

TRANSPORTATION IMPACT STUDY

PROPOSED RESIDENCES AT ALEWIFE STATION CAMBRIDGE, MASSACHUSETTS

Prepared for:

CRITERION DEVELOPMENT PARTNERS
WALTHAM, MASSACHUSETTS

January 2017

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CITY OF CAMBRIDGE

Special Permit Transportation Impact Study (TIS)

Summary Sheet

Planning Board Permit Number: _____

Project Name: PROPOSED RESIDENCES AT ALEWIFE STATION

Address: 195-211 Concord Turnpike, Cambridge, MA

Owner/Developer Name: Criterion Development Partners

Contact Person: Andrew Kaye

Contact Address: 1601 Trapelo road, Suite 280

Waltham, MA 02451

Contact Phone: 781-890-5600

ITE sq. ft.: 320 Apartment Units (325 Units analyzed)

Zoning sq. ft.: _____

Land Use Type: Residential

Existing Parking Spaces: 273 Use: Mixed Use/Commercial

New Parking Spaces: 241 Use: Residential

Date of Parking Registration Approval: _____

Trip Generation:	Daily	AM Peak Hour	PM Peak Hour
Total Trips	2,240	208	172
Vehicle	840	78	65
Transit	1,006	95	76
Pedestrian	180	16	14
Bicycle	90	8	7

Mode Split (person trips): Vehicle: 39 %

(Residential) Transit: 45 %

Pedestrian: 8 %

Bicycle: 4 %

Other: 4 %

Transportation Consultant: Vanasse and Associates, Inc.

Contact Name: Scott W. Thornton, P.E.

Phone: 978-474-8800

Date of Building Permit Approval: _____

CITY OF CAMBRIDGE
Special Permit Transportation Impact Study (TIS)

Planning Board Criteria Performance Summary
Page 1

Planning Board Permit Number: _____

Project Name: PROPOSED RESIDENCES AT ALEWIFE STATION

Total Data Entries = 145 Total Number of Criteria Exceedences = 15

1. Project Vehicle Trip Generation

Weekday = 840 AM Peak Hour = 78 PM Peak Hour = 65

Below Criteria? [Y/N]	Y/Y/Y
-----------------------	-------

2. Level of Service (LOS)

Intersection	A.M. Peak Hour			P.M. Peak Hour		
	Existing	With Project	Below Criteria?	Existing	With Project	Below Criteria?
Route 2 at Alewife Brook Parkway Signal 1	F	F (0.2)	Y	E	E	Y
Route 2 at Alewife Brook Parkway Signal 2	C	C	Y	B	B	Y
Route 2 at Alewife Brook Parkway Signal 3	B	B	Y	A	A	Y
Route 2 at Alewife Brook Parkway Signal 4	D	D	Y	E	E	Y
Alewife Brook Parkway at Massachusetts Avenue	D	D	Y	D	D	Y
Alewife Access Ramp at Steel Place	A	A	Y	E	E (0.1)	Y
Acorn Park Drive at Alewife Station Access Ramp	F	F	Y (3.0)	C	C	Y
Site Drive at Route 2 EB	C	C	Y	C	C	Y
Lake Street at Frontage Road	B	B	Y	B	B	Y
Lake Street at Route 2 WB Ramps	B	B	Y	B	B	Y
Frontage Road at Acorn Park Drive	A	A	Y	C	C	Y
Frontage Road at Route 2 EB	D	C	Y	B	B	Y

Note: Percentage Roadway Volume Increases shown in parentheses.

3. Traffic on Residential Streets

No residential streets exist at the study locations. This criterion does not apply to the study.

4. Lane Queue (for Signalized Intersections Critical Lane)

Intersection	No. of Lanes Analyzed	A.M. Peak Hour			P.M. Peak Hour		
		Existing	With Project	Below Criteria?	Existing	With Project	Below Criteria?
Route 2 at Alewife Brook Parkway^a:	14						
Route 2 EB LT1		11	11	Y	10	10	Y
Route 2 EB LT2		11	11	Y	10	10	Y
Route 2 EB RT1		12	12	Y	6	6	Y
Route 2 EB RT2		12	12	Y	6	6	Y
Alewife Station Exit WB TH		3	3	Y	6	6	Y
Alewife Station Exit WB RT		2	2	Y	6	6	Y
Alewife Brook Parkway NB LT1		31	31	Y	25	30	Y
Alewife Brook Parkway NB LT2		31	31	Y	25	30	Y
Alewife Brook Parkway NB TH1		4	4	Y	4	4	Y
Alewife Brook Parkway NB TH2		4	4	Y	4	4	Y
Alewife Brook Parkway SB TH1		7	7	Y	6	6	Y
Alewife Brook Parkway SB TH2		7	7	Y	6	6	Y
Alewife Brook Parkway SB RT1		19	19	Y	20	20	Y
Alewife Brook Parkway SB RT2	19	19	Y	20	20	Y	
Massachusetts Avenue at Alewife Brook Parkway:	12						
Massachusetts Avenue EB LT		2	2	Y	3	3	Y
Massachusetts Avenue EB TH		14	14	Y	9	9	Y
Massachusetts Avenue EB TH/RT		14	14	Y	9	9	Y
Massachusetts Avenue WB LT		7	7	Y	7	7	Y
Massachusetts Avenue WB TH		5	5	Y	10	10	Y
Massachusetts Avenue WB TH/RT		5	5	Y	10	10	Y
Alewife Brook Parkway NB LT		2	2	Y	4	4	Y
Alewife Brook Parkway NB TH		11	11	Y	17	17	Y
Alewife Brook Parkway NB TH/RT		11	11	Y	17	17	Y
Alewife Brook Parkway SB LT		5	5	Y	5	5	Y
Alewife Brook Parkway SB TH		14	14	Y	14	14	Y
Alewife Brook Parkway SB TH/RT	14	14	Y	14	14	Y	
Lake Street at Route 2 WB Ramps:	6						
Lake Street EB LT		3	3	Y	5	5	Y
Lake Street EB TH		4	4	Y	5	5	Y
Lake Street WB TH		4	4	Y	2	2	Y
Lake Street WB TH/RT		4	4	Y	2	2	Y
Route 2 WB off Ramp LT/TH		2	2	Y	1	1	Y
Route 2 WB off Ramp RT		0	0	Y	0	0	Y
Lake Street at Frontage Road:	6						
Lake Street EB TH		4	4	Y	7	7	Y
Lake Street WB LT		1	1	Y	1	1	Y
Lake Street WB TH1		3	3	Y	2	2	Y
Lake Street WB TH2		3	3	Y	2	2	Y
Frontage Road NB LT/UT		3	3	Y	4	4	Y
Frontage Road NB RT	0	0	Y	0	0	Y	
Frontage Road at Acorn Park Drive:	4						
Frontage Road EB TH		1	1	Y	1	1	Y
Frontage Road EB TH/RT		1	1	Y	1	1	Y
Acorn Park Drive NB LT		2	3	Y	5	5	Y
Acorn Park Drive NB RT	0	0	Y	0	0	Y	

5. Pedestrian and Bicycle Facilities (for Critical Pedestrian Crossing)

Pedestrian LOS

Intersection	A.M. Peak Hour			P.M. Peak Hour		
	Existing PLOS	With Project	Below Criteria?	Existing PLOS	With Project	Below Criteria?
<i>Alewife Brook Parkway at Alewife Station Exit:</i> Crossing Alewife Station Exit (East)	E	E	N	--	--	--
<i>Massachusetts Avenue at Alewife Brook Parkway:</i> Crossing Massachusetts Avenue (East)	E	E	N	E	E	N
Crossing Massachusetts Avenue (West)	E	E	N	E	E	N
Crossing Alewife Brook Parkway (North)	E	E	N	E	E	N
Crossing Alewife Brook Parkway (South)	E	E	N	E	E	N
<i>Site Drive (entering traffic) at Route 2 EB:</i> Crossing Site Drive (South)	--	--	--	A	A	Y
<i>Site Drive (exiting traffic) at Route 2 EB:</i> Crossing Site Drive (South)	--	--	--	A	A	Y
<i>Alewife Access Ramp at Steel Place:</i> Crossing Alewife Station Exit (East)	B	B	Y	F	F	N
Crossing Garage Ramp (West)	A	A	Y	A	A	Y
Crossing Alewife Access Ramp (North)	F	F	N	F	F	N
<i>Frontage Road at Acorn Park Drive:</i> Crossing Acorn Park Drive (South)	C	C	Y	--	--	--
<i>Lake Street at Frontage Road:</i> Crossing Lake Street (East)	D	D	Y	D	D	Y
Crossing Frontage Road (South)	B	B	Y	B	B	Y
<i>Lake Street at Route 2 WB Ramps:</i> Crossing Lake Street (East)	D	D	Y	D	D	Y
Crossing Route 2 WB On-Ramp (North)	D	D	Y	E	E	N
Crossing Route 2 WB Off-Ramp (South)	D	D	Y	E	E	N
<i>Acorn Park Drive at Alewife Access Ramp</i> Crossing Acorn Park Drive (South)	C	C	Y	A	A	Y

Safe Pedestrian and Bicycle Facilities

Adjacent Street or Public Right-of-Way	Adjacent Sidewalks Present?	Adjacent Bicycle Facilities Present?
Route 2	Y	N ^a
Multi-Use Path	Y	Y

^aNo bike activities are allowed along Route 2.

EXECUTIVE SUMMARY

PURPOSE OF STUDY

Vanasse & Associates, Inc. (VAI) has conducted a Transportation Impact Study (TIS) for a proposed residential development to be located at 195-211 Concord Turnpike (Route 2) in Cambridge. The property is currently occupied by the existing Gateway Motel and Conference Center and Lanes & Games bowling alley. This study reviews the potential transportation impacts, defines site access requirements, and recommends mitigation measures necessary to accommodate redevelopment of the site. The study also reviews the project with respect to the City of Cambridge Special Permit Criteria (SPC) regarding traffic impacts, is in accordance with the City's guidelines for TIS, and follows the scoping determination dated September 16, 2016. The following briefly summarizes the study findings.

PROJECT DESCRIPTION

The project, as currently planned, will consist of the redevelopment of an existing property into distinct residential uses. This includes the demolition of the existing buildings (former Lanes & Games bowling alley and the Gateway Motel) and construction of a building providing 320 apartment units. Access will be provided through one right-turn only entrance driveway and one right-turn only exit driveway to Route 2 eastbound. An Access Permit from the Massachusetts Department of Transportation (MassDOT) will be required for the Project. Parking will be provided for 241 vehicles and approximately 336 long-term bicycle spaces and 32 short-term bicycle spaces will also be provided. The site is bounded by Route 2 to the north, an existing residential apartment building to the west, and Discovery Park to the south and east.

EXISTING CONDITIONS

Existing Traffic Volumes

A field inventory of existing study area roadways was conducted to document traffic conditions in the existing 2016 analysis year. Items collected regarding the study area roadways and intersections include roadway geometrics, traffic control devices, traffic signal timing plans, traffic volumes, vehicle queues, pedestrian crossing volumes, bicycle volumes, and safety data for the

roadways in the vicinity of the site. Transportation information and data used in this study were collected during June and September 2016.

Existing Public Transit

The site is located within ½ mile of the Massachusetts Bay Transportation Authority (MBTA) Alewife Station, where the Red Line subway and several MBTA and private transit bus routes terminate. From the Red Line, connections to the other subway lines can be made via Park Street, Downtown Crossing, and commuter rail lines can be accessed through the South Station stop, also on the Red Line.

SITE-GENERATED TRAFFIC VOLUMES

The Project is currently proposed for 320 apartment units; however, the trip generation and analysis is based on 325 units so this analysis is conservative. To identify the trip generation of the Project, the Monitoring Report and peak-hour driveway counts for the adjacent Vox on Two residential development were utilized to develop a person trip rate per apartment unit. This rate was then applied to the unit count of 325 units and adjusted using mode splits identified in a residential mode split survey contained in the Vox Monitoring Report to develop estimates of vehicle, transit, pedestrian, and bicycle trips to be generated by the Project. This approach was discussed and approved with City officials.

The modal split assumptions for the project are approximately 35 percent drive-alone automobile trips; 4 percent rideshare automobile trips; 45 percent transit; 8 percent pedestrian; 4 percent bicycle; and 4 percent “other” trips, which may include working at home.

SPECIAL PERMIT CRITERIA

As required by the City, the project’s impact has been measured against 5 criteria as indicators of the project’s impact. Based upon the SPC and study area intersections, there are a total of 145 indicators which were reviewed. None of the criteria were exceeded by any of the Project’s impacts. One of the indicators is exceeded by virtue of the Project location adjacent to Route 2. A total of 14 indicators related to pedestrian operations were exceeded under Existing Conditions analysis (without the project). Overall the project has satisfied 130 indicators of impact with minimal project impact expected.

RECOMMENDATIONS

The Project is expected to have a minimal impact on area transportation facilities. However, this requires Project residents to have similar characteristics as those from the adjacent Vox on Two residential development. One way to encourage similar prospective residents is through the provision of a number of the same Travel Demand Management (TDM) measures in use at the Vox development. With the Project location near the Alewife T station, the Applicant and property management team will be able to effectively promote alternative transportation for residents to reduce single-occupant vehicle (SOV) traffic, as has been documented with the adjacent Vox development. This will effectively mitigate the Project impact on road and intersection facilities in the area.

Transportation Demand Management

Reducing the amount of traffic generated by the proposed development is an important component of the transportation mitigation plan. The goal of the proposed traffic reduction strategy is to reduce the use of SOVs by encouraging car/vanpooling, bicycle commuting, the use of public transportation and pedestrian travel. This practice was utilized for the Vox on Two development and that site has significantly lower traffic generation than initially estimated, lower parking utilization than initially estimated, and is currently at approximately 98 percent occupancy. A number of measures will be implemented as a part of the Project in an effort to reduce the number of vehicle trips generated by the project, including the use of area shuttle buses for residents as well as provision of a MBTA Charlie card of equivalent value of a monthly pass to each adult member of a new household after the household has established residency, among other strategies. The Applicant will commit to the implementation of these traffic reduction strategies and will work with the City to implement these measures.

Project Access

The Project is currently designed with its own entrance and exit driveways to Route 2. This is proposed in the event that separate owners operate the Project and the Vox on Two development. If there is an opportunity to connect to the Vox on Two development to share driveways, the Applicant will proceed with this connection, but currently the development must be permitted through the City and MassDOT with its own driveways.

The vehicle site access and egress will be provided via Route 2, with separate right turn only entrance and exit driveways. A One-Way sign and "NO LEFT TURN" sign will be posted on the driveway approach at the Route 2 intersection. Details of this design will be evaluated with the District 6 Office of MassDOT.

SUMMARY

Overall, the Applicant is committed to the implementation of the above project mitigation strategies to reduce the overall project impact. Of the 145 project indicators reviewed, none were directly exceeded by the project impact.

In summary, this project is a redevelopment of existing commercial properties which reduces the net traffic impact on area road facilities. The Project is adjacent to another residential community which has a very low transportation impact due to a successful TDM program, the central tenets of which will also be implemented at the Project. This residential project is expected to have similar traffic impacts as the existing commercial uses on site, particularly during the weekday evening peak hour. The TDM measures and intentionally constrictive parking conditions will further reduce the project's traffic impacts resulting in a positive change in the area.

INTRODUCTION

VAI has conducted a Transportation Impact Study (TIS) for a proposed residential development project located at 195-211 Concord Turnpike (Route 2) in Cambridge, Massachusetts. This study reviews the potential transportation impacts, defines site access requirements, and recommends mitigation measures necessary to accommodate redevelopment of the site. In addition, the study reviews the project with respect to the SPC ordinance. The study was completed in accordance with the City's guidelines for TIS and follows the scoping determination dated September 16, 2016.

The project, as currently planned, will consist of the redevelopment of an existing property into distinct residential uses. This includes the demolition of the existing buildings (former Lanes & Games bowling alley and the Gateway Motel) and construction of a building providing 320 apartment units. Access will be provided through one right-turn only entrance driveway and one right-turn only exit driveway to Route 2 eastbound. An Access Permit from the Massachusetts Department of Transportation (MassDOT) will be required for the Project. Parking will be provided for 241 vehicles and approximately 336 long-term bicycle spaces and 32 short-term bicycle spaces will also be provided. The site is bounded by Route 2 to the north, an existing residential apartment building to the west, and Discovery Park to the south and east. The site in relation to area transportation facilities is shown in Figure 1, while a preliminary site plan is depicted in Figure 2. An Existing Conditions Plan documenting adjacent parcels and ownership, easements, and property line information is shown in Figure 3.

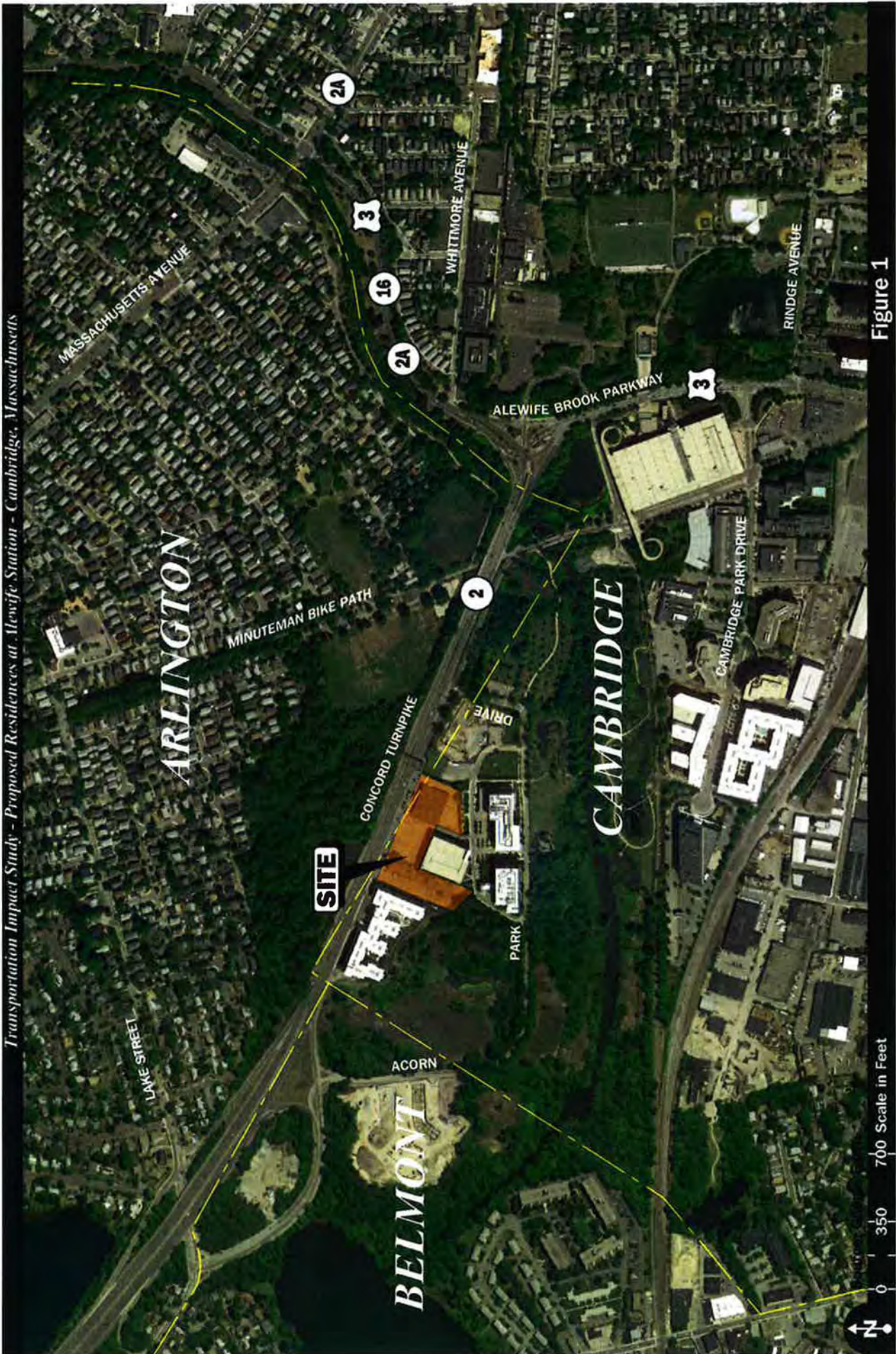
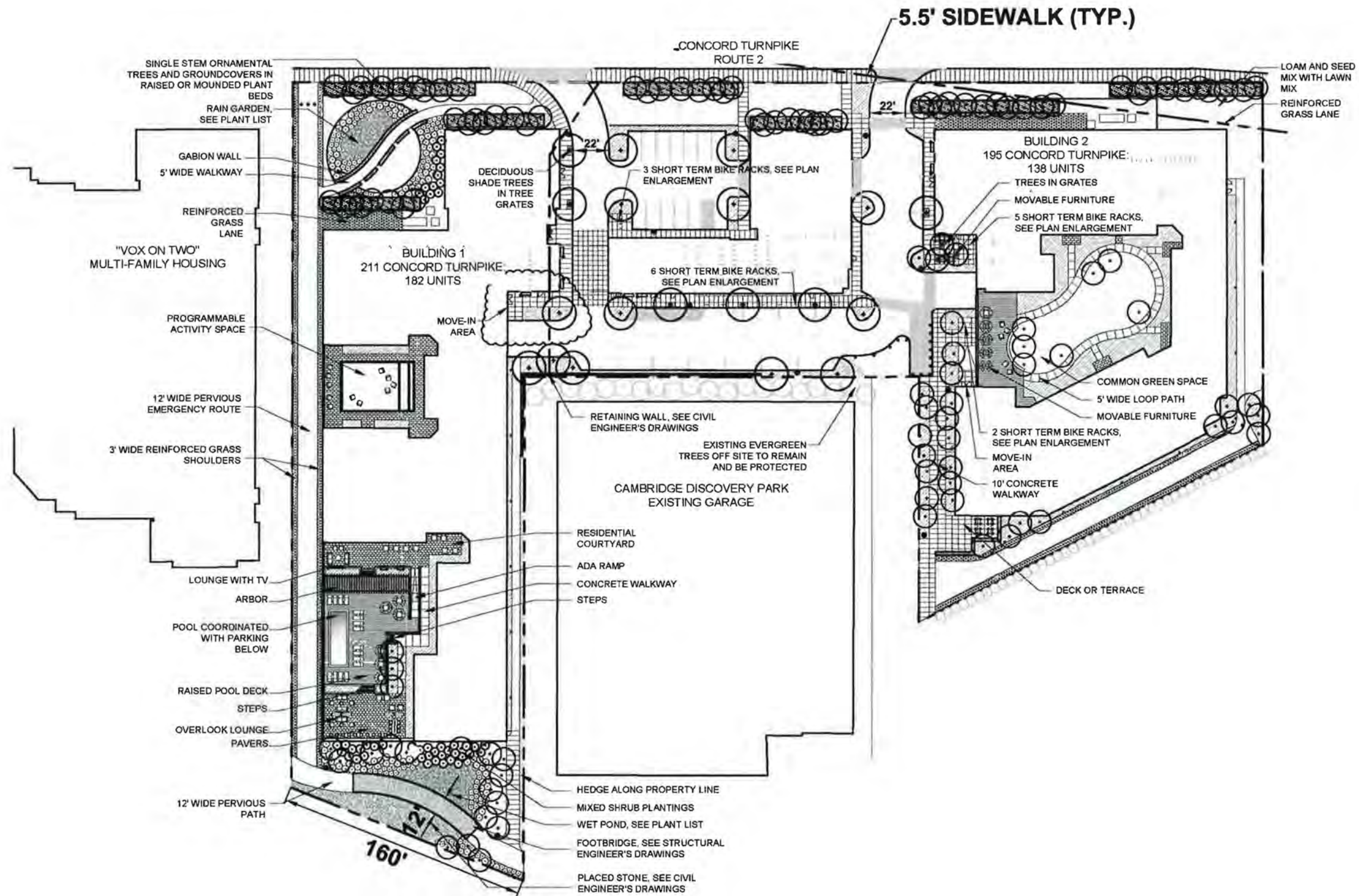


Figure 1

Site Location Map

Vanasse & Associates, Inc.
Transportation Engineers & Planners





Source: Copley Wolff Design Group.
 0 35 70 Scale in Feet



Figure 2
 Site Plan

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EXISTING CONDITIONS

EXISTING TRAFFIC CONDITIONS

A field inventory of existing study area roadways was conducted to document baseline traffic conditions. Items collected regarding the study area roadways and intersections include roadway geometrics, traffic control devices, traffic signal timing plans, traffic volumes, vehicle queues, pedestrian crossing volumes, bicycle volumes, and safety data for the roadways in the vicinity of the site. Traffic volumes were measured by means of ATR counts and substantiated by manual intersection turning-movement and vehicle-classification counts. Other transportation-related data inventoried include area parking supply and regulations, transit stop and services, and provision of bicycle and pedestrian facilities.

DESCRIPTION OF PROJECT STUDY AREA

The project study area was determined in consultation with City transportation officials. The study area was confirmed in the September 16, 2016 Scoping Determination from the City to VAI. The study area is listed below:

1. Concord Turnpike (Route 2) at Alewife Brook Parkway (4 intersections);
2. Acorn Park Drive at Frontage Road;
3. Lake Street at Route 2 westbound ramps;
4. Lake Street at Frontage Road/Route 2 eastbound ramps;
5. Frontage Road at Route 2;
6. Acorn Park Drive at Route 2 off ramp;
7. Site driveways at Route 2;
8. Steel Place at Alewife Station Access Road at Alewife Brook Parkway on-ramp; and,
9. Massachusetts Avenue at Alewife Brook Parkway.

Transportation Network

Regional access to the area is provided via Route 2 to the west and Alewife Parkway to the east, north and south. In the immediate vicinity of the site, local access is provided from Frontage Road and Lake Street.

Geometric and Traffic Control

Intersection geometry and lane usage was obtained from field inventory and observations conducted by VAI in July and September 2016. A graphical depiction of intersection inventory for the study area intersections are shown in Figure 4 through Figure 9. Traffic signal timing and phasing for the signalized intersections was obtained from either MassDOT District 4/District 6 Traffic Operations or the City of Cambridge.

EXISTING TRAFFIC VOLUMES

Traffic Counts

To establish baseline traffic conditions within the study area, ATR counts and manual turning movement and vehicle classification counts were conducted by VAI in June and September 2016. Intersection counts were conducted on September 14 and September 29, 2016. A review of seasonal traffic data from the nearest permanent count station¹ indicates that June- and September-month volumes are 8.1 and 9.9 percent higher than average-month volumes, respectively. Consequently, the collected volumes were used without seasonal adjustment.

Inspection of the raw count data indicated that the overall weekday morning and evening peak hours vary. It should be noted, however, that the individual intersection peak hours were used in the analysis to present a “worst case” composite peak-hour condition. The traffic count data sheets are provided in the Appendix. The 2016 Existing condition weekday morning and evening peak-hour traffic-volume networks are depicted on Figure 10 and Figure 11 and summarized in Table 1. Table 2 summarizes the peak hour occurrence during the weekday morning and evening peak hours at the study intersections. The average hourly volumes recorded at the ATR location are summarized in Table 3.

Table 1
2016 EXISTING TRAFFIC VOLUMES^a

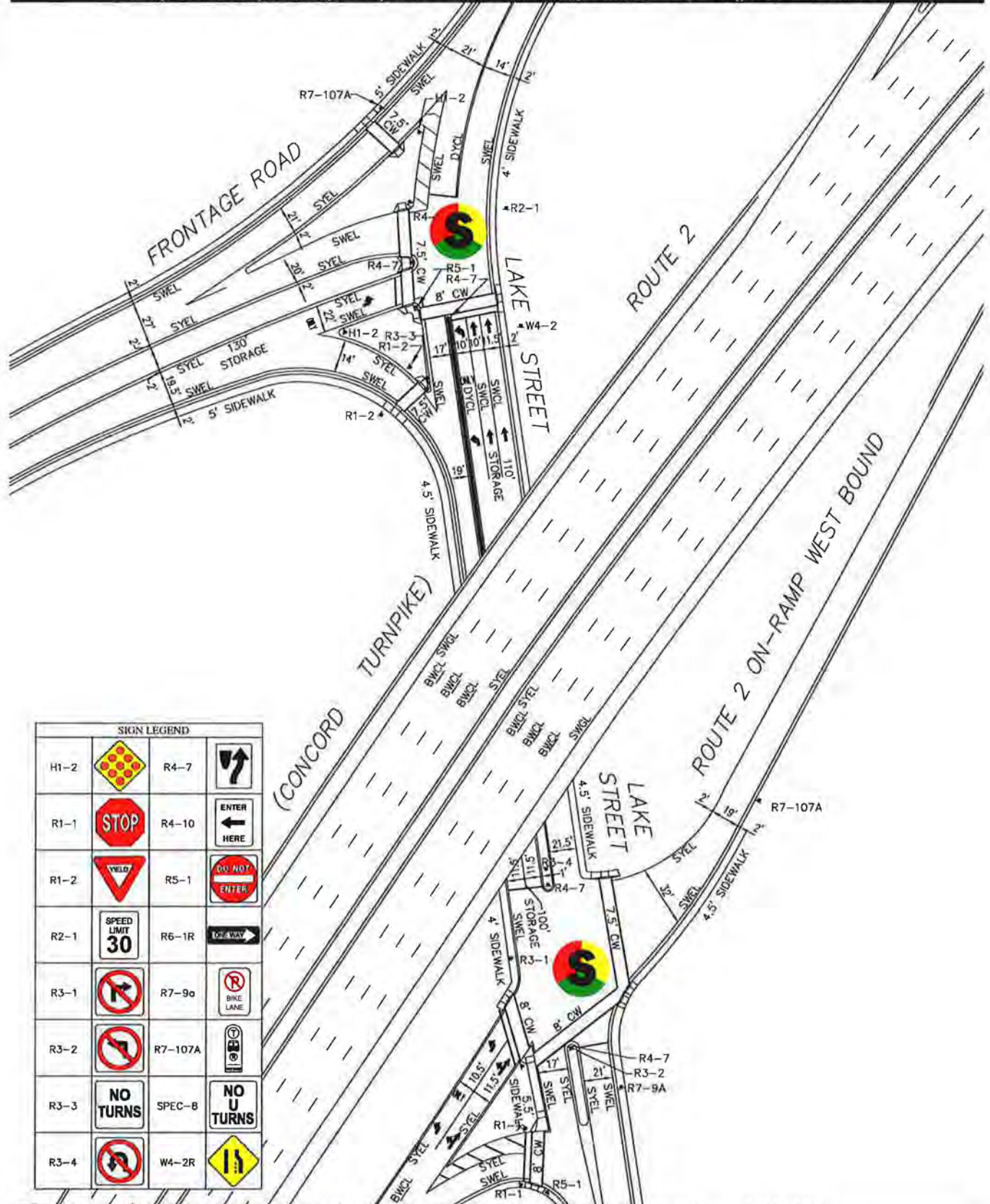
Location	ADT ^a	Morning Peak Hour			Evening Peak Hour		
		Vehicles Per Hour	K Factor ^b	Directional Distribution ^c	Vehicles per Hour	K Factor	Directional Distribution
Acorn Park Drive, south of Alewife Station Access Ramp	1,290	259	20.1	93.8% NB	80	6.2	70.0% NB
Route 2, west of Acorn Park Drive	76,582	5,026	6.6	50.1% WB	5,452	7.1	54.0% WB
Acorn Park Drive, south of Frontage Road	2,984	580	19.4	82.4% SB	201	6.7	81.6% NB
Frontage Road, west of Acorn Park Drive	8,262	1,465	17.7	50.2% WB	1,005	12.2	85.7% WB

^aAverage daily traffic in vehicles per day, counted by VAI in September 2016.

^bPercent of daily volume in peak hour.

^cPeak-hour traffic basis. EB = eastbound; WB = westbound; NB = northbound; SB = southbound.

¹ MassDOT Permanent Count Station H8509; located on I-95, 0.6 miles north of Route 2, 2015.



