

## MEMORANDUM

**TO:** Ms. Suzanne Decavèle  
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**FROM:** Mr. Jeffrey S. Dirk, P.E., PTOE, FITE  
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*Professional Engineer in CT, MA, ME, NH, RI and VA*

**DATE:** September 15, 2022

**RE:** 9361

**SUBJECT:** Transportation Impact Assessment  
Proposed Age-Qualified Multifamily Residential Development – 10 High Street  
Topsfield, Massachusetts

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Vanasse & Associates, Inc. (VAI) has conducted a Transportation Impact Assessment (TIA) in order to determine the potential impacts on the transportation infrastructure associated with the proposed construction of an age-qualified residential development to be located at 10 High Street (Route 97) in Topsfield, Massachusetts (hereafter referred to as the “Project”). This study evaluates the following specific areas as they relate to the Project: i) access requirements; ii) potential off-site improvements; and iii) safety considerations; and identifies and analyzes existing traffic conditions and future traffic conditions, both with and without the Project along Route 97 and at the Main Street/High Street/High Street Extension, High Street/East Common Street, and High Street/South Common Street intersections. Based on this assessment, we have concluded the following with respect to the Project:

1. Using trip-generation statistics published by the Institute of Transportation Engineers (ITE),<sup>1</sup> the Project is expected to generate approximately 144 vehicle trips on an average weekday (two-way, 24-hour volume), with 9 vehicle trips expected during the weekday morning peak-hour and 11 vehicle trips expected during the weekday evening peak-hour;
2. The Project will not result in a significant impact (increase) on motorist delays or vehicle queuing over Existing or anticipated future conditions without the Project (No-Build conditions), acknowledging that one or more movements at the study area intersections are currently operating or are predicted to operate at or over capacity (i.e., level-of-service (LOS) “E” or “F”, respectively) independent of the Project;
3. All movements at the Project site driveway intersection with High Street are predicted to operate at LOS C with negligible vehicle queuing predicted, with actual operating conditions expected to be related to vehicle queuing on the High Street approach to Main Street;

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<sup>1</sup>*Trip Generation*, 11<sup>th</sup> Edition; Institute of Transportation Engineers; Washington, DC; 2021.



4. Independent of the Project, the Main Street/High Street/High Street Extension intersection was found to have a motor vehicle crash rate that is above the MassDOT average crash rate for similar intersections. As such, specific recommendations have been provided to advance safety-related improvements at the intersection;
5. Lines of sight at the Project site driveway intersection with High Street were found to exceed or can be made to exceed the recommended minimum distance for the intersection to operate in a safe manner based on the appropriate approach speed.

In consideration of the above, we have concluded that the Project can be accommodated within the confines of the existing transportation infrastructure in a safe and efficient manner with the implementation of the recommendations defined herein.

The following details our assessment of the Project.

## **PROJECT DESCRIPTION**

The Project will entail the construction of a 44± unit, age-qualified (age 55+), multifamily residential development to be located at 10 High Street (Route 97) in Topsfield, Massachusetts. The Project site encompasses approximately 12.5± acres of land bound by residential properties and areas of open and wooded space to the north; residential properties, High Street, Deer Run and low-lying wetland areas to the south; residential properties, areas of open and wooded space and low-lying wetland areas to the east; and a residential property and the Joyful Noises Preschool to the west. The Project site currently contains areas of open and wooded space that include sports fields that will be removed to accommodate the Project. Figure 1 depicts the Project site location in relation to the existing roadway network.

Access to the Project will be provided by way of a new driveway that will intersect the north side of High Street opposite South Common Street. Off-street parking will be provided for 44 vehicles in a surface parking lot, or a parking ratio of 1.0 parking spaces per unit.

## **STUDY METHODOLOGY**

This study was prepared in consultation with MassDOT and the Town of Topsfield; was performed in accordance with MassDOT's *Transportation Impact Assessment (TIA) Guidelines* and the standards of the Traffic Engineering and Transportation Planning professions for the preparation of such reports; and was conducted in three distinct stages.

The first stage involved an assessment of existing conditions in the study area and included an inventory of roadway geometrics; pedestrian and bicycle facilities; on-street parking; public transportation services; observations of traffic flow; and collection of pedestrian, bicycle, and vehicle counts.

In the second stage of the study, future traffic conditions were projected and analyzed. Specific travel demand forecasts for the Project were assessed along with future traffic demands due to expected traffic growth independent of the Project. A seven-year time horizon was selected for analyses consistent with MassDOT guidelines. The analysis conducted in stage two identifies existing or projected future capacity, safety, and access issues, as these areas relate to the transportation infrastructure.

The third stage of the study presents and evaluates measures to address deficiencies in the transportation infrastructure, if any, identified in stage two of the study.







Figure 1

Site Location Map



## EXISTING CONDITIONS

A comprehensive field inventory of existing conditions within the study area was conducted in May 2022. This inventory included the collection of traffic-volume data and vehicle travel speed measurements, as well as a review of existing pedestrian and bicycle accommodations, public transportation services, and motor vehicle crash data. The following summarizes existing conditions within the study area.

### Roadway

#### **High Street (Route 97)**

High Street is a two-lane, urban minor arterial roadway that traverses the study area in a general east-west direction and is under Town jurisdiction. In the vicinity of the Project site, High Street provides two 11 to 12-foot-wide lanes that are separated by a double yellow centerline, with 3 to 4-foot-wide marked shoulders. The posted speed limit in the vicinity of the Project site is 25 miles per hour (mph), changing to 30 mph to the east. A 20 mph School Zone has been established for the segment of High Street between 14 High Street (approximate) and Main Street that is in effect on school days when children are present. A Sidewalk is provided along the south side of the roadway east of South Common Street. Street lights are not provided in the vicinity of the Project site. Land use along High Street within the study area consists of the Project site, residential properties, the Topsfield Town Library, the Joyful Noises Preschool and areas of open and wooded space.

### Intersections

Table 1 and Figure 2 summarize existing lane use, traffic control, and pedestrian and bicycle accommodations at the study area intersections as observed in May 2022.

**Table 1**  
**STUDY AREA INTERSECTION DESCRIPTION**

<b>Intersection</b>	<b>Traffic Control Type<sup>a</sup></b>	<b>No. of Travel Lanes Provided</b>	<b>Shoulder Provided? (Yes/No/Width)</b>	<b>Pedestrian Accommodations? (Yes/No/Description)</b>	<b>Bicycle Accommodations? (Yes/No/Description)</b>
Main St./ High St./ High St. Ext.	S	1 general-purpose travel lane on all approaches	Yes; 2 to 3-feet on all legs	Yes; a sidewalk is provided along the west side of Main St., with a marked crosswalk provided for crossing the High St. Ext. approach	Yes; shared-traveled way <sup>b</sup>
High St/ East Common St.	S	1 general-purpose travel lane on all approaches	Yes; 3-feet on High St.	No	Yes; shared-traveled way
High St./ South Common St.	S	1 general-purpose travel lane on all approaches; South Common St. is one-way (approaching High St.); on-street parking provided along both sides of South Common St.	Yes; 3 to 4-feet on High St.	Yes; sidewalks are provided along the south side of High St. and the east side of South Common St.	Yes; shared-traveled way

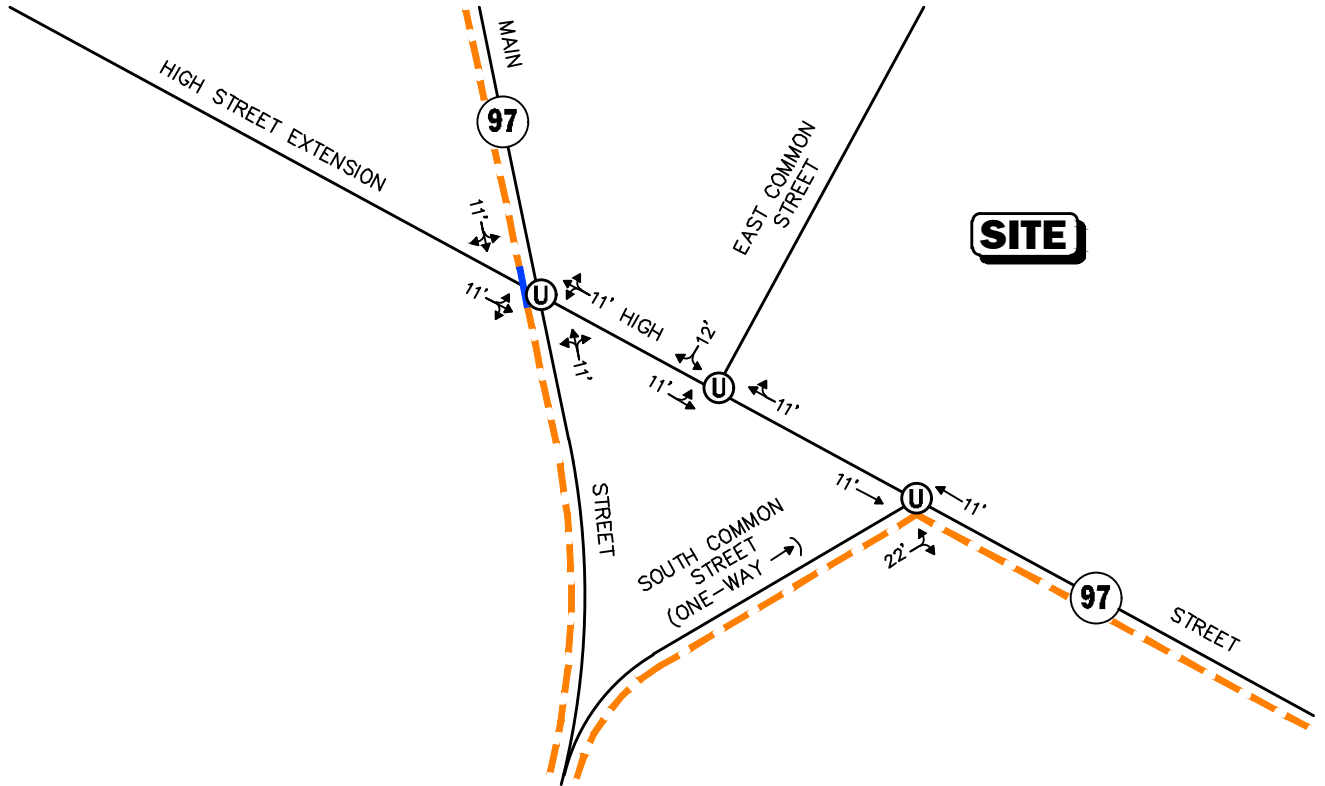
<sup>a</sup>S = STOP-sign control.

