

TRAFFIC IMPACT AND ACCESS STUDY

RETAIL MOTOR FUEL OUTLET REDEVELOPMENT LITTLETON, MASSACHUSETTS



181 Ballardvale Street, Suite 202
Wilmington, MA 01887
(978) 570-2999

SUBMITTED TO:

Energy North Group
2 International Way
Lawrence, Massachusetts 01843

February 2023

(GPI Project No.: NEX-2021267.00)

***Energy North Group
Retail Motor Fuel Outlet Redevelopment
Traffic Impact and Access Study
February 6, 2023***

TECHNICAL MEMORANDUM

REF: NEX-2021267.00

DATE: February 6, 2023

TO: Mr. Michael Tierney
Energy North Group
2 International Way
Lawrence, Massachusetts 01843

FROM: Mr. Robert E. Bollinger, P.E., PTOE, Traffic Engineering Department Head
Ms. Susannah E. Theriault, P.E., Project Engineer
Ms. Cecilia Donaldson, Assistant Designer

RE: Traffic Impact and Access Study
Retail Motor Fuel Outlet Redevelopment
254-260 Ayer Road – Littleton, Massachusetts

INTRODUCTION

Greenman-Pedersen, Inc. (GPI) has prepared this *Traffic Impact and Access Study* (TIAS) for a proposed retail motor fuel outlet redevelopment to be located at 254-260 Ayer Road (Route 2A/110) in Littleton, Massachusetts. The existing site consists of nine (9) vehicle fueling positions (vfps) and a one-story 1,983 square foot (sf) convenience store. The project consists of razing the entire site and constructing a 6,000 (±) sf convenience store with 12 vfps. Access and egress to the site currently exist via two full-access driveways on the south side of Ayer Road, west of its intersection with Willow Road and Bruce Street. As proposed the site will continue to provide two driveways: the eastern driveway will remain in approximately its current location but will be limited to exit only traffic; and the western driveway will be relocated approximately 140 feet to the west and allowing full-access (entering and exiting traffic). This TIAS evaluates the traffic impacts and access/egress requirements for the proposed redevelopment.



FIGURE I
SITE LOCATION MAP



Greenman-Pedersen, Inc.
RETAIL MOTOR FUEL REDEVELOPMENT – LITTLETON, MASSACHUSETTS

EXISTING CONDITIONS

Study Area

Evaluation of the traffic impacts associated with the proposed project requires an evaluation of existing and projected traffic volumes on the adjacent street, the volume of traffic expected to be generated by the project, and the impact that this traffic will have on the adjacent street. In preparing the TIAS for the proposed site, the following intersections have been analyzed and evaluated:

- Ayer Road at Willow Road and Bruce Street & East Site Driveway (signalized)
- Ayer Road at the West Site Driveway

Ayer Rd (Route 2A/110)

Ayer Road is under the jurisdiction of the Massachusetts Department of Transportation (MassDOT) and is classified as an urban principal arterial. It is an east-west roadway and generally provides one through lane in each direction with a posted speed limit of 40 miles per hour (mph). In the vicinity of the project site, there are no sidewalks or bicycle travel lanes.

Willow Road

Willow Road is under the jurisdiction of the Town of Littleton and is classified as a rural minor collector. It is a north-south roadway and generally provides one through lane in each direction with a posted speed limit of 25 mph. In the vicinity of the project site, there are no sidewalks or bicycle travel lanes.

Bruce Street

Bruce Street is under the jurisdiction of the Town of Littleton and is classified as a rural minor collector. It is a north-south roadway and generally provides one through lane in each direction with a posted speed limit of 30 mph. In the vicinity of the project site, there are no sidewalks or bicycle travel lanes.

Ayer Rd (Route 2A/110) at Willow Road/Bruce Street and East Site Driveway

The intersection of Ayer Road (Route 2A/110) at Willow Road/Bruce Street and the East Site Driveway is signalized for all movements, including the east site driveway and a residential home at 249 Ayer Road. Ayer Road has 12-foot lanes in each direction with variable-width shoulders ranging from half a foot to a foot and a half. The Bruce Street approach has an 11 foot through lane with no separation between the directions of travel and a channelized right turn lane with a width of 20 feet. No shoulders are provided on either side of Bruce Street. The Willow Road approach has one 12.5-foot lane for all movements, a one-foot shoulder on the westbound side of the roadway and a foot and a half shoulder on the eastern side. The eastern site driveway is 60 feet wide and the residential driveway is 40 feet wide.

Public Transportation

The Massachusetts Bay Transportation Authority (MBTA) Commuter Rail provides two stops along the Fitchburg line which runs from Wachusett to North Station in Boston. The Littleton/Route 495 stop is 3.8 miles southeast of the site and the Ayer stop is located 3 miles west of the site. The commuter rail has trips inbound and outbound to/from Boston every hour. Montachusett Regional Transit Authority (MART) also has a commuter rail shuttle that leaves out of the Juniper Networks (Park & Ride Lot) and stops at the Littleton/Route 495 commuter rail station, IBM, Red Hat Inc, Juniper Networks and Technology Park

Entrance. In the morning, the shuttle only goes to the first stop (Juniper Networks Park & Ride Lot) at 7:10 AM before arriving at the Commuter Rail, however, an hour later, the shuttle travels to all stops. In the evening, the shuttle travels the same route with departure from Technology Park Entrance at 4:40 PM and again an hour later. All public Transportation information is provided in the Appendix.

Traffic Volumes

Base traffic conditions within the study area were developed by conducting manual-turning movement counts (TMCs), vehicle classification counts, and automatic traffic recorder (ATR) counts, including speeds, in September 2022. The TMCs and vehicle classification counts were performed during the weekday AM peak period (7:00 to 9:00 AM), weekday PM peak period (4:00 to 6:00 PM), and the Saturday midday peak period (11:00 AM to 2:00 PM). The ATRs were used to obtain weekday and Saturday daily traffic volumes along Ayer Road (Route 2A/110) adjacent to the site. These counts revealed that the weekday AM peak hour occurred from 7:15 to 8:15 AM, the weekday PM peak hour occurred from 5:00 to 6:00 PM, and the Saturday midday peak hour occurred from 12:45 to 1:45 PM. All traffic-count data are provided in the Appendix.

Traffic on a given roadway typically fluctuates throughout the year depending on the area and the type of roadway. To determine if the September traffic-volume data needed to be adjusted to account for this fluctuation, historical traffic-volume data were reviewed from the MassDOT records.¹ This information revealed that September traffic volumes are approximately three percent above average-month conditions. Therefore, to be conservative the traffic volumes were not adjusted as to reflect above average-month conditions. The MassDOT seasonal adjustment data is provided in the Appendix.

Table 1 summarizes the existing daily and peak-hour traffic volumes on Ayer Road adjacent to the site. The 2022 Existing traffic-flow networks for the weekday AM, weekday PM, and Saturday midday peak hours are shown graphically on Figures 2, 3, and 4.

TABLE 1
Existing Traffic Volume Summary

Location/Time Period	Daily Volume (vpd) ^a	Peak Hour Volume (vph) ^b	K Factor (%) ^c	Directional Distribution ^d
Ayer Road (Route 2A/110), adjacent to the site:				
Weekday Daily	10,750			
Weekday AM Peak Hour		753	7.0	66% EB
Weekday PM Peak Hour		954	8.9	66% WB
Saturday Daily	8,590			
Saturday Midday Peak Hour		690	8.0	55% EB

^a In vehicles per day. Not adjusted in order to be conservative.

^b In vehicles per hour. Volumes obtained from Figures 2 through 4.

^c Percentage of daily traffic occurring during the peak hour.

^d WB = westbound, EB = eastbound. Percentages from volumes on Figures 2 through 4.

¹ MassDOT Transportation Data Management System; Station 4091, Interstate 495, north of Ramp-Route 2 WB to Route 495 NB (Littleton).

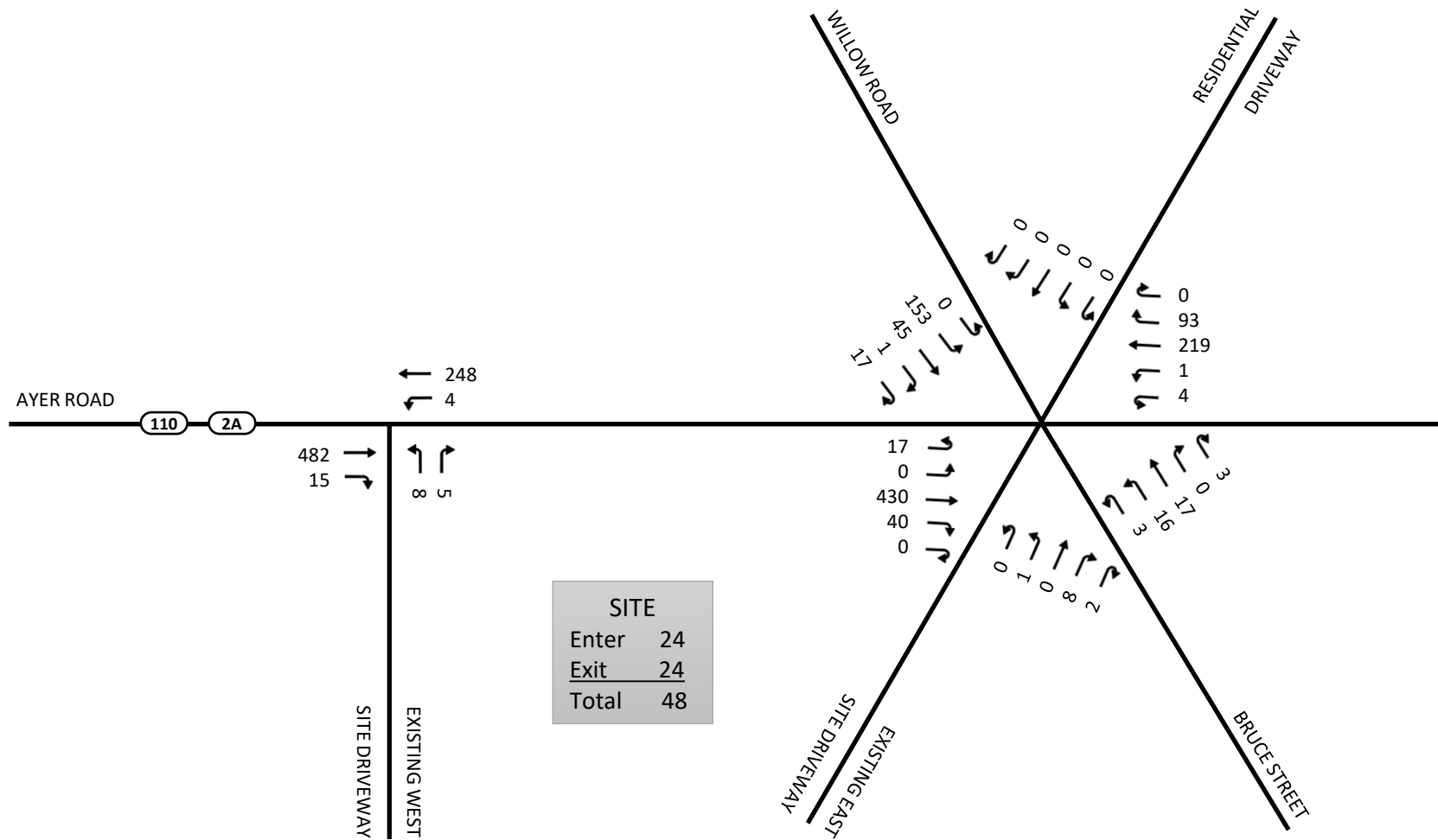


FIGURE 2

**2022 EXISTING TRAFFIC VOLUMES
WEEKDAY AM PEAK HOUR**

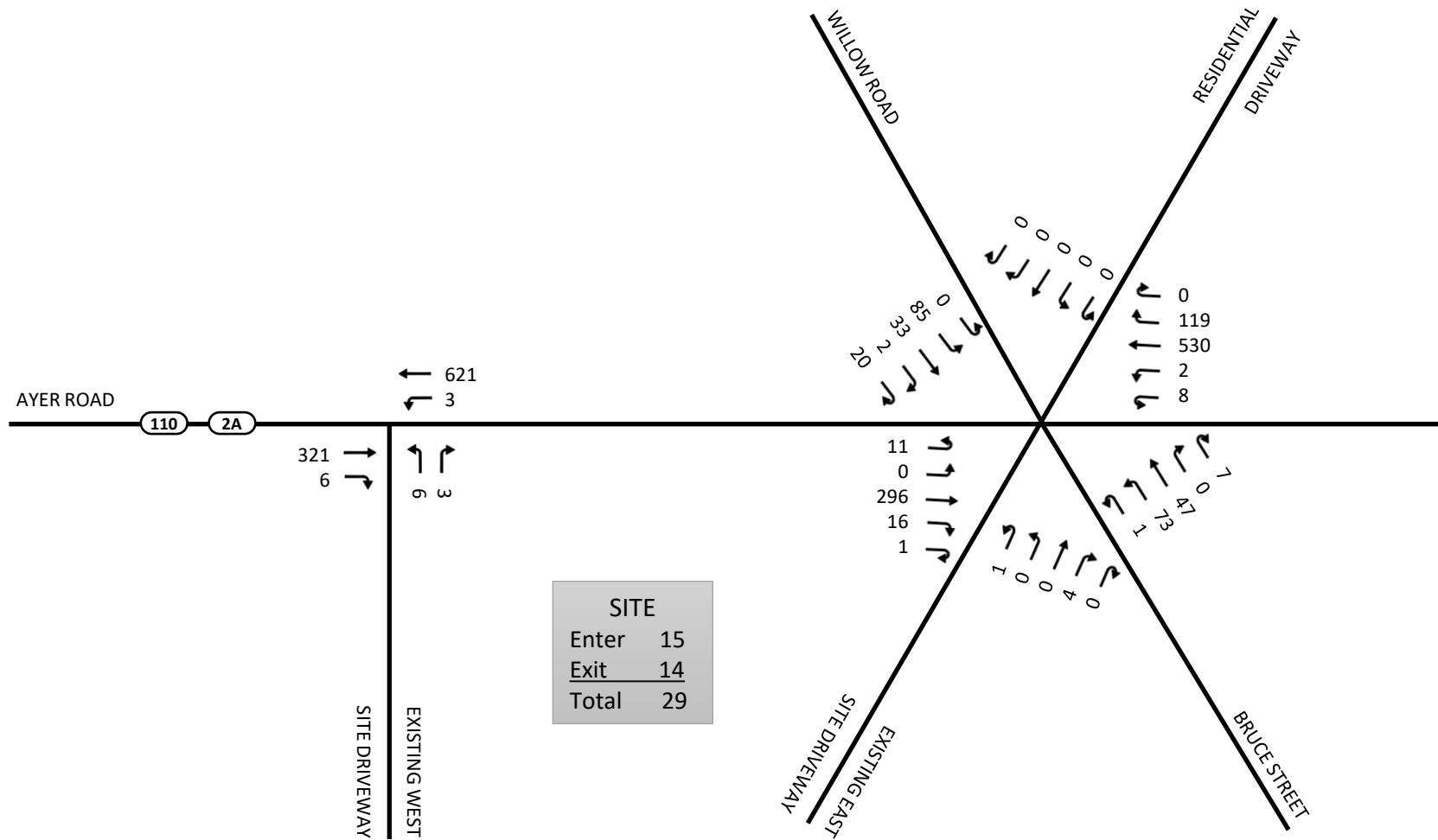


FIGURE 3

**2022 EXISTING TRAFFIC VOLUMES
WEEKDAY PM PEAK HOUR**

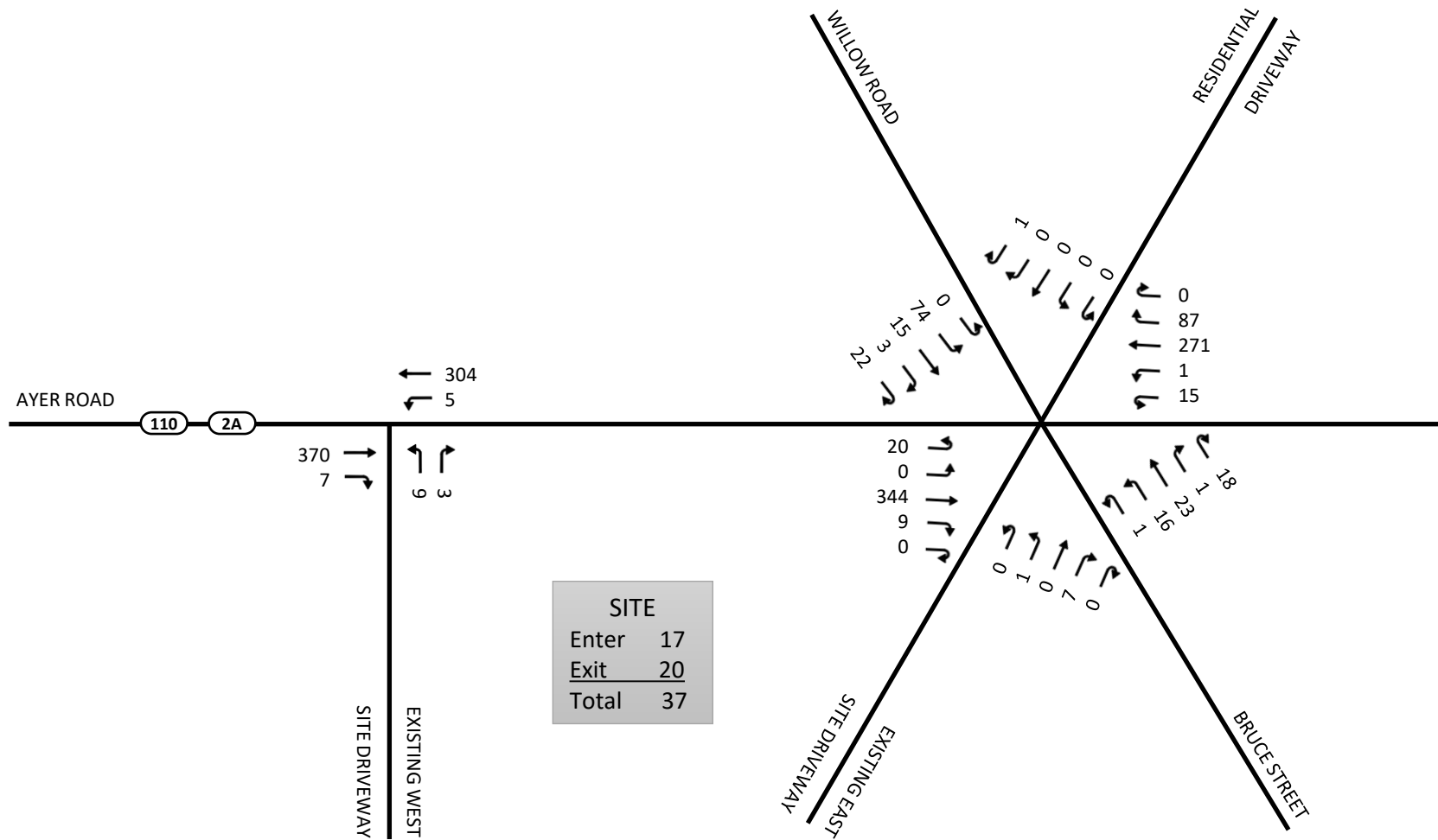


FIGURE 4

**2022 EXISTING TRAFFIC VOLUMES
SATURDAY MIDDAY PEAK HOUR**

Collisions

Collision data for the study area intersections were obtained from MassDOT (2015 through 2019) for the latest five years available. Table 2 summarizes the data.

In addition to the collision summary, crash occurrence also should be compared to the volume of traffic through a particular intersection to determine any significance. Accordingly, the crash rates were calculated for each study area intersection and compared with the statewide and district-wide averages. An intersection crash rate is a measure of the frequency of collisions compared to the volume of traffic through an intersection and is presented in crashes per million entering vehicles (c/mev). For unsignalized intersections, the statewide and district-wide (District 3) average is 0.57 c/mev and 0.61 c/mev respectively. For signalized intersections, the statewide and district-wide average is 0.78 c/mev and 0.89 c/mev respectively. A comparison of the calculated crash rate to these averages can be used to establish the significance of collision occurrence and whether or not potential safety problems exist. All crash rate worksheets are provided in the Appendix.

Based on the MassDOT data, the Ayer Road (Route 2A/110) / Willow Road / Bruce Street / Eastern Site Driveway / Residential Driveway intersection experienced an average of approximately seven collisions per year with a crash rate (1.36 c/mev), which is greater than the statewide and District 3 averages for signalized or unsignalized intersections. The crashes were mainly split between rear-end collisions and angle collisions. Additionally, two crashes were single vehicle collisions with a utility pole and another fixed object such as a wall or building. Although the majority of the collisions only resulted in property damage, there was one fatal collision in 2015. One of the contributing factors to the fatal collision was listed as “disregarded traffic signs, signals, road markings”, however, without the detailed crash report, it is difficult to draw any conclusions. Temporary signalization was installed at this intersection in 2016. Additionally, a Road Safety Audit (RSA)² was conducted in 2020 with safety enhancements to be incorporated into the current MassDOT intersection improvement project (Project #608443) at this location. More details regarding the MassDOT project are provided in the *Planned Roadway Improvements* section of this report.

Based on the MassDOT data, the Ayer Road / Western Site Driveway intersection experienced less than one crash a year which resulted in a crash rate (0.20 c/mev) which is less than the statewide and District 3 average for unsignalized intersections. Of the four crashes, one was a head-on collision, one was an angle collision, one was unknown, and one was a single vehicle collision with a pedestrian in 2019, which was fatal. Again, without the detailed crash report, it is difficult to draw any conclusions.

Collision data was also requested from the Littleton Police Department. Data was obtained between August 2017 and August 2022, however, only two crashes were reported. Due to the low crash occurrence, this data is likely not inclusive of all crashes that took place, and therefore, the data was excluded from this report.

² Stantec; *Road Safety Audit, Ayer Road (Routes 2A and 110) at Willow Road and Bruce Street*, Town of Littleton, Massachusetts; April 24, 2020 – Final Report.

TABLE 2
Collision Summary

Location	Number of Collisions			Severity ^a				Collision Type ^b						Percent During	
	Total	Average per Year	Crash Rate ^c	PD	PI	F	NR	SS	RE	CM	FO	HO	U	Commuter Peak ^d	Wet/Icy Conditions ^e
Ayer Road / Willow Road / Bruce Street / Eastern Site Driveway / Residential Driveway	35	7.00	1.36	28	6	1	--	2	18	10	2	--	3	14%	2.9%
Ayer Road at Western Site Driveway	4	0.80	0.20	3	--	1	--	--	--	1	1	1	1	50%	0%

Source: MassDOT (2015-2019).

^a PD = property damage only; PI = personal injury; F = fatality, NR = not reported.

^b SS = sideswipe; RE = rear end; CM = cross movement/angle; FO = fixed object; HO = head-on; U = unknown

^c Measured in crashes per million entering vehicles for intersections and in crashes per million vehicle miles traveled for roadway segments.

^d Percent of vehicle incidents that occurred during the weekday AM (7:00 AM-9:00 AM) and weekday PM (4:00 PM -6:00 PM) commuter peak periods.

^e Represents the percentage of only “known” collisions occurring during inclement weather conditions.

Vehicle Speeds

Vehicle speed measurements were conducted along Ayer Road (Route 2A/110) by use of radar. The primary use of this information is explained in the *Sight Distance* section where the speeds are correlated to sight distance measurements taken at the location of the westerly site driveway to assure that adequate sight distances exist at the driveway to provide safe operation. The results of the speed measurements are summarized in Table 3.

TABLE 3
Observed Travel Speeds

Location/Direction	Posted Speed Limit ^a	Average Speed ^b	85 th Percentile Speed ^c
Ayer Road, adjacent to the site:			
<i>Eastbound</i>	45	39	44
<i>Westbound</i>	45	37	42

^a In miles per hour (mph).

^b Average speed of all observed vehicles.

^c Speed at, or below which 85 percent of all observed vehicles travel.

As shown in Table 3, the average speeds along Ayer Road were found to be 39 mph and 37 mph in the eastbound and westbound directions, respectively. The 85th percentile speeds were 44 mph and 42 mph in the eastbound and westbound directions, respectively. The observed speeds were found to be slightly lower than the posted speed limit of 45 mph, likely due to the proximity of the traffic signal.

Sight Distance

To identify potential safety concerns associated with site access and egress, sight distances have been evaluated at the proposed westerly site driveway location to determine if the available sight distances for vehicles exiting the site meet or exceed the minimum distances required for approaching vehicles to safely stop. The available sight distances were compared with minimum requirements, as established by the American Association of State Highway and Transportation Officials (AASHTO)³. AASHTO is the national standard by which vehicle sight distance is calculated, measured, and reported. The Massachusetts Department of Transportation (MassDOT) and the Executive Office of Energy and Environmental Affairs (EEA) require the use of AASHTO sight distance standards when preparing traffic impact assessments and studies, as stated in their guidelines for traffic impact assessments.

Sight distance is the length of roadway ahead that is visible to the driver. Stopping Sight Distance (SSD) is the minimum distance required for a vehicle traveling at a certain speed to safely stop before reaching a stationary object in its path. The values are based on a driver perception and reaction time of 2.5 seconds and a braking distance calculated for wet, level pavements. When the roadway is either on an upgrade or downgrade, grade correction factors are applied. Stopping sight distance is measured from an eye height of 3.5 feet to an object height of 2 feet above street level, equivalent to the taillight height of a passenger car. The SSD is measured along the centerline of the traveled way of the major road.

³ A Policy on Geometric Design of Highways and Streets; American Association of State Highway and Transportation Officials (AASHTO); 2018.

Intersection sight distance (ISD) is provided on minor street approaches to allow the drivers of stopped vehicles a sufficient view of the major roadway to decide when to enter the major roadway. By definition, ISD is the minimum distance required for a motorist exiting a minor street to turn onto the major street, without being overtaken by an approaching vehicle reducing its speed from the design speed to 70 percent of the design speed. ISD is measured from an eye height of 3.5 feet to an object height of 3.5 feet above street level. The use of an object height equal to the driver eye height makes intersection sight distances reciprocal (i.e., if one driver can see another vehicle, then the driver of that vehicle can also see the first vehicle). When the minor street is on an upgrade that exceeds 3 percent, grade correction factors are applied.

SSD is generally more important as it represents the minimum distance required for safe stopping while ISD is based only upon acceptable speed reductions to the approaching traffic stream. The ISD, however, must be equal to or greater than the minimum required SSD in order to provide safe operations at the intersection. In accordance with the AASHTO manual, *“If the available sight distance for an entering or crossing vehicle is at least equal to the appropriate stopping sight distance for the major road, then drivers have sufficient sight distance to anticipate and avoid collisions. However, in some cases, this may require a major-road vehicle to stop or slow to accommodate the maneuver by a minor-road vehicle. To enhance traffic operations, intersection sight distances that exceed stopping sight distances are desirable along the major road.”* Accordingly, ISD should be at least equal to the distance required to allow a driver approaching the minor road to safely stop.

The available SSD and ISD at the proposed westerly site driveway location were measured and compared to minimum requirements as established by AASHTO. Based on the posted and observed speeds, the SSD and ISD requirements at the intersection were calculated. The required minimum sight distances for the driveway are compared to the available distances, as shown in Table 4.

TABLE 4
Sight Distance Summary

Location/Direction	Stopping Sight Distance (feet)		Intersection Sight Distance (feet)		
	Measured	Minimum Required ^a	Measured	Minimum Required ^b	Desirable ^c
Ayer Road at Western Site Drive:					
West of driveway (EB)	500+	360	460	360	430
East of driveway (WB)	500+	360	300	360	530

^a Values based on posted speed limit of 45 mph since the 85th percentile speeds on Ayer Road are less than the speed limit.

^b Values based on AASHTO requirements for SSD.

^c Values based on AASHTO requirements for ISD for posted speed of 45 mph on Ayer Road.

As indicated in Table 4 above, available sight distances to the west of the proposed site driveway on Ayer Road exceed the minimum and desirable SSD and ISD requirements for safe operation. To the east of the driveway the intersection sight distance requirements were not met due to overgrowth of existing vegetation. As part of the redevelopment, the vegetation will be cleared, and it is expected that the intersection sight distance will exceed the 360-foot minimum requirement for safe operation. Sight lines should be confirmed based on the precise driveway location in relation to the finished grade and associated plan and profile of the final site plan that incorporates MassDOT project elements and potential off-site improvements.

To ensure the safe and efficient flow of traffic to and from the site, it is recommended that any proposed plantings, vegetation, landscaping, and signing along the site frontage be kept low to the ground (no more than 3.0 feet above street level) or set back sufficiently from Ayer Road so as not to inhibit the available sight lines.

FUTURE CONDITIONS

To estimate the impact of site-generated traffic within the study area, existing traffic volumes were projected to the year 2029, representing a seven-year design horizon in accordance with state guidelines. The proposed redevelopment is expected to be completed and fully operational well within this time frame. Traffic volumes on the roadway network at that time will include existing traffic and new traffic due to normal traffic growth. Consideration of these factors resulted in the development of 2029 No-Build traffic volumes, which assume that the proposed development is not built. The incremental impacts of the proposed project may then be determined by adding site-generated traffic volumes (Build conditions) and making comparisons to the No-Build conditions.

Traffic Growth

To develop the 2029 No-Build forecast volumes, two components of traffic growth were considered. First, an annual growth percentage of 0.5% was used to be consistent with the Functional Design Report⁴ prepared in November 2020.

Second, any planned or approved specific developments in the area that would generate a significant volume of traffic on study area roadways within the next seven years were considered. Based on discussions with the town of Littleton and the neighboring town of Ayer, there are no notable developments near the proposed development.

Planned Roadway Improvements

MassDOT has an intersection improvement project (Project #608443) at the intersection of Ayer Road (Route 2A) / Willow Street / Bruce Street. The PS&E plans were received in June of 2022, the project was advertised for construction bids on September 10, 2022 and is programmed to begin construction in early 2023. The project is planned to be funded through the 2022 Transportation Improvement Program for the Boston Metropolitan Planning Organization. Improvements proposed as part of this project to the Ayer Road (Route 2A) / Willow Street / Bruce Street intersection include the following:

- Improved pedestrian and bicycle facilities;
- Widening of Ayer Road (Route 2A/110) to provide exclusive left-turn lanes on both approaches;
- Widening of Willow Road to provide an exclusive right-turn lane; and
- Associated signal phasing and timing modifications that reflect the proposed geometric improvements.

These improvements were incorporated into the 2029 No-Build condition and the PS&E plans are provided in the Appendix.

⁴ Green International Affiliates, Inc.; *Reconstruction of Route 2A (Ayer Road) at Willow Road and Bruce Street*, Littleton, Massachusetts; November 2020.

No-Build Conditions

The 2029 No-Build peak-hour traffic volumes were accordingly developed by applying a 0.5 percent compounded annual traffic growth rate (3.55 percent over seven years) to the 2022 Existing traffic volumes. The 2029 No-Build traffic volumes are shown graphically on Figures 5, 6 and 7 for the weekday AM, weekday PM, and Saturday midday peak hours, respectively.

Trip Generation

The existing site consists of nine (9) vehicle fueling positions (vfps) and a one-story 1,983 square foot (sf) convenience store. The project consists of razing the entire site and constructing a 6,000 (±) sf convenience store with 12 vfps.

Traffic to be generated by the proposed development was forecast using trip rates contained in the ITE *Trip Generation, 11th Edition*⁵ for Land Use Code (LUC) 945 (Convenience Store/Gas Station). All trip-generation data are provided in the Appendix. Not all of the vehicle trips expected to be generated by the proposed development represent *new* trips on the study area roadway system. Studies have shown that for developments such as the one proposed, a substantial portion of the site-generated vehicle trips are already present in the adjacent passing stream of traffic. Based on information published in the ITE *Trip Generation Manual*, the average *pass-by* trip percentage is 76 percent during the weekday AM and 75 percent during the weekday PM peak hour for LUC 945 (Convenience Store/Gas Station). The *pass-by* data are provided in the Appendix. Table 3 summarizes the results of the trip-generation estimates.

It should be noted that the trips counted at the existing site are much lower than the ITE trip generation estimates based on the 9 vfps currently on the site, and therefore, the trip generation estimates for the proposed site based on 12 vfps are likely overestimated.

⁵ *Trip Generation, 11th Edition*. Institute of Transportation Engineers; Washington, DC; 2021.

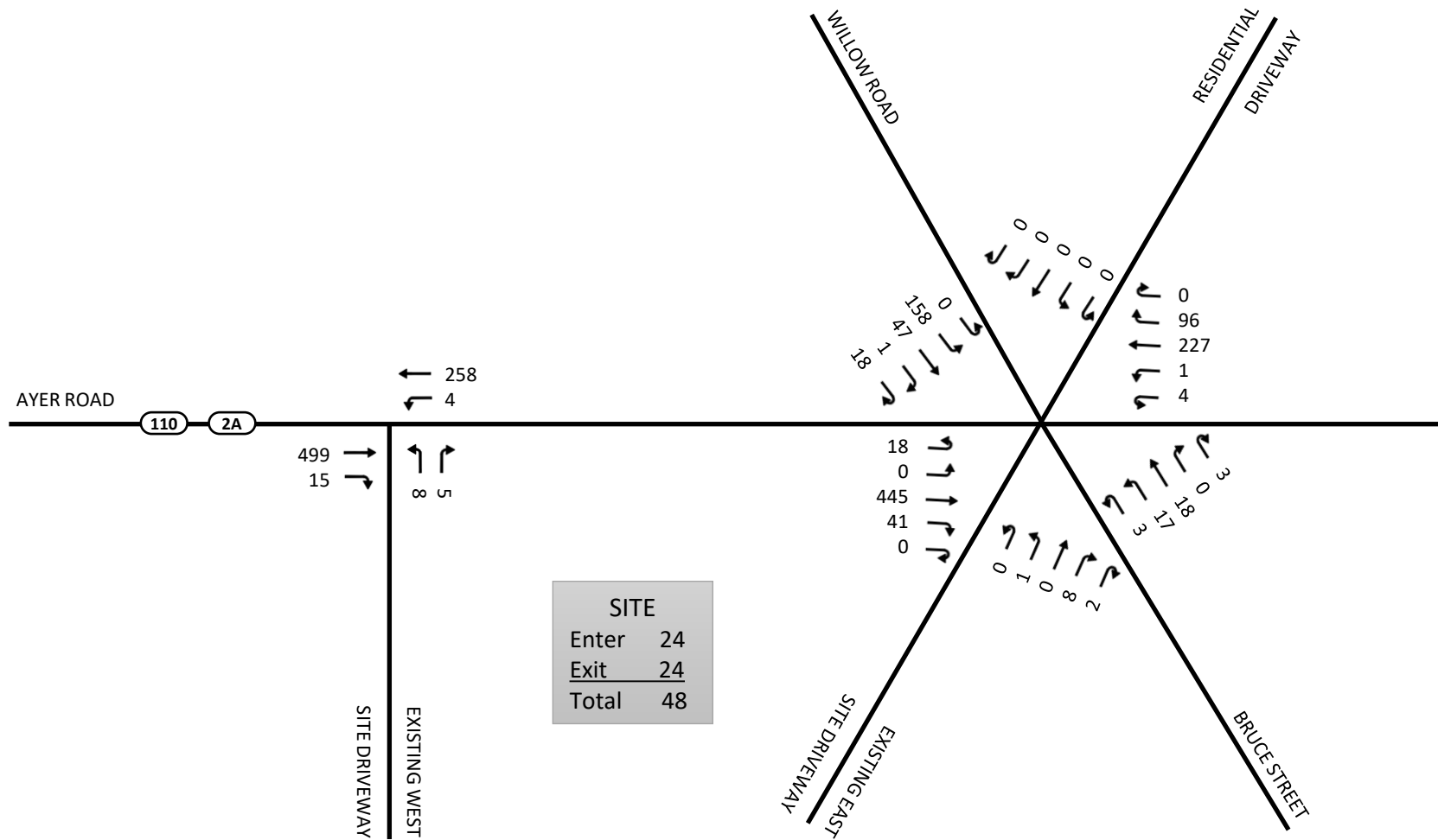


FIGURE 5

**2029 NO-BUILD TRAFFIC VOLUMES
WEEKDAY AM PEAK HOUR**

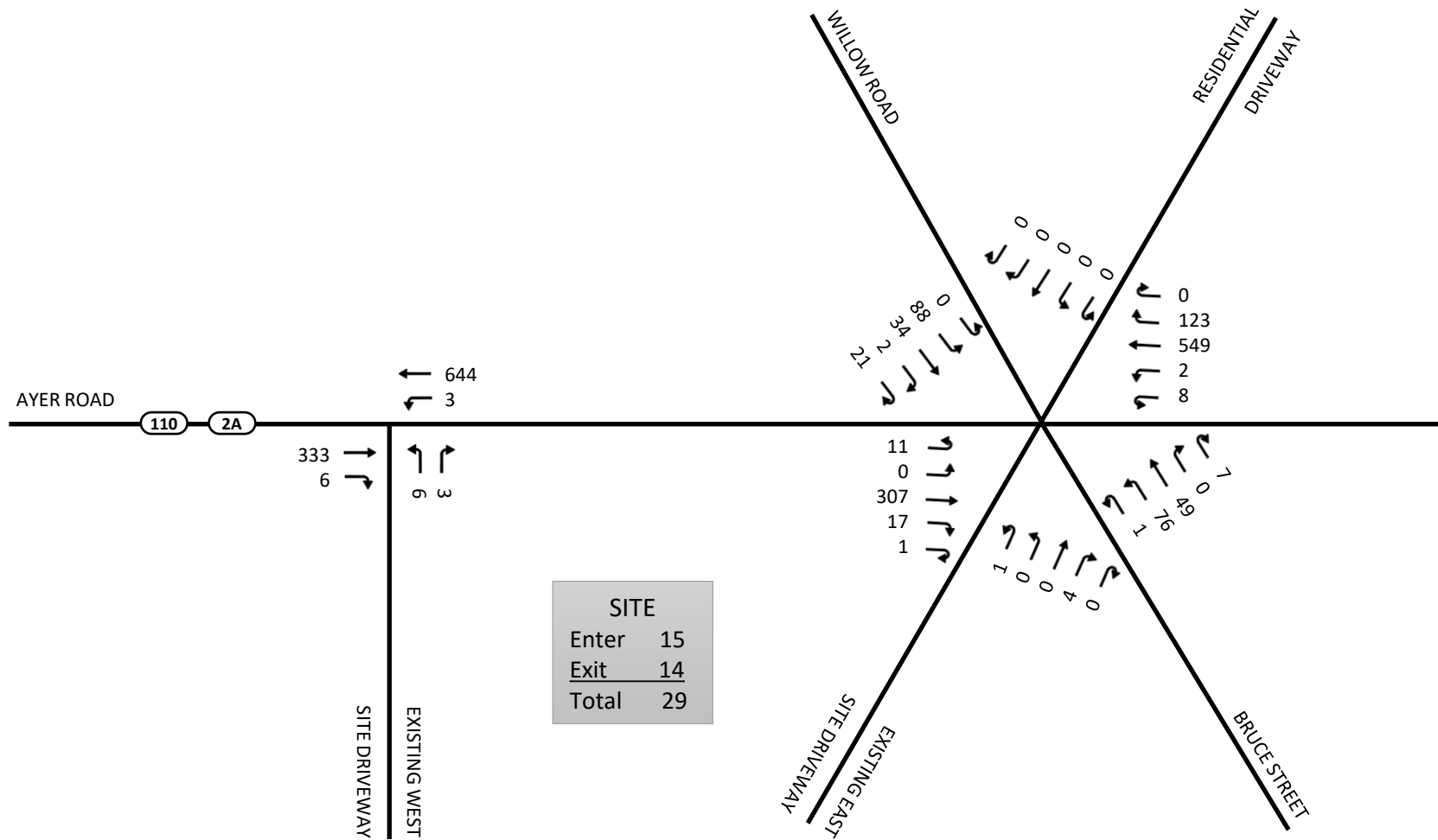


FIGURE 6

**2029 NO-BUILD TRAFFIC VOLUMES
WEEKDAY PM PEAK HOUR**

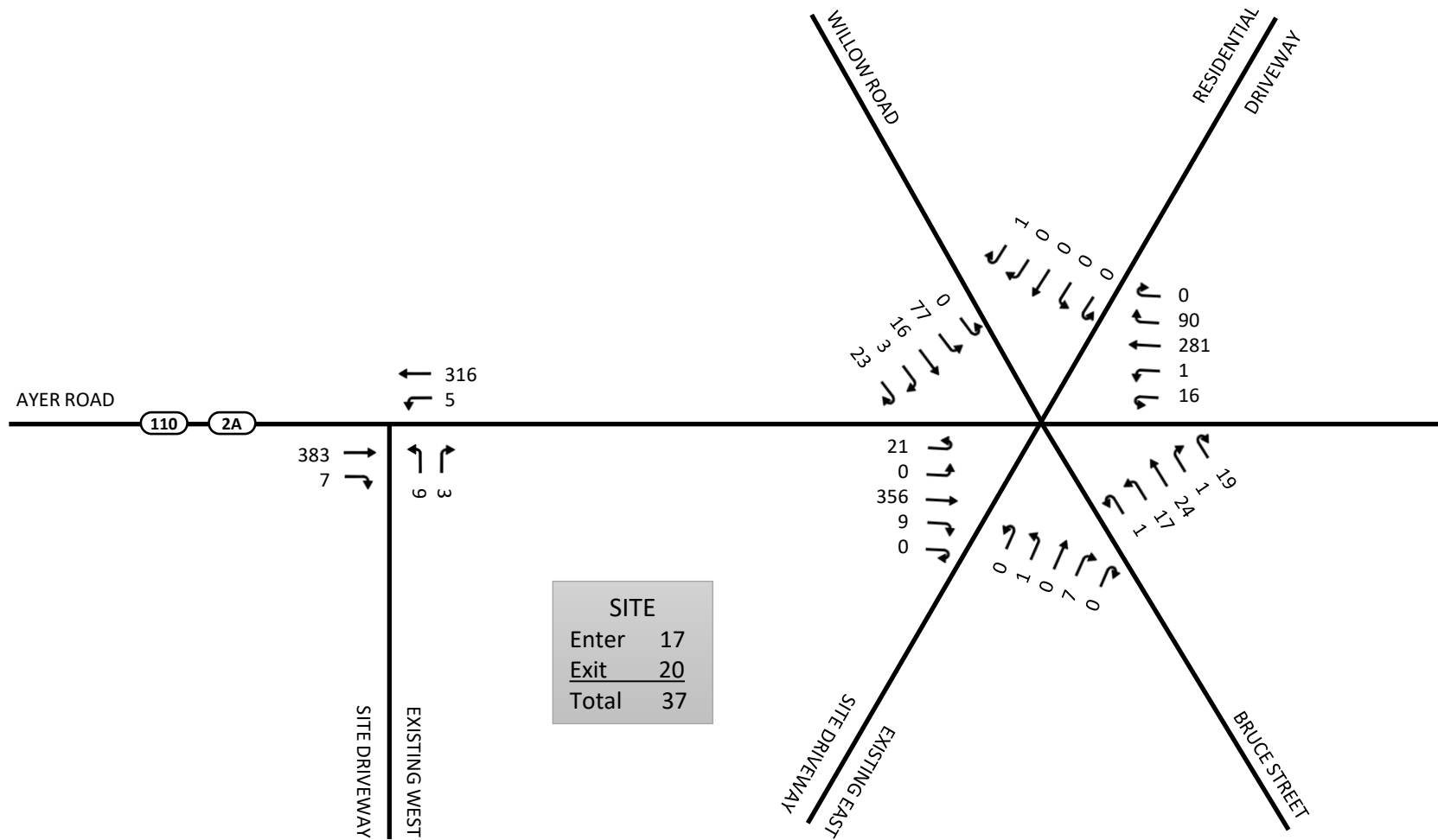


FIGURE 7

**2029 NO-BUILD TRAFFIC VOLUMES
SATURDAY MIDDAY PEAK HOUR**

TABLE 5
Peak Hour Trip-Generation Summary

Peak Hour/Direction	Total Trips		Additional Trips		
	Proposed Trips ^a	Existing Trips ^b	Total Trips ^c	Pass-By Trips ^d	New Trips ^e
Weekday AM Peak Hour:					
Enter	169	24	145	111	34
Exit	<u>170</u>	<u>24</u>	<u>146</u>	<u>111</u>	<u>35</u>
Total	339	48	291	222	69
Weekday PM Peak Hour:					
Enter	163	15	148	112	36
Exit	<u>164</u>	<u>14</u>	<u>150</u>	<u>112</u>	<u>38</u>
Total	327	29	298	224	74
Saturday Midday Peak Hour:					
Enter	192	17	175	131	44
Exit	<u>193</u>	<u>20</u>	<u>173</u>	<u>131</u>	<u>42</u>
Total	385	37	348	262	86

^a ITE LUC 945 (Convenience Store/Gas Station, Subcategory 9-15 VFPS) based on 6,000 SF.

^b Based on traffic counts conducted on Thursday, September 22, 2022 and Saturday, September 24, 2022.

^c Proposed Trips minus Existing Trips.

^d Convenience Store/Gas Station Trips – 76 percent of Total Additional Trips during the weekday AM peak hour and 75 percent of Total Additional Trips during the weekday PM and Saturday midday peak hours.

^e Total Additional Trips minus Additional Pass-By Trips.

As shown in Table 3, the proposed redevelopment is expected to generate 69 additional *new* vehicles trips (34 entering and 35 exiting) during the weekday AM peak hour, 74 additional *new* vehicles trips (36 entering and 38 exiting) during the weekday PM peak hour, and 86 additional *new* vehicle tips (44 entering and 42 exiting) during the Saturday midday peak hour. It should be noted that the volume of *pass-by* traffic does not reduce the total volume of traffic generated by the redevelopment and the external trips will still be realized as turning movements at the site driveways.

Project Environmental Review (MEPA) Thresholds

The trip generation of the proposed project was assessed to determine if it would meet or exceed any thresholds that would require formal environmental review with respect to traffic under Massachusetts Environmental Policy Act (MEPA). One of the thresholds for MEPA environmental review is the total volume of daily traffic generated by a project. If a proposed development project requires a state permit and generates a total of more than 2,000 new daily vehicle trips, then an Environmental Notification Form (ENF) must be prepared and filed with MEPA. The document must then be subject to both governmental agency and public review and comment, and the primary government entity responsible for reviewing the proposed project plans and issuing the permits and approvals that are required to allow for the construction of the proposed project must take the comments made by other government agencies and the public on these documents into consideration as part of its decision-making process on the proposed project.

The trip generation methodology was described in the *Trip Generation* section of this report. The daily vehicle trips associated with the proposed project are summarized in Table 6.

TABLE 6
Daily Trip-Generation Summary

Peak Hour/Direction	Total Trips		Additional Trips		
	Existing Trips ^a	Proposed Trips ^b	Total Trips ^c	Pass-By Trips ^d	New Trips ^e
Weekday Daily:					
<i>Enter</i>	694	2,101	1,407	1,055	352
<i>Exit</i>	<u>694</u>	<u>2,101</u>	<u>1,407</u>	<u>1,055</u>	<u>352</u>
<i>Total</i>	1,388	4,202	2,814	2,110	704
Saturday Daily:					
<i>Enter</i>	694	2,100	1,406	1,055	351
<i>Exit</i>	<u>694</u>	<u>2,100</u>	<u>1,406</u>	<u>1,055</u>	<u>351</u>
<i>Total</i>	1,388	4,200	2,812	2,110	702

^a ITE LUC 945 (Convenience Store/Gas Station, Subcategory 9-15 VFPS) based on 1,983 SF.

^b ITE LUC 945 (Convenience Store/Gas Station, Subcategory 9-15 VFPS) based on 6,000 SF.

^c Additional Trips (Proposed Trips minus Existing Trips) seen at the site driveways.

^d 75 percent of LUC 945 Additional Total Trips during the weekday daily.

^e Additional Total Trips minus Additional Pass-By Trips.

As shown in Table 6, the additional daily traffic is estimated to be approximately 2,814 vehicle trips during a weekday and 2,812 vehicle trips during a Saturday. As a result, the project is expected to exceed the MEPA Transportation review thresholds set forth in 301 CMR 11.10(6)(b) for the preparation of an ENF.

