Transportation Impact Assessment

Proposed Residential Development
Longley Road and Sand Hill Road
Groton, Massachusetts

Prepared for:

Restoration Capital
Sudbury, Massachusetts

September 2020

Prepared by:

Vanasse & Associates inc
Transportation Engineers & Planners

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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

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

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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 28-unit age-qualified (55+) residential community to be known as The Village at Shepley Hill and located off Longley Road and Sand Hill Road in Groton, Massachusetts (hereafter referred to as the Project). This assessment was prepared in consultation with the Town of Groton 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 104 vehicle trips on an average weekday (two-way, 24-hour volume), with 6 vehicle trips expected during the weekday morning peak-hour and 7 vehicle trips expected during the weekday evening peak-hour;

2. In comparison to a 33-unit conventional (non-age-qualified) multifamily residential development, the Project would generate approximately 106 fewer vehicle trips on an average weekday (two-way24-hour volume), with 11 fewer vehicle trips expected during the weekday morning peak-hour and 15 fewer vehicle trips expected during the weekday evening peak-hour;

3. 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 all movements at the study intersections shown to continue to operate at a level-of-service (LOS) B or better under all analysis conditions, where an LOS of "D" or better is defined as "acceptable" traffic operations;

4. All movements at the Project site roadway intersections with Longley Road and Sand Hill Road were shown to operate at LOS A during both the weekday morning and evening peak hours with negligible vehicle queuing predicted;

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

5. 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

6. Lines of sight at the Project site roadway intersections with Longley Road and Sand Hill Road 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.

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 two (2) roadways that will intersect the west side of Longley Road approximately 500 feet south of Sand Hill Road and the south side of Sand Hill Road approximately 1,150 feet west of Longley Road, respectively. 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. In addition, a STOP-sign and marked STOP-line should be installed on the westbound approach to the internal intersection within the Project site where a marked crosswalk should be provided for crossing the east leg of the intersection.

- 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]

- Illumination should be provided at the Project site roadway intersections with Longley Road and Sand Hill Road.

- A sidewalk should be provided along at least one side of the Project site roadway and extend to both Longley Road and Sand Hill Road.

- 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 roadways.

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

- Signs and landscaping to be installed as a part of the Project within the intersection sight triangle areas of the Project site roadways should be designed and maintained so as not to restrict lines of sight.

- Existing trees and vegetation located along the south side of Sand Hill Road within the intersection triangle areas of the Project site roadway should be selectively trimmed or removed and maintained, and the existing embankment to the east of the Project site roadway along the south side of Sand Hill Road should be regraded in order to provide the required line of sight. We note that the required sight line improvements can be completed within the Project site and/or the public right-of-way with the required approvals.

- Snow windrows within sight triangle areas of the Project site roadways should be promptly removed where such accumulations would impede sight lines.

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 an age-qualified residential development to be known as The Village at Shepley Hill and located off Longley Road and Sand Hill Road in Groton, 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 Longley Road and Sand Hill Road, and the following specific intersections: Longley Road at Sand Hill Road and Longley Road at Nashua Street.

PROJECT DESCRIPTION

The Project will entail the construction of a 28-unit age-qualified (55+) residential community that will be comprised of 14 two-unit buildings to be located off Longley Road and Sand Hill Road in Groton, Massachusetts. The Project site encompasses approximately 28± acres of undeveloped land that is bounded by residential properties and Sand Hill Road to the north; residential properties and areas of open and wooded space to the south; Longley Road, residential properties and areas of open and wooded space to the east; and residential properties and areas of open and wooded space owned and managed by the Groton Conservation Trust to the west. Figure 1 depicts the Project site location in relation to the existing roadway network.

Access to the Project site will be provided by way of two (2) roadways that will intersect the west side of Longley Road approximately 500 feet south of Sand Hill Road and the south side of Sand Hill Road approximately 1,150 feet west of Longley Road, respectively.

Off-street parking will be provided for a minimum of two (2) vehicles per unit in individual driveways and garages in accordance with Section 218-23, *Off-street parking and loading*, of the Zoning Bylaw of the Town of Groton.[3]

[3]A minimum of two (2) parking spaces per dwelling unit is required.

Figure 1

Site Location Map

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STUDY METHODOLOGY

This study was prepared in consultation with the Town of Groton and the 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 August 2020. The field investigation consisted of an inventory of existing roadway geometrics; pedestrian and bicycle facilities; public transportation services; 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 Longley Road and Sand Hill Road and the following specific intersections: Longley Road at Sand Hill Road and Longley Road at Nashua Road.

The following describes the study area roadways and intersections.

Roadways

Longley Road

- Two-lane urban minor arterial roadway under Town jurisdiction
- Traverses study area in a general north-south direction between Hollis Street and the Pepperell Town Line, where Longley Road becomes Groton Street
- Provides two 11 to 14-foot wide travel lanes that are separated by a double-yellow centerline with 1 to 2-foot wide marked shoulders provided
- The posted speed limit is 30 miles per hour (mph) within the study area
- Sidewalks and illumination are not provided within the study area
- Land use within the study area consists of the Project site, residential properties, and areas of open and wooded space

Sand Hill Road

- Two-lane local access roadway under Town jurisdiction
- Traverses study area in a general east-west direction between Longley Road and Common Street
- Provides two 11-foot wide travel lanes that are separated by a single-yellow centerline with no marked shoulders provided
- The posted speed limit is 30 mph within the study area
- Sidewalks and illumination are not provided within the study area

- Land use within the study area consists of the Project site, residential 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 August 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)
Longley Rd./ Sand Hill Rd.	S	1 general purpose travel lane on all approaches	Yes; 1-foot on Longley Rd.	No	No
Longley Rd./ Nashua Rd.	S	1 general purpose travel lane on all approaches	Yes; 1-foot on Longley Rd. and 2-feet on Nashua Rd.	No	No

[a]S = STOP-sign control.
[b]Combined 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, manual turning movement counts (TMCs) and vehicle classification counts were completed in August 2020. The ATR counts were conducted on August 11th through August 12th, 2020 (Tuesday through Wednesday, inclusive) on Longley Road and Sand Hill Road in the vicinity of the Project site in order to record weekday traffic conditions over an extended period, with weekday morning (7:00 to 9:00 AM) and evening (4:00 to 6:00 PM) peak period manual TMCs performed at the study intersections on August 13, 2020 (Thursday). These time periods were selected for analysis purposes as they are representative of the peak-traffic-volume hours for both the Project and the adjacent roadway network.

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. 4090 located on Interstate 495 in Littleton were reviewed.[4] Based on a review of this data, it was determined that traffic volumes for the month of August are approximately 9.1 percent above average-month conditions. As such, the August traffic volumes were not adjusted downward in order to provide a conservative (above-average) analysis condition.

[4]MassDOT Traffic Volumes for the Commonwealth of Massachusetts; 2020.

Legend:

- Ⓤ — Unsignalized Intersection
- XX' — Lane Use and Travel Lane Width

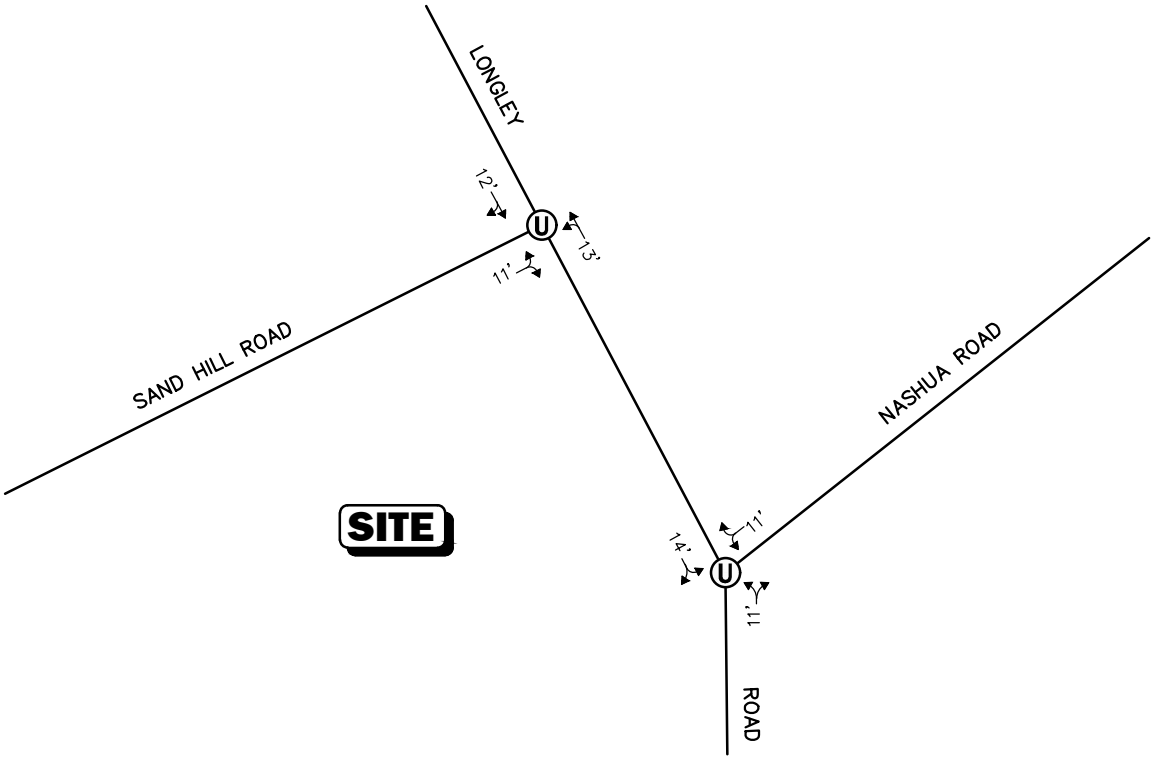

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Figure 2

Existing Intersection Lane Use, Travel Lane Width and Pedestrian Facilities

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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 August 2020 traffic volumes that were collected as a part of this assessment were adjusted upward by 28 percent based on a comparison of August 2019 and August 2020 traffic volume data obtained from MassDOT Continuous Count Station No. 4090.

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]
Longley Road, south of Sand Hill Road	4,085	--	--	--
Weekday Morning (7:30 – 8:30 AM)	--	225	5.5	67.1% SB
Weekday Evening (4:30 – 5:30 PM)	--	333	8.2	58.3% NB
Sand Hill Road, west of Longley Road	595	--	--	--
Weekday Morning (7:30 – 8:30 AM)	--	37	6.2	56.8% EB
Weekday Evening (4:30 – 5:30 PM)	--	53	8.9	54.7% EB

[a]Average weekday traffic in vehicles per day.
[b]Vehicles per hour.
[c]Percent of daily traffic occurring during the peak hour.
[d]Percent traveling in peak direction.
NB = northbound, SB= southbound, EB=eastbound

As can be seen in Table 2, Longley Road in the vicinity of the Project site was found to accommodate approximately 4,085 vehicles on an average weekday (two-way, 24-hour volume), with approximately 225 vehicles per hour (vph) during the weekday morning peak-hour and 333 vph during the weekday evening peak-hour.

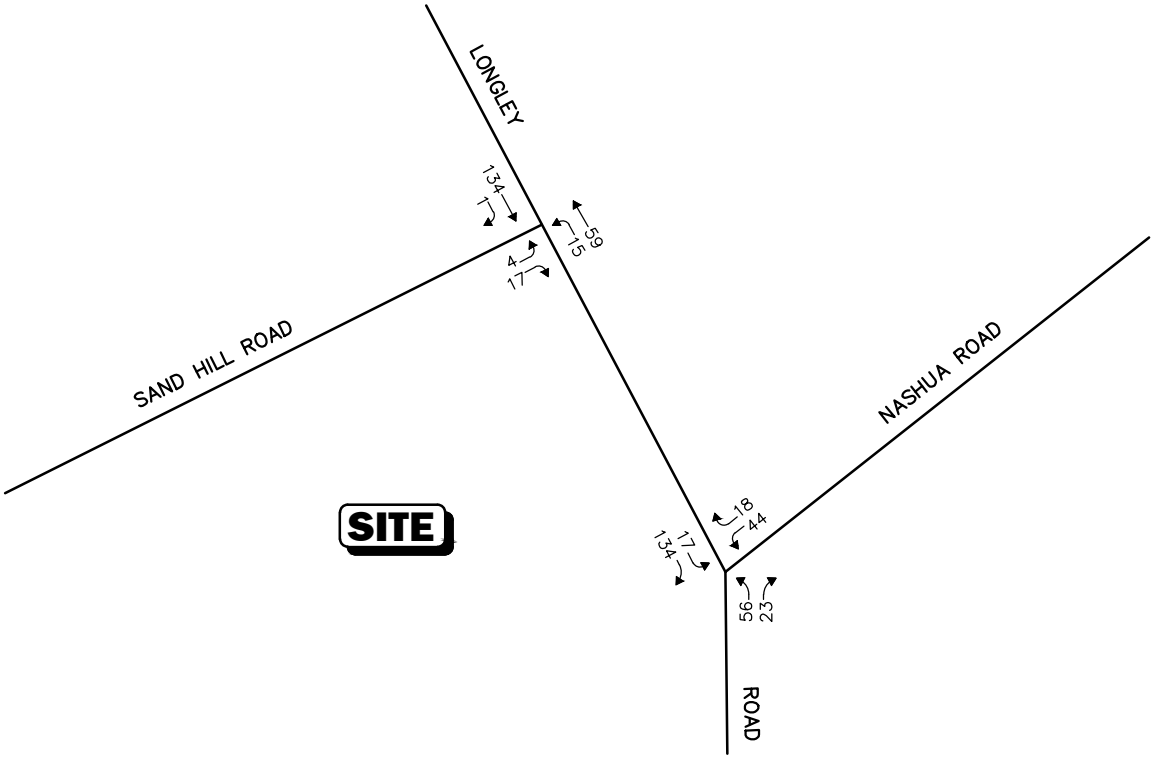
Sand Hill Road in the vicinity of the Project site was found to accommodate approximately 595 vehicles on an average weekday, with approximately 37 vph during the weekday morning peak-hour and 53 vph during the weekday evening peak-hour.

PEDESTRIAN AND BICYCLE FACILITIES

A comprehensive field inventory of pedestrian and bicycle facilities within the study area was undertaken in August 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 and formal bicycle facilities are not provided within the study area and neither Longley Road nor Sand Hill Road provide sufficient width on a continuous basis to accommodate bicycle travel in a shared traveled-way condition (i.e., bicyclists and motor vehicles sharing the traveled-way).[5]

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

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



WEEKDAY EVENING PEAK HOUR (4:30 - 5:30 PM)

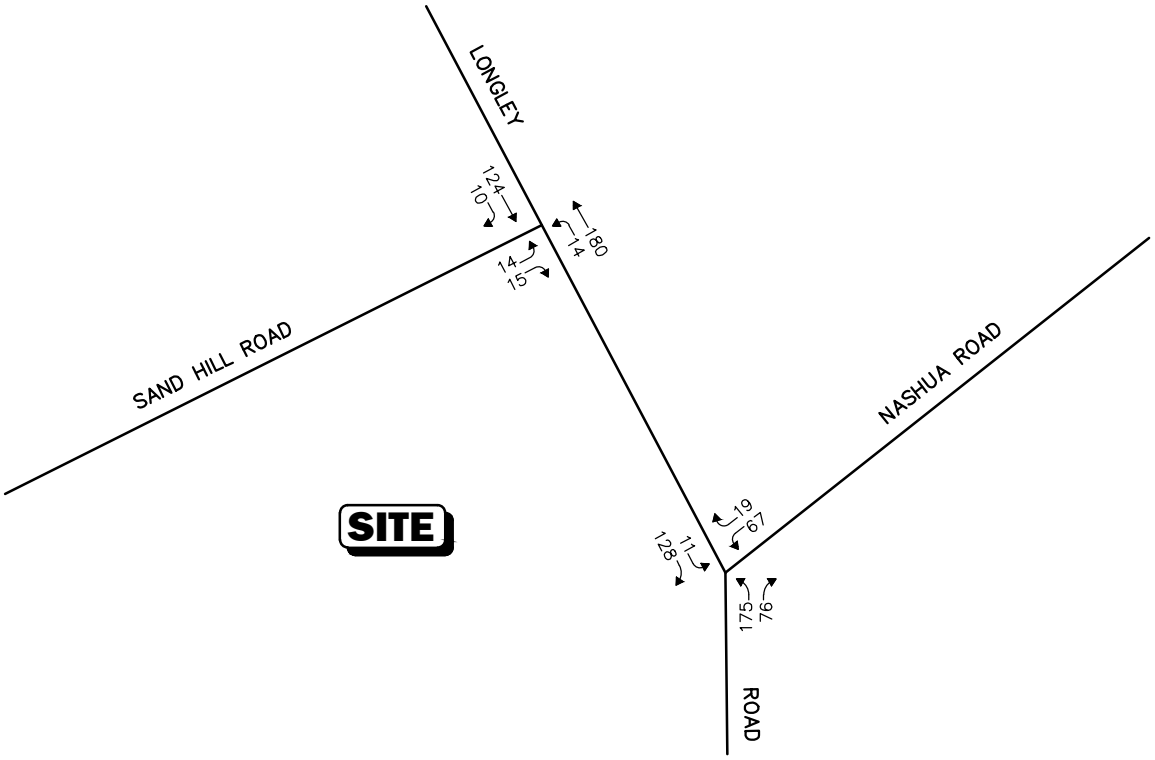


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Figure 3

2020 Existing
Peak Hour Traffic Volumes

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PUBLIC TRANSPORTATION

Regularly scheduled public transportation services are not currently provided in the vicinity of the Project site or within the study area. The Lowell Regional Transit Authority (LRTA) provides on-demand, curb-to-curb transportation services for eligible residents of the Town of Groton through its Road Runner program. The service must be reserved at least two days in advance. In addition, the LRTA Road Runner program also provides Dial-a-Ride paratransit services to eligible people who cannot use fixed-route transit all or some of the time due to a physical, cognitive or mental disability in compliance with the Americans with Disabilities Act (ADA).

SPOT SPEED MEASUREMENTS

Vehicle travel speed measurements were performed on Longley Road and Sand Hill Road in the vicinity of the Project site in conjunction with the ATR counts. Table 3 summarizes the vehicle travel speed measurements.

Table 3
VEHICLE TRAVEL SPEED MEASUREMENTS

	Longley Road		Sand Hill Road	
	Northbound	Southbound	Eastbound	Westbound
Mean Travel Speed (mph)	37	40	31	31
85th Percentile Speed (mph)	40	44	36	34
Posted Speed Limit (mph)	30	30	30	30

mph = miles per hour.

As can be seen in Table 3, the mean vehicle travel speed along Longley Road in the vicinity of the Project site was found to be 37 mph in the northbound direction and 40 mph southbound. 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 40 mph in the northbound direction and 44 mph southbound, which is 10 to 14 mph above the posted speed limit in the vicinity of the Project site (30 mph). The 85th percentile speed is used as the basis of engineering design and in the evaluation of sight distances, and is often used in establishing posted speed limits.

The mean vehicle travel speed along Sand Hill Road in the vicinity of the Project site was found to be 31 mph in both the east and westbound directions. The measured 85th percentile vehicle travel speed was found to be 36 mph in the eastbound direction and 34 mph westbound, which is 4 to 6 mph above the posted speed limit in the vicinity of the Project site (30 mph).

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 both found to have experienced one (1) reported motor vehicle crash over the five-year review period and were found to have a motor vehicle crash rate below the MassDOT statewide and District average crash rates for an unsignalized intersection 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 there are no locations within the Town of Groton that are included on MassDOT's Highway Safety Improvement Program (HSIP) listing as high crash locations. 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]

	Longley Rd/ Sand Hill Rd	Longley Rd/ Nashua Rd
Traffic Control Type:[b]	U	U
Year:		
2013	1	0
2014	0	0
2015	0	0
2016	0	1
2017	0	0
Total	1	1
Average	0.20	0.20
Rate[c]	0.14	0.10
MassDOT Crash Rate:[d]	0.57/0.61	0.57/0.61
Significant?[e]	No	No
Type:		
Angle	1	0
Rear-End	0	0
Head-On	0	0
Sideswipe	0	0
Fixed Object	0	1
Pedestrian/Bicycle	0	0
Unknown/Other	0	0
Total	1	1
Conditions:		
Clear	0	1
Cloudy	1	0
Rain	0	0
Snow/Ice	0	0
Total	1	1
Lighting:		
Daylight	1	0
Dawn/Dusk	0	0
Dark (Road Lit)	0	1
Dark (Road Unlit)	0	0
Total	1	1
Day of Week:		
Monday through Friday	0	1
Saturday	1	0
Sunday	0	0
Total	1	1
Severity:		
Property Damage Only	1	0
Personal Injury	0	1
Fatality	0	0
Total	1	1

[a]Source: MassDOT Safety Management/Traffic Operations Unit records, 2013 through 2017.
[b]Traffic Control Type: U = unsignalized.
[c]Crash rate per million vehicles entering the intersection.
[d]Statewide/District crash rate.
[e]The intersection crash rate is significant if it is found to exceed the MassDOT crash rate for the MassDOT Highway Division District in which the Project is located (District 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 Groton 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 Development, 340 Longley Road, Groton, Massachusetts. This project consists of the construction of a 3-lot residential development to be located at 340 Longley Road. 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).

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 Groton, Pepperell and Dunstable 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 1.4 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 Groton 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.

No-Build Traffic Volumes

The 2027 No-Build condition peak-hour traffic-volumes were developed by applying the 1.5 percent per year compounded annual background traffic growth rate to the 2020 Existing peak-hour traffic volumes. The resulting 2027 No-Build weekday morning and evening peak-hour traffic volumes are shown on Figure 4.

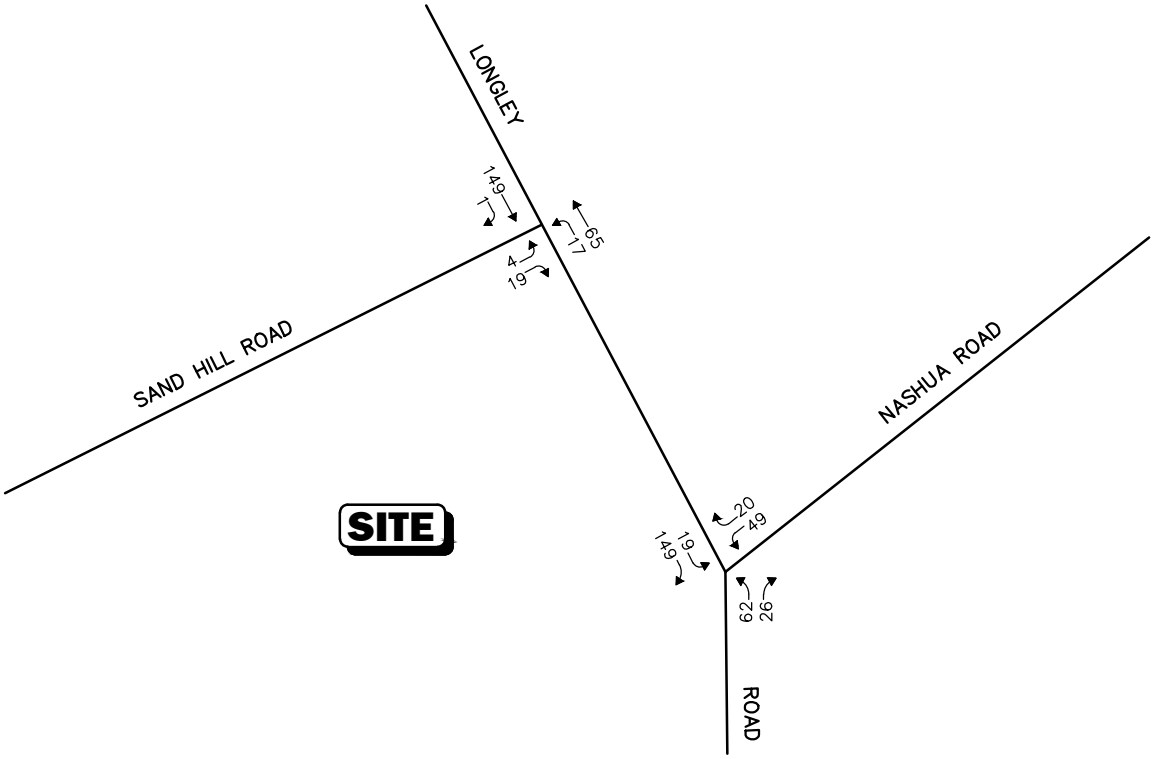
PROJECT-GENERATED TRAFFIC

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, age-qualified (55+) residential community that will be comprised of 14 two-unit buildings. In order to develop the traffic characteristics of the Project, trip-generation statistics published by the ITE[6] for a similar land use as that proposed were used. ITE Land Use Code 252, *Senior Adult Housing - Attached*, was used to develop the traffic characteristics of the Project, the results of which are summarized in Table 5.

[6]Ibid 1.