SIGN LEGEND		
H1-2		R4-7
R1-1		R4-10
R1-2		R5-1
R2-1		R6-1R
R3-1		R7-9a
R3-2		R7-107A
R3-3		SPEC-B
R3-4		W4-2R

Source: Cambridge Community Development Neighborhood Map and field inventory conducted by VAI

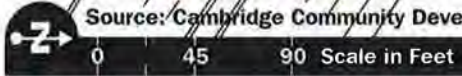


Figure 4



**Intersection Inventory
Route 2 / Frontage Road at
Lake Street**

SIGN LEGEND	
R3-17	
R4-7A	
R5-1A	
W11-1	
W16-1	



Source: Cambridge Community Development Neighborhood Map and field inventory conducted by VAI

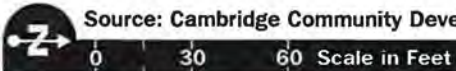
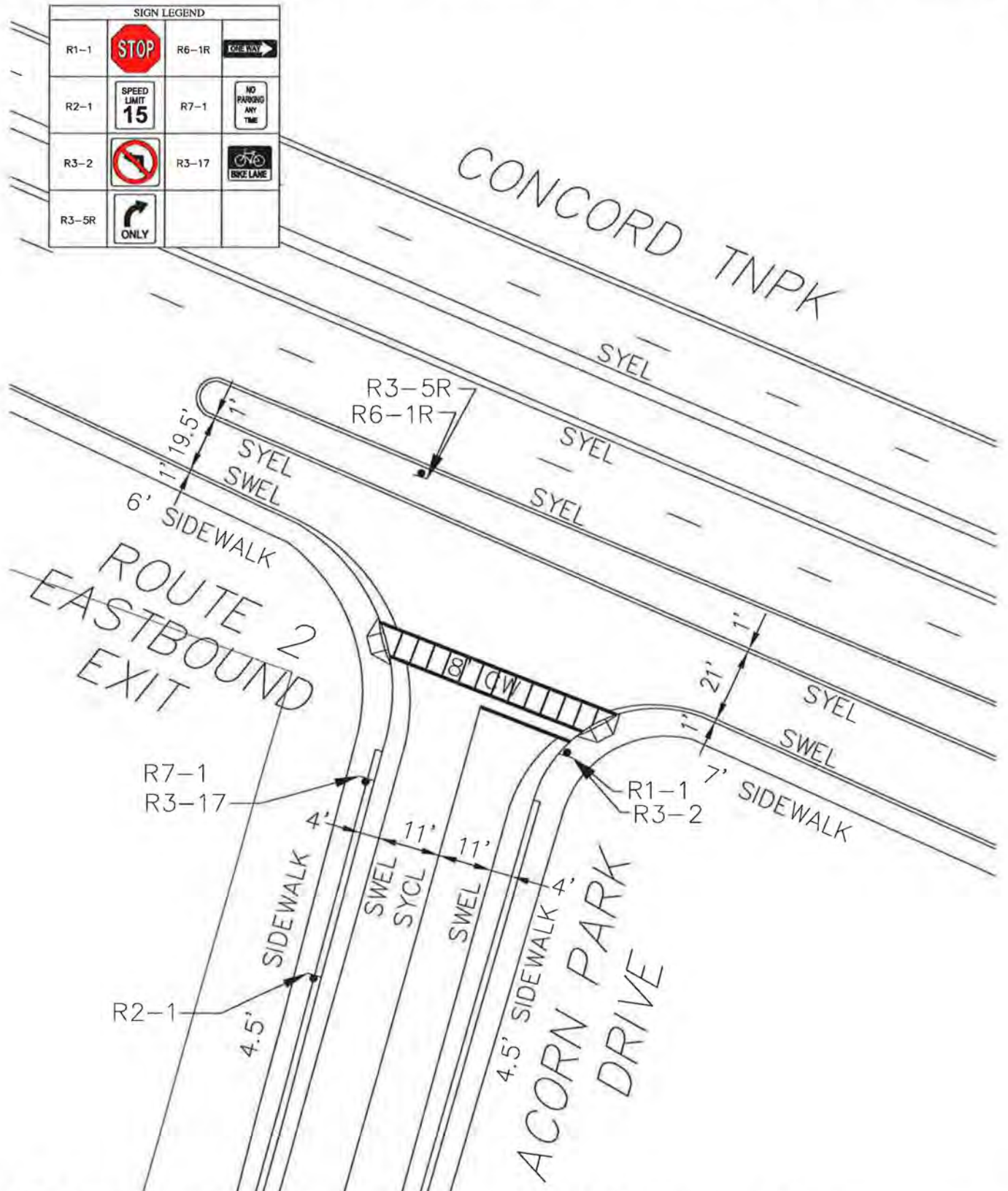


Figure 5

Intersection Inventory
Acorn Park Drive at
Frontage Road





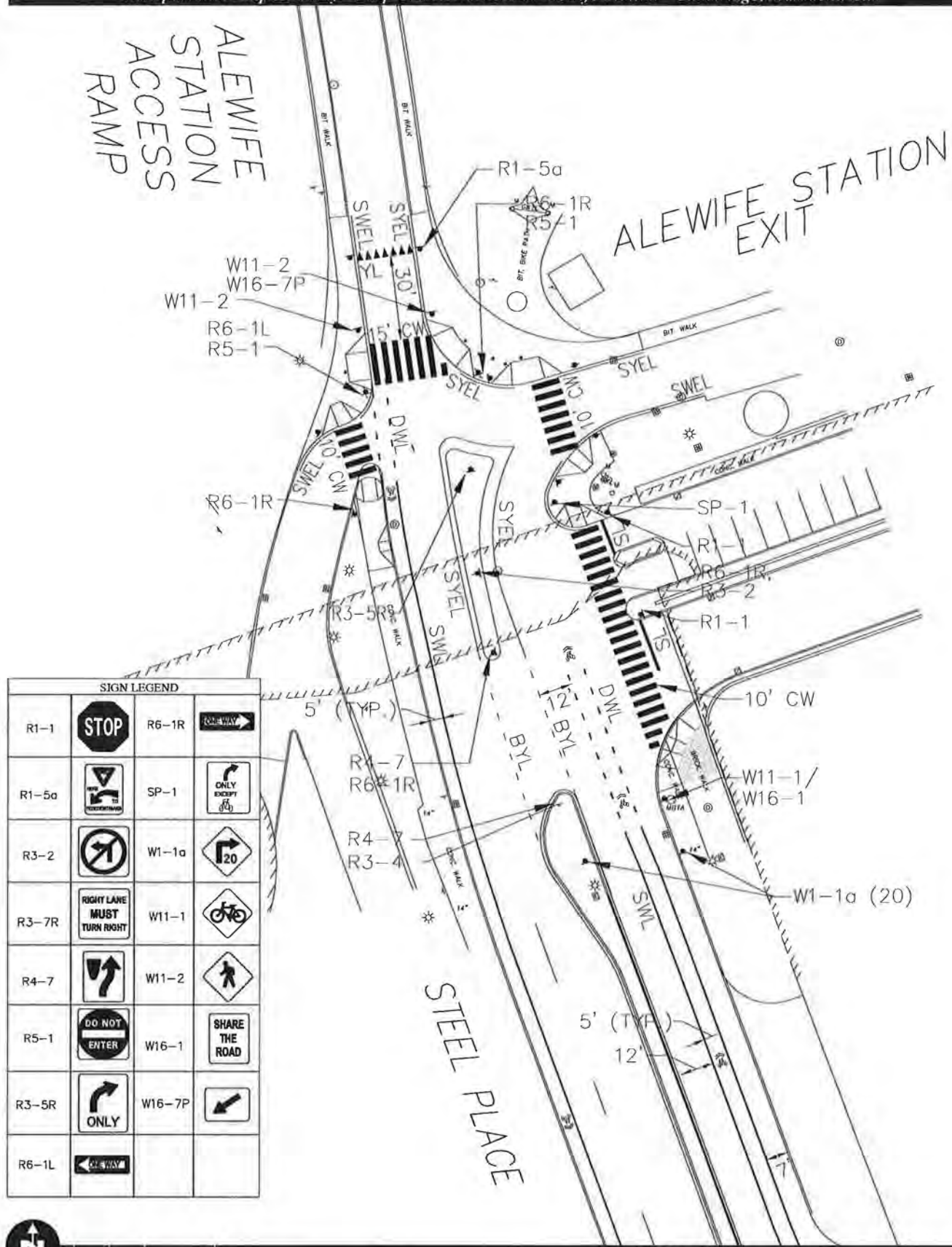
Source: Cambridge Community Development Neighborhood Map and field inventory conducted by VAI

0 20 40 Scale in Feet

Figure 6



**Intersection Inventory
Alewife Station Off-Ramp at
Acorn Park Drive**



SIGN LEGEND		
R1-1		R6-1R
R1-5a		SP-1
R3-2		W1-1a
R3-7R		W11-1
R4-7		W11-2
R5-1		W16-1
R3-5R		W16-7P
R6-1L		



Figure 7
Intersection Inventory
Alewife Station Access Ramp
at Alewife Station Exit and
Steel Place

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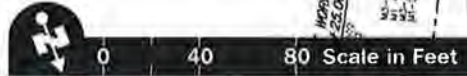
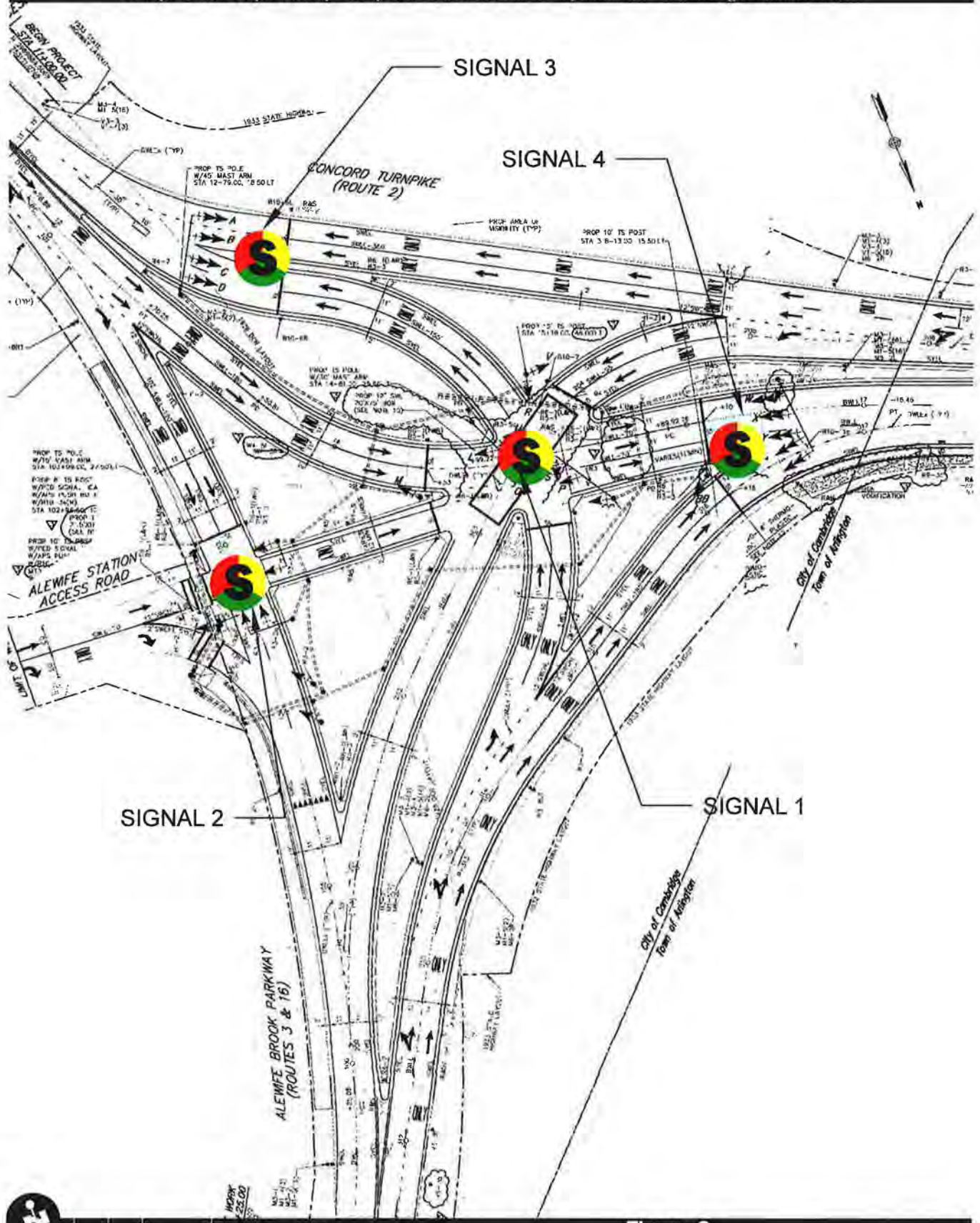
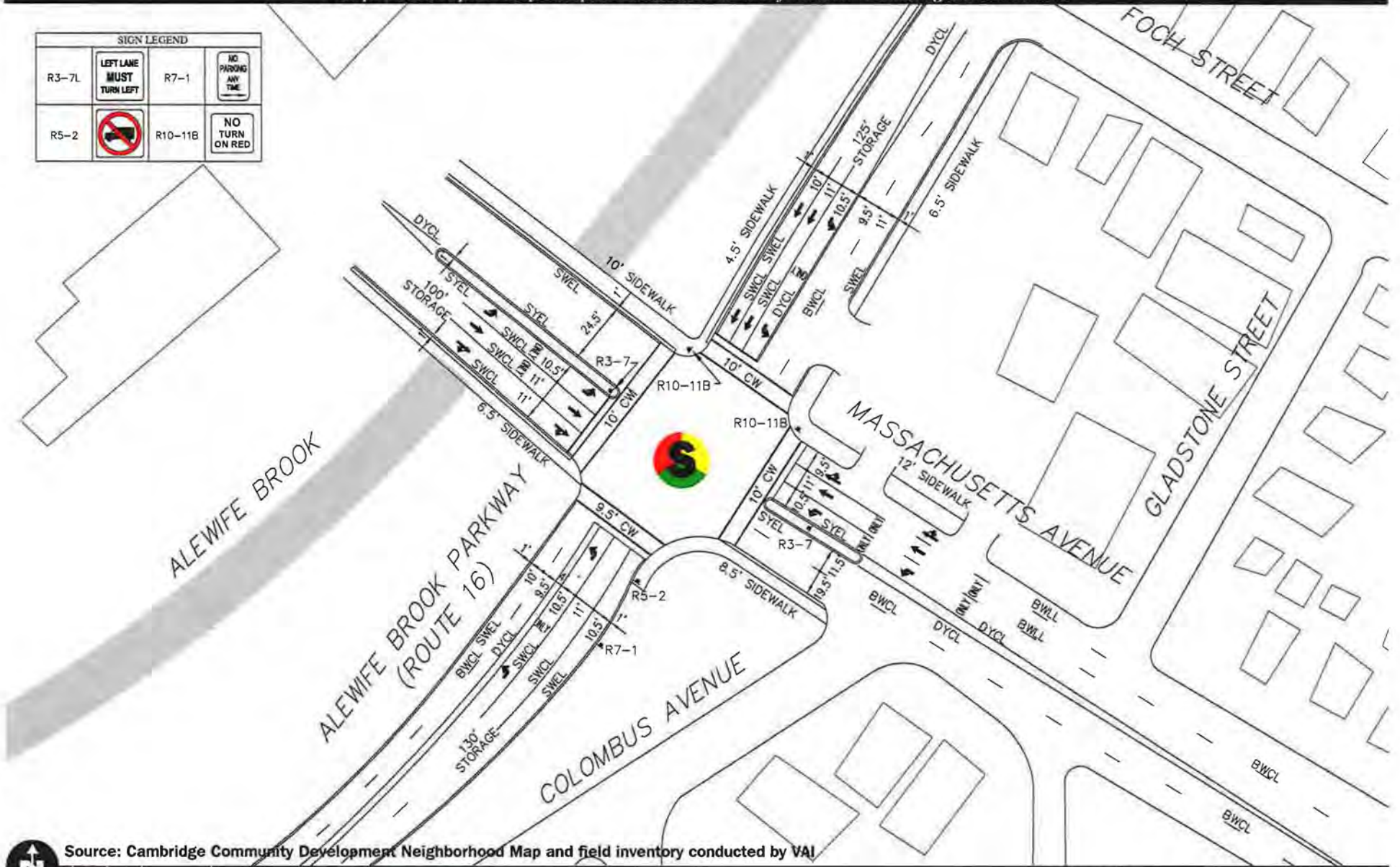


Figure 8

Intersection Inventory
Route 2 at Alewife Brook Parkway



SIGN LEGEND			
R3-7L	LEFT LANE MUST TURN LEFT	R7-1	NO PARKING ANY TIME
R5-2		R10-11B	NO TURN ON RED



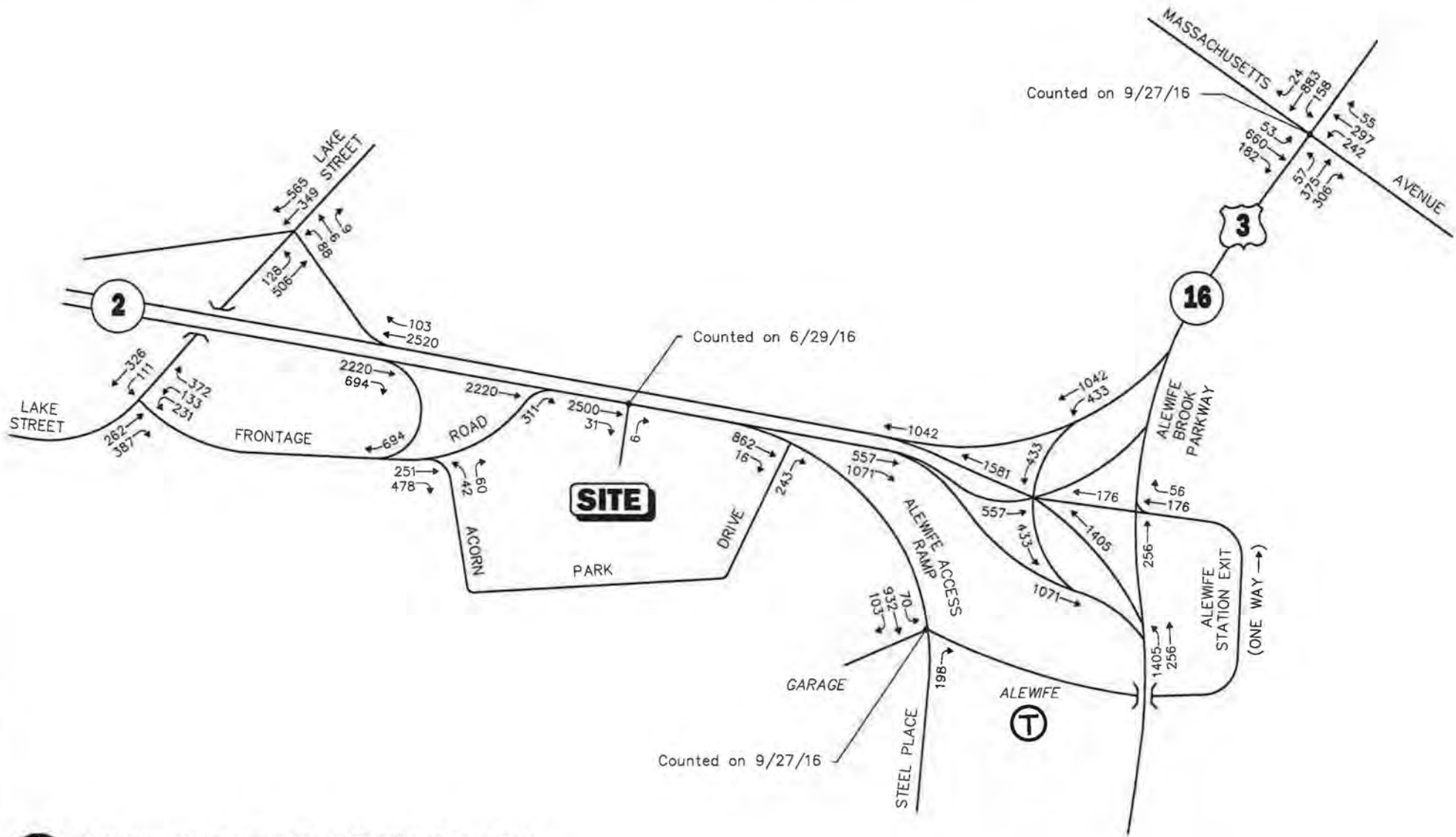
Source: Cambridge Community Development Neighborhood Map and field inventory conducted by VAI

0 30 60 Scale in Feet



Figure 9

Intersection Inventory
Alewife Brook Parkway and
Massachusetts Avenue

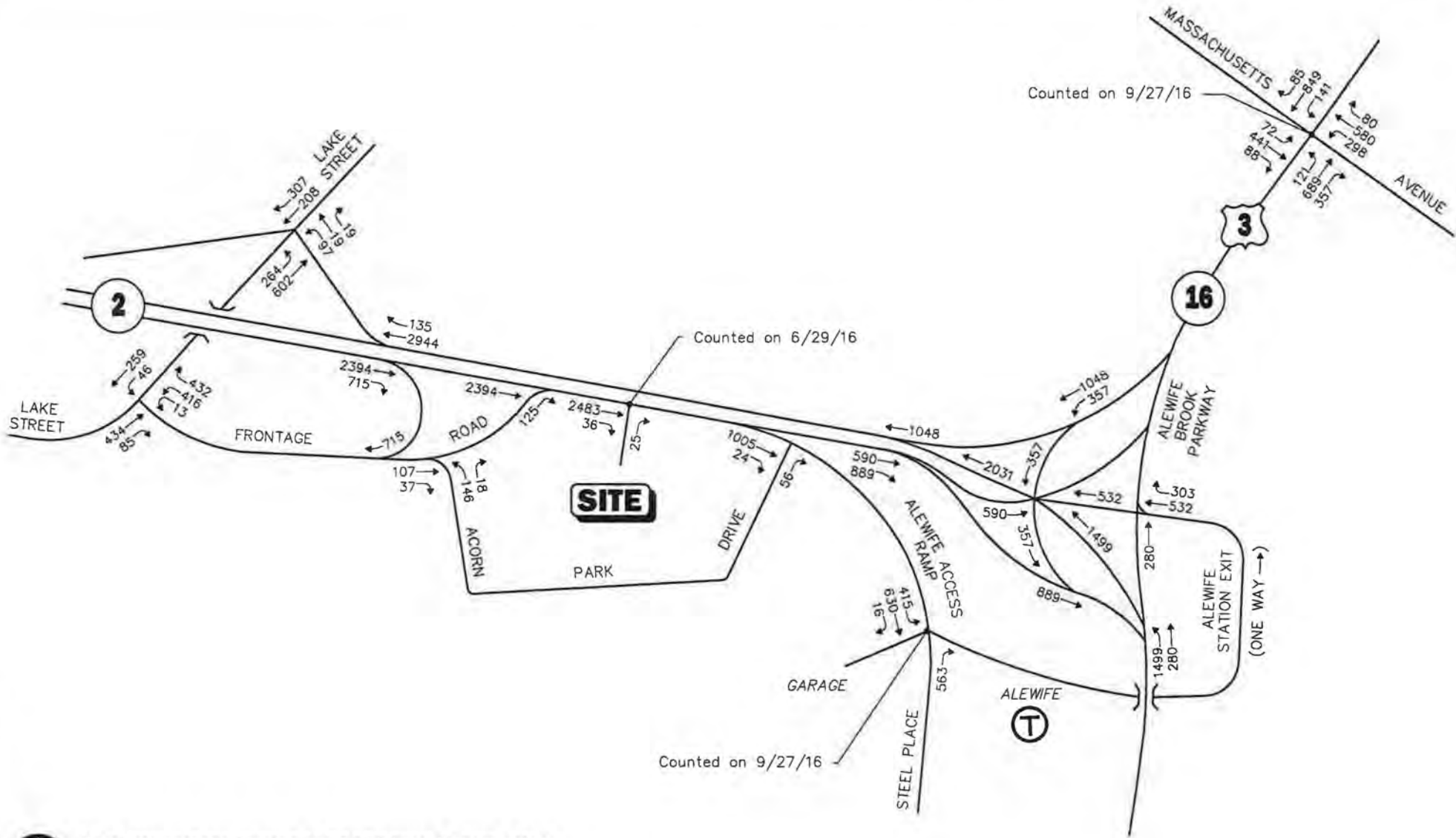


Note: Intersections Counted on 9/14/16 Except Where Noted
 Not To Scale



Figure 10
 2016 Existing
 Weekday Morning
 Peak Hour Traffic Volumes

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Note: Intersections Counted on 9/14/16 Except Where Noted
Not To Scale

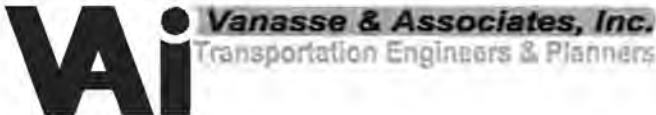


Figure 11
2016 Existing
Weekday Evening
Peak Hour Traffic Volumes

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Table 2
SUMMARY OF PEAK-HOUR INTERSECTION
CHARACTERISTICS^a

Location	Morning Peak Hour	Evening Peak Hour
Lake Street at		
Route 2 WB Off-ramp	8:00-9:00 AM	4:45-5:45 PM
Frontage Road	7:30-8:30 AM	5:30-6:30 PM
Acorn Park Drive at		
Frontage Road	7:45-8:45 AM	5:30-6:30 PM
Alewife Station Access Ramp	7:30-8:30 AM	4:45-5:45 PM
Route 2 at		
Frontage Road	7:45-8:45 AM	5:30-6:30 PM
Alewife Brook Parkway	7:30-8:30 AM	4:30-5:30 PM
Alewife Brook Parkway at		
Massachusetts Avenue	8:30-9:30 AM	5:15-6:15 PM
Alewife Station Access Ramp at		
Steel Place	8:30-9:30 AM	5:15-6:15 PM

^aCounted by VAI in September 2016.

Table 3
AVERAGE HOURLY TRAFFIC VOLUMES AT ATR LOCATIONS^a

Start Time	Acorn Park Drive, south of Alewife Station Access Ramp	Route 2, west of Acorn Park Drive	Acorn Park Drive, south of Frontage Road	Frontage Road, west of Acorn Park Drive
12:00 AM	1	521	2	11
1:00	1	250	2	8
2:00	0	143	0	4
3:00	1	142	3	7
4:00	4	416	16	25
5:00	35	2,005	34	73
6:00	54	5,117	102	465
7:00	186	5,865	398	1,047
8:00	205	5,027	590	1,316
9:00	157	4,641	215	586
10:00	52	3,723	91	291
11:00	68	3,545	118	268
12:00 PM	51	3,337	169	285
1:00	34	3,448	141	271
2:00	33	4,185	143	317
3:00	65	4,456	153	482
4:00	66	5,624	212	650
5:00	94	5,610	336	839
6:00	68	5,119	137	573
7:00	45	4,167	62	354
8:00	14	3,063	31	195
9:00	30	2,661	21	106
10:00	18	2,103	8	64
11:00	14	1,419	6	33
Total	1,296	76,587	2,990	8,270

^aVolumes based on ATR counts conducted by VAI in September 2016; expressed in vph.

A review of the ATR data on Route 2 indicates that volume builds steadily from 3:00 AM until 7:00 AM when it appears to diminish. However, what is instead likely occurring is that the congestion from the Alewife Brook Parkway intersection with Route 2 is reducing the ability of vehicles to continue at speed; thus giving the indication that volume is decreasing.

Acorn Park Drive Queuing

Observations were conducted of operations on Acorn Park Drive in the vicinity of the intersection with the Alewife Station Access Ramp. Currently, the segment of Acorn Park Drive between this intersection and the eastern intersection with Discovery Way is posted as restricted to bus use only between 7AM and 9AM, Monday through Friday. Control of this restriction was observed to be left to the regulatory signs in place on Acorn Park Drive and occasionally a dynamic message sign at the intersection of Acorn Park Drive and Frontage Road. However, passenger vehicles were observed using this segment of the roadway during the weekday morning peak period. Vehicle queues of up to 11 vehicles were reached or nearly to the curve in Acorn Park Drive near the Alewife Reservation Multi-Use Path connection. This appears in the ATR data for Acorn Park Drive south of the Alewife Station Access Ramp where the weekday morning volume increases nearly fourfold between 6:00 AM and 8:00 AM, but only buses traveling northbound and cars traveling southbound should be using this segment at this time.

However, this queue is not expected to impact vehicle access for the proposed project as motorists would be expected to turn right into Acorn Park Drive to travel to destinations to the west and there are no passenger car restrictions on this direction of travel.

BICYCLES

Bicycle counts were conducted at the study area intersections and on the multi-use path between Vox on Two and Discovery Park during the peak-hour vehicle count periods of 2016 described above. This path crosses the existing site property for approximately 160 feet and will be improved as a part of the Project. Counts were conducted in good weather in June 2016 during the weekday morning and weekday evening peak periods at the path, and were conducted at the intersections in September 2016. Bicycle volumes include both bicycles traveling on and off the sidewalks, and are provided in Figure 12 for the weekday morning peak hour and Figure 13 for the weekday evening peak-hour.

Multi-Use Path

Observations were also conducted of bicyclists using the multi-use path to Discovery Way in Discovery Park and how they transitioned from the sidewalk to the roadway. Observations indicated the bicyclists used either the beveled section of curbing near the path to access the roadway or continued on the sidewalk to the wheelchair ramps near the Discovery Park garage building entrance. No bicyclists were observed conflicting with pedestrians.

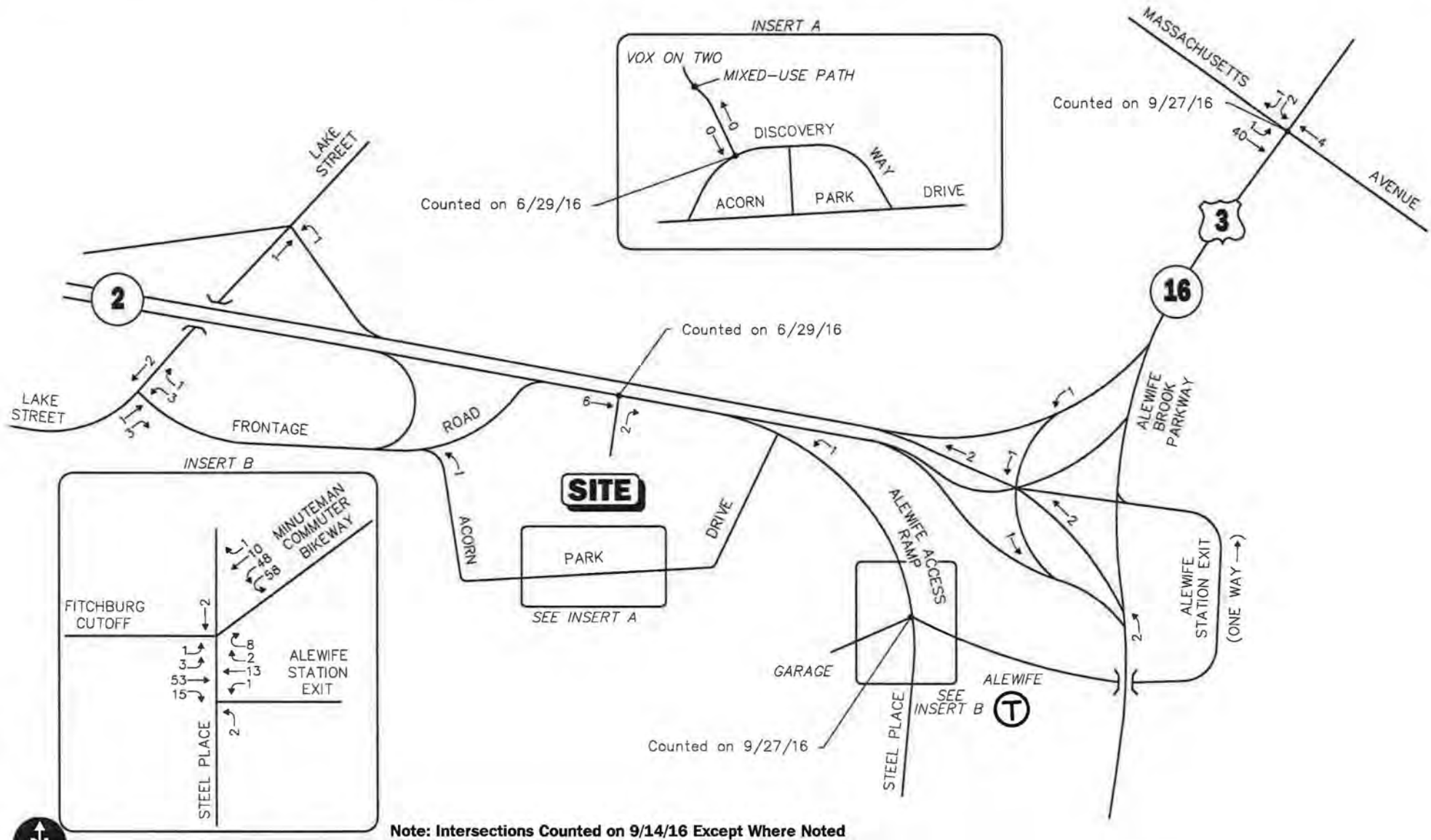
PEDESTRIANS

Pedestrian counts were conducted at the study area intersections and on the multi-use path between Vox on Two and Discovery Park. The pedestrian volumes are depicted in Figure 14 for the weekday morning peak hour and Figure 15 for the weekday evening peak hour. Pedestrians were also counted entering and exiting the Vox on Two development; however these were more “door counts” of people and not related to pedestrians that left the site to walk east or west along Route 2.

Pedestrian Overpass and Route 2 Sidewalk

Observations were conducted of the pedestrian overpass on Route 2, just east of the site. The overpass is generally in adequate condition, showing oxidation of metal surfaces but no surface rust. Metal mesh along the walkway is secure, and the staircase structure flexes slightly during use but is generally stable. There is one location where a +/- 4 inch perforation of the staircase landing on the westbound side exists; however the area around the hole is stable. At the time of the observations, 2 pedestrians were observed using the overpass. Discussions indicated they were crossing from the recreational fields in Arlington to Belmont.

The sidewalk on the westbound side of Route 2 was also observed. This sidewalk and the overpass exist for MBTA bus passengers on the outbound service routes. In addition, guardrail exists in proximity to the overpass to protect vehicles from striking light poles and the overpass, but the separation between the guardrail and the curbline is approximately 4 feet, with the usable width approximately 2 feet due to debris and overgrown vegetation.



