4.0 Transportation

4.1 Introduction

Vanasse Hangen Brustlin, Inc. (VHB) has completed an updated transportation impact analysis reflecting the currently proposed development within the Assembly Square District. The overall Project involves the development of a large scale, mixed-use development by FR Sturtevant Street, LLC (the "Proponent"), an affiliate of Federal Realty Investment Trust (FRIT). However, the proposed development program has been modified based on current real estate market conditions. With the changes outlined in this assessment, the Project is more consistent with the City of Somerville's expressed goals for the Assembly Square District to consist of a vibrant mixed-use community. The following section summarizes the currently proposed development scenario in greater detail.

4.2 Project Description

In July 2012 IKEA announced that it would no longer be constructing a store at the Project site. Since that time the Proponent purchased the approximately 12-acre parcel ("Block 11") formerly proposed for IKEA, and is now planning to develop additional office space for Partners Healthcare. Other changes include the addition of a new health club and ancillary retail space oriented to on-site users. A detailed summary of the current proposed development program as compared to that reviewed during the MEPA process which concluded in 2010 is provided in Table 4-1.

As shown in Table 4-1, the primarily automobile-oriented IKEA store is being replaced with office space which should be more heavily-oriented to the new MBTA station. Specifically, approximately 1,155,000 square feet (sf) of office space is now proposed for Block 11, along with 75,000 sf of supporting retail space (including restaurants and a daycare facility) and a 50,000 square foot health club. To accommodate this additional development the residential portion of the site has been reduced by 257 units (a 12 percent reduction). Other minor changes to the previously reviewed building program include the number of hotel rooms and cinema screens being slightly reduced. The Project still will contain a variety of office, residential and retail uses so as to create a self-sustaining urban village designed following smart growth principles.

Table 4-1 Proposed Assembly Square Development Comparison

	2010 FEIR Program	May 2014 Proposal	Difference
Office	1,750,000 sf	2,801,333 sf	+1,051,333 sf
IKEA	340,000 sf	0 sf	(340,000) sf
Health Club	N/A	50,000 sf	+50,000 sf
Retail	450,000 sf	527,024 sf	+77,024 sf
Residential	2,100 units	1,843 units	(257) units
Hotel	200 rooms	170 rooms	(30) rooms
Cinema	14 screens	12 screens	(2) screens

Through early 2014 the only portion of the Project to have been built and occupied is the 4,500 sf of restaurant space comprising Block 10 of the site; however, construction of Blocks 1 through 4 has been underway since 2012 with several tenant spaces expected to open presently and within the immediate future. This space will include a mixture of residential units, office space, and retail space (including a cinema, a Legoland Discovery Center and various retail/restaurants uses). Development on the remainder of the site is expected to occur within the next five years.

The new Block 11 development will be constructed in two phases. The first phase, Phase A, will involve the construction of a portion of the two mixed-use buildings to include 768,375 sf of office space and the 105,922 sf of retail/restaurant space. The proposed 7-level parking garage will be constructed along with an adjacent surface parking lot resulting in a total supply of 1,997 parking spaces. The second and final phase of Block 11's development, Phase B, will involve the construction of the remaining 338,203 sf of office space resulting in the full build-out of 1,106,578 sf of office space within Block 11 the proposed 12,500 sf of daycare space also will be constructed as part of this phase. The daycare will be operated by Partners Healthcare and is intended to be available only to Partners Healthcare employees. Finally, the existing surface parking lot will be replaced through a 907-space expansion to the structured parking resulting in the total 2,904 space planned parking supply. This parking supply will be utilized both by the office tenants and visitors to the retail uses within Block 11. Of this supply, 1,617 spaces will be dedicated to the office tenants with the remaining 380 spaces being available for visitors to the retail or restaurant uses. This entire retail-oriented parking supply will be available under Phase A. Approximately 1,617 office parking spaces will be provided under the initial Phase A, with the remaining 907 structured offices parking spaces being built in conjunction with the 338,203 sf of Phase B office area. With these changes, the overall parking supply for the Project now will be accommodated by a total of 9,815 parking spaces (including 246 on-street parking spaces). This represents an increase of 861 spaces as compared to the development program reviewed in the 2010 FEIR for the Project.

4.3 Transportation Analysis Methodology

During the original MEPA review the long-term, phased nature of the project over a 10- to 15-year horizon required that a multi-step, phased traffic analysis be conducted. This was primarily due to the timing of the planned new MBTA Orange Line station, which was expected to occur during the latter half of the Project Build-out. Construction of the new MBTA station has advanced significantly to the point where it should be in operation as soon as late 2014. Originally, it was expected that the majority of the Assembly Square development would be in place prior to that station opening. Instead, as of early 2014 only 4,500 sf of restaurant space was open out of the new Assembly Square Mixed-Use Redevelopment. With construction nearing completion for several buildings by the end of 2014 over half of the approved retail space will be in operation, along with roughly 21-percent of the approved residential units and 5-percent of the currently approved office space. Unlike the original scenario analyzed, the new MBTA station will now be opening only months after these new uses are in operation instead of near the end of the overall build-out.

■

4.3.1 Traffic Operations Evaluation

With these changes noted above the focus of this NPC transportation analysis is on confirming that the modified full-build-out volumes still can be accommodated with the existing infrastructure put in place for the originally planned development. All of the initial traffic mitigation identified during the original MEPA review has since been constructed. Those improvements were put in place in anticipation of Phase 1 of the overall Project including the proposed IKEA store. The only remaining mitigation beyond that phase involves the construction of new signalized at-grade u-turn connection from the northbound segment of Mystic Avenue to the departing southbound segment leading to the Route I-93 southbound on-ramp. Originally this mitigation was not planned to occur until midway through the overall site development before the opening of the new station. That work will now commence concurrent with the development of Block 11 pending permit approval by MassDOT and/or DCR. Accordingly, this section of the NPC provides additional information regarding this work, as well as a summary of the mitigation implemented to date.

As discussed later in this chapter, the changes to the development program result in a decrease in Project trip generation on Saturdays on both a daily and peak-hour basis. Accordingly, with that reduction there is no need to revisit Saturday operating conditions. Likewise, the weekday daily trip generation associated with the Project also will be reduced with these changes. However, while the elimination of IKEA clearly will reduce traffic on weekends, and on a weekday daily basis, the office space replacing it will generate additional traffic during the weekday commuter peak hours. The analysis conducted as part of this NPC indicates that the revised volumes and patterns will have a negligible impact on most of the intersections on the periphery of the study area. However, updated capacity analyses have been conducted at several key locations to determine if modifications are needed to the intersection or signal

configuration. As discussed herein, the results of these analyses indicate that the transportation infrastructure already implemented as mitigation for the originally proposed Project is still more than adequate for accommodating traffic associated with the revised development program.

To determine the level of analysis required for the key study area intersections VHB reviewed the previously projected roadway network volumes for the 2018 Build condition (full Project build-out) for the weekday morning and evening peak hours. To develop the new Build volumes reflecting the new development program, traffic associated with the previously proposed IKEA was removed from the network and replaced with the new Partner's office traffic. Additional adjustments also were made to reflect the other changes summarized in Table 4-1. By comparing these new Build volumes to those contained in the original 2010 MEPA analysis an appropriate study area could be determined based on the relative traffic volume increases. These projected differences in traffic volumes resulting from the Project are documented later in this chapter. For locations in close proximity to the Project site, detailed capacity analyses are necessary to determine if the Project change creates the need for any further mitigation. Likewise, capacity analyses also were conducted for those locations currently included in the MassDOT Highway Safety Improvement Program database. Updated crash analyses also were conducted for these locations. The resulting study area for this NPC Transportation Analysis is documented following this section.

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4.3.2 Transit Analysis

As requested by MassDOT, this NPC includes an evaluation of the projected MBTA Orange Line ridership both with and without the Project change considering the increased office space on the site. These analysis results are summarized later in this section.

■

4.3.3 Parking Analysis

With the reduced daily traffic associated with the Project Change, the only transportation-related MEPA threshold that is exceeded is the proposed parking supply. To evaluate the parking needs for the new Partner's office development, as well as the Project as a whole, this chapter contains a comprehensive parking supply and demand analysis prepared by Cambridge Systematics on behalf of Partners Healthcare. The purpose of that evaluation is both to document the adequacy of the proposed supply, and also to help ensure that the available parking is not excessive to the point where use of public transportation or other non-automobile means of travel to the site are discouraged.

4.4 Study Area

VHB has revisited the previously reviewed study area based on the revised development program. The additional weekday peak hour trip generation requires that certain locations be reanalyzed to determine if revisions are needed to the intersection or signal configuration. However, VHB's preliminary analysis indicates that most of the study area intersections will only experience nominal increases in traffic as a result of the project change. As part of this analysis VHB compared the additional traffic associated with the Project change to the previously reviewed 2018 Build condition volumes at key locations. For most locations VHB found that the additional traffic resulted in an approximately one-percent increase in intersection volumes, which would not create a perceptible impact. However, for some locations, such as the main Route 28 access/egress points, updated capacity analyses are required based on the updated Build volumes. As noted earlier, updated capacity analyses also were conducted for those locations included in MassDOT's Highway Safety Improvement Program database. This analysis was conducted using a seven-year horizon from current conditions so that a 2021 Build condition would now be analyzed as part of this NPC. The resulting study area considered in this NPC is summarized in the following section.

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4.4.1 Intersection Capacity Analysis – Study Area Locations

To help ensure that project traffic is appropriately accommodated VHB conducted updated capacity analyses at each of the following locations to determine if changes to the signal or intersection configurations may be required:

- Route 28 (Fellsway) at Assembly Square Drive
- Route 28 (Fellsway) at Middlesex Avenue
- Route I-93/Route 28/Mystic Avenue interchange:
  - Route 28 (Fellsway) southbound at Mystic Avenue northbound
  - Mystic Avenue at Wheatland Street/Route 28 southbound
  - Route 28 (Fellsway) southbound at Mystic Avenue southbound
  - Route 28 (Fellsway) southbound at Route 28 (Fellsway) northbound
- Route 28 (McGrath Highway) at Broadway
- Route 28 (McGrath Highway) at Medford Street
- Mystic Avenue northbound at Lombardi Street/Assembly Square Drive
- Middlesex Avenue at Foley Street
- Route 38 (Mystic Avenue)/Temple Road
- Cambridge Street at Route I-93 northbound off-ramp

- Wellington Circle:
  - Route 16 (Revere Beach Parkway) at Route 28 (Fellsway) southbound
  - Route 16 (Revere Beach Parkway) at Route 28 (Fellsway) northbound
  - Route 28 (Fellsway) northbound at Middlesex Avenue
  - Route 28 (Fellsway) at President's Landing

These locations were selected based on VHB's previous studies in this area, and input from MassDOT. Following its review of VHB's initially suggested study area for this NPC assess MassDOT requested that any intersections listed in MassDOT's Highway Safety Improvement Program (HSIP) database also be included as part of the study area. A listing of the HSIP intersections and associated crash analysis as provided later in this assessment. The capacity analysis and/or traffic-volume comparisons for these locations also are summarized in detail in the Traffic Operation Analysis section of this chapter. As with the prior MEPA transportation assessments, the study area for the Project generally extends along Route 28 from Broadway to Wellington Circle, and along Mystic Avenue from Sullivan Square to Shore Drive. The focus of the traffic analysis in this NPC is on how certain key locations will function as a result of the Project change. While traffic volumes may change slightly at other previously studied intersections the focus of this evaluation is on those key locations where traffic volumes or patterns may change more significantly as a result of the Project change.

4.5 Coordination with State Officials

Prior to the filing of this NPC, the Proponent and VHB have been coordinating with the various public agencies and other stakeholders involved with the addition of Partner's Healthcare to the Assembly Square. The following section provides a general summary of that concerning the evaluation of the potential transportation aspects of the Project.

4.5.1 MassDOT

VHB met with MassDOT's Public/Private Development Unit on April 8, 2014 to discuss the currently proposed development program as it compares to the development reviewed in the MEPA process that concluded in 2010. Following that meeting, VHB provided a memorandum to MassDOT (dated April 15, 2014) which outlined the general scope and analysis methodology to be presented in the NPC. MassDOT provided comments on this document in a memorandum dated April 30, 2014. Both the VHB and subsequent MassDOT memoranda are provided in Attachments 4-1 and 4-2, respectively. The scope of work for the following transportation analysis was based on this input combined with VHB's analyses conducted to date.

4.5.2 Department of Conservation and Recreation

Prior to the preparation and filing of this NPC, VHB provided a memorandum to DCR dated April 17, 2014 which outlined the general scope and analysis methodology to be presented in the NPC. The scope identified was identical to that outlined in the MassDOT memorandum, though the transportation analysis in this chapter has been expanded further based on the MassDOT request noted above. The memorandum to DCR is provided for reference in Attachment 4-1.

4.6 Study Area Traffic Volumes

The original MEPA transportation analysis included a highly-detailed, comprehensive Traffic Impact and Access Study which considered the Project's impacts on a phased basis. That document identified the extensive transportation infrastructure improvements which would be needed to accommodate the Project, almost all of which have since been constructed in and around Assembly Square. As part of this NPC, VHB has reviewed traffic conditions in the area compared to those contained in the prior MEPA traffic analysis.

To help identify any area traffic growth that may have occurred since the prior studies were prepared, VHB recently conducted traffic counts at two key locations in the vicinity of Assembly Square. VHB conducted continuous 72-hour traffic counts over a three-day period (including Saturday) on both Route 28 and Mystic Avenue Northbound, which are the two primary surface arterial roadways abutting the Assembly Square District. These counts were conducted between Thursday, April 10, 2014 and Saturday April 12, 2014 on both roadways, and are summarized below in Table 4-2. The count sheets are provided in Attachment 4-3 for reference. Counts previously conducted by VHB on these roadways also have been provided for comparison purposes in Table 4-2.

As shown in Table 4-2, traffic on Route 28 actually has decreased by almost two-percent since the conclusion of the original MEPA review process in 2010. Likewise, volumes on Mystic Avenue also are almost eight-person lower than the levels observed in 2010. While the counts were conducted in different months the application of seasonal adjustment factors would not result in the new counts being significantly different than the volumes observed in 2010, or in the years prior to that. Regardless, as requested by MassDOT, the capacity analysis conducted as part of this NPC assessment considered a new 2021 Build horizon year, instead of the 2018 Build year considered in the prior analysis. In doing so, an additional three years of traffic growth have been added onto the future Build conditions volumes even though the count data above do not substantiate that further additional growth. This is discussed further in the Traffic Operations Analysis section of this study.

Table 4-2 Weekday Traffic Volume Comparison

Count Date	ADT[a]	Morning Peak Hour Volume[b]	Morning Peak Hour K Factor[c]	Morning Peak Hour Dir. Dist.[d]	Evening Peak Hour Volume	Evening Peak Hour K Factor	Evening Peak Hour Dir. Dist.
Route 28:							
January 26, 2006	56,610	4,170	7.4%	67% (SB)	3,880	6.9%	56% (NB)
June 25, 2009	67,990	4,355	6.4%	65% (SB)	4,280	6.3%	56% (NB)
June 17, 2010	63,875	4,380	6.9%	67% (SB)	4,450	7.0%	54% (NB)
April 10, 2014	62,751	4,478	7.1%	68% (SB)	4,197	6.7%	56% (NB)
Mystic Avenue northbound:							
June 17, 2010	21,175	1,030	4.9%	N/A	2,030	9.6%	N/A
April 10, 2014	19,489	1,076	5.5%	N/A	1,674	8.6%	N/A

Source: Automatic traffic recorder counts conducted by VHB on Route 28 south of Middlesex Avenue and on Mystic Avenue northwest of Lombardi Street.

a. Average Daily Traffic volume expressed in vehicles per day.
b. Vehicles per hour
c. Represents the percent of daily traffic that occurs during the peak hour.
d. Directional distribution of peak hour traffic.

4.7 Safety Assessment

As requested by MassDOT, VHB reviewed MassDOT's Highway Safety Improvement Program (HSIP) database and found that the following locations were identified as high-crash intersection location cluster within the 2007 – 2011 time period:

- Route 28 (Fellsway) at Assembly Square Drive
- Route 28 (Fellsway) at Middlesex Avenue
- Route I-93/Route 28/Mystic Avenue interchange:
  - Route 28 (Fellsway) southbound at Mystic Avenue northbound
  - Route 28 (Fellsway) southbound at Mystic Avenue southbound
  - Route 28 (Fellsway) southbound at Route 28 (Fellsway) northbound
- Route 28 (McGrath Highway) at Broadway
- Route 28 (McGrath Highway) at Medford Street
- Mystic Avenue northbound at Lombardi Street/Assembly Square Drive
- Route 38 (Mystic Avenue)/Temple Road
- Cambridge Street at Route I-93 northbound off-ramp
- Wellington Circle:
  - Route 16 (Revere Beach Parkway) at Route 28 (Fellsway) southbound
  - Route 16 (Revere Beach Parkway) at Route 28 (Fellsway) northbound
  - Route 28 (Fellsway) northbound at Middlesex Avenue
  - Route 28 (Fellsway) at President's Landing

To identify potential vehicle crash trends and/or roadway deficiencies in the project study area, the most current vehicle crash data for the study area intersections was obtained from MassDOT for the years 2007 to 2011. This updated crash analysis was conducted both for the current NPC study area intersections as well as all of the intersections evaluated in the prior Project traffic studies.