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



WEEKDAY EVENING PEAK HOUR (4:30 - 5:30 PM)

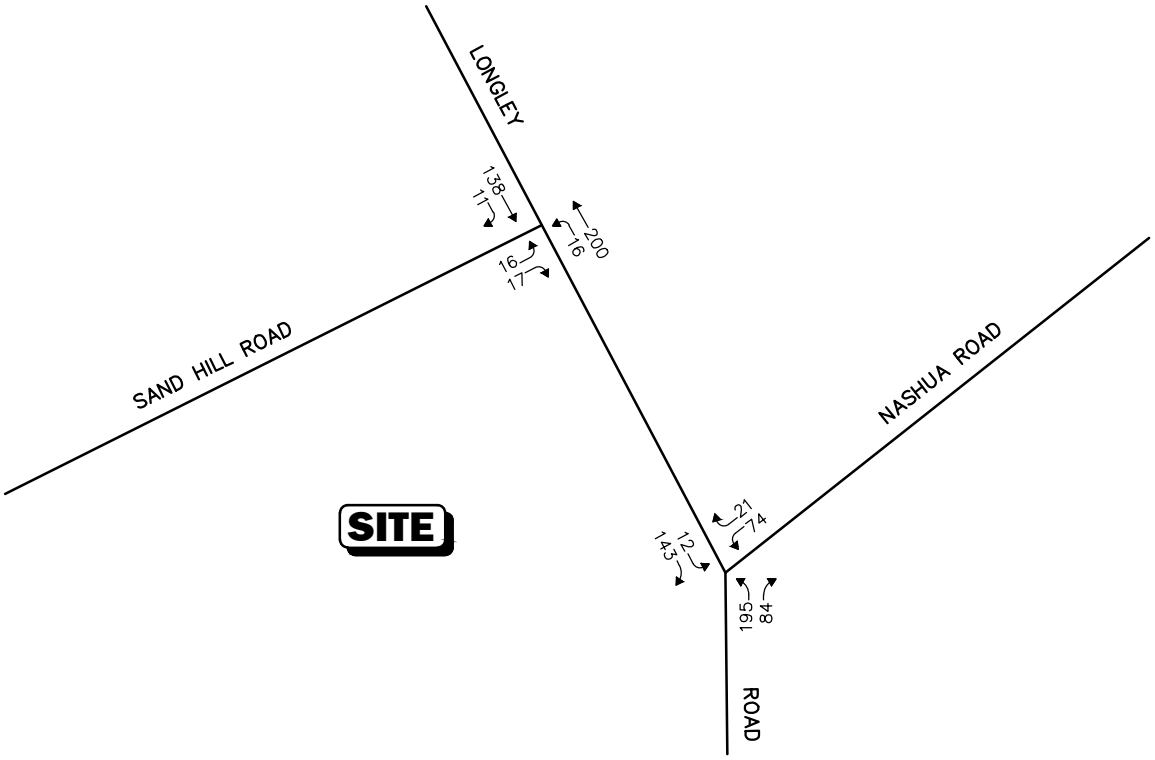


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Figure 4

2027 No Build
Peak Hour Traffic Volumes

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Table 5
TRIP GENERATION SUMMARY

Time Period	Vehicle Trips[a]		
	Entering	Exiting	Total
Average Weekday:	52	52	104
Weekday Morning Peak-Hour:	2	4	6
Weekday Evening Peak-Hour:	4	3	7

[a]Based on ITE LUC 252, *Senior Adult Housing - Attached.*

Project-Generated Traffic Volume Summary

As can be seen in Table 5, the Project is expected to generate approximately 104 vehicle trips on an average weekday (two-way, 24-hour volume, or 52 vehicles entering and 52 exiting), with 6 vehicle trips (2 vehicles entering and 4 exiting) expected during the weekday morning peak-hour and 7 vehicle trips (4 vehicles entering and 3 exiting) expected during the weekday evening peak-hour.

The relatively low traffic volumes that are expected to be associated with the Project are a direct result of the intent to design and market the residential units to residents over the age of 55, many of whom are "empty nesters" and some may be retired. Residential developments with such demographics generate less traffic during the traditional commuter peak hours which is reflected by the traffic volumes that are shown in Table 5. Table 6 compares the traffic volumes associated with the Project to those of a 33-unit conventional (non-age-qualified) multifamily residential community.

Table 6
TRAFFIC VOLUME COMPARISON

Time Period/Direction	Vehicle Trips		
	(A) Proposed Age-Restricted Residential Community (28 Units)[a]	(B) Conventional Multifamily Residential Community (33 Units)[b]	(A-B) Difference
Average Weekday Daily:	104	210	-106
Weekday Morning Peak Hour:	6	17	-11
Weekday Evening Peak Hour:	7	22	-15

[a]Based on ITE LUC 252, *Senior Adult Housing - Attached.*
[b]Based on ITE LUC 220, *Multifamily Housing (Low-Rise)*.

Traffic Volume Comparison

As can be seen in Table 6, in comparison to a 35-unit conventional multifamily residential community, the Project is expected to generate approximately 106 fewer vehicle trips on an average weekday (two-way, 24-hour volume), with 11 fewer vehicle trips expected during the weekday morning peak-hour and 15 fewer vehicle trips expected during the weekday evening peak-hour.

TRIP DISTRIBUTION AND ASSIGNMENT

The directional distribution of generated trips to and from the Project site was determined based on a review of Journey-to-Work data obtained from the U.S. Census for persons residing in the Town of Groton 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.

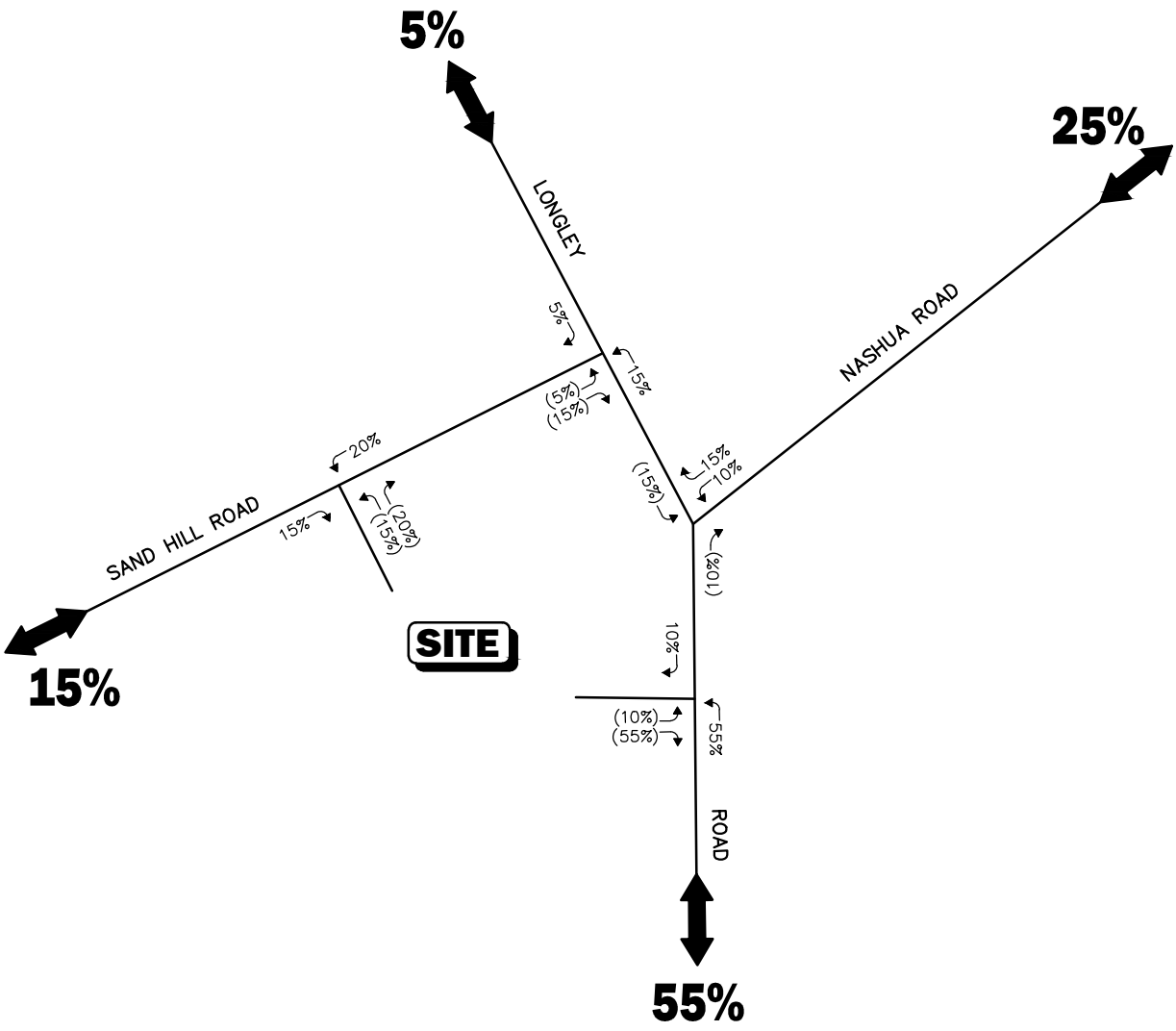
A summary of peak-hour projected traffic-volume changes outside of the study area that is the subject of this assessment is shown in Table 7. These changes are a result of the construction of the Project.

Table 7
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
Longley Road, north of Sand Hill Road:					
Weekday Morning	198	219	219	0	0.0
Weekday Evening	328	365	365	0	0.0
Longley Road, south of Nashua Road:					
Weekday Morning	257	286	289	3	1.0
Weekday Evening	446	496	500	4	0.8
Sand Hill Road, west of Longley Road:					
Weekday Morning	37	41	42	1	2.4
Weekday Evening	53	60	61	1	1.7
Nashua Road, east of Longley Road:					
Weekday Morning	102	114	116	2	1.8
Weekday Evening	173	191	193	2	1.0

Legend:

XX	Entering Trips
(XX)	Exiting Trips



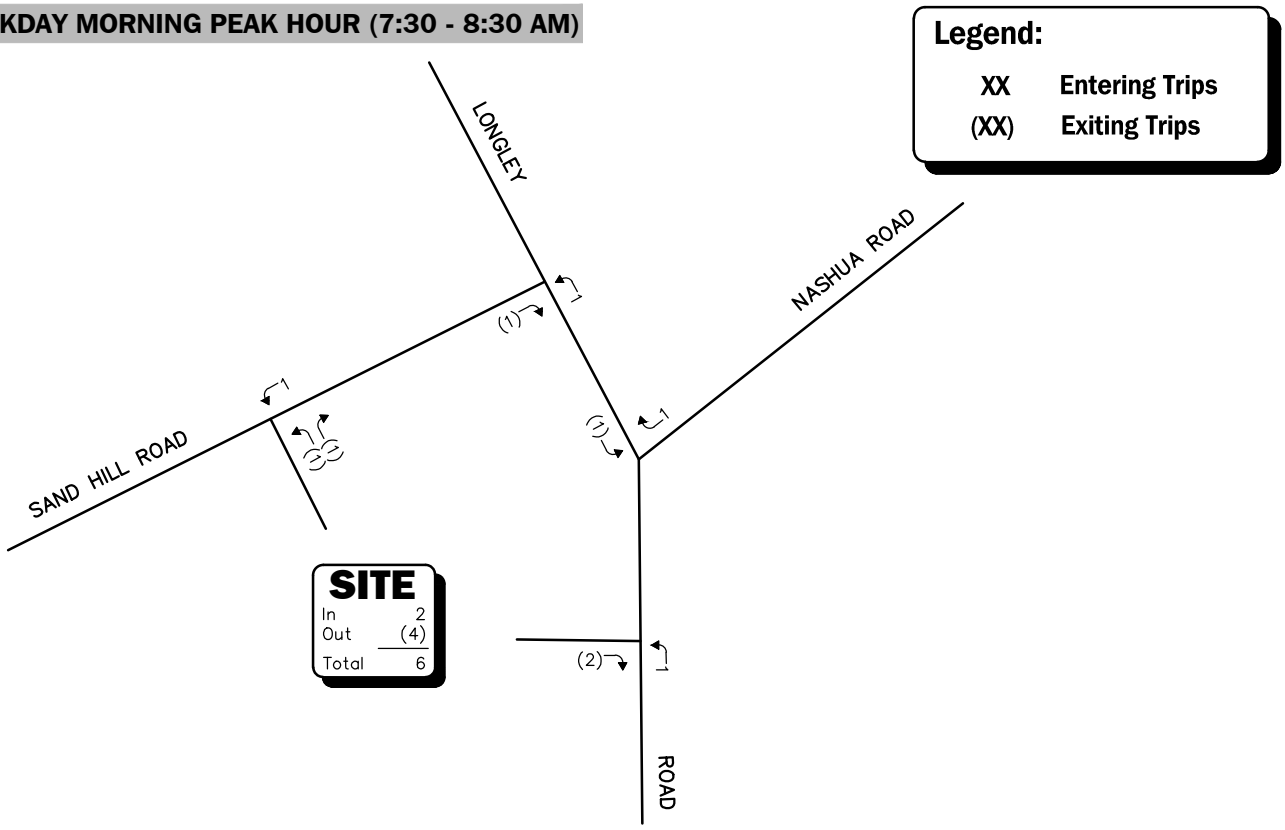
Not To Scale

Figure 5

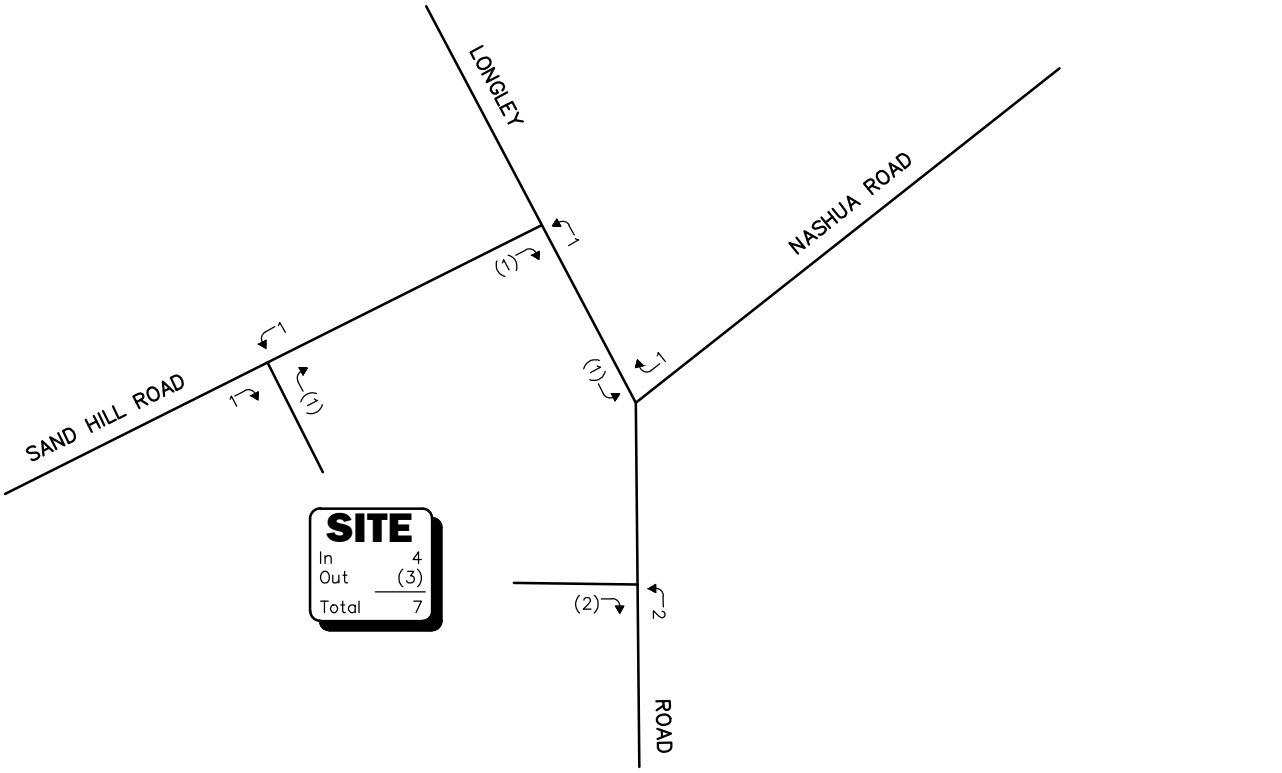
Trip Distribution Map

Vanasse & Associates inc

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



WEEKDAY EVENING PEAK HOUR (4:30 - 5:30 PM)



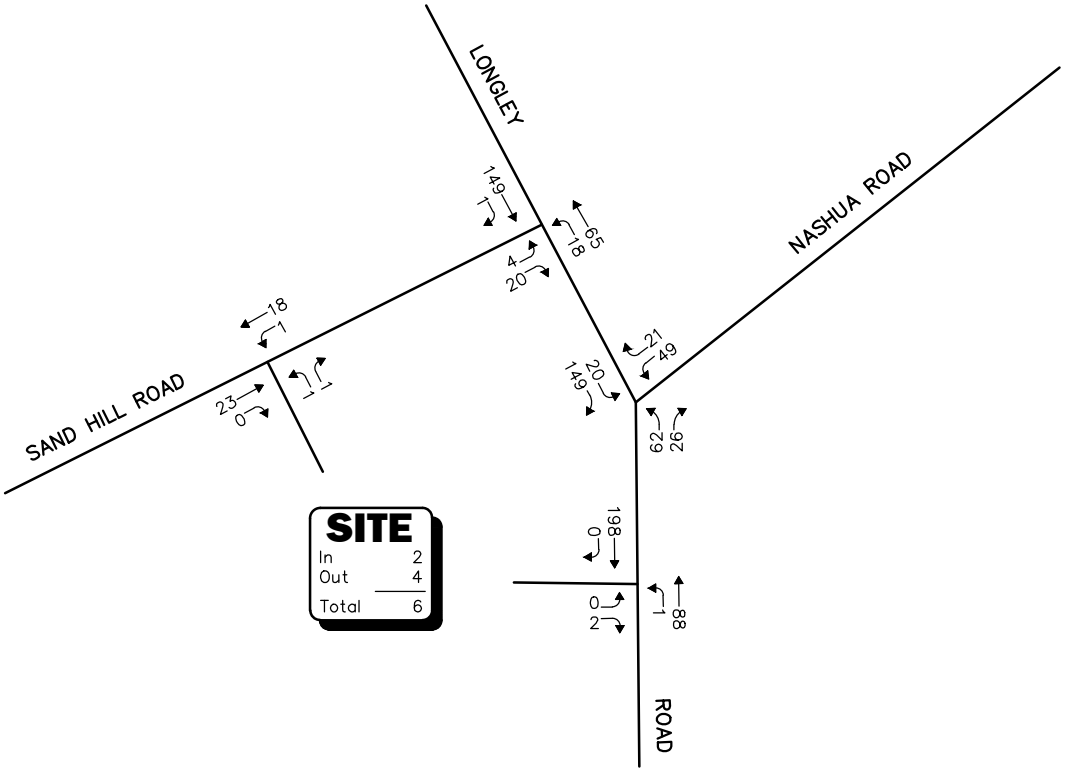
Not To Scale

Figure 6

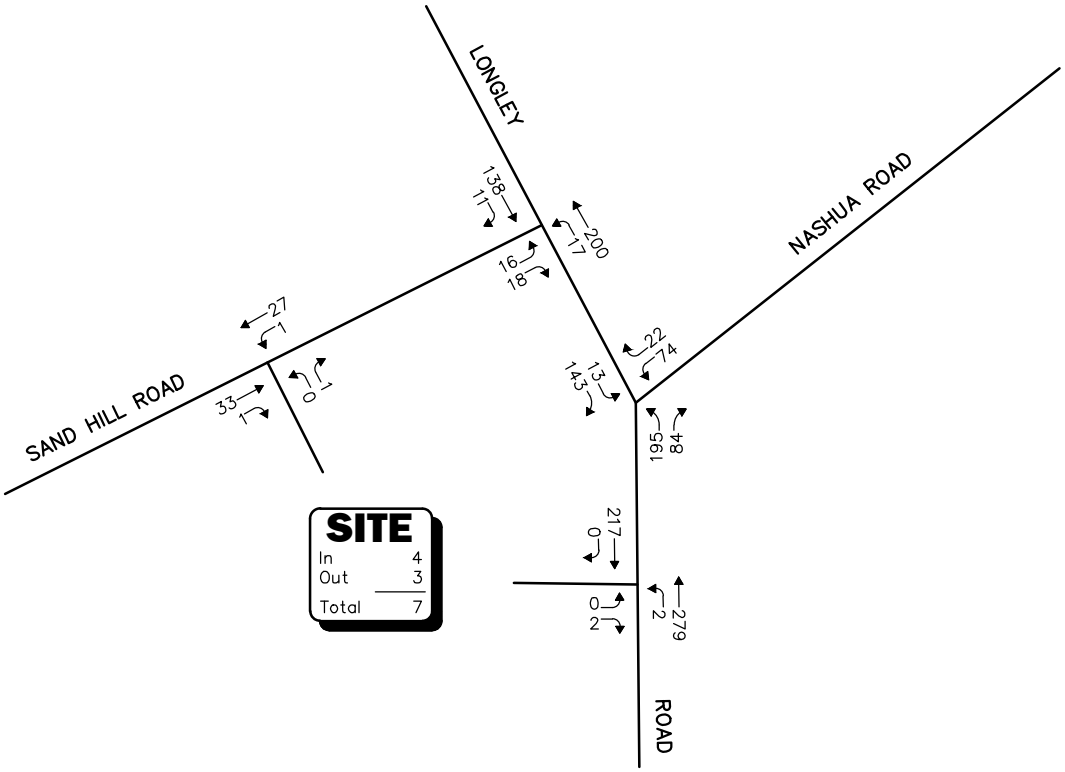
Project-Generated Peak Hour Traffic Volumes

Vanasse & Associates inc

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



WEEKDAY EVENING PEAK HOUR (4:30 - 5:30 PM)



Not To Scale

Figure 7

2027 Build
Peak Hour Traffic Volumes

Vanasse & Associates inc

As shown in Table 7, Project-related traffic-volume increases outside of the study area relative to 2027 No-Build conditions are anticipated to range from 0.0 to 2.4 percent during the peak periods, with vehicle increases shown to range from 0 to 4 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.***

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.

[7]The 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 8 summarizes the relationship between level of service and average control delay for two-way stop controlled and all-way stop controlled intersections.

Table 8
LEVEL-OF-SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS[a]

Level-Of-Service by Volume-to-Capacity Ratio		Average Control Delay (Seconds Per Vehicle)
v/c ≤ 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

[a]Source: *Highway Capacity Manual*; Transportation Research Board; Washington, DC; 2010; page 19-2.

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

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 in Table 8, 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.

As can be seen in Table 9, the addition of Project-related traffic to the study area intersections is not predicted to result in a change in LOS or an increase in vehicle queuing for any movement over No-Build conditions. Project-related impacts at the study area intersections were identified as follows:

Longley Road at Sand Hill Road – No-change in LOS or vehicle queuing is predicted to occur for any movement over No-Build conditions, with all movements shown to continue to operate at LOS B or better with negligible vehicle queuing.

Longley Road at Nashua Road – No-change in LOS or vehicle queuing is predicted to occur for any movement over No-Build conditions, with all movements shown to continue to operate at LOS B or better with vehicle queues of up to one (1) vehicle.

Longley Road and Sandy Hill Road at the Project Site Roadways – All movements at the Project site roadway intersections with Longley Road and Sandy Hill Road were shown to operate at LOS A during both the weekday morning and evening peak hours with negligible vehicle queuing.

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] 95th	Demand	Delay	LOS	Queue 95th	Demand	Delay	LOS	Queue 95th
Longley Road at Sand Hill Road												
Weekday Morning:												
Sand Hill Road EB LT/RT	21	9.4	A	0	23	9.5	A	0	24	9.5	A	0
Longley Road NB LT/TH	74	1.5	A	0	82	1.6	A	0	83	1.6	A	0
Longley Road SB TH/RT	135	0.0	A	0	150	0.0	A	0	150	0.0	A	0
Weekday Evening:												
Sand Hill Road EB LT/RT	29	10.1	B	0	33	10.4	B	0	34	10.4	B	0
Longley Road NB LT/TH	194	0.5	A	0	216	0.6	A	0	217	0.6	A	0
Longley Road SB TH/RT	134	0.0	A	0	149	0.0	A	0	149	0.0	A	0
Longley Road at Nashua Road												
Weekday Morning:												
Nashua Road WB LT/RT	62	10.3	B	1	69	10.6	B	1	70	10.6	B	1
Longley Road NB TH/RT	79	0.0	A	0	88	0.0	A	0	88	0.0	A	0
Longley Road SB LT/TH	151	0.8	A	0	168	0.8	A	0	169	0.9	A	0
Weekday Evening:												
Nashua Road WB LT/RT	86	11.3	B	1	95	12.2	B	1	96	12.2	B	1
Longley Road NB TH/RT	251	0.0	A	0	279	0.0	A	0	279	0.0	A	0
Longley Road SB LT/TH	139	0.6	A	0	155	0.6	A	0	156	0.7	A	0
Longley Road at the Project Site Roadway												
Weekday Morning:												
Project Site Roadway EB LT/RT	--	--	--	--	--	--	--	--	2	9.4	A	0
Longley Road NB LT/TH	--	--	--	--	--	--	--	--	89	0.1	A	0
Longley Road SB TH/RT	--	--	--	--	--	--	--	--	198	0.0	A	0
Weekday Evening:												
Project Site Roadway EB LT/RT	--	--	--	--	--	--	--	--	2	9.5	A	0
Longley Road NB LT/TH	--	--	--	--	--	--	--	--	281	0.1	A	0
Longley Road SB TH/RT	--	--	--	--	--	--	--	--	217	0.0	A	0
Sand Hill Road at the Project Site Roadway												
Weekday Morning:												
Sand Hill Road EB TH/RT	--	--	--	--	--	--	--	--	23	0.0	A	0
Sand Hill Road WB LT/TH	--	--	--	--	--	--	--	--	19	0.4	A	0
Project Site Roadway NB LT/RT	--	--	--	--	--	--	--	--	2	8.7	A	0
Weekday Evening:												
Sand Hill Road EB TH/RT	--	--	--	--	--	--	--	--	34	0.0	A	0
Sand Hill Road WB LT/TH	--	--	--	--	--	--	--	--	28	0.3	A	0
Project Site Roadway NB LT/RT	--	--	--	--	--	--	--	--	1	8.5	A	0

[a]Demand in vehicles per hour.
[b]Average control delay per vehicle (in seconds).
[c]Level-of-Service.
[d]Queue length in vehicles.
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 intersections with Longley Road and Sand Hill Road 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 10 presents the measured SSD and ISD at the subject intersections.

[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.

Table 10
SIGHT DISTANCE MEASUREMENTS[a]

Intersection/Sight Distance Measurement	Feet		
	Required Minimum (SSD)	Desirable (ISD)[b]	Measured
Longley Road at the Project Roadway			
Stopping Sight Distance:			
Longley Road approaching from the north	360	--	458
Longley Road approaching from the south	360	--	500+
Intersection Sight Distance:			
Looking to the north from the Project Roadway	360	430	423
Looking to the south from the Project Roadway	360	500	500+
Sand Hill Road at the Project Roadway			
Stopping Sight Distance:			
Sand Hill Road approaching from the east	250	--	250/400+[c]
Sand Hill Road approaching from the west	260	--	400+
Intersection Sight Distance:			
Looking to the east from the Project Roadway	250	390	250+[c]
Looking to the west from the Project Roadway	260	345	400+[c]

[a]Recommended 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 the following approach speeds: 45 mph along Longley Road; 35 mph approaching from the east (westbound) along Sand Hill Road; 36 mph approaching from the west (eastbound) along Sand Hill Road.

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

[c]Available sight distance with the selective trimming/removal of trees and vegetation located within the sight triangle areas and the regrading of the embankment to the east of the Project site roadway along the south side of Sand Hill Road.

