Nitsch Engineering

Traffic Impact Report

1165R Mass Ave Apartments
1165R Massachusetts Avenue
Arlington, MA

May 12, 2021

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Nitsch Engineering Project #13990.

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1 Introduction

Nitsch Engineering has prepared this Traffic Impact Report (TIR) for the proposed 1165R Mass Ave Apartments ("Project"), a building renovation and expansion project that will include an apartment complex with structured parking in the Mirak Innovation Park, located at 1165R Massachusetts Avenue in Arlington, Massachusetts. This TIR will review existing roadway conditions, access/egress, crash data, and traffic volumes, and it will analyze existing and future conditions at intersections in the study area to establish the impact the proposed improvements would have on traffic operations.

Figure 1 shows the Locus Map and Figure 2 shows the existing site and study area.

1.1 Existing Site

The proposed Project is located within the Mirak Innovation Park at 1165R Massachusetts Avenue in Arlington, Massachusetts. The Mirak Innovation Park is bounded by Massachusetts Avenue to the south, Quinn Road (Mirak Innovation Park East Driveway) to the east, the Minuteman Commuter Bikeway to the north, Forest Street to the southwest, and Ryder Street to the west. Mill Brook passes through the Innovation Park from west to east.

The site is located adjacent to the 2-story Workbar building, located at 1167 Massachusetts Avenue. Adjacent to Workbar is a 3-story building ("southeast building"), and north of Mill Brook is a 4-story office building and a 1-story annex building bisected by a 12-foot wide reinforced concrete bridge over Mill Brook, which provides one (1) 9-foot bi-directional travel lane for access to the rear parking lots. All access to and egress from the Innovation Park is provided via Quinn Road, an Innovation Park driveway off Massachusetts Avenue ("West Driveway"), and a driveway off Ryder Street. In addition to Workbar, the two other main abutters are the Mirak Hyundai Car Dealership and the Robert Annese Law Office. Both uses were granted an easement to use the West Driveway access for all egress and ingress.

Seventy-six parking spaces are provided for Workbar and "Mill Building" tenants behind the existing Workbar building, as indicated on the site survey conducted by Control Point Associates, dated November 13, 2019. An additional 48 parking spaces behind the Mirak Chevrolet are also provided for tenants via a short-term lease agreement.

1.2 Proposed Development

Based on the current Site Plan, the proponent proposes to demolish the 3-story building east of Workbar and the 1-story annex building to the north of Mill Brook to develop two (2) new buildings and renovate two (2) existing buildings. The buildings to be removed are referred to as the "Mill Building" in this report. The Project will consist of three (3) apartment buildings with 130 dwelling units and one (1) building for amenity space. Table 1 presents the current plan for the Apartment Mix.

Table 1 – Apartment Mix

Type	Percent Mix	Number of Units	Number of Bedrooms
Studio	24%	31	31
1-Bedroom	42%	55	55
2-Bedroom	24%	31	62
3-Bedroom	10%	13	39
Total	**100%**	**130**	**187**

Existing surface parking behind Workbar will be eliminated. However, 124 new parking spaces will be provided in the garages of Buildings #2 and #4, and 11 surface parking spaces will be provided. An agreement has been established to allow Workbar tenants to occupy 40 parking spaces during weekday business hours and 10 parking spaces at night and on weekends.

To accommodate two-way vehicular traffic and pedestrian traffic from Massachusetts Avenue to the north of Mill Brook, the bridge will have to be reconstructed to include two (2) 10.5-foot travel lanes and a minimum 4-foot wide sidewalk. The project team has employed a structural engineering team to assess the existing bridge conditions and to design a new bridge that will accommodate daily traffic as well as emergency vehicles.

1.3 Study Area

The study area includes the Mirak Innovation Park site, 12 adjacent roadway segments, and seven (7) intersections.

Roadways

- Massachusetts Avenue;
- Forest Street;
- Peirce Street;
- Ryder Street;
- Appleton Street;
- Appleton Place;
- Burton Street;
- Pine Court;
- Quinn Road (Mirak Innovation Park East Driveway);
- Mirak Innovation Park West Driveway;
- Quinn Access Road; and
- Mirak Innovation Park Ryder Street Driveway.

Intersections

- Massachusetts Avenue and Appleton Street/Appleton Place/Commercial Driveway;
- Massachusetts Avenue and Forest Street/Burton Street/Mirak Innovation Park West Driveway;
- Massachusetts Avenue and Pine Court;
- Massachusetts Avenue and Quinn Road (Mirak Innovation Park East Driveway);
- Mirak Innovation Park West Driveway and Quinn Access Road;
- Forest Street and Ryder Street/Peirce Street; and
- Ryder Street and Mirak Innovation Park Ryder Street Driveway.

1.4 Methodology

The traffic analysis herein summarizes the following:

1. A data collection of existing transportation conditions, including traffic data, crash history, roadway capacities, parking, transit, pedestrian and bicycle circulation, loading, and site conditions.

2. An evaluation of future transportation conditions and an assessment of potential traffic impacts associated with the Project and other neighboring projects. Long-term impacts are evaluated for the year 2025, based on a five-year horizon from the 2020 base year. Expected roadway, parking, transit, pedestrian, and loading conditions and deficiencies are identified. This section includes the following scenarios:
   a. The No-Build Scenario (2025), which includes general background growth and additional vehicular traffic associated with specific proposed or planned developments and roadway changes in the vicinity of the Project site; and
   b. The Build Scenario (2025), which also includes specific travel demand forecasts associated with the Project.
3. An evaluation of crash data and traffic volumes to determine if a traffic signal is warranted at any of the study intersections
4. An identification of appropriate measures to mitigate Project-related impacts identified in the previous phase.
5. An evaluation of short-term traffic impacts associated with construction activities.

Figure 1: Locus Map

1165R Mass Ave Apartments

Arlington, MA

Data Source: MassGIS

Nitsch Project #13990.

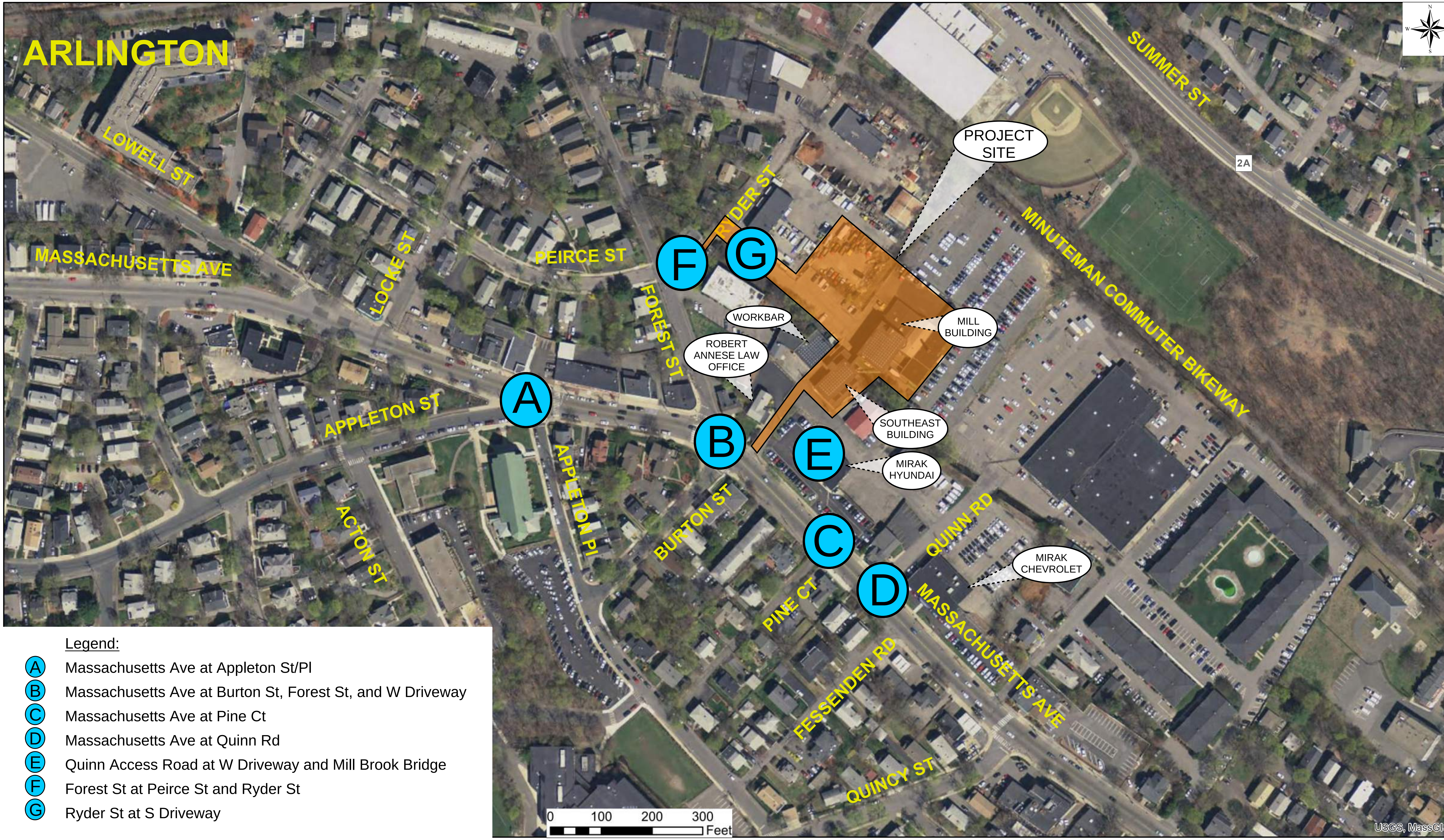

Figure 2: Existing Site and Study Area

1165R Mass Ave Apartments

Arlington, MA

Data Source: MassGIS

Nitsch Project #: 13990.

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2 Existing Conditions

2.1 Roadways

Massachusetts Avenue

Massachusetts Avenue, colloquially referred to as Mass Ave, is a two-lane principal arterial roadway under Town of Arlington jurisdiction that stretches for 16 miles from the Dorchester neighborhood of Boston northwest to Minuteman Park in Lexington. Near the site, Massachusetts Avenue runs generally east-west with one lane in each direction, each approximately 14 feet wide, separated by a double-yellow center line. The sidewalks along both sides of the roadway are in good condition. Two-hour parking is provided on both sides of the roadway via 8-foot wide parking lanes, and shared bicycle pavement markings (“sharrows”) are provided in both directions in the vehicular travel lanes. The posted speed limit along Massachusetts Avenue in the site vicinity is 30 miles per hour (mph). There are two (2) Massachusetts Bay Transportation Authority (MBTA) bus stops in the site vicinity, one in each direction, that service the MBTA’s 77 and 79 bus routes.

Forest Street

Forest Street is a two-lane collector roadway under Town of Arlington jurisdiction that runs in the general north-south direction from its northern terminus at Summer Street approximately a quarter mile to its southern terminus at Massachusetts Avenue. Near the site, Forest Street is 22 feet wide with no lane markings. Asphalt sidewalks in good condition are present on both side of the roadway, and on-street parking is restricted near the site. The speed limit is not posted along the roadway.

Peirce Street

Peirce Street is a two-lane local roadway under Town of Arlington jurisdiction that runs in the east-west direction from its western terminus at Locke Street approximately 0.15 miles to its eastern terminus as Forest Street. Near the site, Peirce Street is 22 feet wide with no lane markings. Concrete sidewalks with grass buffers are present and parking is allowed on both sides of the roadway. The speed limit is not posted along the roadway.

Ryder Street

Ryder Street is a two-lane private way, half of which is under ownership of the Project, from Forest Street to the site driveway. Ryder Street runs in the northeast-southwest direction from its southwestern terminus at Forest Street at Mill Brook to its northeastern terminus at the Minuteman Commuter Bikeway. Adjacent to the Ryder Street Driveway, Ryder Street is only 20 feet wide, though parking is not restricted on either side of the roadway. Asphalt sidewalk in good condition is provided only on the east side on the Ryder Street Bridge over Mill Brook, and no pavement markings are present along the roadway. The speed limit is not posted along the roadway.

Appleton Street

Appleton Street is a two-lane major collector roadway under Town of Arlington jurisdiction that runs in the northeast-southwest direction that connects Massachusetts Avenue, at its northeastern terminus, to Concord Avenue (Route 2) at its southwestern terminus. At its intersection with Massachusetts Avenue, the roadway provides one lane with marked shoulder in each direction, each lane approximately 12 feet wide, separated by a double-yellow center line. Centerline markings and shoulder makings are present from Massachusetts Avenue to Acton Street, about 200 feet to the west. Concrete sidewalks with grass buffers are present on both sides of the roadway. Although the marked shoulders are not wide enough for standard vehicles to park, parking is not restricted along the roadway. The speed limit is not posted along the roadway.

Appleton Place

Appleton Place is a two-lane local roadway under Town of Arlington jurisdiction that runs in the general northwest-southeast direction that connects Massachusetts Avenue at its northwestern terminus to Quincy Road approximately a quarter mile to the southeast. The road is 22 feet wide with no lane markings. Concrete sidewalks are present on both sides of the roadway, and parking is not restricted on the southeast-bound side of the road. The speed limit is not posted along the roadway.

Burton Street

Burton Street is a two-lane local roadway under Town of Arlington jurisdiction that runs in the north-south direction from its northern terminus at Massachusetts Avenue approximately three-quarters of a mile to its southern terminus at Appleton Place. The road is 22 feet wide with no lane markings. Concrete sidewalks with grass buffer strips are present and parking is not restricted on both sides of the roadway. The speed limit is not posted along the roadway.

Pine Court

Pine Court is a narrow privately owned local roadway that runs in the north-south direction from its northern terminus at Massachusetts Avenue approximately three-quarters of a mile to its southern terminus at Appleton Place**.** Although the road is narrow, parking is not restricted. Sidewalks are not provided on either side of the roadway; and the pavement is in poor condition and in need of repairs. The speed limit is not posted along the roadway.

