

Transportation Impact Assessment

Apple Hill Estates Residential Development
31 Hunting Lane
Sherborn, Massachusetts

Prepared for:

Barsky Estate Realty Trust
Natick, Massachusetts

October 2020

Prepared by:

 **Vanasse &
Associates inc**
Transportation Engineers & Planners

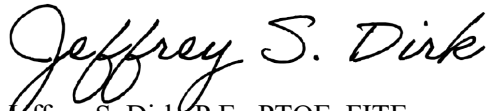
35 New England Business Center Drive
Suite 140
Andover, MA 01810

Dear Reviewer:

This letter shall certify that this *Transportation Impact Assessment* has been prepared under my direct supervision and responsible charge. I am a Registered Professional Engineer (P.E.) in the Commonwealth of Massachusetts (Massachusetts P.E. No. 38871, Civil) and hold Certification as a Professional Traffic Operations Engineer (PTOE) from the Transportation Professional Certification Board, Inc. (TPCB), an independent affiliate of the Institute of Transportation Engineers (ITE) (PTOE Certificate No. 993). I am also a Fellow of the Institute of Transportation Engineers (FITE).

Sincerely,

VANASSE & ASSOCIATES, INC.



Jeffrey S. Dirk, P.E., PTOE, FITE
Managing Partner

CONTENTS

EXECUTIVE SUMMARY	1
Recommendations.....	2
INTRODUCTION	4
Project Description.....	4
Study Methodology.....	5
EXISTING CONDITIONS.....	6
Traffic Volumes	7
Pedestrian and Bicycle Facilities	9
Public Transportation.....	9
Spot Speed Measurements	9
Motor Vehicle Crash Data	10
FUTURE CONDITIONS.....	12
Future Traffic Growth.....	12
Project-Generated Traffic	14
Trip Distribution and Assignment	15
Future Traffic Volumes - Build Condition	15
TRAFFIC OPERATIONS ANALYSIS.....	16
Methodology	16
Analysis Results.....	19
SIGHT DISTANCE EVALUATION	22
CONCLUSIONS AND RECOMMENDATIONS	24
Conclusions.....	24
Recommendations.....	25

FIGURES

No.	Title
1	Site Location Map
2	Existing Intersection Lane Use, Travel Lane Width and Pedestrian Facilities
3	2020 Existing Peak Hour Traffic Volumes
4	2027 No-Build Peak Hour Traffic Volumes
5	Trip-Distribution Map
6	Project-Generated Peak Hour Traffic Volumes
7	2027 Build Peak Hour Traffic Volumes

TABLES

No.	Title
1	Study Area Intersection Description
2	2020 Existing Traffic Volumes
3	Vehicle Travel Speed Measurements
4	Motor Vehicle Crash Data Summary
5	Trip-Generation Summary
6	Peak-Hour Traffic-Volume Increases
7	Level-of-Service Criteria for Unsignalized Intersections
8	Level-of-Service Criteria for Signalized Intersections
9	Unsignalized Intersection Level-of-Service and Vehicle Queue Summary
10	Signalized Intersection Level-of-Service and Vehicle Queue Summary
11	Sight Distance Measurements
12	Mitigated Signalized Intersection Level-of-Service and Vehicle Queue Summary

EXECUTIVE SUMMARY

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 a residential development to be known as Apple Hill Estates and located at 31 Hunting Lane in Sherborn, Massachusetts (hereafter referred to as the Project). This assessment was prepared in consultation with the Town of Sherborn and the Massachusetts Department of Transportation (MassDOT), and 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.

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),¹ the Project is expected to generate approximately 172 vehicle trips on an average weekday (two-way, 24-hour volume), with 14 vehicle trips expected during the weekday morning peak-hour and 19 vehicle trips expected during the weekday evening peak-hour;
2. The Project will not have a significant impact (increase) on motorist delays or vehicle queuing over Existing or anticipated future conditions without the Project (No-Build conditions), with majority of the movements at the study intersections shown to continue to operate at a level-of-service (LOS) D or better under all analysis conditions, where an LOS of "D" or better is defined as "acceptable" traffic operations;
3. No apparent safety deficiencies were noted with respect to the motor vehicle crash history at the study area intersections, with all of the intersections found to have motor vehicle crash rates below the MassDOT average crash rates for similar intersections; and
4. Lines of sight at the Project site roadway intersection with Hunting Lane were found to exceed or could be made to exceed the recommended minimum distance for safe operation 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 implementation of the recommendations that follow.

¹*Trip Generation*, 10th Edition; Institute of Transportation Engineers; Washington, DC; 2017.

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 at off-site locations evaluated in conjunction with this study. 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.

Project Access

Access to the Project site will be provided by way of a new roadway that will intersect the south side of Hunting Lane approximately 950 feet west of the railroad crossing. 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 roadway should be a minimum of 22-feet in width and designed to accommodate the turning and maneuvering requirements of the largest anticipated responding emergency vehicle.
- 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)*.²
- A sidewalk has been provided along one side of the Project site roadway and extends to Hunting Lane.
- Americans with Disabilities Act (ADA) compliant wheelchair ramps should be provided at all pedestrian crossings internal to the Project site and for crossing the Project site roadway.
- Signs and landscaping to be installed as a part of the Project within the intersection sight triangle areas of the Project site roadway should be designed and maintained so as not to restrict lines of sight.
- Snow windrows within sight triangle areas of the Project site roadway should be promptly removed where such accumulations would impede sight lines.
- Existing trees and vegetation located along the south side of Hunting Lane within the intersection triangle areas of the Project site roadway should be selectively trimmed or removed and maintained.

Off-Site

Route 27 at Route 16

Independent of the Project, left-turn movements from the Route 16 approach to the signalized intersection of Route 16 at Route 27 were shown to be operating over capacity (i.e., LOS F) during the weekday evening peak hour under 2020 Existing conditions. In an effort to improve traffic

²*Manual on Uniform Traffic Control Devices (MUTCD)*; Federal Highway Administration; Washington, D.C.; 2009.

operations at the intersection, it is recommended that an optimal traffic signal timing plan be implemented at this intersection in order to improve traffic operations and reduce vehicle queueing. With implementation of an optimal traffic signal timing plan, overall intersection operations will be improved from LOS E to LOS D during the weekday evening peak-hour, with operating conditions for the Route 16 left-turn movement shown to improve from LOS F to LOS E with reduced vehicle queueing.

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.

INTRODUCTION

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 a residential development to be known as Apple Hill Estates and located at 31 Hunting Lane in Sherborn, 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 North Main Street (Route 27) and Hunting Lane, and the following specific intersections: Route 27 at Hunting Lane and Route 27 at Eliot Street (Route 16).

PROJECT DESCRIPTION

The Project will entail the construction of a 28-unit residential community that will be comprised of one (1) single-family home, 12 two-unit multifamily buildings (24 dwelling units), and one (1) three-unit multifamily building (three (3) dwelling units) to be located at 31 Hunting Lane in Sherborn, Massachusetts. The Project site encompasses approximately 29.82± acres of land that is bounded by residential properties and Hunting Lane to the north, and areas of open and wooded space to the south, east and west. Figure 1 depicts the Project site location in relation to the existing roadway network. The Project site is currently occupied by a single family home and associated appurtenances, and areas of open and wooded space. In conjunction with the Project, the existing single-family home will be subsumed into the development.

Access to the Project site will be provided by way of a new roadway that will intersect the south side of Hunting Lane approximately 950 feet west of the railroad crossing. Off-street parking will be provided for a minimum of two (2) vehicles per unit in individual driveways and garages.



Figure 1

Site Location Map

STUDY METHODOLOGY

This study was prepared in consultation with the Town of Sherborn and Massachusetts Department of Transportation (MassDOT); 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's *Transportation Impact Assessment (TIA) Guidelines*. The traffic analysis conducted in stage two identifies existing or projected future roadway capacity, traffic safety, and site access issues.

The third stage of the study presents and evaluates measures to address traffic and safety issues, if any, identified in stage two of the study.

EXISTING CONDITIONS

A comprehensive field inventory of existing conditions within the study area was conducted in May 2020. The field investigation consisted of an inventory of existing roadway geometrics; pedestrian and bicycle facilities; traffic volumes; and operating characteristics; as well as posted speed limits and land use information within the study area. The study area that was assessed for the Project consisted of North Main Street (Route 27) and Hunting Lane and the following specific intersections: Route 27 at Hunting Lane and Route 27 at Eliot Street (Route 16).

The following describes the study area roadways and intersections.

Roadways

Hunting Lane

- Hunting Lane is two-lane local roadway under Town jurisdiction
- Traverses study area in a general east-west direction between Green Lane and Route 27
- Provides a 20± foot wide traveled-way that accommodates two-way travel and includes 1 to 2-foot wide marked shoulders with no centerline
- The posted speed limit varies between 20 and 30 miles per hour (mph)
- Sidewalks are not provided
- A railroad crossing with flashing warning signals is located approximately 550 feet west of Route 27
- Land use within the study area consists of the Project site, residential properties and areas of open and wooded space

North Main Street (Route 27)

- Route 27 is a two-lane urban principle arterial roadway under Town jurisdiction
- Traverses the Town in a general north-south direction providing access to the Town of Natick to the north and the Town of Medfield to the south
- Provides two 10 to 14-foot wide travel lanes that are separated by a double-yellow centerline with 1 to 2-foot wide marked shoulders
- Illumination is provided intermittently by way of street lights mounted on wood poles

- The posted speed limit varies from 30 to 35 mph, with a 20 mph school zone posted approaching Route 16 for the Pine Hill Elementary School that is applicable Monday through Friday from 7:30-8:30 AM and 2:30-3:30 PM
- A 5-foot wide sidewalk is provided along the west side of the roadway
- Land use consists of the residential and commercial properties 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 2020.

Table 1
STUDY AREA INTERSECTION DESCRIPTION

Intersection	Traffic Control Type^a	No. of Travel Lanes Provided	Shoulder Provided? (Yes/No/Width)	Pedestrian Accommodations? (Yes/No/Description)	Bicycle Accommodations? (Yes/No/Description)
Rte. 27/ Hunting Ln.	S	1 general-purpose travel lane on all approaches	Yes– 2 feet on Rte. 27 and 1 to 2 feet on Hunting Ln.	Yes – A sidewalk is provided along west side of Rte. 27; crosswalk provided for crossing Hunting Ln.	Yes - Shared traveled-way on Rte. 27 ^b
Rte. 27/ Rte. 16	TS	1 right-turn lane, and 1 through/left-turn travel lane on Rte. 27 northbound; 1 general-purpose travel lane on Rte. 27 southbound; 1 wide (flared) travel lane on Rte. 16 that functions as 2 lanes	Yes – 1 to 2 feet on Rte. 27 and 1 to 4 feet on Rte. 16	Yes – Sidewalks are provided along west side of Rte. 27, along the north side of Rte. 16 and along the south side of Rte. 16 to Pine Hill Ln.; crosswalks provided across the Rte. 27 north and south legs; pedestrian traffic signal equipment and phasing (exclusive) provided	Yes - Shared traveled-way

^aTS = traffic signal control; S = STOP-sign control; Y = YIELD-sign control.

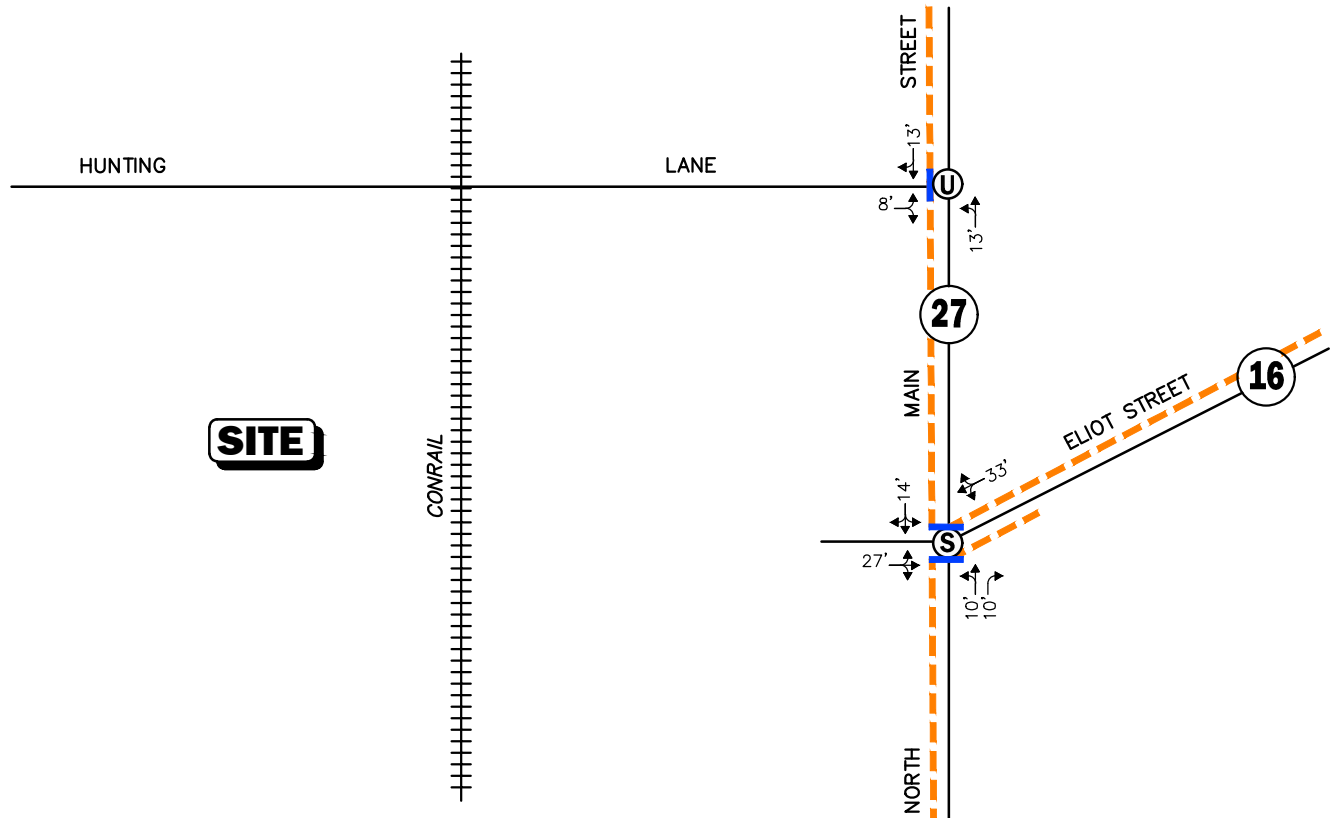
^bCombined shoulder and travel lane width equal to or exceed 14 feet.

TRAFFIC VOLUMES

In order to determine existing traffic-volume demands and flow patterns within the study area, automatic traffic recorder (ATR) counts and manual turning movement and vehicle classification counts (TMCs) were obtained for the study area from counts that were performed December 2016 due to the impact on traffic volumes and trip patterns resulting from the COVID-19 pandemic. The 2016 traffic count data included a 48-hour ATR that was conducted on Route 27 north of Eliot Street on December 6th and 7th (Tuesday through Wednesday, inclusive) and TMC's that were performed during the weekday morning (7:00 to 9:00 AM) and evening (4:00 to 6:00 PM) peak periods on December 7, 2016 (Wednesday) at the Route 27/Route 16 intersection. This data was supplemented by ATRs that were performed as a part of this assessment on April 15th and 16th (Wednesday through Thursday, inclusive) on Hunting Lane in the vicinity of the Project site and

Legend:

- Ⓢ Signalized Intersection
- Ⓤ Unsignalized Intersection
- Sidewalk
- Crosswalk
- xx' ↔ Lane Use and Travel Lane Width



Not To Scale



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Figure 2

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

on Route 27 at the same location that the December 2016 ATR count was performed in order to develop an adjustment factor to account for the impact to traffic volumes resulting from the pandemic.

Traffic-Volume Adjustments

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. AET09 located on Massachusetts Turnpike (Interstate 90) in Framingham were reviewed.³ Based on a review of this data, it was determined that traffic volumes for the month of April are approximately 3.0 percent above average-month conditions and traffic volumes for the month of December are approximately 8.0 percent below average-month conditions. As such, the December traffic volumes were adjusted upward by 8.0 percent in order to represent average-month conditions and the April traffic volumes were not were not adjusted downward in order to provide a conservative (above-average) analysis condition.

In order to account for the impact on traffic volumes and trip patterns resulting from the “safer-at-home” order and the phased “Reopening Massachusetts” plan that was issued by the Governor on May 18, 2020, in response to the COVID-19 pandemic, the traffic volume data that was collected as a part of the ATR count on Route 27 in 2020 were compared to the December 2016 traffic volumes that were collected at the same location. The April and December traffic volumes were both adjusted to average-month conditions and the 2016 traffic volumes were expanded to 2020 by applying a background traffic growth rate of 1.5 percent per year (discussion follows) in order to allow for a comparison of the data. Based on this pre and post COVID-19 traffic count data comparison, the traffic volume data that was collected as a part of this assessment were adjusted upward by 60 percent in order to account for the reduced traffic volumes resulting from the phased “Reopening Massachusetts” plan and the absence of school related traffic. In addition, the 2016 TMCs were adjusted to 2020 traffic volume conditions by applying the 1.5 percent per year compounded annual background traffic growth rate to the seasonally adjusted traffic volumes.

The 2020 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 Figure 3.

Table 2
2020 EXISTING TRAFFIC VOLUMES

Location/Peak Hour	AWT ^a	VPH ^b	K Factor ^c	Directional Distribution ^d
<i>North Main Street (Route 27), north of Eliot Street (Route 16)</i>	17,375	--	--	--
Weekday Morning (7:30 – 8:30 AM)	--	1,446	8.3	65.9% NB
Weekday Evening (4:45 – 5:45 PM)	--	1,311	7.5	60.6% SB
<i>Hunting Lane, in the vicinity of the Project site</i>	490	--	--	--
Weekday Morning (10:00 – 11:00 AM)	--	55	11.2	52.9% EB
Weekday Evening (12:00 – 14:00 PM)	--	57	11.6	54.3% EB

^aAverage weekday traffic in vehicles per day.

^bVehicles per hour.

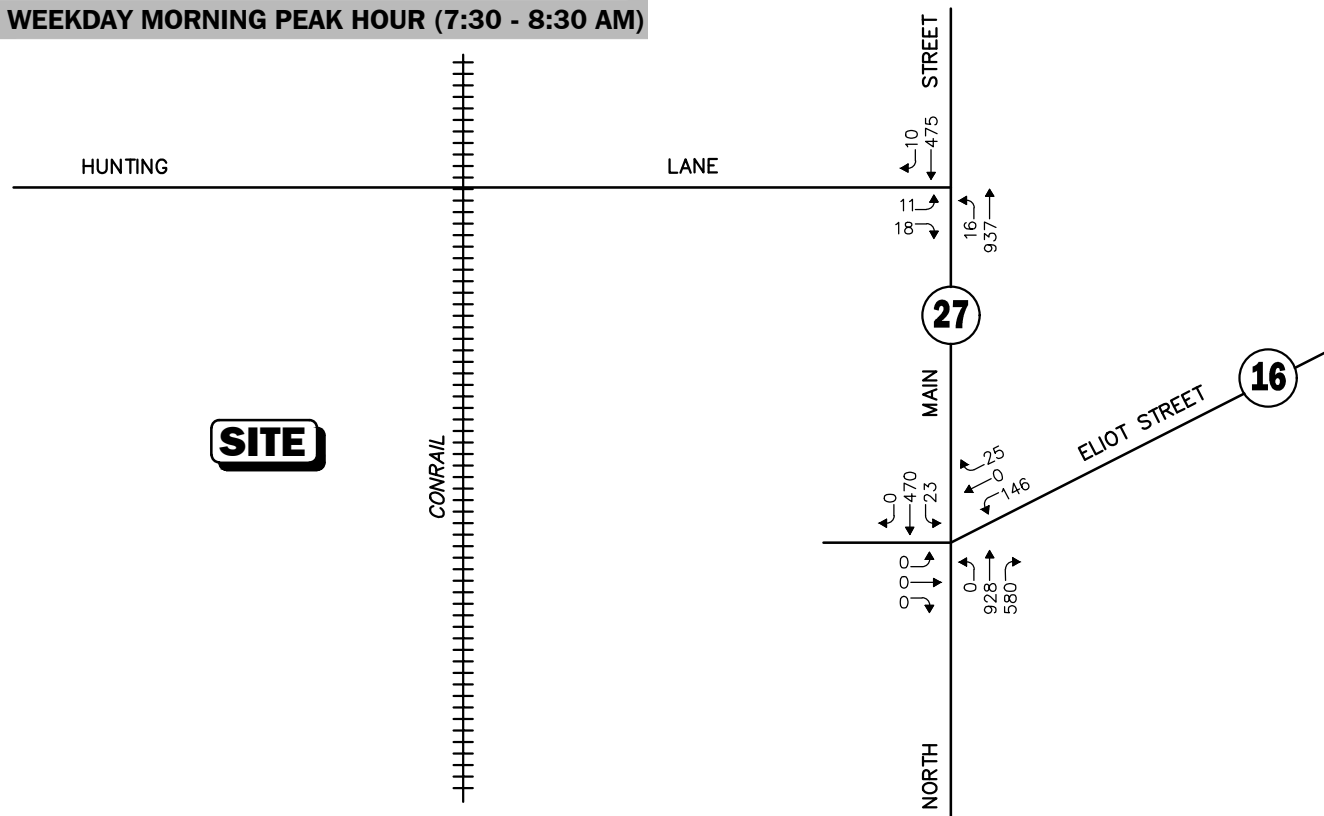
^cPercent of daily traffic occurring during the peak hour.

^dPercent traveling in peak direction.

NB = northbound, SB= southbound, EB=eastbound, WB=westbound

³MassDOT Traffic Volumes for the Commonwealth of Massachusetts; 2020.

WEEKDAY MORNING PEAK HOUR (7:30 - 8:30 AM)



WEEKDAY EVENING PEAK HOUR (4:45 - 5:45 PM)

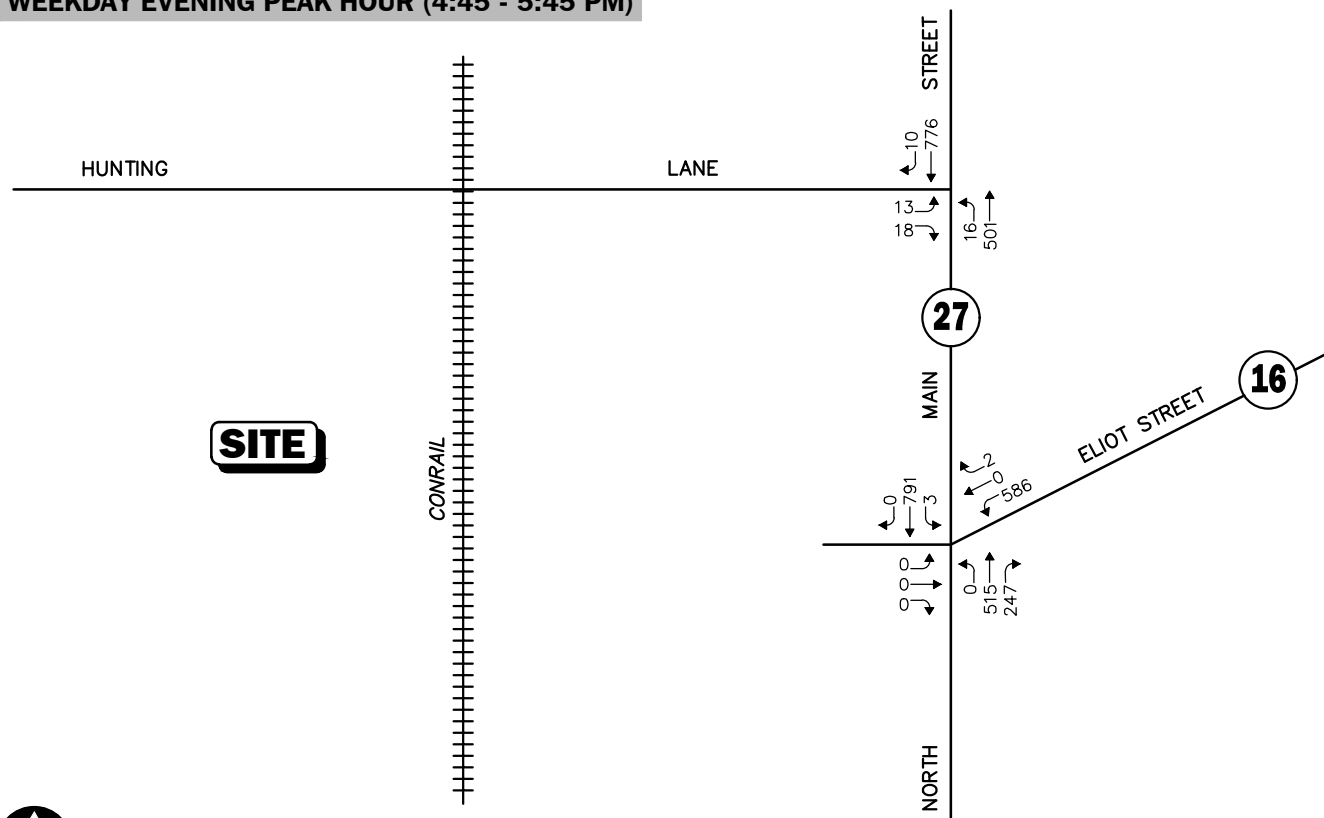


Figure 3

2020 Existing
Peak Hour Traffic Volumes



As can be seen in Table 2, Route 27 in the vicinity of the Project site was found to accommodate approximately 17,375 vehicles on an average weekday (two-way, 24-hour volume), with approximately 1,446 vehicles per hour (vph) during the weekday morning peak-hour and 1,311 vph during the weekday evening peak-hour.

Hunting Lane in the vicinity of the Project site was found to accommodate approximately 490 vehicles on an average weekday (two-way, 24-hour volume), with approximately 55 vehicles per hour (vph) during the weekday morning peak-hour and 57 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 2020. The field inventory consisted of a review of the location of sidewalks and pedestrian crossing locations along the study roadways and at the study area intersections. As detailed on Figure 2, sidewalks are provided along the west side of Route 27, along the north side of Route 16 and along the south side of Route 16 between Route 27 and Pine Lane (access to the Pine Hill Elementary School). Marked crosswalks are provided for crossing Hunting Lane at Route 27 and the Route 27 north and south leg of the Route 27/Route 16 intersection which include pedestrian traffic signal equipment and phasing.

Formal bicycle facilities are not provided within the study area; however, Route 27 and Route 16 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).⁴

PUBLIC TRANSPORTATION

Public transportation services are not currently provided within the Town of Sherborn. To the north of the Project site, the Massachusetts Bay Transportation Authority (MBTA) provides Commuter Rail service to South Station in Boston on the Framingham/Worcester Line from Natick and West Natick Stations, which are within an approximate 7 to 9 minute driving distance of the Project site.

SPOT SPEED MEASUREMENTS

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

⁴A minimum combined travel lane and paved shoulder width of 14-feet is required to support bicycle travel in a shared traveled-way condition.

Table 3
VEHICLE TRAVEL SPEED MEASUREMENTS

	Hunting Lane	
	Eastbound	Westbound
Mean Travel Speed (mph)	27	25
85 th Percentile Speed (mph)	33	31
Posted Speed Limit (mph)	30	30

mph = miles per hour.

As can be seen in Table 3, the mean vehicle travel speed along Hunting Lane in the vicinity of the Project site was found to be 27 mph in the eastbound direction and 25 mph westbound. The measured 85th 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 31 mph westbound, which is 1 to 3 mph above the posted speed limit in the vicinity of the Project site (30 mph). The 85th percentile speed is used as the direction 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 (2013 through 2017, inclusive) in order 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 presented in Table 4.

As can be seen in Table 4, the study area intersections were found to have averaged approximately five (5) or fewer reported motor vehicle crashes over the five-year review period, the majority of which occurred on a weekday, under clear weather conditions during daylight, and involved rear-end type collisions that resulted in property damage only. All of the study intersections were found to have a motor vehicle crash rate below the MassDOT statewide and District average crash rates for a signalized or unsignalized intersection, as appropriate, for the MassDOT Highway Division District in which the intersections are located (District 3).

A review of the MassDOT statewide High Crash Location List indicated that none of the study intersections 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 provided in the Appendix.

Table 4
MOTOR VEHICLE CRASH DATA SUMMARY^a

	Route 27/ Hunting Lane	Route 27/ Route 16
Traffic Control Type: ^b	U	TS
<i>Year:</i>		
2013	2	5
2014	4	5
2015	5	4
2016	1	4
2017	<u>2</u>	<u>5</u>
Total	14	23
Average	2.80	4.60
Rate ^c	0.43	0.48
MassDOT Crash Rate: ^d	0.57/0.61	0.78/0.89
Significant? ^e	No	No
<i>Type:</i>		
Angle	1	3
Rear-End	11	13
Sideswipe	1	1
Single Vehicle Crash	1	5
Unknown/Other	<u>0</u>	<u>1</u>
Total	14	23
<i>Conditions:</i>		
Clear	11	14
Cloudy	1	1
Rain	2	6
Snow/Ice	<u>0</u>	<u>2</u>
Total	14	23
<i>Lighting:</i>		
Daylight	11	17
Dawn/Dusk	1	0
Dark (Road Lit)	1	6
Dark (Road Unlit)	<u>1</u>	<u>0</u>
Total	14	23
<i>Day of Week:</i>		
Monday through Friday	14	18
Saturday	0	5
Sunday	<u>0</u>	<u>0</u>
Total	14	23
<i>Severity:</i>		
Property Damage Only	11	16
Non-fatal Injury	<u>3</u>	<u>7</u>
Total	14	23

^aSource: MassDOT Safety Management/Traffic Operations Unit records, 2013 through 2017.

^bTraffic Control Type: U = unsignalized; TS = traffic signal.

^cCrash rate per million vehicles entering the intersection.

^dStatewide/District crash rate.

^eThe 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 3).

FUTURE CONDITIONS

Traffic volumes in the study area were projected to the year 2027, which reflects a seven-year planning horizon consistent with MassDOT's *Transportation Impact Assessment (TIA) Guidelines*. Independent of the Project, traffic volumes on the roadway network in the year 2027 under No-Build conditions include all existing traffic and new traffic resulting from background traffic growth. Anticipated Project-generated traffic volumes superimposed upon the 2027 No-Build traffic volumes reflect 2027 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 Sherborn Office of Planning and Development was consulted in order to determine if there were any projects planned within the study area 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 Community, 41 North Main Street (Route 27), Sherborn, Massachusetts. This proposed project consists of the construction of a 60-unit multifamily residential development to be located at 41 North Main Street.

Proposed Residential Development, 59 North Main Street, Sherborn, Massachusetts. This project consists of the construction of 12 single-family homes to be located at 59 North Main Street.

Villages, 84 Coolidge Street, Sherborn, Massachusetts. This project consists of the construction of an 88-unit residential development to be located at 84 Coolidge Street. Traffic volumes associated with this project within the study area are expected to be relatively minor and would be reflected in the general background traffic growth rate (discussion follows).

Traffic volumes associated with the aforementioned specific development projects by others that are expected to result in an increase in traffic within the study area that would exceed the general background traffic growth rate were obtained from the traffic study prepared in support of the project or were developed using trip-generation information available from the ITE⁵ for the appropriate land use, and were assigned onto the study area roadway network based on existing traffic patterns where no other information was available. 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 Sherborn were reviewed in order to determine general traffic growth trends in the area. This data indicates that traffic volumes have fluctuated over the past several years, with the average growth rate found to be approximately 1.5 percent per year. As such, a compounded annual background traffic growth rate of 1.5 percent per year was used in order to account for future traffic growth and presently unforeseen development within the study area.

Roadway Improvement Projects

The Town of Sherborn and MassDOT were contacted in order to determine if there were any planned future roadway improvement projects expected to be complete by 2027 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.

Sherborn Circulation Plan

In 2018, the Town of Sherborn advanced a general plan for circulation improvements that emphasizes improvements to the transportation infrastructure that will enhance safety and facilitate mobility for all roadway users. The plan identified several concerns by residents including commuter traffic congestion in the town center; the lack of safe walking and biking routes; and poor access to public transportation. In addition, the Town adopted a Complete Streets Policy in 2016 which identified the following goals within the study area:

- Improve roadways and intersections for safe and efficient movement of vehicles. This section provides an option for redesigning Route 27/Route 16 intersection.
- Design roadways and intersections for safe sharing of the traveled-way by vehicles and bicycles.
- Encourage and support walking as a safe and pleasant mode of travel around the town center and throughout Town.

⁵Ibid 1.

The Project has been designed to be consistent with these goals and will not to preclude the future changes along Route 27 contemplated by the Town as a part of the aforementioned planning studies.

No-Build Traffic Volumes

The 2027 No-Build condition peak-hour traffic-volumes were developed by applying the 1.0 percent per year compounded annual background traffic growth rate to the 2020 Existing peak-hour traffic volumes and then adding the peak-hour traffic volumes associated with the identified specific development projects by others. The resulting 2027 No-Build weekday morning and evening peak-hour traffic volumes are shown on Figure 4.