<sup>b</sup>Combined shoulder and travel lane width equal to or exceed 14 feet.



**Legend:**

- ⓪ Unsignalized Intersection
- - - Sidewalk
- Crosswalk
- xx' ↔ Lane Use and Travel Lane Width



**SITE**

Not To Scale

**Figure 2**

**Existing Intersection Lane Use, Travel Lane Width, and Pedestrian Facilities**



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## Existing Traffic Volumes

In order to determine existing traffic-volume demands and flow patterns within the study area, automatic traffic recorder (ATR) counts, turning movement counts (TMCs), and vehicle classification counts were completed in May 2022. The ATR counts were conducted on High Street, west of South Common Street, on May 4<sup>th</sup> and 5<sup>th</sup>, 2022 (Wednesday through Thursday, inclusive) in order to record weekday traffic conditions over an extended period, with weekday morning (7:00 to 9:00 AM) and evening (4:00 to 6:00 PM) peak-period TMCs performed at the study intersections on May 4<sup>th</sup>, 2022 (Wednesday). These time periods were selected for analysis purposes as they are representative of the peak-traffic-volume hours for both the Project and the adjacent roadway network.

In order to evaluate the potential for seasonal fluctuation of traffic volumes within the study area, traffic-volume data from MassDOT Continuous Count Station No. 5085 located on Interstate 95 (I-95) in Boxford were reviewed. Based on a review of this data, it was determined that traffic volumes for the month of May are approximately 3.2 percent *above* average-month conditions. As such, a seasonal adjustment was not required as the May traffic volume data is representative of traffic-volume conditions that are higher than those under average-month conditions.

In order to account for the impact on traffic volumes and trip patterns resulting from the COVID-19 pandemic, traffic volume data collected at MassDOT Continuous Count Station No. 35 located on the Yankee Division Highway in Beverly in May 2019 were compared to May 2022 traffic volumes that were collected at the same location. Based on this pre- and post-COVID-19 traffic-volume comparison, the traffic-volume data that was collected as part of this assessment was found to be approximately 5.5 percent *below* the traffic-volume conditions that existed prior to the COVID-19 pandemic. After accounting for the May traffic volumes being 3.2 percent *above* average-month conditions, the raw traffic volumes were adjusted upward by 2.3 percent<sup>2</sup> to be representative of traffic volumes conditions that existed prior to the COVID-19 pandemic.

The 2022 Existing traffic volumes are summarized in Table 2, with the weekday morning and evening peak-hour traffic volumes graphically depicted on Figure 3. Note that the peak-hour traffic volumes presented in Table 2 were obtained from the TMCs and are reflected on the aforementioned figures.

**Table 2**  
**2022 EXISTING TRAFFIC VOLUMES**

Location/Peak-Hour	AWT <sup>a</sup>	VPH <sup>b</sup>	K Factor <sup>c</sup>	Directional Distribution <sup>d</sup>
<i>High Street, west of South Common Street:</i>	6,570	--	--	--
Weekday Morning (7:45 – 8:45 AM)	--	684	10.4	66.5% EB
Weekday Evening (4:00 – 5:00 PM)	--	652	9.9	71.6% WB

<sup>a</sup>Average weekday traffic in vehicles per day.

<sup>b</sup>Vehicles per hour.

<sup>c</sup>Percent of daily traffic occurring during the peak-hour.

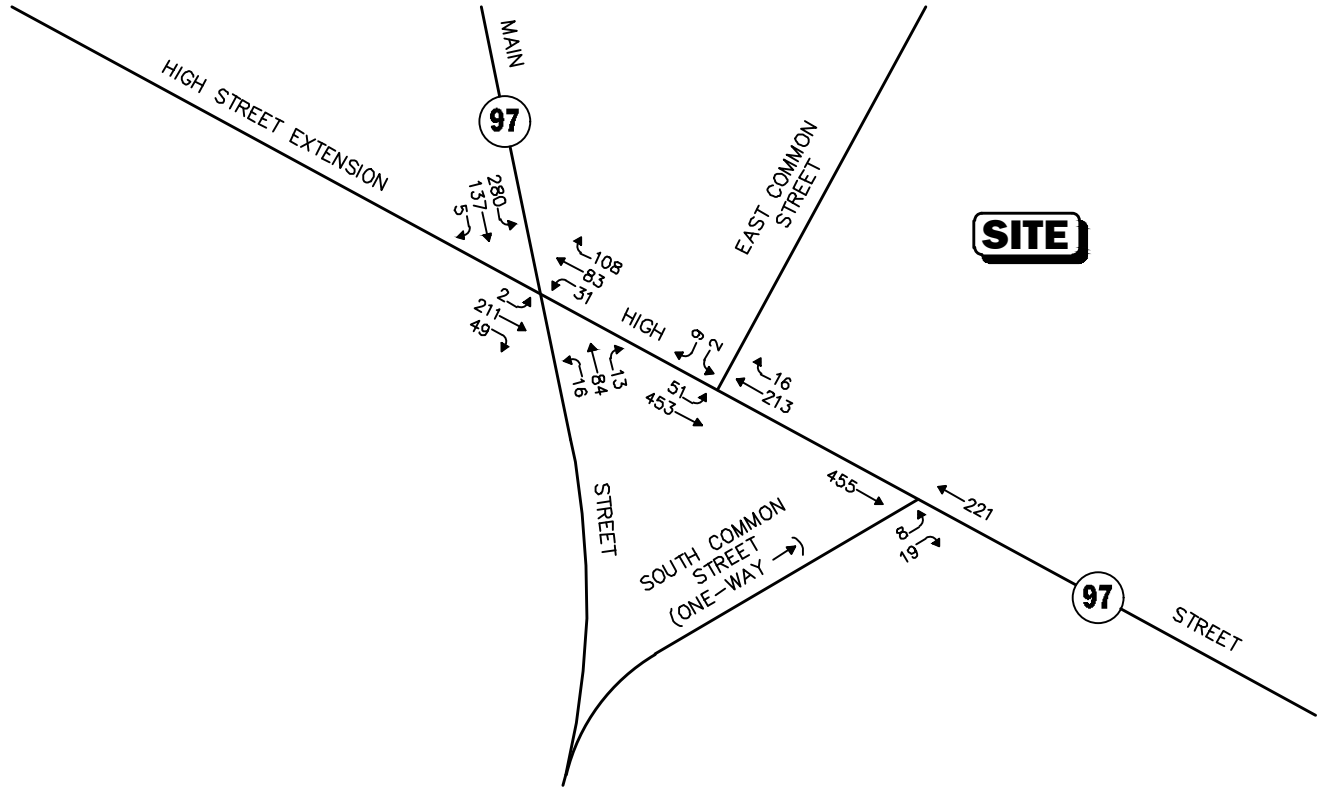
<sup>d</sup>Percent traveling in peak direction.

EB = eastbound; WB = westbound.