Not To Scale

Figure 12

2016 Existing
 Weekday Morning
 Peak Hour Bicycle Volumes

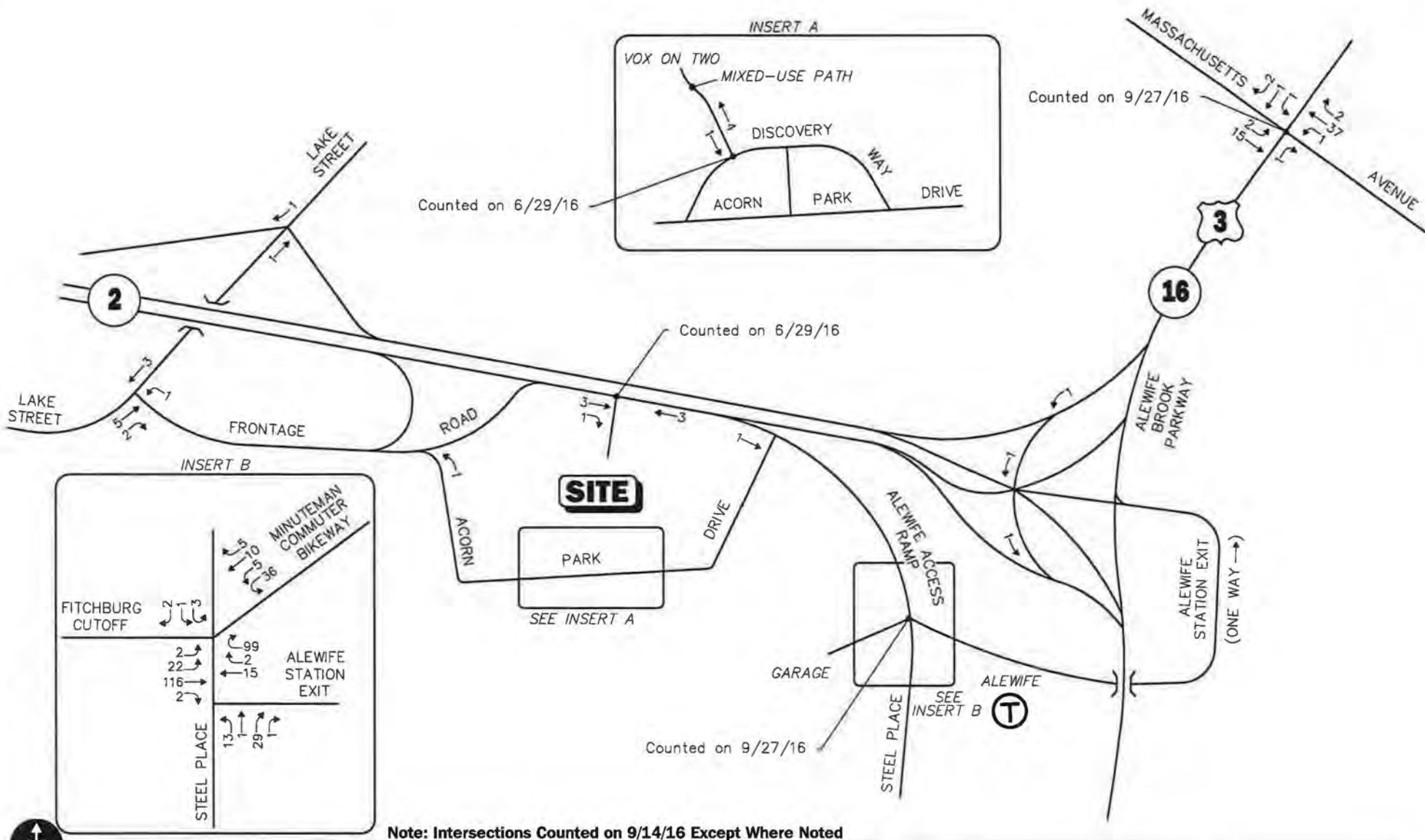


Figure 13
2016 Existing
Weekday Evening
Peak Hour Bicycle Volumes

The sidewalk on the eastbound side of Route 2 between the Project and Alewife Station was also observed. New tip-down wheelchair ramps have been constructed over the eastern curb-cuts for the Project site (Lanes & Games driveway). No detectable warning strips are in place. The sidewalk is approximately 8 feet wide in some areas and narrows to approximately 5.5 feet wide where a guardrail exists along the main parking field in front of the site. There is also an electric meter box and a sign post in this area, further reducing available sidewalk width. The sidewalk is in fair condition with no major deficiencies in the vicinity of the site; however between Acorn Park Drive and Alewife Station there are locations where obstacles exist preventing the full 5.5 foot width of the sidewalk from being used. In some cases there are planters or vegetation that occupies a portion of the sidewalk width. These obstructions do not make travel impossible, but likely require pedestrians moving in opposite directions to pass individually.

EXISTING VEHICLE QUEUES

Vehicle queues were observed at signalized study area intersections, per City guidelines. Table 4 summarizes the vehicle queue observations by intersection approach and lanes.

Table 4
EXISTING QUEUE OBSERVATIONS^a

Intersection/Lane ^b	Morning Peak Hour	Evening Peak Hour
<i>Route 2 at Alewife Brook Parkway:</i>		
Route 2 EB LT1	19	20+
Route 2 EB LT2	19	20+
Route 2 EB RT1	20+	7
Route 2 EB RT2	20+	8
Alewife Station Exit Ramp WB TH	3	8
Alewife Station Exit Ramp WB RT	0	1
Alewife Brook Parkway NB LT1	19	20+
Alewife Brook Parkway NB LT2	18	20+
Alewife Brook Parkway NB TH1	1	2
Alewife Brook Parkway NB TH2	2	1
Alewife Brook Parkway SB TH1	9	6
Alewife Brook Parkway SB TH2	9	7
Alewife Brook Parkway SB RT1	8	7
Alewife Brook Parkway SB RT2	10	10
<i>Acorn Park Drive at Frontage Road:</i>		
Frontage Road EB TH	3	0
Frontage Road EB RT	0	0
Acorn Park Drive WB NB LT	0	2
Acorn Park Drive WB NB RT	6	0
<i>Lake Street at Route 2 WB Ramps:</i>		
Route 2 WB Ramp WB LT	2	1
Route 2 WB Ramp WB RT	0	0
Lake Street NB LT	2	6
Lake Street NB TH/RT	1	10
Lake Street SB TH	2	2
Lake Street SB TH/RT	2	5
<i>Lake Street at Frontage Road:</i>		
Frontage Road EB LT	9	11
Frontage Road EB RT	0	10
Lake Street NB TH	4	6
Lake Street SB LT	3	2
Lake Street SB TH1	2	2
Lake Street SB TH2	1	1

(See notes at end of Table)

Table 4 (Continued)
EXISTING QUEUE OBSERVATIONS^a

Intersection/Lane ^b	Morning Peak Hour	Evening Peak Hour
<i>Alewife Brook Parkway at Massachusetts Avenue:</i>		
Massachusetts Avenue EB LT	1	2
Massachusetts Avenue EB TH	30	6
Massachusetts Avenue EB TH/RT	28	7
Massachusetts Avenue WB LT	18	20
Massachusetts Avenue WB TH	13	20
Massachusetts Avenue WB TH/RT	1	6
Alewife Brook Parkway NB LT	2	2
Alewife Brook Parkway NB TH	5	20
Alewife Brook Parkway NB TH/RT	12	20
Alewife Brook Parkway SB LT	6	3
Alewife Brook Parkway SB TH	20	16
Alewife Brook Parkway SB TH/RT	16	19

^aSource: Based upon observations conducted by VAI in September 2016.

^bEB = eastbound; WB = westbound; NB = northbound; SB = southbound; LT = left-turning movements; TH = through movements; RT = right-turning movements.

Route 2 Queuing near Project Driveways

Vehicle queues were observed on Route 2 in the vicinity of the Project driveways. The queues extending back from the Route 2/Alewife Brook Parkway intersection are highly variable but on several occasions, queues during the morning peak period extended beyond the Project location and nearly to Lake Street. On these occasions, when vehicles were essentially blocking the driveways, vehicles exiting the existing site and the adjacent Vox on Two site were always able to enter Route 2 with a minimum of delay. Route 2 motorists were observed creating “courtesy gaps” to allow vehicles to exit the driveways. This behavior occurred when queues extended to Lake Street and also when queues extended past the driveways. No difficulties in entering queued traffic were observed during these periods.

EXISTING PUBLIC TRANSIT SYSTEM

The project site is located within ½ mile of the MBTA Alewife Red Line Station located on Alewife Brook Parkway and Cambridgepark Drive. This station serves as a terminal stop for several MBTA and private transit bus routes and the Red Line rapid rail transit line. Of the seven connecting bus routes at Alewife station, four routes stop near or adjacent to the project site on Route 2 or on Lake Street: Routes 62, 76, 67, and 84. A bus shelter is provided on Lake Street at Frontage Road. The bus routes, hours of operation, peak-hour headways and capacity information supplied by the MBTA are tabulated in Table 5. The regional public transportation map is depicted in Figure 16.



Figure 16

Public Transportation System



**Table 5
MBTA BUS SERVICE**

Route No.	Route	Hours of Operation ^a	Peak-Hour Headway (minutes) ^b	Peak-Hour Peak-Direction Planning Capacity ^c	Daily Ridership ^b	Estimated Daily Capacity
62	Bedford V.A. Hospital – Alewife Station	5:47 AM to 9:04 PM	30	120	1,644	2,820
67	Turkey Hill – Alewife Station ^g	5:53 AM to 8:32 PM	25	144	588	2,760
76	Hanscom/Lincoln Labs – Alewife Station	6:05 AM to 10:39 PM	30	120	991	2,700
79	Arlington Heights – Alewife Station via Massachusetts Avenue ^e	6:57 AM to 9:50 PM	20	180	1,261	3,720
84	Arlmont Village – Alewife Station via Park Circle ^e	6:44 AM to 6:24 PM	30/17 ^d	120/212	356	1,380
350	North Burlington – Alewife Station via Burlington Mall	6:20 AM to 10:56 PM	20	180	1,653	3,420
351	Oak Park/Bedford Woods – Alewife Station via Middlesex Turnpike ^{e,f}	6:15 AM to 7:01 PM	50/60 ^d	72/60	190	480

^aBased on current MBTA schedule.

^bSource: MBTA Ridership and Service Statistics 2014.

^cPlanning capacity is 60 passengers per bus.

^dMorning headway/evening headway.

^eWeekday Service Only

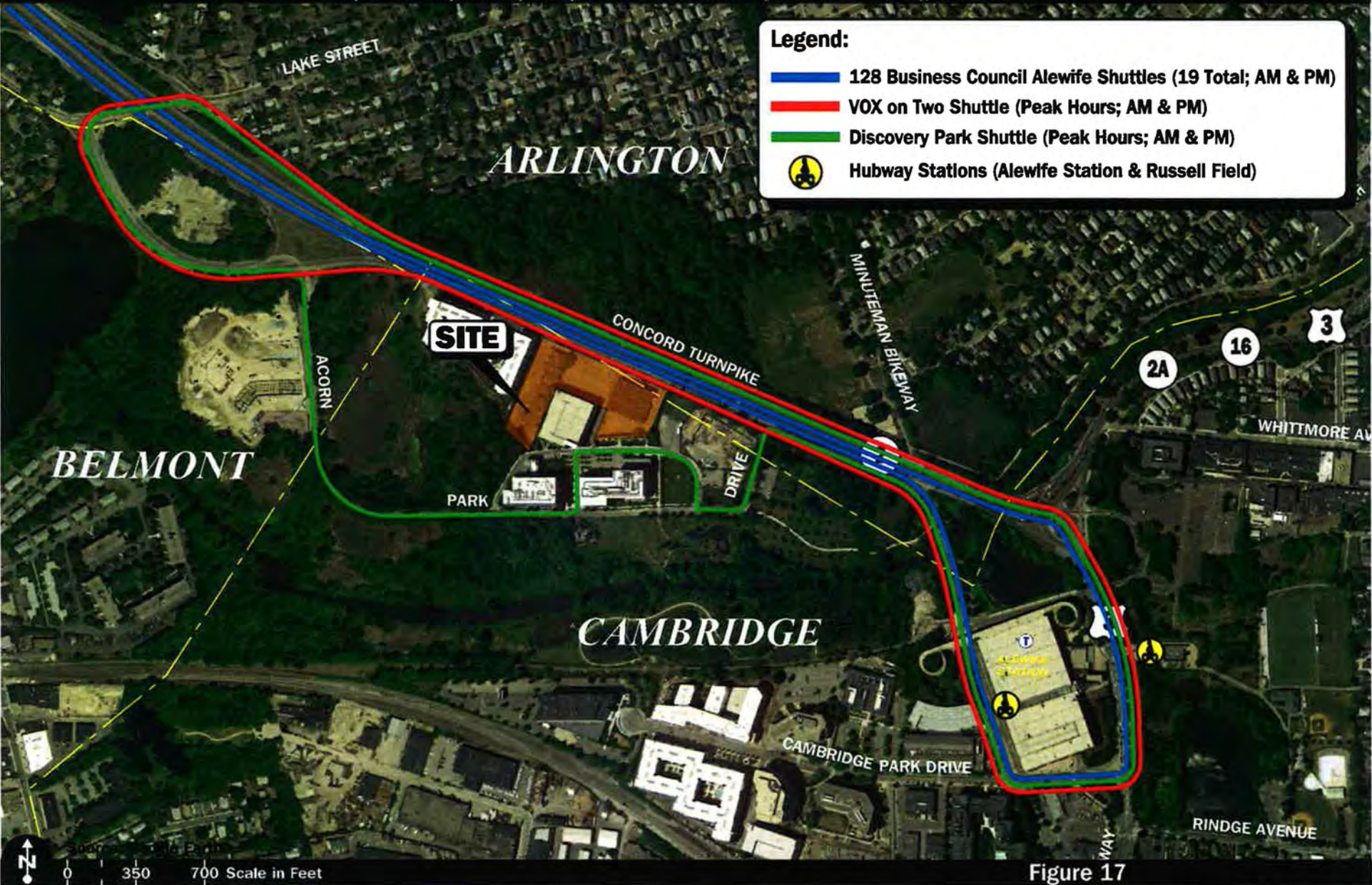
^fOperates during peak periods only; outbound in morning, inbound in evening.

Private Transit

There are also a number of private transit services (including the Hubway bike sharing system) providing transit services in the area. The 128 Business Council Transportation Management Association (TMA) provides 19 shuttle routes (weekday morning and weekday evening peak periods) between Route 128 and Alewife Station. The Alewife TMA also provides a shuttle bus service between locations between the Fresh Pond Rotary and the Alewife Station. There are two Hubway bike sharing stations in the area, one at Alewife Station and the other at Russell Field off Rindge Avenue. These services are shown on Figure 17.

LAND USE

Land uses in the vicinity of the site were researched and inventoried in September 2016. The study area land uses are shown in Figure 18.



Legend:


- 128 Business Council Alewife Shuttles (19 Total; AM & PM)
- VOX on Two Shuttle (Peak Hours; AM & PM)
- Discovery Park Shuttle (Peak Hours; AM & PM)
-  Hubway Stations (Alewife Station & Russell Field)

Figure 17
Private Transit Services

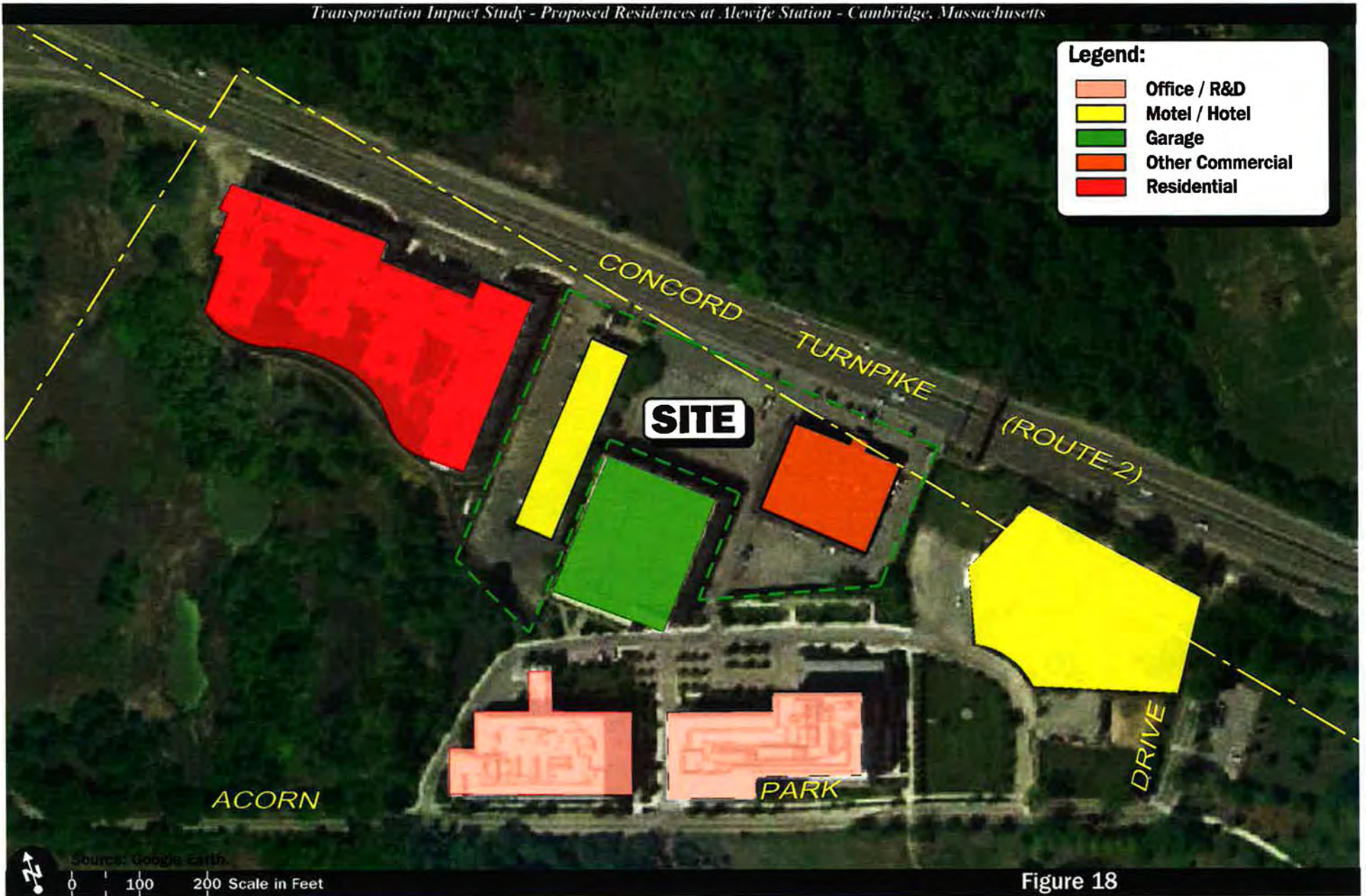


Figure 18

Land Use Map

VEHICLE CRASH DATA

Crash data for the study area were collected from MassDOT for the three most recent calendar years of available data to examine crash trends occurring within the study area. These data are presented in Table 6.

As shown in Table 6, a total of 117 crashes were recorded at 8 intersections in the reviewing years from 2012 to 2014. The intersection of Alewife Brook Parkway at Route 2 has recorded the highest number of crashes of the study area intersections, averaging 17.7 crashes per year. Approximately 75 percent of the reported crashes at this intersection were angle-type or rear-end collisions, which is typical for a congested intersection. The intersection of Massachusetts Avenue with Alewife Brook Parkway was the next highest frequency location, with 11.0 crashes per year. No crashes were recorded at the site driveway intersections with Route 2.

Crash Rate Review

The crash data were reviewed to compare crash rates with MassDOT District 6 and statewide averages. The District 6 averages are 0.70 crashes per million entering vehicles (mev) for signalized intersections and 0.53 crashes per mev for unsignalized intersections while the statewide averages are 0.77 and 0.58 crashes/mev for this respective intersection types. Only one location was determined to exceed the averages: the Acorn Park Drive intersection with the Alewife Station Access Ramp. The data indicates that 87 percent of the crashes are rear-end crashes involving vehicles traveling east on the ramp. This may be due to congestion on the ramp as the possible causes listed for most of the crashes involved "following too closely".

Also reviewed was the presence of pedestrians or bicyclists in the crash data. The data indicated two crashes where pedestrians were involved: one crash at the Alewife Brook Parkway/Massachusetts Avenue intersection and one at the Route 2/Alewife Brook Parkway intersection. The crash at the Massachusetts Avenue location involved a vehicle traveling east turning right and striking a pedestrian in the crosswalk. Personal injury was involved. The crash at the Route 2/Alewife Brook Parkway location involved a rear-end collision between two vehicles with a pedestrian in the roadway being struck. No injuries were reported (property damage only). No crashes involving bicyclists were indicated in the crash data. Crash rates for pedestrian involvement were calculated and are presented in Table 6.

Table 6
CRASH DATA SUMMARY^a

Scenario	Acorn Park Drive at Frontage Road	Lake Street at Frontage Road	Lake Street at Route 2 WB Ramps	Alewife Station Access Ramp at Acorn Park Drive	Route 2 at Frontage Road	Route 2 at Alewife Brook Parkway	Alewife station Access Ramp at Steel Place	Alewife Brook Parkway at Massachusetts Avenue
<i>Year:</i>								
2012	0	1	0	3	1	11	1	13
2013	0	0	3	9	4	20	0	10
2014	<u>1</u>	<u>2</u>	<u>2</u>	<u>3</u>	<u>1</u>	<u>22</u>	<u>0</u>	<u>10</u>
Total	1	3	5	15	6	53	1	33
Average ^a	0.33	1.00	1.67	5.00	2.00	17.67	0.33	11.00
Crash Rate ^b	0.20	0.20	0.36	0.78	0.15	0.63	0.03	0.56
Significant ^c	No/No	No/No	No/No	Yes/Yes	No/No	No/No	No/No	No/No
Pedestrian Crash Rate	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.02
<i>Type:</i>								
Angle	0	1	0	0	0	13	0	9
Rear-End	0	0	1	13	4	27 ^d	1	18
Head-On	0	0	0	0	0	0	0	1
Sideswipe	0	0	0	0	0	9	0	4
Fixed Object	0	2	3	1	1	4	0	0
Pedestrian	0	0	0	0	0	0	0	1
Other	<u>1</u>	<u>0</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	1	3	5	15	6	53	1	33
<i>Time</i>								
Weekday 7:00 AM to 9:00 AM	0	0	1	1	0	3	1	2
Weekday 4:00 PM to 6:00 PM	0	0	0	3	0	4	0	7
Remainder of Day	<u>1</u>	<u>3</u>	<u>4</u>	<u>11</u>	<u>6</u>	<u>46</u>	<u>0</u>	<u>24</u>
Total	1	3	5	15	6	53	0	33
<i>Pavement Conditions:</i>								
Dry	1	2	4	14	5	45	1	27
Wet	0	0	1	1	1	7	0	3
Snow/Icy	0	1	0	0	0	0	0	2
Other/Unknown	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>1</u>	<u>0</u>	<u>1</u>
Total	1	3	5	15	6	53	1	33
<i>Day of Week</i>								
Monday through Friday	1	3	3	15	5	39	1	24
Saturday and Sunday	<u>0</u>	<u>0</u>	<u>2</u>	<u>0</u>	<u>1</u>	<u>14</u>	<u>0</u>	<u>9</u>
Total	1	3	5	15	6	53	1	33
<i>Severity:</i>								
Property Damage Only	0	2	4	12	5	42	0	21
Personal Injury	1	1	0	2	1	9	0	8
Fatality	0	0	0	0	0	0	0	0
Other	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>	<u>0</u>	<u>2</u>	<u>1</u>	<u>4</u>
Total	1	3	5	15	6	53	1	33

^aAverage number of crashes over three-year period.

^bCrash rate per million entering vehicles (mev).

^cSignificant if crash rate is above 0.70/0.77 for signalized intersections or 0.53/0.58 for unsignalized intersections based on MassDOT District 6/Statewide averages, respectively.

^dPedestrian also involved in one crash.

Source: MassDOT Crash Data, 2012 through 2014.

TRIP GENERATION AND DISTRIBUTION

EXISTING SITE TRIP GENERATION

The existing site currently contains a 78-room motel (Cambridge Gateway Motel and Conference Center) and a 46,814 square feet (sf) bowling alley (Lanes & Games), with a total of 4 curb cuts onto Route 2 eastbound. While the City's 1990 parking inventory indicates 99 customer/visitor parking spaces for Lanes & Games and 79 visitor/customer parking spaces at the Gateway Motel for a total of 178 parking spaces, existing survey indicates a total of 273 spaces on site. Approximately 55 employees work at the bowling alley while 8 employees work at the motel.

Both of these uses are currently occupied and generating traffic. Counts were conducted of the driveways during the weekday morning and weekday evening peak periods on June 29, 2016. This would be considered a typical day with no conferences booked at the motel and no functions booked at the bowling alley. The bowling alley has league play every day so there are no days when leagues are not in operation. The results are shown below in Table 7.

Table 7
EXISTING SITE VEHICLE TRIP
GENERATION SUMMARY^a

<u>Time Period/Direction</u>	<u>Observed Vehicle Trips</u>
Weekday Morning Peak Hour	
Entering	31
<u>Exiting</u>	<u>6</u>
Total	37
Weekday Evening Peak Hour	
Entering	36
<u>Exiting</u>	<u>25</u>
Total	61

^aCounted by VAI in June 2016.

These trips were expanded throughout the study area and are shown on Figure 19 for the weekday morning peak hour and Figure 20 for the weekday evening peak hour.

PROPOSED SITE TRIP GENERATION

The Project is currently proposed for 320 apartment units; however, the trip generation and analysis is based on 325 units so this analysis is conservative. To identify the trip generation of the Project, the Monitoring Report and peak-hour driveway counts for the adjacent Vox on Two residential development were utilized.

The Vox on Two development is currently at approximately 98 percent occupancy. This development is a 227 unit apartment complex with a similar Route 2 driveway configuration as the Project. Traffic counts were conducted of this site and compared with the initial projections from the TIS² for the development. This comparison is shown below in Table 8.

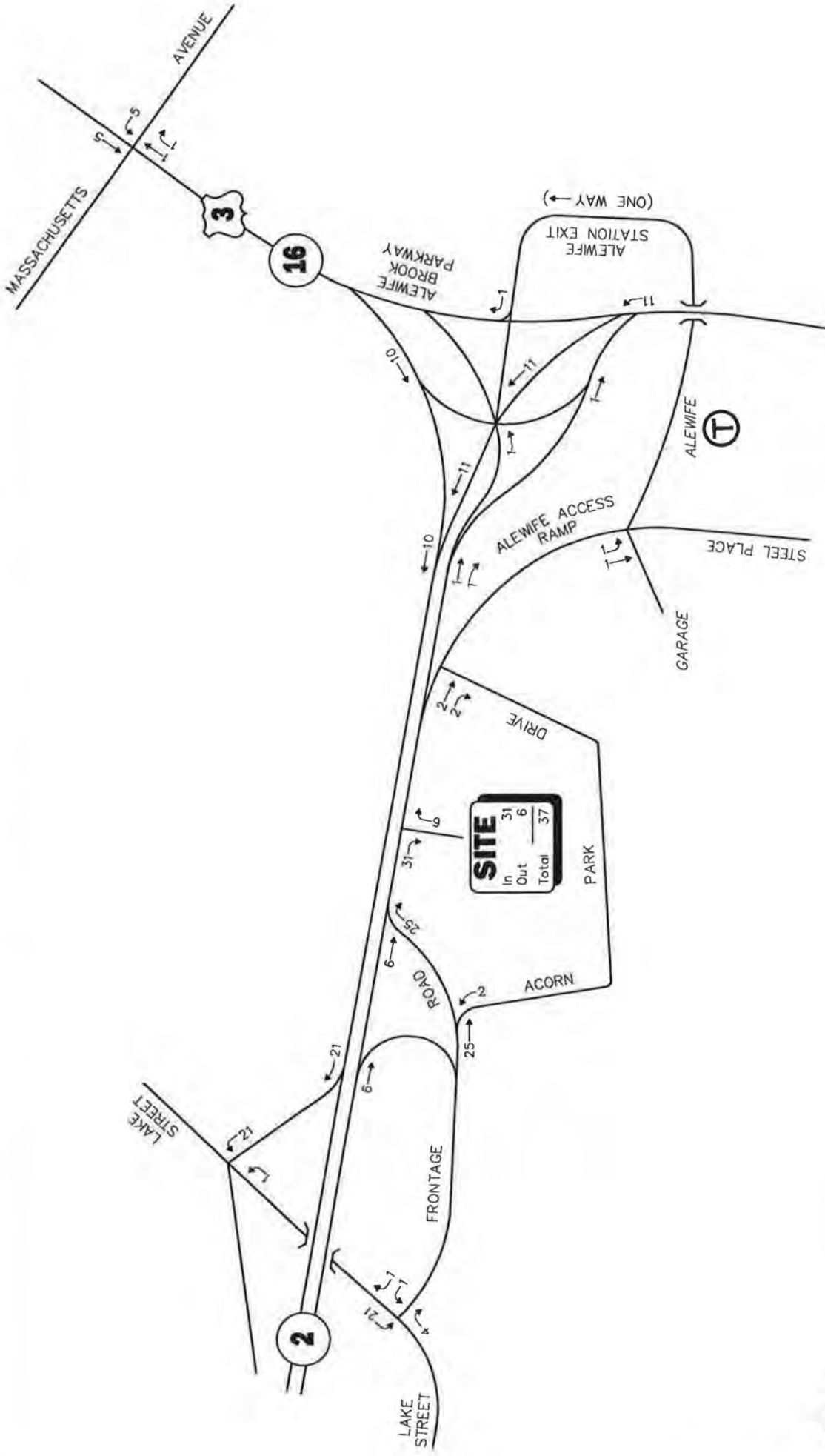
**Table 8
VOX ON TWO VEHICLE TRIP GENERATION COMPARISON**

Time Period/Direction	Projected Vehicle Trips ^a	Observed Vehicle Trips ^b	Percent Change, Projected to Observed
Weekday Morning Peak Hour			
Entering	19	15	--
Exiting	75	38	--
Total	94	53	-44
Weekday Evening Peak Hour			
Entering	75	23	--
Exiting	40	21	--
Total	115	44	-62

^aFrom TIS, December 2010.
^bCounted by VAI in June 2016.

As shown in Table 8, the actual peak-hour vehicle trip generation was between 44 and 62 percent lower than initial estimates. To determine overall trip generation of the Vox site, including trips made using transit, pedestrian, and bicycle modes, a person-trip rate was calculated using mode splits identified in a residential mode split survey contained in the Vox Monitoring Report and the observed vehicle trips. This person-trip rate was discussed with and approved by City officials prior to use in this report, with the rate shown in Table 9.

² TIS, Proposed Residences at Alewife; Cambridge, MA; VAI; 2010.



Not To Scale

VAI
Vanasse & Associates, Inc.
Transportation Engineers & Planners

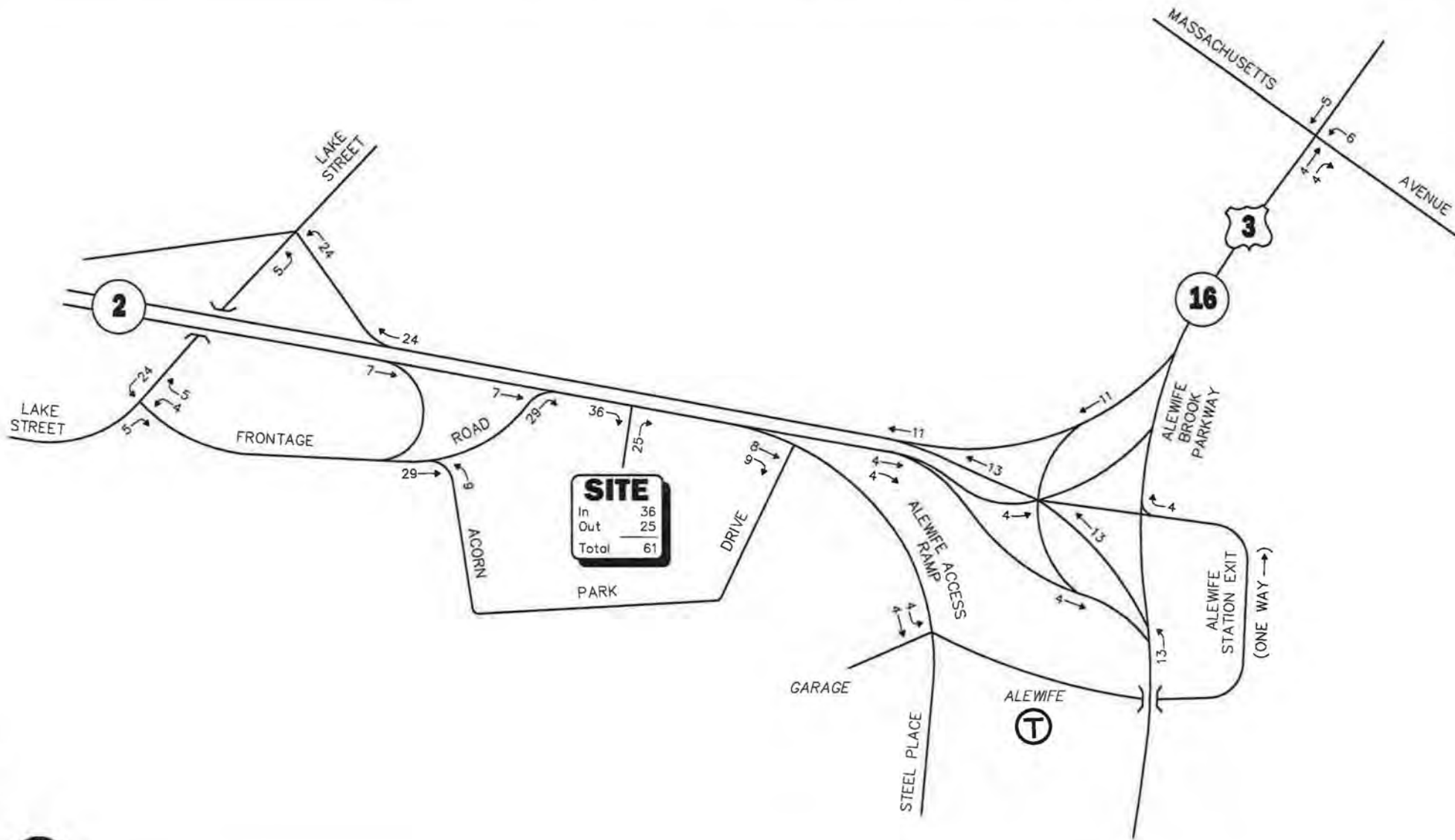


Figure 20
Existing Site
Weekday Evening
Peak Hour Traffic Volumes

Not To Scale

VAI Vanasse & Associates, Inc.
 Transportation Engineers & Planners

Table 9
VOX ON TWO PERSON-TRIP GENERATION RATE

Time Period/Direction	Base Vehicle Trip Rate ^a	Resulting Person Trip Rate ^b
Average Weekday Daily	6.65 ^c	6.89 ^d
Weekday Morning Peak Hour		
Entering	0.07	0.18
<u>Exiting</u>	<u>0.17</u>	<u>0.46</u>
Total	0.24	0.64
Weekday Evening Peak Hour		
Entering	0.10	0.28
<u>Exiting</u>	<u>0.09</u>	<u>0.25</u>
Total	0.19	0.53

^aCounted by VAI in June 2016. Based on 222 occupied units.