Quinn Road

Quinn Road is two-way local roadway under Town of Arlington jurisdiction that runs in the north-south direction. The road serves as a driveway entrance to the Mirak Innovation Park next to the Mirak Chevrolet service center. At its intersection with Massachusetts Avenue, the road is approximately 30 feet with no lane markings and no sidewalks. The speed limit is not posted along the roadway.

Mirak Innovation Park West Driveway

Mirak Innovation Park West Driveway is private and under ownership of the Project proponent. The driveway runs in the north-south direction, connecting Massachusetts Avenue to the Workbar/Mirak Mill parking lot over the Mill Brook bridge. The driveway is approximately 20 feet wide with no lane markings and no sidewalks.

Quinn Access Road

Quinn Access Road is a privately owned roadway that runs parallel to Massachusetts Avenue in the east-west direction, connecting the Mirak Innovation Park West Driveway to Quinn Road south of Mill Brook. The roadway is not under the ownership of the project proponent. The road serves as access to three small, paved surface parking lots that are used by abutting businesses. The speed limit is not posted along the roadway.

Mirak Innovation Park Ryder Street Driveway

Mirak Innovation Park Ryder Street Driveway is privately owned and under ownership of the project proponent. The driveway runs in the east-west direction from Ryder Street to the Mirak Mill Park West Driveway north of Mill Brook. The driveway provides direct access to the existing surface parking space located to the north of Workbar. This driveway has been historically used for vehicular access, parking, and material storage by the Legacy owners of the subject property. The driveway also provides via easements, access to the abutting property at 15 Ryder Street.

2.2 Study Intersections

Massachusetts Avenue and Appleton Street/Appleton Place/Commercial Driveway

Massachusetts Avenue intersects with Appleton Street, Appleton Place, and a commercial driveway to form a five-legged intersection, with the Massachusetts Avenue approaches operating freely, and the Appleton Street and Appleton Place under stop control. The Massachusetts Avenue eastbound and westbound approaches consist of one full-movement lane with adjacent on-street parking in each direction. The Appleton Street northeast-bound approach and the Appleton Place northbound approach each consist of one full-movement lane with stop signs and stop bars present. The commercial driveway southbound approach consists of one full-movement lane with no stop signs or stop bars present. Bus stops for the MBTA Bus Routes 77 and 79 are located at the Massachusetts Avenue eastbound approach. Ladder-style painted crosswalks are present at the westbound and northbound approaches accompanied by wheelchair ramps with detectable warning panels at each corner. Traffic signals are present at each corner of the intersection and flash yellow to warn motorists to proceed with caution. The signal provides a pedestrian activated traffic signal that operates under “flash” when not activated and steady “yellow/red” with “Walk/Don’t Walk” when activated. The intersection effectively operates as an unsignalized intersection. Although the traffic signal does not meet current federal regulations stated in the Manual of Uniform Traffic Control Devices (MUTCD), there is no current plan by the Town to revise the traffic signal.

Massachusetts Avenue and Forest Street/Burton Street/Mirak Innovation Park West Driveway

Massachusetts Avenue intersects with Forest Street, Burton Street, and the Mirak Innovation Park West Driveway to form a five-legged unsignalized intersection, with the two Massachusetts Avenue approaches operating freely, and the Forest Street, Burton Street, and West Driveway approaches under stop control. The Massachusetts Avenue eastbound and westbound approaches consist of one 14-foot wide full-movement lane with adjacent on-street parking in each direction. The Burton Street northbound approach consists of one full-movement lane with a stop sign and stop bar present and no posted parking restrictions. The Forest Street southeast-bound approach consists of one full-movement lane with parking restricted on both sides of the roadway and a stop sign and stop bar present. The West Driveway southbound approach provides one lane in each direction, though there are no pavement markings present. Ladder-style painted crosswalks are present at the eastbound, northbound, and southbound approaches, accompanied by wheelchair ramps with detectable warning panels at each corner.

Massachusetts Avenue and Pine Court

Massachusetts Avenue intersects with Pine Court to form a three-legged unsignalized intersection, with the Massachusetts Avenue approaches operating freely, and the Pine Court approach under stop control. The Massachusetts Avenue eastbound and westbound approaches consist of one full-movement lane with adjacent on-street parking in each direction. The Pine Court northbound approach consists of one full-movement lane; however, there is no stop sign, yield sign, or stop bar present. A ladder-style painted crosswalk is present at the Pine Court approach accompanied by wheelchair ramps with detectable warning panels at each corner.

Massachusetts Avenue and Quinn Road (Mirak Innovation Park East Driveway)

Massachusetts Avenue intersects with Quinn Road to form a three-legged unsignalized intersection, with the Massachusetts Avenue approaches operating freely, and the Quinn Road approach under stop control. The Massachusetts Avenue eastbound and westbound approaches consist of one full-movement lane with adjacent on-street parking in each direction. The Quinn Road southbound approach consists of one full-movement lane with a stop sign and stop bar. The stop sign for the southbound approach is attached to a utility pole on the left side of the approach. A ladder-style painted crosswalk is present at the Quinn Road approach accompanied by wheelchair ramps with detectable warning panels at each corner.

Mirak Innovation Park West Driveway and Quinn Access Road

The West Driveway intersects with Quinn Access Road to form a three-legged unsignalized intersection, with the West Driveway approaches operating freely and the Quinn Access Road westbound approach terminating at the West Driveway. The West Driveway and Quinn Access Road approaches consist of one full-movement lane in each direction with no stop signs or stop bars present.

Forest Street and Ryder Street/Peirce Street

Forest Street intersects with Peirce Street and Ryder Street to form a four-legged unsignalized intersection, with the Forest Street approaches operating freely, and the Ryder Street and Peirce Street approaches under stop control. The Forest Street northbound and southbound approaches consist of one full-movement lane with adjacent on-street parking in each direction. The Peirce Street eastbound approach consists of one full-movement lane with a stop sign and stop bar. The Ryder Street westbound approach, offset slightly to the south relative to Peirce Street, consists of one full-movement lane; however, there is no stop sign, yield sign, or stop bar present. A ladder-style painted crosswalk is present at the Peirce Street approach accompanied by wheelchair ramps with detectable warning panels at each corner.

Ryder Street and Mirak Innovation Park Ryder Street Driveway

Ryder Street intersects with Mirak Mill Ryder Street Driveway to form a three-legged unsignalized intersection, with the Ryder Street approaches operating freely and the driveway westbound approach under stop control. The Ryder Street eastbound and westbound approaches consist of one full-movement lane with adjacent on-street parking in each direction. The Ryder Street Driveway approach consists of one full-movement lane with no stop signs or stop bars present.

2.3 Public Transportation

Subway

Alewife Station is located about 3.5 miles southeast of the study area at the intersection of Concord Turnpike and Alewife Brook Parkway in Cambridge. The station is the northern terminus of the MBTA's Red Line, which provides direct access to Downtown Boston and other cities, including Somerville, Quincy, and Braintree.

Bus

MBTA bus services are available near the site. MBTA Bus Route 67, connecting Alewife Station and Turkey Hill, runs along Summer Street. The closest stops for Route 67 traveling to Alewife are located on the south side of Summer Street about 125 feet east of Forest Street and at the intersection of Washington Street and Summer Street. Bus Route 67 coming from Alewife to Turkey Hill stops at the intersection of Summer Street and Washington Street and then travels along Washington Street to Lawrence Lane. MBTA Bus Routes 77 and 79 run along Massachusetts Avenue near the site. Route 77 connects between Arlington Heights and Harvard Square, and Route 79 connects between Arlington Heights and Alewife Station. The closest designated stops for both inbound and outbound directions for these routes are located at the intersection of Massachusetts Avenue and Appleton Street/Appleton Place and at the intersection of Massachusetts Avenue and Quincy Street. Routes 67 and 79 provide direct access to Alewife Station, and Route 77 provides access to East Arlington, Somerville, and Cambridge.

2.4 Bicycle Facilities

The Minuteman Commuter Bikeway, a 10-mile long paved trail connecting Bedford to Alewife Station, passes near the north boundary of the Mirak Innovation Park, running parallel to Massachusetts Avenue. The length of the bikeway from Ryder Street to Alewife Station is about 3.5 miles, making it a useful non-motorized commuting option. Access to the Bikeway is provided at the north end of Ryder Street, making it easily accessible from the proposed site. Massachusetts Avenue has shared lanes with Sharrows in both directions of travel, and Appleton Street has paved shoulders in both directions that can be used by bicyclists. Shared or dedicated bicycle lanes are not present on the rest the town-owned or private roadways in the project area, though motorized volumes are comparatively low on those roads. A dockless bike-sharing program was being operated in the town until the end of 2019.

2.5 Pedestrian Mobility

Sidewalks are present on both sides of Massachusetts Avenue, Forest Street, Appleton Street, Appleton Place, and Burton Street, providing ample opportunity for pedestrian mobility. Crosswalks are present at the intersection of Forest Street and Ryder Street/Peirce Street and at all intersections along Massachusetts Avenue. On-site sidewalks are not currently present on the West Driveway from Massachusetts Avenue or on the Site Driveway from Ryder Street.

3 Existing Traffic Conditions

3.1 Traffic Count Data

Nitsch Engineering retained Precision Data Industries, Inc. (PDI) of Framingham, Massachusetts to collect traffic data within the study area, including both Automatic Traffic Recorder (ATR) counts and Turning Movement Counts (TMCs).

ATR Data

PDI collected ATR counts for a continuous 48-hour period at five locations from Tuesday, February 4, 2020 to Wednesday, February 5, 2020. The ATR data with seasonal adjustments per Section 3.2 are summarized in Table 2. The ATR data and calculations are included in Appendix A.

Table 2 – Automatic Traffic Recorder (ATR) Summary

Location	Period	ADT[a] Volumes (vpd)[b]	ADT[a] Directional Distribution		Peak Hour Traffic Period	Peak Hour Traffic Volumes (vph)[c]	Peak Hour Traffic Directional Distribution		K Factor[d]
Massachusetts Avenue, between Burton Road and Pine Court	Weekday	13,127	51%	EB	Morning	1,051	53%	WB	0.08
					Afternoon	1,084	56%	EB	0.08
Mirak Mill Park West Driveway, north of Massachusetts Avenue	Weekday	464	53%	NB	Morning	48	85%	NB	0.10
					Afternoon	41	77%	SB	0.09
Quinn Road, north of Massachusetts Avenue	Weekday	546	50%	SB	Morning	52	67%	NB	0.10
					Afternoon	41	76%	SB	0.08
Forest Street, north of Massachusetts Avenue	Weekday	4,042	56%	NB	Morning	480	61%	SB	0.12
					Afternoon	425	71%	NB	0.11
Burton Road, south of Massachusetts Avenue	Weekday	548	65%	SB	Morning	71	50%	SB	0.13
					Afternoon	27	67%	NB	0.05

[a]Average Daily Traffic; [b]Vehicles per day; [c]Vehicles per hour; [d]Proportion of daily traffic
NB = Northbound, SB = Southbound, EB = Eastbound, WB = Westbound

TMC Data

PDI collected TMC data at the seven (7) study intersections on Tuesday, February 4, 2020. TMC data was recorded from 7:00 AM to 9:00 AM to capture the weekday morning traffic peak hours and from 4:00 PM to 6:00 PM to capture the weekday evening traffic peak hours. The counts included passenger vehicles, heavy vehicles, bicycles, and pedestrians. The existing peak-hour traffic volumes at these intersections in the form of turning movements, seasonally adjusted per Section 3.2, are shown in Figure 3. The existing pedestrian peak-hour volumes are shown on Figure 4. The TMC data is included in Appendix A.

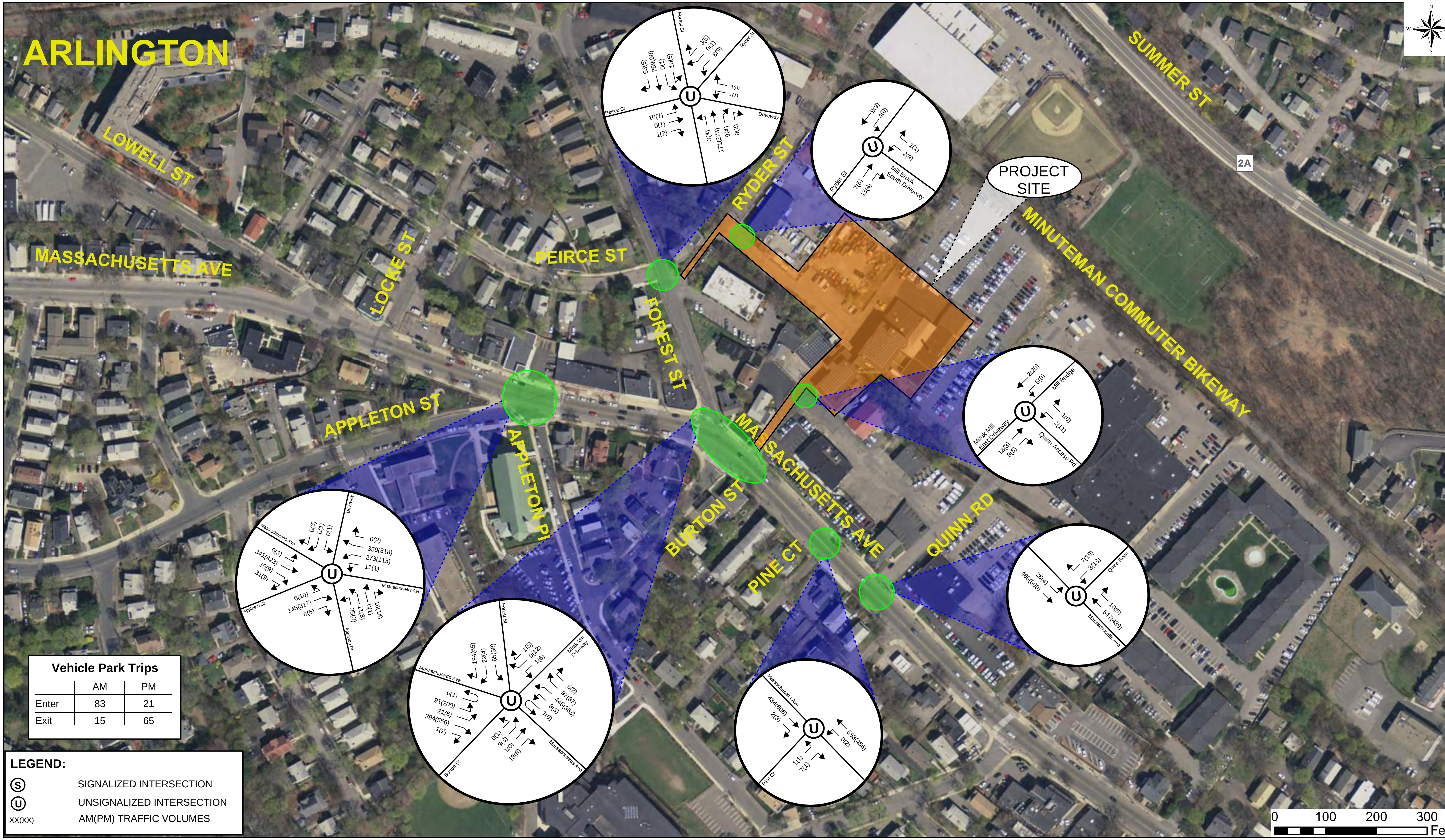

Figure 3: 2020 Existing Peak Hour Volumes

1165R Mass Ave Apartments

Arlington, MA

Data Source: MassGIS

Nitsch Project #13990.

