

MEMORANDUM

DATE: July 18, 2011

TO: Mr. Robert France
Mount Laurel Development, LLC.
P.O. Box 1444
1000 Mount Laurel Circle, Suite 4
Shirley, MA 01464

FROM: Robert J. Michaud, P.E. – Managing Principal 
Daniel A. Dumais, E.I.T. – Senior Transportation Engineer

RE: **Proposed Mixed Use development**
134 Main Street – Groton, MA

MDM Transportation Consultants, Inc. (MDM) has prepared this traffic impact assessment (TIA) for the proposed mixed use development to be located at 134 Main Street (Routes 119/225) in Groton, Massachusetts. This memorandum describes existing (baseline) traffic conditions for adjacent roadways, evaluates safety-related conditions at key study locations, trip generation characteristics of the proposed development, quantifies incremental traffic impacts of the site development on area roadways, and identifies access improvements to support the site as required.

Key findings of the traffic assessment are as follows:

- *Traffic Generation.* The proposed mixed-use development is estimated to generate approximately 16 vehicle trips (6 entering and 10 exiting) during the morning peak hour and 22 vehicle trips (9 entering and 13 exiting) during the weekday evening peak hour. On a daily basis, the proposed development is estimated to generate approximately 242 vehicle trips on a weekday with 50 percent entering and exiting.
- *Safety Characteristics.* No immediate safety countermeasures are required at the study intersections based solely on historic crash data. Likewise, safe stopping sight distance (SSD) is available for oncoming vehicles to detect, react and stop for vehicles exiting the proposed site driveway onto Route 119/225 based on regulatory speed limits in the area.

- *Adequate Roadway Capacity & Operations.* Adequate capacity is available along Route 119/225 to accommodate the modest projected traffic increases for the proposed mixed-use development. Mainline travel along Route 119/225 operates with minimal delays under existing conditions. The project will result in nominal impact to operations along Route 119/225 with an increase in traffic of 22 vehicles or less during the peak hours (1% increase). This level of increase is well within the day to day fluctuations in traffic volumes along said roadway and will be imperceptible to the average motorist. The proposed site driveway will operate with relatively long delays during the peak hours; however, the critical left turn exiting traffic from the development is estimated at approximately 1 vehicle every 6 minutes or less which will be managed on-site with no material impact to on-site parking or circulation.

PROJECT DESCRIPTION

The project site is an approximate 5.5-acre tract of land located at 134 Main Street (Routes 119/225) on the eastern side of Main Street in Groton, Massachusetts. The location of the site relative to adjacent roadways is shown in **Figure 1**. The site is comprised of three buildings which include a residential building (5,932 sf), and two commercial buildings (7,300) that are associated with an antique furniture and fine arts shop, café, and antique restoration shop. Currently, the site is served by a single 12± foot wide driveway located along the eastern side of Main Street directly opposite to driveway (restricted to enter only) for a strip plaza. The existing driveway for the Site merges with the driveway for Old Groton Inn property and provides a single curb cut along Routes 119/225.

Under the proposed development plan the site will include 15 residential townhomes, 3 second floor apartment units above commercial space, and 3,500 sf of commercial building space supported by 74 on-site parking spaces (54 townhome garage/driveway spaces and 20 mixed use parking lot spaces that includes 2 HP spaces). For traffic analysis purposes, commercial uses at the Site are assumed to include 2,500 sf of medical/dental office and 1,000 sf of specialty retail use. As part of the redevelopment of the Site, the access/egress driveway will be relocated to the north, opposite the existing (southerly) Ace Hardware driveway, and will provide an increased pavement width of 20 feet. This driveway location will also maximize the curb-cut separation distance between the driveway and Old Groton Inn driveway. The preliminary site layout prepared by GPR Inc. is presented in **Figure 2**.

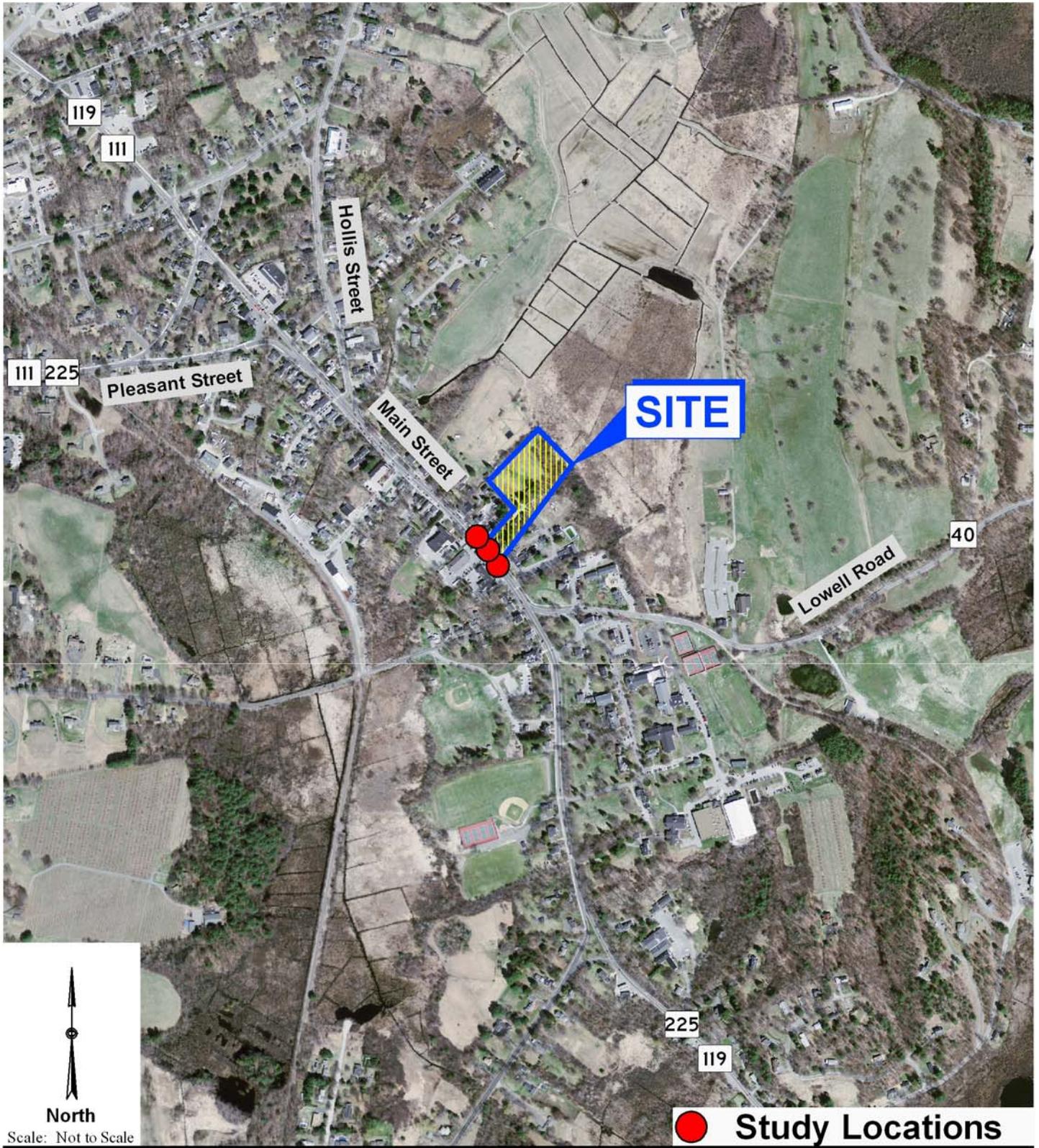
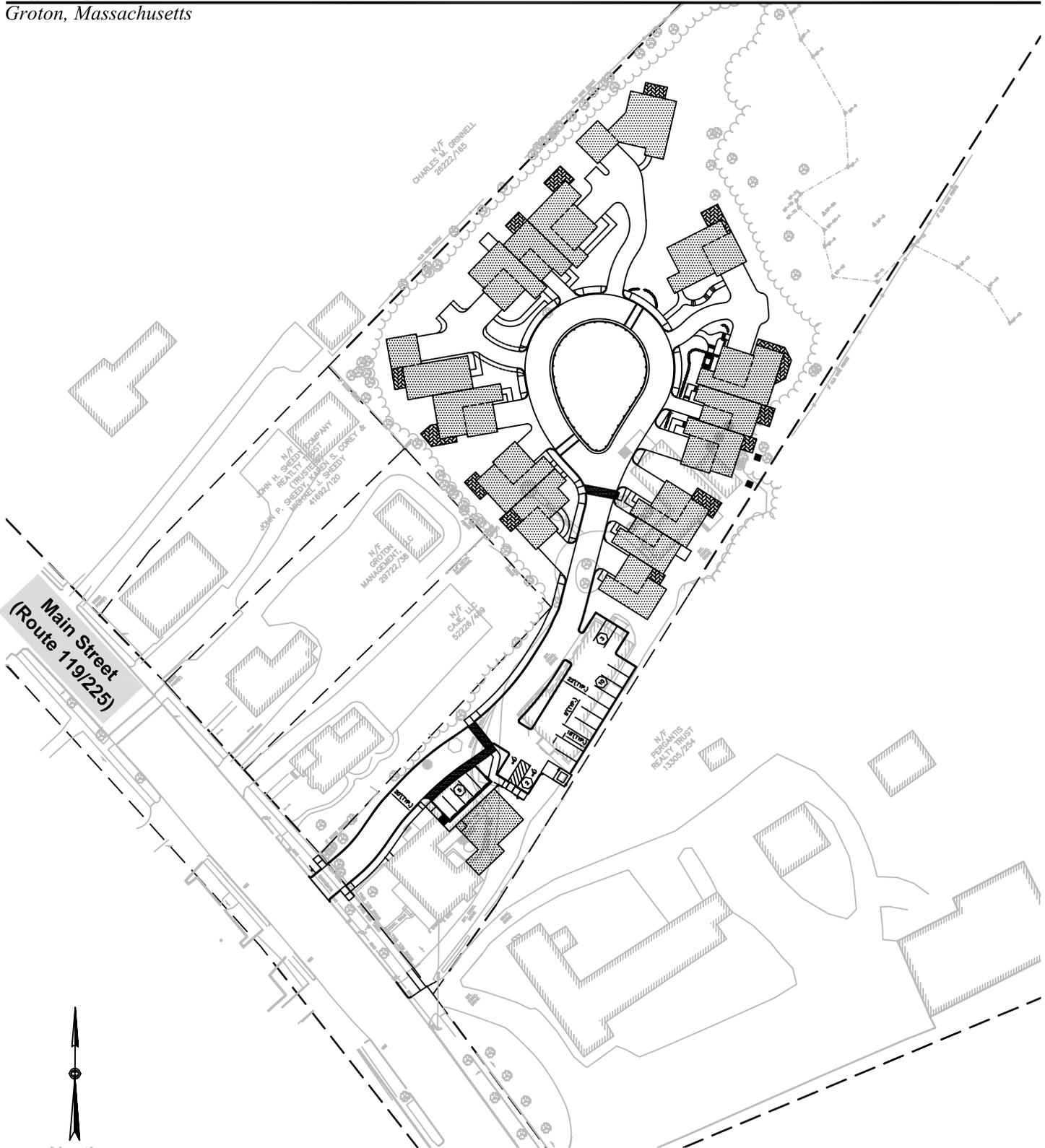