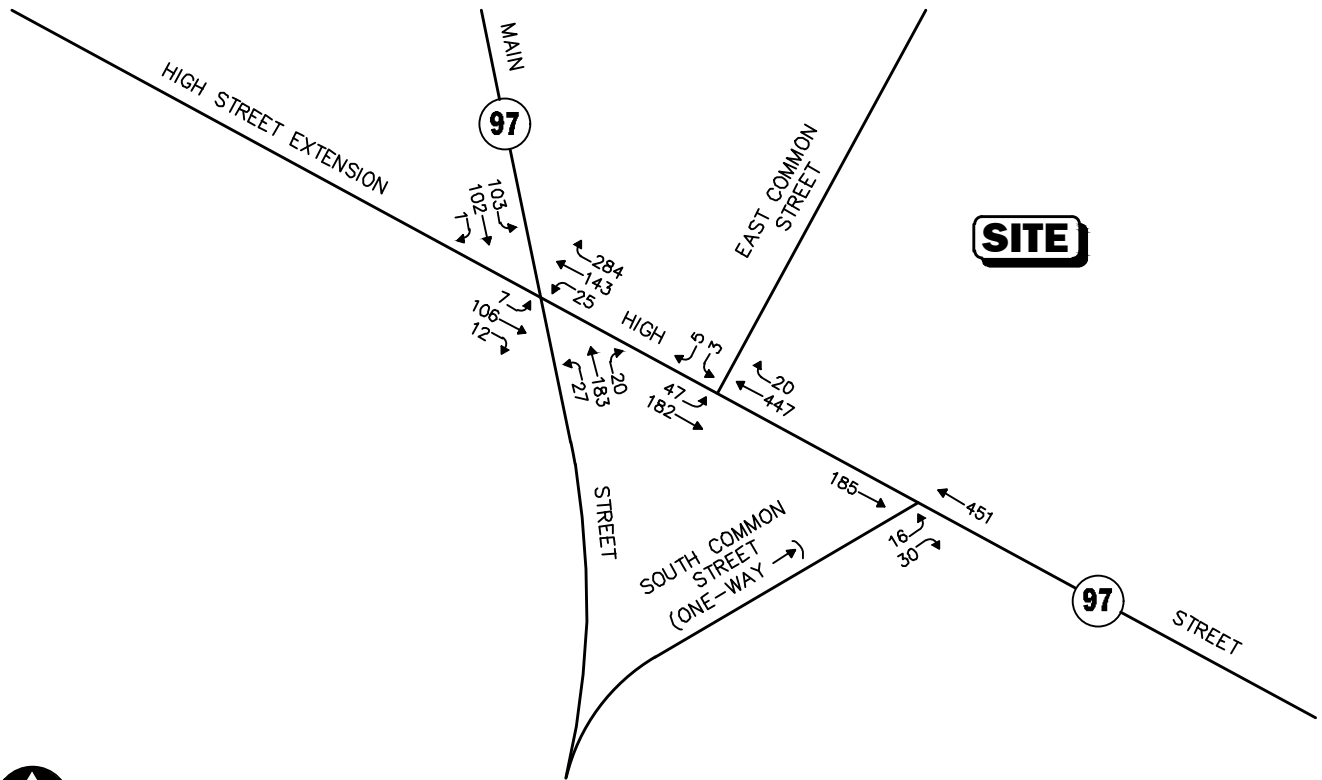
<sup>2</sup>The difference between the COVID-19 adjustment (+5.5 percent) and the seasonal adjustment (-3.2 percent).



WEEKDAY MORNING PEAK HOUR (7:45 TO 8:45 AM)



WEEKDAY EVENING PEAK HOUR (4:00 TO 5:00 PM)



Not To Scale Figure 3



2022 Existing Peak-Hour Traffic Volumes

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As can be seen in Table 2, High Street, in the vicinity of the Project site, was found to accommodate approximately 6,570 vehicles on an average weekday (two-way, 24-hour volume), with approximately 684 vehicles per hour (vph) during the weekday morning peak-hour and 652 vph during the weekday evening peak-hour.

**Pedestrian and Bicycle Facilities**

A comprehensive field inventory of pedestrian and bicycle facilities within the study area was undertaken in May 2022. The field inventory consisted of a review of the location of sidewalks and pedestrian crossing locations along the study roadway and at the study intersections, as well as the location of existing and planned future bicycle facilities. As detailed on Figure 2, sidewalks are provided along the west side of Main Street, along the east side of South Common Street and along the south side of High Street east of South Common Street, with a marked crosswalk provided for crossing the High Street Extension leg of the Main Street/High Street/High Street Extension intersection.

Formal bicycle facilities are not provided within the study area; however, the study area roadways generally provide sufficient width (combined travel lane and shoulder) to support bicycle travel in a shared traveled-way configuration (i.e., motor vehicles and bicyclists sharing the roadway).<sup>3</sup>

**Public Transportation**

Regularly scheduled public transportation services are not currently provided within the Town of Topsfield or in the immediate vicinity of the Project site. Prior to the COVID-19 pandemic, the Coach Company provided fixed-route bus service to Copley Square in Boston on the Boston Commuter route from the Topsfield Park-and-Ride, which is located at 16 Park Street, approximately 0.5 miles southwest from the Project site. This bus service has been suspended at this time.

**Spot Speed Measurements**

Vehicle travel speed measurements were performed on High Street in the vicinity of the Project site in conjunction with the ATR counts. Table 3 summarizes the vehicle travel speed measurements.

**Table 3  
VEHICLE TRAVEL SPEED MEASUREMENTS**

	High Street	
	Eastbound	Westbound
Mean Travel Speed (mph)	30	21
85 <sup>th</sup> Percentile Speed (mph)	33	27
Posted Speed Limit (mph)	25	25

mph = miles per hour.

<sup>3</sup>A minimum combined travel lane and paved shoulder width of 14-feet is required to support bicycle travel in a shared traveled-way condition.





As can be seen in Table 3, the mean vehicle travel speed along High Street in the vicinity of the Project site was found to be 30 mph in the eastbound direction and 21 mph westbound. The measured 85<sup>th</sup> percentile vehicle travel speed, or the speed at which 85 percent of the observed vehicles traveled at or below, was found to be 33 mph in the eastbound direction and 27 mph westbound, which is 2 to 8 mph above the posted speed limit at the Project site (25 mph). The 85<sup>th</sup> percentile speed is used as the basis of engineering design and in the evaluation of sight distances and is often used in establishing posted speed limits.

### **Motor Vehicle Crash Data**

Motor vehicle crash information for the study area intersections was provided by the MassDOT Highway Division Safety Management/Traffic Operations Unit for the most recent five-year period available (2015 through 2019, inclusive) to examine motor vehicle crash trends occurring within the study area. The data is summarized by intersection, type, severity, roadway and weather conditions, and day of occurrence, and is presented in Table 4.

As can be seen in Table 4, with the exception of the Main Street/High Street/High Street Extension intersection, the study area intersections were found to have experienced one (1) reported motor vehicle crashes per year over the five-year review period and were identified to have motor vehicle crash rates that are *below* both the MassDOT Statewide and District average crash rates for similar intersections for the MassDOT Highway Division District in which the intersections are located (District 4).

The Main Street/High Street/High Street Extension intersection was found to have experienced 17 reported motor vehicle crashes of the five-year review period, or an average of 3.4 crashes per year, the majority of which occurred on a weekday; during daylight; under clear weather conditions; and involved angle-type collisions that resulted in property damage only. The intersection was identified to have a motor vehicle crash rate that was *above* the MassDOT statewide and District average crash rates for similar intersections. As such, recommendations have been provided to advance safety-related improvements at this intersection (discussed in the *Recommendations* section of this assessment).

A review of the MassDOT statewide High Crash Location List indicated that there are no locations within the study area that are included on MassDOT's Highway Safety Improvement Program (HSIP) listing as a high crash location. In addition, no fatal motor vehicle crashes were reported to have occurred at the study area intersections over the five-year review period.

The detailed MassDOT Crash Rate Worksheets are attached.



**Table 4**  
**MOTOR VEHICLE CRASH DATA SUMMARY<sup>a</sup>**

	Main St./ High St./High St. Ext.	High St./East Common St.	High St./South Common St.
Traffic Control Type <sup>b</sup>	U	U	U
<i>Year:</i>			
2015	4	0	0
2016	2	0	1
2017	3	0	0
2018	3	1	0
<u>2019</u>	<u>5</u>	<u>0</u>	<u>0</u>
Total	17	1	1
Average	3.40	0.20	0.20
Crash Rate <sup>c</sup>	0.83	0.07	0.07
MassDOT Crash Rate: <sup>d</sup>	0.57/0.57	0.57/0.57	0.57/0.57
Significant? <sup>e</sup>	Yes	No	No
<i>Type:</i>			
Angle	14	0	1
Head-On	0	0	0
Rear-End	1	0	0
Rear-to-Rear	0	0	0
Sideswipe	1	1	0
Fixed Object	1	0	0
Pedestrian/Bicycle	0	0	0
<u>Unknown/Other</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	17	1	1
<i>Conditions:</i>			
Clear	9	1	0
Cloudy	5	0	1
Rain	1	0	0
Snow/Ice	2	0	0
<u>Not Reported/Other</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	17	1	1
<i>Lighting:</i>			
Daylight	15	1	0
Dawn/Dusk	0	0	0
Dark (Road Lit)	1	0	1
<u>Dark (Road Unlit)</u>	<u>1</u>	<u>0</u>	<u>0</u>
Total	17	1	1
<i>Day of Week:</i>			
Monday-Friday	12	0	1
Saturday	3	1	0
<u>Sunday</u>	<u>2</u>	<u>0</u>	<u>0</u>
Total	17	1	1
<i>Severity:</i>			
Property Damage Only	14	1	1
Non-fatal Injury	3	0	0
Fatalities	0	0	0
<u>Not Reported</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	17	1	1

<sup>a</sup>Source: MassDOT Safety Management/Traffic Operations Unit records, 2015 through 2019.