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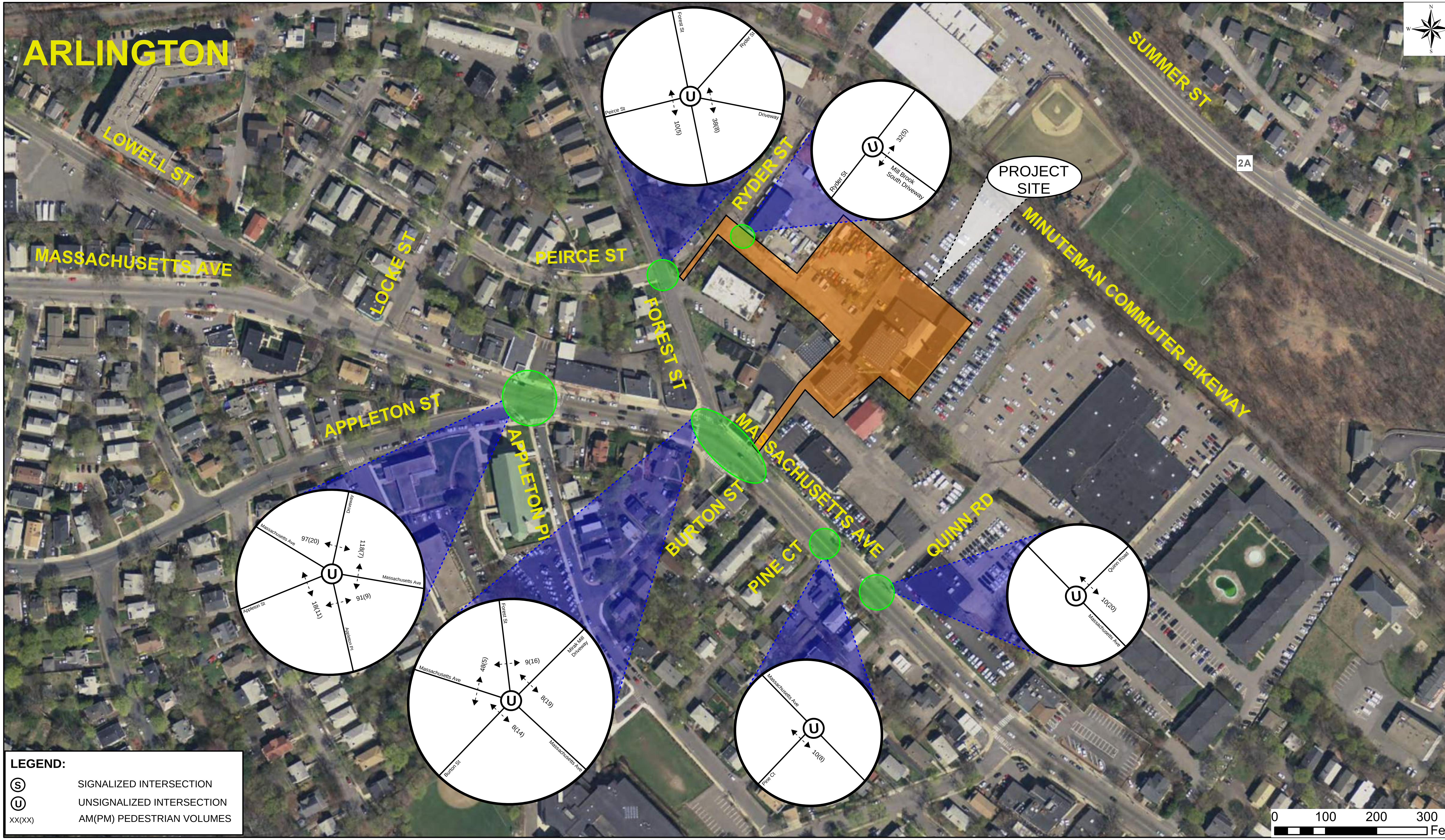

Figure 4: 2020 Existing Pedestrian Peak Hour Volumes

1165R Mass Ave Apartments

Arlington, MA

Data Source: MassGIS

Nitsch Project #13990.

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3.2 Seasonal Adjustment

Nitsch Engineering queried MassDOT traffic data for counts nearby that would establish a seasonal adjustment for the volumes we measured in May and June. No local data was available, so Nitsch Engineering used MassDOT's 2019 Weekday Seasonal Adjustment Factors.

Massachusetts Avenue falls within Group U3 – "Urban Other Principal Arterial." Forest Street, Appleton Street, and Appleton Place fall within U5 –" Urban Major Collector." Peirce Street, Ryder Street, Burton Street, Quinn Road, and Pine Court fall within U7 – "Urban Local Road." The seasonal factors for counts within Group U3 for the month of February is 1.03, indicating that traffic volumes are 3% lower than average. For Groups U5 and U7, the seasonal factor for February is 1.00, indicating that it represents an average month. To present a conservative approach, we increased the counted volumes on all Massachusetts Avenue approaches by 3%, and we did not adjust the volumes on the approaches of all other roadways. Traffic volumes in Table 2 and Figure 3 reflect the seasonal adjustment. MassDOT's 2019 Weekday Seasonal Factors are included in Appendix B.

3.3 Parking Utilization Assessment

Site Utilization

As the Project will be eliminating most of the parking lot behind Workbar, the Proponent has agreed to provide enough garage parking to reserve 40 weekday spaces and 10 evening and weekend spaces for Workbar tenants. Therefore, Nitsch Engineering conducted a parking utilization assessment to determine the existing demand for Workbar tenants and determine if the agreed-upon allotted spaces would provide enough capacity. The parking lots allocated for Workbar and "Mill Building" tenant parking were counted on Wednesday, January 29, 2020 from 6:00 PM to 8:00 PM, on Thursday, January 30, 2020 from 6:00 AM to 8:00 AM and from 12:00 PM to 2:00 PM, and on Saturday, February 1, 2020 from 9:00 AM to 11:00 AM. Standard methodology for determining parking generation is to use the Institute of Transportation Engineers' (ITE) *Parking Generation, 5th Edition*[1] ("the ITE method"). Per ITE these count periods represent the peak and off-peak hours for a typical residential development during the weekday; and the combined overlapping peak hours for an office and residential development on a Saturday.

The parking utilization assessment summary is shown in Table 3.

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[1] *Parking Generation*, Institute of Transportation Engineers, 5th Edition, 2019, Washington, D.C.

Table 3 – Site Parking Utilization Assessment Summary

Day and Time		Occupied Spaces	Maximum Utilization %
Weekday Morning	6:00 AM - 6:30 AM	1	4%
	6:30 AM - 7:00 AM	1	
	7:00 AM - 7:30 AM	3	
	7:30 AM - 8:00 AM	3	
Weekday Midday	12:00 PM - 12:30 PM	43	68%
	12:30 PM - 1:00 PM	52	
	1:00 PM - 1:30 PM	47	
	1:30 PM - 2:00 PM	45	
Weekday Evening	6:00 PM - 6:30 PM	5	7%
	6:30 PM - 7:00 PM	3	
	7:00 PM - 7:30 PM	4	
	7:30 PM - 8:00 PM	4	
Saturday Mid-morning	9:00 AM - 9:30 AM	3	5%
	9:30 AM - 10:00 AM	4	
	10:00 AM - 10:30 AM	4	
	10:30 AM - 11:00 AM	4	

Table 3 shows that during the weekday, the maximum utilization rate for the Workbar and “Mill Building” tenants is lowest in the morning and highest in the midday period. During the weekday, the highest number of spaces occupied during midday was 52. As this number represents the occupancy for the combined uses, it is necessary to determine the portion that is allocated to just the Workbar tenants.

The initial methodology outlined in the March 9, 2021 TIR used ITE Parking Land Use Code (LUC) 710 – “General Office Building” to estimate the Workbar parking utilization. This methodology ultimately yielded a parking demand of 23 vehicles at peak utilization.

Upon review of the Town of Arlington’s peer review, the project team reevaluated the parking demand and calculated the peak utilization for the Workbar based on the occupied gross floor area for each site use. It was found that the approximate 17,000 square feet shown on the ALTA survey is only the building footing area for the “Mill Building.” Therefore, we were able to receive the building occupancy data from the Town Assessor’s database, which is included in Appendix I of the revised TIR. The “Mill Building” which comprises four sub-buildings, totals 43,307 square feet of gross floor area. However, the data indicates that only 24,545 square feet of gross floor area was occupied. The Workbar comprised 11,670 square feet of occupied gross floor area. Therefore, the occupied “Mill Building” area represents 68% of the site utilization and the Workbar represents 32% of the site utilization. This results in an increased parking demand for the “Mill Building” and a reduced parking demand for the Workbar.

From this data, we can conclude that Workbar tenants occupied 17 parking spaces during the Weekday mid-day and 1 parking space during the Saturday mid-morning period. Therefore, the 40 parking spaces for during the weekday and 10 spaces on Saturday that will be provided for Workbar will be sufficient to meet the anticipated demand.

Comparable Developments

In addition to the site utilization, Nitsch Engineering initially conducted parking utilization counts at three (3) nearby apartment complexes to determine the parking utilization at similar residential transit-oriented developments in Arlington to determine the future parking required at the site (described in Section 7.6). The following developments were counted:

- Brigham Square Apartments at 30 Mill Street on January 29, 2020 from 6:00 AM to 8:00 AM and 12:00 to 2:00 PM, on January 30, 2020 from 6:00 PM to 8:00 PM, and on February 1, 2020 from 9:00 AM to 11:00 AM;
- Arlington 360 at 4205 Symmes Circle on January 30, 2020 from 12:00 PM to 2:00 PM; and
- The Legacy at Arlington Center at 438 Massachusetts Avenue on February 1, 2020 from 9:00 AM to 2:00 PM.

To obtain the peak parking demand at the other developments in addition to our own on-site observations, the management companies were contacted to obtain parking information, including the total number of spaces provided and the number of spaces reserved. It should be noted that all three developments were operating between 0-3% vacancy at the time the parking counts were collected.

Upon review of the Town of Arlington's peer review, it was assumed that the collected data does not adequately predict peak parking utilization. To address these parking concerns, the team took an additional three-step approach to confirm the parking utilizations used in the previous TIR. Knowing that we were not able to conduct individual counts at Arlington 360, we received updated parking utilization data from Greystar, the building's management company. The data, included in Appendix C, is consistent with our initial findings in stated in the revised March 9, 2021 TIR.

To obtain the time-of-day parking utilization for the Legacy, the management company was able to have the parking counts recounted internally for the following dates and times:

- Saturday, April 17, 2021 from 9:00 AM to 11:00 AM
- Tuesday, April 20, 2021 from 6:00 AM to 8:00 AM, 12:00 PM to 2:00 PM, 6:00 PM to 8:00 PM, and 11:00 PM to 1:00 AM (Wednesday)

The information from Legacy was used to obtain the peak parking utilization as well as the utilization reduction during the Weekday mid-day period.

To confirm the peak utilization for the Brigham Square Apartments, which was not believed to be obtained from the initial counts, we conducted an additional night count on Tuesday, April 20, 2021 from 11:00 PM to 1:00 AM (Wednesday). As expected, the peak utilization obtained from the Weekday morning counts represents the peak throughout the day. The Weekday night counts were slightly less than the Weekday morning, so the peak utilization used in the previous calculations was used for the revised calculations.

Table 4 summarizes the parking count data at nearby apartment complexes and compares the previous TIR to the current calculations.

Table 4 – Apartment Complex Parking Utilization Assessment Summary

	Location			Average
	The Legacy at Arlington Center	Brigham Square Apartments	Arlington 360	
March 9, 2021 Traffic Impact Report				
Total Parking Spaces	155	153	284	
Number of Bedrooms	247	179	241	
Peak Parking Observed	83	99	182	
Peak Parking Utilization (spaces/bd)	**0.34**	**0.55**	**0.76**	**0.55**
April 30, 2021 Traffic Impact Report				
Total Parking Spaces	155	153	282	
Number of Bedrooms	247	179	241	
Peak Parking Observed	100	99	175	
Peak Parking Utilization (spaces/bd)	**0.40**	**0.55**	**0.73**	**0.56**

As shown in Table 4, the peak parking utilization calculated from the new data is for the most part consistent with the data collected in February 2020 which is presented in the March 9, 2021 TIR. The average peak utilization of 0.56 spaces/bedroom yields an anticipated parking demand of 105 vehicles.