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 intersection in the district in which the town or city is located (District 4 for Somerville, Boston and Medford) could indicate safety or geometric issues for a particular intersection. The latest published crash rate by MassDOT in District 4 is 0.77 for signalized intersection and 0.58 for unsignalized intersections. These rates imply that, on average, 0.77 crashes occurred per million vehicles entering signalized intersections throughout District 4, and 0.58 accidents occurred per million vehicles entering unsignalized intersections. 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. A summary of the study intersections vehicle crash history is presented in Table 4-3 and the crash analysis worksheets are provided in Attachment 4-4.

As with prior studies of this area, the Wellington Circle signalized rotary intersection in Medford experienced the highest number of crashes during the time period reviewed. This location is actually made up of three signalized intersections operating in conjunction with each other in addition to multiple smaller unsignalized intersections. While crashes for the intersection of Route 28 and President's Landing are included in the Wellington Circle section of the table that intersection is actually located south of the signalized rotary and functions as a separate intersection. With the exception of Revere Beach Parkway (Route 16) westbound at Route 28 northbound and Mystic Valley Parkway (Route 16) at Route 28 southbound, all other locations within Wellington Circle have crash rates below District 4 average rate of 0.77 for signalized intersections. As part of a surrounding community agreement with the City of Medford, the Wynn Everett casino/resort project has agreed to provide up to $1.5 million for a design to improve traffic at Wellington Circle. While minor changes to the signal operation have been made in recent years, this level of funding will help advance the design of the substantial improvements which would be required to address existing safety and operational concerns at this location.

The Route 28/Mystic Avenue interchange continues to experience the highest number of accidents within the Somerville portion of the study area. Previous studies of this area indicated that some portion of the crashes at the Route 28 southbound/Mystic Avenue northbound intersection may have been due to poor signal visibility. As part of the Phase 1 mitigation for the Project new mast arms were installed facing both the Route 28 southbound and Mystic Avenue northbound approaches to this location. While updated data following that improvement are not

yet available, that mitigation should have helped to improve conditions at this location due to the increased visibility of the signal heads.

Table 4-3 Vehicular Crash Summary (2007 – 2011)

	Route 28 at:			Mystic Avenue at:				Broadway at: McGrath Highway	Middlesex Avenue at: Foley Street
	Grand Union Boulevard	Middlesex Avenue	Mystic Avenue[a]	Shore Drive	Wheatland Street	New Road	Lombardi Street[b]		
Signalized?	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year									
2007	0	6	46	5	4	2	2	13	2
2008	1	14	41	4	8	1	0	12	1
2009	1	14	44	4	0	1	3	11	2
2010	2	4	41	5	5	0	4	6	2
2011	2	2	30	4	0	0	3	9	0
Total	6	40	202	22	17	4	12	51	7
Collision Type									
Angle	0	7	99	3	10	2	10	12	2
Head-on	0	0	1	0	0	0	0	0	0
Rear-end	3	21	65	13	5	1	2	24	0
Rear-to-rear	0	0	1	0	0	0	0	0	0
Sideswipe	2	6	19	2	0	1	0	2	3
Single Vehicle Crash	1	4	13	4	0	0	0	10	1
Unknown	0	2	4	0	2	0	0	3	1
Total	6	40	202	22	17	4	12	51	7
Severity									
Fatality	0	0	1	0	0	0	0	0	0
Injury	3	10	73	10	4	1	2	23	2
Property	3	27	116	11	13	3	10	22	5
Unknown	0	3	12	1	0	0	0	6	0
Total	6	40	202	22	17	4	12	51	7
Time of day									
Weekday, 7 AM-9 AM	0	5	7	1	3	0	1	9	0
Weekday, 4 PM – 6 PM	2	5	25	7	0	1	2	7	1
Saturday, 11 AM – 2 PM	0	4	10	1	0	0	0	1	0
Weekday, other time	3	20	100	9	10	3	6	22	5
Weekend, other time	1	6	60	4	4	0	3	12	1
Total	6	40	202	22	17	4	12	51	7
Pavement Conditions									
Dry	4	26	150	18	10	2	7	44	4
Wet	2	12	41	4	7	2	4	4	3
Snow	0	0	5	0	0	0	0	3	0
Icy	0	2	1	0	0	0	1	0	0
Other	0	0	3	0	0	0	0	0	0
Unknown	0	0	2	0	0	0	0	0	0
Total	6	40	202	22	17	4	12	51	7
Non Motorist (Bike, Ped)	0	0	5	0	0	0	0	5	1
MassDOT Average Crash Rate	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77
MassDOT Calculated Crash Rate	0.06	0.41	N/A	0.37	0.37	0.09	N/A	0.44	0.43

Source: MassDOT database. Note that it is not always possible, with the database, to determine the precise locations of accidents. Some locations have been combined in order to provide the most accurate information available.

N/A Indicates multiple locations; crash rate could not be calculated.

a Includes accidents occurring at either Fellsway (Route 28) and Mystic Avenue or McGrath (Route 28) and Mystic Avenue.

b Includes accidents occurring at either Alfred Lombardi Street at Mystic Avenue Northbound, Alfred Lombardi at Mystic Avenue Southbound, and Mystic Avenue at the U-Turn.

Table 4-3 (continued)
Vehicular Crash Summary (2007 – 2011) – Wellington Circle

	Route 28 Northbound at:				Route 28 Southbound at:			Route 28 at:		
	Revere Beach Parkway (Rt. 16)		Middlesex Avenue	U-Turn to Route 28 Southbound	Mystic Valley Parkway (Rt.16)		U-Turn to Route 28 Northbound	Unspecified Location (at Wellington Circle)	President's Landing	Total Wellington Circle
	Eastbound	Westbound			Eastbound	Westbound				
Signalized?	YES	YES	YES	NO	YES	YES	NO	N/A	YES	
Year										
2007	2	33	2	3	17	21	0	11	7	96
2008	4	32	0	1	26	26	2	4	6	101
2009	1	24	1	2	14	11	0	0	6	59
2010	6	17	2	2	12	2	1	0	3	45
2011	8	11	0	0	13	7	1	0	2	42
Total	21	117	5	8	82	67	4	15	24	343
Collision Type										
Angle	6	30	4	3	42	18	2	2	6	113
Head-on	0	0	0	0	0	0	0	0	0	0
Rear-end	5	43	0	2	17	17	1	9	16	110
Rear-to-rear	0	0	0	0	0	0	0	0	0	0
Sideswipe	5	30	1	1	16	19	1	1	2	76
Single Vehicle Crash	3	5	0	1	2	5	0	2	0	18
Unknown	2	9	0	1	5	8	0	1	0	26
Total	21	117	5	8	82	67	4	15	24	343
Severity										
Fatality	0	0	0	0	0	0	0	0	0	0
Injury	6	31	2	1	23	18	2	4	9	96
Property	12	70	3	6	55	44	2	10	15	217
Unknown	3	16	0	1	4	5	0	1	0	30
Total	21	117	5	8	82	67	4	15	24	343
Time of day										
Weekday, 7 AM-9 AM	1	11	2	0	13	13	1	4	4	49
Weekday, 4 PM – 6 PM	2	15	2	2	8	8	0	1	2	40
Saturday, 11 AM – 2 PM	0	3	0	0	3	5	0	2	1	14
Weekday, other time	13	56	0	2	42	33	1	5	10	162
Weekend, other time	5	32	1	4	16	8	2	3	7	78
Total	21	117	5	8	82	67	4	15	24	343
Pavement Conditions										
Dry	17	95	3	4	68	53	4	11	14	269
Wet	4	17	2	3	13	10	0	3	9	61
Snow	0	1	0	1	0	0	0	0	0	2
Icy	0	0	0	0	0	1	0	1	1	3
Other	0	1	0	0	0	0	0	0	0	1
Unknown	0	3	0	0	1	3	0	0	0	7
Total	21	117	5	8	82	67	4	15	24	343
Non Motorist (Bike, Ped)	2	2	0	0	2	1	0	0	0	7
MassDOT Average Crash Rate	0.77	0.77	0.77	0.58	0.77	0.77	0.58	0.77	0.77	
MHD Crash Rate	0.20	1.11	0.11	N/A	0.95	0.78	N/A	N/A	0.24	

Source: MassDOT database. Note it is not always possible with the database to determine the precise locations of all accidents. Some locations have been combined so as to provide the most accurate information available.

N/A Indicates multiple locations; crash rate could not be calculated.

Table 4-3 (continued)
Vehicular Crash Summary (2007 – 2011) – Sullivan Square

	Sullivan Square at:						Cambridge Street at:				
	Alford Street SB/ West Street	Main Street West	Rutherford Avenue	Main Street East	Alford Street NB	Unspecified Location	I-93 NB Off-Ramp	Spice Street/ MBTA Lot	Maffa Way/ Alford Street	Maffa Way at MBTA Lot	Total Sullivan Square
Signalized?	NO	NO	NO	NO	NO	N/A	YES	NO	YES	NO	
Year											
2007	0	5	12	3	1	0	1	0	4	0	26
2008	2	3	4	0	1	0	2	0	1	0	13
2009	2	0	2	0	4	0	1	0	1	0	10
2010	3	6	6	0	3	1	0	1	3	0	23
2011	1	2	2	0	0	1	0	1	2	1	10
Total	8	16	26	3	9	2	4	2	11	1	82
Collision Type											
Angle	3	4	7	0	2	0	1	1	2	1	21
Head-on	0	0	0	0	0	0	0	0	0	0	0
Rear-end	5	2	4	1	4	0	3	0	3	0	22
Rear-to-rear	0	0	0	0	0	0	0	0	1	0	1
Sideswipe	0	4	11	2	1	0	0	0	2	0	20
Single Vehicle Crash	0	3	1	0	1	1	0	0	0	0	6
Unknown	0	3	3	0	1	1	0	1	3	0	12
Total	8	16	26	3	9	2	4	2	11	1	82
Severity											
Fatality	0	0	0	0	0	0	0	0	0	0	0
Injury	3	3	4	0	3	2	2	2	3	0	22
Property	4	9	17	1	3	0	2	0	1	1	38
Unknown	1	4	5	2	3	0	0	0	7	0	22
Total	8	16	26	3	9	2	4	2	11	1	82
Time of day											
Weekday, 7 AM-9 AM	1	4	7	1	1	0	0	0	1	0	15
Weekday, 4 PM – 6 PM	0	1	1	0	4	0	0	0	0	0	6
Saturday, 11 AM – 2 PM	3	0	0	0	0	0	0	0	0	0	3
Weekday, other time	4	11	15	2	1	1	3	2	6	1	46
Weekend, other time	0	0	3	0	3	1	1	0	4	0	12
Total	8	16	26	3	9	2	4	2	11	1	82
Pavement Conditions											
Dry	6	13	22	3	5	2	0	1	8	1	61
Wet	2	1	3	0	2	0	4	1	1	0	14
Snow	0	0	0	0	0	0	0	0	0	0	0
Icy	0	1	1	0	0	0	0	0	0	0	2
Other	0	0	0	0	0	0	0	0	0	0	0
Unknown	0	1	0	0	2	0	0	0	2	0	5
Total	8	16	26	3	9	2	4	2	11	1	82
Non Motorist (Bike, Ped)	0	0	1	0	0	1	0	0	0	0	2
MassDOT Average Crash Rate	0.58	0.58	0.58	0.58	0.58	N/A	0.76	0.58	0.76	0.58	
MHD Crash Rate	0.16	0.31	0.37	0.04	0.15	N/A	0.09	0.06	0.17	0.03	

Source: MassDOT database.
Note: It is not always possible with the database to determine the precise locations of all accidents. Some locations have been combined so as to provide the most accurate information available
N/A Indicates multiple locations; crash rate could not be calculated.

The roadway improvements already constructed as Project mitigation also involved the reconfiguration of Route 28's signalized intersections with Grand Union Boulevard and Middlesex Avenue. That mitigation involved improved pedestrian crossings and other enhancements which improved conditions for both motorists and pedestrians at this location. Substantial improvements also were implemented at the Route I-93/Lombardi Street intersection in the form of a new four-signal interconnected signal system. These improvements, along with mitigation implemented at Mystic Avenue/New Road, Middlesex Avenue/Foley Street and Mystic Avenue at Kensington Street (improved pedestrian crossing) have significantly improved traffic conditions at these locations.

4.8 Trip Generation

The trip generation analysis presented during the original MEPA process was a complicated exercise largely due to the timing of the new MBTA Orange Line station relative to the phased construction of the various proposed uses. However, the new MBTA station is now expected to be open as soon as late 2014 and all the transportation improvements associated with the former IKEA proposal already have been implemented. The only remaining mitigation beyond that previously proposed phase involves the construction of new signalized at-grade u-turn connection from the northbound segment of Mystic Avenue to the departing southbound segment leading to the Route I-93 southbound on-ramp. Originally this mitigation was not planned to occur until midway through the overall site development before the opening of the new station. That work will now commence concurrent with the development of Block 11 pending permit approval by MassDOT and/or DCR. With that mitigation and the previously constructed improvements being in place now instead of on a phased basis the focus of the current NPC analysis will be on the trip generation associated with the full build-out of the entire project.

■

4.8.1 Trip Generation Methodology

As requested by MassDOT, the following section provides a detailed narrative of how the Project trip generation was calculated, along with a summary of the underlying trip-sharing, transit, and pass-by assumptions used. In summary, the updated trip generation was developed in the following manner which was used for the previously reviewed 2010 FEIR transportation analysis:

Step 1: Base Rates

The Institute of Transportation Engineers *Trip Generation Manual*[1] publishes trip generation data for a variety of land uses. These rates and equations are developed for single-use projects typically located in the suburbs. Thus, these rates do not account for any benefits arising from the transit-oriented, mixed-use nature of the Project. Therefore, these rates and associated trips represent the "base" trip generation numbers (i.e., prior to any credit resulting from the unique characteristics of the Project.) The following land use codes were used in this step:

- LUC 220 – Apartment
- LUC 230 – Condominium/Townhouse
- LUC 310 – Hotel
- LUC 445 - Cinema
- LUC 710 – General Office Building
- LUC 820 – Shopping Center

Step 2: Internal Trips

Shared-trips between the residential, hotel, office and retail components of the Project were calculated using guidelines recommended by the Institute of Transportation Engineers (ITE) *Trip Generation Handbook*[2]. While these shared trips represent new traffic to the individual uses, they do not show up as new vehicle trips on the surrounding roadway network aside from the internal site driveways. The ITE guidelines involve the following:

a) *Estimate the anticipated unconstrained internal capture rate between each pair of land uses.* The handbook provides percentages of expected sharing between uses for different time periods. The percentages range from 0 percent (from office to residential in the midday peak hour) to 53 percent (from residential to retail in the evening peak hour).

b) *Estimate the unconstrained demand volume by direction.* The trip generation associated with the land use is multiplied by the percentage suggested above. For each pair of land use two values are computed: the maximum potential amount of shared trips it could generate to another specific use, and the maximum number of trips it could be expected to receive from another given use.

c) *Estimate balanced demand by direction.* The two values for each pairing of land uses are compared and the lower (controlling) value is selected. For instance, if for trips from retail to office the retail could generate 15 internal trips but the office could only receive 11 internal trips, the controlling value is 11 internal trips between the two uses.

▼

1 Trip Generation Manual; Ninth Edition; Institute of Transportation Engineers; Washington, D.C.; 2012.
2 Trip Generation Handbook; Institute of Transportation Engineers; Washington, D.C.; 2012.

d) Estimate total internal trips to/from multi-use development land uses. The internal trip volumes to and from each land use is calculated.

e) Estimate the total external trips for each land use. The external trip volumes to and from each land use is determined by subtracting the internal trips from the "base" trips.

f) Calculate the internal capture rate for multi-use site. The overall internal capture rate is computed by dividing the net external trip generation estimate by the original "base" trip generation estimate and subtracting the quotient from 100 percent.

Table 4-4 depicts the resulting internal capture rates for the different time periods of the Project.

Table 4-4 Internal Capture Rates

Time Period	2010 FEIR – Full Build Condition	2014 NPC – Full Build Condition
Weekday		
Daily	15.4%	15.1%
Morning Peak Hour	N/A	0.7%
Evening Peak Hour	12.7%	11.2%
Saturday		
Daily	16.3%	16.6%
Midday Peak Hour	12.1%	12.5%

As shown through Table 4-4, during the critical weekday conditions the updated trip sharing assumptions are slightly lower, and more conservative, than those calculated in the 2010 Project FEIR.

Step 3: Non-Vehicle Trips

As detailed in the 2010 FEIR, a detailed analysis was conducted to estimate the probable modes splits for the Project. The information gathered included empirical data from the U.S. Census Transportation Planning Package, research on transit-oriented development, and sample mode shares from similar large projects. The following process was used to determine non-vehicle (transit, bicycle and pedestrian) trips:

a) Transform vehicle trips into person trips. Vehicle trips were converted into person trips by multiplying them by the appropriate vehicle occupancy rate (VOR). Guidelines provided by the Transportation Research Board[3] suggest that the following VOR (which were used in the 2010 FEIR) are appropriate:

▼

3 NCHRP Report 365 Travel Estimation Techniques for Urban Planning; Transportation Research Board National Research Council.