<sup>b</sup>Traffic Control Type: U = unsignalized.

<sup>c</sup>Crash rate per million vehicles entering the intersection.

<sup>d</sup>Statewide/District crash rate.

<sup>e</sup>The intersection crash rate is significant if it is found to exceed the MassDOT crash rate for the MassDOT Highway Division District in which the Project is located (District 4).



## **FUTURE CONDITIONS**

Traffic volumes in the study area were projected to the year 2029, which reflects a seven-year planning horizon consistent with MassDOT guidelines. Independent of the Project, traffic volumes on the roadway network in the year 2029 under No-Build conditions include all existing traffic and new traffic resulting from background traffic growth. Anticipated Project-generated traffic volumes superimposed upon the 2029 No-Build traffic volumes reflect 2029 Build traffic-volume conditions with the Project.

### **Future Traffic Growth**

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

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

To provide a conservative analysis framework, both procedures were used, the salient components of which are described below.

### **Specific Development by Others**

The Town of Topsfield Planning Department was consulted in order to determine if there were any projects that would have an impact on future traffic volumes at the study intersections. Based on this consultation, the following projects were identified for inclusion in this assessment:

- ***Proposed Residential Development, 57 Perkins Row, Topsfield, Massachusetts.*** This project entails the construction of a 44-unit residential development to be located at 57 Perkins Row to the southeast of the Project site. Traffic volumes associated with this project within the study area of this assessment are expected to be relatively minor and would be reflected in the general background traffic growth rate (discussion follows).
- ***Proposed Residential Development, Perkins Row, Topsfield, Massachusetts.*** This project entails the construction of a residential development to be located off of Perkins Row, proximate to Route 97, to the southeast of the Project site. Traffic volumes associated with this project within the study area of this assessment are expected to be relatively minor and would be reflected in the general background traffic growth rate.
- ***Proposed Commercial Development, School Street, Topsfield, Massachusetts.*** This potential future project will entail the redevelopment of the former Highway Department garage located off School Street to the south of the Project site to accommodate a commercial use. At this time, no definitive plans or applications for the project have been submitted to the Town and, as such, this project has not been included in the future conditions traffic volumes.
- ***Proposed Mixed-Use Development, Routes 1 & 97, Topsfield, Massachusetts.*** This potential future project will entail the construction of a mixed-use development to be located proximate to the Route 1/Route 97 intersection to the southeast of the Project site. At this time, no definitive



plans or applications for the project have been submitted to the Town and, as such, this project has not been included in the future conditions traffic volumes.

No other developments were identified at this time that are expected to result in an increase in traffic within the study area beyond the general background traffic growth rate.

### **General Background Traffic Growth**

Traffic-volume data compiled by MassDOT from permanent count stations located in Topsfield and Boxford were reviewed in order to determine general traffic growth trends in the area. This data indicates that annual traffic volumes have fluctuated over the past several years, with the average growth rate found to be approximately 1.44 percent per year. In order to provide a prudent planning condition for the Project, a slightly higher 1.5 percent per year compounded annual background traffic growth rate was used in order to account for future traffic growth and presently unforeseen development within the study area.

### **Roadway Improvement Projects**

The Town of Topsfield and MassDOT were contacted in order to determine if there were any planned future roadway improvement projects expected to be complete by 2029 within the study area. Based on these discussions, no roadway improvement projects aside from routine maintenance activities were identified to be planned within the study area at this time.

### **No-Build Traffic Volumes**

The 2029 No-Build condition peak-hour traffic volumes were developed by applying the 1.5 percent per year compounded annual background traffic growth rate to the 2022 Existing peak-hour traffic volumes. The resulting 2029 No-Build weekday morning and evening peak-hour traffic volumes are shown on Figure 4.

### **Project-Generated Traffic**

Design year (2029 Build) traffic volumes for the study area roadways were determined by estimating Project-generated traffic volumes and assigning those volumes on the study roadways. The following sections describe the methodology used to develop the anticipated traffic characteristics of the Project.

As proposed, the Project will entail the construction of a 44± unit, age-qualified (age 55+) multifamily residential development. In order to develop the traffic characteristics of the Project, trip-generation statistics published by the ITE<sup>4</sup> for a similar land use as that proposed were used. ITE Land Use Code (LUC) 252, *Senior Adult Housing – Multifamily*, was used to develop the traffic characteristics of the Project, the results of which are summarized in Table 5.

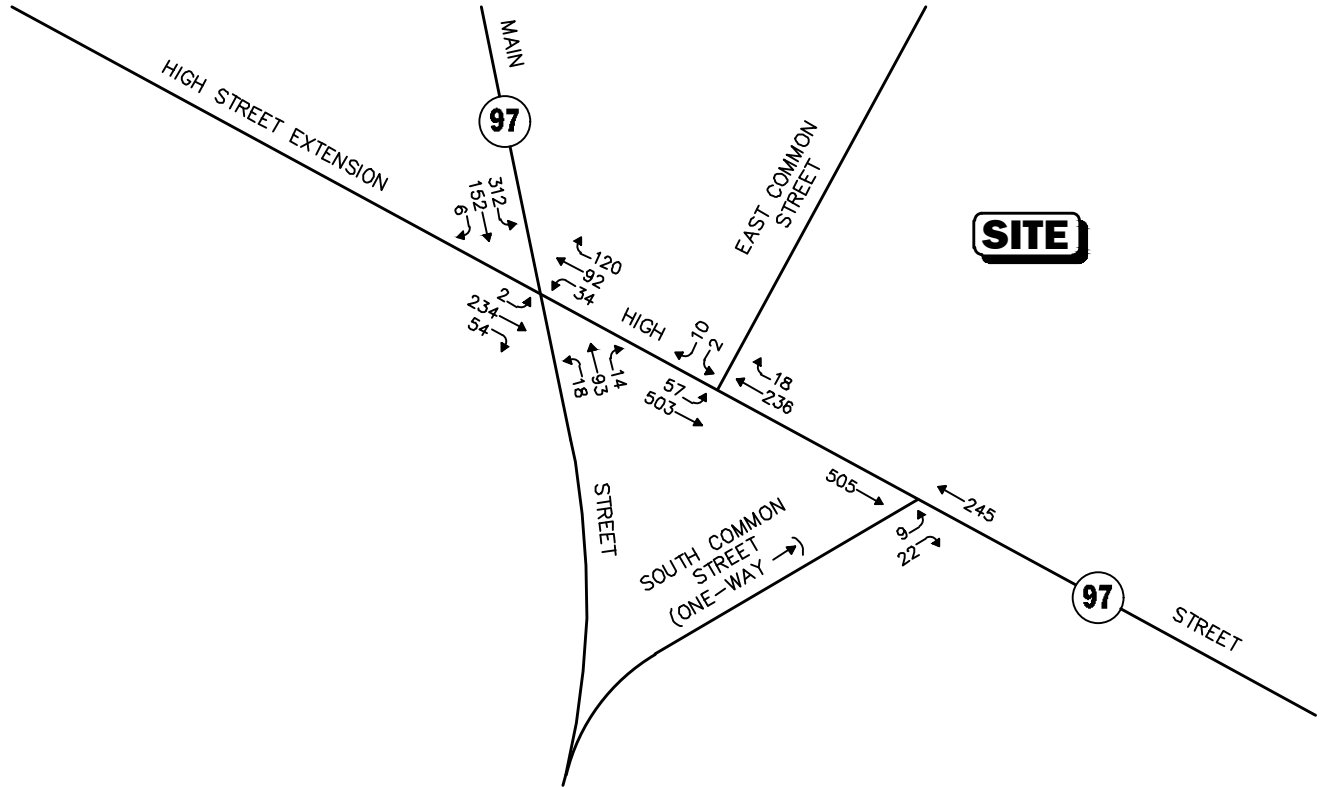
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<sup>4</sup>Ibid 1.