Figure 1



North

Scale: Not to Scale

Source: GPR, Inc.

Figure 2

STUDY METHODOLOGY

This transportation impact assessment is conducted in accordance with EOEEA/MassDOT traffic study guidelines, and consists of several steps. The first step documents existing conditions in the transportation study area, including an inventory of roadway geometry, observed traffic volumes and safety characteristics. Next, future year traffic conditions are forecast that account for other planned area developments, normal area growth, and development-related traffic increases. The third step quantifies operating characteristics of study intersections. Specific attention is given to the incremental impacts of the proposed development. Finally, improvements are described that address specific development-related operational needs as required.

STUDY AREA

This TIA evaluates transportation characteristics of roadways and intersections that provide a primary means of access to the site, and that are likely to sustain a measurable level of traffic impact from the development. The study area includes the following intersections, which are also identified in **Figure 1**:

- Routes 119/225 at Ace Hardware Northerly Driveway (Unsignalized)
- Routes 119/225 at Ace Hardware Southerly Driveway (Unsignalized)
- Routes 119/225 at Plaza Driveway/The Old Groton Inn Driveway (Unsignalized)

EXISTING ROADWAY CHARACTERISTICS

An overview of roadway classification and geometric characteristics is provided below for study roadways and intersections.

Roadways

Main Street (Route 119/225)

Route 119/225 is classified by the Massachusetts Department of Transportation (MassDOT) as an Urban Other Principal Arterial roadway under Local (Town) Jurisdiction. Main Street is a north-south roadway in the project area which connects the Boston Road to the south with South Road in the Town of Pepperell to the north. Regionally, Route 119 connects local communities with I-495 to the south and with Route 13 to the north to New Hampshire. The roadway in the immediate project area provides one lane of travel in each direction contains sidewalks and a grass strip along both edges sides of the roadway and has a posted speed limit of 30 miles per hour. Pavement markings include a double yellow centerline and parking is permitted on both sides of the roadway. Land use along Route 119/225 in the immediate project

area includes a mix of land uses including commercial/ retail uses, residential homes, office uses, restaurants, and religious uses.

Intersection

Route 119/225 at Ace Hardware Driveways

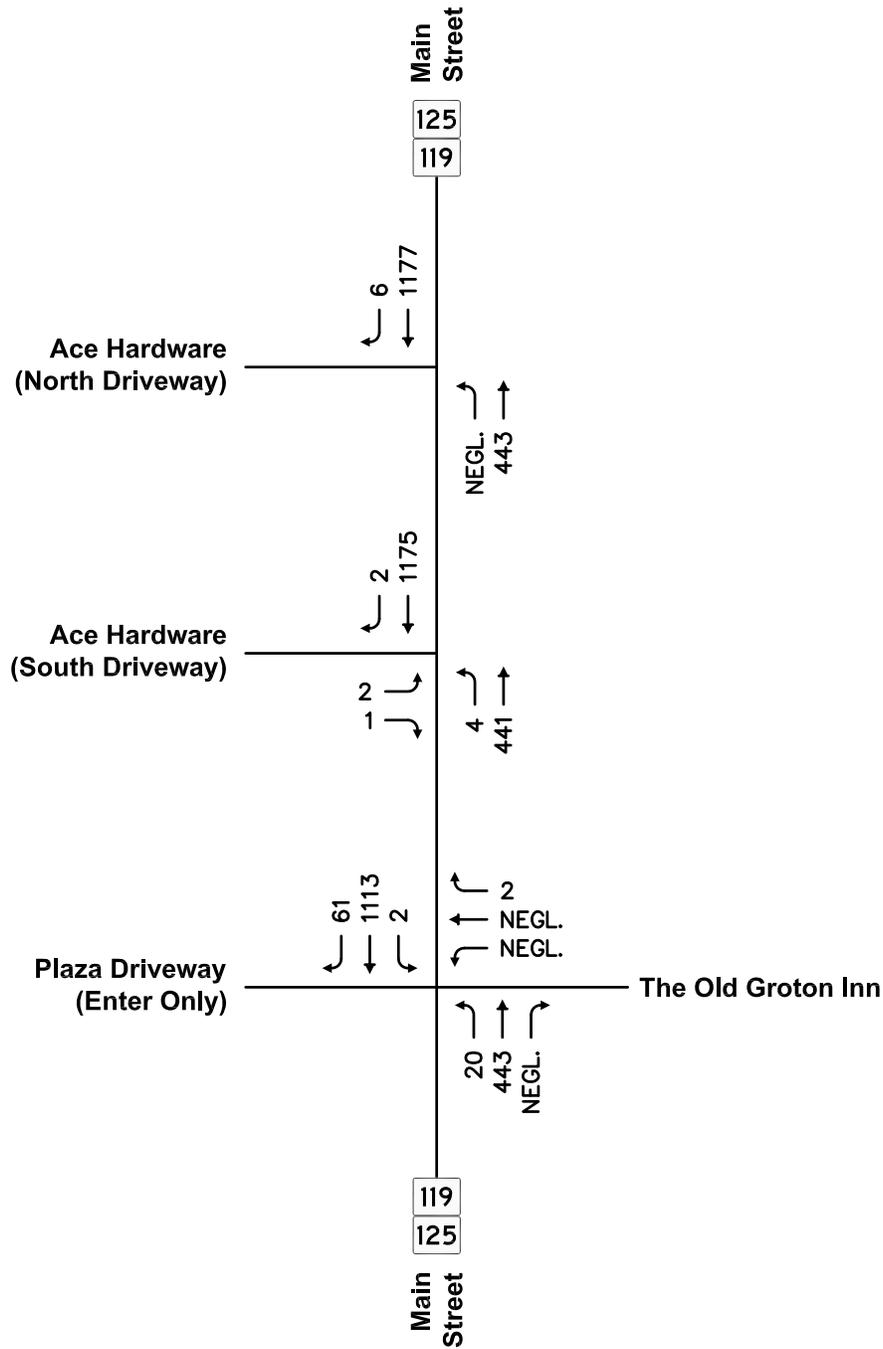
Route 119/225 meets the Ace Hardware Driveways to form two unsignalized intersections. The northerly driveway is restricted to enter only movements. Route 119/225 northbound approaches provide single through/ left turn lanes. The Route 119/225 southbound approaches provide single through/ right travel lanes. The Ace Hardware southerly driveway provides a shared left/right lane under STOP sign control.