	Weekday			Saturday	
	Daily	AM	PM	Daily	Midday
Retail	1.44	1.55	1.45	1.44	1.44
Residential	1.49	1.49	1.49	1.49	1.49
Office	1.11	1.17	1.13	1.11	1.04

b) *Determine the mode split for the Project.* The number of non-vehicle trips was determined by multiplying the person trips by the percentage expected to utilize transit, bicycling and walking to access the Project. Table 4-5 shows the resulting percentages assumed in the 2010 FEIR, which are also utilized for this current assessment.

Table 4-5 Mode Split Percentages

Time Period	2010 FEIR – Full Build Condition	2014 NPC – Full Build Condition
Transit		
IKEA	0%	N/A
Retail	5%	5%
Residential	47%	47%
Office	25%	25%
Bicycle/Walk		
IKEA	0%	N/A
Retail	5%	5%
Residential	5%	5%
Office	5%	5%

N/A IKEA no longer proposed as part of Project.

As shown in Table 4-5, the transit use projections for this current NPC assessment are the same as those summarized in the 2010 FEIR. As part of that analysis, 2000 Census transit mode shares were analyzed for home-based and work-based trips for a range of metropolitan Boston locations including Wellington Station, Alewife Station, the City of Medford, Kendall Square and Lechmere Station as well as Assembly Square. Existing mode shares for Assembly Square and these other areas were determined to be representative of what may be expected for the Project.

Following the construction of the new MBTA Orange Line Station, residential transit use should be considerably higher than that reflected by the current use in the Assembly Square area. The existing Alewife MBTA station could provide a good indicator of potential residential transit use: 35-47%. The 47% transit share

also coordinates well with the data from a demographically similar area in San Francisco, California where 46% transit usage was observed. These data are summarized and documented in greater detail in Attachment 4-5. From the Alewife station it takes about 22 minutes to reach Downtown Crossing in Boston, while it is estimated that the ride time from Assembly Square to Downtown Crossing would be less than half that. It can be expected that with proper marketing, people will choose to live at Assembly Square due to quick access to downtown Boston and neighborhood-focused on-site retail. Demographically, the new Assembly Square project may also attract residents similar to those at Alewife.

Office-related transit use should also obviously increase considerably with the construction of a new MBTA Orange Line station. With the low parking ratios that will be provided combined with other transportation demand management (TDM) measures it is expected that office transit usage will reach 25% following the construction of the new station.

Retail is typically the most limited use as far as maximizing transit usage. This is due to the majority of the traffic associated with retail uses being from customers, which aren't affected to the same degree by TDM measures. Regardless, VHB expects that retail transit usage at the site could reach 5% with the construction of the new MBTA station. It is important to note that transit use by employees of the various retail stores should also approach the 25% levels considered for office employees. However, VHB did not attempt to quantify the number of retail employees within the Assembly Square district and instead assumed a flat 5% retail transit credit. The overall number of transit riders associated with the Project should be higher with the formerly proposed IKEA use being replaced with office space.

c) *Deduct transit, bicycle and walk person trips and transform resulting trips back into vehicle trips.* Utilizing the same VORs presented above, the resulting person trips are converted back into vehicle trips.

Step 4: Pass-by/Diverted-link Trips

Retail uses typically attract a significant percentage of their traffic from traffic streams passing the site. Thus, a 25 percent pass-by rate was used to determine the pass-by trip credit for the retail trips in accordance with EEA/EOTA guidelines.

Step 5: New Trips

The new vehicular trips for the Project result from subtracting the internal trips, non-vehicle trips and pass-by/diverted-link trips as appropriate from the "base" trips.

4.8.2 Project Trip Generation Summary

As noted above, the first step of the trip generation process involves estimating trip generation for each major project component using standard Institute of Transportation Engineers (ITE) data[4]. Table 4-6 compares the resulting unadjusted trip generation estimates to those previously evaluated during the original MEPA review. A detailed summary of the trip generation calculations is provided in Attachment 4-6.

Table 4-6 Assembly Square Full Build-out Trip Generation Comparison – Total Unadjusted Trips

Time Period	2010 MEPA Approved[1]	2014 NPC Proposal[2]	Difference
Weekday Daily (vpd)	45,450	45,055	-395
Weekday Morning Peak (vph)			
Enter	2,095	2,795	700
Exit	1,050	1,060	10
Total	3,145	3,855	710
Weekday Evening Peak (vph)			
Enter	1,985	1,979	-6
Exit	2,955	3,807	852
Total	4,940	5,786	846
Saturday Daily (vpd)	44,470	36,755	-7,715
Saturday Midday Peak (vph)			
Enter	2,195	2,147	-48
Exit	1,840	1,845	5
Total	4,035	3,992	-43

vpd Vehicles per day
vph Vehicles per hour
Source: Assembly Square Mixed-Use Redevelopment – Draft Environmental Impact Report; VHB, Inc., Watertown, MA (June 2, 2008).
Source: Trip Generation Manual; Ninth Edition; Institute of Transportation Engineers; Washington, D.C.; 2012.

As shown in Table 4-6, the overall unadjusted weekday daily volumes decrease as a result of the proposed changes. With the primary change of IKEA being replaced with new office space Saturday volumes decrease on both a daily level and during peak-hour conditions. However, with the change in development the weekday peak hour volumes are expected to increase.

The trip generation was further refined to reflect internal shared trips, mode-splits, and pass-by traffic using the same assumptions from the original analysis as

4 Trip Generation Manual; Ninth Edition; Institute of Transportation Engineers; Washington, D.C.; 2012.

discussed earlier in Section 4.7.1. Once the base trip generation was calculated the expected amount of shared-trip interaction between the various site components was estimated based on ITE data[5].

For consistency the same mode splits used in the original analysis will be utilized for the NPC (with the exception of the IKEA which is no longer planned). The revisions to the project should help promote a more transit-oriented environment. The previously proposed IKEA use was not expected to have significant transit ridership, while the new office workers using this space should find the MBTA station to be a highly convenient and attractive option. With the new MBTA station planned to be in operation as soon as late 2014, the NPC analysis used the same full build-out mode split assumptions from the original study as shown earlier in Table 4-5.

Table 4-7 compares the originally evaluated trip generation to that associated with the revised development considering internal shared trips, mode splits and retail pass-by traffic. A detailed summary of the associated trip generation calculations is provided in Attachment 4-6.

Table 4-7 Assembly Square Full Build-out Trip Generation Comparison – Net New Vehicle Trips

Time Period	2010 MEPA Approved[1]	2014 NPC Proposal[2]	Difference
Weekday Daily (vpd)	24,810	23,259	-1,551
Weekday Morning Peak (vph)			
Enter	1,450	1,905	455
Exit	590	599	9
Total	2,040	2,504	464
Weekday Evening Peak (vph)			
Enter	1,065	1,000	-65
Exit	1,770	2,328	558
Total	2,835	3,328	493
Saturday Daily (vpd)	24,720	17,218	-7,502
Saturday Midday Peak (vph)			
Enter	1,350	1,159	-191
Exit	1,040	956	-84
Total	2,390	2,115	-275

vpd Vehicles per day
vph Vehicles per hour
1. Source: Assembly Square Mixed-Use Redevelopment – Draft Environmental Impact Report; VHB, Inc., Watertown, MA (June 2, 2008).
2. Source: Trip Generation Manual; Ninth Edition; Institute of Transportation Engineers; Washington, D.C.; 2012.

5 Ibid.

4.9 Trip Distribution and Assignment

The 2010 FEIR highlighted the different trip distribution patterns that were used for the residential, office, retail, and IKEA site components. While the IKEA will no longer be constructed the other general uses are still planned, though at different overall levels than those previously considered. VHB recently obtained employee home zip code data for Partners Boston-based employees that now will be working in Somerville. Table 4-8 summarizes the previously reviewed trip distribution patterns for the Project, and individual trip distribution graphics for each use as presented in the 2010 FEIR are provided in Figures 4-1 through 4-4. The IKEA trip distribution is shown in the table and graphics for reference only. As the IKEA is no longer proposed for the Project site the IKEA trip distribution is not used in determining where the new Partners office traffic will be traveling to and from.

Table 4-8 Assembly Square Redevelopment
Vehicle Trip Distribution Summary

		2010 FEIR[1]				2014 NPC[2]
Route	Direction	Residential	Retail	IKEA	Office	Partners Healthcare Office
I-93	north	11%	3%	50%	25%	24%
I-93	south	28%	1%	28%	21%	49%
Route 28	northwest	3%	6%	1%	6%	3%
Route 28	southeast	14%	15%	4%	14%	8%
Route 16	west	1%	5%	1%	1%	0%
Route 16	east	1%	3%	4%	7%	6%
Broadway	northwest	11%	18%	2%	8%	3%
Medford Street	northwest	22%	17%	6%	6%	4%
Mystic Avenue	north	3%	12%	2%	4%	1%
Mystic Avenue	south	3%	4%	2%	5%	2%
Local Roadways	--	3%	16%	--	3%	0%
Total	--	100%	100%	100%	100%	100%

1. Source: Assembly Square Mixed-Use Redevelopment – Final Environmental Impact Report; VHB, Inc., Watertown, MA (March 2010).
2. Source: Employee residence zip-code data for Boston-based employees relocating to Somerville Project site.

As shown in Table 4-8, the Partner's based data reflects a significantly higher proportion of office employees arriving from the south of the Project site on Route I-93 as compared to the previous census-based projections. However, this reflects the current Partners Boston workforce including a higher proportion of employees that live to the south of the Project site. Due to its location, a smaller percentage of office workers in Somerville live to the south of Boston likely due to the distance and time associated with having to travel through Boston as part of their commute. Most of the employees relocating to the Somerville location likely will continue to live at their current residence. However, over the time the Partners Somerville workforce may gradually shift with the resulting trip distribution being similar to that shown by the

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Figure 4-1
Residential Trip Distribution

Assembly Square Mixed-Use Redevelopment
Somerville, Massachusetts

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Figure 4-2
Retail Trip Distribution

Assembly Square Mixed-Use Redevelopment
Somerville, Massachusetts

REFERENCE ONLY

IKEA NO LONGER PROPOSED

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Figure 4-3
IKEA Trip Distribution

Assembly Square Mixed-Use Redevelopment
Somerville, Massachusetts

Vanasse Hangen Brustlin, Inc.

Figure 4-4
Office Trip Distribution

Assembly Square Mixed-Use Redevelopment
Somerville, Massachusetts

Somerville census data. In conducting this analysis an important distinction must be made between where employees live geographically and what route they use to travel to and from work. The Partners zip code data provided indicate that over 40-percent of its employees will live in communities to the north of Boston. However, while these employees physically may live north of the Project site, their travel route may involve them approaching the site from the south as reflected by Table 4-10. For instance, some commuters along the north shore may use Route 1 South to travel to the site. Because Route 1 intersects I-93 to the south of the site, those employees actually would end up traveling northbound on I-93 to make their final leg of their trip to the site. Similar patterns may occur for workers located to the northwest of the Project site.

For the purpose of this NPC transportation analysis it is assumed that the Partners employees will follow the same distribution patterns as the other Assembly Square office workers as estimated in the 2010 FEIR. In doing so, this maximizes the amount of office workers exiting the site directly onto Route 28 via either Grand Union Boulevard or Middlesex Avenue. In fact, if Partners employees follow the trip distribution shown in the right-hand column of Table 4-10, there would be a reduced impact to Route 28, the Route 28/Mystic Avenue interchange, and nearby local roadways. Under that scenario, 49-percent of the Partner's employees would be exiting the site onto Mystic Avenue northbound and utilizing the planned signalized at-grade u-turn connection to Mystic Avenue southbound leading to the Route I-93 South on-ramp. While that mitigation previously was not planned to occur until midway through the overall Project timeline that work will now commence concurrent with the development of block 11 pending permit approval by MassDOT and/or DCR. By not assigning traffic in that manner the analysis in this assessment is overly conservative in that it overestimates the amount of Project traffic being added to the critical Route 28 access points.

The following section summarizes how the updated site-generated traffic was added to the study area roadways and intersections using the trip distribution patterns discussed above.

4.10 2021 Build Conditions

The original Project DEIR and FEIR included analyses of existing and future conditions considering the multiple phases of the Project. Ultimately the final Project mitigation was based on the 2018 Build condition volumes considering the full build-out of the entire Assembly Square Redevelopment Project. The focus of this current NPC transportation analysis is on confirming the adequacy of the surrounding transportation infrastructure to accommodate volumes associated with the revised full build-out condition. The new Build volumes were developed by removing traffic associated with the former IKEA proposal from the study area roadway network. A limited amount of traffic also was removed from the network to reflect the reduction

of 257 residential units, two cinema screens and 30 hotel rooms. Once that traffic was removed, the new Partners office traffic was added to the network, along with the additional traffic associated with the planned Block 11 retail space. These adjustments were made using the trip generation and trip distribution methodologies summarized in the previous section. Following this exercise, the newly created 2018 Build volumes reflect the current NPC development program. Those volumes were further refined as discussed in the following section.

The original DEIR/FEIR transportation analysis considered as 2018 Build horizon year. While the Project still may be completed within that timeframe MassDOT has requested that a seven-year build horizon be used for this current NPC analysis so that a 2021 Build year would be evaluated. This was done by applying a one-percent annual growth rate to the updated 2018 Build volumes discussed above. The resulting 2021 Build Weekday Morning and Weekday Evening traffic volume networks are provided in Figures 4-5 through 4-10. Worksheets showing how the changes in traffic volumes were assigned to the study area intersections to create the 2021 Build volumes are provided in Attachment 4-8.

This slightly overstates the future growth as the annual one-percent growth rate was applied to roadway volumes including both the Project-generated traffic, as well as traffic generated by nearby background development projects. Standard practice is for growth rates to be applied to base volumes before background and site-generated traffic volumes have been added to the network. Accordingly, the actual future volumes likely will be lower than those projected using this more conservative methodology. The following section provides a summary of the background development projects included in the original DEIR/FEIR projections, and notes the current status of those projects.

■

4.10.1 Background Development Projects

The transportation analysis conducted for the previous MEPA process considered both normal traffic growth, and traffic growth associated with nearby development projects. The traffic study considered several nearby development projects that were either planned or approved at that time. Traffic generated by the following potential background development projects beyond Assembly Square was incorporated into the future traffic volume projections in the original assessment, and are also utilized for this current NPC analysis:

- **North Point – Somerville/Cambridge/Boston:** The North Point project, similar to the proposed Assembly Square redevelopment project, consists of several phases. The North Point full-build program, envisioned to be completed in 2022, consisted of the construction of a total of 3,540 residential units, 2,140,000 sf of office, 75,000 sf of ancillary retail and 90 hotel rooms. These numbers include the North Point, Lechmere, and Charles E. Smith sites. While some components of

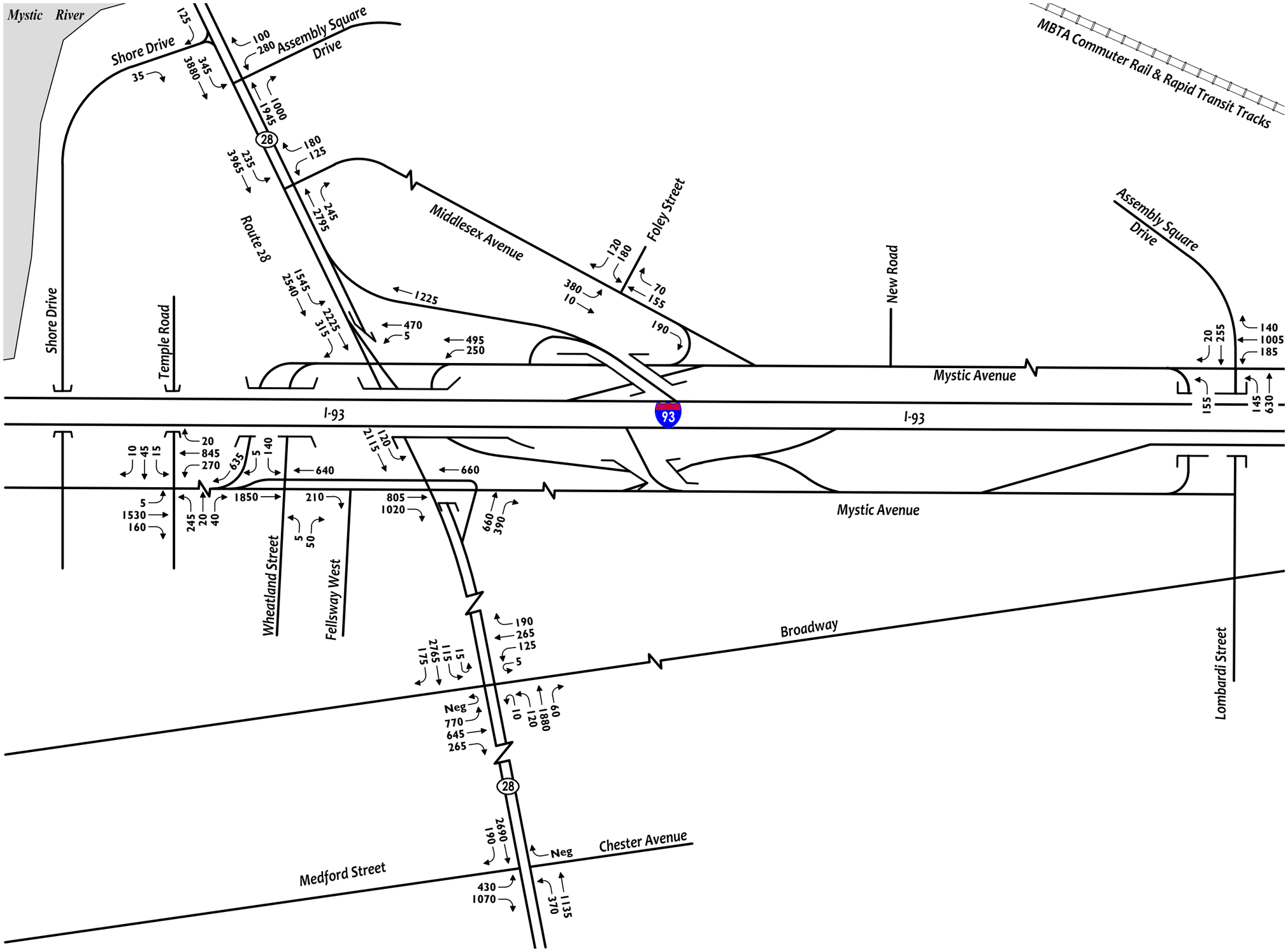

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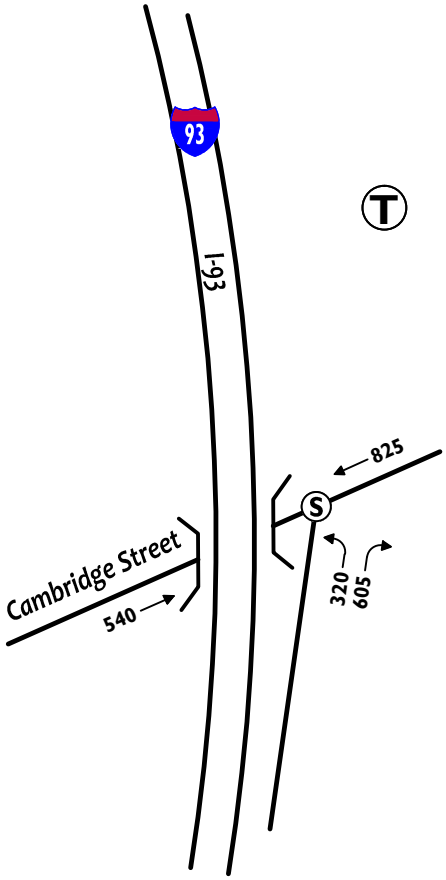
Figure 4-5