Trip Distribution

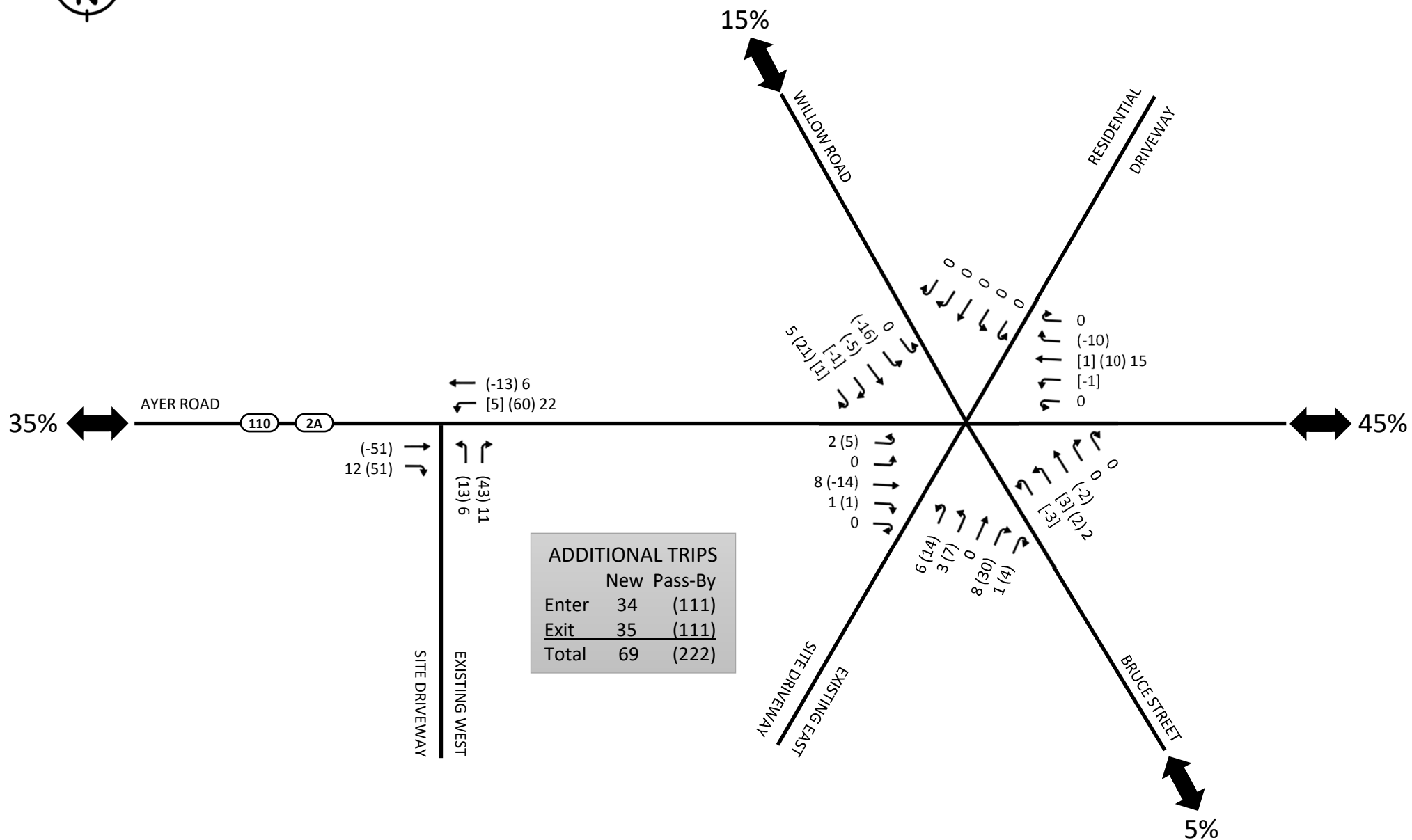
Having estimated project-generated vehicle trips, the next step is to determine the distribution of project traffic and assign these trips to the local roadway network. The directional distribution of site traffic is dependent on expected travel routes to and from the site and existing travel patterns. Accordingly, for “new trips,” approximately 45 percent of the site-generated traffic is expected to and from the east along Ayer Road, 35 percent is expected to and from the west along Ayer Road, 5 percent is expected to and from the southeast along Bruce Street, and 15 percent is expected to and from the northwest along Willow Road. The pass-by trips will follow the existing flow of traffic on Ayer Road.

Build Traffic Volumes

Based on the traffic generation and distribution estimates for this project, the traffic volumes associated with the proposed redevelopment were assigned to the roadway network. The site-generated traffic networks are shown on Figures 8 through 10 for the weekday AM, weekday PM and Saturday midday peak hours, respectively. The site-generated traffic volumes were then combined with the 2029 No-Build traffic volumes to develop the 2029 Build peak-hour traffic-volume networks. The 2029 Build weekday AM, weekday PM, and Saturday midday peak hour traffic volumes are illustrated on Figures 11 through 13, respectively.

Traffic Increases

The proposed redevelopment will result in increases in traffic on the study area roadways. As shown on Figures 8 through 10, traffic-volume increases beyond the study area during the peak hours are expected to be in the range of 4 to 39 vehicles trips. These increases represent, on average, one additional vehicle trip approximately every 1.5 to 15 minutes during the peak hours.



[XX] = Redistributed Trips

FIGURE 8
SITE-GENERATED TRAFFIC VOLUMES
WEEKDAY AM PEAK HOUR

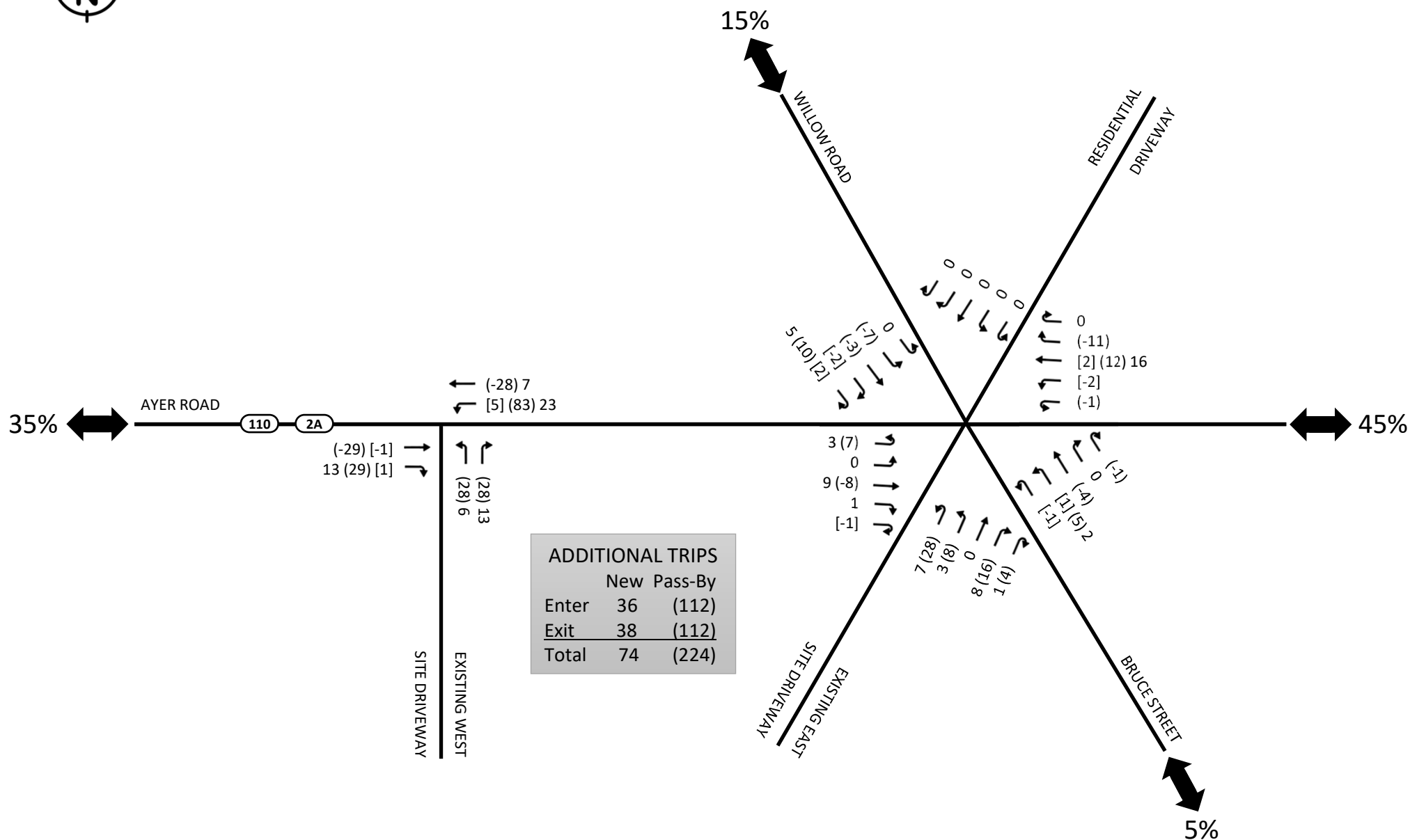
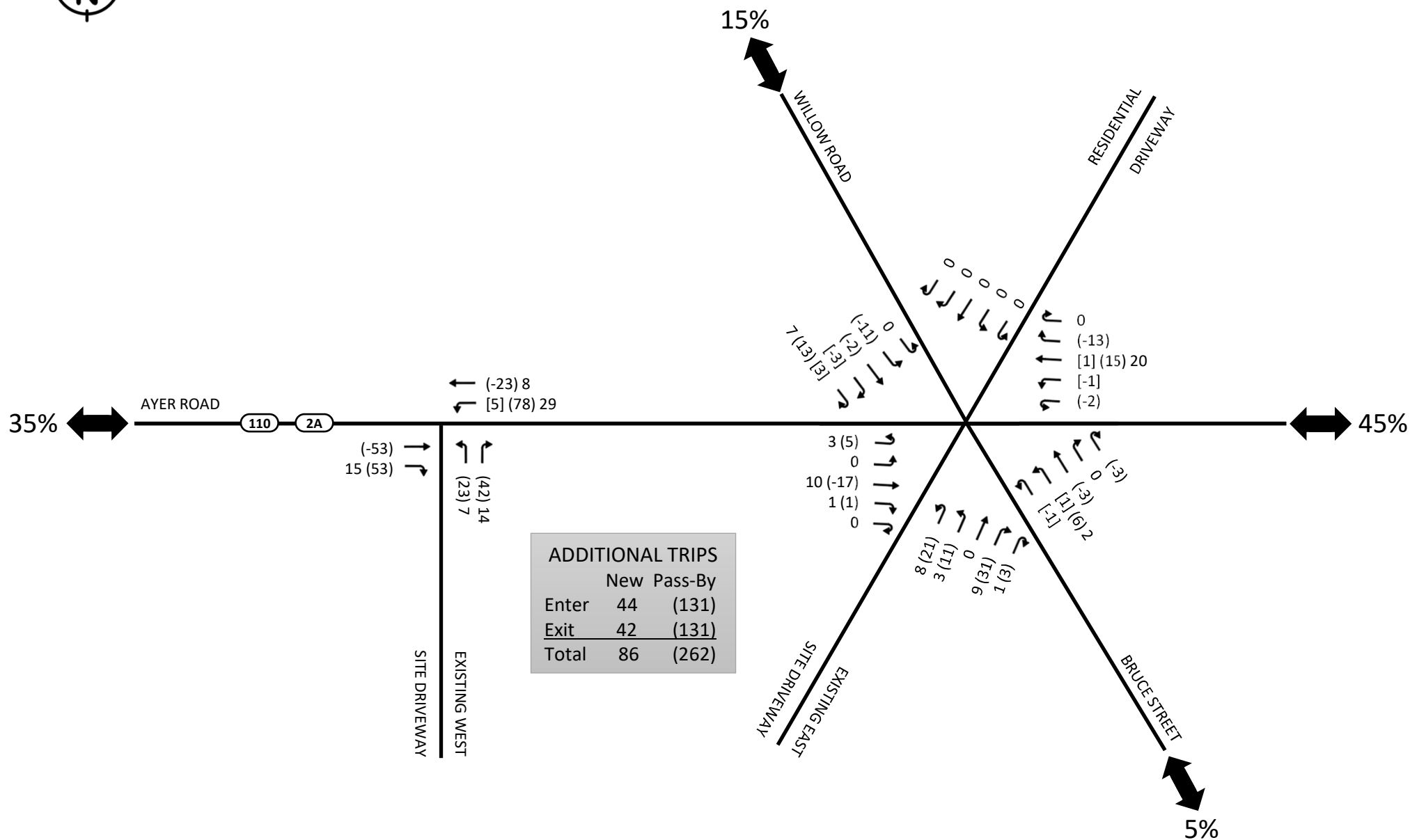


FIGURE 9

SITE-GENERATED TRAFFIC VOLUMES
WEEKDAY PM PEAK HOUR



[XX] = Redistributed Trips



Greenman-Pedersen, Inc.
RETAIL MOTOR FUEL REDEVELOPMENT – LITTLETON, MASSACHUSETTS

FIGURE 10
SITE-GENERATED TRAFFIC VOLUMES
SATURDAY MIDDAY PEAK HOUR

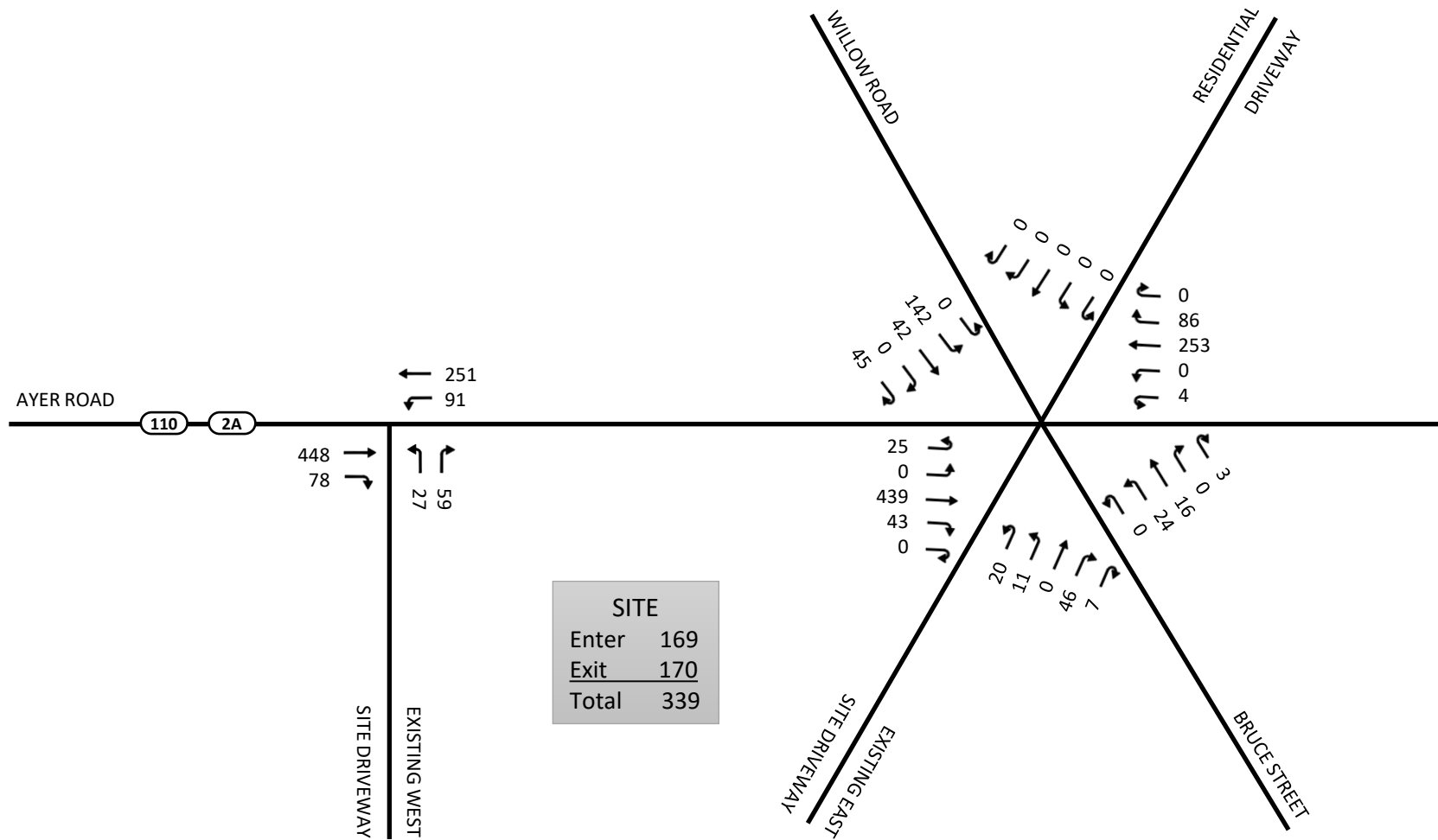


FIGURE 11
2029 BUILD TRAFFIC VOLUMES
WEEKDAY AM PEAK HOUR

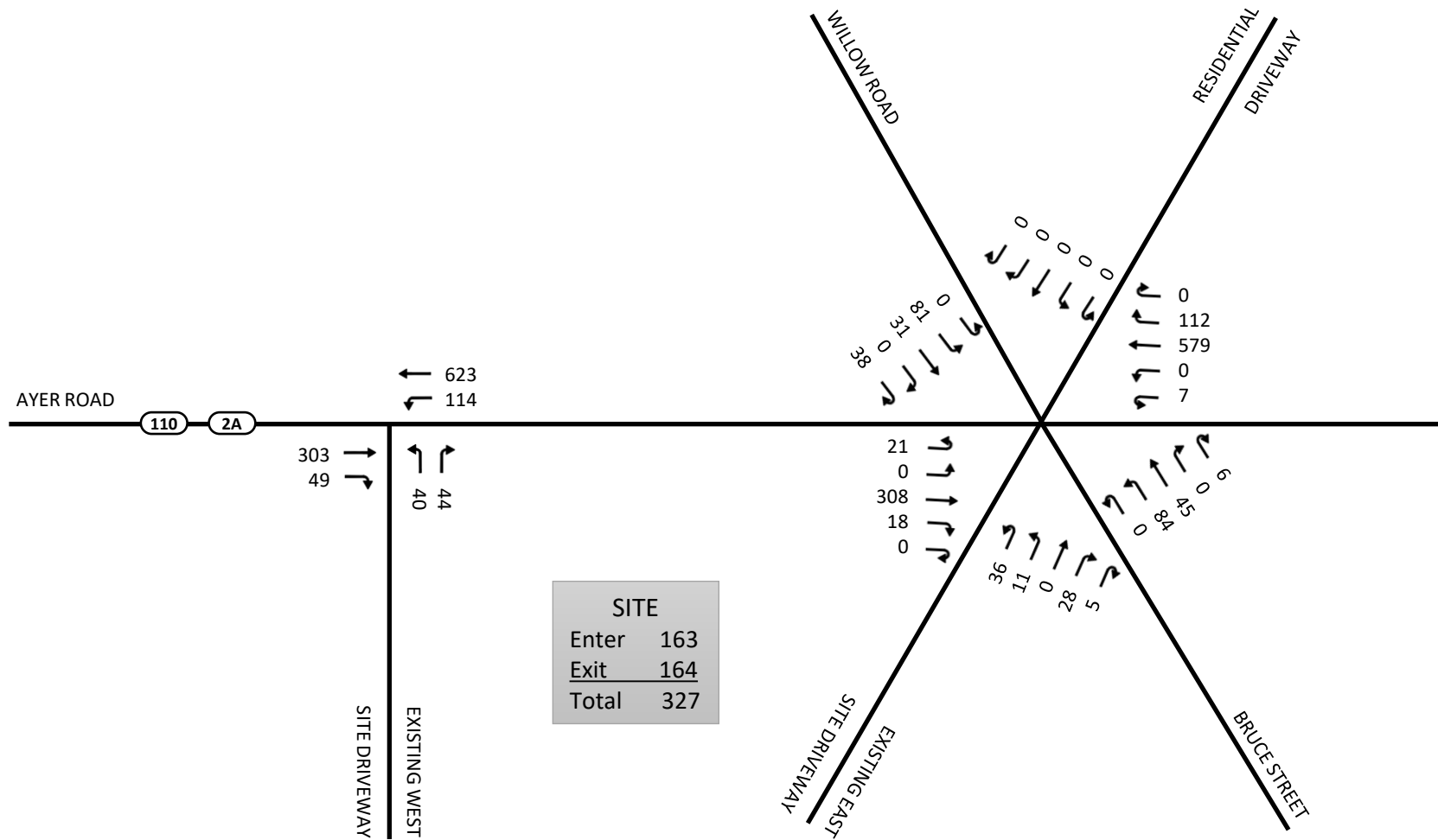


FIGURE 12

**2029 BUILD TRAFFIC VOLUMES
WEEKDAY PM PEAK HOUR**

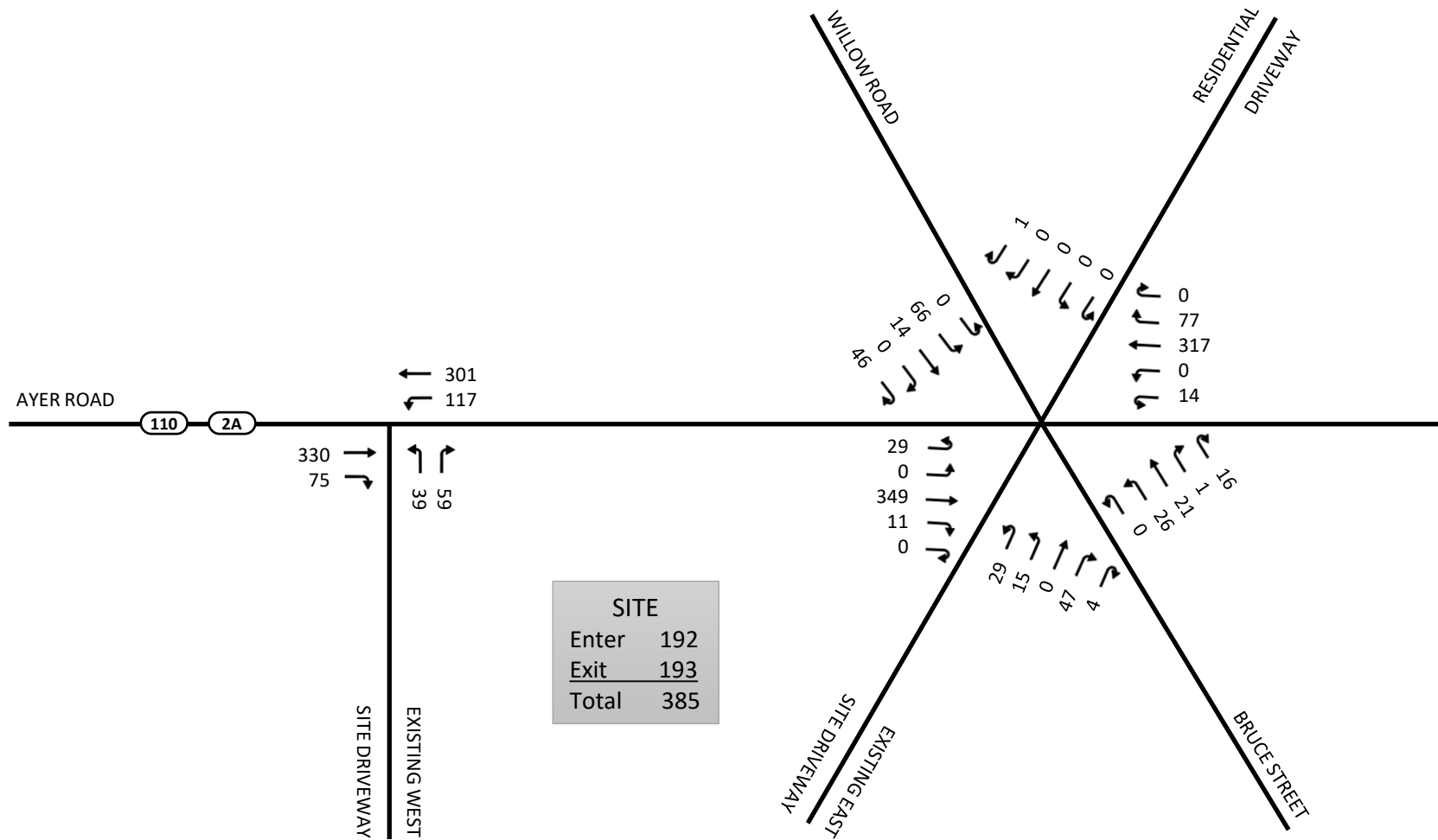


FIGURE 13

**2029 BUILD TRAFFIC VOLUMES
SATURDAY MIDDAY PEAK HOUR**

CAPACITY AND QUEUE ANALYSIS

Capacity and queue analyses were conducted at all study area locations under 2022 Existing, 2029 No-Build, and 2029 Build traffic-volume conditions. The impact of site-generated traffic can be measured by comparing 2029 No-Build conditions to 2029 Build conditions.

Methodology

The capacity analysis methodology is based on the concepts and procedures in the *Highway Capacity Manual* (HCM)⁶ and is described in the Appendix. HCM 2000 was utilized for the signalized intersections because neither HCM 6 nor HCM 2010 supports more than four approaches. It was also utilized for the unsignalized intersection for consistency.

For signalized intersections, the maximum back of queue during a typical (average) signal cycle and a 95th percentile signal cycle were calculated for each lane group during the peak periods studied. The back of queue is the length of a backup of vehicles from the stop line of a signalized intersection to the last vehicle in the queue that is required to stop, regardless of the signal indication. The length of this queue depends on a number of factors including signal timing, vehicle arrival patterns, and the saturation flow rate. For unsignalized intersections, the 95th percentile queue represents the length of queue of the critical minor-street movement that is not expected to be exceeded 95 percent of the time during the analysis period (typically one hour). In this case, the queue length is a function of the capacity of the movement and the movement's degree of saturation.

Analysis Results

The results of the level-of-service (LOS) and queue analyses are shown in Table 7 and are discussed below. Capacity and queue analyses were conducted at the study area intersections utilizing *Synchro* software.⁷ The capacity and queue analysis worksheets for all conditions are provided in the Appendix.

Ayer Road (Route 2A/110) / Bruce Street / Willow Road / Eastern Site Driveway / Residential Driveway

As shown in Table 7, under existing traffic-volume conditions, the overall intersection of Ayer Road (Route 2A/110) / Bruce Street / Willow Road / Eastern Site Driveway / Residential Driveway operates at LOS B with all movements at LOS C or better. Under future conditions, with the MassDOT improvement project in place, the overall intersection is expected to operate at LOS C or better with all movements at LOS D or better. With the proposed redevelopment in place, the signalized intersection is expected to remain at an overall LOS C with all movements at LOS D or better. Increases in delay as a result of the redevelopment are expected to be less than seven (7) seconds on the overall intersection. Under the future build condition, all volume-to-capacity (v/c) ratios are below 1.00 indicating there will be adequate capacity to accommodate the anticipated traffic volumes.

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

⁷ *Synchro plus SimTraffic 11*; Trafficware LLC.; Sugar Land, TX; 2019.

Ayer Road (Route 2A/110) at Western Site Driveway

Under existing and future traffic-volume conditions, the Ayer Road westbound left-turn movement into the westerly site driveway operates at optimal levels (LOS A) with queue lengths of one vehicle or less. The proposed site driveway approach is expected to operate at LOS C/D during the peak hours with queue lengths of one to two vehicles. The v/c ratios on Ayer Road as well as the site driveway are well below 1.00 indicating there will be adequate capacity to accommodate the anticipated traffic volumes.

TABLE 7
Intersection Capacity Analysis Summary

Intersection/Peak Hour/Lane Group	2022 Existing				2029 No-Build				2029 Build			
	V/C ^a	Del. ^b	LOS ^c	Queue ^d	V/C	Del.	LOS	Queue	V/C	Del.	LOS	Queue
Ayer Road (Route 2A/110) / Bruce Street / Willow Road / Gas Station Eastern Driveway / Residential Driveway												
<i>Weekday AM:</i>												
Ayer Road EB left turn	--	--	--	--/--	0.17	33.1	C	<25/36	0.19	35.6	D	<25/43
Ayer Road EB through/right turn	0.72	16.5	B	109/261	0.64	15.1	B	123/389	0.66	18.0	B	195/363
Ayer Road WB left turn	--	--	--	--/--	0.02	14.6	B	<25/<25	0.02	17.6	B	<25/<25
Ayer Road WB through/right turn	0.55	12.8	B	69/157	0.62	20.9	C	112/303	0.69	26.6	C	167/305
Gas Station NB approach	0.01	27.1	C	<25/<25	0.15	34.6	C	<25/25	0.49	36.2	D	48/122
Residential Driveway SB approach	0.00	0.0	A	<25/<25	0.00	0.0	A	<25/<25	0.00	0.0	A	<25/<25
Willow Road SE left turn/through	0.62	21.0	C	50/221	0.64	27.0	C	76/196	0.63	30.8	C	96/175
Willow Road SE right turn	--	--	--	--/--	0.04	15.3	B	<25/<25	0.10	18.1	B	<25/29
Bruce Street NW approach	0.03	14.6	B	<25/<25	0.03	19.2	B	<25/<25	0.03	22.8	C	<25/<25
Overall Intersection	0.70	16.2	B	--/--	0.74	19.7	B	--/--	0.75	24.2	C	--/--
<i>Weekday PM:</i>												
Ayer Road EB left turn	--	--	--	--/--	0.12	41.3	D	<25/25	0.20	43.7	D	<25/40
Ayer Road EB through/right turn	0.46	8.4	A	51/113	0.31	7.1	A	62/153	0.33	8.8	A	102/154
Ayer Road WB left turn	--	--	--	--/--	0.02	9.5	A	<25/<25	0.02	11.8	B	<25/<25
Ayer Road WB through/right turn	0.76	13.9	B	106/296	0.78	20.7	C	286/651	0.85	28.9	C	423/675
Gas Station NB approach	0.17	26.8	C	<25/<25	0.07	42.4	D	<25/<25	0.55	47.0	D	55/115
Residential Driveway SB approach	0.00	0.0	A	<25/<25	0.00	0.0	A	<25/<25	0.00	0.0	A	<25/<25
Willow Road SE left turn/through	0.65	25.9	C	38/173	0.64	41.3	D	68/159	0.62	44.0	D	73/135
Willow Road SE right turn	--	--	--	--/--	0.06	26.9	C	<25/<25	0.11	29.4	C	<25/36
Bruce Street NW approach	0.12	18.2	B	<25/25	0.12	32.2	C	<25/<25	0.13	35.6	D	<25/<25
Overall Intersection	0.77	14.3	B	--/--	0.76	20.7	C	--/--	0.81	27.2	C	--/--

^a Volume-to-capacity ratio.

^b Average control delay in seconds per vehicle.

^c Level of service.

^d Average/95th percentile queue length in feet per lane (assuming 25 feet per vehicle).

TABLE 7 (continued)
Intersection Capacity Analysis Summary

Intersection/Peak Hour/Lane Group	2022 Existing				2029 No-Build				2029 Build			
	V/C ^a	Del. ^b	LOS ^c	Queue ^d	V/C	Del.	LOS	Queue	V/C	Del.	LOS	Queue
Ayer Road (Route 2A/110) / Bruce Street / Willow Road / Gas Station Eastern Driveway / Residential Driveway												
<i>Saturday Midday:</i>												
Ayer Road EB left turn	--	--	--	--/--	0.18	33.0	C	<25/41	0.22	36.4	D	<25/53
Ayer Road EB through/right turn	0.62	14.6	B	55/199	0.42	11.1	B	56/239	0.43	13.1	B	100/235
Ayer Road WB left turn	--	--	--	--/--	0.04	13.8	B	<25/<25	0.04	16.4	B	<25/<25
Ayer Road WB through/right turn	0.61	14.2	B	52/204	0.59	18.9	B	103/318	0.65	23.7	C	165/341
Gas Station NB approach	0.23	27.4	C	<25/<25	0.12	34.3	C	<25/<25	0.61	41.6	D	45/173
Residential Driveway SB approach	0.00	25.5	C	<25/<25	0.01	33.5	C	<25/<25	0.01	38.0	D	<25/<25
Willow Road SE left turn/through	0.48	20.7	C	<25/111	0.45	29.6	C	28/119	0.46	34.7	C	35/106
Willow Road SE right turn	--	--	--	--/--	0.07	21.8	C	<25/<25	0.14	25.8	C	<25/36
Bruce Street NW approach	0.20	18.6	B	<25/48	0.22	27.5	C	<25/73	0.30	33.1	C	<25/78
Overall Intersection	0.52	15.7	B	--/--	0.52	18.0	B	--/--	0.59	23.5	C	--/--

^a Volume-to-capacity ratio.

^b Average control delay in seconds per vehicle.

^c Level of service.

^d Average/95th percentile queue length in feet per lane (assuming 25 feet per vehicle).

TABLE 7 (continued)
Intersection Capacity Analysis Summary

Intersection/Peak Hour/Lane Group	2022 Existing				2029 No-Build				2029 Build			
	V/C ^a	Del. ^b	LOS ^c	Queue ^d	V/C	Del.	LOS	Queue	V/C	Del.	LOS	Queue
Ayer Road (Route 2A/110) / Gas Station Western Driveway												
<i>Weekday AM:</i>												
Ayer Road WB left turn	0.01	0.2	A	--/<25	0.00	0.2	A	--/<25	0.11	3.5	A	--/<25
Gas Station Driveway NB approach	0.05	14.6	B	--/<25	0.04	14.8	B	--/<25	0.25	17.7	C	--/<25
<i>Weekday PM:</i>												
Ayer Road WB left turn	0.00	0.1	A	--/<25	0.00	0.1	A	--/<25	0.10	2.5	A	--/<25
Gas Station Driveway NB approach	0.07	21.1	C	--/<25	0.04	18.5	C	--/<25	0.41	32.5	D	--/47
<i>Saturday Midday:</i>												
Ayer Road WB left turn	0.00	0.2	A	--/<25	0.00	0.2	A	--/<25	0.11	3.3	A	--/<25
Gas Station Driveway NB approach	0.05	14.2	B	--/<25	0.03	14.0	B	--/<25	0.27	17.8	C	--/28

^a Volume-to-capacity ratio.

^b Average control delay in seconds per vehicle.

^c Level of service.

^d Average/95th percentile queue length in feet per lane (assuming 25 feet per vehicle).

RECOMMENDED IMPROVEMENTS

The final phase of the transportation analysis process is to identify improvement measures useful in improving anticipated deficiencies. In order to determine the appropriate geometric configuration of Ayer Road (Route 2A/110) on its approaches to the proposed western site driveway, auxiliary left-turn lane warrants analyses were conducted. This analysis assessed the need for a separate left-turn lane on the mainline approach to the proposed western site driveway. Analysis of left-turn treatment indicates that a separate westbound left-turn lane on Ayer Road is justified. Accordingly, Concept #1 and Concept #2 were prepared and are shown on Figures 14 and 15. The turn lane warrant analyses are provided in the Appendix.

The results of the LOS and queue analyses are shown in Table 8. The capacity and queue analysis worksheets are provided in the Appendix. Operationally, the intersection is expected to operate similarly with or without the westbound left-turn lane, however, the turn lane provides a considerable improvement in terms of safety.

REVISIONS

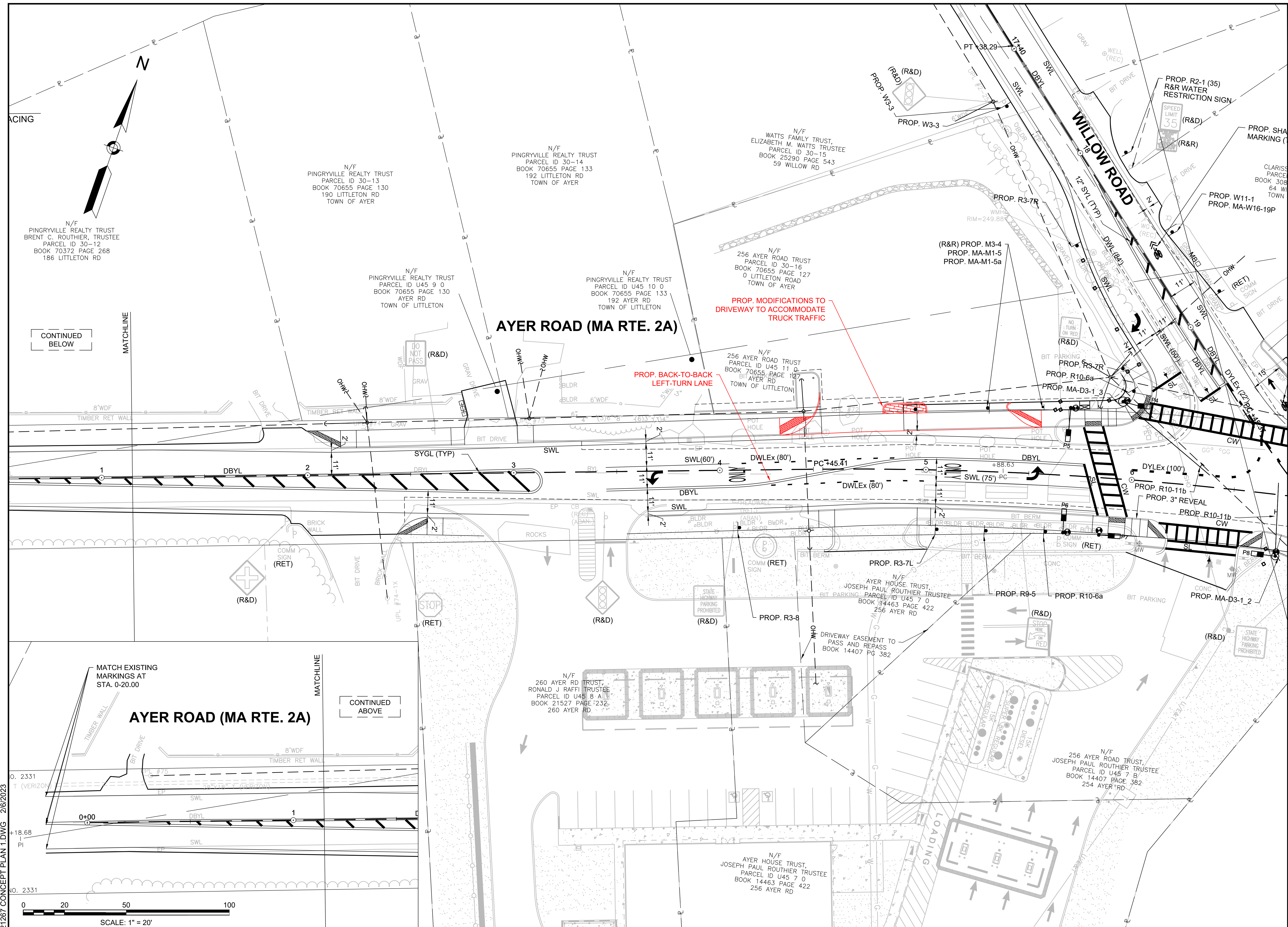
NO.	REVISION	DATE
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DRAWN/DESIGN BY	CHECKED BY
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DIP	EMR
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SCALE: 1"=20'

1 OF 5



REVISIONS

NO.	REVISION	DATE
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DIP	EMR
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SCALE: 1"=20'

2 OF 5



TABLE 8
Intersection Capacity Analysis Summary – Recommended Improvements

Intersection/Peak Hour/Lane Group	2029 No-Build				2029 Build				2029 Build with Improvements			
	V/C ^a	Del. ^b	LOS ^c	Queue ^d	V/C	Del.	LOS	Queue	V/C	Del.	LOS	Queue
Ayer Road (Route 2A/110) / Gas Station Western Driveway												
<i>Weekday AM:</i>												
Ayer Road WB left turn	0.00	0.2	A	--/<25	0.11	3.5	A	--/<25	0.11	9.5	A	--/<25
Gas Station Driveway NB approach	0.04	14.8	B	--/<25	0.25	17.7	C	--/<25	0.24	17.3	C	--/<25
<i>Weekday PM:</i>												
Ayer Road WB left turn	0.00	0.1	A	--/<25	0.10	2.5	A	--/<25	0.10	8.4	A	--/<25
Gas Station Driveway NB approach	0.04	18.5	C	--/<25	0.41	32.5	D	--/47	0.41	31.9	D	--/47
<i>Saturday Midday:</i>												
Ayer Road WB left turn	0.00	0.2	A	--/<25	0.11	3.3	A	--/<25	0.11	8.6	A	--/<25
Gas Station Driveway NB approach	0.03	14.0	B	--/<25	0.27	17.8	C	--/28	0.27	17.6	C	--/27

^a Volume-to-capacity ratio.

^b Average control delay in seconds per vehicle.

^c Level of service.

^d Average/95th percentile queue length in feet per lane (assuming 25 feet per vehicle).

CONCLUSIONS

Existing and future conditions in the study area have been described, analyzed, and evaluated with respect to traffic operations and the impact of the proposed redevelopment. Conclusions of this effort are presented below.

- The proposed retail motor fuel outlet redevelopment to be located at 254-260 Ayer Road (Route 2A/110) in Littleton, Massachusetts. The existing site consists of nine (9) vehicle fueling positions (vfps) and a one-story 1,983 square foot (sf) convenience store. The project consists of razing the entire site and constructing a 6,000 (±) sf convenience store with 12 vfps. Access and egress to the site currently exist via two full-access driveways on the south side of Ayer Road, west of its intersection with Willow Road and Bruce Street. As proposed the site will continue to provide two driveways: the eastern driveway will remain in approximately its current location but will be limited to exit only traffic; and the western driveway will be relocated approximately 140 feet to the west and allowing full-access (entering and exiting traffic).
- Available sight distances to the west of the proposed site driveway on Ayer Road exceed the minimum and desirable SSD and ISD requirements for safe operation. To the east of the driveway the intersection sight distance requirements were not met due to overgrowth of existing vegetation. As part of the redevelopment, the vegetation will be cleared, and it is expected that the intersection sight distance will exceed the 360-foot minimum requirement for safe operation. Sight lines should be confirmed based on the precise driveway location in relation to the finished grade and associated plan and profile of the final site plan that incorporates MassDOT project elements and potential off-site improvements. To ensure the safe and efficient flow of traffic to and from the site, it is recommended that any proposed plantings, vegetation, landscaping, and signing along the site frontage be kept low to the ground (no more than 3.0 feet above street level) or set back sufficiently from Ayer Road so as not to inhibit the available sight lines.
- The proposed redevelopment is expected to generate 291 *additional* vehicles trips (145 entering and 146 exiting) during the weekday AM peak hour, 298 *additional* vehicles trips (148 entering and 150 exiting) during the weekday PM peak hour, and 348 *additional* vehicle trips (175 entering and 173 exiting) during the Saturday midday peak hour. It should be noted that these are the additional trips seen at the site driveways.

Due to a portion of those being pass-by trips, the number of additional trips beyond the site driveway and new to the area are 69 *additional* vehicles trips (34 entering and 35 exiting) during the weekday AM peak hour, 74 *additional* vehicles trips (36 entering and 38 exiting) during the weekday PM peak hour, and 86 *additional* vehicle trips (44 entering and 42 exiting) during the Saturday midday peak hour.

- Under existing traffic-volume conditions, the overall intersection of Ayer Road (Route 2A/110) / Bruce Street / Willow Road / Eastern Site Driveway / Residential Driveway operates at LOS B with all movements at LOS C or better. Under future conditions, with the MassDOT improvement project in place, the overall intersection is expected to operate at LOS C or better with all movements at LOS D or better. With the proposed redevelopment in place, the signalized intersection is expected to remain at an overall LOS C with all movements at LOS D or better. Increases in delay as a result of the redevelopment are expected to be less than seven (7) seconds on the overall intersection. Under the future build condition, all volume-to-capacity (v/c) ratios are below 1.00 indicating there will be adequate capacity to accommodate the anticipated traffic volumes.

- Under existing and future traffic-volume conditions, the Ayer Road westbound left-turn movement into the westerly site driveway operates at optimal levels (LOS A) with queue lengths of one vehicle or less. The proposed site driveway approach is expected to operate at LOS C/D during the peak hours with queue lengths of one to two vehicles. The v/c ratios on Ayer Road as well as the site driveway are well below 1.00 indicating there will be adequate capacity to accommodate the anticipated traffic volumes.
- In order to determine the appropriate geometric configuration of Ayer Road (Route 2A/110) on its approaches to the proposed western site driveway, auxiliary left-turn lane warrants analyses were conducted. This analysis assessed the need for a separate left-turn lane on the mainline approach to the proposed western site driveway. Analysis of left-turn treatment indicates that a separate westbound left-turn lane on Ayer Road is justified. Operationally, the intersection is expected to operate similarly with or without the westbound left-turn lane, however, the turn lane provides a considerable improvement in terms of safety.

- APPENDIX

- *Public Transportation Information*
 - *Traffic Count Data*
- *Traffic-Volume Adjustment Data*
- *MassDOT Crash Rate Worksheets*
 - *Sight Distance Calculations*
- *MassDOT Improvement Project Plans*
 - *Trip Generation Calculations*
 - *Capacity Analysis Methodology*
- *Capacity and Queue Analysis Worksheets*
 - *Auxiliary Lane Warrant Analysis*

PUBLIC TRANSPORTATION INFORMATION

FITCHBURG LINE

FALL/WINTER SCHEDULE Effective October 17, 2022

Monday to Friday

Inbound to Boston

Inbound to Boston			AM								PM								
ZONE	STATION	TRAIN #	400	402	404	406	408	410	412	414	416	418	420	422	424	426	428	430	432
	Bikes Allowed																		
8	Wachusett		4:25	5:25	6:25	7:33	8:33	9:33	10:33	11:33	-	1:33	-	3:33	4:28	5:28	6:25	7:25	9:25
8	Fitchburg		4:33	5:33	6:33	7:41	8:41	9:41	10:41	11:41	-	1:41	-	3:41	4:36	5:36	6:33	7:33	9:33
8	North Leominster		4:40	5:40	6:40	7:48	8:48	9:48	10:48	11:48	-	1:48	-	3:48	4:43	5:43	6:40	7:40	9:40
8	Shirley		4:48	5:48	6:48	7:56	8:56	f 9:56	f 10:56	f 11:56	-	f 1:56	-	f 3:56	f 4:51	f 5:51	f 6:48	f 7:48	f 9:48
8	Ayer		4:53	5:53	6:53	8:01	9:01	10:01	11:01	12:01	-	2:01	-	4:01	4:56	5:56	6:53	7:53	9:53
7	Littleton/Route 495		5:01	6:01	7:01	8:09	9:09	10:09	11:09	12:09	1:09	2:09	3:09	4:09	5:04	6:04	7:01	8:01	10:01
6	South Acton		5:07	6:07	7:07	8:16	9:16	10:16	11:16	12:16	1:16	2:16	3:16	4:16	5:10	6:10	7:07	8:07	10:07
5	West Concord		5:12	6:12	7:12	8:29	9:29	f 10:29	f 11:29	f 12:29	f 1:29	f 2:29	f 3:29	f 4:29	f 5:15	f 6:15	f 7:12	f 8:12	f 10:12
5	Concord		5:17	6:18	7:18	8:34	9:34	f 10:34	f 11:34	f 12:34	f 1:34	f 2:34	f 3:34	f 4:34	f 5:20	f 6:20	f 7:17	f 8:17	f 10:17
4	Lincoln		5:24	6:25	7:25	8:41	9:41	f 10:41	f 11:41	f 12:41	f 1:41	f 2:41	f 3:41	f 4:41	f 5:27	f 6:27	f 7:24	f 8:24	f 10:24
3	Kendal Green		5:30	6:31	7:31	8:47	9:47	f 10:47	f 11:47	f 12:47	f 1:47	f 2:47	f 3:47	f 4:47	f 5:33	f 6:33	f 7:30	f 8:30	f 10:30
2	Brandeis/Roberts		5:34	6:36	7:36	8:52	9:51	f 10:51	f 11:51	f 12:51	f 1:51	f 2:51	f 3:51	f 4:51	f 5:37	f 6:37	f 7:34	f 8:34	f 10:34
2	Waltham		5:39	6:41	7:41	8:57	9:56	10:56	11:56	12:56	1:56	2:56	3:56	4:56	5:42	6:42	7:39	8:39	10:39
1	Waverley		5:44	6:46	7:46	9:02	10:01	f 11:01	f 12:01	f 1:01	f 2:01	f 3:01	f 4:01	f 5:01	f 5:47	f 6:47	f 7:44	f 8:44	f 10:44
1	Belmont		5:46	6:48	7:49	9:04	10:03	f 11:03	f 12:03	f 1:03	f 2:03	f 3:03	f 4:03	f 5:03	f 5:49	f 6:49	f 7:46	f 8:46	f 10:46
1A	Porter Square		5:52	6:54	7:55	9:10	10:09	11:09	12:09	1:09	2:09	3:09	4:09	5:09	5:55	6:55	7:52	8:52	10:52
1A	North Station		6:08	7:10	8:11	9:26	10:24	11:24	12:24	1:24	2:24	3:24	4:24	5:24	6:10	7:10	8:07	9:07	11:07

Monday to Friday

Outbound from Boston

Outbound from Boston			AM								PM									
ZONE	STATION	TRAIN #	401	403	405	407	409	411	413	415	417	419	421	423	425	427	429	431	433	
	Bikes Allowed																			
1A	North Station		5:30	6:30	7:30	8:30	9:30	10:30	11:30	12:30	1:30	2:30	3:30	4:30	5:30	6:30	7:30	8:50	10:50	
1A	Porter Square		5:40	6:40	7:40	8:40	9:40	10:40	11:40	12:40	1:40	2:40	3:40	4:40	5:40	6:40	7:40	9:00	11:00	
1	Belmont		f 5:45	f 6:45	f 7:45	f 8:45	f 9:45	f 10:45	f 11:45	f 12:45	f 1:45	f 2:45	3:45	4:45	5:45	6:45	f 7:45	f 9:05	f 11:05	
1	Waverley		f 5:47	f 6:47	f 7:47	f 8:47	f 9:47	f 10:47	f 11:47	f 12:47	f 1:47	f 2:47	3:47	4:47	5:47	6:47	f 7:47	f 9:07	f 11:07	
2	Waltham		5:52	6:52	7:52	8:52	9:52	10:52	11:52	12:52	1:52	2:52	3:52	4:52	5:53	6:52	7:52	9:12	11:12	
2	Brandeis/Roberts		f 5:55	f 6:55	f 7:55	f 8:55	f 9:55	f 10:55	f 11:55	f 12:55	f 1:55	f 2:55	3:55	4:55	5:56	6:55	7:55	f 9:15	f 11:15	
3	Kendal Green		f 5:59	f 6:59	f 8:00	f 9:00	f 10:00	f 11:00	f 12:00	f 1:00	f 2:00	f 3:00	4:00	4:59	6:00	6:59	7:59	f 9:19	f 11:19	
4	Lincoln		f 6:04	f 7:04	f 8:06	f 9:06	f 10:06	f 11:06	f 12:06	f 1:06	f 2:06	f 3:06	4:06	5:04	6:05	7:04	8:04	f 9:24	f 11:24	
5	Concord		f 6:09	f 7:09	f 8:12	f 9:12	f 10:12	f 11:12	f 12:12	f 1:12	f 2:12	f 3:12	4:12	5:09	6:10	7:09	8:09	f 9:29	f 11:29	
5	West Concord		f 6:13	f 7:13	f 8:17	f 9:17	f 10:17	f 11:17	f 12:17	f 1:17	f 2:17	f 3:17	4:17	5:14	6:15	7:13	8:13	f 9:33	f 11:33	
6	South Acton		6:18	7:18	8:23	9:23	10:23	11:23	12:23	1:23	2:23	3:23	4:23	5:19	6:20	7:18	8:18	9:38	11:38	
7	Littleton/Route 495		6:25	7:25	8:30	9:30	10:30	11:30	12:30	1:30	2:30	3:30	4:30	5:27	6:28	7:25	8:25	9:45	11:45	
8	Ayer		f 6:33	f 7:33	f 8:38	f 9:38	f 10:38	f 11:38	-	f 1:38	-	f 3:38	4:38	5:35	6:36	7:33	8:33	f 9:53	f 11:53	
8	Shirley		f 6:38	f 7:38	f 8:43	f 9:43	f 10:43	f 11:43	-	f 1:43	-	f 3:43	4:43	5:40	6:41	7:38	f 8:38	f 9:58	f 11:58	
8	North Leominster		6:47	7:47	8:52	9:52	10:52	11:52	-	1:52	-	3:52	4:52	5:49	6:50	7:47	8:47	10:07	12:07	
8	Fitchburg		L 6:57	L 8:00	L 9:02	L 10:02	L 11:02	L 12:02	-	L 2:02	-	L 4:02	L 5:02	L 6:00	L 7:01	L 7:57	L 8:57	L 10:17	L 12:17	
8	Wachusett		7:07	8:10	9:12	10:12	11:12	12:12	-	2:12	-	4:12	5:13	6:10	7:12	8:08	9:07	10:27	12:27	

Weekend

Inbound to Boston

Inbound to Boston			AM				PM			
SATURDAY TRAIN #		1400	1402	1404	1406	1408	1410	1412	1414	
ZONE	STATION	SUNDAY TRAIN #	2400	2402	2404	2406	2408	2410	2412	2414
Bikes Allowed										
8	Wachusett		5:00	7:30	10:00	12:00	2:00	4:00	6:00	9:00
8	Fitchburg		5:08	7:38	10:08	12:08	2:08	4:08	6:08	9:08
8	North Leominster		5:15	7:45	10:15	12:15	2:15	4:15	6:15	9:15
8	Shirley		f 5:23	f 7:53	f 10:23	f 12:23	f 2:23	f 4:23	f 6:23	f 9:23
8	Ayer		5:28	7:58	10:28	12:28	2:28	4:28	6:28	9:28
7	Littleton/Rte495		5:36	8:06	10:36	12:36	2:36	4:36	6:36	9:36
6	South Acton		5:42	8:12	10:42	12:42	2:42	4:42	6:42	9:42
5	West Concord		f 5:47	f 8:17	f 10:47	f 12:47	f 2:47	f 4:47	f 6:47	f 9:47
5	Concord		f 5:52	f 8:22	f 10:52	f 12:52	f 2:52	f 4:52	f 6:52	f 9:52
4	Lincoln		f 5:59	f 8:29	f 10:59	f 12:59	f 2:59	f 4:59	f 6:59	f 9:59
3	Kendal Green		f 6:05	f 8:35	f 11:05	f 1:05	f 3:05	f 5:05	f 7:05	f 10:05
2	Brandeis/Roberts		f 6:09	f 8:39	f 11:09	f 1:09	f 3:09	f 5:09	f 7:09	f 10:09
2	Waltham		6:14	8:44	11:14	1:14	3:14	5:14	7:14	10:14
1	Waverley		f 6:19	f 8:49	f 11:19	f 1:19	f 3:19	f 5:19	f 7:19	f 10:19
1	Belmont		f 6:21	f 8:51	f 11:21	f 1:21	f 3:21	f 5:21	f 7:21	f 10:21
1A	Porter Square		6:27	8:57	11:27	1:27	3:27	5:27	7:27	10:27
1A	North Station		6:42	9:12	11:42	1:42	3:42	5:42	7:42	10:42

Weekend

Outbound from Boston

Outbound from Boston			AM			PM				
SATURDAY TRAIN #			1401	1403	1405	1407	1409	1411	1413	1415
ZONE	STATION	SUNDAY TRAIN #	2401	2403	2405	2407	2409	2411	2413	2415
Bikes Allowed										
1A	North Station		7:20	9:50	11:50	1:50	3:50	5:50	8:35	10:55
1A	Porter Square		7:30	10:00	12:00	2:00	4:00	6:00	8:45	11:05
1	Belmont		f 7:35	f 10:05	f 12:05	f 2:05	f 4:05	f 6:05	f 8:50	f 11:10
1	Waverley		f 7:37	f 10:07	f 12:07	f 2:07	f 4:07	f 6:07	f 8:52	f 11:12
2	Waltham		7:42	10:12	12:12	2:12	4:12	6:12	8:57	11:17
2	Brands/Roberts		f 7:45	f 10:15	f 12:15	f 2:15	f 4:15	f 6:15	f 9:00	f 11:20
3	Kendal Green		f 7:49	f 10:19	f 12:19	f 2:19	f 4:19	f 6:19	f 9:04	f 11:24
4	Lincoln		f 7:54	f 10:24	f 12:24	f 2:24	f 4:24	f 6:24	f 9:09	f 11:29
5	Concord		f 7:59	f 10:29	f 12:29	f 2:29	f 4:29	f 6:29	f 9:14	f 11:34
5	West Concord		f 8:03	f 10:33	f 12:33	f 2:33	f 4:33	f 6:33	f 9:18	f 11:38
6	South Acton		8:08	10:38	12:38	2:38	4:38	6:38	9:23	11:43
7	Littleton/Rte495		8:15	10:45	12:45	2:45	4:45	6:45	9:30	11:50
8	Ayer		f 8:23	f 10:53	f 12:53	f 2:53	f 4:53	f 6:53	f 9:38	f 11:58
8	Shirley		f 8:28	f 10:58	f 12:58	f 2:58	f 4:58	f 6:58	f 9:43	f 12:03
8	North Leominster		8:37	11:07	1:07	3:07	5:07	7:07	9:52	12:12
8	Fitchburg		L 8:47	L 11:17	L 1:17	L 3:17	L 5:17	L 7:17	L 10:02	L 12:22
8	Wachusett		8:57	11:27	1:27	3:27	5:27	7:27	10:12	12:32

HOW TO RIDE

- Please arrive at your stop five minutes ahead of time.
- Signal the driver by raising your arm as the bus approaches.
- Please have your fare ready when boarding to avoid delays.
- Allow other passengers to de-board before you enter the bus.
- After boarding please be seated immediately.