^bBased on conversion of observed vehicle trips to person trips using vehicle mode split of 39% per survey data.

^cFrom ITE LUC 220, Apartment.

^dBased on ratio of ITE data for Apartment and observed vehicle trip rates.

This identified person-trip generation rate was applied to the unit count of 325 units and adjusted to develop estimates of vehicle, transit, pedestrian, and bicycle trips to be generated by the Project.

The modal split assumptions for the project are approximately 35 percent drive-alone automobile trips; 4 percent rideshare automobile trips; 45 percent transit; 8 percent pedestrian; 4 percent bicycle; and 4 percent “other” trips, which may include working at home.

Daily trips were developed using Institute of Transportation Engineers (ITE) trip generation data from the relevant land use code³ and adjusted using the person trip data identified previously. On a daily basis, the site is expected to generate 840 vehicle trips (420 in and 420 out) on an average weekday. On an hourly basis, the site is expected to generate 78 vehicle trips (21 in and 57 out) and 65 vehicle trips (35 in and 30 out) during the weekday morning and weekday evening commuter peak hours, respectively.

Transit trips are expected to be 1,006 (503 in and 503 out) on a daily basis, and 95 trips (28 in and 67 out) and 76 trips (38 in and 38 out) during the morning and evening peak hours, respectively.

Pedestrian trips are estimated to be 180 (90 in and 90 out) on a daily basis, and 16 trip (4 in and 12 out) and 14 trips (8 in and 6 out) during the morning and evening peak hours, respectively.

Bicycle trips are estimated to be 90 (45 in and 45 out) on a daily basis, 8 trips (2 in and 6 out), and 7 trips (4 in and 3 out) during the morning and evening peak hours, respectively.

³ Land Use Code (LUC) 220, Apartment; *Trip Generation, 9th Edition*; ITE, Washington, D.C.; 2012.

The project trip generation is summarized in Table 10. The project is expected to generate an average of 10 truck trips per day, exclusive of peak move-in periods.

Table 10
PROJECT TRIP GENERATION SUMMARY

Time Period/Direction	Person Trips ^a							Automobile Trips
	Total ^b	Drive Alone Trips ^c	Ridesharing Trips ^d	Transit Trips ^e	Pedestrian Trips ^f	Bicycle Trips ^g	Other Trips ^h	Projected Automobile Trips ⁱ
<i>Average Weekday Daily^j:</i>								
Entering	1,120	392	45	503	90	45	45	420
Exiting	<u>1,120</u>	<u>392</u>	<u>45</u>	<u>503</u>	<u>90</u>	<u>45</u>	<u>45</u>	<u>420</u>
Total	2,240	784	90	1,006	180	90	90	840
<i>Weekday Morning Peak Hour:</i>								
Entering	58	20	2	28	4	2	2	21
Exiting	<u>150</u>	<u>53</u>	<u>6</u>	<u>67</u>	<u>12</u>	<u>6</u>	<u>6</u>	<u>57</u>
Total	208	73	8	95	16	8	8	78
<i>Weekday Evening Peak Hour:</i>								
Entering	90	32	4	38	8	4	4	35
Exiting	<u>82</u>	<u>29</u>	<u>3</u>	<u>38</u>	<u>6</u>	<u>3</u>	<u>3</u>	<u>30</u>
Total	172	61	7	76	14	7	7	65

^aMode splits based on Residential Mode Split Summary administered to VOX on Two Residents, September 2016

^bBased on 325 units and VOX on Two observed trip rates except where noted.

^cAssume 35 percent of total person trips.

^dAssume 4 percent of total person trips.

^eAssume 45 percent of total person trips.

^fAssume 8 percent of total person trips.

^gAssume 4 percent of total person trips.

^hInclude working at home, assume 4 percent of total person trips.

ⁱDrive-alone plus rideshare person trips divided by vehicle occupancy ratio of 1.04 persons per vehicle per local census data.

^jBased on ITE LUC 220, Apartment daily rates and adjusted using VOX on Two calculated vehicle- and person-trip rates.

TRAFFIC DISTRIBUTION AND ASSIGNMENT

A localized and regional distribution is typical for these developments. The localized distribution of generated trips to and from the proposed development is expected to follow existing traffic patterns which, in turn, are a function of population densities and available travel routes. The regional trip distribution on the other hand, was developed using the Vox on Two monitoring report. This report identified locations of work/school trips for residents participating in the mode split survey. Work/school trips from those residents driving alone were used to develop the distribution. This approach was requested by and discussed with City officials.

Based upon this data, the overall trip-distribution pattern was developed in consultation with City officials and is summarized in Table 11. A graphical depiction appears on Figure 21.

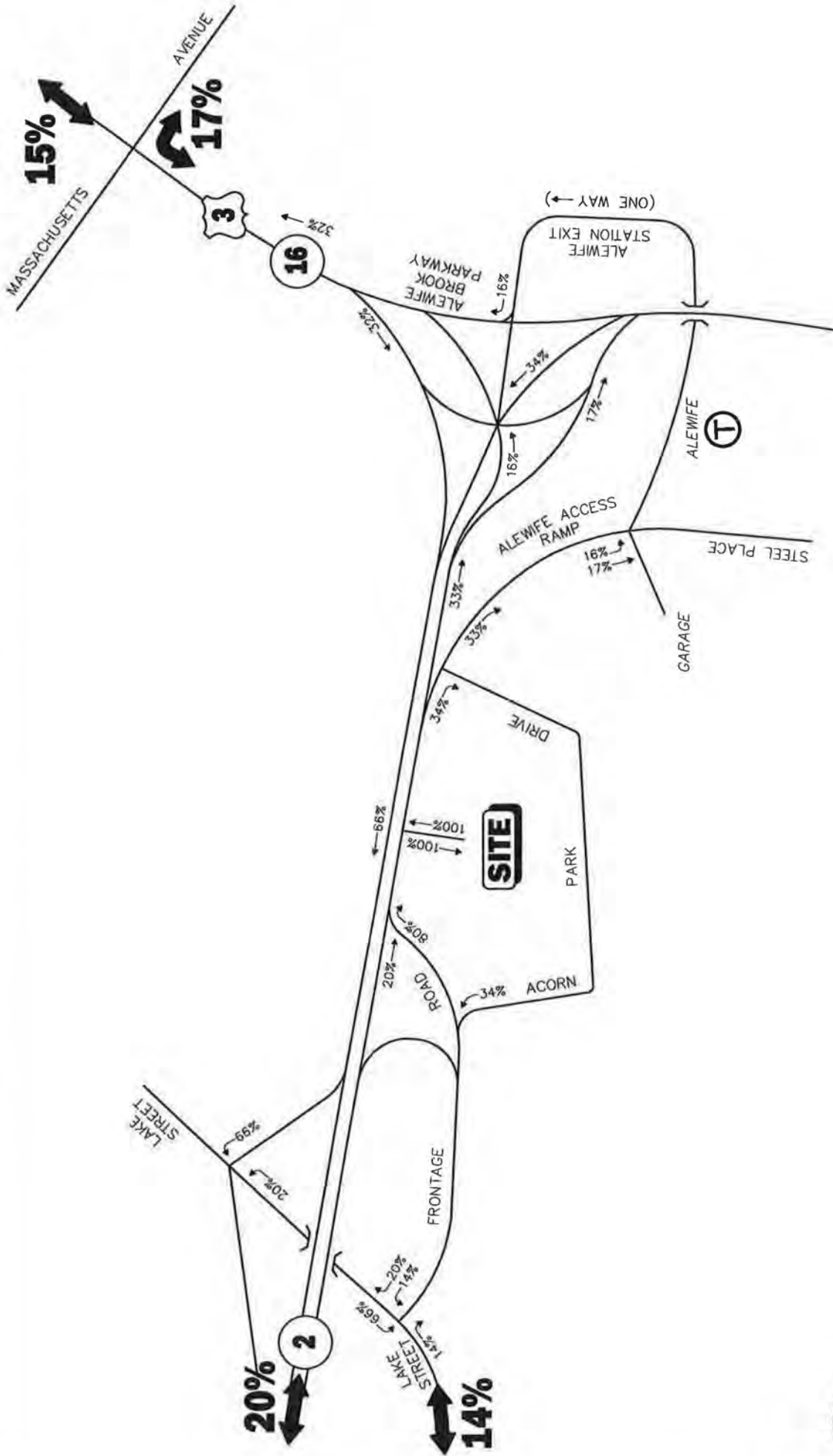
Table 11
TRIP DISTRIBUTION SUMMARY

<u>Roadway</u>	<u>Direction (To/From)</u>	<u>Percent To/From the Site</u>
Route 2	West	20
Lake Street	West	14
Alewife Brook Parkway	North	15
Massachusetts Avenue	East	17
Alewife Brook Parkway	South	<u>34</u>
TOTAL		100

The peak-hour site-generated traffic volumes were distributed on the roadway network according to the distribution shown in Table 11 and Figure 21. Figures 22 and 23 depict the proposed weekday morning and weekday evening site-generated traffic volume flow networks for 2016 conditions. Figures 24 and 25 depict the Net New Site-Generated weekday morning and weekday evening peak-hour traffic volume networks, which represent the increase in vehicle trips due to the Project after the vehicle trips from the existing uses are subtracted from the network.

It is reasonable to subtract these trips as the uses will be removed to construct the Project. The 2016 Build analysis is based on the impacts of the Project upon Existing traffic conditions, and the Project and the other uses cannot both be generating traffic simultaneously. The Gateway Motel trips could conceivably represent trips associated with the Discovery Park hotel proposed to open shortly, but traffic associated with that project is included in the 2021 Future condition analysis and is not part of the 2016 Build condition.

These Net New volumes were then added to the 2016 Existing condition traffic flow networks to derive the 2016 Build condition networks, shown as Figure 26 for the weekday morning peak hour and Figure 27 for the weekday evening peak hour. Figure 28 and Figure 29 represent the projected 2016 Build weekday morning and weekday evening peak-hour Bicycle Volumes. Figure 30 and Figure 31 represent the projected 2016 Build weekday morning and weekday evening peak-hour Pedestrian Volumes.



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Figure 21
Trip Distribution

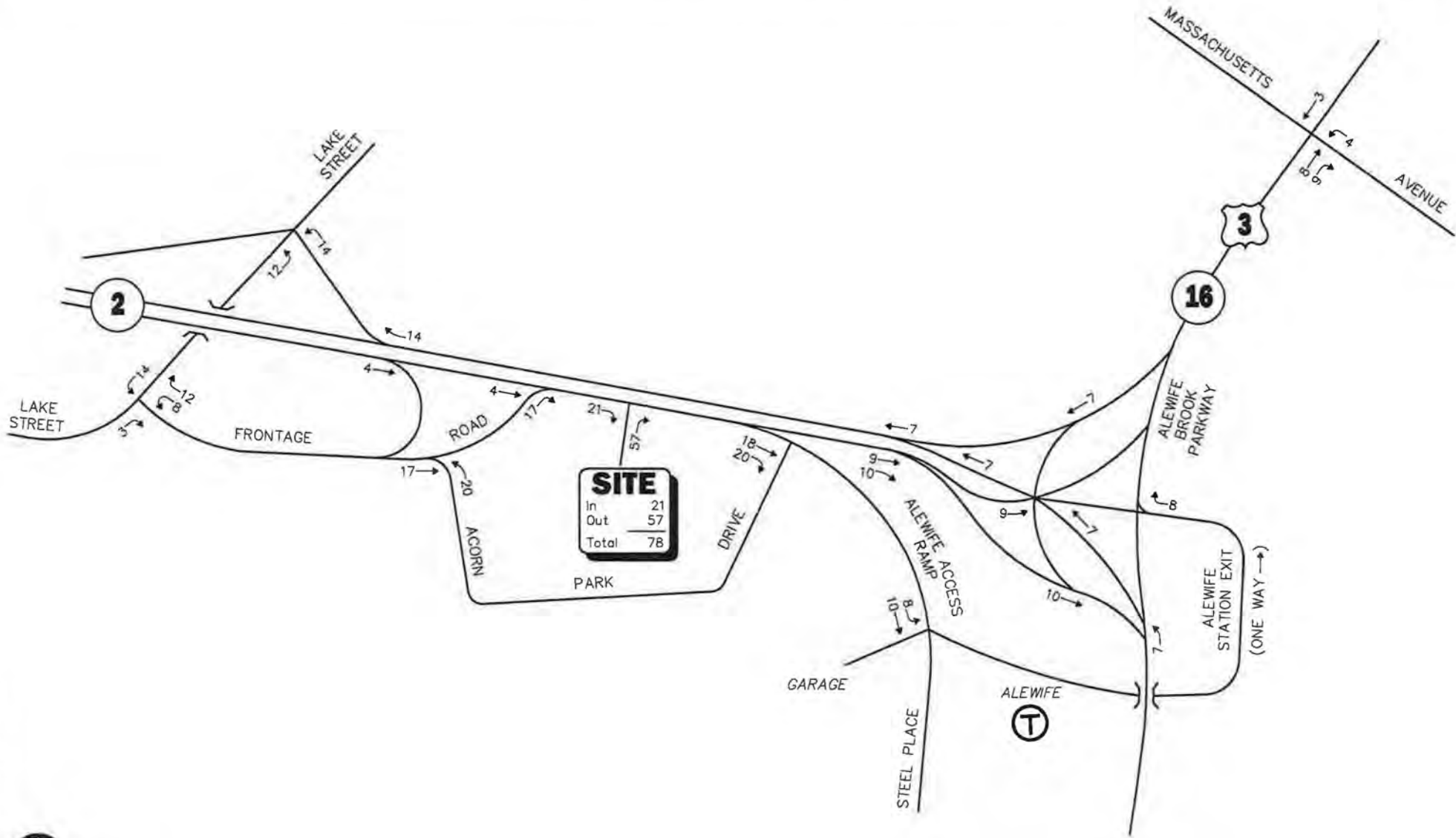


Figure 22

Proposed Site Generated
 Weekday Morning
 Peak Hour Traffic Volumes

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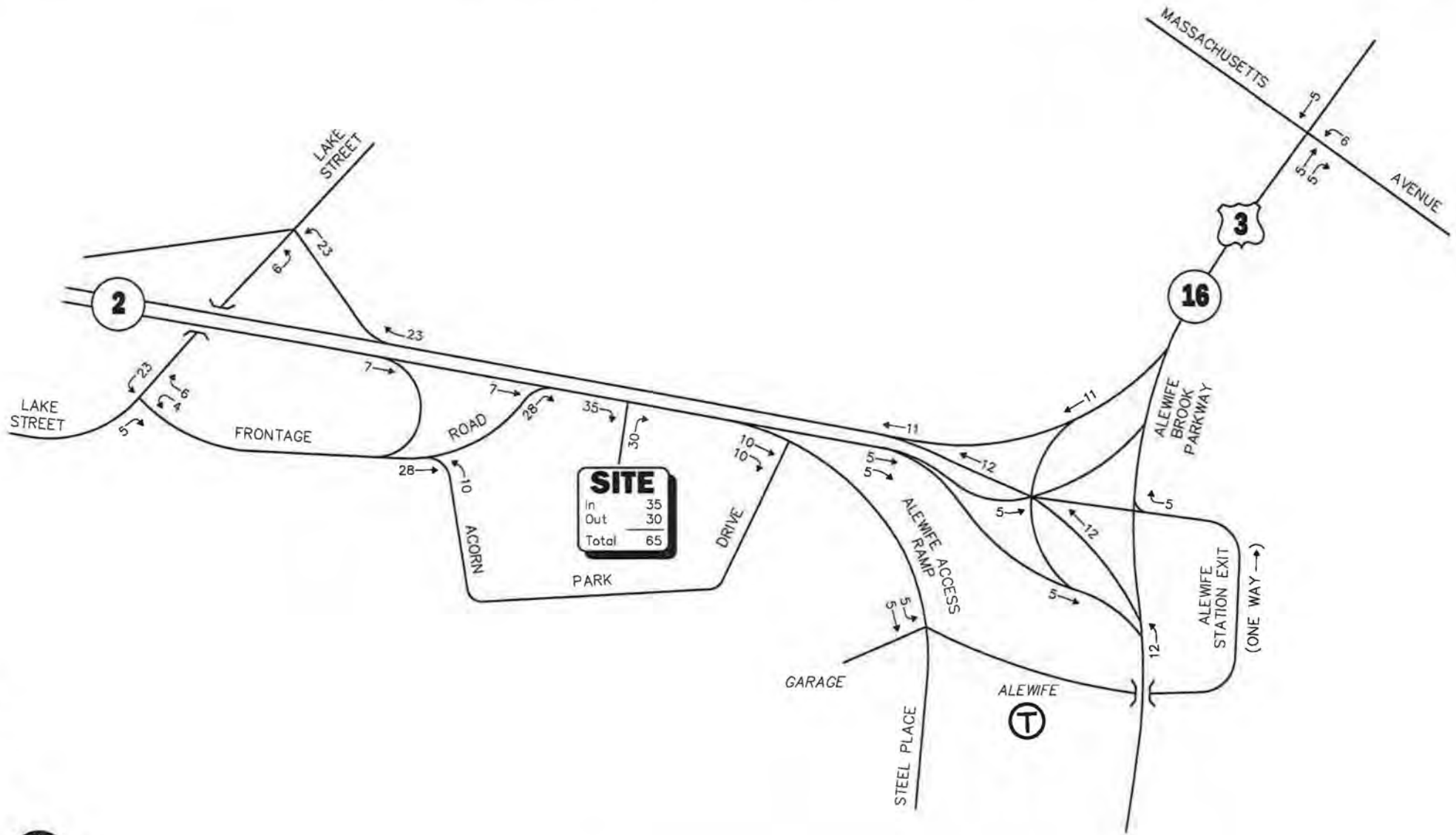


Figure 23

Proposed Site Generated
Weekday Evening
Peak Hour Traffic Volumes



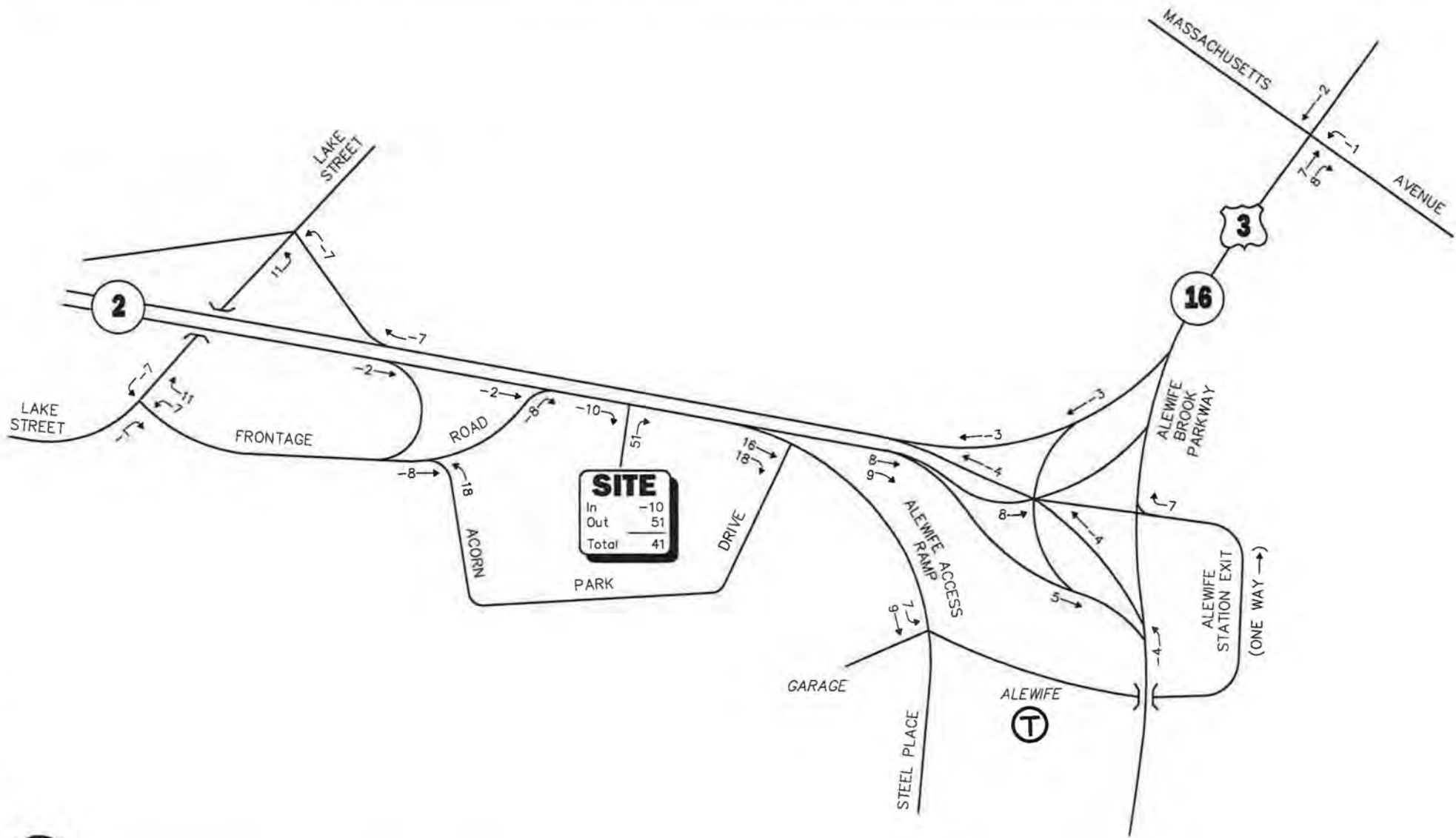


Figure 24
Net New Site Generated
Weekday Morning
Peak Hour Traffic Volumes

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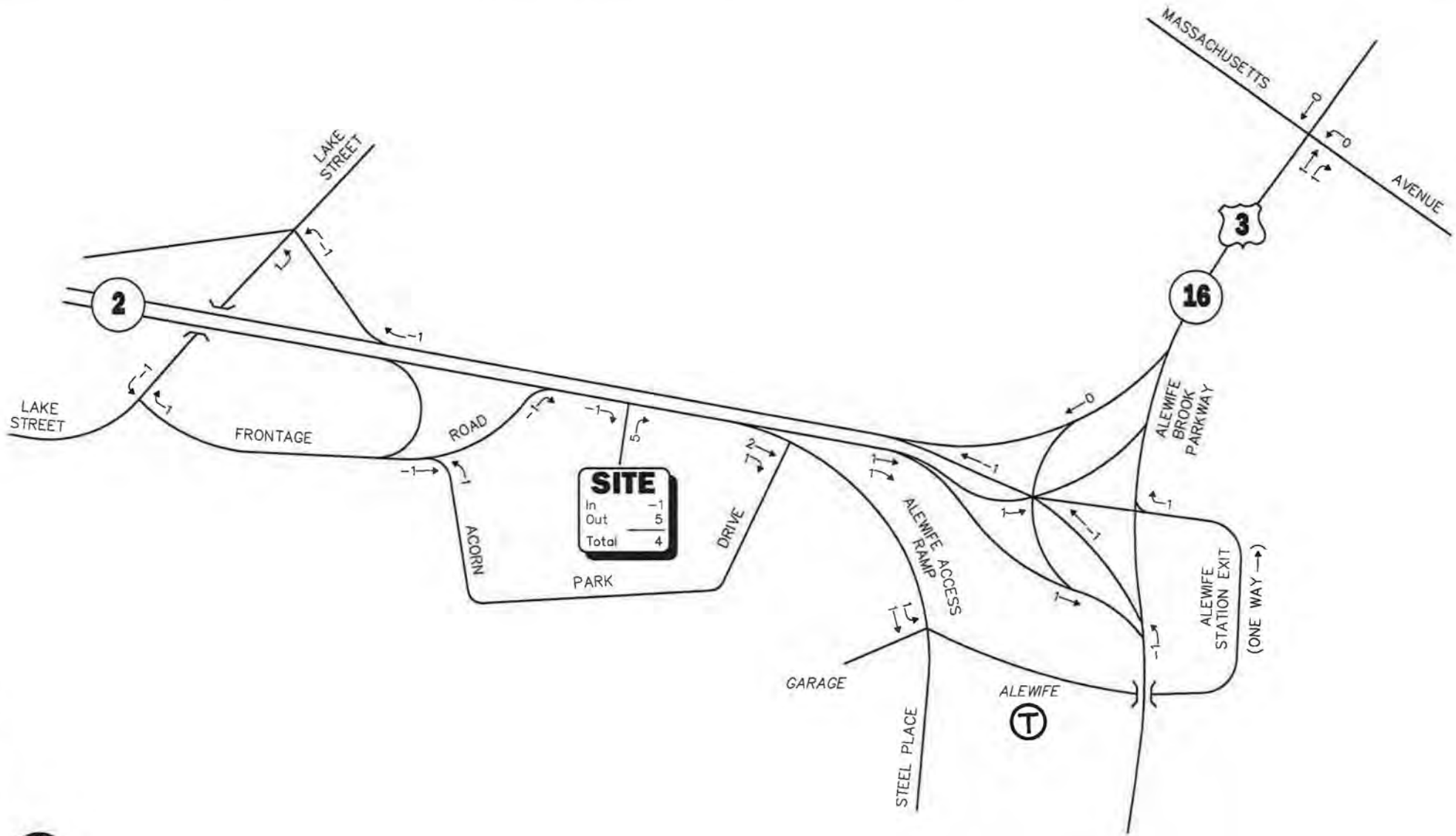


Figure 25

New Net Site Generated
 Weekday Evening
 Peak Hour Traffic Volumes

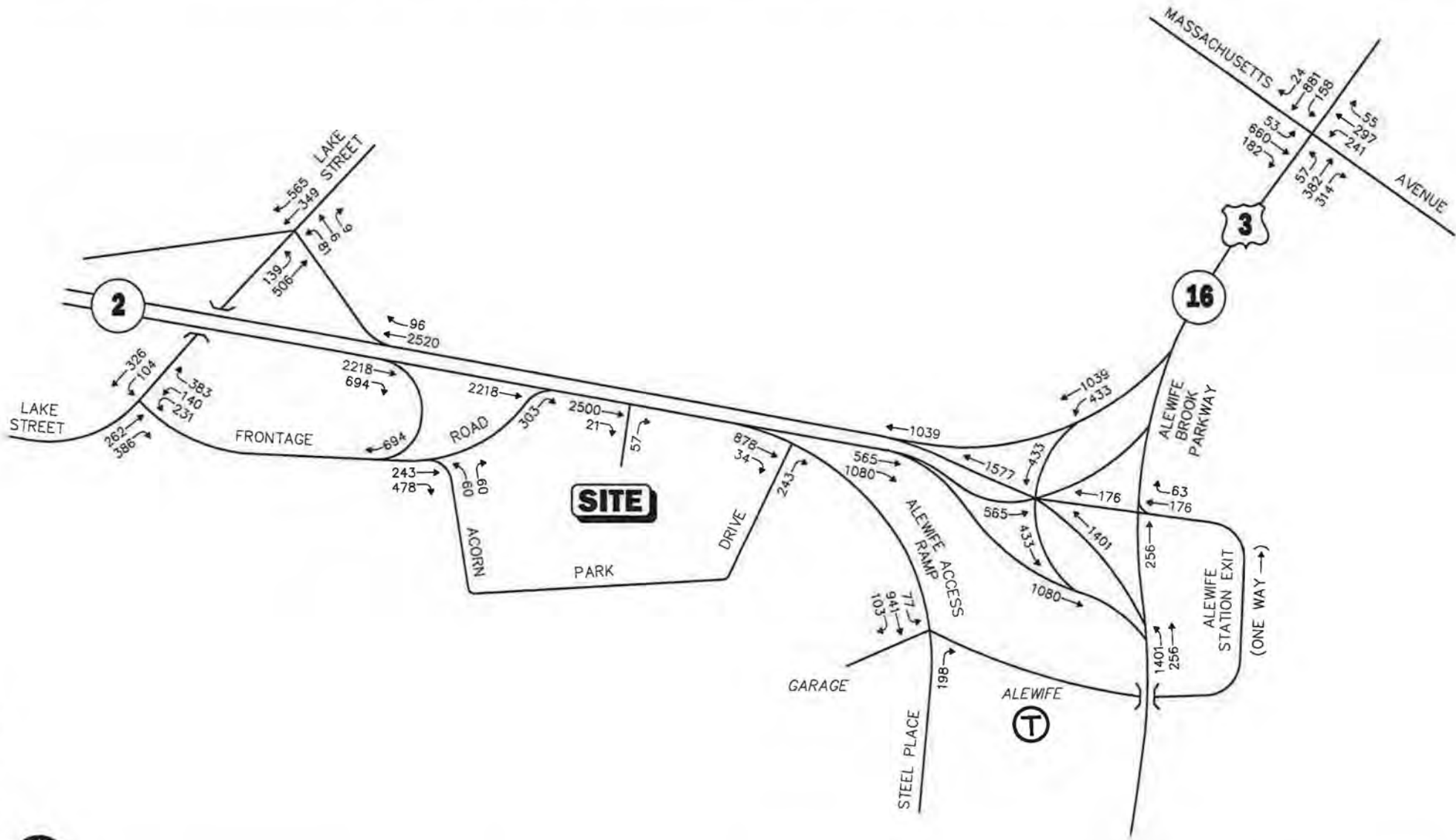
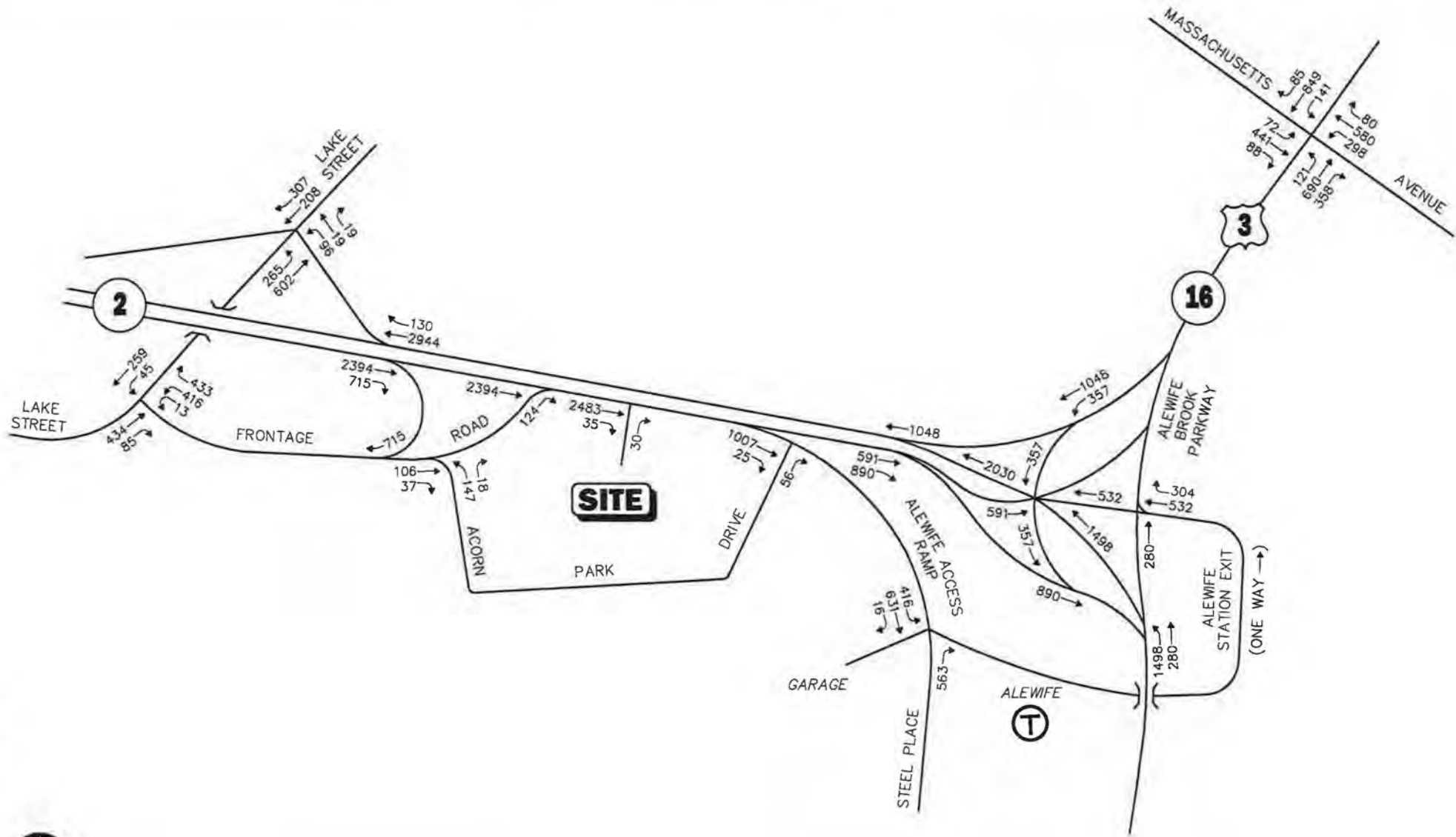


Figure 26
2016 Build
Weekday Morning
Peak Hour Traffic Volumes

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Figure 27
2016 Build
Weekday Evening
Peak Hour Traffic Volumes