2021 Build Conditions Weekday
Morning Peak Hour Traffic Volumes
Assembly Square Mixed-Use Redevelopment
Somerville, Massachusetts

Ⓢ Signalized Intersection

Ⓣ MBTA Station



Not to Scale

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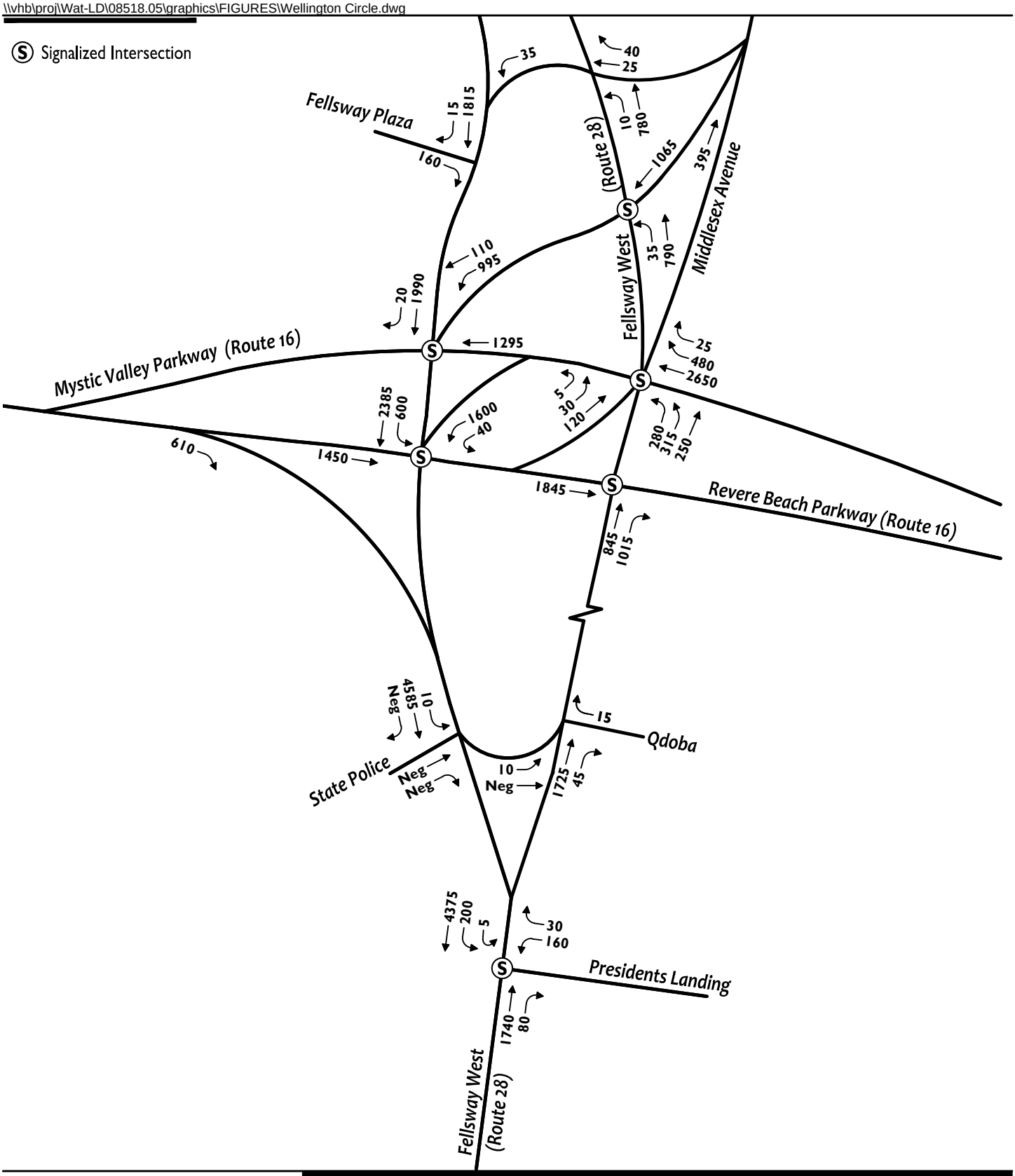
2021 Build Conditions Weekday
Morning Peak Hour Traffic Volumes
Sullivan Square - Charlestown

Figure 4-6

Assembly Square Mixed-Use Redevelopment
Somerville, Massachusetts



Not to Scale

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2021 Build Conditions Weekday
Morning Peak Hour Traffic Volumes
Wellington Circle - Medford

Figure 4-7

Assembly Square Mixed-Use Redevelopment
Somerville,, Massachusetts

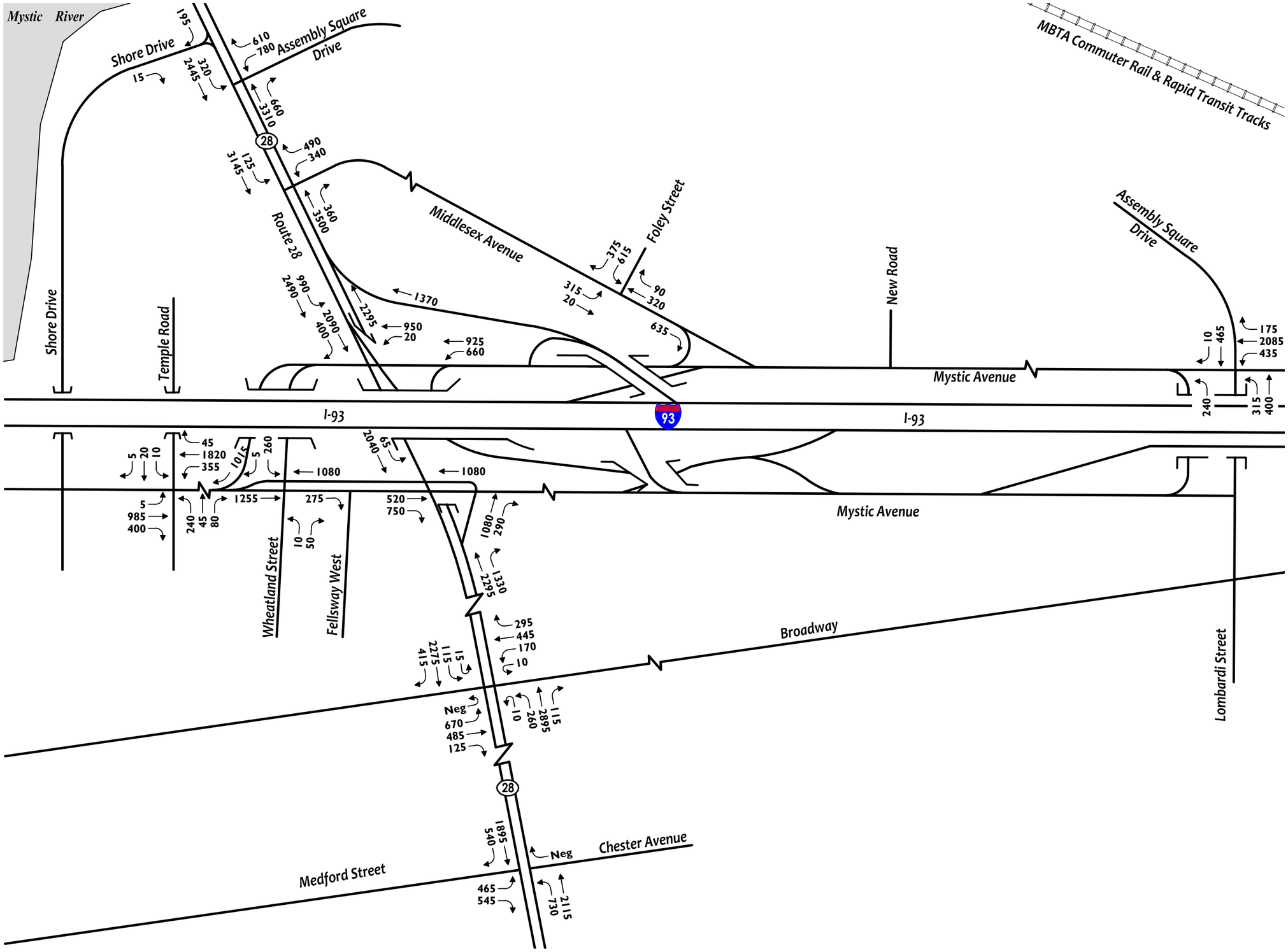

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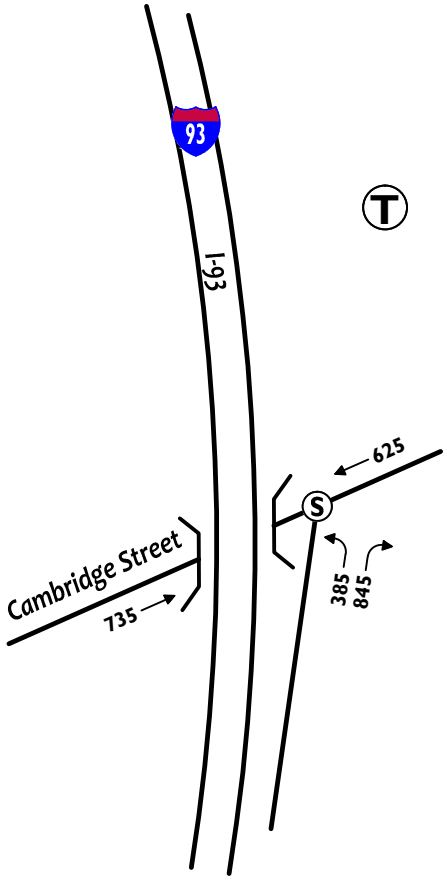
Figure 4-8

2021 Build Conditions Weekday
Evening Peak Hour Traffic Volumes
Assembly Square Mixed-Use Redevelopment
Somerville, Massachusetts

Signalized Intersection

MBTA Station



Not to Scale

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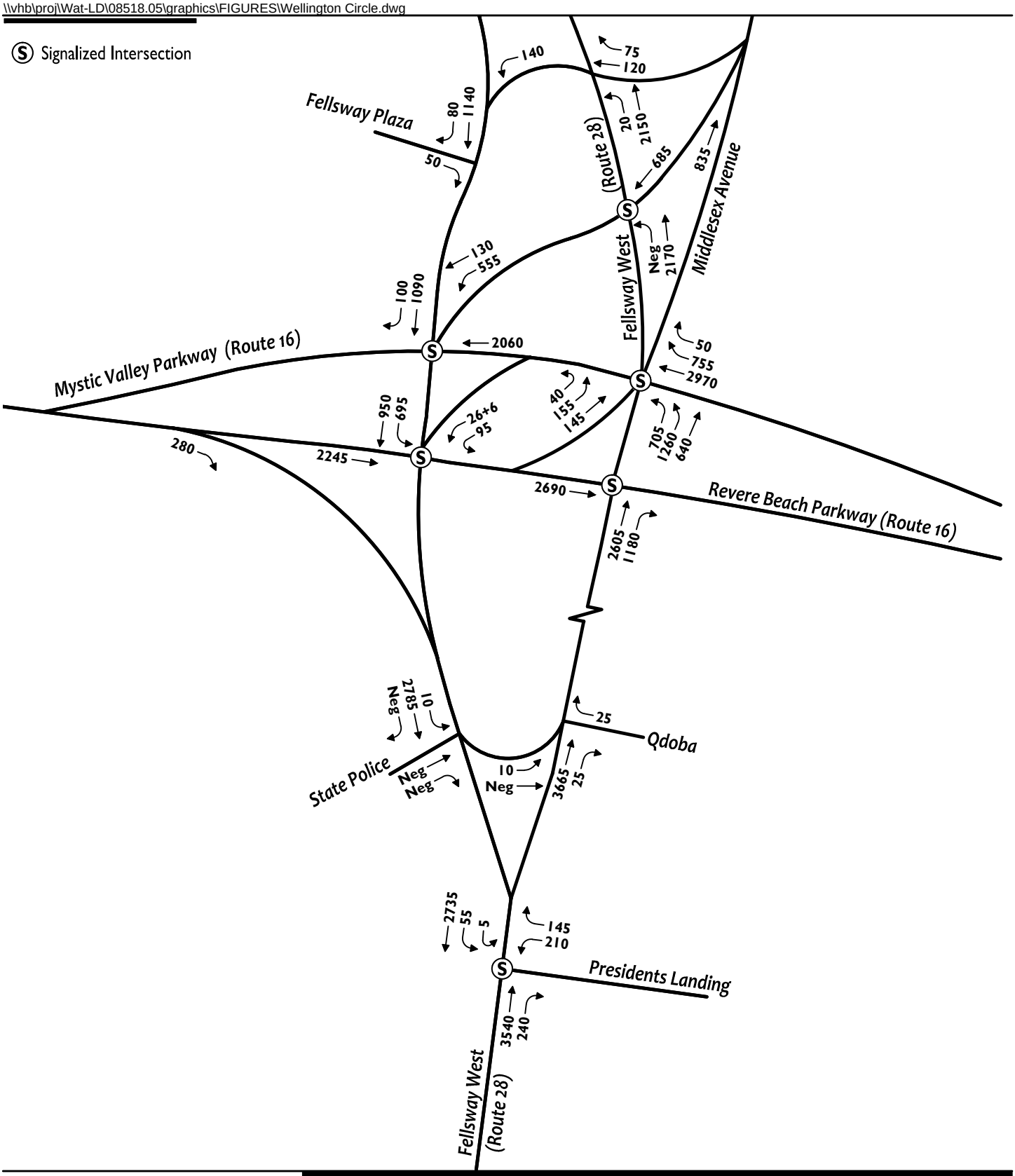
2021 Build Conditions Weekday
Evening Peak Hour Traffic Volumes
Sullivan Square - Charlestown

Figure 4-9

Assembly Square Mixed-Use Redevelopment
Somerville, Massachusetts



Not to Scale

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2021 Build Conditions Weekday Evening Peak Hour Traffic Volumes
Wellington Circle - Medford

Figure 4-10

Assembly Square Mixed-Use Redevelopment
Somerville, Massachusetts

this project have changed in recent years, the overall project trip generation has remained comparable to that considered in the prior Project studies, so that the associated background volumes should not need to be revisited.

