	0.29	13	B	22	58
NB T	0.07	15	B	26	22	0.14	8	A	19	42	0.14	8	A	18	43
SB L/T/R	0.61	36	D	133	182	0.62	32	C	160	201	0.60	30	C	163	200
Overall		25	C				32	C				34	C		
Lombardi Way at I-93 Southbound Off-Ramp															
<i>Weekday Morning</i>															
EB L	0.15	32	C	19	38	0.73	42	D	153	212	0.73	42	D	153	212
EB R	0.54	31	C	117	145	0.40	22	C	95	133	0.40	22	C	96	134
NB T	0.07	8	A	6	42	0.09	12	B	17	54	0.09	11	B	17	53
SB T	0.30	19	B	143	157	0.35	24	C	142	m180	0.36	24	C	146	m182
Overall		20	C				26	C				26	C		
<i>Weekday Evening</i>															
EB L	0.17	33	C	21	44	0.54	40	D	81	124	0.54	40	D	81	124
EB R	0.54	30	C	115	162	0.57	30	C	133	179	0.57	30	C	133	179
NB T	0.12	7	A	21	64	0.14	9	A	40	78	0.14	9	A	40	78
SB T	0.26	11	B	74	97	0.36	14	B	11	143	0.37	15	B	124	158
Overall		15	B				19	B				19	B		
<i>Saturday Midday</i>															
EB L	0.38	46	D	31	60	0.65	48	D	92	147	0.65	48	D	92	147
EB R	0.48	9	A	22	56	0.41	11	B	47	85	0.41	11	B	49	87
NB T	0.09	2	A	4	2	0.10	3	A	4	51	0.10	3	A	4	54
SB T	0.20	13	B	82	106	0.29	18	B	107	126	0.30	18	B	110	128
Overall		11	B				17	B				18	B		

a Volume to capacity ratio.

b Average total delay, in seconds per vehicle.

c Level-of-service.

d 50th percentile queue, in feet.

e 95th percentile queue, 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 5-12 Signalized Intersection Capacity Analysis (continued)

Location / Movement	2017 Existing Conditions					2024 No-Build Conditions					2024 Build Conditions				
	v/c ^a	Del ^b	LOS ^c	50 Q ^d	95 Q ^e	v/c	Del	LOS	50 Q	95 Q	v/c	Del	LOS	50 Q	95 Q
Broadway at Lombardi Way / Mt. Vernon Street															
<i>Weekday Morning</i>															
EB L	0.21	32	C	29	61	0.25	32	C	37	73	0.27	33	C	40	78
EB T	0.47	28	C	116	174	0.50	28	C	126	190	0.50	28	C	126	190
NB L/T/R	0.26	20	C	61	122	0.31	22	C	80	148	0.32	22	C	80	148
SB L	1.09	114	F	~358	#497	1.20	>120	F	~384	#604	>1.20	>120	F	~399	#619
SB R	0.65	13	B	86	117	0.64	9	A	88	17	0.64	10	A	89	17
Overall		54	D				63	E				69	E		
<i>Weekday Evening</i>															
EB L	0.49	38	D	74	120	0.51	38	D	83	140	0.51	38	D	83	140
EB T	0.43	27	C	108	157	0.44	26	C	112	173	0.44	26	C	112	173
NB L/T/R	0.42	25	C	106	189	0.53	29	C	139	234	0.53	29	C	139	234
SB L	0.90	116	F	180	#358	>1.20	>120	F	~329	#529	>1.20	>120	F	~370	#575
SB R	0.74	15	B	69	107	0.77	14	B	90	134	0.77	14	B	96	146
Overall		42	D				74	E				89	F		
<i>Saturday Midday</i>															
EB L	0.41	40	D	51	95	0.47	43	D	59	112	0.47	43	D	59	112
EB T	0.45	30	C	101	158	0.47	30	C	108	177	0.47	30	C	108	177
NB L/T/R	0.27	19	B	74	129	0.32	20	C	93	156	0.32	20	C	93	156
SB L	0.61	47	D	156	#239	0.76	70	E	183	#351	0.79	77	E	188	#369
SB R	0.73	19	B	81	65	0.77	27	C	38	216	0.77	28	C	36	219
Overall		29	C				38	D				40	D		