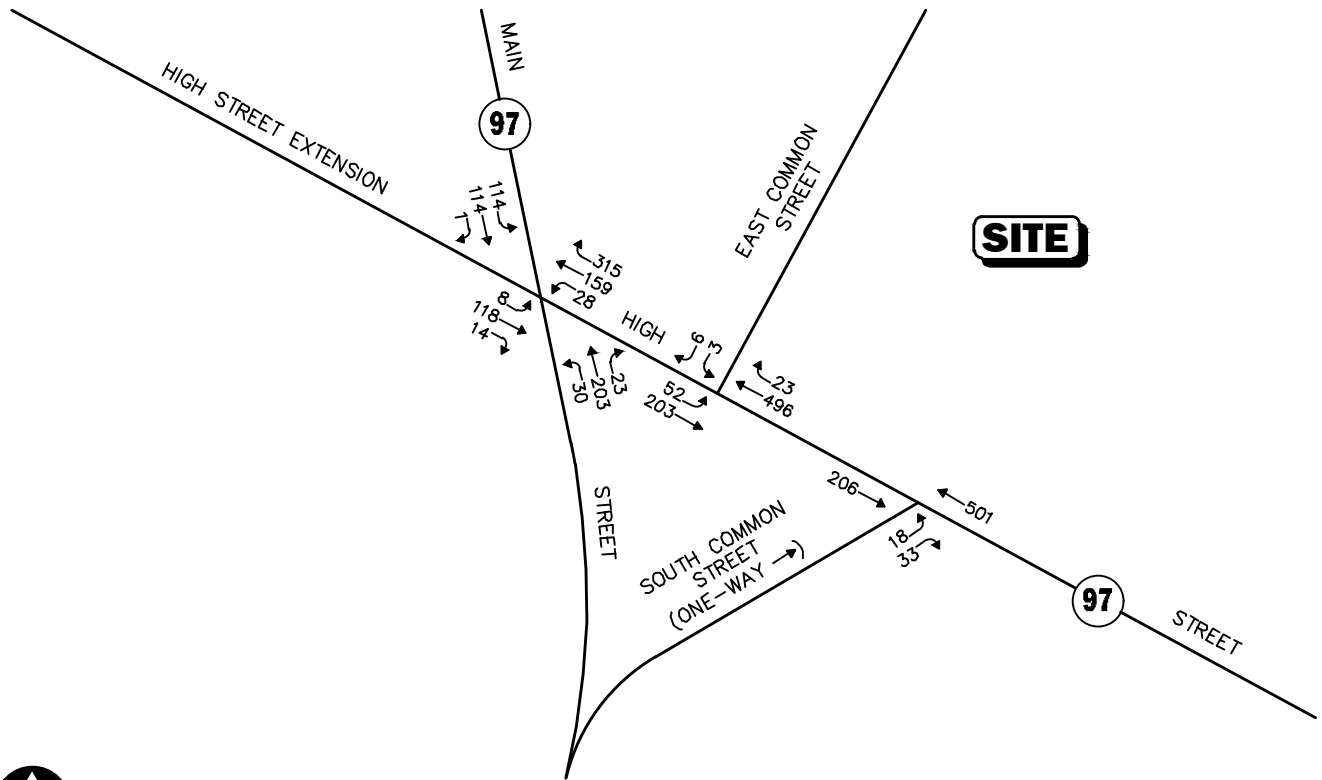




WEEKDAY MORNING PEAK HOUR (7:45 TO 8:45 AM)



WEEKDAY EVENING PEAK HOUR (4:00 TO 5:00 PM)



Not To Scale Figure 4



2029 No-Build Peak-Hour Traffic Volumes

**Table 5**  
**TRIP GENERATION SUMMARY**

Time Period	Vehicle Trips <sup>a</sup>		
	Entering	Exiting	Total
<i>Average Weekday:</i>	72	72	144
<i>Weekday Morning Peak-Hour:</i>	3	6	9
<i>Weekday Evening Peak-Hour:</i>	6	5	11

<sup>a</sup>Based on ITE LUC 252, *Senior Adult Housing - Multifamily*.

### **Project-Generated Traffic-Volume Summary**

As can be seen in Table 5, the Project is expected to generate approximately 144 vehicle trips on an average weekday (two-way, 24-hour volume, or 72 vehicles entering and 72 exiting), with 9 vehicle trips (3 vehicles entering and 6 exiting) expected during the weekday morning peak-hour and 11 vehicle trips (6 vehicles entering and 5 exiting) expected during the weekday evening peak-hour.

### **Trip Distribution and Assignment**

The directional distribution of generated trips to and from the Project site was determined based on a review of U.S. Census Journey-to-Work data for the Town of Topsfield and then refined based on a review of existing traffic patterns within the study area. The general trip distribution for the Project is graphically depicted on Figure 5, with the additional traffic that is expected to be generated by the Project assigned on the study area roadway network as shown on Figure 6.

### **Build Traffic Volumes**

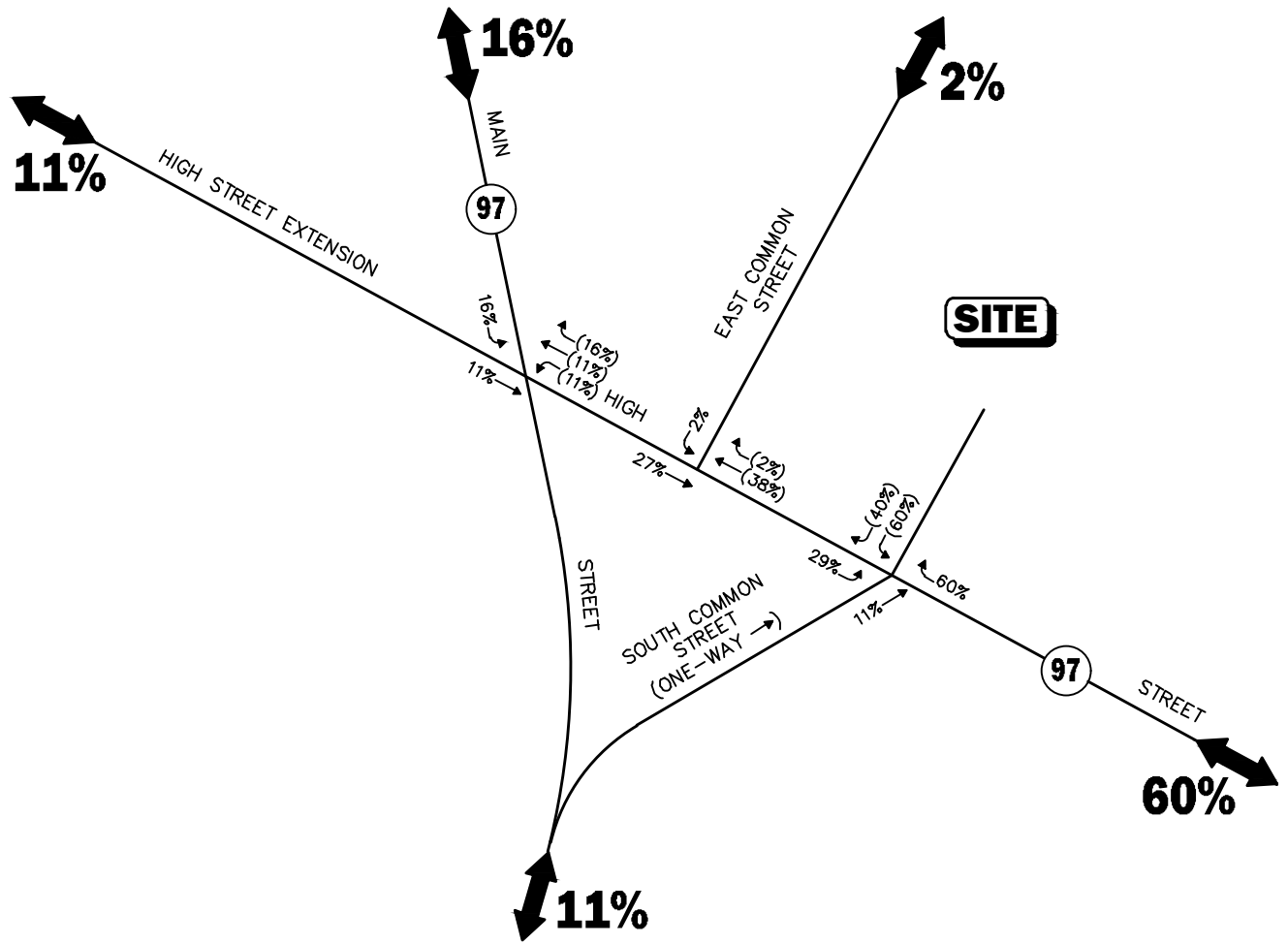
The 2029 Build condition traffic volumes consist of the 2029 No-Build traffic volumes with the addition of the traffic expected to be generated by the Project. The 2029 Build weekday morning and evening peak-hour traffic volumes are graphically depicted on Figure 7.

### **TRAFFIC OPERATIONS ANALYSIS**

In order to assess the potential impact of the Project on the roadway network, a detailed traffic operations analysis (motorist delays, vehicle queuing, and level-of-service) was performed for the study intersection. Capacity analyses provide an indication of how well transportation facilities serve the traffic demands placed upon them, with vehicle queue analyses providing a secondary measure of the operational characteristics of an intersection or section of roadway under study.