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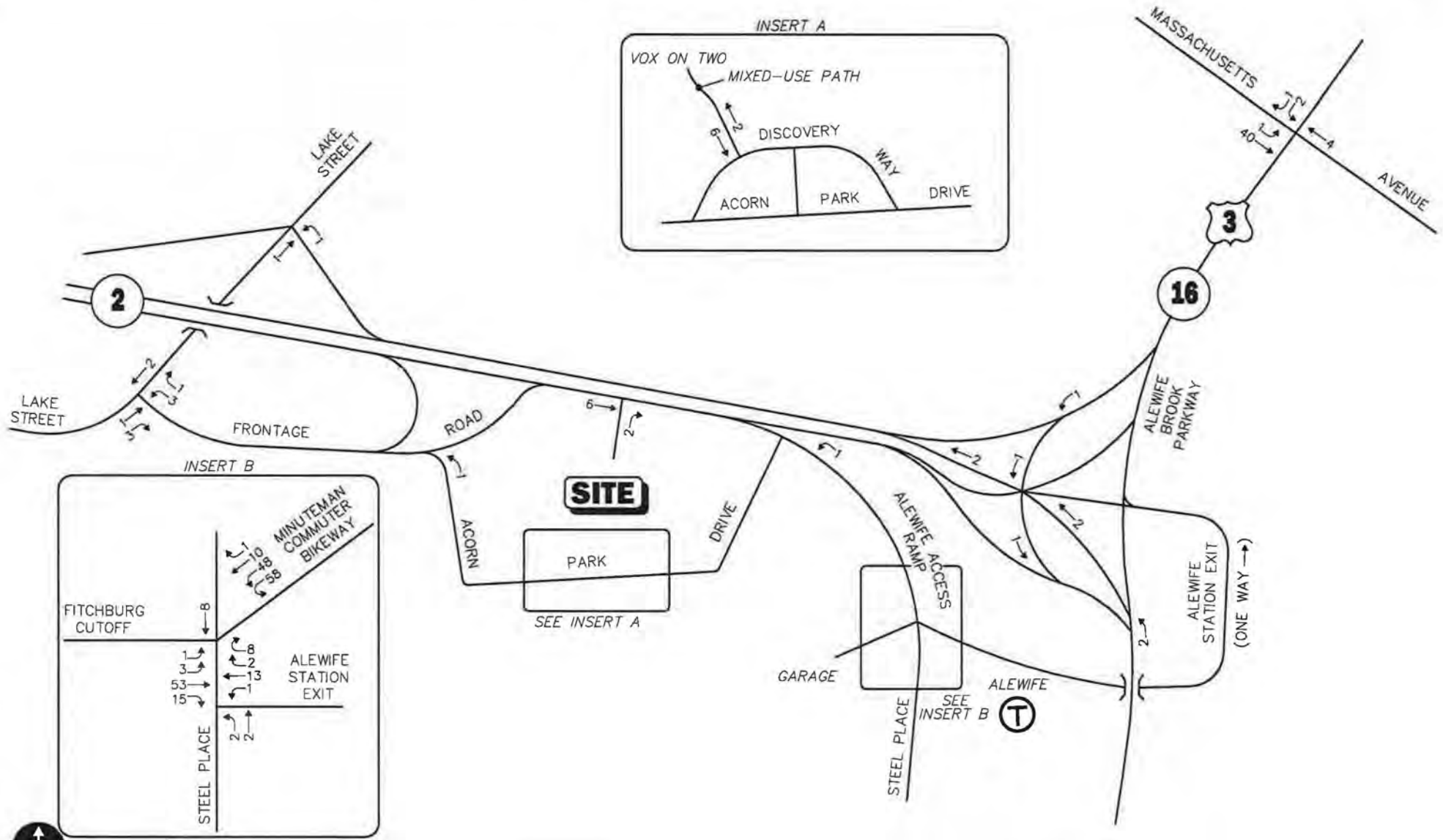


Figure 28

2016 Build
Weekday Morning
Peak Hour Bicycle Volumes

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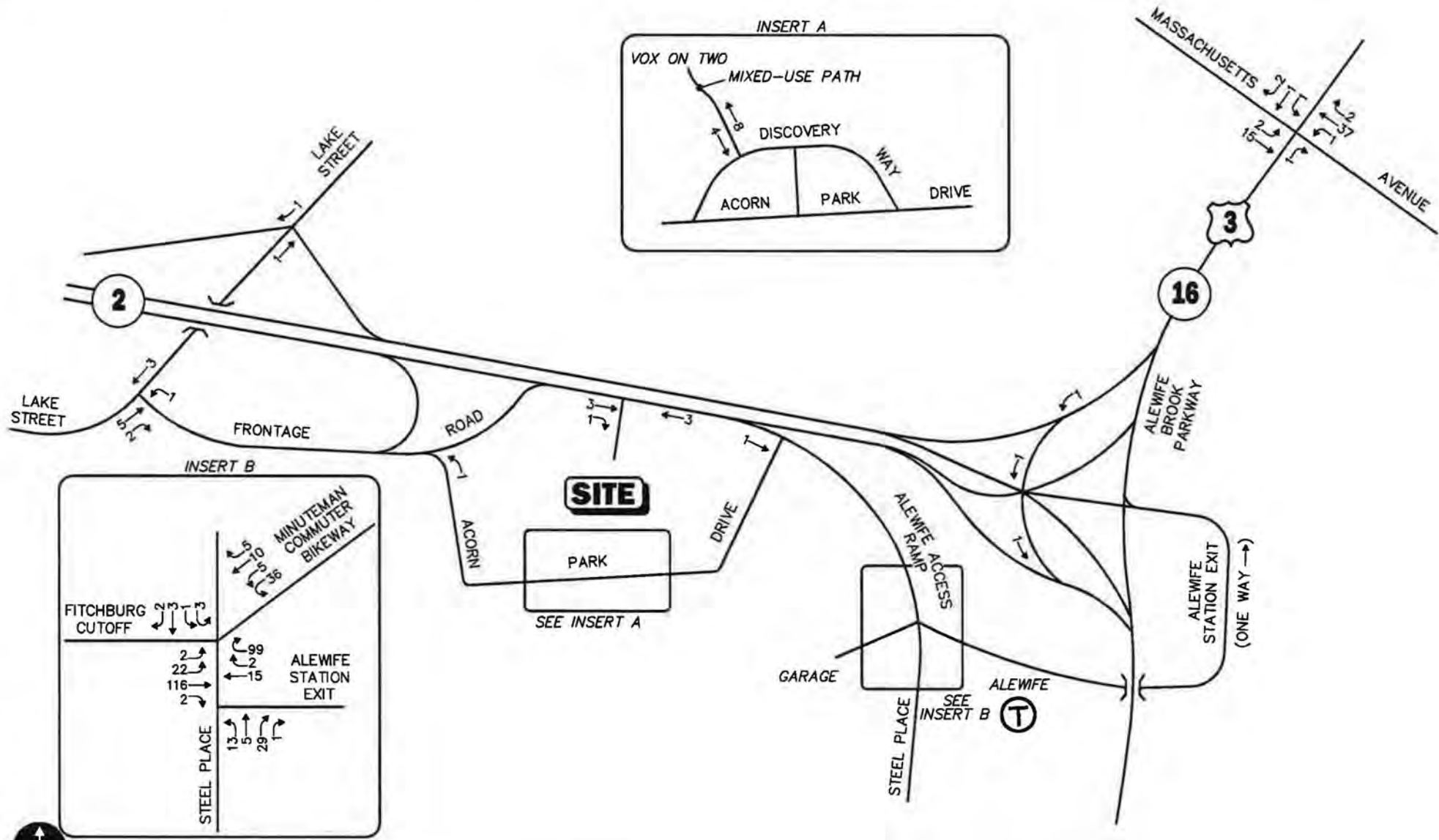
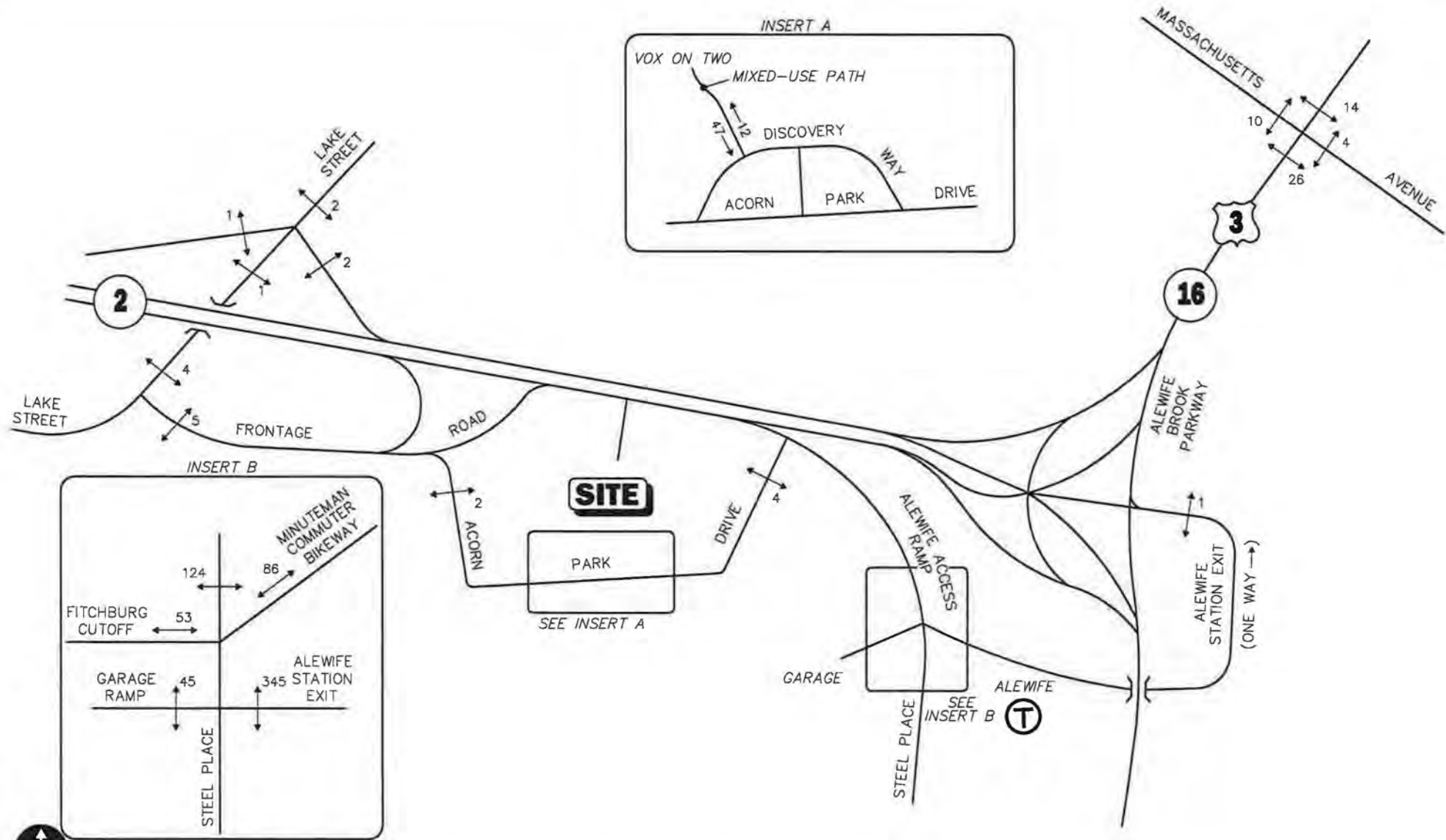


Figure 29
 2016 Build
 Weekday Evening
 Peak Hour Bicycle Volumes

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North Arrow
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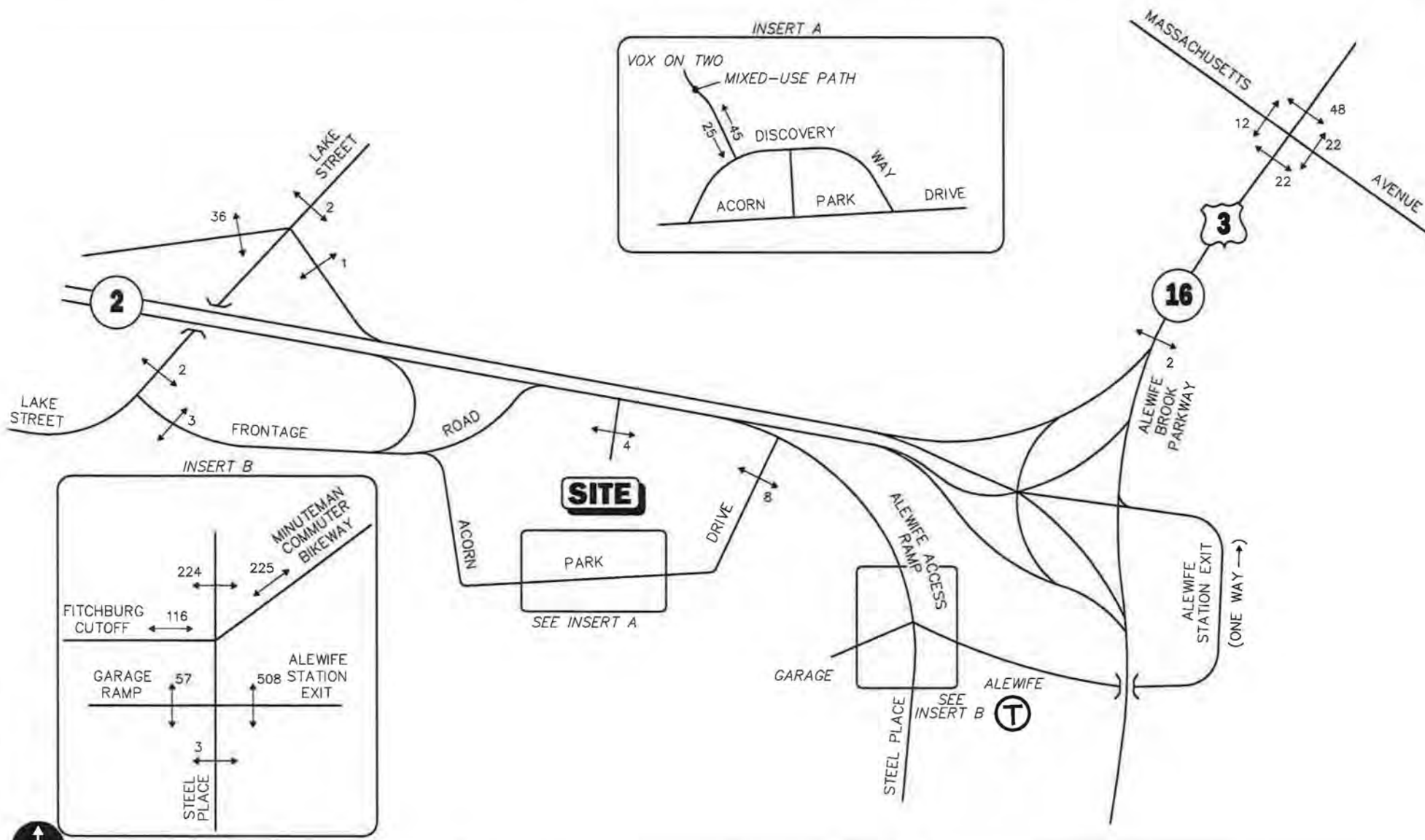
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Figure 30

2016 Build
Weekday Morning
Peak Hour Pedestrian Volumes



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Figure 31

2016 Build
Weekday Evening
Peak Hour Pedestrian Volumes

It should be noted that walking and bicycling residents will be directed to use the multi-use path located at the south of the site. It is expected that the majority of pedestrians would use this path rather than walk along the existing Route 2 sidewalk. Currently the multi-use path uses a straight section of pavement for its 160 foot length across the site; this is proposed to be revised through a curvilinear alignment with landscaping provided on site.

YEAR 2021 TRAFFIC VOLUMES

To determine overall traffic conditions in the area and consistent with City guidelines, a future 2021 condition was developed and analyzed. Traffic volumes on the roadway network at that time would include traffic related to specific development by others expected to be completed by 2021 and traffic associated with the proposed development. This analysis is presented below.

FUTURE CONDITIONS

Traffic growth on area roadways is a function of the expected land development in the immediate area as well as the surrounding region. Several methods can be used to estimate this growth. A procedure frequently employed estimates an annual percentage increase in traffic growth and applies that percentage to all traffic volumes under study. The drawback to such a procedure is that some turning volumes may actually grow at either a higher or a lower rate at particular intersections.

An alternative procedure identifies the location and type of planned development, estimates the traffic to be generated, and assigns it to the area roadway network. This produces a more realistic estimate of growth for local traffic. However, the drawback of this procedure is that the potential growth in population and development external to the study area would not be accounted for in the traffic projections.

To provide a conservative analysis framework, both procedures were used.

Specific Development by Others

The City of Cambridge and the Towns of Arlington and Belmont were consulted to identify specific developments within the area that may bring additional traffic to the study area by the 2021 design year. Based on the discussions, the following projects were identified:

- 130 Cambridgepark Drive – residential use
- 88 Cambridgepark Drive – residential use
- 605 Concord Ave – residential use
- Discovery Park Hotel and Buildings 400 and 500 – R&D Use
- 35 Cambridgepark Drive renovation and expansion project – R&D Use
- 87-95 Fawcett Street – residential use

- Belmont Uplands Project (Resident's at Acorn Park) – residential use
- Mugar site development – residential use

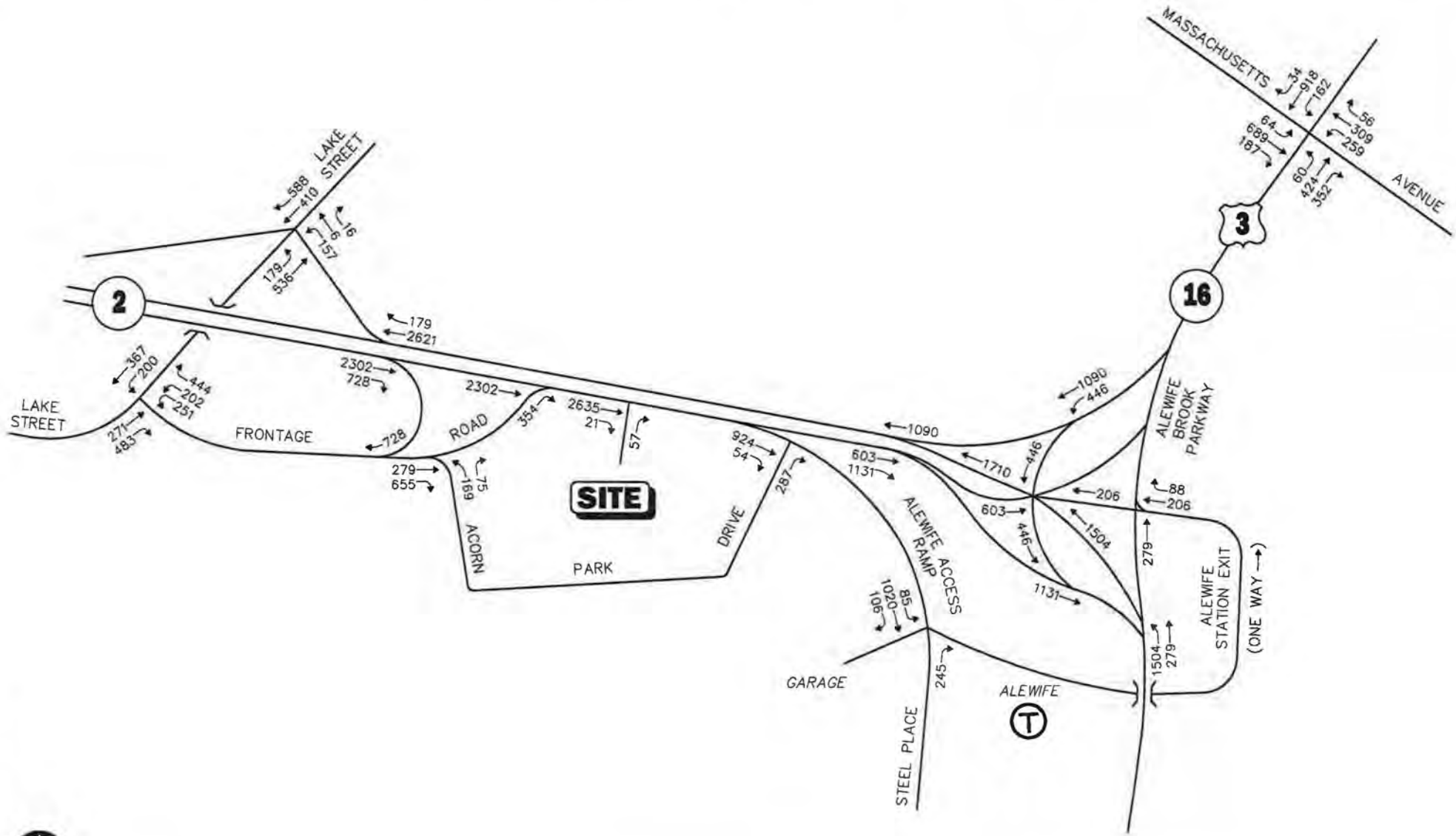
2021 Future Traffic Volumes

To account for general non-specific traffic growth, a compounded annual growth rate of 0.5 percent was applied to 2016 Existing condition traffic volumes, in accordance with City scoping determination. Trips generated by the background site-specific projects were then added along with the expected traffic from the Project to develop the 2021 Future condition traffic-volume networks. Figures 32 and 33 depict the 2021 Future weekday morning and evening peak-hour traffic-volume networks.

PLANNED ROADWAY IMPROVEMENTS

The City of Cambridge and Town of Belmont were requested to identify any proposed future roadway changes in the area that might have an effect on traffic conditions. Discussions indicated the following improvement is underway:

- The Route 2 junction with Alewife Brook Parkway (Routes 3 and 16) has been reconstructed to perform minor widening, eliminate a merge condition on Route 2 westbound, and to improve through capacity and vehicle queue storage at the junction. This location actually consists of four intersections, programmed to work in coordinated operation. MassDOT officials have indicated that the project is nearly complete, with some outstanding items related to signal coordination between this and other locations on Alewife Brook Parkway and some other signal equipment not yet accepted. The time frame for the completion of this work is spring 2017. The timing and phasing for this series of intersections was provided by MassDOT District 6 Traffic Operations and represents the latest information available.

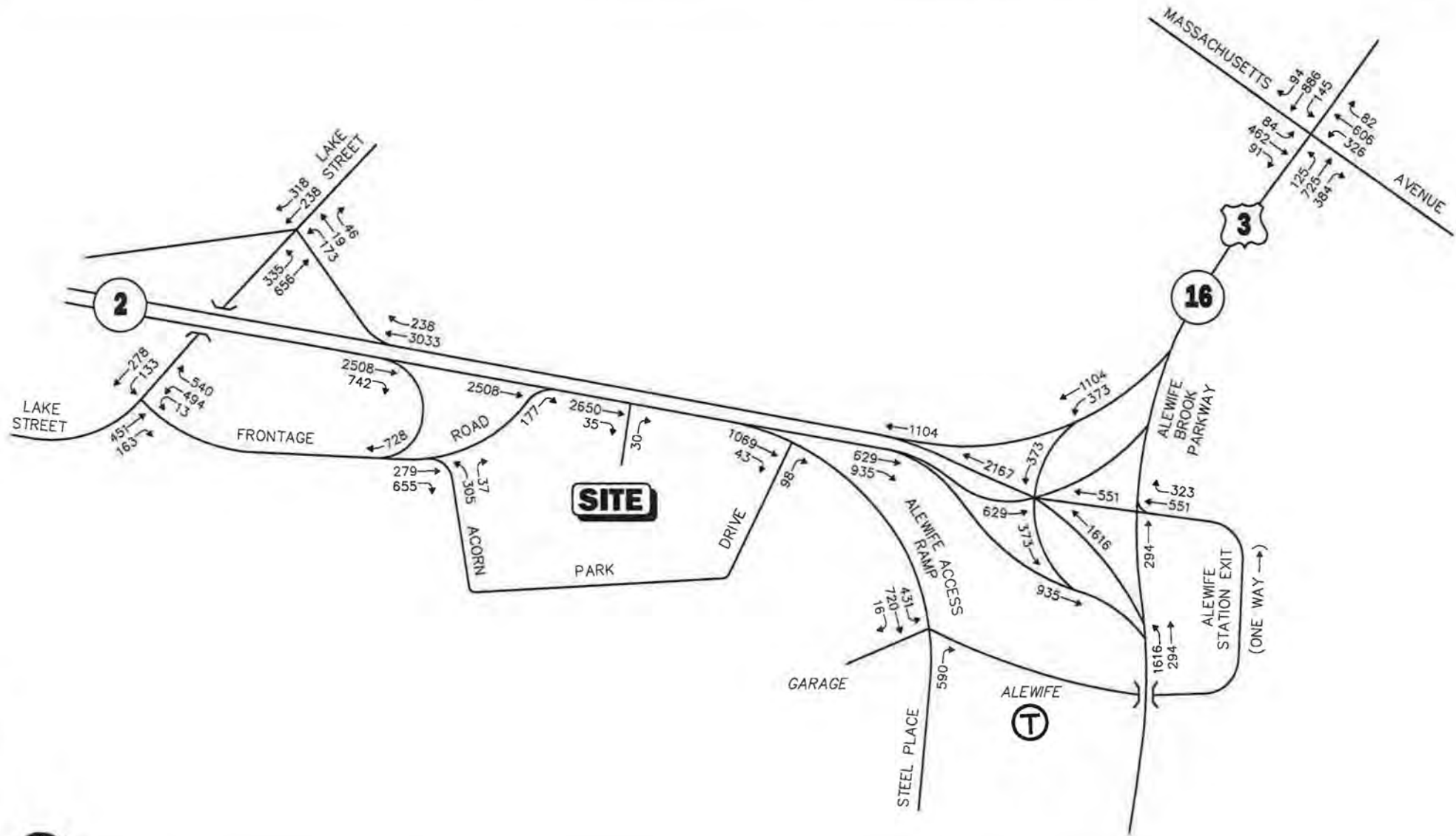


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Figure 32
2021 Future
Weekday Morning
Peak Hour Traffic Volumes

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Figure 33
2021 Future
Weekday Evening
Peak Hour Traffic Volumes

TRAFFIC OPERATIONS AND ARTICLE 19 SPECIAL PERMIT CRITERIA ANALYSIS

Measuring existing and future traffic volumes quantifies traffic flow within the study area. To assess quality of flow, roadway capacity analyses were conducted under 2016 Baseline, 2016 Build, and 2021 Future Build conditions. Capacity analyses provide an indication of how well the roadway facilities serve the traffic demands placed upon them.

The SPC consist of five measures as indicators to evaluate project impacts. The methodology for the analysis is from the Cambridge “Guidelines for Presenting Information to the Planning Board”, approved November 27, 2001, and revised in 2004. Referenced in the guidelines are capacity analysis procedures presented in the *Highway Capacity Manual (HCM)* and summarized in the Appendix. Based upon the SPC and study area intersections, there are a total of 145 indicators that were reviewed. The Project itself does not result in any exceedences. The site’s location adjacent to Route 2 results in one exceedence for bicycle access, while Existing conditions (without the project) analysis indicates 14 indicators that do not meet the City criteria for pedestrian operations. Overall, 130 indicators are satisfied by the project.

PROJECT VEHICLE – TRIP GENERATION-SPECIAL PERMIT CRITERIA 1

The SPC indicators for vehicle trip-generation are summarized in Table 12. As shown, the 3 indicators are satisfied for the project.

Table 12
SPECIAL PERMIT CRITERIA 1
PROJECT VEHICLE-TRIP GENERATION

<u>Time Period</u>	<u>Threshold</u>	<u>Project</u>	<u>Indicator</u>
Weekday Daily	2,000	840	Under
Weekday Morning Peak Hour	240	78	Under
Weekday Evening Peak Hour	240	65	Under

CAPACITY ANALYSIS RESULTS – SPECIAL PERMIT CRITERIA 2

Level-of-service analyses were conducted for the 2016 Existing, 2016 Build, and 2021 Build conditions, in accordance with City direction. Analysis for the signalized intersections is shown in Table 13 and Table 14 for signalized and unsignalized locations, respectively. The analysis worksheets are contained in the Appendix.

Signalized Intersections

As shown in Table 13, all 16 indicators are satisfied for the 2016 Build condition

Unsignalized Intersections

As shown in Table 14, all eight indicators are satisfied for the 2016 Build condition.

The Route 2 and Site Drive location was analyzed with the use of counts on Route 2 that identified the overall volume split between the three lanes passing by the site. During the weekday morning peak hour, approximately 39 percent of the overall Route 2 volume was contained in the outside lane while during the weekday evening peak hour, approximately 30 percent of the volume was present in this lane. Therefore, the analysis reviewed the delays of vehicles exiting the driveway due to vehicles in this outside lane on Route 2.

Table 13
SPECIAL PERMIT CRITERIA 2
VEHICLE LEVEL-OF-SERVICE SUMMARY - SIGNALIZED INTERSECTIONS

Signalized Intersection/Peak Hour/Movement	2016 Existing			2016 Build			SPC 2 Indicator ^d	2021 Future		
	V/C ^a	Delay ^b	LOS ^c	V/C	Delay	LOS		V/C	Delay	LOS
Route 2 at Alewife Brook Parkway: Signal 1										
<i>Weekday Morning Peak Hour:</i>										
Route 2 EB LT	1.00	88.7	F	1.01	91.9	F	--	1.08	109.2	F
Alewife Station Exit WB TH	0.28	17.7	B	0.28	17.7	B	--	0.33	18.0	B
Alewife Brook Parkway NB LT	1.14	108.1	F	1.14	106.9	F	--	1.22	140.8	F
Alewife Brook Parkway SB LT	0.55	44.3	D	0.55	44.3	D	--	0.56	44.7	D
Overall	--	86.4	F	--	86.4	F	No (0.2)	--	108.3	F
<i>Weekday Evening Peak Hour:</i>										
Route 2 EB LT	1.02	84.2	F	1.02	84.6	F	--	1.08	102.8	F
Alewife Station Exit WB TH	0.67	18.5	B	0.67	18.5	B	--	0.70	19.0	B
Alewife Brook Parkway NB LT	1.04	70.7	E	1.04	70.4	E	--	1.13	93.4	F
Alewife Brook Parkway SB LT	0.66	47.9	D	0.66	47.9	D	--	0.69	49.0	D
Overall	--	60.9	E	--	60.9	E	No	--	76.5	E
Route 2 at Alewife Brook Parkway: Signal 2										
<i>Weekday Morning Peak Hour:</i>										
Alewife Station Exit WB TH	0.19	9.2	A	0.19	9.2	A	--	0.22	9.6	A
Alewife Station Exit WB RT	0.11	21.1	C	0.12	21.3	C	--	0.17	22.0	C
Alewife Brook Parkway NB TH	0.32	40.0	D	0.32	40.0	D	--	0.35	40.5	D
Overall	--	26.0	C	--	25.9	C	No	--	25.8	C
<i>Weekday Evening Peak Hour:</i>										
Alewife Station Exit WB TH	0.47	8.5	A	0.47	8.5	A	--	0.49	8.8	A
Alewife Station Exit WB RT	0.45	19.8	B	0.46	19.8	B	--	0.48	20.4	C
Alewife Brook Parkway NB TH	0.48	43.5	D	0.48	43.5	D	--	0.50	43.9	D
Overall	--	19.9	B	--	19.9	B	No	--	20.5	C

See notes at end of table.

Table 13 (Continued)
SPECIAL PERMIT CRITERIA 2
VEHICLE LEVEL-OF-SERVICE SUMMARY - SIGNALIZED INTERSECTIONS

Signalized Intersection/Peak Hour/Movement	2016 Existing			2016 Build			SPC 2 Indicator ^d	2021 Future		
	V/C ^a	Delay ^b	LOS ^c	V/C	Delay	LOS		V/C	Delay	LOS
Route 2 at Alewife Brook Parkway: Signal 3										
<i>Weekday Morning Peak Hour:</i>										
Route 2 EB RT	0.63	14.6	B	0.63	14.7	B	--	0.66	15.4	B
Alewife Brook Parkway SB LT	0.49	5.4	A	0.49	5.4	A	--	0.51	5.5	A
Overall	--	12.0	B	--	12.1	B	No	--	12.6	B
<i>Weekday Evening Peak Hour:</i>										
Route 2 EB RT	0.47	7.1	A	0.47	7.1	A	--	0.49	7.3	A
Alewife Brook Parkway SB LT	0.59	10.4	B	0.59	10.4	B	--	0.62	11.5	B
Overall	--	8.0	A	--	8.0	A	No	--	8.5	A
Route 2 at Alewife Brook Parkway: Signal 4										
<i>Weekday Morning Peak Hour:</i>										
Alewife Station Exit WB TH/Alewife Brook Parkway NB LT	0.75	54.0	D	0.75	54.0	D	--	0.81	54.4	D
Alewife Brook Parkway SB RT	0.86	40.1	D	0.86	39.8	D	--	0.91	44.1	D
Overall	--	48.5	D	--	48.4	D	No	--	50.4	D
<i>Weekday Evening Peak Hour:</i>										
Alewife Station Exit WB TH/Alewife Brook Parkway NB LT	0.80	56.0	E	0.80	56.0	E	--	0.85	56.5	E
Alewife Brook Parkway SB RT	1.03	70.6	E	1.03	70.6	E	--	1.09	89.0	F
Overall	--	61.1	E	--	61.1	E	No	--	67.7	E

See notes at end of table.