PROJECT-GENERATED TRAFFIC

Design year (2027 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 28-unit residential community that will consist of one (1) single-family home, 12 two-unit multifamily buildings (24 dwelling units), and one (1) three-unit multifamily building (three (3) dwelling units). In order to develop the traffic characteristics of the Project, trip-generation statistics published by the ITE⁶ for a similar land use as that proposed were used. ITE Land Use Code 220, *Multifamily Housing (Low-Rise)*, was used to develop the traffic characteristics of the Project, the results of which are summarized in Table 5.

Table 5
TRIP GENERATION SUMMARY

Time Period	Vehicle Trips^a		
	Entering	Exiting	Total
<i>Average Weekday:</i>	86	86	172
<i>Weekday Morning Peak-Hour:</i>	3	11	14
<i>Weekday Evening Peak-Hour:</i>	12	7	19

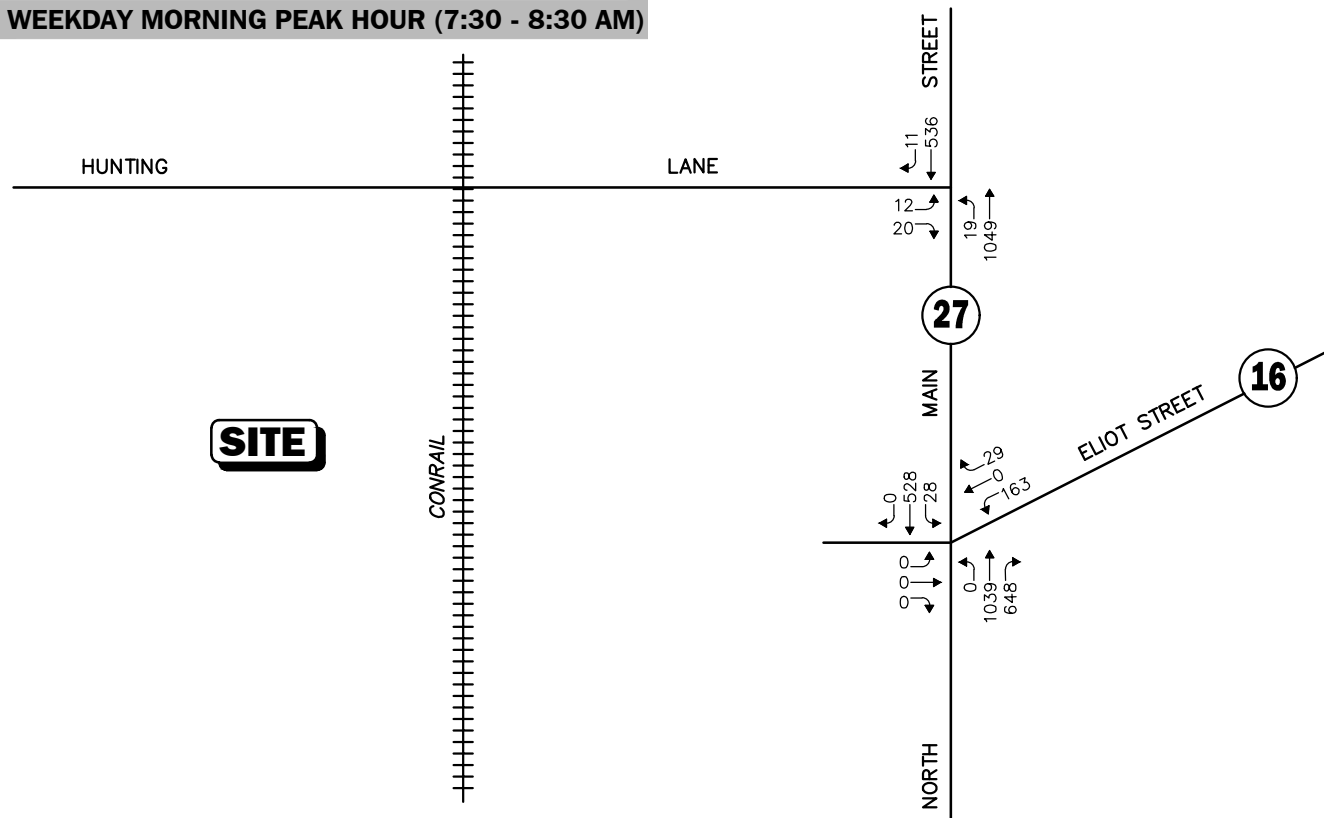
^aBased on ITE LUC 220, *Multifamily Housing (Low-Rise)*.

Project-Generated Traffic Volume Summary

As can be seen in Table 5, the Project is expected to generate approximately 172 vehicle trips on an average weekday (two-way, 24-hour volume, or 86 vehicles entering and 86 exiting), with 14 vehicle trips (3 vehicles entering and 11 exiting) expected during the weekday morning peak-hour and 19 vehicle trips (12 vehicles entering and 7 exiting) expected during the weekday evening peak-hour.

⁶Ibid 1.

WEEKDAY MORNING PEAK HOUR (7:30 - 8:30 AM)



WEEKDAY EVENING PEAK HOUR (4:45 - 5:45 PM)

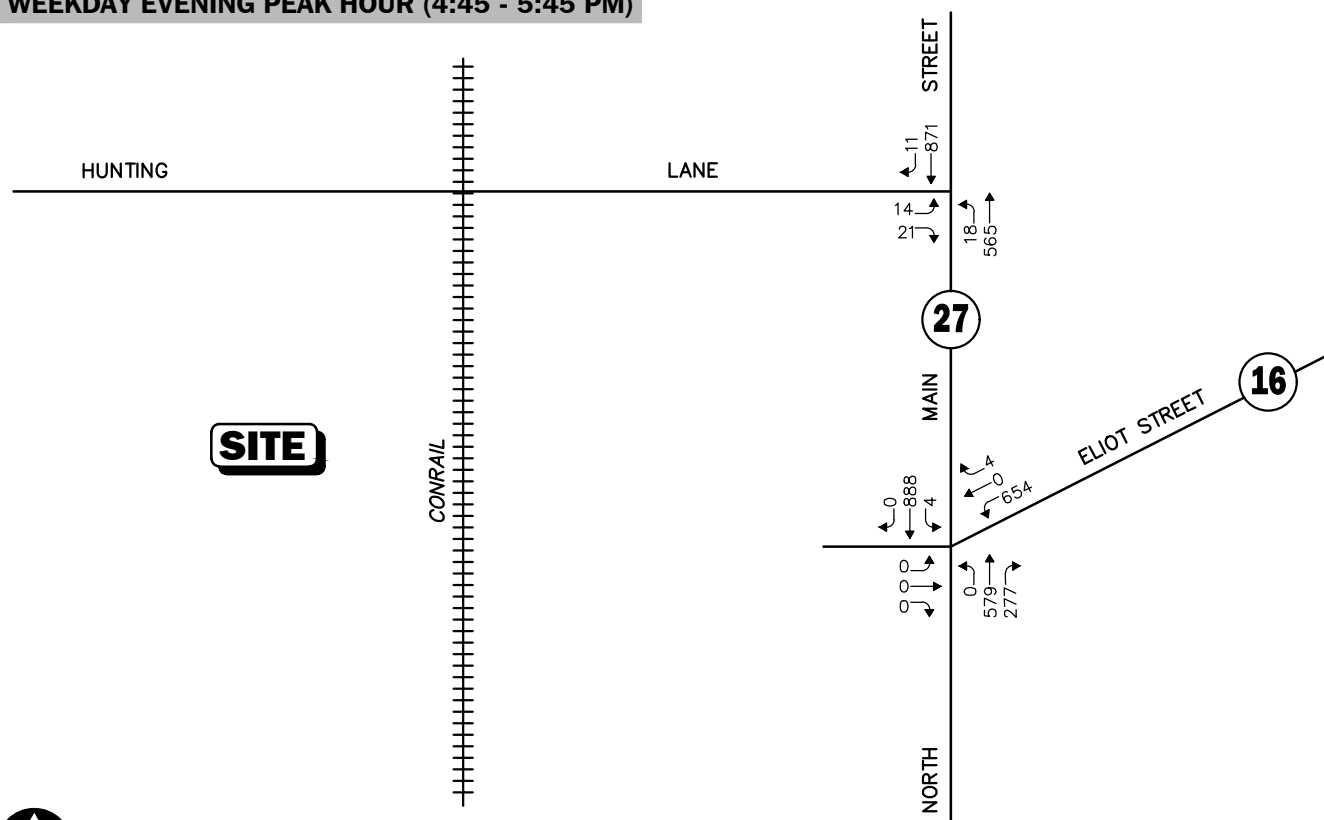


Figure 4

2027 No-Build
Peak Hour Traffic Volumes

TRIP DISTRIBUTION AND ASSIGNMENT

The directional distribution of generated trips to and from the Project site was determined based on a review of Journey-to-Work data obtained from the U.S. Census for persons residing in the Town of Sherborn and then refined based on existing traffic patterns within the study area. This methodology is consistent with the residential nature of the Project. The general trip distribution for the Project is graphically depicted on Figure 5. The additional traffic expected to be generated by the Project was assigned on the study area roadway network as shown on Figure 6 for the weekday morning and evening peak hours, respectively.

FUTURE TRAFFIC VOLUMES - BUILD CONDITION

The 2027 Build condition traffic volumes consist of the 2027 No-Build traffic volumes with the additional traffic expected to be generated by the Project added to them. The 2027 Build weekday morning and evening peak-hour traffic-volumes are graphically depicted on Figure 7.

A summary of peak-hour projected traffic-volume changes outside of the study area that is the subject of this assessment is shown in Table 6. These changes are a result of the construction of the Project.

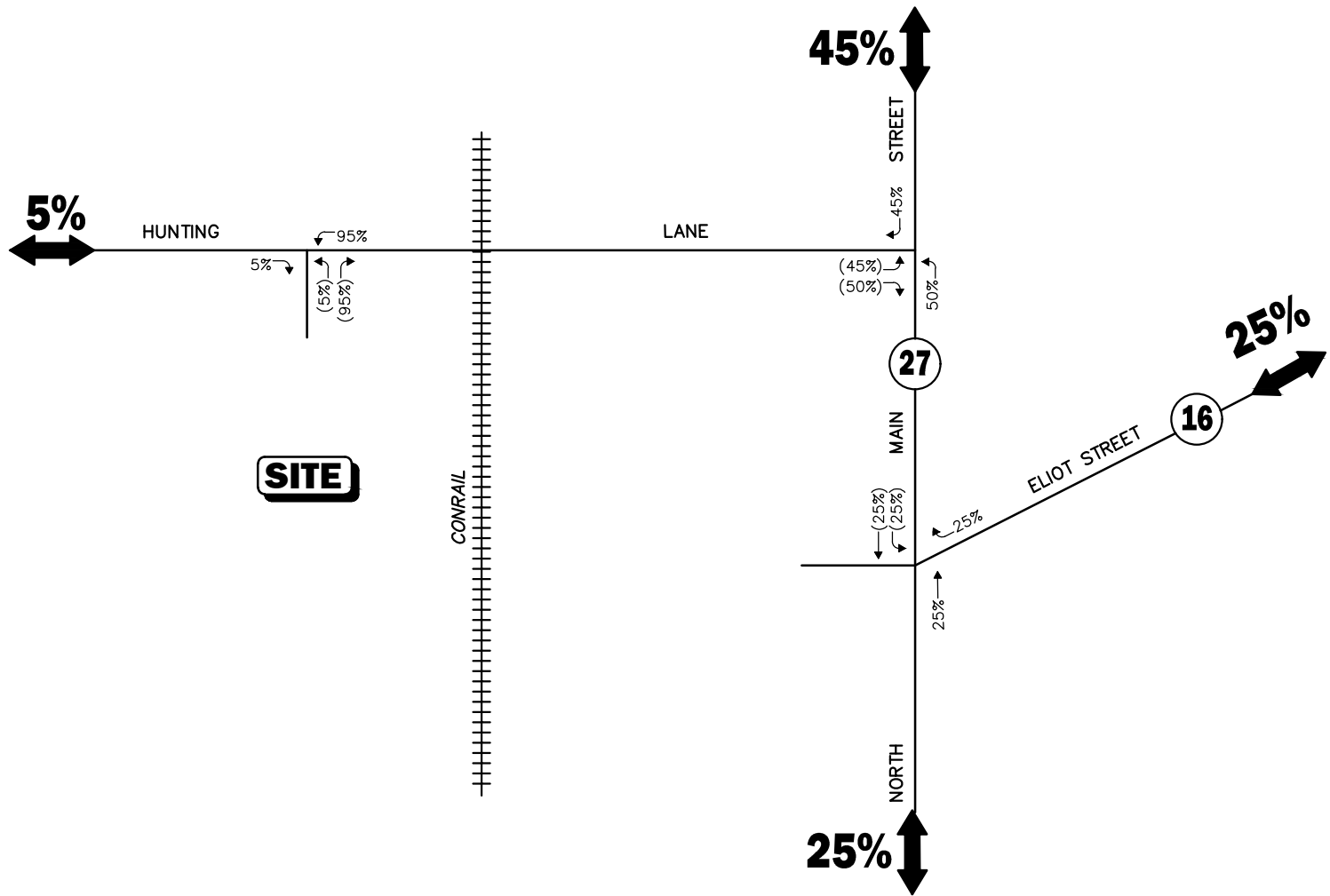
Table 6
PEAK-HOUR TRAFFIC-VOLUME INCREASES

Location/Peak Hour	2020 Existing	2027 No-Build	2027 Build	Traffic Volume Increase Over No-Build	Percent Increase Over No-Build
<i>Route 27, north of Hunting Lane:</i>					
Weekday Morning	1,433	1,608	1,614	6	0.4
Weekday Evening	1,300	1,461	1,469	8	0.5
<i>Route 27, south of Route 16:</i>					
Weekday Morning	2,124	2,378	2,381	3	0.1
Weekday Evening	2,139	2,398	2,402	4	0.2
<i>Route 16, east of Route 27:</i>					
Weekday Morning	774	868	872	4	0.5
Weekday Evening	838	939	944	5	0.5
<i>Hunting Lane, west of Site Roadway:</i>					
Weekday Morning	55	62	63	1	1.6
Weekday Evening	57	64	66	2	3.1

As shown in Table 6, Project-related traffic-volume increases outside of the study area relative to 2027 No-Build conditions are anticipated to range from 0.1 to 3.1 percent during the peak periods, with vehicle increases shown to range from 1 to 8 vehicles. ***When distributed over the peak-hour, the predicted traffic volume increases would not result in a significant impact (increase) on motorist delays or vehicle queuing outside of the immediate study area that is the subject of this assessment.***

Legend:

XX Entering Trips
(XX) Exiting Trips



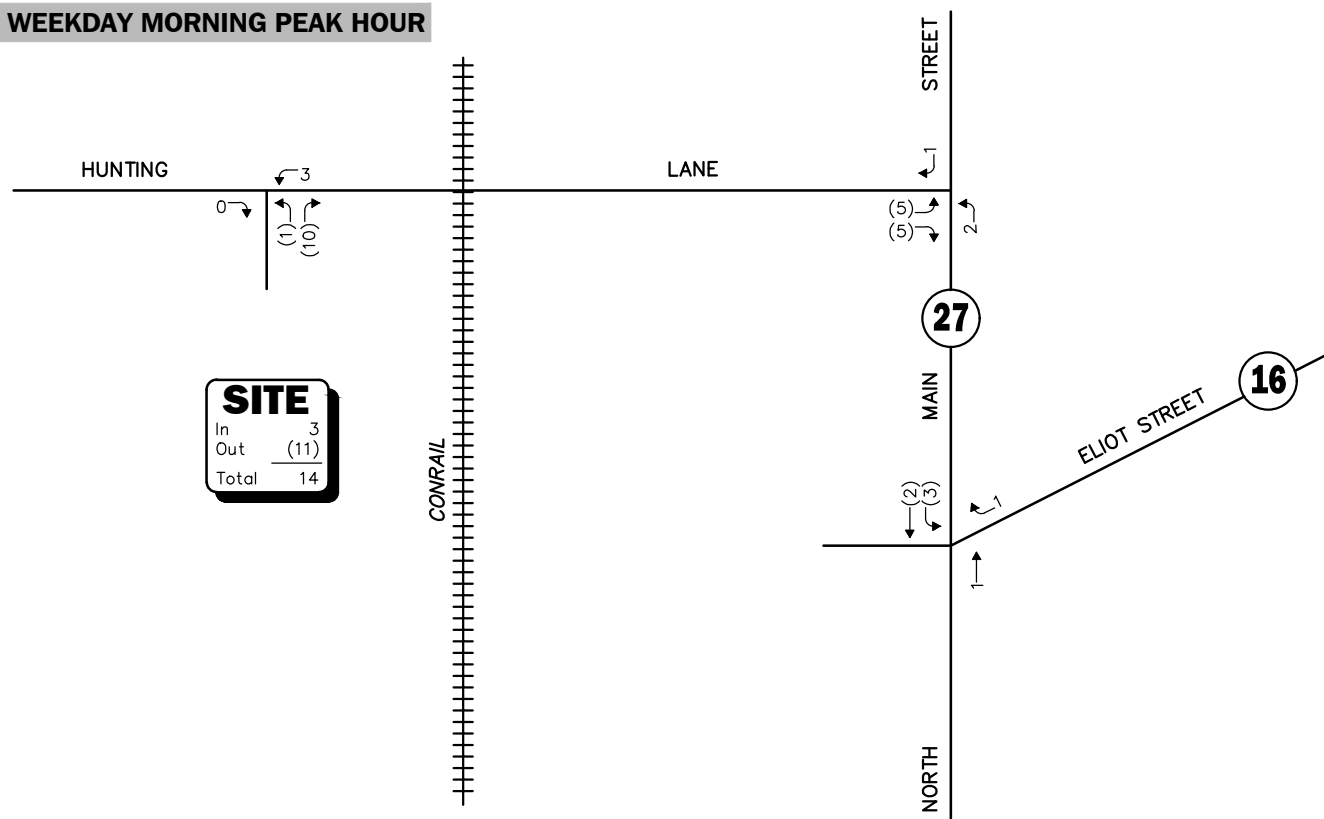
Not To Scale

Figure 5

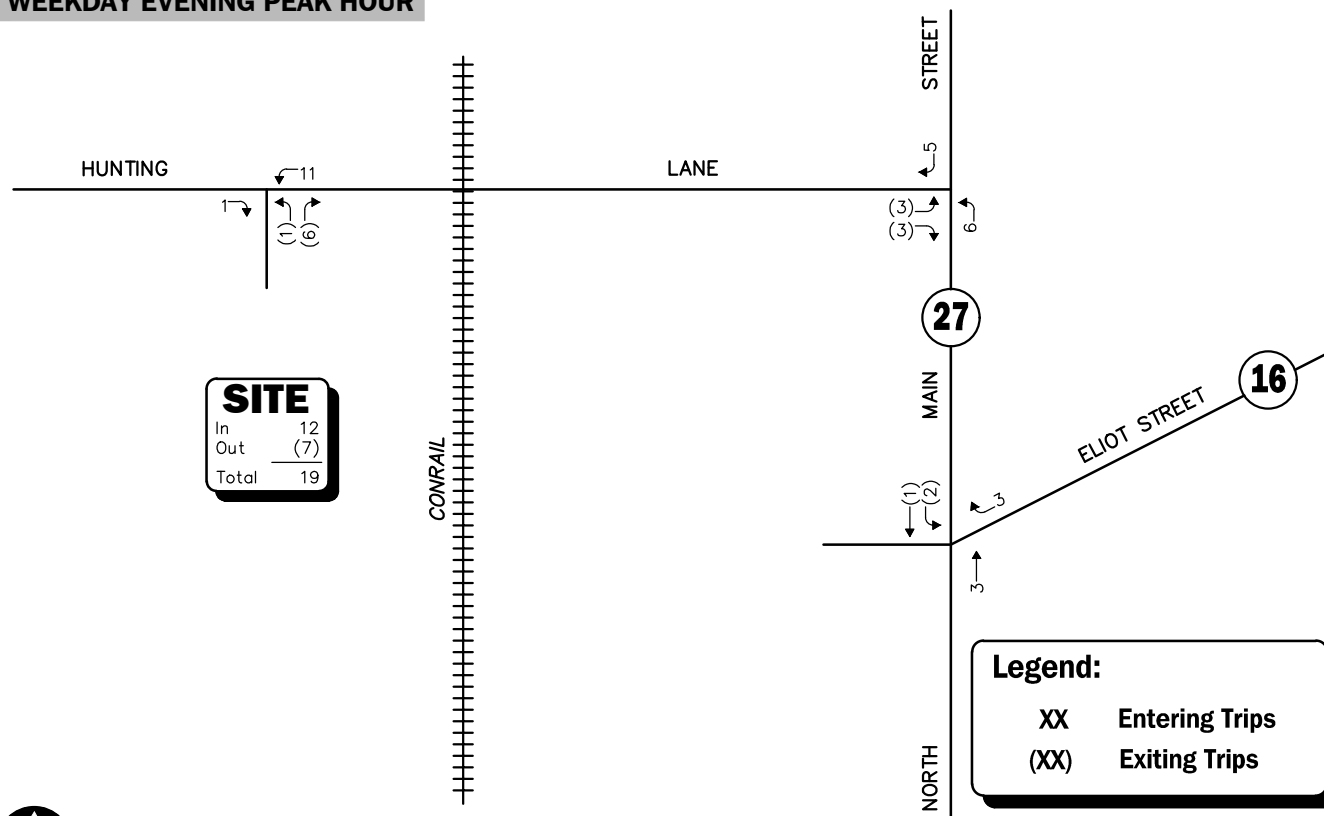
Trip Distribution Map



WEEKDAY MORNING PEAK HOUR



WEEKDAY EVENING PEAK HOUR



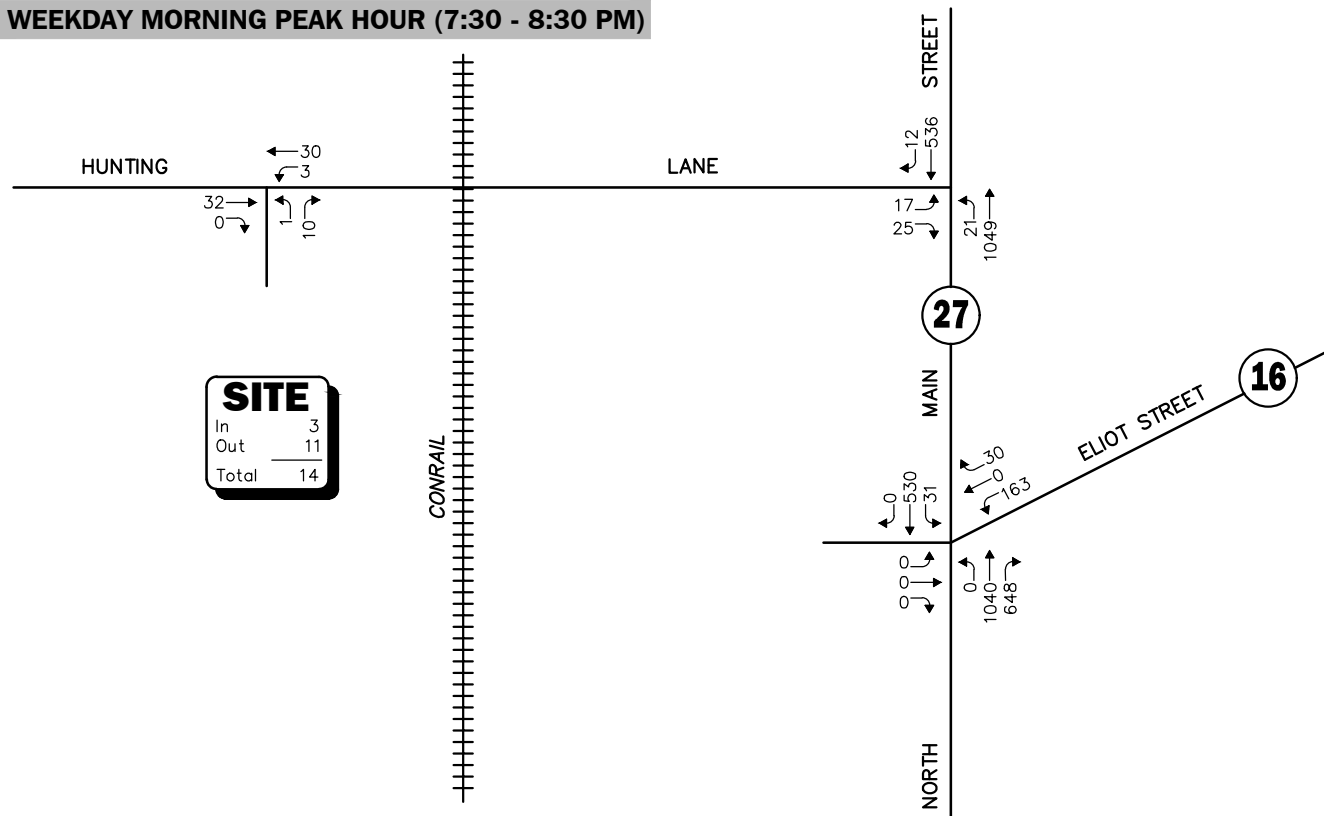
Legend:

- XX Entering Trips
- (XX) Exiting Trips



Figure 6

WEEKDAY MORNING PEAK HOUR (7:30 - 8:30 PM)



WEEKDAY EVENING PEAK HOUR (4:45 - 5:45 PM)

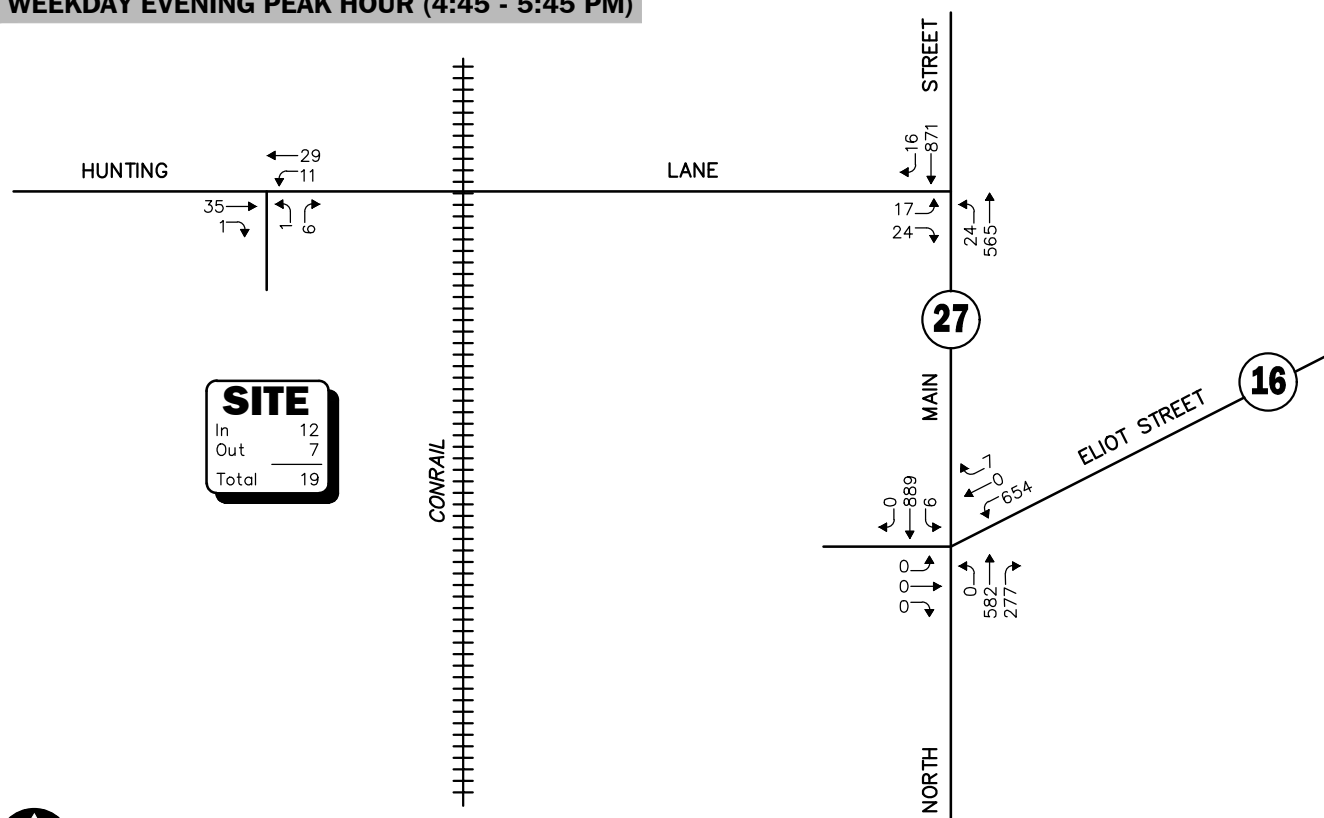


Figure 7

2027 Build
Peak Hour Traffic Volumes



TRAFFIC OPERATIONS ANALYSIS

Measuring existing and future traffic volumes quantifies traffic flow within the study area. To assess quality of flow, roadway capacity and vehicle queue analyses were conducted under Existing, No-Build and Build traffic volume conditions. Capacity analyses provide an indication of how well the roadway 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.

METHODOLOGY

Levels of Service

A primary result of capacity analyses is the assignment of level of service to traffic facilities under various traffic-flow conditions.⁷ The concept of level of service 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 level-of-service (LOS) A representing the best operating conditions and LOS F representing congested or constrained operating conditions.

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.

⁷The capacity analysis methodology is based on the concepts and procedures presented in the *Highway Capacity Manual*; Transportation Research Board; Washington, DC; 2010.

Unsignalized Intersections

The six levels of service for unsignalized intersections may be described as follows:

- *LOS A* represents a condition with little or no control delay to minor street traffic.
- *LOS B* represents a condition with short control delays to minor street traffic.
- *LOS C* represents a condition with average control delays to minor street traffic.
- *LOS D* represents a condition with long control delays to minor street traffic.
- *LOS E* represents operating conditions at or near capacity level, with very long control delays to minor street traffic.
- *LOS F* represents a condition where minor street demand volume exceeds capacity of an approach lane, with extreme control delays resulting.

The levels of service of unsignalized intersections are determined by application of a procedure described in the 2010 *Highway Capacity Manual*.⁸ Level of service is measured in terms of average control delay. Mathematically, control delay is a function of the capacity and degree of saturation of the lane group and/or approach under study and is a quantification of motorist delay associated with traffic control devices such as traffic signals and STOP signs. Control delay includes the effects of initial deceleration delay approaching a STOP sign, stopped delay, queue move-up time, and final acceleration delay from a stopped condition. Definitions for level of service at unsignalized intersections are also given in the 2010 *Highway Capacity Manual*. Table 7 summarizes the relationship between level of service and average control delay for two-way stop controlled and all-way stop controlled intersections.

Table 7
LEVEL-OF-SERVICE CRITERIA FOR
UNSIGNALIZED INTERSECTIONS^a

Level-Of-Service by Volume-to-Capacity Ratio		Average Control Delay (Seconds Per Vehicle)
$v/c \leq 1.0$	$v/c > 1.0$	
A	F	≤ 10.0
B	F	10.1 to 15.0
C	F	15.1 to 25.0
D	F	25.1 to 35.0
E	F	35.1 to 50.0
F	F	> 50.0

^aSource: *Highway Capacity Manual*; Transportation Research Board; Washington, DC; 2010; page 19-2.

⁸*Highway Capacity Manual*; Transportation Research Board; Washington, DC; 2010.

Signalized Intersections

The six levels of service for signalized intersections may be described as follows:

- *LOS A* describes operations with very low control delay; most vehicles do not stop at all.
- *LOS B* describes operations with relatively low control delay. However, more vehicles stop than *LOS A*.
- *LOS C* describes operations with higher control delays. Individual cycle failures may begin to appear. The number of vehicles stopping is significant at this level, although many still pass through the intersection without stopping.
- *LOS D* describes operations with control delay in the range where the influence of congestion becomes more noticeable. Many vehicles stop, and individual cycle failures are noticeable.
- *LOS E* describes operations with high control delay values. Individual cycle failures is frequent occurrences.
- *LOS F* describes operations with high control delay values that often occur with over-saturation. Poor progression and long cycle lengths may also be major contributing causes to such delay levels.

Levels of service for signalized intersections are calculated using the operational analysis methodology of the 2000 Highway Capacity Manual and implemented as a part of the Synchro® 10 software as recommended by MassDOT. This method assesses the effects of signal type, timing, phasing, and progression; vehicle mix; and geometrics on delay. Level-of-service designations are based on the criterion of control or signal delay per vehicle. Control or signal delay is a measure of driver discomfort, frustration, and fuel consumption, and includes initial deceleration delay approaching the traffic signal, queue move-up time, stopped delay and final acceleration delay. Table 8 summarizes the relationship between level of service and control delay. The tabulated control delay criterion may be applied in assigning level-of-service designations to individual lane groups, to individual intersection approaches, or to entire intersections.