- **Cambridge Research Park – Cambridge:** This project involves the construction of approximately 400 hotel rooms and 157 apartments.
- **Station Landing – Medford:** this mixed-use development project is located at the southeast corner of the Revere Beach Parkway (Route 16) and Middlesex Fells Parkway (Route 28) adjacent to the Wellington MBTA Station. In addition to the existing 165,000 sf of office space on that site, the project originally involved the construction of approximately 100,000 sf of retail space, a 190-room hotel, and 650 housing units. To date, 584 residential units, a 160-room hotel, and 80,250 sf of retail/restaurant space has been constructed, with an additional 50,300 sf of health club space. No further development is planned for that site, and the studies for that project indicate that the associated trip generation has remained generally unchanged.
- **Wellington Business Center – Medford**: This project, proposed between Santilli Circle and Wellington Circle, consisted of approximately 385,000 square feet of office space.
- **Wellington Place – Medford:** This project proposed in the vicinity of the Wellington Business Center included 137 residential units.
- **Stop & Shop Supermarket –** Medford: This project has been constructed since the prior Assembly Square traffic studies and consisted of the demolition of a former Ames store and the construction of a new 64,350 square foot Stop & Shop supermarket in its place with the addition of one fuel pump to an existing fueling facility on that site. The site is located at the southwest quadrant of the Route 28/Riverside Avenue intersection in Medford. The volumes associated with this development were previously factored into the DEIR/FEIR 2018 Build volume projections for the Project.
- **Telecom City – Medford/Malden/Everett –** this project originally involved the redevelopment of over 200 acres of land in Medford, Malden and Everett. The project is now known as "River's Edge" and is located entirely in Medford. The project now consists of 525,000 sf of office space with 222 luxury apartment units.
- **Best Buy – Everett:** An approximately 32,000 square foot Best Buy store and small retail was constructed adjacent to Santilli Circle in Everett since the prior Assembly Square traffic studies were conducted, but the volumes associated with that development were included in the 2018 Build volume projections for the Project.
- **Little Neck Lofts –Boston:** Approximately 146 condominiums to be located between Caldwell Street, Brighton Street and Perkins Street, near Sullivan Square, have since been built.

Since the original study was conducted most of these developments are now in operation. However, some of these projects did not advance but with a revised, less intensive building program. One notable nearby development project currently being proposed is the Wynn Everett casino/resort in Everett. This project involves over 3,900 gaming positions, a new 500-room resort hotel, 89,140 sf of retail space, with associated convention/meeting space and other amenities. While that project has not been approved, the volumes associated with it have been incorporated into the updated transportation analysis included in this Chapter.

As noted earlier, this NPC transportation analysis includes volume comparisons of the original 2018 Build projections from the 2010 FEIR to the changes in traffic volumes resulting from the new development proposal. To allow for a more direct comparison of this Project's impacts, the background projects listed above have not been revisited for these volume comparisons. The only exception to this is that the traffic associated with the potential Wynn casino/resort has been incorporated into the updated 2021 Build network volumes used for conducting capacity analyses. This methodology allows for the volumes associated with the current development proposal to be readily compared to those previously reviewed by MEPA.

Table 4-9 shows how the previously projected 2018 Build volumes at several key locations were affected by the Project change, with traffic associated with the various site components being added or subtracted as discussed earlier. While this comparison shows only minor increases in volume at these locations updated capacity analyses were conducted for the study area intersections identified at the start of the Chapter, with the results summarized later in this section.

Table 4-9 Build Condition – Intersection traffic volumes comparison

		Project Component Trip Distribution				Project Component Trip Assignment							
		Residential	Office	Retail	IKEA	Residential	Office	Retail	IKEA	Total Change	2018 Build Volumes	Change	Percent
Wellington Circle													
Weekday AM													
Enter	From/SB	5%	14%	14%	6%	-1	78	5	-7	75			
Exit	To/NB	5%	14%	14%	6%	-2	10	5	-3	10			
Total	Total					-3	88	9	-10	84	9,710	84	0.90%
Weekday PM													
Enter	From/SB	5%	14%	14%	6%	-2	19	10	-14	14			
Exit	To/NB	5%	14%	14%	6%	-1	96	12	-11	96			
Total	Total					-3	115	23	-25	109	11,260	109	1.0%
Sullivan Square													
Weekday AM													
Enter	From/NB	3%	5%	4%	2%	-1	28	1	-2	26			
Exit	To/SB	3%	5%	4%	2%	-1	4	1	-1	3			
Total	Total					-2	31	3	-3	29	5,205	29	0.6%
Weekday PM													
Enter	From/NB	3%	5%	4%	2%	-1	7	3	-5	4			
Exit	To/SB	3%	5%	4%	2%	-1	34	4	-4	33			
Total	Total					-2	41	6	-8	37	5,910	37	0.6%
Rt. 28/Broadway													
Weekday AM													
Enter	From/SB	47%	14%	50%	12%	-9	78	17	-13	72			
Exit	To/NB	47%	14%	50%	12%	-18	10	17	-7	3			
Total	Total					-26	88	34	-20	75	7,000	75	1.1%
Weekday PM													
Enter	From/SB	47%	14%	50%	12%	-20	19	37	-28	9			
Exit	To/NB	47%	14%	50%	12%	-11	96	44	-22	106			
Total	Total					-31	115	81	-50	115	7,775	115	1.5%
Mystic Avenue SB to Lombardi													
Weekday AM													
Enter	From/NB	15%	30%	20%	52%	-3	166	7	-58	112	860	112	13.0%
Weekday PM													
Enter	From/NB	15%	30%	20%	52%	-6	41	15	-120	-70	830	-70	-8.5%
Mystic Avenue at Shore Road													
Weekday AM													
Enter	From/SB	3%	4%	12%	2%	-1	22	4	-2	23			
Exit	To/NB	3%	4%	12%	2%	-1	3	4	-1	5			
Total	Total					-2	25	8	-3	28	2,825	28	1.0%
Weekday PM													
Enter	From/SB	3%	4%	12%	2%	-1	6	9	-5	9			
Exit	To/NB	3%	4%	12%	2%	-1	27	11	-4	33			
Total	Total					-2	33	19	-8	42	3,390	42	1.2%
Route 28/Route I-93 Mystic Avenue interchange – south side													
Weekday AM													
Enter	From/NB-EB	51%	33%	67%	14%	-9	183	22	-16	180			
Exit	To/SB-WB	51%	33%	65%	14%	-19	24	22	-8	19			
Total	Total					-29	207	45	-24	199	7,225	199	2.8%
Weekday PM													
Enter	From/NB-EB	51%	33%	67%	14%	-22	45	50	-32	41			
Exit	To/SB-WB	51%	33%	65%	14%	-12	226	57	-26	244			
Total	Total					-34	271	107	-58	286	7,965	286	3.6%

4.11 MBTA Orange Line Ridership

As part of the Trip Generation analysis transit use associated with the Project was estimated. The anticipated public transportation use considered both the planned MBTA Orange Line Station, as well as the existing Assembly Square MBTA bus service. As requested by MassDOT, VHB reviewed both the prior 2010 FEIR transit projections as compared to those expected with the revised development program considered for this NPC.

As part of this effort VHB reviewed analysis provided by the Central Transportation Planning Staff (CTPS) of the Boston Metropolitan Planning Organization. The analysis provided by CTPS in 2009 was used as part of the approval process for the new Assembly Square Orange Line Station. That analysis included estimates of the ridership demand for the new station, along with potential impacts to the overall Orange Line operation and bus service in the area. The prior CTPS analysis and supplemental calculations by VHB are provided for reference in Attachment 4-9.

The CTPS analysis evaluated 2006 base year and 2030 horizon year conditions. The 2030 Build condition evaluated the new station considering the full redevelopment of both the Project site and other surrounding properties within the Assembly Square district as well as the demand diverted from other nearby stations. CTPS estimated conditions for both low- and high demand scenarios, with between 4,800 and 5,400 daily boardings projected for the new Assembly Square station. For the purpose of this NPC evaluation VHB relied upon the maximum high-demand condition analyzed by CTPS.

Once the demand for the station was estimated, CTPS conducted a peak load analysis for weekday morning and evening peak-hour conditions. The morning analysis focused on the Orange Line southbound segment (heading inbound to Boston) extending from Oak Grove Station in Malden to Community College in Charlestown. The evening analysis evaluated conditions on the Orange Line northbound segment between North Station in Boston and Oak Grove in Malden.

For the 2030 horizon year high-demand condition CTPS estimated that the maximum demand in the southbound direction would be 8,582 riders during the weekday morning peak hour, and 9,114 riders in the northbound direction during the weekday evening peak hour.

The CTPS peak load analysis was conducted considering MBTA's Policy Max Load (MPML) of 10,218 persons for during one hour. This translates into the segments of the Orange Line analyzed being between 84- and 89-percent of capacity for the maximum high-demand conditions projected for the 2030 horizon year. The demanded assumptions developed by CTPS considered a variety of factors,

including the originally proposed redevelopment of Assembly Square. Accordingly, the focus of this current NPC transit analysis is on the potential impacts to the line resulting from the Project *change*. Table 4-10 summarizes the originally projected transit trips (both train and bus riders) on a daily basis and during the critical peak periods studied as part of this assessment.

Table 4-10 Assembly Square Redevelopment Project
Transit Trips – MBTA train and bus riders

Direction	2010 FEIR*	2014 NPC	Difference
Weekday Daily			
Boardings	5,139	5,261	122
Alightings	4,931	5,041	110
Total transit trips	10,069	10,301	+232
Weekday Morning Peak Hour			
Boardings	543	522	-21
Alightings	634	843	209
Total transit trips	1,177	1,364	+187
Weekday Evening Peak Hour			
Boardings	673	922	249
Alightings	471	474	3
Total transit trips	1,144	1,396	+252
Saturday Daily			
Boardings	3,761	3,680	-81
Alightings	3,651	3,710	59
Total transit trips	7,411	7,390	-21
Saturday Midday Peak Hour			
Boardings	327	364	37
Alightings	369	423	54
Total transit trips	696	786	+90

* Source: Assembly Square Mixed-Use Redevelopment – Draft Environmental Impact Report; VHB, Inc., Watertown, MA (June 2, 2008).

In Table 4-10, the *boarding* values shown represent transit riders exiting the Project site and boarding a MBTA bus or train. Likewise, the *alighting* values represent riders getting off of a MBTA train or bus and arriving at the site. As shown in Table 4-10, the Project change will result in 122 additional boardings on a typical weekday with 110 additional alightings compared to the former condition analyzed in the 2010 FEIR. As noted earlier, the development Project FEIR did not make any distinction between bus or train trips.

A notable benefit associated with the Project change is that the resulting commuting patterns generally are opposite those for most riders on the Orange Line. For instance, during the weekday morning period the critical highest demand is in the southbound direction with most commuters heading into Boston. With the Project

change there actually will be a reduction in residential units, with a corresponding reduction in transit riders boarding at Assembly Square Station and heading southbound into Boston. There will be an increase of 209 riders (primarily office-related) in the southbound direction. However, those riders will be getting off the train at Assembly Station before the peak demand on the line which occurs further to the south at Community College in Charlestown. This analysis is extremely conservative in that it assumes all of the Project transit ridership is solely in the form of Orange Line riders heading in the southbound direction without any bus ridership assumed. Even under that condition, the peak demand on this line further to the south remains at 84-percent with the demand at Assembly Square Station remaining at 67-percent of capacity.

During the weekday evening peak hour there will be an increased number of boardings associated with office workers leaving the site and boarding the train to head home. For the purpose of this analysis it is conservatively assumed that all of the additional transit demand summarized in Table 4-12 is in the form of train riders leaving the site and heading only in the peak northbound direction. In fact, some of that transit ridership will be in the form of bus trips and train trips being split between the northbound and southbound directions, further minimizing the demand on the line. Regardless, even with the conservative assumptions used the maximum demand under the 2030 horizon year considered in the CTPS study only would increase by three-percent to 92% of capacity on the peak segment of the line to the north.

As part of this assessment VHB revisited the prior CTPS analysis to incorporate the current changes to the Project into the analysis used for the permitting of the new Assembly Square Station. Several sections of the Orange Line have been previously identified by the MBTA as being highly congested. One limiting factor in addressing that congestion is the age and condition of the Orange Line vehicle fleet, which needs to be replaced. Regardless, this congestion is oriented in the downtown Boston area, with the most congested area falling between North Station and Downtown Crossings. One particular benefit of the Project is that it is located to the north of Boston where ridership levels on this segment are lower for the reasons outlined in this section. The updated analysis summarized above indicates that the additional peak hour ridership associated with this Project will not significantly affect the capacity of the Orange Line in this area.

4.12 Assembly Row Parking Demand and Supply Overview

To evaluate the parking needs associated with the Project Partners Healthcare retained Cambridge Systematics to conduct the following parking supply and demand analysis. Partners Consolidation at Assembly Row consists of two phases. Phase A consists of an approximately 700,000 net square foot building and a 1,997 space parking garage and is scheduled for completion in 2016. Phase B consists of an

additional 325,000 net square feet and 907 parking spaces to be built in a subsequent phase. Detailed below are the parking demand and supply projections for each of these phases.

With the consolidation of 14 different Partners administrative offices, 4,750 employees will be relocated as part of Phase A to an approximately 700,000 net square foot building at Assembly Row. Seventy-five percent of these employees (approximately 3,563) are assumed to be on-site during peak work hours, as a result of sick days, vacations, off-site meetings, flex-time scheduling and telecommuting. As part of the transportation planning exercise, representative mode share data was collected from existing employees and adjusted for the new location. Using current commuting behavior, 50% of employees will drive alone, 19% will drive with someone else, 26% will take some form of mass transit and an additional 5% will walk or ride a bicycle to Assembly Row. Based on this projected mode share, an estimated 2,135 parking spaces are required as part of the initial Phase A build out.

Table 4-11 Partners Assembly Row Consolidation
Mode Split and Parking Demand – Phase A

	Projected Mode Share	Employees
Total Employees		4750
Employees on Site	75%	3563
Employees Who Drive	50%	1797
Employees Who Drive Together	19%	677
Employees Who Use Transit	26%	922
Employees Who Walk/Bike	5%	167
Total	100%	3563
Parking Demand for Drive Alone		1797
Parking Demand for Shared Drive		338
TOTAL PARKING DEMAND		2135
Parking Demand/1000 SF		3.05

The Phase A parking garage will have a total of 1,997 spaces with up to 380 spaces earmarked for retail customers leaving 1,617 parking spaces for Partners. Based on the mode share assumptions, a parking space deficit of 518 is anticipated. Therefore, transportation demand management practices, including financial incentives, transit-oriented programs and parking management programs will be employed to reduce the parking demand.

Phase B assumes an additional build out of approximately 325,000 net square feet of space for Partners, although is not known at this time specifically how Partners will use this space. Using existing employee travel behavior adjusted for the Assembly Square location, the potential future parking demand is estimated at an additional 991 spaces as part of the Phase B build out. However, since the build out of Phase B is five or more years away, it is anticipated that employee transportation preferences will evolve such that:

- there will be less reliance on the private automobile among new hires; and
- some existing employees will have relocated to live closer to work or transit and, as a result, will not commute by car.

It is estimated that an additional 907 parking spaces can be built in Phase B for a total garage capacity of 2,904 spaces. Allowing the continued use of 380 spaces for retail customers, 2,524 parking spaces will be available for Partners. While this capacity presents a combined deficit of approximately 603 spaces across both phases, the combination of changes in employee travel preferences over time and transportation demand management techniques will reduce the parking demand such that it is consistent with the supply provided.

Table 4-12
Partners Assembly Row Consolidation
Total Partners Parking Demand Phase A + Phase B

	Parking Demand Based on Currently Projected Mode Share	# Partners Parking Spaces
Phase A SF (net)	700,000	700,000
Parking Demand/1000 SF	3.05	2.31
TOTAL Parking Spaces Phase A	2135	1,617
Phase B SF (net)	325,000	325,000
Parking Demand/1000 SF	3.05	2.79
Total Parking Spaces Phase B	991	907
Total Parking Spaces Phase A + Phase B	3,127	2,524
Parking Demand/1000 SF	3.05	2.46

4.13 Traffic Operations Analysis

Measuring existing traffic volumes and projecting future traffic volumes quantifies traffic flow within the study area. To assess quality of flow, roadway capacity analyses were conducted with respect to the updated 2021 Build condition. 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.

4.13.1 Level-of-Service Criteria

For consistency with the previously reviewed transportation analysis, the evaluation criteria used to analyze area intersections and roadways in this updated traffic evaluation are based on the 2000 *Highway Capacity Manual* [HCM][6]. Level of service [LOS] is the term 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, freedom to maneuver, and safety. Level of service provides an index to the operational qualities of a roadway segment or an intersection. Level-of-service designations range from A to F, with LOS A representing the best operating conditions and LOS F representing the worst operating conditions.

The level-of-service designation is 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 entering or exiting the side street, which is generally the left-turn out of the side street.

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 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.

6 Transportation Research Board, Highway Capacity Manual, Washington, D.C., 2000.

4.14 Signalized Intersection Capacity Analysis – 2021 Build Condition

Level-of-service analyses were conducted for the 2021 Build condition for the study-area intersections. The results shown are for the 2018 Build condition as presented in the prior MEPA analysis, along with the current analysis results associated with the modified 2021 Build condition analyzed as part of this NPC. The capacity analyses results are summarized in Table 4-15 and the analysis worksheets are included in Attachment 4-10.

The capacity analysis worksheets previously presented as part of the DEIR and FEIR are provided for reference in Attachment 4-10. In conducting the updated analysis for the currently proposed Project VHB did not make changes to trip distribution assumptions for the various Project uses, or revisit the status of previously identified background projects in this area. This was done to provide for as direct a comparison as possible, which allows for the impacts of the Project change to be more readily identified. However, as requested by MassDOT, the horizon year for this current NPC assessment is 2021, which results in three additional years of background growth compared to the prior DEIR/FEIR analysis. Furthermore, traffic generated by the potential Wynn Everett casino/resort also was added into the updated future roadway volumes. The original DEIR/FEIR analysis was based on Synchro 6 software, while the current NPC analysis was conducted using Synchro 7 software. While the overall methodologies remain unchanged, there are some subtle differences that occur at some study area intersections. Accordingly, the updated capacity analysis results reflect changes due to both the analysis software used as well as additional traffic growth unrelated to the Project. [Attachment 4-11 also contains updated versions of the prior DEIR/FEIR analysis now conducted using the same Synchro 7 software utilized for the current NPC analysis. The Synchro 7 based results of the former DEIR/FEIR condition are not shown in the following analysis table results. Instead, they are provided as appendix material only for software consistency purposes and general reference.] The anticipated operation of key study area intersections is discussed in detail following Table 4-13.