Route 119/225 at Strip Plaza Driveway/Site/ Old Groton Inn Driveway

Route 119/225 meets the Strip Plaza (enter only driveway)/ Site/ Old Groton Inn Driveway to form a four-leg unsignalized intersection. The Route 119/225 northbound approach provides a single left/ through/right turn lane. The Route 119/225 southbound approach provides a single general purposes lane. The Strip Plaza driveway is restricted to enter-only movements. The Site/ Old Groton Inn westbound approach provides a shared left/ through right turn lane under STOP sign control.

BASELINE TRAFFIC DATA

Traffic-volume data used in this study were obtained by manual methods. Manual turning movement counts (TMCs) were conducted along study area roadways and intersections in May 2011. Traffic data were collected during the weekday morning (7:00 to 9:00 AM) and weekday evening (4:00 to 6:00 PM) peak periods. These hours represent the busiest commuter-related traffic and peak activity periods for the proposed site. A review of MassDOT permanent count station data for the area indicated that May is an above-average traffic month. However, to represent a somewhat conservative analysis the May traffic data were not seasonally adjusted (i.e., were not reduced to average season conditions). The weekday morning and evening peak hours of traffic volume for the study intersections are shown in **Figure 3 and Figure 4**. MassDOT permanent count station data is provided in the **Attachments**.

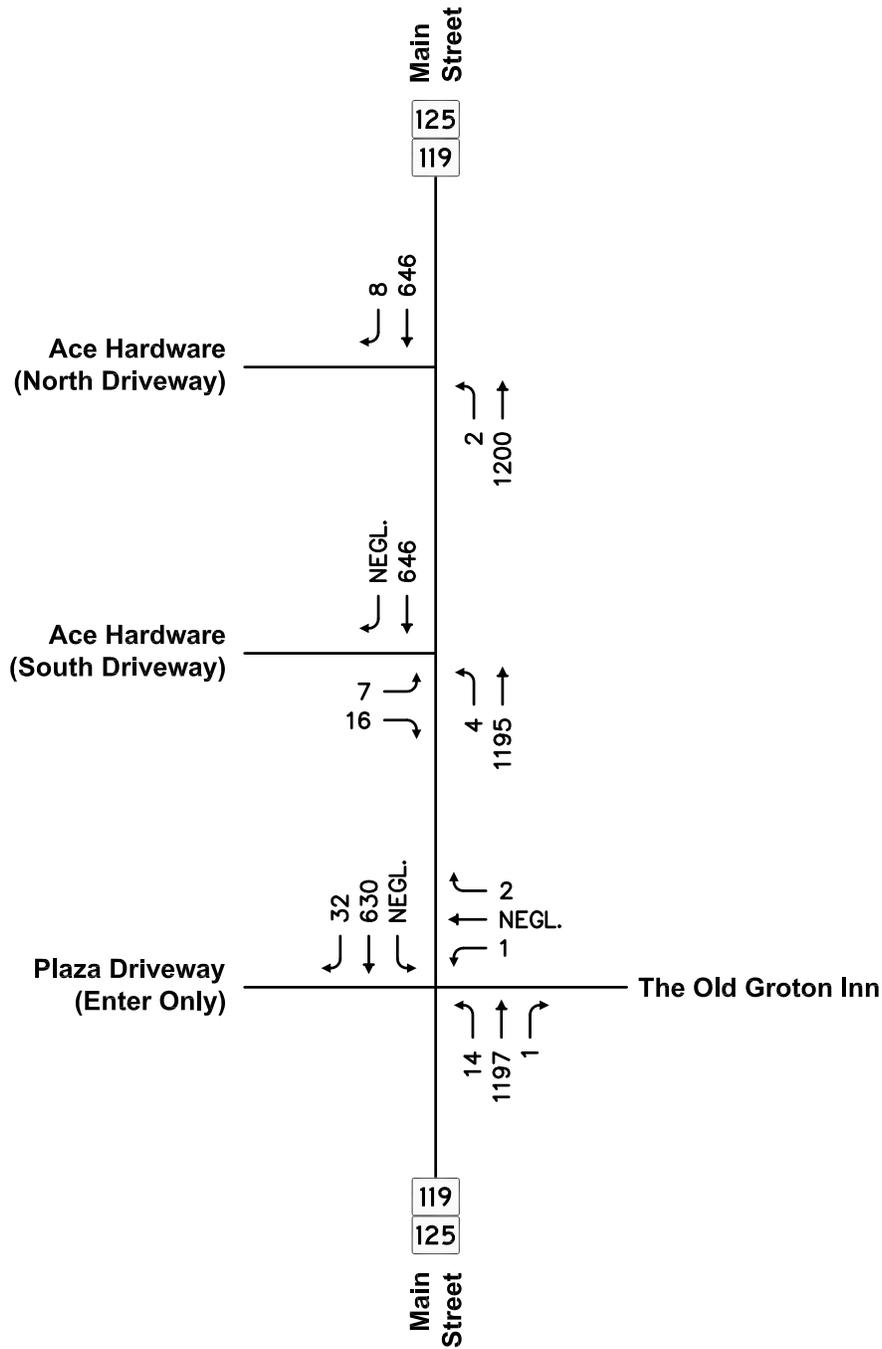


North

Scale: Not to Scale

Figure 3

**2011 Existing Conditions
Weekday Morning Peak Hour Traffic Volumes**



North

Scale: Not to Scale

Figure 4

**2011 Existing Conditions
Weekday Evening Peak Hour Traffic Volumes**

INTERSECTION CRASH HISTORY

In order to identify crash trends and safety characteristics for study area intersections, crash data were obtained from MassDOT for the Town of Groton for the three-year period 2007 through 2009 (the most recent data currently available from MassDOT). A summary of the crash data with crash rates for the study intersection with reported crashes is detailed in **Table 1**. The other study intersections did not have any reported crashes during the study period. The crash rate quantifies the number of crashes per million entering vehicles. MassDOT has determined the official District 3 (which includes the Town of Groton) crash rate to be 0.68 for unsignalized intersections. This rate represents MassDOT's "average" crash rate and serves as a basis for comparing the reported crash rate for the study intersections.

As summarized in **Table 1**, three (3) crashes were reported for the unsignalized intersection of Main Street at Ave Hardware (northerly)/ Prescott School/ Nashoba Vision driveway. The resulting crash rate of 0.12 is below to the District 3 average crash rate for unsignalized intersections. The crashes included two rear-end type crashes on the eastbound exit from the Prescott School and the remaining crash was sideswipe type crash involving a westbound vehicle and parked vehicle at Nashoba Vision. All of the reported crashes resulted in property damage type crashes under dry roadway conditions which generally are indicate slow speed crashes. One of the crashes occurred during the afternoon peak period.

In summary, the study intersections experienced a crash rates well below the District 3 average and no immediate safety countermeasures are warranted based solely on the crash history at the study intersections.

**TABLE 1
INTERSECTION CRASH SUMMARY
2007 THROUGH 2009¹**

Data Category	INTERSECTION
	Route 119/225 at Ace Hardware (northerly/ Prescott School/ Nashoba Vision
Traffic Control	Unsignalized
Crash Rate ²	0.12
District 3 Avg ³	0.68
<i>Year:</i>	
2007	2
2008	1
<u>2009</u>	<u>0</u>
Total	3
<i>Type:</i>	
Angle	0
Rear-End	2
Head-On	0
Sideswipe	1
Single Vehicle	0
Other/Unknown	0
<i>Severity:</i>	
P. Damage Only	3
Personal Injury	0
Fatality	0
Other/Unknown	0
<i>Conditions:</i>	
Dry	3
Wet	0
Snow	0
Other	0
<i>Time:</i>	
7:00 to 9:00 AM	0
4:00 to 6:00 PM	1
Rest of Day	2

¹ Source: MassDOT Crash Database.

² Crashes per million entering vehicles (MEV)

³ District 3 Average Crash Rate

2016 NO-BUILD TRAFFIC CONDITIONS

Evaluation of the proposed development impacts requires the establishment of a future baseline analysis condition. This section estimates future roadway and traffic conditions with and without the proposed development. For this evaluation, a five-year planning horizon (year 2016) was selected consistent with standard industry practice.

To determine the impact of site-generated traffic volumes on the roadway network under future conditions, baseline traffic volumes in the study area were projected to a future year condition. Traffic volumes on the roadway network at that time, in the absence of the development (that is, the No-Build condition), includes existing traffic, new traffic due to general background traffic growth, and traffic related to specific developments by others that are currently under review at the local and/or state level. Consideration of these factors resulted in the development of No-Build traffic volumes. Anticipated site-generated traffic volumes were then superimposed upon these No-Build traffic-flow networks to develop future Build conditions.

The following sections provide an overview of the future No-Build traffic volumes.