To obtain the parking utilization reduction during the Weekday mid-day and Saturday mid-morning, we used the two new sources for time-of-day data (The Legacy and Brigham). We used the average of the new datasets and found the utilization reduction is consistent with the previous calculations; 18% reduction during the Weekday mid-day and 10% reduction during the Saturday mid-morning. Parking data calculations are provided in Appendix C.

4 Safety Analysis

4.1 Historical Data

We researched the crash data within the study area for the three (3) most recent years available from the MassDOT records, 2016 to 2018. Table 5 summarizes the crash statistics for the seven study intersections.

Table 5 – Crash Statistics

	Number of Crashes			Severity				Manner of Collision				Incl.	Percent During	
Location	Year	Total Crashes	Annual Average	PD[a]	PI[b]	NR[c]	F[d]	A[e]	RE[f]	HO[g]	Other[h]	Ped/ Bike[j]	Peak Hours[k]	Wet/Icy Conditions
Massachusetts Avenue and Appleton Street/ Appleton Place/ Commercial Driveway	2016	3	1.7	2		1					3		33%	
	2017	2		2				1	1					50%
	2018	0												
	Total	**5**		**4**	**0**	**1**	**0**	**1**	**1**	**0**	**3**	**0**	**20%**	**20%**
Massachusetts Avenue and Forest Street/ Burton Street/ West Driveway	2016	0	0.3											
	2017	1				1			1					
	2018	0												
	Total	**1**		**0**	**0**	**1**	**0**	**0**	**1**	**0**	**0**	**0**	**0%**	**0%**
Massachusetts Avenue and Pine Court	2016	0	0.3											
	2017	0												
	2018	1			1			1					100%	100%
	Total	**1**		**0**	**1**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**100%**	**100%**
Massachusetts Avenue and Quinn Road	2016	0	0.0											
	2017	0												
	2018	0												
	Total	**0**		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0%**	**0%**
West Driveway and Quinn Access Road	2016	0	0.0											
	2017	0												
	2018	0												
	Total	**0**		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0%**	**0%**
Forest Street and Ryder Street/ Peirce Street	2016	0	0.3											
	2017	0												
	2018	1		1				1						
	Total	**1**		**1**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0%**	**0%**
Ryder Street and Ryder Street Driveway	2016	0	0.0											
	2017	0												
	2018	0												
	Total	**0**		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0%**	**0%**

[a]Property Damage Only; [b]Personal Injury Only (non-Fatal Injury); [c]Not Reported; [d]Fatality; [e]Angle; [f]Rear-end; [g]Head-on; [h]Sideswipe, opposite direction; sideswipe, same direction, single vehicle crash, rear-to-rear, not reported, unknown, etc.; [j]Includes pedestrian or cyclist; [k]Occurred between 7-9am or 4-6pm

A total of 8 crashes were reported within the study area from 2016 to 2018. There were no reported crashes at the intersections of Massachusetts Avenue and Quinn Road, Mirak Innovation Park West Driveway and Quinn Access Road, and Ryder Street and Mirak Innovation Park Ryder Street Driveway during the study period. In terms of severity, one (1) crash in the study area reported personal injury, four (4) crashes were reported as property damage only, and there were no crashes with fatalities. Angle and sideswipe crashes were the most frequent type of crash with a total of three (3) crashes each, and there were two (2) rear-end crashes. No crashes involving pedestrians or bicycles were reported. Twenty-five percent of all crashes in the study area occurred during peak hours, and 25% of all crashes occurred under wet/icy conditions.

Crash rates for intersections are expressed by the number of crashes per million entering vehicles (MEV). Table 6 compares the crash rates for the study intersections with the Statewide and District 4 averages. The intersection crash rate calculations are included in Appendix D.

Table 6 – Crash Rate Summary

Location	Facility Type	Number of Crashes[a]	Crash Rate[b]	Average Rates[b,c]		Comparison to Average Rates	
				District 4	Statewide	District 4	Statewide
Massachusetts Avenue and Appleton Street/Appleton Place/ Commercial Driveway	Unsignalized Intersection	5	0.30	0.73	0.78	Below	Below
Massachusetts Avenue and Forest Street/Burton Street/ West Driveway	Unsignalized Intersection	1	0.05	0.57	0.57	Below	Below
Massachusetts Avenue and Pine Court	Unsignalized Intersection	1	0.07	0.57	0.57	Below	Below
Massachusetts Avenue and Quinn Road	Unsignalized Intersection	0	0.00	0.57	0.57	Below	Below
West Driveway and Quinn Access Road	Unsignalized Intersection	0	0.00	0.57	0.57	Below	Below
Forest Street and Ryder Street/Peirce Street	Unsignalized Intersection	1	0.13	0.57	0.57	Below	Below
Ryder Street and Ryder Street Driveway	Unsignalized Intersection	0	0.00	0.57	0.57	Below	Below

[a]Based on 3-year crash history from MassDOT, 2016-2018
[b]Intersections: Crashes per million entering vehicles (MEV),
[c]Based on latest MassDOT crash data website

The crash rates at all study intersections are all well below the District 4 and Statewide averages.

4.2 2020 Crashes

As historical data is only available through 2018, crashes in 2019 and 2020 were not captured in the Safety Analysis. However, it is important to note that in May 2020, a fatal collision involving a bicyclist occurred at the intersection of Massachusetts Avenue and Appleton Street/Appleton Place and in June 2020, a non-fatal vehicle crash occurred at the intersection of Massachusetts Avenue and Forest Street/Burton Street/West Driveway.

While the details of the crashes were not available at the time of this study, it is evident that these locations experience serious safety issues related to bicyclist and motorist conflicts. Intersection geometry, limited on-street bicycle facilities, flashing traffic signal equipment, congestion, and other inhibiting factors could all contribute to the safety issues at these intersections. Since the initial submission of the TIR in July 2020, the Town has been working with a traffic consultant to conduct a Road Safety Audit to evaluate the intersections and determine the most appropriate mitigation measures.

5 Sight Distance

Stopping Sight Distance (SSD) is the length of the roadway ahead that is visible to the driver and should be long enough to enable a vehicle traveling at or near the design speed to stop before reaching a stationary object in its path. Stopping sight distance is the sum of the distance traversed by the vehicle from the instant the driver sights an object necessitating a stop to the instant the brakes are applied, and the distance needed to stop the vehicle from the instant brake application begins.

Intersection Sight Distance (ISD) is the length of the leg of the departure sight triangle along the major road in both directions for a vehicle stopped on the minor road waiting to depart. The critical departure sight triangles for the driveways along Massachusetts Avenue and Ryder Street are for traffic approaching from either the left or right. The SSD and ISD values associated with a given design speed are shown in Table 7.

Table 7 – Sight Distance Criteria

DESIGN SPEED (MPH)	DESIGN STOPPING SIGHT DISTANCE VALUE[1] (FT)	RECOMMENDED INTERSECTION SIGHT DISTANCE VALUE[2] (FT)
15	80	170
20	115	225
25	155	280
30	200	335
35	250	390
40	305	445
45	360	500
50	425	555
55	495	610
60	570	665
65	645	720
70	730	775
75	820	830
80	910	885

Source: *A Policy on Geometric Design of Highways and Streets, AASHTO, Washington DC (2011)*

[1]Design value based on a grade of less than 3%, a brake reaction distance predicted on a time of 2.5 seconds and a deceleration rate of 11.2 ft/s^2

[2]Recommended value based on Case B1 - a stopped passenger car to turn left onto a two-lane highway with no median and grades 3% or less

The posted speed limit for Massachusetts Avenue is 30 MPH and for Ryder Street is 25 MPH. According to their respective speed limit the sight distances were selected for comparison between the site measured and the calculated. For both streets, sight distance was measured at approximately 10 feet from the edge of pavement based on observed driving behavior. Table 8 summarizes the sight distance evaluation.

Table 8 – Sight Distance Evaluation

Intersecting Street	Stopping Sight Distance (SSD)			Intersection Sight Distance (ISD)		
	Traveling	Calculated	Measured	Looking	Calculated	Measured
Mass Ave and W Driveway	EB	200'	>500’	Right	335'	>500’
	WB	200’	>500’	Left	335'	>500’
Mass Ave and Quinn Road	EB	200'	>500’	Right	335'	>500’
	WB	200’	>500’	Left	335'	>500’
Ryder St and Ryder Driveway	EB	155’	105’	Right	280’	360’
	WB	155’	360’	Left	280’	105’

As shown in Table 8, SSD is adequate for both eastbound and westbound traffic at the Massachusetts Avenue driveway. Traffic calming measures are proposed by way of a speed table on Ryder Street at the driveway to reduce speed and compensate for the limited sight distance to the west.

6 Signal Warrant Analysis

We conducted traffic signal warrant analyses for the two (2) unsignalized driveways for Mirak Innovation Park along Massachusetts Avenue to determine whether signalization might be justified. We used the 2020 ATR volumes for Massachusetts Avenue, Forest Street, Burton Street, Mirak Mill Ryder Street Driveway, and Quinn Road to analyze the intersections of Massachusetts Avenue at Forest Street/Burton Street/Mirak Mill Ryder Street Driveway and Massachusetts Avenue at Quinn Road (Mirak Innovation Park East Driveway).

The current MUTCD contains nine (9) traffic signal warrants, at least one of which should be satisfied to justify the installation of a traffic signal at a location. Satisfying one or more warrants, however, does not necessarily require the installation of a traffic signal. The traffic signal warrants are:

- Warrant 1: Eight-Hour Vehicular Volume;
- Warrant 2: Four-Hour Vehicular Volume;
- Warrant 3: Peak Hour;
- Warrant 4: Pedestrian Volume;
- Warrant 5: School Crossing;
- Warrant 6: Coordinated Signal System;
- Warrant 7: Crash Experience;
- Warrant 8: Roadway Network; and
- Warrant 9: Intersection Near a Grade Crossing.

We conducted the signal warrant analysis using the procedures contained in the MUTCD. Not all warrants are applicable to all intersections, and data availability may limit which warrants can be evaluated. For this analysis, we evaluated three warrants: eight-hour vehicular volume, four-hour vehicular volume, and peak hour volume.

Based on our analysis of existing conditions, the intersection of Massachusetts Avenue at Quinn Street did not meet any of the warrants. However, the intersection of Massachusetts Avenue at Forest Street/Burton Street/ West Driveway met all three (3) evaluated warrants. As shown in our Capacity Analysis in Section 8.5, the proposed project does not significantly degrade intersection operations that would warrant the proponent to install a new traffic signal. The Project Team has learned that the Select Board has approved the creation of a design review committee to study both short-term and long-term improvements at the intersection of Appleton Street/Appleton Place and Massachusetts Avenue.

Appendix E includes the signal warrant analysis worksheets.

7 Future No-Build Traffic Conditions

Nitsch Engineering used the 2020 existing traffic volumes as the baseline for projecting traffic volumes to future 2025 No-Build conditions. To determine future 2025 conditions, the following steps are included:

- Project existing 2020 traffic volumes five (5) years in the future to the horizon year (2025) using an annual background traffic growth factor to account for regional growth;
- Add traffic volumes associated with any planned developments that may impact the study area;
- Include any planned roadway improvements that may affect traffic volumes; and
- Analyze the study area location to determine future traffic operations.

7.1 Background Growth

We reviewed the Town of Arlington's 2015 Master Plan to determine an appropriate growth rate to apply to the 2020 existing traffic volumes. As noted in Table 2.1 in Chapter 2 of the Master Plan, the expected growth from 2020 to 2030 is 3.3%, which equates to an annual 0.33% background growth rate. Understanding that development is increasing in the Greater Boston Area, we selected a conservative rate of 2.0% per year to represent regional background growth of traffic in this area. We applied this growth rate over the 5-year design period for the turning movement data.

7.2 Additional Development and Planned Roadway Development

Nitsch Engineering contacted the Town of Arlington Planning Board to establish any planned developments that will potentially add traffic to the study area who indicated that there are no planned developments or roadway projects in the vicinity that would affect our development.

However, in collaboration with the Project team we learned that a 50-unit hotel with ancillary restaurant space will be developed in the vicinity of the Project at 1207 – 1211 Massachusetts Avenue. According to the Traffic Impact Study developed by BSC Group, Inc dated June 2020, the hotel is anticipated to generate an approximate net increase of 18 trips during the weekday morning peak hour and 23 trips during the weekday evening peak hour. For the purposes of the Project Traffic Impact Report, the conservative 2% background growth rate applied to the existing traffic volumes is sufficient to capture the anticipated hotel traffic volume.

7.3 2025 No-Build Traffic Volumes

We developed the 2025 No-Build volumes by the applying annual growth rate for five (5) years to the 2020 Existing traffic volumes at the study intersections. Figure 5 presents the peak hour traffic volumes for 2025 No-Build conditions.