FOR DISABLED RIDERS

- All MART buses are equipped with wheelchair lifts and reserved seating areas with chair ties.
- In the event a lift is not available, your driver will notify MART, and a lift-equipped MART van will be sent to enable you to complete your journey.
- To qualify for discount fares and get a proper ID, please call 800-922-5636.
- The TDD number for deaf and hearing-impaired passengers is 800-789-0577.

BAD WEATHER RULES

- For safety reasons, MART has the right to postpone or cancel service or to deviate from its regular routes because of accidents, bad weather or other emergencies. For updates tune to **WPKZ AM 1280**; call MART at **800-922-5636**; or visit our website at <http://www.mrta.us/customer-information/service-alerts>.

NO SERVICE ON WEEKENDS OR THESE HOLIDAYS:

New Year's Day, Martin Luther King Jr. Day, President's Day, Patriot's Day, Memorial Day, Independence Day, Labor Day, Columbus Day, Veteran's Day, Thanksgiving, and Christmas Day

FARES

FIXED ROUTE

Adult	\$1.25
Student (18 & younger,)	\$0.60
Elders (60 and older)	\$0.60
Disabled Riders (with Medicare, Statewide or other proper ID)	\$0.60
Children (5 and under with an adult)	Free

PASSES

Monthly Regular	\$25.00
Monthly Elderly, Disabled, Veterans, Students	\$20.00

Exact Fare Required: You can pay the driver cash or load cash value (don't have to worry about exact change) on the CharlieCard. If you use the shuttle regularly then a monthly pass is the best value. **Paper passes can be purchased at Littleton Town Hall (Tax Collector's Office) or from the bus driver until further notice.**

You may purchase passes at any of the following MART locations:

- 100 Main St, Fitchburg, MA
- 1427R Water St, Fitchburg, MA

Also Littleton Town Hall or bus driver

MART buses and shuttle vans, if equipped with a fare-box or card validator, accept the CharlieCard™. This fare card is how we issue MART's bus passes. Riders can also put cash stored-value on the card to use for single bus trips. CharlieCard™ stored-value lets you ride on MART and nine other RTA's (such as WRTA in Worcester) or the MBTA bus/subway system.



Littleton-Westford Commuter Rail Shuttle

Fares & Schedules

Effective Date: June 4, 2018



www.mrta.us

Montachusett Regional Transit Authority
1427R Water St, Fitchburg, MA 01420
(978) 345-7711 or (800) 922-5636
E-mail: contactMART@mrta.us



IB = Inbound Train to Boston
OB = Outbound Train from Boston

A.M. Service Monday-Friday Only		
Stop Location	Departure Time	Corresponding MBTA Train
Juniper Networks (Park & Ride Lot)	7:10 AM	
Littleton Commuter Rail Station (Arrive)	7:35 AM	IB: 7:46 AM
Littleton Commuter Rail Station (Depart)	7:50 AM	OB: 7:40 AM
IBM	8:00 AM	
Red Hat, Inc.	8:05 AM	
Juniper Networks	8:13 AM	
Technology Park Entrance	8:15 AM	
Littleton Commuter Rail Station	8:50 AM	IB: 8:35 AM OB: 8:41 AM
IBM	9:00 AM	
Red Hat, Inc.	9:05 AM	
Juniper Networks	9:13 AM	
Technology Park Entrance	9:15 AM	

P.M. Service Monday-Friday Only		
Stop Location	Departure Time	Corresponding MBTA Train
Technology Park Entrance	4:40 PM	
Juniper Networks	4:42 PM	
Red Hat, Inc.	4:50 PM	
IBM	4:55 PM	
Littleton Commuter Rail Station (Arrive)	5:05 PM	IB: 5:15 PM
Littleton Commuter Rail Station (Depart)	5:20 PM	OB: 5:00 PM & 5:14 PM
Technology Park Entrance	5:40 PM	
Juniper Networks (Park & Ride Lot)	5:42 PM	
Red Hat, Inc.	5:55 PM	
IBM	6:00 PM	
Littleton Commuter Rail Station (Arrive)	6:10 PM	IB: 6:18 PM
Littleton Commuter Rail Station (Depart)	6:38 PM	OB: 6:28 PM
Juniper Networks (Park & Ride Lot)	on-demand	

Roads Travelled - To Train Station: Start at Juniper Park & Ride Lot to Technology Park Drive, Nixon Rd, Littleton Rd (Rte. 110/2A Westford) to King St (Rte. 110/2A Littleton), IBM Parking Lot, Auman St, King St, Rogers St, Foster St to MBTA Littleton/495 Station.
From Train Station: Foster, King, Auman, IBM Parking Lot, King, Littleton, Nixon, Technology Park, Juniper Parking Lot, Technology Park Drive.



MART now has bike racks on all our fixed route buses and shuttle vans

TRAFFIC IMPACT AND ACCESS STUDY

Retail Motor Fuel Outlet – Littleton, Massachusetts

TRAFFIC COUNT DATA



Location Map: 228830 Littleton, MA

Precision Data Industries, LLC 157 Washington Street, Suite 2, Hudson, MA 01749 ph: 508-875-0100 email: datarequests@pdillc.com



Client:
GPI

Engineer:
C. Donaldson

Site Code:
NEX-2021267.00

Date:
Thurs 9/22 thru Sat 9/24/2022

PDI Job #
228830

City, State:
Littleton, MA

Ayer Road (Route 2A)
west of Gulf West Site Drive
City, State: Littleton, MA
Client: GPI/ C. Donaldson
Site Code: NEX-2021267.00



PDI File # 228830 ATR-A

Count Date: Thursday, September 22, 2022
Direction: EB

AM	Cars	Single Unit Heavy	Multi Unit Heavy	Total
12:00 AM	9	0	0	9
12:15 AM	6	0	0	6
12:30 AM	4	0	1	5
12:45 AM	5	1	1	7
1:00 AM	3	1	0	4
1:15 AM	1	0	0	1
1:30 AM	1	0	2	3
1:45 AM	0	0	0	0
2:00 AM	6	0	1	7
2:15 AM	3	0	1	4
2:30 AM	11	0	0	11
2:45 AM	2	1	1	4
3:00 AM	13	0	0	13
3:15 AM	5	1	2	8
3:30 AM	9	1	2	12
3:45 AM	4	0	6	10
4:00 AM	4	0	2	6
4:15 AM	7	0	2	9
4:30 AM	12	0	6	18
4:45 AM	17	0	4	21
5:00 AM	37	0	1	38
5:15 AM	36	0	7	43
5:30 AM	41	1	4	46
5:45 AM	43	1	1	45
6:00 AM	75	1	7	83
6:15 AM	94	7	7	108
6:30 AM	119	0	6	125
6:45 AM	139	1	4	144
7:00 AM	140	2	3	145
7:15 AM	123	3	6	132
7:30 AM	106	3	6	115
7:45 AM	120	5	5	130
8:00 AM	104	7	8	119
8:15 AM	109	6	5	120
8:30 AM	118	6	6	130
8:45 AM	89	9	5	103
9:00 AM	65	6	5	76
9:15 AM	88	6	0	94
9:30 AM	80	4	6	90
9:45 AM	60	2	7	69
10:00 AM	46	3	6	55
10:15 AM	45	5	6	56
10:30 AM	55	7	6	68
10:45 AM	60	9	7	76
11:00 AM	48	10	4	62
11:15 AM	61	3	8	72
11:30 AM	54	6	9	69
11:45 AM	60	8	9	77

PM	Cars	Single Unit Heavy	Multi Unit Heavy	Total
12:00 PM	54	3	4	61
12:15 PM	71	3	11	85
12:30 PM	66	9	8	83
12:45 PM	75	8	6	89
1:00 PM	78	4	2	84
1:15 PM	78	8	6	92
1:30 PM	70	4	7	81
1:45 PM	57	5	7	69
2:00 PM	67	3	7	77
2:15 PM	83	8	3	94
2:30 PM	91	5	8	104
2:45 PM	71	8	7	86
3:00 PM	92	4	4	100
3:15 PM	60	2	1	63
3:30 PM	121	4	3	128
3:45 PM	91	4	6	101
4:00 PM	90	4	4	98
4:15 PM	101	3	4	108
4:30 PM	87	2	7	96
4:45 PM	83	1	2	86
5:00 PM	102	2	2	106
5:15 PM	78	1	2	81
5:30 PM	65	2	2	69
5:45 PM	67	1	2	70
6:00 PM	67	1	2	70
6:15 PM	62	1	3	66
6:30 PM	47	2	1	50
6:45 PM	48	1	2	51
7:00 PM	37	3	2	42
7:15 PM	41	0	2	43
7:30 PM	49	0	1	50
7:45 PM	29	0	4	33
8:00 PM	38	0	1	39
8:15 PM	32	0	2	34
8:30 PM	23	0	0	23
8:45 PM	21	0	7	28
9:00 PM	7	0	1	8
9:15 PM	33	0	1	34
9:30 PM	28	0	2	30
9:45 PM	21	0	0	21
10:00 PM	23	0	0	23
10:15 PM	7	0	1	8
10:30 PM	9	1	2	12
10:45 PM	7	0	0	7
11:00 PM	18	0	0	18
11:15 PM	6	0	0	6
11:30 PM	12	0	0	12
11:45 PM	10	1	0	11

AM Total	2337	126	185	2648
Percentage	88.26%	4.76%	6.99%	
AM Peak	6:30 AM	10:15 AM	11:00 AM	6:30 AM
Volume	521	31	30	546

PM Total	2573	108	149	2830
Percentage	90.92%	3.82%	5.27%	
PM Peak	3:30 PM	12:30 PM	12:00 PM	3:30 PM
Volume	403	29	29	435

Day Total	4910	234	334	5478
Percentage	89.63%	4.27%	6.10%	

Ayer Road (Route 2A)
west of Gulf West Site Drive
City, State: Littleton, MA
Client: GPI/ C. Donaldson
Site Code: NEX-2021267.00



PDI File # 228830 ATR-A

Count Date: Friday, September 23, 2022
Direction: EB

AM	Cars	Single Unit Heavy	Multi Unit Heavy	Total
12:00 AM	3	0	0	3
12:15 AM	5	0	1	6
12:30 AM	2	1	1	4
12:45 AM	6	1	2	9
1:00 AM	1	0	1	2
1:15 AM	1	0	1	2
1:30 AM	0	1	1	2
1:45 AM	0	0	0	0
2:00 AM	5	0	2	7
2:15 AM	4	0	3	7
2:30 AM	11	1	0	12
2:45 AM	8	0	2	10
3:00 AM	4	0	1	5
3:15 AM	5	2	1	8
3:30 AM	8	1	2	11
3:45 AM	5	0	0	5
4:00 AM	6	0	0	6
4:15 AM	11	1	1	13
4:30 AM	11	0	10	21
4:45 AM	19	0	1	20
5:00 AM	29	0	4	33
5:15 AM	42	1	6	49
5:30 AM	60	1	8	69
5:45 AM	46	1	5	52
6:00 AM	72	1	6	79
6:15 AM	87	1	8	96
6:30 AM	127	5	7	139
6:45 AM	117	3	4	124
7:00 AM	118	4	5	127
7:15 AM	114	8	4	126
7:30 AM	90	2	4	96
7:45 AM	101	1	4	106
8:00 AM	97	6	5	108
8:15 AM	109	4	3	116
8:30 AM	82	2	9	93
8:45 AM	57	6	3	66
9:00 AM	59	4	6	69
9:15 AM	75	1	5	81
9:30 AM	81	4	7	92
9:45 AM	55	4	8	67
10:00 AM	67	5	5	77
10:15 AM	75	2	2	79
10:30 AM	60	4	5	69
10:45 AM	62	6	5	73
11:00 AM	63	7	5	75
11:15 AM	71	8	4	83
11:30 AM	68	6	3	77
11:45 AM	68	7	7	82

PM	Cars	Single Unit Heavy	Multi Unit Heavy	Total
12:00 PM	84	2	9	95
12:15 PM	94	6	7	107
12:30 PM	71	5	5	81
12:45 PM	83	7	6	96
1:00 PM	68	8	6	82
1:15 PM	81	4	7	92
1:30 PM	77	3	4	84
1:45 PM	80	5	7	92
2:00 PM	75	7	4	86
2:15 PM	77	3	0	80
2:30 PM	90	2	4	96
2:45 PM	62	6	3	71
3:00 PM	76	4	4	84
3:15 PM	79	7	2	88
3:30 PM	110	6	4	120
3:45 PM	128	0	1	129
4:00 PM	80	2	5	87
4:15 PM	115	6	4	125
4:30 PM	73	5	0	78
4:45 PM	62	3	1	66
5:00 PM	101	2	3	106
5:15 PM	87	1	1	89
5:30 PM	77	1	3	81
5:45 PM	87	2	1	90
6:00 PM	85	0	2	87
6:15 PM	69	1	1	71
6:30 PM	64	2	4	70
6:45 PM	68	1	2	71
7:00 PM	59	2	3	64
7:15 PM	50	1	0	51
7:30 PM	43	1	7	51
7:45 PM	54	0	2	56
8:00 PM	39	0	0	39
8:15 PM	33	2	2	37
8:30 PM	26	0	3	29
8:45 PM	28	0	2	30
9:00 PM	15	0	3	18
9:15 PM	25	0	0	25
9:30 PM	25	0	0	25
9:45 PM	29	0	0	29
10:00 PM	26	0	0	26
10:15 PM	26	0	2	28
10:30 PM	22	0	2	24
10:45 PM	14	0	0	14
11:00 PM	21	1	1	23
11:15 PM	18	0	1	19
11:30 PM	11	0	0	11
11:45 PM	5	0	0	5

AM Total	2267	112	177	2556
Percentage	88.69%	4.38%	6.92%	
AM Peak	6:30 AM	11:00 AM	5:30 AM	6:30 AM
Volume	476	28	27	516

PM Total	2872	108	128	3108
Percentage	92.41%	3.47%	4.12%	
PM Peak	3:30 PM	12:15 PM	12:00 PM	3:30 PM
Volume	433	26	27	461

Day Total	5139	220	305	5664
Percentage	90.73%	3.88%	5.38%	

Ayer Road (Route 2A)
west of Gulf West Site Drive
City, State: Littleton, MA
Client: GPI/ C. Donaldson
Site Code: NEX-2021267.00



PDI File # 228830 ATR-A

Count Date: Saturday, September 24, 2022
Direction: EB

AM	Cars	Single Unit Heavy	Multi Unit Heavy	Total
12:00 AM	2	0	1	3
12:15 AM	3	0	0	3
12:30 AM	8	0	1	9
12:45 AM	5	2	1	8
1:00 AM	5	0	0	5
1:15 AM	1	1	1	3
1:30 AM	1	0	0	1
1:45 AM	6	1	1	8
2:00 AM	9	0	0	9
2:15 AM	2	0	0	2
2:30 AM	6	0	0	6
2:45 AM	3	0	1	4
3:00 AM	6	1	1	8
3:15 AM	3	0	0	3
3:30 AM	3	1	0	4
3:45 AM	3	0	3	6
4:00 AM	2	1	2	5
4:15 AM	4	0	1	5
4:30 AM	3	1	4	8
4:45 AM	8	0	1	9
5:00 AM	12	0	3	15
5:15 AM	19	0	3	22
5:30 AM	26	1	1	28
5:45 AM	16	0	3	19
6:00 AM	21	0	3	24
6:15 AM	14	2	2	18
6:30 AM	30	3	3	36
6:45 AM	33	2	2	37
7:00 AM	27	0	1	28
7:15 AM	33	2	5	40
7:30 AM	54	2	1	57
7:45 AM	39	0	4	43
8:00 AM	58	2	3	63
8:15 AM	60	0	0	60
8:30 AM	64	2	3	69
8:45 AM	53	1	2	56
9:00 AM	60	1	4	65
9:15 AM	76	1	1	78
9:30 AM	53	2	1	56
9:45 AM	80	4	3	87
10:00 AM	69	1	1	71
10:15 AM	69	2	1	72
10:30 AM	80	2	2	84
10:45 AM	68	2	2	72
11:00 AM	70	3	3	76
11:15 AM	96	0	1	97
11:30 AM	67	3	3	73
11:45 AM	69	1	2	72

PM	Cars	Single Unit Heavy	Multi Unit Heavy	Total
12:00 PM	102	1	2	105
12:15 PM	95	1	2	98
12:30 PM	95	1	1	97
12:45 PM	86	0	2	88
1:00 PM	109	2	0	111
1:15 PM	72	0	0	72
1:30 PM	102	2	1	105
1:45 PM	88	0	0	88
2:00 PM	84	1	0	85
2:15 PM	76	0	0	76
2:30 PM	79	0	1	80
2:45 PM	58	0	0	58
3:00 PM	86	1	1	88
3:15 PM	77	0	1	78
3:30 PM	95	3	0	98
3:45 PM	79	0	0	79
4:00 PM	46	0	0	46
4:15 PM	83	0	0	83
4:30 PM	90	1	0	91
4:45 PM	69	0	0	69
5:00 PM	77	1	0	78
5:15 PM	114	2	0	116
5:30 PM	158	0	0	158
5:45 PM	111	0	1	112
6:00 PM	70	0	0	70
6:15 PM	60	1	0	61
6:30 PM	77	0	0	77
6:45 PM	55	0	0	55
7:00 PM	62	0	0	62
7:15 PM	55	0	0	55
7:30 PM	38	0	0	38
7:45 PM	37	0	0	37
8:00 PM	44	0	0	44
8:15 PM	28	0	0	28
8:30 PM	21	0	0	21
8:45 PM	22	1	0	23
9:00 PM	18	0	0	18
9:15 PM	19	0	0	19
9:30 PM	15	0	1	16
9:45 PM	20	0	0	20
10:00 PM	14	0	0	14
10:15 PM	18	1	0	19
10:30 PM	19	1	0	20
10:45 PM	17	0	0	17
11:00 PM	17	2	0	19
11:15 PM	6	1	0	7
11:30 PM	6	0	0	6
11:45 PM	7	0	0	7

AM Total	1499	47	81	1627
Percentage	92.13%	2.89%	4.98%	
AM Peak	10:30 AM	9:30 AM	7:15 AM	10:30 AM
Volume	314	9	13	329

PM Total	2876	23	13	2912
Percentage	98.76%	0.79%	0.45%	
PM Peak	5:00 PM	12:15 PM	12:00 PM	5:00 PM
Volume	460	4	7	464

Day Total	4375	70	94	4539
Percentage	96.39%	1.54%	2.07%	

Ayer Road (Route 2A)
west of Gulf West Site Drive
City, State: Littleton, MA
Client: GPI/ C. Donaldson
Site Code: NEX-2021267.00



PDI File # 228830 ATR-A

Count Date: Thursday, September 22, 2022
Direction: WB

AM	Cars	Single Unit Heavy	Multi Unit Heavy	Total
12:00 AM	4	0	0	4
12:15 AM	3	0	1	4
12:30 AM	4	0	0	4
12:45 AM	4	0	0	4
1:00 AM	3	0	2	5
1:15 AM	2	0	3	5
1:30 AM	1	0	0	1
1:45 AM	1	0	0	1
2:00 AM	0	0	1	1
2:15 AM	3	0	0	3
2:30 AM	0	0	1	1
2:45 AM	2	1	1	4
3:00 AM	2	0	0	2
3:15 AM	5	0	2	7
3:30 AM	3	0	0	3
3:45 AM	6	2	0	8
4:00 AM	7	1	1	9
4:15 AM	8	0	2	10
4:30 AM	10	1	2	13
4:45 AM	19	0	2	21
5:00 AM	10	0	5	15
5:15 AM	7	0	5	12
5:30 AM	16	2	3	21
5:45 AM	29	1	5	35
6:00 AM	24	0	4	28
6:15 AM	38	1	2	41
6:30 AM	53	2	4	59
6:45 AM	50	3	5	58
7:00 AM	35	3	2	40
7:15 AM	42	4	4	50
7:30 AM	59	2	3	64
7:45 AM	55	3	3	61
8:00 AM	68	5	2	75
8:15 AM	48	5	1	54
8:30 AM	45	2	2	49
8:45 AM	66	7	2	75
9:00 AM	54	6	7	67
9:15 AM	53	4	5	62
9:30 AM	49	3	8	60
9:45 AM	71	8	8	87
10:00 AM	58	6	7	71
10:15 AM	67	6	4	77
10:30 AM	52	4	10	66
10:45 AM	46	0	8	54
11:00 AM	76	4	6	86
11:15 AM	62	3	5	70
11:30 AM	50	2	8	60
11:45 AM	64	6	6	76

PM	Cars	Single Unit Heavy	Multi Unit Heavy	Total
12:00 PM	67	7	6	80
12:15 PM	53	5	6	64
12:30 PM	69	9	6	84
12:45 PM	84	9	16	109
1:00 PM	81	6	7	94
1:15 PM	67	7	13	87
1:30 PM	61	3	10	74
1:45 PM	54	2	5	61
2:00 PM	56	2	6	64
2:15 PM	82	5	8	95
2:30 PM	75	7	6	88
2:45 PM	95	3	3	101
3:00 PM	110	5	7	122
3:15 PM	84	3	4	91
3:30 PM	119	3	6	128
3:45 PM	109	1	3	113
4:00 PM	121	5	2	128
4:15 PM	108	4	3	115
4:30 PM	112	1	2	115
4:45 PM	121	1	2	124
5:00 PM	116	3	4	123
5:15 PM	155	2	1	158
5:30 PM	177	2	4	183
5:45 PM	146	3	6	155
6:00 PM	105	0	2	107
6:15 PM	80	1	2	83
6:30 PM	77	0	2	79
6:45 PM	70	0	2	72
7:00 PM	68	0	0	68
7:15 PM	60	0	2	62
7:30 PM	46	0	0	46
7:45 PM	50	1	0	51
8:00 PM	38	0	0	38
8:15 PM	46	0	1	47
8:30 PM	37	0	1	38
8:45 PM	35	0	1	36
9:00 PM	34	0	1	35
9:15 PM	38	0	0	38
9:30 PM	29	0	0	29
9:45 PM	18	0	0	18
10:00 PM	24	0	2	26
10:15 PM	30	0	2	32
10:30 PM	22	0	0	22
10:45 PM	14	0	1	15
11:00 PM	13	1	0	14
11:15 PM	13	0	0	13
11:30 PM	11	0	1	12
11:45 PM	11	0	0	11

AM Total	1434	97	152	1683
Percentage	85.20%	5.76%	9.03%	
AM Peak	11:00 AM	9:45 AM	9:45 AM	9:45 AM
Volume	252	24	29	301

PM Total	3291	101	156	3548
Percentage	92.76%	2.85%	4.40%	
PM Peak	5:00 PM	12:30 PM	12:45 PM	5:00 PM
Volume	594	31	46	619

Day Total	4725	198	308	5231
Percentage	90.33%	3.79%	5.89%	

Ayer Road (Route 2A)
west of Gulf West Site Drive
City, State: Littleton, MA
Client: GPI/ C. Donaldson
Site Code: NEX-2021267.00



PDI File # 228830 ATR-A

Count Date: Friday, September 23, 2022
Direction: WB

AM	Cars	Single Unit Heavy	Multi Unit Heavy	Total
12:00 AM	5	0	1	6
12:15 AM	7	0	2	9
12:30 AM	5	0	0	5
12:45 AM	3	1	1	5
1:00 AM	2	0	1	3
1:15 AM	6	0	1	7
1:30 AM	3	0	1	4
1:45 AM	2	0	0	2
2:00 AM	4	0	1	5
2:15 AM	1	0	1	2
2:30 AM	2	0	0	2
2:45 AM	4	2	0	6
3:00 AM	0	0	1	1
3:15 AM	2	1	0	3
3:30 AM	4	0	1	5
3:45 AM	6	0	3	9
4:00 AM	1	1	3	5
4:15 AM	8	1	3	12
4:30 AM	12	1	3	16
4:45 AM	8	1	2	11
5:00 AM	7	0	2	9
5:15 AM	12	1	4	17
5:30 AM	19	0	3	22
5:45 AM	34	0	6	40
6:00 AM	25	2	1	28
6:15 AM	35	2	4	41
6:30 AM	50	3	3	56
6:45 AM	53	2	3	58
7:00 AM	52	2	4	58
7:15 AM	46	0	2	48
7:30 AM	51	4	4	59
7:45 AM	60	4	5	69
8:00 AM	52	3	6	61
8:15 AM	59	4	10	73
8:30 AM	41	2	5	48
8:45 AM	51	8	3	62
9:00 AM	48	6	10	64
9:15 AM	53	3	5	61
9:30 AM	55	9	4	68
9:45 AM	61	6	7	74
10:00 AM	48	3	10	61
10:15 AM	48	6	11	65
10:30 AM	46	6	11	63
10:45 AM	48	3	8	59
11:00 AM	54	7	7	68
11:15 AM	71	7	1	79
11:30 AM	68	1	11	80
11:45 AM	77	10	11	98

PM	Cars	Single Unit Heavy	Multi Unit Heavy	Total
12:00 PM	78	5	9	92
12:15 PM	65	4	12	81
12:30 PM	90	7	5	102
12:45 PM	66	3	3	72
1:00 PM	62	6	5	73
1:15 PM	68	4	2	74
1:30 PM	66	3	5	74
1:45 PM	60	5	3	68
2:00 PM	74	4	8	86
2:15 PM	91	8	6	105
2:30 PM	90	3	4	97
2:45 PM	114	4	6	124
3:00 PM	111	11	3	125
3:15 PM	106	5	4	115
3:30 PM	130	7	4	141
3:45 PM	99	0	3	102
4:00 PM	125	7	4	136
4:15 PM	130	1	3	134
4:30 PM	130	5	1	136
4:45 PM	151	1	4	156
5:00 PM	115	1	1	117
5:15 PM	115	0	2	117
5:30 PM	94	1	5	100
5:45 PM	133	2	2	137
6:00 PM	78	1	1	80
6:15 PM	108	0	2	110
6:30 PM	91	0	1	92
6:45 PM	77	1	2	80
7:00 PM	90	1	0	91
7:15 PM	67	1	5	73
7:30 PM	63	0	2	65
7:45 PM	47	0	1	48
8:00 PM	48	0	0	48
8:15 PM	62	0	0	62
8:30 PM	31	0	0	31
8:45 PM	41	1	2	44
9:00 PM	43	0	1	44
9:15 PM	30	1	0	31
9:30 PM	28	0	0	28
9:45 PM	27	1	0	28
10:00 PM	39	0	0	39
10:15 PM	29	0	3	32
10:30 PM	18	0	0	18
10:45 PM	20	0	0	20
11:00 PM	23	0	0	23
11:15 PM	12	0	0	12
11:30 PM	15	1	2	18
11:45 PM	9	0	1	10

AM Total	1409	112	186	1707
Percentage	82.54%	6.56%	10.90%	
AM Peak	11:00 AM	8:45 AM	10:00 AM	11:00 AM
Volume	270	26	40	325

PM Total	3459	105	127	3691
Percentage	93.71%	2.84%	3.44%	
PM Peak	4:00 PM	2:45 PM	12:00 PM	4:00 PM
Volume	536	27	29	562

Day Total	4868	217	313	5398
Percentage	90.18%	4.02%	5.80%	

Ayer Road (Route 2A)
west of Gulf West Site Drive
City, State: Littleton, MA
Client: GPI/ C. Donaldson
Site Code: NEX-2021267.00



PDI File # 228830 ATR-A

Count Date: Saturday, September 24, 2022
Direction: WB

AM	Cars	Single Unit Heavy	Multi Unit Heavy	Total
12:00 AM	8	0	0	8
12:15 AM	10	0	2	12
12:30 AM	13	0	0	13
12:45 AM	9	0	1	10
1:00 AM	7	0	0	7
1:15 AM	2	1	1	4
1:30 AM	6	0	1	7
1:45 AM	3	0	1	4
2:00 AM	5	0	2	7
2:15 AM	0	0	0	0
2:30 AM	6	0	0	6
2:45 AM	4	0	2	6
3:00 AM	7	1	0	8
3:15 AM	0	0	1	1
3:30 AM	1	0	0	1
3:45 AM	2	0	1	3
4:00 AM	3	0	2	5
4:15 AM	1	0	0	1
4:30 AM	4	1	0	5
4:45 AM	7	0	2	9
5:00 AM	1	0	4	5
5:15 AM	4	0	1	5
5:30 AM	7	0	0	7
5:45 AM	11	1	2	14
6:00 AM	8	0	2	10
6:15 AM	15	1	3	19
6:30 AM	26	1	2	29
6:45 AM	30	0	1	31
7:00 AM	32	1	2	35
7:15 AM	34	1	3	38
7:30 AM	39	0	3	42
7:45 AM	43	1	2	46
8:00 AM	34	1	1	36
8:15 AM	50	1	3	54
8:30 AM	33	2	1	36
8:45 AM	38	1	3	42
9:00 AM	60	3	2	65
9:15 AM	67	1	2	70
9:30 AM	54	1	2	57
9:45 AM	77	2	2	81
10:00 AM	70	3	0	73
10:15 AM	77	0	0	77
10:30 AM	75	2	2	79
10:45 AM	68	1	3	72
11:00 AM	74	1	1	76
11:15 AM	72	1	0	73
11:30 AM	77	4	6	87
11:45 AM	87	0	2	89

PM	Cars	Single Unit Heavy	Multi Unit Heavy	Total
12:00 PM	63	0	1	64
12:15 PM	83	1	1	85
12:30 PM	55	1	1	57
12:45 PM	61	0	1	62
1:00 PM	84	0	1	85
1:15 PM	78	1	1	80
1:30 PM	83	0	3	86
1:45 PM	75	1	0	76
2:00 PM	70	0	1	71
2:15 PM	85	0	0	85
2:30 PM	80	0	2	82
2:45 PM	62	0	0	62
3:00 PM	71	0	0	71
3:15 PM	71	1	0	72
3:30 PM	53	0	0	53
3:45 PM	54	1	0	55
4:00 PM	57	0	0	57
4:15 PM	68	0	1	69
4:30 PM	58	0	0	58
4:45 PM	51	1	0	52
5:00 PM	64	0	1	65
5:15 PM	63	1	0	64
5:30 PM	66	0	0	66
5:45 PM	54	1	0	55
6:00 PM	69	0	1	70
6:15 PM	107	0	0	107
6:30 PM	69	0	0	69
6:45 PM	79	0	0	79
7:00 PM	58	0	1	59
7:15 PM	83	1	0	84
7:30 PM	44	1	0	45
7:45 PM	51	0	0	51
8:00 PM	32	0	0	32
8:15 PM	36	0	0	36
8:30 PM	38	0	0	38
8:45 PM	31	0	2	33
9:00 PM	29	0	1	30
9:15 PM	32	0	0	32
9:30 PM	19	0	0	19
9:45 PM	22	0	0	22
10:00 PM	25	1	0	26
10:15 PM	16	0	0	16
10:30 PM	17	0	0	17
10:45 PM	20	0	0	20
11:00 PM	16	0	1	17
11:15 PM	21	0	0	21
11:30 PM	8	0	0	8
11:45 PM	14	0	0	14

AM Total	1361	33	71	1465
Percentage	92.90%	2.25%	4.85%	
AM Peak	11:00 AM	8:15 AM	7:00 AM	11:00 AM
Volume	310	7	10	325

PM Total	2545	12	20	2577
Percentage	98.76%	0.47%	0.78%	
PM Peak	6:00 PM	12:00 PM	12:45 PM	1:00 PM
Volume	324	2	6	327

Day Total	3906	45	91	4042
Percentage	96.64%	1.11%	2.25%	

Ayer Road (Route 2A)
west of Gulf West Site Drive
City, State: Littleton, MA
Client: GPI/ C. Donaldson
Site Code: NEX-2021267.00



PDI File # 228830 ATR-A

Direction: EB

Weekly Report

Day	Thursday		Friday		Saturday										Week	
Date	09/22/22		09/23/22		09/24/22										Ave	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
12:00	9	61	3	95	3	105	0	0	0	0	0	0	0	0	5	87
12:15	6	85	6	107	3	98	0	0	0	0	0	0	0	0	5	97
12:30	5	83	4	81	9	97	0	0	0	0	0	0	0	0	6	87
12:45	7	89	9	96	8	88	0	0	0	0	0	0	0	0	8	91
1:00	4	84	2	82	5	111	0	0	0	0	0	0	0	0	4	92
1:15	1	92	2	92	3	72	0	0	0	0	0	0	0	0	2	85
1:30	3	81	2	84	1	105	0	0	0	0	0	0	0	0	2	90
1:45	0	69	0	92	8	88	0	0	0	0	0	0	0	0	3	83
2:00	7	77	7	86	9	85	0	0	0	0	0	0	0	0	8	83
2:15	4	94	7	80	2	76	0	0	0	0	0	0	0	0	4	83
2:30	11	104	12	96	6	80	0	0	0	0	0	0	0	0	10	93
2:45	4	86	10	71	4	58	0	0	0	0	0	0	0	0	6	72
3:00	13	100	5	84	8	88	0	0	0	0	0	0	0	0	9	91
3:15	8	63	8	88	3	78	0	0	0	0	0	0	0	0	6	76
3:30	12	128	11	120	4	98	0	0	0	0	0	0	0	0	9	115
3:45	10	101	5	129	6	79	0	0	0	0	0	0	0	0	7	103
4:00	6	98	6	87	5	46	0	0	0	0	0	0	0	0	6	77
4:15	9	108	13	125	5	83	0	0	0	0	0	0	0	0	9	105
4:30	18	96	21	78	8	91	0	0	0	0	0	0	0	0	16	88
4:45	21	86	20	66	9	69	0	0	0	0	0	0	0	0	17	74
5:00	38	106	33	106	15	78	0	0	0	0	0	0	0	0	29	97
5:15	43	81	49	89	22	116	0	0	0	0	0	0	0	0	38	95
5:30	46	69	69	81	28	158	0	0	0	0	0	0	0	0	48	103
5:45	45	70	52	90	19	112	0	0	0	0	0	0	0	0	39	91
6:00	83	70	79	87	24	70	0	0	0	0	0	0	0	0	62	76
6:15	108	66	96	71	18	61	0	0	0	0	0	0	0	0	74	66
6:30	125	50	139	70	36	77	0	0	0	0	0	0	0	0	100	66
6:45	144	51	124	71	37	55	0	0	0	0	0	0	0	0	102	59
7:00	145	42	127	64	28	62	0	0	0	0	0	0	0	0	100	56
7:15	132	43	126	51	40	55	0	0	0	0	0	0	0	0	99	50
7:30	115	50	96	51	57	38	0	0	0	0	0	0	0	0	89	46
7:45	130	33	106	56	43	37	0	0	0	0	0	0	0	0	93	42
8:00	119	39	108	39	63	44	0	0	0	0	0	0	0	0	97	41
8:15	120	34	116	37	60	28	0	0	0	0	0	0	0	0	99	33
8:30	130	23	93	29	69	21	0	0	0	0	0	0	0	0	97	24
8:45	103	28	66	30	56	23	0	0	0	0	0	0	0	0	75	27
9:00	76	8	69	18	65	18	0	0	0	0	0	0	0	0	70	15
9:15	94	34	81	25	78	19	0	0	0	0	0	0	0	0	84	26
9:30	90	30	92	25	56	16	0	0	0	0	0	0	0	0	79	24
9:45	69	21	67	29	87	20	0	0	0	0	0	0	0	0	74	23
10:00	55	23	77	26	71	14	0	0	0	0	0	0	0	0	68	21
10:15	56	8	79	28	72	19	0	0	0	0	0	0	0	0	69	18
10:30	68	12	69	24	84	20	0	0	0	0	0	0	0	0	74	19
10:45	76	7	73	14	72	17	0	0	0	0	0	0	0	0	74	13
11:00	62	18	75	23	76	19	0	0	0	0	0	0	0	0	71	20
11:15	72	6	83	19	97	7	0	0	0	0	0	0	0	0	84	11
11:30	69	12	77	11	73	6	0	0	0	0	0	0	0	0	73	10
11:45	77	11	82	5	72	7	0	0	0	0	0	0	0	0	77	8
Total	2648	2830	2556	3108	1627	2912	0	0	0	0	0	0	0	0	2277	2950
Day Total	5478		5664		4539		0		0		0		0		5227	
Peak HR	6:30 AM	3:30 PM	6:30 AM	3:30 PM	10:30 AM	5:00 PM									6:30 AM	03:30 PM
Volume	546	435	516	461	329	464									401	401

Ayer Road (Route 2A)
west of Gulf (West Site Drive)
City, State: Littleton, MA
Client: GPI/ C. Donaldson
Site Code: NEX-2021267.00



PDI File #: 228830 ATR-A (Speed)

Count Date
Thursday, September 22, 2022

Speed (60-minute)

EB																
Start Time:	1 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40 to 44	45 to 49	50 to 54	55 to 59	60 to 64	65 to 69	70+	Total	85th %ile	Ave Speed
12:00 AM	1	0	0	0	1	1	6	6	0	0	1	0	0	16	47.8	42.6
1:00 AM	0	0	0	1	2	5	3	3	0	0	0	0	0	14	45.1	38.9
2:00 AM	0	0	0	0	3	1	6	1	0	0	0	0	0	11	44.0	39.9
3:00 AM	0	0	0	0	1	4	5	9	0	0	0	0	0	19	47.3	43.0
4:00 AM	0	0	0	0	5	10	20	16	3	1	0	1	0	56	48.8	42.7
5:00 AM	0	0	2	6	12	22	38	12	0	1	1	0	0	94	44.1	39.1
6:00 AM	0	0	2	5	26	78	71	15	2	1	1	0	0	201	43.0	38.9
7:00 AM	1	2	1	5	34	99	66	20	1	1	0	0	2	232	43.0	38.4
8:00 AM	3	0	2	16	66	112	46	7	0	0	0	0	0	252	41.0	35.8
9:00 AM	2	1	3	15	84	142	43	5	1	1	2	0	0	299	40.0	35.7
10:00 AM	0	1	3	6	65	138	67	9	1	0	3	1	2	296	41.0	37.5
11:00 AM	0	2	6	4	79	126	67	11	1	0	1	0	2	299	41.0	37.0
12:00 PM	2	2	1	32	103	153	60	7	2	0	0	0	0	362	40.0	35.5
1:00 PM	3	4	3	19	66	160	55	9	2	1	0	0	1	323	40.0	36.0
2:00 PM	3	6	14	24	84	139	78	8	1	0	0	1	1	359	41.0	35.4
3:00 PM	2	0	4	23	91	208	109	16	2	0	0	1	0	456	41.0	36.9
4:00 PM	0	2	8	18	54	219	154	25	5	0	0	0	0	485	42.0	38.0
5:00 PM	2	0	4	22	99	296	165	21	2	1	0	0	0	612	41.4	37.4
6:00 PM	0	1	1	7	46	137	122	28	1	0	1	0	0	344	43.0	38.7
7:00 PM	1	1	1	4	19	110	81	6	1	0	0	0	0	224	41.6	38.1
8:00 PM	1	0	2	2	12	67	64	9	1	0	0	0	0	158	42.0	38.7
9:00 PM	1	0	0	0	15	41	47	13	0	0	0	0	0	117	43.6	39.2
10:00 PM	0	0	0	1	7	26	47	13	4	0	1	0	0	99	45.0	41.2
11:00 PM	0	1	0	0	3	14	27	4	0	0	0	0	0	49	43.0	39.7
Total	22	23	57	210	977	2308	1447	273	30	7	11	4	8	5377	42.0	37.4
Percent	0.41%	0.43%	1.06%	3.91%	18.17%	42.92%	26.91%	5.08%	0.56%	0.13%	0.20%	0.07%	0.15%			

AM Peak	8:00 AM	7:00 AM	11:00 AM	8:00 AM	9:00 AM	9:00 AM	6:00 AM	7:00 AM	4:00 AM	4:00 AM	10:00 AM	4:00 AM	7:00 AM	9:00 AM
Volume	3	2	6	16	84	142	71	20	3	1	3	1	2	299
PM Peak	1:00 PM	2:00 PM	2:00 PM	12:00 PM	12:00 PM	5:00 PM	5:00 PM	6:00 PM	4:00 PM	1:00 PM	6:00 PM	2:00 PM	1:00 PM	5:00 PM
Volume	3	6	14	32	103	296	165	28	5	1	1	1	1	612

15th Percentile:	33.0 MPH	Average Speed:	37.4 MPH	Posted Speed Limit:	45 MPH
50th Percentile:	38.0 MPH	10 MPH Pace:	33 to 42 MPH	Number of Vehicles > 45 MPH:	216
85th Percentile:	42.0 MPH	Number in Pace:	3959	Percent of Vehicles > 45 MPH:	4.0%
95th Percentile:	45.0 MPH	Percent in Pace:	73.6%		

Ayer Road (Route 2A)
west of Gulf (West Site Drive)
City, State: Littleton, MA
Client: GPI/ C. Donaldson
Site Code: NEX-2021267.00



PDI File #: 228830 ATR-A (Speed)

Count Date
Thursday, September 22, 2022

Speed (60-minute)

WB																
Start Time:	1 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40 to 44	45 to 49	50 to 54	55 to 59	60 to 64	65 to 69	70+	Total	85th %ile	Ave Speed
12:00 AM	0	0	0	0	3	9	7	4	3	0	0	0	0	26	47.3	41.0
1:00 AM	0	0	0	0	1	2	2	3	0	0	0	0	0	8	47.0	41.8
2:00 AM	0	0	0	0	2	10	13	2	1	0	0	0	0	28	44.0	40.3
3:00 AM	1	0	0	0	2	11	13	18	1	0	0	0	0	46	47.0	41.8
4:00 AM	0	0	0	1	6	16	32	7	1	0	0	0	0	63	44.0	40.1
5:00 AM	1	2	2	5	19	64	105	24	3	0	0	0	0	225	44.0	39.5
6:00 AM	5	8	27	47	101	162	65	9	0	0	0	0	0	424	40.0	34.0
7:00 AM	6	17	32	74	124	146	67	10	0	0	0	0	0	476	40.0	33.0
8:00 AM	12	22	40	83	107	92	26	3	0	0	0	0	0	385	38.0	30.2
9:00 AM	1	2	19	25	109	91	14	1	1	0	0	0	0	263	38.0	33.1
10:00 AM	1	4	5	18	61	99	37	3	0	0	0	0	0	228	40.0	34.9
11:00 AM	5	1	12	26	69	81	50	4	1	0	0	0	0	249	40.0	34.5
12:00 PM	5	6	15	39	83	78	18	2	0	0	0	0	0	246	38.0	32.3
1:00 PM	5	6	6	28	100	85	24	4	0	0	0	0	0	258	39.0	33.3
2:00 PM	5	13	24	41	60	91	34	7	0	0	0	0	0	275	39.0	32.4
3:00 PM	9	7	25	52	85	83	23	3	0	0	0	0	0	287	38.0	31.6
4:00 PM	2	8	12	32	80	122	55	5	0	0	0	0	0	316	40.0	34.6
5:00 PM	6	0	5	19	56	102	63	9	0	0	0	0	0	260	41.0	35.8
6:00 PM	1	0	2	10	30	89	71	20	1	0	0	0	0	224	43.0	37.9
7:00 PM	1	1	6	7	41	66	33	3	0	0	0	0	0	158	40.0	35.4
8:00 PM	0	1	0	5	30	46	32	11	1	0	0	0	0	126	43.0	37.3
9:00 PM	1	0	0	2	21	38	26	8	0	0	0	0	0	96	42.8	37.7
10:00 PM	0	0	0	0	5	13	21	8	1	1	0	0	0	49	45.0	40.8
11:00 PM	0	0	0	0	1	6	27	10	3	0	0	0	1	48	47.0	43.3
Total	67	98	232	514	1196	1602	858	178	17	1	0	0	1	4764	41.0	34.5
Percent	1.41%	2.06%	4.87%	10.79%	25.10%	33.63%	18.01%	3.74%	0.36%	0.02%	0.00%	0.00%	0.02%			

AM Peak	8:00 AM	8:00 AM	8:00 AM	8:00 AM	7:00 AM	6:00 AM	5:00 AM	5:00 AM	12:00 AM					7:00 AM
Volume	12	22	40	83	124	162	105	24	3	0	0	0	0	476
PM Peak	3:00 PM	2:00 PM	3:00 PM	3:00 PM	1:00 PM	4:00 PM	6:00 PM	6:00 PM	11:00 PM	10:00 PM			11:00 PM	4:00 PM
Volume	9	13	25	52	100	122	71	20	3	1	0	0	1	316

15th Percentile:	28.0 MPH	Average Speed:	34.5 MPH	Posted Speed Limit:	45 MPH
50th Percentile:	35.0 MPH	10 MPH Pace:	31 to 40 MPH	Number of Vehicles > 45 MPH:	130
85th Percentile:	41.0 MPH	Number in Pace:	2936	Percent of Vehicles > 45 MPH:	2.7%
95th Percentile:	44.0 MPH	Percent in Pace:	61.6%		