- a Volume to capacity ratio.
b Average total delay, in seconds per vehicle.
c Level-of-service.
d 50th percentile queue, in feet.
e 95th percentile queue, 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 5-12 Signalized Intersection Capacity Analysis (continued)

Location / Movement	2017 Existing Conditions					2024 No-Build Conditions					2024 Build Conditions				
	v/c ^a	Del ^b	LOS ^c	50 Q ^d	95 Q ^e	v/c	Del	LOS	50 Q	95 Q	v/c	Del	LOS	50 Q	95 Q
Wellington Circle East															
<i>Weekday Morning</i>															
EB HL	0.01	50	D	3	m4	0.01	61	E	3	m4	0.01	61	E	3	m4
EB HL/BL	0.10	50	D	0	m56	0.14	60	E	0	m0	0.14	60	E	0	m0
EB T	0.49	15	B	93	129	0.48	7	A	50	m50	0.48	7	A	50	m50
WB T	0.81	37	D	294	335	0.98	84	F	367	#448	0.99	89	F	371	#453
WB R	0.73	32	C	198	319	0.85	42	D	238	#420	0.85	42	D	238	#420
NB L	0.46	41	D	89	159	0.18	28	C	41	68	0.18	28	C	41	68
NB L/T/BR	0.51	38	D	96	133	0.38	30	C	90	123	0.39	30	C	91	124
NB R	0.77	27	C	271	426	0.98	56	E	389	#643	0.99	58	E	396	#651
Overall		30	C				52	D				54	D		
<i>Weekday Evening</i>															
EB HL	0.17	30	C	28	m41	0.19	31	C	41	87	0.19	31	C	41	87
EB HL/BL	0.55	34	C	95	m142	0.61	53	D	153	243	0.61	53	D	153	243
EB T	0.84	11	B	120	m130	1.00	89	F	429	#530	1.00	89	F	429	#530
WB T	0.94	76	E	323	#390	1.11	92	F	~458	#521	1.12	93	F	~459	#523
WB R	1.02	74	E	~313	#534	1.15	118	F	~424	#639	1.15	118	F	~424	#639
NB L	0.74	44	D	227	#375	0.43	30	C	117	162	0.43	30	C	118	164
NB L/T/BR	>1.20dr	105	F	~445	#546	>1.20dr	>120	F	~514	#610	>1.20dr	>120	F	~524	#621
NB R	0.95	42	D	451	#741	>1.20	>120	F	~842	#1092	>1.20	>120	F	~864	#1115
Overall		58	E				104	F				106	F		
<i>Saturday Midday</i>															
EB HL	0.16	18	B	18	m32	0.18	19	B	24	m24	0.18	19	B	24	m24
EB HL/BL	0.43	20	B	53	m87	0.48	21	C	67	m66	0.48	21	C	67	m66
EB T	0.75	10	B	119	m128	0.91	57	E	133	m129	0.91	57	E	133	m129
WB T	0.91	52	D	315	#359	1.07	88	F	~429	#493	1.07	88	F	~430	#495
WB R	0.95	59	E	274	#483	1.05	84	F	~354	#564	1.05	84	F	~354	#564
NB L	0.63	38	D	183	289	0.37	29	C	97	138	0.37	29	C	97	138
NB L/T/BR	1.00dr	35	C	205	257	1.08dr	36	D	230	283	1.08dr	36	D	231	284
NB R	1.06	70	E	~634	#876	>1.20	>120	F	~945	#1200	>1.20	>120	F	~952	#1207
Overall		40	D				80	E				80	E		
Wellington Circle North															
<i>Weekday Morning</i>															
WB T	0.50	31	C	118	138	0.40	32	C	99	127	0.40	32	C	99	127
NB T	0.19	5	A	53	48	0.21	4	A	41	m42	0.21	4	A	41	m42
Overall		20	B				18	B				18	B		
<i>Weekday Evening</i>															
WB T	0.56	35	C	109	142	0.41	36	D	86	114	0.41	36	D	86	114
NB T	0.40	4	A	9	m8	0.48	16	B	7	m9	0.48	19	B	7	m9
Overall		14	B				21	C				23	C		
<i>Saturday Midday</i>															
WB T	0.53	31	C	128	161	0.46	33	C	116	146	0.46	33	C	116	146
NB T	0.29	3	A	29	m34	0.33	3	A	26	m32	0.33	3	A	26	m32
Overall		16	B				15	B				15	B		