Table 8
LEVEL-OF-SERVICE CRITERIA
FOR SIGNALIZED INTERSECTIONS^a

Level of Service	Control (Signal) Delay Per Vehicle (Seconds)
A	≤10.0
B	10.1 to 20.0
C	20.1 to 35.0
D	35.1 to 55.0
E	55.1 to 80.0
F	>80.0

^aSource: *Highway Capacity Manual*, Transportation Research Board; Washington, DC; 2000; page 16-2.

Vehicle Queue Analysis

Vehicle queue analyses are a direct measurement of an intersection's ability to process vehicles under various traffic control and volume scenarios and lane use arrangements. The vehicle queue analysis was performed using the Synchro® intersection capacity analysis software which is based upon the methodology and procedures presented in the 2010 *Highway Capacity Manual*. The Synchro® vehicle queue analysis methodology is a simulation based model which reports the number of vehicles that experience a delay of six seconds or more at an intersection. For signalized intersections, Synchro® reports both the average (50th percentile) the 95th percentile vehicle queue. For unsignalized intersections, Synchro® reports the 95th percentile vehicle queue. Vehicle queue lengths are a function of the capacity of the movement under study and the volume of traffic being processed by the intersection during the analysis period. The 95th percentile vehicle queue is the vehicle queue length that will be exceeded only 5 percent of the time, or approximately three minutes out of sixty minutes during the peak one hour of the day (during the remaining fifty-seven minutes, the vehicle queue length will be less than the 95th percentile queue length).

ANALYSIS RESULTS

Level-of-service and vehicle queue analyses were conducted for 2020 Existing, 2027 No-Build and 2027 Build conditions for the intersections within the study area. The results of the intersection capacity and vehicle queue analyses are summarized on Table 9 and Table 10, with the detailed analysis results presented in the Appendix.

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

Unsignalized Intersections

Project-related impacts at the unsignalized study area intersections are shown on Table 9 and are defined as follows:

Route 27/Hunting Lane – All movements at this unsignalized intersection are predicted to operate at LOS D or better during the peak hours with the addition of Project-related traffic (no change over No-Build conditions). Project-related impacts at the intersection were defined as an increase in average control delay of up to 4.1 seconds with no increase in vehicle queuing. All movements along Route 27 are predicted to operate at LOS A with negligible vehicle queuing expected.

Hunting Lane at Project Site Roadway - All movements at this intersection were shown to operate at LOS A during the peak hours with negligible vehicle queuing predicted.

Signalized Intersection

Project-related impacts at the signalized study area intersections are shown on Table 10 and are defined as follows:

Route 27 at Route 16 – No-change in LOS is expected to occur for any movement over No-Build conditions. Independent of the Project, it was noted that left-turn movements from the Route 16 approach are currently operating over capacity (i.e., LOS F) during the weekday evening peak hour. Vehicle queues at the intersection were shown to increase by 2-3 vehicles with the addition of Project-related traffic.

Table 9
UNSIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

Unsignalized Intersection/ Peak Hour/Movement	2020 Existing				2027 No-Build				2027 Build			
	Demand ^a	Delay ^b	LOS ^c	Queue ^d 95 th	Demand	Delay	LOS	Queue 95 th	Demand	Delay	LOS	Queue 95 th
North Main Street (Route 27)/Hunting Lane:												
<i>Weekday Morning Peak-Hour:</i>												
Hunting Lane EB LT/RT	29	23.3	C	1	22	29.9	D	1	42	34.0	D	1
Route 27 NB LT/TH	953	0.1	A	0	1,068	0.2	A	0	1,070	0.2	A	0
Route 27 SB RT/TH	485	0.0	A	0	547	0.0	A	0	548	0.0	A	0
<i>Weekday Evening Peak-Hour:</i>												
Hunting Lane EB LT/RT	31	24.2	C	1	35	30.1	D	1	41	32.7	D	1
Route 27 NB LT/TH	517	0.3	A	0	583	0.3	A	0	589	0.4	A	0
Route 27 SB RT/TH	786	0.0	A	0	882	0.0	A	0	887	0.0	A	0
Project Site Roadway/Hunting Lane:												
<i>Weekday Morning Peak-Hour:</i>												
Hunting Lane EB RT/TH	--	--	--	--	--	--	--	--	32	0.0	A	0
Hunting Lane WB LT/TH	--	--	--	--	--	--	--	--	33	0.7	A	0
Project Site Roadway NB LT/RT	--	--	--	--	--	--	--	--	11	8.5	A	0
<i>Weekday Evening Peak-Hour:</i>												
Hunting Lane EB RT/TH	--	--	--	--	--	--	--	--	36	0.0	A	0
Hunting Lane WB LT/TH	--	--	--	--	--	--	--	--	40	2.0	A	0
Project Site Roadway NB LT/RT	--	--	--	--	--	--	--	--	7	8.6	A	0

^aDemand in vehicles per hour.

^bAverage control delay per vehicle (in seconds).

^cLevel-of-Service.

^dQueue length in vehicles.

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

Table 10
SIGNALIZED INTERSECTION LEVEL-OF-SERVICE SUMMARY

Signalized Intersection/Peak Hour	2020 Existing				2027 No-Build				2027 Build			
	V/C ^a	Delay ^b	LOS ^c	Queue ^d Avg/95 th	V/C	Delay	LOS	Queue Avg/95 th	V/C	Delay	LOS	Queue Avg/95 th
Route 27/Eliot Street (Route 16):												
<i>Weekday Morning:</i>												
Rte. 16 WB LT	0.58	26.1	C	98/139	0.62	27.1	C	111/110	0.62	27.1	C	111/110
Rte. 16 WB RT	0.04	21.1	C	1/12	0.05	20.9	C	2/12	0.06	20.9	C	2/12
Rte. 27 NB TH	0.82	14.3	B	288/970 ^f	0.92	24.4	C	417/760 ^f	0.93	24.5	C	419/761 ^f
Rte. 27 NB RT	0.35	0.8	A	0/27	0.39	0.8	A	0/0	0.39	0.8	A	0/0
Rte. 27 SB LT/TH	0.56	7.9	A	150/580 ^f	0.89	24.3	C	226/476 ^f	0.89	24.3	C	228/480 ^f
Overall	--	10.8	B	--	--	18.7	B	--	--	18.7	B	--
<i>Weekday Evening:</i>												
Rte. 16 WB LT	1.15	>80.0	F	356 ^e /587	1.42	>80.0	F	468 ^e /669 ^f	1.42	>80.0	F	468 ^e /669 ^f
Rte. 16 WB RT	0.00	16.4	B	0/5	0.01	19.7	B	1/8	0.01	19.7	B	2/11
Rte. 27 NB TH	0.55	9.7	A	140/213	0.57	9.7	A	167/253	0.58	9.7	A	168/254
Rte. 27 NB RT	0.15	0.6	A	0/0	0.17	0.5	A	0/0	0.17	0.5	A	0/0
Rte. 27 SB LT/TH	0.80	16.2	B	264/414	0.84	17.4	B	331/567 ^f	0.84	17.8	B	334/624 ^f
Overall	--	38.4	D	--	--	70.3	E	--	--	70.3	E	--

^aVolume-to-capacity ratio.

^bControl (signal) delay per vehicle in seconds.

^cLevel-of-Service.

^dQueue length in feet.

^eVolume exceeds capacity, queue is theoretically infinite. Queue shown is maximum after two cycles.

^f95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.

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

SIGHT DISTANCE EVALUATION

Sight distance measurements were performed at the Project site roadway intersection with Hunting Lane in accordance with MassDOT and American Association of State Highway and Transportation Officials (AASHTO)⁹ 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 on-coming 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 11 presents the measured SSD and ISD at the subject intersection.

Table 11
SIGHT DISTANCE MEASUREMENTS^a

Intersection/Sight Distance Measurement	Feet		
	Required Minimum (SSD)	Desirable (ISD) ^b	Measured
<i>Hunting Lane at the Project Roadway</i>			
<i>Stopping Sight Distance:</i>			
Hunting Lane approaching from the east	210	--	258
Hunting Lane approaching from the west	230	--	500+
<i>Intersection Sight Distance:</i>			
Looking to the east from the Project Roadway	210	345	189/242 ^c
Looking to the west from the Project Roadway	230	365	177/375 ^c

^aRecommended minimum values obtained from *A Policy on Geometric Design of Highways and Streets*, 7th Edition; American Association of State Highway and Transportation Officials (AASHTO); 2018; and based on an approach speed of 33 mph eastbound and 31 mph westbound along Hunting Lane.

^bValues 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.

^cAvailable sight distance with the selective trimming/removal of trees and vegetation located within the sight triangle areas.

⁹*A Policy on Geometric Design of Highway and Streets*, 7th Edition; American Association of State Highway and Transportation Officials (AASHTO); Washington D.C.; 2018.

As can be seen in Table 11, with the selective trimming or removal of trees and vegetation located within the sight triangle areas of the Project site roadway, the available lines of sight will exceed the recommended minimum sight distances to function in a safe manner (SSD) based on the measured 85th percentile travel speeds along Hunting Lane (31/33 mph), which are 1 to 3 mph above the posted speed limit in this area (30 mph).

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

VAI has conducted a TIA in order to determine the potential impacts on the transportation infrastructure associated with the proposed construction of a 28-unit residential community to be known as Apple Hill Estates and located 31 Hunting Lane in Sherborn, 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,¹⁰ the Project is expected to generate approximately 172 vehicle trips on an average weekday (two-way, 24-hour volume), with 14 vehicle trips expected during the weekday morning peak-hour and 19 vehicle trips expected during the weekday evening peak-hour;
2. The Project will not have a significant impact (increase) on motorist delays or vehicle queuing over Existing or anticipated future conditions without the Project (No-Build conditions), with majority of the movements at the study intersections shown to continue to operate at LOS D or better under all analysis conditions, where an LOS of “D” or better is defined as “acceptable” traffic operations;
3. No apparent safety deficiencies were noted with respect to the motor vehicle crash history at the study area intersections, with all of the intersections found to have motor vehicle crash rates below the MassDOT average crash rates for similar intersections; and
4. Lines of sight at the Project site roadway intersection with Hunting Lane were found to exceed or could be made to exceed the recommended minimum distance for safe operation 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 implementation of the recommendations that follow.

¹⁰Ibid 1.

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 at off-site locations evaluated in conjunction with this study. 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.

Project Access

Access to the Project site will be provided by way of a new roadway that will intersect the south side of Hunting Lane approximately 950 feet west of the railroad crossing. 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 roadway should be a minimum of 22-feet in width and designed to accommodate the turning and maneuvering requirements of the largest anticipated responding emergency vehicle.
- 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).¹¹
- A sidewalk has been provided along one side of the Project site roadway and extends to Hunting Lane.
- Americans with Disabilities Act (ADA) compliant wheelchair ramps should be provided at all pedestrian crossings internal to the Project site and for crossing the Project site roadway.
- Signs and landscaping to be installed as a part of the Project within the intersection sight triangle areas of the Project site roadway should be designed and maintained so as not to restrict lines of sight.
- Snow windrows within sight triangle areas of the Project site roadway should be promptly removed where such accumulations would impede sight lines.
- Existing trees and vegetation located along the south side of Hunting Lane within the intersection triangle areas of the Project site roadway should be selectively trimmed or removed and maintained.

Off-Site

Route 27 at Route 16

Independent of the Project, left-turn movements from the Route 16 approach to the signalized intersection of Route 16 at Route 27 were shown to be operating over capacity (i.e., LOS F) during the weekday evening peak hour under 2020 Existing conditions. In an effort to improve traffic

¹¹Ibid 2.

operations at the intersection, it is recommended that an optimal traffic signal timing plan be implemented at this intersection in order to improve traffic operations and reduce vehicle queueing. With implementation of an optimal traffic signal timing plan, overall intersection operations will be improved from LOS E to LOS D during the weekday evening peak-hour, with operating conditions for the Route 16 left-turn movement shown to improve from LOS F to LOS E with reduced vehicle queueing.

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.

Table 12
MITIGATED SIGNALIZED INTERSECTION LEVEL-OF-SERVICE SUMMARY

Signalized Intersection/Peak Hour	2027 No-Build				2027 Build				2027 Build with Mitigation			
	V/C ^a	Delay ^b	LOS ^c	Queue ^d Avg/95 th	V/C	Delay	LOS	Queue Avg/95 th	V/C	Delay	LOS	Queue Avg/95 th
Route 27/Eliot Street (Route 16):												
<i>Weekday Morning:</i>												
Rte. 16 WB LT	0.62	27.1	C	111/110	0.62	27.1	C	111/110	0.62	27.1	C	111/110
Rte. 16 WB RT	0.05	20.9	C	2/12	0.06	20.9	C	2/12	0.06	20.9	C	2/12
Rte. 27 NB TH	0.92	24.4	C	417/760 ^f	0.93	24.5	C	419/761 ^f	0.93	24.5	C	419/761 ^f
Rte. 27 NB RT	0.39	0.8	A	0/0	0.39	0.8	A	0/0	0.39	0.8	A	0/0
Rte. 27 SB LT/TH	0.89	24.3	C	226/476 ^f	0.89	24.3	C	228/480 ^f	0.89	24.3	C	228/480 ^f
Overall	--	18.7	B	--	--	18.7	B	--	--	18.7	B	--
<i>Weekday Evening:</i>												
Rte. 16 WB LT	1.42	>80.0	F	468 ^e /669 ^f	1.42	>80.0	F	468 ^e /669 ^f	1.07	76.3	E	352 ^e /547 ^f
Rte. 16 WB RT	0.01	19.7	B	1/8	0.01	19.7	B	2/11	0.01	13.7	B	1/9
Rte. 27 NB TH	0.57	9.7	A	167/253	0.58	9.7	A	168/254	0.69	15.5	B	203/315
Rte. 27 NB RT	0.17	0.5	A	0/0	0.17	0.5	A	0/0	0.17	0.0	A	0/0
Rte. 27 SB LT/TH	0.84	17.4	B	331/567 ^f	0.84	17.8	B	334/624 ^f	1.02	17.8	D	416/675 ^f
Overall	--	70.3	E	--	--	70.3	E	--	--	42.9	D	--

^aVolume-to-capacity ratio.

^bControl (signal) delay per vehicle in seconds.

^cLevel-of-Service.

^dQueue length in feet.

^eVolume exceeds capacity, queue is theoretically infinite. Queue shown is maximum after two cycles.

^f95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.

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

APPENDIX

PROJECT SITE PLAN
AUTOMATIC TRAFFIC RECORDER COUNT DATA
MANUAL TURNING MOVEMENT COUNT DATA
SEASONAL ADJUSTMENT DATA
VEHICLE TRAVEL SPEED DATA
MOTOR VEHICLE CRASH DATA
CRASH RATE WORKSHEETS
GENERAL BACKGROUND TRAFFIC GROWTH
BACKGROUND DEVELOPMENT NETWORKS
TRIP-GENERATION CALCULATIONS
TRIP-DISTRIBUTION CALCULATIONS
CAPACITY ANALYSIS WORKSHEETS

PROJECT SITE PLAN

NOTES:

- THE PROPERTY BOUNDARY SHOWN HEREON WAS TAKEN FROM PLAN TITLED "PLAN OF LAND, SHERBORN, MA" PREPARED FOR WILMA I. & ORVILLE J. BROWN, PREPARED BY METROWEST ENGINEERING, INC., DATED OCTOBER 1, 1993, LAST REVISED NOVEMBER 4, 1993. THE PROPERTY LINE HAS NOT BEEN VERIFIED BY A FIELD SURVEY BY ALLEN & MAJOR ASSOCIATES, INC.
- EXISTING CONDITIONS SHOWN HEREON ARE THE RESULT OF AERIAL IMAGERY AND MASS GIS DATA. THE EXISTING CONDITIONS AND TOPOGRAPHY HAVE NOT BEEN VERIFIED BY A FIELD SURVEY BY ALLEN & MAJOR ASSOCIATES, INC.
- SLOPED GRANITE CURBING SHALL BE INSTALLED AT ALL STREET INTERSECTIONS ON THE CURVE AND EXTENDING AT LEAST EIGHT FEET BEYOND THE TANGENT POINT. SLOPED GRANITE CURBING SEGMENTS AT LEAST EIGHT FEET IN LENGTH SHALL ALSO BE INSTALLED AT ALL CATCH BASINS SO AS TO EXTEND NOT LESS THAN FOUR FEET IN EITHER DIRECTION FROM THE CATCH BASIN CENTER LINE.
- THIS PLAN ASSUMES THE MERGER OF PROPERTIES IDENTIFIED ON TOWN OF SHERBORN ASSESSORS MAP 11 AS LOTS 2, 3B & 3C.
- THE INFORMATION SHOWN ON THIS PLAN IS THE SOLE PROPERTY OF ALLEN & MAJOR ASSOCIATES, INC. ITS INTENDED USE IS TO PROVIDE INFORMATION. ANY ALTERATION, MISUSE, OR RECALCULATION OF INFORMATION OR DATA WITHOUT THE EXPRESSED, WRITTEN CONSENT OF ALLEN & MAJOR ASSOCIATES, INC. IS STRICTLY PROHIBITED.

ZONING SUMMARY TABLE
RESIDENTIAL A & RESIDENTIAL B (RA & RB) DISTRICT

ITEM	REQUIRED		PROPOSED
	RA DISTRICT	RB DISTRICT	MAP 11 LOT 2, 3B, & 3C
MINIMUM LOT AREA	1 ACRE	2 ACRES	29.82 ACRES
MINIMUM FRONTAGE	150 FEET	200 FEET	828 FEET
MINIMUM LOT WIDTH	150 FEET	200 FEET	200 FEET
MINIMUM LOT DEPTH	N/A	N/A	N/A
MINIMUM FRONT SETBACK	60 FEET	60 FEET	356.9 FEET
MINIMUM SIDE SETBACK	30 FEET	40 FEET	26.9 FEET*
MINIMUM REAR SETBACK	30 FEET	30 FEET	70.8 FEET
MAXIMUM HEIGHT (STORIES)	2.5	2.5	2 STORIES
MAXIMUM HEIGHT (FEET)	35 FEET	35 FEET	<35 FEET
MAXIMUM LOT COVERAGE	N/A	N/A	N/A

ZONING SUMMARY TABLE NOTES:

- TOTAL LOT AREA AND FRONTAGE ARE FROM ONLINE PROPERTY TAX CARDS AND GIS.
- MINIMUM LOT WIDTH SHALL BE MEASURED AT FRONT SETBACK LINE AND AT BUILDING LINE. AT NO POINT BETWEEN THE REQUIRED FRONTAGE AND THE BUILDING LINE SHALL LOT WIDTH BE REDUCED TO LESS THAN 50 FEET, WITHOUT EXCEPTION FROM THE PLANNING BOARD.

* RELIEF REQUIRED

REQUIRED RELIEF:

- ZONING BY-LAWS
 - § 4.2 SCHEDULE OF DIMENSIONAL REQUIREMENTS: MINIMUM SIDE YARD SETBACK
- RULES AND REGULATIONS
 - § 4.1.4 MAXIMUM OF ONE SINGLE FAMILY RESIDENTIAL DWELLING PER LOT
 - § 4.3.7.b. MAXIMUM LENGTH OF DEAD-END STREET. 600 FEET ALLOWED, 1,150 FEET PROPOSED

HUNTING LANE
(PUBLIC - VARIABLE WIDTH)

LEGEND

BUILDING	
CURB	
SIDEWALK	
GRAVEL ACCESS	
SETBACK LINE	
BASELINE	
SIGN	
STEEL GUARDRAIL	
WOOD FENCE	
TREE LINE	

SCHEMATIC DESIGN
ISSUED FOR REVIEW
NOVEMBER 14, 2019

PROFESSIONAL ENGINEER FOR
ALLEN & MAJOR ASSOCIATES, INC.

REV DATE DESCRIPTION

APPLICANT/OWNER:

BARSKY REAL ESTATE TRUST
P.O. BOX 826
NATICK, MA 01760

PROJECT:

APPLE HILL ESTATES
31 HUNTING LANE
SHERBORN, MA 01770

PROJECT NO. 2513-02 DATE: Nov. 14, 2019

SCALE: 1" = 60' DWG. NAME: C2513-02

DESIGNED BY: SM CHECKED BY: MAM

PREPARED BY:

ALLEN & MAJOR ASSOCIATES, INC.
civil engineering • land surveying
environmental consulting • landscape architecture
www.allenmajor.com
100 COMMERCE WAY
WOUBURN MA 01801
TEL: (781) 935-6889
FAX: (781) 935-2896
WOUBURN, MA • LAKEVILLE, MA • MANCHESTER, NH

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DRAWING TITLE:
LAYOUT & MATERIALS
PLAN

SHEET NO.
C-102

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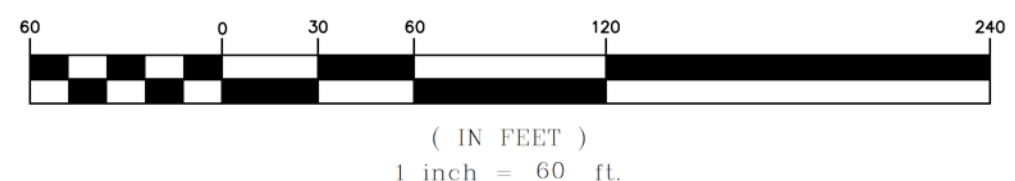
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GRAPHIC SCALE



AUTOMATIC TRAFFIC RECORDER COUNT DATA

Accurate Counts
978-664-2565

Page 1

Location : South Main Street
Location : North of Eliot Street
City/State: Sherborn, MA

8587VOL1

Start Time	4/15/2020 Wed	SB		Hour Totals		NB		Hour Totals		Combined Totals	
		Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
12:00		6	71			3	63				
12:15		4	75			3	81				
12:30		3	90			3	68				
12:45		4	80	17	316	1	85	10	297	27	613
01:00		3	76			1	67				
01:15		3	70			1	59				
01:30		0	78			3	68				
01:45		0	106	6	330	0	59	5	253	11	583
02:00		0	75			3	72				
02:15		1	74			3	77				
02:30		0	106			2	75				
02:45		3	96	4	351	2	50	10	274	14	625
03:00		0	103			0	72				
03:15		1	105			3	84				
03:30		1	109			4	86				
03:45		1	97	3	414	4	52	11	294	14	708
04:00		0	98			1	64				
04:15		0	76			3	61				
04:30		4	105			7	77				
04:45		2	92	6	371	5	77	16	279	22	650
05:00		6	85			11	70				
05:15		7	93			18	63				
05:30		12	59			41	54				
05:45		12	56	37	293	33	51	103	238	140	531
06:00		24	49			40	52				
06:15		37	55			34	61				
06:30		49	34			79	48				
06:45		36	35	146	173	64	32	217	193	363	366
07:00		40	35			56	33				
07:15		39	34			73	28				
07:30		43	27			84	24				
07:45		47	17	169	113	66	21	279	106	448	219
08:00		45	25			77	19				
08:15		51	21			67	18				
08:30		37	17			63	17				
08:45		47	15	180	78	62	13	269	67	449	145
09:00		43	9			53	9				
09:15		49	10			63	10				
09:30		48	8			43	6				
09:45		55	6	195	33	59	9	218	34	413	67
10:00		47	8			55	8				
10:15		53	5			57	10				
10:30		55	7			58	11				
10:45		60	10	215	30	68	4	238	33	453	63
11:00		64	3			50	8				
11:15		60	7			75	5				
11:30		61	5			76	4				
11:45		82	5	267	20	68	4	269	21	536	41
Total		1245	2522			1645	2089			2890	4611
Percent		33.1%	66.9%			44.1%	55.9%			38.5%	61.5%

Accurate Counts
978-664-2565

Page 2

Location : South Main Street
Location : North of Eliot Street
City/State: Sherborn, MA

8587VOL1

Start Time	4/16/2020 Thu	SB		Hour Totals		NB		Hour Totals		Combined Totals	
		Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
12:00		5	73			4	75				
12:15		2	72			2	56				
12:30		5	75			4	73				
12:45		4	70	16	290	1	54	11	258	27	548
01:00		3	66			2	65				
01:15		1	69			0	86				
01:30		0	85			1	73				
01:45		0	70	4	290	0	74	3	298	7	588
02:00		1	90			0	50				
02:15		0	85			2	63				
02:30		0	81			1	62				
02:45		2	91	3	347	2	64	5	239	8	586
03:00		0	118			0	73				
03:15		1	91			0	84				
03:30		0	115			1	68				
03:45		1	78	2	402	3	77	4	302	6	704
04:00		0	104			3	69				
04:15		0	77			1	65				
04:30		3	68			6	70				
04:45		0	89	3	338	5	62	15	266	18	604
05:00		6	104			7	67				
05:15		6	81			16	67				
05:30		12	73			28	56				
05:45		10	76	34	334	36	60	87	250	121	584
06:00		17	53			41	52				
06:15		39	59			47	39				
06:30		50	58			65	47				
06:45		41	30	147	200	77	45	230	183	377	383
07:00		38	34			47	29				
07:15		49	24			57	34				
07:30		54	34			65	24				
07:45		50	31	191	123	68	26	237	113	428	236
08:00		35	19			61	12				
08:15		59	20			81	25				
08:30		49	8			61	19				
08:45		51	8	194	55	61	15	264	71	458	126
09:00		45	10			51	6				
09:15		51	7			58	11				
09:30		55	14			53	9				
09:45		55	6	206	37	59	9	221	35	427	72
10:00		56	8			48	2				
10:15		57	6			55	10				
10:30		58	5			57	11				
10:45		66	12	237	31	56	4	216	27	453	58
11:00		60	2			60	9				
11:15		59	9			84	4				
11:30		64	9			54	5				
11:45		64	6	247	26	53	3	251	21	498	47
Total		1284	2473			1544	2063			2828	4536
Percent		34.2%	65.8%			42.8%	57.2%			38.4%	61.6%
Grand Total		2529	4995			3189	4152			5718	9147
Percent		33.6%	66.4%			43.4%	56.6%			38.5%	61.5%
ADT		ADT 7,432	AADT 7,432								

Accurate Counts
978-664-2565

Page 1

Location : South Main Street
Location : North of Eliot Street
City/State: Sherborn, MA

8587VOL1

Start Time	4/13/2020		Tue		Wed		Thu		Fri		Sat		Sun		Week Average	
	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB
12:00 AM	*	*	*	*	17	10	16	11	*	*	*	*	*	*	16	10
01:00	*	*	*	*	6	5	4	3	*	*	*	*	*	*	5	4
02:00	*	*	*	*	4	10	3	5	*	*	*	*	*	*	4	8
03:00	*	*	*	*	3	11	2	4	*	*	*	*	*	*	2	8
04:00	*	*	*	*	6	16	3	15	*	*	*	*	*	*	4	16
05:00	*	*	*	*	37	103	34	87	*	*	*	*	*	*	36	95
06:00	*	*	*	*	146	217	147	230	*	*	*	*	*	*	146	224
07:00	*	*	*	*	169	279	191	237	*	*	*	*	*	*	180	258
08:00	*	*	*	*	180	269	194	264	*	*	*	*	*	*	187	266
09:00	*	*	*	*	195	218	206	221	*	*	*	*	*	*	200	220
10:00	*	*	*	*	215	238	237	216	*	*	*	*	*	*	226	227
11:00	*	*	*	*	267	269	247	251	*	*	*	*	*	*	257	260
12:00 PM	*	*	*	*	316	297	290	258	*	*	*	*	*	*	303	278
01:00	*	*	*	*	330	253	290	298	*	*	*	*	*	*	310	276
02:00	*	*	*	*	351	274	347	239	*	*	*	*	*	*	349	256
03:00	*	*	*	*	414	294	402	302	*	*	*	*	*	*	408	298
04:00	*	*	*	*	371	279	338	266	*	*	*	*	*	*	354	272
05:00	*	*	*	*	293	238	334	250	*	*	*	*	*	*	314	244
06:00	*	*	*	*	173	193	200	183	*	*	*	*	*	*	186	188
07:00	*	*	*	*	113	106	123	113	*	*	*	*	*	*	118	110
08:00	*	*	*	*	78	67	55	71	*	*	*	*	*	*	66	69
09:00	*	*	*	*	33	34	37	35	*	*	*	*	*	*	35	34
10:00	*	*	*	*	30	33	31	27	*	*	*	*	*	*	30	30
11:00	*	*	*	*	20	21	26	21	*	*	*	*	*	*	23	21
Lane	0	0	0	0	3767	3734	3757	3607	0	0	0	0	0	0	3759	3672
Day	0		0		7501		7364		0		0		0		7431	
AM Peak	-	-	-	-	11:00	07:00	11:00	08:00	-	-	-	-	-	-	11:00	08:00
Vol.	-	-	-	-	267	279	247	264	-	-	-	-	-	-	257	266
PM Peak	-	-	-	-	15:00	12:00	15:00	15:00	-	-	-	-	-	-	15:00	15:00
Vol.	-	-	-	-	414	297	402	302	-	-	-	-	-	-	408	298

Comb. Total	0	0	7501	7364	0	0	0	7431
ADT	ADT 7,432	AADT 7,432						

Accurate Counts
978-664-2565

Location : Hunting Lane
Location : at # 31
City/State: Sherborn, MA

8586VOL1

Start Time	4/15/2020 Wed	WB		Hour Totals		EB		Hour Totals		Combined Totals	
		Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
12:00		0	3			0	5				
12:15		0	5			1	4				
12:30		0	4			0	3				
12:45		0	7	0	19	0	9	1	21	1	40
01:00		0	2			0	6				
01:15		0	4			0	7				
01:30		0	4			0	2				
01:45		0	4	0	14	0	3	0	18	0	32
02:00		0	5			2	4				
02:15		0	6			0	4				
02:30		0	6			0	4				
02:45		0	5	0	22	0	4	2	16	2	38
03:00		0	2			0	3				
03:15		0	4			0	1				
03:30		0	4			0	4				
03:45		0	1	0	11	0	1	0	9	0	20
04:00		0	2			0	6				
04:15		1	3			1	3				
04:30		0	1			0	0				
04:45		0	2	1	8	0	6	1	15	2	23
05:00		0	1			0	3				
05:15		0	7			1	1				
05:30		0	2			0	1				
05:45		0	5	0	15	0	2	1	7	1	22
06:00		0	2			0	3				
06:15		0	1			1	1				
06:30		1	2			2	1				
06:45		0	3	1	8	0	1	3	6	4	14
07:00		2	1			2	1				
07:15		0	1			1	0				
07:30		2	1			0	1				
07:45		1	2	5	5	1	1	4	3	9	8
08:00		2	1			2	0				
08:15		1	2			3	4				
08:30		4	0			1	1				
08:45		3	0	10	3	2	0	8	5	18	8
09:00		1	0			1	0				
09:15		2	0			3	0				
09:30		1	0			3	0				
09:45		5	0	9	0	5	0	12	0	21	0
10:00		2	0			5	0				
10:15		2	0			5	0				
10:30		2	1			2	0				
10:45		0	0	6	1	1	0	13	0	19	1
11:00		3	0			3	0				
11:15		1	0			4	0				
11:30		8	0			4	0				
11:45		2	0	14	0	7	0	18	0	32	0
Total		46	106			63	100			109	206
Percent		30.3%	69.7%			38.7%	61.3%			34.6%	65.4%

Accurate Counts
978-664-2565

Location : Hunting Lane
Location : at # 31
City/State: Sherborn, MA

8586VOL1

Start Time	4/16/2020 Thu	WB		Hour Totals		EB		Hour Totals		Combined Totals	
		Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
12:00		0	2			0	5				
12:15		0	2			0	2				
12:30		0	4			0	5				
12:45		0	2	0	10	0	5	0	17	0	27
01:00		0	2			0	2				
01:15		0	1			0	2				
01:30		0	5			0	2				
01:45		0	4	0	12	0	3	0	9	0	21
02:00		0	6			0	1				
02:15		0	0			0	1				
02:30		0	3			0	2				
02:45		0	2	0	11	0	5	0	9	0	20
03:00		0	5			0	2				
03:15		0	4			0	3				
03:30		0	4			0	4				
03:45		1	3	1	16	1	4	1	13	2	29
04:00		0	2			0	5				
04:15		0	5			0	2				
04:30		0	4			0	5				
04:45		0	2	0	13	0	2	0	14	0	27
05:00		0	8			0	2				
05:15		0	0			1	2				
05:30		0	2			0	0				
05:45		0	0	0	10	1	3	2	7	2	17
06:00		0	0			0	0				
06:15		1	1			0	1				
06:30		0	2			1	2				
06:45		0	1	1	4	1	0	2	3	3	7
07:00		1	4			3	1				
07:15		1	1			1	0				
07:30		1	1			3	0				
07:45		2	0	5	6	2	0	9	1	14	7
08:00		1	0			1	1				
08:15		3	0			5	1				
08:30		2	0			3	0				
08:45		4	2	10	2	2	2	11	4	21	6
09:00		4	0			4	1				
09:15		2	0			3	0				
09:30		2	0			2	1				
09:45		2	0	10	0	1	0	10	2	20	2
10:00		1	0			5	1				
10:15		3	0			11	0				
10:30		1	1			4	2				
10:45		1	0	6	1	3	0	23	3	29	4
11:00		2	1			2	0				
11:15		5	0			8	0				
11:30		5	0			0	0				
11:45		5	0	17	1	1	0	11	0	28	1
Total		50	86			69	82			119	168
Percent		36.8%	63.2%			45.7%	54.3%			41.5%	58.5%
Grand Total		96	192			132	182			228	374
Percent		33.3%	66.7%			42.0%	58.0%			37.9%	62.1%
ADT		ADT 301	AADT 301								