Ayer Road (Route 2A)
 west of Gulf (West Site Drive)
 City, State: Littleton, MA
 Client: GPI/ C. Donaldson
 Site Code: NEX-2021267.00



PDI File #: 228830 ATR-A (Speed)

Count Date
 Thursday, September 22, 2022

Speed (60-minute)																
Combined EB and WB																
Start Time:	1 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40 to 44	45 to 49	50 to 54	55 to 59	60 to 64	65 to 69	70+	Total	85th %ile	Ave Speed
12:00 AM	1	0	0	0	4	10	13	10	3	0	1	0	0	42	47.9	41.6
1:00 AM	0	0	0	1	3	7	5	6	0	0	0	0	0	22	46.0	39.9
2:00 AM	0	0	0	0	5	11	19	3	1	0	0	0	0	39	44.0	40.2
3:00 AM	1	0	0	0	3	15	18	27	1	0	0	0	0	65	47.0	42.1
4:00 AM	0	0	0	1	11	26	52	23	4	1	0	1	0	119	46.0	41.3
5:00 AM	1	2	4	11	31	86	143	36	3	1	1	0	0	319	44.0	39.4
6:00 AM	5	8	29	52	127	240	136	24	2	1	1	0	0	625	41.0	35.6
7:00 AM	7	19	33	79	158	245	133	30	1	1	0	0	2	708	41.0	34.8
8:00 AM	15	22	42	99	173	204	72	10	0	0	0	0	0	637	39.0	32.4
9:00 AM	3	3	22	40	193	233	57	6	2	1	2	0	0	562	39.0	34.5
10:00 AM	1	5	8	24	126	237	104	12	1	0	3	1	2	524	41.0	36.4
11:00 AM	5	3	18	30	148	207	117	15	2	0	1	0	2	548	41.0	35.9
12:00 PM	7	8	16	71	186	231	78	9	2	0	0	0	0	608	39.0	34.2
1:00 PM	8	10	9	47	166	245	79	13	2	1	0	0	1	581	40.0	34.8
2:00 PM	8	19	38	65	144	230	112	15	1	0	0	1	1	634	41.0	34.1
3:00 PM	11	7	29	75	176	291	132	19	2	0	0	1	0	743	40.0	34.8
4:00 PM	2	10	20	50	134	341	209	30	5	0	0	0	0	801	42.0	36.7
5:00 PM	8	0	9	41	155	398	228	30	2	1	0	0	0	872	41.0	36.9
6:00 PM	1	1	3	17	76	226	193	48	2	0	1	0	0	568	43.0	38.4
7:00 PM	2	2	7	11	60	176	114	9	1	0	0	0	0	382	41.0	37.0
8:00 PM	1	1	2	7	42	113	96	20	2	0	0	0	0	284	43.0	38.1
9:00 PM	2	0	0	2	36	79	73	21	0	0	0	0	0	213	43.0	38.5
10:00 PM	0	0	0	1	12	39	68	21	5	1	1	0	0	148	45.0	41.0
11:00 PM	0	1	0	0	4	20	54	14	3	0	0	0	1	97	46.0	41.5
Total	89	121	289	724	2173	3910	2305	451	47	8	11	4	9	10141	42.0	36.0
Percent	0.88%	1.19%	2.85%	7.14%	21.43%	38.56%	22.73%	4.45%	0.46%	0.08%	0.11%	0.04%	0.09%			

AM Peak	8:00 AM	8:00 AM	8:00 AM	8:00 AM	9:00 AM	7:00 AM	5:00 AM	5:00 AM	4:00 AM	4:00 AM	10:00 AM	4:00 AM	7:00 AM	7:00 AM
Volume	15	22	42	99	193	245	143	36	4	1	3	1	2	708
PM Peak	3:00 PM	2:00 PM	2:00 PM	3:00 PM	12:00 PM	5:00 PM	5:00 PM	6:00 PM	4:00 PM	1:00 PM	6:00 PM	2:00 PM	1:00 PM	5:00 PM
Volume	11	19	38	75	186	398	228	48	5	1	1	1	1	872

15th Percentile:	31.0 MPH	Average Speed:	36.0 MPH	Posted Speed Limit:	45 MPH
50th Percentile:	37.0 MPH	10 MPH Pace:	32 to 41 MPH	Number of Vehicles > 45 MPH:	346
85th Percentile:	42.0 MPH	Number in Pace:	6799	Percent of Vehicles > 45 MPH:	3.4%
95th Percentile:	45.0 MPH	Percent in Pace:	67.0%		

Ayer Road (Route 2A)
west of Gulf (West Site Drive)
City, State: Littleton, MA
Client: GPI/ C. Donaldson
Site Code: NEX-2021267.00



PDI File #: 228830 ATR-A (Speed)

Count Date
Friday, September 23, 2022

Speed (60-minute)

EB																
Start Time:	1 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40 to 44	45 to 49	50 to 54	55 to 59	60 to 64	65 to 69	70+	Total	85th %ile	Ave Speed
12:00 AM	0	0	0	0	7	3	9	6	0	0	0	0	0	25	46.0	39.8
1:00 AM	1	0	0	1	5	2	3	2	2	0	0	0	0	16	46.8	37.1
2:00 AM	0	0	0	0	1	1	10	4	0	0	0	0	0	16	45.0	42.1
3:00 AM	0	0	0	0	2	1	7	8	1	0	0	0	0	19	47.0	43.6
4:00 AM	0	0	0	0	2	10	23	12	5	0	0	0	0	52	48.4	42.6
5:00 AM	0	0	1	5	9	23	43	12	0	1	0	0	0	94	44.0	39.4
6:00 AM	0	0	0	4	28	82	63	12	1	1	0	0	0	191	43.0	38.7
7:00 AM	0	3	0	10	31	96	76	20	6	2	0	1	0	245	44.0	38.8
8:00 AM	0	2	3	8	44	113	76	16	3	0	0	1	0	266	43.0	37.8
9:00 AM	0	2	5	18	62	116	73	17	2	1	0	2	1	299	42.0	37.3
10:00 AM	1	4	7	19	68	96	70	12	6	0	0	0	0	283	42.0	36.4
11:00 AM	2	0	3	16	71	146	89	10	2	1	0	2	1	343	42.0	37.2
12:00 PM	1	1	6	18	64	158	90	18	5	1	0	0	0	362	42.0	37.3
1:00 PM	0	0	5	11	47	127	98	13	2	1	0	0	0	304	42.0	37.9
2:00 PM	0	2	8	19	57	147	158	27	2	1	0	0	1	422	43.0	38.2
3:00 PM	1	1	2	14	60	200	159	42	4	2	2	0	0	487	43.0	38.6
4:00 PM	3	1	15	24	133	280	111	10	1	0	0	0	0	578	40.0	36.0
5:00 PM	3	4	8	37	85	193	116	16	1	0	0	0	0	463	41.0	36.3
6:00 PM	1	0	1	10	38	188	102	17	2	0	1	0	0	360	42.0	38.2
7:00 PM	1	1	3	10	49	119	74	16	0	0	0	1	0	274	42.0	37.5
8:00 PM	0	2	2	6	13	69	83	13	0	0	0	0	0	188	43.0	38.9
9:00 PM	2	0	1	3	5	51	55	12	3	0	0	0	0	132	43.4	39.3
10:00 PM	0	2	1	1	10	31	51	12	1	1	0	0	0	110	44.0	39.6
11:00 PM	0	0	0	3	5	19	24	14	1	0	0	1	0	67	46.0	40.4
Total	16	25	71	237	896	2271	1663	341	50	12	3	8	3	5596	42.0	37.8
Percent	0.29%	0.45%	1.27%	4.24%	16.01%	40.58%	29.72%	6.09%	0.89%	0.21%	0.05%	0.14%	0.05%			

AM Peak	11:00 AM	10:00 AM	10:00 AM	10:00 AM	11:00 AM	11:00 AM	11:00 AM	7:00 AM	7:00 AM	7:00 AM		9:00 AM	9:00 AM	11:00 AM
Volume	2	4	7	19	71	146	89	20	6	2	0	2	1	343
PM Peak	4:00 PM	5:00 PM	4:00 PM	5:00 PM	4:00 PM	4:00 PM	3:00 PM	3:00 PM	12:00 PM	3:00 PM	3:00 PM	7:00 PM	2:00 PM	4:00 PM
Volume	3	4	15	37	133	280	159	42	5	2	2	1	1	578

15th Percentile:	33.0 MPH	Average Speed:	37.8 MPH	Posted Speed Limit:	45 MPH
50th Percentile:	38.0 MPH	10 MPH Pace:	34 to 43 MPH	Number of Vehicles > 45 MPH:	288
85th Percentile:	42.0 MPH	Number in Pace:	4061	Percent of Vehicles > 45 MPH:	5.1%
95th Percentile:	46.0 MPH	Percent in Pace:	72.6%		

Ayer Road (Route 2A)
west of Gulf (West Site Drive)
City, State: Littleton, MA
Client: GPI/ C. Donaldson
Site Code: NEX-2021267.00



PDI File #: 228830 ATR-A (Speed)

Count Date
Friday, September 23, 2022

Speed (60-minute)

WB																
Start Time:	1 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40 to 44	45 to 49	50 to 54	55 to 59	60 to 64	65 to 69	70+	Total	85th %ile	Ave Speed
12:00 AM	1	0	0	1	1	6	9	4	1	1	0	0	0	24	45.6	40.3
1:00 AM	0	0	0	0	0	0	5	1	0	0	0	0	0	6	45.0	43.2
2:00 AM	0	0	0	1	2	10	16	10	2	0	0	0	0	41	45.0	41.7
3:00 AM	0	0	0	0	1	7	20	5	0	0	0	0	0	33	44.2	41.4
4:00 AM	0	0	0	0	6	10	33	13	4	0	0	0	0	66	46.0	41.7
5:00 AM	1	3	2	6	26	82	79	15	2	1	0	0	0	217	43.0	38.2
6:00 AM	5	8	13	53	90	148	75	11	1	0	0	0	0	404	41.0	34.6
7:00 AM	5	3	19	24	107	174	84	9	3	0	0	0	0	428	41.0	35.3
8:00 AM	2	16	27	33	62	108	53	4	0	0	0	0	0	305	40.0	33.3
9:00 AM	2	1	17	23	64	113	49	16	1	1	0	0	0	287	41.0	35.5
10:00 AM	6	4	9	22	72	124	43	1	0	0	1	1	0	283	40.0	34.7
11:00 AM	3	3	13	25	55	96	58	8	0	0	0	0	0	261	41.0	35.0
12:00 PM	10	6	8	49	67	131	50	6	0	0	0	0	0	327	40.0	33.8
1:00 PM	4	2	9	21	88	123	68	11	1	1	0	0	0	328	41.0	35.6
2:00 PM	4	2	11	28	85	104	57	11	1	0	0	0	0	303	41.0	35.1
3:00 PM	1	2	12	29	90	128	65	7	0	0	0	0	0	334	41.0	35.2
4:00 PM	2	5	19	25	72	89	55	6	0	1	0	0	0	274	41.0	34.5
5:00 PM	2	1	13	27	70	131	59	7	0	0	0	1	0	311	41.0	35.4
6:00 PM	5	2	8	17	60	107	59	13	0	0	0	0	0	271	41.0	35.7
7:00 PM	4	3	9	14	39	88	38	9	0	1	0	0	0	205	41.0	35.2
8:00 PM	0	0	6	19	28	46	30	8	1	0	0	0	0	138	42.0	35.7
9:00 PM	0	0	0	8	16	30	36	5	0	0	0	0	0	95	43.0	37.7
10:00 PM	4	0	0	1	11	32	30	17	0	0	0	0	0	95	45.0	38.5
11:00 PM	0	0	1	2	3	14	23	15	3	0	0	0	0	61	46.0	41.2
Total	61	61	196	428	1115	1901	1094	212	20	6	1	2	0	5097	41.0	35.5
Percent	1.20%	1.20%	3.85%	8.40%	21.88%	37.30%	21.46%	4.16%	0.39%	0.12%	0.02%	0.04%	0.00%			

AM Peak	10:00 AM	8:00 AM	8:00 AM	6:00 AM	7:00 AM	7:00 AM	7:00 AM	9:00 AM	4:00 AM	12:00 AM	10:00 AM	10:00 AM		7:00 AM
Volume	6	16	27	53	107	174	84	16	4	1	1	1	0	428
PM Peak	12:00 PM	12:00 PM	4:00 PM	12:00 PM	3:00 PM	12:00 PM	1:00 PM	10:00 PM	11:00 PM	1:00 PM		5:00 PM		3:00 PM
Volume	10	6	19	49	90	131	68	17	3	1	0	1	0	334

15th Percentile:	30.0 MPH	Average Speed:	35.5 MPH	Posted Speed Limit:	45 MPH
50th Percentile:	36.0 MPH	10 MPH Pace:	32 to 41 MPH	Number of Vehicles > 45 MPH:	149
85th Percentile:	41.0 MPH	Number in Pace:	3259	Percent of Vehicles > 45 MPH:	2.9%
95th Percentile:	44.0 MPH	Percent in Pace:	63.9%		

Ayer Road (Route 2A)
west of Gulf (West Site Drive)
City, State: Littleton, MA
Client: GPI/ C. Donaldson
Site Code: NEX-2021267.00



PDI File #: 228830 ATR-A (Speed)

Count Date
Friday, September 23, 2022

Speed (60-minute) Combined EB and WB																
Start Time:	1 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40 to 44	45 to 49	50 to 54	55 to 59	60 to 64	65 to 69	70+	Total	85th %ile	Ave Speed
12:00 AM	1	0	0	1	8	9	18	10	1	1	0	0	0	49	46.0	40.1
1:00 AM	1	0	0	1	5	2	8	3	2	0	0	0	0	22	46.9	38.8
2:00 AM	0	0	0	1	3	11	26	14	2	0	0	0	0	57	45.0	41.8
3:00 AM	0	0	0	0	3	8	27	13	1	0	0	0	0	52	47.0	42.2
4:00 AM	0	0	0	0	8	20	56	25	9	0	0	0	0	118	47.0	42.1
5:00 AM	1	3	3	11	35	105	122	27	2	2	0	0	0	311	44.0	38.6
6:00 AM	5	8	13	57	118	230	138	23	2	1	0	0	0	595	42.0	35.9
7:00 AM	5	6	19	34	138	270	160	29	9	2	0	1	0	673	42.0	36.6
8:00 AM	2	18	30	41	106	221	129	20	3	0	0	1	0	571	41.0	35.4
9:00 AM	2	3	22	41	126	229	122	33	3	2	0	2	1	586	42.0	36.4
10:00 AM	7	8	16	41	140	220	113	13	6	0	1	1	0	566	41.0	35.5
11:00 AM	5	3	16	41	126	242	147	18	2	1	0	2	1	604	41.0	36.3
12:00 PM	11	7	14	67	131	289	140	24	5	1	0	0	0	689	41.0	35.6
1:00 PM	4	2	14	32	135	250	166	24	3	2	0	0	0	632	42.0	36.7
2:00 PM	4	4	19	47	142	251	215	38	3	1	0	0	1	725	42.0	36.9
3:00 PM	2	3	14	43	150	328	224	49	4	2	2	0	0	821	42.0	37.2
4:00 PM	5	6	34	49	205	369	166	16	1	1	0	0	0	852	40.0	35.5
5:00 PM	5	5	21	64	155	324	175	23	1	0	0	1	0	774	41.0	35.9
6:00 PM	6	2	9	27	98	295	161	30	2	0	1	0	0	631	42.0	37.1
7:00 PM	5	4	12	24	88	207	112	25	0	1	0	1	0	479	42.0	36.5
8:00 PM	0	2	8	25	41	115	113	21	1	0	0	0	0	326	43.0	37.5
9:00 PM	2	0	1	11	21	81	91	17	3	0	0	0	0	227	43.0	38.6
10:00 PM	4	2	1	2	21	63	81	29	1	1	0	0	0	205	44.4	39.1
11:00 PM	0	0	1	5	8	33	47	29	4	0	0	1	0	128	46.0	40.8
Total	77	86	267	665	2011	4172	2757	553	70	18	4	10	3	10693	42.0	36.7
Percent	0.72%	0.80%	2.50%	6.22%	18.81%	39.02%	25.78%	5.17%	0.65%	0.17%	0.04%	0.09%	0.03%			

AM Peak	10:00 AM	8:00 AM	8:00 AM	6:00 AM	10:00 AM	7:00 AM	7:00 AM	9:00 AM	4:00 AM	5:00 AM	10:00 AM	9:00 AM	9:00 AM	7:00 AM
Volume	7	18	30	57	140	270	160	33	9	2	1	2	1	673

PM Peak	12:00 PM	12:00 PM	4:00 PM	12:00 PM	4:00 PM	4:00 PM	3:00 PM	3:00 PM	12:00 PM	1:00 PM	3:00 PM	5:00 PM	2:00 PM	4:00 PM
Volume	11	7	34	67	205	369	224	49	5	2	2	1	1	852

15th Percentile:	31.0 MPH	Average Speed:	36.7 MPH	Posted Speed Limit:	45 MPH
50th Percentile:	37.0 MPH	10 MPH Pace:	33 to 42 MPH	Number of Vehicles > 45 MPH:	437
85th Percentile:	42.0 MPH	Number in Pace:	7282	Percent of Vehicles > 45 MPH:	4.1%
95th Percentile:	45.0 MPH	Percent in Pace:	68.1%		

Ayer Road (Route 2A)
west of Gulf (West Site Drive)
City, State: Littleton, MA
Client: GPI/ C. Donaldson
Site Code: NEX-2021267.00



PDI File #: 228830 ATR-A (Speed)

Count Date
Saturday, September 24, 2022

Speed (60-minute)

EB																
Start Time:	1 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40 to 44	45 to 49	50 to 54	55 to 59	60 to 64	65 to 69	70+	Total	85th %ile	Ave Speed
12:00 AM	0	1	0	1	7	12	19	5	0	0	0	0	0	45	44.0	38.8
1:00 AM	0	0	0	1	1	9	7	5	0	0	0	0	0	23	45.0	40.3
2:00 AM	0	0	0	0	3	5	5	5	0	0	1	0	0	19	46.0	41.1
3:00 AM	0	0	0	0	1	3	6	3	0	0	0	0	0	13	45.2	41.5
4:00 AM	0	0	0	0	2	10	6	2	2	0	0	0	0	22	47.4	40.7
5:00 AM	0	0	0	0	3	8	15	8	1	0	0	0	0	35	45.9	41.3
6:00 AM	0	0	1	3	5	28	41	18	0	1	1	0	1	99	46.0	41.0
7:00 AM	0	0	1	10	15	37	67	33	4	1	0	0	0	168	46.0	40.2
8:00 AM	2	0	1	6	27	60	58	13	4	1	0	0	0	172	43.0	38.3
9:00 AM	1	0	5	11	50	120	82	9	1	1	1	0	0	281	42.0	37.4
10:00 AM	2	1	4	2	31	136	113	22	4	0	0	0	2	317	43.0	38.9
11:00 AM	1	2	4	7	25	162	102	25	4	0	0	0	0	332	43.0	38.4
12:00 PM	0	0	0	12	42	97	103	14	5	4	1	1	0	279	43.0	38.8
1:00 PM	1	0	4	5	38	119	124	18	6	0	0	0	0	315	43.0	38.7
2:00 PM	0	2	7	23	37	120	90	16	2	1	1	0	0	299	42.0	37.5
3:00 PM	0	1	6	13	24	110	69	21	2	0	0	0	0	246	43.0	37.9
4:00 PM	0	1	12	7	30	88	69	18	1	2	0	0	0	228	43.0	37.9
5:00 PM	1	2	4	13	32	107	73	6	1	1	0	0	0	240	42.0	37.0
6:00 PM	1	3	6	2	22	104	149	21	4	1	0	0	0	313	43.0	39.2
7:00 PM	2	0	3	3	32	106	78	16	1	1	0	0	0	242	43.0	38.3
8:00 PM	1	1	1	2	22	49	38	23	1	0	0	0	0	138	45.0	38.8
9:00 PM	1	1	0	2	4	28	56	14	2	0	0	0	0	108	44.0	40.4
10:00 PM	1	1	1	0	3	22	33	17	3	0	0	0	0	81	46.0	40.5
11:00 PM	0	0	0	0	3	18	29	8	3	0	0	0	0	61	45.0	41.2
Total	14	16	60	123	459	1558	1432	340	51	14	5	1	3	4076	44.0	38.6
Percent	0.34%	0.39%	1.47%	3.02%	11.26%	38.22%	35.13%	8.34%	1.25%	0.34%	0.12%	0.02%	0.07%			

AM Peak	8:00 AM	11:00 AM	9:00 AM	9:00 AM	9:00 AM	11:00 AM	10:00 AM	7:00 AM	7:00 AM	6:00 AM	2:00 AM		10:00 AM	11:00 AM
Volume	2	2	5	11	50	162	113	33	4	1	1	0	2	332

PM Peak	7:00 PM	6:00 PM	4:00 PM	2:00 PM	12:00 PM	2:00 PM	6:00 PM	8:00 PM	1:00 PM	12:00 PM	12:00 PM	12:00 PM		1:00 PM
Volume	2	3	12	23	42	120	149	23	6	4	1	1	0	315

15th Percentile:	34.0 MPH	Average Speed:	38.6 MPH	Posted Speed Limit:	45 MPH
50th Percentile:	39.0 MPH	10 MPH Pace:	35 to 44 MPH	Number of Vehicles > 45 MPH:	285
85th Percentile:	44.0 MPH	Number in Pace:	2990	Percent of Vehicles > 45 MPH:	7.0%
95th Percentile:	46.0 MPH	Percent in Pace:	73.4%		

Ayer Road (Route 2A)
 west of Gulf (West Site Drive)
 City, State: Littleton, MA
 Client: GPI/ C. Donaldson
 Site Code: NEX-2021267.00



PDI File #: 228830 ATR-A (Speed)

Count Date
 Saturday, September 24, 2022

Speed (60-minute)

WB																
Start Time:	1 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40 to 44	45 to 49	50 to 54	55 to 59	60 to 64	65 to 69	70+	Total	85th %ile	Ave Speed
12:00 AM	0	0	0	0	1	5	10	5	1	0	1	0	0	23	48.0	43.0
1:00 AM	0	0	0	0	1	4	6	6	0	1	0	0	0	18	48.0	42.9
2:00 AM	0	0	0	0	0	5	9	6	0	0	0	0	0	20	47.0	42.1
3:00 AM	0	0	0	1	5	5	8	3	1	0	0	0	0	23	44.7	39.3
4:00 AM	0	0	0	0	2	8	12	5	3	0	0	0	0	30	47.7	41.9
5:00 AM	0	0	0	1	5	15	41	19	2	2	0	0	0	85	46.0	41.9
6:00 AM	2	0	0	2	10	30	45	20	2	0	0	0	0	111	45.0	39.8
7:00 AM	0	0	2	6	15	49	69	23	0	1	0	0	0	165	44.0	39.5
8:00 AM	2	2	1	14	53	102	56	13	0	0	0	0	0	243	41.0	36.3
9:00 AM	3	2	2	21	61	108	55	9	2	0	1	0	0	264	41.0	36.0
10:00 AM	0	2	8	12	62	119	57	5	1	0	0	0	0	266	40.0	36.1
11:00 AM	3	8	8	28	83	116	50	5	1	0	0	0	0	302	40.0	34.6
12:00 PM	4	4	11	19	75	176	64	11	0	0	0	0	0	364	41.0	35.6
1:00 PM	5	0	3	26	75	167	62	15	0	0	0	0	0	353	41.0	36.1
2:00 PM	1	0	2	6	40	143	79	11	3	0	0	0	0	285	42.0	37.8
3:00 PM	6	0	3	23	69	131	87	10	2	0	0	0	0	331	41.0	36.2
4:00 PM	1	1	1	7	45	127	75	13	2	0	0	0	0	272	42.0	37.6
5:00 PM	4	7	20	26	93	146	104	11	0	0	0	0	0	411	42.0	35.4
6:00 PM	0	1	4	11	29	101	77	18	1	0	0	0	0	242	43.0	37.9
7:00 PM	1	0	5	5	30	88	54	8	0	0	0	0	0	191	42.0	37.3
8:00 PM	2	1	1	6	14	54	27	8	0	1	0	0	0	114	43.0	37.0
9:00 PM	0	0	0	1	9	32	17	11	0	0	0	0	0	70	44.7	39.1
10:00 PM	0	0	0	0	3	18	29	11	5	0	0	0	0	66	46.0	41.7
11:00 PM	0	0	0	0	1	13	19	3	1	1	0	0	0	38	44.0	41.0
Total	34	28	71	215	781	1762	1112	249	27	6	2	0	0	4287	42.0	36.9
Percent	0.79%	0.65%	1.66%	5.02%	18.22%	41.10%	25.94%	5.81%	0.63%	0.14%	0.05%	0.00%	0.00%			

AM Peak	9:00 AM	11:00 AM	10:00 AM	11:00 AM	11:00 AM	10:00 AM	7:00 AM	7:00 AM	4:00 AM	5:00 AM	12:00 AM			11:00 AM
Volume	3	8	8	28	83	119	69	23	3	2	1	0	0	302

PM Peak	3:00 PM	5:00 PM	5:00 PM	1:00 PM	5:00 PM	12:00 PM	5:00 PM	6:00 PM	10:00 PM	8:00 PM				5:00 PM
Volume	6	7	20	26	93	176	104	18	5	1	0	0	0	411

15th Percentile:	32.0 MPH	Average Speed:	36.9 MPH	Posted Speed Limit:	45 MPH
50th Percentile:	37.0 MPH	10 MPH Pace:	34 to 43 MPH	Number of Vehicles > 45 MPH:	183
85th Percentile:	42.0 MPH	Number in Pace:	2990	Percent of Vehicles > 45 MPH:	4.3%
95th Percentile:	45.0 MPH	Percent in Pace:	69.7%		

Ayer Road (Route 2A)
west of Gulf (West Site Drive)
City, State: Littleton, MA
Client: GPI/ C. Donaldson
Site Code: NEX-2021267.00



PDI File #: 228830 ATR-A (Speed)

Count Date
Saturday, September 24, 2022

Speed (60-minute) Combined EB and WB																
Start Time:	1 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40 to 44	45 to 49	50 to 54	55 to 59	60 to 64	65 to 69	70+	Total	85th %ile	Ave Speed
12:00 AM	0	1	0	1	8	17	29	10	1	0	1	0	0	68	45.0	40.2
1:00 AM	0	0	0	1	2	13	13	11	0	1	0	0	0	41	46.0	41.5
2:00 AM	0	0	0	0	3	10	14	11	0	0	1	0	0	39	46.0	41.6
3:00 AM	0	0	0	1	6	8	14	6	1	0	0	0	0	36	45.0	40.1
4:00 AM	0	0	0	0	4	18	18	7	5	0	0	0	0	52	48.0	41.4
5:00 AM	0	0	0	1	8	23	56	27	3	2	0	0	0	120	46.0	41.7
6:00 AM	2	0	1	5	15	58	86	38	2	1	1	0	1	210	46.0	40.4
7:00 AM	0	0	3	16	30	86	136	56	4	2	0	0	0	333	45.0	39.8
8:00 AM	4	2	2	20	80	162	114	26	4	1	0	0	0	415	42.0	37.1
9:00 AM	4	2	7	32	111	228	137	18	3	1	2	0	0	545	41.0	36.7
10:00 AM	2	3	12	14	93	255	170	27	5	0	0	0	2	583	42.0	37.6
11:00 AM	4	10	12	35	108	278	152	30	5	0	0	0	0	634	41.0	36.5
12:00 PM	4	4	11	31	117	273	167	25	5	4	1	1	0	643	42.0	37.0
1:00 PM	6	0	7	31	113	286	186	33	6	0	0	0	0	668	42.0	37.3
2:00 PM	1	2	9	29	77	263	169	27	5	1	1	0	0	584	42.0	37.6
3:00 PM	6	1	9	36	93	241	156	31	4	0	0	0	0	577	42.0	36.9
4:00 PM	1	2	13	14	75	215	144	31	3	2	0	0	0	500	42.0	37.7
5:00 PM	5	9	24	39	125	253	177	17	1	1	0	0	0	651	42.0	36.0
6:00 PM	1	4	10	13	51	205	226	39	5	1	0	0	0	555	43.0	38.6
7:00 PM	3	0	8	8	62	194	132	24	1	1	0	0	0	433	43.0	37.9
8:00 PM	3	2	2	8	36	103	65	31	1	1	0	0	0	252	44.0	38.0
9:00 PM	1	1	0	3	13	60	73	25	2	0	0	0	0	178	44.5	39.8
10:00 PM	1	1	1	0	6	40	62	28	8	0	0	0	0	147	46.0	41.0
11:00 PM	0	0	0	0	4	31	48	11	4	1	0	0	0	99	45.0	41.1
Total	48	44	131	338	1240	3320	2544	589	78	20	7	1	3	8363	43.0	37.8
Percent	0.57%	0.53%	1.57%	4.04%	14.83%	39.70%	30.42%	7.04%	0.93%	0.24%	0.08%	0.01%	0.04%			

AM Peak	8:00 AM	11:00 AM	10:00 AM	11:00 AM	9:00 AM	11:00 AM	10:00 AM	7:00 AM	4:00 AM	5:00 AM	9:00 AM		10:00 AM	11:00 AM
Volume	4	10	12	35	111	278	170	56	5	2	2	0	2	634
PM Peak	1:00 PM	5:00 PM	5:00 PM	5:00 PM	5:00 PM	1:00 PM	6:00 PM	6:00 PM	10:00 PM	12:00 PM	12:00 PM	12:00 PM		1:00 PM
Volume	6	9	24	39	125	286	226	39	8	4	1	1	0	668

15th Percentile:	33.0 MPH	Average Speed:	37.8 MPH	Posted Speed Limit:	45 MPH
50th Percentile:	38.0 MPH	10 MPH Pace:	34 to 43 MPH	Number of Vehicles > 45 MPH:	468
85th Percentile:	43.0 MPH	Number in Pace:	5948	Percent of Vehicles > 45 MPH:	5.6%
95th Percentile:	46.0 MPH	Percent in Pace:	71.1%		

PDI File #: 228830 A
Location: N: Willow Road S: Bruce Street NE: Driveway
Location: E: Ayer Road (Route 2A) W: Littleton Road (Route 2A/110) SW: Gulf (East Drive)
City, State: Littleton, MA
Client: GPI/ C. Donaldson
Site Code: NEX-2021267.00
Count Date: Thursday, September 22, 2022
Start Time: 7:00 AM
End Time: 9:00 AM
Class:



Cars and Heavy Vehicles (Combined)

	Willow Road							Driveway							Ayer Road (Route 2A)							Bruce Street							Gulf (East Drive)							Littleton Road (Route 2A/110)							Total
	from North							from Northeast							from East							from South							from Southwest							from West							
	Right	Bear Right	Thru	Left	Hard Left	U-Turn	Total	Hard Right	Bear Right	Thru	Bear Left	Hard Left	U-Turn	Total	Hard Right	Right	Thru	Bear Left	Left	U-Turn	Total	Right	Bear Right	Thru	Left	Hard Left	U-Turn	Total	Hard Right	Bear Right	Thru	Bear Left	Hard Left	U-Turn	Total	Hard Right	Right	Thru	Bear Left	Left	U-Turn	Total	
7:00 AM	5	2	7	35	0	0	49	0	0	0	0	0	0	0	0	22	34	0	1	0	57	1	0	5	1	0	0	7	0	3	0	0	0	0	3	0	20	116	0	9	0	145	261
7:15 AM	1	1	21	35	0	0	58	0	0	0	0	0	0	0	0	20	45	0	2	0	67	0	0	2	4	2	0	8	2	1	0	0	0	0	3	0	12	116	0	5	0	133	269
7:30 AM	4	0	10	39	0	0	53	0	0	0	0	0	0	0	0	16	55	0	0	0	71	0	0	4	3	1	0	8	0	3	0	0	0	0	3	0	12	91	0	5	0	108	243
7:45 AM	3	0	6	45	0	0	54	0	0	0	0	0	0	0	0	36	57	0	0	0	93	2	0	7	2	0	0	11	0	2	0	1	0	0	3	0	9	115	0	6	0	130	291
Total	13	3	44	154	0	0	214	0	0	0	0	0	0	0	0	94	191	0	3	0	288	3	0	18	10	3	0	34	2	9	0	1	0	0	12	0	53	438	0	25	0	516	1064
8:00 AM	9	0	8	34	0	0	51	0	0	0	0	0	0	0	0	21	62	1	2	0	86	1	0	4	7	0	0	12	0	2	0	0	0	0	2	0	7	108	0	1	0	116	267
8:15 AM	2	2	4	41	0	0	49	0	0	0	0	0	0	0	0	20	48	3	0	0	71	3	0	4	4	0	0	11	2	5	0	2	0	0	9	1	6	103	0	7	0	117	257
8:30 AM	6	1	7	36	0	0	50	0	0	0	0	0	0	0	0	14	39	0	0	0	53	2	0	5	1	0	0	8	1	1	0	0	0	0	2	0	10	106	0	11	0	127	240
8:45 AM	6	0	10	43	0	0	59	0	0	0	0	0	0	0	0	18	64	0	0	0	82	0	0	13	5	0	0	18	0	2	0	1	0	0	3	0	3	91	0	2	0	96	258
Total	23	3	29	154	0	0	209	0	0	0	0	0	0	0	0	73	213	4	2	0	292	6	0	26	17	0	0	49	3	10	0	3	0	0	16	1	26	408	0	21	0	456	1022
Grand Total	36	6	73	308	0	0	423	0	0	0	0	0	0	0	0	167	404	4	5	0	580	9	0	44	27	3	0	83	5	19	0	4	0	0	28	1	79	846	0	46	0	972	2086
Approach %	8.5	1.4	17.3	72.8	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.8	69.7	0.7	0.9	0.0		10.8	0.0	53.0	32.5	3.6	0.0		17.9	67.9	0.0	14.3	0.0	0.0		0.1	8.1	87.0	0.0	4.7	0.0		
Total %	1.7	0.3	3.5	14.8	0.0	0.0	20.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0	19.4	0.2	0.2	0.0	27.8	0.4	0.0	2.1	1.3	0.1	0.0	4.0	0.2	0.9	0.0	0.2	0.0	0.0	1.3	0.0	3.8	40.6	0.0	2.2	0.0	46.6	
Exiting Leg Total	261							0							1182							162							14							467							2086
Cars	32	6	72	256	0	0	366	0	0	0	0	0	0	0	0	126	359	4	3	0	492	8	0	44	26	2	0	80	4	18	0	3	0	0	25	1	78	771	0	40	0	890	1853
% Cars	88.9	100.0	98.6	83.1	0.0	0.0	86.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	75.4	88.9	100.0	60.0	0.0	84.8	88.9	0.0	100.0	96.3	66.7	0.0	96.4	80.0	94.7	0.0	75.0	0.0	0.0	89.3	100.0	98.7	91.1	0.0	87.0	0.0	91.6	88.8
Exiting Leg Total	213							0							1053							157							13							417							1853
Heavy Vehicles	4	0	1	52	0	0	57	0	0	0	0	0	0	0	0	41	45	0	2	0	88	1	0	0	1	1	0	3	1	1	0	1	0	0	3	0	1	75	0	6	0	82	233
% Heavy Vehicles	11.1	0.0	1.4	16.9	0.0	0.0	13.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.6	11.1	0.0	40.0	0.0	15.2	11.1	0.0	0.0	3.7	33.3	0.0	3.6	20.0	5.3	0.0	25.0	0.0	0.0	10.7	0.0	1.3	8.9	0.0	13.0	0.0	8.4	11.2
Exiting Leg Total	48							0							129							5							1							50							233

Peak Hour Analysis from 07:00 AM to 09:00 AM begins at:

7:15 AM	Willow Road							Driveway						Ayer Road (Route 2A)						Bruce Street						Gulf (East Drive)						Littleton Road (Route 2A/110)								Total			
	from North							from Northeast						from East						from South						from Southwest						from West											
	Right	Bear Right	Thru	Left	Hard Left	U-Turn	Total	Hard Right	Bear Right	Thru	Bear Left	Hard Left	U-Turn	Total	Hard Right	Right	Thru	Bear Left	Left	U-Turn	Total	Right	Bear Right	Thru	Left	Hard Left	U-Turn	Total	Hard Right	Bear Right	Thru	Bear Left	Hard Left	U-Turn	Total	Hard Right	Right	Thru	Bear Left		Left	U-Turn	Total
7:15 AM	1	1	21	35	0	0	58	0	0	0	0	0	0	0	0	20	45	0	2	0	67	0	0	2	4	2	0	8	2	1	0	0	0	0	3	0	12	116	0	5	0	133	269
7:30 AM	4	0	10	39	0	0	53	0	0	0	0	0	0	0	0	16	55	0	0	0	71	0	0	4	3	1	0	8	0	3	0	0	0	0	3	0	12	91	0	5	0	108	243
7:45 AM	3	0	6	45	0	0	54	0	0	0	0	0	0	0	0	36	57	0	0	0	93	2	0	7	2	0	0	11	0	2	0	1	0	0	3	0	9	115	0	6	0	130	291
8:00 AM	9	0	8	34	0	0	51	0	0	0	0	0	0	0	0	21	62	1	2	0	86	1	0	4	7	0	0	12	0	2	0	0	0	0	2	0	7	108	0	1	0	116	267
Total Volume	17	1	45	153	0	0	216	0	0	0	0	0	0	0	0	93	219	1	4	0	317	3	0	17	16	3	0	39	2	8	0	1	0	0	11	0	40	430	0	17	0	487	1070
% Approach Total	7.9	0.5	20.8	70.8	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	29.3	69.1	0.3	1.3	0.0		7.7	0.0	43.6	41.0	7.7	0.0		18.2	72.7	0.0	9.1	0.0	0.0		0.0	8.2	88.3	0.0	3.5	0.0		
PHF	0.472	0.250	0.536	0.850	0.000	0.000	0.931	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.646	0.883	0.250	0.500	0.000	0.852	0.375	0.000	0.607	0.571	0.375	0.000	0.813	0.250	0.667	0.000	0.250	0.000	0.000	0.917	0.000	0.833	0.927	0.000	0.708	0.000	0.915	0.919
Cars	15	1	45	132	0	0	193	0	0	0	0	0	0	0	0	67	194	1	2	0	264	3	0	17	16	2	0	38	2	8	0	1	0	0	11	0	39	389	0	16	0	444	950
Cars %	88.2	100.0	100.0	86.3	0.0	0.0	89.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	72.0	88.6	100.0	50.0	0.0	83.3	100.0	0.0	100.0	100.0	66.7	0.0	97.4	100.0	100.0	0.0	100.0	0.0	0.0	100.0	0.0	97.5	90.5	0.0	94.1	0.0	91.2	88.8
Heavy Vehicles	2	0	0	21	0	0	23	0	0	0	0	0	0	0	0	26	25	0	2	0	53	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	41	0	1	0	43	120
Heavy Vehicles %	11.8	0.0	0.0	13.7	0.0	0.0	10.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.0	11.4	0.0	50.0	0.0	16.7	0.0	0.0	0.0	0.0	33.3	0.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	9.5	0.0	5.9	0.0	8.8	11.2	
Cars Enter Leg	15	1	45	132	0	0	193	0	0	0	0	0	0	0	0	67	194	1	2	0	264	3	0	17	16	2	0	38	2	8	0	1	0	0	11	0	39	389	0	16	0	444	950
Heavy Enter Leg	2	0	0	21	0	0	23	0	0	0	0	0	0	0	0	26	25	0	2	0	53	0	0	0	0	1	0	1	0	0	0	0	0	0	1	41	0	1	0	43	120		
Total Entering Leg	17	1	45	153	0	0	216	0	0	0	0	0	0	0	0	93	219	1	4	0	317	3	0	17	16	3	0	39	2	8	0	1	0	0	11	0	40	430	0	17	0	487	1070
Cars Exiting Leg							101								0						532							88													225	950	
Heavy Exiting Leg							27								0						62							3													27	120	
Total Exiting Leg							128								0						594							91													252	1070	

PDI File #: 228830 A
Location: N: Willow Road S: Bruce Street NE: Driveway
Location: E: Ayer Road (Route 2A) W: Littleton Road (Route 2A/110) SW: Gulf (East Drive)
City, State: Littleton, MA
Client: GPI/ C. Donaldson
Site Code: NEX-2021267.00
Count Date: Thursday, September 22, 2022
Start Time: 7:00 AM
End Time: 9:00 AM
Class:



Bicycles (on Roadway and Crosswalks)

	Willow Road								Driveway								Ayer Road (Route 2A)								Bruce Street								Gulf (East Drive)								Littleton Road (Route 2A/110)								Total		
	from North								from Northeast								from East								from South								from Southwest								from West										
	Right	Near Right	Thru	Left	Hard Left	U-Turn	CW-SB	CW-NB	Total	Hard Right	Near Right	Thru	Near Left	Hard Left	U-Turn	CW-SB	CW-NB	Total	Hard Right	Right	Thru	Near Left	Left	U-Turn	CW-SB	CW-NB	Total	Right	Near Right	Thru	Left	Hard Left	U-Turn	CW-NWB	CW-SB	Total	Hard Right	Right	Thru	Near Left	Left	U-Turn	CW-NB	CW-SB	Total						
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Approach %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Exiting Leg Total	0								0								0								0								0								0								0		

Peak Hour Analysis from 07:00 AM to 09:00 AM begins at:

7:00 AM	Willow Road								Driveway								Ayer Road (Route 2A)								Bruce Street								Gulf (East Drive)								Littleton Road (Route 2A/110)								Total		
	from North								from Northeast								from East								from South								from Southwest								from West										
	Right	Near Right	Thru	Left	Hard Left	U-Turn	CW-EB	CW-WB	Total	Hard Right	Near Right	Thru	Near Left	Hard Left	U-Turn	CW-SEB	CW-NWB	Total	Hard Right	Right	Thru	Near Left	Left	U-Turn	CW-SB	CW-NB	Total	Right	Near Right	Thru	Left	Hard Left	U-Turn	CW-NWB	CW-SB	Total	Hard Right	Right	Thru	Near Left	Left	U-Turn	CW-NB	CW-SB	Total						
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Approach Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
PHF	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
Entering Leg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exiting Leg																																																			
Total	0								0								0								0								0								0								0		

PDI File #: 228830 A
Location: N: Willow Road S: Bruce Street NE: Driveway
Location: E: Ayer Road (Route 2A) W: Littleton Road (Route 2A/110) SW: Gulf (East Drive)
City, State: Littleton, MA
Client: GPI/ C. Donaldson
Site Code: NEX-2021267.00
Count Date: Thursday, September 22, 2022
Start Time: 7:00 AM
End Time: 9:00 AM
Class:



Pedestrians

	Willow Road								Driveway								Ayer Road (Route 2A)								Bruce Street								Gulf (East Drive)								Littleton Road (Route 2A/110)								Total		
	from North								from Northeast								from East								from South								from Southwest								from West										
	Right	Rear Right	Thru	Left	Hard Left	U-Turn	CW-EB	CW-WB	Total	Hard Right	Rear Right	Thru	Rear Left	Hard Left	U-Turn	CW-SEB	CW-NWB	Total	Hard Right	Right	Thru	Rear Left	Left	U-Turn	CW-SB	CW-NB	Total	Right	Rear Right	Thru	Left	Hard Left	U-Turn	CW-WB	CW-EB	Total	Hard Right	Right	Thru	Rear Left	Left	U-Turn	CW-NB	CW-SB	Total						
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Approach %	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total %	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exiting Leg Total	0								0								0								0								0								0								0		

Peak Hour Analysis from 07:00 AM to 09:00 AM begins at:

7:00 AM	Willow Road								Driveway								Ayer Road (Route 2A)								Bruce Street								Gulf (East Drive)								Littleton Road (Route 2A/110)								Total			
	from North								from Northeast								from East								from South								from Southwest								from West											
	Right	Rear Right	Thru	Left	Hard Left	U-Turn	CW-EB	CW-WB	Total	Hard Right	Rear Right	Thru	Rear Left	Hard Left	U-Turn	CW-SEB	CW-NWB	Total	Hard Right	Right	Thru	Rear Left	Left	U-Turn	CW-SB	CW-NB	Total	Right	Rear Right	Thru	Rear Left	Hard Left	U-Turn	CW-WNB	CW-SB	Total	Hard Right	Right	Thru	Rear Left	Left	U-Turn	CW-NB	CW-SB	Total							
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Approach Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PHF	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Entering Leg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exiting Leg	0								0								0								0								0								0								0			
Total	0								0								0								0								0								0								0			

PDI File #: 228830 A
Location: N: Willow Road S: Bruce Street NE: Driveway
Location: E: Ayer Road (Route 2A) W: Littleton Road (Route 2A/110) SW: Gulf (East Drive)
City, State: Littleton, MA
Client: GPI/ C. Donaldson
Site Code: NEX-2021267.00
Count Date: Thursday, September 22, 2022
Start Time: 4:00 PM
End Time: 6:00 PM
Class:



Cars and Heavy Vehicles (Combined)

	Willow Road							Driveway							Ayer Road (Route 2A)							Bruce Street							Gulf (East Drive)							Littleton Road (Route 2A/110)							Total	
	from North							from Northeast							from East							from South							from Southwest							from West								
	Right	Bear Right	Thru	Left	Hard Left	U-Turn	Total	Hard Right	Bear Right	Thru	Bear Left	Hard Left	U-Turn	Total	Hard Right	Right	Thru	Bear Left	Left	U-Turn	Total	Right	Bear Right	Thru	Left	Hard Left	U-Turn	Total	Hard Right	Bear Right	Thru	Bear Left	Hard Left	U-Turn	Total	Hard Right	Right	Thru	Bear Left	Left	U-Turn	Total		
4:00 PM	11	0	8	24	0	0	43	0	0	0	0	0	0	0	0	28	115	0	1	0	144	2	0	20	6	0	0	28	2	0	0	0	0	0	2	0	8	85	0	7	0	100	317	
4:15 PM	6	0	10	28	0	0	44	0	0	0	0	0	0	0	0	26	92	0	3	0	121	2	0	10	14	1	0	27	0	2	0	1	0	0	3	0	1	97	0	5	0	103	298	
4:30 PM	4	0	6	34	0	0	44	0	0	0	0	0	0	0	0	40	103	0	4	0	147	0	0	10	14	0	0	24	0	2	0	0	0	0	2	0	3	88	0	6	0	97	314	
4:45 PM	4	0	9	25	0	0	38	0	0	0	0	0	0	0	0	37	95	0	0	0	132	0	0	18	22	0	0	40	0	0	0	1	0	0	1	0	4	77	0	3	0	84	295	
Total	25	0	33	111	0	0	169	0	0	0	0	0	0	0	0	131	405	0	8	0	544	4	0	58	56	1	0	119	2	4	0	2	0	0	8	0	16	347	0	21	0	384	1224	
5:00 PM	4	1	7	31	0	0	43	0	0	0	0	0	0	0	0	34	109	0	1	0	144	2	0	9	11	0	0	22	0	1	0	0	0	0	0	1	1	5	97	0	2	0	105	315
5:15 PM	5	0	6	15	0	0	26	0	0	0	0	0	0	0	0	27	142	1	4	0	174	2	0	19	12	0	0	33	0	1	0	0	0	0	1	0	2	72	0	5	0	79	313	
5:30 PM	8	1	7	18	0	0	34	0	0	0	0	0	0	0	0	27	141	1	2	0	171	0	0	9	32	0	0	41	0	2	0	0	1	0	3	0	6	60	0	2	0	68	317	
5:45 PM	3	0	13	21	0	0	37	0	0	0	0	0	0	0	0	31	138	0	1	0	170	3	0	10	18	1	0	32	0	0	0	0	0	0	0	3	67	0	2	0	72	311		
Total	20	2	33	85	0	0	140	0	0	0	0	0	0	0	0	119	530	2	8	0	659	7	0	47	73	1	0	128	0	4	0	0	1	0	5	1	16	296	0	11	0	324	1256	
Grand Total	45	2	66	196	0	0	309	0	0	0	0	0	0	0	0	250	935	2	16	0	1203	11	0	105	129	2	0	247	2	8	0	2	1	0	13	1	32	643	0	32	0	708	2480	
Approach %	14.6	0.6	21.4	63.4	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.8	77.7	0.2	1.3	0.0		4.5	0.0	42.5	52.2	0.8	0.0		15.4	61.5	0.0	15.4	7.7	0.0		0.1	4.5	90.8	0.0	4.5	0.0			
Total %	1.8	0.1	2.7	7.9	0.0	0.0	12.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.1	37.7	0.1	0.6	0.0	48.5	0.4	0.0	4.2	5.2	0.1	0.0	10.0	0.1	0.3	0.0	0.1	0.0	0.0	0.5	0.0	1.3	25.9	0.0	1.3	0.0	28.5		
Exiting Leg Total	389							0							858							116							7							1110							2480	
Cars	42	2	66	183	0	0	293	0	0	0	0	0	0	0	0	238	895	2	16	0	1151	11	0	104	129	2	0	246	2	8	0	2	1	0	13	1	32	603	0	30	0	666	2369	
% Cars	93.3	100.0	100.0	93.4	0.0	0.0	94.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	95.2	95.7	100.0	100.0	0.0	95.7	100.0	0.0	99.0	100.0	100.0	0.0	99.6	100.0	100.0	0.0	100.0	100.0	0.0	100.0	100.0	93.8	0.0	93.8	0.0	94.1	95.5		
Exiting Leg Total	374							0							805							116							7							1067							2369	
Heavy Vehicles	3	0	0	13	0	0	16	0	0	0	0	0	0	0	0	12	40	0	0	0	52	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	40	0	2	0	42	111	
% Heavy Vehicles	6.7	0.0	0.0	6.6	0.0	0.0	5.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	4.3	0.0	0.0	0.0	4.3	0.0	0.0	1.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.2	0.0	6.3	0.0	5.9	4.5		
Exiting Leg Total	15							0							53							0							0							43							111	

Peak Hour Analysis from 04:00 PM to 06:00 PM begins at:

5:00 PM	Willow Road							Driveway							Ayer Road (Route 2A)							Bruce Street							Gulf (East Drive)							Littleton Road (Route 2A/110)							Total
	from North							from Northeast							from East							from South							from Southwest							from West							
	Right	Bear Right	Thru	Left	Hard Left	U-Turn	Total	Hard Right	Bear Right	Thru	Bear Left	Hard Left	U-Turn	Total	Hard Right	Right	Thru	Bear Left	Left	U-Turn	Total	Right	Bear Right	Thru	Left	Hard Left	U-Turn	Total	Hard Right	Bear Right	Thru	Bear Left	Hard Left	U-Turn	Total	Hard Right	Right	Thru	Bear Left	Left	U-Turn	Total	
5:00 PM	4	1	7	31	0	0	43	0	0	0	0	0	0	0	0	34	109	0	1	0	144	2	0	9	11	0	0	22	0	1	0	0	0	0	1	1	5	97	0	2	0	105	315
5:15 PM	5	0	6	15	0	0	26	0	0	0	0	0	0	0	0	27	142	1	4	0	174	2	0	19	12	0	0	33	0	1	0	0	0	0	1	0	2	72	0	5	0	79	313
5:30 PM	8	1	7	18	0	0	34	0	0	0	0	0	0	0	0	27	141	1	2	0	171	0	0	9	32	0	0	41	0	2	0	0	1	0	3	0	6	60	0	2	0	68	317
5:45 PM	3	0	13	21	0	0	37	0	0	0	0	0	0	0	0	31	138	0	1	0	170	3	0	10	18	1	0	32	0	0	0	0	0	0	0	3	67	0	2	0	72	311	
Total Volume	20	2	33	85	0	0	140	0	0	0	0	0	0	0	0	119	530	2	8	0	659	7	0	47	73	1	0	128	0	4	0	0	1	0	5	1	16	296	0	11	0	324	1256
% Approach Total	14.3	1.4	23.6	60.7	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.1	80.4	0.3	1.2	0.0		5.5	0.0	36.7	57.0	0.8	0.0		0.0	80.0	0.0	0.0	20.0	0.0		0.3	4.9	91.4	0.0	3.4	0.0		
PHF	0.625	0.500	0.635	0.685	0.000	0.000	0.814	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.875	0.933	0.500	0.500	0.000	0.947	0.583	0.000	0.618	0.570	0.250	0.000	0.780	0.000	0.500	0.000	0.000	0.250	0.000	0.417	0.250	0.667	0.763	0.000	0.550	0.000	0.771	0.991
Cars	20	2	33	80	0	0	135	0	0	0	0	0	0	0	0	115	509	2	8	0	634	7	0	47	73	1	0	128	0	4	0	0	1	0	5	1	16	281	0	10	0	308	1210
Cars %	100.0	100.0	100.0	94.1	0.0	0.0	96.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	96.6	96.0	100.0	100.0	0.0	96.2	100.0	0.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	100.0	100.0	94.9	0.0	90.9	0.0	95.1	96.3	
Heavy Vehicles	0	0	0	5	0	0	5	0	0	0	0	0	0	0	0	4	21	0	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	1	0	16	46	
Heavy Vehicles %	0.0	0.0	0.0	5.9	0.0	0.0	3.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4	4.0	0.0	0.0	3.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.1	0.0	9.1	0.0	4.9	3.7	
Cars Enter Leg	20	2	33	80	0	0	135	0	0	0	0	0	0	0	0	115	509	2	8	0	634	7	0	47	73	1	0	128	0	4	0	0	1	0	5	1	16	281	0	10	0	308	1210
Heavy Enter Leg	0	0	0	5	0	0	5	0	0	0	0	0	0	0	0	4	21	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	1	0	16	46	
Total Entering Leg	20	2	33	85	0	0	140	0	0	0	0	0	0	0	0	119	530	2	8	0	659	7	0	47	73	1	0	128	0	4	0	0	1	0	5	1	16	296	0	11	0	324	1256
Cars Exiting Leg							172									0					372																					603	1210
Heavy Exiting Leg							5									0					20																					21	46
Total Exiting Leg							177									0					392																					624	1256

PDI File #: 228830 A
Location: N: Willow Road S: Bruce Street NE: Driveway
Location: E: Ayer Road (Route 2A) W: Littleton Road (Route 2A/110) SW: Gulf (East Drive)
City, State: Littleton, MA
Client: GPI/ C. Donaldson
Site Code: NEX-2021267.00
Count Date: Thursday, September 22, 2022
Start Time: 4:00 PM
End Time: 6:00 PM
Class:



Bicycles (on Roadway and Crosswalks)

	Willow Road								Driveway								Ayer Road (Route 2A)								Bruce Street								Gulf (East Drive)								Littleton Road (Route 2A/110)								Total			
	from North								from Northeast								from East								from South								from Southwest								from West											
	Right	Near Right	Thru	Left	Hard Left	U-Turn	CW-EB	CW-WB	Total	Hard Right	Near Right	Thru	Near Left	Hard Left	U-Turn	CW-SEB	CW-NWB	Total	Hard Right	Right	Thru	Near Left	Left	U-Turn	CW-SB	CW-NB	Total	Right	Near Right	Thru	Left	Hard Left	U-Turn	CW-WB	CW-EB	Total	Hard Right	Right	Thru	Near Left	Left	U-Turn	CW-NB	CW-SB	Total							
4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:15 PM	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
5:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Grand Total	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Approach %	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Total %	0.0	0.0	50.0	0.0	0.0	0.0	0.0	0.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Exiting Leg Total	1								0								0								1								0								2											

Peak Hour Analysis from 04:00 PM to 06:00 PM begins at:

4:30 PM	Willow Road								Driveway								Ayer Road (Route 2A)								Bruce Street								Gulf (East Drive)								Littleton Road (Route 2A/110)								Total																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
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	Right	Bear Right	Thru	Left	Hard Left	U-Turn	CW-EB	CW-WB	Total	Hard Right	Bear Right	Thru	Bear Left	Hard Left	U-Turn	CW-SEB	CW-NWB	Total	Hard Right	Right	Thru	Bear Left	Left	U-Turn	CW-SB	CW-NB	Total	Right	Bear Right	Thru	Left	Hard Left	U-Turn	CW-WB	CW-EB	Total	Hard Right	Bear Right	Thru	Bear Left	Left	U-Turn	CW-NWB	CW-SB	Total																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
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PDI File #: 228830 A
Location: N: Willow Road S: Bruce Street NE: Driveway
Location: E: Ayer Road (Route 2A) W: Littleton Road (Route 2A/110) SW: Gulf (East Drive)
City, State: Littleton, MA
Client: GPI/ C. Donaldson
Site Code: NEX-2021267.00
Count Date: Thursday, September 22, 2022
Start Time: 4:00 PM
End Time: 6:00 PM
Class:



Pedestrians

	Willow Road								Driveway								Ayer Road (Route 2A)								Bruce Street								Gulf (East Drive)								Littleton Road (Route 2A/110)								Total			
	from North								from Northeast								from East								from South								from Southwest								from West											
	Right	Rear Right	Thru	Left	Hard Left	U-Turn	CW-SB	CW-NB	Total	Hard Right	Rear Right	Thru	Rear Left	Hard Left	U-Turn	CW-SB	CW-NB	Total	Hard Right	Right	Thru	Rear Left	Left	U-Turn	CW-SB	CW-NB	Total	Right	Rear Right	Thru	Left	Hard Left	U-Turn	CW-NWB	CW-SB	Total	Hard Right	Right	Thru	Rear Left	Left	U-Turn	CW-NB	CW-SB	Total							
4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:00 PM	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
5:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Grand Total	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Approach %	0	0	0	0	0	0	100	0	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total %	0	0	0	0	0	0	50	0	50	0	0	0	0	0	0	50	0	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Exiting Leg Total	2								2								0								0								0								0								4			

Peak Hour Analysis from 04:00 PM to 06:00 PM begins at:

4:15 PM	Willow Road								Driveway								Ayer Road (Route 2A)								Bruce Street								Gulf (East Drive)								Littleton Road (Route 2A/110)								Total																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
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	Right	Bear Right	Thru	Left	Hard Left	U-Turn	CW-EB	CW-WB	Total	Hard Right	Bear Right	Thru	Bear Left	Hard Left	U-Turn	CW-SEB	CW-NWB	Total	Hard Right	Right	Thru	Bear Left	Left	U-Turn	CW-SB	CW-NB	Total	Right	Bear Right	Thru	Left	Hard Left	U-Turn	CW-WB	CW-EB	Total	Hard Right	Right	Thru	Bear Left	Left	U-Turn	CW-NB	CW-SB	Total																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
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PDI File #: 228830 A
Location: N: Willow Road S: Bruce Street NE: Driveway
Location: E: Ayer Road (Route 2A) W: Littleton Road (Route 2A/110) SW: Gulf (East Drive)
City, State: Littleton, MA
Client: GPI/ C. Donaldson
Site Code: NEX-2021267.00
Count Date: Saturday, September 24, 2022
Start Time: 11:00 AM
End Time: 2:00 PM
Class:



Cars and Heavy Vehicles (Combined)

	Willow Road							Driveway							Ayer Road (Route 2A)							Bruce Street							Gulf (East Drive)							Littleton Road (Route 2A/110)							Total		
	from North							from Northeast							from East							from South							from Southwest							from West									
	Right	Bear Right	Thru	Left	Hard Left	U-Turn	Total	Hard Right	Bear Right	Thru	Bear Left	Hard Left	U-Turn	Total	Hard Right	Right	Thru	Bear Left	Left	U-Turn	Total	Right	Bear Right	Thru	Left	Hard Left	U-Turn	Total	Hard Right	Bear Right	Thru	Bear Left	Hard Left	U-Turn	Total	Hard Right	Right	Thru	Bear Left	Left	U-Turn	Total			
11:00 AM	5	0	5	15	0	0	25	0	0	0	0	0	0	0	0	19	71	0	2	0	92	2	0	8	3	1	0	14	0	1	0	2	0	0	3	0	4	69	0	7	0	80	214		
11:15 AM	8	0	2	27	0	0	37	0	0	0	0	0	0	0	0	16	65	0	4	0	85	5	0	4	0	0	9	1	2	0	0	1	0	4	0	5	97	0	0	0	102	237			
11:30 AM	10	0	3	18	0	0	31	0	0	0	0	0	0	0	0	11	76	0	2	0	89	2	0	6	2	0	10	0	1	0	0	1	0	2	0	2	65	0	6	0	73	205			
11:45 AM	7	0	4	23	0	0	34	0	0	0	0	0	0	0	0	12	72	0	2	0	86	3	0	7	6	0	16	0	2	0	0	0	0	2	0	4	64	0	5	0	73	211			
Total	30	0	14	83	0	0	127	0	0	0	0	0	0	0	0	58	284	0	10	0	352	12	0	25	11	1	0	49	1	6	0	2	2	0	11	0	15	295	0	18	0	328	867		
12:00 PM	9	0	4	18	0	0	31	0	0	0	0	0	0	0	0	26	51	0	4	0	81	2	0	4	7	1	0	14	0	1	0	0	0	0	1	0	5	84	0	11	0	100	227		
12:15 PM	5	1	5	20	0	0	31	0	0	0	0	0	0	0	0	18	76	0	1	0	95	5	0	4	1	0	10	0	2	0	0	0	0	2	1	5	86	0	7	0	99	237			
12:30 PM	7	1	2	21	0	0	31	0	0	0	0	0	0	0	0	13	44	0	2	0	59	3	0	3	5	0	11	0	5	0	1	0	0	6	0	1	88	0	4	0	93	200			
12:45 PM	8	1	3	23	0	0	35	0	0	0	0	0	0	0	0	16	52	0	5	0	73	4	0	6	3	0	13	0	3	0	1	0	0	4	0	4	78	0	3	0	85	210			
Total	29	3	14	82	0	0	128	0	0	0	0	0	0	0	0	73	223	0	12	0	308	14	0	17	16	1	0	48	0	11	0	2	0	0	13	1	15	336	0	25	0	377	874		
1:00 PM	5	0	5	14	0	0	24	1	0	0	0	0	0	1	0	21	71	0	2	0	94	6	0	2	8	0	0	16	0	2	0	0	0	0	2	0	1	107	0	5	0	113	250		
1:15 PM	3	1	2	21	0	0	27	0	0	0	0	0	0	0	0	29	70	1	6	0	106	5	0	12	3	0	20	0	2	0	0	0	0	2	0	2	61	0	6	0	69	224			
1:30 PM	5	1	5	16	0	0	27	0	0	0	0	0	0	0	0	21	74	0	2	0	97	3	1	3	2	1	0	10	0	0	0	0	0	0	0	0	2	98	0	6	0	106	240		
1:45 PM	5	1	3	15	0	0	24	0	0	0	0	0	0	0	0	13	67	0	4	0	84	5	0	3	6	0	14	1	0	0	0	0	0	1	0	4	79	0	1	0	84	207			
Total	18	3	15	66	0	0	102	1	0	0	0	0	0	1	0	84	282	1	14	0	381	19	1	20	19	1	0	60	1	4	0	0	0	0	5	0	9	345	0	18	0	372	921		
Grand Total	77	6	43	231	0	0	357	1	0	0	0	0	0	1	0	215	789	1	36	0	1041	45	1	62	46	3	0	157	2	21	0	4	2	0	29	1	39	976	0	61	0	1077	2662		
Approach %	21.6	1.7	12.0	64.7	0.0	0.0		100.0	0.0	0.0	0.0	0.0	0.0		0.0	20.7	75.8	0.1	3.5	0.0		28.7	0.6	39.5	29.3	1.9	0.0		6.9	72.4	0.0	13.8	6.9	0.0		0.1	3.6	90.6	0.0	5.7	0.0				
Total %	2.9	0.2	1.6	8.7	0.0	0.0	13.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.1	29.6	0.0	1.4	0.0	39.1	1.7	0.0	2.3	1.7	0.1	0.0	5.9	0.1	0.8	0.0	0.2	0.1	0.0	1.1	0.0	1.5	36.7	0.0	2.3	0.0	40.5			
Exiting Leg Total	343							1							1273							120							11							914							2662		
Cars	73	6	42	222	0	0	343	1	0	0	0	0	0	1	0	205	767	1	36	0	1009	45	1	61	46	3	0	156	2	20	0	4	2	0	28	1	38	949	0	56	0	1044	2581		
% Cars	94.8	100.0	97.7	96.1	0.0	0.0	96.1	100.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	95.3	97.2	100.0	100.0	0.0	96.9	100.0	100.0	98.4	100.0	100.0	0.0	99.4	100.0	95.2	0.0	100.0	100.0	0.0	96.6	100.0	97.4	97.2	0.0	91.8	0.0	96.9	97.0		
Exiting Leg Total	327							1							1236							118							11							888							2581		
Heavy Vehicles	4	0	1	9	0	0	14	0	0	0	0	0	0	0	0	10	22	0	0	0	32	0	0	1	0	0	0	1	0	1	0	0	0	0	1	0	1	27	0	5	0	33	81		
% Heavy Vehicles	5.2	0.0	2.3	3.9	0.0	0.0	3.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7	2.8	0.0	0.0	0.0	3.1	0.0	0.0	1.6	0.0	0.0	0.0	0.6	0.0	4.8	0.0	0.0	0.0	0.0	3.4	0.0	2.6	2.8	0.0	8.2	0.0	3.1	3.0		
Exiting Leg Total	16							0							37							2							0							26							81		

Peak Hour Analysis from 11:00 AM to 02:00 PM begins at:

12:45 PM	Willow Road							Driveway							Ayer Road (Route 2A)							Bruce Street							Gulf (East Drive)							Littleton Road (Route 2A/110)							Total
	from North							from Northeast							from East							from South							from Southwest							from West							
	Right	Bear Right	Thru	Left	Hard Left	U-Turn	Total	Hard Right	Bear Right	Thru	Bear Left	Hard Left	U-Turn	Total	Hard Right	Right	Thru	Bear Left	Left	U-Turn	Total	Right	Bear Right	Thru	Left	Hard Left	U-Turn	Total	Hard Right	Bear Right	Thru	Bear Left	Hard Left	U-Turn	Total	Hard Right	Right	Thru	Bear Left	Left	U-Turn	Total	
12:45 PM	8	1	3	23	0	0	35	0	0	0	0	0	0	0	0	16	52	0	5	0	73	4	0	6	3	0	0	13	0	3	0	1	0	0	4	0	4	78	0	3	0	85	210
1:00 PM	5	0	5	14	0	0	24	1	0	0	0	0	0	1	0	21	71	0	2	0	94	6	0	2	8	0	0	16	0	2	0	0	0	0	2	0	1	107	0	5	0	113	250
1:15 PM	3	1	2	21	0	0	27	0	0	0	0	0	0	0	0	29	70	1	6	0	106	5	0	12	3	0	0	20	0	2	0	0	0	0	2	0	2	61	0	6	0	69	224
1:30 PM	5	1	5	16	0	0	27	0	0	0	0	0	0	0	0	21	74	0	2	0	97	3	1	3	2	1	0	10	0	0	0	0	0	0	0	2	98	0	6	0	106	240	
Total Volume	21	3	15	74	0	0	113	1	0	0	0	0	0	1	0	87	267	1	15	0	370	18	1	23	16	1	0	59	0	7	0	1	0	0	8	0	9	344	0	20	0	373	924
% Approach Total	18.6	2.7	13.3	65.5	0.0	0.0		100.0	0.0	0.0	0.0	0.0	0.0		0.0	23.5	72.2	0.3	4.1	0.0		30.5	1.7	39.0	27.1	1.7	0.0		0.0	87.5	0.0	12.5	0.0	0.0		0.0	2.4	92.2	0.0	5.4	0.0		
PHF	0.656	0.750	0.750	0.804	0.000	0.000	0.807	0.250	0.000	0.000	0.000	0.000	0.250	0.873	0.000	0.750	0.902	0.250	0.625	0.000	0.873	0.750	0.250	0.479	0.500	0.250	0.000	0.738	0.000	0.583	0.000	0.250	0.000	0.000	0.500	0.000	0.563	0.804	0.000	0.833	0.000	0.825	0.924
Cars	21	3	15	73	0	0	112	1	0	0	0	0	0	1	0	84	261	1	15	0	361	18	1	22	16	1	0	58	0	7	0	1	0	0	8	0	8	338	0	20	0	366	906
Cars %	100.0	100.0	100.0	98.6	0.0	0.0	99.1	100.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	97.6	97.6	100.0	100.0	0.0	97.6	100.0	100.0	95.7	100.0	100.0	0.0	98.3	0.0	100.0	0.0	100.0	0.0	0.0	100.0	0.0	88.9	98.3	0.0	100.0	0.0	98.1	98.1
Heavy Vehicles	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	3	6	0	0	0	9	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	6	0	0	7	18	
Heavy Vehicles %	0.0	0.0	0.0	1.4	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4	2.2	0.0	0.0	2.4	0.0	0.0	4.3	0.0	0.0	0.0	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.1	1.7	0.0	0.0	0.0	1.9	1.9	
Cars Enter Leg	21	3	15	73	0	0	112	1	0	0	0	0	0	1	0	84	261	1	15	0	361	18	1	22	16	1	0	58	0	7	0	1	0	0	8	0	8	338	0	20	0	366	906
Heavy Enter Leg	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	3	6	0	0	0	9	0	0	1	0	0	1	1	0	0	0	0	0	0	0	1	6	0	0	7	18		
Total Entering Leg	21	3	15	74	0	0	113	1	0	0	0	0	0	1	0	87	267	1	15	0	370	18	1	23	16	1	0	59	0	7	0	1	0	0	8	0	9	344	0	20	0	373	924
Cars Exiting Leg							128							1							436						38							5						298		906	
Heavy Exiting Leg							4							0							7						1							0						6		18	
Total Exiting Leg							132							1							443						39							5							304		924



**PRECISION
DATA
INDUSTRIES, LLC**

157 Washington Street, Suite 2
Hudson, MA 01749
Office: 508-875-0100 Fax: 508-875-0118

[illegible][illegible]



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DATA
INDUSTRIES, LLC

157 Washington Street, Suite 2
Hudson, MA 01749
Office: 508-875-0100 Fax: 508-875-0118

[illegible][illegible]

PDI File #: **228830 B**
 Location: **S: Gulf (West Dr)**
 Location: **E: Ayer Road (Route 2A/110) W: Ayer Road (Route 2A/110)**
 City, State: **Littleton, MA**
 Client: **GPI/ C. Donaldson**
 Site Code: **NEX-2021267.00**
 Count Date: **Thursday, September 22, 2022**
 Start Time: **7:00 AM**
 End Time: **9:00 AM**
 Class:



Cars and Heavy Vehicles (Combined)

	Ayer Road (Route 2A/110)				Gulf (West Dr)				Ayer Road (Route 2A/110)				Total
	from East				from South				from West				
	Thru	Left	U-Turn	Total	Right	Left	U-Turn	Total	Right	Thru	U-Turn	Total	
7:00 AM	39	1	0	40	2	0	0	2	2	142	0	144	186
7:15 AM	48	1	0	49	1	2	0	3	4	128	0	132	184
7:30 AM	61	0	0	61	0	3	0	3	4	110	0	114	178
7:45 AM	60	2	0	62	3	2	0	5	3	126	0	129	196
Total	208	4	0	212	6	7	0	13	13	506	0	519	744
8:00 AM	74	1	0	75	1	1	0	2	4	118	0	122	199
8:15 AM	54	0	0	54	0	0	0	0	4	115	0	119	173
8:30 AM	46	1	0	47	2	1	0	3	2	128	0	130	180
8:45 AM	75	0	0	75	0	1	0	1	0	103	0	103	179
Total	249	2	0	251	3	3	0	6	10	464	0	474	731
Grand Total	457	6	0	463	9	10	0	19	23	970	0	993	1475
Approach %	98.7	1.3	0.0		47.4	52.6	0.0		2.3	97.7	0.0		
Total %	31.0	0.4	0.0	31.4	0.6	0.7	0.0	1.3	1.6	65.8	0.0	67.3	
Exiting Leg Total				979				29				467	1475
Cars	404	5	0	409	9	9	0	18	21	889	0	910	1337
% Cars	88.4	83.3	0.0	88.3	100.0	90.0	0.0	94.7	91.3	91.6	0.0	91.6	90.6
Exiting Leg Total				898				26				413	1337
Heavy Vehicles	53	1	0	54	0	1	0	1	2	81	0	83	138
% Heavy Vehicles	11.6	16.7	0.0	11.7	0.0	10.0	0.0	5.3	8.7	8.4	0.0	8.4	9.4
Exiting Leg Total				81				3				54	138

Peak Hour Analysis from 07:00 AM to 09:00 AM begins at:

7:15 AM	Ayer Road (Route 2A/110)				Gulf (West Dr)				Ayer Road (Route 2A/110)				Total
	from East				from South				from West				
	Thru	Left	U-Turn	Total	Right	Left	U-Turn	Total	Right	Thru	U-Turn	Total	
7:15 AM	48	1	0	49	1	2	0	3	4	128	0	132	184
7:30 AM	61	0	0	61	0	3	0	3	4	110	0	114	178
7:45 AM	60	2	0	62	3	2	0	5	3	126	0	129	196
8:00 AM	74	1	0	75	1	1	0	2	4	118	0	122	199
Total Volume	243	4	0	247	5	8	0	13	15	482	0	497	757
% Approach Total	98.4	1.6	0.0		38.5	61.5	0.0		3.0	97.0	0.0		
PHF	0.821	0.500	0.000	0.823	0.417	0.667	0.000	0.650	0.938	0.941	0.000	0.941	0.951
Cars	215	3	0	218	5	7	0	12	15	439	0	454	684
Cars %	88.5	75.0	0.0	88.3	100.0	87.5	0.0	92.3	100.0	91.1	0.0	91.3	90.4
Heavy Vehicles	28	1	0	29	0	1	0	1	0	43	0	43	73
Heavy Vehicles %	11.5	25.0	0.0	11.7	0.0	12.5	0.0	7.7	0.0	8.9	0.0	8.7	9.6
Cars Enter Leg	215	3	0	218	5	7	0	12	15	439	0	454	684
Heavy Enter Leg	28	1	0	29	0	1	0	1	0	43	0	43	73
Total Entering Leg	243	4	0	247	5	8	0	13	15	482	0	497	757
Cars Exiting Leg				444				18				222	684
Heavy Exiting Leg				43				1				29	73
Total Exiting Leg				487				19				251	757

PDI File #: **228830 B**
 Location: **S: Gulf (West Dr)**
 Location: **E: Ayer Road (Route 2A/110) W: Ayer Road (Route 2A/110)**
 City, State: **Littleton, MA**
 Client: **GPI/ C. Donaldson**
 Site Code: **NEX-2021267.00**
 Count Date: **Thursday, September 22, 2022**
 Start Time: **7:00 AM**
 End Time: **9:00 AM**
 Class:



Bicycles (on Roadway and Crosswalks)

	Ayer Road (Route 2A/110)						Gulf (West Dr)						Ayer Road (Route 2A/110)						Total
	from East						from South						from West						
	Thru	Left	U-Turn	CW-SB	CW-NB	Total	Right	Left	U-Turn	CW-WB	CW-EB	Total	Right	Thru	U-Turn	CW-NB	CW-SB	Total	
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Approach %	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0		
Total %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Exiting Leg Total	0						0						0						0

Peak Hour Analysis from 07:00 AM to 09:00 AM begins at:

7:00 AM	Ayer Road (Route 2A/110)						Gulf (West Dr)						Ayer Road (Route 2A/110)						Total
	from East						from South						from West						
	Thru	Left	U-Turn	CW-SB	CW-NB	Total	Right	Left	U-Turn	CW-WB	CW-EB	Total	Right	Thru	U-Turn	CW-NB	CW-SB	Total	
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Approach Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PHF	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Entering Leg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exiting Leg	0						0						0						0
Total	0						0						0						0

PDI File #: **228830 B**
 Location: **S: Gulf (West Dr)**
 Location: **E: Ayer Road (Route 2A/110) W: Ayer Road (Route 2A/110)**
 City, State: **Littleton, MA**
 Client: **GPI/ C. Donaldson**
 Site Code: **NEX-2021267.00**
 Count Date: **Thursday, September 22, 2022**
 Start Time: **7:00 AM**
 End Time: **9:00 AM**
 Class:



Pedestrians

	Ayer Road (Route 2A/110)						Gulf (West Dr)						Ayer Road (Route 2A/110)						Total	
	from East						from South						from West							
	Thru	Left	U-Turn	CW-SB	CW-NB	Total	Right	Left	U-Turn	CW-WB	CW-EB	Total	Right	Thru	U-Turn	CW-NB	CW-SB	Total		
7:00 AM	0	0	0	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2
7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45 AM	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Total	0	0	0	2	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	3
8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	0	2	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Approach %	0	0	0	66.667	33.333		0	0	0	0	0	0	0	0	0	0	0	0		
Total %	0	0	0	66.667	33.333	100	0	0	0	0	0	0	0	0	0	0	0	0		
Exiting Leg Total	3						0						0						3	

Peak Hour Analysis from 07:00 AM to 09:00 AM begins at:

7:00 AM	Ayer Road (Route 2A/110)						Gulf (West Dr)						Ayer Road (Route 2A/110)						Total	
	from East						from South						from West							
	Thru	Left	U-Turn	CW-SB	CW-NB	Total	Right	Left	U-Turn	CW-WB	CW-EB	Total	Right	Thru	U-Turn	CW-NB	CW-SB	Total		
7:00 AM	0	0	0	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2
7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45 AM	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Total Volume	0	0	0	2	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	3
% Approach Total	0.0	0.0	0.0	66.7	33.3		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
PHF	0.000	0.000	0.000	0.500	0.250	0.375	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.375
Entering Leg	0	0	0	2	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Exiting Leg	3						0						0						3	
Total	6						0						0						6	

PDI File #: **228830 B**
 Location: **S: Gulf (West Dr)**
 Location: **E: Ayer Road (Route 2A/110) W: Ayer Road (Route 2A/110)**
 City, State: **Littleton, MA**
 Client: **GPI/ C. Donaldson**
 Site Code: **NEX-2021267.00**
 Count Date: **Thursday, September 22, 2022**
 Start Time: **4:00 PM**
 End Time: **6:00 PM**
 Class:



Cars and Heavy Vehicles (Combined)

	Ayer Road (Route 2A/110)				Gulf (West Dr)				Ayer Road (Route 2A/110)				Total
	from East				from South				from West				
	Thru	Left	U-Turn	Total	Right	Left	U-Turn	Total	Right	Thru	U-Turn	Total	
4:00 PM	129	1	0	130	1	4	0	5	4	96	0	100	235
4:15 PM	111	1	0	112	0	4	0	4	3	103	0	106	222
4:30 PM	114	4	0	118	1	1	0	2	2	95	0	97	217
4:45 PM	126	1	0	127	1	1	0	2	0	83	0	83	212
Total	480	7	0	487	3	10	0	13	9	377	0	386	886
5:00 PM	122	0	0	122	0	1	0	1	1	106	0	107	230
5:15 PM	155	1	0	156	2	2	0	4	5	76	0	81	241
5:30 PM	180	1	0	181	0	3	0	3	0	67	0	67	251
5:45 PM	155	1	0	156	1	0	0	1	0	71	0	71	228
Total	612	3	0	615	3	6	0	9	6	320	0	326	950
Grand Total	1092	10	0	1102	6	16	0	22	15	697	0	712	1836
Approach %	99.1	0.9	0.0		27.3	72.7	0.0		2.1	97.9	0.0		
Total %	59.5	0.5	0.0	60.0	0.3	0.9	0.0	1.2	0.8	38.0	0.0	38.8	
Exiting Leg Total	703				25				1108				1836
Cars	1051	10	0	1061	6	16	0	22	15	653	0	668	1751
% Cars	96.2	100.0	0.0	96.3	100.0	100.0	0.0	100.0	100.0	93.7	0.0	93.8	95.4
Exiting Leg Total	659				25				1067				1751
Heavy Vehicles	41	0	0	41	0	0	0	0	0	44	0	44	85
% Heavy Vehicles	3.8	0.0	0.0	3.7	0.0	0.0	0.0	0.0	0.0	6.3	0.0	6.2	4.6
Exiting Leg Total	44				0				41				85

Peak Hour Analysis from 04:00 PM to 06:00 PM begins at:

5:00 PM	Ayer Road (Route 2A/110)				Gulf (West Dr)				Ayer Road (Route 2A/110)				Total
	from East				from South				from West				
	Thru	Left	U-Turn	Total	Right	Left	U-Turn	Total	Right	Thru	U-Turn	Total	
5:00 PM	122	0	0	122	0	1	0	1	1	106	0	107	230
5:15 PM	155	1	0	156	2	2	0	4	5	76	0	81	241
5:30 PM	180	1	0	181	0	3	0	3	0	67	0	67	251
5:45 PM	155	1	0	156	1	0	0	1	0	71	0	71	228
Total Volume	612	3	0	615	3	6	0	9	6	320	0	326	950
% Approach Total	99.5	0.5	0.0		33.3	66.7	0.0		1.8	98.2	0.0		
PHF	0.850	0.750	0.000	0.849	0.375	0.500	0.000	0.563	0.300	0.755	0.000	0.762	0.946
Cars	590	3	0	593	3	6	0	9	6	303	0	309	911
Cars %	96.4	100.0	0.0	96.4	100.0	100.0	0.0	100.0	100.0	94.7	0.0	94.8	95.9
Heavy Vehicles	22	0	0	22	0	0	0	0	0	17	0	17	39
Heavy Vehicles %	3.6	0.0	0.0	3.6	0.0	0.0	0.0	0.0	0.0	5.3	0.0	5.2	4.1
Cars Enter Leg	590	3	0	593	3	6	0	9	6	303	0	309	911
Heavy Enter Leg	22	0	0	22	0	0	0	0	0	17	0	17	39
Total Entering Leg	612	3	0	615	3	6	0	9	6	320	0	326	950
Cars Exiting Leg				306				9				596	911
Heavy Exiting Leg				17				0				22	39
Total Exiting Leg				323				9				618	950

PDI File #: **228830 B**
 Location: **S: Gulf (West Dr)**
 Location: **E: Ayer Road (Route 2A/110) W: Ayer Road (Route 2A/110)**
 City, State: **Littleton, MA**
 Client: **GPI/ C. Donaldson**
 Site Code: **NEX-2021267.00**
 Count Date: **Thursday, September 22, 2022**
 Start Time: **4:00 PM**
 End Time: **6:00 PM**
 Class:



Bicycles (on Roadway and Crosswalks)

	Ayer Road (Route 2A/110)						Gulf (West Dr)						Ayer Road (Route 2A/110)						Total
	from East						from South						from West						
	Thru	Left	U-Turn	CW-SB	CW-NB	Total	Right	Left	U-Turn	CW-WB	CW-EB	Total	Right	Thru	U-Turn	CW-NB	CW-SB	Total	
4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Approach %	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0		
Total %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Exiting Leg Total	0						0						0						0

Peak Hour Analysis from 04:00 PM to 06:00 PM begins at:

4:00 PM	Ayer Road (Route 2A/110)						Gulf (West Dr)						Ayer Road (Route 2A/110)						Total
	from East						from South						from West						
	Thru	Left	U-Turn	CW-SB	CW-NB	Total	Right	Left	U-Turn	CW-WB	CW-EB	Total	Right	Thru	U-Turn	CW-NB	CW-SB	Total	
4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Approach Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PHF	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Entering Leg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exiting Leg	0						0						0						0
Total	0						0						0						0

PDI File #: **228830 B**
 Location: **S: Gulf (West Dr)**
 Location: **E: Ayer Road (Route 2A/110) W: Ayer Road (Route 2A/110)**
 City, State: **Littleton, MA**
 Client: **GPI/ C. Donaldson**
 Site Code: **NEX-2021267.00**
 Count Date: **Thursday, September 22, 2022**
 Start Time: **4:00 PM**
 End Time: **6:00 PM**
 Class:



Pedestrians

	Ayer Road (Route 2A/110)						Gulf (West Dr)						Ayer Road (Route 2A/110)						Total
	from East						from South						from West						
	Thru	Left	U-Turn	CW-SB	CW-NB	Total	Right	Left	U-Turn	CW-WB	CW-EB	Total	Right	Thru	U-Turn	CW-NB	CW-SB	Total	
4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:15 PM	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
4:30 PM	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1
4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	2
5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	0	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	2
Approach %	0	0	0	50	50		0	0	0	0	0	0	0	0	0	0	0	0	
Total %	0	0	0	50	50	100	0	0	0	0	0	0	0	0	0	0	0	0	
Exiting Leg Total	2						0						0						2

Peak Hour Analysis from 04:00 PM to 06:00 PM begins at:

4:00 PM	Ayer Road (Route 2A/110)						Gulf (West Dr)						Ayer Road (Route 2A/110)						Total
	from East						from South						from West						
	Thru	Left	U-Turn	CW-SB	CW-NB	Total	Right	Left	U-Turn	CW-WB	CW-EB	Total	Right	Thru	U-Turn	CW-NB	CW-SB	Total	
4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:15 PM	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
4:30 PM	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1
4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	2
% Approach Total	0.0	0.0	0.0	50.0	50.0		0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	
PHF	0.000	0.000	0.000	0.250	0.250	0.500	0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.500
Entering Leg	0	0	0	1	1	2	0	0	0	0	0	0		0	0	0	0	0	2
Exiting Leg	2						0						0						2
Total	4						0						0						4

PDI File #: **228830 B**
 Location: **S: Gulf (West Dr)**
 Location: **E: Ayer Road (Route 2A/110) W: Ayer Road (Route 2A/110)**
 City, State: **Littleton, MA**
 Client: **GPI/ C. Donaldson**
 Site Code: **NEX-2021267.00**
 Count Date: **Saturday, September 24, 2022**
 Start Time: **11:00 AM**
 End Time: **2:00 PM**
 Class:



Cars and Heavy Vehicles (Combined)

	Ayer Road (Route 2A/110)				Gulf (West Dr)				Ayer Road (Route 2A/110)				Total
	from East				from South				from West				
	Thru	Left	U-Turn	Total	Right	Left	U-Turn	Total	Right	Thru	U-Turn	Total	
11:00 AM	75	2	0	77	2	0	0	2	3	70	0	73	152
11:15 AM	72	4	0	76	2	0	0	2	2	95	0	97	175
11:30 AM	87	0	0	87	0	0	0	0	2	69	0	71	158
11:45 AM	86	0	0	86	1	3	0	4	5	76	0	81	171
Total	320	6	0	326	5	3	0	8	12	310	0	322	656
12:00 PM	63	0	0	63	3	0	0	3	3	103	0	106	172
12:15 PM	85	0	0	85	1	0	0	1	4	93	0	97	183
12:30 PM	56	1	0	57	2	1	0	3	6	89	0	95	155
12:45 PM	57	3	0	60	0	5	0	5	2	85	0	87	152
Total	261	4	0	265	6	6	0	12	15	370	0	385	662
1:00 PM	84	1	0	85	0	1	0	1	0	110	0	110	196
1:15 PM	78	0	0	78	0	2	0	2	2	70	0	72	152
1:30 PM	85	1	0	86	3	1	0	4	3	102	0	105	195
1:45 PM	74	0	0	74	1	1	0	2	4	83	0	87	163
Total	321	2	0	323	4	5	0	9	9	365	0	374	706
Grand Total	902	12	0	914	15	14	0	29	36	1045	0	1081	2024
Approach %	98.7	1.3	0.0		51.7	48.3	0.0		3.3	96.7	0.0		
Total %	44.6	0.6	0.0	45.2	0.7	0.7	0.0	1.4	1.8	51.6	0.0	53.4	
Exiting Leg Total	1060				48				916				2024
Cars	875	12	0	887	14	14	0	28	35	1014	0	1049	1964
% Cars	97.0	100.0	0.0	97.0	93.3	100.0	0.0	96.6	97.2	97.0	0.0	97.0	97.0
Exiting Leg Total	1028				47				889				1964
Heavy Vehicles	27	0	0	27	1	0	0	1	1	31	0	32	60
% Heavy Vehicles	3.0	0.0	0.0	3.0	6.7	0.0	0.0	3.4	2.8	3.0	0.0	3.0	3.0
Exiting Leg Total	32				1				27				60

Peak Hour Analysis from 11:00 AM to 02:00 PM begins at:

1:00 PM	Ayer Road (Route 2A/110)				Gulf (West Dr)				Ayer Road (Route 2A/110)				Total
	from East				from South				from West				
	Thru	Left	U-Turn	Total	Right	Left	U-Turn	Total	Right	Thru	U-Turn	Total	
1:00 PM	84	1	0	85	0	1	0	1	0	110	0	110	196
1:15 PM	78	0	0	78	0	2	0	2	2	70	0	72	152
1:30 PM	85	1	0	86	3	1	0	4	3	102	0	105	195
1:45 PM	74	0	0	74	1	1	0	2	4	83	0	87	163
Total Volume	321	2	0	323	4	5	0	9	9	365	0	374	706
% Approach Total	99.4	0.6	0.0		44.4	55.6	0.0		2.4	97.6	0.0		
PHF	0.944	0.500	0.000	0.939	0.333	0.625	0.000	0.563	0.563	0.830	0.000	0.850	0.901
Cars	315	2	0	317	4	5	0	9	9	359	0	368	694
Cars %	98.1	100.0	0.0	98.1	100.0	100.0	0.0	100.0	100.0	98.4	0.0	98.4	98.3
Heavy Vehicles	6	0	0	6	0	0	0	0	0	6	0	6	12
Heavy Vehicles %	1.9	0.0	0.0	1.9	0.0	0.0	0.0	0.0	0.0	1.6	0.0	1.6	1.7
Cars Enter Leg	315	2	0	317	4	5	0	9	9	359	0	368	694
Heavy Enter Leg	6	0	0	6	0	0	0	0	0	6	0	6	12
Total Entering Leg	321	2	0	323	4	5	0	9	9	365	0	374	706
Cars Exiting Leg				363				11				320	694
Heavy Exiting Leg				6				0				6	12
Total Exiting Leg				369				11				326	706

PDI File #: **228830 B**
 Location: **S: Gulf (West Dr)**
 Location: **E: Ayer Road (Route 2A/110) W: Ayer Road (Route 2A/110)**
 City, State: **Littleton, MA**
 Client: **GPI/ C. Donaldson**
 Site Code: **NEX-2021267.00**
 Count Date: **Saturday, September 24, 2022**
 Start Time: **12:45 PM**
 End Time: **1:45 PM**
 Class:

Cars and Heavy Vehicles (Combined)

	Ayer Road (Route 2A/110)				Gulf (West Dr)				Ayer Road (Route 2A/110)				Total
	from East				from South				from West				
	Thru	Left	U-Turn	Total	Right	Left	U-Turn	Total	Right	Thru	U-Turn	Total	
12:45 PM	57	3	0	60	0	5	0	5	2	85	0	87	152
Total	261	4	0	265	6	6	0	12	15	370	0	385	662
1:00 PM	84	1	0	85	0	1	0	1	0	110	0	110	196
1:15 PM	78	0	0	78	0	2	0	2	2	70	0	72	152
1:30 PM	85	1	0	86	3	1	0	4	3	102	0	105	195
Total	321	2	0	323	4	5	0	9	9	365	0	374	706
Grand Total	582	6	0	588	10	11	0	21	24	735	0	759	1368
Approach %	99.0	1.0	0.0		47.6	52.4	0.0		3.2	96.8	0.0		
Total %	42.5	0.4	0.0	43.0	0.7	0.8	0.0	1.5	1.8	53.7	0.0	55.5	
Exiting Leg Total	745				30				593				1368
Cars	570	6	0	576	9	11	0	20	23	720	0	743	1339
% Cars	97.9	100.0	0.0	98.0	90.0	100.0	0.0	95.2	95.8	98.0	0.0	97.9	97.9
Exiting Leg Total	729				29				581				1339
Heavy Vehicles	12	0	0	12	1	0	0	1	1	15	0	16	29
% Heavy Vehicles	2.1	0.0	0.0	2.0	10.0	0.0	0.0	4.8	4.2	2.0	0.0	2.1	2.1
Exiting Leg Total	16				1				12				29

Peak Hour Analysis from 12:45 PM to 01:45 PM begins at:

12:45 PM	Ayer Road (Route 2A/110)				Gulf (West Dr)				Ayer Road (Route 2A/110)				Total
	from East				from South				from West				
	Thru	Left	U-Turn	Total	Right	Left	U-Turn	Total	Right	Thru	U-Turn	Total	
12:45 PM	57	3	0	60	0	5	0	5	2	85	0	87	152
1:00 PM	84	1	0	85	0	1	0	1	0	110	0	110	196
1:15 PM	78	0	0	78	0	2	0	2	2	70	0	72	152
1:30 PM	85	1	0	86	3	1	0	4	3	102	0	105	195
Total Volume	304	5	0	309	3	9	0	12	7	367	0	374	695
% Approach Total	98.4	1.6	0.0		25.0	75.0	0.0		1.9	98.1	0.0		
PHF	0.894	0.417	0.000	0.898	0.250	0.450	0.000	0.600	0.583	0.834	0.000	0.850	0.886
Cars	298	5	0	303	3	9	0	12	7	359	0	366	681
Cars %	98.0	100.0	0.0	98.1	100.0	100.0	0.0	100.0	100.0	97.8	0.0	97.9	98.0
Heavy Vehicles	6	0	0	6	0	0	0	0	0	8	0	8	14
Heavy Vehicles %	2.0	0.0	0.0	1.9	0.0	0.0	0.0	0.0	0.0	2.2	0.0	2.1	2.0
Cars Enter Leg	298	5	0	303	3	9	0	12	7	359	0	366	681
Heavy Enter Leg	6	0	0	6	0	0	0	0	0	8	0	8	14
Total Entering Leg	304	5	0	309	3	9	0	12	7	367	0	374	695
Cars Exiting Leg				362				12				307	681
Heavy Exiting Leg				8				0				6	14
Total Exiting Leg				370				12				313	695

PDI File #: **228830 B**
 Location: **S: Gulf (West Dr)**
 Location: **E: Ayer Road (Route 2A/110) W: Ayer Road (Route 2A/110)**
 City, State: **Littleton, MA**
 Client: **GPI/ C. Donaldson**
 Site Code: **NEX-2021267.00**
 Count Date: **Saturday, September 24, 2022**
 Start Time: **11:00 AM**
 End Time: **2:00 PM**



Bicycles (on Roadway and Crosswalks)

	Ayer Road (Route 2A/110)						Gulf (West Dr)						Ayer Road (Route 2A/110)						Total
	from East						from South						from West						
	Thru	Left	U-Turn	CW-SB	CW-NB	Total	Right	Left	U-Turn	CW-WB	CW-EB	Total	Right	Thru	U-Turn	CW-NB	CW-SB	Total	
11:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:30 PM	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
12:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
1:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Approach %	100.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0		
Total %	100.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Exiting Leg Total	0						0						1						1

Peak Hour Analysis from 11:00 AM to 02:00 PM begins at:

11:45 AM	Ayer Road (Route 2A/110)						Gulf (West Dr)						Ayer Road (Route 2A/110)						Total
	from East						from South						from West						
	Thru	Left	U-Turn	CW-SB	CW-NB	Total	Right	Left	U-Turn	CW-WB	CW-EB	Total	Right	Thru	U-Turn	CW-NB	CW-SB	Total	
11:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:30 PM	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Total Volume	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
% Approach Total	100.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0		
PHF	0.250	0.000	0.000	0.000	0.000	0.250	0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.250
Entering Leg	1	0	0	0	0	1	0	0	0	0	0	0		0	0	0	0	0	1
Exiting Leg	0						0						1						1
Total	1						0						1						2

PDI File #: **228830 B**
 Location: **S: Gulf (West Dr)**
 Location: **E: Ayer Road (Route 2A/110) W: Ayer Road (Route 2A/110)**
 City, State: **Littleton, MA**
 Client: **GPI/ C. Donaldson**
 Site Code: **NEX-2021267.00**
 Count Date: **Saturday, September 24, 2022**
 Start Time: **11:00 AM**
 End Time: **2:00 PM**
 Class:



Pedestrians

	Ayer Road (Route 2A/110)						Gulf (West Dr)						Ayer Road (Route 2A/110)						Total
	from East						from South						from West						
	Thru	Left	U-Turn	CW-SB	CW-NB	Total	Right	Left	U-Turn	CW-WB	CW-EB	Total	Right	Thru	U-Turn	CW-NB	CW-SB	Total	
11:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Approach %	0	0	0	0	0		0	0	0	0	0		0	0	0	0	0		
Total %	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Exiting Leg Total	0						0						0						0

Peak Hour Analysis from 11:00 AM to 02:00 PM begins at:

11:00 AM	Ayer Road (Route 2A/110)						Gulf (West Dr)						Ayer Road (Route 2A/110)						Total
	from East						from South						from West						
	Thru	Left	U-Turn	CW-SB	CW-NB	Total	Right	Left	U-Turn	CW-WB	CW-EB	Total	Right	Thru	U-Turn	CW-NB	CW-SB	Total	
11:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Approach Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PHF	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Entering Leg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exiting Leg	0						0						0						0
Total	0						0						0						0

TRAFFIC-VOLUME ADJUSTMENT DATA

ADT by Day of Week by Month for 1/1/2017 - 12/31/2017
Criteria: Location ID = 4091, From 1/1/1900 To 12/31/2049 12:00:00 AM

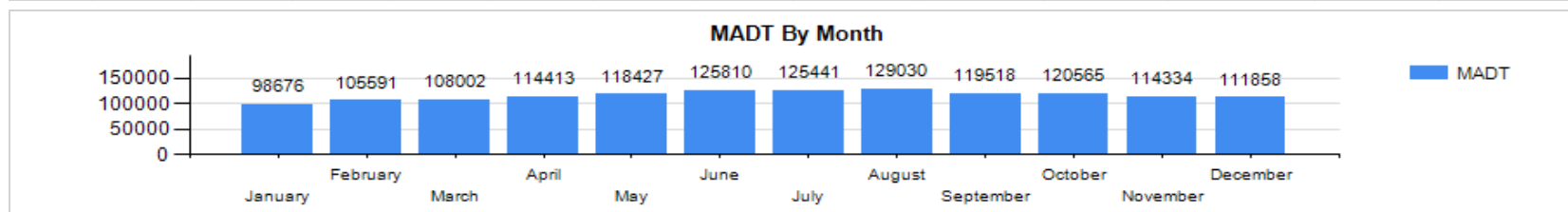
District
Community Littleton
County Middlesex
Factor Group U1-Boston

Location ID 4091
Direction 2-WAY
RoadBed ML

Located On INTERSTATE 495
AADT 116569
Collection Type HPMS
Functional Class (1) Interstate

	Average Daily Number of Vehicles							Avg. Day (Mon-Sun)	Avg. Day as % of Year Avg.	Avg. Weekday (Mon-Thu)	Avg. Day as % of Avg. Weekday (Mon-Thu)	Avg. Weekday (Mon-Fri)	Avg. Day as % of Avg. Weekday (Mon-Fri)	Avg. Day (Mon-Sat)
	Sun	Mon	Tue	Wed	Thu	Fri	Sat							
JAN	76,551	105,521	102,472	104,347	113,342	113,955	74,550	98,676	85.09%	106,421	92.72%	107,927	91.43%	102,365
FEB			83,367	115,822		117,584		105,591	91.05%	99,595	106.02%	105,591	100.00%	105,591
MAR	86,577	108,317	112,340	116,294	123,526	117,137	91,828	108,002	93.13%	115,119	93.82%	115,523	93.49%	111,574
APR	96,513	114,942	117,870	119,532	125,826	127,528	98,683	114,413	98.66%	119,543	95.71%	121,140	94.45%	117,397
MAY	98,872	111,949	122,236	125,460	130,355	132,246	107,874	118,427	102.12%	122,500	96.68%	124,449	95.16%	121,687
JUN	111,934	126,154	125,843	131,011	136,909	136,214	112,609	125,810	108.48%	129,979	96.79%	131,226	95.87%	128,123
JUL	112,831	123,279	115,749	132,242	136,051	137,647	120,296	125,441	108.16%	126,830	98.90%	128,994	97.25%	127,544
AUG	115,319	131,049	128,881	131,177	138,386	138,782	119,624	129,030	111.26%	132,373	97.47%	133,655	96.54%	131,317
SEP	103,686	112,799	122,145	121,300	129,730	137,495	109,474	119,518	103.06%	121,494	98.37%	124,694	95.85%	122,157
OCT	105,178	117,322	121,146	121,194	127,360	137,235	114,523	120,565	103.96%	121,756	99.02%	124,851	96.57%	123,130
NOV	95,435	115,822	123,355	120,123	121,275	121,325	103,011	114,334	98.59%	120,144	95.16%	120,380	94.98%	117,485
DEC	83,555	115,748	112,568	124,485	132,270	128,467	85,919	111,858	96.45%	121,268	92.24%	122,708	91.16%	116,576
Year	98,768	116,627	115,664	121,916	128,639	128,801	103,490	115,972		119,752	96.84%	121,761	95.25%	118,745

-2.8%



NOTE: VALUES ARE ROUNDED; TOTALS AND PERCENTS MAY NOT ADD UP.