As can be seen in Table 10, with the selective trimming or removal of trees and vegetation located along Sand Hill Road within the sight triangle areas of the Project site roadway and the regrading of the existing embankment to the east of the Project site roadway along the south side of Sand Hill Road, the available lines of sight exceed or can be made to exceed the recommended minimum sight distance to function in a safe manner (SSD) based on the measured 85th percentile travel speeds along Longley Road (40/44 mph) and Sand Hill Road (34/36 mph), which were found to be 4 to 14 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 age-qualified (55+) residential community to be known as The Village at Shepley Hill and located off Longley Road and Sand Hill Road in Groton, 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 104 vehicle trips on an average weekday (two-way, 24-hour volume), with 6 vehicle trips expected during the weekday morning peak-hour and 7 vehicle trips expected during the weekday evening peak-hour;

2. In comparison to a 33-unit conventional (non-age-qualified) multifamily residential development, the Project would generate approximately 106 fewer vehicle trips on an average weekday (two-way24-hour volume), with 11 fewer vehicle trips expected during the weekday morning peak-hour and 15 fewer vehicle trips expected during the weekday evening peak-hour;

3. 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 all movements at the study intersections shown to continue to operate at LOS B or better under all analysis conditions, where an LOS of "D" or better is defined as "acceptable" traffic operations;

4. All movements at the Project site roadway intersections with Longley Road and Sand Hill Road were shown to operate at LOS A during both the weekday morning and evening peak hours with negligible vehicle queuing predicted;

[10] Ibid 1.

5. 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

6. Lines of sight at the Project site roadway intersections with Longley Road and Sand Hill Road 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.

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 two (2) roadways that will intersect the west side of Longley Road approximately 500 feet south of Sand Hill Road and the south side of Sand Hill Road approximately 1,150 feet west of Longley Road, respectively. 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. In addition, a STOP-sign and marked STOP-line should be installed on the westbound approach to the internal intersection within the Project site where a marked crosswalk should be provided for crossing the east leg of the intersection.

- 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]

- Illumination should be provided at the Project site roadway intersections with Longley Road and Sand Hill Road.

- A sidewalk should be provided along at least one side of the Project site roadway and extend to both Longley Road and Sand Hill Road.

[11] Ibid 2.

- 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 roadways.

- Signs and landscaping to be installed as a part of the Project within the intersection sight triangle areas of the Project site roadways should be designed and maintained so as not to restrict lines of sight.

- Existing trees and vegetation located along the south side of Sand Hill Road within the intersection triangle areas of the Project site roadway should be selectively trimmed or removed and maintained, and the existing embankment to the east of the Project site roadway along the south side of Sand Hill Road should be regraded in order to provide the required line of sight. We note that the required sight line improvements can be completed within the Project site and/or the public right-of-way with the required approvals.

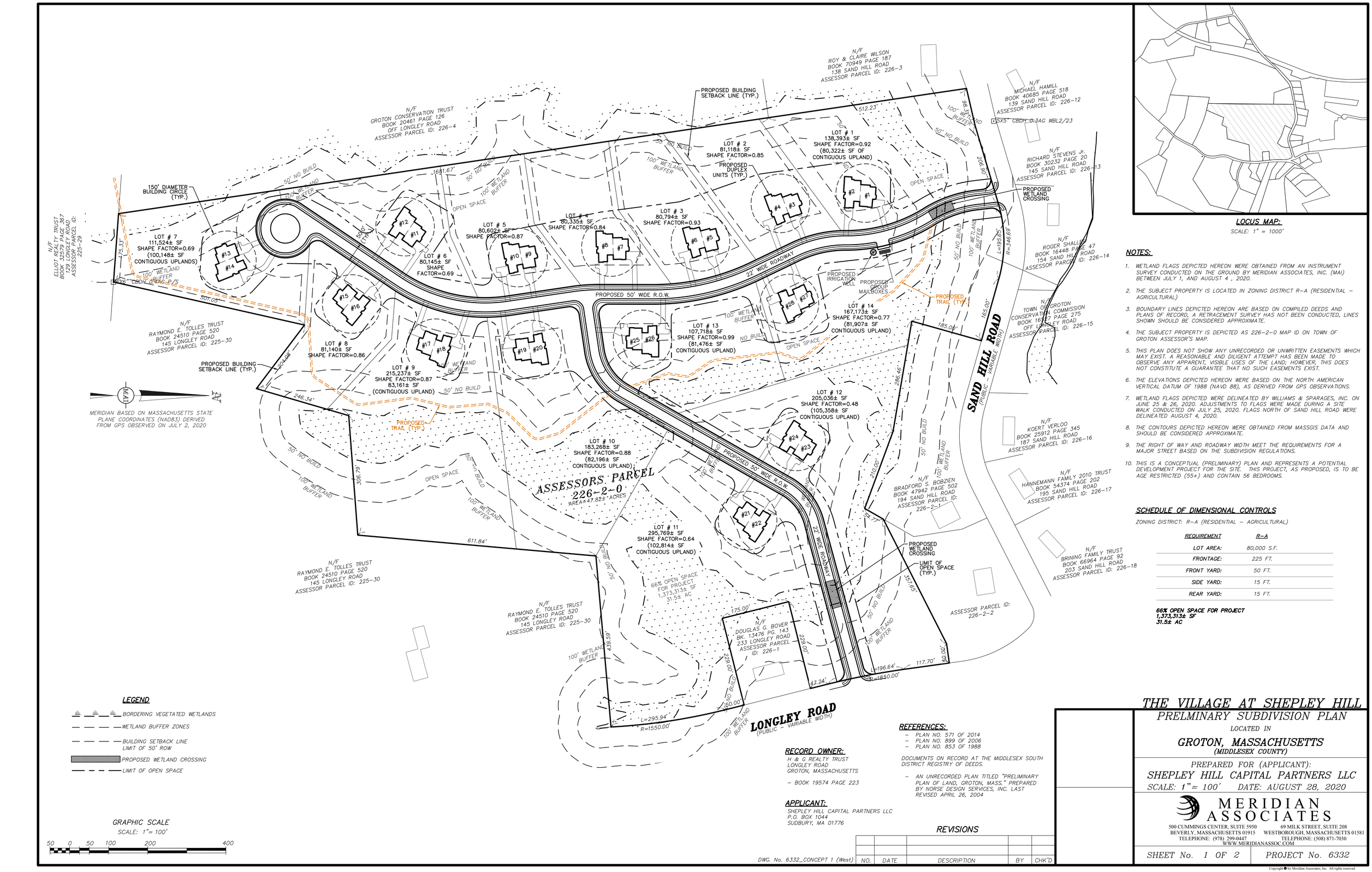
- Snow windrows within sight triangle areas of the Project site roadways should be promptly removed where such accumulations would impede sight lines.

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.

APPENDIX

PROJECT SITE PLAN
AUTOMATIC TRAFFIC RECORDER COUNT DATA
MANUAL TURNING MOVEMENT COUNT DATA
SEASONAL ADJUSTMENT DATA
COVID-19 ADJUSTMENT DATA
VEHICLE TRAVEL SPEED DATA
MASSDOT CRASH RATE WORKSHEETS AND HIGH CRASH LOCATION MAPPING
GENERAL BACKGROUND TRAFFIC GROWTH
TRIP-GENERATION CALCULATIONS
COMPARATIVE TRIP-GENERATION CALCULATIONS
JOURNEY TO WORK TRIP DISTRIBUTION
CAPACITY ANALYSIS WORKSHEETS

PROJECT SITE PLAN



LOCUS MAP:

SCALE: 1" = 1000'

NOTES:

1. WETLAND FLAGS DEPICTED HEREON WERE OBTAINED FROM AN INSTRUMENT SURVEY CONDUCTED ON THE GROUND BY MERIDIAN ASSOCIATES, INC. (MAI) BETWEEN JULY 1, AND AUGUST 4 , 2020.
2. THE SUBJECT PROPERTY IS LOCATED IN ZONING DISTRICT R-A (RESIDENTIAL – AGRICULTURAL)
3. BOUNDARY LINES DEPICTED HEREON ARE BASED ON COMPILED DEEDS AND PLANS OF RECORD, A RETRACEMENT SURVEY HAS NOT BEEN CONDUCTED, LINES SHOWN SHOULD BE CONSIDERED APPROXIMATE.
4. THE SUBJECT PROPERTY IS DEPICTED AS 226-2-0 MAP ID ON TOWN OF GROTON ASSESSOR'S MAP.
5. THIS PLAN DOES NOT SHOW ANY UNRECORDED OR UNWRITTEN EASEMENTS WHICH MAY EXIST. A REASONABLE AND DILIGENT ATTEMPT HAS BEEN MADE TO OBSERVE ANY APPARENT, VISIBLE USES OF THE LAND; HOWEVER, THIS DOES NOT CONSTITUTE A GUARANTEE THAT NO SUCH EASEMENTS EXIST.
6. THE ELEVATIONS DEPICTED HEREON WERE BASED ON THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88), AS DERIVED FROM GPS OBSERVATIONS.
7. WETLAND FLAGS DEPICTED WERE DELINEATED BY WILLIAMS & SPARAGES, INC. ON JUNE 25 & 26, 2020. ADJUSTMENTS TO FLAGS WERE MADE DURING A SITE WALK CONDUCTED ON JULY 25, 2020. FLAGS NORTH OF SAND HILL ROAD WERE DELINEATED AUGUST 4, 2020.
8. THE CONTOURS DEPICTED HEREON WERE OBTAINED FROM MASSGIS DATA AND SHOULD BE CONSIDERED APPROXIMATE.
9. THE RIGHT OF WAY AND ROADWAY WIDTH MEET THE REQUIREMENTS FOR A MAJOR STREET BASED ON THE SUBDIVISION REGULATIONS.
10. THIS IS A CONCEPTUAL (PRELIMINARY) PLAN AND REPRESENTS A POTENTIAL DEVELOPMENT PROJECT FOR THE SITE. THIS PROJECT, AS PROPOSED, IS TO BE AGE RESTRICTED (55+) AND CONTAIN 56 BEDROOMS.

SCHEDULE OF DIMENSIONAL CONTROLS

ZONING DISTRICT: R-A (RESIDENTIAL – AGRICULTURAL)

REQUIREMENT	R-A
LOT AREA:	80,000 S.F.
FRONTAGE:	225 FT.
FRONT YARD:	50 FT.
SIDE YARD:	15 FT.
REAR YARD:	15 FT.

66% OPEN SPACE FOR PROJECT
1,373,313± SF
31.5± AC

LEGEND

- BORDERING VEGETATED WETLANDS
- WETLAND BUFFER ZONES
- BUILDING SETBACK LINE / LIMIT OF 50' ROW
- PROPOSED WETLAND CROSSING
- LIMIT OF OPEN SPACE

RECORD OWNER:

H & G REALTY TRUST
LONGLEY ROAD
GROTON, MASSACHUSETTS

– BOOK 19574 PAGE 223

APPLICANT:

SHEPLEY HILL CAPITAL PARTNERS LLC
P.O. BOX 1044
SUDBURY, MA 01776

REFERENCES:

- PLAN NO. 571 OF 2014
- PLAN NO. 899 OF 2006
- PLAN NO. 853 OF 1988

DOCUMENTS ON RECORD AT THE MIDDLESEX SOUTH DISTRICT REGISTRY OF DEEDS.

- AN UNRECORDED PLAN TITLED "PRELIMINARY PLAN OF LAND, GROTON, MASS." PREPARED BY NORSE DESIGN SERVICES, INC. LAST REVISED APRIL 26, 2004

REVISIONS

NO.	DATE	DESCRIPTION	BY	CHK'D

DWG. No. 6332_CONCEPT 1 (West)

THE VILLAGE AT SHEPLEY HILL

PRELIMINARY SUBDIVISION PLAN

LOCATED IN

GROTON, MASSACHUSETTS
(MIDDLESEX COUNTY)

PREPARED FOR (APPLICANT):
SHEPLEY HILL CAPITAL PARTNERS LLC

SCALE: 1"= 100' DATE: AUGUST 28, 2020

MERIDIAN ASSOCIATES
500 CUMMINGS CENTER, SUITE 5950 BEVERLY, MASSACHUSETTS 01915 TELEPHONE: (978) 299-0447
69 MILK STREET, SUITE 208 WESTBOROUGH, MASSACHUSETTS 01581 TELEPHONE: (508) 871-7030
WWW.MERIDIANASSOC.COM

SHEET No. 1 OF 2 PROJECT No. 6332

AUTOMATIC TRAFFIC RECORDER COUNT DATA

Vanasse & Associates

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

Vanasse & Associates
Location: Longley Road
Location: At Site Drive
City: Groton, MA

Site Code: 00868505

Start	10-Aug-20		Tue		Wed		Thu		Fri		Sat		Sun		Week Average	
Time	Northboun	Southbo	Northbou	Southbo	Northbou	Southbo	Northbou	Southbo	Northbou	Southbo	Northbou	Southbo	Northbou	Southbo	Northbou	Southbo
12:00 AM	*	*	6	3	3	2	2	2	*	*	*	*	*	*	4	2
01:00	*	*	1	2	4	2	0	1	*	*	*	*	*	*	2	2
02:00	*	*	3	1	3	3	**3**	4	*	*	*	*	*	*	3	3
03:00	*	*	1	7	2	5	0	3	*	*	*	*	*	*	1	5
04:00	*	*	4	19	3	15	2	7	*	*	*	*	*	*	3	14
05:00	*	*	8	67	7	72	0	**22**	*	*	*	*	*	*	5	54
06:00	*	*	30	129	24	126	3	19	*	*	*	*	*	*	19	91
07:00	*	*	55	**172**	59	**161**	*	*	*	*	*	*	*	*	57	**166**
08:00	*	*	58	122	69	146	*	*	*	*	*	*	*	*	64	134
09:00	*	*	65	109	64	125	*	*	*	*	*	*	*	*	64	117
10:00	*	*	**86**	89	83	100	*	*	*	*	*	*	*	*	84	94
11:00	*	*	77	89	**100**	106	*	*	*	*	*	*	*	*	**88**	98
12:00 PM	*	*	99	106	88	102	*	*	*	*	*	*	*	*	94	104
01:00	*	*	88	89	95	88	*	*	*	*	*	*	*	*	92	88
02:00	*	*	110	102	138	103	*	*	*	*	*	*	*	*	124	102
03:00	153	93	**196**	109	169	113	*	*	*	*	*	*	*	*	173	105
04:00	**163**	**101**	167	106	**195**	**120**	*	*	*	*	*	*	*	*	**175**	**109**
05:00	133	93	152	**116**	167	103	*	*	*	*	*	*	*	*	151	104
06:00	104	73	114	74	117	53	*	*	*	*	*	*	*	*	112	67
07:00	64	41	86	53	56	55	*	*	*	*	*	*	*	*	69	50
08:00	50	28	58	29	46	33	*	*	*	*	*	*	*	*	51	30
09:00	25	21	45	19	24	11	*	*	*	*	*	*	*	*	31	17
10:00	22	9	25	11	16	10	*	*	*	*	*	*	*	*	21	10
11:00	12	5	16	10	8	3	*	*	*	*	*	*	*	*	12	6
Lane	726	464	1550	1633	1540	1657	10	58	0	0	0	0	0	0	1499	1572
Day	1190		3183		3197		68		0		0		0		3071	
AM Peak	-	-	10:00	07:00	11:00	07:00	02:00	05:00	-	-	-	-	-	-	11:00	07:00
Vol.	-	-	86	172	100	161	3	22	-	-	-	-	-	-	88	166
PM Peak	16:00	16:00	15:00	17:00	16:00	16:00	-	-	-	-	-	-	-	-	16:00	16:00
Vol.	163	101	196	116	195	120	-	-	-	-	-	-	-	-	175	109

Comb. Total	1190	3183	3197	68	0	0	0	3071

ADT ADT 3,070 AADT 3,070

Vanasse & Associates

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

Vanasse & Associates
Location: Sand Hill Road
Location: At Site Drive
City: Groton, MA

Site Code: 00868504

Start Time	10-Aug-20 Westbou	10-Aug-20 Eastbou	Tue Westbou	Tue Eastbou	Wed Westbou	Wed Eastbou	Thu Westbou	Thu Eastbou	Fri Westbou	Fri Eastbou	Sat Westbou	Sat Eastbou	Sun Westbou	Sun Eastbou	Week Average Westbou	Week Average Eastbou
12:00 AM	*	*	0	1	0	1	0	1	*	*	*	*	*	*	0	1
01:00	*	*	0	0	0	1	1	0	*	*	*	*	*	*	0	0
02:00	*	*	0	0	1	0	1	0	*	*	*	*	*	*	1	0
03:00	*	*	0	0	0	0	0	0	*	*	*	*	*	*	0	0
04:00	*	*	0	0	0	0	0	0	*	*	*	*	*	*	0	0
05:00	*	*	3	0	2	1	**3**	0	*	*	*	*	*	*	3	0
06:00	*	*	3	5	5	3	1	**2**	*	*	*	*	*	*	3	3
07:00	*	*	7	10	8	10	*	*	*	*	*	*	*	*	8	10
08:00	*	*	16	15	13	16	*	*	*	*	*	*	*	*	14	16
09:00	*	*	14	**26**	16	13	*	*	*	*	*	*	*	*	15	**20**
10:00	*	*	14	13	16	**17**	*	*	*	*	*	*	*	*	15	15
11:00	*	*	**18**	18	**17**	17	*	*	*	*	*	*	*	*	**18**	18
12:00 PM	*	*	15	22	11	17	*	*	*	*	*	*	*	*	13	**20**
01:00	*	*	**20**	20	15	15	*	*	*	*	*	*	*	*	**18**	18
02:00	15	**22**	10	15	18	**21**	*	*	*	*	*	*	*	*	14	19
03:00	**24**	21	7	**24**	18	14	*	*	*	*	*	*	*	*	16	20
04:00	13	18	18	20	**24**	21	*	*	*	*	*	*	*	*	18	20
05:00	17	21	18	23	14	14	*	*	*	*	*	*	*	*	16	19
06:00	14	14	9	20	13	20	*	*	*	*	*	*	*	*	12	18
07:00	5	16	9	15	13	17	*	*	*	*	*	*	*	*	9	16
08:00	3	6	4	9	12	13	*	*	*	*	*	*	*	*	6	9
09:00	6	5	4	9	4	3	*	*	*	*	*	*	*	*	5	6
10:00	5	2	1	2	4	2	*	*	*	*	*	*	*	*	3	2
11:00	0	2	1	4	1	3	*	*	*	*	*	*	*	*	1	3
Lane	102	127	191	271	225	239	6	3	0	0	0	0	0	0	208	253
Day	229		462		464		9		0		0		0		461	
AM Peak	-	-	11:00	09:00	11:00	10:00	05:00	06:00	-	-	-	-	-	-	11:00	09:00
Vol.	-	-	18	26	17	17	3	2	-	-	-	-	-	-	18	20
PM Peak	15:00	14:00	13:00	15:00	16:00	14:00	-	-	-	-	-	-	-	-	13:00	12:00
Vol.	24	22	20	24	24	21	-	-	-	-	-	-	-	-	18	20

Comb. Total	229	462	464	9	0	0	0	461

ADT ADT 460 AADT 460

MANUAL TURNING MOVEMENT COUNT DATA

Vanasse & Associates

Longley Road at Sand Hill Road
Groton, MA
Weather: Clear

File Name : 868501am
Site Code : 00868501
Start Date : 8/13/2020
Page No : 1

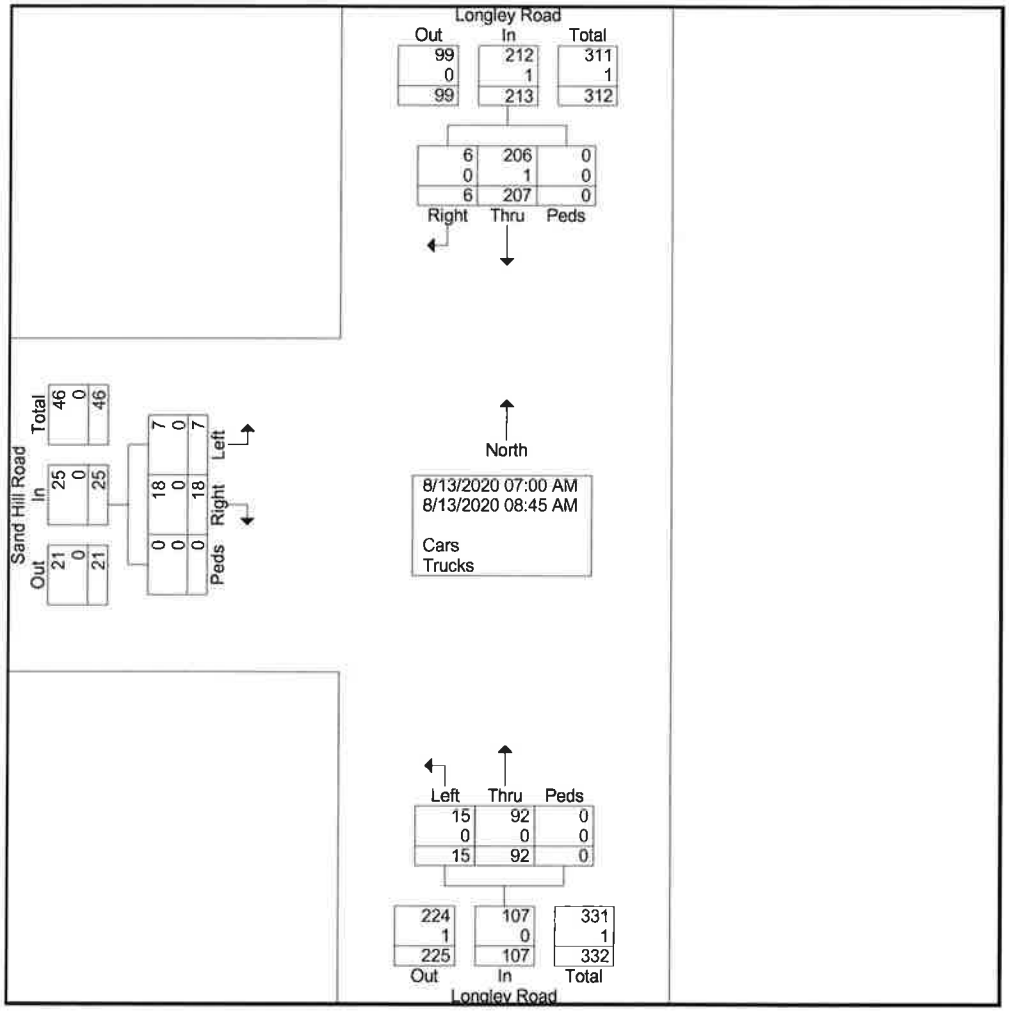
Groups Printed- Cars - Trucks

	Longley Road From North				Longley Road From South				Sand Hill Road From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
07:00 AM	0	28	0	28	9	0	0	9	1	2	0	3	40
07:15 AM	2	30	0	32	13	0	0	13	1	0	0	1	46
07:30 AM	0	30	0	30	8	2	0	10	3	0	0	3	43
07:45 AM	0	26	0	26	9	6	0	15	2	1	0	3	44
Total	2	114	0	116	39	8	0	47	7	3	0	10	173
08:00 AM	0	25	0	25	12	1	0	13	3	0	0	3	41
08:15 AM	1	24	0	25	17	3	0	20	5	2	0	7	52
08:30 AM	1	22	0	23	9	2	0	11	1	1	0	2	36
08:45 AM	2	22	0	24	15	1	0	16	2	1	0	3	43
Total	4	93	0	97	53	7	0	60	11	4	0	15	172
Grand Total	6	207	0	213	92	15	0	107	18	7	0	25	345
Apprch %	2.8	97.2	0		86	14	0		72	28	0		
Total %	1.7	60	0	61.7	26.7	4.3	0	31	5.2	2	0	7.2	
Cars	6	206	0	212	92	15	0	107	18	7	0	25	344
% Cars	100	99.5	0	99.5	100	100	0	100	100	100	0	100	99.7
Trucks	0	1	0	1	0	0	0	0	0	0	0	0	1
% Trucks	0	0.5	0	0.5	0	0	0	0	0	0	0	0	0.3

Vanasse & Associates

Longley Road at Sand Hill Road
Groton, MA
Weather: Clear

File Name : 868501am
Site Code : 00868501
Start Date : 8/13/2020
Page No : 2



Vanasse & Associates

Longley Road at Sand Hill Road
Groton, MA
Weather: Clear

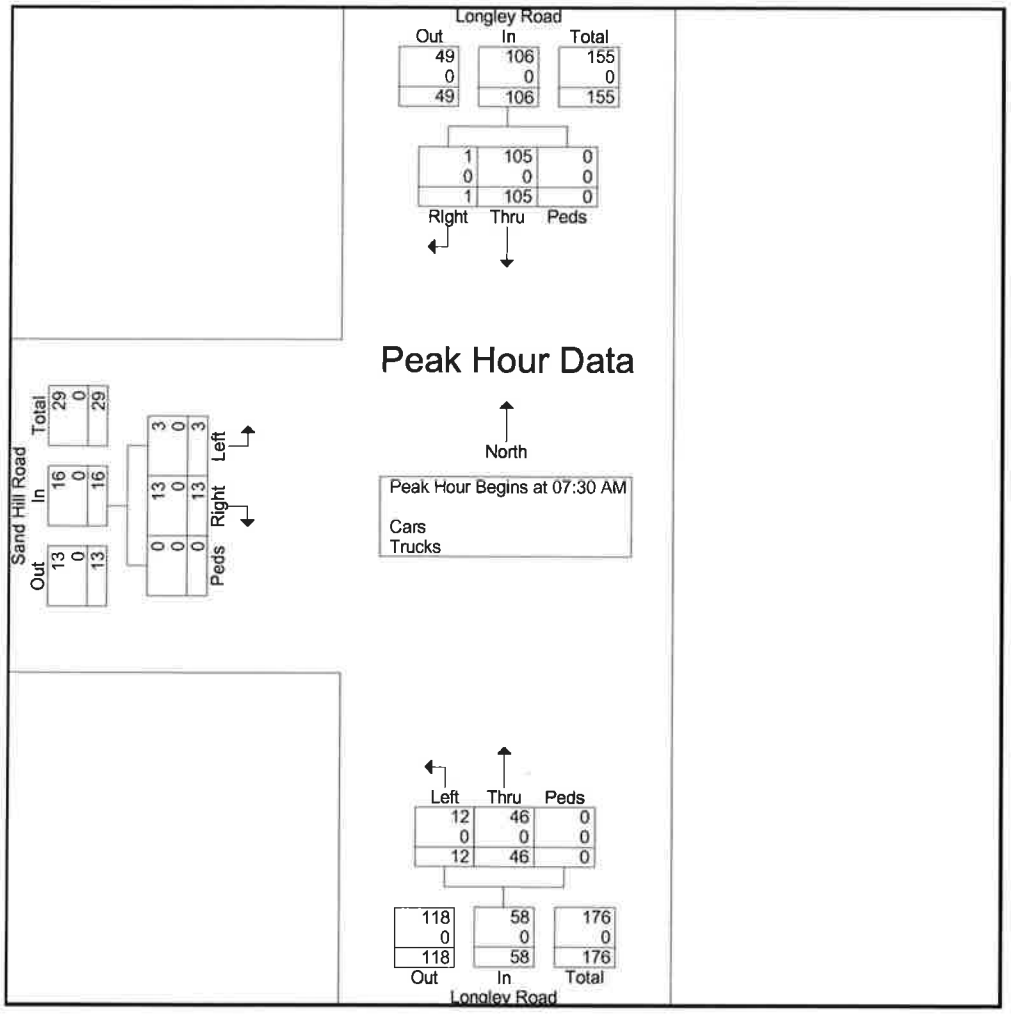
File Name : 868501am
Site Code : 00868501
Start Date : 8/13/2020
Page No : 3