a Volume to capacity ratio.

b Average total delay, in seconds per vehicle.

c Level-of-service.

d 50th percentile queue, in feet.

e 95th percentile queue, 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.

dr Defacto right lane.

Table 5-12 Signalized Intersection Capacity Analysis (continued)

Location / Movement	2017 Existing Conditions					2024 No-Build Conditions					2024 Build Conditions				
	v/c ^a	Del ^b	LOS ^c	50 Q ^d	95 Q ^e	v/c	Del	LOS	50 Q	95 Q	v/c	Del	LOS	50 Q	95 Q
Wellington Circle West															
<i>Weekday Morning</i>															
EB T	0.65	39	D	136	167	1.05	86	F	~170	#225	1.05	86	F	~170	#225
WB L	1.19	110	F	~323	#395	1.09	67	E	~326	m#344	0.11	72	E	~334	m#346
WB T	0.69	11	B	52	105	0.55	11	B	69	m75	0.55	12	B	70	m74
SB L	0.37	36	D	71	103	0.27	28	C	63	96	0.27	28	C	63	97
SB T/R	>1.20	>120	F	~353	#415	0.91	44	D	289	#375	0.92	46	D	293	#383
SWB L/T	0.76	71	E	147	176	1.03	112	F	~127	#189	1.03	112	F	~127	#189
SWB T ^f	0.22	64	E	38	m76	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Overall		76	E				58	E				59	E		
<i>Weekday Evening</i>															
EB T	0.72	33	C	233	269	0.89	43	D	276	313	0.89	43	D	276	313
WB L	1.02	70	E	~180	m#306	1.09	96	F	~378	#469	1.10	95	F	~380	#472
WB T	0.62	12	B	105	m141	0.53	52	D	214	254	0.53	53	D	215	255
SB L	0.97	81	F	145	#244	0.85	58	E	162	#246	0.85	58	E	162	#246
SB T/R	0.67	45	D	94	131	0.62	41	D	112	151	0.63	42	D	113	153
SWB L/T	0.88	79	E	107	#156	0.97	80	E	98	#155	0.97	80	E	98	#155
SWB T ^f	0.60	77	E	65	m#122	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Overall		45	D				61	E				61	E		
<i>Saturday Midday</i>															
EB T	0.72	37	D	195	229	1.09	95	F	~264	#323	1.09	95	F	~264	#323
WB L	1.02	77	E	~105	m#345	1.04	75	E	~159	m#139	1.05	75	E	~161	m#139
WB T	0.54	15	B	121	m158	0.47	17	B	121	m116	0.47	17	B	121	m116
SB L	0.98	79	E	169	#271	0.91	63	E	175	#272	0.91	63	E	174	#272
SB T/R	0.67	41	D	104	141	0.66	40	D	117	158	0.67	40	D	119	159
SWB L/T	1.01	96	F	~151	#229	0.98	90	F	142	#202	0.98	90	F	142	#202
SWB T ^f	0.61	72	E	80	#155	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Overall		54	D				66	E				66	E		