Location : Hunting Lane
Location : at # 31
City/State: Sherborn, MA

8586VOL1

Start Time	4/13/2020		Tue		Wed		Thu		Fri		Sat		Sun		Week Average	
	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB
12:00 AM	*	*	*	*	0	1	0	0	*	*	*	*	*	*	0	0
01:00	*	*	*	*	0	0	0	0	*	*	*	*	*	*	0	0
02:00	*	*	*	*	0	2	0	0	*	*	*	*	*	*	0	1
03:00	*	*	*	*	0	0	1	1	*	*	*	*	*	*	0	0
04:00	*	*	*	*	1	1	0	0	*	*	*	*	*	*	0	0
05:00	*	*	*	*	0	1	0	2	*	*	*	*	*	*	0	2
06:00	*	*	*	*	1	3	1	2	*	*	*	*	*	*	1	2
07:00	*	*	*	*	5	4	5	9	*	*	*	*	*	*	5	6
08:00	*	*	*	*	10	8	10	11	*	*	*	*	*	*	10	10
09:00	*	*	*	*	9	12	10	10	*	*	*	*	*	*	10	11
10:00	*	*	*	*	6	13	6	23	*	*	*	*	*	*	6	18
11:00	*	*	*	*	14	18	17	11	*	*	*	*	*	*	16	14
12:00 PM	*	*	*	*	19	21	10	17	*	*	*	*	*	*	14	19
01:00	*	*	*	*	14	18	12	9	*	*	*	*	*	*	13	14
02:00	*	*	*	*	22	16	11	9	*	*	*	*	*	*	16	12
03:00	*	*	*	*	11	9	16	13	*	*	*	*	*	*	14	11
04:00	*	*	*	*	8	15	13	14	*	*	*	*	*	*	10	14
05:00	*	*	*	*	15	7	10	7	*	*	*	*	*	*	12	7
06:00	*	*	*	*	8	6	4	3	*	*	*	*	*	*	6	4
07:00	*	*	*	*	5	3	6	1	*	*	*	*	*	*	6	2
08:00	*	*	*	*	3	5	2	4	*	*	*	*	*	*	2	4
09:00	*	*	*	*	0	0	0	2	*	*	*	*	*	*	0	1
10:00	*	*	*	*	1	0	1	3	*	*	*	*	*	*	1	2
11:00	*	*	*	*	0	0	1	0	*	*	*	*	*	*	0	0
Lane	0	0	0	0	152	163	136	151	0	0	0	0	0	0	142	154
Day	0		0		315		287		0		0		0		296	
AM Peak	-	-	-	-	11:00	11:00	11:00	10:00	-	-	-	-	-	-	11:00	10:00
Vol.	-	-	-	-	14	18	17	23	-	-	-	-	-	-	16	18
PM Peak	-	-	-	-	14:00	12:00	15:00	12:00	-	-	-	-	-	-	14:00	12:00
Vol.	-	-	-	-	22	21	16	17	-	-	-	-	-	-	16	19

Comb. Total	0	0	315	287	0	0	0	296
ADT	ADT 301	AADT 301						



PRECISION
D A T A
INDUSTRIES, LLC

46 Morton Street, Framingham, MA 01702
Office: 508-875-0100 Fax: 508-875-0118
Email: datarequests@pdillc.com

North Main Street (Route 27)
north of Eliot Street (Route 16)
City, State: Sherborn, MA
Client: Green International/ J. Sobel

165403 A Volume
Site Code: TBA

Start	NB			SB			Combin		12/6/201		
Time	A.M.	P.M.		A.M.	P.M.		A.M.	P.M.	6	Tue	
12:00	5	130		12	83		17	213			
12:15	2	113		7	115		9	228			
12:30	2	114		7	115		9	229			
12:45	1	110	467	5	105	418	6	215	885		
01:00	1	90		3	122		4	212			
01:15	2	84		3	152		5	236			
01:30	2	105		1	129		3	234			
01:45	4	94	373	2	119	522	6	213	895		
02:00	3	94		0	131		3	225			
02:15	2	103		1	159		3	262			
02:30	1	106		0	146		1	252			
02:45	0	108	411	0	169	605	0	277	1016		
03:00	2	95		0	175		2	270			
03:15	6	98		1	164		7	262			
03:30	7	89		0	151		7	240			
03:45	3	88	370	0	174	664	3	262	1034		
04:00	4	89		2	182		6	271			
04:15	7	84		4	182		11	266			
04:30	16	107		4	167		20	274			
04:45	14	73	353	4	164	695	18	237	1048		
05:00	27	92		11	169		38	261			
05:15	37	104		10	167		47	271			
05:30	53	98		17	172		70	270			
05:45	79	76	370	18	166	674	97	242	1044		
06:00	106	77		20	176		126	253			
06:15	125	86		59	151		184	237			
06:30	171	65		65	152		236	217			
06:45	186	78	306	73	129	608	259	207	914		
07:00	201	56		78	124		279	180			
07:15	167	57		123	110		290	167			
07:30	152	47		116	91		268	138			
07:45	202	37	197	116	94	419	318	131	616		
08:00	208	42		101	76		309	118			
08:15	189	40		106	87		295	127			
08:30	238	41		110	86		348	127			
08:45	212	32	155	68	76	325	280	108	480		
09:00	203	33		76	70		279	103			
09:15	139	41		92	77		231	118			
09:30	106	28		83	51		189	79			
09:45	189	26	128	80	65	263	269	91	391		
10:00	165	20		82	50		247	70			
10:15	134	26		69	39		203	65			
10:30	148	20		78	21		226	41			
10:45	129	6	72	85	27	137	214	33	209		
11:00	121	10		80	27		201	37			
11:15	115	7		90	24		205	31			
11:30	127	11		110	8		237	19			
11:45	113	8	36	88	13	72	201	21	108		
Total	4126	3238		2160	5402		6286	8640			
Percent	65.6%	37.5%		34.4%	62.5%						
Day Total	7364			7562			14926				
Peak	08:00	-	12:00	-	07:15	-	03:45	-	03:45	-	-
Vol.	847	-	467	-	456	-	705	-	1073	-	-
P.H.F.	0.890	-	0.898	-	0.927	-	0.968	-	0.968	-	-



PRECISION
D A T A
INDUSTRIES, LLC

46 Morton Street, Framingham, MA 01702
Office: 508-875-0100 Fax: 508-875-0118
Email: datarequests@pdillc.com

North Main Street (Route 27)
north of Eliot Street (Route 16)
City, State: Sherborn, MA
Client: Green International/ J. Sobel

165403 A Volume
Site Code: TBA

Start	NB				SB				Combin		12/7/201		
Time	A.M.		P.M.		A.M.		P.M.		A.M.		P.M.	6	Wed
12:00	3		125		12		112		15		237		
12:15	3		140		8		117		11		257		
12:30	6		110		3		120		9		230		
12:45	6	18	121	496	8	31	122	471	14	49	243	967	
01:00	2		89		2		126		4		215		
01:15	1		99		5		125		6		224		
01:30	2		122		0		121		2		243		
01:45	5	10	113	423	0	7	125	497	5	17	238	920	
02:00	2		103		4		155		6		258		
02:15	2		86		4		164		6		250		
02:30	2		104		4		144		6		248		
02:45	1	7	96	389	1	13	161	624	2	20	257	1013	
03:00	3		112		2		182		5		294		
03:15	1		102		0		189		1		291		
03:30	2		99		1		165		3		264		
03:45	3	9	76	389	2	5	192	728	5	14	268	1117	
04:00	5		98		0		176		5		274		
04:15	6		102		5		166		11		268		
04:30	11		84		7		156		18		240		
04:45	15	37	101	385	5	17	165	663	20	54	266	1048	
05:00	16		84		8		172		24		256		
05:15	28		106		14		156		42		262		
05:30	71		104		17		166		88		270		
05:45	83	198	92	386	15	54	172	666	98	252	264	1052	
06:00	109		75		35		170		144		245		
06:15	141		69		39		172		180		241		
06:30	187		85		54		172		241		257		
06:45	191	628	70	299	78	206	132	646	269	834	202	945	
07:00	198		71		83		100		281		171		
07:15	131		44		114		109		245		153		
07:30	202		56		100		105		302		161		
07:45	194	725	51	222	123	420	92	406	317	1145	143	628	
08:00	207		32		90		97		297		129		
08:15	214		35		105		80		319		115		
08:30	201		34		83		103		284		137		
08:45	213	835	40	141	103	381	77	357	316	1216	117	498	
09:00	194		44		79		72		273		116		
09:15	178		35		94		85		272		120		
09:30	175		57		78		67		253		124		
09:45	134	681	24	160	91	342	60	284	225	1023	84	444	
10:00	129		22		71		44		200		66		
10:15	128		20		69		36		197		56		
10:30	134		23		79		17		213		40		
10:45	123	514	17	82	91	310	25	122	214	824	42	204	
11:00	149		12		80		23		229		35		
11:15	116		4		122		30		238		34		
11:30	156		9		131		15		287		24		
11:45	125	546	3	28	105	438	12	80	230	984	15	108	
Total	4208		3400		2224		5544		6432		8944		
Percent	65.4%		38.0%		34.6%		62.0%						
Day Total			7608				7768				15376		
Peak	08:00	-	12:00	-	11:00	-	03:00	-	07:30	-	03:00	-	-
Vol.	835	-	496	-	438	-	728	-	1235	-	1117	-	-
P.H.F.	0.975		0.886		0.836		0.948		0.968		0.950		

MANUAL TURNING MOVEMENT COUNT DATA



PRECISION
D A T A
INDUSTRIES, LLC

46 Morton Street, Framingham, MA 01702
Office: 508-875-0100 Fax: 508-875-0118
Email: datarequests@pdillc.com

N/S: N. Main Street (Route 27/16)
E/W: Eliot Street (Route 16)/ Driveway
City, State: Sherborn, MA
Client: Green/ J. Sobel

File Name : 165403 A
Site Code : TBA
Start Date : 12/7/2016
Page No : 1

Groups Printed- Cars - Heavy Vehicles

	North Main Street (Route 27) From North				Eliot Street (Route 16) From East				North Main Street (Route 27/16) From South				Driveway From West				Int. Total
Start Time	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	
07:00 AM	0	78	5	0	3	1	28	0	156	194	0	0	0	0	2	0	467
07:15 AM	0	93	8	0	3	0	41	0	106	141	0	0	0	0	1	0	393
07:30 AM	0	115	4	0	3	0	27	0	138	196	0	0	0	0	0	0	483
07:45 AM	0	117	4	0	1	0	27	0	137	205	0	0	0	0	0	0	491
Total	0	403	21	0	10	1	123	0	537	736	0	0	0	0	3	0	1834
08:00 AM	0	88	4	0	1	0	27	0	124	206	0	0	0	0	0	0	450
08:15 AM	0	90	8	0	17	0	47	0	107	202	0	0	0	0	0	0	471
08:30 AM	0	87	6	0	4	0	51	0	115	201	0	0	0	0	0	0	464
08:45 AM	0	99	6	0	4	0	25	0	122	214	0	0	0	0	1	0	471
Total	0	364	24	0	26	0	150	0	468	823	0	0	0	0	1	0	1856
Grand Total	0	767	45	0	36	1	273	0	1005	1559	0	0	0	0	4	0	3690
Apprch %	0	94.5	5.5	0	11.6	0.3	88.1	0	39.2	60.8	0	0	0	0	100	0	
Total %	0	20.8	1.2	0	1	0	7.4	0	27.2	42.2	0	0	0	0	0.1	0	
Cars	0	726	38	0	29	1	259	0	964	1500	0	0	0	0	4	0	3521
% Cars	0	94.7	84.4	0	80.6	100	94.9	0	95.9	96.2	0	0	0	0	100	0	95.4
Heavy Vehicles	0	41	7	0	7	0	14	0	41	59	0	0	0	0	0	0	169
% Heavy Vehicles	0	5.3	15.6	0	19.4	0	5.1	0	4.1	3.8	0	0	0	0	0	0	4.6

	North Main Street (Route 27) From North					Eliot Street (Route 16) From East					North Main Street (Route 27/16) From South					Driveway From West					Int. Total
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	0	115	4	0	119	3	0	27	0	30	138	196	0	0	334	0	0	0	0	0	483
07:45 AM	0	117	4	0	121	1	0	27	0	28	137	205	0	0	342	0	0	0	0	0	491
08:00 AM	0	88	4	0	92	1	0	27	0	28	124	206	0	0	330	0	0	0	0	0	450
08:15 AM	0	90	8	0	98	17	0	47	0	64	107	202	0	0	309	0	0	0	0	0	471
Total Volume	0	410	20	0	430	22	0	128	0	150	506	809	0	0	1315	0	0	0	0	0	1895
% App. Total	0	95.3	4.7	0		14.7	0	85.3	0		38.5	61.5	0	0		0	0	0	0		
PHF	.000	.876	.625	.000	.888	.324	.000	.681	.000	.586	.917	.982	.000	.000	.961	.000	.000	.000	.000	.000	.965
Cars	0	387	17	0	404	16	0	124	0	140	487	780	0	0	1267	0	0	0	0	0	1811
% Cars	0	94.4	85.0	0	94.0	72.7	0	96.9	0	93.3	96.2	96.4	0	0	96.3	0	0	0	0	0	95.6
Heavy Vehicles	0	23	3	0	26	6	0	4	0	10	19	29	0	0	48	0	0	0	0	0	84
% Heavy Vehicles	0	5.6	15.0	0	6.0	27.3	0	3.1	0	6.7	3.8	3.6	0	0	3.7	0	0	0	0	0	4.4



PRECISION
D A T A
INDUSTRIES, LLC

46 Morton Street, Framingham, MA 01702
Office: 508-875-0100 Fax: 508-875-0118
Email: datarequests@pdillc.com

File Name : 165403 A
Site Code : TBA
Start Date : 12/7/2016
Page No : 1

N/S: N. Main Street (Route 27/16)
E/W: Eliot Street (Route 16)/ Driveway
City, State: Sherborn, MA
Client: Green/ J. Sobel

Groups Printed- Cars

	North Main Street (Route 27) From North				Eliot Street (Route 16) From East				North Main Street (Route 27/16) From South				Driveway From West				Int. Total
Start Time	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	
07:00 AM	0	76	3	0	3	1	25	0	147	188	0	0	0	0	2	0	445
07:15 AM	0	88	8	0	3	0	39	0	102	138	0	0	0	0	1	0	379
07:30 AM	0	110	4	0	3	0	26	0	135	191	0	0	0	0	0	0	469
07:45 AM	0	110	4	0	1	0	27	0	133	196	0	0	0	0	0	0	471
Total	0	384	19	0	10	1	117	0	517	713	0	0	0	0	3	0	1764
08:00 AM	0	84	3	0	1	0	27	0	119	195	0	0	0	0	0	0	429
08:15 AM	0	83	6	0	11	0	44	0	100	198	0	0	0	0	0	0	442
08:30 AM	0	85	5	0	3	0	48	0	109	189	0	0	0	0	0	0	439
08:45 AM	0	90	5	0	4	0	23	0	119	205	0	0	0	0	1	0	447
Total	0	342	19	0	19	0	142	0	447	787	0	0	0	0	1	0	1757
Grand Total	0	726	38	0	29	1	259	0	964	1500	0	0	0	0	4	0	3521
Apprch %	0	95	5	0	10	0.3	89.6	0	39.1	60.9	0	0	0	0	100	0	
Total %	0	20.6	1.1	0	0.8	0	7.4	0	27.4	42.6	0	0	0	0	0.1	0	

	North Main Street (Route 27) From North					Eliot Street (Route 16) From East					North Main Street (Route 27/16) From South					Driveway From West					Int. Total
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	0	110	4	0	114	3	0	26	0	29	135	191	0	0	326	0	0	0	0	0	469
07:45 AM	0	110	4	0	114	1	0	27	0	28	133	196	0	0	329	0	0	0	0	0	471
08:00 AM	0	84	3	0	87	1	0	27	0	28	119	195	0	0	314	0	0	0	0	0	429
08:15 AM	0	83	6	0	89	11	0	44	0	55	100	198	0	0	298	0	0	0	0	0	442
Total Volume	0	387	17	0	404	16	0	124	0	140	487	780	0	0	1267	0	0	0	0	0	1811
% App. Total	0	95.8	4.2	0		11.4	0	88.6	0		38.4	61.6	0	0		0	0	0	0		
PHF	.000	.880	.708	.000	.886	.364	.000	.705	.000	.636	.902	.985	.000	.000	.963	.000	.000	.000	.000	.000	.961



PRECISION
D A T A
INDUSTRIES, LLC

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N/S: N. Main Street (Route 27/16)
E/W: Eliot Street (Route 16)/ Driveway
City, State: Sherborn, MA
Client: Green/ J. Sobel

File Name : 165403 A
Site Code : TBA
Start Date : 12/7/2016
Page No : 1

Groups Printed- Heavy Vehicles

	North Main Street (Route 27) From North				Eliot Street (Route 16) From East				North Main Street (Route 27/16) From South				Driveway From West				Int. Total
Start Time	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	
07:00 AM	0	2	2	0	0	0	3	0	9	6	0	0	0	0	0	0	22
07:15 AM	0	5	0	0	0	0	2	0	4	3	0	0	0	0	0	0	14
07:30 AM	0	5	0	0	0	0	1	0	3	5	0	0	0	0	0	0	14
07:45 AM	0	7	0	0	0	0	0	0	4	9	0	0	0	0	0	0	20
Total	0	19	2	0	0	0	6	0	20	23	0	0	0	0	0	0	70
08:00 AM	0	4	1	0	0	0	0	0	5	11	0	0	0	0	0	0	21
08:15 AM	0	7	2	0	6	0	3	0	7	4	0	0	0	0	0	0	29
08:30 AM	0	2	1	0	1	0	3	0	6	12	0	0	0	0	0	0	25
08:45 AM	0	9	1	0	0	0	2	0	3	9	0	0	0	0	0	0	24
Total	0	22	5	0	7	0	8	0	21	36	0	0	0	0	0	0	99
Grand Total	0	41	7	0	7	0	14	0	41	59	0	0	0	0	0	0	169
Apprch %	0	85.4	14.6	0	33.3	0	66.7	0	41	59	0	0	0	0	0	0	
Total %	0	24.3	4.1	0	4.1	0	8.3	0	24.3	34.9	0	0	0	0	0	0	

	North Main Street (Route 27) From North					Eliot Street (Route 16) From East					North Main Street (Route 27/16) From South					Driveway From West					Int. Total
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 08:00 AM																					
08:00 AM	0	4	1	0	5	0	0	0	0	0	5	11	0	0	16	0	0	0	0	0	21
08:15 AM	0	7	2	0	9	6	0	3	0	9	7	4	0	0	11	0	0	0	0	0	29
08:30 AM	0	2	1	0	3	1	0	3	0	4	6	12	0	0	18	0	0	0	0	0	25
08:45 AM	0	9	1	0	10	0	0	2	0	2	3	9	0	0	12	0	0	0	0	0	24
Total Volume	0	22	5	0	27	7	0	8	0	15	21	36	0	0	57	0	0	0	0	0	99
% App. Total	0	81.5	18.5	0		46.7	0	53.3	0		36.8	63.2	0	0		0	0	0	0		
PHF	.000	.611	.625	.000	.675	.292	.000	.667	.000	.417	.750	.750	.000	.000	.792	.000	.000	.000	.000	.000	.853



46 Morton Street, Framingham, MA 01702
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File Name : 165403 A
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Start Date : 12/7/2016
Page No : 1

[illegible][illegible]



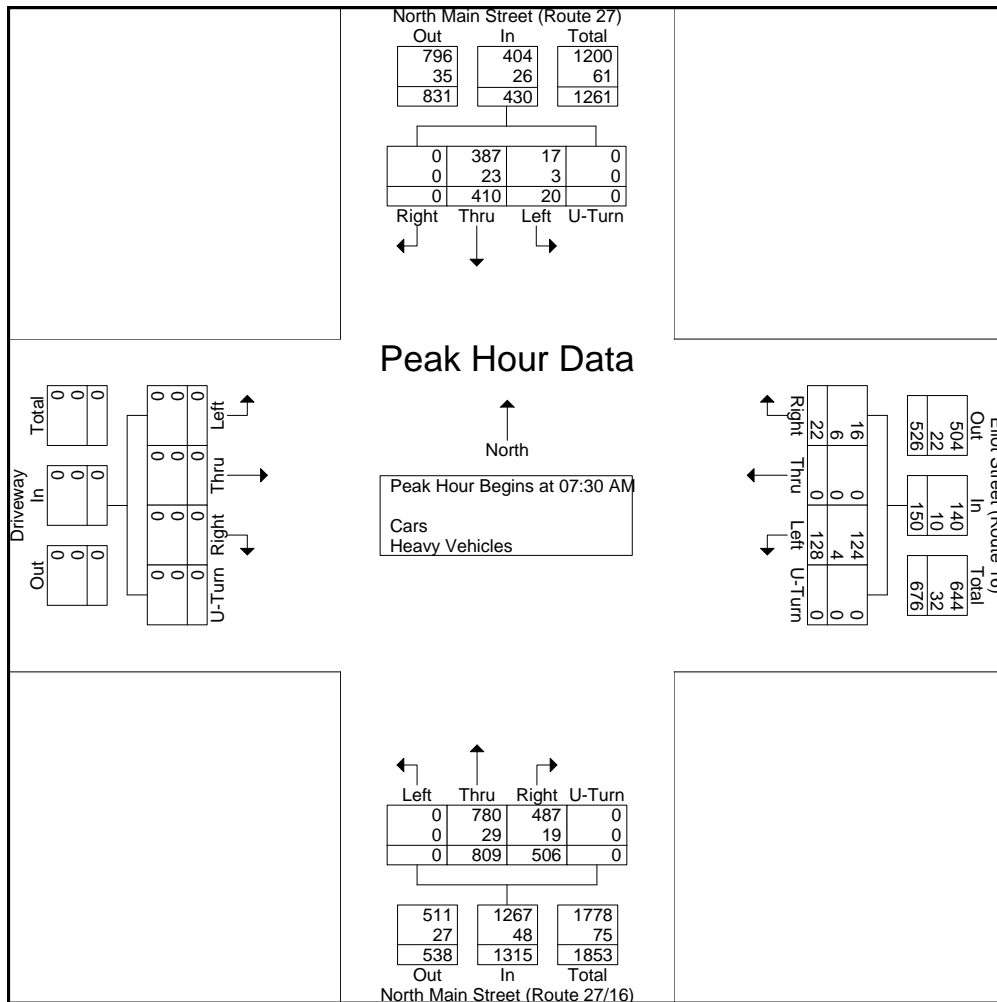
PRECISION
D A T A
INDUSTRIES, LLC

46 Morton Street, Framingham, MA 01702
Office: 508-875-0100 Fax: 508-875-0118
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N/S: N. Main Street (Route 27/16)
E/W: Eliot Street (Route 16)/ Driveway
City, State: Sherborn, MA
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File Name : 165403 A
Site Code : TBA
Start Date : 12/7/2016
Page No : 1

	North Main Street (Route 27) From North					Eliot Street (Route 16) From East					North Main Street (Route 27/16) From South					Driveway From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	0	115	4	0	119	3	0	27	0	30	138	196	0	0	334	0	0	0	0	0	483
07:45 AM	0	117	4	0	121	1	0	27	0	28	137	205	0	0	342	0	0	0	0	0	491
08:00 AM	0	88	4	0	92	1	0	27	0	28	124	206	0	0	330	0	0	0	0	0	450
08:15 AM	0	90	8	0	98	17	0	47	0	64	107	202	0	0	309	0	0	0	0	0	471
Total Volume	0	410	20	0	430	22	0	128	0	150	506	809	0	0	1315	0	0	0	0	0	1895
% App. Total	0	95.3	4.7	0		14.7	0	85.3	0		38.5	61.5	0	0		0	0	0	0		
PHF	.000	.876	.625	.000	.888	.324	.000	.681	.000	.586	.917	.982	.000	.000	.961	.000	.000	.000	.000	.000	.965
Cars	0	387	17	0	404	16	0	124	0	140	487	780	0	0	1267	0	0	0	0	0	1811
% Cars	0	94.4	85.0	0	94.0	72.7	0	96.9	0	93.3	96.2	96.4	0	0	96.3	0	0	0	0	0	95.6
Heavy Vehicles	0	23	3	0	26	6	0	4	0	10	19	29	0	0	48	0	0	0	0	0	84
% Heavy Vehicles	0	5.6	15.0	0	6.0	27.3	0	3.1	0	6.7	3.8	3.6	0	0	3.7	0	0	0	0	0	4.4





PRECISION
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INDUSTRIES, LLC

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N/S: N. Main Street (Route 27/16)
E/W: Eliot Street (Route 16)/ Driveway
City, State: Sherborn, MA
Client: Green/ J. Sobel

File Name : 165403 AA
Site Code : TBA
Start Date : 12/7/2016
Page No : 1

Groups Printed- Cars - Heavy Vehicles

	North Main Street (Route 27) From North				Eliot Street (Route 16) From East				North Main Street (Route 27/16) From South				Driveway From West				Int. Total
Start Time	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	
04:00 PM	0	189	1	0	2	0	121	0	46	109	0	0	0	0	0	0	468
04:15 PM	0	169	0	0	1	0	131	0	30	128	0	0	0	0	0	0	459
04:30 PM	0	169	1	0	3	0	120	0	52	116	0	0	0	0	0	0	461
04:45 PM	0	173	0	0	0	0	111	0	61	111	0	0	0	0	0	0	456
Total	0	700	2	0	6	0	483	0	189	464	0	0	0	0	0	0	1844
05:00 PM	0	168	1	0	0	0	134	0	45	98	0	0	0	0	0	0	446
05:15 PM	0	162	1	0	0	0	140	0	55	132	0	0	0	0	0	0	490
05:30 PM	0	187	1	0	2	0	126	0	55	108	0	0	0	0	0	0	479
05:45 PM	1	168	2	0	3	0	129	0	45	107	0	0	0	0	0	0	455
Total	1	685	5	0	5	0	529	0	200	445	0	0	0	0	0	0	1870
Grand Total	1	1385	7	0	11	0	1012	0	389	909	0	0	0	0	0	0	3714
Apprch %	0.1	99.4	0.5	0	1.1	0	98.9	0	30	70	0	0	0	0	0	0	
Total %	0	37.3	0.2	0	0.3	0	27.2	0	10.5	24.5	0	0	0	0	0	0	
Cars	1	1364	7	0	11	0	988	0	389	883	0	0	0	0	0	0	3643
% Cars	100	98.5	100	0	100	0	97.6	0	100	97.1	0	0	0	0	0	0	98.1
Heavy Vehicles	0	21	0	0	0	0	24	0	0	26	0	0	0	0	0	0	71
% Heavy Vehicles	0	1.5	0	0	0	0	2.4	0	0	2.9	0	0	0	0	0	0	1.9

	North Main Street (Route 27) From North					Eliot Street (Route 16) From East					North Main Street (Route 27/16) From South					Driveway From West					Int. Total
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:45 PM																					
04:45 PM	0	173	0	0	173	0	0	111	0	111	61	111	0	0	172	0	0	0	0	0	456
05:00 PM	0	168	1	0	169	0	0	134	0	134	45	98	0	0	143	0	0	0	0	0	446
05:15 PM	0	162	1	0	163	0	0	140	0	140	55	132	0	0	187	0	0	0	0	0	490
05:30 PM	0	187	1	0	188	2	0	126	0	128	55	108	0	0	163	0	0	0	0	0	479
Total Volume	0	690	3	0	693	2	0	511	0	513	216	449	0	0	665	0	0	0	0	0	1871
% App. Total	0	99.6	0.4	0		0.4	0	99.6	0		32.5	67.5	0	0		0	0	0	0		
PHF	.000	.922	.750	.000	.922	.250	.000	.913	.000	.916	.885	.850	.000	.000	.889	.000	.000	.000	.000	.000	.955
Cars	0	682	3	0	685	2	0	495	0	497	216	442	0	0	658	0	0	0	0	0	1840
% Cars	0	98.8	100	0	98.8	100	0	96.9	0	96.9	100	98.4	0	0	98.9	0	0	0	0	0	98.3
Heavy Vehicles	0	8	0	0	8	0	0	16	0	16	0	7	0	0	7	0	0	0	0	0	31
% Heavy Vehicles	0	1.2	0	0	1.2	0	0	3.1	0	3.1	0	1.6	0	0	1.1	0	0	0	0	0	1.7



PRECISION
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N/S: N. Main Street (Route 27/16)
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City, State: Sherborn, MA
Client: Green/ J. Sobel

File Name : 165403 AA
Site Code : TBA
Start Date : 12/7/2016
Page No : 1

Groups Printed- Cars

	North Main Street (Route 27) From North				Eliot Street (Route 16) From East				North Main Street (Route 27/16) From South				Driveway From West				Int. Total
Start Time	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	
04:00 PM	0	186	1	0	2	0	119	0	46	99	0	0	0	0	0	0	453
04:15 PM	0	166	0	0	1	0	127	0	30	124	0	0	0	0	0	0	448
04:30 PM	0	164	1	0	3	0	118	0	52	111	0	0	0	0	0	0	449
04:45 PM	0	170	0	0	0	0	101	0	61	109	0	0	0	0	0	0	441
Total	0	686	2	0	6	0	465	0	189	443	0	0	0	0	0	0	1791
05:00 PM	0	166	1	0	0	0	131	0	45	96	0	0	0	0	0	0	439
05:15 PM	0	161	1	0	0	0	138	0	55	130	0	0	0	0	0	0	485
05:30 PM	0	185	1	0	2	0	125	0	55	107	0	0	0	0	0	0	475
05:45 PM	1	166	2	0	3	0	129	0	45	107	0	0	0	0	0	0	453
Total	1	678	5	0	5	0	523	0	200	440	0	0	0	0	0	0	1852
Grand Total	1	1364	7	0	11	0	988	0	389	883	0	0	0	0	0	0	3643
Apprch %	0.1	99.4	0.5	0	1.1	0	98.9	0	30.6	69.4	0	0	0	0	0	0	
Total %	0	37.4	0.2	0	0.3	0	27.1	0	10.7	24.2	0	0	0	0	0	0	

	North Main Street (Route 27) From North					Eliot Street (Route 16) From East					North Main Street (Route 27/16) From South					Driveway From West					Int. Total
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	0	166	1	0	167	0	0	131	0	131	45	96	0	0	141	0	0	0	0	0	439
05:15 PM	0	161	1	0	162	0	0	138	0	138	55	130	0	0	185	0	0	0	0	0	485
05:30 PM	0	185	1	0	186	2	0	125	0	127	55	107	0	0	162	0	0	0	0	0	475
05:45 PM	1	166	2	0	169	3	0	129	0	132	45	107	0	0	152	0	0	0	0	0	453
Total Volume	1	678	5	0	684	5	0	523	0	528	200	440	0	0	640	0	0	0	0	0	1852
% App. Total	0.1	99.1	0.7	0		0.9	0	99.1	0		31.2	68.8	0	0		0	0	0	0		
PHF	.250	.916	.625	.000	.919	.417	.000	.947	.000	.957	.909	.846	.000	.000	.865	.000	.000	.000	.000	.000	.955



PRECISION
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File Name : 165403 AA
Site Code : TBA
Start Date : 12/7/2016
Page No : 1

Groups Printed- Heavy Vehicles

	North Main Street (Route 27) From North				Eliot Street (Route 16) From East				North Main Street (Route 27/16) From South				Driveway From West				Int. Total
Start Time	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	
04:00 PM	0	3	0	0	0	0	2	0	0	10	0	0	0	0	0	0	15
04:15 PM	0	3	0	0	0	0	4	0	0	4	0	0	0	0	0	0	11
04:30 PM	0	5	0	0	0	0	2	0	0	5	0	0	0	0	0	0	12
04:45 PM	0	3	0	0	0	0	10	0	0	2	0	0	0	0	0	0	15
Total	0	14	0	0	0	0	18	0	0	21	0	0	0	0	0	0	53
05:00 PM	0	2	0	0	0	0	3	0	0	2	0	0	0	0	0	0	7
05:15 PM	0	1	0	0	0	0	2	0	0	2	0	0	0	0	0	0	5
05:30 PM	0	2	0	0	0	0	1	0	0	1	0	0	0	0	0	0	4
05:45 PM	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Total	0	7	0	0	0	0	6	0	0	5	0	0	0	0	0	0	18
Grand Total	0	21	0	0	0	0	24	0	0	26	0	0	0	0	0	0	71
Apprch %	0	100	0	0	0	0	100	0	0	100	0	0	0	0	0	0	
Total %	0	29.6	0	0	0	0	33.8	0	0	36.6	0	0	0	0	0	0	