Background Growth

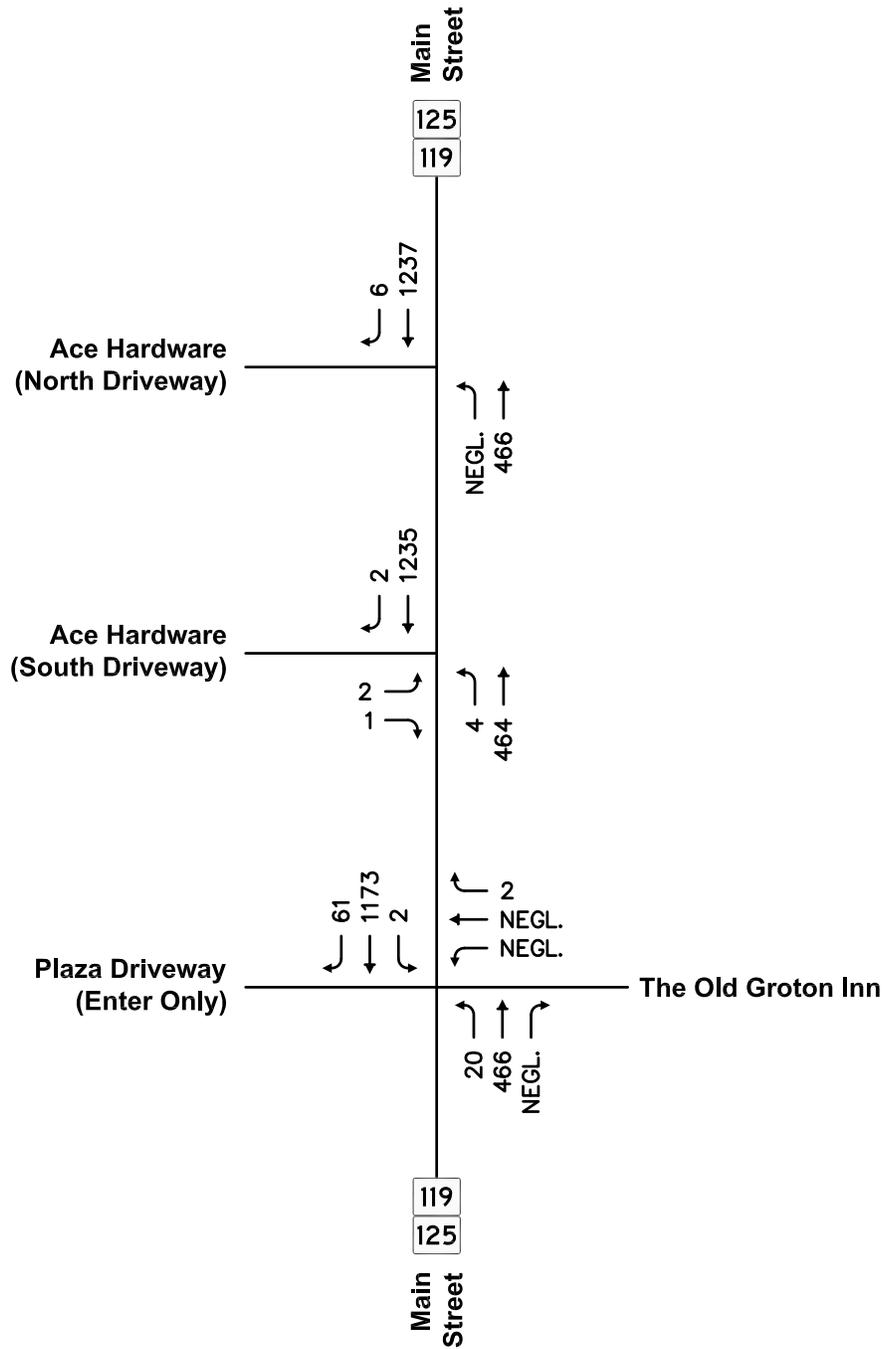
Background traffic includes demand generated by other planned developments in the area as well as demand increases caused by external factors. External factors are general increases in traffic not attributable to a specific development and are determined using historical data.

Permanent count station data published by MassDOT for the area indicates a negative (-0.2%) yearly average growth rate. For purposes of this evaluation, a 1.0 percent growth rate was used (5 percent increase over a 5-year horizon). This growth rate is higher than historic rates, and, as such, is also expected to account for any small fluctuation in hourly traffic as may occur from time to time in the study area and traffic associated with other potential small developments in the area. MassDOT permanent count station data and background growth calculations are provided in the **Attachments**.

Review of Massachusetts Environmental Policy Act (MEPA) files and a discussion with Town Planning Staff indicates that there are no area projects currently under local permitting review that may increase traffic at study intersections.

2016 No-Build Traffic Volume Networks

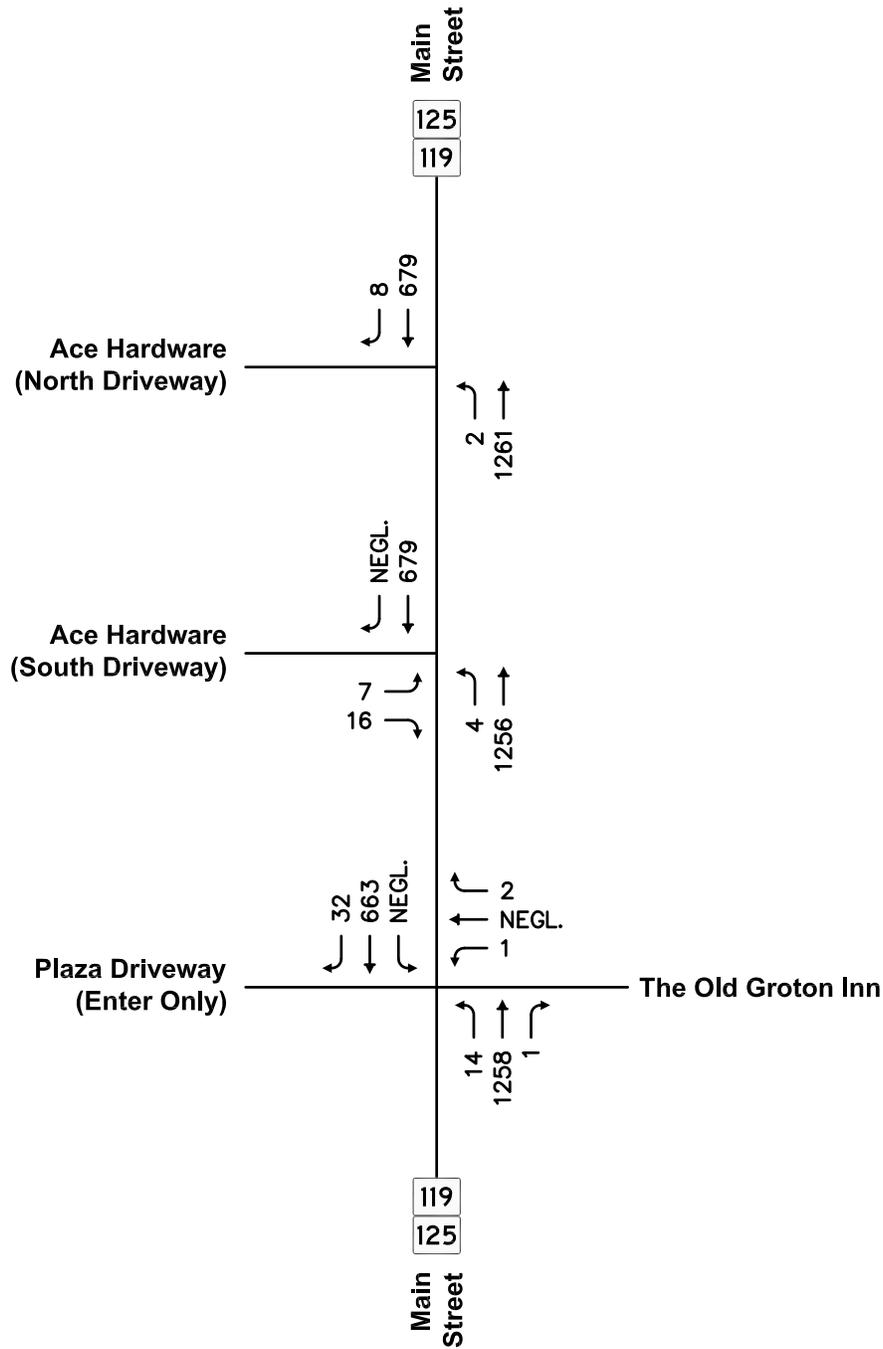
In summary, to account for future traffic growth in the study area future No-Build traffic volumes are developed by increasing the existing volumes by approximately 5 percent (1 percent compounded annually over 5 years). The resulting 2016 No-Build traffic volumes are displayed in **Figure 5** and **Figure 6**.