TRAFFIC IMPACT AND ACCESS STUDY

Retail Motor Fuel Outlet – Littleton, Massachusetts

MASSDOT CRASH RATE WORKSHEETS

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Littleton COUNT DATE : Sep-22

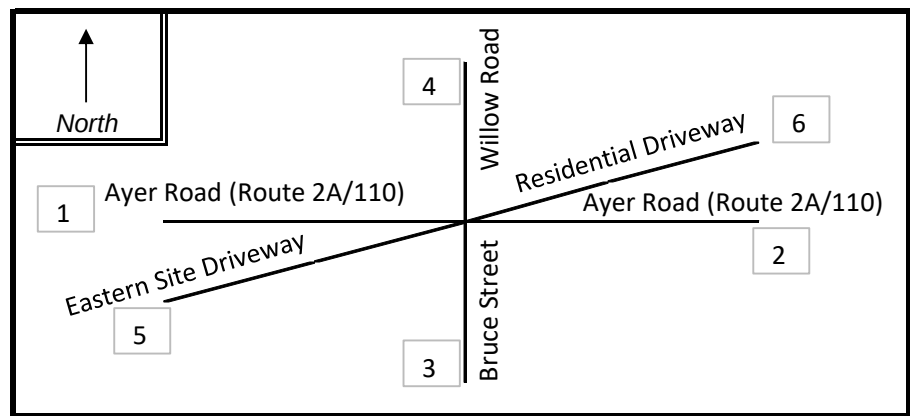
DISTRICT : 3 UNSIGNALIZED : ☐ SIGNALIZED : ☒

~ INTERSECTION DATA ~

MAJOR STREET : Ayer Road (Route 2A/110)

MINOR STREET(S) : Willow Road, Bruce Street, Eastern Site Driveway, Residential Driveway

**INTERSECTION
DIAGRAM**
(Label Approaches)



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	6	Total Peak Hourly Approach Volume
DIRECTION :	EB	WB	NB	SB	NEB	SWB	
PEAK HOURLY VOLUMES (AM/PM) :	324	659	128	140	5	0	1,256

" K " FACTOR :

0.089

INTERSECTION ADT (V) = TOTAL DAILY
APPROACH VOLUME :

14,112

TOTAL # OF CRASHES :

35

OF
YEARS :

5

AVERAGE # OF
CRASHES PER YEAR (A) :

7.00

CRASH RATE CALCULATION :

1.36

$$\text{RATE} = \frac{(A * 1,000,000)}{(V * 365)}$$

Comments : Thursday PM volumes used

Project Title & Date : NEX-2021267.00 Littleton - Retail Motor Fuel Outlet

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Littleton COUNT DATE : Sep-22

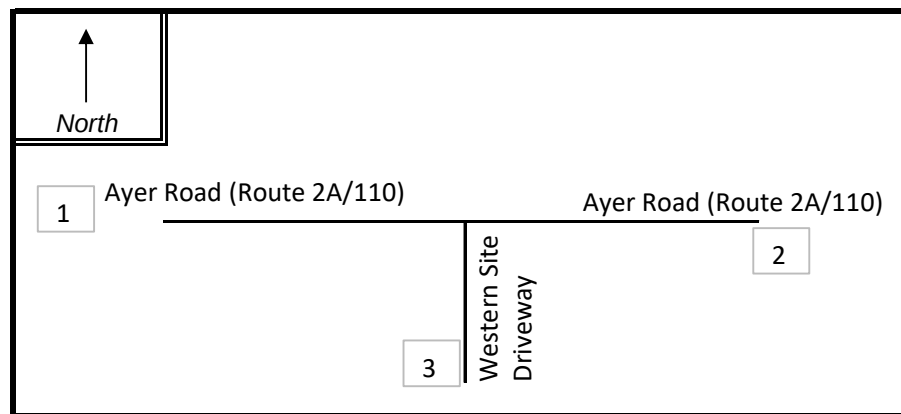
DISTRICT : 3 UNSIGNALIZED : ☒ SIGNALIZED : ☐

~ INTERSECTION DATA ~

MAJOR STREET : Ayer Road (Route 2A/110)

MINOR STREET(S) : Western Site Driveway

INTERSECTION
DIAGRAM
(Label Approaches)



PEAK HOUR VOLUMES

APPROACH :	1	2	3	Total Peak Hourly Approach Volume
DIRECTION :	EB	WB	NB	
PEAK HOURLY VOLUMES (AM/PM) :	327	624	9	960

" K " FACTOR : **0.089**

INTERSECTION ADT (V) = TOTAL DAILY
APPROACH VOLUME :

10,787

TOTAL # OF CRASHES :

4

OF
YEARS :

5

AVERAGE # OF
CRASHES PER YEAR (A) :

0.80

CRASH RATE CALCULATION :

0.20

$$\text{RATE} = \frac{(A * 1,000,000)}{(V * 365)}$$

Comments : Thursday PM volumes used

Project Title & Date : NEX-2021267.00 Littleton - Retail Motor Fuel Outlet

SIGHT DISTANCE CALCULATIONS

AASHTO Recommended Sight Distance Summary (Passenger Vehicles)

LOCATION: Ayer Road at Western Site Driveway

Side Street Direction: NB
 Number of Lanes on Mainline = 3
 Median Width (Feet) = 0

STOPPING SIGHT DISTANCE

Mainline Direction: EB
 85th Percentile Speed (V) = 45 MPH
 Grade (G) = -0.4%
 Apply Grade Adjustment No
 Brake Reaction Time (T) = 2.5 seconds
 Deceleration Rate (A) = 11.2 ft/s²
 $SSD = 1.47 V * T + 1.075 V^2 / A = 360 \text{ FT}$
SSD = 360 FT

Mainline Direction: WB
 85th Percentile Speed (V) = 45 MPH
 Grade (G) = 0.4%
 Apply Grade Adjustment No
 Brake Reaction Time (T) = 2.5 seconds
 Deceleration Rate (A) = 11.2 ft/s²
 $SSD = 1.47 V * T + 1.075 V^2 / A = 358 \text{ FT}$
SSD = 360 FT

INTERSECTION SIGHT DISTANCE

RIGHT TURN FROM STOP: West of Driveway
 Posted Speed (V) = 45 MPH
 Minor Street Approach Grade (G) = 0.0%
 Apply Grade Adjustment No
 Time Gap (t_g) = 6.5 seconds
 $ISD (\text{Right Turn from Stop}) = 1.47 * t_g * V = 430 \text{ FT}$
ISD (Right Turn from Stop) = 430 FT

LEFT TURN FROM STOP: East of Driveway
 Posted Speed (V) = 45 MPH
 Minor Street Approach Grade (G) = 0.0%
 Apply Grade Adjustment No
 Time Gap (t_g) = 8 seconds
 $ISD (\text{Left Turn from Stop}) = 1.47 * t_g * V = 530 \text{ FT}$
ISD (Left Turn from Stop) = 530 FT

MASSDOT IMPROVEMENT PROJECT PLANS

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	31	78
PROJECT FILE NO.		608443	

308443 TR1(SIGN & PVMT MARKS) DWG Plotted on 28-Jun-2022 9:34 AM

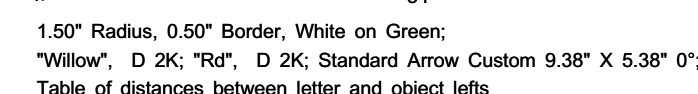


STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	32	78
PROJECT FILE NO.		608443	

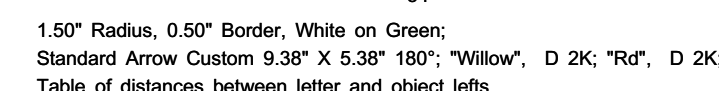
308443 TR1(SIGN & PVMT MARKS) DWG Plotted on 28-Jun-2022 9:34 AM



STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	34	78
PROJECT FILE NO.		608443	



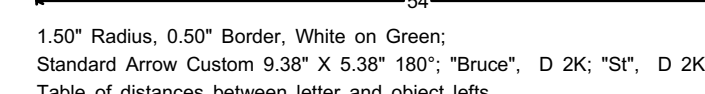
4.64	W	i	l	l	o	w	R	d	⇒	2.64
------	---	---	---	---	---	---	---	---	---	------



2.64	13.38	6.12	2.16	2.16	1.92	4.14	11.28	3.16	2.40	4.6
------	-------	------	------	------	------	------	-------	------	------	-----

1.50" Radius, 0.50" Border, White on Green;
"Bruce", D 2K; "St", D 2K; Standard Arrow Custom 9.38" X 5.38" 0";
Table of distances between letter and object left

6.76	B	r	u	c	e	S	t	→	4.76
------	---	---	---	---	---	---	---	---	------

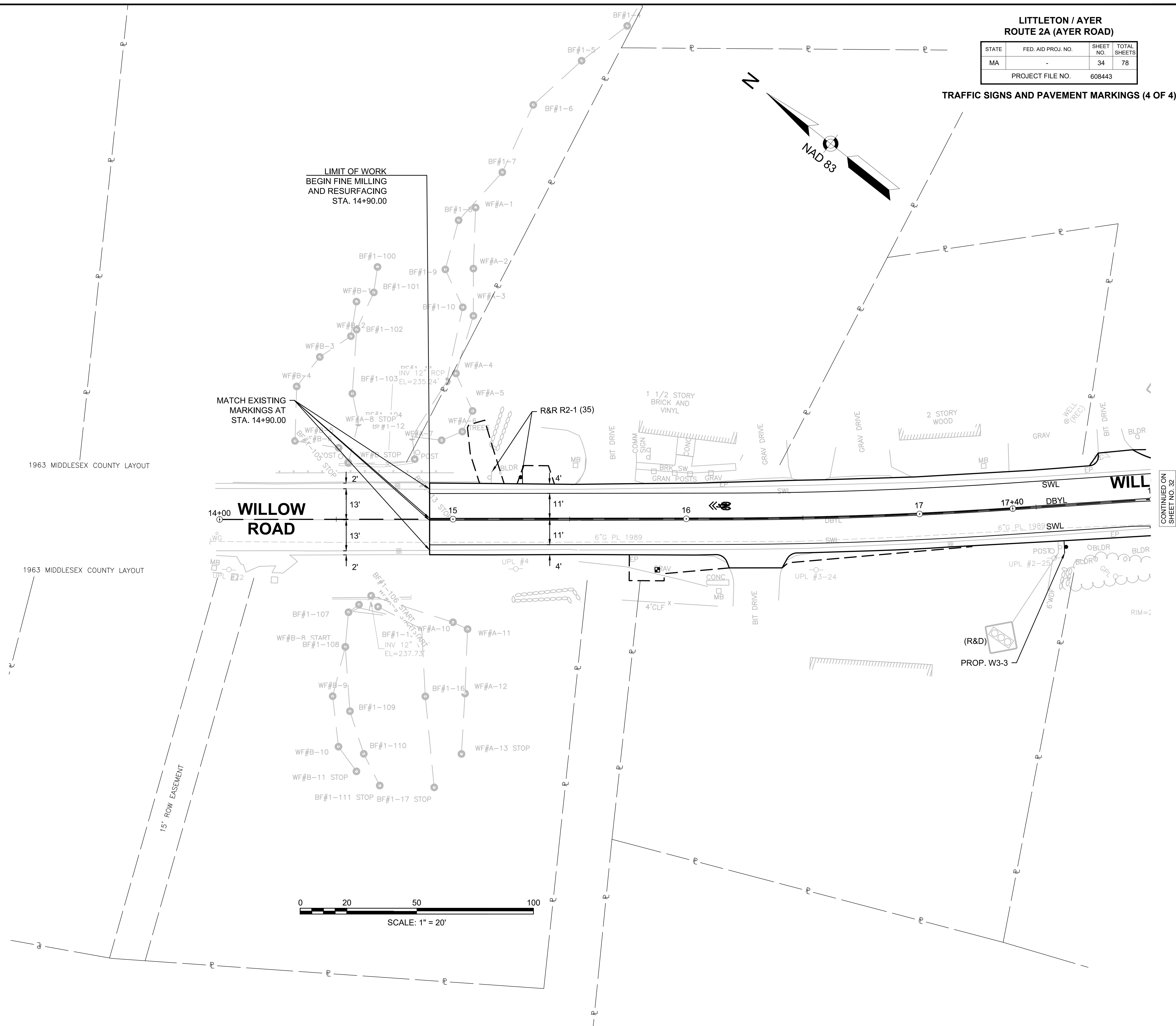


4.76	←	B	r	u	c	e	S	t	6.7
------	---	---	---	---	---	---	---	---	-----

1.50" Radius, 0.50" Border, White on Green;
[Ayer] D 2K; [Rd] D 2K;
Table of distances between letter and object lefts.

6.7	A	y	e	r	R	d	6.7
5.4		5.0	4.4	8.2	3.2	2.4	

MA-D3-1_3 DETAIL
NOT TO SCALE

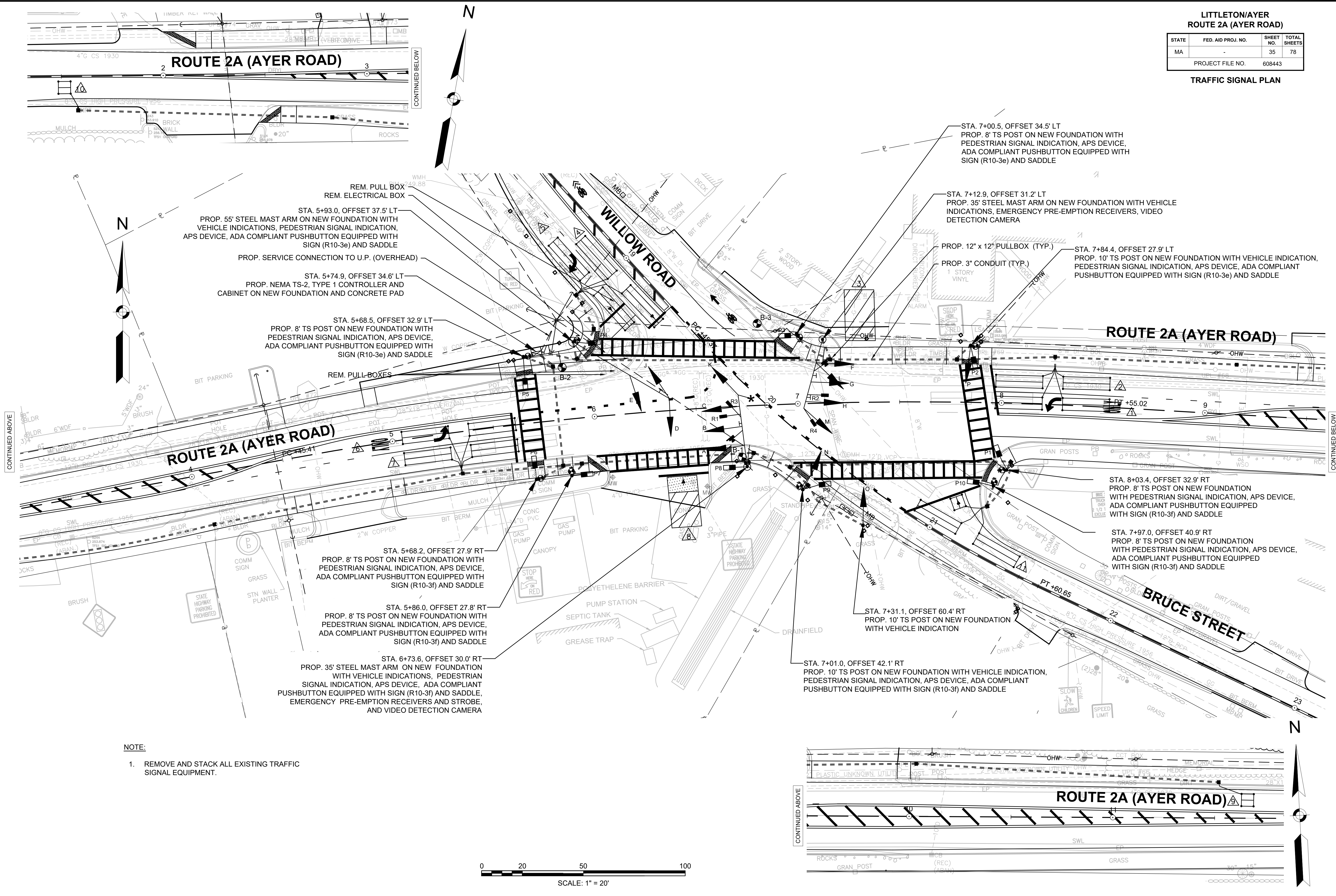


CONTINUED ON PAGE 100

LITTLETON/AYER
ROUTE 2A (AYER ROAD)

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	35	78
PROJECT FILE NO.		608443	

TRAFFIC SIGNAL PLAN



LITTLETON/AYER
ROUTE 2A (AYER ROAD)

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	36	78
PROJECT FILE NO. 608443			
SIGNAL TIMING SEQUENCING			

LOOP DETECTOR DATA

DETECTOR NUMBER	LOOP SIZE	Ø CALLED	Ø EXT.	MODE A=PULSE B=PRES.	DELAY TIME	EXT. TIME
1	6'X23'	6	6	B	0	-
2	6'X23'	6	6	B	0	-
4	6'X23'	7	7	B	0	-
5	6'X23'	4	4	B	0	-
6	6'X23'	5	5	B	0	-
7	6'X23'	2	2	B	0	-
9	6'X6'	-	6	A	0	3
10	6'X6'	-	2 & 5	A	0	3
11	6'X23'	8	8	B	0	-

VIDEO DETECTION DATA

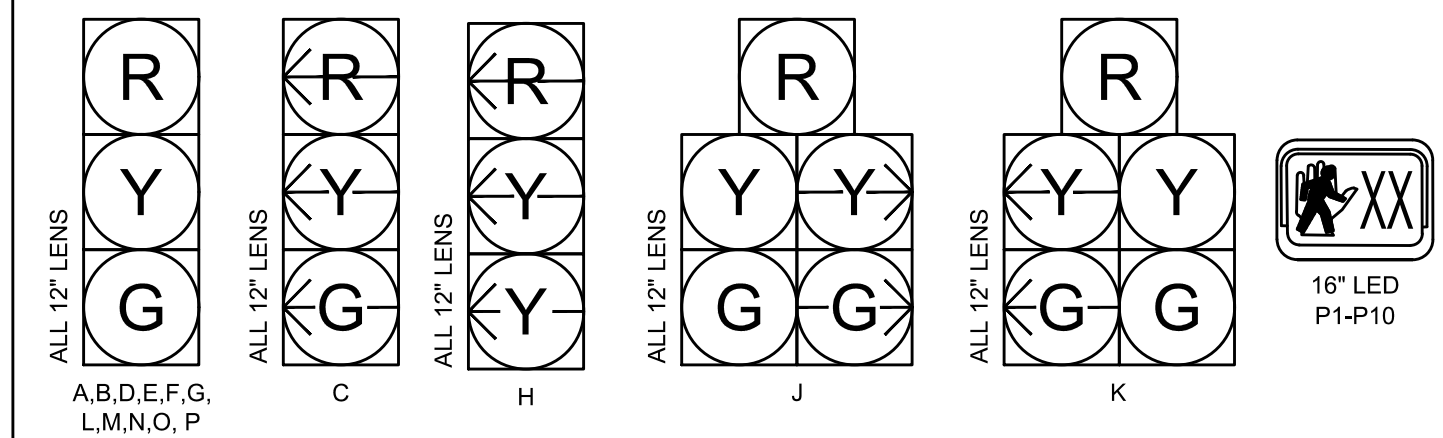
DETECTOR NUMBER	Ø CALLED	Ø EXT.	OPERATIONS	DELAY TIME	EXT. TIME
3	10	10	PRESENCE	-	-
8	11	11	PRESENCE	-	-

MAJOR ITEMS REQUIRED

PAY ITEM	QUANTITY	ITEM
816.01	1	SERVICE CONNECTION (OVERHEAD)
	1	ATC CONTROLLER, CAB. & FDN
	2	35 FT. GALV. STEEL MAST ARM ASSEMBLY, BASE & FDN
	1	55 FT. GALV. STEEL MAST ARM ASSEMBLY, BASE & FDN
	6	8 FT. PEDESTRIAN SIGNAL POST, BASE & FDN
	3	10 FT. SIGNAL POST, BASE & FDN
	14	12 INCH 1 WAY 3-SECTION LED VEHICLE SIGNAL INDICATION
	1	12 INCH 1 WAY 5-SECTION LED VEHICLE SIGNAL INDICATION
	10	16 INCH LED PEDESTRIAN SIGNAL INDICATION WITH COUNTDOWN
	10	APS DEVICE, SIGN (R10-3f) & SADDLE
	1	PREEMPTION PHASE SELECTOR MODULE-FOUR CHANNEL
	1	PREEMPTION CARD RACK
	1	EMERGENCY PRE-EMPTION CONFIRMATION STROBE LIGHT
	4	EMERGENCY PRE-EMPTION RECEIVER (DETECTOR) - ONE WAY
	2	VIDEO DETECTION CAMERA
	16	WIRE LOOP INSTALLED IN ROADWAY

PLUS ALL NECESSARY DUCT, CABLE, LABOR, MISCELLANEOUS MATERIAL AND EQUIPMENT TO COMPLETE THE INSTALLATION OF A FULLY OPERATIONAL SIGNAL SYSTEM AS INTENDED ON THESE PLANS

SIGNAL IDENTIFICATION



- NOTES:
- ALL VEHICLE LENSES SHALL BE LED TYPE.
 - ALL VEHICLE SIGNAL HEADS SHALL BE 12 INCHES.
 - ALL HOUSINGS TO BE PROVIDED WITH TUNNEL VISORS AND 5-INCH NON-GLAUVERED BACKPLATES WITH 3-INCH YELLOW RETROREFLECTIVE BORDER.
 - ALL HOUSINGS TO BE FIXED MOUNTED.

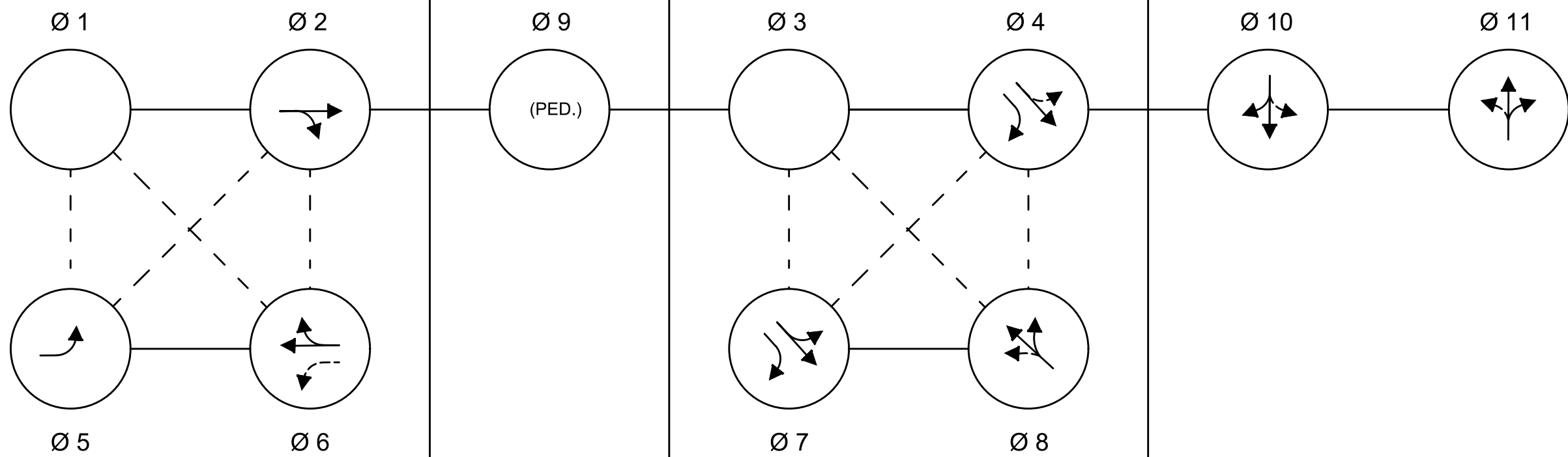
SEQUENCE & TIMING FOR FULL ACTUATED CONTROL WILLOW ROAD / BRUCE STREET AT ROUTE 2A (AYER ROAD)			INTERVALS																											FLASHING OPERATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
APPROACH			DIRECTION	HOUSINGS																												FY																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
ROUTE 2A (AYER ROAD)			EB	A, B	G	Y	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R

- NOTES:
- STANDARD NEMA CLEARANCES SHALL APPLY.
 - MAXIMUM GREEN 1 SHALL BE IN EFFECT ON WEEKDAYS FROM 6AM TO 9AM.
 - MAXIMUM GREEN 2 SHALL BE IN EFFECT ON WEEKDAYS FROM 3PM TO 6PM.
 - PREEMPTION MINIMUM GREENS SHALL BE SIX SECONDS.
 - EMERGENCY VEHICLE PREEMPTION SHALL BE ACTUATED BY AN OPTICAL SIGNAL FROM AN OPTICAL EMITTER MOUNTED ON AN EMERGENCY VEHICLE AND RECEIVED BY AN OPTICAL DETECTOR LOCATED AT INTERSECTION. A SEPARATE RECEIVING DETECTOR IS REQUIRED FOR EACH DETECTED APPROACH.
 - NORMAL CLEARANCES SHALL BE PROVIDED ON PHASES THAT ARE TERMINATED BY PREEMPTION DEMAND.
 - PEDESTRIAN PHASE SHOULD ONLY BE SERVED UPON PEDESTRIANS' PUSHBUTTON ACTIVATION.

FIRE PRE-EMPTION SCHEDULE				
RECEIVER AND PRIORITY	PRE-EMPT PHASE ASSIGNMENT	APPROACH AND MOVEMENT	VEHICLE PHASE ASSIGNMENT	NEXT PHASE CALLED
R1	2	EB	Ø 2 + Ø 5	Ø 2 + Ø 6
R2	1	WB	Ø 6	Ø 2 + Ø 6
R3	4	SEB	Ø 4 + Ø 7	Ø 4 + Ø 8
R4	3	NWB	Ø 8	Ø 4 + Ø 8

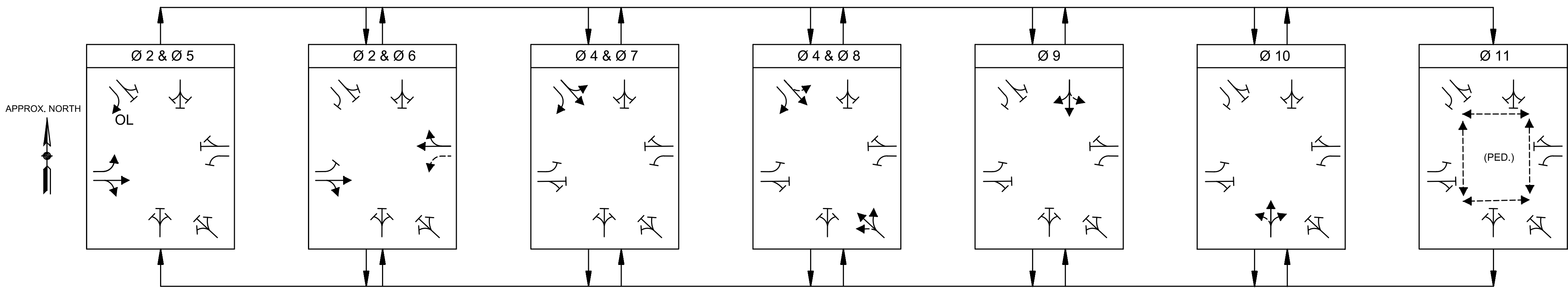
- NOTES:
- EMERGENCY VEHICLE PRE-EMPTION SIGNALS SHALL BE OPTICALLY TRANSMITTED BY OPTICAL EMITTERS MOUNTED IN EMERGENCY VEHICLES AND RECEIVED BY OPTICAL RECEIVERS LOCATED AT THE INTERSECTION.
 - PRE-EMPTION SIGNALS SHALL BE SERVICED ON A PRIORITY BASIS WITH RECEIVERS ASSIGNED DESCENDING PRIORITIES AS FOLLOWS: (R1, R2, R3, THEN R4)
 - MINIMUM GREEN, NORMAL VEHICLE AND PEDESTRIAN CLEARANCE SHALL BE PROVIDED ON PHASES THAT ARE TO BE TERMINATED BY PRE-EMPTION DEMAND.
 - ONCE PRE-EMPTION TERMINATES THE SIGNAL WILL RETURN TO PHASE SHOWN IN COLUMN "NEXT PHASE CALLED" TO RESUME NORMAL OPERATION.

DUAL RING PHASING NOTES:



- PHASES ASSOCIATED BY A SOLID LINE SHALL NOT OPERATE CONCURRENTLY.
- PHASES ASSOCIATED BY A DASHED LINE MAY OPERATE CONCURRENTLY.
- THROUGH MOVEMENTS MAY INCLUDE RIGHT TURNS.
- IF THE ASSIGNED RIGHT OF WAY FOR ANY TRAFFIC MOVEMENT IS TO REMAIN IN EFFECT DURING THE NEXT CALLED PHASE, THE SIGNAL INDICATIONS FOR THAT TRAFFIC MOVEMENT SHALL NOT CHANGE DURING THE CHANGE INTERVAL(S) UNLESS OTHERWISE NOTED.

PREFERENTIAL PHASING SEQUENCE



TRIP-GENERATION CALCULATIONS

Existing Site

1,983 SF

9 VFPS

Proposed Site

6,000 SF

12 VFPS

		Existing		Proposed	Additional		
		LUC 945	Counts	LUC 945	Total	Pass-By	New
Weekday Daily							
	In	694	--	2,101	1,407	1,055	352
	<u>Out</u>	<u>694</u>	--	<u>2,101</u>	<u>1,407</u>	<u>1,055</u>	<u>352</u>
	Total	1,388	--	4,202	2,814	2,110	704
Weekday AM							
	In	56	24	169	145	111	34
	<u>Out</u>	<u>56</u>	<u>24</u>	<u>170</u>	<u>146</u>	<u>111</u>	<u>35</u>
	Total	112	48	339	291	222	69
Weekday PM							
	In	54	15	163	148	112	36
	<u>Out</u>	<u>54</u>	<u>14</u>	<u>164</u>	<u>150</u>	<u>112</u>	<u>38</u>
	Total	108	29	327	298	224	74
Saturday Daily							
	In	694	--	2,100	1,406	1,055	351
	<u>Out</u>	<u>694</u>	--	<u>2,100</u>	<u>1,406</u>	<u>1,055</u>	<u>351</u>
	Total	1,388	--	4,200	2,812	2,110	702
SAT Midday							
	In	63	17	192	175	131	44
	<u>Out</u>	<u>64</u>	<u>20</u>	<u>193</u>	<u>173</u>	<u>131</u>	<u>42</u>
	Total	127	37	385	348	262	86

*Traffic Counts from September 2022 used instead of ITE Estimates for peak hours.

LUC 945 Pass-By	
Weekday	75%
AM	76%
PM	75%
Saturday	75%
SAT	75%

Institute of Transportation Engineers (ITE)

Land Use Code (LUC) 945 - Convenience Store/Gas Station

Subcategory: VFP (9-15vfps)

General Urban/Suburban

Average Vehicle Trips Ends vs: 1,000 Sq. Feet Gross Floor Area

Independent Variable (X): 1.983

AVERAGE WEEKDAY DAILY

$$T = 700.43 * (X)$$

$$T = 700.43 * 1.983$$

$$T = 1388.95$$

$$T = 1,388 \text{ vehicle trips}$$

with 50% (694 vpd) entering and 50% (694 vpd) exiting.

WEEKDAY MORNING PEAK HOUR OF ADJACENT STREET TRAFFIC

$$T = 56.52 * (X)$$

$$T = 56.52 * 1.983$$

$$T = 112.08$$

$$T = 112 \text{ vehicle trips}$$

with 50% (56 vph) entering and 50% (56 vph) exiting.

WEEKDAY EVENING PEAK HOUR OF ADJACENT STREET TRAFFIC

$$T = 54.52 * (X)$$

$$T = 54.52 * 1.983$$

$$T = 108.11$$

$$T = 108 \text{ vehicle trips}$$

with 50% (54 vph) entering and 50% (54 vph) exiting.

SATURDAY DAILY

$$T = 700.00 * (X)$$

$$T = 700.00 * 1.983$$

$$T = 1388.10$$

$$T = 1,388 \text{ vehicle trips}$$

with 50% (694 vpd) entering and 50% (694 vpd) exiting.

SATURDAY PEAK HOUR OF GENERATOR

$$T = 64.13 * (X)$$

$$T = 64.13 * 1.983$$

$$T = 127.17$$

$$T = 127 \text{ vehicle trips}$$

with 50% (63 vph) entering and 50% (64 vph) exiting.

Institute of Transportation Engineers (ITE)

Land Use Code (LUC) 945 - Convenience Store/Gas Station

Subcategory: VFP (9-15vfps)

General Urban/Suburban

Average Vehicle Trips Ends vs: 1,000 Sq. Feet Gross Floor Area

Independent Variable (X): 6.000

AVERAGE WEEKDAY DAILY

$$T = 700.43 * (X)$$

$$T = 700.43 * 6.000$$

$$T = 4202.58$$

$$T = 4,202 \text{ vehicle trips}$$

with 50% (2,101 vpd) entering and 50% (2,101 vpd) exiting.

WEEKDAY MORNING PEAK HOUR OF ADJACENT STREET TRAFFIC

$$T = 56.52 * (X)$$

$$T = 56.52 * 6.000$$

$$T = 339.12$$

$$T = 339 \text{ vehicle trips}$$

with 50% (169 vph) entering and 50% (170 vph) exiting.

WEEKDAY EVENING PEAK HOUR OF ADJACENT STREET TRAFFIC

$$T = 54.52 * (X)$$

$$T = 54.52 * 6.000$$

$$T = 327.12$$

$$T = 327 \text{ vehicle trips}$$

with 50% (163 vph) entering and 50% (164 vph) exiting.

SATURDAY DAILY

$$T = 700.00 * (X)$$

$$T = 700.00 * 6.000$$

$$T = 4200.00$$

$$T = 4,200 \text{ vehicle trips}$$

with 50% (2,100 vpd) entering and 50% (2,100 vpd) exiting.

SATURDAY PEAK HOUR OF GENERATOR

$$T = 64.13 * (X)$$

$$T = 64.13 * 6.000$$

$$T = 384.78$$

$$T = 385 \text{ vehicle trips}$$

with 50% (192 vph) entering and 50% (193 vph) exiting.

Vehicle Pass-By Rates by Land Use

Source: ITE *Trip Generation Manual*, 11th Edition

Land Use Code	945									
Land Use	Convenience Store/Gas Station									
Setting	General Urban/Suburban									
Time Period	Weekday AM Peak Period									
# Data Sites	16 Sites with between 2 and 8 VFP					28 Sites with between 9 and 20 VFP				
Average Pass-By Rate	60% for Sites with between 2 and 8 VFP					76% for Sites with between 9 and 20 VFP				
	Pass-By Characteristics for Individual Sites									
						Non-Pass-By Trips			Adj Street Peak	
GFA (000)	VFP	State or Province	Survey Year	# Interviews	Pass-By Trip (%)	Primary (%)	Diverted (%)	Total (%)	Hour Volume	Source
2	8	Maryland	1992	46	87	13	0	13	2235	25
2.1	6	Maryland	1992	26	58	23	19	42	2080	25
2.1	6	Maryland	1992	26	58	23	19	42	2080	25
2.2	8	Maryland	1992	31	47	34	19	53	1785	25
2.2	< 8	Indiana	1993	79	56	6	38	44	635	2
2.2	8	Maryland	1992	35	78	9	13	22	7080	25
2.3	6	Maryland	1992	37	32	41	27	68	2080	25
2.3	< 8	Kentucky	1993	58	64	5	31	36	1255	2
2.3	6	Maryland	1992	37	32	41	27	68	2080	25
2.4	< 8	Kentucky	1993	—	48	17	35	52	1210	2
2.6	< 8	Kentucky	1993	—	72	15	13	28	940	2
2.8	< 8	Kentucky	1993	—	54	11	35	46	1240	2
3	< 8	Indiana	1993	62	74	10	16	26	790	2
3.6	< 8	Kentucky	1993	49	67	4	29	33	1985	2
3.7	< 8	Kentucky	1993	49	66	16	18	34	990	2
4.694	12	Maryland	2000	—	72	—	—	28	2440	30
4.694	12	Maryland	2000	—	78	—	—	22	1561	30
4.694	12	Maryland	2000	—	79	—	—	21	2764	30
4.848	12	Virginia	2000	—	55	—	—	45	1398	30
5.06	12	Pennsylvania	2000	—	84	—	—	16	3219	30
5.242	12	Virginia	2000	—	74	—	—	26	1160	30
5.242	12	Virginia	2000	—	71	—	—	29	548	30
5.488	12	Delaware	2000	—	80	—	—	20	—	30
5.5	12	Pennsylvania	2000	—	85	—	—	15	2975	30
4.2	< 8	Kentucky	1993	47	62	19	19	38	1705	2
4.694	16	Maryland	2000	—	90	—	—	10	2278	30
4.694	16	Delaware	2000	—	74	—	—	26	2185	30
4.694	16	Delaware	2000	—	58	—	—	42	962	30
4.694	16	Delaware	2000	—	84	—	—	16	2956	30
4.694	16	New Jersey	2000	—	79	—	—	21	1859	30
4.694	20	Delaware	2000	—	84	—	—	16	3864	30
4.848	16	Virginia	2000	—	68	—	—	32	2106	30
4.848	16	Virginia	2000	—	85	—	—	15	2676	30
4.848	16	Virginia	2000	—	75	—	—	25	3244	30
4.848	16	Virginia	2000	—	71	—	—	29	1663	30
4.993	16	Pennsylvania	2000	—	75	—	—	25	1991	30
5.094	16	New Jersey	2000	—	86	—	—	14	1260	30
5.5	16	Pennsylvania	2000	—	82	—	—	18	1570	30
5.543	16	Pennsylvania	2000	—	84	—	—	16	1933	30
5.565	16	Pennsylvania	2000	—	77	—	—	23	2262	30
5.565	16	Pennsylvania	2000	—	68	—	—	32	2854	30
5.565	16	New Jersey	2000	—	58	—	—	42	1253	30
5.565	16	New Jersey	2000	—	79	—	—	21	1928	30
5.565	16	New Jersey	2000	---	84	---	---	16	1953	30

Vehicle Pass-By Rates by Land Use										
Source: ITE Trip Generation Manual , 11th Edition										
Land Use Code	945									
Land Use	Convenience Store/Gas Station									
Setting	General Urban/Suburban									
Time Period	Weekday PM Peak Period									
# Data Sites	12 Sites with between 2 and 8 VFP					28 Sites with between 9 and 20 VFP				
Average Pass-By Rate	56% for Sites with between 2 and 8 VFP					75% for Sites with between 9 and 20 VFP				
	Pass-By Characteristics for Individual Sites									
GFA (000)	VFP	State or Province	Survey Year	# Interviews	Pass-By Trip (%)	Non-Pass-By Trips			Adj Street Peak	
						Primary (%)	Diverted (%)	Total (%)	Hour Volume	Source
2.1	8	Maryland	1992	31	52	13	35	48	1785	25
2.1	6	Maryland	1992	30	53	20	27	47	1060	25
2.2	< 8	Indiana	1993	115	48	16	36	52	820	2
2.3	< 8	Kentucky	1993	67	57	16	27	43	1954	2
2.3	6	Maryland	1992	55	40	11	49	60	2760	25
2.4	< 8	Kentucky	1993	—	58	13	29	42	2655	2
2.6	< 8	Kentucky	1993	68	67	15	18	33	950	2
2.8	< 8	Kentucky	1993	—	62	11	27	38	2875	2
3	< 8	Indiana	1993	80	65	15	20	35	1165	2
3.6	< 8	Kentucky	1993	60	56	17	27	44	2505	2
3.7	< 8	Kentucky	1993	70	61	16	23	39	2175	2
4.2	< 8	Kentucky	1993	61	58	26	16	42	2300	2
4.694	12	Maryland	2000	—	78	—	—	22	3549	30
4.694	12	Maryland	2000	—	67	—	—	33	2272	30
4.694	12	Maryland	2000	—	66	—	—	34	3514	30
4.848	12	Virginia	2000	—	71	—	—	29	2350	30
5.06	12	Pennsylvania	2000	—	91	—	—	9	4181	30
5.242	12	Virginia	2000	—	70	—	—	30	2445	30
5.242	12	Virginia	2000	—	56	—	—	44	950	30
5.488	12	Delaware	2000	—	73	—	—	27	—	30
5.5	12	Pennsylvania	2000	—	84	—	—	16	4025	30
4.694	16	Maryland	2000	—	89	—	—	11	2755	30
4.694	16	Delaware	2000	—	73	—	—	27	1858	30
4.694	16	Delaware	2000	—	59	—	—	41	1344	30
4.694	16	Delaware	2000	—	72	—	—	28	3434	30
4.694	16	New Jersey	2000	—	81	—	—	19	1734	30
4.694	20	Delaware	2000	—	76	—	—	24	1616	30
4.848	16	Virginia	2000	—	67	—	—	33	2.954	30
4.848	16	Virginia	2000	—	78	—	—	22	3086	30
4.848	16	Virginia	2000	—	83	—	—	17	4143	30
4.848	16	Virginia	2000	—	73	—	—	27	2534	30
4.993	16	Pennsylvania	2000	—	72	—	—	28	2917	30
5.094	16	New Jersey	2000	—	86	—	—	14	1730	30
5.5	16	Pennsylvania	2000	—	90	—	—	10	2616	30
5.543	16	Pennsylvania	2000	—	87	—	—	13	2363	30
5.565	16	Pennsylvania	2000	—	81	—	—	19	2770	30
5.565	16	Pennsylvania	2000	—	76	—	—	24	3362	30
5.565	16	New Jersey	2000	—	61	—	—	39	1713	30
5.565	16	New Jersey	2000	—	86	—	—	14	1721	30
5.565	16	New Jersey	2000	---	81	---	---	19	2227	30

CAPACITY ANALYSIS METHODOLOGY

CAPACITY ANALYSIS METHODOLOGY

A primary result of capacity analysis is the assignment of levels of service to traffic facilities under various traffic flow conditions. The capacity analysis methodology is based on the concepts and procedures in the *Highway Capacity Manual* (HCM).⁸ The concept of level of service (LOS) is defined as a qualitative measure describing operational conditions within a traffic stream and their perception by motorists and/or passengers. A level-of-service definition provides an index to quality of traffic flow in terms of such factors as speed, travel time, freedom to maneuver, traffic interruptions, comfort, convenience, and safety.

Six levels of service are defined for each type of facility. They are given letter designations from A to F, with LOS A representing the best operating conditions and LOS F the worst. Since the level of service of a traffic facility is a function of the traffic flows placed upon it, such a facility may operate at a wide range of levels of service, depending on the time of day, day of week, or period of year. A description of the operating condition under each level of service is provided below:

- *LOS A* describes conditions with little to no delay to motorists.
- *LOS B* represents a desirable level with relatively low delay to motorists.
- *LOS C* describes conditions with average delays to motorists.
- *LOS D* describes operations where the influence of congestion becomes more noticeable. Delays are still within an acceptable range.
- *LOS E* represents operating conditions with high delay values. This level is considered by many agencies to be the limit of acceptable delay.
- *LOS F* is considered to be unacceptable to most drivers with high delay values that often occur, when arrival flow rates exceed the capacity of the intersection.

Unsignalized Intersections

Levels of service for unsignalized intersections are calculated using the operational analysis methodology of the HCM. The procedure accounts for lane configuration on both the minor and major street approaches, conflicting traffic stream volumes, and the type of intersection control (STOP, YIELD, or all-way STOP control). The definition of level of service for unsignalized intersections is a function of average *control* delay. Control delay includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. The level-of-service criteria for unsignalized intersections are shown in Table A-1.

Signalized Intersections

Levels of service for signalized intersections are also calculated using the operational analysis methodology of the HCM. The methodology for signalized intersections assesses the effects of signal type, timing, phasing, and progression; vehicle mix; and geometrics on average *control* delay. Control delay includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. Table A-1 summarizes the relationship between level of service and average control delay.

⁸ *Highway Capacity Manual 2000*, Transportation Research Board; Washington, D.C.; 2000.

TABLE A-1
Level-of-Service Criteria for Intersections

Level of Service	Unsignalized Intersection Criteria Average Control Delay (Seconds per Vehicle)	Signalized Intersection Criteria Average Control Delay (Seconds per Vehicle)
A	≤10	≤10
B	>10 and ≤15	>10 and ≤20
C	>15 and ≤25	>20 and ≤35
D	>25 and ≤35	>35 and ≤55
E	>35 and ≤50	>55 and ≤80
F	>50	>80

Source *Highway Capacity Manual 2000*, Transportation Research Board; Washington, D.C.; 2000.
Pages 10-16, 20-6, and 17-2.

For signalized intersections, this delay criterion may be applied in assigning level-of-service designations to individual lane groups, to individual intersection approaches, or to the entire intersection. For unsignalized intersections, this delay criterion may be applied in assigning level-of-service designations to individual lane groups or to individual intersection approaches.