- a Volume to capacity ratio.
b Average total delay, in seconds per vehicle.
c Level-of-service.
d 50th percentile queue, in feet.
e 95th percentile queue, in feet.
f Lane Geometry on the intersection approaches changed due to mitigation by Wynn Casino.
~ 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 5-12 Signalized Intersection Capacity Analysis (continued)

Location / Movement	2017 Existing Conditions					2024 No-Build Conditions					2024 Build Conditions				
	v/c ^a	Del ^b	LOS ^c	50 Q ^d	95 Q ^e	v/c	Del	LOS	50 Q	95 Q	v/c	Del	LOS	50 Q	95 Q
Fellsway (Route 28) at Riverside Avenue															
<i>Weekday Morning</i>															
EB L	0.55	58	E	54	#166	0.57	60	E	54	#185	0.57	60	E	54	#185
EB T/R	0.58	45	D	127	297	0.57	45	D	127	316	0.59	46	D	131	322
WB L/T/R	>1.20	>120	F	~329	#794	>1.20	>120	F	~386	#872	>1.20	>120	F	~391	#877
NB L	0.77	72	E	122	#334	0.77	71	E	131	#360	0.77	71	E	131	#360
NB T/R	0.24	36	D	61	139	0.28	36	D	72	158	0.28	36	D	73	160
SB L	0.48	64	E	41	120	0.52	66	E	45	#139	0.52	66	E	45	#139
SB T/R	1.12	100	F	~398	#897	>1.20	>120	F	~542	#1054	>1.20	>120	F	~551	#1066
Overall		101	F				>120	F				>120	F		
<i>Weekday Evening</i>															
EB L	>1.20	>120	F	~246	#630	>1.20	>120	F	~265	#661	>1.20	>120	F	~265	#661
EB T/R	0.96	77	E	269	#728	1.02	90	F	288	#777	1.02	90	F	288	#777
WB L/T/R	>1.20	>120	F	~243	#528	>1.20	>120	F	~261	#587	>1.20	>120	F	~261	#587
NB L	0.78	70	E	139	#381	0.84	75	E	161	#453	0.86	78	E	166	#465
NB T/R	0.66	42	D	202	401	0.83	47	D	267	#579	0.84	48	D	272	#591
SB L	0.26	53	D	43	121	0.27	52	D	47	129	0.27	52	D	47	129
SB T/R	0.44	36	D	115	241	0.51	38	D	136	282	0.51	38	D	138	284
Overall		101	F				>120	F				>120	F		
<i>Saturday Midday</i>															
EB L	1.07	116	F	171	#525	1.14	>120	F	~181	#575	1.14	>120	F	~181	#575
EB T/R	0.94	69	E	248	#695	0.94	70	E	251	#739	0.94	70	E	251	#739
WB L/T/R	>1.20	>120	F	~184	#522	>1.20	>120	F	~229	#582	>1.20	>120	F	~229	#582
NB L	0.68	68	E	89	219	0.72	70	E	101	#251	0.72	70	E	101	#251
NB T/R	0.39	36	D	101	236	0.47	37	D	128	286	0.47	37	D	129	288
SB L	0.55	76	E	30	98	0.23	54	D	30	96	0.23	54	D	30	93
SB T/R	0.43	34	C	103	243	0.52	36	D	132	298	0.52	36	D	134	300
Overall		77	E				91	F				91	F		

- a Volume to capacity ratio.
b Average total delay, in seconds per vehicle.
c Level-of-service.
d 50th percentile queue, in feet.
e 95th percentile queue, 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.

As shown in Table 5-12, some of the study area intersections are projected to operate at or near theoretical capacity under future conditions with or without the proposed Project. The following sections compare the updated analysis results to the formerly projected 2018 Build condition results.