	Longley Road From North				Longley Road From South				Sand Hill Road From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	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	**30**	0	**30**	8	2	0	10	3	0	0	3	43
07:45 AM	0	26	0	26	9	**6**	0	15	2	1	0	3	44
08:00 AM	0	25	0	25	12	1	0	13	3	0	0	3	41
08:15 AM	**1**	24	0	25	**17**	3	0	**20**	**5**	**2**	0	**7**	**52**
Total Volume	1	105	0	106	46	12	0	58	13	3	0	16	180
% App. Total	0.9	99.1	0		79.3	20.7	0		81.2	18.8	0		
PHF	.250	.875	.000	.883	.676	.500	.000	.725	.650	.375	.000	.571	.865
Cars	1	105	0	106	46	12	0	58	13	3	0	16	180
% Cars	100	100	0	100	100	100	0	100	100	100	0	100	100
Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0
% Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0

Vanasse & Associates

Longley Road at Sand Hill Road
Groton, MA
Weather: Clear

File Name : 868501am
Site Code : 00868501
Start Date : 8/13/2020
Page No : 4



Vanasse & Associates

Longley Road at Sand Hill Road
Groton, MA
Weather: Clear

File Name : 868501am
Site Code : 00868501
Start Date : 8/13/2020
Page No : 1

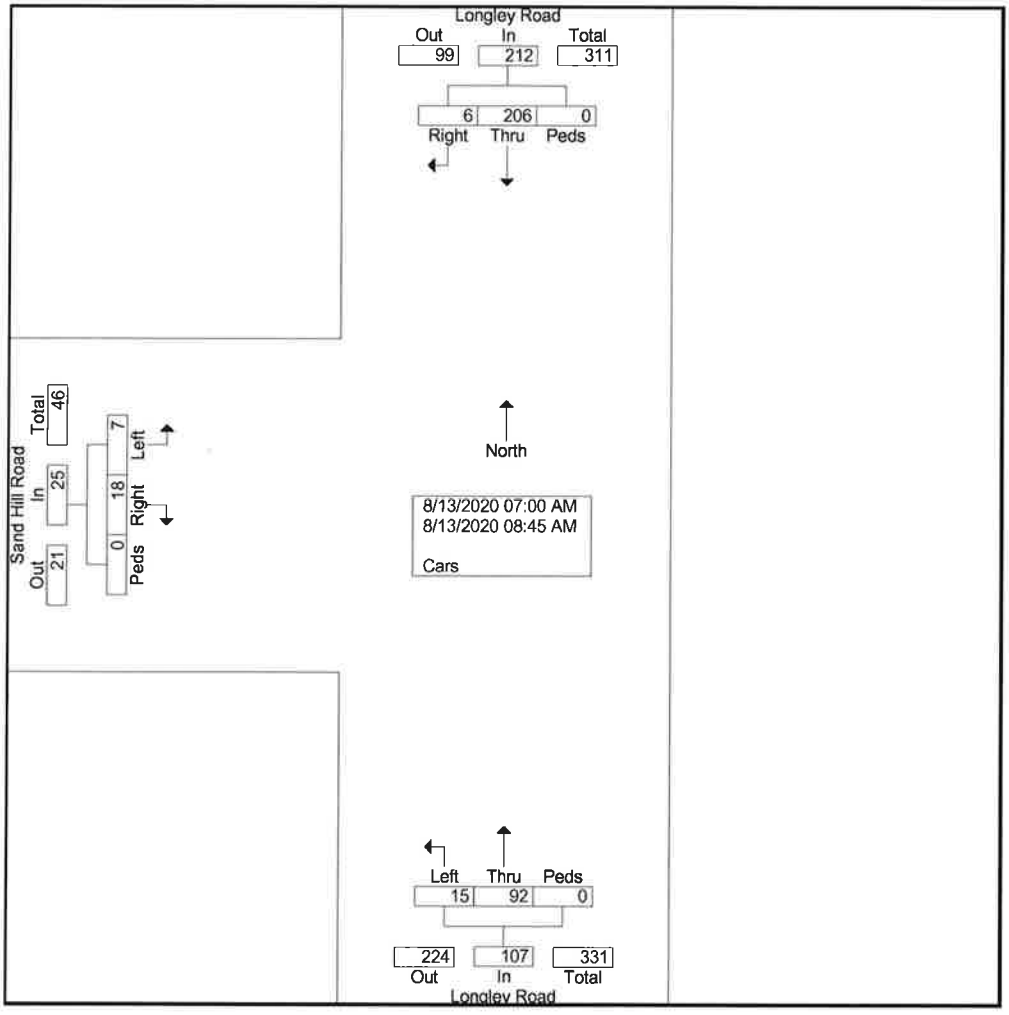
Groups Printed- Cars

	Longley Road From North				Longley Road From South				Sand Hill Road From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
07:00 AM	0	28	0	28	9	0	0	9	1	2	0	3	40
07:15 AM	2	30	0	32	13	0	0	13	1	0	0	1	46
07:30 AM	0	30	0	30	8	2	0	10	3	0	0	3	43
07:45 AM	0	26	0	26	9	6	0	15	2	1	0	3	44
Total	2	114	0	116	39	8	0	47	7	3	0	10	173
08:00 AM	0	25	0	25	12	1	0	13	3	0	0	3	41
08:15 AM	1	24	0	25	17	3	0	20	5	2	0	7	52
08:30 AM	1	22	0	23	9	2	0	11	1	1	0	2	36
08:45 AM	2	21	0	23	15	1	0	16	2	1	0	3	42
Total	4	92	0	96	53	7	0	60	11	4	0	15	171
Grand Total	6	206	0	212	92	15	0	107	18	7	0	25	344
Apprch %	2.8	97.2	0		86	14	0		72	28	0		
Total %	1.7	59.9	0	61.6	26.7	4.4	0	31.1	5.2	2	0	7.3	

Vanasse & Associates

Longley Road at Sand Hill Road
Groton, MA
Weather: Clear

File Name : 868501am
Site Code : 00868501
Start Date : 8/13/2020
Page No : 2

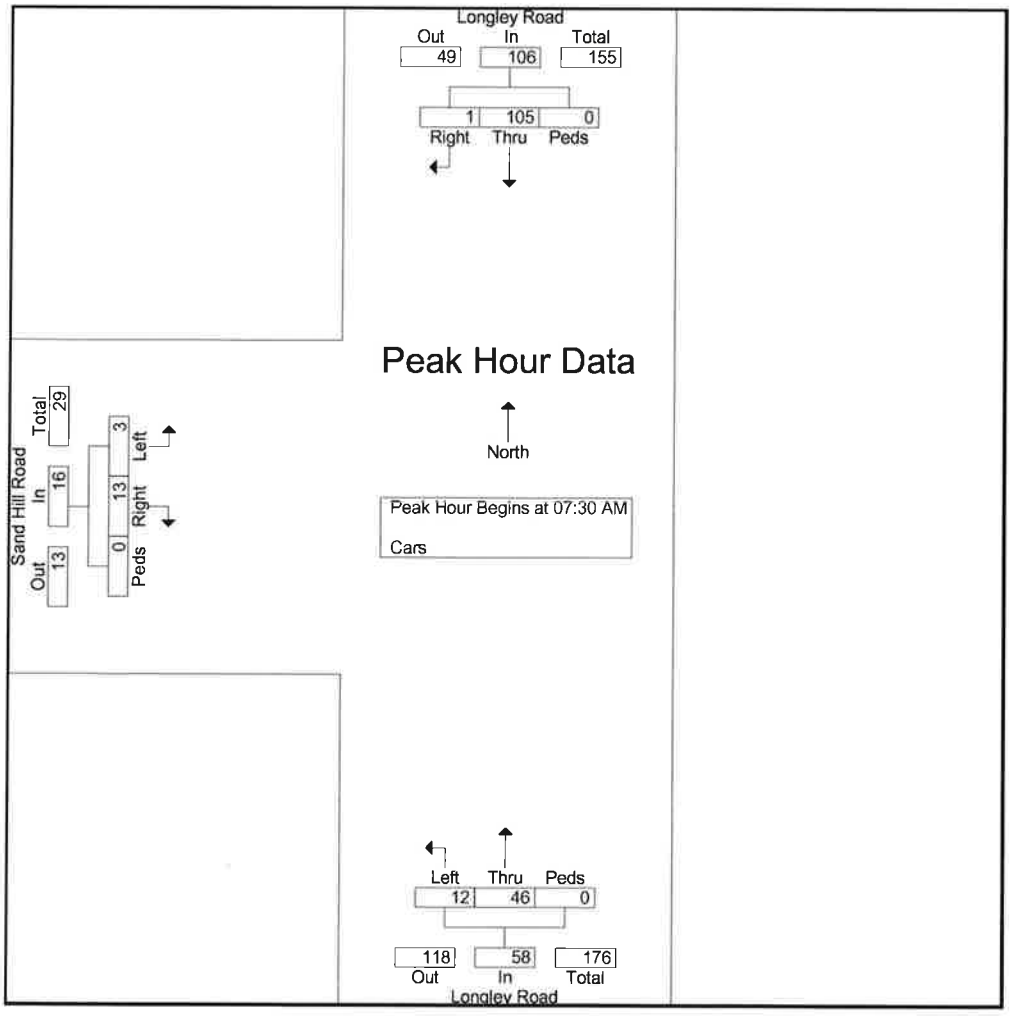


Vanasse & Associates

Longley Road at Sand Hill Road
Groton, MA
Weather: Clear

File Name : 868501am
Site Code : 00868501
Start Date : 8/13/2020
Page No : 3

	Longley Road From North				Longley Road From South				Sand Hill Road From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	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	**30**	0	**30**	8	2	0	10	3	0	0	3	43
07:45 AM	0	26	0	26	9	**6**	0	15	2	1	0	3	44
08:00 AM	0	25	0	25	12	1	0	13	3	0	0	3	41
08:15 AM	**1**	24	0	25	**17**	3	0	**20**	**5**	**2**	0	**7**	**52**
Total Volume	1	105	0	106	46	12	0	58	13	3	0	16	180
% App. Total	0.9	99.1	0		79.3	20.7	0		81.2	18.8	0		
PHF	.250	.875	.000	.883	.676	.500	.000	.725	.650	.375	.000	.571	.865



Vanasse & Associates

Longley Road at Sand Hill Road
Groton, MA
Weather: Clear

File Name : 868501am
Site Code : 00868501
Start Date : 8/13/2020
Page No : 1

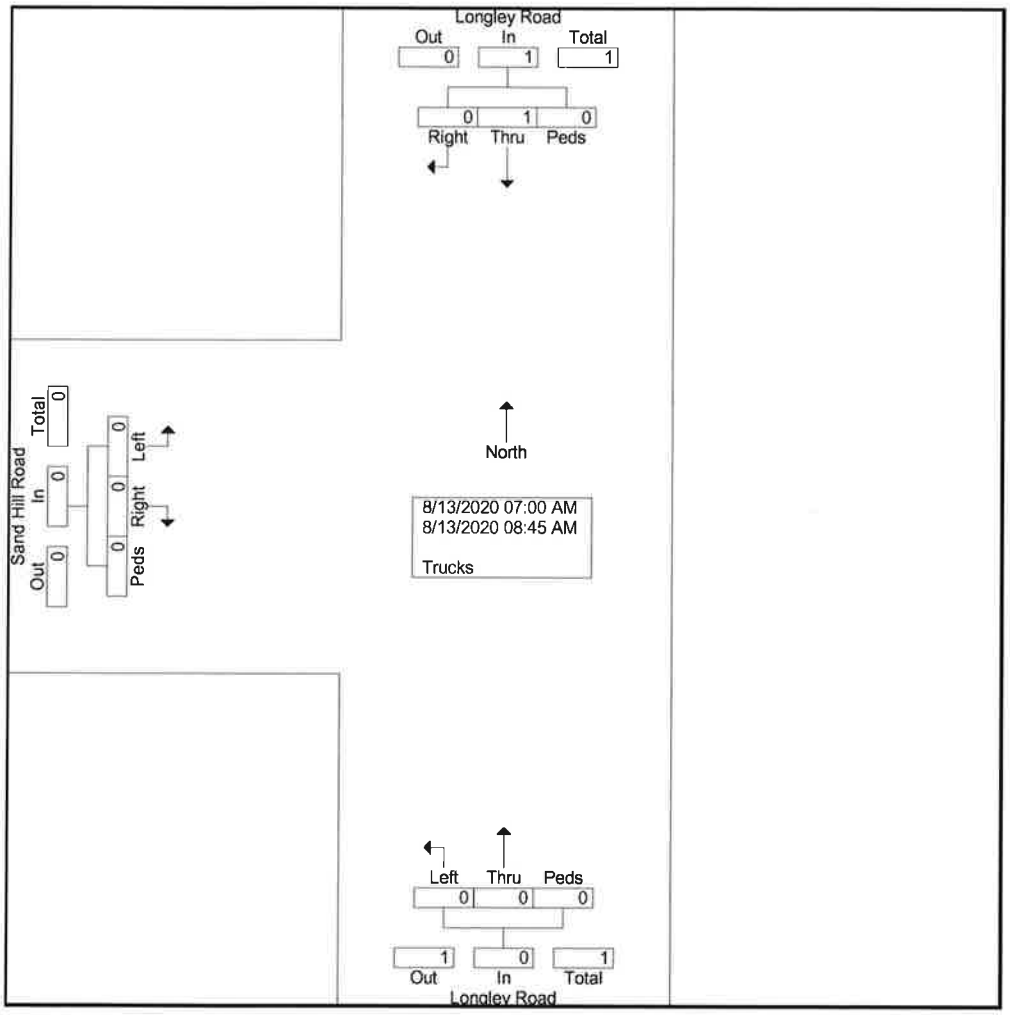
Groups Printed- Trucks

	Longley Road From North				Longley Road From South				Sand Hill Road From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
08:45 AM	0	1	0	1	0	0	0	0	0	0	0	0	1
Total	0	1	0	1	0	0	0	0	0	0	0	0	1
Grand Total	0	1	0	1	0	0	0	0	0	0	0	0	1
Apprch %	0	100	0		0	0	0		0	0	0		
Total %	0	100	0	100	0	0	0	0	0	0	0	0	

Vanasse & Associates

Longley Road at Sand Hill Road
Groton, MA
Weather: Clear

File Name : 868501am
Site Code : 00868501
Start Date : 8/13/2020
Page No : 2

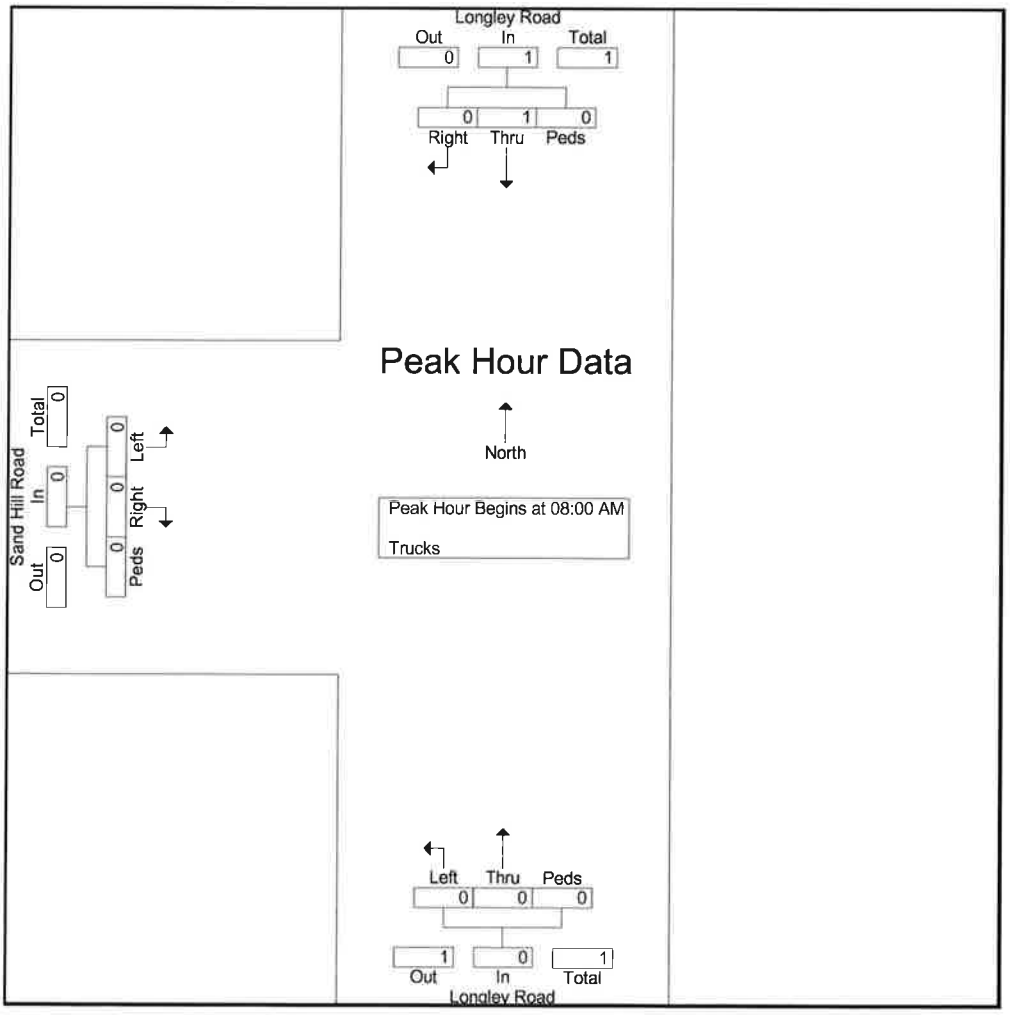


Vanasse & Associates

Longley Road at Sand Hill Road
Groton, MA
Weather: Clear

File Name : 868501am
Site Code : 00868501
Start Date : 8/13/2020
Page No : 3

	Longley Road From North				Longley Road From South				Sand Hill Road From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	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 08:00 AM													
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
08:45 AM	0	1	0	1	0	0	0	0	0	0	0	0	1
Total Volume	0	1	0	1	0	0	0	0	0	0	0	0	1
% App. Total	0	100	0		0	0	0		0	0	0		
PHF	.000	.250	.000	.250	.000	.000	.000	.000	.000	.000	.000	.000	.250



Vanasse & Associates

Longley Road at Sand Hill Road
Groton, MA
Weather: Clear

File Name : 868501pm
Site Code : 00868601
Start Date : 8/13/2020
Page No : 1

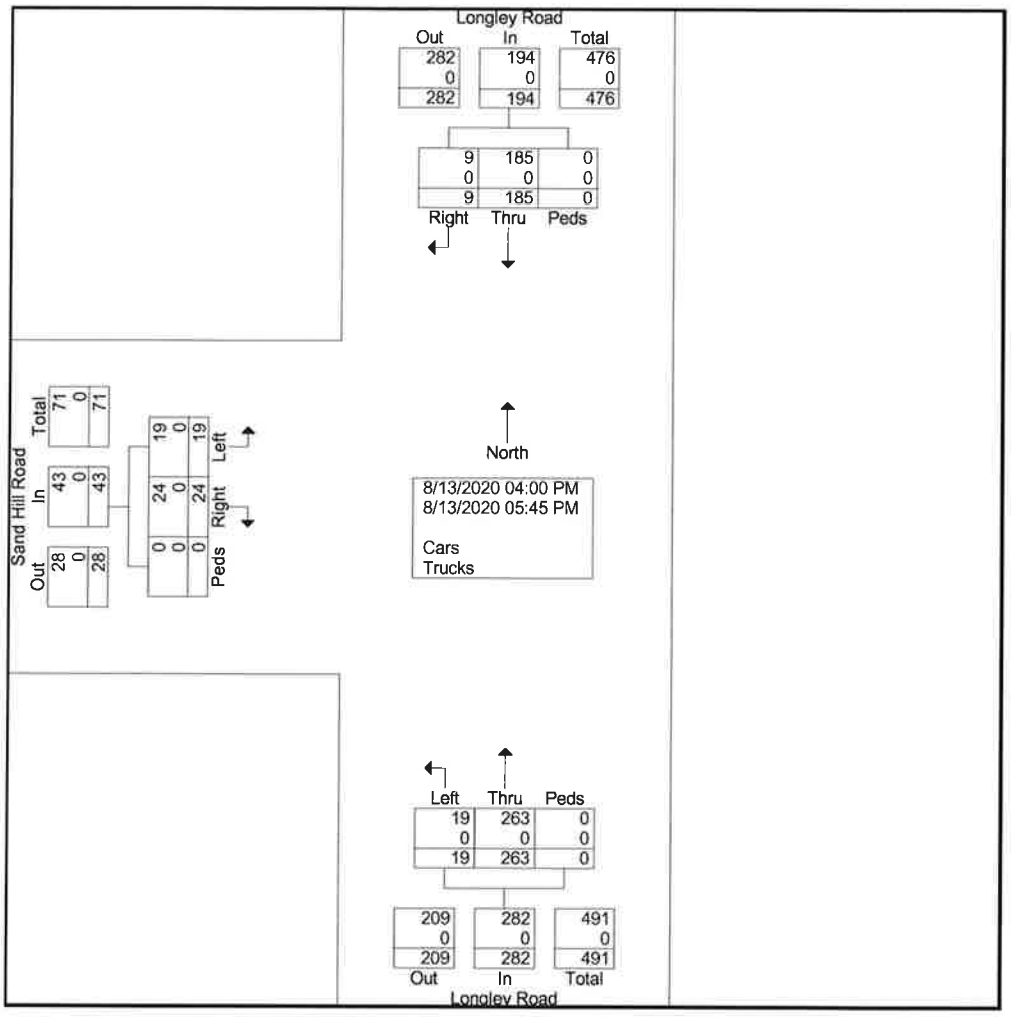
Groups Printed- Cars - Trucks

	Longley Road From North				Longley Road From South				Sand Hill Road From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
04:00 PM	1	24	0	25	42	1	0	43	3	4	0	7	75
04:15 PM	3	26	0	29	25	5	0	30	6	2	0	8	67
04:30 PM	2	22	0	24	34	2	0	36	2	2	0	4	64
04:45 PM	2	25	0	27	40	3	0	43	1	3	0	4	74
Total	8	97	0	105	141	11	0	152	12	11	0	23	280
05:00 PM	0	28	0	28	34	2	0	36	0	0	0	0	64
05:15 PM	1	18	0	19	39	4	0	43	4	2	0	6	68
05:30 PM	0	25	0	25	28	0	0	28	5	1	0	6	59
05:45 PM	0	17	0	17	21	2	0	23	3	5	0	8	48
Total	1	88	0	89	122	8	0	130	12	8	0	20	239
Grand Total	9	185	0	194	263	19	0	282	24	19	0	43	519
Apprch %	4.6	95.4	0		93.3	6.7	0		55.8	44.2	0		
Total %	1.7	35.6	0	37.4	50.7	3.7	0	54.3	4.6	3.7	0	8.3	
Cars	9	185	0	194	263	19	0	282	24	19	0	43	519
% Cars	100	100	0	100	100	100	0	100	100	100	0	100	100
Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0
% Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0

Vanasse & Associates

Longley Road at Sand Hill Road
Groton, MA
Weather: Clear

File Name : 868501pm
Site Code : 00868601
Start Date : 8/13/2020
Page No : 2



Vanasse & Associates

Longley Road at Sand Hill Road
Groton, MA
Weather: Clear

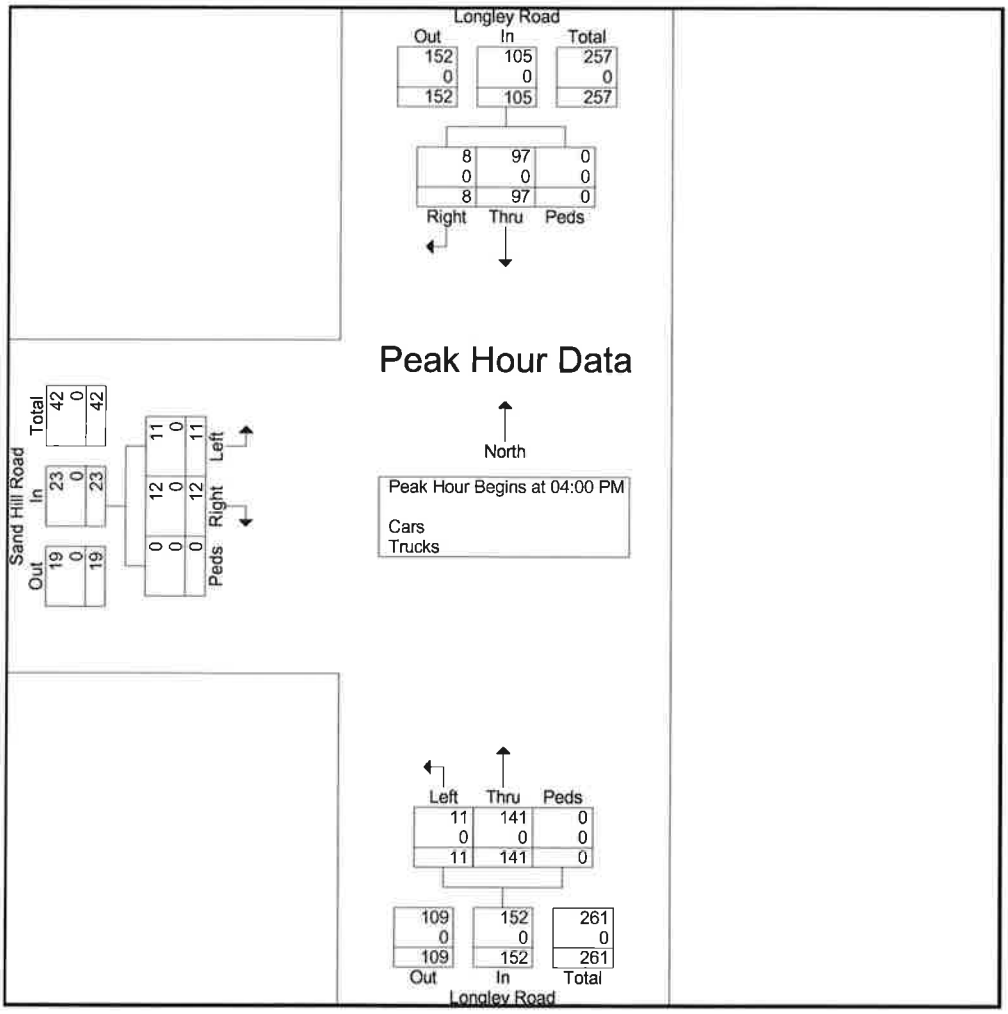
File Name : 868501pm
Site Code : 00868601
Start Date : 8/13/2020
Page No : 3