CAPACITY AND QUEUE ANALYSIS WORKSHEETS

1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110 Timings

2022 Existing
Timing Plan: Weekday AM

												
Lane Group	EBL2	EBT	WBL2	WBL	WBT	NBL	NBT	SEL	SET	NWL2	NWL	NWT
Lane Configurations												
Traffic Volume (vph)	17	430	4	1	219	1	0	153	45	3	16	17
Future Volume (vph)	17	430	4	1	219	1	0	153	45	3	16	17
Turn Type	Perm	NA	Perm	Perm	NA	Perm	NA	Perm	NA	Perm	Perm	NA
Protected Phases		2			6		10		4			8
Permitted Phases	2	2	6	6		10		4		8	8	
Detector Phase	2	2	6	6	6	10	10	4	4	8	8	8
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Total Split (s)	48.0	48.0	48.0	48.0	48.0	10.0	10.0	22.0	22.0	22.0	22.0	22.0
Total Split (%)	53.3%	53.3%	53.3%	53.3%	53.3%	11.1%	11.1%	24.4%	24.4%	24.4%	24.4%	24.4%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		-2.0			-2.0		-2.0		-2.0			-2.0
Total Lost Time (s)		4.0			4.0		4.0		4.0			4.0
Lead/Lag						Lag	Lag					
Lead-Lag Optimize?												
Recall Mode	Min	Min	Min	Min	Min	None	None	None	None	None	None	None
Act Effct Green (s)		26.8			26.8		6.2		17.9			17.9
Actuated g/C Ratio		0.49			0.49		0.11		0.33			0.33
v/c Ratio		0.66			0.50		0.04		0.57			0.08
Control Delay		15.4			12.5		0.2		25.8			0.3
Queue Delay		0.0			0.0		0.0		0.0			0.0
Total Delay		15.4			12.5		0.2		25.8			0.3
LOS		B			B		A		C			A
Approach Delay		15.4			12.5		0.2		25.8			0.3
Approach LOS		B			B		A		C			A

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 54.4

Natural Cycle: 70

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.66

Intersection Signal Delay: 15.8

Intersection Capacity Utilization 65.7%

Analysis Period (min) 15

Intersection LOS: B

ICU Level of Service C

Splits and Phases: 1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110

 Ø2	 Ø4	 Ø9	 Ø10
48 s	22 s	10 s	10 s
 Ø6	 Ø8		
48 s	22 s		

1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110
Timings

2022 Existing
Timing Plan: Weekday AM

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	10.0
Total Split (s)	10.0
Total Split (%)	11%
Yellow Time (s)	4.0
All-Red Time (s)	2.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	Lead
Lead-Lag Optimize?	
Recall Mode	None
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Intersection Summary	

1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110
Queues

2022 Existing
Timing Plan: Weekday AM

					
Lane Group	EBT	WBT	NBT	SET	NWT
Lane Group Flow (vph)	528	373	12	232	49
v/c Ratio	0.66	0.50	0.04	0.57	0.08
Control Delay	15.4	12.5	0.2	25.8	0.3
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	15.4	12.5	0.2	25.8	0.3
Queue Length 50th (ft)	109	69	0	50	0
Queue Length 95th (ft)	261	157	0	#221	0
Internal Link Dist (ft)	179	174	132	468	564
Turn Bay Length (ft)					
Base Capacity (vph)	1368	1260	342	426	615
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.39	0.30	0.04	0.54	0.08

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110
 HCM Signalized Intersection Capacity Analysis

2022 Existing
 Timing Plan: Weekday AM

												
Movement	EBL2	EBT	EBR	WBL2	WBL	WBT	WBR	NBL	NBT	NBR	NBR2	SBT
Lane Configurations												
Traffic Volume (vph)	17	430	40	4	1	219	93	1	0	8	2	0
Future Volume (vph)	17	430	40	4	1	219	93	1	0	8	2	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11	11	12	12	12	12	12
Total Lost time (s)		4.0				4.0			4.0			
Lane Util. Factor		1.00				1.00			1.00			
Frt		0.99				0.96			0.88			
Flt Protected		1.00				1.00			1.00			
Satd. Flow (prot)		1659				1514			1658			
Flt Permitted		0.98				0.99			0.95			
Satd. Flow (perm)		1632				1502			1582			
Peak-hour factor, PHF	0.92	0.92	0.92	0.85	0.85	0.85	0.85	0.92	0.92	0.92	0.92	0.25
Adj. Flow (vph)	18	467	43	5	1	258	109	1	0	9	2	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	11	0	0	0
Lane Group Flow (vph)	0	528	0	0	0	373	0	0	1	0	0	0
Heavy Vehicles (%)	6%	10%	3%	50%	0%	11%	28%	0%	0%	0%	0%	0%
Turn Type	Perm	NA		Perm	Perm	NA		Perm	NA			
Protected Phases		2				6			10			9
Permitted Phases	2	2		6	6			10				
Actuated Green, G (s)		24.7				24.7			0.6			
Effective Green, g (s)		26.7				26.7			2.6			
Actuated g/C Ratio		0.45				0.45			0.04			
Clearance Time (s)		6.0				6.0			6.0			
Vehicle Extension (s)		3.0				3.0			3.0			
Lane Grp Cap (vph)		737				678			69			
v/s Ratio Prot												
v/s Ratio Perm		c0.32				0.25			c0.00			
v/c Ratio		0.72				0.55			0.01			
Uniform Delay, d1		13.1				11.8			27.0			
Progression Factor		1.00				1.00			1.00			
Incremental Delay, d2		3.3				1.0			0.0			
Delay (s)		16.5				12.8			27.1			
Level of Service		B				B			C			
Approach Delay (s)		16.5				12.8			27.1			0.0
Approach LOS		B				B			C			A
Intersection Summary												
HCM 2000 Control Delay			16.2				HCM 2000 Level of Service		B			
HCM 2000 Volume to Capacity ratio			0.70									
Actuated Cycle Length (s)			59.1				Sum of lost time (s)		16.0			
Intersection Capacity Utilization			65.7%				ICU Level of Service		C			
Analysis Period (min)			15									
c Critical Lane Group												

1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110
 HCM Signalized Intersection Capacity Analysis

2022 Existing
 Timing Plan: Weekday AM

								
Movement	SEL	SET	SER	SER2	NWL2	NWL	NWT	NWR2
Lane Configurations								
Traffic Volume (vph)	153	45	1	17	3	16	17	3
Future Volume (vph)	153	45	1	17	3	16	17	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11	11	11
Total Lost time (s)		4.0					4.0	
Lane Util. Factor		1.00					1.00	
Frt		0.99					0.99	
Flt Protected		0.97					0.98	
Satd. Flow (prot)		1582					1726	
Flt Permitted		0.76					0.82	
Satd. Flow (perm)		1241					1447	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.81	0.81	0.81	0.81
Adj. Flow (vph)	165	48	1	18	4	20	21	4
RTOR Reduction (vph)	0	0	0	0	0	0	34	0
Lane Group Flow (vph)	0	232	0	0	0	0	15	0
Heavy Vehicles (%)	14%	0%	0%	12%	33%	0%	0%	0%
Turn Type	Perm	NA			Perm	Perm	NA	
Protected Phases		4					8	
Permitted Phases	4				8	8		
Actuated Green, G (s)		15.8					15.8	
Effective Green, g (s)		17.8					17.8	
Actuated g/C Ratio		0.30					0.30	
Clearance Time (s)		6.0					6.0	
Vehicle Extension (s)		3.0					3.0	
Lane Grp Cap (vph)		373					435	
v/s Ratio Prot								
v/s Ratio Perm		0.19					0.01	
v/c Ratio		0.62					0.03	
Uniform Delay, d1		17.8					14.6	
Progression Factor		1.00					1.00	
Incremental Delay, d2		3.2					0.0	
Delay (s)		21.0					14.6	
Level of Service		C					B	
Approach Delay (s)		21.0					14.6	
Approach LOS		C					B	
Intersection Summary								

2: Gas Sta. (west) & Rte 2A/110 HCM Unsignalized Intersection Capacity Analysis

2022 Existing
Timing Plan: Weekday AM

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	482	15	4	248	8	5
Future Volume (Veh/h)	482	15	4	248	8	5
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.94	0.94	0.82	0.82	0.65	0.65
Hourly flow rate (vph)	513	16	5	302	12	8
Pedestrians				1		
Lane Width (ft)				12.0		
Walking Speed (ft/s)				3.5		
Percent Blockage				0		
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)				259		
pX, platoon unblocked					0.93	
vC, conflicting volume			529		833	522
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			529		784	522
tC, single (s)			4.3		6.4	6.3
tC, 2 stage (s)						
tF (s)			2.4		3.5	3.4
p0 queue free %			99		96	98
cM capacity (veh/h)			931		338	533
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	529	307	20			
Volume Left	0	5	12			
Volume Right	16	0	8			
cSH	1700	931	396			
Volume to Capacity	0.31	0.01	0.05			
Queue Length 95th (ft)	0	0	4			
Control Delay (s)	0.0	0.2	14.6			
Lane LOS		A	B			
Approach Delay (s)	0.0	0.2	14.6			
Approach LOS			B			
Intersection Summary						
Average Delay			0.4			
Intersection Capacity Utilization			36.6%	ICU Level of Service		A
Analysis Period (min)			15			

1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110 Timings

2022 Existing
Timing Plan: Weekday PM

												
Lane Group	EBL2	EBT	WBL2	WBL	WBT	NBL2	NBT	SEL	SET	NWL2	NWL	NWT
Lane Configurations												
Traffic Volume (vph)	11	296	8	2	530	1	0	85	33	1	73	47
Future Volume (vph)	11	296	8	2	530	1	0	85	33	1	73	47
Turn Type	Perm	NA	Perm	Perm	NA	Perm	NA	Perm	NA	Perm	Perm	NA
Protected Phases		2			6		10		4			8
Permitted Phases	2	2	6	6		10		4		8	8	
Detector Phase	2	2	6	6	6	10	10	4	4	8	8	8
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Total Split (s)	55.0	55.0	55.0	55.0	55.0	10.0	10.0	15.0	15.0	15.0	15.0	15.0
Total Split (%)	61.1%	61.1%	61.1%	61.1%	61.1%	11.1%	11.1%	16.7%	16.7%	16.7%	16.7%	16.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		-2.0			-2.0		-2.0		-2.0			-2.0
Total Lost Time (s)		4.0			4.0		4.0		4.0			4.0
Lead/Lag						Lag	Lag					
Lead-Lag Optimize?												
Recall Mode	Min	Min	Min	Min	Min	None	None	None	None	None	None	None
Act Effct Green (s)		29.9			29.9		6.3		11.6			11.6
Actuated g/C Ratio		0.58			0.58		0.12		0.23			0.23
v/c Ratio		0.43			0.70		0.06		0.59			0.36
Control Delay		7.5			12.0		27.2		33.6			6.8
Queue Delay		0.0			0.0		0.0		0.0			0.0
Total Delay		7.5			12.0		27.2		33.6			6.8
LOS		A			B		C		C			A
Approach Delay		7.5			12.0		27.2		33.6			6.8
Approach LOS		A			B		C		C			A

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 51.3

Natural Cycle: 75

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.70

Intersection Signal Delay: 12.8

Intersection Capacity Utilization 62.2%

Analysis Period (min) 15

Intersection LOS: B

ICU Level of Service B

Splits and Phases: 1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110

 Ø2	 Ø4	 Ø9	 Ø10
55 s	15 s	10 s	10 s
 Ø6	 Ø8		
55 s	15 s		

1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110
Timings

2022 Existing
Timing Plan: Weekday PM

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	10.0
Total Split (s)	10.0
Total Split (%)	11%
Yellow Time (s)	4.0
All-Red Time (s)	2.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	Lead
Lead-Lag Optimize?	
Recall Mode	None
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Intersection Summary	

1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110
Queues

2022 Existing
Timing Plan: Weekday PM

					
Lane Group	EBT	WBT	NBT	SET	NWT
Lane Group Flow (vph)	420	693	12	173	164
v/c Ratio	0.43	0.70	0.06	0.59	0.36
Control Delay	7.5	12.0	27.2	33.6	6.8
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	7.5	12.0	27.2	33.6	6.8
Queue Length 50th (ft)	51	106	3	38	0
Queue Length 95th (ft)	113	296	10	#173	25
Internal Link Dist (ft)	179	174	132	468	564
Turn Bay Length (ft)					
Base Capacity (vph)	1576	1590	197	293	453
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.27	0.44	0.06	0.59	0.36

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110
 HCM Signalized Intersection Capacity Analysis

2022 Existing
 Timing Plan: Weekday PM

												
Movement	EBL2	EBT	EBR	EBR2	WBL2	WBL	WBT	WBR	NBL2	NBT	NBR	SBT
Lane Configurations												
Traffic Volume (vph)	11	296	16	1	8	2	530	119	1	0	4	0
Future Volume (vph)	11	296	16	1	8	2	530	119	1	0	4	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11	11	11	12	12	12	12
Total Lost time (s)		4.0					4.0			4.0		
Lane Util. Factor		1.00					1.00			1.00		
Frpb, ped/bikes		1.00					1.00			1.00		
Flpb, ped/bikes		1.00					1.00			1.00		
Frt		0.99					0.98			0.89		
Flt Protected		1.00					1.00			0.99		
Satd. Flow (prot)		1736					1719			1672		
Flt Permitted		0.97					0.99			0.95		
Satd. Flow (perm)		1694					1709			1602		
Peak-hour factor, PHF	0.77	0.77	0.77	0.77	0.95	0.95	0.95	0.95	0.42	0.42	0.42	0.25
Adj. Flow (vph)	14	384	21	1	8	2	558	125	2	0	10	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	420	0	0	0	0	693	0	0	12	0	0
Confl. Peds. (#/hr)	2							2				
Confl. Bikes (#/hr)												
Heavy Vehicles (%)	9%	5%	0%	0%	0%	0%	4%	3%	0%	0%	0%	0%
Turn Type	Perm	NA			Perm	Perm	NA		Perm	NA		
Protected Phases		2					6			10		9
Permitted Phases	2	2			6	6			10			
Actuated Green, G (s)		27.8					27.8			0.5		
Effective Green, g (s)		29.8					29.8			2.5		
Actuated g/C Ratio		0.53					0.53			0.04		
Clearance Time (s)		6.0					6.0			6.0		
Vehicle Extension (s)		3.0					3.0			3.0		
Lane Grp Cap (vph)		904					912			71		
v/s Ratio Prot												
v/s Ratio Perm		0.25					0.41			0.01		
v/c Ratio		0.46					0.76			0.17		
Uniform Delay, d1		8.1					10.2			25.7		
Progression Factor		1.00					1.00			1.00		
Incremental Delay, d2		0.4					3.7			1.1		
Delay (s)		8.4					13.9			26.8		
Level of Service		A					B			C		
Approach Delay (s)		8.4					13.9			26.8		0.0
Approach LOS		A					B			C		A
Intersection Summary												
HCM 2000 Control Delay			14.3									
HCM 2000 Volume to Capacity ratio			0.77									
Actuated Cycle Length (s)			55.8							16.0		
Intersection Capacity Utilization			62.2%									
Analysis Period (min)			15									
c Critical Lane Group												

1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110
 HCM Signalized Intersection Capacity Analysis

2022 Existing
 Timing Plan: Weekday PM

								
Movement	SEL	SET	SER	SER2	NWL2	NWL	NWT	NWR2
Lane Configurations								
Traffic Volume (vph)	85	33	2	20	1	73	47	7
Future Volume (vph)	85	33	2	20	1	73	47	7
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11	11	11
Total Lost time (s)		4.0					4.0	
Lane Util. Factor		1.00					1.00	
Frpb, ped/bikes		1.00					1.00	
Flpb, ped/bikes		1.00					1.00	
Frt		0.98					0.99	
Flt Protected		0.97					0.97	
Satd. Flow (prot)		1677					1772	
Flt Permitted		0.75					0.76	
Satd. Flow (perm)		1295					1377	
Peak-hour factor, PHF	0.81	0.81	0.81	0.81	0.78	0.78	0.78	0.78
Adj. Flow (vph)	105	41	2	25	1	94	60	9
RTOR Reduction (vph)	0	0	0	0	0	0	130	0
Lane Group Flow (vph)	0	173	0	0	0	0	34	0
Confl. Peds. (#/hr)								
Confl. Bikes (#/hr)			1	1				
Heavy Vehicles (%)	6%	0%	0%	0%	0%	0%	0%	0%
Turn Type	Perm	NA			Perm	Perm	NA	
Protected Phases		4					8	
Permitted Phases	4				8	8		
Actuated Green, G (s)		9.5					9.5	
Effective Green, g (s)		11.5					11.5	
Actuated g/C Ratio		0.21					0.21	
Clearance Time (s)		6.0					6.0	
Vehicle Extension (s)		3.0					3.0	
Lane Grp Cap (vph)		266					283	
v/s Ratio Prot								
v/s Ratio Perm		0.13					0.02	
v/c Ratio		0.65					0.12	
Uniform Delay, d1		20.3					18.0	
Progression Factor		1.00					1.00	
Incremental Delay, d2		5.6					0.2	
Delay (s)		25.9					18.2	
Level of Service		C					B	
Approach Delay (s)		25.9					18.2	
Approach LOS		C					B	
Intersection Summary								

2: Gas Sta. (west) & Rte 2A/110 HCM Unsignalized Intersection Capacity Analysis

2022 Existing
Timing Plan: Weekday PM

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	321	6	3	621	6	3
Future Volume (Veh/h)	321	6	3	621	6	3
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.76	0.76	0.85	0.85	0.56	0.56
Hourly flow rate (vph)	422	8	4	731	11	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)				259		
pX, platoon unblocked					0.71	
vC, conflicting volume			430		1165	426
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			430		1029	426
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		94	99
cM capacity (veh/h)			1140		185	633
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	430	735	16			
Volume Left	0	4	11			
Volume Right	8	0	5			
cSH	1700	1140	238			
Volume to Capacity	0.25	0.00	0.07			
Queue Length 95th (ft)	0	0	5			
Control Delay (s)	0.0	0.1	21.2			
Lane LOS		A	C			
Approach Delay (s)	0.0	0.1	21.2			
Approach LOS			C			
Intersection Summary						
Average Delay			0.3			
Intersection Capacity Utilization			45.1%	ICU Level of Service		A
Analysis Period (min)			15			

1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110

Timings

2022 Existing

Timing Plan: Saturday MIDDAY

												
Lane Group	EBL2	EBT	WBL2	WBL	WBT	NBL	NBT	SBT	SEL	SET	NWL2	NWL
Lane Configurations												
Traffic Volume (vph)	20	344	15	1	271	1	0	0	74	15	1	16
Future Volume (vph)	20	344	15	1	271	1	0	0	74	15	1	16
Turn Type	Perm	NA	Perm	Perm	NA	Perm	NA	NA	Perm	NA	Perm	Perm
Protected Phases		2			6		10	9		4		
Permitted Phases	2	2	6	6		10			4		8	8
Detector Phase	2	2	6	6	6	10	10	9	4	4	8	8
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Total Split (s)	55.0	55.0	55.0	55.0	55.0	10.0	10.0	10.0	15.0	15.0	15.0	15.0
Total Split (%)	61.1%	61.1%	61.1%	61.1%	61.1%	11.1%	11.1%	11.1%	16.7%	16.7%	16.7%	16.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		-2.0			-2.0		-2.0	-2.0		-2.0		
Total Lost Time (s)		4.0			4.0		4.0	4.0		4.0		
Lead/Lag						Lag	Lag	Lead				
Lead-Lag Optimize?												
Recall Mode	Min	Min	Min	Min	Min	None	None	None	None	None	None	None
Act Effct Green (s)		23.3			23.3		6.4	6.4		11.8		
Actuated g/C Ratio		0.50			0.50		0.14	0.14		0.26		
v/c Ratio		0.51			0.50		0.07	0.00		0.39		
Control Delay		11.5			11.4		23.5	0.0		22.8		
Queue Delay		0.0			0.0		0.0	0.0		0.0		
Total Delay		11.5			11.4		23.5	0.0		22.8		
LOS		B			B		C	A		C		
Approach Delay		11.5			11.4		23.5			22.8		
Approach LOS		B			B		C			C		

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 46.2

Natural Cycle: 60

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.51

Intersection Signal Delay: 13.3

Intersection Capacity Utilization 52.5%

Analysis Period (min) 15

Intersection LOS: B

ICU Level of Service A

Splits and Phases: 1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110

 Ø2	 Ø4	 Ø9	 Ø10
55 s	15 s	10 s	10 s
 Ø6	 Ø8		
55 s	15 s		

1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110
Timings

2022 Existing
Timing Plan: Saturday MIDDAY



Lane Group	NWT
Lane Configurations	
Traffic Volume (vph)	23
Future Volume (vph)	23
Turn Type	NA
Protected Phases	8
Permitted Phases	
Detector Phase	8
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	10.0
Total Split (s)	15.0
Total Split (%)	16.7%
Yellow Time (s)	4.0
All-Red Time (s)	2.0
Lost Time Adjust (s)	-2.0
Total Lost Time (s)	4.0
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	None
Act Effect Green (s)	11.8
Actuated g/C Ratio	0.26
v/c Ratio	0.19
Control Delay	15.8
Queue Delay	0.0
Total Delay	15.8
LOS	B
Approach Delay	15.8
Approach LOS	B

Intersection Summary

1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110
Queues

2022 Existing
Timing Plan: Saturday MIDDAY

						
Lane Group	EBT	WBT	NBT	SBT	SET	NWT
Lane Group Flow (vph)	449	429	16	4	141	79
v/c Ratio	0.51	0.50	0.07	0.00	0.39	0.19
Control Delay	11.5	11.4	23.5	0.0	22.8	15.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	11.5	11.4	23.5	0.0	22.8	15.8
Queue Length 50th (ft)	55	52	3	0	19	8
Queue Length 95th (ft)	199	204	14	0	#111	47
Internal Link Dist (ft)	179	174	132	164	468	564
Turn Bay Length (ft)						
Base Capacity (vph)	1632	1599	216	942	359	407
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.28	0.27	0.07	0.00	0.39	0.19

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110

HCM Signalized Intersection Capacity Analysis

2022 Existing

Timing Plan: Saturday MIDDAY

												
Movement	EBL2	EBT	EBR	WBL2	WBL	WBT	WBR	NBL	NBT	NBR	SBT	SBR2
Lane Configurations												
Traffic Volume (vph)	20	344	9	15	1	271	87	1	0	7	0	1
Future Volume (vph)	20	344	9	15	1	271	87	1	0	7	0	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11	11	12	12	12	12	12
Total Lost time (s)		4.0				4.0			4.0		4.0	
Lane Util. Factor		1.00				1.00			1.00		1.00	
Frpb, ped/bikes		1.00				1.00			0.97		1.00	
Flpb, ped/bikes		1.00				1.00			1.00		1.00	
Frt		1.00				0.97			0.88		0.86	
Flt Protected		1.00				1.00			0.99		1.00	
Satd. Flow (prot)		1788				1738			1620		1644	
Flt Permitted		0.97				0.97			0.95		1.00	
Satd. Flow (perm)		1731				1696			1556		1644	
Peak-hour factor, PHF	0.83	0.83	0.83	0.87	0.87	0.87	0.87	0.50	0.50	0.50	0.25	0.25
Adj. Flow (vph)	24	414	11	17	1	311	100	2	0	14	0	4
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	4	0
Lane Group Flow (vph)	0	449	0	0	0	429	0	0	16	0	0	0
Confl. Peds. (#/hr)										1		
Confl. Bikes (#/hr)												
Heavy Vehicles (%)	0%	2%	11%	0%	0%	2%	3%	0%	0%	0%	0%	0%
Turn Type	Perm	NA		Perm	Perm	NA		Perm	NA		NA	
Protected Phases		2				6			10		9	
Permitted Phases	2	2		6	6			10				
Actuated Green, G (s)		21.2				21.2			0.5		0.5	
Effective Green, g (s)		23.2				23.2			2.5		2.5	
Actuated g/C Ratio		0.42				0.42			0.04		0.04	
Clearance Time (s)		6.0				6.0			6.0		6.0	
Vehicle Extension (s)		3.0				3.0			3.0		3.0	
Lane Grp Cap (vph)		719				705			69		73	
v/s Ratio Prot											c0.00	
v/s Ratio Perm		c0.26				0.25			c0.01			
v/c Ratio		0.62				0.61			0.23		0.00	
Uniform Delay, d1		12.9				12.7			25.7		25.5	
Progression Factor		1.00				1.00			1.00		1.00	
Incremental Delay, d2		1.7				1.5			1.7		0.0	
Delay (s)		14.6				14.2			27.4		25.5	
Level of Service		B				B			C		C	
Approach Delay (s)		14.6				14.2			27.4		25.5	
Approach LOS		B				B			C		C	
Intersection Summary												
HCM 2000 Control Delay			15.7				HCM 2000 Level of Service		B			
HCM 2000 Volume to Capacity ratio			0.52									
Actuated Cycle Length (s)			55.8				Sum of lost time (s)		16.0			
Intersection Capacity Utilization			52.5%				ICU Level of Service		A			
Analysis Period (min)			15									
c Critical Lane Group												

1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110
 HCM Signalized Intersection Capacity Analysis

2022 Existing
 Timing Plan: Saturday MIDDAY

									
Movement	SEL	SET	SER	SER2	NWL2	NWL	NWT	NWR	NWR2
Lane Configurations									
Traffic Volume (vph)	74	15	3	22	1	16	23	1	18
Future Volume (vph)	74	15	3	22	1	16	23	1	18
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11	11	11	11
Total Lost time (s)		4.0					4.0		
Lane Util. Factor		1.00					1.00		
Frpb, ped/bikes		0.99					0.99		
Flpb, ped/bikes		1.00					1.00		
Frt		0.97					0.96		
Flt Protected		0.97					0.99		
Satd. Flow (prot)		1703					1691		
Flt Permitted		0.81					0.90		
Satd. Flow (perm)		1415					1546		
Peak-hour factor, PHF	0.81	0.81	0.81	0.81	0.74	0.74	0.74	0.74	0.74
Adj. Flow (vph)	91	19	4	27	1	22	31	1	24
RTOR Reduction (vph)	0	0	0	0	0	0	16	0	0
Lane Group Flow (vph)	0	141	0	0	0	0	63	0	0
Confl. Peds. (#/hr)	1							1	1
Confl. Bikes (#/hr)			2	2				1	1
Heavy Vehicles (%)	1%	0%	0%	0%	0%	0%	4%	0%	0%
Turn Type	Perm	NA			Perm	Perm	NA		
Protected Phases		4					8		
Permitted Phases	4				8	8			
Actuated Green, G (s)		9.6					9.6		
Effective Green, g (s)		11.6					11.6		
Actuated g/C Ratio		0.21					0.21		
Clearance Time (s)		6.0					6.0		
Vehicle Extension (s)		3.0					3.0		
Lane Grp Cap (vph)		294					321		
v/s Ratio Prot									
v/s Ratio Perm		0.10					0.04		
v/c Ratio		0.48					0.20		
Uniform Delay, d1		19.4					18.3		
Progression Factor		1.00					1.00		
Incremental Delay, d2		1.2					0.3		
Delay (s)		20.7					18.6		
Level of Service		C					B		
Approach Delay (s)		20.7					18.6		
Approach LOS		C					B		
Intersection Summary									

2: Gas Sta. (west) & Rte 2A/110 HCM Unsignalized Intersection Capacity Analysis

2022 Existing
Timing Plan: Saturday MIDDAY

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↰			↱	↰	↱
Traffic Volume (veh/h)	370	7	5	304	9	3
Future Volume (Veh/h)	370	7	5	304	9	3
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.85	0.85	0.94	0.94	0.56	0.56
Hourly flow rate (vph)	435	8	5	323	16	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)				259		
pX, platoon unblocked					0.88	
vC, conflicting volume			443		772	439
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			443		673	439
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		96	99
cM capacity (veh/h)			1128		371	622
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	443	328	21			
Volume Left	0	5	16			
Volume Right	8	0	5			
cSH	1700	1128	411			
Volume to Capacity	0.26	0.00	0.05			
Queue Length 95th (ft)	0	0	4			
Control Delay (s)	0.0	0.2	14.2			
Lane LOS		A	B			
Approach Delay (s)	0.0	0.2	14.2			
Approach LOS			B			
Intersection Summary						
Average Delay			0.4			
Intersection Capacity Utilization			30.0%	ICU Level of Service		A
Analysis Period (min)			15			

1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110

2029 No-Build

Timings

Timing Plan: Weekday AM

												
Lane Group	EBL2	EBT	WBL2	WBL	WBT	NBL	NBT	SEL	SET	SER2	NWL2	NWL
Lane Configurations												
Traffic Volume (vph)	18	445	4	1	227	1	0	158	47	18	3	17
Future Volume (vph)	18	445	4	1	227	1	0	158	47	18	3	17
Turn Type	Prot	NA	Perm	Perm	NA	Perm	NA	pm+pt	NA	pm+ov	Perm	Perm
Protected Phases	5	2			6		10	7	4	5		
Permitted Phases		2	6	6		10		4		4	8	8
Detector Phase	5	2	6	6	6	10	10	7	4	5	8	8
Switch Phase												
Minimum Initial (s)	6.0	8.0	8.0	8.0	8.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Minimum Split (s)	12.0	15.0	15.0	15.0	15.0	13.0	13.0	9.5	12.5	12.0	12.5	12.5
Total Split (s)	13.0	51.0	38.0	38.0	38.0	13.0	13.0	13.5	39.0	13.0	25.5	25.5
Total Split (%)	11.2%	44.0%	32.8%	32.8%	32.8%	11.2%	11.2%	11.6%	33.6%	11.2%	22.0%	22.0%
Yellow Time (s)	4.0	5.0	5.0	5.0	5.0	4.0	4.0	3.5	3.5	4.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	3.0	3.0	0.0	3.0	2.0	3.5	3.5
Lost Time Adjust (s)	-2.0	-3.0	-3.0		-3.0		-3.0		-2.5	-2.5		
Total Lost Time (s)	4.0	4.0	4.0		4.0		4.0		4.0	3.5		
Lead/Lag	Lead		Lag	Lag	Lag	Lag	Lag	Lead		Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	Min	Min	Min	Min	None	None	None	None	None	None	None
Act Effct Green (s)	9.2	34.7	28.3		28.3		9.9		21.4	35.1		
Actuated g/C Ratio	0.14	0.52	0.42		0.42		0.15		0.32	0.53		
v/c Ratio	0.09	0.61	0.02		0.55		0.05		0.56	0.03		
Control Delay	36.7	16.9	19.0		23.2		36.3		28.2	9.8		
Queue Delay	0.0	0.0	0.0		0.0		0.0		0.0	0.0		
Total Delay	36.7	16.9	19.0		23.2		36.3		28.2	9.8		
LOS	D	B	B		C		D		C	A		
Approach Delay		17.6			23.1		36.3		26.7			
Approach LOS		B			C		D		C			

Intersection Summary

Cycle Length: 116

Actuated Cycle Length: 66.7

Natural Cycle: 90

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.61

Intersection Signal Delay: 20.6

Intersection Capacity Utilization 58.4%

Analysis Period (min) 15

Intersection LOS: C

ICU Level of Service B

Splits and Phases: 1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110

 Ø2	 Ø4	 Ø9	 Ø10
51 s	39 s	13 s	13 s
 Ø5	 Ø6	 Ø7	 Ø8
13 s	38 s	13.5 s	25.5 s

1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110
Timings

2029 No-Build
Timing Plan: Weekday AM



Lane Group	NWT	Ø9
Lane Configurations	↕	
Traffic Volume (vph)	18	
Future Volume (vph)	18	
Turn Type	NA	
Protected Phases	8	9
Permitted Phases		
Detector Phase	8	
Switch Phase		
Minimum Initial (s)	6.0	6.0
Minimum Split (s)	12.5	13.0
Total Split (s)	25.5	13.0
Total Split (%)	22.0%	11%
Yellow Time (s)	3.0	4.0
All-Red Time (s)	3.5	3.0
Lost Time Adjust (s)	-2.5	
Total Lost Time (s)	4.0	
Lead/Lag	Lag	Lead
Lead-Lag Optimize?		
Recall Mode	None	None
Act Effct Green (s)	21.4	
Actuated g/C Ratio	0.32	
v/c Ratio	0.07	
Control Delay	0.2	
Queue Delay	0.0	
Total Delay	0.2	
LOS	A	
Approach Delay	0.2	
Approach LOS	A	
Intersection Summary		

Queues

Timing Plan: Weekday AM

								
Lane Group	EBL2	EBT	WBL2	WBT	NBT	SET	SER2	NWT
Lane Group Flow (vph)	20	529	4	352	12	224	20	44
v/c Ratio	0.09	0.61	0.02	0.55	0.05	0.56	0.03	0.07
Control Delay	36.7	16.9	19.0	23.2	36.3	28.2	9.8	0.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	36.7	16.9	19.0	23.2	36.3	28.2	9.8	0.2
Queue Length 50th (ft)	7	123	1	112	4	76	4	0
Queue Length 95th (ft)	36	389	10	303	25	196	15	0
Internal Link Dist (ft)		179		174	132	468		564
Turn Bay Length (ft)	75		75				50	
Base Capacity (vph)	245	1255	298	850	235	717	749	728
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.08	0.42	0.01	0.41	0.05	0.31	0.03	0.06
Intersection Summary								

1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110

HCM Signalized Intersection Capacity Analysis

2029 No-Build

Timing Plan: Weekday AM

												
Movement	EBL2	EBT	EBR	WBL2	WBL	WBT	WBR	NBL	NBT	NBR	NBR2	SBT
Lane Configurations												
Traffic Volume (vph)	18	445	41	4	1	227	96	1	0	8	2	0
Future Volume (vph)	18	445	41	4	1	227	96	1	0	8	2	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11	11	12	12	12	12	12
Total Lost time (s)	4.0	4.0		4.0		4.0			4.0			
Lane Util. Factor	1.00	1.00		1.00		1.00			1.00			
Frt	1.00	0.99		1.00		0.96			0.88			
Flt Protected	0.95	1.00		0.95		1.00			1.00			
Satd. Flow (prot)	1646	1657		1163		1513			1658			
Flt Permitted	0.95	1.00		0.43		1.00			0.95			
Satd. Flow (perm)	1646	1657		532		1511			1582			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	20	484	45	4	1	247	104	1	0	9	2	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	20	529	0	4	0	352	0	0	12	0	0	0
Heavy Vehicles (%)	6%	10%	3%	50%	0%	11%	28%	0%	0%	0%	0%	0%
Turn Type	Prot	NA		Perm	Perm	NA		Perm	NA			
Protected Phases	5	2				6			10			9
Permitted Phases		2		6	6			10				
Actuated Green, G (s)	3.4	34.4		25.0		25.0			0.8			
Effective Green, g (s)	5.4	37.4		28.0		28.0			3.8			
Actuated g/C Ratio	0.07	0.50		0.38		0.38			0.05			
Clearance Time (s)	6.0	7.0		7.0		7.0			7.0			
Vehicle Extension (s)	3.0	3.0		3.0		3.0			3.0			
Lane Grp Cap (vph)	119	832		200		568			80			
v/s Ratio Prot	0.01	c0.32										
v/s Ratio Perm				0.01		0.23			c0.01			
v/c Ratio	0.17	0.64		0.02		0.62			0.15			
Uniform Delay, d1	32.4	13.5		14.6		18.9			33.8			
Progression Factor	1.00	1.00		1.00		1.00			1.00			
Incremental Delay, d2	0.7	1.6		0.0		2.0			0.9			
Delay (s)	33.1	15.1		14.6		20.9			34.6			
Level of Service	C	B		B		C			C			
Approach Delay (s)		15.8				20.8			34.6			0.0
Approach LOS		B				C			C			A
Intersection Summary												
HCM 2000 Control Delay			19.7			HCM 2000 Level of Service			B			
HCM 2000 Volume to Capacity ratio			0.74									
Actuated Cycle Length (s)			74.4			Sum of lost time (s)			23.5			
Intersection Capacity Utilization			58.4%			ICU Level of Service			B			
Analysis Period (min)			15									
c Critical Lane Group												

1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110
 HCM Signalized Intersection Capacity Analysis

2029 No-Build
 Timing Plan: Weekday AM

								
Movement	SEL	SET	SER	SER2	NWL2	NWL	NWT	NWR2
Lane Configurations								
Traffic Volume (vph)	158	47	1	18	3	17	18	3
Future Volume (vph)	158	47	1	18	3	17	18	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11	11	11
Total Lost time (s)		4.0		3.5			4.0	
Lane Util. Factor		1.00		1.00			1.00	
Frt		1.00		0.85			0.99	
Flt Protected		0.96		1.00			0.98	
Satd. Flow (prot)		1596		1394			1738	
Flt Permitted		0.75		1.00			0.83	
Satd. Flow (perm)		1238		1394			1474	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	172	51	1	20	3	18	20	3
RTOR Reduction (vph)	0	0	0	0	0	0	31	0
Lane Group Flow (vph)	0	224	0	20	0	0	13	0
Heavy Vehicles (%)	14%	0%	0%	12%	33%	0%	0%	0%
Turn Type	pm+pt	NA		pm+ov	Perm	Perm	NA	
Protected Phases	7	4		5			8	
Permitted Phases	4			4	8	8		
Actuated Green, G (s)		18.7		22.1			18.7	
Effective Green, g (s)		21.2		27.1			21.2	
Actuated g/C Ratio		0.28		0.36			0.28	
Clearance Time (s)		6.5		6.0			6.5	
Vehicle Extension (s)		3.0		3.0			3.0	
Lane Grp Cap (vph)		352		507			420	
v/s Ratio Prot				0.00				
v/s Ratio Perm		c0.18		0.01			0.01	
v/c Ratio		0.64		0.04			0.03	
Uniform Delay, d1		23.2		15.3			19.2	
Progression Factor		1.00		1.00			1.00	
Incremental Delay, d2		3.7		0.0			0.0	
Delay (s)		27.0		15.3			19.2	
Level of Service		C		B			B	
Approach Delay (s)		26.0					19.2	
Approach LOS		C					B	
Intersection Summary								

2: Gas Sta. (west) & Rte 2A/110 HCM Unsignalized Intersection Capacity Analysis

2029 No-Build
Timing Plan: Weekday AM

								
Movement	EBT	EBR	WBL	WBT	NBL	NBR		
Lane Configurations								
Traffic Volume (veh/h)	499	15	4	258	8	5		
Future Volume (Veh/h)	499	15	4	258	8	5		
Sign Control	Free			Free	Stop			
Grade	0%			0%	0%			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92		
Hourly flow rate (vph)	542	16	4	280	9	5		
Pedestrians				1				
Lane Width (ft)				12.0				
Walking Speed (ft/s)				3.5				
Percent Blockage				0				
Right turn flare (veh)								
Median type	None			None				
Median storage veh)								
Upstream signal (ft)				259				
pX, platoon unblocked					0.89			
vC, conflicting volume				558	838	551		
vC1, stage 1 conf vol								
vC2, stage 2 conf vol								
vCu, unblocked vol				558	758	551		
tC, single (s)				4.3	6.4	6.3		
tC, 2 stage (s)								
tF (s)				2.4	3.5	3.4		
p0 queue free %				100	97	99		
cM capacity (veh/h)				907	336	513		
Direction, Lane #	EB 1	WB 1	NB 1					
Volume Total	558	284	14					
Volume Left	0	4	9					
Volume Right	16	0	5					
cSH	1700	907	383					
Volume to Capacity	0.33	0.00	0.04					
Queue Length 95th (ft)	0	0	3					
Control Delay (s)	0.0	0.2	14.8					
Lane LOS		A	B					
Approach Delay (s)	0.0	0.2	14.8					
Approach LOS			B					
Intersection Summary								
Average Delay				0.3				
Intersection Capacity Utilization				37.5%	ICU Level of Service	A		
Analysis Period (min)				15				

1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110

2029 No-Build

Timings

Timing Plan: Weekday PM

												
Lane Group	EBL2	EBT	WBL2	WBL	WBT	NBL2	NBT	SEL	SET	SER2	NWL2	NWL
Lane Configurations												
Traffic Volume (vph)	11	307	8	2	549	1	0	88	34	21	1	76
Future Volume (vph)	11	307	8	2	549	1	0	88	34	21	1	76
Turn Type	Prot	NA	Perm	Perm	NA	Perm	NA	pm+pt	NA	pm+ov	Perm	Perm
Protected Phases	5	2			6		10	7	4	5		
Permitted Phases		2	6	6		10		4		4	8	8
Detector Phase	5	2	6	6	6	10	10	7	4	5	8	8
Switch Phase												
Minimum Initial (s)	6.0	8.0	8.0	8.0	8.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Minimum Split (s)	12.0	15.0	15.0	15.0	15.0	13.0	13.0	9.5	12.5	12.0	12.5	12.5
Total Split (s)	13.0	67.0	54.0	54.0	54.0	13.0	13.0	9.5	22.0	13.0	12.5	12.5
Total Split (%)	11.0%	56.8%	45.8%	45.8%	45.8%	11.0%	11.0%	8.1%	18.6%	11.0%	10.6%	10.6%
Yellow Time (s)	4.0	5.0	5.0	5.0	5.0	4.0	4.0	3.5	3.5	4.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	3.0	3.0	0.0	3.0	2.0	3.5	3.5
Lost Time Adjust (s)	-2.0	-3.0	-3.0		-3.0		-3.0		-2.5	-2.5		
Total Lost Time (s)	4.0	4.0	4.0		4.0		4.0		4.0	3.5		
Lead/Lag	Lead		Lag	Lag	Lag	Lag	Lag	Lead		Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	Min	Min	Min	Min	None	None	None	None	None	None	None
Act Effct Green (s)	8.5	56.9	50.1		50.1		9.2		16.0	25.5		
Actuated g/C Ratio	0.10	0.68	0.60		0.60		0.11		0.19	0.31		
v/c Ratio	0.07	0.30	0.01		0.71		0.03		0.58	0.05		
Control Delay	41.0	6.8	11.2		20.0		40.2		44.2	18.7		
Queue Delay	0.0	0.0	0.0		0.0		0.0		0.0	0.0		
Total Delay	41.0	6.8	11.2		20.0		40.2		44.2	18.7		
LOS	D	A	B		B		D		D	B		
Approach Delay		8.0			19.9		40.2		40.5			
Approach LOS		A			B		D		D			

Intersection Summary

Cycle Length: 118

Actuated Cycle Length: 83.2

Natural Cycle: 110

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.71

Intersection Signal Delay: 17.4

Intersection Capacity Utilization 67.1%

Analysis Period (min) 15

Intersection LOS: B

ICU Level of Service C

Splits and Phases: 1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110

 Ø2				 Ø4		 Ø9	 Ø10
67 s				22 s		16 s	13 s
 Ø5	 Ø6			 Ø7	 Ø8		
13 s	54 s			9.5 s	12.5 s		

1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110
Timings

2029 No-Build
Timing Plan: Weekday PM



Lane Group	NWT	Ø9
Lane Configurations	↕	
Traffic Volume (vph)	49	
Future Volume (vph)	49	
Turn Type	NA	
Protected Phases	8	9
Permitted Phases		
Detector Phase	8	
Switch Phase		
Minimum Initial (s)	6.0	6.0
Minimum Split (s)	12.5	13.0
Total Split (s)	12.5	16.0
Total Split (%)	10.6%	14%
Yellow Time (s)	3.0	4.0
All-Red Time (s)	3.5	3.0
Lost Time Adjust (s)	-2.5	
Total Lost Time (s)	4.0	
Lead/Lag	Lag	Lead
Lead-Lag Optimize?		
Recall Mode	None	None
Act Effct Green (s)	16.0	
Actuated g/C Ratio	0.19	
v/c Ratio	0.34	
Control Delay	2.1	
Queue Delay	0.0	
Total Delay	2.1	
LOS	A	
Approach Delay	2.1	
Approach LOS	A	
Intersection Summary		

Queues

Timing Plan: Weekday PM

								
Lane Group	EBL2	EBT	WBL2	WBT	NBT	SET	SER2	NWT
Lane Group Flow (vph)	12	353	9	733	5	135	23	145
v/c Ratio	0.07	0.30	0.01	0.71	0.03	0.58	0.05	0.34
Control Delay	41.0	6.8	11.2	20.0	40.2	44.2	18.7	2.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	41.0	6.8	11.2	20.0	40.2	44.2	18.7	2.1
Queue Length 50th (ft)	6	62	2	286	3	68	8	0
Queue Length 95th (ft)	25	153	11	#651	15	#159	24	0
Internal Link Dist (ft)		179		174	132	468		564
Turn Bay Length (ft)	75		75				50	
Base Capacity (vph)	177	1350	622	1054	178	270	485	431
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.07	0.26	0.01	0.70	0.03	0.50	0.05	0.34

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110
 HCM Signalized Intersection Capacity Analysis

2029 No-Build
 Timing Plan: Weekday PM

												
Movement	EBL2	EBT	EBR	EBR2	WBL2	WBL	WBT	WBR	NBL2	NBT	NBR	SBT
Lane Configurations												
Traffic Volume (vph)	11	307	17	1	8	2	549	123	1	0	4	0
Future Volume (vph)	11	307	17	1	8	2	549	123	1	0	4	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11	11	11	12	12	12	12
Total Lost time (s)	4.0	4.0			4.0		4.0			4.0		
Lane Util. Factor	1.00	1.00			1.00		1.00			1.00		
Frpb, ped/bikes	1.00	1.00			1.00		1.00			1.00		
Flpb, ped/bikes	1.00	1.00			1.00		1.00			1.00		
Frt	1.00	0.99			1.00		0.97			0.89		
Flt Protected	0.95	1.00			0.95		1.00			0.99		
Satd. Flow (prot)	1601	1740			1745		1714			1678		
Flt Permitted	0.95	1.00			0.55		1.00			0.95		
Satd. Flow (perm)	1601	1740			1010		1713			1610		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	12	334	18	1	9	2	597	134	1	0	4	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	12	353	0	0	9	0	733	0	0	5	0	0
Confl. Peds. (#/hr)	2							2				
Confl. Bikes (#/hr)												
Heavy Vehicles (%)	9%	5%	0%	0%	0%	0%	4%	3%	0%	0%	0%	0%
Turn Type	Prot	NA			Perm	Perm	NA		Perm	NA		
Protected Phases	5	2					6			10		9
Permitted Phases		2			6	6			10			
Actuated Green, G (s)	3.5	56.6			47.1		47.1			1.0		
Effective Green, g (s)	5.5	59.6			50.1		50.1			4.0		
Actuated g/C Ratio	0.06	0.65			0.55		0.55			0.04		
Clearance Time (s)	6.0	7.0			7.0		7.0			7.0		
Vehicle Extension (s)	3.0	3.0			3.0		3.0			3.0		
Lane Grp Cap (vph)	96	1133			553		937			70		
v/s Ratio Prot	0.01	c0.20										
v/s Ratio Perm					0.01		c0.43			c0.00		
v/c Ratio	0.12	0.31			0.02		0.78			0.07		
Uniform Delay, d1	40.7	7.0			9.5		16.4			42.0		
Progression Factor	1.00	1.00			1.00		1.00			1.00		
Incremental Delay, d2	0.6	0.2			0.0		4.3			0.4		
Delay (s)	41.3	7.1			9.5		20.7			42.4		
Level of Service	D	A			A		C			D		
Approach Delay (s)		8.3					20.6			42.4		0.0
Approach LOS		A					C			D		A
Intersection Summary												
HCM 2000 Control Delay			20.7									
HCM 2000 Volume to Capacity ratio			0.76									
Actuated Cycle Length (s)			91.5							23.5		
Intersection Capacity Utilization			67.1%							C		
Analysis Period (min)			15									
c Critical Lane Group												

1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110
 HCM Signalized Intersection Capacity Analysis

2029 No-Build
 Timing Plan: Weekday PM

								
Movement	SEL	SET	SER	SER2	NWL2	NWL	NWT	NWR2
Lane Configurations								
Traffic Volume (vph)	88	34	2	21	1	76	49	7
Future Volume (vph)	88	34	2	21	1	76	49	7
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11	11	11
Total Lost time (s)		4.0		3.5			4.0	
Lane Util. Factor		1.00		1.00			1.00	
Frpb, ped/bikes		1.00		0.98			1.00	
Flpb, ped/bikes		1.00		1.00			1.00	
Frt		1.00		0.85			0.99	
Flt Protected		0.97		1.00			0.97	
Satd. Flow (prot)		1697		1537			1772	
Flt Permitted		0.69		1.00			0.65	
Satd. Flow (perm)		1220		1537			1178	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	96	37	2	23	1	83	53	8
RTOR Reduction (vph)	0	0	0	0	0	0	120	0
Lane Group Flow (vph)	0	135	0	23	0	0	25	0
Confl. Peds. (#/hr)								
Confl. Bikes (#/hr)			1	1				
Heavy Vehicles (%)	6%	0%	0%	0%	0%	0%	0%	0%
Turn Type	pm+pt	NA		pm+ov	Perm	Perm	NA	
Protected Phases	7	4		5			8	
Permitted Phases	4			4	8	8		
Actuated Green, G (s)		13.4		16.9			13.4	
Effective Green, g (s)		15.9		21.9			15.9	
Actuated g/C Ratio		0.17		0.24			0.17	
Clearance Time (s)		6.5		6.0			6.5	
Vehicle Extension (s)		3.0		3.0			3.0	
Lane Grp Cap (vph)		212		367			204	
v/s Ratio Prot				0.00				
v/s Ratio Perm		0.11		0.01			0.02	
v/c Ratio		0.64		0.06			0.12	
Uniform Delay, d1		35.1		26.9			31.9	
Progression Factor		1.00		1.00			1.00	
Incremental Delay, d2		6.1		0.1			0.3	
Delay (s)		41.3		26.9			32.2	
Level of Service		D		C			C	
Approach Delay (s)		39.2					32.2	
Approach LOS		D					C	
Intersection Summary								

2: Gas Sta. (west) & Rte 2A/110 HCM Unsignalized Intersection Capacity Analysis

2029 No-Build
Timing Plan: Weekday PM

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↰			↱	↰	↱
Traffic Volume (veh/h)	333	6	3	644	6	3
Future Volume (Veh/h)	333	6	3	644	6	3
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	362	7	3	700	7	3
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)				259		
pX, platoon unblocked					0.68	
vC, conflicting volume			369		1072	366
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			369		866	366
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		97	100
cM capacity (veh/h)			1201		220	684
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	369	703	10			
Volume Left	0	3	7			
Volume Right	7	0	3			
cSH	1700	1201	276			
Volume to Capacity	0.22	0.00	0.04			
Queue Length 95th (ft)	0	0	3			
Control Delay (s)	0.0	0.1	18.5			
Lane LOS		A	C			
Approach Delay (s)	0.0	0.1	18.5			
Approach LOS			C			
Intersection Summary						
Average Delay			0.2			
Intersection Capacity Utilization			46.3%	ICU Level of Service		A
Analysis Period (min)			15			

1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110

2029 No-Build

Timings

Timing Plan: Saturday MIDDAY

												
Lane Group	EBL2	EBT	WBL2	WBL	WBT	NBL	NBT	SBT	SEL	SET	SER2	NWL2
Lane Configurations												
Traffic Volume (vph)	21	356	16	1	281	1	0	0	77	16	23	1
Future Volume (vph)	21	356	16	1	281	1	0	0	77	16	23	1
Turn Type	Prot	NA	Perm	Perm	NA	Perm	NA	NA	pm+pt	NA	pm+ov	Perm
Protected Phases	5	2			6		10	9	7	4	5	
Permitted Phases		2	6	6		10			4		4	8
Detector Phase	5	2	6	6	6	10	10	9	7	4	5	8
Switch Phase												
Minimum Initial (s)	6.0	8.0	8.0	8.0	8.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Minimum Split (s)	12.0	15.0	15.0	15.0	15.0	13.0	13.0	13.0	9.5	12.5	12.0	12.5
Total Split (s)	13.0	67.0	54.0	54.0	54.0	13.0	13.0	16.0	9.5	22.0	13.0	12.5
Total Split (%)	11.0%	56.8%	45.8%	45.8%	45.8%	11.0%	11.0%	13.6%	8.1%	18.6%	11.0%	10.6%
Yellow Time (s)	4.0	5.0	5.0	5.0	5.0	4.0	4.0	4.0	3.5	3.5	4.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	3.0	3.0	3.0	0.0	3.0	2.0	3.5
Lost Time Adjust (s)	-2.0	-3.0	-3.0		-3.0		-3.0	-3.0		-2.5	-2.5	
Total Lost Time (s)	4.0	4.0	4.0		4.0		4.0	4.0		4.0	3.5	
Lead/Lag	Lead		Lag	Lag	Lag	Lag	Lag	Lead	Lead		Lead	Lag
Lead-Lag Optimize?												
Recall Mode	None	Min	Min	Min	Min	None	None	None	None	None	None	None
Act Effct Green (s)	10.0	38.0	31.5		31.5		10.8	10.8		15.0	22.4	
Actuated g/C Ratio	0.17	0.65	0.53		0.53		0.18	0.18		0.25	0.38	
v/c Ratio	0.08	0.34	0.03		0.44		0.03	0.00		0.29	0.04	
Control Delay	34.5	9.8	16.0		17.6		34.5	35.0		28.3	12.3	
Queue Delay	0.0	0.0	0.0		0.0		0.0	0.0		0.0	0.0	
Total Delay	34.5	9.8	16.0		17.6		34.5	35.0		28.3	12.3	
LOS	C	A	B		B		C	C		C	B	
Approach Delay		11.2			17.6		34.5	35.0		25.2		
Approach LOS		B			B		C	C		C		

Intersection Summary

Cycle Length: 118

Actuated Cycle Length: 58.9

Natural Cycle: 80

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.44

Intersection Signal Delay: 16.4

Intersection Capacity Utilization 48.7%

Analysis Period (min) 15

Intersection LOS: B

ICU Level of Service A

Splits and Phases: 1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110

 Ø2		 Ø4		 Ø9		 Ø10
67 s		22 s		16 s		13 s
 Ø5	 Ø6	 Ø7	 Ø8			
13 s	54 s	9.5 s	12.5 s			

1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110
Timings

2029 No-Build
Timing Plan: Saturday MIDDAY

		
Lane Group	NWL	NWT
Lane Configurations		
Traffic Volume (vph)	17	24
Future Volume (vph)	17	24
Turn Type	Perm	NA
Protected Phases		8
Permitted Phases	8	
Detector Phase	8	8
Switch Phase		
Minimum Initial (s)	6.0	6.0
Minimum Split (s)	12.5	12.5
Total Split (s)	12.5	12.5
Total Split (%)	10.6%	10.6%
Yellow Time (s)	3.0	3.0
All-Red Time (s)	3.5	3.5
Lost Time Adjust (s)		-2.5
Total Lost Time (s)		4.0
Lead/Lag	Lag	Lag
Lead-Lag Optimize?		
Recall Mode	None	None
Act Effct Green (s)		14.6
Actuated g/C Ratio		0.25
v/c Ratio		0.17
Control Delay		22.9
Queue Delay		0.0
Total Delay		22.9
LOS		C
Approach Delay		22.9
Approach LOS		C
Intersection Summary		