Grand Union Boulevard at Foley Street

A new fully-actuated traffic signal recently was installed at the Grand Union Boulevard/Foley Street intersection. The underlying design of that location considered both existing conditions, and the projected ongoing development of the Assembly Square District. As shown in Table 5-13, this location is projected to operate at an overall LOS E during the weekday evening peak hour under future conditions with or without the Project. The signal operation includes an exclusive

pedestrian phase. While that feature may result in periodic increased delays for vehicular traffic, it provides for an overall more pedestrian-friendly environment while still allowing for vehicular traffic to be processed. The signal timings at this location can be reviewed on an ongoing basis to determine if any adjustments to the current timing plan might be appropriate to accommodate any travel pattern changes.

Route 28 at Grand Union Boulevard / Route 28 at Middlesex Avenue

Both the intersections of Route 28 at Grand Union Boulevard and Route 28 at Middlesex Avenue operate under a single traffic-signal controller. Under future conditions both intersections are expected to operate at or near theoretical capacity. During the initial redevelopment of the Assembly Square District both intersections were reconstructed with significant access enhancements and improved pedestrian accommodations. Providing additional travel lanes or significant improvements to either location do not appear feasible. Instead, the Project site is being developed to promote use of alternate travel means (public transportation, biking, and walking) to help minimize the amount of vehicular traffic travelling to and from the Site, and through both of these signals. The newly installed u-turn signal at Mystic Avenue northbound heading to the Route I-93 South on-ramp also should provide a new option for exiting Project Site traffic which otherwise might need to exit the Site through these locations.

Route 28 at Mystic Avenue

As noted earlier, this location is currently being evaluated as part of a planned MassDOT improvement project for the overall Route I-93/Route 28/Mystic Avenue interchange. As shown in Table 5-13, this location is projected to operate at LOS E during the weekday morning peak hour under future conditions with or without the Project. While the MassDOT project largely will focus on enhancements for pedestrian and bicycle traffic, the overall signal operation also will be reviewed as part of that effort, with changes to the current signal operation being a possibility.

Route 28 at Broadway

As shown in Table 5-13, this location currently operates at LOS F during both the weekday morning and evening peak hours, and will continue to do so under future conditions. Similarly, the intersection is project to operate at LOS E during the Saturday midday peak hour, and LOS F under the Build condition. The change from LOS E to LOS F operations is primarily due to the reported delay being one second below the 80-second LOS E/F dividing threshold. The reported six seconds of additional delay under the 2024 Build condition should not create a perceptible difference in the intersection operation.

Route 28 at Pearl Street

As shown in Table 5-13, this intersection is projected to operate at LOS E during both the weekday morning and evening peak hours under the 2024 No-Build and Build conditions. During the Saturday midday peak hour, the intersection is expected to maintain its current LOS C operations with or without the Project. The Project is only expected to result in one additional second of delay at this location during the weekday evening peak hour, which will not result in a perceptible impact in the intersection operation.

Mystic Avenue at Grand Union Boulevard/Lombardi Street and Broadway at Lombardi Street

These two intersections are part of a four-signal closed loop system currently maintained by MassDOT. The other two signals in this system are the Mystic Avenue northbound intersection with the Mystic Avenue/I-93 South off-ramp, and Lombardi Street intersection with the Mystic Avenue/I-93 South off-ramp. As shown in Table 5-13, the Mystic Avenue at Grand Union Boulevard/Lombardi Street intersection is projected to operate at LOS F during the weekday evening peak hour under the 2024 No-Build and Build conditions. Likewise, the Broadway at Lombardi Street intersection will operate at LOS E during this same time period under the 2024 No-Build condition, and LOS F during the 2024 Build condition. To help improve operating conditions at the intersections, the Proponent will be installing an adaptive traffic signal system. This is discussed in more detail in the mitigation section of this report.

Unsignalized Intersection Capacity Analysis

Capacity analyses conducted by VHB for the signalized intersections are summarized in Table 5-13. The capacity analyses were conducted for the 2017 Existing, 2024 No-Build, and 2024 Build conditions.