North

Scale: Not to Scale

Figure 5



North

Scale: Not to Scale

Figure 6

**2016 No-Build Conditions
Weekday Evening Peak Hour Traffic Volumes**

BUILD TRAFFIC CONDITIONS

Future 2016 Build traffic conditions are developed by estimating additional trips associated with the proposed development, estimating likely travel patterns for these new trips and adding the resulting trips to the 2016 No-Build traffic networks. Specific methodologies and assumptions used to estimate trips and trip distribution are discussed below.

Trip Generation

The trip generation estimates for the proposed residential development are provided for the weekday morning and weekday evening periods, which correspond to the critical weekday analysis periods for the proposed use and adjacent street traffic flow. New traffic generated by the project was estimated using trip rates published in ITE's *Trip Generation*¹ for the Land Use Codes (LUC) 220 – Apartment, LUC 230 – Residential Condominium/ Townhouse, LUC 720 - Medical/Dental Office and LUC 814 - Specialty Retail. **Table 2** presents the trip-generation estimate for the proposed development based on ITE methodology.

TABLE 2
TRIP-GENERATION SUMMARY

Period/Direction	Site Trips				Total Trips
	Apartment ¹	Condominium/ Townhouse ²	Medical/Dental Office ³	Specialty Retail ⁴	
<i>Weekday Morning Peak Hour:</i>					
Entering	0	1	5	0	6
Exiting	2	6	1	1	10
Total	2	7	6	1	16
<i>Weekday Evening Peak Hour:</i>					
Entering	1	5	2	1	9
Exiting	1	3	7	2	13
Total	2	8	9	3	22
<i>Weekday Daily (24-Hour)</i>	20	88	90	44	242

Source: ITE *Trip Generation*, Eighth Edition; 2008.

¹ Based on ITE LUC 220 applied to 3 units.

² Based on ITE LUC 230 applied to 15 units.

³ Based on ITE LUC 720 applied to 2, 500 sf.

⁴ Based on ITE LUC 814 applied to 1,000 sf.

¹*Trip Generation*, Eighth Edition; Institute of Transportation Engineers; Washington, DC; 2008.

As summarized in **Table 2**, the proposed development is estimated to generate approximately 16 vehicle trips (6 entering and 10 exiting) during the weekday morning peak hour and 22 vehicle trips (9 entering and 13 exiting) during the weekday evening peak hour. On a daily basis, the proposed residential use is estimated to generate approximately 242 vehicle trips on a weekday with 50 percent entering and exiting. Trip generation calculations are provided in the **Attachments**.

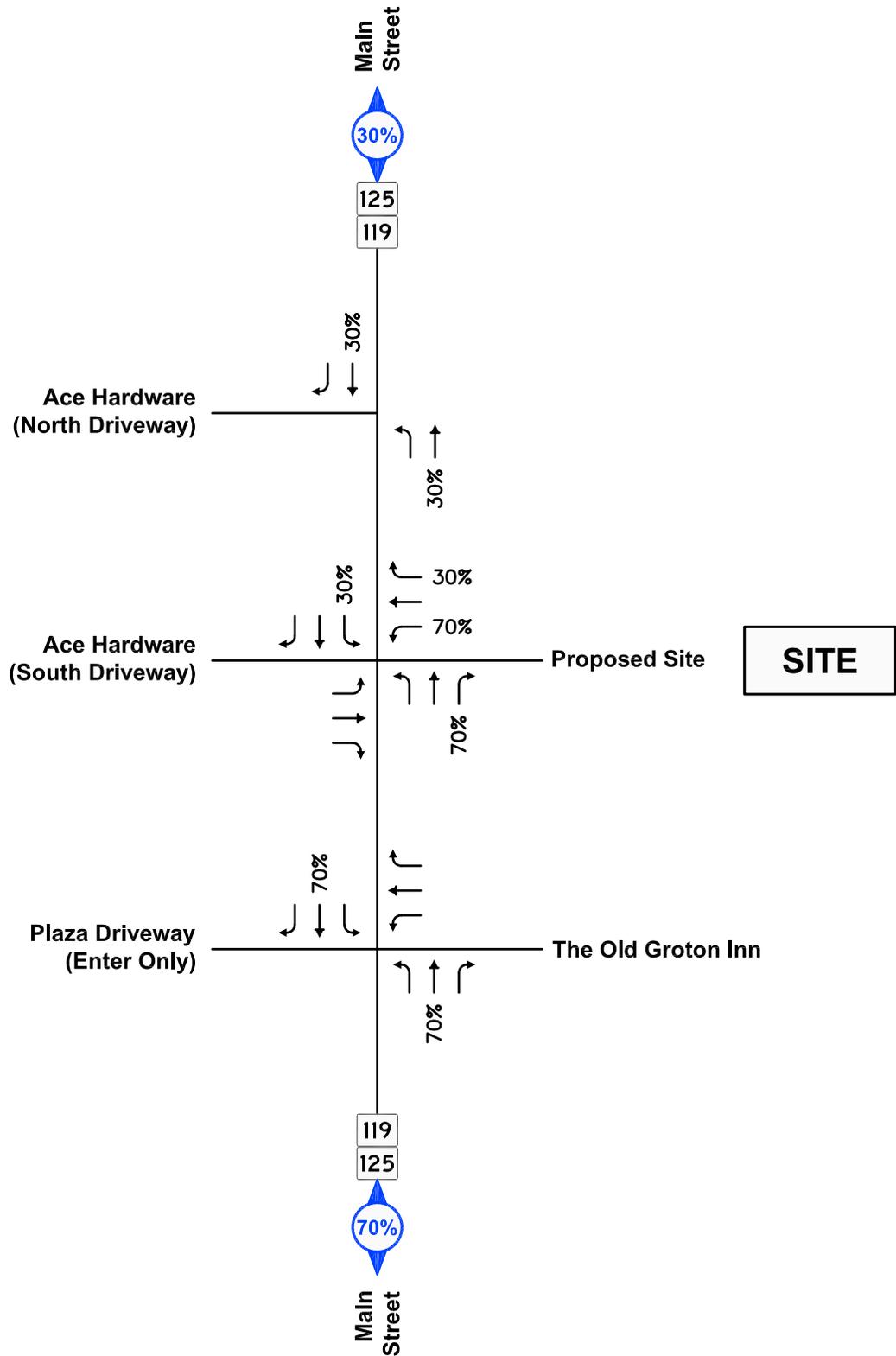
Trip Distribution

The distribution for projected traffic for the mixed-use development is based on existing travel patterns of the adjacent roadway. The resulting trip distribution is presented in **Figure 7**.

Development-related trips for the development were assigned to the roadway network using the ITE trip-generation estimates shown in **Table 2** and the distribution patterns presented in **Figure 7**. New development-related trips at each intersection approach for the weekday morning and weekday evening peak hours are quantified in **Figure 8 and Figure 9**.