	Longley Road From North				Longley Road From South				Sand Hill Road From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	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 04:00 PM													
04:00 PM	1	24	0	25	**42**	1	0	**43**	3	**4**	0	7	**75**
04:15 PM	**3**	**26**	0	**29**	25	**5**	0	30	**6**	2	0	**8**	67
04:30 PM	2	22	0	24	34	2	0	36	2	2	0	4	64
04:45 PM	2	25	0	27	40	3	0	43	1	3	0	4	74
Total Volume	8	97	0	105	141	11	0	152	12	11	0	23	280
% App. Total	7.6	92.4	0		92.8	7.2	0		52.2	47.8	0		
PHF	.667	.933	.000	.905	.839	.550	.000	.884	.500	.688	.000	.719	.933
Cars	8	97	0	105	141	11	0	152	12	11	0	23	280
% Cars	100	100	0	100	100	100	0	100	100	100	0	100	100
Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0
% Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0

Vanasse & Associates

Longley Road at Sand Hill Road
Groton, MA
Weather: Clear

File Name : 868501pm
Site Code : 00868601
Start Date : 8/13/2020
Page No : 4



Vanasse & Associates

Longley Road at Sand Hill Road
Groton, MA
Weather: Clear

File Name : 868501pm
Site Code : 00868601
Start Date : 8/13/2020
Page No : 1

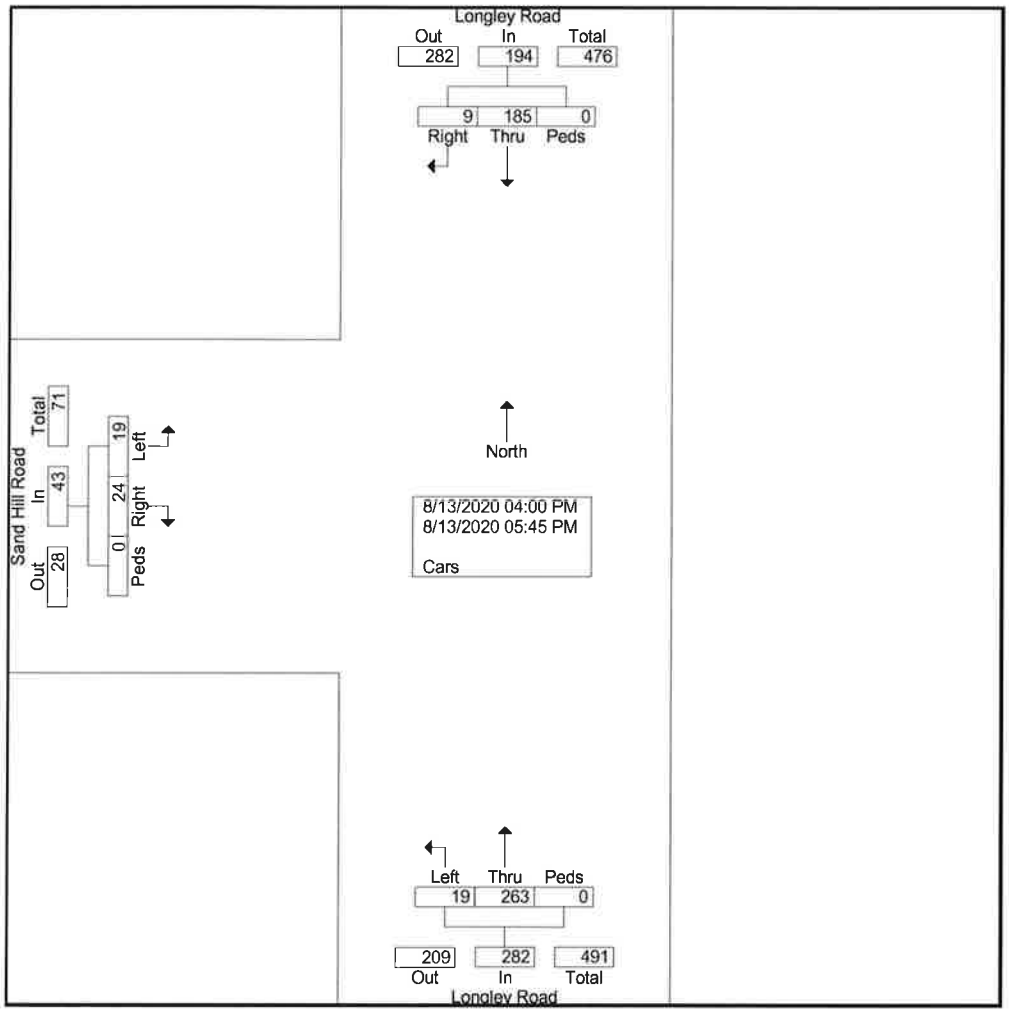
Groups Printed- Cars

	Longley Road From North				Longley Road From South				Sand Hill Road From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
04:00 PM	1	24	0	25	42	1	0	43	3	4	0	7	75
04:15 PM	3	26	0	29	25	5	0	30	6	2	0	8	67
04:30 PM	2	22	0	24	34	2	0	36	2	2	0	4	64
04:45 PM	2	25	0	27	40	3	0	43	1	3	0	4	74
Total	8	97	0	105	141	11	0	152	12	11	0	23	280
05:00 PM	0	28	0	28	34	2	0	36	0	0	0	0	64
05:15 PM	1	18	0	19	39	4	0	43	4	2	0	6	68
05:30 PM	0	25	0	25	28	0	0	28	5	1	0	6	59
05:45 PM	0	17	0	17	21	2	0	23	3	5	0	8	48
Total	1	88	0	89	122	8	0	130	12	8	0	20	239
Grand Total	9	185	0	194	263	19	0	282	24	19	0	43	519
Apprch %	4.6	95.4	0		93.3	6.7	0		55.8	44.2	0		
Total %	1.7	35.6	0	37.4	50.7	3.7	0	54.3	4.6	3.7	0	8.3	

Vanasse & Associates

Longley Road at Sand Hill Road
Groton, MA
Weather: Clear

File Name : 868501pm
Site Code : 00868601
Start Date : 8/13/2020
Page No : 2

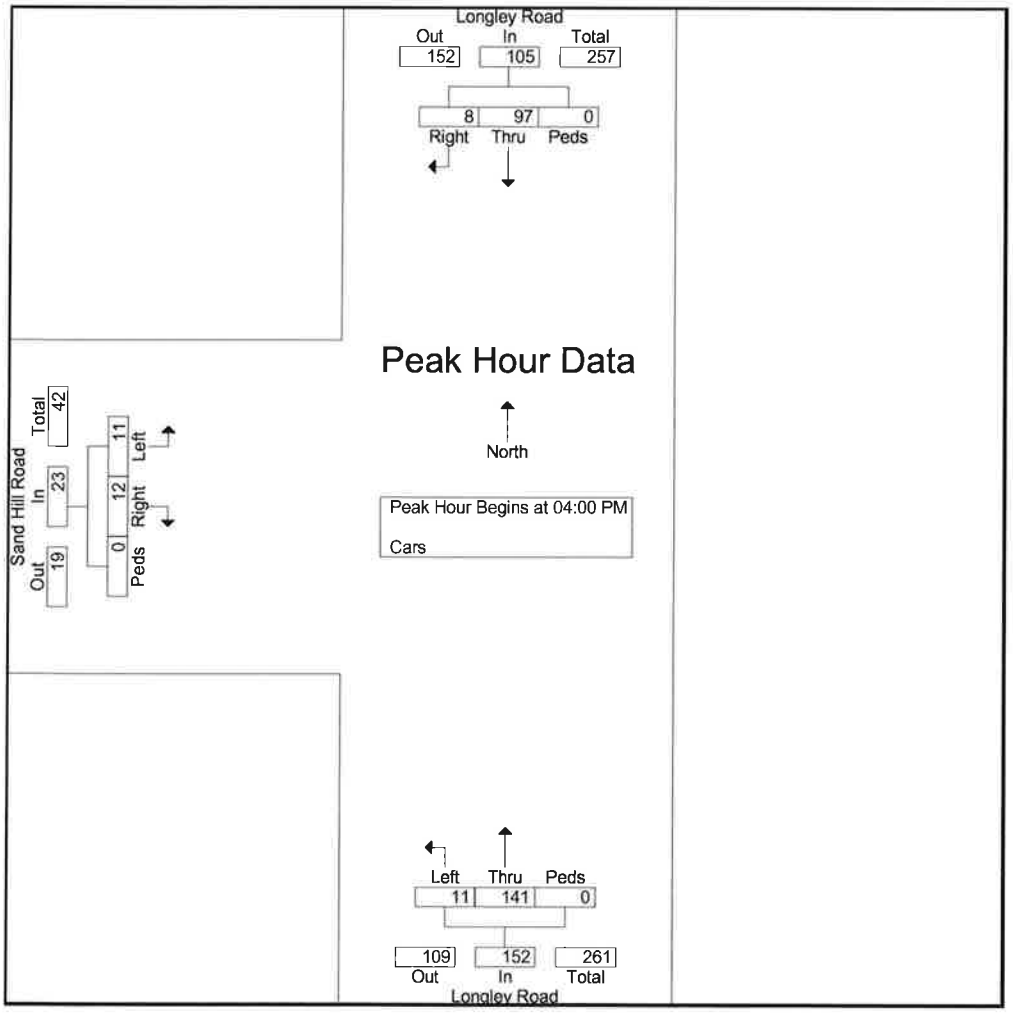


Vanasse & Associates

Longley Road at Sand Hill Road
Groton, MA
Weather: Clear

File Name : 868501pm
Site Code : 00868601
Start Date : 8/13/2020
Page No : 3

	Longley Road From North				Longley Road From South				Sand Hill Road From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	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 04:00 PM													
04:00 PM	1	24	0	25	**42**	1	0	**43**	3	**4**	0	7	**75**
04:15 PM	**3**	**26**	0	**29**	25	**5**	0	30	**6**	2	0	**8**	67
04:30 PM	2	22	0	24	34	2	0	36	2	2	0	4	64
04:45 PM	2	25	0	27	40	3	0	43	1	3	0	4	74
Total Volume	8	97	0	105	141	11	0	152	12	11	0	23	280
% App. Total	7.6	92.4	0		92.8	7.2	0		52.2	47.8	0		
PHF	.667	.933	.000	.905	.839	.550	.000	.884	.500	.688	.000	.719	.933



Vanasse & Associates

Longley Road at Sand Hill Road
Groton, MA
Weather: Clear

File Name : 868501pm
Site Code : 00868601
Start Date : 8/13/2020
Page No : 1

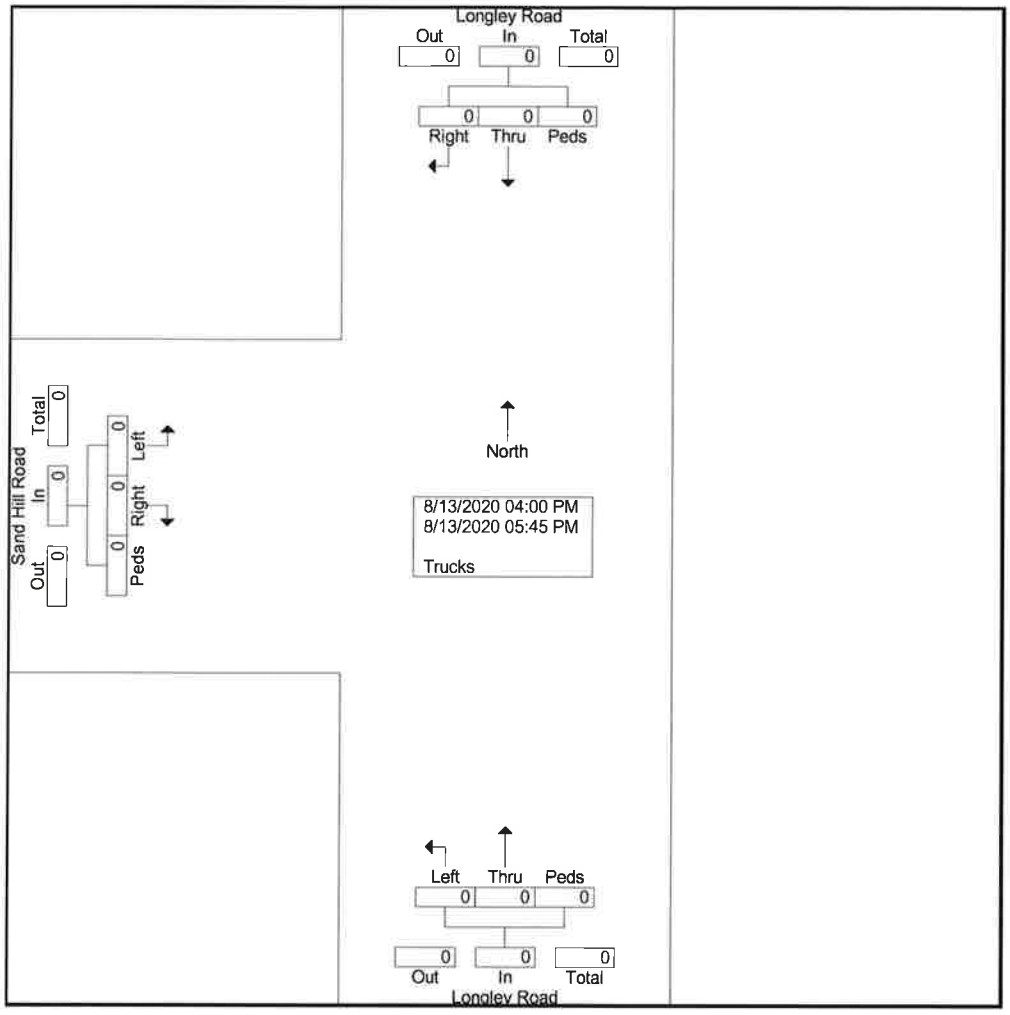
Groups Printed- Trucks

	Longley Road From North				Longley Road From South				Sand Hill Road From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0
05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
05:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	0	0	0	0	0	0	0	0	0	0	0
Apprch %	0	0	0		0	0	0		0	0	0		
Total %													

Vanasse & Associates

Longley Road at Sand Hill Road
Groton, MA
Weather: Clear

File Name : 868501pm
Site Code : 00868601
Start Date : 8/13/2020
Page No : 2

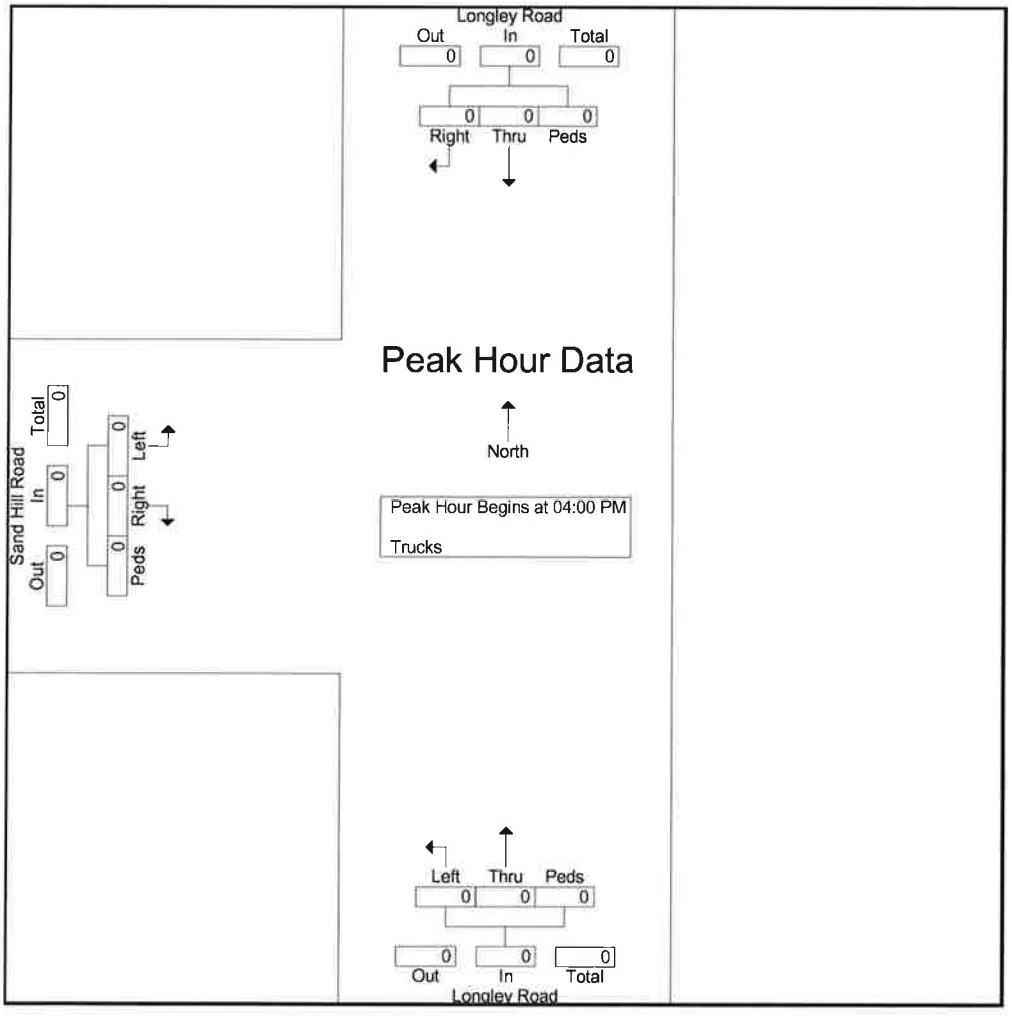


Vanasse & Associates

Longley Road at Sand Hill Road
Groton, MA
Weather: Clear

File Name : 868501pm
Site Code : 00868601
Start Date : 8/13/2020
Page No : 3

	Longley Road From North				Longley Road From South				Sand Hill Road From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	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 04:00 PM													
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0
% App. Total	0	0	0		0	0	0		0	0	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000



Vanasse & Associates

Longley Road at Nashua Road
Groton, MA
Weather: Clear

File Name : 868502am
Site Code : 00868502
Start Date : 8/13/2020
Page No : 1

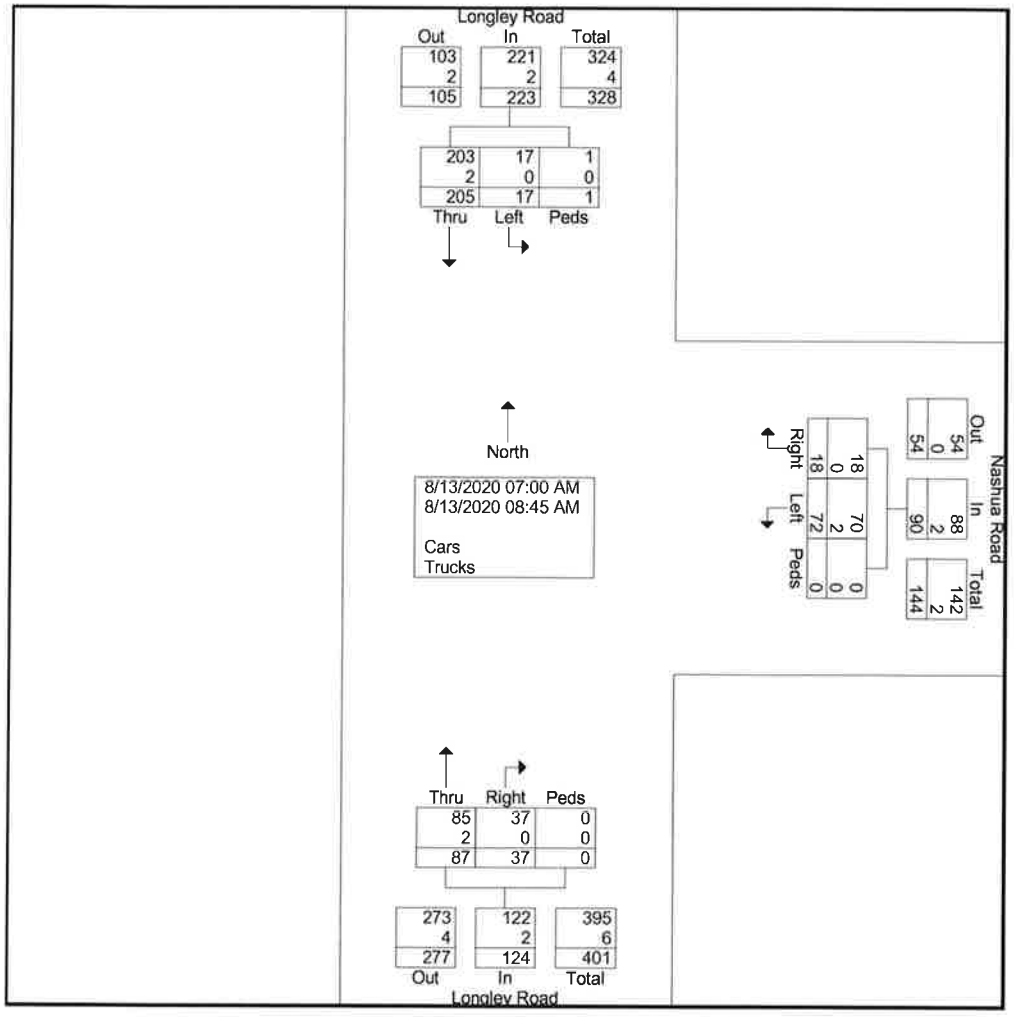
Groups Printed- Cars - Trucks

	Longley Road From North				Nashua Road From East				Longley Road From South				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
07:00 AM	28	0	1	29	1	5	0	6	4	9	0	13	48
07:15 AM	29	2	0	31	2	14	0	16	7	10	0	17	64
07:30 AM	29	3	0	32	4	10	0	14	3	6	0	9	55
07:45 AM	26	1	0	27	6	6	0	12	4	9	0	13	52
Total	112	6	1	119	13	35	0	48	18	34	0	52	219
08:00 AM	24	4	0	28	1	6	0	7	4	12	0	16	51
08:15 AM	24	5	0	29	3	12	0	15	7	17	0	24	68
08:30 AM	22	1	0	23	0	7	0	7	3	10	0	13	43
08:45 AM	23	1	0	24	1	12	0	13	5	14	0	19	56
Total	93	11	0	104	5	37	0	42	19	53	0	72	218
Grand Total	205	17	1	223	18	72	0	90	37	87	0	124	437
Apprch %	91.9	7.6	0.4		20	80	0		29.8	70.2	0		
Total %	46.9	3.9	0.2	51	4.1	16.5	0	20.6	8.5	19.9	0	28.4	
Cars	203	17	1	221	18	70	0	88	37	85	0	122	431
% Cars	99	100	100	99.1	100	97.2	0	97.8	100	97.7	0	98.4	98.6
Trucks	2	0	0	2	0	2	0	2	0	2	0	2	6
% Trucks	1	0	0	0.9	0	2.8	0	2.2	0	2.3	0	1.6	1.4

Vanasse & Associates

Longley Road at Nashua Road
Groton, MA
Weather: Clear

File Name : 868502am
Site Code : 00868502
Start Date : 8/13/2020
Page No : 2



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Longley Road at Nashua Road
Groton, MA
Weather: Clear

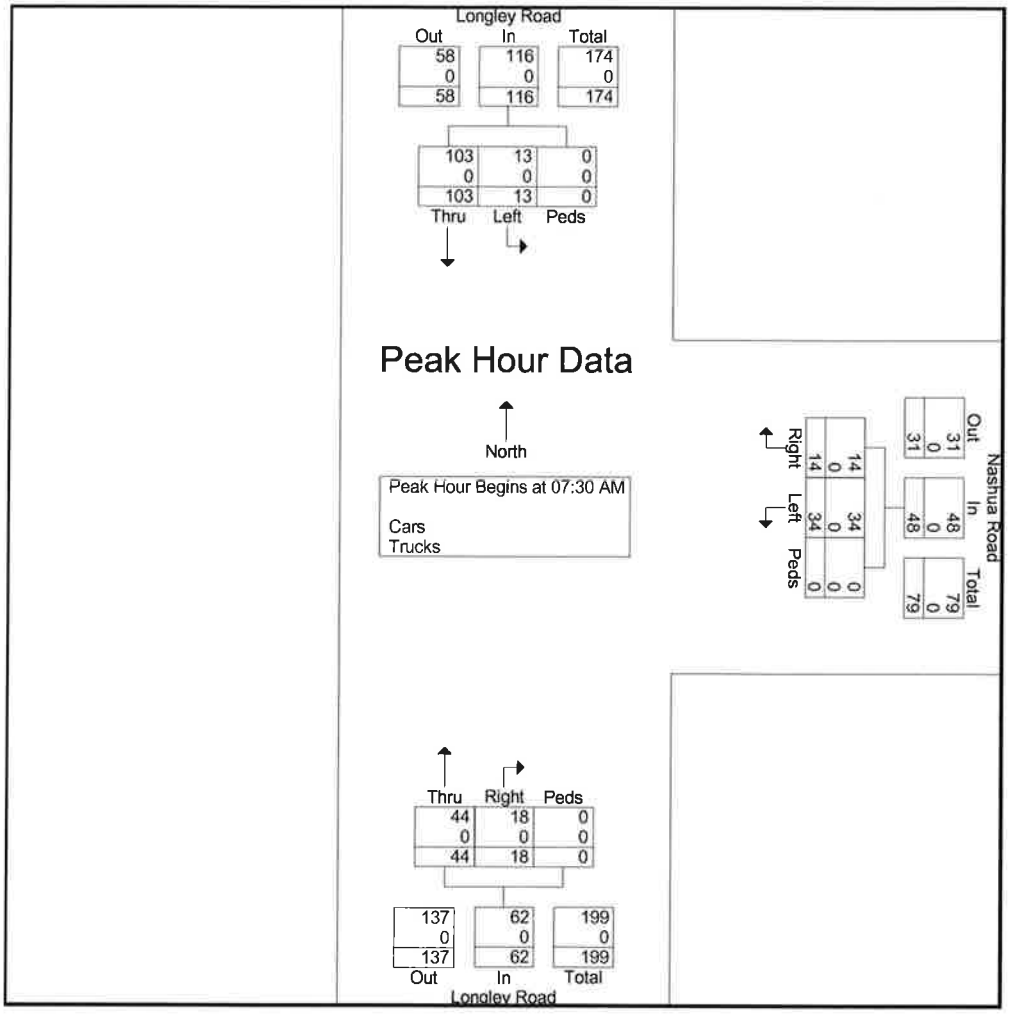
File Name : 868502am
Site Code : 00868502
Start Date : 8/13/2020
Page No : 3