	North Main Street (Route 27) From North					Eliot Street (Route 16) From East					North Main Street (Route 27/16) From South					Driveway From West					Int. Total
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:00 PM																					
04:00 PM	0	3	0	0	3	0	0	2	0	2	0	10	0	0	10	0	0	0	0	0	15
04:15 PM	0	3	0	0	3	0	0	4	0	4	0	4	0	0	4	0	0	0	0	0	11
04:30 PM	0	5	0	0	5	0	0	2	0	2	0	5	0	0	5	0	0	0	0	0	12
04:45 PM	0	3	0	0	3	0	0	10	0	10	0	2	0	0	2	0	0	0	0	0	15
Total Volume	0	14	0	0	14	0	0	18	0	18	0	21	0	0	21	0	0	0	0	0	53
% App. Total	0	100	0	0		0	0	100	0		0	100	0	0		0	0	0	0		
PHF	.000	.700	.000	.000	.700	.000	.000	.450	.000	.450	.000	.525	.000	.000	.525	.000	.000	.000	.000	.000	.883



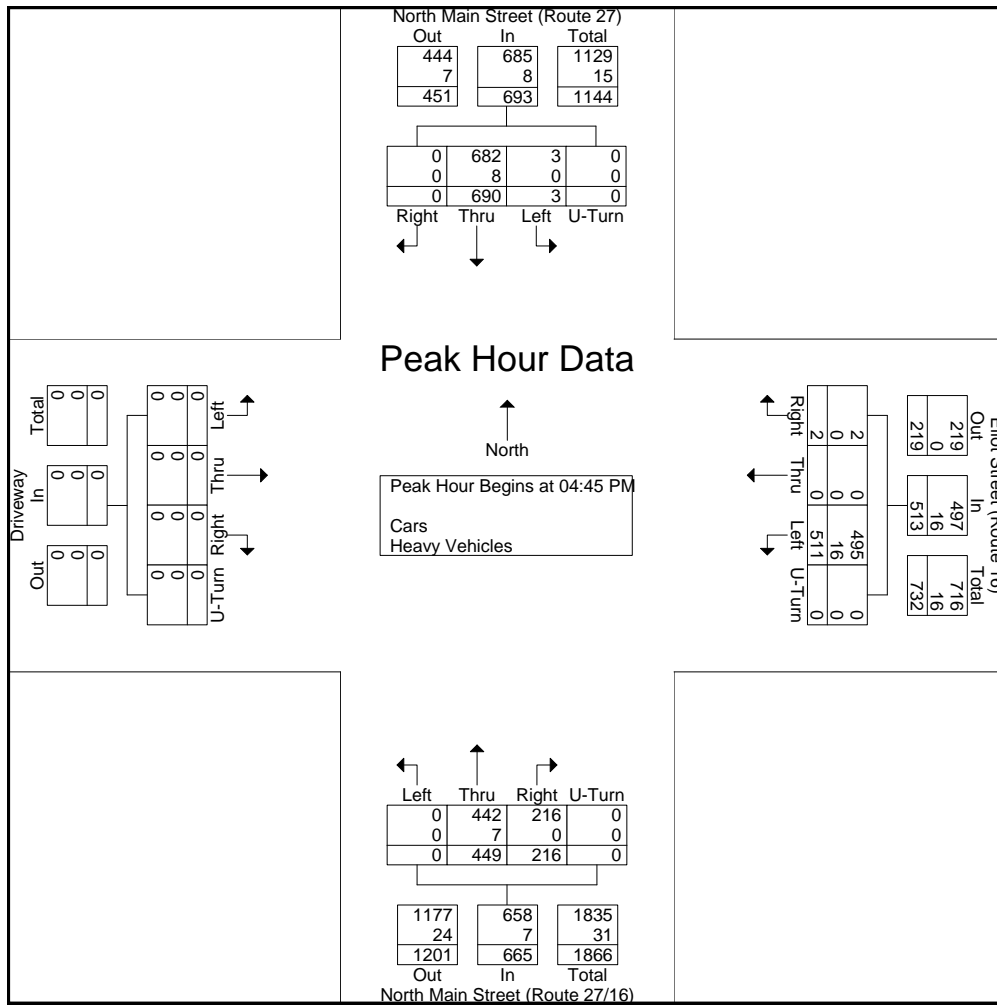
PRECISION
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INDUSTRIES, LLC

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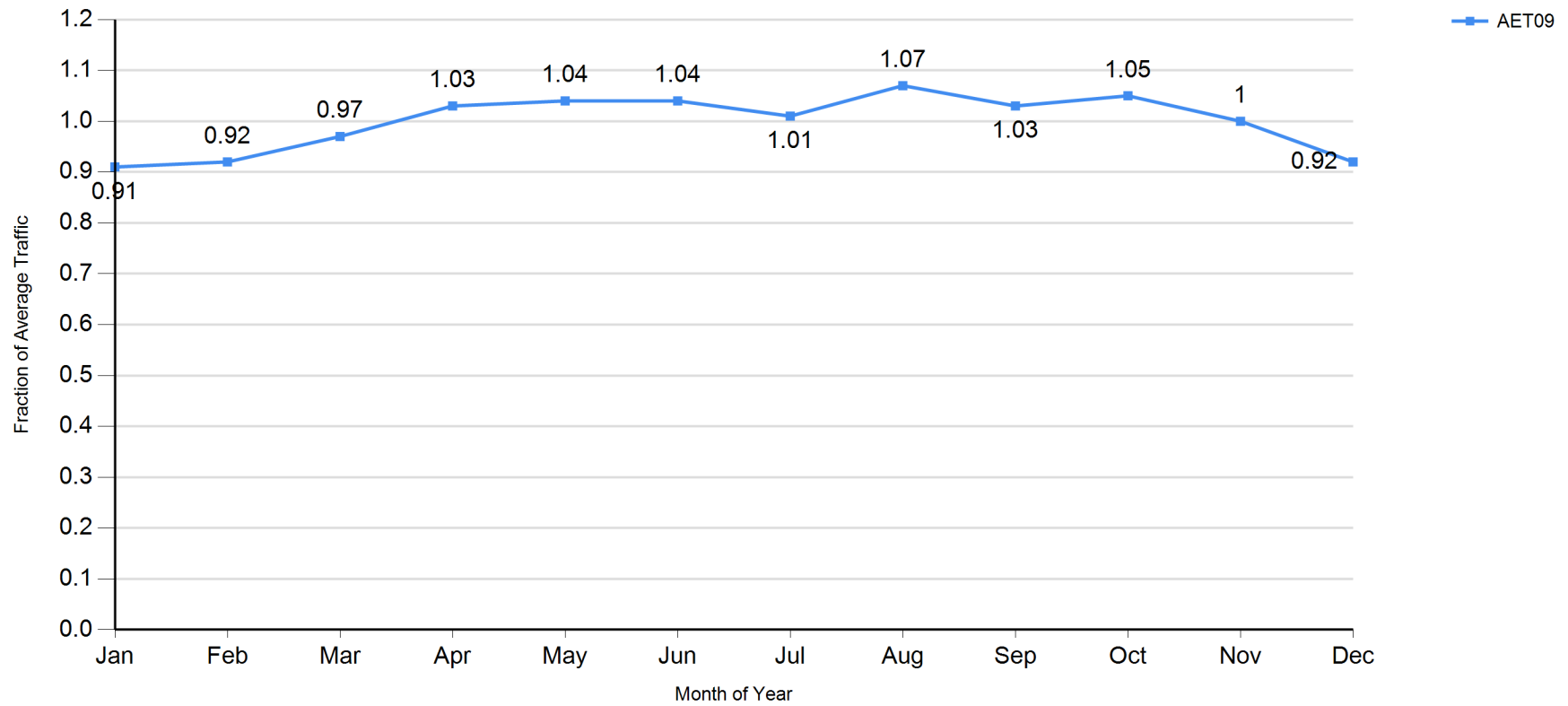
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	North Main Street (Route 27) From North					Eliot Street (Route 16) From East					North Main Street (Route 27/16) From South					Driveway From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:45 PM																					
04:45 PM	0	173	0	0	173	0	0	111	0	111	61	111	0	0	172	0	0	0	0	0	456
05:00 PM	0	168	1	0	169	0	0	134	0	134	45	98	0	0	143	0	0	0	0	0	446
05:15 PM	0	162	1	0	163	0	0	140	0	140	55	132	0	0	187	0	0	0	0	0	490
05:30 PM	0	187	1	0	188	2	0	126	0	128	55	108	0	0	163	0	0	0	0	0	479
Total Volume	0	690	3	0	693	2	0	511	0	513	216	449	0	0	665	0	0	0	0	0	1871
% App. Total	0	99.6	0.4	0		0.4	0	99.6	0		32.5	67.5	0	0		0	0	0	0		
PHF	.000	.922	.750	.000	.922	.250	.000	.913	.000	.916	.885	.850	.000	.000	.889	.000	.000	.000	.000	.000	.955
Cars	0	682	3	0	685	2	0	495	0	497	216	442	0	0	658	0	0	0	0	0	1840
% Cars	0	98.8	100	0	98.8	100	0	96.9	0	96.9	100	98.4	0	0	98.9	0	0	0	0	0	98.3
Heavy Vehicles	0	8	0	0	8	0	0	16	0	16	0	7	0	0	7	0	0	0	0	0	31
% Heavy Vehicles	0	1.2	0	0	1.2	0	0	3.1	0	3.1	0	1.6	0	0	1.1	0	0	0	0	0	1.7



SEASONAL ADJUSTMENT DATA

Traffic Pattern by Month for 1/1/2019 - 12/31/2019



Massachusetts Highway Department

Traffic Pattern by Month for 1/1/2019 - 12/31/2019

Factor Group	Station	Weight	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
U1-Boston	AET09	0	0.907	0.921	0.967	1.033	1.039	1.043	1.014	1.071	1.034	1.051	1.003	0.916
	Average of Weighted Factors		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

VEHICLE SPEED DATA

Accurate Counts
978-664-2565

Page 1

Location : Hunting Lane
Location : at # 31
City/State: Sherborn, MA

8586SPD1

WB

Start Time	1 3	4 6	7 9	10 12	13 15	16 18	19 21	22 24	25 27	28 30	31 33	34 36	37 39	40 999	Total
04/15/20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:00	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
05:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06:00	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
07:00	0	0	0	0	0	0	0	1	2	2	0	0	0	0	5
08:00	0	0	0	1	0	1	2	3	2	0	1	0	0	0	10
09:00	0	0	0	1	0	0	1	2	3	1	1	0	0	0	9
10:00	0	0	0	0	0	1	1	1	0	0	2	0	1	0	6
11:00	1	0	0	0	0	0	1	3	4	4	0	1	0	0	14
12 PM	0	0	0	0	0	1	3	2	5	3	4	0	1	0	19
13:00	0	0	0	0	1	1	2	3	2	1	2	0	1	1	14
14:00	0	0	1	0	1	1	0	2	4	6	5	1	1	0	22
15:00	0	0	0	0	0	0	0	5	3	1	0	1	1	0	11
16:00	1	0	0	0	0	1	2	3	0	0	1	0	0	0	8
17:00	1	0	1	0	0	2	1	1	3	3	1	2	0	0	15
18:00	0	0	0	0	0	0	0	1	0	4	1	2	0	0	8
19:00	0	0	0	0	1	0	0	1	0	0	2	0	1	0	5
20:00	1	0	0	0	0	1	1	0	0	0	0	0	0	0	3
21:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22:00	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	4	0	2	2	3	10	15	28	28	26	20	7	6	1	152

Daily

15th Percentile : 18 MPH
50th Percentile : 25 MPH
85th Percentile : 31 MPH
95th Percentile : 35 MPH

Mean Speed(Average) : 25 MPH
10 MPH Pace Speed : 22-31 MPH
Number in Pace : 89
Percent in Pace : 58.6%
Number of Vehicles > 30 MPH : 34
Percent of Vehicles > 30 MPH : 22.4%

Location : Hunting Lane
Location : at # 31
City/State: Sherborn, MA

8586SPD1

WB

Start Time	1 3	4 6	7 9	10 12	13 15	16 18	19 21	22 24	25 27	28 30	31 33	34 36	37 39	40 999	Total
04/16/20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:00	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
04:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06:00	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
07:00	0	0	0	0	0	1	0	0	1	1	1	1	0	0	5
08:00	0	0	0	1	0	0	1	1	3	1	2	0	1	0	10
09:00	0	0	0	0	0	0	3	0	3	1	1	1	0	1	10
10:00	1	0	0	0	0	0	1	2	1	1	0	0	0	0	6
11:00	0	0	0	0	1	2	0	5	5	2	1	1	0	0	17
12 PM	0	0	0	0	0	1	2	1	2	2	1	1	0	0	10
13:00	0	0	0	0	0	2	1	1	2	3	2	1	0	0	12
14:00	0	0	0	0	0	3	0	0	4	3	0	1	0	0	11
15:00	2	0	0	0	0	0	5	2	3	2	1	1	0	0	16
16:00	0	0	0	0	1	1	2	2	5	1	0	1	0	0	13
17:00	0	0	0	0	0	1	1	1	3	2	1	1	0	0	10
18:00	0	0	0	0	0	0	0	1	1	0	0	1	1	0	4
19:00	0	0	0	1	0	0	0	1	0	0	3	1	0	0	6
20:00	0	0	0	0	0	0	0	1	1	0	0	0	0	0	2
21:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22:00	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
23:00	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Total	3	0	0	2	2	12	16	19	34	21	13	11	2	1	136

Daily

15th Percentile : 18 MPH
50th Percentile : 25 MPH
85th Percentile : 31 MPH
95th Percentile : 34 MPH

Mean Speed(Average) : 25 MPH
10 MPH Pace Speed : 21-30 MPH
Number in Pace : 79
Percent in Pace : 58.1%
Number of Vehicles > 30 MPH : 27
Percent of Vehicles > 30 MPH : 19.9%

Grand Total	7	0	2	4	5	22	31	47	62	47	33	18	8	2	288
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Overall

15th Percentile : 18 MPH
50th Percentile : 25 MPH
85th Percentile : 31 MPH
95th Percentile : 34 MPH

Mean Speed(Average) : 25 MPH
10 MPH Pace Speed : 22-31 MPH
Number in Pace : 167
Percent in Pace : 58.0%
Number of Vehicles > 30 MPH : 61
Percent of Vehicles > 30 MPH : 21.2%

Location : Hunting Lane
Location : at # 31
City/State: Sherborn, MA

8586SPD1

EB

Start Time	1 3	4 6	7 9	10 12	13 15	16 18	19 21	22 24	25 27	28 30	31 33	34 36	37 39	40 999	Total
04/15/20	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:00	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2
03:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:00	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
05:00	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
06:00	0	0	0	0	0	0	0	0	1	1	0	1	0	0	3
07:00	0	0	0	0	0	0	0	0	0	1	1	0	2	0	4
08:00	0	0	0	0	1	0	0	0	1	1	2	3	0	0	8
09:00	0	0	0	0	0	1	0	3	2	3	2	1	0	0	12
10:00	0	0	0	0	0	1	2	0	2	2	3	0	2	1	13
11:00	0	0	0	0	0	1	0	2	4	1	4	5	1	0	18
12 PM	0	0	0	0	0	0	2	4	4	0	6	2	1	2	21
13:00	0	0	0	1	0	0	1	3	4	4	3	1	1	0	18
14:00	0	0	0	0	0	1	1	0	3	1	3	5	2	0	16
15:00	0	0	0	0	0	0	2	1	1	1	1	3	0	0	9
16:00	0	0	0	1	1	0	4	3	3	2	1	0	0	0	15
17:00	1	0	0	0	0	0	0	1	1	0	2	1	0	1	7
18:00	0	0	0	0	0	0	1	1	0	2	1	0	1	0	6
19:00	1	0	0	0	0	0	0	0	0	0	1	1	0	0	3
20:00	2	0	1	0	0	0	0	1	0	1	0	0	0	0	5
21:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	4	0	1	2	2	5	13	19	29	20	30	24	10	4	163

Daily

15th Percentile : 20 MPH
50th Percentile : 27 MPH
85th Percentile : 34 MPH
95th Percentile : 36 MPH

Mean Speed(Average) : 27 MPH
10 MPH Pace Speed : 25-34 MPH
Number in Pace : 87
Percent in Pace : 53.4%
Number of Vehicles > 30 MPH : 68
Percent of Vehicles > 30 MPH : 41.7%

Location : Hunting Lane
Location : at # 31
City/State: Sherborn, MA

8586SPD1

EB

Start Time	1 3	4 6	7 9	10 12	13 15	16 18	19 21	22 24	25 27	28 30	31 33	34 36	37 39	40 999	Total
04/16/20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:00	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
04:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:00	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2
06:00	0	0	0	0	0	0	1	1	0	0	0	0	0	0	2
07:00	0	0	0	0	0	0	0	2	0	1	2	2	1	1	9
08:00	0	0	0	0	0	0	2	3	2	2	0	2	0	0	11
09:00	0	0	0	0	0	0	1	1	2	1	2	0	1	2	10
10:00	2	0	1	0	2	3	0	1	1	6	4	3	0	0	23
11:00	0	0	0	0	0	0	3	0	2	1	1	1	1	2	11
12 PM	0	0	0	0	0	1	1	1	4	2	4	4	0	0	17
13:00	0	0	0	0	0	0	0	0	1	2	2	2	0	2	9
14:00	0	0	0	0	0	1	0	0	3	2	1	1	1	0	9
15:00	0	0	0	0	0	0	2	2	1	4	3	1	0	0	13
16:00	0	0	0	0	1	1	3	2	1	2	2	1	0	1	14
17:00	0	0	0	1	0	2	0	1	0	2	1	0	0	0	7
18:00	0	0	0	0	0	0	0	0	0	0	1	1	1	0	3
19:00	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
20:00	0	0	0	0	0	0	1	0	0	1	2	0	0	0	4
21:00	0	0	0	0	0	0	1	0	0	0	0	1	0	0	2
22:00	0	0	0	0	0	0	0	1	0	0	1	1	0	0	3
23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	2	0	1	1	3	9	15	15	17	27	26	21	5	9	151

Daily

15th Percentile : 19 MPH
50th Percentile : 27 MPH
85th Percentile : 33 MPH
95th Percentile : 35 MPH

Mean Speed(Average) : 27 MPH
10 MPH Pace Speed : 27-36 MPH
Number in Pace : 80
Percent in Pace : 53.0%
Number of Vehicles > 30 MPH : 61
Percent of Vehicles > 30 MPH : 40.4%

Grand Total	6	0	2	3	5	14	28	34	46	47	56	45	15	13	314
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Overall

15th Percentile : 19 MPH
50th Percentile : 27 MPH
85th Percentile : 33 MPH
95th Percentile : 35 MPH

Mean Speed(Average) : 27 MPH
10 MPH Pace Speed : 25-34 MPH
Number in Pace : 164
Percent in Pace : 52.2%
Number of Vehicles > 30 MPH : 129
Percent of Vehicles > 30 MPH : 41.1%

Location : Hunting Lane
Location : at # 31
City/State: Sherborn, MA

8586SPD1

WB, EB

Start Time	1 3	4 6	7 9	10 12	13 15	16 18	19 21	22 24	25 27	28 30	31 33	34 36	37 39	40 999	Total
04/15/20	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:00	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2
03:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:00	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2
05:00	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
06:00	0	0	0	0	0	0	0	0	1	2	0	1	0	0	4
07:00	0	0	0	0	0	0	0	1	2	3	1	0	2	0	9
08:00	0	0	0	1	1	1	2	3	3	1	3	3	0	0	18
09:00	0	0	0	1	0	1	1	5	5	4	3	1	0	0	21
10:00	0	0	0	0	0	2	3	1	2	2	5	0	3	1	19
11:00	1	0	0	0	0	1	1	5	8	5	4	6	1	0	32
12 PM	0	0	0	0	0	1	5	6	9	3	10	2	2	2	40
13:00	0	0	0	1	1	1	3	6	6	5	5	1	2	1	32
14:00	0	0	1	0	1	2	1	2	7	7	8	6	3	0	38
15:00	0	0	0	0	0	0	2	6	4	2	1	4	1	0	20
16:00	1	0	0	1	1	1	6	6	3	2	2	0	0	0	23
17:00	2	0	1	0	0	2	1	2	4	3	3	3	0	1	22
18:00	0	0	0	0	0	0	1	2	0	6	2	2	1	0	14
19:00	1	0	0	0	1	0	0	1	0	0	3	1	1	0	8
20:00	3	0	1	0	0	1	1	1	0	1	0	0	0	0	8
21:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22:00	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	8	0	3	4	5	15	28	47	57	46	50	31	16	5	315

Daily

15th Percentile : 19 MPH
50th Percentile : 26 MPH
85th Percentile : 33 MPH
95th Percentile : 36 MPH

Mean Speed(Average) : 26 MPH
10 MPH Pace Speed : 24-33 MPH
Number in Pace : 169
Percent in Pace : 53.7%
Number of Vehicles > 30 MPH : 102
Percent of Vehicles > 30 MPH : 32.4%

Location : Hunting Lane
Location : at # 31
City/State: Sherborn, MA

8586SPD1

WB, EB

Start Time	1 3	4 6	7 9	10 12	13 15	16 18	19 21	22 24	25 27	28 30	31 33	34 36	37 39	40 999	Total
04/16/20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:00	0	0	0	0	0	1	0	1	0	0	0	0	0	0	2
04:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:00	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2
06:00	0	0	0	0	0	0	1	1	0	1	0	0	0	0	3
07:00	0	0	0	0	0	1	0	2	1	2	3	3	1	1	14
08:00	0	0	0	1	0	0	3	4	5	3	2	2	1	0	21
09:00	0	0	0	0	0	0	4	1	5	2	3	1	1	3	20
10:00	3	0	1	0	2	3	1	3	2	7	4	3	0	0	29
11:00	0	0	0	0	1	2	3	5	7	3	2	2	1	2	28
12 PM	0	0	0	0	0	2	3	2	6	4	5	5	0	0	27
13:00	0	0	0	0	0	2	1	1	3	5	4	3	0	2	21
14:00	0	0	0	0	0	4	0	0	7	5	1	2	1	0	20
15:00	2	0	0	0	0	0	7	4	4	6	4	2	0	0	29
16:00	0	0	0	0	2	2	5	4	6	3	2	2	0	1	27
17:00	0	0	0	1	0	3	1	2	3	4	2	1	0	0	17
18:00	0	0	0	0	0	0	0	1	1	0	1	2	2	0	7
19:00	0	0	0	1	0	0	0	1	0	1	3	1	0	0	7
20:00	0	0	0	0	0	0	1	1	1	1	2	0	0	0	6
21:00	0	0	0	0	0	0	1	0	0	0	0	1	0	0	2
22:00	0	0	0	0	0	1	0	1	0	0	1	1	0	0	4
23:00	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Total	5	0	1	3	5	21	31	34	51	48	39	32	7	10	287

Daily

15th Percentile : 18 MPH
50th Percentile : 26 MPH
85th Percentile : 32 MPH
95th Percentile : 35 MPH

Mean Speed(Average) : 26 MPH
10 MPH Pace Speed : 24-33 MPH
Number in Pace : 149
Percent in Pace : 51.9%
Number of Vehicles > 30 MPH : 88
Percent of Vehicles > 30 MPH : 30.7%

Grand Total	13	0	4	7	10	36	59	81	108	94	89	63	23	15	602
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Overall

15th Percentile : 18 MPH
50th Percentile : 26 MPH
85th Percentile : 32 MPH
95th Percentile : 35 MPH

Mean Speed(Average) : 26 MPH
10 MPH Pace Speed : 24-33 MPH
Number in Pace : 318
Percent in Pace : 52.8%
Number of Vehicles > 30 MPH : 190
Percent of Vehicles > 30 MPH : 31.6%

MOTOR VEHICLE CRASH DATA

Crash Number	City Town Name	Crash Severity	Crash Status	Crash Time	Crash Year	Injury Severity Reported	Driver - Youngest Known	Driver Contributing Circumstances (All Drivers)	Light Conditions	Manner of Collision	MassDOT District	Road Surface Condition	Roadway Junction Type	Total Fatalities	Actions Prior to Crash (All Vehicles)	Travel Directions (All)	Weather Conditions	Vehicle Sequence of Events (All Vehicles)	Latitude	Longitude
3660670	SHERBORN	Property damage only (none injured)	Closed	5:28 PM	2013	No injury	35-44	D1: (Over-correcting/over-steering)	Dark - lighted roadway	Single vehicle crash	3	Snow	Not at junction	0	V1: Travelling	V1: E	Clear	V1:(Ran off road left),(Collision with tree)	42.248	-71.37
3660671	SHERBORN	Property damage only (none injured)	Closed	2:21 AM	2013	No injury	18-20	D1: (Operating vehicle in erratic, reckless, careless, negligent or aggressive manner),(Inattention)	Dark - lighted roadway	Single vehicle crash	3	Dry	T-intersection	0	V1: Travelling	V1: W	Clear	V1:(Collision with curb),(Collision with light pole or other post/support),(Collision with highway traffic sign post),(Collision with fence)	42.248	-71.37
3660751	SHERBORN	Non-fatal injury	Closed	7:00 PM	2013	al injury - f	25-34	D1: (No improper driving) / D2: (Unknown)	Daylight	Rear-end	3	Wet	Y-intersection	0	V1: Slowing d	V1: S / V2: S	Cloudy/Rain	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	42.248	-71.37
3661167	SHERBORN	Property damage only (none injured)	Closed	9:42 AM	2013	No injury	25-34	D1: (Failed to yield right of way) / D2: (No improper driving)	Daylight	Sideswipe, same direction	3	Wet	T-intersection	0	V1: Travelling	V1: N / V2: N	Rain	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	42.248	-71.37
3747449	SHERBORN	Property damage only (none injured)	Closed	2:56 PM	2013	No injury	18-20	D1: (Driving too fast for conditions) / D2: (No improper driving)	Daylight	Rear-end	3	Snow	T-intersection	0	V1: Travelling	V1: E / V2: E	Snow/Cloudy	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	42.248	-71.37
3799138	SHERBORN	Property damage only (none injured)	Closed	3:54 PM	2014	No injury	35-44	D1: (Inattention) / D2: (No improper driving)	Daylight	Rear-end	3	Wet	T-intersection	0	V1: Slowing d	V1: S / V2: S	Rain	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	42.248	-71.37
3822065	SHERBORN	Property damage only (none injured)	Closed	3:59 PM	2014	No injury	55-64	D1: (No improper driving) / D2: (Inattention),(Followed too closely)	Daylight	Rear-end	3	Wet	Not at junction	0	V1: Slowing d	V1: E / V2: E	Rain	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	42.248	-71.37
3886031	SHERBORN	Property damage only (none injured)	Closed	6:27 PM	2014	No injury	18-20	D1: (Other improper action) / D2: (No improper driving) / D3: (No improper driving)	Daylight	Rear-end	3	Wet	Not at junction	0	V1: Travelling	V1: W / V2: W / V3: W	Rain	V1:(Collision with parked motor vehicle) V2:(Collision with motor vehicle in traffic),(Collision with parked motor vehicle) V3:(Collision with motor vehicle in traffic)	42.248	-71.37
3886932	SHERBORN	Property damage only (none injured)	Closed	6:09 PM	2014	No injury	65-74	D1: (Made an improper turn) / D2: (Unknown)	Daylight	Angle	3	Dry	T-intersection	0	V1: Making U	V1: E / V2: E	Clear	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	42.248	-71.37
3980455	SHERBORN	Property damage only (none injured)	Closed	9:30 PM	2014	No injury	16-17	D1: (Other improper action) / D2: (No improper driving)	Dark - lighted roadway	Rear-end	3	Wet	T-intersection	0	V1: Travelling	V1: S / V2: S	Clear	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	42.248	-71.37
4025736	SHERBORN	Property damage only (none injured)	Closed	9:13 PM	2015	No injury	35-44	D1: (Driving too fast for conditions)	Dark - lighted roadway	Single vehicle crash	3	Snow	Not at junction	0	V1: Travelling	V1: E	Snow	V1:(Collision with curb),(Collision with highway traffic sign post)	42.248	-71.37
4065729	SHERBORN	Property damage only (none injured)	Closed	1:23 AM	2015	No injury	25-34	D1: (Inattention),(Distracted) / D2: (No improper driving)	Daylight	Rear-end	3	Dry	T-intersection	0	V1: Travelling	V1: N / V2: N	Clear	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	42.248	-71.37
4066046	SHERBORN	Non-fatal injury	Closed	2:48 PM	2015	ury - Non-i	25-34	D1: (No improper driving) / D2: (Driving too fast for conditions),(Other improper action)	Daylight	Rear-end	3	Dry	T-intersection	0	V1: Slowing d	V1: S / V2: S	Clear	V1:(Other) V2:(Other)	42.248	-71.37
4132419	SHERBORN	Non-fatal injury	Closed	12:18 PM	2015	ury - Non-i	55-64	D1: (Physical impairment)	Daylight	Single vehicle crash	3	Dry	Not at junction	0	V1: Turning le	V1: E	Clear	V1:(Collision with other fixed object(wall, building, tunnel, etc.))	42.248	-71.37

Crash Number	City Town Name	Crash Severity	Crash Status	Crash Time	Crash Year	Injury Severity Reported	Driver - Youngest Known	Driver Contributing Circumstances (All Drivers)	Light Conditions	Manner of Collision	MassDOT District	Road Surface Condition	Roadway Junction Type	Total Fatalities	Actions Prior to Crash (All Vehicles)	Travel Directions (All)	Weather Conditions	Vehicle Sequence of Events (All Vehicles)	Latitude	Longitude
4162274	SHERBORN	Non-fatal injury	Closed	3:51 PM	2016	jury - Non-injury	16-17	D1: (No improper driving) / D2: (Followed too closely),(Unknown)	Daylight	Rear-end	3	Dry	T-intersection	0	V1: Slowing down	V1: N / V2: N	Clear	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	42.248	-71.37
4162530	SHERBORN	Property damage only (none injured)	Closed	4:37 PM	2016	No injury	21-24	D1: (No improper driving) / D2: (Followed too closely),(Inattention)	Daylight	Rear-end	3	Dry	T-intersection	0	V1: Slowing down	V1: S / V2: S	Clear	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	42.248	-71.37
4182406	SHERBORN	Non-fatal injury	Closed	7:34 AM	2016	jury - Non-injury	18-20	D1: (No improper driving) / D2: (No improper driving)	Daylight	Angle	3	Dry	T-intersection	0	V1: Travelling	V1: N / V2: E	Clear	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	42.248	-71.37
4258931	SHERBORN	Property damage only (none injured)	Closed	9:46 AM	2016	No injury	75-84	D1: (Unknown) / D2: (Unknown)	Daylight	Unknown	3	Dry	T-intersection	0	V1: Slowing down	V1: W / V2: W	Clear	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	42.248	-71.37
4322777	SHERBORN	Non-fatal injury	Closed	3:18 PM	2017	al injury - Injury	45-54		Daylight	Rear-end	3	Dry	Four-way intersection	0	V1: Slowing down	V1: S / V2: S / V3: S	Clear	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic) V3:(Collision with motor vehicle in traffic)	42.248	-71.37
4354309	SHERBORN	Property damage only (none injured)	Closed	3:41 PM	2017	No injury	45-54	D1: (Inattention) / D2: (No improper driving)	Daylight	Rear-end	3	Dry	T-intersection	0	V1: Slowing down	V1: W / V2: W	Cloudy	V1:(Other),(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	42.248	-71.37
4423819	SHERBORN	Property damage only (none injured)	Closed	12:31 PM	2017	No injury	21-24	D1: (No improper driving) / D2: (Driving too fast for conditions),(Over-correcting/over-steering)	Daylight	Angle	3	Wet	T-intersection	0	V1: Slowing down	V1: W / V2: E	Cloudy/Rain	V1:(Collision with motor vehicle in traffic) V2:(Cross median or centerline),(Collision with motor vehicle in traffic)	42.248	-71.37
4428119	SHERBORN	Property damage only (none injured)	Closed	10:12 PM	2017	No injury	65-74	D1: (Driving too fast for conditions)	Dark - lighted roadway	Single vehicle crash	3	Dry	T-intersection	0	V1: Travelling	V1: W	Clear	V1:(Collision with other fixed object(wall, building, tunnel, etc.)),(Collision with curb),(Collision with highway traffic sign post)	42.248	-71.37
4474422	SHERBORN	Non-fatal injury	Closed	5:16 PM	2017	jury - Non-injury	45-54	D1: (Fatigued/asleep),(Followed too closely) / D2: (No improper driving) / D3: (No improper driving)	Dark - lighted roadway	Rear-end	3	Dry	Not at junction	0	V1: Travelling	V1: W / V2: W / V3: W	Clear	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic) V3:(Collision with motor vehicle in traffic)	42.248	-71.37
3747457	SHERBORN	Property damage only (none injured)	Closed	2:34 PM	2013	No injury	65-74	D1: (Inattention) / D2: (No improper driving)	Daylight	Rear-end	3	Dry	Not at junction	0	V1: Slowing down	V1: S / V2: S	Cloudy	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	42.25	-71.37
3747493	SHERBORN	Property damage only (none injured)	Closed	1:02 PM	2014	No injury	35-44	D1: (No improper driving) / D2: (Inattention),(Followed too closely)	Daylight	Rear-end	3	Wet	Not at junction	0	V1: Slowing down	V1: N / V2: N	Clear	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	42.25	-71.37
3748343	SHERBORN	Non-fatal injury	Closed	4:48 PM	2013	al injury - Injury	45-54	D1: (No improper driving)	Dark - lighted roadway	Rear-end	3	Wet	Not at junction	0	V1: Slowing down	V1: S	Clear	V1:(Collision with motor vehicle in traffic)	42.25	-71.37
3791714	SHERBORN	Property damage only (none injured)	Closed	8:18 AM	2014	No injury	25-34	D1: (No improper driving) / D2: (Unknown)	Daylight	Rear-end	3	Dry	Not at junction	0	V1: Slowing down	V1: S / V2: S	Clear	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	42.25	-71.37
3869335	SHERBORN	Property damage only (none injured)	Closed	9:09 AM	2014	No injury	25-34	D1: (No improper driving) / D2: (Unknown)	Daylight	Rear-end	3	Dry	Not at junction	0	V1: Slowing down	V1: N / V2: N	Clear	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	42.25	-71.37