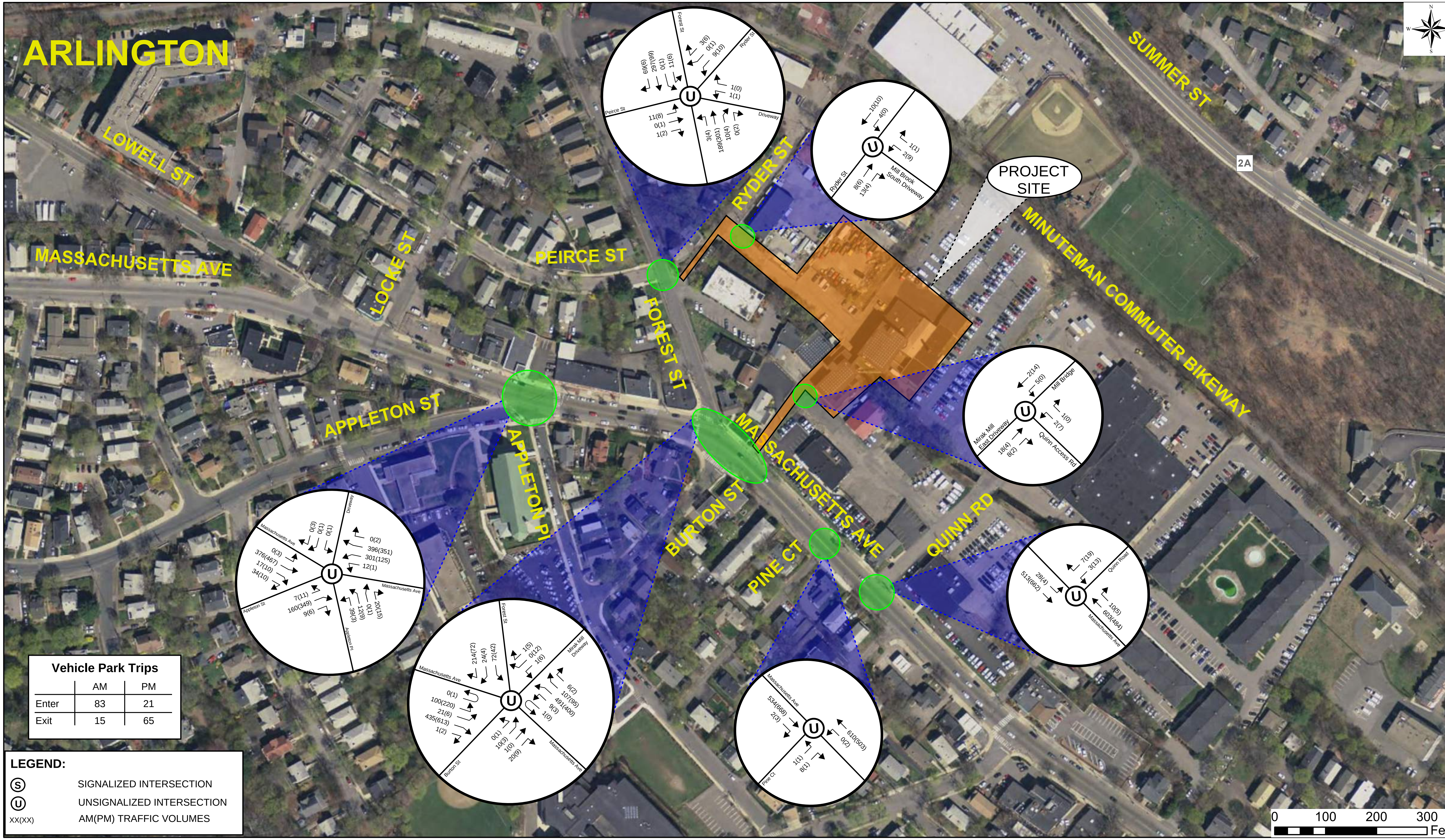


Figure 5: 2025 No-Build Peak Hour Volumes

1165R Mass Ave Apartments

Arlington, MA

Data Source: MassGIS

Nitsch Project #13990.

Nitsch Engineering

8 Proposed Future Conditions

8.1 Proposed 1165R Mass Ave Apartments Site

The proponent proposes to demolish the 3-story building east of Workbar and the 1-story annex building to the north of Mill Brook to develop two (2) new buildings and renovate two (2) existing buildings. The Project will consist of three (3) apartment buildings with 130 dwelling units and one (1) building for amenity space.

Vehicle Access and Circulation

To provide an efficient site circulation and limit the impacts to the abutters, wayfinding signage will be placed at the egress approach to the West Driveway (at the Quinn Access Road) and at the ingress approach to the Ryder Street Driveway. The wayfinding signage will indicate that tenants will have ingress-only provided at the West Driveway and egress-only at the Ryder Street Driveway. However, access at the West Driveway will remain ingress and egress for the two abutters, the Mirak Hyundai car dealership and the Robert Annese Law Office. Similarly, access at the Ryder Street Driveway will remain ingress and egress for all abutters. The existing monument ID sign at the end of the West Driveway (at Massachusetts Avenue) will be modified to display resident and Workbar entry only. Access via Quinn Road and the Quinn Access Road will remain two-way for all users. To accommodate two-way traffic and pedestrian traffic from Massachusetts Avenue to the north of Mill Brook, the bridge will have to be reconstructed to include two (2) 10.5-foot travel lanes and a minimum 4-foot wide sidewalk.

Given the low volume of site-generated traffic, especially during the midday hours, access and operations for the abutting businesses will not be significantly impacted. During the weekday midday hours when the abutting businesses are expected to be at a peak, the new development is expected to generate on average 35 vehicles per hour or approximately one vehicle every two minutes. This is not deemed to be a significant amount of traffic affecting access or operations on-site and off-site.

Parking

Parking will be provided via 14 spaces in the basement-level garage of Building 2 south of Mill Brook, 110 spaces in the two-level garage of Building 4 north of Mill Brook, and surface parking with eleven (11) spaces, totaling 135 proposed parking spaces. Access to the two-level garage will be provided via a two-way driveway on the south side of the building, and access to the basement-level garage will be provided via a two-way driveway on the east side of the reconstructed southeast building. An shared parking plan has been established to allow Workbar tenants to occupy 40 parking spaces during the weekday business hours and 10 parking spaces at night and on the weekends.

It is anticipated that all parking spaces will be numbered and that all Workbar tenants and residents will have a form of identification (such as a parking sticker or tag) designating reserved and non-reserved spaces within the garage. Resident parking spaces will be leased at market rates. Upon signing a tenant lease agreement or Workbar membership, the user will be given a site circulation diagram along with documentation indicating that they will be penalized if the designated site circulation is not adhered to. An on-site transportation coordinator will be present and responsible for maintaining parking and access compliance.

Pedestrian and Bicycle Accommodations

Pedestrian and bicycle accommodations and safety are paramount for a successful development in an urban area. The site has been designed to provide a raised pedestrian sidewalk with guardrail along the south side of the Ryder Street Driveway to separate the vehicular traffic from pedestrian traffic and provide sidewalk access to Ryder

Street, Forest Street, and Massachusetts Avenue. In addition, the main pedestrian entrance to the building complex is separated from the main parking garage entrance and exit to reduce potential conflicts. The proposed raised sidewalk on the new bridge will also provide a safe pedestrian connection over the Mill Brook.

As the site is adjacent to the Minuteman Commuter Bikeway and shared bicycle lanes on Massachusetts Avenue, it is important that the development provide the adequate bicycle accommodations to support the use of bicycles for residents. The development will provide interior bicycle parking for 100 bicycles with repair and maintenance stations. Commuter access to the Minuteman Commuter Bikeway will be provided via Ryder Street, and local bicycle access to Massachusetts Avenue will be provided over the bridge and via Ryder Street.

Figure 6 presents the proposed site access for vehicles, pedestrians, and bicycles.

Explored Alternative Connections

The Proponent explored different options to provide a direct pedestrian connection from Massachusetts Avenue to the site. The Massachusetts Avenue West Driveway is too narrow (20 feet wide) and too steep (grades up to 12%) to provide pedestrian or bicycle access to the Property. Moreover, the Massachusetts Avenue West Driveway is encumbered by a recorded easement, which grants the abutting properties rights of ingress and egress, preventing the narrowing of the easement for installation of a sidewalk even if such an installation were feasible.

As confirmed by the Town Engineer, Quinn Road is, in fact, a public way and is one of three existing vehicular connections to the Property. The Quinn Road connector driveway is owned by others, but the Proponent has access rights from the Property to the Quinn Road. As such, the proponent does not have rights to modify the connector driveway to accommodate pedestrian access.

Based upon multiple meetings with the neighborhood group, the Proponent is proposing extensive improvements to the south of the Ryder Street exit of the Property, including: (a) repaving the existing paved surface from the Ryder Street exit of the Property to Forest Street; (b) reconstructing the existing sidewalk from the Ryder Street exit of the Property to Forest Street to create an accessible connection, including new crosswalks and wheel chair ramps at the 9 Ryder Street driveway curb cut; (c) the insertion of a new crosswalk and wheelchair ramps at Ryder and Forest Streets; and (d) a speed table on Ryder Street at the intersection with the Ryder Street exit driveway.

The Applicant does not have any rights with respect to the private way on Ryder Street from the Ryder Street exit to the Minuteman Commuter Bikeway. Any improvements to that segment of Ryder Street should be required of the of the abutting property owners at 15 Ryder Street, 33 Ryder Street, and the other commercial businesses that use the private right-of-way for vehicular access.

With respect to the utility pole within the Massachusetts Avenue West Driveway, the Proponent investigated relocating the pole and discussed relocation with the utility company. Power service for the new residential project will be provided from Ryder Street, not via the Massachusetts Avenue West Driveway. The existing utility pole on the Massachusetts Avenue West Driveway is owned by the utility company and provides power and data services to the abutting property owners. The relocation is not feasible for the following reasons: (a) the pole would need to be moved by the utility company and located on another property owner's property; (b) relocation of the pole would trigger the need to move connecting utility poles servicing businesses on the Quinn Road connector and the Massachusetts Avenue West Driveway, as well as relocation of poles on Massachusetts Avenue to meet current utility company standard; and (c) the costs associated with the reworking and relocation of the poles would be substantial, would not address the power needs for the project, would render the project economically unfeasible if imposed on the project, and presumably would not be a cost the abutters would consider incurring.

Figure 6: Site Access Diagram
1165R Mass Ave Apartments
Arlington, MA
Data Source: MassGIS
Nitsch Project #13990.

Nitsch Engineering

8.2 Trip Generation

As the existing "Mill Building" will be eliminated, and replaced with the apartment complex, a trip generation credit must be applied to accurately determine the traffic impacts. Therefore, we calculated the trip generation for the existing use and the proposed use to obtain the net trip generation. Standard methodology for determining trip generation of a site is to use the ITE *Trip Generation, 10th Edition*[2] ("the ITE method").

For the existing "Mill Building" we used Land Use Code (LUC) 710 – "General Office Building." The trip generation rate for the independent variable "1,000 square feet of gross floor area" was applied to the 24,545 square feet of occupied floor area.

For the new apartment complex, we used LUC 221 – "Multifamily Housing (Mid-Rise)", which includes apartments, townhouses, and condominiums located within the same building with at least three (3) other dwelling units and between three (3) and 10 levels (floors) of residence. Table 9 represents the total unadjusted peak hour trip generation. The ITE Trip Generation worksheets are included in Appendix F.

Table 9 – Peak Hour Trip Generation

Period	Direction	ITE Office Trips (24,545 SF)	ITE Housing Trips (130 units)	Net Project Trips
Weekday Morning	Enter	31	9	-22
	Exit	5	38	33
	Total	**36**	**47**	**11**
Weekday Evening	Enter	6	46	40
	Exit	31	22	-9
	Total	**37**	**68**	**31**

Table 9 shows that the weekday morning entering and weekday evening exiting trips generated from the proposed development are less than the trips generated from the existing land use, resulting in a net negative projected trip number. To accurately represent the overall trip generation for the Innovation Park, it is acceptable to apply the negative number.

Mode Share

Based on the Census Tract 3566.01 data, 74% of commuters use a car as the primary travel mode. With the heavy traffic and the high cost of owning a car, urban areas recently have been seeing a significant drop in automobile uses and an increase in use of public transit, bicycling, and walking. For this site, with its proximity to the Minuteman Commuter Bikeway and the MBTA Bus Route 79, which both have direct connections to Alewife Station, it is expected that the number of bicyclists and public transit users would be higher than average for its census tract, resulting in a lower number of vehicle (car) trips. In addition, it is anticipated that changes to

[2] *Trip Generation*, Institute of Transportation Engineers, 10th Edition, 2017, Washington, D.C.

employer operations during the COVID-19 pandemic will persist to some degree after the pandemic, increasing the number of employees who will work from home compared to before the pandemic.

However, to provide a conservative traffic analysis, we used the Census Tract data with the higher rate for cars. For this assessment, we adjusted mode share and applied it to the net trip generation, as shown in Table 10.

Table 10 – Mode Share for 1165R Mass Ave Apartments (Net Trip Generation)

Mode	Census Tract 3566.01	Weekday Morning			Weekday Evening		
		Enter	Exit	Total	Enter	Exit	Total
CAR	74%	-16	24	8	30	-7	23
TRANSIT	21%	-5	7	2	8	-2	6
BICYCLE	1%	0	0	0	0	0	0
WALK	2%	-1	1	0	1	0	1
TAXI	0%	0	0	0	0	0	0
WORK FROM HOME	2%	0	1	1	1	0	1
Total	**100%**	**-22**	**33**	**11**	**40**	**-9**	**31**

To obtain the projected traffic volume that will be added to the roadway network, the appropriate vehicle occupancy rates should be applied to car-person trips shown in Table 10. However, as the net number of car trips are low, a vehicle occupancy rate of 1.0 persons per car was used to provide a conservative analysis.

8.3 Trip Distribution

We based the additional peak-hour trips to/from the site using the existing directional distribution based on our traffic counts as shown in Table 11.

Table 11 – Trip Distribution

Direction and Roadway	Percentage
To/From East on Massachusetts Avenue	60%
To/From West on Massachusetts Avenue	25%
To/From Southwest on Appleton Street	15%
Total	**100%**
Source: Figure 3: 2020 Existing Peak Hour Volumes	

8.4 Trip Assignment

We assigned the new peak-hour trips to the study intersections by multiplying the quantity of new trips from Table 10 by the Trip Distribution percentages shown in Figure 7. The resultant new trip assignment volumes are shown in Figure 8.