	Longley Road From North				Nashua Road From East				Longley Road From South				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	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	**29**	3	0	**32**	4	10	0	14	3	6	0	9	55
07:45 AM	26	1	0	27	**6**	6	0	12	4	9	0	13	52
08:00 AM	24	4	0	28	1	6	0	7	4	12	0	16	51
08:15 AM	24	**5**	0	29	3	**12**	0	**15**	**7**	**17**	0	**24**	**68**
Total Volume	103	13	0	116	14	34	0	48	18	44	0	62	226
% App. Total	88.8	11.2	0		29.2	70.8	0		29	71	0		
PHF	.888	.650	.000	.906	.583	.708	.000	.800	.643	.647	.000	.646	.831
Cars	103	13	0	116	14	34	0	48	18	44	0	62	226
% Cars	100	100	0	100	100	100	0	100	100	100	0	100	100
Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0
% Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0

Vanasse & Associates

Longley Road at Nashua Road
Groton, MA
Weather: Clear

File Name : 868502am
Site Code : 00868502
Start Date : 8/13/2020
Page No : 4



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Longley Road at Nashua Road
Groton, MA
Weather: Clear

File Name : 868502am
Site Code : 00868502
Start Date : 8/13/2020
Page No : 1

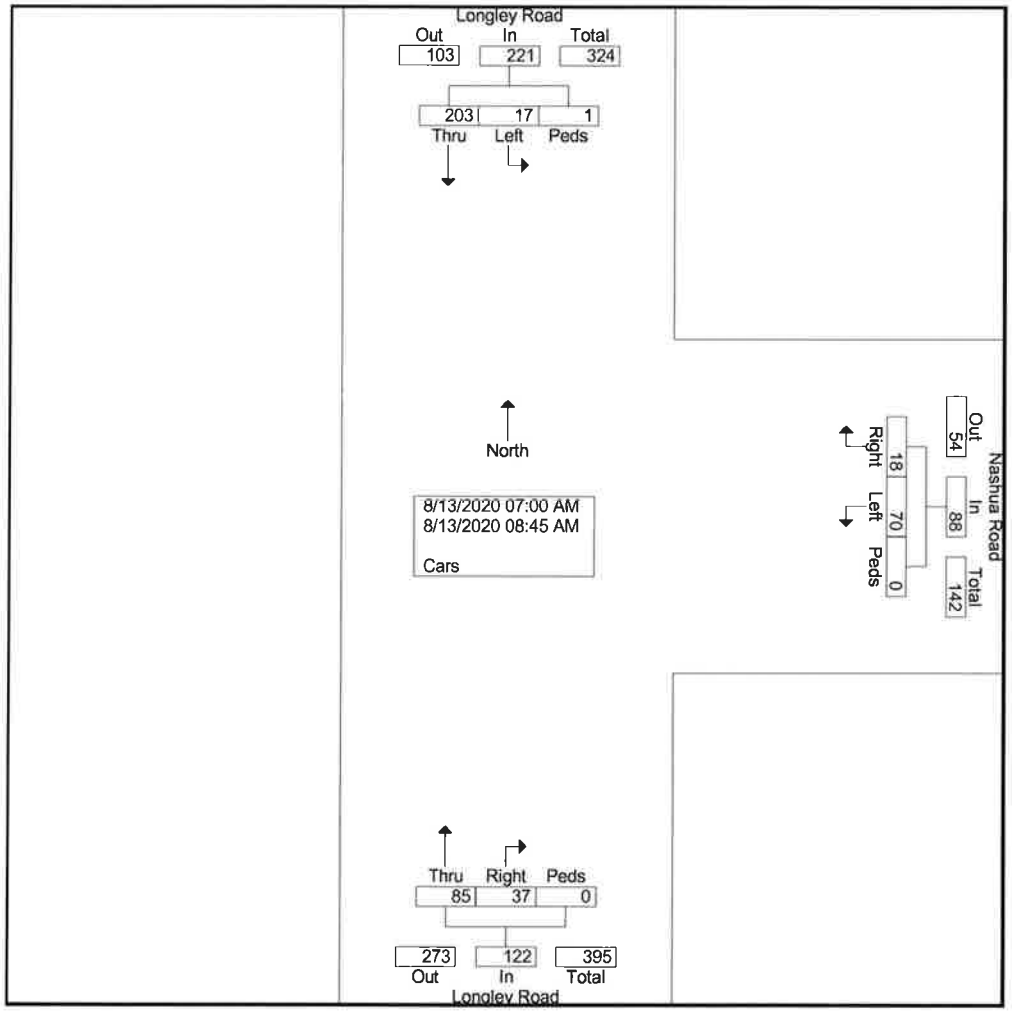
Groups Printed- Cars

	Longley Road From North				Nashua Road From East				Longley Road From South				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
07:00 AM	28	0	1	29	1	5	0	6	4	9	0	13	48
07:15 AM	29	2	0	31	2	14	0	16	7	9	0	16	63
07:30 AM	29	3	0	32	4	10	0	14	3	6	0	9	55
07:45 AM	26	1	0	27	6	6	0	12	4	9	0	13	52
Total	112	6	1	119	13	35	0	48	18	33	0	51	218
08:00 AM	24	4	0	28	1	6	0	7	4	12	0	16	51
08:15 AM	24	5	0	29	3	12	0	15	7	17	0	24	68
08:30 AM	21	1	0	22	0	6	0	6	3	10	0	13	41
08:45 AM	22	1	0	23	1	11	0	12	5	13	0	18	53
Total	91	11	0	102	5	35	0	40	19	52	0	71	213
Grand Total	203	17	1	221	18	70	0	88	37	85	0	122	431
Apprch %	91.9	7.7	0.5		20.5	79.5	0		30.3	69.7	0		
Total %	47.1	3.9	0.2	51.3	4.2	16.2	0	20.4	8.6	19.7	0	28.3	

Vanasse & Associates

Longley Road at Nashua Road
Groton, MA
Weather: Clear

File Name : 868502am
Site Code : 00868502
Start Date : 8/13/2020
Page No : 2



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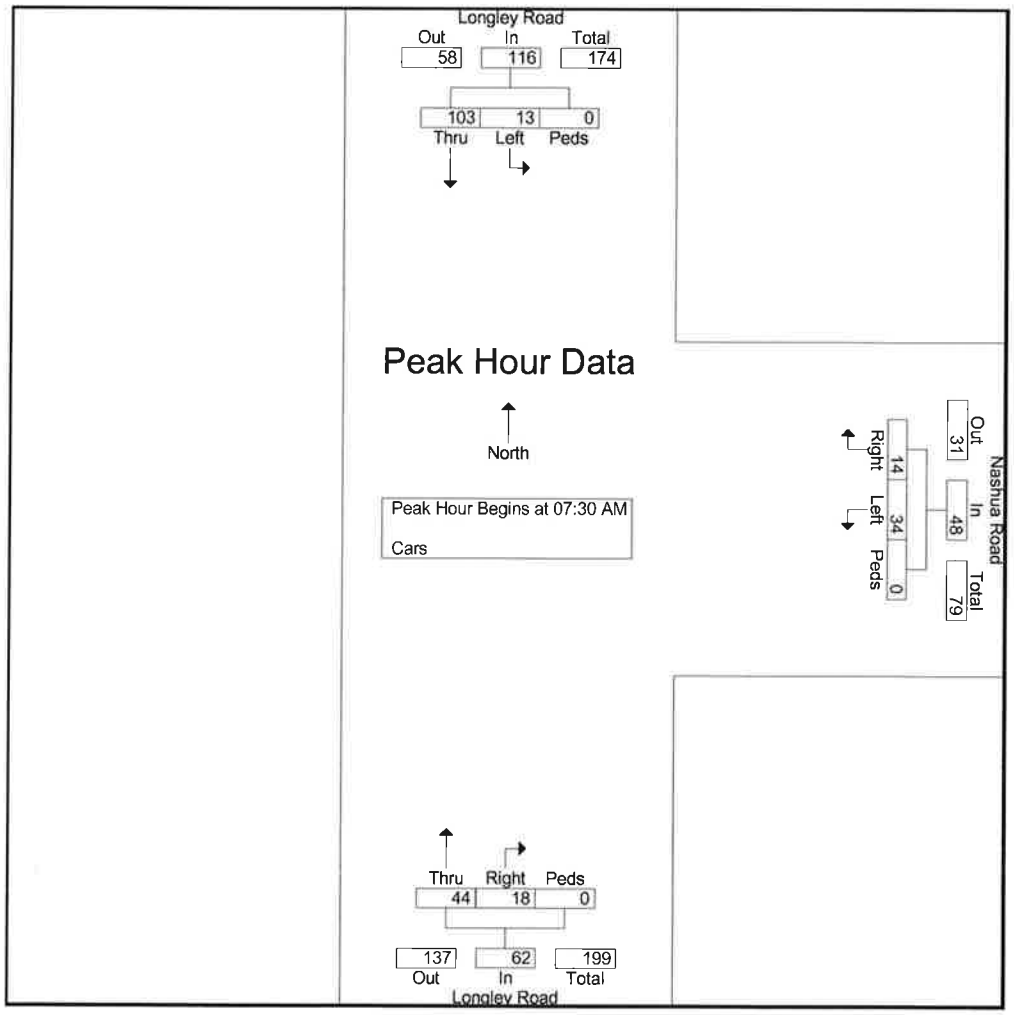
Longley Road at Nashua Road
Groton, MA
Weather: Clear

File Name : 868502am
Site Code : 00868502
Start Date : 8/13/2020
Page No : 3

	Longley Road From North				Nashua Road From East				Longley Road From South				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	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	**29**	3	0	**32**	4	10	0	14	3	6	0	9	55
07:45 AM	26	1	0	27	**6**	6	0	12	4	9	0	13	52
08:00 AM	24	4	0	28	1	6	0	7	4	12	0	16	51
08:15 AM	24	**5**	0	29	3	**12**	0	**15**	**7**	**17**	0	**24**	**68**
Total Volume	103	13	0	116	14	34	0	48	18	44	0	62	226
% App. Total	88.8	11.2	0		29.2	70.8	0		29	71	0		
PHF	.888	.650	.000	.906	.583	.708	.000	.800	.643	.647	.000	.646	.831



Vanasse & Associates

Longley Road at Nashua Road
Groton, MA
Weather: Clear

File Name : 868502am
Site Code : 00868502
Start Date : 8/13/2020
Page No : 1

Groups Printed- Trucks

	Longley Road From North				Nashua Road From East				Longley Road From South				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	1	0	1	1
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	1	0	1	1
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30 AM	1	0	0	1	0	1	0	1	0	0	0	0	2
08:45 AM	1	0	0	1	0	1	0	1	0	1	0	1	3
Total	2	0	0	2	0	2	0	2	0	1	0	1	5
Grand Total	2	0	0	2	0	2	0	2	0	2	0	2	6
Apprch %	100	0	0		0	100	0		0	100	0		
Total %	33.3	0	0	33.3	0	33.3	0	33.3	0	33.3	0	33.3	

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Longley Road at Nashua Road
Groton, MA
Weather: Clear

File Name : 868502am
Site Code : 00868502
Start Date : 8/13/2020
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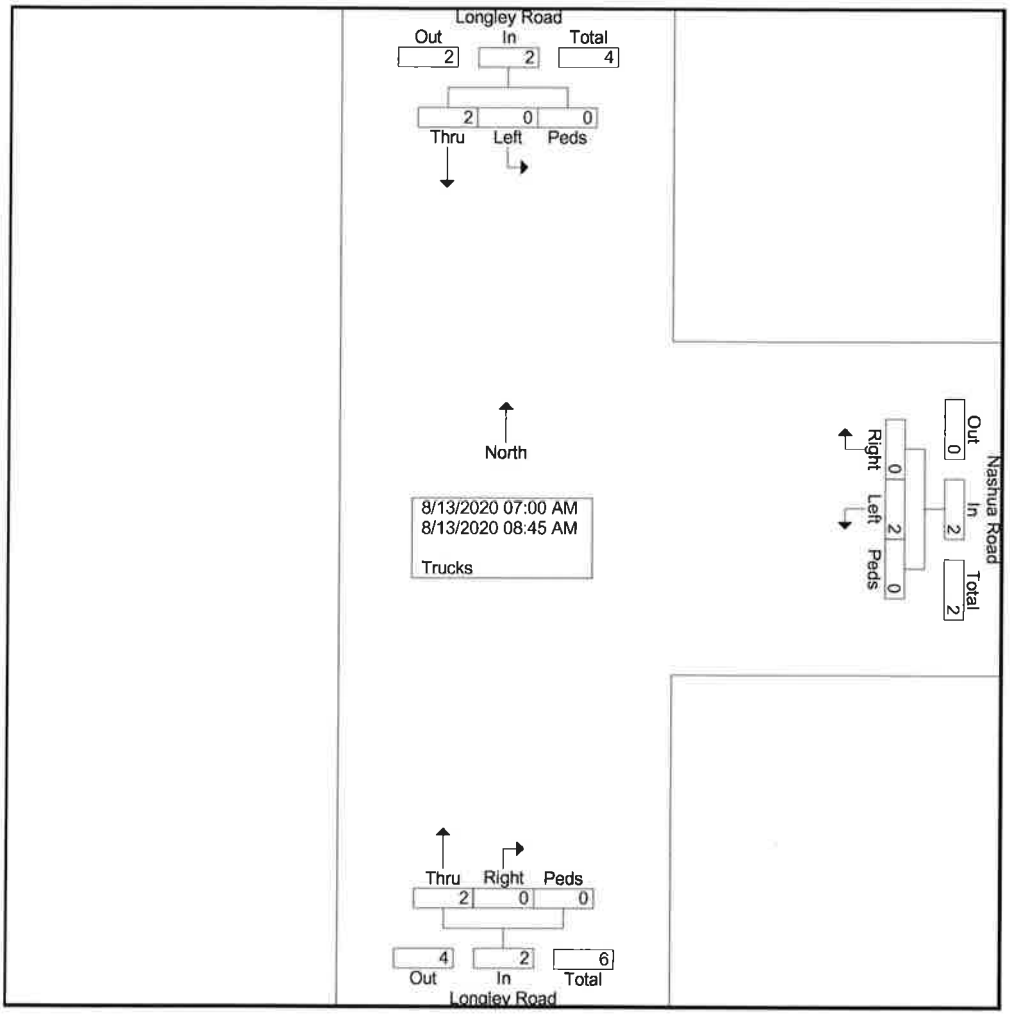
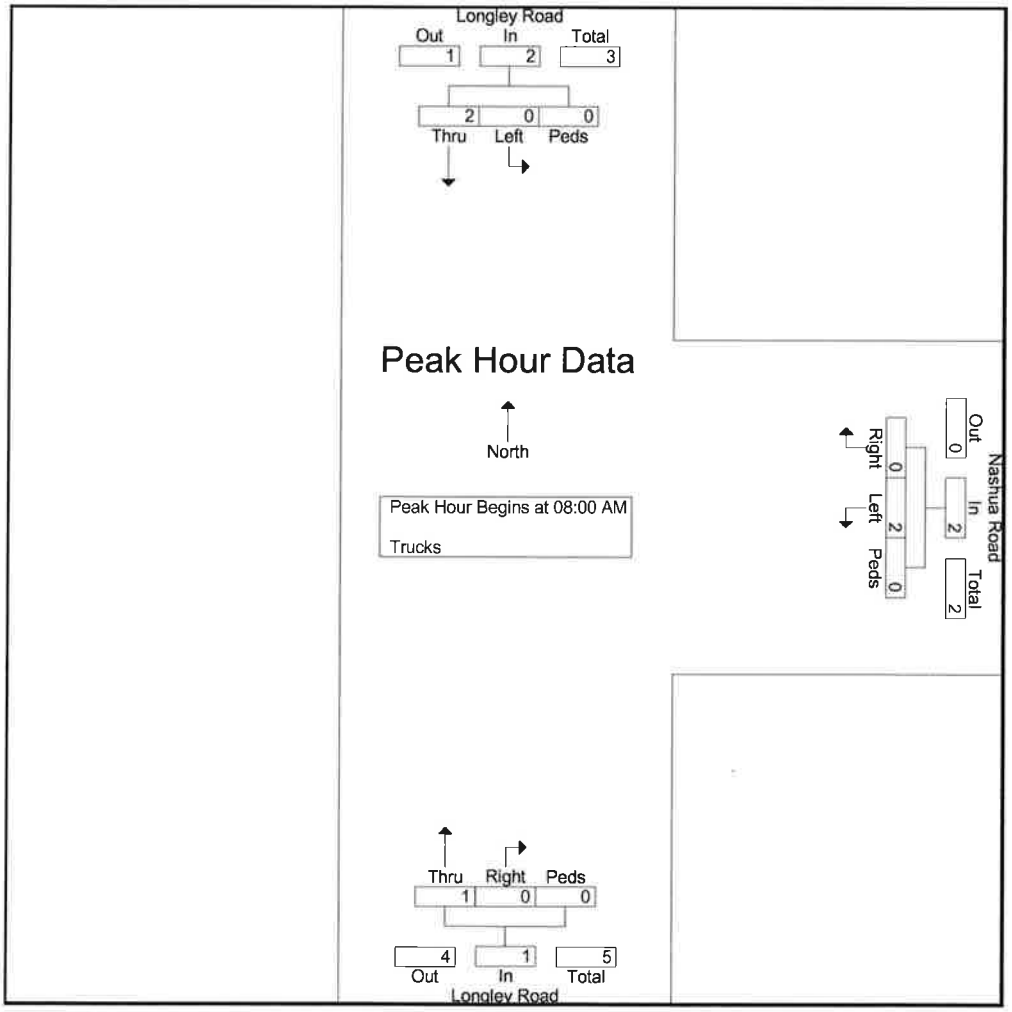


Vanasse & Associates

Longley Road at Nashua Road
Groton, MA
Weather: Clear

File Name : 868502am
Site Code : 00868502
Start Date : 8/13/2020
Page No : 3

	Longley Road From North				Nashua Road From East				Longley Road From South				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	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 08:00 AM													
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30 AM	**1**	0	0	**1**	0	**1**	0	**1**	0	0	0	0	2
08:45 AM	1	0	0	1	0	1	0	1	0	**1**	0	**1**	**3**
Total Volume	2	0	0	2	0	2	0	2	0	1	0	1	5
% App. Total	100	0	0		0	100	0		0	100	0		
PHF	.500	.000	.000	.500	.000	.500	.000	.500	.000	.250	.000	.250	.417



Vanasse & Associates

Longley Road at Nashua Road
Groton, MA
Weather: Clear

File Name : 868502pm
Site Code : 00868502
Start Date : 8/13/2020
Page No : 1

Groups Printed- Cars - Trucks

	Longley Road From North				Nashua Road From East				Longley Road From South				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
04:00 PM	22	1	0	23	1	6	0	7	9	41	0	50	80
04:15 PM	24	8	0	32	4	6	0	10	16	27	0	43	85
04:30 PM	26	1	0	27	3	11	0	14	19	34	0	53	94
04:45 PM	18	4	0	22	5	13	0	18	14	32	0	46	86
Total	90	14	0	104	13	36	0	49	58	134	0	192	345
05:00 PM	24	0	0	24	3	14	1	18	10	33	0	43	85
05:15 PM	20	3	0	23	4	14	0	18	16	38	0	54	95
05:30 PM	23	7	0	30	0	9	0	9	17	30	0	47	86
05:45 PM	14	4	0	18	3	6	0	9	13	14	0	27	54
Total	81	14	0	95	10	43	1	54	56	115	0	171	320
Grand Total	171	28	0	199	23	79	1	103	114	249	0	363	665
Apprch %	85.9	14.1	0		22.3	76.7	1		31.4	68.6	0		
Total %	25.7	4.2	0	29.9	3.5	11.9	0.2	15.5	17.1	37.4	0	54.6	
Cars	170	28	0	198	23	79	1	103	114	247	0	361	662
% Cars	99.4	100	0	99.5	100	100	100	100	100	99.2	0	99.4	99.5
Trucks	1	0	0	1	0	0	0	0	0	2	0	2	3
% Trucks	0.6	0	0	0.5	0	0	0	0	0	0.8	0	0.6	0.5

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Longley Road at Nashua Road
Groton, MA
Weather: Clear

File Name : 868502pm
Site Code : 00868502
Start Date : 8/13/2020
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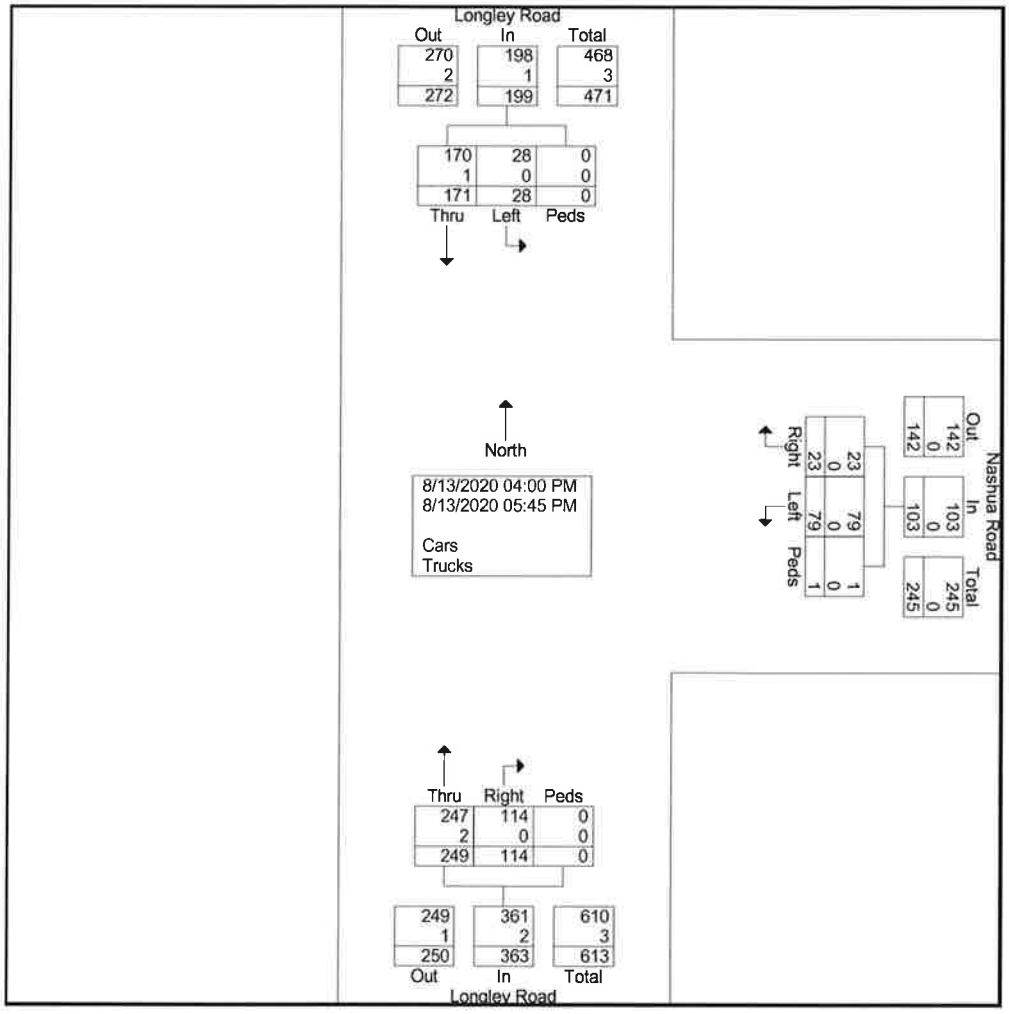

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Longley Road at Nashua Road
Groton, MA
Weather: Clear

File Name : 868502pm
Site Code : 00868502
Start Date : 8/13/2020
Page No : 3

	Longley Road From North				Nashua Road From East				Longley Road From South				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	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 04:30 PM													
04:30 PM	**26**	1	0	**27**	3	11	0	14	**19**	34	0	53	94
04:45 PM	18	**4**	0	22	**5**	13	0	**18**	14	32	0	46	86
05:00 PM	24	0	0	24	3	**14**	**1**	18	10	33	0	43	85
05:15 PM	20	3	0	23	4	14	0	18	16	**38**	0	**54**	**95**
Total Volume	88	8	0	96	15	52	1	68	59	137	0	196	360
% App. Total	91.7	8.3	0		22.1	76.5	1.5		30.1	69.9	0		
PHF	.846	.500	.000	.889	.750	.929	.250	.944	.776	.901	.000	.907	.947
Cars	87	8	0	95	15	52	1	68	59	136	0	195	358
% Cars	98.9	100	0	99.0	100	100	100	100	100	99.3	0	99.5	99.4
Trucks	1	0	0	1	0	0	0	0	0	1	0	1	2
% Trucks	1.1	0	0	1.0	0	0	0	0	0	0.7	0	0.5	0.6