In brief, six levels of service are defined for each type of facility. They are given letter designations ranging from A to F, with LOS “A” representing the best operating conditions and LOS “F” representing congested or constrained operations. An LOS of “E” is representative of a transportation facility that is operating at its design capacity with an LOS of “D” generally defined as the limit of “acceptable” traffic operations. Since the level-of-service of a traffic facility is a function of the 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 the year. The Synchro® intersection capacity analysis software, which is based on the analysis methodologies





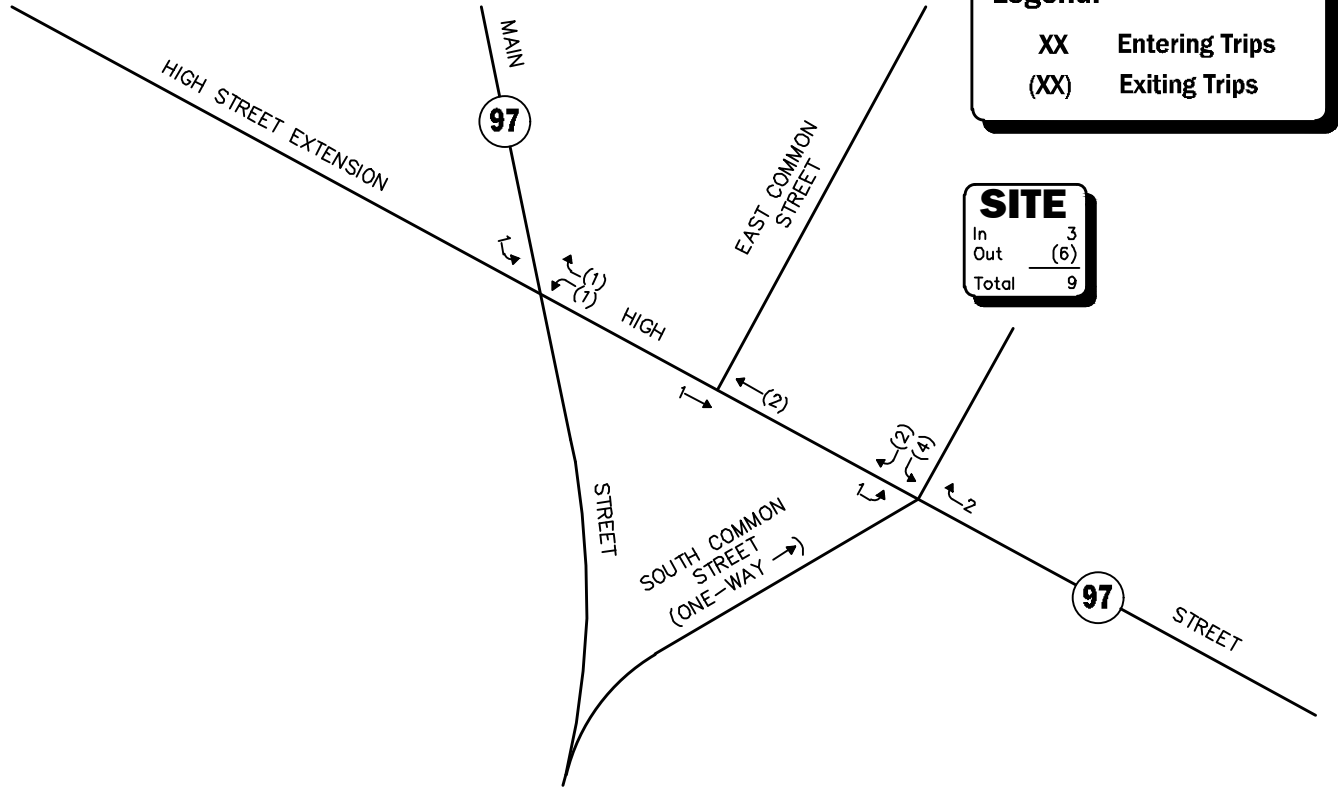
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Figure 5  
Trip Distribution Map

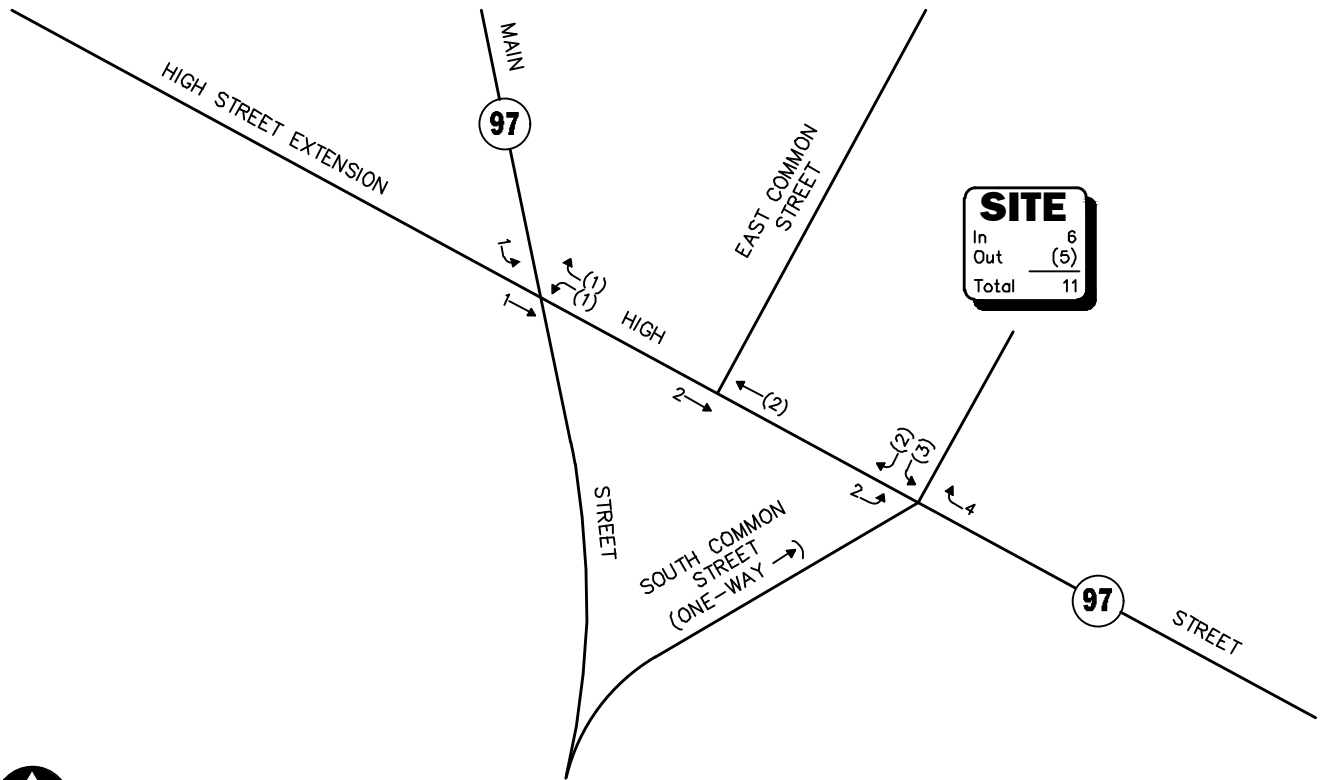


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WEEKDAY MORNING PEAK HOUR (7:45 TO 8:45 AM)



WEEKDAY EVENING PEAK HOUR (4:00 TO 5:00 PM)



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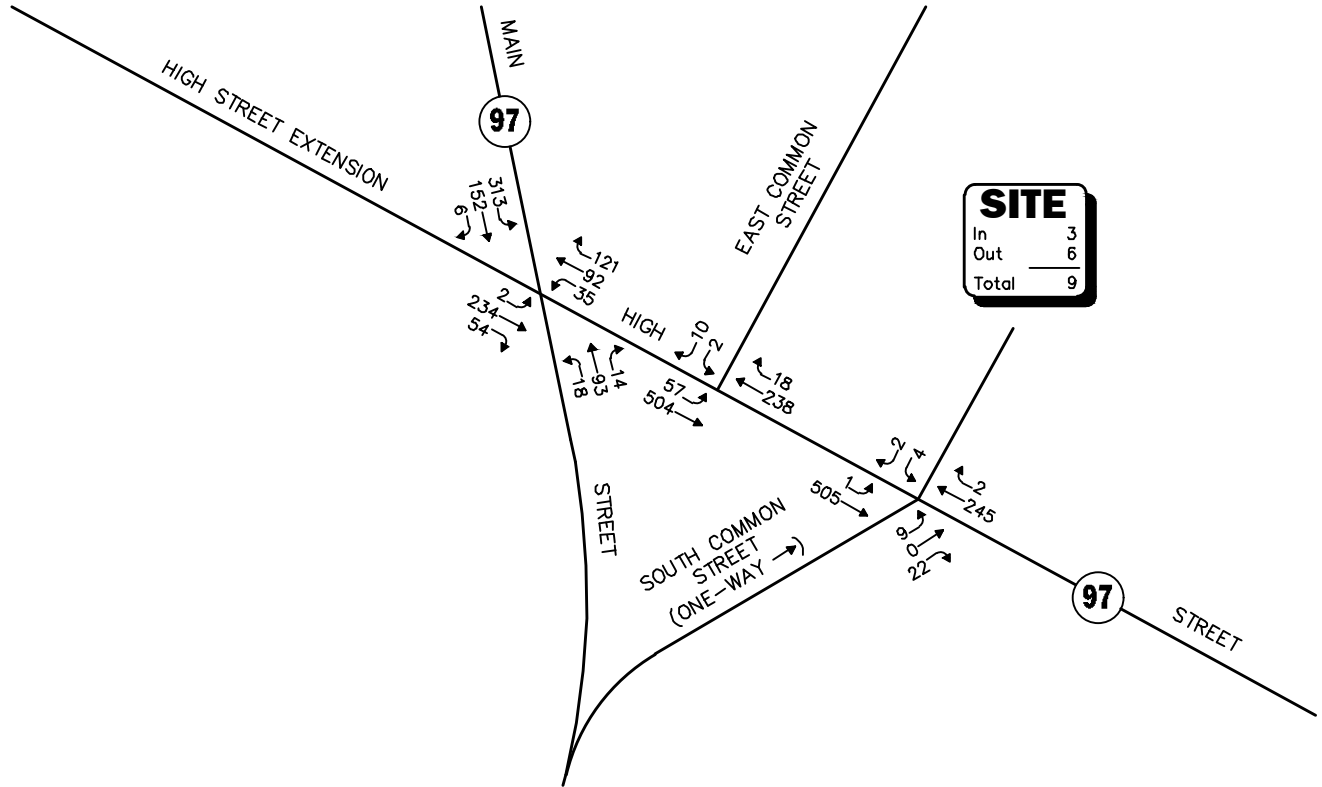
Figure 6