Table 5-13 Unsignalized Intersection Capacity Analysis

Location / Movement	2017 Existing Conditions					2024 No-Build Conditions					2024 Build Conditions				
	D ^a	v/c ^b	Del ^c	LOS ^d	95 Q ^e	D	v/c	Del	LOS	95 Q	D	v/c	Del	LOS	95 Q
Mystic Avenue (Route 38) at Middlesex Avenue															
<i>Weekday Morning</i>															
SB R	20	0.05	10	A	5	165	0.25	12	B	25	175	0.30	13	B	33
<i>Weekday Evening</i>															
SB R	45	0.11	12	B	10	440	0.90	47	E	263	470	1.03	77	F	370
<i>Saturday Midday</i>															
SB R	75	0.13	11	B	10	290	0.50	16	C	70	305	0.56	18	C	85
Foley Street at Site Driveway (Block 21 Driveway)^f															
<i>Weekday Morning</i>															
WB L	30	0.04	9	A	3	30	0.03	9	A	3	25	0.03	9	A	3
NB L/R	25	0.08	13	B	8	25	0.07	15	B	5	15	0.03	13	B	3
<i>Weekday Evening</i>															
WB L	30	0.03	8	A	3	30	0.03	8	A	3	15	0.01	8	A	0
NB L/R	135	0.30	13	B	30	145	0.33	16	C	35	100	0.16	11	B	15
<i>Saturday Midday</i>															
WB L	25	0.03	8	A	3	25	0.03	8	A	3	15	0.02	9	A	0
NB L/R	70	0.19	13	B	18	75	0.17	14	B	15	40	0.08	12	B	8
Foley Street at K-Mart Driveway / Driveway (Road K)^g															
<i>Weekday Morning</i>															
EB L	15	0.01	8	A	0	15	0.01	8	A	0	15	0.01	8	A	0
WB L	neg	-	0	A	0	neg	-	0	A	0	25	0.03	9	A	3
NB L/T/R	1	0.01	13	B	0	25	0.07	15	B	5	75	0.24	19	C	23
SB L/T	16	0.05	13	B	3	15	0.05	15	C	3	15	0.06	17	C	5
SB R	35	0.05	9	A	5	40	0.05	9	A	5	40	0.05	9	A	5
<i>Weekday Evening</i>															
EB L	95	0.08	8	A	8	100	0.11	9	A	10	100	0.11	9	A	10
WB L	1	0.00	8	A	0	1	0.00	8	A	0	20	0.02	8	A	3
NB L/T/R	5	0.02	13	B	3	85	0.34	24	C	35	275	1.13	>120	F	325
SB L/T	30	0.10	16	C	8	30	0.16	26	D	15	30	0.21	34	D	20
SB R	65	0.08	10	A	8	70	0.11	11	B	10	70	0.11	11	B	10
<i>Saturday Midday</i>															
EB L	140	0.14	8	A	13	150	0.14	9	A	13	150	0.14	9	A	13
WB L	neg	-	0	A	0	neg	-	0	A	0	15	0.01	8	A	0
NB L/T/R	4	0.03	20	C	3	35	0.19	26	D	18	125	0.58	39	E	83
SB L/T	50	0.25	25	C	23	55	0.33	34	D	33	55	0.38	41	E	40
SB R	75	0.11	10	A	10	80	0.12	10	B	10	80	0.12	10	B	10

a Demand, in vehicles

b Volume to capacity ratio.

c Average total delay, in seconds per vehicle.

d Level-of-service.

e 95th percentile queue, in feet.

f Northbound approach becomes Block 21 Driveway in 2024 Build conditions.

g Northbound approach becomes Road K in 2024 Build conditions.