Table 13 (Continued)
SPECIAL PERMIT CRITERIA 2
VEHICLE LEVEL-OF-SERVICE SUMMARY - SIGNALIZED INTERSECTIONS

Signalized Intersection/Peak Hour/Movement	2016 Existing			2016 Build			SPC 2 Indicator ^d	2021 Future		
	V/C ^a	Delay ^b	LOS ^c	V/C	Delay	LOS		V/C	Delay	LOS
<i>Alewife Brook Parkway at Massachusetts Avenue</i>										
<i>Weekday Morning Peak Hour:</i>										
Massachusetts Avenue EB LT	0.40	57.9	E	0.40	57.9	E	--	0.48	61.1	E
Massachusetts Avenue EB TH/RT	0.98	65.8	E	0.98	65.8	E	--	1.02	75.1	E
Massachusetts Avenue WB LT	1.06	115.6	F	1.05	114.6	F	--	1.13	138.3	F
Massachusetts Avenue WB TH/RT	0.34	30.6	C	0.34	30.6	C	--	0.35	30.9	C
Alewife Brook Parkway NB LT	0.40	55.6	E	0.40	55.6	E	--	0.42	56.3	E
Alewife Brook Parkway NB TH/RT	0.74	40.7	D	0.76	41.4	D	--	0.84	46.2	D
Alewife Brook Parkway SB LT	0.87	90.3	F	0.87	90.3	F	--	0.89	92.8	F
Alewife Brook Parkway SB TH/RT	0.79	41.1	D	0.79	41.0	D	--	0.83	43.1	D
Overall	--	54.7	D	--	54.7	D	No	--	60.5	E
<i>Weekday Evening Peak Hour:</i>										
Massachusetts Avenue EB LT	0.59	68.6	E	0.59	68.6	E	--	0.65	72.2	E
Massachusetts Avenue EB TH/RT	0.76	48.6	D	0.76	48.6	D	--	0.80	51.3	D
Massachusetts Avenue WB LT	0.89	66.5	E	0.89	66.5	E	--	0.97	81.5	F
Massachusetts Avenue WB TH/RT	0.69	40.5	D	0.69	40.5	D	--	0.77	44.6	D
Alewife Brook Parkway NB LT	0.72	72.7	E	0.72	72.7	E	--	0.75	74.9	E
Alewife Brook Parkway NB TH/RT	0.92	48.0	D	0.92	48.2	D	--	0.99	60.3	E
Alewife Brook Parkway SB LT	0.81	80.9	F	0.81	80.9	F	--	0.83	83.8	F
Alewife Brook Parkway SB TH/RT	0.79	38.4	D	0.79	38.4	D	--	0.84	41.4	D
Overall	--	48.3	D	--	48.3	D	No	--	55.0	E

See notes at end of table.

Table 13 (Continued)
SPECIAL PERMIT CRITERIA 2
VEHICLE LEVEL-OF-SERVICE SUMMARY - SIGNALIZED INTERSECTIONS

Signalized Intersection/Peak Hour/Movement	2016 Existing			2016 Build			SPC 2 Indicator ^d	2021 Future		
	V/C ^a	Delay ^b	LOS ^c	V/C	Delay	LOS		V/C	Delay	LOS
Frontage Road at Lake Street										
<i>Weekday Morning Peak Hour:</i>										
Lake Street EB TH	0.55	24.4	C	0.55	24.4	C	--	0.57	27.1	C
Lake Street EB RT	0.27	0.4	A	0.27	0.4	A	--	0.34	0.6	A
Lake Street WB LT	0.17	22.1	C	0.16	22.1	C	--	0.28	24.1	C
Lake Street WB TH	0.35	7.7	A	0.35	7.7	A	--	0.39	8.8	A
Frontage Road NB LT	0.54	26.6	C	0.55	26.7	C	--	0.63	29.2	C
Frontage Road NB RT	0.26	0.4	A	0.26	0.4	A	--	0.31	0.5	A
Overall	--	11.7	B	0.55	11.7	B	No	--	13.2	B
<i>Weekday Evening Peak Hour:</i>										
Lake Street EB TH	0.67	24.9	C	0.67	24.9	C	--	0.69	27.7	C
Lake Street EB RT	0.06	0.1	A	0.06	0.1	A	--	0.12	0.2	A
Lake Street WB LT	0.09	29.3	C	0.09	29.4	C	--	0.26	32.4	C
Lake Street WB TH	0.26	7.3	A	0.26	7.3	A	--	0.28	8.1	A
Frontage Road NB LT	0.59	29.9	C	0.59	29.9	C	--	0.65	33.2	C
Frontage Road NB RT	0.28	0.4	A	0.28	0.4	A	--	0.35	0.6	A
Overall	--	16.0	B	--	16.0	B	No	--	17.5	B

See notes at end of table.

Table 13 (Continued)
SPECIAL PERMIT CRITERIA 2
VEHICLE LEVEL-OF-SERVICE SUMMARY - SIGNALIZED INTERSECTIONS

Signalized Intersection/Peak Hour/Movement	2016 Existing			2016 Build			SPC 2 Indicator ^d	2021 Future		
	V/C ^a	Delay ^b	LOS ^c	V/C	Delay	LOS		V/C	Delay	LOS
Lake Street at Route 2 WB Ramps										
<i>Weekday Morning Peak Hour:</i>										
Lake Street EB LT	0.38	32.6	C	0.42	33.1	C	--	0.56	38.3	D
Lake Street EB TH	0.39	5.3	A	0.39	5.2	A	--	0.45	7.2	A
Lake Street WB TH/RT	0.57	9.2	A	0.57	9.1	A	--	0.65	13.2	B
Route 2 WB off Ramp NB LT	0.27	38.3	D	0.25	38.0	D	--	0.46	42.5	D
Route 2 WB off Ramp NB LT/TH	0.28	38.6	D	0.26	38.5	D	--	0.46	42.8	D
Route 2 WB off Ramp NB RT	0.01	0.0	A	0.01	0.0	A	--	0.01	0.0	A
Overall	--	11.6	B	--	11.6	B	No	--	16.6	B
<i>Weekday Evening Peak Hour:</i>										
Lake Street EB LT	0.54	29.2	C	0.55	29.1	C	--	0.72	37.9	D
Lake Street EB TH	0.47	6.2	A	0.47	6.2	A	--	0.57	8.6	A
Lake Street WB TH/RT	0.43	8.8	A	0.43	8.8	A	--	0.47	9.9	A
Route 2 WB off Ramp NB LT	0.25	36.3	D	0.25	36.4	D	--	0.42	40.3	D
Route 2 WB off Ramp NB LT/TH	0.29	37.7	D	0.29	37.7	D	--	0.46	42.1	D
Route 2 WB off Ramp NB RT	0.01	0.0	A	0.01	0.0	A	--	0.03	0.0	A
Overall	--	13.3	B	--	13.3	B	No	--	17.7	B

See notes at end of table.

Table 13 (Continued)
SPECIAL PERMIT CRITERIA 2
VEHICLE LEVEL-OF-SERVICE SUMMARY - SIGNALIZED INTERSECTIONS

Signalized Intersection/Peak Hour/Movement	2016 Existing			2016 Build			SPC 2 Indicator ^d	2021 Future		
	V/C ^a	Delay ^b	LOS ^c	V/C	Delay	LOS		V/C	Delay	LOS
Frontage Road at Acorn Park Drive										
<i>Weekday Morning Peak Hour:</i>										
Frontage Road EB TH/RT	0.34	1.7	A	0.34	2.0	A	--	0.48	3.4	A
Acorn Park Drive NB LT	0.43	33.9	C	0.53	35.5	D	--	0.86	47.8	D
Acorn Park Drive NB RT	0.42	9.6	A	0.39	8.5	A	--	0.32	5.5	A
Overall	--	5.8	A	--	7.1	A	No	--	14.5	B
<i>Weekday Evening Peak Hour:</i>										
Frontage Road EB TH/RT	0.07	4.3	A	0.07	4.3	A	--	0.17	3.9	A
Acorn Park Drive NB LT	0.67	37.6	D	0.67	37.6	D	--	0.96	62.2	E
Acorn Park Drive NB RT	0.09	9.1	A	0.09	9.1	A	--	0.12	7.1	A
Overall	--	23.7	C	--	23.9	C	No	--	37.3	D

^aVolume to capacity ratio.

^bAverage control delay per vehicle (in seconds) for the critical movements.

^cLevel of service.

^dSpecial Permit Criteria 2 – Level of Service. Percentage volume increases shown in parentheses.

Table 14
SPECIAL PERMIT CRITERIA 2
VEHICLE LEVEL-OF-SERVICE SUMMARY - UNSIGNALIZED INTERSECTIONS

Unsignalized Intersection/ Critical Movement/Peak Hour	2016 Existing			2016 Build			SPC 2 Indicator ^d	2021 Future		
	Demand ^a	Delay ^b	LOS ^c	Demand	Delay	LOS		Demand	Delay	LOS
Frontage Road at Route 2 EB^e										
<i>Right turn movement from NB Frontage Road:</i>										
Weekday Morning	311	25.6	D	303	24.5	C	No	354	35.3	E
Weekday Evening	125	12.7	B	124	12.7	B	No	177	14.1	B
Acorn Park Drive at Alewife Access Ramp										
<i>Right turn movements from Acorn Park Drive:</i>										
Weekday Morning	243	81.3	F	243	92.5	F	No(3.0)	287	191.7	F
Weekday Evening	56	22.3	C	56	22.4	C	No	98	31.6	D
Alewife Access Ramp at Steel Place										
<i>Right turn movement from Steel Place</i>										
Weekday Morning	198	6.1	A	198	6.2	A	No	245	7.0	A
Weekday Evening	563	45.5	E	563	45.8	E	No (0.1)	590	61.1	F
Site Drive at Route 2 EB										
<i>Right turn movements from Site Drive:</i>										
Weekday Morning	6	18.8	C	57	23.4	C	No	57	25.5	D
Weekday Evening	25	15.6	C	30	15.8	C	No	30	16.7	C

^aDemand (in vehicles per hour) for the critical movements.

^bAverage control delay per vehicle (in seconds) for the critical movements.

^cLevel of service.

^dSpecial Permit Criteria 2 – Level of Service. Percentage volume increases shown in parentheses.

Under 2016 Existing conditions during the weekday morning peak hour the intersection operates with 81.3 seconds of delay per vehicle. This indicates the intersection is near capacity. With the addition of 34 vehicles in the 2016 Build condition the intersection shows delays of 92.5 seconds per vehicle indicating that just a small increase in volume will have a large increase in delay. The delay increase per each additional vehicle added will get larger for each additional vehicle. For example adding one car may increase the delay per vehicle by one second but when you add another vehicle it may add 1.1 second per vehicle of delay and so on. This is more a function of the delay calculations exceeding the practical limits of their range, i.e. more accurate at lower levels of delay, less accurate at higher levels of delay. We would therefore expect that the 110 vehicle increase from the 2016 Build to the 2021 Future condition would have a major impact on the delay results due to the intersection already being near capacity.

At the intersection of the Alewife Access Ramp and Steel Place there is no traffic control for vehicles present. There are signs to yield for pedestrians and bicyclists but no yield or stop signs for vehicles on either of the approaches. Observations indicated that in the absence of pedestrians or bicyclists, the southbound left-turn movement from Route 2 typically did not yield to northbound right-turn movements. The southbound left-turn movement reaches the Alewife Station exit ramp earlier than the northbound right-turn movement, which then yields the priority of movement. In this case, the northbound right-turn movement is the critical movement.

Figure 34 and Figure 35 depict the vehicle LOS summaries in a graphical map format for the weekday morning and weekday evening peak hours, respectively. Figure 36 and Figure 37 provide graphical maps of vehicle delay changes at the study area intersections for the weekday morning and weekday evening peak hours, respectively. These delay change maps depict the change in delay from Existing to Build and from Existing to Future conditions. This information is also summarized below in Table 15 and Table 16 for the weekday morning and weekday evening peak hours, respectively.

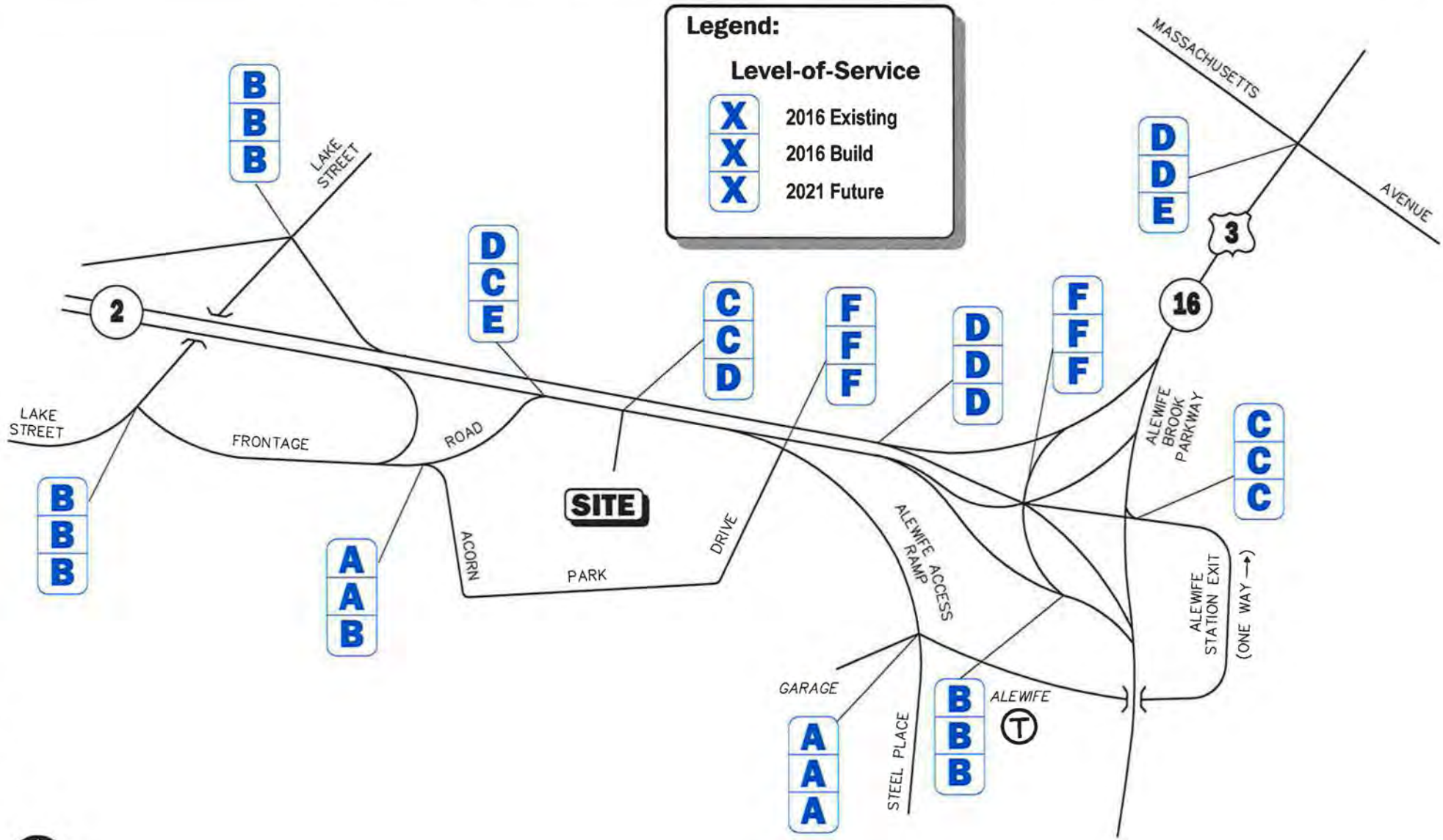
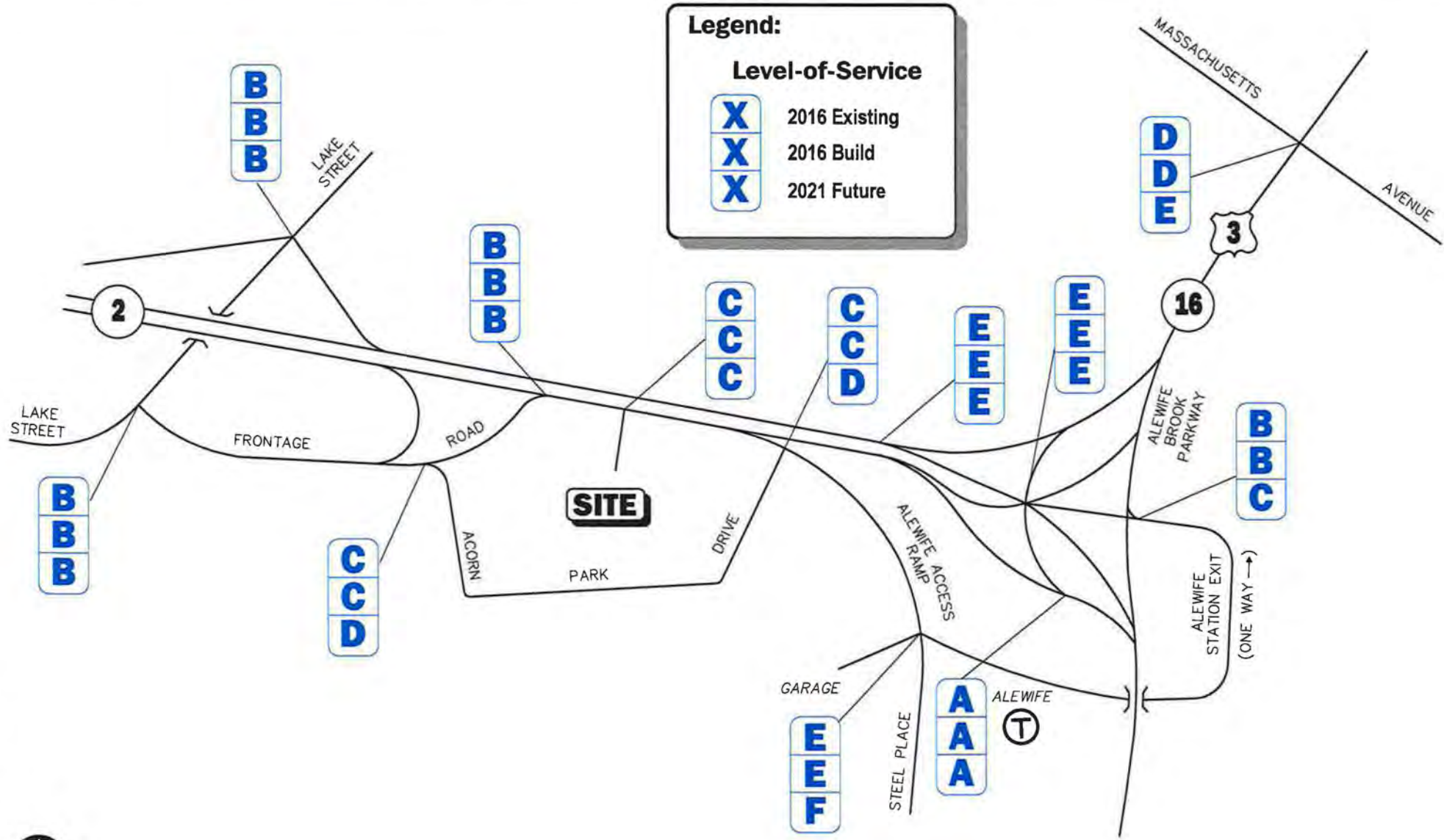


Figure 34

Vehicle LOS Map
Weekday Morning
Peak Hour

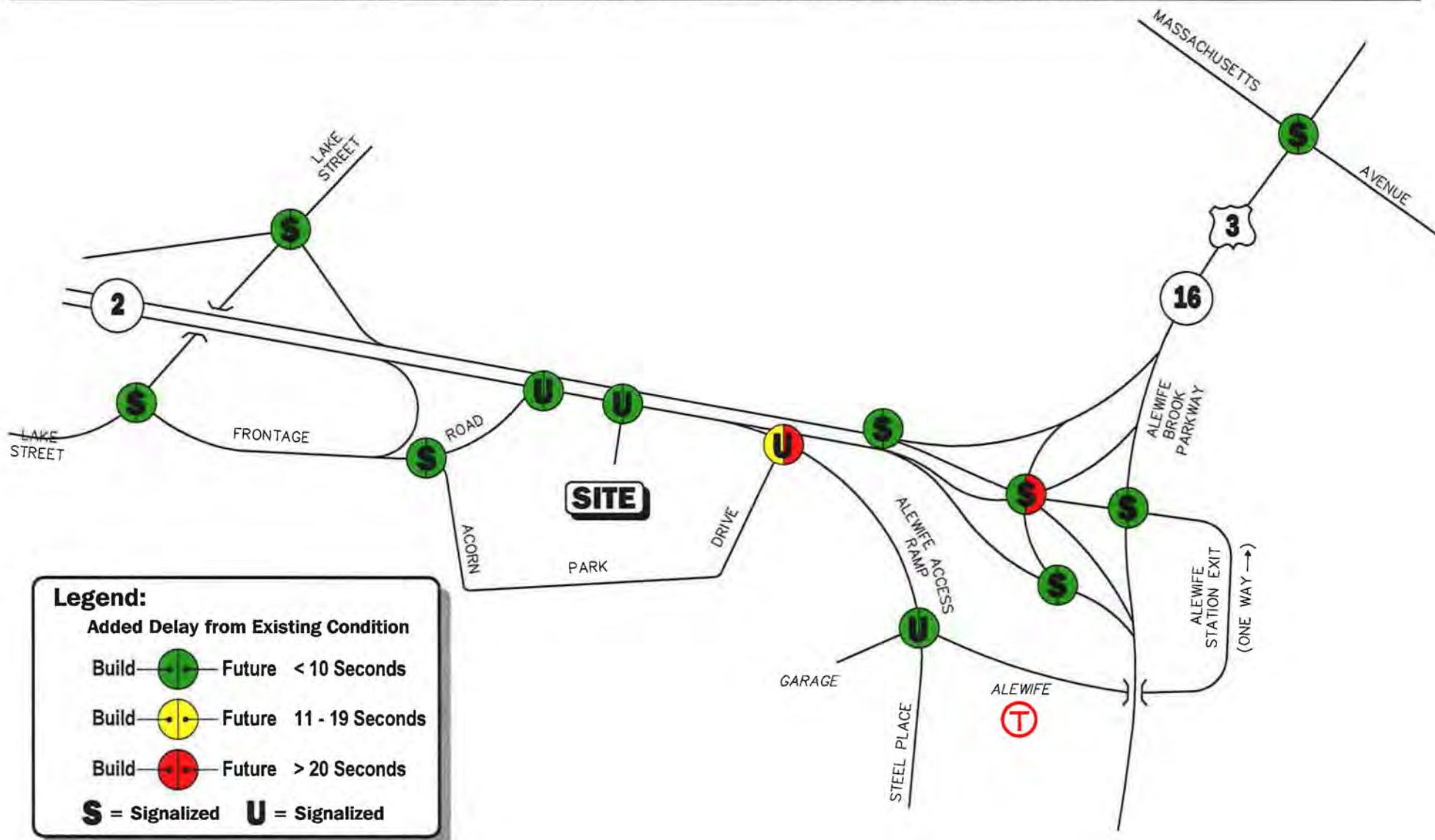




Not To Scale

Figure 35

Vehicle LOS Map
Weekday Evening
Peak Hour



Not To Scale



Figure 36
Vehicle Delay Change Map
Weekday Morning
Peak Hour Traffic Volumes

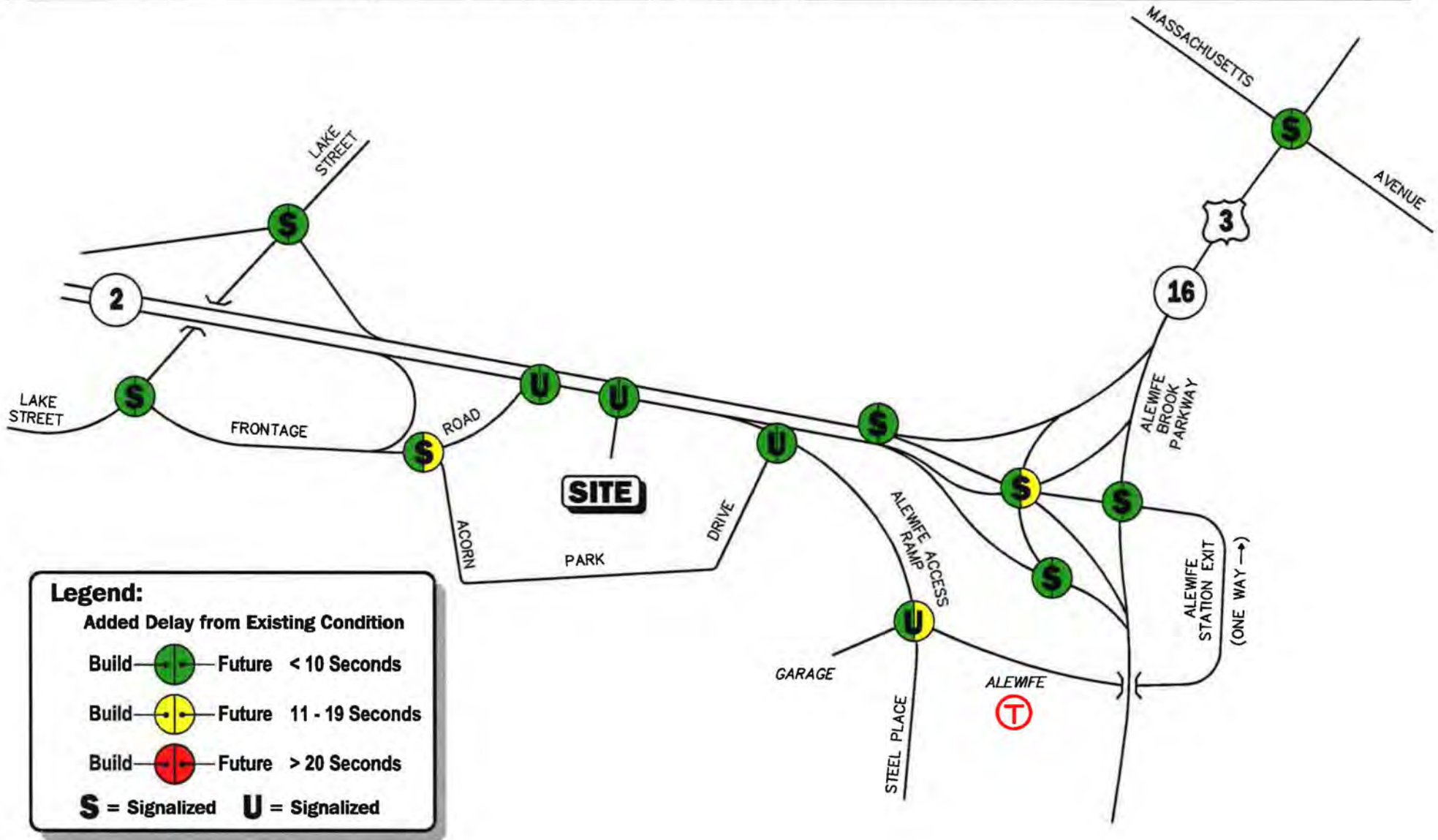


Figure 37

Vehicle Delay Change Map
Weekday Evening
Peak Hour Traffic Volumes

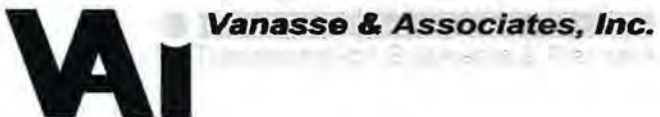


Table 15

INTERSECTION NET INCREASE IN DELAY – WEEKDAY MORNING PEAK HOUR

Intersection/Movement	2016 Existing Delay	2016 Build Delay	Difference in Delay ^a (Existing to Build)	2021 Future Delay	Difference in Delay (Existing to Future)
Signalized Intersections					
Route 2 at Alewife Brook Parkway:					
Signal 1: Route 2 EB LT at Alewife Brook Parkway NB LT/ SB LT	86.4	86.4	0	108.3	21.9
Signal 2: Alewife Station Exit at Alewife Brook Parkway NB RT	26	25.9	-0.1	25.8	-0.2
Signal 3: Route 2 EB RT at Alewife Brook Parkway SB LT	12	12.1	0.1	12.6	0.6
Signal 4: Alewife Brook Parkway SB RT at Alewife Brook Parkway NB LT	48.5	48.4	-0.1	50.4	1.9
Massachusetts Avenue at Alewife Brook Parkway	54.7	54.7	0.0	60.5	5.8
Lake Street at Frontage Road	11.7	11.7	0.0	13.2	1.5
Lake Street at Route 2 WB Ramps	11.6	11.6	0.0	16.6	5.0
Frontage Road at Acorn Park Drive	5.8	7.1	1.3	14.5	8.7
Unsignalized Intersections					
Route 2 EB at Frontage Road	25.6	24.5	-1.1	35.3	9.7
Route 2 EB at Site Drive	18.8	23.4	4.6	25.5	6.7
Alewife Access Ramp at Acorn Park Drive	81.3	92.5	11.2	191.7	110.4
Alewife Access Ramp at Steel Place	6.1	6.2	0.1	7.0	0.9

^aGreen indicates increase of 0 to 10 seconds, yellow indicates 11 to 20 seconds, red indicates greater than 20 seconds in the conditions noted.

Table 16
INTERSECTION NET INCREASE IN DELAY – WEEKDAY EVENING PEAK HOUR

Intersection/Movement	2016 Existing Delay	2016 Build Delay	Difference in Delay (Existing to Build)	2021 Future Delay	Difference in Delay (Existing to Future)
Signalized Intersections					
Route 2 at Alewife Brook Parkway:					
Signal 1: Route 2 EB LT at Alewife Brook Parkway NB LT/ SB LT	60.9	60.9	0.0	76.5	15.6
Signal 2: Alewife Station Exit at Alewife Brook Parkway NB RT	19.9	19.9	0.0	20.5	0.6
Signal 3: Route 2 EB RT at Alewife Brook Parkway SB LT	8.0	8.0	0.0	8.5	0.5
Signal 4: Alewife Brook Parkway SB RT at Alewife Brook Parkway NB LT	61.1	61.1	0.0	67.7	6.6
Massachusetts Avenue at Alewife Brook Parkway	48.3	48.3	0.0	55.0	6.7
Lake Street at Frontage Road	16.0	16.0	0.0	17.5	1.5
Lake Street at Route 2 WB Ramps	13.3	13.3	0.0	17.7	4.4
Frontage Road at Acorn Park Drive	23.7	23.9	0.2	37.3	13.6
Unsignalized Intersections					
Route 2 EB at Frontage Road	12.7	12.7	0.0	14.1	1.4
Route 2 EB at Site Drive	15.6	15.8	0.2	16.7	1.1
Alewife Access Ramp at Acorn Park Drive	22.3	22.4	0.1	31.6	9.3
Alewife Access Ramp at Steel Place	45.5	45.8	0.3	61.1	15.6

TRAFFIC VOLUME INCREASE ON RESIDENTIAL STREETS – SPECIAL PERMIT CRITERIA 3

The project is located in an office/hotel/R&D mixed-use area to the west of Alewife Station. Although the Vox on Two apartment complex is a residential use adjacent to the Project, Route 2 is not a residential street therefore this criterion does not apply for this use. No other residential uses are present on the adjacent streets. Therefore, Criteria 3 does not apply to the 2016 Build conditions.

QUEUE ANALYSES – SPECIAL PERMIT CRITERIA 4

As required in the City scoping guidelines, vehicle queues were calculated for each approach for all of the signalized study area intersections using Synchro. Table 17 summarizes the 2016 Existing observed, 2016 Existing calculated, 2016 Build calculated, relationship to the SPC indicators, and 2021 Build calculated.

As shown in Table 17, all 84 indicators are satisfied for the 2016 Build condition.

Table 17
SPECIAL PERMIT CRITERIA 4 – QUEUE ANALYSIS RESULTS^a

Intersection/Lane	Weekday Morning Peak Hour					Weekday Evening Peak Hour				
	2016 Observed ^b	2016 Existing Calculated	2016 Build Calculated	SPC 4 Indicator ^c	2021 Future Calculated	2016 Observed ^b	2016 Existing Calculated	2016 Build Calculated	SPC 4 Indicator ^c	2021 Future Calculated
Lake Street at Route 2 WB Ramps:										
Lake Street EB LT	2	3	3	No	4	6	5	5	No	7
Lake Street EB TH	1	4	4	No	5	10	5	5	No	6
Lake Street WB TH	2	4	4	No	6	2	2	2	No	2
Lake Street WB TH/RT	2	4	4	No	6	5	2	2	No	2
Route 2 WB off Ramp LT/TH	2	2	2	No	3	1	1	1	No	2
Route 2 WB off Ramp RT	0	0	0	No	0	0	0	0	No	0
Lake Street at Frontage Road:										
Lake Street EB TH	4	4	4	No	5	6	7	7	No	8
Lake Street WB LT	3	1	1	No	2	2	1	1	No	2
Lake Street WB TH1	2	3	3	No	4	2	2	2	No	3
Lake Street WB TH2	1	3	3	No	4	1	2	2	No	3
Frontage Road NB LT/UT	9	3	3	No	4	11	4	4	No	5
Frontage Road NB RT	0	0	0	No	0	10	0	0	No	0
Frontage Road at Acorn Park Drive:										
Frontage Road EB TH	3	1	1	No	2	0	1	1	No	1
Frontage Road EB TH/RT	0	1	1	No	2	0	1	1	No	1
Acorn Park Drive NB LT	0	2	3	No	8	2	5	5	No	11
Acorn Park Drive NB RT	6	0	0	No	0	0	0	0	No	0

See notes at end of table

Table 17 (Continued)
SPECIAL PERMIT CRITERIA 4 – QUEUE ANALYSIS RESULTS^a

Intersection/Lane	Weekday Morning Peak Hour					Weekday Evening Peak Hour				
	2016 Observed ^b	2016 Existing Calculated	2016 Build Calculated	SPC 4 Indicator ^c	2021 Future Calculated	2016 Observed ^b	2016 Existing Calculated	2016 Build Calculated	SPC 4 Indicator ^c	2021 Future Calculated
Route 2 at Alewife Brook Parkway^d:										
Route 2 EB LT1	19	11	11	No	13	20+	10	10	No	11
Route 2 EB LT2	19	11	11	No	13	20+	10	10	No	11
Route 2 EB RT1	20+	12	12	No	13	7	6	6	No	6
Route 2 EB RT2	20+	12	12	No	13	8	6	6	No	6
Alewife Station Exit WB TH	3	3	3	No	3	8	6	6	No	7
Alewife Station Exit WB RT	0	2	2	No	2	1	6	6	No	7
Alewife Brook Parkway NB LT1	19	31	31	No	35	20+	25	30	No	28
Alewife Brook Parkway NB LT2	18	31	31	No	35	20+	25	30	No	28
Alewife Brook Parkway NB TH1	1	4	4	No	5	2	4	4	No	4
Alewife Brook Parkway NB TH2	2	4	4	No	5	1	4	4	No	4
Alewife Brook Parkway SB TH1	9	7	7	No	8	6	6	6	No	6
Alewife Brook Parkway SB TH2	9	7	7	No	8	7	6	6	No	6
Alewife Brook Parkway SB RT1	8	19	19	No	20	7	20	20	No	22
Alewife Brook Parkway SB RT2	10	19	19	No	20	10	20	20	No	22
Massachusetts Avenue at Alewife Brook Parkway:										
Massachusetts Avenue EB LT	1	2	2	No	2	2	3	3	No	3
Massachusetts Avenue EB TH	30	14	14	No	16	6	9	9	No	9
Massachusetts Avenue EB TH/RT	28	14	14	No	16	7	9	9	No	9
Massachusetts Avenue WB LT	18	7	7	No	8	20	7	7	No	8
Massachusetts Avenue WB TH	13	5	5	No	5	20	10	10	No	11
Massachusetts Avenue WB TH/RT	1	5	5	No	5	6	10	10	No	11
Alewife Brook Parkway NB LT	2	2	2	No	2	2	4	4	No	4
Alewife Brook Parkway NB TH	5	11	11	No	12	20	17	17	No	18
Alewife Brook Parkway NB TH/RT	12	11	11	No	12	20	17	17	No	18
Alewife Brook Parkway SB LT	6	5	5	No	5	3	5	5	No	5
Alewife Brook Parkway SB TH	20	14	14	No	15	16	14	14	No	15
Alewife Brook Parkway SB TH/RT	16	14	14	No	15	19	14	14	No	15

^aAll queues calculated using Synchro methodology

^bAverage observed queue.