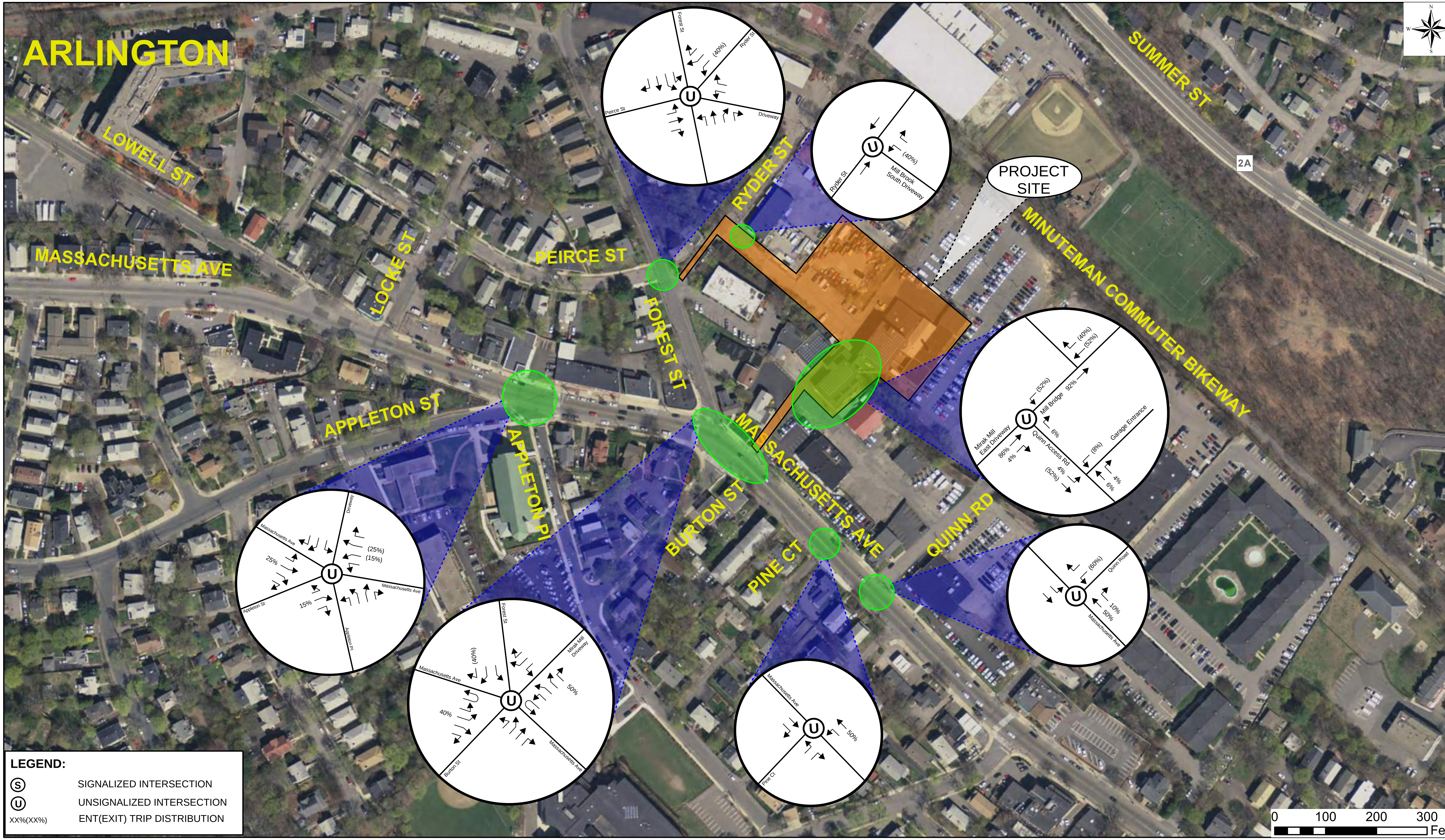


Figure 7: Trip Distribution

1165R Mass Ave Apartments

Arlington, MA

Data Source: MassGIS

Nitsch Project #13990.

Nitsch Engineering

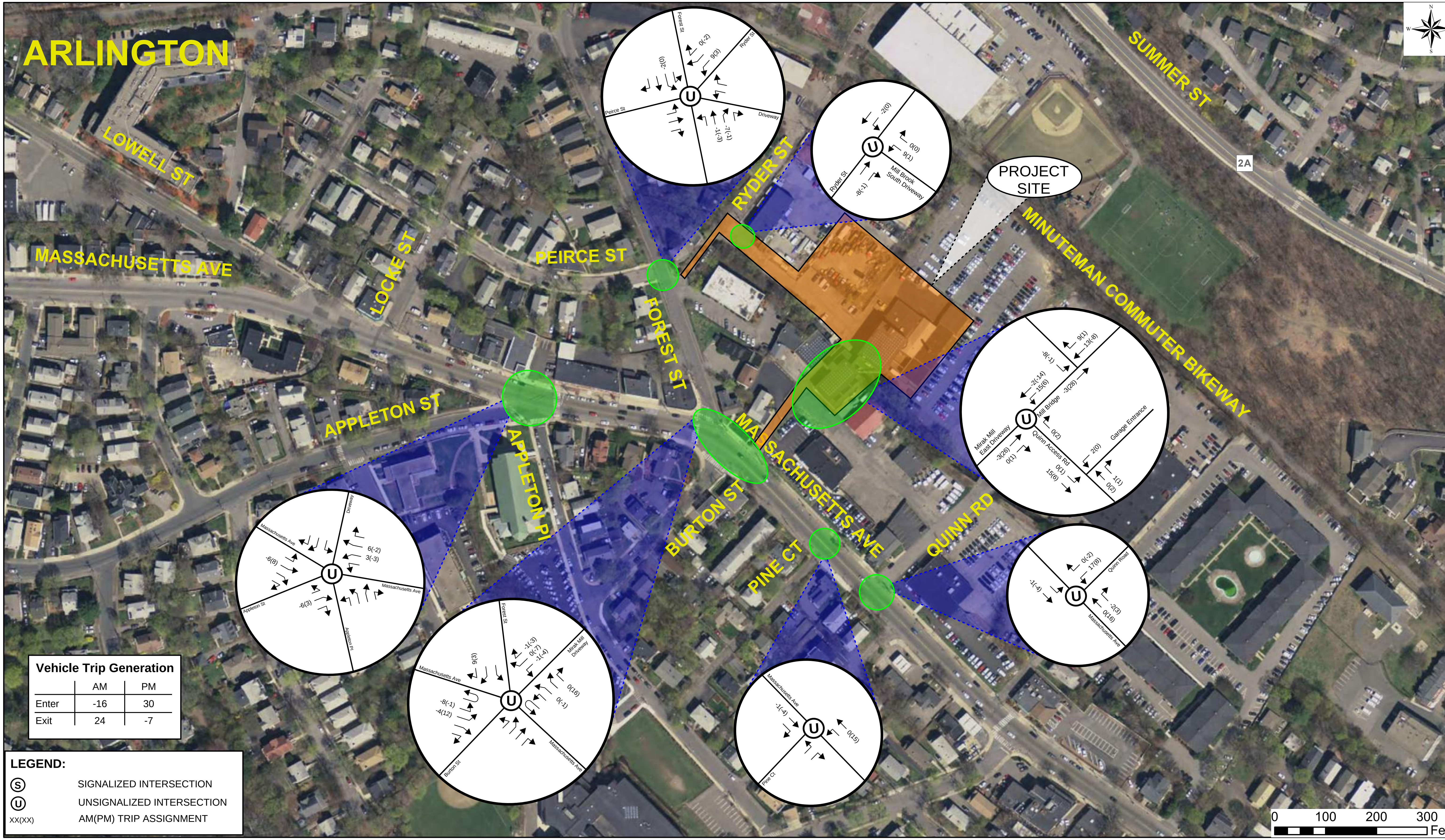


Figure 8: Net Trip Generation Assignment

1165R Mass Ave Apartments

Arlington, MA

Data Source: MassGIS

Nitsch Project #13990.

Nitsch Engineering

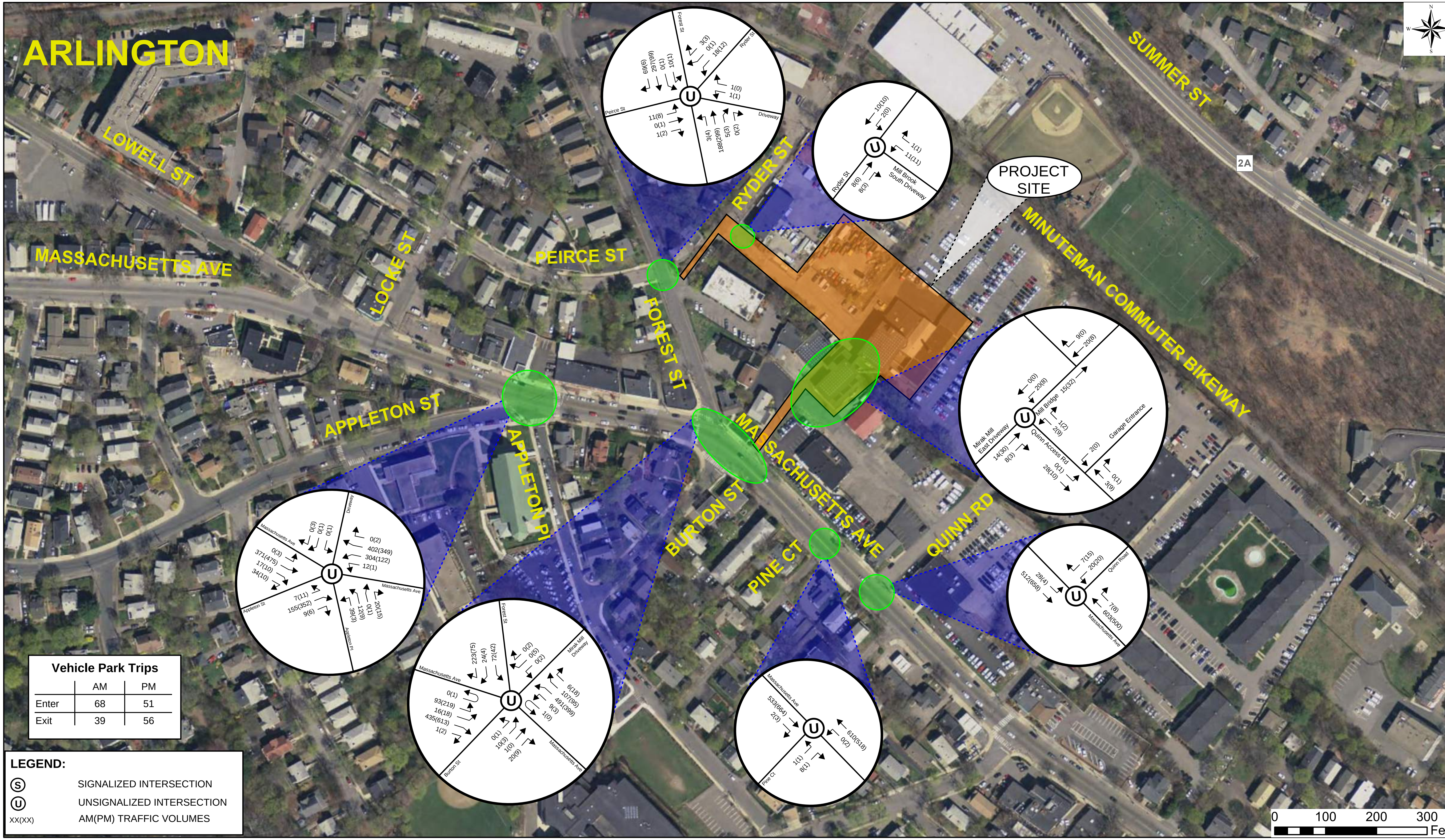
As noted in Section 8.1, vehicle circulation and access for the site will change with the use therefore changing the overall Mirak Innovation Park trip distribution. The overall Park trips at the driveways are compared in Table 12.

Table 12 – Driveway Volume Comparison

Driveway	Weekday Morning						Weekday Evening					
	2020 Existing			2025 Build			2020 Existing			2025 Build		
	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total
West Driveway	28	2	30	23	0	23	8	23	31	36	9	45
Quinn Road	38	10	48	35	27	62	9	32	41	12	35	47
Ryder Street Driveway	18	3	21	10	12	22	4	10	14	3	12	15
Total	**84**	**15**	**99**	**68**	**39**	**107**	**21**	**65**	**86**	**51**	**56**	**107**

8.5 2025 Build Traffic Volumes

We added the Trip Assignment volumes from Figure 8 to 2025 No-Build conditions traffic volumes from Figure 5 to yield the 2025 Build conditions peak-hour traffic volumes, which are shown in Figure 9.



Vehicle Park Trips

	AM	PM
Enter	68	51
Exit	39	56

Figure 9: 2025 Build Peak Hour Volumes

1165R Mass Ave Apartments

Arlington, MA

Data Source: MassGIS

Nitsch Project #13990.

Nitsch Engineering

8.6 Parking Generation

To determine the required amount of parking needed for the proposed development, we compared the parking rates from the Town of Arlington Zoning Board of Appeals (ZBA), the Town of Arlington Master Plan, the ITE *Parking General Manual*, 5th Edition, and the parking utilization study. For the ITE rates, we used Land Use Code 221 "Multifamily Housing (Mid-Rise)." Given the proposed apartment mix, it was determined the best means to calculate parking would be to use the number of bedrooms as the independent variable. From the data we collected from comparable developments in the Town, we found that average peak parking utilization in the area is 0.56 spaces per bedroom (see Table 4 in Section 3.3). The parking rate comparisons are shown in Table 13 below.