Crash Number	City Town Name	Crash Severity	Crash Status	Crash Time	Crash Year	Injury Severity Reported	Driver - Youngest Known	Driver Contributing Circumstances (All Drivers)	Light Conditions	Manner of Collision	MassDOT District	Road Surface Condition	Roadway Junction Type	Total Fatalities	Actions Prior to Crash (All Vehicles)	Travel Directions (All)	Weather Conditions	Vehicle Sequence of Events (All Vehicles)	Latitude	Longitude
3895832	SHERBORN	Property damage only (none injured)	Closed	5:57 PM	2014	No injury	25-34	D1: (No improper driving) / D2: (Made an improper turn)	Daylight	Angle	3	Dry	Not at junction	0	V1: Slowing down	V1: N / V2: N	Clear	V1:(Other) V2:(Other)	42.25	-71.37
4049431	SHERBORN	Property damage only (none injured)	Closed	6:03 PM	2015	No injury	18-20	D1: (No improper driving) / D2: (Inattention)	Daylight	Rear-end	3	Dry	T-intersection	0	V1: Slowing down	V1: N / V2: N	Clear	V1:(Other) V2:(Other)	42.25	-71.37
4057958	SHERBORN	Property damage only (none injured)	Closed	10:49 AM	2015	No injury	45-54	D1: (No improper driving) / D2: (Failed to yield right of way)	Daylight	Sideswipe, opposite direction	3	Dry	Driveway	0	V1: Travelling	V1: N / V2: S	Clear	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	42.249	-71.37
4069696	SHERBORN	Non-fatal injury	Closed	4:41 PM	2015	al injury - f	25-34	D1: (No improper driving) / D2: (Driving too fast for conditions),(Followed too closely)	Daylight	Rear-end	3	Wet	T-intersection	0	V1: Slowing down	V1: N / V2: N	Cloudy/Rain	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	42.25	-71.37
4078655	SHERBORN	Non-fatal injury	Closed	5:40 AM	2015	ury - Non-in	55-64	D1: (Fatigued/asleep),(Operating vehicle in erratic, reckless, careless, negligent or aggressive manner)	Dawn	Single vehicle crash	3	Dry	Not at junction	0	V1: Travelling	V1: N	Clear	V1:(Ran off road right),(Collision with utility pole),(Overturn/rollover)	42.249	-71.37
4099834	SHERBORN	Property damage only (none injured)	Closed	10:08 AM	2015	No injury	45-54	D1: (No improper driving) / D2: (Unknown)	Daylight	Rear-end	3	Dry	T-intersection	0	V1: Slowing down	V1: N / V2: N	Clear	V1:(Collision with motor vehicle in traffic),(Ran off road right) V2:(Collision with motor vehicle in traffic)	42.25	-71.37
4185829	SHERBORN	Property damage only (none injured)	Closed	7:47 AM	2016	No injury	18-20	D1: (No improper driving) / D2: (No improper driving) / D3: (No improper driving) / D4: (Driving too fast for conditions)	Daylight	Rear-end	3	Wet	Not at junction	0	V1: Slowing down	V1: N / V2: N / V3: N / V4: N	Cloudy/Rain	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic) V3:(Collision with motor vehicle in traffic) V4:(Collision with motor vehicle in traffic)	42.249	-71.37
4326334	SHERBORN	Property damage only (none injured)	Closed	6:22 PM	2017	No injury	25-34	D1: (Followed too closely) / D2: (No improper driving)	Dark - roadway not lighted	Rear-end	3	Dry	Not at junction	0	V1: Travelling	V1: S / V2: S	Clear	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	42.25	-71.37
4327533	SHERBORN	Property damage only (none injured)	Closed	3:56 PM	2017	No injury	16-17	D1: (Inattention) / D2: (No improper driving)	Daylight	Rear-end	3	Dry	Not at junction	0	V1: Travelling	V1: N / V2: N	Clear	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	42.25	-71.37

CRASH RATE WORKSHEETS

Masshighway

CRASH RATE WORKSHEET

CITY/TOWN : Franklin COUNT DATE : 2020

DISTRICT : 3 UNSIGNALIZED : ☐ SIGNALIZED : ☒

MHD USE ONLY

Source #

~ INTERSECTION DATA ~

MAJOR STREET : Route 27

ST #

MINOR STREET(S) : Hunting Lane

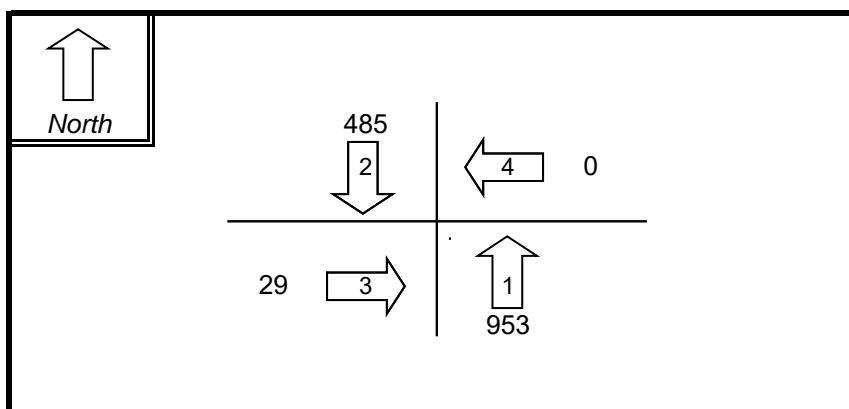
ST #

ST #

ST #

ST #

**INTERSECTION
DIAGRAM
(Label Approaches)**



INTERSECTION

REF #

Peak Hour Volumes

APPROACH :	1	2	3	4	5	Total Entering Vehicles
DIRECTION :	NB	SB	EB	WB		
VOLUMES (PM) :	953	485	29	0		1,467

" K " FACTOR : **0.083** APPROACH ADT : **17,675** ADT = TOTAL VOL/"K" FACT.

TOTAL # OF ACCIDENTS : **14** # OF YEARS : **5** AVERAGE # OF ACCIDENTS (A) : **2.80**

CRASH RATE CALCULATION : **0.43** RATE = $\frac{(A * 1,000,000)}{(ADT * 365)}$

Comments : Accident Rate for District 3 signalized intersections = 0.89

Accident Rate for District 3 unsignalized intersections = 0.61

Statewide Accident Rate for Signalized Intersection = 0.78 and Unsignalized/Intersection = 0.57

Masshighway

CRASH RATE WORKSHEET

CITY/TOWN : Franklin COUNT DATE : 2020

DISTRICT : 3 UNSIGNALIZED : ☐ SIGNALIZED : ☒

MHD USE ONLY

Source #

~ INTERSECTION DATA ~

MAJOR STREET : Route 27

ST #

MINOR STREET(S) : Route 16

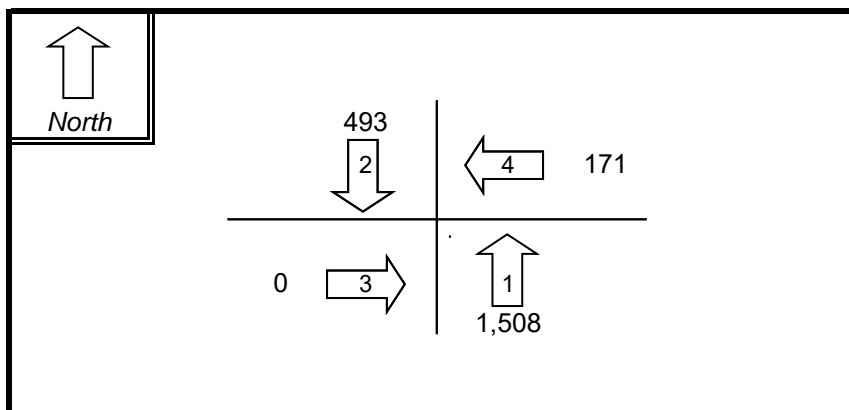
ST #

ST #

ST #

ST #

**INTERSECTION
DIAGRAM**
(Label Approaches)



INTERSECTION
REF #

Peak Hour Volumes

APPROACH :	1	2	3	4	5	Total Entering Vehicles
DIRECTION :	NB	SB	EB	WB		
VOLUMES (PM) :	1,508	493	0	171		2,172

" K " FACTOR : **0.083** APPROACH ADT : **26,169** ADT = TOTAL VOL/"K" FACT.

TOTAL # OF ACCIDENTS : **23** # OF YEARS : **5** AVERAGE # OF ACCIDENTS (A) : **4.60**

CRASH RATE CALCULATION : **0.48** RATE = $\frac{(A * 1,000,000)}{(ADT * 365)}$

Comments : Accident Rate for District 3 signalized intersections = 0.89

Accident Rate for District 3 unsignalized intersections = 0.61

Statewide Accident Rate for Signalized Intersection = 0.78 and Unsignalized/Intersection = 0.57

GENERAL BACKGROUND TRAFFIC GROWTH

Proposed Residential Building
Sherborn, MA

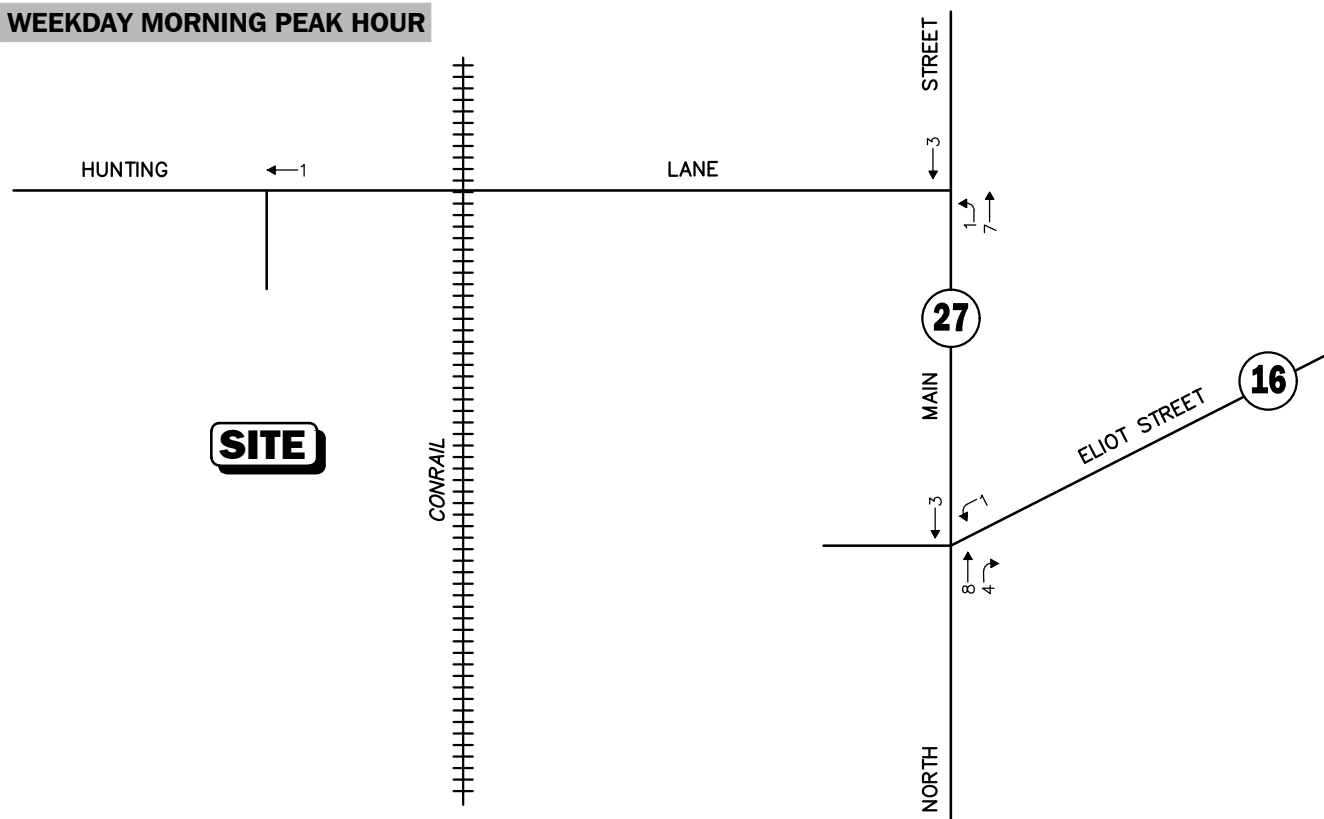
General Background Traffic Growth - Daily Traffic Volumes

Station Number	ROUTE/STREET	LOCATION	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Annual Growth Rate
411	NORTH MAIN STREET	Middlesex County	7,457		8,100					8,791	8,905	9,003	9,113	1.8%
39	NORTH MEADOWS ROAD	Norfolk County	7,500										8,513	1.3%
														1.50%

Adjusted Rate: 1.5

BACKGROUND DEVELOPMENT NETWORKS

WEEKDAY MORNING PEAK HOUR



WEEKDAY EVENING PEAK HOUR

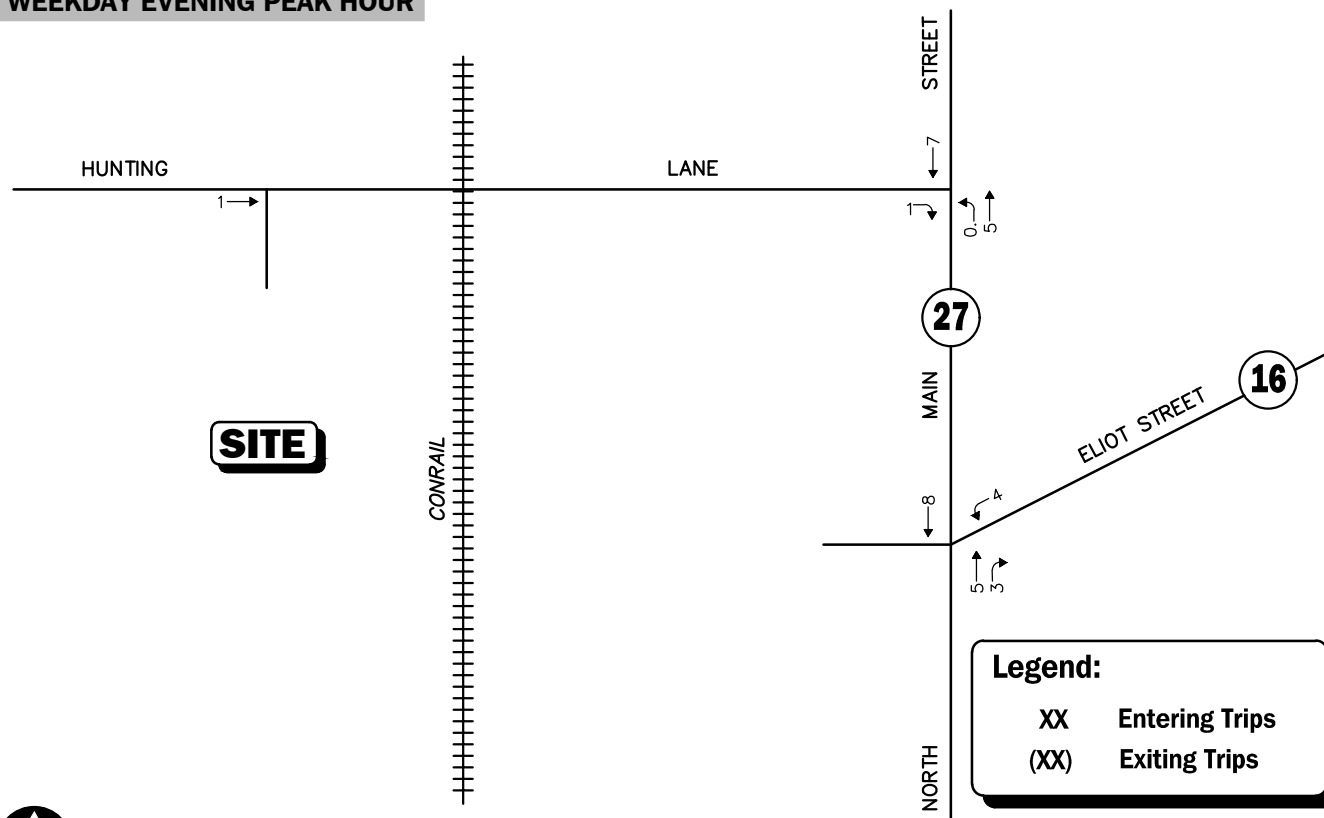
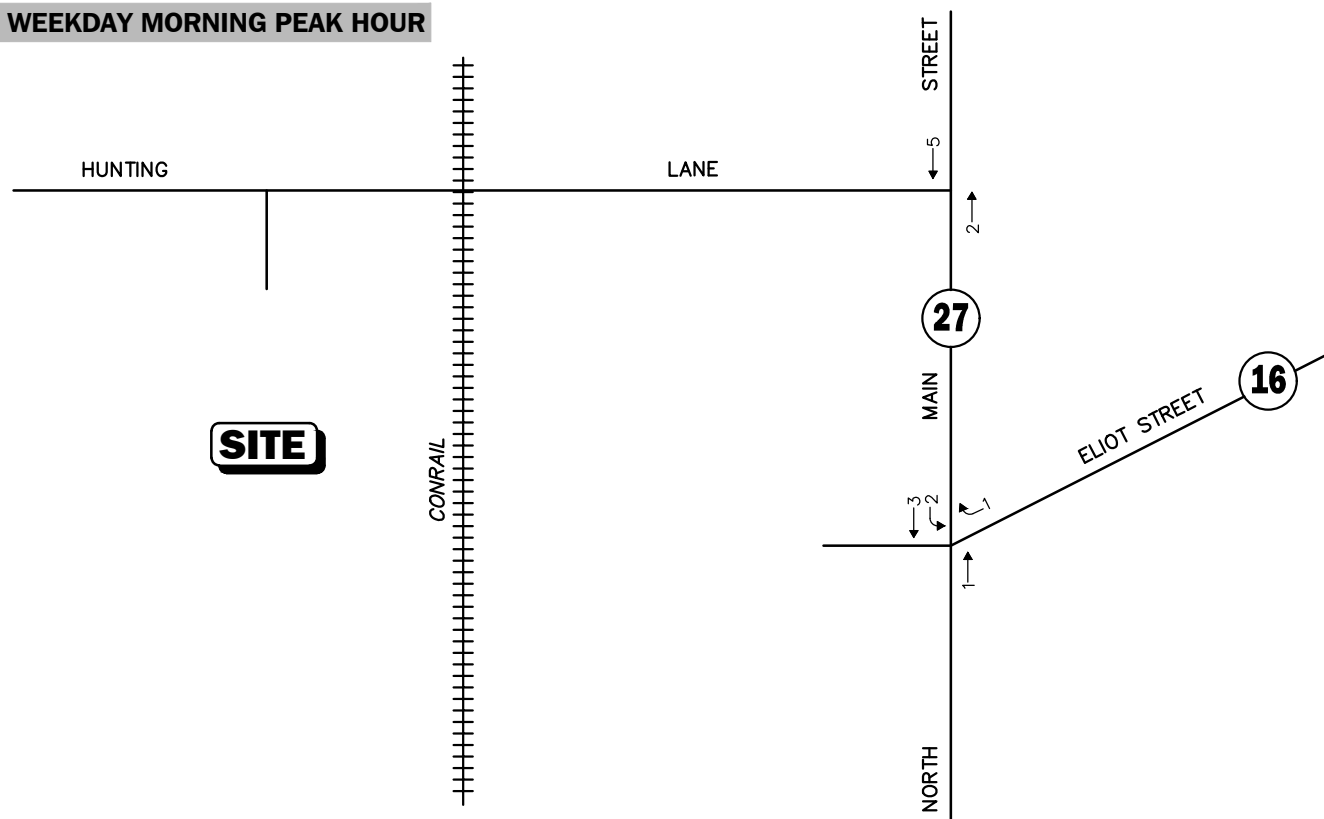
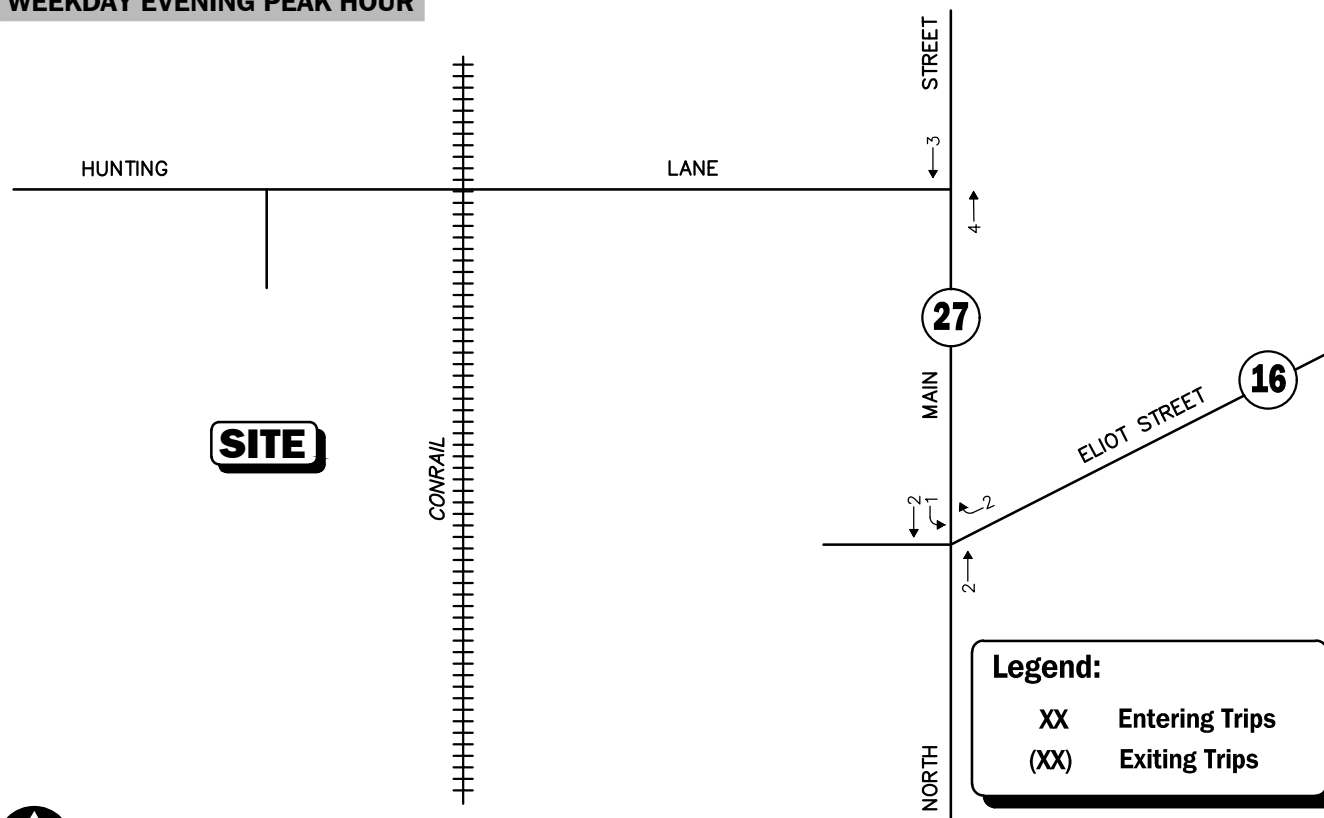


Figure A

WEEKDAY MORNING PEAK HOUR



WEEKDAY EVENING PEAK HOUR



Legend:

- XX Entering Trips
- (XX) Exiting Trips



Figure B

Background Development
59 North Main Street



TRIP-GENERATION CALCULATIONS

Land Use: 220

Multifamily Housing (Low-Rise)

Description

Low-rise multifamily housing includes apartments, townhouses, and condominiums located within the same building with at least three other dwelling units and that have one or two levels (floors). Multifamily housing (mid-rise) (Land Use 221), multifamily housing (high-rise) (Land Use 222), and off-campus student apartment (Land Use 225) are related land uses.

Additional Data

In prior editions of *Trip Generation Manual*, the low-rise multifamily housing sites were further divided into rental and condominium categories. An investigation of vehicle trip data found no clear differences in trip making patterns between the rental and condominium sites within the ITE database. As more data are compiled for future editions, this land use classification can be reinvestigated.

For the three sites for which both the number of residents and the number of occupied dwelling units were available, there were an average of 2.72 residents per occupied dwelling unit.

For the two sites for which the numbers of both total dwelling units and occupied dwelling units were available, an average of 96.2 percent of the total dwelling units were occupied.

This land use included data from a wide variety of units with different sizes, price ranges, locations, and ages. Consequently, there was a wide variation in trips generated within this category. Other factors, such as geographic location and type of adjacent and nearby development, may also have had an effect on the site trip generation.

Time-of-day distribution data for this land use are presented in Appendix A. For the 10 general urban/suburban sites with data, the overall highest vehicle volumes during the AM and PM on a weekday were counted between 7:15 and 8:15 a.m. and 4:45 and 5:45 p.m., respectively. For the one site with Saturday data, the overall highest vehicle volume was counted between 9:45 and 10:45 a.m. For the one site with Sunday data, the overall highest vehicle volume was counted between 11:45 a.m. and 12:45 p.m.

For the one dense multi-use urban site with 24-hour count data, the overall highest vehicle volumes during the AM and PM on a weekday were counted between 7:00 and 8:00 a.m. and 6:15 and 7:15 p.m., respectively.

For the three sites for which data were provided for both occupied dwelling units and residents, there was an average of 2.72 residents per occupied dwelling unit.

The average numbers of person trips per vehicle trip at the five general urban/suburban sites at which both person trip and vehicle trip data were collected were as follows:

- 1.13 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 7 and 9 a.m.
- 1.21 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 4 and 6 p.m.

The sites were surveyed in the 1980s, the 1990s, the 2000s, and the 2010s in British Columbia (CAN), California, District of Columbia, Florida, Georgia, Illinois, Indiana, Maine, Maryland, Minnesota, New Jersey, New York, Ontario, Oregon, Pennsylvania, South Dakota, Tennessee, Texas, Utah, Virginia, and Washington.

It is expected that the number of bedrooms and number of residents are likely correlated to the number of trips generated by a residential site. Many of the studies included in this land use did not indicate the total number of bedrooms. To assist in the future analysis of this land use, it is important that this information be collected and included in trip generation data submissions.

Source Numbers

168, 187, 188, 204, 211, 300, 305, 306, 319, 320, 321, 357, 390, 412, 418, 525, 530, 571, 579, 583, 864, 868, 869, 870, 896, 903, 918, 946, 947, 948, 951

Multifamily Housing (Low-Rise) (220)

Vehicle Trip Ends vs: Dwelling Units

On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.

Setting/Location: General Urban/Suburban

Number of Studies: 42

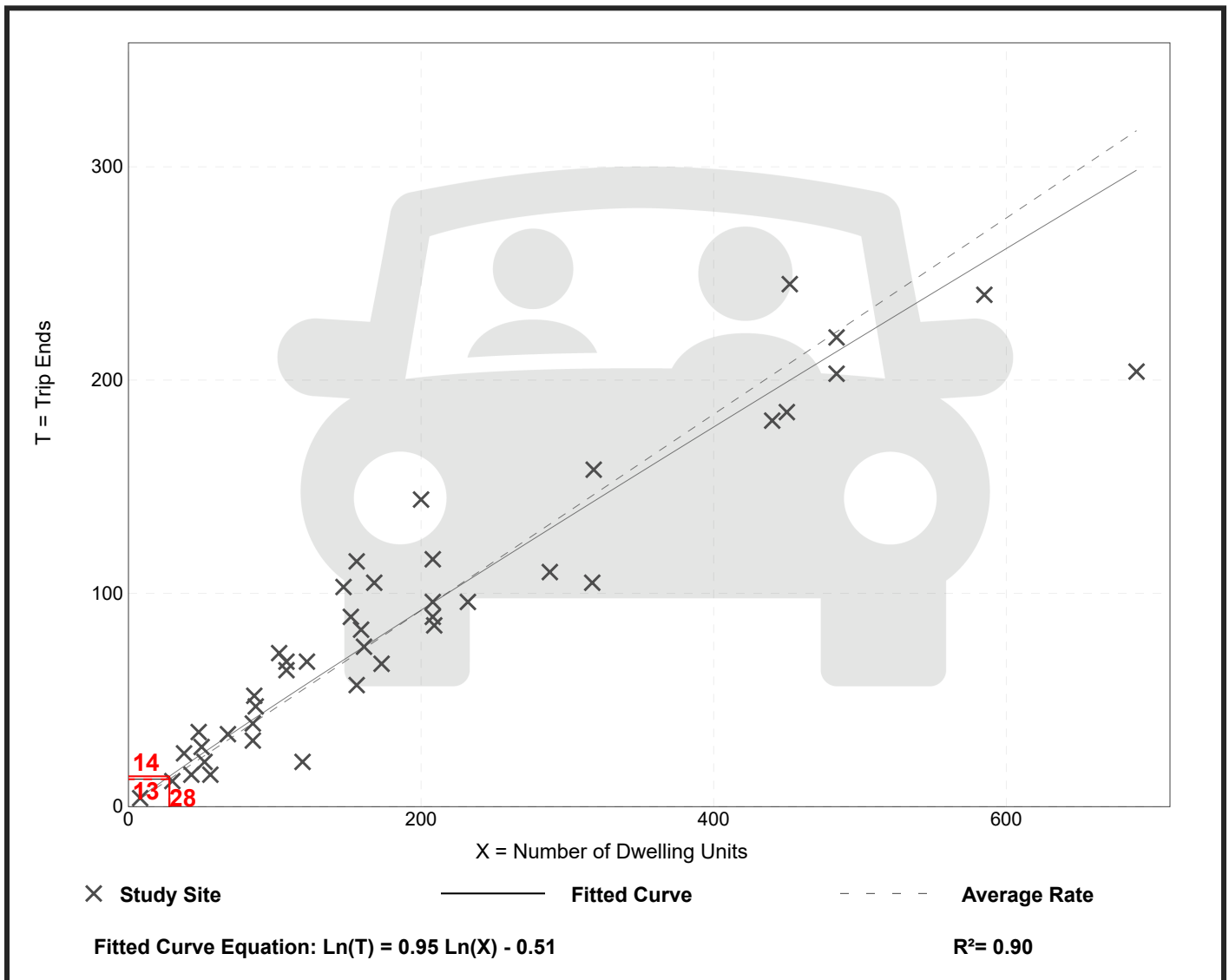
Avg. Num. of Dwelling Units: 199

Directional Distribution: 23% entering, 77% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.46	0.18 - 0.74	0.12

Data Plot and Equation



Multifamily Housing (Low-Rise) (220)

Vehicle Trip Ends vs: Dwelling Units

On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.