Table 4-13 Signalized Intersection Capacity Analysis Summary

Intersection	2010 FEIR – 2018 Build Condition V/C[a]	Delay[b]	LOS[c]	Average Queue[d]	95th % Queue[e]	2014 NPC – 2021 Build Condition V/C	Delay	LOS	Average Queue	95th % Queue
Route 28 at Grand Union Boulevard										
Weekday Morning										
Grand Union Blvd. WB L	0.95	88.7	F	127	#173	1.06	119.9	F	~155	#205
Grand Union Blvd. WB R	0.25	40.0	D	55	92	0.30	40.5	D	67	106
Route 28 NB T	0.54	1.7	A	45	39	0.56	1.8	A	44	m50
Route 28 NB R	0.53	0.7	A	0	0	0.69	0.8	A	3	m3
Route 28 SB L	1.00	108.7	F	~114	#206	>1.2	>120	F	~181	#279
Route 28 SB T	1.04	42.9	D	~1,201	#1,270	1.13	79.9	E	~1,282	#1348
Overall	0.98	31.6	C			1.09	56.0	E		
Weekday Evening										
Grand Union Blvd. WB L	>1.2	>120	F	~380	#385	>1.2	>120	F	~588	#565
Grand Union Blvd. WB R	>1.2	>120	F	~670	#696	>1.2	>120	F	~875	#876
Route 28 NB T	0.99	8.7	A	190	m110	1.03	22.0	C	~272	m109
Route 28 NB R	0.42	0.1	A	0	m0	0.43	0.1	A	0	m0
Route 28 SB L	1.10	137.0	F	~142	#236	1.15	156.4	F	~155	#251
Route 28 SB T	0.70	13.2	B	389	441	0.78	17.3	B	432	4898
Overall	1.08	43.3	D			1.19	83.7	F		
Route 28 at Middlesex Avenue										
Weekday Morning										
Middlesex Avenue WB L	0.41	51.6	D	50	79	0.45	51.9	D	55	86
Middlesex Avenue WB R	0.45	42.6	D	80	152	0.47	42.9	D	86	159
Route 28 NB T	0.86	20.6	C	575	653	0.98	32.7	C	789	#981
Route 28 NB R	0.16	0.2	A	0	0	0.16	0.2	A	0	0
Route 28 SB L	0.87	63.2	E	100	m97	0.89	63.7	E	102	m94
Route 28 SB T	0.95	2.7	A	55	m53	1.04	20.3	C	101	m53
Overall	0.90	12.9	B			0.97	26.7	C		
Weekday Evening										
Middlesex Avenue WB L	0.46	44.3	D	109	155	0.53	45	D	130	180
Middlesex Avenue WB R	0.93	66.6	E	319	#535	0.93	67	E	336	#564
Route 28 NB T	>1.2	>120	F	~1,290	#1,365	>1.2	>120	F	~1,399	#1,470
Route 28 NB R	0.18	0.2	A	0	0	0.15	0	A	0	0
Route 28 SB L	0.43	59.7	E	45	m58	0.43	57	E	46	m52
Route 28 SB T	0.73	3.5	A	204	m200	0.83	8	B	508	M283
Overall	1.10	77.4	E			1.13	83	F		
Route I-93/Route 28/Mystic Avenue interchange:										
Route 28 southbound at I-93 off-ramp/ Mystic Avenue northbound										
Weekday Morning										
Mystic Avenue WB LT	0.29	19	B	129	166	0.31	19.5	B	136	174
Route 28 SB L	1.02	60	E	~695	#832	1.06	64.0	E	~744	m#760
Route 28 SB TR	1.14	101	F	~884	#976	1.19	119.6	F	~953	m#966
Overall	0.72	78	E			0.75	89.9	F		
Weekday Evening										
Mystic Avenue WB LT	0.48	16	B	248	287	0.50	16.4	B	265	305
Route 28 SB L	0.72	34	C	330	408	0.78	34.3	C	303	417
Route 28 SB TR	1.16	117	F	~780	#875	>1.2	>120	F	~976	#1,071
Overall	0.76	74	E			0.84	115.8	F		

Table 4-13 Signalized Intersection Capacity Analysis Summary

Intersection	2010 FEIR – 2018 Build Condition V/C[a]	Delay[b]	LOS[c]	Average Queue[d]	95th % Queue[e]	2014 NPC – 2021 Build Condition V/C	Delay	LOS	Average Queue	95th % Queue
Route 28 southbound at Mystic Avenue										
Weekday Morning										
Mystic Avenue SB T	0.81	10.4	B	107	m96	0.81	10.7	B	109	m94
Mystic Avenue SB R	0.76	10.4	B	84	m76	0.88	12.4	B	98	m86
Mystic Avenue NB T	0.40	0.3	A	1	2	0.41	0.3	A	1	2
Route 28 SB TR	0.95	8.8	A	85	m75	1.00	12.7	B	89	m75
Overall	0.88	8.1	A			0.94	10.4	B		
Weekday Evening										
Mystic Avenue SB T	0.47	9.7	A	95	114	0.48	9.9	A	100	119
Mystic Avenue SB R	0.47	9.9	A	81	109	0.51	10.4	B	91	127
Mystic Avenue NB T	0.50	0.3	A	3	4	0.51	0.3	A	3	m4
Route 28 SB TR	0.95	12.7	B	94	m80	1.09	53.7	D	~677	m79
Overall	0.69	8.7	A			0.75	28.5	C		
Route 28 southbound at Mystic Avenue southbound/Wheatland Street										
Weekday Morning										
Mystic Avenue SB T	1.16	108.9	F	~957	#1,075	>1.2	>120	F	~1,033	#1,150
Mystic Avenue NB T	0.44	0.6	A	3	4	0.45	0.6	A	3	4
Wheatland Street NB T	0.11	17.7	B	37	39	0.12	17.8	B	41	43
Route 28 SB L	0.14	26.4	C	46	m55	0.15	26.4	C	48	m56
Overall	0.65	75.0	E			0.68	90.0	F		
Weekday Evening										
Mystic Avenue SB T	0.60	18.1	B	321	390	0.63	18.6	B	342	413
Mystic Avenue NB T	0.56	1.1	A	10	12	0.58	1.3	A	10	12
Wheatland Street NB T	0.06	22.9	C	9	23	0.08	23.2	C	20	33
Route 28 SB L	0.27	34.9	C	93	m117	0.29	34.5	C	95	m115
Overall	0.47	13.0	B			0.49	13.3	B		
Route 28 southbound at Mystic Avenue northbound										
Weekday Morning										
Mystic Avenue SB T	0.41	16.0	B	321	m406	0.43	16.9	B	364	m434
Route 28 NB L	0.77	44.5	D	259	330	0.79	45.7	D	269	342
Route 28 NB R	0.70	44.6	D	183	312	0.76	48.4	D	212	#377
Overall	0.51	31.3	C			0.53	32.6	C		
Weekday Evening										
Mystic Avenue SB T	0.31	23.9	C	222	m255	0.32	24.3	C	237	m268
Route 28 NB L	0.86	42.3	D	387	475	0.88	44.3	D	402	#501
Route 28 NB R	0.20	27.4	C	10	70	0.24	27.9	C	26	92
Overall	0.51	34.1	C			0.53	35.3	D		

Table 4-13 Signalized Intersection Capacity Analysis Summary

Intersection	2010 FEIR – 2018 Build Condition V/C[a]	Delay[b]	LOS[c]	Average Queue[d]	95th % Queue[e]	2014 NPC – 2021 Build Condition V/C	Delay	LOS	Average Queue	95th % Queue
Route 28 at Broadway										
Weekday Morning										
Broadway EB L	1.14	140.9	F	~389	#612	>1.2	>120	F	~456	#684
Broadway EB LT	0.96	63.8	E	306	#404	1.06dl	77.0	E	~334	#442
Broadway EB R	0.47	41.6	D	76	171	0.51	42.2	D	86	185
Broadway WB L	0.51	46.7	D	108	157	0.47	45.1	D	103	152
Broadway WB T	0.51	45.7	D	118	144	0.53	45.2	D	128	157
Broadway WB R	0.51	46.9	D	83	140	0.52	46.2	D	88	147
Route 28 NB L	0.63	52.3	D	101	m#181	0.68	55.2	E	106	m#188
Route 28 NB TR	1.02	68.6	E	~568	m515	1.12	105.5	F	~669	m#599
Route 28 SB L	0.64	56.2	E	104	#242	0.70	61.0	E	110	#253
Route 28 SB TR	1.72	365.7	F	~1349	#1,410	>1.2	>120	F	~1,427	#1,486
Overall	1.16	191.1	F			1.23	219.5	F		
Weekday Evening										
Broadway EB L	1.07	115.8	F	~344	#561	1.13	135.4	F	~380	#601
Broadway EB LT	0.90dl	48.1	D	242	297	0.95dl	50.2	D	256	313
Broadway EB R	0.19	38.0	D	24	80	0.21	38.2	D	27	85
Broadway WB L	0.58	45.4	D	143	229	0.52	43.1	D	131	213
Broadway WB T	0.61	44.7	D	165	222	0.68	46.0	D	196	258
Broadway WB R	0.73	52.8	D	150	#265	0.74	53.1	D	161	#296
Route 28 NB L	>1.2	>120	F	~354	m#470	>1.2	>120	F	~371	m#490
Route 28 NB TR	>1.2	>120	F	~1353	m#1305	>1.2	>120	F	~1,421	m#1,367
Route 28 SB L	1.02	127.0	F	~168	#313	1.13	165.2	F	~176	#322
Route 28 SB TR	>1.2	>120	F	~962	#1055	>1.2	>120	F	~1,143	#1,231
Overall	1.31	227.5	F			1.37	264.2	F		
Route 28 at Medford Street										
Weekday Morning										
Medford Street EB L	>1.2	>120	F	~521	#723	>1.2	>120	F	~592	#800
Medford Street EB R	0.77	36.6	D	165	#234	0.82	40.4	D	189	#293
Route 28 NB L	0.59	41.6	D	143	208	0.64	43.6	D	150	213
Route 28 NB T	0.38	6.2	A	71	216	0.42	6.5	A	82	246
Route 28 SB TR	>1.2	>120	F	~1,102	m#663	>1.2	>120	F	~1,159	m#656
Overall	>1.2	>120	F			>1.2	>120	F		
Weekday Evening										
Medford Street EB L	1.85	450.6	F	~552	#760	1.89	468.0	F	~568	#776
Medford Street EB R	0.19	20.5	C	0	14	0.20	19.7	B	0	14
Route 28 NB L	0.75	40.8	D	276	326	0.74	39.5	D	281	337
Route 28 NB T	0.59	8.3	A	171	525	0.62	8.6	A	184	562
Route 28 SB TR	1.18	139.0	F	~737	m#819	1.33	210.2	F	~897	m#812
Overall	1.14	94.4	F			1.21	123.7	F		
Mystic Avenue at Temple Road										
Weekday Morning										
Mystic Avenue SB LTR	1.19	118.6	F	~661	#1,077	>1.2	>120	F	~718	#1,147
Mystic Avenue NB L	1.04	114.3	F	117	#372	1.09	114.4	F	~129	#392
Mystic Avenue NB TR	0.44	11.0	B	127	278	0.43	11.3	B	124	272
Temple Road NB L	0.83	49.8	D	157	#342	0.82	49.2	D	160	#345
Temple Road NB TR	0.08	27.8	C	10	47	0.08	27.6	C	10	47
Temple Road SB LTR	0.16	28.5	C	36	80	0.15	28.2	C	36	80
Overall	1.05	79.6	E			1.09	96.0	F		
Weekday Evening										
Mystic Avenue SB LTR	0.91	31.5	C	~464	#858	0.99	45.4	D	402	#838
Mystic Avenue NB L	>1.2	>120	F	~232	#556	>1.2	>120	F	~251	#578
Mystic Avenue NB TR	0.86	17.7	B	374	#963	0.91	22.2	C	437	#1,053
Temple Road NB L	0.76	44.4	D	128	#292	0.76	43.9	D	131	#297
Temple Road NB TR	0.18	30.1	C	25	85	0.18	29.8	C	25	87
Temple Road SB LTR	0.12	29.5	C	23	41	0.12	29.2	C	23	41
Overall	1.19	42.2	D			1.22	42.2	D		

Table 4-13 Signalized Intersection Capacity Analysis Summary

Intersection	2010 FEIR – 2018 Build Condition V/C[a]	Delay[b]	LOS[c]	Average Queue[d]	95th % Queue[e]	2014 NPC – 2021 Build Condition V/C	Delay	LOS	Average Queue	95th % Queue
Mystic Avenue northbound at Grand Union Boulevard/Lombardi Street										
Weekday Morning										
Mystic Avenue WB L	0.30	20.4	C	76	131	0.33	22.1	C	78	134
Mystic Avenue WB TR	0.61	23.8	C	186	233	0.72	27.2	C	209	260
Lombardi Drive NB L	0.43	25.0	C	77	m95	0.40	29.8	C	76	134
Lombardi Drive NB T	0.27	4.7	A	33	m44	0.33	9.5	A	96	128
Grand Union Blvd. SB TR	0.49	27.4	C	128	204	0.51	28.0	C	137	216
Overall	0.52	19.4	B			0.56	22.2	B		
Weekday Evening										
Mystic Avenue WB L	0.60	24.7	C	202	319	0.64	27.0	C	224	333
Mystic Avenue WB TR	1.04	60.2	E	~476	#643	1.18	117.7	F	~643	#739
Lombardi Drive NB L	0.67	26.1	C	151	m245	0.65	28.5	C	155	m219
Lombardi Drive NB T	0.26	8.9	A	48	m91	0.22	11.7	B	53	m78
Grand Union Blvd. SB TR	1.06	98.4	F	~309	#498	1.24	164.9	F	~410	#611
Overall	0.93	50.9	D			1.02	94.7	F		
Mystic Avenue northbound at Route I-93 SB ramp u-turn										
Weekday Morning										
Mystic Avenue NB T	0.38	3.3	A	26	39	0.41	3.8	A	27	60
Route I-93 SB ramp L	0.05	21.1	C	0	13	0.06	21.2	C	3	24
Overall	0.27	5.3	A			0.29	5.9	A		
Weekday Evening										
Mystic Avenue NB T	0.65	3.3	A	30	m31	0.70	5.9	A	81	m29
Route I-93 SB ramp L	0.31	33.8	C	61	97	0.34	34.1	C	68	104
Overall	0.57	6.3	A			0.62	8.6	A		
Middlesex Avenue at Foley Street										
Weekday Morning										
Middlesex Avenue EB L	0.57	33.0	C	116	166	0.58	33.4	C	114	170
Middlesex Avenue EB LT	0.54	32.1	C	121	169	0.53	32.1	C	114	168
Middlesex Avenue WB T	0.12	15.9	B	31	71	0.12	15.8	B	31	69
Middlesex Avenue WB R	0.07	5.6	A	10	41	0.09	5.5	A	13	47
Foley Street SB L	0.60	36.0	D	100	165	0.61	36.1	D	103	169
Foley Street SB R	0.19	16.2	B	38	28	0.22	16.5	B	43	35
Overall	0.36	26.3	C			0.36	25.9	C		
Weekday Evening										
Middlesex Avenue EB L	0.49	30.4	C	101	173	0.51	32.1	C	96	162
Middlesex Avenue EB LT	0.49	30.3	C	111	186	0.46	31.4	C	95	158
Middlesex Avenue WB T	0.39	29.9	C	89	#160	0.36	28.5	C	85	#160
Middlesex Avenue WB R	0.09	6.1	A	17	49	0.10	5.4	A	16	51
Foley Street SB L	0.93	46.5	D	331	#447	1.11	97.8	F	~500	#605
Foley Street SB R	0.42	9.4	C	89	57	0.48	10.7	B	117	65
Overall	0.65	29.7	C			0.73	49.4	D		
Route 28 southbound at Mystic Avenue northbound new U-turn										
Weekday Morning										
Route 28 SB T	0.56	7.3	A	222	m217	0.57	11.1	B	350	m212
Mystic Avenue NB U-turn	0.56	50.7	D	93	134	0.51	48.3	D	92	130
Overall	0.56	13.4	B			0.56	16.3	B		
Weekday Evening										
Route 28 SB T	0.37	7.8	A	144	112	0.43	24.5	C	353	304
Mystic Avenue NB U-turn	0.75	49.9	D	184	232	0.69	42.4	D	214	257
Overall	0.45	23.6	C			0.50	31.7	C		