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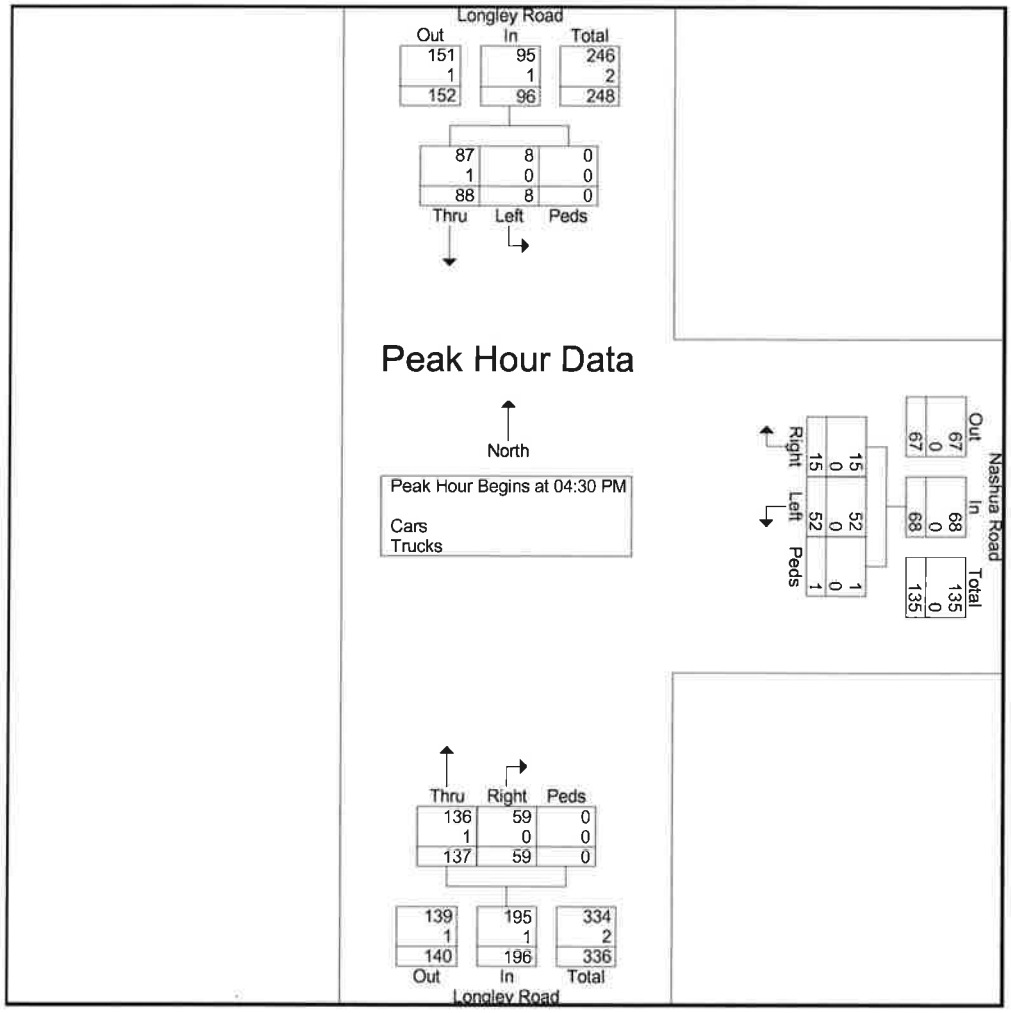
Longley Road at Nashua Road
Groton, MA
Weather: Clear

File Name : 868502pm
Site Code : 00868502
Start Date : 8/13/2020
Page No : 4



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Longley Road at Nashua Road
Groton, MA
Weather: Clear

File Name : 868502pm
Site Code : 00868502
Start Date : 8/13/2020
Page No : 1

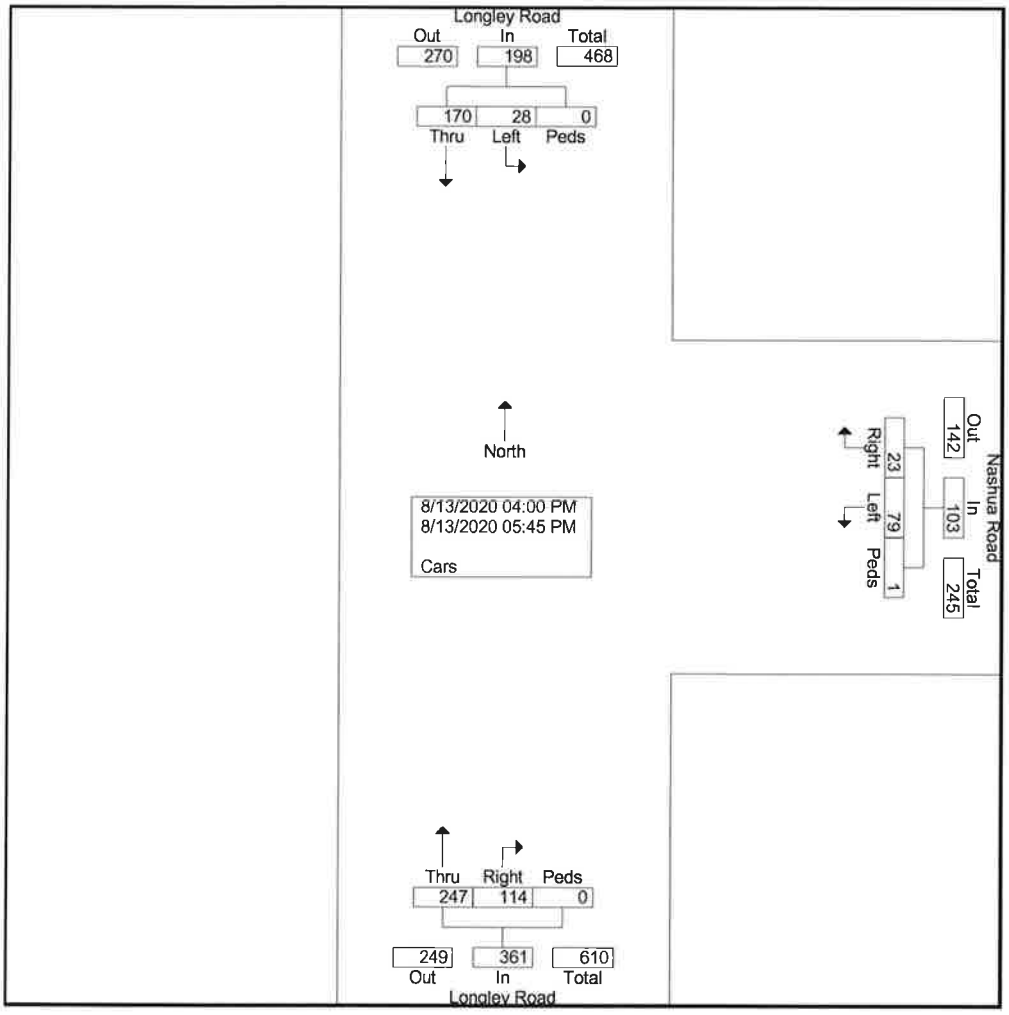
Groups Printed- Cars

	Longley Road From North				Nashua Road From East				Longley Road From South				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
04:00 PM	22	1	0	23	1	6	0	7	9	40	0	49	79
04:15 PM	24	8	0	32	4	6	0	10	16	27	0	43	85
04:30 PM	25	1	0	26	3	11	0	14	19	34	0	53	93
04:45 PM	18	4	0	22	5	13	0	18	14	32	0	46	86
Total	89	14	0	103	13	36	0	49	58	133	0	191	343
05:00 PM	24	0	0	24	3	14	1	18	10	33	0	43	85
05:15 PM	20	3	0	23	4	14	0	18	16	37	0	53	94
05:30 PM	23	7	0	30	0	9	0	9	17	30	0	47	86
05:45 PM	14	4	0	18	3	6	0	9	13	14	0	27	54
Total	81	14	0	95	10	43	1	54	56	114	0	170	319
Grand Total	170	28	0	198	23	79	1	103	114	247	0	361	662
Apprch %	85.9	14.1	0		22.3	76.7	1		31.6	68.4	0		
Total %	25.7	4.2	0	29.9	3.5	11.9	0.2	15.6	17.2	37.3	0	54.5	

Vanasse & Associates

Longley Road at Nashua Road
Groton, MA
Weather: Clear

File Name : 868502pm
Site Code : 00868502
Start Date : 8/13/2020
Page No : 2

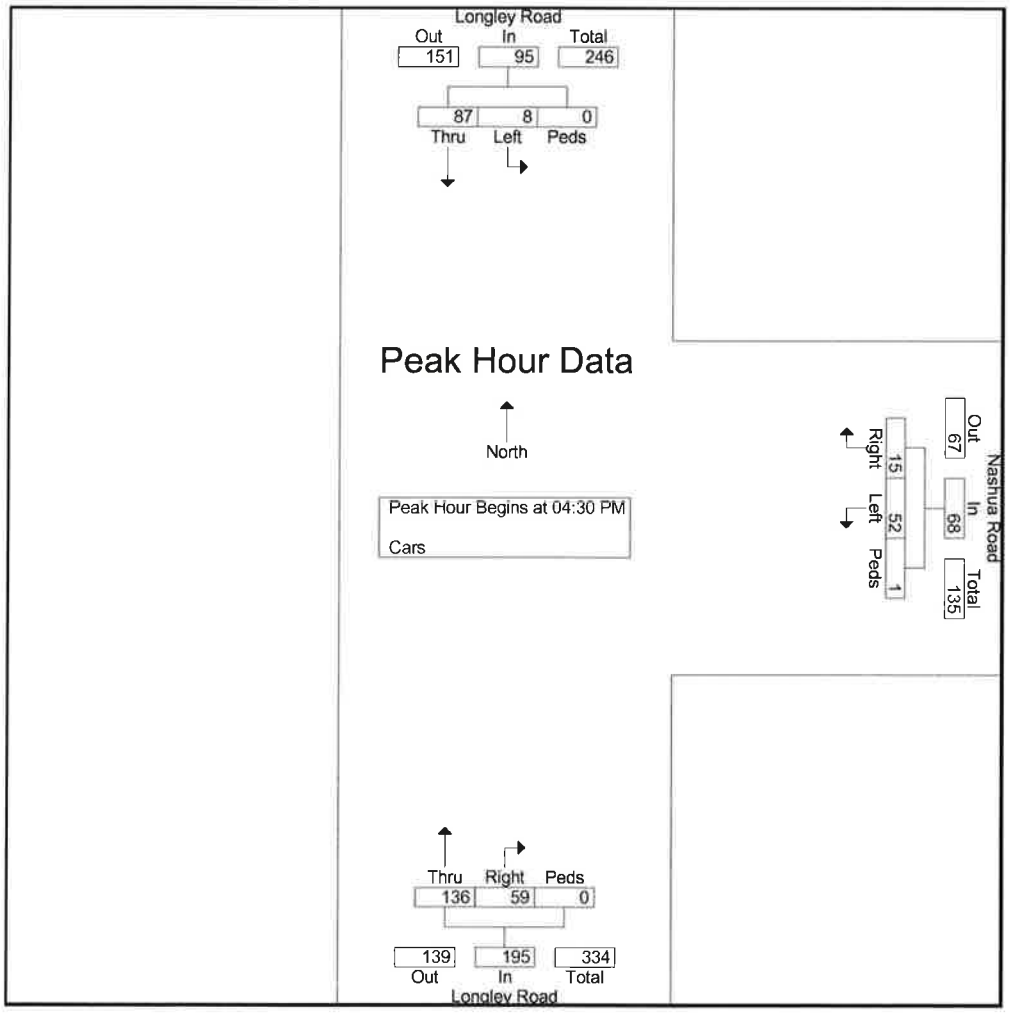


Vanasse & Associates

Longley Road at Nashua Road
Groton, MA
Weather: Clear

File Name : 868502pm
Site Code : 00868502
Start Date : 8/13/2020
Page No : 3

	Longley Road From North				Nashua Road From East				Longley Road From South				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	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 04:30 PM													
04:30 PM	**25**	1	0	**26**	3	11	0	14	**19**	34	0	**53**	93
04:45 PM	18	**4**	0	22	**5**	13	0	**18**	14	32	0	46	86
05:00 PM	24	0	0	24	3	**14**	**1**	18	10	33	0	43	85
05:15 PM	20	3	0	23	4	14	0	18	16	**37**	0	53	**94**
Total Volume	87	8	0	95	15	52	1	68	59	136	0	195	358
% App. Total	91.6	8.4	0		22.1	76.5	1.5		30.3	69.7	0		
PHF	.870	.500	.000	.913	.750	.929	.250	.944	.776	.919	.000	.920	.952



Vanasse & Associates

Longley Road at Nashua Road
Groton, MA
Weather: Clear

File Name : 868502pm
Site Code : 00868502
Start Date : 8/13/2020
Page No : 1

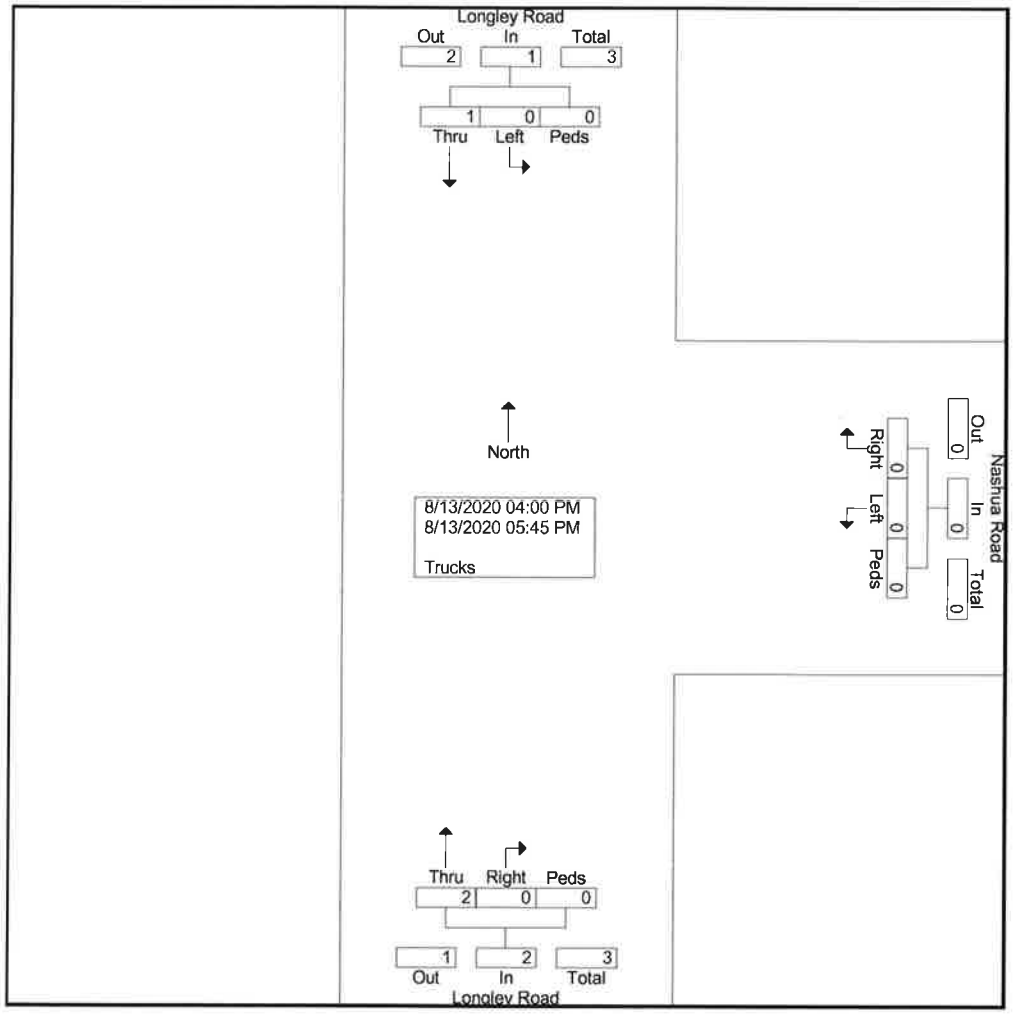
Groups Printed- Trucks

	Longley Road From North				Nashua Road From East				Longley Road From South				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
04:00 PM	0	0	0	0	0	0	0	0	0	1	0	1	1
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
04:30 PM	1	0	0	1	0	0	0	0	0	0	0	0	1
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	1	0	0	1	0	0	0	0	0	1	0	1	2
05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
05:15 PM	0	0	0	0	0	0	0	0	0	1	0	1	1
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
05:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	1	0	1	1
Grand Total	1	0	0	1	0	0	0	0	0	2	0	2	3
Apprch %	100	0	0		0	0	0		0	100	0		
Total %	33.3	0	0	33.3	0	0	0	0	0	66.7	0	66.7	

Vanasse & Associates

Longley Road at Nashua Road
Groton, MA
Weather: Clear

File Name : 868502pm
Site Code : 00868502
Start Date : 8/13/2020
Page No : 2

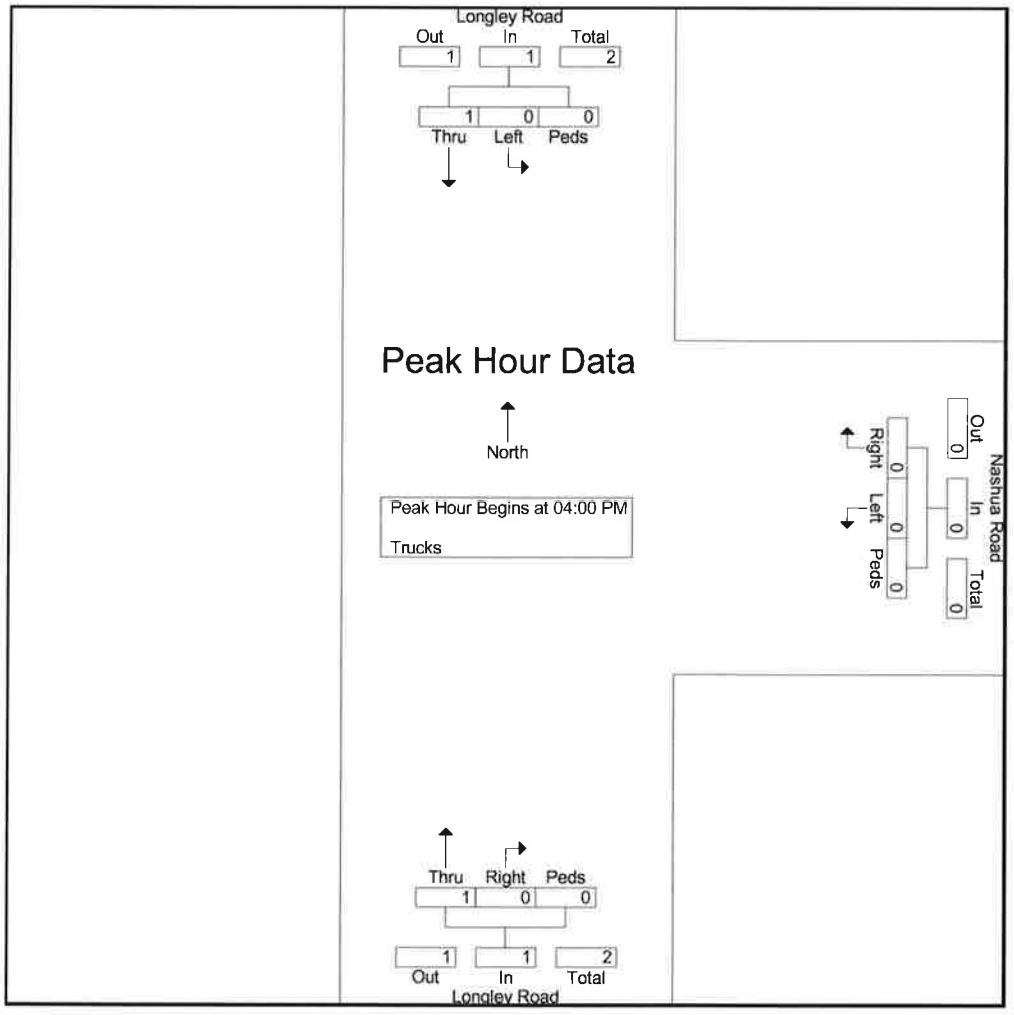


Vanasse & Associates

Longley Road at Nashua Road
Groton, MA
Weather: Clear

File Name : 868502pm
Site Code : 00868502
Start Date : 8/13/2020
Page No : 3

	Longley Road From North				Nashua Road From East				Longley Road From South				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	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 04:00 PM													
04:00 PM	0	0	0	0	0	0	0	0	0	**1**	0	**1**	**1**
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
04:30 PM	**1**	0	0	**1**	0	0	0	0	0	0	0	0	1
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	1	0	0	1	0	0	0	0	0	1	0	1	2
% App. Total	100	0	0		0	0	0		0	100	0		
PHF	.250	.000	.000	.250	.000	.000	.000	.000	.000	.250	.000	.250	.500



SEASONAL ADJUSTMENT DATA

Massachusetts Highway Department
4090: Monthly Hourly Volume for August 2019

Location ID:	**4090**	**Seasonal Factor Group:**	**U1-Boston**
County:	**Middlesex**	**Daily Factor Group:**	
Funcationl Class	**1**	**Axle Factor Group:**	**U1-Boston**
Location:	**INTERSTATE 495**	**Growth Factor Group:**	

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	TOTAL	QC Status
1																										
2	1223	717	598	638	1119	2963	5873	7433	7246	7071	7037	7311	7547	7677	7689	8164	7625	7793	6596	5163	3836	2941	2404	1878	118542	Accepted
3	1179	788	585	503	700	1424	2580	4204	6006	6711	6860	5489	7222	7039	7105	6630	6273	5713	4968	4042	3071	2827	2574	2048	96541	Accepted
4	1217	638	431	304	384	677	1392	2151	3834	5520	6778	7577	7024	6689	6824	6565	6544	6515	6038	5434	4387	3515	2258	1572	94268	Accepted
5	910	611	414	571	999	3285	6442	8099	7676	7200	6744	6388	6330	6105	7098	7968	7937	7804	6206	3942	2675	2206	1566	1165	110341	Accepted
6	722	551	470	597	1048	3142	6540	8125	7513	7265	6461	5544	5431	5850	7021	7992	8152	8132	6326	3822	2840	2126	1619	1010	108299	Accepted
7	719	553	458	521	1032	3134	6427	8235	7688	6743	6416	5725	5930	6088	6354	6206	7720	7966	6285	3825	2767	1989	1617	1144	105542	Accepted
8	757	534	514	593	1047	3100	6177	8076	8091	7140	6638	6689	6644	6698	7922	8266	8270	7925	7209	4374	3430	2515	2002	1364	115975	Accepted
9	856	740	549	620	1074	2978	5681	7388	7355	7256	7358	7535	7333	7747	8085	8307	8076	7624	6714	5672	4043	2769	2448	1906	120114	Accepted
10	1289	727	512	497	735	1417	2523	4102	6263	7254	7695	7428	7943	7407	7518	6516	6644	6018	5404	4367	3374	3065	2512	2022	103232	Accepted
11	1138	603	412	327	364	692	1434	2274	4009	5739	7236	7662	7526	7436	7081	7000	7082	6884	6244	5640	3947	3965	2334	1319	98348	Accepted
12	804	527	479	499	1098	3319	6466	8101	7964	7427	6375	6646	6168	6201	6925	7901	7388	8023	6359	4363	3083	2038	1651	1075	110880	Accepted
13	718	575	516	565	1066	3105	6389	8317	7861	6886	5895	5656	5902	6173	7058	8079	8046	8144	5964	3717	2559	1932	1577	1023	107723	Accepted
14	727	541	480	513	1036	3207	6204	8360	8027	7503	6237	6165	6085	6196	7358	8055	8374	7852	6494	4025	2950	2196	1758	1134	111477	Accepted
15	767	561	484	597	1091	3119	6301	8137	8294	7321	7043	6428	7001	6587	7779	7877	8395	8422	7200	5069	3400	2778	2135	1611	118397	Accepted
16	985	652	564	593	1085	2962	5578	7036	7166	7048	6972	6483	7128	7637	7497	7482	7948	7890	6224	5172	3882	3026	2240	1755	115005	Accepted
17	1231	718	523	489	680	1366	2526	3998	5370	6978	7729	7915	7804	7851	7460	7321	6686	6416	5057	3940	3483	2886	2283	1894	102604	Accepted
18	1297	616	405	327	419	662	1361	2227	3806	5507	7115	7439	7264	7382	7014	6956	6707	6570	5987	5409	3999	3335	2141	1213	95158	Accepted
19	741	492	479	608	1072	3255	6132	7976	7626	6945	6385	6597	6069	6405	7099	7656	7629	8128	6541	4037	2766	1928	1671	946	109183	Accepted
20	664	510	513	605	1073	3190	6339	8133	7901	7219	6282	5848	5816	5918	6892	7948	8250	8142	6604	4323	2983	2163	1738	1235	110289	Accepted
21	897	551	503	606	1029	3042	6414	8325	7667	7242	6074	5960	5780	5785	7670	7673	8100	7954	6433	4005	2736	2057	1661	1117	109281	Accepted
22	794	532	450	544	1069	3080	6200	8317	7917	6568	6177	6572	5712	6819	8294	7961	8185	8513	7078	5143	3303	2557	2190	1899	115874	Accepted
23	1148	630	584	626	1075	2890	5500	7149	7049	6602	7541	7409	7308	7548	8242	7625	8038	8002	6519	4683	3450	2806	2253	1617	116294	Accepted
24	1031	662	505	509	652	1310	2541	3769	5165	6570	7108	7777	7457	7563	6943	7064	6628	5988	5286	4294	3412	2871	2550	1787	99442	Accepted
25	1150	609	458	330	392	638	1245	2058	3802	5232	6721	7463	7281	7670	6742	6932	6810	6583	6111	5003	4031	3354	2109	1349	94073	Accepted
26	854	516	415	513	1028	3059	6237	8066	7619	6781	6108	6338	5913	6048	6826	7792	8111	7874	6236	3712	2837	1936	1448	986	107253	Accepted
27	669	542	456	549	1090	3113	6361	8327	7720	6504	5711	5145	5379	5709	7130	8102	8136	7960	6391	3865	2656	1902	1589	1029	106035	Accepted
28	902	575	448	546	982	3311	6257	8176	7908	6805	5722	5534	5396	5852	7221	7561	7472	6912	6853	4050	2651	1999	1393	1166	105692	Accepted
29	679	528	477	572	1010	3193	6295	8478	8092	6699	6329	6133	6044	6460	7923	8343	7938	8306	6935	5385	3528	2493	2018	1739	115597	Accepted
30	1344	813	600	639	1121	2943	5595	6957	6838	6943	6954	7344	7502	7180	7923	8078	7418	7311	6287	5451	4217	3552	2600	1725	117335	Accepted
31	1109	743	563	506	656	1287	2426	4004	5175	6360	7249	7141	6788	6826	6315	5846	5490	5119	4612	3896	3364	2739	2161	1446	91821	Accepted
																								Average	**107687**	
																								2019 AADT	**97935**	
																								Seasonal	**0.909**	

COVID-19 ADJUSTMENT DATA

GUIDANCE ON TRAFFIC COUNT DATA

Revised: April, 2020

massDOT
Massachusetts Department of Transportation
Highway Division

Introduction

Traffic counts are currently at historic lows and may underrepresent a realistic existing condition. Current MassDOT guidelines, however, require the use of existing count data for the purposes of planning and designing projects. The purpose of this document is to provide guidance for alternative methods that may be used to supplement or replace existing traffic count data.