Setting/Location: General Urban/Suburban

Number of Studies: 50

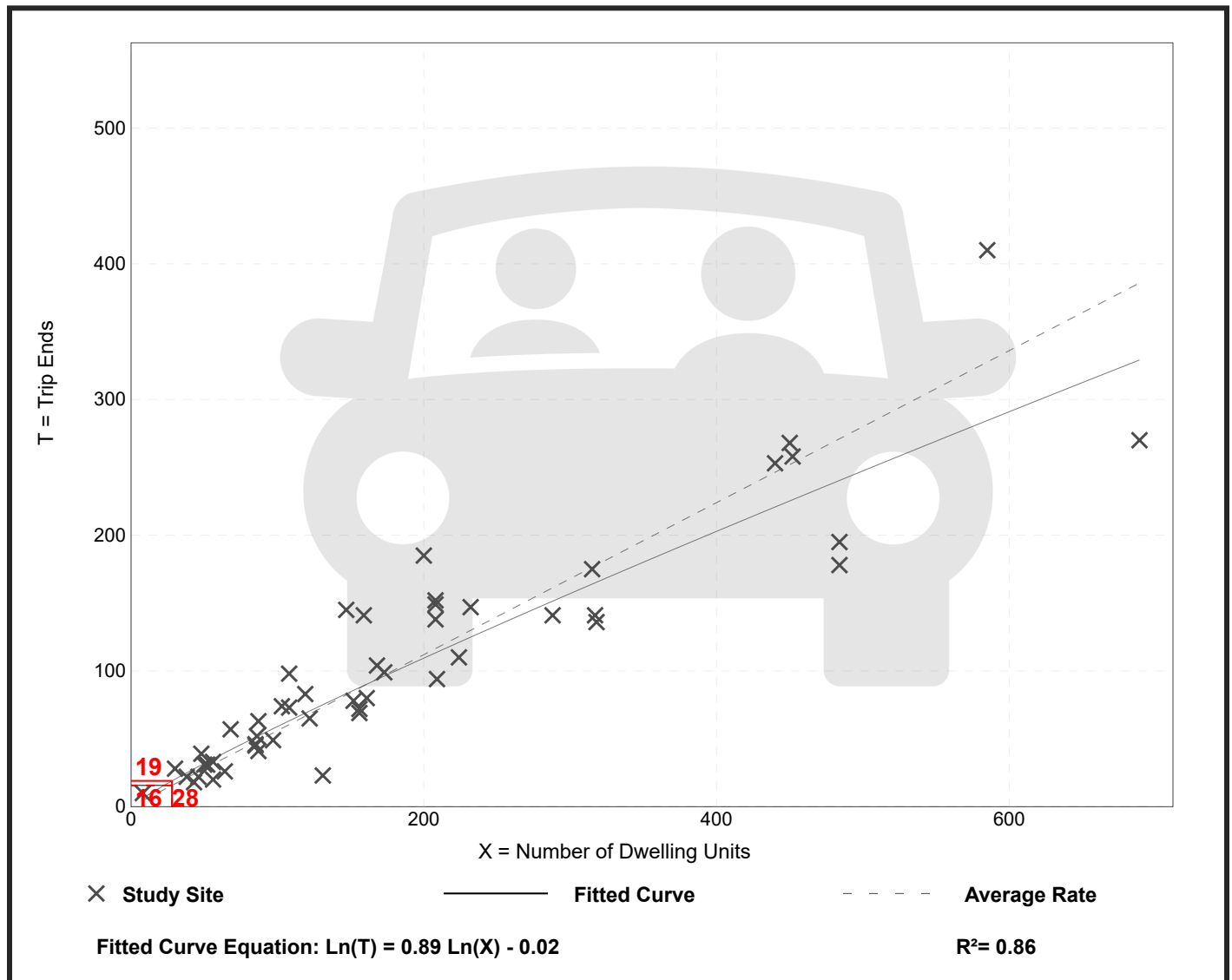
Avg. Num. of Dwelling Units: 187

Directional Distribution: 63% entering, 37% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.56	0.18 - 1.25	0.16

Data Plot and Equation



Multifamily Housing (Low-Rise) (220)

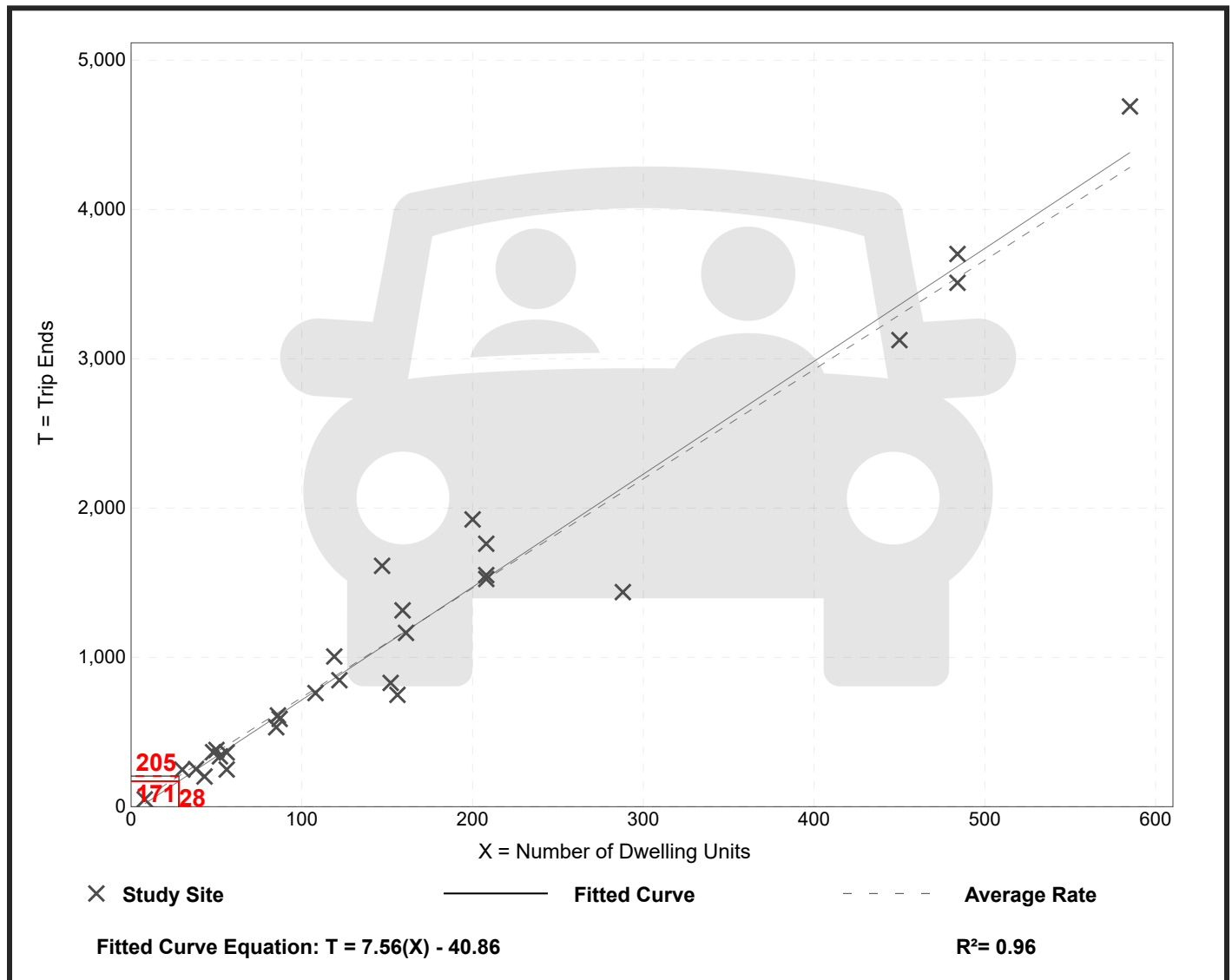
Vehicle Trip Ends vs: Dwelling Units
On a: Weekday

Setting/Location: General Urban/Suburban
Number of Studies: 29
Avg. Num. of Dwelling Units: 168
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
7.32	4.45 - 10.97	1.31

Data Plot and Equation



TRIP-DISTRIBUTION CALCULATIONS

Table 3. Residence MCD/County to Workplace MCD/County Commuting Flows for the United

For more information on sampling and estimation methods, confidentiality protection, and sampling and Universe: Workers 16 years and over.

Commuting flows are sorted by residence state, residence county, and residence minor civil division.

Residence						Place of Work			Commuting Flow
State FIPS Code	County FIPS Code	Minor Civil Division FIPS Code	State Name	County Name	Minor Civil Division Name	State Name	County Name	Minor Civil Division Name	Workers in Commuting Flow
25	017	61380	Massachu	Middlesex	Sherborn	Massachu	Suffolk	Boston	331
25	017	61380	Massachu	Middlesex	Sherborn	Massachu	Middlesex	Sherborn	299
25	017	61380	Massachu	Middlesex	Sherborn	Massachu	Middlesex	Natick	194
25	017	61380	Massachu	Middlesex	Sherborn	Massachu	Middlesex	Framingh	155
25	017	61380	Massachu	Middlesex	Sherborn	Massachu	Norfolk	Wellesley	127
25	017	61380	Massachu	Middlesex	Sherborn	Massachu	Middlesex	Newton	106
25	017	61380	Massachu	Middlesex	Sherborn	Massachu	Middlesex	Waltham	98
25	017	61380	Massachu	Middlesex	Sherborn	Massachu	Worcester	Worcester	50
25	017	61380	Massachu	Middlesex	Sherborn	Massachu	Middlesex	Concord	42
25	017	61380	Massachu	Middlesex	Sherborn	Massachu	Norfolk	Dover	42
25	017	61380	Massachu	Middlesex	Sherborn	Massachu	Worcester	Westboro	42
25	017	61380	Massachu	Middlesex	Sherborn	Massachu	Middlesex	Weston	31
25	017	61380	Massachu	Middlesex	Sherborn	Massachu	Middlesex	Wayland	29
25	017	61380	Massachu	Middlesex	Sherborn	Massachu	Norfolk	Needham	28
25	017	61380	Massachu	Middlesex	Sherborn	Massachu	Norfolk	Westwoo	26
25	017	61380	Massachu	Middlesex	Sherborn	Massachu	Middlesex	Cambridg	24
25	017	61380	Massachu	Middlesex	Sherborn	Massachu	Middlesex	Holliston	23

16.4% 20.1%
14.8% 18.2%
9.6% 11.8%
7.7% 9.4%
6.3% 7.7%
5.3% 6.4%
4.9% 6.0%
2.5% 3.0%
2.1% 2.6%
2.1% 2.6%
2.1% 2.6%
1.5% 1.9%
1.4% 1.8%
1.4% 1.7%
1.3% 1.6%
1.2% 1.5%
1.1% 1.4%

Exiting				%	Entering				%
Matrix %					Matrix %				
Hunting Lane	Route 27 North	Eliot Street East	Route 27 South		Hunting Lane	Route 27 North	Eliot Street East	Route 27 South	
	0.5	0.5		1		0.5	0.5		1
	0.2		0.8	1		0.2		0.8	1
	1			1		1			1
0.8	0.2			1	0.8	0.2			1
	0.5	0.5		1		0.5	0.5		1
	0.5	0.5		1		0.5	0.5		1
	0.5	0.5		1		0.5	0.5		1
	0.9		0.1	1		0.9		0.1	1
	1			1		1			1
		0.6	0.4	1			0.6	0.4	1
	0.4		0.6	1		0.4		0.6	1
	0.5	0.5		1		0.5	0.5		1
	1			1		1			1
		0.6	0.4	1			0.6	0.4	1
			1	1				1	1
	0.5	0.5		1		0.5	0.5		1
			1	1				1	1

Table 3. Residence MCD/County to Workplace MCD/County Commuting Flows for the United

For more information on sampling and estimation methods, confidentiality protection, and sampling and Universe: Workers 16 years and over.

Commuting flows are sorted by residence state, residence county, and residence minor civil division.

Residence						Place of Work			Commuting Flow
State FIPS Code	County FIPS Code	Minor Civil Division FIPS Code	State Name	County Name	Minor Civil Division Name	State Name	County Name	Minor Civil Division Name	Workers in Commuting Flow
25	017	61380	Massachu	Middlesex	Sherborn	Massachu	Suffolk	Boston	331
25	017	61380	Massachu	Middlesex	Sherborn	Massachu	Middlesex	Sherborn	299
25	017	61380	Massachu	Middlesex	Sherborn	Massachu	Middlesex	Natick	194
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25	017	61380	Massachu	Middlesex	Sherborn	Massachu	Norfolk	Wellesley	127
25	017	61380	Massachu	Middlesex	Sherborn	Massachu	Middlesex	Newton	106
25	017	61380	Massachu	Middlesex	Sherborn	Massachu	Middlesex	Waltham	98
25	017	61380	Massachu	Middlesex	Sherborn	Massachu	Worcester	Worcester	50
25	017	61380	Massachu	Middlesex	Sherborn	Massachu	Middlesex	Concord	42
25	017	61380	Massachu	Middlesex	Sherborn	Massachu	Norfolk	Dover	42
25	017	61380	Massachu	Middlesex	Sherborn	Massachu	Worcester	Westboro	42
25	017	61380	Massachu	Middlesex	Sherborn	Massachu	Middlesex	Weston	31
25	017	61380	Massachu	Middlesex	Sherborn	Massachu	Middlesex	Wayland	29
25	017	61380	Massachu	Middlesex	Sherborn	Massachu	Norfolk	Needham	28
25	017	61380	Massachu	Middlesex	Sherborn	Massachu	Norfolk	Westwoo	26
25	017	61380	Massachu	Middlesex	Sherborn	Massachu	Middlesex	Cambridg	24
25	017	61380	Massachu	Middlesex	Sherborn	Massachu	Middlesex	Holliston	23

2,019

1,647

Exiting				%	Entering				%
Trip Distribution					Trip Distribution				
Hunting Lane	Route 27 North	Eliot Street East	Route 27 South		Hunting Lane	Route 27 North	Eliot Street East	Route 27 South	
0	165.5	165.5	0	331	0	165.5	165.5	0	331
0	59.8	0	239.2	299	0	59.8	0	239.2	299
0	194	0	0	194	0	194	0	0	194
124	31	0	0	155	124	31	0	0	155
0	63.5	63.5	0	127	0	63.5	63.5	0	127
0	53	53	0	106	0	53	53	0	106
0	49	49	0	98	0	49	49	0	98
0	45	0	5	50	0	45	0	5	50
0	42	0	0	42	0	42	0	0	42
0	0	25.2	16.8	42	0	0	25.2	16.8	42
0	16.8	0	25.2	42	0	16.8	0	25.2	42
0	15.5	15.5	0	31	0	15.5	15.5	0	31
0	29	0	0	29	0	29	0	0	29
0	0	16.8	11.2	28	0	0	16.8	11.2	28
0	0	0	26	26	0	0	0	26	26
0	12	12	0	24	0	12	12	0	24
0	0	0	23	23	0	0	0	23	23
				1647					1647
124	776.1	400.5	346.4		124	776.1	400.5	346.4	
7.5%	47.1%	24.3%	21.0%		7.5%	47.1%	24.3%	21.0%	
5%	45%	25%	25%		5%	45%	25%	25%	

CAPACITY ANALYSIS

Route 27/Hunting Lane

Route 27/Route 16

Hunting Lane/Site Roadway

Route 27/Hunting Lane

HCM 2010 TWSC
4: North Main Street & Hunting Lane

2020 existing morning peak hour
10/02/2020

Intersection						
Int Delay, s/veh	0.5					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y			4	1	
Traffic Vol, veh/h	11	18	16	937	475	10
Future Vol, veh/h	11	18	16	937	475	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	12	20	17	1018	516	11

Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	1574	522	527	0	-	0
Stage 1	522	-	-	-	-	-
Stage 2	1052	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	121	555	1040	-	-	-
Stage 1	595	-	-	-	-	-
Stage 2	336	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	116	555	1040	-	-	-
Mov Cap-2 Maneuver	116	-	-	-	-	-
Stage 1	572	-	-	-	-	-
Stage 2	336	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	23.3	0.1	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1040	-	228	-	-
HCM Lane V/C Ratio	0.017	-	0.138	-	-
HCM Control Delay (s)	8.5	0	23.3	-	-
HCM Lane LOS	A	A	C	-	-
HCM 95th %tile Q(veh)	0.1	-	0.5	-	-

HCM 2010 TWSC
4: North Main Street & Hunting Lane

2020 existing evening peak hour
10/02/2020

Intersection						
Int Delay, s/veh	0.7					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y			↑	↑	
Traffic Vol, veh/h	13	18	16	501	776	10
Future Vol, veh/h	13	18	16	501	776	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	14	20	17	545	843	11




Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	1428	849	854	0	-	0
Stage 1	849	-	-	-	-	-
Stage 2	579	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	149	361	785	-	-	-
Stage 1	419	-	-	-	-	-
Stage 2	560	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	144	361	785	-	-	-
Mov Cap-2 Maneuver	144	-	-	-	-	-
Stage 1	406	-	-	-	-	-
Stage 2	560	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	24.2	0.3	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	785	-	221	-	-
HCM Lane V/C Ratio	0.022	-	0.152	-	-
HCM Control Delay (s)	9.7	0	24.2	-	-
HCM Lane LOS	A	A	C	-	-
HCM 95th %tile Q(veh)	0.1	-	0.5	-	-

Intersection

Int Delay, s/veh 0.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	12	20	19	1049	536	11
Future Vol, veh/h	12	20	19	1049	536	11
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	13	22	21	1140	583	12

Major/Minor	Minor2	Major1	Major2
Conflicting Flow All	1771	589	595
Stage 1	589	-	-
Stage 2	1182	-	-
Critical Hdwy	6.42	6.22	4.12
Critical Hdwy Stg 1	5.42	-	-
Critical Hdwy Stg 2	5.42	-	-
Follow-up Hdwy	3.518	3.318	2.218
Pot Cap-1 Maneuver	91	508	981
Stage 1	554	-	-
Stage 2	291	-	-
Platoon blocked, %			
Mov Cap-1 Maneuver	86	508	981
Mov Cap-2 Maneuver	86	-	-
Stage 1	522	-	-
Stage 2	291	-	-

Approach	EB	NB	SB
HCM Control Delay, s	29.9	0.2	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	981	-	179	-	-
HCM Lane V/C Ratio	0.021	-	0.194	-	-
HCM Control Delay (s)	8.7	0	29.9	-	-
HCM Lane LOS	A	A	D	-	-
HCM 95th %tile Q(veh)	0.1	-	0.7	-	-

Intersection						
Int Delay, s/veh	0.8					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y			↑	↑	
Traffic Vol, veh/h	14	21	18	565	871	11
Future Vol, veh/h	14	21	18	565	871	11
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	15	23	20	614	947	12

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	1607	953	959	0	-	0
Stage 1	953	-	-	-	-	-
Stage 2	654	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	116	314	717	-	-	-
Stage 1	375	-	-	-	-	-
Stage 2	517	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	111	314	717	-	-	-
Mov Cap-2 Maneuver	111	-	-	-	-	-
Stage 1	359	-	-	-	-	-
Stage 2	517	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	30.1	0.3	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	717	-	181	-	-
HCM Lane V/C Ratio	0.027	-	0.21	-	-
HCM Control Delay (s)	10.2	0	30.1	-	-
HCM Lane LOS	B	A	D	-	-
HCM 95th %tile Q(veh)	0.1	-	0.8	-	-

HCM 2010 TWSC
4: North Main Street & Hunting Lane

2027 build morning peak hour
10/02/2020

Intersection						
Int Delay, s/veh	1					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y			↑	↑	
Traffic Vol, veh/h	17	25	21	1049	536	12
Future Vol, veh/h	17	25	21	1049	536	12
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	18	27	23	1140	583	13




Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	1776	590	596	0	-	0
Stage 1	590	-	-	-	-	-
Stage 2	1186	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	91	508	980	-	-	-
Stage 1	554	-	-	-	-	-
Stage 2	290	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	85	508	980	-	-	-
Mov Cap-2 Maneuver	85	-	-	-	-	-
Stage 1	519	-	-	-	-	-
Stage 2	290	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	34	0.2	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	980	-	169	-	-
HCM Lane V/C Ratio	0.023	-	0.27	-	-
HCM Control Delay (s)	8.8	0	34	-	-
HCM Lane LOS	A	A	D	-	-
HCM 95th %tile Q(veh)	0.1	-	1	-	-

Intersection

Int Delay, s/veh 1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	17	24	24	565	871	16
Future Vol, veh/h	17	24	24	565	871	16
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	18	26	26	614	947	17

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	1622	956	964	0	-	0
Stage 1	956	-	-	-	-	-
Stage 2	666	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	113	313	714	-	-	-
Stage 1	373	-	-	-	-	-
Stage 2	511	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	107	313	714	-	-	-
Mov Cap-2 Maneuver	107	-	-	-	-	-
Stage 1	352	-	-	-	-	-
Stage 2	511	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	32.7	0.4	0
HCM LOS	D		











Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	714	-	174	-	-
HCM Lane V/C Ratio	0.037	-	0.256	-	-
HCM Control Delay (s)	10.2	0	32.7	-	-
HCM Lane LOS	B	A	D	-	-
HCM 95th %tile Q(veh)	0.1	-	1	-	-

Route 27/Route 16

Lanes, Volumes, Timings
5: North Main Street & Eliot Street






2020 existing morning peak hour

10/02/2020

							
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT	Ø9
Lane Configurations							
Traffic Volume (vph)	146	25	928	580	23	470	
Future Volume (vph)	146	25	928	580	23	470	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	
Storage Length (ft)	0	90		155	0		
Storage Lanes	1	1		1	0		
Taper Length (ft)	25				25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Frt		0.850		0.850			
Flt Protected	0.950					0.998	
Satd. Flow (prot)	1752	1272	1827	1553	0	1782	
Flt Permitted	0.950					0.854	
Satd. Flow (perm)	1752	1272	1827	1553	0	1525	
Right Turn on Red		Yes		Yes			
Satd. Flow (RTOR)		40		604			
Link Speed (mph)	40		30			30	
Link Distance (ft)	285		340			370	
Travel Time (s)	4.9		7.7			8.4	
Lane Group Flow (vph)	247	42	967	604	0	554	
Turn Type	Prot	Perm	NA	pm+ov	Perm	NA	
Protected Phases	8		2	8		6	9
Permitted Phases	8	8		2	6		
Detector Phase	8	8	2	8	6	6	
Switch Phase							
Minimum Initial (s)	1.0	1.0	5.0	1.0	5.0	5.0	5.0
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Total Split (s)	26.0	26.0	51.0	26.0	51.0	51.0	15.0
Total Split (%)	28.3%	28.3%	55.4%	28.3%	55.4%	55.4%	16%
Maximum Green (s)	20.0	20.0	45.0	20.0	45.0	45.0	9.0
Yellow Time (s)	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
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							
Lead-Lag Optimize?							
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	Min	None	None	None	None
Walk Time (s)							7.0
Flash Dont Walk (s)							11.0
Pedestrian Calls (#/hr)							0
Act Effct Green (s)	17.8	17.8	47.1	72.9		47.1	
Actuated g/C Ratio	0.24	0.24	0.65	1.00		0.65	
v/c Ratio	0.58	0.12	0.82	0.39		0.56	
Control Delay	29.9	8.6	18.6	0.7		10.8	
Queue Delay	0.0	0.0	0.0	0.0		0.0	
Total Delay	29.9	8.6	18.6	0.7		10.8	
LOS	C	A	B	A		B	
Approach Delay	26.8		11.7			10.8	
Approach LOS	C		B			B	

Lanes, Volumes, Timings
5: North Main Street & Eliot Street

2020 existing morning peak hour
10/02/2020

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT Ø9
Queue Length 50th (ft)	98	1	288	0		122
Queue Length 95th (ft)	99	10	#637	0		233
Internal Link Dist (ft)	205		260			290
Turn Bay Length (ft)		90		155		
Base Capacity (vph)	529	412	1180	1543		985
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	0.47	0.10	0.82	0.39		0.56

Intersection Summary

Area Type: Other

Cycle Length: 92

Actuated Cycle Length: 72.9

Natural Cycle: 120

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.82

Intersection Signal Delay: 13.3

Intersection LOS: B

Intersection Capacity Utilization 68.6%





ICU Level of Service C

Analysis Period (min) 15

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.












Splits and Phases: 5: North Main Street & Eliot Street

	Ø2			Ø9
51 s			15 s	
	Ø6		Ø8	
51 s		26 s		

HCM Signalized Intersection Capacity Analysis












5: North Main Street & Eliot Street

2020 existing morning peak hour
10/02/2020

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	146	25	928	580	23	470
Future Volume (vph)	146	25	928	580	23	470
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
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	0.85	1.00	0.85		1.00
Flt Protected	0.95	1.00	1.00	1.00		1.00
Satd. Flow (prot)	1752	1272	1827	1553		1781
Flt Permitted	0.95	1.00	1.00	1.00		0.85
Satd. Flow (perm)	1752	1272	1827	1553		1525
Peak-hour factor, PHF	0.59	0.59	0.96	0.96	0.89	0.89
Adj. Flow (vph)	247	42	967	604	26	528
RTOR Reduction (vph)	0	30	0	66	0	0
Lane Group Flow (vph)	247	12	967	538	0	554
Heavy Vehicles (%)	3%	27%	4%	4%	15%	6%
Turn Type	Prot	Perm	NA	pm+ov	Perm	NA
Protected Phases	8		2	8		6
Permitted Phases	8	8		2	6	
Actuated Green, G (s)	15.8	15.8	45.1	60.9		45.1
Effective Green, g (s)	17.8	17.8	47.1	64.9		47.1
Actuated g/C Ratio	0.24	0.24	0.65	0.89		0.65
Clearance Time (s)	6.0	6.0	6.0	6.0		6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0		3.0
Lane Grp Cap (vph)	427	310	1180	1553		985
v/s Ratio Prot	c0.14		c0.53	0.08		
v/s Ratio Perm		0.01		0.26		0.36
v/c Ratio	0.58	0.04	0.82	0.35		0.56
Uniform Delay, d1	24.2	21.0	9.7	0.6		7.2
Progression Factor	1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	1.9	0.1	4.6	0.1		0.7
Delay (s)	26.1	21.1	14.3	0.8		7.9
Level of Service	C	C	B	A		A
Approach Delay (s)	25.4		9.1			7.9
Approach LOS	C		A			A
Intersection Summary						
HCM 2000 Control Delay			10.8		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.83			
Actuated Cycle Length (s)			72.9		Sum of lost time (s)	14.0
Intersection Capacity Utilization			68.6%		ICU Level of Service	C
Analysis Period (min)			15			
c Critical Lane Group						

Lanes, Volumes, Timings
5: North Main Street & Eliot Street

2020 existing evening peak hour
10/02/2020

							
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT	Ø9
Lane Configurations							
Traffic Volume (vph)	586	2	515	247	3	791	
Future Volume (vph)	586	2	515	247	3	791	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	
Storage Length (ft)	0	90		155	0		
Storage Lanes	1	1		1	0		
Taper Length (ft)	25				25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Frt		0.850		0.850			
Flt Protected	0.950						
Satd. Flow (prot)	1752	1615	1863	1615	0	1900	
Flt Permitted	0.950					0.999	
Satd. Flow (perm)	1752	1615	1863	1615	0	1898	
Right Turn on Red		Yes		Yes			
Satd. Flow (RTOR)		1		278			
Link Speed (mph)	40		30			30	
Link Distance (ft)	285		340			370	
Travel Time (s)	4.9		7.7			8.4	
Peak Hour Factor	0.92	0.92	0.89	0.89	0.92	0.92	
Heavy Vehicles (%)	3%	0%	2%	0%	1%	0%	
Shared Lane Traffic (%)							
Lane Group Flow (vph)	637	2	579	278	0	863	
Enter Blocked Intersection	No	No	No	No	No	No	
Lane Alignment	Left	Right	Left	Right	Left	Left	
Median Width(ft)	12		0			0	
Link Offset(ft)	0		0			0	
Crosswalk Width(ft)	16		16			16	
Two way Left Turn Lane							
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Turning Speed (mph)	15	9		9	15		
Protected Phases	8		2	8		6	9
Permitted Phases	8	8		2	6		
Minimum Initial (s)	1.0	1.0	5.0	1.0	5.0	5.0	5.0
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Total Split (s)	26.0	26.0	51.0	26.0	51.0	51.0	15.0
Total Split (%)	28.3%	28.3%	55.4%	28.3%	55.4%	55.4%	16%
Maximum Green (s)	20.0	20.0	45.0	20.0	45.0	45.0	9.0
Yellow Time (s)	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
Lead/Lag							
Lead-Lag Optimize?							
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	Min	None	None	None	None
Walk Time (s)							7.0
Flash Dont Walk (s)							11.0
Pedestrian Calls (#/hr)							0
Act Effct Green (s)	22.3	22.3	39.9	70.3		39.9	
Actuated g/C Ratio	0.32	0.32	0.57	1.00		0.57	
v/c Ratio	1.15	0.00	0.55	0.17		0.80	

Lanes, Volumes, Timings
5: North Main Street & Eliot Street

2020 existing evening peak hour

10/02/2020

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Control Delay	114.0	17.0	11.4	0.2		18.4
Queue Delay	0.0	0.0	0.0	0.0		0.0
Total Delay	114.0	17.0	11.4	0.2		18.4
LOS	F	B	B	A		B
Approach Delay	113.7		7.8			18.4
Approach LOS	F		A			B
Queue Length 50th (ft)	~356	0	140	0		264
Queue Length 95th (ft)	#587	5	213	0		414
Internal Link Dist (ft)	205		260			290
Turn Bay Length (ft)		90		155		
Base Capacity (vph)	554	512	1260	1615		1283
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	1.15	0.00	0.46	0.17		0.67

Intersection Summary

Area Type: Other

Cycle Length: 92

Actuated Cycle Length: 70.3

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 1.15

Intersection Signal Delay: 40.4

Intersection LOS: D

Intersection Capacity Utilization 83.1%

ICU Level of Service E

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.












Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

5: North Main Street & Eliot Street












2020 existing evening peak hour

10/02/2020

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	586	2	515	247	3	791
Future Volume (vph)	586	2	515	247	3	791
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
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	0.85	1.00	0.85		1.00
Flt Protected	0.95	1.00	1.00	1.00		1.00
Satd. Flow (prot)	1752	1615	1863	1615		1900
Flt Permitted	0.95	1.00	1.00	1.00		1.00
Satd. Flow (perm)	1752	1615	1863	1615		1897
Peak-hour factor, PHF	0.92	0.92	0.89	0.89	0.92	0.92
Adj. Flow (vph)	637	2	579	278	3	860
RTOR Reduction (vph)	0	1	0	32	0	0
Lane Group Flow (vph)	637	1	579	246	0	863
Heavy Vehicles (%)	3%	0%	2%	0%	1%	0%
Turn Type	Prot	Perm	NA	pm+ov	Perm	NA
Protected Phases	8		2	8		6
Permitted Phases	8	8		2	6	
Actuated Green, G (s)	20.2	20.2	37.9	58.1		37.9
Effective Green, g (s)	22.2	22.2	39.9	62.1		39.9
Actuated g/C Ratio	0.32	0.32	0.57	0.89		0.57
Clearance Time (s)	6.0	6.0	6.0	6.0		6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0		3.0
Lane Grp Cap (vph)	554	511	1060	1615		1079
v/s Ratio Prot	c0.36		0.31	0.05		
v/s Ratio Perm		0.00		0.10		c0.45
v/c Ratio	1.15	0.00	0.55	0.15		0.80
Uniform Delay, d1	23.9	16.4	9.4	0.5		11.9
Progression Factor	1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	86.8	0.0	0.6	0.0		4.2
Delay (s)	110.7	16.4	10.0	0.6		16.2
Level of Service	F	B	B	A		B
Approach Delay (s)	110.4		7.0			16.2
Approach LOS	F		A			B
Intersection Summary						
HCM 2000 Control Delay			38.4		HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio			1.02			
Actuated Cycle Length (s)			70.1		Sum of lost time (s)	14.0
Intersection Capacity Utilization			83.1%		ICU Level of Service	E
Analysis Period (min)			15			
c Critical Lane Group						

Lanes, Volumes, Timings
5: North Main Street & Eliot Street







2027 no build morning peak hour
10/02/2020

							
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT	Ø9
Lane Configurations							
Traffic Volume (vph)	163	29	1039	648	28	528	
Future Volume (vph)	163	29	1039	648	28	528	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	
Storage Length (ft)	0	90		155	0		
Storage Lanes	1	1		1	0		
Taper Length (ft)	25				25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Frt		0.850		0.850			
Flt Protected	0.950					0.998	
Satd. Flow (prot)	1752	1272	1827	1553	0	1781	
Flt Permitted	0.950					0.617	
Satd. Flow (perm)	1752	1272	1827	1553	0	1101	
Right Turn on Red		Yes		Yes			
Satd. Flow (RTOR)		42		675			
Link Speed (mph)	40		30			30	
Link Distance (ft)	285		340			370	
Travel Time (s)	4.9		7.7			8.4	
Peak Hour Factor	0.59	0.59	0.96	0.96	0.89	0.89	
Heavy Vehicles (%)	3%	27%	4%	4%	15%	6%	
Adj. Flow (vph)	276	49	1082	675	31	593	
Shared Lane Traffic (%)							
Lane Group Flow (vph)	276	49	1082	675	0	624	
Enter Blocked Intersection	No	No	No	No	No	No	
Lane Alignment	Left	Right	Left	Right	Left	Left	
Median Width(ft)	12		0			0	
Link Offset(ft)	0		0			0	
Crosswalk Width(ft)	16		16			16	
Two way Left Turn Lane							
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Turning Speed (mph)	15	9		9	15		
Number of Detectors	1	1	2	1	1	2	
Detector Template	Left	Right	Thru	Right	Left	Thru	
Leading Detector (ft)	20	20	100	20	20	100	
Trailing Detector (ft)	0	0	0	0	0	0	
Detector 1 Position(ft)	0	0	0	0	0	0	
Detector 1 Size(ft)	20	20	6	20	20	6	
Detector 1 Type	CI+Ex	CI+Ex	CI+Ex	CI+Ex	CI+Ex	CI+Ex	
Detector 1 Channel							
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(ft)			94			94	
Detector 2 Size(ft)			6			6	
Detector 2 Type			CI+Ex			CI+Ex	
Detector 2 Channel							
Detector 2 Extend (s)			0.0			0.0	
Turn Type	Prot	Perm	NA	pm+ov	Perm	NA	
Protected Phases	8		2	8		6	9

Lanes, Volumes, Timings
5: North Main Street & Eliot Street

2027 no build morning peak hour

10/02/2020

							
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT	Ø9
Permitted Phases	8	8		2	6		
Detector Phase	8	8	2	8	6	6	
Switch Phase							
Minimum Initial (s)	1.0	1.0	5.0	1.0	5.0	5.0	5.0
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Total Split (s)	26.0	26.0	51.0	26.0	51.0	51.0	15.0
Total Split (%)	28.3%	28.3%	55.4%	28.3%	55.4%	55.4%	16%
Maximum Green (s)	20.0	20.0	45.0	20.0	45.0	45.0	9.0
Yellow Time (s)	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
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							
Lead-Lag Optimize?							
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	Min	None	None	None	None
Walk Time (s)							7.0
Flash Dont Walk (s)							11.0
Pedestrian Calls (#/hr)							0
Act Effct Green (s)	18.7	18.7	47.1	73.9		47.1	
Actuated g/C Ratio	0.25	0.25	0.64	1.00		0.64	
v/c Ratio	0.62	0.14	0.93	0.43		0.89	
Control Delay	31.0	9.4	29.1	0.9		30.8	
Queue Delay	0.0	0.0	0.0	0.0		0.0	
Total Delay	31.0	9.4	29.1	0.9		30.8	
LOS	C	A	C	A		C	
Approach Delay	27.8		18.3			30.8	
Approach LOS	C		B			C	
Queue Length 50th (ft)	111	2	417	0		226	
Queue Length 95th (ft)	110	12	#760	0		#476	
Internal Link Dist (ft)	205		260			290	
Turn Bay Length (ft)		90		155			
Base Capacity (vph)	523	409	1165	1547		702	
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	0.53	0.12	0.93	0.44		0.89	

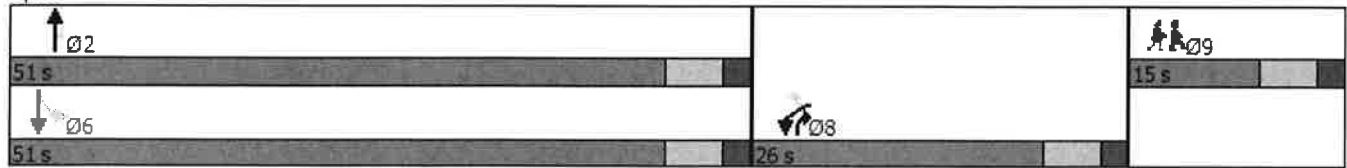
Intersection Summary

Area Type: Other
 Cycle Length: 92
 Actuated Cycle Length: 73.9
 Natural Cycle: 130
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.93
 Intersection Signal Delay: 22.3
 Intersection Capacity Utilization 76.1%
 Analysis Period (min) 15
 # 95th percentile volume exceeds capacity, queue may be longer.