Table 4-13 Signalized Intersection Capacity Analysis Summary

Intersection	2010 FEIR – 2018 Build Condition V/C[a]	Delay[b]	LOS[c]	Average Queue[d]	95th % Queue[e]	2014 NPC – 2021 Build Condition V/C	Delay	LOS	Average Queue	95th % Queue
Cambridge Street at Route I-93 NB off-ramp										
Weekday Morning										
Cambridge Street EB T	0.41	27.6	C	203	254	0.44	28.2	C	211	264
Cambridge Street WB T	0.59	34.8	C	422	493	0.62	37.2	D	439	507
Route I-93 NB L	0.67	68.1	E	313	374	0.88	69.0	E	324	374
Route I-93 NB R	0.66	27.5	C	250	350	0.80	34.9	C	385	517
Overall	0.69	36.2	D			0.75	39.0	D		
Weekday Evening										
Cambridge Street EB T	0.63	35.2	D	345	341	0.81	47.9	D	418	361
Cambridge Street WB T	0.43	46.0	D	283	347	0.56	60.4	E	312	367
Route I-93 NB L	0.88	65.8	E	370	442	0.66	37.9	D	325	441
Route I-93 NB R	0.70	26.2	C	360	481	0.99	54.6	D	797	#1,193
Overall	0.73	40.7	D	345	341	0.92	51.3	D		
Wellington Circle:										
Route 16 at Route 28 SB										
Weekday Morning										
Route 16 EB T	>1.2	>120	F	~407	#471	>1.2	>120	F	~438	#503
Route 16 WB L	>1.2	>120	F	~512	m#585	>1.2	>120	F	~559	m#632
Route 16 WB T	0.78	24.5	C	404	m484	0.81	25.2	C	428	m510
Route 28 SB L	0.84	45.2	D	169	#252	0.87	47.6	D	176	#266
Route 28 SB T	>1.2	>120	F	~626	#721	>1.2	>120	F	~666	#762
Route 28 SB R	0.01	0.0	A	0	0	0.01	0.0	A	0	0
Middlesex Avenue SB L	1.17	132.2	F	~258	#345	>1.2	>120	F	~276	#365
Middlesex Avenue SB R	0.47	45.2	D	80	m113	0.44	44.2	D	75	m103
Overall	1.54	234.1	F			1.62	263.2	F		
Weekday Evening										
Route 16 EB T	1.05	65.3	E	~381	#445	1.14	98.8	F	~440	#504
Route 16 WB L	>1.2	>120	F	~510	m#522	>1.2	>120	F	~562	m#579
Route 16 WB T	1.00	23.2	C	667	m#684	1.06	47.0	D	~741	m#760
Route 28 SB L	1.17	132.1	F	~250	#360	>1.2	>120	F	~270	#381
Route 28 SB T	>1.2	>120	F	~293	#382	>1.2	>120	F	~312	#401
Route 28 SB R	0.06	0.1	A	0	0	0.06	0.1	A	0	0
Middlesex Avenue SB L	0.94	82.4	F	135	#195	0.99	92.3	F	142	#210
Middlesex Avenue SB R	0.80	87.1	F	102	m#210	0.75	81.1	E	96	#194
Overall	>1.2	>120	F			>1.2	>120	F		
Route 16 at Route 28 NB										
Weekday Morning										
Route 16 EB L	0.36	30.7	C	50	m42	0.37	30.6	C	52	m41
Route 16 EB T	>1.2	>120	F	~585	m#428	>1.2	>120	F	~628	m#439
Route 16 WB T	0.57	10.9	B	196	223	0.60	11.3	B	214	242
Route 16 WB R	0.56	13.0	B	156	246	0.58	13.3	B	163	257
Route 28 NB L	>1.2	>120	F	~175	#337	>1.2	>120	F	~175	#337
Route 28 NB LT	>1.2	>120	F	~185	#267	>1.2	>120	F	~183	#264
Route 28 NB R	0.60	11.0	B	169	231	0.63	11.4	B	183	250
Overall	0.94	96.3	F			0.98	104.8	F		
Weekday Evening										
Route 16 EB L	0.54	28.6	C	109	m101	0.54	28.1	C	109	m94
Route 16 EB T	>1.2	>120	F	~808	m#722	>1.2	>120	F	~809	m#647
Route 16 WB T	0.90	28.8	C	368	414	0.90	28.8	C	368	414
Route 16 WB R	>1.2	>120	F	~588	#810	>1.2	>120	F	~588	#810
Route 28 NB L	>1.2	>120	F	~602	#840	>1.2	>120	F	~605	#844
Route 28 NB LT	>1.2	>120	F	~633	#734	>1.2	>120	F	~631	#733
Route 28 NB R	0.68	15.1	B	135	#195	0.68	15.1	B	223	301
Overall	>1.2	>120	F			>1.2	>120	F		

Table 4-13 Signalized Intersection Capacity Analysis Summary

Intersection	2010 FEIR – 2018 Build Condition V/C[a]	Delay[b]	LOS[c]	Average Queue[d]	95th % Queue[e]	2014 NPC – 2021 Build Condition V/C	Delay	LOS	Average Queue	95th % Queue
Route 28 NB at Middlesex Avenue										
Weekday Morning										
Route 28 NB LT	0.31	3.3	A	49	m34	0.32	3.4	A	53	m37
Middlesex Avenue SB T	0.72	31.9	C	185	203	0.74	32.4	C	192	209
Middlesex Avenue SB R	0.05	24.0	C	0	27	0.05	24.0	C	0	27
Overall	0.44	19.4	B			0.45	19.7	B		
Weekday Evening										
Route 28 NB LT	0.65	4.8	A	112	m71	0.69	5.5	A	121	m76
Middlesex Avenue SB T	0.48	31.0	C	101	131	0.50	31.2	C	104	135
Middlesex Avenue SB R	0.52	35.1	D	94	165	0.53	35.6	D	99	170
Overall	0.62	12.7	B			0.65	13.1	B		
Route 28 at President's Landing										
Weekday Morning										
President's Landing WB L	0.63	32.7	D	101	144	0.63	35.6	D	101	144
President's Landing WB R	0.06	15.2	B	11	23	0.06	15.2	B	11	24
Route 28 NB TR	0.79	20.3	C	308	#437	0.82	21.4	C	328	#509
Route 28 SB L	0.66	37.7	D	105	183	0.65	37..3	D	102	179
Route 28 SB T	>1.2	>120	F	~1,373	#1,576	>1.2	>120	F	~1,487	#1,693
Overall	>1.2	>120	F			>1.2	>120	F		
Weekday Evening										
President's Landing WB L	0.79	45.8	D	145	194	0.79	45.8	D	145	194
President's Landing WB R	0.34	22.1	C	77	104	0.34	22.1	C	77	104
Route 28 NB TR	>1.2	>120	F	~1,121	#1,227	1.47	230.7	F	~1,245	#1,346
Route 28 SB L	0.32	37.7	D	33	76	0.32	37.7	D	33	70
Route 28 SB R	0.97	22.8	C	475	#764	1.03	37.5	D	~733	#849
Overall	>1.2	>120	F			>1.2	>120	F		

a Volume-to-capacity ratio.
b Average delay per vehicle in seconds.
c Level of Service.
d 50th percentile queue measured in feet.
e 95th percentile queue measured in feet
m Volume for 95th percentile queue is metered by upstream signal. The analysis software considers a theoretical condition in which traffic arrives at the near-maximum (95th percentile) rate continuously over the course of the entire hour analyzed. With this assumed "metering" of the queue the software indicates that the artificially-inflated traffic volume cannot be processed through the upstream signal where the queued traffic originates.
95th percentile volume exceeds capacity, queue may be longer
~ volume exceeds capacity; queue is theoretically infinite
dl lane functions as defacto left-turn lane under condition analyzed
Note: Delay cannot be accurately calculated when volume-to-capacity ratio exceeds 1.20 or 1/PHF; delays can be assumed to exceed 120 seconds.
EB = Eastbound; WB = Westbound; NB = Northbound; SB = Southbound;
L = Left; T = Through; R = Right

As shown in Table 4-13, the prior DEIR/FEIR analysis indicated that several of the study area intersections were projected to be operating near theoretical capacity under the previously reviewed 2018 Build condition. The following sections compare the updated analysis results to the formerly projected 2018 Build condition results.

Route 28/Grand Union Boulevard

In the 2010 FEIR Route 28's intersection with Grand Union Boulevard (formerly Assembly Square Drive) was projected to operate at LOS C and D during the weekday morning and evening peak hours, respectively, under the 2018 Build condition. [If those same formerly project 2018 Build volumes were updated using

the same Synchro 7 software utilized for the current NPC analysis the intersection would operate at LOS D and LOS E during these same respective time periods.] With the additional traffic generated by the Project this intersection will now operate at LOS E and LOS F during these same respective time periods.

The additional delays during the weekday morning peak hour are primarily associated with the additional entering volume. The majority of that volume (an additional 240 trips) will be turning onto Grand Union Boulevard as right turns from Route 28. There also will be an additional 75 vehicles (roughly two per signal cycle) turning left from Route 28 into the site. While the intersection operates at an overall LOS E, this is due to the overall delays being one second over the threshold separating LOS D from LOS E.

During the weekday evening peak hour this intersection is projected to operate at an overall LOS F due to the overall intersection delay being four seconds over the dividing threshold between LOS E and LOS F. Those additional delays are due to the increased volume of exiting site traffic from Grand Union Boulevard. While this results in increased delays and queuing on that approach, that condition generally should be limited to the late afternoon period when office traffic exits. Regardless, those impacts will be to the Grand Union Boulevard approach and not to Route 28.

As noted earlier, the analysis was conducted using the same census-based office trip distribution used in the 2010 FEIR. The data provided by Partners indicate that a significantly higher percentage of employees may be traveling to and from the site using Route I-93 to the south. If the Partners trip distribution was used for this current NPC analysis there would be less traffic entering and exiting the site at this location. Instead, a higher percentage of arriving employees would be coming from Route I-93 northbound at Exit 29 and entering the site as right-turns from Route 28 onto Grand Union Boulevard. Likewise, the census-based distribution used maximizes the amount of exiting left-turns from the site onto Route 28. With up to 49-percent of the Partners office traffic being oriented to the south those employees likely would instead choose to use the new Mystic Avenue at-grade u-turn connection planned to access the Route I-93 southbound on-ramp. In doing so these motorists would avoid Route 28's signalized intersections with both Grand Union Boulevard and Middlesex Avenue. Accordingly, the analysis results presented are overstated in terms of Route 28 impacts.

As with all of the study area intersections, the 2021 Build volumes include an additional three years of traffic growth (at a one-percent annual growth rate) compared to the previously reviewed 2018 condition. The new volumes also include traffic generated by the proposed Wynne Everett casino/resort project. During the weekday morning peak hour this combination adds 69 and 130 additional vehicles to Route 28 northbound and southbound, respectively. During the evening peak hour the increase is 141 vehicles in the northbound direction and 132 vehicles heading southbound. By incorporating this additional traffic which is unrelated to the Project

an exact comparison between the former and currently proposed Build conditions is no longer provided, as this extra traffic skews the results at all of the study area locations. By comparison, the Project change adds 241 and 25 additional vehicles on Route 28 northbound turning right onto Grand Union Boulevard during the respective weekday morning and evening peak hours. During these same respective weekday morning and evening peak hours the Project changes generates 29 and 190 additional vehicles turning left from Grand Union Boulevard onto this segment of Route 28. Based on this breakdown, the extra three years of growth rate results in 199 additional vehicles on Route 28 as compared to the 270 vehicles generated by the Project. However, during the weekday evening peak hour the 273 vehicle increase due to the extra three years of growth actually exceeds the additional 225 vehicles generated by the Project for this segment. Accordingly, while the new 2021 Build condition results show increased delays, a significant portion of that can be attributed to outside factors unrelated to the impacts of this Project change.

Route 28/Middlesex Avenue

In the 2010 FEIR the Route 28/Middlesex Avenue intersection was projected to operate at LOS B and E during the weekday morning and evening peak hours, respectively. With the additional traffic generated by the Project this intersection will now operate at LOS C and LOS F during these same respective time periods.

The additional delays during the weekday morning peak hour are generally minor as the intersection turning movements were not significantly affected by the Project change. During the weekday evening peak hour this intersection is projected to operate at an overall LOS F. The intersection turning movements do not change significantly due to the Project change. However, as the intersection is operating just below the LOS E/F dividing line threshold the minor additional delay results in the intersection degrading to LOS F. As noted above, if the likely distribution of Partners office traffic was utilized instead of the census-based office distribution, there would be less exiting traffic oriented to and from both the Middlesex Avenue and Assembly Square Drive driveways during this time period. However, for consistency with the prior DEIR/FEIR analysis that same office distribution was utilized for this current analysis, which in turn overstates the impacts to Route 28.

As noted for the Route 28/Grand Union Boulevard intersection, a substantial portion of the increased delays at this location can be attributed to traffic growth in the area entirely unrelated to the Project change. During the weekday morning peak hour, approximately 42-percent of the increased volume on this segment between the 2018 and 2021 horizon years is due to the combination of normal traffic growth and the Everett casino project. During the weekday evening peak hour 55-percent of the increased volume is due to these other factors which are unrelated to the Project change. Accordingly, the impacts of the Project change by itself are not as notable when properly considering these other factors. This same relationship existing to varying degrees at the other study area intersections discussed below.

Route 28 Southbound/Mystic Avenue northbound/Route I-93 North off-ramp

The 2010 FEIR analysis indicated that Route 28's intersection with Mystic Avenue northbound/Route I-93 North off-ramp was projected to operate at LOS E during both the weekday morning and evening peak hours. With the Project change operations will degrade to LOS F during both time periods. However, this intersection already was projected to be operating near the LOS E/F dividing line. The critical Route 28 southbound approach was projected to operate over theoretical capacity and at LOS F during both time periods so any increased volume disproportionally increases delays. The amount of exiting through-traffic heading in this direction is likely overstated as it does not reflect Partners traffic being more heavily oriented to Route I-93 South. Specifically, with that distribution only 15-percent of the exiting Partners traffic would be heading south through this intersection on Route 28 instead of the 28-percent level assumed by the census-based distribution.

Mystic Avenue at Route 28 southbound /Wheatland Street

Analysis of the formerly proposed 2018 Build condition indicated that this intersection was projected to operate at LOS E and LOS B during the respective weekday morning and evening peak hours. With the Project change this location will degrade to LOS F during the weekday morning peak hour while remaining at LOS B during the weekday evening peak hour. The weekday morning change in LOS is driven by the Mystic Avenue southbound approach which already was projected to be operating over theoretical capacity and at LOS F. With the additional delays on this approach the 95th percentile queue is anticipated to increase by 75-feet (roughly three vehicles).

Mystic Avenue at Temple Road

The Mystic Avenue/Temple Road intersection was previously projected to operate at LOS E and LOS D during the weekday morning and evening peak hours, respectively. The updated analysis for the 2021 Build condition indicates that this location will now operate at LOS F during the weekday morning peak hour while remaining at LOS D during the weekday evening peak hour. Mystic Avenue southbound is the critical approach to this intersection, and queues are expected to increase by 70 feet (roughly three vehicles) as a result of the Project change.

Mystic Avenue at Grand Union Boulevard/Lombardi Street

Analysis of the formerly proposed 2018 Build condition indicated that this intersection was projected to operate at LOS B and LOS D during the respective weekday morning and evening peak hours. With the updated 2021 analysis this location is now projected to remain at LOS B during the weekday morning peak hour, while degrading to LOS F during the weekday evening peak hour. This change

is driven by conditions on both the Mystic Avenue and Grand Union Boulevard approaches. The Mystic Avenue approach previously was expected to operate over theoretical capacity and at LOS E. With the additional Project traffic that approach will degrade to LOS F, but with queues only increasing by 96 feet (four vehicles). With the additional office traffic leaving the site via Grand Union Boulevard that approach will continue to operate at LOS F, but with increased delays. The 95th percentile queue on that approach is expected to increase by 113 feet (roughly five vehicles). Regardless, both these increased delays and queues will be experienced by only exiting site traffic from a limited period during late weekday afternoons.

The additional delays during the weekday morning peak hour are primarily associated with the additional entering volume. The majority of that volume (an additional 240 trips) will be turning onto Grand Union Boulevard as right turns from Route 28. There also will be an additional 75 vehicles (roughly two per signal cycle) turning left from Route 28 into the site. While the intersection operates at an overall LOS E, this is due to the overall delays being one second over the threshold separating LOS D from LOS E.

During the weekday evening peak hour this intersection is projected to operate at an overall LOS F due to the overall intersection delay being four seconds over the dividing threshold between LOS E and LOS F. Those additional delays are due to the increased volume of exiting site traffic from Grand Union Boulevard. While this results in increased delays and queuing on that approach, that condition generally should be limited to the late afternoon period when office traffic exits. Regardless, those impacts will be to the Grand Union Boulevard approach and not to Route 28.

4.15 Traffic Mitigation Overview

The original DEIR/FEIR Transportation assessments identified several transportation-related improvements both within the Assembly Square District and in the surrounding area. The design of these improvements has since been completed, though only a minor portion of the overall site development is currently in place and occupied. Specifically, the only remaining mitigation involves the construction of new signalized at-grade u-turn connection from the northbound segment of Mystic Avenue to the departing southbound segment leading to the Route I-93 southbound on-ramp. While that mitigation previously was not planned to occur until midway through the overall site development, that work will now commence concurrent with the development of block 11 pending permit approval by MassDOT and/or DCR. The following section summarizes the substantial roadway improvements which were implemented both within the Assembly Square District and on the surrounding study area roadways and intersections.