Table 5-13 Unsignalized Intersection Capacity Analysis (continued)

Location / Movement	2017 Existing Conditions					2024 No-Build Conditions					2024 Build Conditions									
	D ^a	v/c ^b	Del ^c	LOS ^d	95 Q ^e	D	v/c	Del	LOS	95 Q	D	v/c	Del	LOS	95 Q					
Revolution Drive at Site Driveway (Road K) ^f / Home Depot Driveway																				
Weekday Morning																				
EB L	50	0.04	8	A	3	55	0.04	8	A	3	80	0.06	8	A	5					
WB L	40	0.03	7	A	3	45	0.03	7	A	3	45	0.03	7	A	3					
NB L/T/R	75	0.15	12	B	13	80	0.17	14	B	15	80	0.20	15	C	18					
SB L/T/R	95	0.17	12	B	15	100	0.21	14	B	20	125	0.26	14	B	25					
Weekday Evening																				
EB L	80	0.07	8	A	5	85	0.09	9	A	8	100	0.11	9	A	10					
WB L	40	0.03	8	A	3	45	0.03	8	A	3	45	0.03	8	A	3					
NB L/T/R	80	0.24	17	C	23	85	0.35	26	D	38	85	0.47	39	E	58					
SB L/T/R	140	0.40	17	C	48	150	0.54	30	D	75	245	0.76	42	E	150					
Saturday Midday																				
EB L	40	0.03	8	A	3	45	0.04	8	A	3	60	0.05	8	A	3					
WB L	90	0.09	8	A	8	95	0.08	8	A	5	95	0.08	8	A	5					
NB L/T/R	160	0.47	20	C	60	170	0.47	22	C	63	170	0.53	27	D	75					
SB L/T/R	100	0.28	16	C	28	105	0.29	18	C	30	140	0.35	18	C	40					
Middlesex Avenue at Block 21 / Block 25 Driveway																				
Weekday Morning WB R						Intersection Does Not Exist under 2017 Existing Conditions					Intersection Does Not Exist under 2024 No-Build Conditions									
Weekday Evening WB R																				
Saturday Midday WB R																				
Grand Union Boulevard at Road L																				
Weekday Morning EB R						Intersection Does Not Exist under 2017 Existing Conditions					Intersection Does Not Exist under 2024 No-Build Conditions									
Weekday Evening EB R																				
Saturday Midday EB R																				

- a Demand, in vehicles
b Volume to capacity ratio.
c Average total delay, in seconds per vehicle.
d Level-of-service.
e 95th percentile queue, in feet.
f Southbound approach becomes Road K in 2024 Build conditions.

As shown in Table 5-13, the majority of the study area intersections currently operate acceptably, and are expected to continue to do so under future conditions. The analysis indicates that exiting traffic onto Foley Street from the newly created Road K will operate at LOS F under the 2024 Build condition. However, the analysis does not reflect gaps that will continue to be created on this roadway segment by the nearby Foley Street signals at Middlesex Avenue and Grand Union Boulevard. With the creation of these gaps, which currently also benefit exiting traffic from the opposing K-Mart driveway, operations should be better than reflected by the analysis results. In the event that motorists find the exiting delays excessive, they will have multiple other options for exiting the Site. For instance, traffic wishing to turn left from Road K onto Foley Street instead could turn right from the garage onto Middlesex Avenue to reach the same point. Traffic turning right from Road K onto

Foley Street should experience lesser delays as that movement is only opposed by eastbound Foley Street traffic. Regardless, with driveways also proposed on Grand Union Boulevard and Revolution Drive, the Site plan has inherent flexibility to accommodate traffic at multiple access/egress points which should help to prevent any one driveway from being overburdened.

5.10 Traffic Mitigation Overview

The traffic study analysis indicates that depending on the nature of a given Project use, approximately 15- to 35-percent of the Project traffic will be passing through the Mystic Avenue/Broadway/Lombardi Street interchange at the southwesterly end of the Assembly Square district. This interchange was reconstructed with significant signal enhancements as part of the initial nearby Assembly Square redevelopment project. However, to help mitigation any potential traffic impacts resulting from this Project, the Proponent is proposing to install an adaptive traffic signal system including the following four locations:

- Mystic Avenue (Route 38) at I-93 Southbound Off-Ramp U-Turn
- Mystic Avenue (Route 38) at Grand Union Boulevard / Lombardi Way
- Lombardi Way at I-93 Southbound Off-Ramp
- Broadway at Lombardi Way / Mt. Vernon Street