Intersection LOS: C
 ICU Level of Service D

Queue shown is maximum after two cycles.













Splits and Phases: 5: North Main Street & Eliot Street



HCM Signalized Intersection Capacity Analysis 5: North Main Street & Eliot Street

2027 no build morning peak hour












10/02/2020

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	163	29	1039	648	28	528
Future Volume (vph)	163	29	1039	648	28	528
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
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
Fr't	1.00	0.85	1.00	0.85		1.00
Flt Protected	0.95	1.00	1.00	1.00		1.00
Satd. Flow (prot)	1752	1272	1827	1553		1781
Flt Permitted	0.95	1.00	1.00	1.00		0.62
Satd. Flow (perm)	1752	1272	1827	1553		1101
Peak-hour factor, PHF	0.59	0.59	0.96	0.96	0.89	0.89
Adj. Flow (vph)	276	49	1082	675	31	593
RTOR Reduction (vph)	0	31	0	73	0	0
Lane Group Flow (vph)	276	18	1082	602	0	624
Heavy Vehicles (%)	3%	27%	4%	4%	15%	6%
Turn Type	Prot	Perm	NA	pm+ov	Perm	NA
Protected Phases	8		2	8		6
Permitted Phases	8	8		2	6	
Actuated Green, G (s)	16.7	16.7	45.1	61.8		45.1
Effective Green, g (s)	18.7	18.7	47.1	65.8		47.1
Actuated g/C Ratio	0.25	0.25	0.64	0.89		0.64
Clearance Time (s)	6.0	6.0	6.0	6.0		6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0		3.0
Lane Grp Cap (vph)	443	322	1166	1553		702
v/s Ratio Prot	c0.16		c0.59	0.10		
v/s Ratio Perm		0.01		0.29		0.57
v/c Ratio	0.62	0.05	0.93	0.39		0.89
Uniform Delay, d1	24.4	20.9	11.8	0.7		11.2
Progression Factor	1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	2.7	0.1	12.5	0.2		13.1
Delay (s)	27.1	20.9	24.4	0.8		24.3
Level of Service	C	C	C	A		C
Approach Delay (s)	26.2		15.3			24.3
Approach LOS	C		B			C
Intersection Summary						
HCM 2000 Control Delay			18.7		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.93			
Actuated Cycle Length (s)			73.8		Sum of lost time (s)	14.0
Intersection Capacity Utilization			76.1%		ICU Level of Service	D
Analysis Period (min)			15			
c Critical Lane Group						

Lanes, Volumes, Timings
5: North Main Street & Eliot Street

2027 no build evening peak hour







10/02/2020

							
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT	Ø9
Lane Configurations							
Traffic Volume (vph)	654	4	579	277	4	888	
Future Volume (vph)	654	4	579	277	4	888	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	
Storage Length (ft)	0	90		155	0		
Storage Lanes	1	1		1	0		
Taper Length (ft)	25				25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Frt		0.850		0.850			
Flt Protected	0.950						
Satd. Flow (prot)	1752	1615	1863	1615	0	1900	
Flt Permitted	0.950					0.998	
Satd. Flow (perm)	1752	1615	1863	1615	0	1896	
Right Turn on Red		Yes		Yes			
Satd. Flow (RTOR)		1		311			
Link Speed (mph)	40		30			30	
Link Distance (ft)	285		340			370	
Travel Time (s)	4.9		7.7			8.4	
Peak Hour Factor	0.92	0.92	0.89	0.89	0.92	0.92	
Heavy Vehicles (%)	3%	0%	2%	0%	1%	0%	
Shared Lane Traffic (%)							
Lane Group Flow (vph)	711	4	651	311	0	969	
Enter Blocked Intersection	No	No	No	No	No	No	
Lane Alignment	Left	Right	Left	Right	Left	Left	
Median Width(ft)	12		0			0	
Link Offset(ft)	0		0			0	
Crosswalk Width(ft)	16		16			16	
Two way Left Turn Lane							
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Turning Speed (mph)	15	9		9	15		
Turn Type	Prot	Perm	NA	pm+ov	Perm	NA	
Protected Phases	8		2	8		6	9
Permitted Phases	8	8		2	6		
Minimum Initial (s)	1.0	1.0	5.0	1.0	5.0	5.0	5.0
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Total Split (s)	26.0	26.0	51.0	26.0	51.0	51.0	24.0
Total Split (%)	25.7%	25.7%	50.5%	25.7%	50.5%	50.5%	24%
Maximum Green (s)	20.0	20.0	45.0	20.0	45.0	45.0	18.0
Yellow Time (s)	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
Total Lost Time (s)	4.0	4.0	4.0	4.0		4.0	
Lead/Lag							
Lead-Lag Optimize?							
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	Min	None	Min	Min	None
Walk Time (s)							7.0
Flash Dont Walk (s)							11.0
Pedestrian Calls (#/hr)							0
Act Effct Green (s)	22.0	22.0	47.0	77.0		47.0	

Lanes, Volumes, Timings
5: North Main Street & Eliot Street

2027 no build evening peak hour

10/02/2020

							
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT	Ø9
Actuated g/C Ratio	0.29	0.29	0.61	1.00		0.61	
v/c Ratio	1.42	0.01	0.57	0.19		0.84	
Control Delay	227.5	18.2	11.5	0.3		20.6	
Queue Delay	0.0	0.0	0.0	0.0		0.0	
Total Delay	227.5	18.2	11.5	0.3		20.6	
LOS	F	B	B	A		C	
Approach Delay	226.4		7.9			20.6	
Approach LOS	F		A			C	
Queue Length 50th (ft)	~468	1	167	0		331	
Queue Length 95th (ft)	#669	8	253	0		#567	
Internal Link Dist (ft)	205		260			290	
Turn Bay Length (ft)		90		155			
Base Capacity (vph)	500	462	1137	1615		1157	
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	1.42	0.01	0.57	0.19		0.84	

Intersection Summary

Area Type: Other

Cycle Length: 101

Actuated Cycle Length: 77

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 1.42

Intersection Signal Delay: 71.6

Intersection LOS: E

Intersection Capacity Utilization 92.8%

ICU Level of Service F

Analysis Period (min) 15





~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 5: North Main Street & Eliot Street












	Ø2				Ø9
51 s				24 s	
	Ø6			Ø8	
51 s		26 s			

HCM Signalized Intersection Capacity Analysis

5: North Main Street & Eliot Street

2027 no build evening peak hour












10/02/2020

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	654	4	579	277	4	888
Future Volume (vph)	654	4	579	277	4	888
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
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	0.85	1.00	0.85		1.00
Flt Protected	0.95	1.00	1.00	1.00		1.00
Satd. Flow (prot)	1752	1615	1863	1615		1900
Flt Permitted	0.95	1.00	1.00	1.00		1.00
Satd. Flow (perm)	1752	1615	1863	1615		1896
Peak-hour factor, PHF	0.92	0.92	0.89	0.89	0.92	0.92
Adj. Flow (vph)	711	4	651	311	4	965
RTOR Reduction (vph)	0	1	0	32	0	0
Lane Group Flow (vph)	711	3	651	279	0	969
Heavy Vehicles (%)	3%	0%	2%	0%	1%	0%
Turn Type	Prot	Perm	NA	pm+ov	Perm	NA
Protected Phases	8		2	8		6
Permitted Phases	8	8		2	6	
Actuated Green, G (s)	20.0	20.0	45.0	65.0		45.0
Effective Green, g (s)	22.0	22.0	47.0	69.0		47.0
Actuated g/C Ratio	0.29	0.29	0.61	0.90		0.61
Clearance Time (s)	6.0	6.0	6.0	6.0		6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0		3.0
Lane Grp Cap (vph)	500	461	1137	1615		1157
v/s Ratio Prot	c0.41		0.35	0.05		
v/s Ratio Perm		0.00		0.12		c0.51
v/c Ratio	1.42	0.01	0.57	0.17		0.84
Uniform Delay, d1	27.5	19.7	9.0	0.5		12.0
Progression Factor	1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	201.3	0.0	0.7	0.1		5.4
Delay (s)	228.8	19.7	9.7	0.5		17.4
Level of Service	F	B	A	A		B
Approach Delay (s)	227.7		6.7			17.4
Approach LOS	F		A			B
Intersection Summary						
HCM 2000 Control Delay	70.3			HCM 2000 Level of Service		E
HCM 2000 Volume to Capacity ratio	1.12					
Actuated Cycle Length (s)	77.0			Sum of lost time (s)		14.0
Intersection Capacity Utilization	92.8%			ICU Level of Service		F
Analysis Period (min)	15					
c Critical Lane Group						

Lanes, Volumes, Timings
5: North Main Street & Eliot Street

2027 build morning peak hour

10/02/2020

							
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT	Ø9
Lane Configurations							
Traffic Volume (vph)	163	30	1040	648	31	530	
Future Volume (vph)	163	30	1040	648	31	530	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	
Storage Length (ft)	0	90		155	0		
Storage Lanes	1	1		1	0		
Taper Length (ft)	25				25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Frt		0.850		0.850			
Flt Protected	0.950					0.997	
Satd. Flow (prot)	1752	1272	1827	1553	0	1893	
Flt Permitted	0.950					0.587	
Satd. Flow (perm)	1752	1272	1827	1553	0	1115	
Right Turn on Red		Yes		Yes			
Satd. Flow (RTOR)		44		675			
Link Speed (mph)	40		30			30	
Link Distance (ft)	285		340			370	
Travel Time (s)	4.9		7.7			8.4	
Peak Hour Factor	0.59	0.59	0.96	0.96	0.89	0.89	
Heavy Vehicles (%)	3%	27%	4%	4%	1%	0%	
Shared Lane Traffic (%)							
Lane Group Flow (vph)	276	51	1083	675	0	631	
Enter Blocked Intersection	No	No	No	No	No	No	
Lane Alignment	Left	Right	Left	Right	Left	Left	
Median Width(ft)	12		0			0	
Link Offset(ft)	0		0			0	
Crosswalk Width(ft)	16		16			16	
Two way Left Turn Lane							
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Turning Speed (mph)	15	9		9	15		
Turn Type	Prot	Perm	NA	pm+ov	Perm	NA	
Protected Phases	8		2	8		6	9
Permitted Phases	8	8		2	6		
Detector Phase	8	8	2	8	6	6	
Switch Phase							
Minimum Initial (s)	1.0	1.0	5.0	1.0	5.0	5.0	5.0
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Total Split (s)	26.0	26.0	51.0	26.0	51.0	51.0	15.0
Total Split (%)	28.3%	28.3%	55.4%	28.3%	55.4%	55.4%	16%
Maximum Green (s)	20.0	20.0	45.0	20.0	45.0	45.0	9.0
Yellow Time (s)	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
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							
Lead-Lag Optimize?							
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	Min	None	Min	Min	None
Walk Time (s)							7.0

Lanes, Volumes, Timings
5: North Main Street & Eliot Street

2027 build morning peak hour
10/02/2020

	↖	↗	↑	↘	↙	↓	
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT	Ø9
Flash Dont Walk (s)							11.0
Pedestrian Calls (#/hr)							0
Act Effct Green (s)	18.7	18.7	47.1	73.9		47.1	
Actuated g/C Ratio	0.25	0.25	0.64	1.00		0.64	
v/c Ratio	0.62	0.14	0.93	0.43		0.89	
Control Delay	31.0	9.4	29.2	0.9		30.5	
Queue Delay	0.0	0.0	0.0	0.0		0.0	
Total Delay	31.0	9.4	29.2	0.9		30.5	
LOS	C	A	C	A		C	
Approach Delay	27.6		18.3			30.5	
Approach LOS	C		B			C	
Queue Length 50th (ft)	111	2	419	0		228	
Queue Length 95th (ft)	110	12	#761	0		#480	
Internal Link Dist (ft)	205		260			290	
Turn Bay Length (ft)		90		155			
Base Capacity (vph)	523	410	1165	1547		711	
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	0.53	0.12	0.93	0.44		0.89	

Intersection Summary

Area Type: Other
 Cycle Length: 92
 Actuated Cycle Length: 73.9
 Natural Cycle: 130
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.93
 Intersection Signal Delay: 22.3
 Intersection LOS: C
 Intersection Capacity Utilization 76.4%
 ICU Level of Service D
 Analysis Period (min) 15
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 5: North Main Street & Eliot Street












↑ Ø2		15 s
51 s		
↓ Ø6	↘ Ø8	
51 s	26 s	

HCM Signalized Intersection Capacity Analysis

5: North Main Street & Eliot Street

2027 build morning peak hour

10/02/2020

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	163	30	1040	648	31	530
Future Volume (vph)	163	30	1040	648	31	530
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
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	0.85	1.00	0.85		1.00
Flt Protected	0.95	1.00	1.00	1.00		1.00
Satd. Flow (prot)	1752	1272	1827	1553		1894
Flt Permitted	0.95	1.00	1.00	1.00		0.59
Satd. Flow (perm)	1752	1272	1827	1553		1115
Peak-hour factor, PHF	0.59	0.59	0.96	0.96	0.89	0.89
Adj. Flow (vph)	276	51	1083	675	35	596
RTOR Reduction (vph)	0	33	0	73	0	0
Lane Group Flow (vph)	276	18	1083	602	0	631
Heavy Vehicles (%)	3%	27%	4%	4%	1%	0%
Turn Type	Prot	Perm	NA	pm+ov	Perm	NA
Protected Phases	8		2	8		6
Permitted Phases	8	8		2	6	
Actuated Green, G (s)	16.7	16.7	45.1	61.8		45.1
Effective Green, g (s)	18.7	18.7	47.1	65.8		47.1
Actuated g/C Ratio	0.25	0.25	0.64	0.89		0.64
Clearance Time (s)	6.0	6.0	6.0	6.0		6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0		3.0
Lane Grp Cap (vph)	443	322	1166	1553		711
v/s Ratio Prot	c0.16		c0.59	0.10		
v/s Ratio Perm		0.01		0.29		0.57
v/c Ratio	0.62	0.06	0.93	0.39		0.89
Uniform Delay, d1	24.4	20.9	11.9	0.7		11.1
Progression Factor	1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	2.7	0.1	12.6	0.2		12.9
Delay (s)	27.1	20.9	24.5	0.8		24.0
Level of Service	C	C	C	A		C
Approach Delay (s)	26.2		15.4			24.0
Approach LOS	C		B			C
Intersection Summary						
HCM 2000 Control Delay			18.7		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.93			
Actuated Cycle Length (s)			73.8		Sum of lost time (s)	14.0
Intersection Capacity Utilization			76.4%		ICU Level of Service	D
Analysis Period (min)			15			
c Critical Lane Group						

Lanes, Volumes, Timings
5: North Main Street & Eliot Street







2027 build evening peak hour

10/02/2020

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	←	→	↑	↑	←	→
Traffic Volume (vph)	654	7	582	277	6	889
Future Volume (vph)	654	7	582	277	6	889
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	90		155	0	
Storage Lanes	1	1		1	0	
Taper Length (ft)	25				25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850		0.850		
Flt Protected	0.950					
Satd. Flow (prot)	1752	1615	1863	1615	0	1900
Flt Permitted	0.950					0.996
Satd. Flow (perm)	1752	1615	1863	1615	0	1892
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		3		311		
Link Speed (mph)	40		30			30
Link Distance (ft)	285		340			370
Travel Time (s)	4.9		7.7			8.4
Peak Hour Factor	0.92	0.92	0.89	0.89	0.92	0.92
Heavy Vehicles (%)	3%	0%	2%	0%	1%	0%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	711	8	654	311	0	973
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		0			0
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Turn Type	Prot	Perm	NA	pm+ov	Perm	NA
Protected Phases	8		2	8		6
Permitted Phases	8	8		2	6	
Minimum Initial (s)	1.0	1.0	5.0	1.0	5.0	5.0
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	24.0
Total Split (s)	26.0	26.0	51.0	26.0	51.0	51.0
Total Split (%)	28.3%	28.3%	55.4%	28.3%	55.4%	55.4%
Maximum Green (s)	20.0	20.0	45.0	20.0	45.0	45.0
Yellow Time (s)	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
Total Lost Time (s)	4.0	4.0	4.0	4.0		4.0
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	Min	None	Min	Min
Walk Time (s)						7.0
Flash Dont Walk (s)						11.0
Pedestrian Calls (#/hr)						0
Act Effct Green (s)	22.0	22.0	47.0	77.0		47.0

Lanes, Volumes, Timings
5: North Main Street & Eliot Street

2027 build evening peak hour
10/02/2020

							
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT	Ø9
Actuated g/C Ratio	0.29	0.29	0.61	1.00		0.61	
v/c Ratio	1.42	0.02	0.58	0.19		0.84	
Control Delay	227.5	17.0	11.5	0.3		20.9	
Queue Delay	0.0	0.0	0.0	0.0		0.0	
Total Delay	227.5	17.0	11.5	0.3		20.9	
LOS	F	B	B	A		C	
Approach Delay	225.2		7.9			20.9	
Approach LOS	F		A			C	
Queue Length 50th (ft)	~468	2	168	0		334	
Queue Length 95th (ft)	#669	11	254	0		#624	
Internal Link Dist (ft)	205		260			290	
Turn Bay Length (ft)		90		155			
Base Capacity (vph)	500	463	1137	1615		1154	
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	1.42	0.02	0.58	0.19		0.84	

Intersection Summary

Area Type: Other

Cycle Length: 92

Actuated Cycle Length: 77

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 1.42

Intersection Signal Delay: 71.5

Intersection LOS: E

Intersection Capacity Utilization 94.5%

ICU Level of Service F

Analysis Period (min) 15





~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 5: North Main Street & Eliot Street












	Ø2			Ø9
51 s			15 s	
	Ø6		Ø8	
51 s		26 s		

HCM Signalized Intersection Capacity Analysis

5: North Main Street & Eliot Street

2027 build evening peak hour











10/02/2020

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	654	7	582	277	6	889
Future Volume (vph)	654	7	582	277	6	889
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
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	0.85	1.00	0.85		1.00
Flt Protected	0.95	1.00	1.00	1.00		1.00
Satd. Flow (prot)	1752	1615	1863	1615		1899
Flt Permitted	0.95	1.00	1.00	1.00		1.00
Satd. Flow (perm)	1752	1615	1863	1615		1892
Peak-hour factor, PHF	0.92	0.92	0.89	0.89	0.92	0.92
Adj. Flow (vph)	711	8	654	311	7	966
RTOR Reduction (vph)	0	2	0	32	0	0
Lane Group Flow (vph)	711	6	654	279	0	973
Heavy Vehicles (%)	3%	0%	2%	0%	1%	0%
Turn Type	Prot	Perm	NA	pm+ov	Perm	NA
Protected Phases	8		2	8		6
Permitted Phases	8	8		2	6	
Actuated Green, G (s)	20.0	20.0	45.0	65.0		45.0
Effective Green, g (s)	22.0	22.0	47.0	69.0		47.0
Actuated g/C Ratio	0.29	0.29	0.61	0.90		0.61
Clearance Time (s)	6.0	6.0	6.0	6.0		6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0		3.0
Lane Grp Cap (vph)	500	461	1137	1615		1154
v/s Ratio Prot	c0.41		0.35	0.05		
v/s Ratio Perm		0.00		0.12		c0.51
v/c Ratio	1.42	0.01	0.58	0.17		0.84
Uniform Delay, d1	27.5	19.7	9.0	0.5		12.0
Progression Factor	1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	201.3	0.0	0.7	0.1		5.8
Delay (s)	228.8	19.7	9.7	0.5		17.8
Level of Service	F	B	A	A		B
Approach Delay (s)	226.5		6.8			17.8
Approach LOS	F		A			B
Intersection Summary						
HCM 2000 Control Delay			70.3		HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio			1.12			
Actuated Cycle Length (s)			77.0		Sum of lost time (s)	14.0
Intersection Capacity Utilization			94.5%		ICU Level of Service	F
Analysis Period (min)			15			
c Critical Lane Group						

Lanes, Volumes, Timings
5: North Main Street & Eliot Street

2027 build morning peak hour with mitigation







10/02/2020

							
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT	Ø9
Lane Configurations							
Traffic Volume (vph)	163	30	1040	648	31	530	
Future Volume (vph)	163	30	1040	648	31	530	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	
Storage Length (ft)	0	90		155	0		
Storage Lanes	1	1		1	0		
Taper Length (ft)	25				25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Frt		0.850		0.850			
Flt Protected	0.950					0.997	
Satd. Flow (prot)	1752	1272	1827	1553	0	1893	
Flt Permitted	0.950					0.470	
Satd. Flow (perm)	1752	1272	1827	1553	0	893	
Right Turn on Red		Yes		Yes			
Satd. Flow (RTOR)		43		577			
Link Speed (mph)	40		30			30	
Link Distance (ft)	285		340			370	
Travel Time (s)	4.9		7.7			8.4	
Peak Hour Factor	0.59	0.59	0.96	0.96	0.89	0.89	
Heavy Vehicles (%)	3%	27%	4%	4%	1%	0%	
Adj. Flow (vph)	276	51	1083	675	35	596	
Shared Lane Traffic (%)							
Lane Group Flow (vph)	276	51	1083	675	0	631	
Enter Blocked Intersection	No	No	No	No	No	No	
Lane Alignment	Left	Right	Left	Right	Left	Left	
Median Width(ft)	12		0			0	
Link Offset(ft)	0		0			0	
Crosswalk Width(ft)	16		16			16	
Two way Left Turn Lane							
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Turning Speed (mph)	15	9		9	15		
Number of Detectors	1	1	2	1	1	2	
Detector Template	Left	Right	Thru	Right	Left	Thru	
Leading Detector (ft)	20	20	100	20	20	100	
Trailing Detector (ft)	0	0	0	0	0	0	
Detector 1 Position(ft)	0	0	0	0	0	0	
Detector 1 Size(ft)	20	20	6	20	20	6	
Detector 1 Type	CI+Ex	CI+Ex	CI+Ex	CI+Ex	CI+Ex	CI+Ex	
Detector 1 Channel							
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(ft)			94			94	
Detector 2 Size(ft)			6			6	
Detector 2 Type			CI+Ex			CI+Ex	
Detector 2 Channel							
Detector 2 Extend (s)			0.0			0.0	
Turn Type	Prot	Perm	NA	pm+ov	Perm	NA	
Protected Phases	8		2	8		6	9

Lanes, Volumes, Timings
5: North Main Street & Eliot Street

2027 build morning peak hour with mitigation

10/02/2020

							
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT	Ø9
Permitted Phases	8	8		2	6		
Detector Phase	8	8	2	8	6	6	
Switch Phase							
Minimum Initial (s)	1.0	1.0	5.0	1.0	5.0	5.0	5.0
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Total Split (s)	28.0	28.0	43.0	28.0	43.0	43.0	24.0
Total Split (%)	29.5%	29.5%	45.3%	29.5%	45.3%	45.3%	25%
Maximum Green (s)	22.0	22.0	37.0	22.0	37.0	37.0	18.0
Yellow Time (s)	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
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							
Lead-Lag Optimize?							
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	Min	None	Min	Min	None
Walk Time (s)							7.0
Flash Dont Walk (s)							11.0
Pedestrian Calls (#/hr)							0
Act Effct Green (s)	18.3	18.3	39.2	65.5		39.2	
Actuated g/C Ratio	0.28	0.28	0.60	1.00		0.60	
v/c Ratio	0.56	0.13	0.99	0.43		1.18	
Control Delay	24.8	7.9	42.6	0.9		119.8	
Queue Delay	0.0	0.0	0.0	0.0		0.0	
Total Delay	24.8	7.9	42.6	0.9		119.8	
LOS	C	A	D	A		F	
Approach Delay	22.1		26.6			119.8	
Approach LOS	C		C			F	
Queue Length 50th (ft)	93	2	~396	0		~317	
Queue Length 95th (ft)	94	11	#763	0		#538	
Internal Link Dist (ft)	205		260			290	
Turn Bay Length (ft)		90		155			
Base Capacity (vph)	644	495	1092	1549		533	
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	0.43	0.10	0.99	0.44		1.18	

Intersection Summary

Area Type: Other

Cycle Length: 95

Actuated Cycle Length: 65.5

Natural Cycle: 130

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 1.18

Intersection Signal Delay: 47.7

Intersection LOS: D

Intersection Capacity Utilization 76.4%

ICU Level of Service D

Analysis Period (min) 15





~ Volume exceeds capacity, queue is theoretically infinite.

Lanes, Volumes, Timings
 5: North Main Street & Eliot Street

2027 build morning peak hour with mitigation
 10/02/2020











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

Splits and Phases: 5: North Main Street & Eliot Street

 Ø2 43 s		 Ø9 24 s
 Ø6 43 s	 Ø8 28 s	












HCM Signalized Intersection Capacity Analysis 2027 build morning peak hour with mitigation
 5: North Main Street & Eliot Street

10/02/2020

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	163	30	1040	648	31	530
Future Volume (vph)	163	30	1040	648	31	530
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
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	0.85	1.00	0.85		1.00
Flt Protected	0.95	1.00	1.00	1.00		1.00
Satd. Flow (prot)	1752	1272	1827	1553		1894
Flt Permitted	0.95	1.00	1.00	1.00		0.47
Satd. Flow (perm)	1752	1272	1827	1553		893
Peak-hour factor, PHF	0.59	0.59	0.96	0.96	0.89	0.89
Adj. Flow (vph)	276	51	1083	675	35	596
RTOR Reduction (vph)	0	31	0	70	0	0
Lane Group Flow (vph)	276	20	1083	605	0	631
Heavy Vehicles (%)	3%	27%	4%	4%	1%	0%
Turn Type	Prot	Perm	NA	pm+ov	Perm	NA
Protected Phases	8		2	8		6
Permitted Phases	8	8		2	6	
Actuated Green, G (s)	16.3	16.3	37.2	53.5		37.2
Effective Green, g (s)	18.3	18.3	39.2	57.5		39.2
Actuated g/C Ratio	0.28	0.28	0.60	0.88		0.60
Clearance Time (s)	6.0	6.0	6.0	6.0		6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0		3.0
Lane Grp Cap (vph)	489	355	1093	1553		534
v/s Ratio Prot	c0.16		0.59	0.11		
v/s Ratio Perm		0.02		0.28		c0.71
v/c Ratio	0.56	0.06	0.99	0.39		1.18
Uniform Delay, d1	20.2	17.3	13.0	0.7		13.1
Progression Factor	1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	1.5	0.1	24.9	0.2		99.7
Delay (s)	21.7	17.3	37.9	0.9		112.9
Level of Service	C	B	D	A		F
Approach Delay (s)	21.0		23.7			112.9
Approach LOS	C		C			F
Intersection Summary						
HCM 2000 Control Delay			44.1		HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio			1.10			
Actuated Cycle Length (s)			65.5		Sum of lost time (s)	14.0
Intersection Capacity Utilization			76.4%		ICU Level of Service	D
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis 2027 build evening peak hour with mitigation 5: North Main Street & Eliot Street




10/02/2020

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	654	7	582	277	6	889
Future Volume (vph)	654	7	582	277	6	889
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
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
Fr _t	1.00	0.85	1.00	0.85		1.00
Fl _t Protected	0.95	1.00	1.00	1.00		1.00
Satd. Flow (prot)	1752	1615	1863	1615		1899
Fl _t Permitted	0.95	1.00	1.00	1.00		1.00
Satd. Flow (perm)	1752	1615	1863	1615		1891
Peak-hour factor, PHF	0.92	0.92	0.89	0.89	0.92	0.92
Adj. Flow (vph)	711	8	654	311	7	966
RTOR Reduction (vph)	0	2	0	35	0	0
Lane Group Flow (vph)	711	6	654	276	0	973
Heavy Vehicles (%)	3%	0%	2%	0%	1%	0%
Turn Type	Prot	Perm	NA	pm+ov	Perm	NA
Protected Phases	8		2	8		6
Permitted Phases	8	8		2	6	
Actuated Green, G (s)	25.0	25.0	34.0	59.0		34.0
Effective Green, g (s)	27.0	27.0	36.0	63.0		36.0
Actuated g/C Ratio	0.38	0.38	0.51	0.89		0.51
Clearance Time (s)	6.0	6.0	6.0	6.0		6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0		3.0
Lane Grp Cap (vph)	666	614	944	1615		958
v/s Ratio Prot	c0.41		0.35	0.06		
v/s Ratio Perm		0.00		0.11		c0.51
v/c Ratio	1.07	0.01	0.69	0.17		1.02
Uniform Delay, d ₁	22.0	13.7	13.3	0.5		17.5
Progression Factor	1.00	1.00	1.00	1.00		1.00
Incremental Delay, d ₂	54.3	0.0	2.2	0.1		33.0
Delay (s)	76.3	13.7	15.5	0.6		50.5
Level of Service	E	B	B	A		D
Approach Delay (s)	75.6		10.7			50.5
Approach LOS	E		B			D
Intersection Summary						
HCM 2000 Control Delay			42.9		HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio			1.15			
Actuated Cycle Length (s)			71.0		Sum of lost time (s)	14.0
Intersection Capacity Utilization			94.5%		ICU Level of Service	F
Analysis Period (min)			15			
c Critical Lane Group						

Hunting Lane/Site Roadway

Intersection

Int Delay, s/veh 1.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	32	0	3	30	1	10
Future Vol, veh/h	32	0	3	30	1	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	35	0	3	33	1	11

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	35
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	4.12	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	2.218	-
Pot Cap-1 Maneuver	-	1576	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	1576	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.7	8.5
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	1027	-	-	1576	-
HCM Lane V/C Ratio	0.012	-	-	0.002	-
HCM Control Delay (s)	8.5	-	-	7.3	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0	-	-	0	-

Intersection

Int Delay, s/veh 1.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑			↑	Y	
Traffic Vol, veh/h	35	1	11	29	1	6
Future Vol, veh/h	35	1	11	29	1	6
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	38	1	12	32	1	7

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	39
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	4.12	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	2.218	-
Pot Cap-1 Maneuver	-	1571	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	1571	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2	8.6
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	1011	-	-	1571	-
HCM Lane V/C Ratio	0.008	-	-	0.008	-
HCM Control Delay (s)	8.6	-	-	7.3	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0	-	-	0	-