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4.15.1 Assembly Square Drive Construction

As traffic mitigation for the planned Assembly Square Redevelopment project substantial roadway improvements were completed. Funding for these improvements (known as the Assembly Square Access Improvements "ASAI" Project) was obtained through the American Recovery and Reinvestment Act (ARRA) with construction having been completed in 2011. As part of these improvements, a new Assembly Square Drive (now named Grand Union Boulevard) was constructed from Route 28 extending south to Mystic Avenue. This new roadway now serves as the primary north-south access the various intersecting side streets within the overall Assembly Square Mixed-Use Redevelopment. The road is a landscaped two-lane roadway (with additional turn lanes at prominent intersections and on-street parking) accommodating bicycle lanes and pedestrian sidewalks as well as vehicular traffic. Immediately to the northwest of Block 1 a new roundabout was constructed at Grand Union Boulevard's intersection with A Street (now known as Great River Road). This gateway location provides access to Great River Road, which will serve Block 1 as well as future additional waterfront development further to the east in Block 2, while also providing an improved connection to the existing Draw 7 Park to the east of the Project site. In addition to these improvements, the following other significant off-site transportation-related enhancements have been implemented as noted below.

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4.15.2 Assembly Square Off-Site Transportation Mitigation

In addition to the new Grand Union Boulevard, a comprehensive off-site traffic mitigation program was implemented as part of the ARRA-funded ASAI project. Specifically, the following off-site improvements previously identified during the Project's 2010 MEPA review have been implemented:

- **Mt. Vernon Street/Lombardi Street at Broadway/ Mystic Avenue Southbound/ Grand Union Boulevard (4 locations):** Mitigation to this interchange consisted of improvements to the existing signalized intersections of Mystic Avenue northbound/Lombardi Street/Grand Union Boulevard and at Broadway/ Lombardi Street/Mount Vernon Street. The Route I-93/Mystic Avenue southbound off-ramp intersection with Lombardi Street also was signalized along with the Mystic Avenue southbound U-turn underpass to Mystic Avenue northbound with all of these signals constructed to operate as part of an interconnected closed-loop system.
- **Mystic Avenue Northbound at New Road:** Improvements at this location involved installing new signal equipment to return this location to its original fully-operative signalized condition.

- **Middlesex Avenue at Foley Street:** The previously inoperative traffic signal at this location was replaced with new equipment to make the intersection fully functional.
- **Route 28 at Grand Union Boulevard and Middlesex Avenue:** The former Assembly Square Drive intersection with Route 28 was reconfigured to allow exiting left turns from the newly named Grand Union Boulevard. In conjunction with this work, new signal equipment and geometric improvements also were e implemented at Route 28/Middlesex Avenue. Due to the proximity of both intersections, both locations operate under a single traffic signal controller.
- **Route 28 at Mystic Avenue Northbound Traffic Signal:** New signal equipment was installed at this location to improve the visibility of traffic signals on both Route 28 and Mystic Avenue at this location.
- **Kensington Avenue:** Safety and accessibility improvements were implemented at an existing pedestrian crossing connecting the northbound and southbound segments of Mystic Avenue under Route I-93.

The design of the locations listed above also featured extensive pedestrian and/or bicycle related improvements to address existing deficiencies. Those included new signalized crosswalks, bicycle detection at traffic signals, dedicated bicycles lanes, and other measures to promote multi-modal travel within Assembly Square. The resulting benefits associated with these features are described in greater detail in the following sections.

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4.15.3 Route 28 at Mystic Avenue Northbound – U-turn Slot

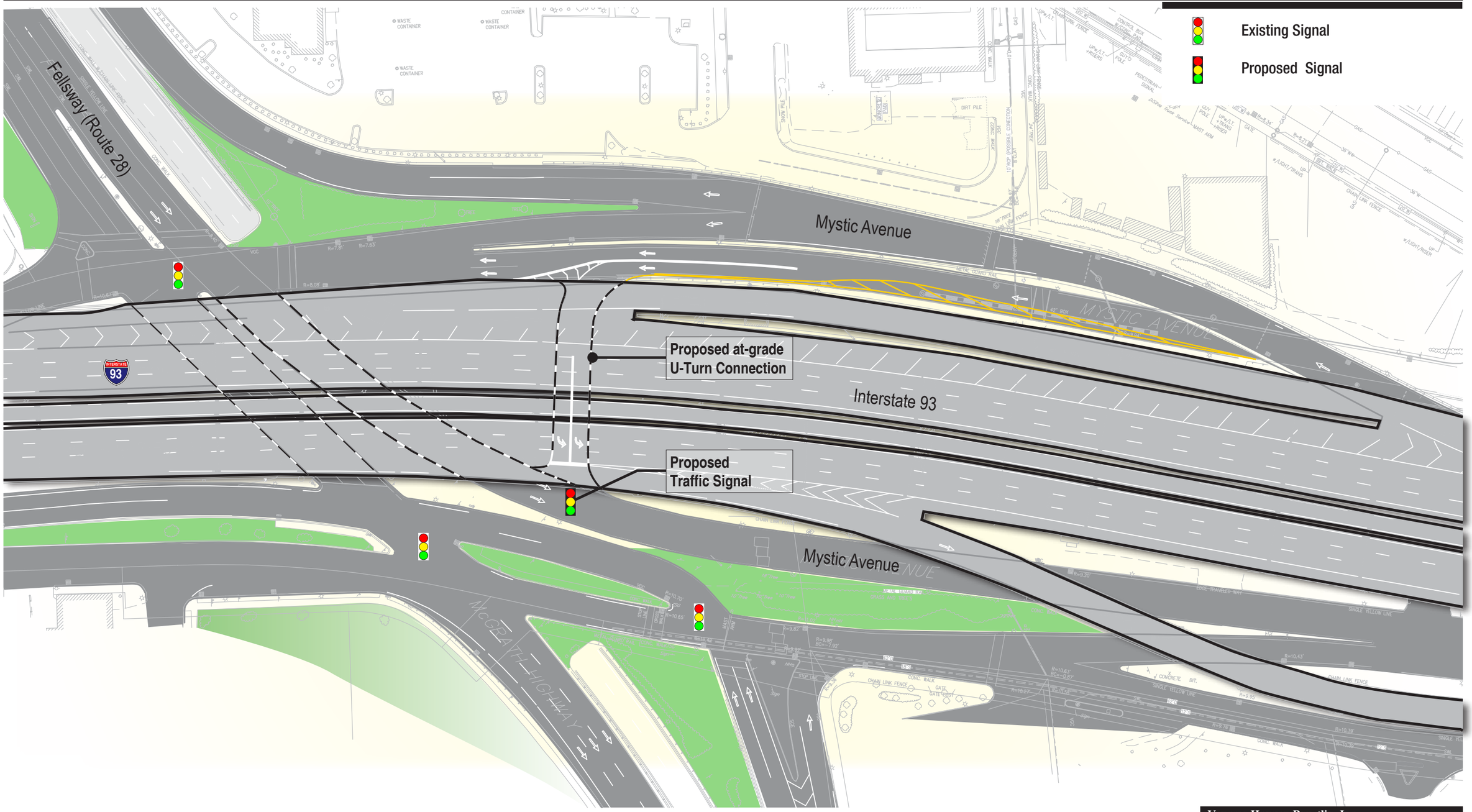
In addition to allowing exiting left turns from Grand Union Boulevard onto Route 28, additional measures were identified to improve egress from the Assembly Square District. Specifically, mitigation was identified to address the anticipated increase in the exiting left-turn demand from Assembly Square onto Route 28. Previously, traffic exiting the Assembly Square District and wishing to return to Route I-93 southbound had to exit from Middlesex Avenue onto Route 28. Even with the recent construction now allowing for exiting left-turns from Grand Union Boulevard, there still is a need for another point of egress for this route. Accordingly, the following mitigation which was presented in the 2010 FEIR still is planned. However, instead of being proposed for midway through the overall site development timeline the Proponent now plans to construct the following improvements concurrent with the development of Block 11 pending permit approval by MassDOT and/or DCR.

There is space available at-grade underneath the Route I-93 overpass to provide a U-turn slot to the east of the Route 28/Mystic Avenue intersection. This would allow for traffic traveling north on Mystic Avenue to reverse direction and access the I-93

southbound on-ramp without having to pass through the signal. The benefit to this measure is that traffic exiting the Assembly Square District wishing to return to Route I-93 would have this option as opposed to having to exit onto Route 28, travel south to the signal at Mystic Avenue, and then access the Mystic Avenue on-ramp leading to Route I-93 south. By using this route motorists will be able to bypass two Route 28 signals, which will help alleviate traffic congestion and delays on Route 28 at two locations. From Assembly Square, this route could be accessed by exiting from either Grand Union Boulevard at Mystic Avenue/Lombardi Street, New Road at Mystic Avenue, or by turning left from Foley Street onto Middlesex Avenue. With these multiple access options, this alternate exit route from the site has the potential for significant use. Furthermore, with the Partners employee distribution identified earlier, this new u-turn may provide an even greater benefit than originally anticipated with the former IKEA proposal. Accordingly, the following specific measures (previously presented in the 2010 FEIR) are planned to be implemented as shown in Figure 4-11:

- Construct the at-grade U-turn slot underneath the Route I-93 overpass to the east of the Route 28/Mystic Avenue intersection. The entry point for this turn slot would be just east of the point where the Route I-93 off-ramp intersects with Mystic Avenue. [By locating the U-turn slot at this location potential weaving conflicts will be avoided.]
- Install a new actuated traffic signal at the point where the U-turn slot intersects the Route 28 southbound to I-93 southbound on-ramp. While it was found that there will be sufficient gaps in the opposing Route 28 southbound to I-93 southbound on-ramp traffic flow to allow for the U-turn slot to operate under a Yield condition, deficiencies in sight distances require that this location operate under signal control. The necessary signal warrants are satisfied to allow for this configuration. The signal will operate in a dependent manner to the Route 28/ Mystic Avenue northbound intersection under the same existing signal controller and phasing/timing plan. This measure will result in traffic turning onto Mystic Avenue from the new U-turn slot running only during the signal phase where Route 28 southbound traffic is stopped at the Route 28/Mystic Avenue intersection.

These plans were previously discussed at a conceptual level with the City of Somerville, DCR and MassDOT. The Proponent will work with these parties to advance these plans which will be constructed by the Proponent following the issuance of the required permits.



Vanasse Hangen Brustlin, Inc.

Figure 4-11
Conceptual Layout
U-Turn - Mystic Avenue Northbound to
Mystic Avenue Southbound
Assembly Square Mixed-Use Redevelopment
Somerville, Massachusetts

4.16 Partners Healthcare Transportation Demand Management (TDM) Plan

The 2010 FEIR had provided a summary of the Transportation Demand Management (TDM) measures associated with the various site components. The new Partner's Healthcare office space is entirely consistent with the goals of the originally proposed TDM program, and should be compatible with the previously established TDM measures. Specifically, the office use will be more oriented towards public destination than the previously considered IKEA store on this portion of the site. The parking supply proposed for the Partner's use also will limit the number of office workers that will be able to drive to the site. Partners Healthcare is pursuing appropriate TDM measures for the Assembly Square development. The following TDM measures are currently being considered:

- As part of the consolidation, Partners will be exploring rerouting of its existing shuttle service system to include a stop at Assembly Row.
- Preferential carpool and vanpool parking within the parking garages and spaces near entrances as a convenience to commuters and to promote ridesharing.
- Ride matching assistance managed by Project transportation coordinator or by MassRIDES so that employees find appropriate carpool and vanpool partners.
- Ability by employees to use pre-tax dollars for the purchase of MBTA passes. The pre-tax purchase is free up to an established maximum from both federal and state income and payroll taxes.
- Subsidies to employees who purchase monthly or multiple trip transit passes.
- Provide a guaranteed ride home program, in conjunction with MassRIDES to eliminate an often-cited deterrent to carpool and vanpool participation.
- Telecommuting options for employees in appropriate jobs.
- Flexible work hours in certain jobs, as appropriate.
- Incentives for bicycle and pedestrian commuters, like covered bicycle storage, changing rooms, and shower facilities.
- Promotional events for transit-riders, cyclists, and pedestrians.
- Direct deposit to employees.

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4.16.1 Traffic Mitigation Funding Commitments

In addition to the physical off-site roadway improvements noted in the previous section, Federal Realty Investment Trust funded additional transportation-related improvements through an Amended and Restated Development Covenant with the

City. These included a significant contribution toward the design and construction of the new MBTA Orange Line station, traffic calming measures, bicycle/pedestrian services, and studies of additional transportation matters. Specifically, the following mitigation funding has been provided as summarized in Table 4-14.

Table 4-14 Transportation Mitigation Funding Summary*

Amount	Purpose
$15,000,000	To be used towards the construction of new MBTA Orange Line Station
$250,000	To be used towards the study, design and implementation of circulation improvements within and/or affecting the Assembly Square Area
$30,000	Funding to City of Somerville for repair of the traffic signal at the intersection of Foley Street and Middlesex Avenue
$100,000	To be used towards the construction of pedestrian walkways to mitigate traffic
$50,000	East Somerville neighborhood improvements; including but not limited to transportation improvements
$50,000	Somerville Ward 5 neighborhood improvements; including but not limited to transportation improvements
$100,000	For feasibility studies for a new Orange Line station to be located in the Assembly Square Area
$100,000	For traffic mitigation and improvement measures on and near lower Broadway in Somerville
$100,000	For a feasibility study regarding pedestrian crossing of Route 28
$150,000	Towards the design and/or construction of infrastructure to service water transportation access.

* Source: Mitigation funding as noted in Amended and Restated Assembly Square Development Covenant by and between Federal Realty Investment Trust, IKEA Property, Inc., City of Somerville and Somerville Redevelopment Authority (the "Development Covenant") and the Master Land Disposition Agreement by and between the Somerville Redevelopment Authority and Federal Realty Investment Trust (the "Master Land Disposition Agreement") both dated as of December 14, 2006.

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4.16.2 Traffic Monitoring

The Proponent will regularly provide the City of Somerville, and other interested agencies, traffic monitoring data collected from built-in detection systems that have been installed at the following locations:

- Route 28 at Grand Union Boulevard
- Route 28 at Middlesex Avenue
- Foley Street at Middlesex Avenue
- New Road at Mystic Avenue Northbound
- Lombardi Street at Broadway
- Lombardi Street at Mystic Avenue Southbound
- Lombardi Street at Mystic Avenue Northbound/ Grand Union Boulevard
- Revolution Drive at Grand Union Boulevard

4.17 Conclusion

Based on the preceding analysis, the addition of Partners Healthcare to the Assembly Square Mixed-Use Redevelopment project should represent a positive change. As noted earlier, replacing the formerly proposed IKEA use with this new office space will significantly reduce traffic volumes during weekend conditions. Likewise, there should also be an overall reduction in weekday daily traffic, though there will be increased volumes during the weekday morning and evening peak commuter periods.

The 2021 Build volumes analyzed as part of this NPC include an additional three years of traffic growth (at a one-percent annual growth rate) compared to the previously reviewed 2018 condition. The new volumes also include traffic generated by the proposed Wynne Everett casino/resort project. During the weekday morning peak hour this combination adds 199 vehicles to Route 28 between Middlesex Avenue and Grand Union Boulevard. During the weekday evening peak hour that combination adds an additional 273 vehicles to this segment. By incorporating this additional traffic which is unrelated to the Project an exact comparison between the former and currently proposed Build conditions is no longer provided. By comparison, the Project change adds 270 and 225 additional vehicles to this same segment of Route 28 during the respective weekday morning and evening peak hours. This translates into approximately 42-percent of the increased Route 28 volume during the weekday morning peak hour being attributable to the combination of normal traffic growth and the Everett casino project. During the weekday evening peak hour 55-percent of the increased volume is due to these other factors which are unrelated to the Project change. Accordingly, the impacts of the Project change by itself are not as notable when properly considering these other factors. This same relationship existing to varying degrees at the other study area intersections.

The preceding NPC transportation analysis assumed that the Partners employees will follow the same distribution patterns projected for the other Assembly Square office workers in the 2010 FEIR. This assumption maximizes the volume of office traffic exiting the site directly onto Route 28 via either Grand Union Boulevard or Middlesex Avenue. Data provided by Partners indicates that approximately 49-percent of its office employees will be leaving the area via Route I93 southbound. In that instance, they would exit the site onto Mystic Avenue northbound and use the planned signalized at-grade u-turn connection to Mystic Avenue southbound leading to the Route I-93 South on-ramp. By not assigning traffic in that manner the analysis in this assessment is overly conservative in that it overestimates the amount of Project traffic being added to Route 28.

The analysis conducted as part of this NPC assessment indicates that volumes will only result in minor increases to the surrounding study area intersection volumes

under peak conditions which should not be perceptible. Regardless, updated capacity analyses were conducted at several key intersections, with accompanying updates to the crash analyses. This analysis indicates that the transportation infrastructure already implemented as mitigation for the originally proposed Project is still more than adequate for accommodating traffic associated with the revised development program.

The parking analysis conducted by Cambridge Systematics for Project change indicates that there will be an overall parking deficit for Block 11 with the new Partners office use and associated supporting retail/commercial space. To address this projected parking deficit Partners will be implementing a variety of transportation demand management measures to reduce the parking demand. Over time it is expected that these measures, combined with the limited parking and availability of the new MBTA Orange Line station immediately adjacent to the site will reduce the parking demand so that it is consistent with the supply provided.

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