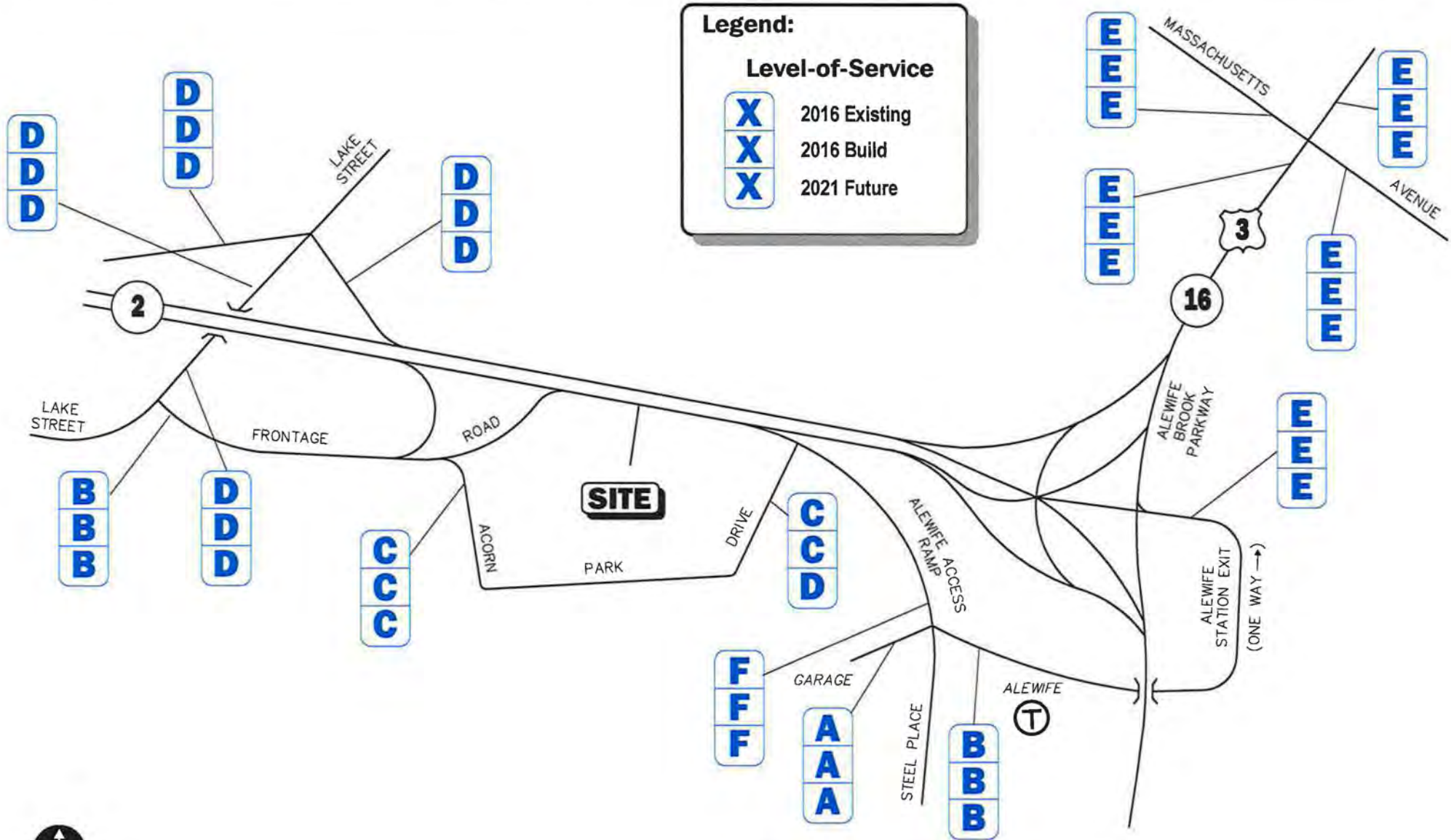
^cSpecial Permit Criteria 4 – Lane Queue

PEDESTRIAN AND BICYCLE FACILITIES – SPECIAL PERMIT CRITERIA 5

Criteria 1 – Pedestrian Level of Service

A pedestrian impact analysis was conducted at all study area intersections under 2016 Existing and 2016 Build conditions, as required in the scoping letter. For signalized intersections, the pedestrian level-of-service (PLOS) calculations measure the adequacy of the pedestrian phases (exclusive or concurrent) for sufficient time to cross major or minor streets. The unsignalized analysis relies on a critical gap procedure. The analysis methodology was based on procedures outlined in the 2000 HCM for signalized and unsignalized intersections, and is provided in the Appendix. Table 18 summarizes the results of the pedestrian analysis at the signalized intersections, while Table 19 presents a summary of the pedestrian analysis at the unsignalized intersections. Analysis indicates all 14 of the exceedences of the criteria occur under existing conditions (without the Project). Overall, 16 of 30 indicators are satisfied for the 2016 Build condition with none of the indicators exceeded by the Project impact.

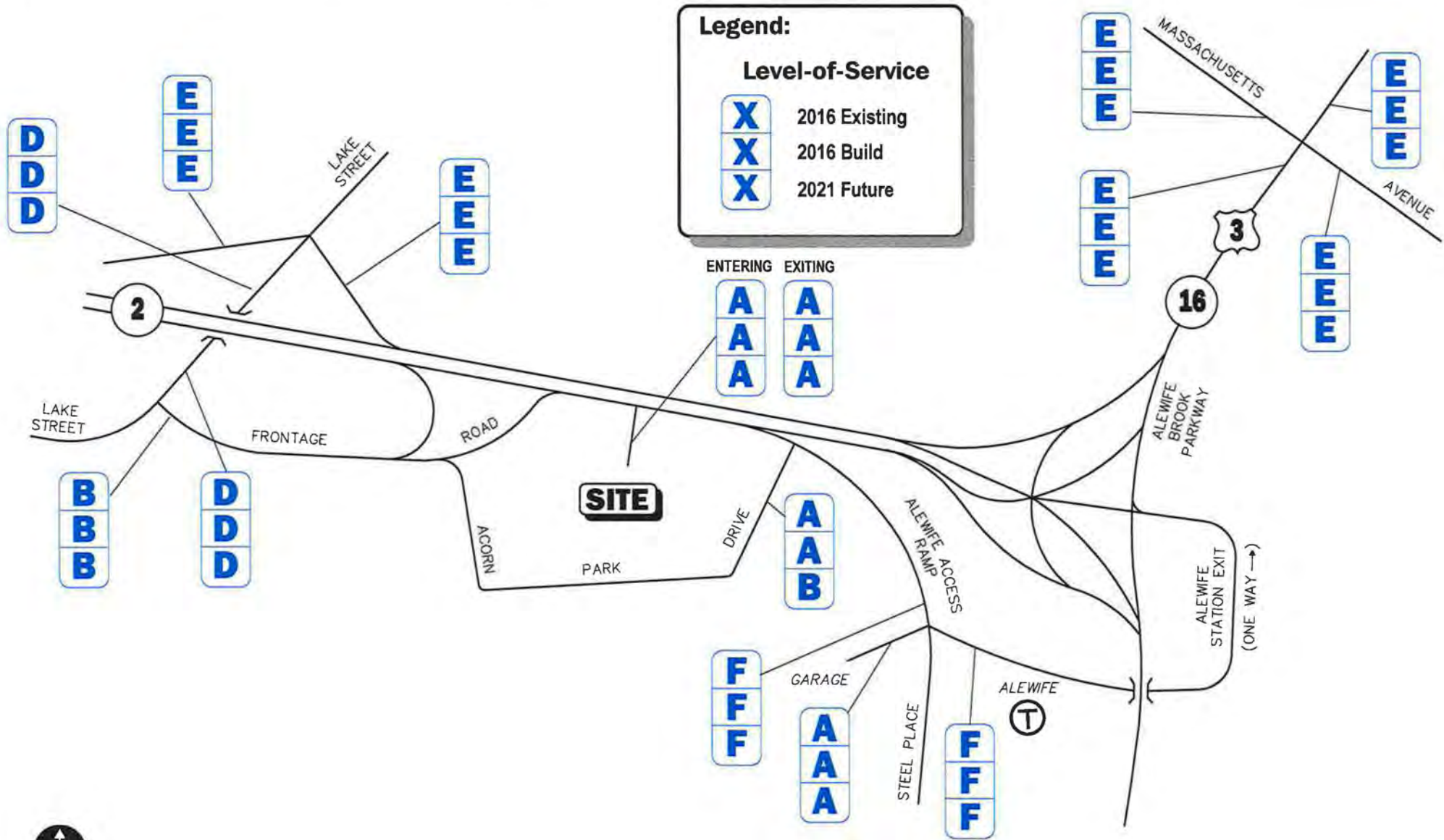
Figure 38 and Figure 39 depict the pedestrian LOS summaries for the intersections in a graphical format for the weekday morning and weekday evening peak hours, respectively.



Not To Scale

Figure 38

**Pedestrian LOS Map
Weekday Morning
Peak Hour**



Not To Scale

Figure 39
Pedestrian LOS Map
Weekday Evening
Peak Hour

Criteria 2 – Safe Pedestrian Facilities

Route 2 provides a paved asphalt sidewalk in the vicinity of the site and other buildings between Frontage Road and the Acorn Park Drive intersection. The sidewalk in front of the Vox on Two development has been reconstructed, and there are wheelchair ramp tip downs where the sidewalk crosses the existing driveways for the site. In addition, the multi-use path between Vox on Two and Discovery Park will pass through the site with connections available. These criteria are therefore met, although the Route 2 sidewalk and the on-site segment of the multi-use path will be replaced as a condition of construction of the Project.

At the request of the Cambridge Community Development Department (CDD), the sidewalk on the easterly side of Building 1 has been eliminated in favor of a porous pavement access path for maintenance purposes only. Signage will be posted and bollards installed to discourage bicyclists use of this path in favor of the on-site street system connection to a widened sidewalk of 10 feet along the westerly side of Building 2 to provide a connection to the Discovery Park sidewalks on the east side of the Discovery Park garage. In addition, CDD requested the installation of a lobby with elevator access in the southeast corner of Building 1 for more direct pedestrian access to and from the multi-use path to Discovery Park. These changes are shown on the revised site plans.

In addition, the proposed alignment of the path is a result of an on-site stormwater management improvement to address an existing undesirable condition. The existing path was located at the far southern perimeter of the Gateway Inn site to avoid disruption of the existing vehicular parking area. Under existing conditions, the vehicular parking area associated with the Cambridge Gateway Inn discharges untreated stormwater runoff directly over the pedestrian/bicycle path and into the adjacent wetland area. This condition leaves the existing low-lying pedestrian/bicycle path in the flow path during storm events.

The Project proposes a stormwater wet pond, intended to hold runoff from the proposed building roof in a natural treatment area that supports wetland plant growth. To maintain continuity, the pedestrian/bicycle path will be elevated on a pedestrian/bike bridge element slightly curved in shape to bring the pathway over the wet pond in an accessible manner for all users and also allow for the construction of a stone berm component of the pond. The elevated pedestrian/bicycle path will allow pedestrians and cyclists to pass over this proposed stormwater management feature on a deck surface that is free-draining and slip-resistant. Therefore, the slight curvature in the path allows for an improvement in the stormwater treatment of the site, provides an interesting alignment, and should not restrict accessibility or mobility for path users.

Table 18
SPECIAL PERMIT CRITERIA 5 – PEDESTRIAN LEVEL-OF-SERVICE SUMMARY
SIGNALIZED INTERSECTIONS

Intersection/Time Period/Crossing Path	2016 Existing			2016 Build			SPC 5 ^a		2021 Future		
	Demand ^b	Delay ^c	LOS ^d	Demand	Delay	LOS	Delay Increase	Exceeds Indicator	Demand	Delay	LOS
<i>Alewife Brook Parkway at Alewife Station Exit</i>											
<i>Weekday Morning:</i>											
Crossing Alewife Station Exit (East)	1	47.4	E	1	47.4	E	0.0	Yes	1	47.4	E
<i>Weekday Evening:</i>											
Crossing Alewife Station Exit (East)	-- ^e	--	--	--	--	--	--	--	--	--	--
<i>Frontage Road at Acorn Park Drive</i>											
<i>Weekday Morning:</i>											
Crossing Acorn Park Drive (South)	2	20.9	C	2	20.9	C	0.0	No	2	20.9	C
<i>Weekday Evening:</i>											
Crossing Acorn Park Drive (South)	--	--	--	--	--	--	--	--	--	--	--
<i>Massachusetts Avenue at Alewife Brook Parkway</i>											
<i>Weekday Morning:</i>											
Massachusetts Avenue (East)	4	47.4	E	4	47.4	E	0.0	Yes	4	47.4	E
Massachusetts Avenue (West)	10	47.4	E	10	47.4	E	0.0	Yes	10	47.4	E
Alewife Brook Parkway (North)	26	47.4	E	26	47.4	E	0.0	Yes	26	47.4	E
Alewife Brook Parkway (South)	14	47.4	E	14	47.4	E	0.0	Yes	14	47.4	E
<i>Weekday Evening:</i>											
Massachusetts Avenue (East)	22	47.4	E	22	47.4	E	0.0	Yes	22	47.4	E
Massachusetts Avenue (West)	12	47.4	E	12	47.4	E	0.0	Yes	12	47.4	E
Alewife Brook Parkway (North)	22	47.4	E	22	47.4	E	0.0	Yes	22	47.4	E
Alewife Brook Parkway (South)	48	47.4	E	48	47.4	E	0.0	Yes	48	47.4	E

See notes at end of table.

Table 18 (Continued)
SPECIAL PERMIT CRITERIA 5 – PEDESTRIAN LEVEL-OF-SERVICE SUMMARY
SIGNALIZED INTERSECTIONS

Intersection/Time Period/Crossing Path	2016 Existing			2016 Build			SPC 5 ^a		2021 Future		
	Demand ^b	Delay ^c	LOS ^d	Demand	Delay	LOS	Delay Increase	Exceeds Indicator	Demand	Delay	LOS
Lake Street at Frontage Road											
<i>Weekday Morning:</i>											
Crossing Lake Street (East)	4	31.4	D	4	31.4	D	0.0	No	4	31.4	D
Crossing Frontage Road (South)	5	17.0	B	5	17.0	B	0.0	No	5	17.0	B
<i>Weekday Evening:</i>											
Crossing Lake Street (East)	2	31.4	D	2	31.4	D	0.0	No	2	31.4	D
Crossing Frontage Road (South)	3	17.0	B	3	17.0	B	0.0	No	3	17.0	B
Lake Street at Route 2 WB Ramps											
<i>Weekday Morning:</i>											
Crossing Lake Street (East)	2	30.3	D	2	30.3	D	0.0	No	2	30.3	D
Crossing Route 2 WB Off-Ramp (South)	2	37.7	D	2	37.7	D	0.0	No	2	37.7	D
Crossing Route 2 WB On-Ramp (North)	1	37.7	D	1	37.7	D	0.0	No	1	37.7	D
<i>Weekday Evening:</i>											
Crossing Lake Street (East)	2	32.6	D	2	32.6	D	0.0	No	2	32.6	D
Crossing Route 2 WB Off-Ramp (South)	1	40.2	E	1	40.2	E	0.0	Yes	1	40.2	E
Crossing Route 2 WB On-Ramp (North)	36	40.2	E	36	40.2	E	0.0	Yes	36	40.2	E

^aSpecial Permit Criteria 5 – Pedestrian Level of Service. Locations outside of Cambridge are not evaluated).

^bDemand in pedestrians per hour.

^cAverage delay per pedestrian (in seconds).

^dPedestrian Level of Service.

^eNo pedestrian volume observed.

Table 19
SPECIAL PERMIT CRITERIA 5 – PEDESTRIAN LEVEL-OF-SERVICE SUMMARY
UNSIGNALIZED INTERSECTIONS

Intersection/Time Period/Crossing Path	2016 Existing			2016 Build			SPC 5 ^a		2021 Future		
	Demand ^b	Delay ^c	LOS ^d	Demand	Delay	LOS	Delay Increase	Exceeds Indicator	Demand	Delay	LOS
Site Drive (entering traffic) at Route 2 EB											
<i>Weekday Morning:</i>											
Crossing Site Drive (South)	-- ^e	--	--	--	--	--	--	--	--	--	--
<i>Weekday Evening:</i>											
Crossing Site Drive (South)	4	0.9	A	4	0.9	A	0.0	No	4	0.9	A
Site Drive (exiting traffic) at Route 2 EB											
<i>Weekday Morning:</i>											
Crossing Site Drive (South)	--	--	--	--	--	--	--	--	--	--	--
<i>Weekday Evening:</i>											
Crossing Site Drive (South)	4	1.1	A	4	1.3	A	0.2	No	4	1.3	A
Acorn Park Drive at Alewife Access Ramp											
<i>Weekday Morning:</i>											
Crossing Acorn Park Drive (South)	4	17.0	C	4	18.9	C	1.9	No	4	26.4	D
<i>Weekday Evening:</i>											
Crossing Acorn Park Drive (South)	8	3.8	A	8	3.8	A	0.0	No	8	7.4	B
Alewife Access Ramp at Steel Place											
<i>Weekday Morning:</i>											
Crossing Alewife Station Exit (East)	345	5.3	B	345	5.5	B	0.2	No	345	7.0	B
Crossing Garage Ramp (West)	12	1.0	A	45	1.0	A	0.0	No	45	1.1	A
Crossing Alewife Access Ramp (North)	124	175.8	F	124	184.6	F	8.8	Yes	124	243.2	F
<i>Weekday Evening:</i>											
Crossing Alewife Station Exit (East)	508	2778.2	F	508	2794.4	F	16.2	Yes	508	6316.1	F
Crossing Garage Ramp (West)	30	0.2	A	57	0.2	A	0.0	No	57	0.2	A
Crossing Alewife Access Ramp (North)	224	288.3	F	224	290.3	F	2.0	Yes	224	816.7	F

^aSpecial Permit Criteria 5 – Pedestrian Level of Service. (Locations outside of Cambridge are not evaluated).

^bDemand in pedestrians per hour.

^cAverage delay per pedestrian (in seconds).

^dPedestrian Level of service.

^eNo pedestrian volume observed.

Criteria 3 – Safe Bicycle Facilities

The site is adjacent to Route 2, where bicycle use is prohibited. Therefore, by virtue of its location, the site does not meet this criterion. However, the multi-use path between Vox on Two and Discovery Park is a valid alternative for bicycle travel and this will be promoted for the Project. Therefore, one of the two criteria for this category is met.

SPECIAL PERMIT CRITERIA SUMMARY

As required by the City, the project's impact has been measured against 5 criteria as indicators of the project's impact. Of the 145 project indicators reviewed, none were directly exceeded by the project impact. One of the indicators is exceeded by virtue of the Project location adjacent to Route 2. A total of 14 indicators related to Pedestrian LOS were exceeded under Existing Conditions analysis (without the project). Overall the project has satisfied 130 indicators of impact.

BICYCLE ANALYSIS

A review of bicycle conditions was conducted at the affected intersections and street segments. The site is in the vicinity of the Alewife Reservation, under control of the Department of Conservation and Recreation (DCR). A Multi-Use Path constructed by Discovery Park through the Alewife Reservation extends to the sidewalk near Alewife Station, on the north side of the Little River.

Currently, Steel Place and Acorn Park Drive provide dedicated lanes for bicyclists. In addition, there are bike paths in the area that provide regional bicycle access into the area from the west and east. The Minuteman Bikeway is a 12-foot wide multi-use path providing an approximately 11-mile connection between Depot Park/South Street in Bedford, Massachusetts to Alewife Station in Cambridge. Within the study area, the Bikeway passes under Route 2 and runs parallel to the Route 2 eastbound exit ramp to Alewife Station. The Linear Park Bike Path follows the Red Line tracks into Somerville starting at Alewife Station, connecting to the Minuteman Bikeway. There is an at-grade crossing of the Route 2 westbound on-ramp, with a crosswalk provided across the ramp, and a crossing under Alewife Brook Parkway. Also in the vicinity of the site is the Fitchburg Cutoff Bikepath. This bike path is approximately one mile long, connecting the northwest corner of the Alewife Station to Brighton Street in Cambridge, near the Belmont town line. There are a series of bike paths along both sides of Alewife Brook in Arlington, Cambridge, and Somerville including the Alewife Brook Greenway Bike Path which extends from the Mystic River to the Minuteman Bikeway.

Although these bike paths provide regional bicycle access, the majority of bicycle traffic from the site is expected to end in Cambridge, Belmont, Arlington, Lexington, Somerville and Boston. These locations have good access to the Minuteman Bikeway, Linear Path, and other connecting multi-use paths, and also have bicycle facilities on local streets. Bicyclists from the site are expected to travel to these bike paths using the multi-use path through the Alewife Reservation, rather than local streets. The presence of the Alewife Station bicycle parking facilities, Hubway stations, and area bike paths will be promoted in literature for the new residents. Figure 40 depicts the pedestrian and bicycle paths in the area adjacent to the project.

City guidelines require identification of conflicting vehicle-turning volume at intersections impacted by the project where bicycle facilities are present or where peak-hour bicycle volumes exceed 10 bicycles on any approach. No mitigation measures are proposed at the study locations that would impact the ability of bicyclists to safely traverse the study area roadways or intersections.

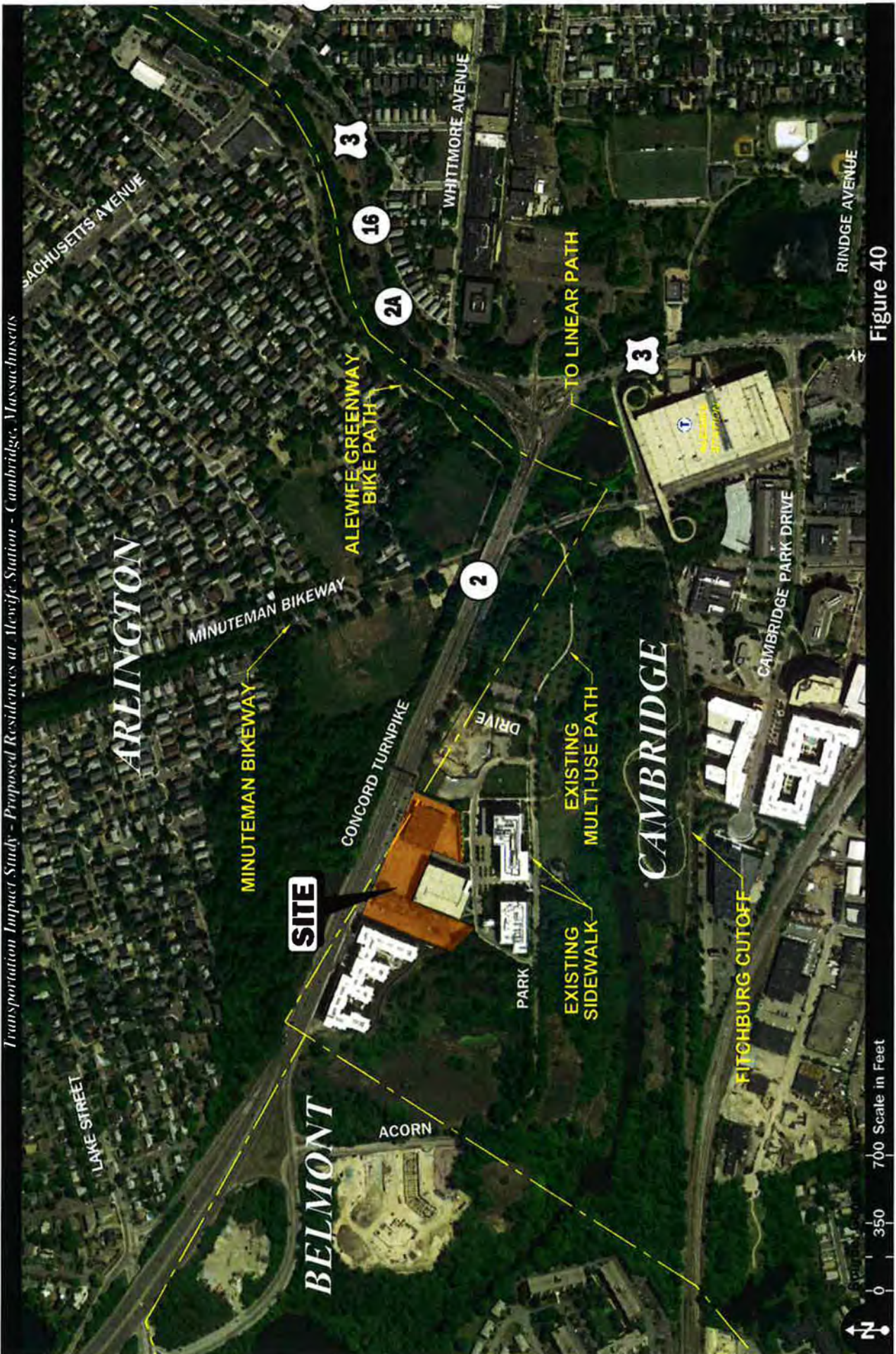


Figure 40

Table 20
BICYCLE-VEHICLE VOLUME CONFLICTS

Roadway/ Intersecting Street/ Time Period	Approach Bicycle Volume	2016 Build	
		Conflicting Vehicles Turning Volume	
		Advancing Volume	Opposing Volume
<i>Massachusetts Avenue at Alewife Brook Parkway:</i>			
<i>Weekday Morning</i>			
Massachusetts Avenue EB TH	40	182	241
Massachusetts Avenue WB TH	--	--	--
<i>Weekday Evening</i>			
Massachusetts Avenue EB TH	15	88	298
Massachusetts Avenue WB TH	37	80	72
<i>Alewife Access Ramp at Steel Place::</i>			
<i>Weekday Morning</i>			
Fitchburg Cutoff to Alewife Access Ramp	1	--	--
Fitchburg Cutoff to Minuteman Commuter Bikeway	3	--	1,121
Fitchburg Cutoff to Alewife Station Exit	53	--	1,121
Fitchburg Cutoff to Steel Place	15	--	103
Alewife Station Exit to Steel Place	1	--	1,018
Alewife Station Exit to Fitchburg Cutoff	13	--	1,121
Alewife Station Exit to Alewife Access Ramp	2	--	1,121
Alewife Station Exit to Minuteman Commuter Bikeway	8	--	--
Minuteman Commuter Bikeway to Alewife Station Exit	58	--	--
Minuteman Commuter Bikeway to Steel Place	48	--	1,018
Minuteman Commuter Bikeway to Fitchburg Cutoff	10	--	1,121
Minuteman Commuter Bikeway to Alewife Access Ramp	1	--	1,121
Steel Place to Fitchburg Cutoff	2	198	1,121
Steel Place to Alewife Access Ramp	2	198	1,121
Alewife Access Ramp to Steel Place	8	103	--
<i>Weekday Evening</i>			
Fitchburg Cutoff to Alewife Access Ramp	2	--	--
Fitchburg Cutoff to Minuteman Commuter Bikeway	22	--	1,063
Fitchburg Cutoff to Alewife Station Exit	116	--	1,063
Fitchburg Cutoff to Steel Place	2	--	16
Alewife Station Exit to Fitchburg Cutoff	15	--	1,063
Alewife Station Exit to Alewife Access Ramp	2	--	1,063
Alewife Station Exit to Minuteman Commuter Bikeway	99	--	--
Minuteman Commuter Bikeway to Alewife Station Exit	36	--	--
Minuteman Commuter Bikeway to Steel Place	5	--	1,047
Minuteman Commuter Bikeway to Fitchburg Cutoff	10	--	1,063
Minuteman Commuter Bikeway to Alewife Access Ramp	5	--	1,063
Steel Place to Fitchburg Cutoff	13	563	1,063
Steel Place to Alewife Access Ramp	5	563	1,063
Steel Place to Minuteman Commuter Bikeway	29	563	416
Steel Place to Alewife Station Exit	1	563	416
Alewife Access Ramp to Minuteman Commuter Bikeway	3	--	1,063
Alewife Access Ramp to Alewife Station Exit	1	--	1,063
Alewife Access Ramp to Steel Place	3	16	0
Alewife Access Ramp to Fitchburg Cutoff	2	--	--

PARKING ANALYSIS

EXISTING CONDITIONS

The existing site provides a total of 273 existing spaces, as determined by site survey. Approximately 69 of these spaces are to the west of the Cambridge Gateway Motel and likely for this use, with approximately 110 spaces located between the motel and bowling alley and the remaining 94 spaces located around and behind the bowling alley. While the City Parking Inventory Form indicates 99 customer/visitor parking spaces at the bowling alley and 79 customer/visitor parking spaces at the motel, it is possible that the parking lots were restriped at some point in the past. Observations indicated that the peak parking for the bowling alley and the motel occurred during the evening time periods (after 7pm).

PROPOSED CONDITIONS

As required in the City guidelines, a parking analysis was conducted to determine future parking demands consistent with area zoning, vehicle-trip generation assumptions, and modal split assumptions for project traffic. As with the Vox on Two site, the Project site is located in the Cambridge Zoning Special District 4A. Zoning Special District 4/4A does not specifically mention parking, but notes, "Except as herein provided, all requirements of and regulations applicable to the Office 2 district shall apply equally to Special Districts 4 and 4A." In Office 2, the minimum residential parking rate is one space per unit. Therefore, zoning requirements indicate a minimum residential parking supply of 320 parking spaces.

However, some residential apartment complexes in Cambridge have been observed to require less than 1.0 space per unit. Accordingly, parking information obtained at the adjacent Vox on Two residential development was used to identify parking demands of the Project. Parking counts were conducted during three time periods in June 2016 at the Vox on Two development to obtain parking utilization data, identifying the number of parking spaces in use at the time of the counts. Table 21 summarizes the results of the parking counts conducted at the Vox on Two site conducted for mid-day, evening, and early morning periods.

**Table 21
VOX ON TWO OBSERVED PARKING UTILIZATION^a**

Time Period	Occupied Parking Spaces	Parking Utilization Ratio ^b
Weekday Mid-Day (noon)	91	40%
Weekday Evening (10pm)	152	67%
Weekday Morning (4am)	174	76%

^aCounted by VAI on June 29th 2016.

^bBased on 227 units.

The Vox on Two site provides a total of 227 parking spaces. At the time of the counts, 198 of those were leased. This indicates a leased ratio of 0.87 spaces/unit. The parking counts indicate a maximum demand ratio of 0.76 spaces per unit. This relationship between demand and leased parking ratios is similar to that observed in a parking study conducted by VAI in 2009. This study counted four complexes and observed a leased parking ratio of 0.74 leased spaces/unit and a maximum observed demand ratio of 0.64 spaces/unit.

The parking for the Project will be accommodated on site with approximately 241 non-dedicated spaces provided for a parking ratio of approximately 0.75 spaces per unit. Parking demands for the three time periods based on the utilization rates identified at the Vox on Two site are shown in Table 22.

**Table 22
PROJECT PARKING DEMAND^a**

Time Period	Parking Demand Ratio ^b	Projected Parking Spaces
Weekday Mid-Day (noon)	0.40	128
Weekday Evening (10pm)	0.67	214
Weekday Morning (4am)	0.76	243

^aBased on 320 units.

^bBased on rates identified in the Vox on Two monitoring study.

Parking will be in an enclosed structure on the ground floor of the site. No below-grade parking will be constructed. A total of 3 guest spaces and 5 employee parking spaces will be provided. Actual locations of these spaces have not yet been determined. It should be noted that at some of Criterion Development Partners' projects, management employees live on-site. This is both for the employee's convenience and as a means to provide management coverage outside of normal business hours. To the extent that this happens at this development, parking demand will be reduced.

Secure access to the garage will be provided through garage doors opened via key card access. Parking fees are proposed to be monthly, will be charged at market rates, and these will be an additional cost above monthly housing costs. Residents will have the option to opt out of leasing

a parking space. No incentives to not own a vehicle are proposed. The ground floor on-site parking is depicted in Figure 41.

BICYCLE PARKING

Both long-term and short-term bicycle racks will be provided for residents and visitors use. The project will provide a total of 336 long-term bicycle spaces in four bike parking areas in the garage. Approximately 18 of these long-term spaces will be tandem spaces. In addition, 32 short-term spaces will be provided in four areas of surface parking along Building 1 and Building 2. The long-term bicycle parking is depicted in Figure 42 and Figure 43, while the short-term bicycle parking is depicted in Figure 44 and Figure 45, shown in 1 inch = 10 feet scale for clarity.

The Dero Bike Hitch© bike rack design by Dero is proposed throughout the site. Specification information is provided in the Appendix.