Project-Generated Peak-Hour Traffic Volumes

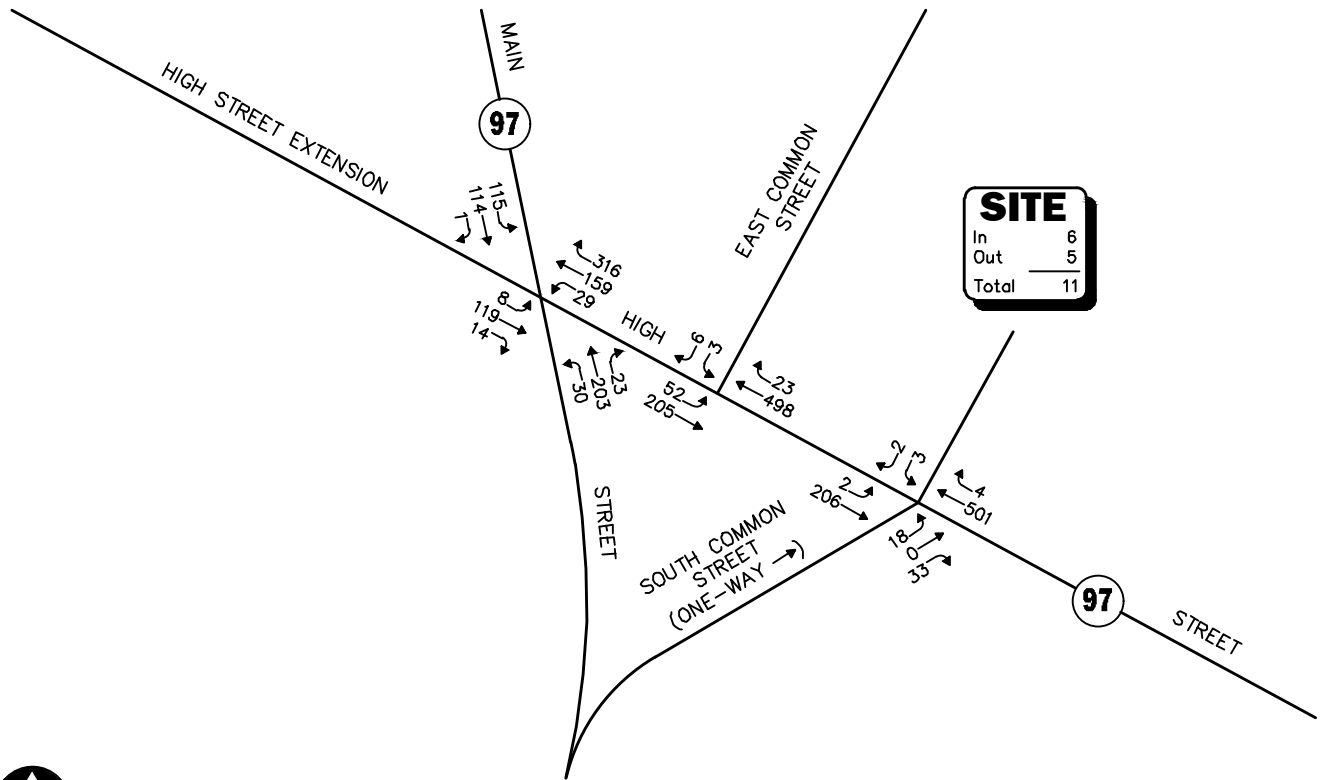




WEEKDAY MORNING PEAK HOUR (7:45 TO 8:45 AM)



WEEKDAY EVENING PEAK HOUR (4:00 TO 5:00 PM)



Not To Scale

Figure 7



2029 Build  
Peak-Hour Traffic Volumes

and procedures presented in the 2010 *Highway Capacity Manual* (HCM)<sup>5</sup> for unsignalized intersections, was used to complete the level-of-service and vehicle queue analyses.

### **Analysis Results**

Level-of-service and vehicle queue analysis were conducted for 2022 Existing, 2029 No-Build, and 2029 Build conditions for the intersections within the study area. The results of the intersection capacity and vehicle queue analyses are summarized in Table 6, with the detailed analysis results attached.

The following is a summary of the level-of-service and vehicle queue analyses for intersections within the study area. For context, we note that an LOS of “D” or better is generally defined as “acceptable” operating conditions.

#### **Main Street at High Street and High Street Extension**

The addition of Project-related traffic was shown to result in an increase in average motorist delay that resulted in a corresponding increase in vehicle queuing of up to two (2) vehicle. Independent of the Project, the High Street and High Street Extension approaches are currently or are predicted to operate at or over capacity (i.e., LOS “E” or LOS “F”) during the peak hours.

#### **High Street at East Common Street**

No changes in level of service or vehicle queuing is predicted to occur for any movement over No-Build conditions, with all movements continuing to operate at LOS B or better and Project-related impacts generally defined as an increase in average motorist delay of less than 1.0 seconds. That being said, actual operating conditions (motorist delays and vehicle queuing) will be directly related to vehicle queuing along High Street approaching Main Street.

#### **High Street at South Common Street and Project Site Driveway**

No changes in level-of-service or vehicle queuing is predicted to occur for any movement over No-Build conditions, with all movements shown to operate at LOS C or better and Project related impacts generally defined as an increase in average motorist delay of up to 1.0 seconds. All movements exiting the Project site driveway were shown to operate at LOS C during the peak hours with negligible vehicle queuing. Actual operating conditions at the intersection and delays for motorists exiting the Project site driveway will be directly related to vehicle queuing along High Street approaching Main Street.

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<sup>5</sup>*Highway Capacity Manual*, Transportation Research Board; Washington, DC; 2010.



**Table 6**  
**UNSIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY**

Unsignalized Intersection/Peak-Hour/Movement	2022 Existing				2029 No-Build				2029 Build			
	Demand <sup>a</sup>	Delay <sup>b</sup>	LOS <sup>c</sup>	Queue <sup>d</sup> 95 <sup>th</sup>	Demand	Delay	LOS	Queue 95 <sup>th</sup>	Demand	Delay	LOS	Queue 95 <sup>th</sup>
<b>Main Street at High Street and High Street Ext.</b>												
<i>Weekday Morning:</i>												
High Street Ext. EB: LT/TH/RT	262	>50.0	F	29	290	>50.0	F	39	290	>50.0	F	39
High Street WB: LT/TH/RT	222	>50.0	F	9	246	>50.0	F	11	248	>50.0	F	13
Main Street NB: LT/TH/RT	113	1.1	A	0	125	1.1	A	0	125	1.1	A	0
Main Street SB: LT/TH/RT	422	5.4	A	1	470	5.5	A	1	471	5.5	A	1
<i>Weekday Evening:</i>												
High Street Ext. EB: LT/TH/RT	125	28.5	D	3	140	44.9	E	5	141	45.7	E	5
High Street WB: LT/TH/RT	452	>50.0	F	11	502	>50.0	F	19	504	>50.0	F	20
Main Street NB: LT/TH/RT	230	0.9	A	0	256	0.9	A	0	256	0.9	A	0
Main Street SB: LT/TH/RT	206	4.0	A	1	229	4.1	A	1	230	4.1	A	1
<b>High Street at East Common Street</b>												
<i>Weekday Morning:</i>												
High Street EB: LT/TH	504	0.8	A	0	560	0.8	A	0	561	0.8	A	0
High Street WB: TH/RT	229	0.0	A	0	254	0.0	A	0	254	0.0	A	0
East Common Street SB: LT/RT	11	11.4	B	0	12	11.8	B	0	12	11.9	B	0
<i>Weekday Evening:</i>												
High Street EB: LT/TH	229	1.7	A	0	255	1.8	A	0	257	1.8	A	0
High Street WB: TH/RT	467	0.0	A	0	519	0.0	A	0	521	0.0	A	0
East Common Street SB: LT/RT	8	13.1	B	0	9	13.8	B	0	9	13.8	B	0
<b>High Street at South Common Street and the Project Site Driveway</b>												
<i>Weekday Morning:</i>												
High Street EB: LT/TH	455	0	A	0	505	0.0	A	0	506	0.0	A	0
High Street WB: TH/RT	221	0	A	0	245	0.0	A	0	247	0.0	A	0
South Common Street NB: LT/TH/RT	27	13.9	B	1	31	15.1	C	1	31	16.1	C	1
Project Site Driveway SB: LT/RT	--	--	--	--	--	--	--	--	6	17.4	C	0
<i>Weekday Evening:</i>												
High Street EB: LT/TH	185	0	A	0	206	0.0	A	0	208	0.1	A	0
High Street WB: TH/RT	451	0	A	0	501	0.0	A	0	505	0.0	A	0
South Common Street NB: LT/TH/RT	46	11.7	B	1	51	12.4	B	1	51	13.3	B	1
Project Site Driveway SB: LT/RT	--	--	--	--	--	--	--	--	5	15.4	C	0

<sup>a</sup>Demand in vehicles per hour.