Build Traffic Volume Networks

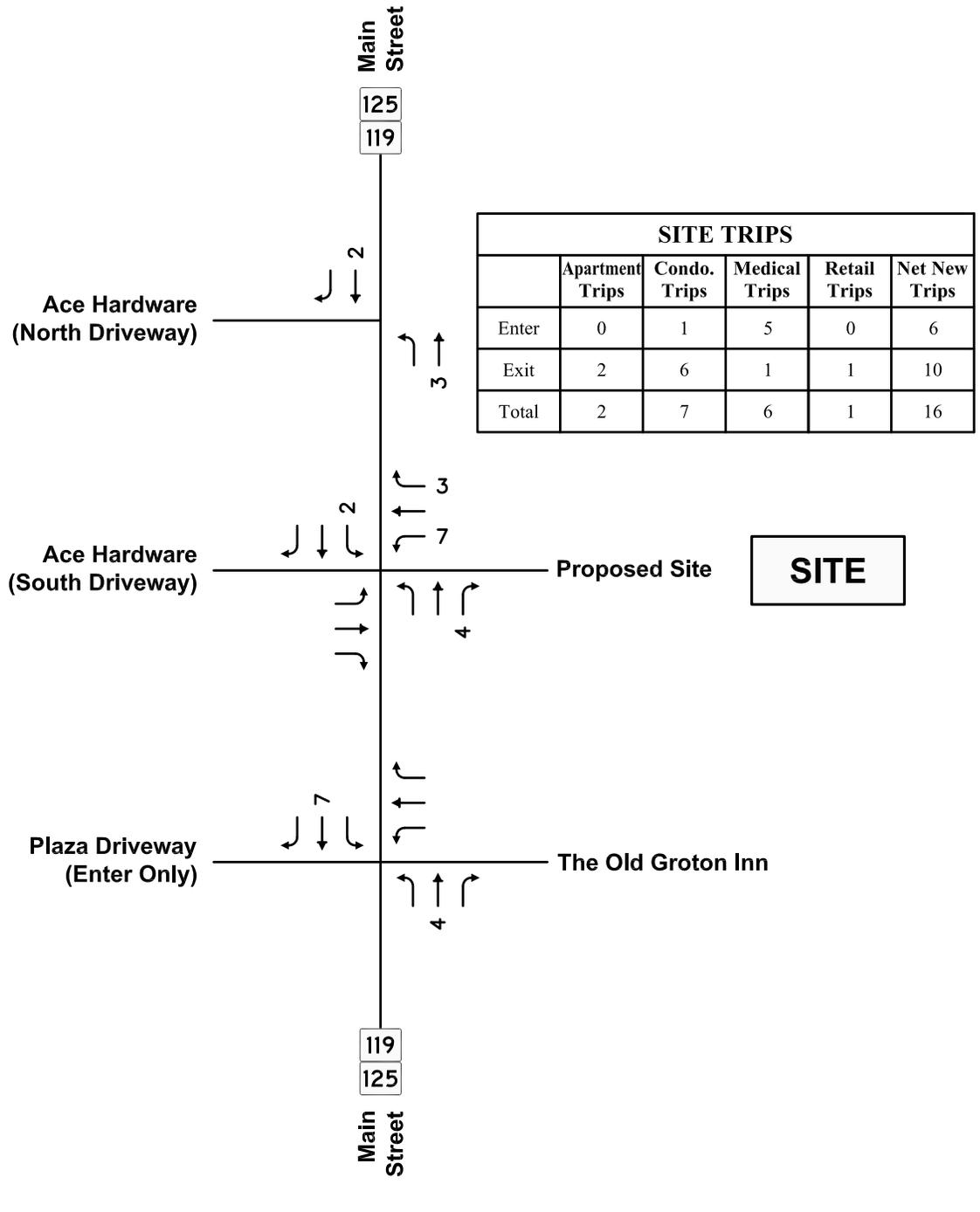
Future Build condition traffic volumes are derived by adding incremental traffic increases for the project to the 2016 No-Build conditions. **Figure 10 and Figure 11** present the 2016 Build condition traffic-volume networks for the weekday morning and weekday evening peak hours.