Queues

Timing Plan: Saturday MIDDAY

									
Lane Group	EBL2	EBT	WBL2	WBT	NBT	SBT	SET	SER2	NWT
Lane Group Flow (vph)	23	397	17	404	9	1	104	25	67
v/c Ratio	0.08	0.34	0.03	0.44	0.03	0.00	0.29	0.04	0.17
Control Delay	34.5	9.8	16.0	17.6	34.5	35.0	28.3	12.3	22.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.5	9.8	16.0	17.6	34.5	35.0	28.3	12.3	22.9
Queue Length 50th (ft)	7	56	3	103	3	0	28	4	14
Queue Length 95th (ft)	41	239	22	318	22	6	119	21	73
Internal Link Dist (ft)		179		174	132	164	468		564
Turn Bay Length (ft)	75		75					50	
Base Capacity (vph)	320	1641	805	1436	287	402	525	610	387
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.07	0.24	0.02	0.28	0.03	0.00	0.20	0.04	0.17
Intersection Summary									

1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110

2029 No-Build

HCM Signalized Intersection Capacity Analysis

Timing Plan: Saturday MIDDAY

												
Movement	EBL2	EBT	EBR	WBL2	WBL	WBT	WBR	NBL	NBT	NBR	SBT	SBR2
Lane Configurations												
Traffic Volume (vph)	21	356	9	16	1	281	90	1	0	7	0	1
Future Volume (vph)	21	356	9	16	1	281	90	1	0	7	0	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11	11	12	12	12	12	12
Total Lost time (s)	4.0	4.0		4.0		4.0			4.0		4.0	
Lane Util. Factor	1.00	1.00		1.00		1.00			1.00		1.00	
Frpb, ped/bikes	1.00	1.00		1.00		1.00			0.97		1.00	
Flpb, ped/bikes	1.00	1.00		1.00		1.00			1.00		1.00	
Frt	1.00	1.00		1.00		0.96			0.88		0.86	
Flt Protected	0.95	1.00		0.95		1.00			0.99		1.00	
Satd. Flow (prot)	1745	1790		1745		1731			1619		1644	
Flt Permitted	0.95	1.00		0.53		1.00			0.96		1.00	
Satd. Flow (perm)	1745	1790		970		1730			1562		1644	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	23	387	10	17	1	305	98	1	0	8	0	1
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	23	397	0	17	0	404	0	0	9	0	1	0
Confl. Peds. (#/hr)										1		
Confl. Bikes (#/hr)												
Heavy Vehicles (%)	0%	2%	11%	0%	0%	2%	3%	0%	0%	0%	0%	0%
Turn Type	Prot	NA		Perm	Perm	NA		Perm	NA		NA	
Protected Phases	5	2				6			10		9	
Permitted Phases		2		6	6			10				
Actuated Green, G (s)	3.4	35.8		26.4		26.4			0.7		0.7	
Effective Green, g (s)	5.4	38.8		29.4		29.4			3.7		3.7	
Actuated g/C Ratio	0.07	0.52		0.40		0.40			0.05		0.05	
Clearance Time (s)	6.0	7.0		7.0		7.0			7.0		7.0	
Vehicle Extension (s)	3.0	3.0		3.0		3.0			3.0		3.0	
Lane Grp Cap (vph)	127	937		384		686			77		82	
v/s Ratio Prot	0.01	c0.22									c0.00	
v/s Ratio Perm				0.02		c0.23			c0.01			
v/c Ratio	0.18	0.42		0.04		0.59			0.12		0.01	
Uniform Delay, d1	32.3	10.8		13.7		17.6			33.6		33.5	
Progression Factor	1.00	1.00		1.00		1.00			1.00		1.00	
Incremental Delay, d2	0.7	0.3		0.0		1.3			0.7		0.1	
Delay (s)	33.0	11.1		13.8		18.9			34.3		33.5	
Level of Service	C	B		B		B			C		C	
Approach Delay (s)		12.3				18.7			34.3		33.5	
Approach LOS		B				B			C		C	
Intersection Summary												
HCM 2000 Control Delay			18.0		HCM 2000 Level of Service				B			
HCM 2000 Volume to Capacity ratio			0.52									
Actuated Cycle Length (s)			74.1		Sum of lost time (s)				23.5			
Intersection Capacity Utilization			48.7%		ICU Level of Service				A			
Analysis Period (min)			15									
c Critical Lane Group												

1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110
 HCM Signalized Intersection Capacity Analysis

2029 No-Build
 Timing Plan: Saturday MIDDAY

									
Movement	SEL	SET	SER	SER2	NWL2	NWL	NWT	NWR	NWR2
Lane Configurations									
Traffic Volume (vph)	77	16	3	23	1	17	24	1	19
Future Volume (vph)	77	16	3	23	1	17	24	1	19
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11	11	11	11
Total Lost time (s)		4.0		3.5			4.0		
Lane Util. Factor		1.00		1.00			1.00		
Frpb, ped/bikes		1.00		0.98			0.99		
Flpb, ped/bikes		1.00		1.00			1.00		
Frt		1.00		0.85			0.96		
Flt Protected		0.96		1.00			0.99		
Satd. Flow (prot)		1739		1537			1687		
Flt Permitted		0.79		1.00			0.89		
Satd. Flow (perm)		1430		1537			1520		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	84	17	3	25	1	18	26	1	21
RTOR Reduction (vph)	0	0	0	0	0	0	13	0	0
Lane Group Flow (vph)	0	104	0	25	0	0	54	0	0
Confl. Peds. (#/hr)	1							1	1
Confl. Bikes (#/hr)			2	2				1	1
Heavy Vehicles (%)	1%	0%	0%	0%	0%	0%	4%	0%	0%
Turn Type	pm+pt	NA		pm+ov	Perm	Perm	NA		
Protected Phases	7	4		5			8		
Permitted Phases	4			4	8	8			
Actuated Green, G (s)		9.4		12.8			9.4		
Effective Green, g (s)		11.9		17.8			11.9		
Actuated g/C Ratio		0.16		0.24			0.16		
Clearance Time (s)		6.5		6.0			6.5		
Vehicle Extension (s)		3.0		3.0			3.0		
Lane Grp Cap (vph)		229		369			244		
v/s Ratio Prot				0.01					
v/s Ratio Perm		c0.07		0.01			0.04		
v/c Ratio		0.45		0.07			0.22		
Uniform Delay, d1		28.2		21.7			27.1		
Progression Factor		1.00		1.00			1.00		
Incremental Delay, d2		1.4		0.1			0.5		
Delay (s)		29.6		21.8			27.5		
Level of Service		C		C			C		
Approach Delay (s)		28.1					27.5		
Approach LOS		C					C		
Intersection Summary									

2: Gas Sta. (west) & Rte 2A/110 HCM Unsignalized Intersection Capacity Analysis

2029 No-Build
Timing Plan: Saturday MIDDAY

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	383	7	5	316	9	3
Future Volume (Veh/h)	383	7	5	316	9	3
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	416	8	5	343	10	3
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)				259		
pX, platoon unblocked					0.85	
vC, conflicting volume			424		773	420
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			424		643	420
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		97	100
cM capacity (veh/h)			1146		373	638
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	424	348	13			
Volume Left	0	5	10			
Volume Right	8	0	3			
cSH	1700	1146	412			
Volume to Capacity	0.25	0.00	0.03			
Queue Length 95th (ft)	0	0	2			
Control Delay (s)	0.0	0.2	14.0			
Lane LOS		A	B			
Approach Delay (s)	0.0	0.2	14.0			
Approach LOS			B			
Intersection Summary						
Average Delay			0.3			
Intersection Capacity Utilization			30.6%	ICU Level of Service		A
Analysis Period (min)			15			

1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110

2029 Build

Timings

Timing Plan: Weekday AM

												
Lane Group	EBL2	EBT	WBL2	WBT	NBL2	NBL	NBT	SEL	SET	SER2	NWL	NWT
Lane Configurations												
Traffic Volume (vph)	25	439	4	253	20	11	0	142	42	45	24	16
Future Volume (vph)	25	439	4	253	20	11	0	142	42	45	24	16
Turn Type	Prot	NA	Perm	NA	Perm	Perm	NA	pm+pt	NA	pm+ov	Perm	NA
Protected Phases	5	2		6			10	7	4	5		8
Permitted Phases		2	6		10	10		4		4	8	
Detector Phase	5	2	6	6	10	10	10	7	4	5	8	8
Switch Phase												
Minimum Initial (s)	6.0	8.0	8.0	8.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Minimum Split (s)	12.0	15.0	15.0	15.0	13.0	13.0	13.0	9.5	12.5	12.0	12.5	12.5
Total Split (s)	13.0	51.0	38.0	38.0	13.0	13.0	13.0	13.5	39.0	13.0	25.5	25.5
Total Split (%)	11.2%	44.0%	32.8%	32.8%	11.2%	11.2%	11.2%	11.6%	33.6%	11.2%	22.0%	22.0%
Yellow Time (s)	4.0	5.0	5.0	5.0	4.0	4.0	4.0	3.5	3.5	4.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	3.0	3.0	3.0	0.0	3.0	2.0	3.5	3.5
Lost Time Adjust (s)	-2.0	-3.0	-3.0	-3.0			-3.0		-2.5	-2.5		-2.5
Total Lost Time (s)	4.0	4.0	4.0	4.0			4.0		4.0	3.5		4.0
Lead/Lag	Lead		Lag	Lag	Lag	Lag	Lag	Lead		Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	Min	Min	Min	None	None	None	None	None	None	None	None
Act Effct Green (s)	8.9	38.2	28.8	28.8			9.4		21.3	31.2		21.3
Actuated g/C Ratio	0.11	0.47	0.35	0.35			0.12		0.26	0.38		0.26
v/c Ratio	0.15	0.67	0.02	0.68			0.48		0.62	0.09		0.08
Control Delay	41.2	22.3	20.8	32.0			49.2		37.6	11.0		0.3
Queue Delay	0.0	0.0	0.0	0.0			0.0		0.0	0.0		0.0
Total Delay	41.2	22.3	20.8	32.0			49.2		37.6	11.0		0.3
LOS	D	C	C	C			D		D	B		A
Approach Delay		23.2		31.9			49.2		32.3			0.3
Approach LOS		C		C			D		C			A

Intersection Summary

Cycle Length: 116

Actuated Cycle Length: 81.5

Natural Cycle: 80

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.68

Intersection Signal Delay: 28.4

Intersection Capacity Utilization 54.8%

Analysis Period (min) 15

Intersection LOS: C

ICU Level of Service A

Splits and Phases: 1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110

 Ø2	 Ø4	 Ø9	 Ø10
51 s	39 s	13 s	13 s
 Ø5	 Ø6	 Ø7	 Ø8
13 s	38 s	13.5 s	25.5 s

1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110
Timings

2029 Build
Timing Plan: Weekday AM

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	6.0
Minimum Split (s)	13.0
Total Split (s)	13.0
Total Split (%)	11%
Yellow Time (s)	4.0
All-Red Time (s)	3.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	Lead
Lead-Lag Optimize?	
Recall Mode	None
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Intersection Summary	

Queues

Timing Plan: Weekday AM

								
Lane Group	EBL2	EBT	WBL2	WBT	NBT	SET	SER2	NWT
Lane Group Flow (vph)	27	524	4	368	92	200	49	46
v/c Ratio	0.15	0.67	0.02	0.68	0.48	0.62	0.09	0.08
Control Delay	41.2	22.3	20.8	32.0	49.2	37.6	11.0	0.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	41.2	22.3	20.8	32.0	49.2	37.6	11.0	0.3
Queue Length 50th (ft)	13	195	1	167	48	96	11	0
Queue Length 95th (ft)	43	363	9	305	#122	175	29	0
Internal Link Dist (ft)		179		174	132	468		564
Turn Bay Length (ft)	75		75				50	
Base Capacity (vph)	190	999	228	668	190	554	542	620
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.14	0.52	0.02	0.55	0.48	0.36	0.09	0.07

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110

2029 Build

HCM Signalized Intersection Capacity Analysis

Timing Plan: Weekday AM

												
Movement	EBL2	EBT	EBR	WBL2	WBT	WBR	NBL2	NBL	NBT	NBR	NBR2	SBT
Lane Configurations												
Traffic Volume (vph)	25	439	43	4	253	86	20	11	0	46	7	0
Future Volume (vph)	25	439	43	4	253	86	20	11	0	46	7	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0		4.0	4.0				4.0			
Lane Util. Factor	1.00	1.00		1.00	1.00				1.00			
Frt	1.00	0.99		1.00	0.96				0.91			
Flt Protected	0.95	1.00		0.95	1.00				0.98			
Satd. Flow (prot)	1646	1657		1163	1533				1707			
Flt Permitted	0.95	1.00		0.43	1.00				0.95			
Satd. Flow (perm)	1646	1657		526	1533				1651			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	27	477	47	4	275	93	22	12	0	50	8	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	27	524	0	4	368	0	0	0	92	0	0	0
Heavy Vehicles (%)	6%	10%	3%	50%	11%	28%	0%	0%	0%	0%	0%	0%
Turn Type	Prot	NA		Perm	NA		Perm	Perm	NA			
Protected Phases	5	2			6				10			9
Permitted Phases		2		6			10	10				
Actuated Green, G (s)	5.0	36.6		25.6	25.6				6.3			
Effective Green, g (s)	7.0	39.6		28.6	28.6				9.3			
Actuated g/C Ratio	0.09	0.48		0.35	0.35				0.11			
Clearance Time (s)	6.0	7.0		7.0	7.0				7.0			
Vehicle Extension (s)	3.0	3.0		3.0	3.0				3.0			
Lane Grp Cap (vph)	140	799		183	534				187			
v/s Ratio Prot	0.02	c0.32			0.24							
v/s Ratio Perm				0.01					c0.06			
v/c Ratio	0.19	0.66		0.02	0.69				0.49			
Uniform Delay, d1	34.9	16.1		17.6	22.9				34.2			
Progression Factor	1.00	1.00		1.00	1.00				1.00			
Incremental Delay, d2	0.7	2.0		0.0	3.7				2.0			
Delay (s)	35.6	18.0		17.6	26.6				36.2			
Level of Service	D	B		B	C				D			
Approach Delay (s)		18.9			26.5				36.2			0.0
Approach LOS		B			C				D			A
Intersection Summary												
HCM 2000 Control Delay			24.2			HCM 2000 Level of Service			C			
HCM 2000 Volume to Capacity ratio			0.75									
Actuated Cycle Length (s)			82.1			Sum of lost time (s)			23.5			
Intersection Capacity Utilization			54.8%			ICU Level of Service			A			
Analysis Period (min)			15									
c Critical Lane Group												

1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110
 HCM Signalized Intersection Capacity Analysis

2029 Build
 Timing Plan: Weekday AM

						
Movement	SEL	SET	SER2	NWL	NWT	NWR2
Lane Configurations						
Traffic Volume (vph)	142	42	45	24	16	3
Future Volume (vph)	142	42	45	24	16	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11
Total Lost time (s)		4.0	3.5		4.0	
Lane Util. Factor		1.00	1.00		1.00	
Frt		1.00	0.85		0.99	
Flt Protected		0.96	1.00		0.97	
Satd. Flow (prot)		1596	1394		1770	
Flt Permitted		0.74	1.00		0.80	
Satd. Flow (perm)		1235	1394		1453	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	154	46	49	26	17	3
RTOR Reduction (vph)	0	0	0	0	34	0
Lane Group Flow (vph)	0	200	49	0	12	0
Heavy Vehicles (%)	14%	0%	12%	0%	0%	0%
Turn Type	pm+pt	NA	pm+ov	Perm	NA	
Protected Phases	7	4	5		8	
Permitted Phases	4		4	8		
Actuated Green, G (s)		18.7	23.7		18.7	
Effective Green, g (s)		21.2	28.7		21.2	
Actuated g/C Ratio		0.26	0.35		0.26	
Clearance Time (s)		6.5	6.0		6.5	
Vehicle Extension (s)		3.0	3.0		3.0	
Lane Grp Cap (vph)		318	487		375	
v/s Ratio Prot			0.01			
v/s Ratio Perm		0.16	0.03		0.01	
v/c Ratio		0.63	0.10		0.03	
Uniform Delay, d1		27.0	18.0		22.8	
Progression Factor		1.00	1.00		1.00	
Incremental Delay, d2		3.9	0.1		0.0	
Delay (s)		30.8	18.1		22.8	
Level of Service		C	B		C	
Approach Delay (s)		28.3			22.8	
Approach LOS		C			C	
Intersection Summary						

2: Gas Sta. (west) & Rte 2A/110 HCM Unsignalized Intersection Capacity Analysis

2029 Build
Timing Plan: Weekday AM

								
Movement	EBT	EBR	WBL	WBT	NBL	NBR		
Lane Configurations								
Traffic Volume (veh/h)	448	78	91	251	27	59		
Future Volume (Veh/h)	448	78	91	251	27	59		
Sign Control	Free			Free	Stop			
Grade	0%			0%	0%			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92		
Hourly flow rate (vph)	487	85	99	273	29	64		
Pedestrians				1				
Lane Width (ft)				12.0				
Walking Speed (ft/s)				3.5				
Percent Blockage				0				
Right turn flare (veh)								
Median type	None			None				
Median storage veh)								
Upstream signal (ft)				259				
pX, platoon unblocked					0.84			
vC, conflicting volume				572	1000	530		
vC1, stage 1 conf vol								
vC2, stage 2 conf vol								
vCu, unblocked vol				572	908	530		
tC, single (s)				4.3	6.4	6.3		
tC, 2 stage (s)								
tF (s)				2.4	3.5	3.4		
p0 queue free %				89	87	88		
cM capacity (veh/h)				896	231	527		
Direction, Lane #	EB 1	WB 1	NB 1					
Volume Total	572	372	93					
Volume Left	0	99	29					
Volume Right	85	0	64					
cSH	1700	896	377					
Volume to Capacity	0.34	0.11	0.25					
Queue Length 95th (ft)	0	9	24					
Control Delay (s)	0.0	3.5	17.7					
Lane LOS		A	C					
Approach Delay (s)	0.0	3.5	17.7					
Approach LOS			C					
Intersection Summary								
Average Delay				2.8				
Intersection Capacity Utilization				62.0%	ICU Level of Service	B		
Analysis Period (min)				15				

1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110

2029 Build

Timings

Timing Plan: Weekday PM

												
Lane Group	EBL2	EBT	WBL2	WBT	NBL2	NBL	NBT	SEL	SET	SER2	NWL	NWT
Lane Configurations												
Traffic Volume (vph)	21	308	7	579	36	11	0	81	31	38	84	45
Future Volume (vph)	21	308	7	579	36	11	0	81	31	38	84	45
Turn Type	Prot	NA	Perm	NA	Perm	Perm	NA	pm+pt	NA	pm+ov	Perm	NA
Protected Phases	5	2		6			10	7	4	5		8
Permitted Phases		2	6		10	10		4		4	8	
Detector Phase	5	2	6	6	10	10	10	7	4	5	8	8
Switch Phase												
Minimum Initial (s)	6.0	8.0	8.0	8.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Minimum Split (s)	12.0	15.0	15.0	15.0	13.0	13.0	13.0	9.5	12.5	12.0	12.5	12.5
Total Split (s)	13.0	67.0	54.0	54.0	13.0	13.0	13.0	9.5	22.0	13.0	12.5	12.5
Total Split (%)	11.0%	56.8%	45.8%	45.8%	11.0%	11.0%	11.0%	8.1%	18.6%	11.0%	10.6%	10.6%
Yellow Time (s)	4.0	5.0	5.0	5.0	4.0	4.0	4.0	3.5	3.5	4.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	3.0	3.0	3.0	0.0	3.0	2.0	3.5	3.5
Lost Time Adjust (s)	-2.0	-3.0	-3.0	-3.0			-3.0		-2.5	-2.5		-2.5
Total Lost Time (s)	4.0	4.0	4.0	4.0			4.0		4.0	3.5		4.0
Lead/Lag	Lead		Lag	Lag	Lag	Lag	Lag	Lead		Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	Min	Min	Min	None	None	None	None	None	None	None	None
Act Effct Green (s)	8.6	60.2	50.4	50.4			9.1		15.8	25.4		15.8
Actuated g/C Ratio	0.09	0.62	0.52	0.52			0.09		0.16	0.26		0.16
v/c Ratio	0.16	0.33	0.02	0.84			0.54		0.61	0.10		0.36
Control Delay	46.0	10.1	13.6	32.3			58.1		52.6	18.9		2.5
Queue Delay	0.0	0.0	0.0	0.0			0.0		0.0	0.0		0.0
Total Delay	46.0	10.1	13.6	32.3			58.1		52.6	18.9		2.5
LOS	D	B	B	C			E		D	B		A
Approach Delay		12.2		32.1			58.1		44.1			2.5
Approach LOS		B		C			E		D			A

Intersection Summary

Cycle Length: 118

Actuated Cycle Length: 97.1

Natural Cycle: 110

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.84

Intersection Signal Delay: 27.1

Intersection Capacity Utilization 68.0%

Analysis Period (min) 15

Intersection LOS: C

ICU Level of Service C

Splits and Phases: 1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110

 Ø2		 Ø4		 Ø9		 Ø10
67 s		22 s		16 s		13 s
 Ø5	 Ø6	 Ø7	 Ø8			
13 s	54 s	9.5 s	12.5 s			

1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110
Timings

2029 Build
Timing Plan: Weekday PM

Lane Group Ø9

Lane Configurations

Traffic Volume (vph)

Future Volume (vph)

Turn Type

Protected Phases 9

Permitted Phases

Detector Phase

Switch Phase

Minimum Initial (s) 6.0

Minimum Split (s) 13.0

Total Split (s) 16.0

Total Split (%) 14%

Yellow Time (s) 4.0

All-Red Time (s) 3.0

Lost Time Adjust (s)

Total Lost Time (s)

Lead/Lag Lead

Lead-Lag Optimize?

Recall Mode None

Act Effect Green (s)

Actuated g/C Ratio

v/c Ratio

Control Delay

Queue Delay

Total Delay

LOS

Approach Delay

Approach LOS

Intersection Summary

Queues

Timing Plan: Weekday PM

								
Lane Group	EBL2	EBT	WBL2	WBT	NBT	SET	SER2	NWT
Lane Group Flow (vph)	23	355	8	751	86	122	41	147
v/c Ratio	0.16	0.33	0.02	0.84	0.54	0.61	0.10	0.36
Control Delay	46.0	10.1	13.6	32.3	58.1	52.6	18.9	2.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.0	10.1	13.6	32.3	58.1	52.6	18.9	2.5
Queue Length 50th (ft)	14	102	3	423	55	73	15	0
Queue Length 95th (ft)	40	154	11	#675	#115	135	36	0
Internal Link Dist (ft)		179		174	132	468		564
Turn Bay Length (ft)	75		75				50	
Base Capacity (vph)	149	1137	523	892	158	230	409	404
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.15	0.31	0.02	0.84	0.54	0.53	0.10	0.36

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110

2029 Build

HCM Signalized Intersection Capacity Analysis

Timing Plan: Weekday PM

												
Movement	EBL2	EBT	EBR	WBL2	WBT	WBR	NBL2	NBL	NBT	NBR	NBR2	SBT
Lane Configurations												
Traffic Volume (vph)	21	308	18	7	579	112	36	11	0	28	5	0
Future Volume (vph)	21	308	18	7	579	112	36	11	0	28	5	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0		4.0	4.0				4.0			
Lane Util. Factor	1.00	1.00		1.00	1.00				1.00			
Frpb, ped/bikes	1.00	1.00		1.00	1.00				1.00			
Flpb, ped/bikes	1.00	1.00		1.00	1.00				0.99			
Frt	1.00	0.99		1.00	0.98				0.95			
Flt Protected	0.95	1.00		0.95	1.00				0.97			
Satd. Flow (prot)	1601	1739		1745	1720				1733			
Flt Permitted	0.95	1.00		0.55	1.00				0.95			
Satd. Flow (perm)	1601	1739		1008	1720				1695			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	23	335	20	8	629	122	39	12	0	30	5	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	23	355	0	8	751	0	0	0	86	0	0	0
Confl. Peds. (#/hr)	2					2		2				
Confl. Bikes (#/hr)												
Heavy Vehicles (%)	9%	5%	0%	0%	4%	3%	0%	0%	0%	0%	0%	0%
Turn Type	Prot	NA		Perm	NA		Perm	Perm	NA			
Protected Phases	5	2			6				10			9
Permitted Phases		2		6			10	10				
Actuated Green, G (s)	5.2	58.5		47.3	47.3				6.0			
Effective Green, g (s)	7.2	61.5		50.3	50.3				9.0			
Actuated g/C Ratio	0.07	0.63		0.51	0.51				0.09			
Clearance Time (s)	6.0	7.0		7.0	7.0				7.0			
Vehicle Extension (s)	3.0	3.0		3.0	3.0				3.0			
Lane Grp Cap (vph)	117	1087		515	880				155			
v/s Ratio Prot	0.01	c0.20			c0.44							
v/s Ratio Perm				0.01					c0.05			
v/c Ratio	0.20	0.33		0.02	0.85				0.55			
Uniform Delay, d1	42.8	8.7		11.8	20.8				42.7			
Progression Factor	1.00	1.00		1.00	1.00				1.00			
Incremental Delay, d2	0.8	0.2		0.0	8.1				4.3			
Delay (s)	43.7	8.8		11.8	28.9				47.0			
Level of Service	D	A		B	C				D			
Approach Delay (s)		11.0			28.7				47.0			0.0
Approach LOS		B			C				D			A
Intersection Summary												
HCM 2000 Control Delay			27.2			HCM 2000 Level of Service			C			
HCM 2000 Volume to Capacity ratio			0.81									
Actuated Cycle Length (s)			98.3			Sum of lost time (s)			23.5			
Intersection Capacity Utilization			68.0%			ICU Level of Service			C			
Analysis Period (min)			15									
c Critical Lane Group												

1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110
 HCM Signalized Intersection Capacity Analysis

2029 Build
 Timing Plan: Weekday PM

						
Movement	SEL	SET	SER2	NWL	NWT	NWR2
Lane Configurations						
Traffic Volume (vph)	81	31	38	84	45	6
Future Volume (vph)	81	31	38	84	45	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11
Total Lost time (s)		4.0	3.5		4.0	
Lane Util. Factor		1.00	1.00		1.00	
Frpb, ped/bikes		1.00	0.99		1.00	
Flpb, ped/bikes		1.00	1.00		1.00	
Frt		1.00	0.85		0.99	
Flt Protected		0.97	1.00		0.97	
Satd. Flow (prot)		1699	1539		1770	
Flt Permitted		0.70	1.00		0.65	
Satd. Flow (perm)		1233	1539		1181	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	88	34	41	91	49	7
RTOR Reduction (vph)	0	0	0	0	123	0
Lane Group Flow (vph)	0	122	41	0	24	0
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)			1			
Heavy Vehicles (%)	6%	0%	0%	0%	0%	0%
Turn Type	pm+pt	NA	pm+ov	Perm	NA	
Protected Phases	7	4	5		8	
Permitted Phases	4		4	8		
Actuated Green, G (s)		13.3	18.5		13.3	
Effective Green, g (s)		15.8	23.5		15.8	
Actuated g/C Ratio		0.16	0.24		0.16	
Clearance Time (s)		6.5	6.0		6.5	
Vehicle Extension (s)		3.0	3.0		3.0	
Lane Grp Cap (vph)		198	367		189	
v/s Ratio Prot			0.01			
v/s Ratio Perm		0.10	0.02		0.02	
v/c Ratio		0.62	0.11		0.13	
Uniform Delay, d1		38.4	29.2		35.3	
Progression Factor		1.00	1.00		1.00	
Incremental Delay, d2		5.6	0.1		0.3	
Delay (s)		44.0	29.4		35.6	
Level of Service		D	C		D	
Approach Delay (s)		40.3			35.6	
Approach LOS		D			D	
Intersection Summary						

2: Gas Sta. (west) & Rte 2A/110 HCM Unsignalized Intersection Capacity Analysis

2029 Build
Timing Plan: Weekday PM

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	303	49	114	623	40	44
Future Volume (Veh/h)	303	49	114	623	40	44
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	329	53	124	677	43	48
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)				259		
pX, platoon unblocked					0.63	
vC, conflicting volume			382		1280	356
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			382		1152	356
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			90		65	93
cM capacity (veh/h)			1188		125	693
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	382	801	91			
Volume Left	0	124	43			
Volume Right	53	0	48			
cSH	1700	1188	220			
Volume to Capacity	0.22	0.10	0.41			
Queue Length 95th (ft)	0	9	47			
Control Delay (s)	0.0	2.5	32.5			
Lane LOS		A	D			
Approach Delay (s)	0.0	2.5	32.5			
Approach LOS			D			
Intersection Summary						
Average Delay			3.9			
Intersection Capacity Utilization			72.9%	ICU Level of Service		C
Analysis Period (min)			15			

1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110

2029 Build

Timings

Timing Plan: Saturday MIDDAY

												
Lane Group	EBL2	EBT	WBL2	WBT	NBL2	NBL	NBT	SBT	SEL	SET	SER2	NWL
Lane Configurations												
Traffic Volume (vph)	29	349	14	317	29	15	0	0	66	14	46	26
Future Volume (vph)	29	349	14	317	29	15	0	0	66	14	46	26
Turn Type	Prot	NA	Perm	NA	Perm	Perm	NA	NA	pm+pt	NA	pm+ov	Perm
Protected Phases	5	2		6			10	9	7	4	5	
Permitted Phases		2	6		10	10			4		4	8
Detector Phase	5	2	6	6	10	10	10	9	7	4	5	8
Switch Phase												
Minimum Initial (s)	6.0	8.0	8.0	8.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Minimum Split (s)	12.0	15.0	15.0	15.0	13.0	13.0	13.0	13.0	9.5	12.5	12.0	12.5
Total Split (s)	13.0	67.0	54.0	54.0	13.0	13.0	13.0	16.0	9.5	22.0	13.0	12.5
Total Split (%)	11.0%	56.8%	45.8%	45.8%	11.0%	11.0%	11.0%	13.6%	8.1%	18.6%	11.0%	10.6%
Yellow Time (s)	4.0	5.0	5.0	5.0	4.0	4.0	4.0	4.0	3.5	3.5	4.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	3.0	3.0	3.0	3.0	0.0	3.0	2.0	3.5
Lost Time Adjust (s)	-2.0	-3.0	-3.0	-3.0			-3.0	-3.0		-2.5	-2.5	
Total Lost Time (s)	4.0	4.0	4.0	4.0			4.0	4.0		4.0	3.5	
Lead/Lag	Lead		Lag	Lag	Lag	Lag	Lag	Lead	Lead		Lead	Lag
Lead-Lag Optimize?												
Recall Mode	None	Min	Min	Min	None	None	None	None	None	None	None	None
Act Effct Green (s)	9.2	41.3	31.7	31.7			9.8	9.8		13.9	21.1	
Actuated g/C Ratio	0.12	0.55	0.42	0.42			0.13	0.13		0.18	0.28	
v/c Ratio	0.15	0.40	0.04	0.59			0.54	0.00		0.34	0.12	
Control Delay	40.1	13.3	18.2	24.7			50.4	41.0		36.5	13.9	
Queue Delay	0.0	0.0	0.0	0.0			0.0	0.0		0.0	0.0	
Total Delay	40.1	13.3	18.2	24.7			50.4	41.0		36.5	13.9	
LOS	D	B	B	C			D	D		D	B	
Approach Delay		15.3		24.4			50.4	41.0		28.3		
Approach LOS		B		C			D	D		C		

Intersection Summary

Cycle Length: 118

Actuated Cycle Length: 75.5

Natural Cycle: 80

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.59

Intersection Signal Delay: 24.2

Intersection Capacity Utilization 57.0%

Analysis Period (min) 15

Intersection LOS: C

ICU Level of Service B

Splits and Phases: 1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110

 Ø2	 Ø4	 Ø9	 Ø10
67 s	22 s	16 s	13 s
 Ø5	 Ø6	 Ø7	 Ø8
13 s	54 s	9.5 s	12.5 s

Timings

Timing Plan: Saturday MIDDAY



Lane Group	NWT
------------	-----

Lane Configurations	
---------------------	---

Traffic Volume (vph)	21
----------------------	----

Future Volume (vph)	21
---------------------	----

Turn Type	NA
-----------	----

Protected Phases	8
------------------	---

Permitted Phases	
------------------	--

Detector Phase	8
----------------	---

Switch Phase	
--------------	--

Minimum Initial (s)	6.0
---------------------	-----

Minimum Split (s)	12.5
-------------------	------

Total Split (s)	12.5
-----------------	------

Total Split (%)	10.6%
-----------------	-------

Yellow Time (s)	3.0
-----------------	-----

All-Red Time (s)	3.5
------------------	-----

Lost Time Adjust (s)	-2.5
----------------------	------

Total Lost Time (s)	4.0
---------------------	-----

Lead/Lag	Lag
----------	-----

Lead-Lag Optimize?	
--------------------	--

Recall Mode	None
-------------	------

Act Effct Green (s)	13.8
---------------------	------

Actuated g/C Ratio	0.18
--------------------	------

v/c Ratio	0.25
-----------	------

Control Delay	30.5
---------------	------

Queue Delay	0.0
-------------	-----

Total Delay	30.5
-------------	------

LOS	C
-----	---

Approach Delay	30.5
----------------	------

Approach LOS	C
--------------	---

Intersection Summary	
----------------------	--

Queues

Timing Plan: Saturday MIDDAY

									
Lane Group	EBL2	EBT	WBL2	WBT	NBT	SBT	SET	SER2	NWT
Lane Group Flow (vph)	32	391	15	429	103	1	87	50	69
v/c Ratio	0.15	0.40	0.04	0.59	0.54	0.00	0.34	0.12	0.25
Control Delay	40.1	13.3	18.2	24.7	50.4	41.0	36.5	13.9	30.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.1	13.3	18.2	24.7	50.4	41.0	36.5	13.9	30.5
Queue Length 50th (ft)	13	100	4	165	45	0	35	10	23
Queue Length 95th (ft)	53	235	20	341	#173	6	106	36	78
Internal Link Dist (ft)		179		174	132	164	468		564
Turn Bay Length (ft)	75		75					50	
Base Capacity (vph)	226	1476	679	1216	191	284	360	442	274
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.14	0.26	0.02	0.35	0.54	0.00	0.24	0.11	0.25

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110

2029 Build

HCM Signalized Intersection Capacity Analysis

Timing Plan: Saturday Midday

												
Movement	EBL2	EBT	EBR	WBL2	WBT	WBR	NBL2	NBL	NBT	NBR	NBR2	SBT
Lane Configurations												
Traffic Volume (vph)	29	349	11	14	317	77	29	15	0	47	4	0
Future Volume (vph)	29	349	11	14	317	77	29	15	0	47	4	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0		4.0	4.0				4.0			4.0
Lane Util. Factor	1.00	1.00		1.00	1.00				1.00			1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00				0.99			1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00				1.00			1.00
Frt	1.00	1.00		1.00	0.97				0.93			0.86
Flt Protected	0.95	1.00		0.95	1.00				0.98			1.00
Satd. Flow (prot)	1745	1788		1745	1744				1701			1644
Flt Permitted	0.95	1.00		0.53	1.00				0.85			1.00
Satd. Flow (perm)	1745	1788		975	1744				1480			1644
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	32	379	12	15	345	84	32	16	0	51	4	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	32	391	0	15	429	0	0	0	103	0	0	1
Confl. Peds. (#/hr)										1		
Confl. Bikes (#/hr)												
Heavy Vehicles (%)	0%	2%	11%	0%	2%	3%	0%	0%	0%	0%	0%	0%
Turn Type	Prot	NA		Perm	NA		Perm	Perm	NA			NA
Protected Phases	5	2			6				10			9
Permitted Phases		2		6			10	10				
Actuated Green, G (s)	5.0	39.5		28.5	28.5				6.5			0.8
Effective Green, g (s)	7.0	42.5		31.5	31.5				9.5			3.8
Actuated g/C Ratio	0.08	0.51		0.38	0.38				0.11			0.05
Clearance Time (s)	6.0	7.0		7.0	7.0				7.0			7.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0				3.0			3.0
Lane Grp Cap (vph)	146	912		368	659				168			74
v/s Ratio Prot	0.02	c0.22			c0.25							c0.00
v/s Ratio Perm				0.02					c0.07			
v/c Ratio	0.22	0.43		0.04	0.65				0.61			0.01
Uniform Delay, d1	35.6	12.8		16.4	21.4				35.1			38.0
Progression Factor	1.00	1.00		1.00	1.00				1.00			1.00
Incremental Delay, d2	0.8	0.3		0.0	2.3				6.5			0.1
Delay (s)	36.4	13.1		16.4	23.7				41.6			38.0
Level of Service	D	B		B	C				D			D
Approach Delay (s)		14.9			23.4				41.6			38.0
Approach LOS		B			C				D			D
Intersection Summary												
HCM 2000 Control Delay			23.5			HCM 2000 Level of Service			C			
HCM 2000 Volume to Capacity ratio			0.59									
Actuated Cycle Length (s)			83.3			Sum of lost time (s)			23.5			
Intersection Capacity Utilization			57.0%			ICU Level of Service			B			
Analysis Period (min)			15									
c Critical Lane Group												

1: Gas Sta./Res. Driveway & Bruce St./Willow Rd. & Rte 2A/110
 HCM Signalized Intersection Capacity Analysis

2029 Build
 Timing Plan: Saturday MIDDAY

								
Movement	SBR2	SEL	SET	SER2	NWL	NWT	NWR	NWR2
Lane Configurations								
Traffic Volume (vph)	1	66	14	46	26	21	1	16
Future Volume (vph)	1	66	14	46	26	21	1	16
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	11	11	11	11	11	11	11
Total Lost time (s)			4.0	3.5		4.0		
Lane Util. Factor			1.00	1.00		1.00		
Frpb, ped/bikes			1.00	0.99		0.99		
Flpb, ped/bikes			1.00	1.00		1.00		
Frt			1.00	0.85		0.96		
Flt Protected			0.96	1.00		0.98		
Satd. Flow (prot)			1745	1539		1699		
Flt Permitted			0.76	1.00		0.84		
Satd. Flow (perm)			1388	1539		1455		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	72	15	50	28	23	1	17
RTOR Reduction (vph)	0	0	0	0	0	9	0	0
Lane Group Flow (vph)	0	0	87	50	0	60	0	0
Confl. Peds. (#/hr)		1					1	1
Confl. Bikes (#/hr)				2			1	1
Heavy Vehicles (%)	0%	1%	0%	0%	0%	4%	0%	0%
Turn Type		pm+pt	NA	pm+ov	Perm	NA		
Protected Phases		7	4	5		8		
Permitted Phases		4		4	8			
Actuated Green, G (s)			9.0	14.0		9.0		
Effective Green, g (s)			11.5	19.0		11.5		
Actuated g/C Ratio			0.14	0.23		0.14		
Clearance Time (s)			6.5	6.0		6.5		
Vehicle Extension (s)			3.0	3.0		3.0		
Lane Grp Cap (vph)			191	351		200		
v/s Ratio Prot				0.01				
v/s Ratio Perm			c0.06	0.02		0.04		
v/c Ratio			0.46	0.14		0.30		
Uniform Delay, d1			33.0	25.7		32.3		
Progression Factor			1.00	1.00		1.00		
Incremental Delay, d2			1.7	0.2		0.8		
Delay (s)			34.7	25.8		33.1		
Level of Service			C	C		C		
Approach Delay (s)			31.5			33.1		
Approach LOS			C			C		
Intersection Summary								

2: Gas Sta. (west) & Rte 2A/110

HCM Unsignalized Intersection Capacity Analysis

2029 Build
Timing Plan: Saturday MIDDAY

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	330	75	117	301	39	59
Future Volume (Veh/h)	330	75	117	301	39	59
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	359	82	127	327	42	64
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)				259		
pX, platoon unblocked					0.82	
vC, conflicting volume			441		981	400
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			441		865	400
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			89		82	90
cM capacity (veh/h)			1130		237	654
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	441	454	106			
Volume Left	0	127	42			
Volume Right	82	0	64			
cSH	1700	1130	385			
Volume to Capacity	0.26	0.11	0.27			
Queue Length 95th (ft)	0	9	28			
Control Delay (s)	0.0	3.3	17.8			
Lane LOS		A	C			
Approach Delay (s)	0.0	3.3	17.8			
Approach LOS			C			
Intersection Summary						
Average Delay			3.4			
Intersection Capacity Utilization			60.0%	ICU Level of Service		B
Analysis Period (min)			15			

2: Gas Sta. (west) & Rte 2A/110

HCM Unsignalized Intersection Capacity Analysis

2029 Build-MIT
Timing Plan: Weekday AM

								
Movement	EBT	EBR	WBL	WBT	NBL	NBR		
Lane Configurations								
Traffic Volume (veh/h)	448	78	91	251	27	59		
Future Volume (Veh/h)	448	78	91	251	27	59		
Sign Control	Free			Free	Stop			
Grade	0%			0%	0%			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92		
Hourly flow rate (vph)	487	85	99	273	29	64		
Pedestrians				1				
Lane Width (ft)				12.0				
Walking Speed (ft/s)				3.5				
Percent Blockage				0				
Right turn flare (veh)								
Median type	None			None				
Median storage veh)								
Upstream signal (ft)				271				
pX, platoon unblocked								
vC, conflicting volume			572		1000	530		
vC1, stage 1 conf vol								
vC2, stage 2 conf vol								
vCu, unblocked vol			572		1000	530		
tC, single (s)			4.3		6.4	6.3		
tC, 2 stage (s)								
tF (s)			2.4		3.5	3.4		
p0 queue free %			89		88	88		
cM capacity (veh/h)			896		242	527		
Direction, Lane #	EB 1	WB 1	WB 2	NB 1				
Volume Total	572	99	273	93				
Volume Left	0	99	0	29				
Volume Right	85	0	0	64				
cSH	1700	896	1700	385				
Volume to Capacity	0.34	0.11	0.16	0.24				
Queue Length 95th (ft)	0	9	0	23				
Control Delay (s)	0.0	9.5	0.0	17.3				
Lane LOS		A		C				
Approach Delay (s)	0.0	2.5		17.3				
Approach LOS				C				
Intersection Summary								
Average Delay			2.5					
Intersection Capacity Utilization			48.8%	ICU Level of Service	A			
Analysis Period (min)			15					

2: Gas Sta. (west) & Rte 2A/110

HCM Unsignalized Intersection Capacity Analysis

2029 Build-MIT
Timing Plan: Weekday PM

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	303	49	114	623	40	44
Future Volume (Veh/h)	303	49	114	623	40	44
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	329	53	124	677	43	48
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)				271		
pX, platoon unblocked					0.65	
vC, conflicting volume				382	1280	356
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol				382	1163	356
tC, single (s)				4.1	6.4	6.2
tC, 2 stage (s)						
tF (s)				2.2	3.5	3.3
p0 queue free %				90	66	93
cM capacity (veh/h)				1188	127	693
Direction, Lane #	EB 1	WB 1	WB 2	NB 1		
Volume Total	382	124	677	91		
Volume Left	0	124	0	43		
Volume Right	53	0	0	48		
cSH	1700	1188	1700	223		
Volume to Capacity	0.22	0.10	0.40	0.41		
Queue Length 95th (ft)	0	9	0	47		
Control Delay (s)	0.0	8.4	0.0	31.9		
Lane LOS		A		D		
Approach Delay (s)	0.0	1.3		31.9		
Approach LOS				D		
Intersection Summary						
Average Delay				3.1		
Intersection Capacity Utilization				44.4%	ICU Level of Service	A
Analysis Period (min)				15		

2: Gas Sta. (west) & Rte 2A/110

HCM Unsignalized Intersection Capacity Analysis

2029 Build-MIT
Timing Plan: Saturday MIDDAY

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	330	75	117	301	39	59
Future Volume (Veh/h)	330	75	117	301	39	59
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	359	82	127	327	42	64
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (ft)				271		
pX, platoon unblocked					0.93	
vC, conflicting volume			441		981	400
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			441		939	400
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			89		83	90
cM capacity (veh/h)			1130		243	654
Direction, Lane #	EB 1	WB 1	WB 2	NB 1		
Volume Total	441	127	327	106		
Volume Left	0	127	0	42		
Volume Right	82	0	0	64		
cSH	1700	1130	1700	391		
Volume to Capacity	0.26	0.11	0.19	0.27		
Queue Length 95th (ft)	0	9	0	27		
Control Delay (s)	0.0	8.6	0.0	17.6		
Lane LOS		A		C		
Approach Delay (s)	0.0	2.4		17.6		
Approach LOS				C		
Intersection Summary						
Average Delay			3.0			
Intersection Capacity Utilization			44.2%	ICU Level of Service		A
Analysis Period (min)			15			

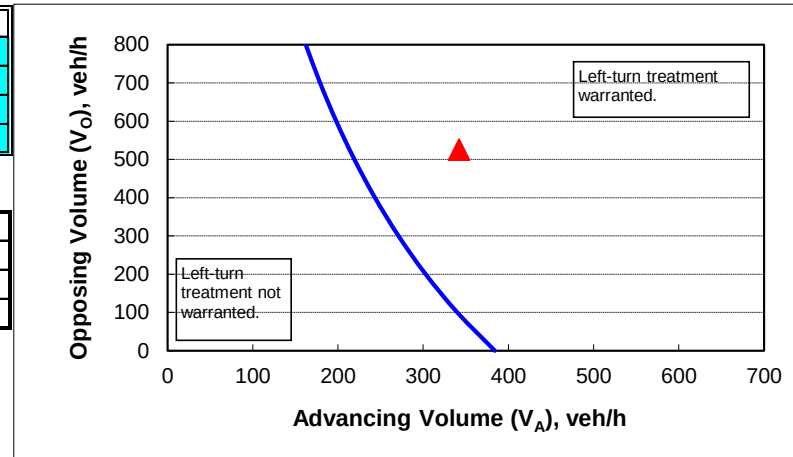
AUXILIARY LANE WARRANT ANALYSIS

Figure 2 - 5. Guideline for determining the need for a major-road left-turn bay at a two-way stop-controlled intersection.**2-lane roadway (English)****INPUT**

Variable	Value
85 th percentile speed, mph:	42
Percent of left-turns in advancing volume (V_A), %:	27%
Advancing volume (V_A), veh/h:	342
Opposing volume (V_O), veh/h:	526

OUTPUT

Variable	Value
Limiting advancing volume (V_A), veh/h:	213
Guidance for determining the need for a major-road left-turn bay:	
Left-turn treatment warranted.	

**CALIBRATION CONSTANTS**

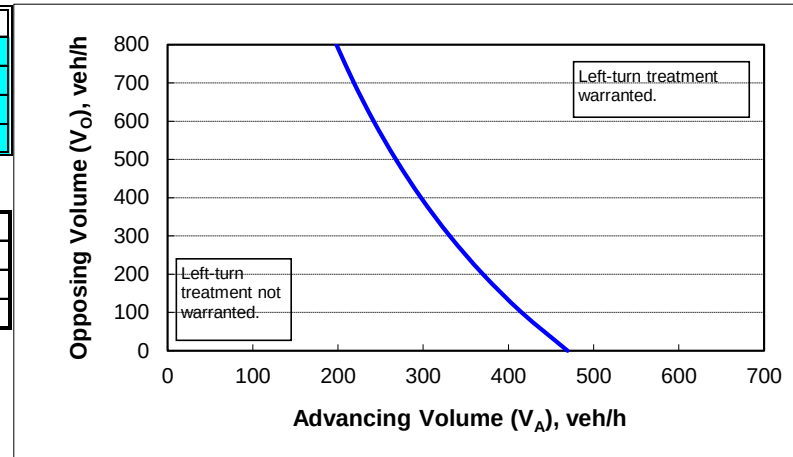
Variable	Value
Average time for making left-turn, s:	3.0
Critical headway, s:	5.0
Average time for left-turn vehicle to clear the advancing lane, s:	1.9

Figure 2 - 5. Guideline for determining the need for a major-road left-turn bay at a two-way stop-controlled intersection.**2-lane roadway (English)****INPUT**

Variable	Value
85 th percentile speed, mph:	42
Percent of left-turns in advancing volume (V_A), %:	15%
Advancing volume (V_A), veh/h:	737
Opposing volume (V_O), veh/h:	352

OUTPUT

Variable	Value
Limiting advancing volume (V_A), veh/h:	313
Guidance for determining the need for a major-road left-turn bay:	
Left-turn treatment warranted.	

**CALIBRATION CONSTANTS**

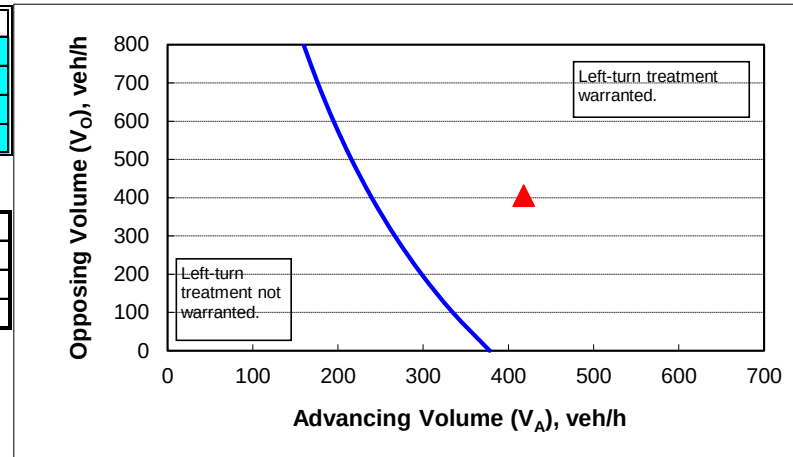
Variable	Value
Average time for making left-turn, s:	3.0
Critical headway, s:	5.0
Average time for left-turn vehicle to clear the advancing lane, s:	1.9

Figure 2 - 5. Guideline for determining the need for a major-road left-turn bay at a two-way stop-controlled intersection.**2-lane roadway (English)****INPUT**

Variable	Value
85 th percentile speed, mph:	42
Percent of left-turns in advancing volume (V_A), %:	28%
Advancing volume (V_A), veh/h:	418
Opposing volume (V_O), veh/h:	405

OUTPUT

Variable	Value
Limiting advancing volume (V_A), veh/h:	238
Guidance for determining the need for a major-road left-turn bay:	
Left-turn treatment warranted.	

**CALIBRATION CONSTANTS**

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway, s:	5.0
Average time for left-turn vehicle to clear the advancing lane, s:	1.9