Table 13 – Parking Requirement Comparisons

Type	# of Units	# of Bed	ZBA		Master Plan		ITE		Study	
			Rate/ unit	# of spaces	Rate/ unit	# of spaces	Rate/ bed	# of spaces	Rate/ bed	# of spaces
Studio	31	31	1	31	1.5	47	0.75	23	0.56	17
1-Bedroom	55	55	1.15	63	1.5	82	0.75	41	0.56	31
2-Bedroom	31	62	1.5	47	1.5	47	0.75	47	0.56	35
3-Bedroom	13	39	2	26	1.5	19	0.75	29	0.56	22
Total	**130**	**187**	**-**	**167**	**-**	**195**	**-**	**140**	**-**	**105**

To calculate the total required spaces in combination with the Workbar, we applied the parking utilization factors discussed in Section 3.3. The 18% Weekday mid-day parking utilization reduction was applied to the number of required apartment spaces and added to the calculated Workbar parking demand, yielding a total parking demand of 103 vehicles (107 vehicles in previous TIR). During the Saturday mid-morning, the calculated parking demand based on a 10% reduction is 96 vehicles (95 vehicles in previous TIR). When adding the required 40 Workbar parking spaces during the Weekday mid-day to the apartments' demand, 126 parking spaces will be required. Adding the 10 Workbar parking spaces to the Saturday mid-morning demand, 104 parking spaces will be required. The parking garage layouts for Buildings 2 and 4 which provide 124 parking spaces in addition to the 11 surface parking spaces will be sufficient to meet the anticipated demand. A summary of the future parking generation is shown in Table 14.

Table 14 – Future Parking Generation

Items		Quantity	
1	Number of proposed bedrooms	187 bedrooms	
2	Required apartment spaces (based on 0.56 spaces/bedroom)	103 spaces	
		Weekday Midday	**Saturday Mid-morning**
3	Anticipated occupied apartment spaces (based on study utilization)	86 spaces (82%)	94 spaces (90%)
4	Calculated required Workbar spaces (from Section 3.3)	17 spaces	1 space
5	Contracted required Workbar spaces	40 spaces	10 spaces
6	**Total calculated required net spaces (rows 3 + 4)**	**103 spaces**	**95 spaces**
7	**Total contract required spaces net spaces (rows 3 + 5)**	**126 spaces**	**104 spaces**

8.7 Construction Management Outline

During construction of the development, no long-term detours or lane closures at any of the study intersections or study roadways is anticipated.

During construction, pedestrian accessibility should be maintained. If necessary, temporary crosswalks and ramps should be provided. All pedestrian accommodations should adhere to Massachusetts Architectural Access Board (MAAB) and Americans with Disabilities Act (ADA) guidelines.

A Construction Management Plan will be provided for review and approval by the Town of Arlington prior to the commencement of construction.

9 Traffic Operations Analysis

9.1 Evaluation Criteria

Traffic operations at intersections are evaluated using the performance measures of average vehicular delay, level of service (LOS), volume-to-capacity (v/c) ratio, and average and 95th percentile queue lengths.

LOS is a qualitative measure that describes operating conditions through letter designations, from A to F. It is defined for intersections in terms of average control delay per vehicle. LOS A indicates the most favorable condition, with minimum traffic delay. LOS F represents the worst condition where there is significant traffic delay. LOS D or better is typically considered desirable for peak-hour operation in urban and suburban settings. The delay designations for each LOS level differ slightly between signalized and unsignalized intersections due to driver expectations and behavior. Table 15 summarizes the LOS criteria for intersections as used in this analysis.

Table 15 – Intersection Level of Service Criteria

Level of Service	Average Control Delay (sec/veh)	
	Signalized	Unsignalized
A	0-10	0-10
B	>10-20	>10-15
C	>20-35	>15-25
D	>35-55	>25-35
E	>55-80	>35-50
F	>80	>50
Source: HCM 2000		

For signalized intersections, LOS is reported by lane group, by approach, and for the entire intersection. For unsignalized intersections, the analysis assumes that the traffic on the mainline is not affected by traffic on the side street. As such, an unsignalized intersection’s LOS is generally reported for left turns on the mainline and all side street movements, and an overall intersection LOS is not determined.

The v/c ratio is a measure of congestion at an intersection approach. The capacity of a facility is the maximum hourly rate at which persons or vehicles reasonably can be expected to traverse a point or a uniform section of a lane or roadway under prevailing roadway, traffic, and control conditions. A v/c ratio below one indicates that the intersection approach has adequate capacity to serve the arriving traffic demand. A v/c ratio that approaches or exceeds 1.0 indicates traffic congestion or poor operating conditions. In that situation, vehicles arrive faster than they can be served, so queue lengths can theoretically grow indefinitely, which is the unstable condition.

Since arrival volumes fluctuate throughout the peak hour, queue lengths vary. The average (50th percentile) queue length represents the maximum back of queue on a typical cycle for a signalized intersection. Average queue lengths are not reported for unsignalized intersections. The 95th percentile queue, reported for both signalized and unsignalized intersections, occurs with 95th percentile traffic volumes, and its length commonly denotes the farthest extent of the vehicle queue.

9.2 Capacity Analyses

We performed capacity analyses for the study intersections under 2020 Existing conditions, 2025 No-Build conditions, and 2025 Build conditions during the weekday morning and evening peak hours using Trafficware's Synchro 10 software. Synchro uses, in part, the traffic operational analysis methodology of the Transportation Research Board's *Highway Capacity Manual* (HCM).[3] We generated the results of the capacity analyses using Synchro's Percentile Delay Method for delay, v/c ratio, and queue lengths, supported by HCM 2000 methodology for unsignalized intersection analysis.

Synchro software has limitations preventing modeling of five-legged complex unsignalized intersections such as the intersection of Massachusetts Avenue at Appleton Street, Appleton Place, and the commercial driveway and the intersection of Massachusetts Avenue at Forest Street, Burton Street, and the Mirak Innovation Park West Driveway. Therefore, the two five-legged intersections were each modeled as two smaller, separate intersections (nodes) and combined.

For each of the five-legged intersections, we determined a logical grouping to model the two nodes. At the intersection of Massachusetts Avenue and Appleton Street/Appleton Place/Commercial Driveway, we modeled Appleton Street and Appleton Place separately from the two legs of Massachusetts Avenue and the Commercial Driveway, with a short, imaginary roadway segment connecting them. Likewise, at the intersection of Massachusetts Avenue and Forest Street/Burton Street/Mirak Innovation Park West Driveway, we modeled the west leg of Massachusetts Avenue Forest Street, and Burton Street separately from the east leg of Massachusetts Avenue and Mirak Innovation Park West Driveway, with a short roadway segment connecting them, mimicking the actual layout.

Each movement across the overall intersection requires a movement at one or both nodes. To calculate the average delay for each approach across the full intersection, we performed the following steps:

1. Multiply the average delay on Approach A from the Synchro output for the associated node by the number of vehicles on Approach A, which gives the total delay on Approach A attributable to movements at only that one node.

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[3] *Highway Capacity Manual 2000 (HCM 2000)*, Transportation Research Board, Washington, D.C., 2000.

2. For the overall movements on Approach A that involve the other node, multiply the average delay on the associated approach at the other node by the number of vehicles making those movements from Approach A, which gives the total delay on Approach A attributable to movements at the other node.
3. Add the two total delay numbers together to get the total delay on Approach A through the full intersection.
4. Divide the total delay on Approach A through the full intersection by the number of vehicles on Approach A to get the average delay per vehicle on the approach.

While the results of this method may not accurately represent the vehicle queuing, the intersection delay and operations represent the field observations. The calculations are included in Appendix G.

Based on the HCM, the critical gap timing, which is crucial in determining the Percentile Delay Method, is related to speed. During the peak hour, it was observed that speeds were significantly lower than the posted speed limit due to heavy density, therefore the peak hour critical gaps along Massachusetts Avenue are less than the off-peak hours. As such, the critical gap timing input data for this Synchro capacity analysis has been calibrated to accurately represent the peak hour traffic conditions.

The Synchro output sheets for the capacity analyses are included in Appendix H.

9.2.1 2020 Existing Conditions Capacity Analysis

The first analysis evaluated traffic operations with 2020 existing traffic volumes under existing geometric conditions and signal timing/phasing. We derived peak hour factors (PHFs) and heavy vehicle percentages from the TMC data. We applied PHFs on an approach-by-approach basis, and we applied heavy vehicle percentages by lane group. Table 16 summarizes the capacity analysis results for the 2020 Existing conditions.

Table 16 – Capacity Analysis Summary: 2020 Existing Conditions

Location	Direction / Movement[a]	Weekday Morning Peak Hour				Weekday Evening Peak Hour			
		v/c Ratio	Delay[b]	LOS	95th Queue[c]	v/c Ratio	Delay[b]	LOS	95th Queue[c]
Massachusetts Avenue and Appleton Street/ Appleton Place/ Commercial Driveway*	Mass Ave EB - LTRR	0.00	0.1	A	0	0.00	0.1	A	0
	Mass Ave WB - LLTR	0.40	9.4	A	49	0.12	3.5	A	10
	Appleton Pl NB - LLTR	0.28	22.8	C	28	0.04	24.1	C	3
	Driveway SB - LLRR	0.00	0.0	A	0	0.07	35.3	E	6
	Appleton St NEB - LLRR	0.50	43.7	E	66	0.40	29.0	D	49
Massachusetts Avenue and Forest Street/ Burton Street/ West Driveway*	Mass Ave EB - LLTR	0.12	3.7	A	10	0.22	5.0	A	21
	Mass Ave WB - LTRR	0.38	0.3	A	0	0.30	0.1	A	0
	Burton St NB - LLTR	0.16	16.2	C	14	0.06	17.2	C	5
	Forest St SB - LLRR	0.88	57.3	F	214	0.40	23.2	C	47
	West Dwy SWB - LTRR	0.02	13.8	B	1	0.06	12.0	B	5
Massachusetts Avenue and Pine Court	Mass Ave EB - TR	0.34	0.0	A	0	0.39	0.0	A	0
	Mass Ave WB - LT	0.00	0.0	A	0	0.00	0.1	A	0
	Pine Ct NB - LR	0.03	11.3	B	2	0.01	13.1	B	1
Massachusetts Avenue and Quinn Road	Mass Ave EB - TL	0.04	1.0	A	3	0.00	0.1	A	0
	Mass Ave WB - TR	0.37	0.0	A	0	0.29	0.0	A	0
	Quinn Rd SB - LR	0.03	12.8	B	3	0.13	13.3	B	11
West Driveway and Quinn Access Road	West Dr WB - LR	0.00	8.8	A	0	0.02	8.8	A	2
	Quinn Access Rd NB - TR	0.03	0.0	A	0	0.01	0.0	A	0
	Quinn Access Rd SB - LT	0.01	5.3	A	1	0.00	0.0	A	0
Forest Street and Ryder Street/Peirce Street	Peirce St EB - LTR	0.05	14.5	B	4	0.02	11.6	B	2
	Ryder St WB - LTR	0.04	14.0	B	3	0.04	11.6	B	3
	Forest St NB - LTR	0.00	0.2	A	0	0.00	0.1	A	0
	Forest St SB - LTR	0.01	0.3	A	1	0.00	0.4	A	0
Ryder Street and Ryder Street Driveway	Ryder St Dwy WB - LR	0.01	9.2	A	1	0.02	8.7	A	1
	Ryder St NB - TR	0.02	0.0	A	0	0.01	0.0	A	0
	Ryder St SB - LT	0.00	2.3	A	0	0.00	0.0	A	0

[a] Direction: NB = Northbound, SB = Southbound, EB = Eastbound, WB = Westbound;
NEB = Northeast-bound, NWB = Northwest-bound, SEB = Southeast-bound, SWB = Southwest-bound
Movement: L = Left-turn, T = Through movement, R = Right-turn, LL = Hard Left + Bear Left, RR = Bear Right + Hard Right
[b] Average vehicle delay (seconds)
[c] 95th percentile queue length in feet, based upon average vehicle length of 25 feet
95th percentile volume exceeds capacity; queue may be longer; queue shown is maximum after two cycles
* Delay and LOS are based on recombination of data from two nodes of a single intersection, v/c ratios and 95th percentile queues based on Synchro output for initial approach

As shown from Table 16, most approaches to the intersections are expected to operate at LOS A or B during both peak hours, with operational deficiencies (lane groups operating at LOS E or F) at only two (2) intersections:

- Massachusetts Avenue and Appleton Street/Appleton Place/Commercial Driveway; and
- Massachusetts Avenue and Forest Street/Burton Street/Mirak Innovation Park West Driveway.

At the intersection of Massachusetts Avenue and Appleton Street/Appleton Place/Commercial Driveway, the stop-controlled Appleton Street approach operates at LOS E during the weekday morning peak hour and LOS D during the weekday evening peak hour. The southbound driveway operates at LOS E during both peak hours due to Synchro limitations, but with driveway volumes less than five (5) vehicles per hour, the approach is not as operationally deficient as the results represent. All other movements operate at LOS D or better in both peak hours.

At the intersection of Massachusetts Avenue and Forest Street/Burton Street/Mirak Innovation Park West Driveway, the stop-controlled Forest Street southbound approach operates at LOS F during the weekday morning peak hour and LOS C during the evening peak hour. Although the critical gap for the southbound approach was adjusted to represent the field condition more accurately, Synchro limitations still represent a delay significantly higher than what was observed during the morning peak hour. All other movements operate at LOS D or better in both peak hours.

9.2.2 2020 No-Build Conditions Capacity Analysis

Under future No-Build conditions, we kept lane geometry and traffic control the same as existing. For all intersections, we applied the 2025 No-Build traffic volumes with the same heavy vehicle percentages and PHFs as existing. Table 17 summarizes the analysis results for 2025 No-Build conditions.