North
Scale: Not to Scale

Figure 7

Trip Distribution

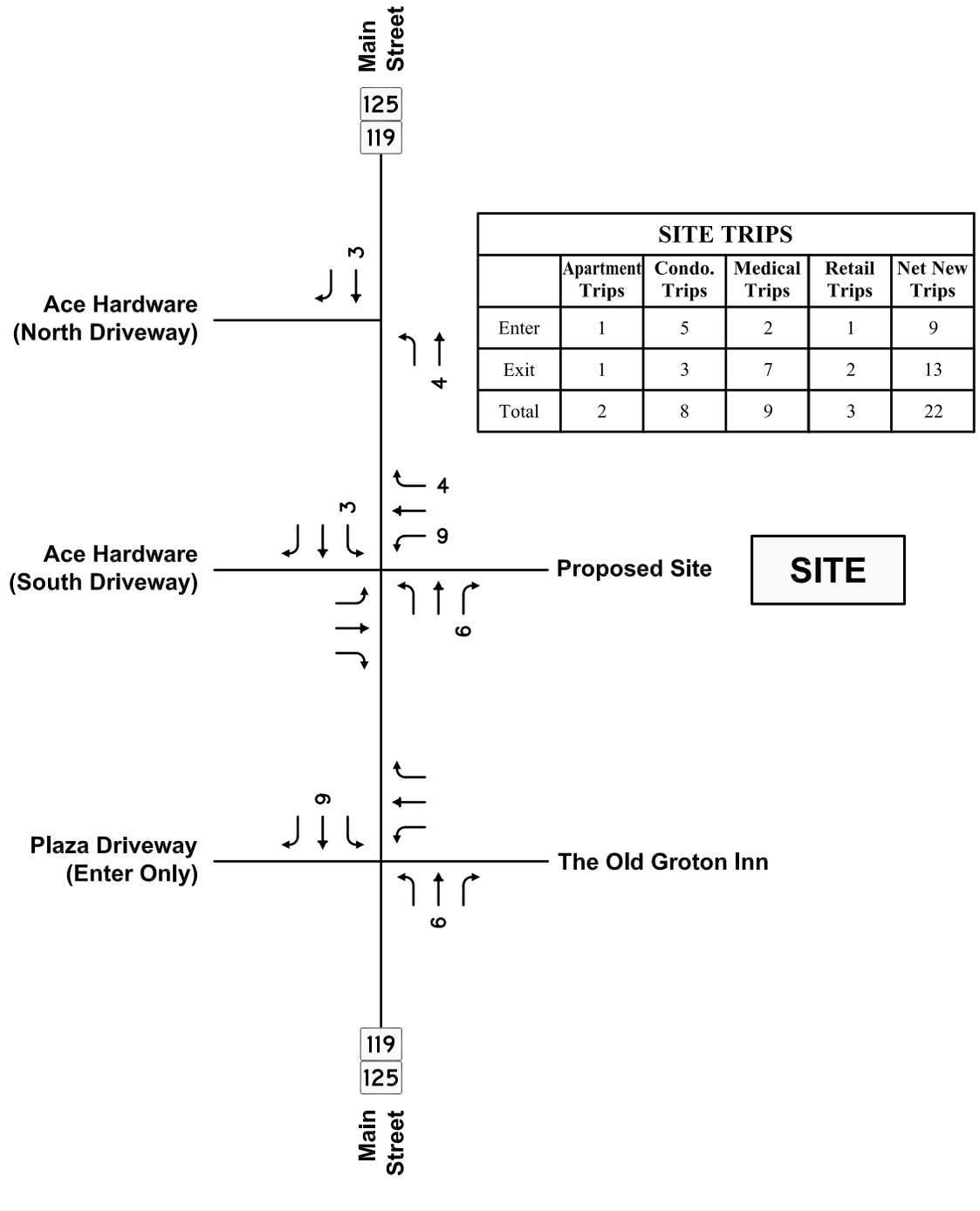


North

Scale: Not to Scale

Figure 8

**Site Generated Trips
Weekday Morning Peak Hour Traffic Volumes**

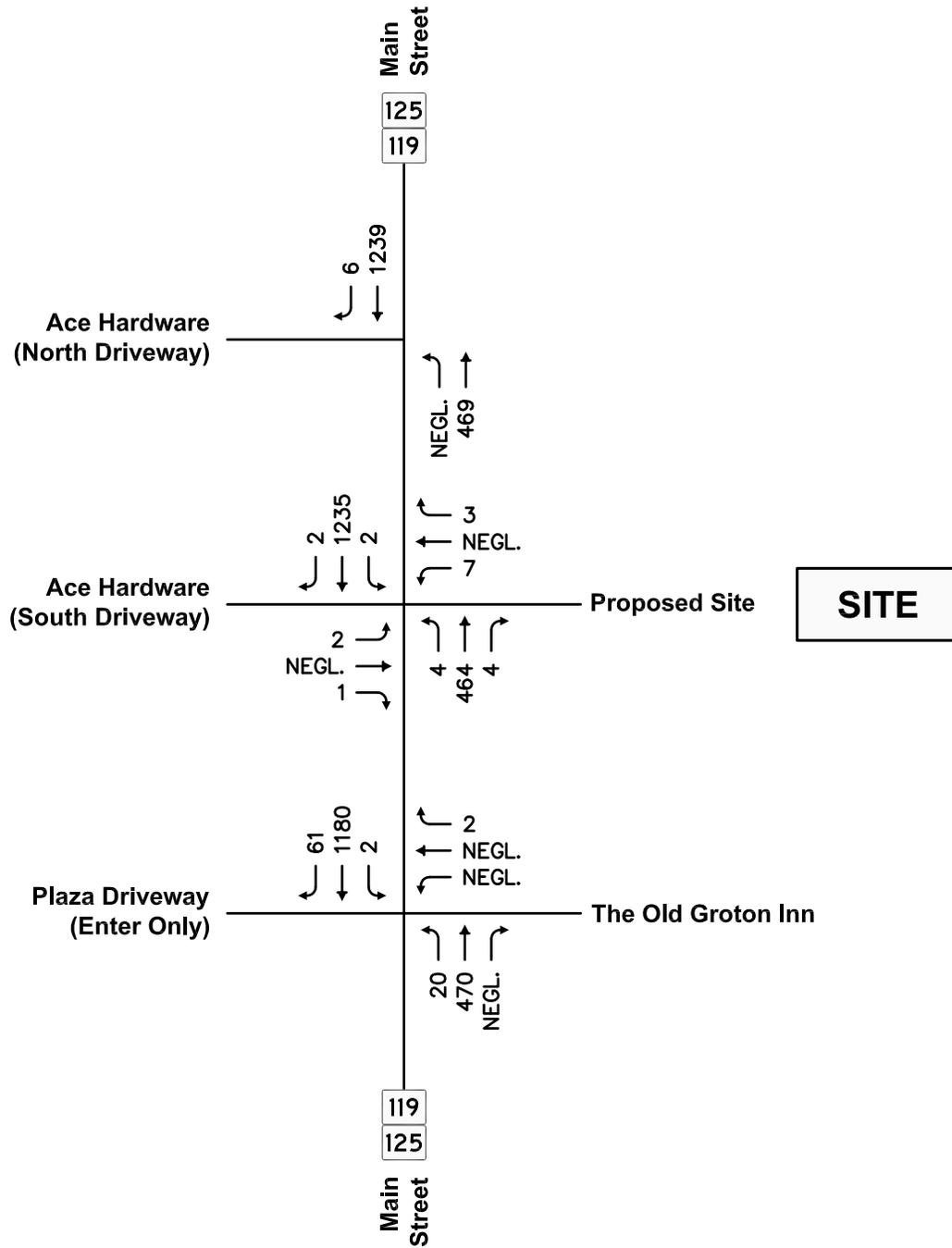


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Scale: Not to Scale

Figure 9

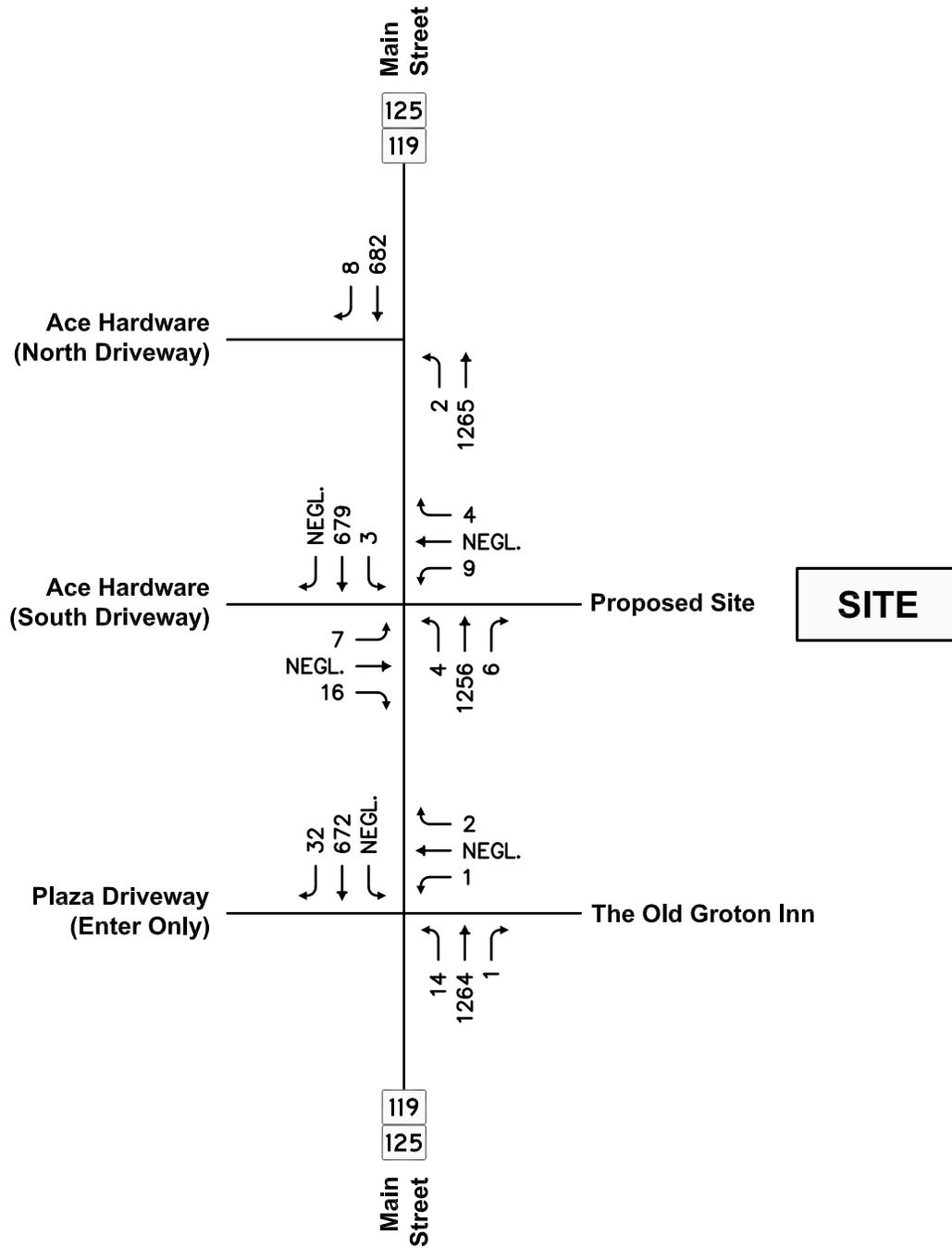
**Site Generated Trips
Weekday Evening Peak Hour Traffic Volumes**



North

Scale: Not to Scale

Figure 10



North

Scale: Not to Scale

Figure 11

INTERSECTION CAPACITY ANALYSIS

Analysis Methodology

Intersection capacity analyses are presented in this section for the Existing, No-Build, and Build traffic-volume conditions. Capacity analyses, conducted in accordance with EOEAA/MassDOT guidelines, provide an index of how well the roadway facilities serve the traffic demands placed upon them. The operational results provide the basis for recommended access and roadway improvements in the following section.

Capacity analysis of intersections is developed using the Synchro® computer software, which implements the methods of the 2000 Highway Capacity Manual (HCM). The resulting analysis presents a level-of-service (LOS) designation for individual intersection movements. The LOS is a letter designation that provides a qualitative measure of operating conditions based on several factors including roadway geometry, speeds, ambient traffic volumes, traffic controls, and driver characteristics. Since the LOS of a traffic facility is a function of the traffic flows placed upon it, such a facility may operate at a wide range of LOS, depending on the time of day, day of week, or period of year. A range of six levels of service are defined on the basis of average delay, ranging from LOS A (the least delay) to LOS F (delays greater than 50 seconds for unsignalized movements). The specific control delays and associated LOS designations are presented in the **Attachments**.

Analysis Results

Level-of-Service (LOS) analyses were conducted for the Existing, No-Build, and Build conditions for the study intersections. The results of the intersection capacity are summarized below in **Table 3** and **Table 4**. Detailed analysis results are presented in the **Attachments**.

**TABLE 3
INTERSECTION CAPACITY ANALYSIS RESULTS
WEEKDAY MORNING PEAK HOUR**

Intersection	Approach	2011 Existing			2016 No-Build			2016 Build		
		v/c ¹	Delay ²	LOS ³	v/c	Delay	LOS	v/c	Delay	LOS
Route 119/225 at Ace Hardware (Southerly)	EB Exit	0.03	35	D	0.03	38	E	0.04	50	F
	WB Exit	n/a ⁴	n/a	n/a	n/a	n/a	n/a	0.13	>50	F
	Northbound	0.01	<5	A	0.01	<5	A	0.01	<5	A
	Southbound	0.72	<5	A	0.76	<5	A	0.00	<5	A
Route 119/225 at Ace Hardware (Northerly)	Northbound	0.00	<5	A	0.00	<5	A	0.00	<5	A
	Southbound	0.72	<5	A	0.76	<5	A	0.76	<5	A
Route 119/225 at Groton Inn/ Site/ Plaza (Northerly)	WB Exit	0.00	12	B	0.00	12	B	0.00	12	B
	Northbound	0.04	<5	A	0.04	<5	A	0.04	<5	A
	Southbound	0.00	<5	A	0.00	<5	A	0.00	<5	A

¹Volume-to-capacity ratio

²Average control delay per vehicle (in seconds)

³Level of service

⁴n/a = not applicable

**TABLE 4
INTERSECTION CAPACITY ANALYSIS RESULTS
WEEKDAY EVENING PEAK HOUR**

Intersection	Approach	2011 Existing			2016 No-Build			2016 Build		
		v/c ¹	Delay ²	LOS ³	v/c	Delay	LOS	v/c	Delay	LOS
Route 119/225 at Ace Hardware (Southerly)	EB Exit	0.14	28	D	0.15	32	D	0.22	46	E
	WB Exit	n/a ⁴	n/a	n/a	n/a	n/a	n/a	0.27	>50	F
	Northbound	0.00	<5	A	0.00	<5	A	0.00	<5	A
	Southbound	0.40	<5	A	0.42	<5	A	0.01	<5	A
Route 119/225 at Ace Hardware (Northerly)	Northbound	0.00	<5	A	0.00	<5	A	0.00	<5	A
	Southbound	0.40	<5	A	0.42	<5	A	0.42	<5	A
Route 119/225 at Groton Inn/ Site/ Plaza (Northerly)	WB Exit	0.03	42	E	0.04	48	E	0.04	49	E
	Northbound	0.02	<5	A	0.02	<5	A	0.02	<5	A
	Southbound	0.00	<5	A	0.00	<5	A	0.00	<5	A