Each of these four locations is currently signalized, and interconnected, so that they all are operating in a coordinated manner under peak-period conditions. However, installing the updated adaptive signal equipment will allow these four signals to operate in a far more flexible, adaptive manner responding to actual traffic conditions continuously on a cycle-by-cycle basis. Adaptive signal control is a relatively new design entity, but it has been found to be very effective, and far more responsive than just relying on predetermined signal timing programs. This new system will help to minimize Project impacts while helping to address existing deficiencies in this area.

5.11 TDM Plan

Transportation Demand Management (TDM) measures are most often directed at commuter travel and implemented at office sites. However, due to the mixed-use and transit-orientated nature of the Proposed Project, there also are opportunities to bring TDM programs to the Proposed Project's other land uses, including the residential housing retail shops, restaurants, and active uses.

The Proponent is committed to becoming an active member of the Assembly Square Transportation Management Association. An overall on-site TDM coordinator will be designated to oversee all TDM programs for each building of the Proposed Project, and the Project site in its entirety. The person(s) in this role will coordinate with other organizations within Assembly Square to help promote a reduced reliance on single-occupant motor-vehicle travel to the Project site.

General TDM measures to be implemented as part of this Project will involve promoting transit use and facilitating bicycle and pedestrian travel both through site amenities and ongoing practices and programs. These will include providing bicycle racks and amenities and also may involve providing a new "Hubway" bike-share station within the Project Site. The mixed-use nature of the site by itself also effectively will function as a TDM measure. Specifically, with the variety of uses proposed both within the Project site and in place in the surrounding area, the need to travel off-site by automobile for dining or shopping opportunities will be minimize. With the mixture of residences and office/lab uses it is possible that some residents may specifically choose to work on site due to it also being their place of employment, further reducing the need for vehicular travel.

5.12 Conclusion

The Proposed Project is consistent with the City of Somerville's transportation-related goals for the Assembly Square district, and the Project is highly consistent and complementary to the surrounding developments in this area. The Project site has been designed to accommodate Project-generated traffic, as well as traffic other nearby planned or potential developments. In summary, the Project will provide the following transportation-related benefits:

- The Project will be a mixed-use, transit-oriented development consistent with the City's goals for this area. With the mixed-use environment, there should be considerable internal trip-sharing between the various uses proposed within the site. For example, the retail and restaurant space provided should be largely oriented to workers or residents already on-site as opposed to traditional shopping center.
- The proposed on-site parking supply will be kept to the minimum levels needed to satisfy tenant and resident needs, while being low enough to help promote travel by biking, walking, or using MBTA transit service, including the nearby MBTA Orange Line Assembly Square station.
- Ample secured bicycle parking will be provided within the Project buildings, with outdoor bicycle racks provided at key points near the building entrances.
- With the Project site having access and egress available from each of the surrounding roadways, Project trips should be quickly and efficiently dissipated without overloading a single given access point. The newly created Road K and Road L within the site will help reduce the number of

curb cuts provided on the surrounding roadways, which will help reduce conflicts.

- A new four-signal adaptive traffic signal system will be installed at the Mystic Avenue/I-93 South/Lombardi Street/Broadway interchange to help improve the efficiency of the traffic signal system already in place in this area. With this new state-of-the-art system, these four signals will function in a flexible, adaptive manner responding to actual traffic conditions continuously on a cycle-by-cycle basis.
- The transportation analysis for the Project was conducted in a highly conservative manner. The underlying mode shares used assume higher automobile use than is anticipated for this area based on prior studies. However, the conservatively high auto use was assumed so that the maximum potential vehicular traffic on the study area roadways would be evaluated.
- New and improved sidewalks both within and surrounding the Project site will help to build upon recently implemented pedestrian improvements in the area, providing an overall cohesive pedestrian-friendly environment within the Assembly Square district.