TRASH REMOVAL AND MOVING OPERATIONS

Two areas have been designated for loading in the garage area for Building 1 and Building 2. The area for Building 1 is in the vicinity of surface parking and a staging area will be provided a short distance away for apartment move-in and move-out. The area for Building 2 allows a truck to back into a dedicated area for loading and for apartment move-in and move-out.

Trash will be contained in trash rooms in separate rooms for each building in the garage. The trash will be wheeled out to trash trucks in the loading area twice per week. There will be no outside dumpsters. Recycling will be contained in the trash rooms and wheeled out with trash.

These loading areas are shown on Figure 46 for Building 1 and Figure 47 for Building 2.

Approximately 10 trucks per day are expected with the facility. Most of these trucks are small box trucks and include courier deliveries and pick-ups. The trash and recycling schedules have yet to be determined but scheduled pick-ups twice a week are currently being considered.

The 10 truck/day figure is exclusive of peak move-in periods, at which time move-in schedules will be coordinated through the management office.

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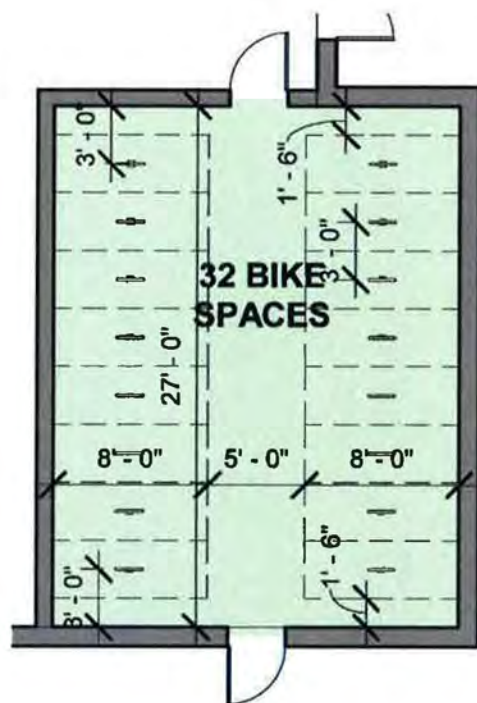
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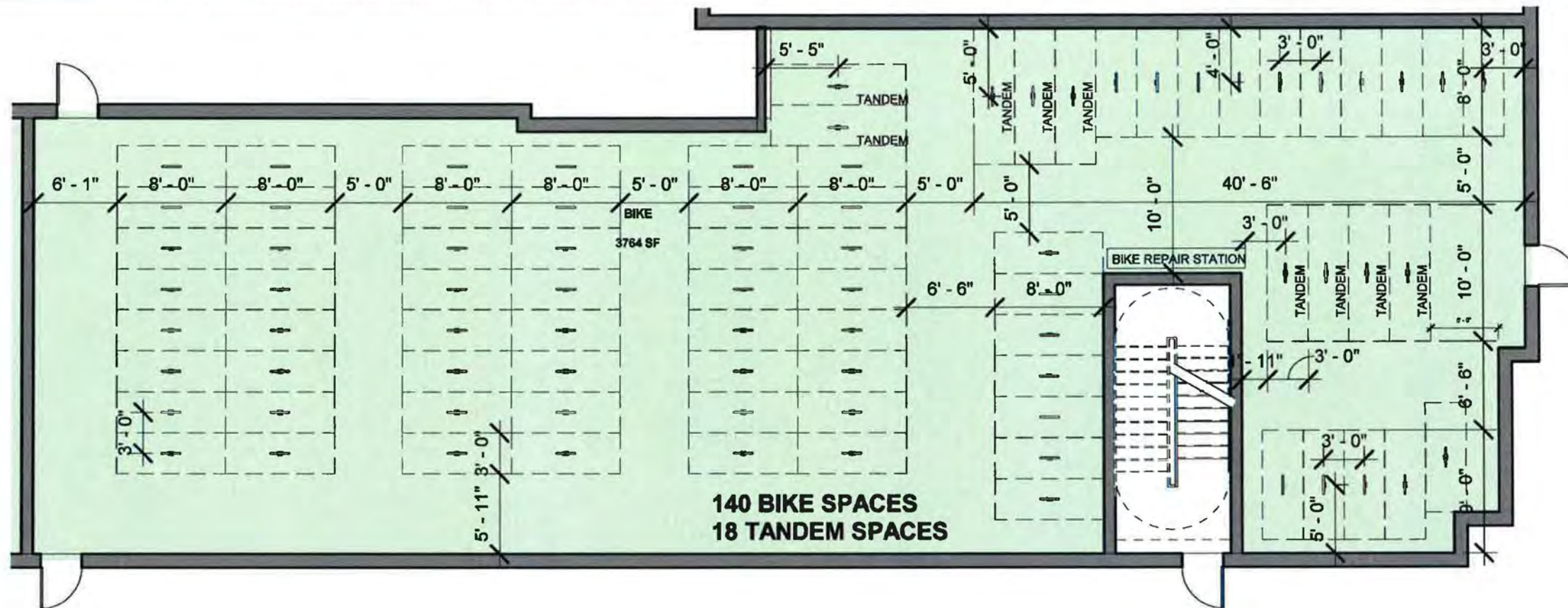


Figure 41

Ground Floor Garage Plan



Level 1 - Bike Parking Building 1 Area 2
1" = 10'-0"



Level 1 - Bike Parking Building 1 Area 1
1" = 10'-0"

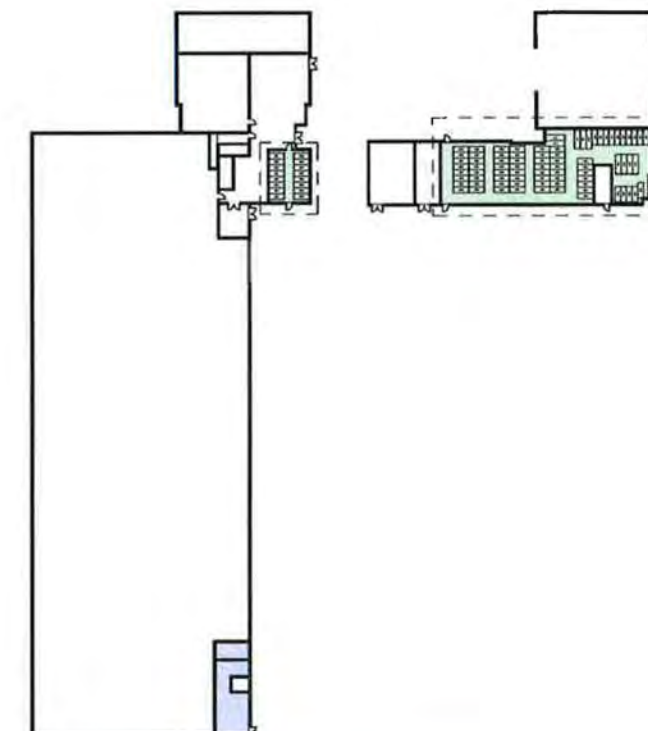
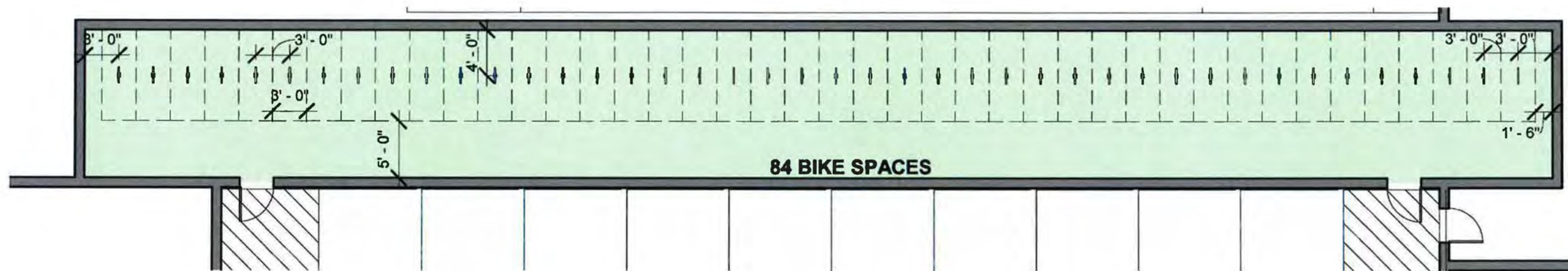
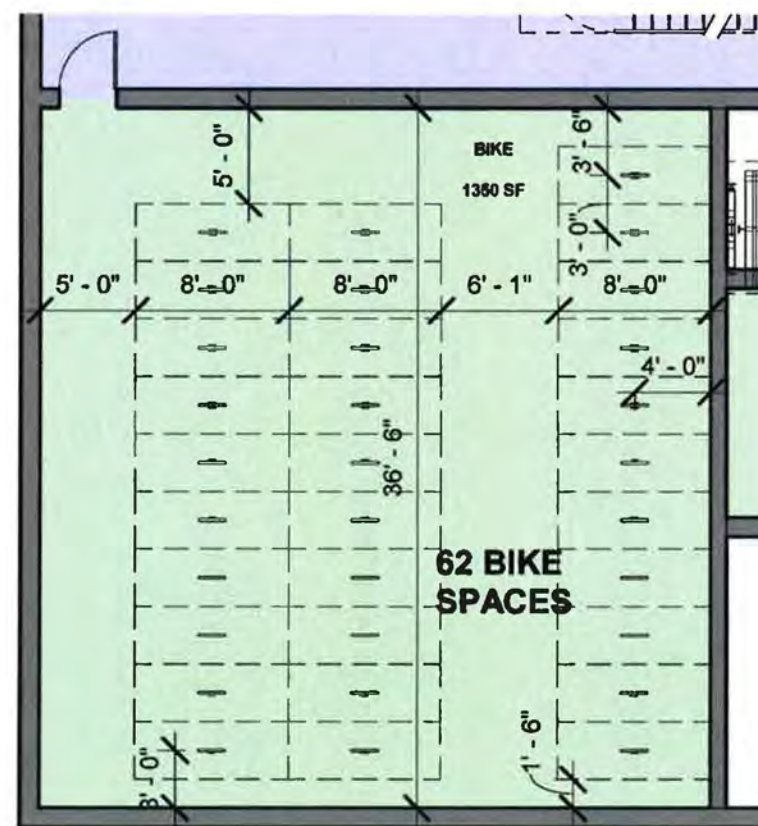


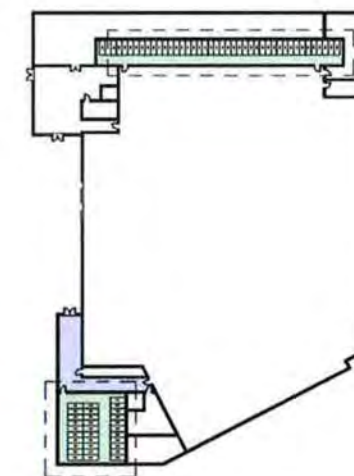
Figure 42
Bike Storage Layout - Building 1



② Level 1 - Bike Parking Building 2 Area 1
1" = 10'-0"

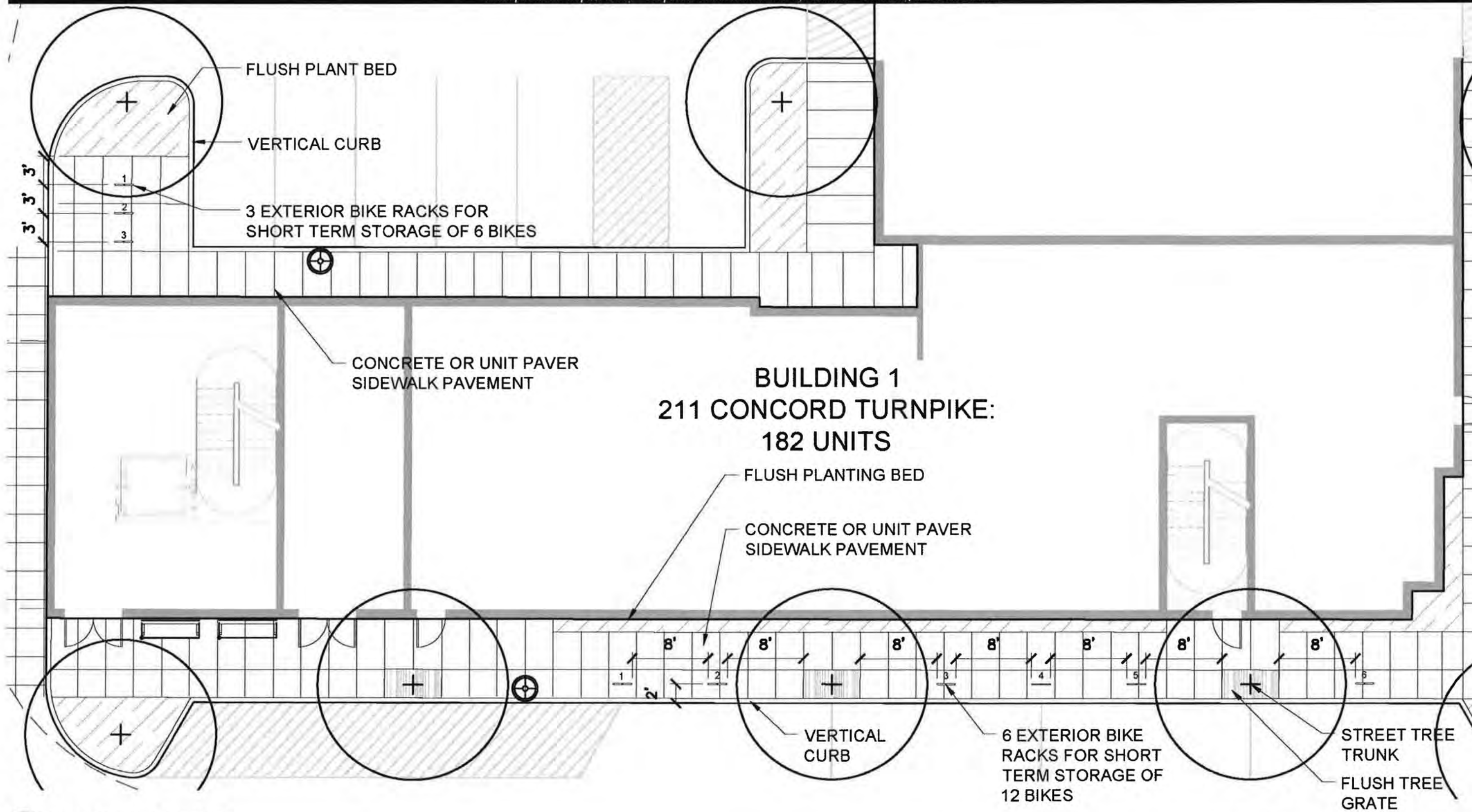


③ Level 1 - Bike Parking Building 2 Area 2
1" = 10'-0"



BIKE STORAGE KEY PLAN

Figure 43
Bike Storage Layout - Building 2

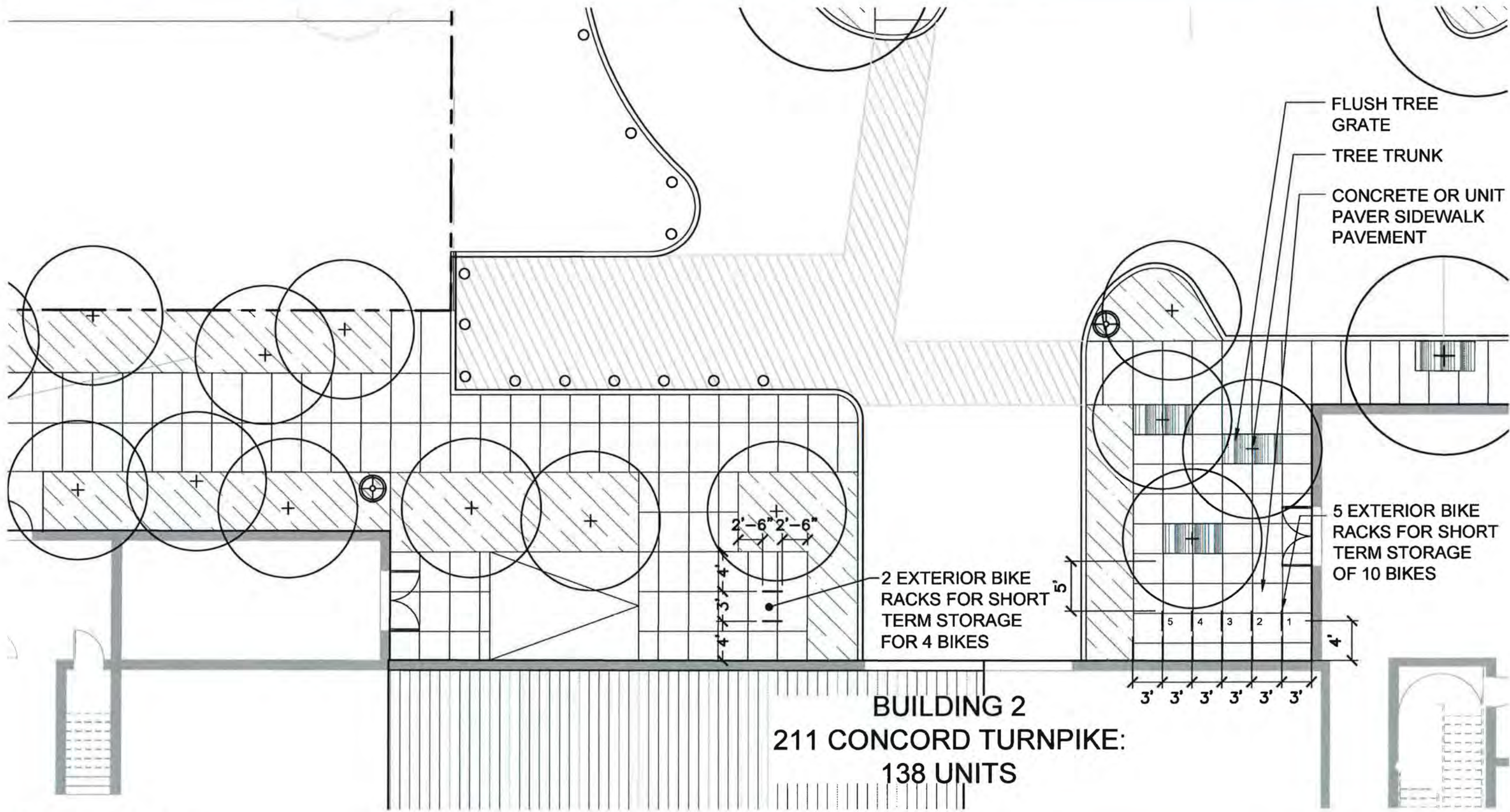


Source: Copley Wolff Design Group.



Figure 44
Building 1 Short Term Bike Parking

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Source: Copley Wolff Design Group.
0 5 10 Scale in Feet



Figure 45
Building 2 Short Term Bike Parking

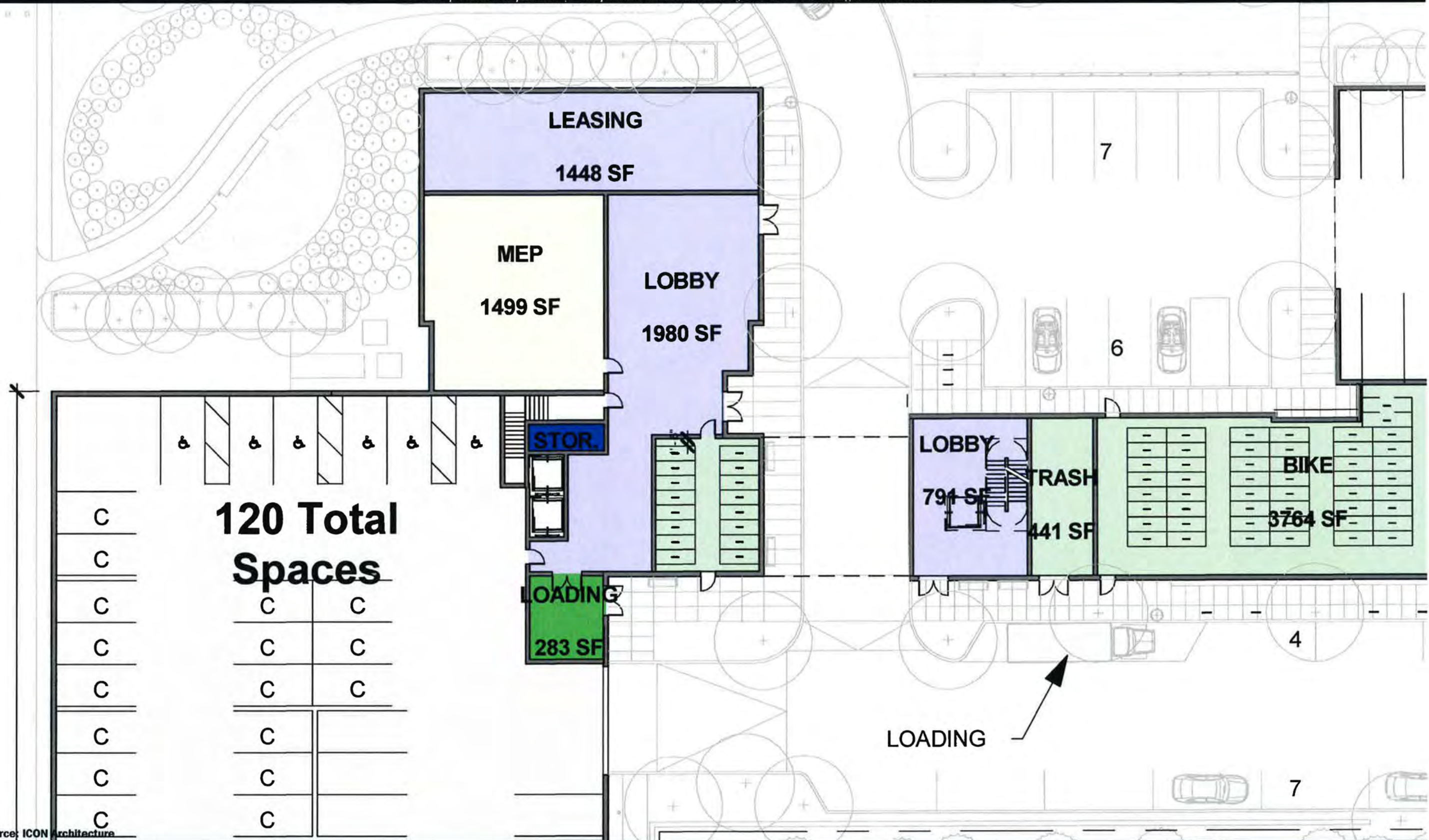


Figure 46

Trash and Moving Vehicle Plan
Building 1

Source: ICON Architecture



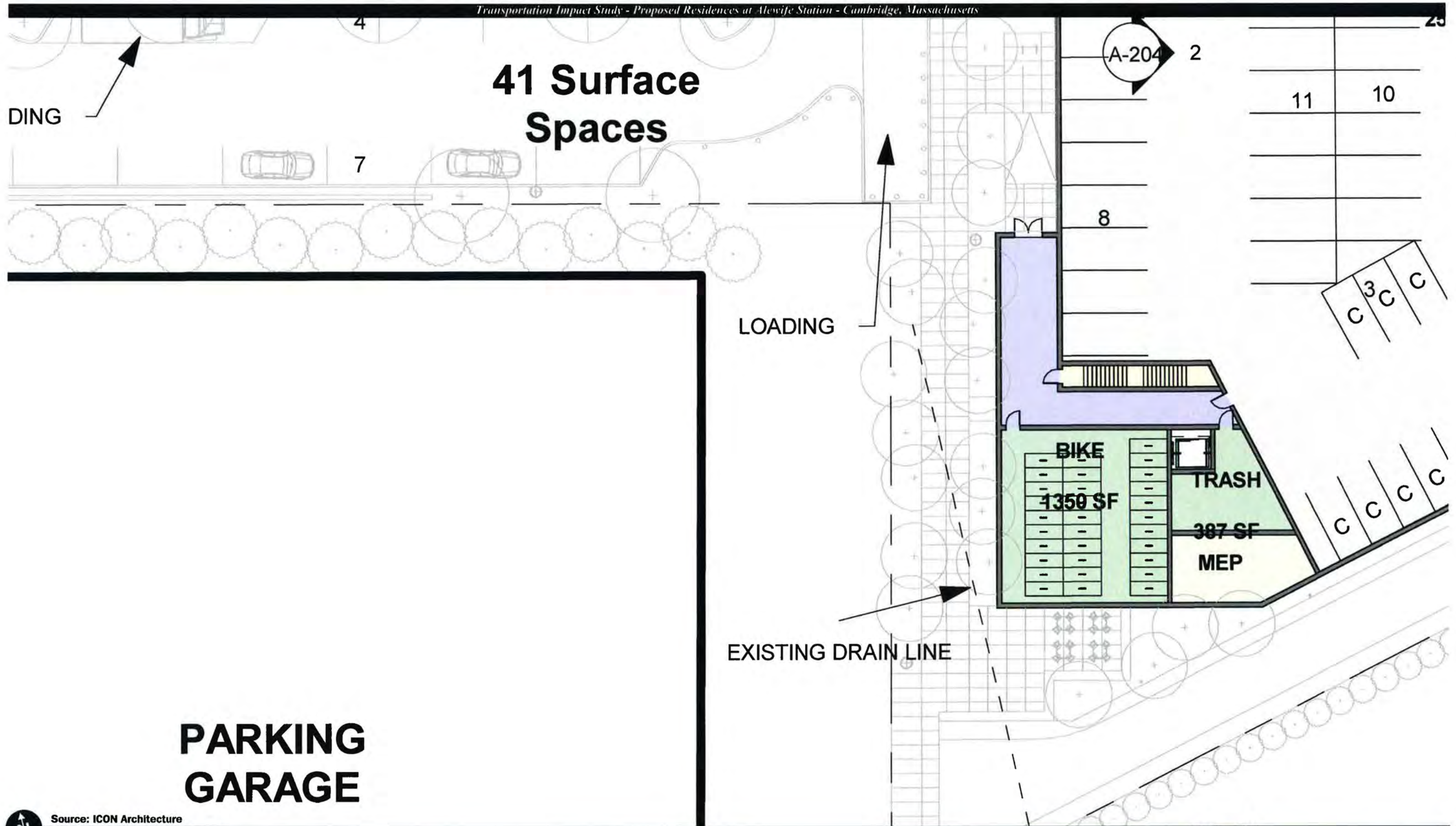


Figure 47
Trash and Moving Vehicle Plan
Building 2

Source: ICON Architecture

0 10 20 Scale in Feet

VAI Vanasse & Associates, Inc.
Transportation Engineers & Planners

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TRANSIT ANALYSIS

An analysis of transit usage was conducted to determine impacts that might be recognized under Build conditions. While there are several bus routes that stop at the Alewife Station or adjacent to the site on Route 2 (soon to be on Acorn Park Drive with the eastbound bus stop relocation proposed by the MBTA), a review of the Vox on Two monitoring report indicates that 98 percent of the residents commute using the Red Line subway with only 2 percent using bus service. The distribution on the transit routes are shown in Table 23.

Table 23
TRANSIT SYSTEM TRIP DISTRIBUTION^a

	Project Transit Trips	Subway Distribution ^b	Bus Distribution ^c
<i>Daily:</i>			
Entering	503	493	10
<u>Exiting</u>	<u>503</u>	<u>493</u>	<u>10</u>
Total	1,006	986	20
Peak-Hour Headways (Minutes)			
		8-9	17-60
<i>Weekday Morning:</i>			
Entering	28	27	1
<u>Exiting</u>	<u>67</u>	<u>66</u>	<u>1</u>
Total	95	93	2
<i>Weekday Evening:</i>			
Entering	38	37	1
<u>Exiting</u>	<u>38</u>	<u>37</u>	<u>1</u>
Total	76	74	23

^aBased on Vox on Two mode split survey information.

^b98 percent assignment.

^c2 percent assignment.

Due to this small increase expected on the bus ridership and the number of bus routes that stop at the Alewife Station, each route is expected to experience only a minor effect of the additional commuters from the proposed development. Ridership on the Red Line rapid transit train is also

expected to experience minor increases due to the project. Rush-hour headways are eight to nine minutes, which would result in only a few commuters riding each train during the peak hours. Table 24 indicates the impacts on the Red Line mode as a result of the project.

Table 24
MBTA RED LINE RIDERSHIP IMPACTS

Time Period	Train Headway ^a	No. of Trains ^b	No. of Cars per Train	Pass. Capacity per Car ^c	Hourly Capacity	Existing		Proposed with Project		Ridership Increase	
						Ridership ^d	V/C ^e	Ridership	V/C	Percent	V/C
Weekday Morning:	8-9 minutes ^f	28	6	167	28,056	3,174	0.11	3,267	0.11	2.9	0.01
Weekday Evening:	8-9 minutes ^f	28	6	167	28,056	3,413	0.12	3,487	0.12	2.2	0.0

^aBased on current MBTA schedule.

^bBoth northbound and southbound directions.

^cDefined on the basis of MBTA policy standards (crush capacity – 260 to 277 passenger capacity).

^dFrom CTPS Red Line Count Results adjusted with most recent Alewife Station entries.

^eVolume-to-capacity ratio.

^fScheduled rush-hour headway values per direction.

As shown in Table 24, sufficient capacity exists on the Red Line to accommodate the expected ridership increases due to the project. Increases in volume-to-capacity (v/c) ratios pertaining to line volume are between 2 and 3 percent.

Given the above transit characteristics and projected ridership information, the existing transit services available to residents and visitors of the proposed project are sufficient to address the expected slight increase in demand.

Provision of Transit Amenities

The nature of the subway facilities allow higher levels of customer amenities to be offered than do the bus stops. The Alewife Station is one of the larger MBTA subway stations, and provides seating and lighted shelters as well as support retail shops and the aforementioned bicycle cages. Bus shelters were observed on Lake Street at Frontage Road, and on Route 2 adjacent to the site. The MBTA is proposing to relocate this bus stop from Route 2 to Acorn Park Drive, which will reduce congestion that currently occurs when the inbound bus stops on Route 2.

RECOMMENDATIONS AND CONCLUSION

RECOMMENDATIONS

The analyses in this TIS indicate the Project is expected to have a minimal impact on area transportation facilities. However, this requires Project residents to have similar characteristics as those from the adjacent Vox on Two residential development. One way to encourage similar prospective residents is through the provision of a number of the same Travel Demand Management (TDM) measures in use at the Vox development. With the Project location near the Alewife T station, the Applicant and property management team will be able to effectively promote alternative transportation for residents to reduce single-occupant vehicle (SOV) traffic, as has been documented with the adjacent Vox development. This will effectively mitigate the Project impact on road and intersection facilities in the area. The TDM measures the Applicant has committed to are identified below.

Transportation Demand Management

Reducing the amount of traffic generated by the proposed development is an important component of the transportation mitigation plan. The goal of the proposed traffic reduction strategy is to reduce the use of SOVs by encouraging the use of public transportation, car/vanpooling, bicycle commuting, and pedestrian travel. This practice was utilized for the Vox on Two development and that site has significantly lower traffic generation than initially estimated, lower parking utilization than initially estimated, and is currently at approximately 98 percent occupancy. The following measures will be implemented as a part of the proposed project and by the property management team in an effort to reduce the number of vehicle trips generated by the project:

- In order to encourage the use of public transportation, the property management team will provide a MBTA Charlie card of equivalent value of a monthly pass to each adult member of a new household after the household has established residency. The Charlie card also allows residents the ability to use the bike cages at Alewife Station and other areas free of charge.
- In order to encourage the use of public transportation, the property management team will make available public transportation schedules, which will be posted in a centralized location for residents. The proximity of the Alewife Station will be emphasized in promotional materials for the site.

- The property management team will investigate the use of the Route 128 Business Council, Vox on Two, and Discovery Park shuttle buses for residents of the Project.
- In order to encourage car/vanpooling, the property management team will coordinate with MassRIDES and the 128 Business Council or the Alewife Transportation Management Associations (TMA) to identify car/vanpool resources that may be available to residents. This information will be posted in a centralized location.
- The property management team will investigate joining either the 128 Business Council or the Alewife TMA. Either TMA could provide a ridematching program among residents of the project and employers of the area.
- The property management team will provide information on available pedestrian and bicycle facilities in the vicinity of the project site. This information will be posted in a centralized location.
- The property management team will submit annual transportation monitoring information of the development to the City PTDM Planning Officer.

The Applicant will investigate the implementation of these traffic reduction strategies and will work with the City, the TMA, and area businesses to implement these programs.

Project Access

The vehicle site access and egress will be provided via Route 2, with separate right turn only entrance and exit driveways. A One-Way sign and “NO LEFT TURN” sign will be posted on the driveway approach at the Route 2 intersection. Details of this design will be evaluated with the District 6 Office of MassDOT.

The Project is currently designed with its own entrance and exit driveways to Route 2. This is proposed in the event that separate owners operate the Project and the Vox on Two development. If there is an opportunity to connect to the Vox on Two development to share driveways, the Applicant will proceed with this connection, but currently the development must be permitted through the City and MassDOT with its own driveways.

CONCLUSION

Overall, the Applicant is committed to the implementation of the above project mitigation strategies to reduce the overall project impact. Of the 145 project indicators reviewed, none were directly exceeded by the project impact. One of the indicators is exceeded by virtue of the Project location adjacent to Route 2. A total of 14 indicators for pedestrian operations were exceeded under Existing Conditions analysis (without the project). Overall the project has satisfied 130 indicators of impact with minimal project impact expected.

In summary, this project is a redevelopment of existing commercial properties which reduces the net traffic impact on area road facilities. The Project is adjacent to another residential community which has a very low transportation impact due to a successful TDM program, the central tenets of which will also be implemented at the Project. This residential project is expected to have similar traffic impacts as the existing commercial uses on site, particularly during the weekday evening peak hour. The TDM measures and intentionally constrictive parking conditions will further reduce the project’s traffic impacts resulting in a positive change in the area.