¹Volume-to-capacity ratio

²Average control delay per vehicle (in seconds)

³Level of service

⁴n/a = not applicable

As summarized in **Table 3** and **Table 4**:

- Mainline travel along Route 119/225 is generally uninhibited with LOS A or better conditions during the weekday morning and weekday evening peak hours. These uninhibited flow conditions are expected to continue under future year conditions with and without additional site-generated traffic.
- The site driveway will experience relatively long delays during the peak hours. However, these delays and associated queuing are attributable to relatively low volume left-turns onto Route 119/225. The critical left turn movement from the site driveway is estimated to occur every 6 minutes or less during the peak hours and will be managed on-site with no material impact to on-site parking or circulation.
- Delays for the Ace Hardware southerly drive are calculated to increase slightly based on theoretical modeling procedures, resulting in a drop in LOS. However, actual delay impacts for these low-volume movements are not expected to be materially different than No Build conditions, as volume changes at the relocated Site driveway opposite Ace Hardware are nominal and no change in volume at Ace hardware are expected. As with the Site driveway, queues at Ace Hardware southerly driveway will be managed on-site with no impact to mainline traffic flow.

In summary, adequate capacity is available along Route 119/225 to accommodate modest projected traffic increases for the proposed mixed-use development. The proposed development will have a minimal impact on operations in the study area with an increase in traffic of 22 vehicles or less along Route 119/225 during the peak hours (1% increase). The critical left turn movement from the site driveway is estimated to occur every 6 minutes or less during the peak hours and will be managed on-site with no material impact to on-site parking or circulation.

SIGHT LINE EVALUATION

The evaluation documents existing sight distances for vehicles exiting the proposed site driveway onto Routes 119/225 with comparison to recommended guidelines for the regulatory posted speed limit in the project area.

The American Association of State Highway and Transportation Officials' (AASHTO) standards² reference two types of sight distance which are relevant at the proposed site driveway intersection with Route 119/225: stopping sight distance (SSD) and intersection sight distance (ISD). Sight lines for critical vehicle movements at the Route 119/225 and proposed site driveway intersection were compared to minimum SSD and ISD for the regulatory speed limit along Route 119/225 in the site vicinity.

Stopping Sight Distance

Sight distance is the length of roadway visible to the motorist to a fixed object. The minimum sight distance available on a roadway should be sufficiently long enough to enable a below-average operator, traveling at or near a regulatory speed limit, to stop safely before reaching a stationary object in its path, in this case, a vehicle exiting from the proposed site driveway onto Route 119/225. The SSD criteria are defined by AASHTO based on design and operating speeds, anticipated driver behavior and vehicle performance, as well as physical roadway conditions. SSD includes the length of roadway traveled during the perception and reaction time of a driver to an object, and the distance traveled during brake application on wet, level pavements. Adjustment factors are applied to account for roadway grades.

SSD was estimated in the field using AASHTO standards for driver's eye (3.5 feet) and object height equivalent to the taillight height of a passenger car (2.0 feet) for the northbound and southbound Route 119/225 approaches to the proposed site driveway. **Table 5** presents a summary of the available SSD for the Route 119/225 roadway segments approaching the proposed site driveway and AASHTO's recommended SSD for the posted (regulatory) speed limit.

²A policy on Geometric Design of Highways and Streets, American Association of State Highway and Transportation Officials (AASHTO), 2004.

TABLE 5
Stopping Sight Distance Summary
Route 119/225 Approaches to Site Driveway

Approach/ Travel Direction	Available Stopping Sight Distance	AASHTO Recommended ¹	
		Regulatory Travel Speed (30 mph)	Criteria Satisfied
Northbound	460 Feet	200 Feet	Yes
Southbound	>600 Feet	200 Feet	Yes

¹Recommended sight distance based on AASHTO, A Policy on Geometric Design of Highways and Streets. Based on driver height of eye of 3.5 feet to object height of 2.0 feet and adjustments for roadway grade if required.

As summarized in **Table 5** analysis results indicate that the available sight lines exceed AASHTO’s recommended SSD criteria for both travel directions along Route 119/225 based on the regulatory speed limit.

Intersection Sight Distance

Clear sight lines provide sufficient sight distance for a stopped driver on a minor-road approach to depart from the intersection and enter or cross the major road. As stated under AASHTO’s Intersection Sight Distance (ISD) considerations, “...If the available sight distance for an entering ...vehicle is at least equal to the appropriate stopping sight distance for the major road, then drivers have sufficient sight distance to avoid collisions...To enhance traffic operations, intersection sight distances that exceed stopping sight distances are desirable along the major road.” AASHTO’s ISD criteria are defined into several “cases”. Each case depends on the type of traffic control at the intersection (e.g. no control, Yield sign, Stop sign, and signal control), and the specific vehicle maneuver in question (crossing, right- or left-turn). AASHTO Cases B1 (left turns) and B2 (right turns) from the proposed site driveway were utilized in determining the recommended intersection sight distance summarized in **Table 6** below.

Available ISD was estimated in the field using AASHTO standards for driver’s eye (3.5 feet), object height (3.5 feet) and decision point (14.5 feet from edge of travel way) for the northbound and southbound directions along Route 119/225. **Table 6** presents a summary of the available ISD for the departure from the proposed site driveway and AASHTO’s recommended ISD for the regulatory speed limit and measured travel speeds.

TABLE 6
Intersection Sight Distance Summary
Site Driveway Departure to Route 119/225

Approach/ Travel Direction	Available Stopping Sight Distance	AASHTO Minimum ¹	
		Regulatory Travel Speed (30 mph)	Criteria Satisfied
<i>Looking North</i>	>600 Feet	335 Feet	Yes
<i>Looking South</i>	460 Feet	290 Feet	Yes

¹Recommended sight distance based on AASHTO, A Policy on Geometric Design of Highways and Streets. Based on driver height of eye of 3.5 feet to object height of 3.5 feet and adjustments for roadway grade if required.

The results of the ISD analysis presented in **Table 6** indicate that the available sight lines looking north and south from the proposed site driveway onto Route 119/225 exceed the recommended sight line requirements from AASHTO for the posted speed limit. MDM recommends limiting the on-street parking within 20 feet of the driveway to provide adequate sight lines and any existing or new plantings (shrubs, bushes) or physical landscape features currently or proposed to be located within the driveway sight lines should also be maintained at a height of 2 feet or less to ensure unobstructed line of sight.

CONCLUSIONS AND RECOMMENDATIONS

The proposed mixed-use development is estimated to generate approximately 16 vehicle trips during the morning peak hour and 22 vehicle trips during the weekday evening peak hour. On a daily basis, the proposed development is estimated to generate approximately 242 vehicle trips on a weekday with 50 percent entering and exiting. Adequate capacity is available along Route 119/225 to accommodate modest projected traffic increases for the proposed mixed-use development. The proposed development will have a minimal impact on operations in the study area with an increase in traffic of 22 vehicles or less during the peak hours (1% increase). The critical left turn movement from the site driveway is estimated to occur every 6 minutes or less during the peak hours and will be managed on-site with no material impact to on-site parking or circulation. MDM recommends access-related improvements aimed at enhancing traffic operations and/or travel safety as follows:

- MUTCD compliant pavement markings and a STOP sign (R1-1) should be installed on the driveway approach to Route 119/225.
- A sidewalk connection should be provided that connects the on-site residential, commercial uses, and parking areas. Likewise, a connection to the existing sidewalk system along Main Street (Routes 119/ 225) should be provided. ADA compliant ramps and marked crosswalk shall be provided where required. Furthermore, the existing sidewalk along the Site frontage shall be improved as needed with the removal of the existing site driveway and installation of the proposed driveway.
- In accordance with MUTCD criteria, on-street parking within 20 feet of the driveway should be restricted to provide adequate sight lines and any existing and/or new plantings (shrubs, bushes) or physical landscape features currently or proposed to be located within the driveway sight lines should also be maintained at a height of 2 feet or less to ensure unobstructed line of sight.
- Provide adequate driveway design and on-site layout to accommodate the largest anticipated delivery vehicle and emergency vehicle access/egress, on-site circulation and access to the proposed buildings.

With the implementation of access-related improvements, there will be adequate capacity along Route 119/225 to accommodate the proposed mixed-use development. Furthermore, with the recommended on-site circulation improvements the access and circulation aisles will provide adequate maneuvering area for truck deliveries/ refuse removal, and emergency vehicle access. The mixed-use nature of the Site will also promote trips between the retail, office and residential uses. Likewise, pedestrian accommodations will promote non-vehicular trips to the nearby commercial, office, religious, and recreational uses in the immediate study area, thus further reducing depending on vehicular trips.