Table 17 – Capacity Analysis Summary: 2025 No-Build Conditions

Location	Direction / Movement[a]	Weekday Morning Peak Hour				Weekday Evening Peak Hour			
		v/c Ratio	Delay[b]	LOS	95th Queue[c]	v/c Ratio	Delay[b]	LOS	95th Queue[c]
Massachusetts Avenue and Appleton Street/ Appleton Place/ Commercial Driveway*	Mass Ave EB - LTRR	0.00	0.1	A	0	0.00	0.1	A	0
	Mass Ave WB - LLTR	0.46	11.0	B	62	0.14	3.8	A	12
	Appleton Pl NB - LLTR	0.32	25.8	D	34	0.04	28.0	D	3
	Driveway SB - LLRR	0.00	0.0	A	0	0.04	22.4	C	3
	Appleton St NEB - LLRR	0.59	54.3	F	91	0.45	33.9	D	60
Massachusetts Avenue and Forest Street/ Burton Street/ West Driveway*	Mass Ave EB - LLTR	0.14	4.2	A	12	0.25	5.8	A	25
	Mass Ave WB - LTRR	0.42	0.3	A	0	0.01	0.1	A	1
	Burton St NB - LLTR	0.20	18.3	C	19	0.08	19.0	C	6
	Forest St SB - LLRR	1.11	120.5	F	344	0.52	31.2	D	70
	West Dwy SWB - LTRR	0.03	17.8	C	2	0.08	12.8	B	7
Massachusetts Avenue and Pine Court	Mass Ave EB - TR	0.37	0.0	A	0	0.43	0.0	A	0
	Mass Ave WB - LT	0.00	0.0	A	0	0.00	0.1	A	0
	Pine Ct NB - LR	0.03	11.7	B	3	0.01	14.0	B	1
Massachusetts Avenue and Quinn Road	Mass Ave EB - TL	0.04	1.0	A	3	0.01	0.1	A	0
	Mass Ave WB - TR	0.41	0.0	A	0	0.32	0.0	A	0
	Quinn Rd SB - LR	0.04	13.6	B	3	0.15	14.2	B	12
West Driveway and Quinn Access Road	West Dr WB - LR	0.00	8.8	A	0	0.02	8.7	A	1
	Quinn Access Rd NB - TR	0.03	0.0	A	0	0.01	0.0	A	0
	Quinn Access Rd SB - LT	0.01	5.3	A	1	0.00	0.0	A	0
Forest Street and Ryder Street/Peirce Street	Peirce St EB - LTR	0.06	15.5	C	5	0.03	12.2	B	2
	Ryder St WB - LTR	0.04	15.0	B	4	0.05	12.1	B	4
	Forest St NB - LTR	0.00	0.2	A	0	0.00	0.1	A	0
	Forest St SB - LTR	0.01	0.3	A	1	0.01	0.5	A	0
Ryder Street and Ryder Street Driveway	Ryder St Dwy WB - LR	0.01	9.2	A	1	0.02	8.8	A	1
	Ryder St NB - TR	0.02	0.0	A	0	0.01	0.0	A	0
	Ryder St SB - LT	0.00	2.2	A	0	0.00	0.0	A	0

[a] Direction: NB = Northbound, SB = Southbound, EB = Eastbound, WB = Westbound;
NEB = Northeast-bound, NWB = Northwest-bound, SEB = Southeast-bound, SWB = Southwest-bound
Movement: L = Left-turn, T = Through movement, R = Right-turn, LL = Hard Left + Bear Left, RR = Bear Right + Hard Right
[b] Average vehicle delay (seconds)
[c] 95th percentile queue length in feet, based upon average vehicle length of 25 feet
95th percentile volume exceeds capacity; queue may be longer; queue shown is maximum after two cycles
* Delay and LOS are based on recombination of data from two nodes of a single intersection, v/c ratios and 95th percentile queues based on Synchro output for initial approach

Under 2025 No-Build traffic conditions, most of the intersection operations are expected to remain the same as under 2020 Existing conditions with only two significant changes in approach delays and levels of service.

At the intersection of Massachusetts Avenue and Appleton Street/Appleton Place/Commercial Driveway, the Appleton Street approach and the southbound driveway approach are both expected to decline during the weekday morning peak hour from LOS E to LOS F. For the Appleton Street approach, the average delay increases by about 10 seconds from 43.7 seconds to 54.3 seconds. During the weekday evening peak hour, the southbound driveway approach improves from LOS E to LOS C. All other approaches remain at LOS D or better, with slight increases in average delays and v/c ratios due to the increased traffic volumes.

9.2.3 2025 Build Conditions Capacity Analysis

We performed capacity analyses for the proposed build conditions that account for the change in site use from the existing office building to the proposed apartment complex. Under these future 2025 Build conditions, we kept lane geometry and traffic control the same at all study intersections.

Table 18 summarizes the analysis results for the 2025 Build conditions.

Table 18 – Capacity Analysis Summary: 2025 Build Conditions

Location	Direction / Movement[a]	Weekday Morning Peak Hour				Weekday Evening Peak Hour			
		v/c Ratio	Delay[b]	LOS	95th Queue[c]	v/c Ratio	Delay[b]	LOS	95th Queue[c]
Massachusetts Avenue and Appleton Street/ Appleton Place/ Commercial Driveway*	Mass Ave EB - LTRR	0.00	0.1	A	0	0.00	0.1	A	0
	Mass Ave WB - LLTR	0.46	11	B	62	0.14	3.7	A	12
	Appleton Pl NB - LLTR	0.32	25.7	D	34	0.04	28.7	D	3
	Driveway SB - LLRR	0.00	0.0	A	0	0.04	22.8	C	3
	Appleton St NEB - LLRR	0.58	53.3	F	87	0.46	34.6	D	60
Massachusetts Avenue and Forest Street/ Burton Street/ West Driveway*	Mass Ave EB - LLTR	0.13	3.8	A	11	0.25	6.0	A	24
	Mass Ave WB - LTRR	0.42	0.3	A	0	0.00	0.34	A	0
	Burton St NB - LLTR	0.20	17.9	C	18	0.08	19.2	C	6
	Forest St SB - LLRR	1.11	118.5	F	349	0.52	30.7	D	71
	West Dwy SWB - LTRR	0.02	21.0	C	1	0.03	12.2	B	2
Massachusetts Avenue and Pine Court	Mass Ave EB - TR	0.37	0.0	A	0	0.43	0.0	A	0
	Mass Ave WB - LT	0.00	0.0	A	0	0.00	0.1	A	0
	Pine Ct NB - LR	0.03	11.7	B	3	0.01	14.1	B	1
Massachusetts Avenue and Quinn Road	Mass Ave EB - TL	0.04	1.0	A	3	0.00	0.1	A	0
	Mass Ave WB - TR	0.41	0.0	A	0	0.33	0.0	A	0
	Quinn Rd SB - LR	0.13	17.9	C	11	0.20	16.1	C	18
West Driveway and Quinn Access Road	West Dr WB - LR	0.00	9.2	A	0	0.02	9.0	A	2
	Quinn Access Rd NB - TR	0.02	0.0	A	0	0.03	0.0	A	0
	Quinn Access Rd SB - LT	0.04	7.6	A	3	0.01	7.3	A	1
Forest Street and Ryder Street/Peirce Street	Peirce St EB - LTR	0.06	15.4	C	5	0.02	12.0	B	2
	Ryder St WB - LTR	0.08	16.0	C	7	0.05	12.3	B	4
	Forest St NB - LTR	0.00	0.2	A	0	0.00	0.1	A	0
	Forest St SB - LTR	0.01	0.3	A	1	0.00	0.1	A	0
Ryder Street and Ryder Street Driveway	Ryder St Dwy WB - LR	0.04	9.4	A	3	0.02	8.8	A	2
	Ryder St NB - TR	0.01	0.0	A	0	0.01	0.0	A	0
	Ryder St SB - LT	0.00	1.9	A	0	0.00	0.0	A	0

[a] Direction: NB = Northbound, SB = Southbound, EB = Eastbound, WB = Westbound;
NEB = Northeast-bound, NWB = Northwest-bound, SEB = Southeast-bound, SWB = Southwest-bound
Movement: L = Left-turn, T = Through movement, R = Right-turn, LL = Hard Left + Bear Left, RR = Bear Right + Hard Right
[b] Average vehicle delay (seconds)
[c] 95th percentile queue length in feet, based upon average vehicle length of 25 feet
95th percentile volume exceeds capacity; queue may be longer; queue shown is maximum after two cycles
* Delay and LOS are based on recombination of data from two nodes of a single intersection, v/c ratios and 95th percentile queues based on Synchro output for initial approach

Under Build conditions, most of the intersections are expected to operate the same as under No-Build conditions with few minor changes.

At the intersection of Massachusetts Avenue and Appleton Street/Appleton Place/Commercial Driveway, the Appleton Street and southbound driveway approaches are expected to remain at LOS F during the weekday morning peak hour. However, they both experience a slight decrease in average delay of less than a second. All other movements are expected to remain at LOS D or better.

At the intersection of Massachusetts Avenue and Forest Street/Burton Street/Mirak Innovation Park West Driveway, the Forest Street approach is expected to remain at LOS F during the weekday morning peak hour with delay increased by 1.1 seconds. All other movements are expected to remain at LOS D or better.

10 Transportation Demand Management

The Proponent is committed to implementing Transportation Demand Management (TDM) measures to minimize automobile usage and Project-related traffic impacts. TDM will be facilitated by the nature of the Project, which does not generate significant peak hour trips, and its proximity to numerous public transit alternatives and bicycle facilities.

On-site management will keep a supply of transit information (schedules, maps, and fare information) to be made available to the residents of the development. The Proponent will work with the Town to develop a TDM program appropriate to the Project and consistent with its level of impact.

The Proponent is prepared to take advantage of good transit and bicycle access in marketing the site to future residents by working with them to implement the following TDM measures to encourage the use of non-vehicular modes of travel.

The TDM measures for the Project may include, but are not limited to, the following:

- ***Orientation Packets:*** The Proponent will provide orientation packets to new residents and tenants containing information on site access and circulation; and available transportation choices, including transit routes/schedules and nearby vehicle sharing locations and bicycle facilities. On-site management will work with residents and tenants as they move in to help facilitate transportation for new arrivals.
- ***Bicycle Accommodation:*** The Proponent will provide interior and exterior bicycle storage in secure, sheltered areas for residents, as well as repair and maintenance stations. Subject to necessary approvals, public-use bicycle racks for visitors will be placed near building entrances and must adhere to the Town of Arlington's regulations.
- ***Electric Vehicle Charging:*** The Proponent will explore the feasibility of providing electric vehicle charging stations within the garages.
- ***Shared-Car Services:*** The Proponent will explore the feasibility of providing a shared car service (e.g., Zip Car) on-site to help reduce the need for residents to own a vehicle.
- ***Transportation Coordinator:*** The Proponent will designate a transportation coordinator to oversee transportation issues including parking, service and loading, and deliveries and will work with residents as they move in to raise awareness of public transportation, bicycling, and walking opportunities.
- ***Project Web Site:*** The web site will include transportation-related information for residents, workers, and visitors.
- ***Transportation Monitoring Program:*** The Proponent will implement a transportation monitoring program that will periodically monitor the TDM program through a Town of Arlington survey. The building TDM program shall be revised as necessary to update the elements as new trip reduction measures become available and/or certain programs become obsolete or ineffective.

Based upon multiple meetings with the neighborhood group, the Proponent is also proposing extensive improvements to the south of the Ryder Street exit of the Property, including:

- Repaving the existing paved surface from the Ryder Street exit of the Property to Forest Street;
- Reconstructing the existing sidewalk from the Ryder Street exit of the Property to Forest Street to create an accessible connection, including new crosswalks and wheelchair ramps at the 9 Ryder Street driveway curb cut; and inserting new a crosswalk and wheelchair ramps at the Ryder Street/Forest Street intersection; and
- Constructing a speed table on Ryder Street at the intersection with the Ryder Street exit driveway.

11 Conclusions

Nitsch Engineering has prepared this Traffic Impact Report (TIR) for the Project in Arlington Massachusetts. We studied seven (7) unsignalized intersections to establish the impact the removal of the existing Mirak Mill office building and the construction of a 130-unit apartment complex would have on intersection traffic operations.

We researched the crash data within the study area for the three (3) most recent years available from the MassDOT records, 2016 to 2018. The crash rates at all study intersections are all well below the District 4 and Statewide averages.

The traffic signal warrant analysis indicates that a traffic signal may be justified under current traffic conditions at the unsignalized intersection of Massachusetts Avenue and Forest Street/Burton Street/Mirak Innovation Park West Driveway, based on the Eight-Hour Vehicular Volume, Four-Hour Vehicular Volume, and Peak Hour warrants. However, as this is an existing condition upon which the project will have minimal effect, it does not require that the Proponent install a new traffic signal.

For future conditions, we projected some of the existing traffic volumes within the study area over a 5-year period to the horizon year 2025 using an annual growth rate of 2.0%, based on expected regional growth.

We estimated the net quantity of vehicle trips the proposed apartment complex would generate based on Institute of Transportation Engineers (ITE) *Trip Generation, 10th Edition* criteria. We applied an appropriate travel mode share based on the census tract data and we distributed the additional vehicle trips to the roadway network using existing travel patterns and site access modifications.

We performed a vehicle capacity analysis to compare the weekday morning and evening peak hours of the 2020 Existing conditions, 2025 No-Build conditions, and 2025 Build conditions for each of the seven (7) study intersections. Under existing conditions, our analysis indicates operational deficiencies at the following two (2) intersections:

- Massachusetts Avenue at Appleton Street/Appleton Place/Commercial Driveway; and
- Massachusetts Avenue and Forest Street/Burton Street/Mirak Innovation Park West Driveway.

Traffic operations are calculated to degrade from the 2020 Existing to 2025 No-Build conditions at some of the stop-controlled approaches to these intersections. However, the change in traffic operations from 2025 No-Build to 2025 Build conditions are so minor that they are considered negligible by current engineering standards. Therefore, as our analysis indicates that there is not a significant degradation in delay because of the Project, we do not recommend any additional changes to the roadway network.