<sup>b</sup>Average control delay per vehicle (in seconds).

<sup>c</sup>Level of service.

<sup>d</sup>Queue length in vehicles.

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

N/A = not calculated.



## SIGHT DISTANCE ASSESSMENT

Sight distance measurements were performed at the High Street/South Common Street/Project site driveway intersection in accordance with MassDOT and American Association of State Highway and Transportation Officials (AASHTO)<sup>6</sup> requirements. Both stopping sight distance (SSD) and intersection sight distance (ISD) measurements were performed. In brief, SSD is the distance required by a vehicle traveling at the design speed of a roadway, on wet pavement, to stop prior to striking an object in its travel path. ISD or corner sight distance (CSD) is the sight distance required by a driver entering or crossing an intersecting roadway to perceive an oncoming vehicle and safely complete a turning or crossing maneuver with on-coming traffic. In accordance with AASHTO standards, if the measured ISD is at least equal to the required SSD value for the appropriate design speed, the intersection can operate in a safe manner. Table 7 presents the measured SSD and ISD at the subject intersection.

**Table 7**  
**SIGHT DISTANCE MEASUREMENTS<sup>a</sup>**

Intersection/Sight Distance Measurement	Feet		
	Required Minimum (SSD)	Desirable (ISD) <sup>b</sup>	Measured
<b><i>High Street at the Project Site driveway</i></b>			
<i>Stopping Sight Distance:</i>			
High Street approaching from the east	250	--	500+
High Street approaching from the west	250	--	300
<i>Intersection Sight Distance:</i>			
Looking to the east from Project driveway	250	335	293/500+ <sup>c</sup>
Looking to the west from Project driveway	250	390	300

<sup>a</sup>Recommended minimum values obtained from *A Policy on Geometric Design of Highways and Streets*, 7<sup>th</sup> Edition; American Association of State Highway and Transportation Officials (AASHTO); 2018; and based on a 35 mph approach speed on High Street.

<sup>b</sup>Values shown are the intersection sight distance for a vehicle turning right or left exiting a roadway under STOP control such that motorists approaching the intersection on the major street should not need to adjust their travel speed to less than 70 percent of their initial approach speed.

<sup>c</sup>Available sight distance with the selective trimming/removal of trees and vegetation located within the sight triangle area to the east of the Project site driveway along the north side of High Street.

As can be seen in Table 7, with the selective trimming/removal of trees and vegetation located within the sight triangle area of the Project site driveway, the available lines of sight to and from the Project site driveway intersection with High Street will exceed the recommended minimum sight distance to function in a safe manner (SSD) based on a 35 mph approach speed, which is above both the measured 85<sup>th</sup> percentile vehicle travel speed (27/33 mph) and the posted speed limit (25 mph) at the Project site driveway.

<sup>6</sup>*A Policy on Geometric Design of Highway and Streets*, 7<sup>th</sup> Edition; American Association of State Highway and Transportation Officials (AASHTO); Washington D.C.; 2018.





## **SUMMARY**

VAI has completed a detailed assessment of the potential impacts on the transportation infrastructure associated with the proposed construction of an age-qualified residential development to be located at 10 High Street in Topsfield, Massachusetts. The following specific areas have been evaluated as they relate to the Project: i) access requirements; ii) potential off-site improvements; and iii) safety considerations; under existing and future conditions, both with and without the Project. Based on this assessment, we have concluded the following with respect to the Project:

1. Using trip-generation statistics published by the ITE,<sup>7</sup> the Project is expected to generate approximately 144 vehicle trips on an average weekday (two-way, 24-hour volume), with 9 vehicle trips expected during the weekday morning peak-hour and 11 vehicle trips expected during the weekday evening peak-hour;
2. The Project will not result in a significant impact (increase) on motorist delays or vehicle queuing over Existing or anticipated future conditions without the Project (No-Build conditions), acknowledging that one or more movements at the study area intersections are currently operating or are predicted to operate at or over capacity (i.e., LOS “E” or “F”, respectively) independent of the Project;
3. All movements at the Project site driveway intersection with High Street are predicted to operate at LOS C with negligible vehicle queuing predicted, with actual operating conditions expected to be related to vehicle queuing on the High Street approach to Main Street;
4. Independent of the Project, the Main Street/High Street/High Street Extension intersection was found to have a motor vehicle crash rate that is above the MassDOT average crash rate for similar intersections. As such, specific recommendations have been provided to advance safety-related improvements at the intersection;
5. Lines of sight at the Project site driveway intersection with High Street were found to exceed or can be made to exceed the recommended minimum distance for the intersection to operate in a safe manner based on the appropriate approach speed.

In consideration of the above, we have concluded that the Project can be accommodated within the confines of the existing transportation infrastructure in a safe and efficient manner with the implementation of the recommendations that follow.

## **RECOMMENDATIONS**

A detailed transportation improvement program has been developed that is designed to provide safe and efficient access to the Project site and address any deficiencies identified as a part of this assessment. The following improvements have been recommended as a part of this evaluation and, where applicable, will be completed in conjunction with the Project subject to receipt of all necessary rights, permits, and approvals.

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<sup>7</sup>Ibid 1.



## **Project Access**

Access to the Project will be provided by way of a new driveway that will intersect the north side of High Street opposite South Common Street. The following recommendations are offered with respect to the design and operation of the Project site access and internal circulation, many of which are reflected on the Site Plans:

- The Project site driveway will be 22 feet in width and designed to accommodate the turning and maneuvering requirements of the largest anticipated responding emergency vehicle.
- Where perpendicular parking is proposed the drive aisle behind the parking should be a minimum of 23 feet in order to facilitate parking maneuvers.
- Vehicles exiting the Project site should be placed under STOP-sign control with a marked STOP-line provided.
- All signs and pavement markings to be installed within the Project site should conform to the applicable standards of the *Manual on Uniform Traffic Control Devices (MUTCD)*.<sup>8</sup>
- A sidewalk has been provided along the Project site driveway that extends to High Street, where a marked crosswalk with Americans with Disabilities Act (ADA)-compliant wheelchair ramps and a pedestrian actuated rectangular rapid flashing beacon with accompanying pedestrian crossing warning signs should be installed for crossing High Street between the Project site and the sidewalk along South Common Street.
- ADA-compliant wheelchair ramps will be provided at pedestrian crossings within the Project.
- Signs and landscaping to be installed as a part of the Project within the intersection sight triangle areas of the Project site driveway should be designed and maintained so as not to restrict lines of sight.
- Snow accumulations (windrows) within sight triangle areas should be promptly removed where such accumulations would impede sight lines.
- Secure bicycle parking should be provided proximate to the residential building.

## **Off-Site**

### **Main Street at High Street and High Street Extension**

Independent of the Project, one or more movements at the Main Street/High Street/High Street Extension intersection are currently or are predicted to operate at or over capacity during the peak hours. Absent improvement, motorist delays are expected to further increase in the future, again, independent of the Project. In addition to and also independent of the Project, the intersection was identified to have a motor vehicle crash history that warrants further review and the advancement of specific improvements to enhance safety. In an effort to identify both safety and capacity improvements for this intersection, the Project proponent will facilitate the completion of a Road Safety Audit (RSA). The RSA will be completed prior to the issuance of a Certificate of Occupancy for the Project and can be used by the Town to support state grant applications for the implementation of the suggested improvements that will be an outcome of the RSA.

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<sup>8</sup>*Manual on Uniform Traffic Control Devices (MUTCD)*; Federal Highway Administration; Washington, D.C.; 2009.



## **Transportation Demand Management**

Public transportation services are not currently provided within the study area or the Town of Topsfield. In an effort to encourage the use of alternative modes of transportation to single-occupant vehicles (SOVs), the follow Transportation Demand Management (TDM) measures will be implemented as part of the Project:

- A transportation coordinator will be assigned for the Project to coordinate the TDM program and serve as a point of contact with the Topsfield Council on Aging (COA);
- A “welcome packet” will be provided to residents detailing available transportation options;
- Pedestrian accommodations have been included within the Project site and consist of a sidewalk that will extend to High Street; and
- Secure bicycle parking will be provided for residents and visitors.

With implementation of the aforementioned recommendations, safe and efficient access will be provided to the Project site and the Project can be accommodated within the confines of the existing and improved transportation system.

cc: File