Use of Historical Counts

MassDOT will accept the use of historical count data in lieu of new traffic counts taken after March 13, 2020. As long as the procedures found in this document are followed, counts taken between January 1, 2014 and March 13, 2020 will be accepted without any additional approval required. Counts take prior to January 1, 2014 will need to be approved by the State Traffic Engineer prior to submitting the functional design report or other traffic engineering study.

How MassDOT Determines Growth Rates

MassDOT oversees approximately 500 permanent counting stations across the Commonwealth that are constantly taking volume data. In addition, MassDOT supplements these permanent count stations with spot counts taken at various locations. All of the count data is geolocated and, when processed, has the following metadata tagged to it:

- Geographic Area Type
  - U = Urban
  - R = Rural
- Functional Class
  - 1 = Interstate
  - 2 = Freeways & Expressways
  - 3 = Other Principal Arterial
  - 4 = Minor Arterial
  - 5 = Major Collector
  - 6 = Minor Collector
  - 7 = Local Road or Street
- Region
  - Boston = Middlesex, Suffolk, and Norfolk Counties
  - Essex = Essex County
  - *Southeast = Bristol, Plymouth, Barnstable, Nantucket, and Dukes Counties
  - *West = Berkshire, Franklin, Hampshire, and Hampden Counties
  - Worcester = Worcester County

This combination of Geographic Area Type, Functional Class, and Region is referred to as Factor Group. Based upon the aggregated count data for each Factor Group, MassDOT establishes day of week, monthly, yearly, and axle correction adjustment factors. These factors are published into reports that can be used to determine historical growth rates.

*Note that beginning in 2016, MassDOT has further refined some of the Factor Groups for portions of the Commonwealth that experience significant seasonal fluctuations in traffic. These Factor Groups supersede Geographic Area Type, Functional Class, and Region and may be applied to

counts taken in 2016 or later anywhere within their boundaries. These Factor Groups are defined as:

- REC East: all towns on Cape Cod, the Town of Plymouth south of Route 3A, all towns on Martha's Vineyard, and Nantucket.
- REC West: roadways with a Functional Class of 3-5 in the towns of Becket, Great Barrington, Lee, Lenox, Stockbridge, and West Stockbridge.

Procedures for Estimating Average Annual Daily Traffic (AADT)

To estimate existing AADT from an historical count, the count location should be classified by Geographic Area Type, Functional Class, and Region per the descriptions from the previous section. Once the classification has been completed, the following steps are required.

1. Axle Correction

(Please note this step is required only if the original count did not include vehicle classification data, typically a single pneumatic tube. If classification data has been included, please proceed directly to Step 2.)

- Identify the year the count was taken.
- Open the Weekday Seasonal Axle Correction file for the year that corresponds to the raw count data.
- Multiply the average daily traffic (ADT) taken from the raw count data by the Axle Factor for the corresponding Factor Group.

2. Seasonal Factor

- Identify the month and year the count was taken.
- Open the Weekday Seasonal Axle Correction file for the year that corresponds to the raw count data.
- Multiply the number obtained in Step 1 (or the raw count data if it contains vehicle classification data) by the Monthly Factor for the corresponding Factor Group.

3. Yearly Growth

- Identify the year the count was taken.
- Open the Yearly Growth Rate file. Note that MassDOT considers 2019 data to be existing.
- The Growth Factors are set up to factor count data to the year shown in the header column from the previous year. Therefore, using the appropriate Factor Group, multiply the number obtained in Step 2 by the growth factor for the year after it was taken. Repeat the factoring until it is grown to 2019.
    - A count taken in 2018 will only need the 2019 factor applied to it.
    - A count taken in 2015 will need to go through four steps of factoring: the 2016 factor, then the 2017 factor, then the 2018 factor, and finally the 2019 factor.

Once these steps have been completed, the existing AADT may be estimated.

Procedures for Estimating Turning Movement Counts (TMCs)

In cases where historic TMCs are available for an intersection, those volumes may be adjusted based upon these procedures in order to estimate existing traffic volumes.

1. Seasonal Factor

- Identify the day, month, and year the count was taken.
- Open the Seasonal Factors Report file for the corresponding year.
- Using the appropriate Factor Group, identify the Seasonal Factor by month and day. If that number is equal to or less than 1, then no Seasonal Factor needs to be applied. If that number is greater than one then the TMC should be multiplied by that number.

2. Yearly Growth

- Using the seasonally factored count data, follow the steps found in Part 3 of Procedures for Estimating AADT.

If no historic TMC can be obtained, consultation with MassDOT's Traffic and Safety Engineering Section is strongly encouraged prior to estimating existing volumes. Failure to do so may result in rejection of the submittal to MassDOT.

Non-Motorized Users

MassDOT does not currently have any methodologies for estimating non-motorized users from historical count data. Based upon mode share and employment data, it can be assumed that non-motorized volumes have increased on a yearly basis. However, without access to data from permanent count stations, it is difficult to provide any type of regional growth or seasonal factors compared to what is available for motorized traffic.

Capturing bicycle and pedestrian data in 2020 in areas that are typically designed to accommodate peaked volumes that are associated with commuting may not be realistic. However, there are many third-party sensor and/or probe data aggregators that may provide good baseline information from 2019. This data is acceptable for use in design and operational analysis.

For recreational facilities, taking new bicycle and pedestrian counts after March 13, 2020 will likely be acceptable, though any adjacent generators of bicycle and pedestrian traffic that are temporarily closed should be taken into consideration prior to taking new counts. Comparing historic third-party sensor or probe data to 2020 data may add additional confidence and, in addition, provide practical future growth rates.

Future Growth Rates

MassDOT recommends that 2019 counts be grown to the build year using growth rates obtained from the Regional Planning Agency (RPA), if available. If specific, known future traffic generators are identified, they may be added to the count either in addition to the growth rate or while partially discounting the growth rate. In all cases, the methodology used for growing the traffic to the build year shall be documented and shall conform to planning and engineering principles.

Traffic Signal Warrant Analysis

Traffic Signal Warrants may be estimated using historic TMC count data that is factored to 2019 using the methodology presented in this document. It is understood that many TMCs will not have 8 hours of data, so it will be acceptable to use Warrant 2 (Four-Hour Vehicular Volume) in place of the typical Warrant 1 (Eight-Hour Vehicular Volume) that MassDOT typically recommends as justification. Warrant 3 (Peak Hour) alone is still not recommended as justification for installation of a traffic signal unless very unusual circumstances exist, per MUTCD standards.

Where no TMCs exist, Traffic Signal Warrants may be estimated using third-party sensor or probe data, estimates based upon ATRs, or combinations thereof, upon authorization from the State Traffic Engineer. The methodology for estimating TMCs shall be presented to MassDOT as part of any request for approval.

2019 Average Count Data – Station 4090 (U1-Boston)

August ADT: 107,687

MassDOT Seasonal Factor (U1-Boston, August 2019): 0.93

$107{,}687 \times 0.93 = \mathbf{100{,}149}$

2020 Average Count Data – Station 4090 (U1-Boston)

August ADT: 84,058

MassDOT Seasonal Factor (U1-Boston, August 2019): 0.93

$84{,}058 \times 0.93 = \mathbf{78{,}174}$

COVID Adjustment

$$\frac{100{,}149}{78{,}174} = \mathbf{1.28}$$

Massachusetts Highway Department
4090: Monthly Hourly Volume for August 2019

Location ID:	**4090**	**Seasonal Factor Group:**	**U1-Boston**
County:	**Middlesex**	**Daily Factor Group:**	
Funcationl Class	**1**	**Axle Factor Group:**	**U1-Boston**
Location:	**INTERSTATE 495**	**Growth Factor Group:**	

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	TOTAL	QC Status
1																										
2	1223	717	598	638	1119	2963	5873	7433	7246	7071	7037	7311	7547	7677	7689	8164	7625	7793	6596	5163	3836	2941	2404	1878	118542	Accepted
3	1179	788	585	503	700	1424	2580	4204	6006	6711	6860	5489	7222	7039	7105	6630	6273	5713	4968	4042	3071	2827	2574	2048	96541	Accepted
4	1217	638	431	304	384	677	1392	2151	3834	5520	6778	7577	7024	6689	6824	6565	6544	6515	6038	5434	4387	3515	2258	1572	94268	Accepted
5	910	611	414	571	999	3285	6442	8099	7676	7200	6744	6388	6330	6105	7098	7968	7937	7804	6206	3942	2675	2206	1566	1165	110341	Accepted
6	722	551	470	597	1048	3142	6540	8125	7513	7265	6461	5544	5431	5850	7021	7992	8152	8132	6326	3822	2840	2126	1619	1010	108299	Accepted
7	719	553	458	521	1032	3134	6427	8235	7688	6743	6416	5725	5930	6088	6354	6206	7720	7966	6285	3825	2767	1989	1617	1144	105542	Accepted
8	757	534	514	593	1047	3100	6177	8076	8091	7140	6638	6689	6644	6698	7922	8266	8270	7925	7209	4374	3430	2515	2002	1364	115975	Accepted
9	856	740	549	620	1074	2978	5681	7388	7355	7256	7358	7535	7333	7747	8085	8307	8076	7624	6714	5672	4043	2769	2448	1906	120114	Accepted
10	1289	727	512	497	735	1417	2523	4102	6263	7254	7695	7428	7943	7407	7518	6516	6644	6018	5404	4367	3374	3065	2512	2022	103232	Accepted
11	1138	603	412	327	364	692	1434	2274	4009	5739	7236	7662	7526	7436	7081	7000	7082	6884	6244	5640	3947	3965	2334	1319	98348	Accepted
12	804	527	479	499	1098	3319	6466	8101	7964	7427	6375	6646	6168	6201	6925	7901	7388	8023	6359	4363	3083	2038	1651	1075	110880	Accepted
13	718	575	516	565	1066	3105	6389	8317	7861	6886	5895	5656	5902	6173	7058	8079	8046	8144	5964	3717	2559	1932	1577	1023	107723	Accepted
14	727	541	480	513	1036	3207	6204	8360	8027	7503	6237	6165	6085	6196	7358	8055	8374	7852	6494	4025	2950	2196	1758	1134	111477	Accepted
15	767	561	484	597	1091	3119	6301	8137	8294	7321	7043	6428	7001	6587	7779	7877	8395	8422	7200	5069	3400	2778	2135	1611	118397	Accepted
16	985	652	564	593	1085	2962	5578	7036	7166	7048	6972	6483	7128	7637	7497	7482	7948	7890	6224	5172	3882	3026	2240	1755	115005	Accepted
17	1231	718	523	489	680	1366	2526	3998	5370	6978	7729	7915	7804	7851	7460	7321	6686	6416	5057	3940	3483	2886	2283	1894	102604	Accepted
18	1297	616	405	327	419	662	1361	2227	3806	5507	7115	7439	7264	7382	7014	6956	6707	6570	5987	5409	3999	3335	2141	1213	95158	Accepted
19	741	492	479	608	1072	3255	6132	7976	7626	6945	6385	6597	6069	6405	7099	7656	7629	8128	6541	4037	2766	1928	1671	946	109183	Accepted
20	664	510	513	605	1073	3190	6339	8133	7901	7219	6282	5848	5816	5918	6892	7948	8250	8142	6604	4323	2983	2163	1738	1235	110289	Accepted
21	897	551	503	606	1029	3042	6414	8325	7667	7242	6074	5960	5780	5785	7670	7673	8100	7954	6433	4005	2736	2057	1661	1117	109281	Accepted
22	794	532	450	544	1069	3080	6200	8317	7917	6568	6177	6572	5712	6819	8294	7961	8185	8513	7078	5143	3303	2557	2190	1899	115874	Accepted
23	1148	630	584	626	1075	2890	5500	7149	7049	6602	7541	7409	7308	7548	8242	7625	8038	8002	6519	4683	3450	2806	2253	1617	116294	Accepted
24	1031	662	505	509	652	1310	2541	3769	5165	6570	7108	7777	7457	7563	6943	7064	6628	5988	5286	4294	3412	2871	2550	1787	99442	Accepted
25	1150	609	458	330	392	638	1245	2058	3802	5232	6721	7463	7281	7670	6742	6932	6810	6583	6111	5003	4031	3354	2109	1349	94073	Accepted
26	854	516	415	513	1028	3059	6237	8066	7619	6781	6108	6338	5913	6048	6826	7792	8111	7874	6236	3712	2837	1936	1448	986	107253	Accepted
27	669	542	456	549	1090	3113	6361	8327	7720	6504	5711	5145	5379	5709	7130	8102	8136	7960	6391	3865	2656	1902	1589	1029	106035	Accepted
28	902	575	448	546	982	3311	6257	8176	7908	6805	5722	5534	5396	5852	7221	7561	7472	6912	6853	4050	2651	1999	1393	1166	105692	Accepted
29	679	528	477	572	1010	3193	6295	8478	8092	6699	6329	6133	6044	6460	7923	8343	7938	8306	6935	5385	3528	2493	2018	1739	115597	Accepted
30	1344	813	600	639	1121	2943	5595	6957	6838	6943	6954	7344	7502	7180	7923	8078	7418	7311	6287	5451	4217	3552	2600	1725	117335	Accepted
31	1109	743	563	506	656	1287	2426	4004	5175	6360	7249	7141	6788	6826	6315	5846	5490	5119	4612	3896	3364	2739	2161	1446	91821	Accepted
																								Average	**107687**	
																								2019 AADT	**97935**	
																								Seasonal	**0.909**	

Massachusetts Highway Department
Statewide Traffic Data Collection
2019 Weekday Seasonal Factors

Factor Group	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Axle Factor
R1	1.22	1.14	1.12	1.06	1.00	0.96	0.87	0.85	0.96	0.99	1.04	1.12	0.85
R2	0.95	0.96	0.98	0.97	0.97	0.93	0.97	0.94	0.96	0.90	0.92	0.93	0.96
R3	1.15	1.06	1.07	1.00	0.89	0.88	0.89	0.89	0.95	0.92	1.02	1.01	0.97
R4-R7	1.09	1.09	1.11	1.02	0.96	0.92	0.89	0.89	0.99	0.98	1.09	1.13	0.98
U1-Boston	1.03	1.01	0.98	0.94	0.94	0.92	0.95	0.93	0.94	0.94	0.97	1.04	0.96
U1-Essex	1.09	1.06	1.03	0.99	0.94	0.90	0.88	0.86	0.93	0.94	0.99	1.06	0.93
U1-Southeast	1.06	1.05	1.01	0.97	0.95	0.93	0.93	0.90	0.94	0.94	0.98	1.04	0.98
U1-West	1.19	1.14	1.09	0.95	0.92	0.89	0.89	0.86	0.91	0.95	0.97	1.07	0.84
U1-Worcester	1.02	1.04	0.97	0.94	0.93	0.91	0.95	0.91	0.93	0.92	0.95	1.10	0.88
U2	1.01	1.00	0.94	0.93	0.91	0.89	0.93	0.90	0.90	0.91	0.94	1.02	0.99
U3	1.06	1.03	0.98	0.94	0.93	0.91	0.95	0.91	0.92	0.93	0.97	1.00	0.98
U4-U7	1.01	1.00	0.95	0.92	0.88	0.86	0.92	0.91	0.92	0.94	0.99	1.04	0.99
Rec - East	1.04	1.16	1.12	0.98	0.92	0.88	0.77	0.81	0.94	1.02	1.08	1.12	0.99
Rec - West	1.30	1.23	1.32	1.18	0.95	0.82	0.70	0.69	0.97	0.96	1.16	1.15	0.98

Round off:
0-999 = 10
>1000 = 100

U = Urban
R = Rural

1 - Interstate
2 - Freeway and Expressway
3 - Other Principal Arterial
4 - Minor Arterial
5 - Major Collector
6 - Minor Collector
7 - Local Road and Street

Recreational - East Group - Cape Cod (all towns) including the town of Plymouth south of Route 3A (stations 7014,7079,7080,7090,7091,7092,7093,7094,7095,7096,7097,7108 and 7178), Martha's Vineyard and Nantucket.

Recreational - West Group - Continuous Stations 2 and 189 including stations 1066,1067,1083,1084,1085,1086,1087,1088,1089,1090,1091,1092,1093,1094,1095,1096,1097,1098,1099,1100,1101,1102,1103,1104,1105,1106,1107,1108,1113, 1114,1116,2196,2197 and 2198.

8/27/2020

Massachusetts Highway Department
4090: Monthly Hourly Volume for August 2020

Location ID:	**4090**	**Seasonal Factor Group:**	**U1-Boston**
County:	**Middlesex**	**Daily Factor Group:**	
Funcationl Class	**1**	**Axle Factor Group:**	**U1-Boston**
Location:	**INTERSTATE 495**	**Growth Factor Group:**	

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	TOTAL	QC Status
1	805	518	422	443	649	1164	2162	3274	4523	5675	6748	7130	7304	6666	6231	6002	5330	4758	4302	3555	3090	2423	1891	1191	86256	Accepted
2	672	398	281	284	359	548	1198	1827	2653	3994	5178	6343	6516	6431	6190	5657	5561	5263	4911	4118	3358	2341	1408	783	76272	Accepted
3	511	384	334	423	870	2595	4088	5247	4893	4726	5019	5255	5251	5268	5996	6279	5904	5340	4089	2989	2398	1796	1252	975	81882	Accepted
4	654	498	437	522	876	2482	4270	4767	4586	4043	4274	4412	4662	4562	5194	5478	4811	4015	2604	2032	1479	1182	930	810	69580	Accepted
5	457	411	392	443	810	2529	4421	4986	4632	4496	3037	2491	4721	5029	5732	6355	6052	5624	4107	2969	2464	1906	1341	1067	76472	Accepted
6	713	522	472	541	883	2565	4560	5146	5120	5172	5257	5560	5364	5681	6351	6653	6759	6310	4399	3269	2530	2133	1625	1144	88729	Accepted
7	765	561	471	513	925	2602	4209	4953	4918	5243	5632	6223	6340	6443	7379	7227	6875	6364	5228	3928	2926	2304	1726	1249	95004	Accepted
8	852	497	445	411	578	1099	2114	3137	4213	5261	6598	7145	7114	7254	6384	6252	5524	4783	4314	3439	2871	2329	1676	1086	85376	Accepted
9	646	422	286	271	326	583	1264	2076	2864	4195	5398	6401	6508	6662	6441	5396	5256	5636	4895	4025	2697	2290	1846	1095	77479	Accepted
10	570	413	360	401	849	2564	4477	5161	5057	4892	5095	5498	5490	5607	6032	6378	5971	5496	4121	2707	2110	1718	1291	971	83229	Accepted
11	644	510	440	519	916	2642	4476	5242	4944	4794	4633	5077	5081	5095	5804	6084	6025	5381	3982	2880	2354	1732	1179	942	81376	Accepted
12																										
13																										
14	737	547	466	531	947	2438	4196	4922	5028	5224	5895	6525	6735	6760	7459	7659	7124	6629	5256	3979	3091	2643	1835	1232	97858	Accepted
15	799	540	397	436	601	1092	2097	3155	4118	5577	6806	7729	7225	7057	6947	6267	5805	4882	4288	3631	2877	2215	1553	1073	87167	Accepted
16	610	422	274	245	316	568	1259	1875	2667	4167	5412	6713	7120	6907	6857	6139	6298	5402	5319	4215	3089	2083	1267	780	80004	Accepted
17	462	405	326	454	841	2503	4266	5154	4787	4774	4963	5698	5628	5776	6233	6529	6199	5620	4144	2902	2212	1680	1136	870	83562	Accepted
18	607	458	435	500	910	2457	4182	5142	4856	4694	4768	4961	5067	5343	5859	6325	6040	5697	4004	3028	2382	1767	1237	918	81637	Accepted
19	641	462	447	522	839	2596	4091	5114	4942	4916	5039	5207	5377	5442	6217	6936	6739	5777	4415	3232	2458	1892	1379	994	85674	Accepted
20	673	477	492	559	909	2535	4200	5073	4854	5184	5468	5706	5845	5771	6571	6952	6464	5959	4921	3725	2881	2025	1565	1079	89888	Accepted
21	734	530	471	536	891	2369	4186	4964	5239	5413	6119	6530	6737	6409	7119	7626	7065	6758	5616	4405	3109	2420	1746	1155	98147	Accepted
22	767	522	399	407	604	1084	1993	3082	4198	5478	6714	7404	6987	6574	6315	6212	5446	5066	4365	3514	2887	2254	1651	1067	84990	Accepted
23	610	459	287	254	315	536	1064	1830	2733	4155	5617	6758	6733	6742	6627	6394	5710	5575	5247	4674	3412	2373	1391	873	80369	Accepted
24	506	329	330	448	866	2650	4450	5114	5026	4647	5088	5334	5059	5261	5971	6549	5717	5861	4022	2944	2218	1693	1132	891	82106	Accepted
25	611	479	463	503	850	2549	4411	5165	4841	4667	4781	4944	5042	5082	5723	6248	5964	5369	4070	2820	2066	1554	1157	917	80276	Accepted
26																										
27																										
28																										
29																										
30																										
31																										

Average **84058**

VEHICLE TRAVEL SPEED DATA

Vanasse & Associates
35 New England Business Center Dr, Suite 140
Andover, MA 01810

Vanasse & Associates
Location: Longley Road
Location: At Site Drive
City: Groton, MA

Site Code: 00868505

Northbound

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
08/10/20	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
01:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
02:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
03:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
04:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
05:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
06:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
07:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
08:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
09:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
12 PM	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
13:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
14:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
15:00	**2**	0	0	2	32	**90**	**26**	0	**1**	0	0	0	0	0	153	40	43
16:00	2	**3**	1	3	**51**	77	22	**4**	0	0	0	0	0	0	**163**	40	44
17:00	0	0	**2**	**5**	36	68	18	4	0	0	0	0	0	0	133	40	44
18:00	0	0	0	5	32	56	11	0	0	0	0	0	0	0	104	39	42
19:00	0	0	0	0	16	38	8	2	0	0	0	0	0	0	64	40	44
20:00	0	0	0	2	16	25	6	1	0	0	0	0	0	0	50	39	43
21:00	0	0	0	0	8	11	5	1	0	0	0	0	0	0	25	42	44
22:00	0	0	0	1	6	8	5	2	0	0	0	0	0	0	22	43	47
23:00	0	0	0	0	2	6	3	1	0	0	0	0	0	0	12	43	46
Total	4	3	3	18	199	379	104	15	1	0	0	0	0	0	726		
Percent	0.6%	0.4%	0.4%	2.5%	27.4%	52.2%	14.3%	2.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak Vol.																	
PM Peak Vol.	15:00 2	16:00 3	17:00 2	17:00 5	16:00 51	15:00 90	15:00 26	16:00 4	15:00 1						16:00 163		

Vanasse & Associates
35 New England Business Center Dr, Suite 140
Andover, MA 01810

Vanasse & Associates
Location: Longley Road
Location: At Site Drive
City: Groton, MA

Site Code: 00868505

Northbound

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
08/11/20	**2**	0	0	2	1	1	0	0	0	0	0	0	0	0	6	35	38
01:00	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	39	39
02:00	0	0	0	0	1	1	1	0	0	0	0	0	0	0	3	42	44
03:00	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	34	34
04:00	0	0	0	0	4	0	0	0	0	0	0	0	0	0	4	34	34
05:00	0	0	0	0	3	4	1	0	0	0	0	0	0	0	8	39	43
06:00	0	0	1	0	7	15	6	1	0	0	0	0	0	0	30	42	44
07:00	0	0	0	**4**	14	25	**11**	1	0	0	0	0	0	0	55	41	44
08:00	2	0	0	3	16	26	10	1	0	0	0	0	0	0	58	41	44
09:00	0	0	1	1	19	32	10	**2**	0	0	0	0	0	0	65	41	44
10:00	1	**1**	2	1	**27**	**44**	9	0	0	**1**	0	0	0	0	**86**	39	43
11:00	2	1	**3**	3	17	41	9	0	**1**	0	0	0	0	0	77	39	43
12 PM	0	0	0	2	26	57	13	1	0	0	0	0	0	0	99	39	43
13:00	**4**	**1**	**3**	1	17	51	9	1	**1**	0	0	0	0	0	88	39	43
14:00	0	0	0	**4**	28	60	17	1	0	0	0	0	0	0	110	40	43
15:00	1	0	1	4	**53**	**106**	**28**	3	0	0	0	0	0	0	**196**	40	43
16:00	0	0	0	3	41	95	25	3	0	0	0	0	0	0	167	40	43
17:00	2	0	1	2	47	76	22	2	0	0	0	0	0	0	152	40	43
18:00	0	0	0	1	36	60	15	2	0	0	0	0	0	0	114	39	43
19:00	0	0	0	0	25	48	8	**5**	0	0	0	0	0	0	86	40	45
20:00	0	0	0	0	26	25	7	0	0	0	0	0	0	0	58	39	42
21:00	0	0	0	2	21	15	5	2	0	0	0	0	0	0	45	40	44
22:00	0	0	0	1	10	6	6	1	1	0	0	0	0	0	25	43	48
23:00	0	0	0	1	4	8	3	0	0	0	0	0	0	0	16	41	43
Total	14	3	12	35	444	797	215	26	3	1	0	0	0	0	1550		
Percent	0.9%	0.2%	0.8%	2.3%	28.6%	51.4%	13.9%	1.7%	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%			
AM Peak	00:00	10:00	11:00	07:00	10:00	10:00	07:00	09:00	11:00	10:00					10:00		
Vol.	2	1	3	4	27	44	11	2	1	1					86		
PM Peak	13:00	13:00	13:00	14:00	15:00	15:00	15:00	19:00	13:00						15:00		
Vol.	4	1	3	4	53	106	28	5	1						196		

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Northbound

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
08/12/20	0	0	0	0	0	2	0	0	0	**1**	0	0	0	0	3	57	59
01:00	0	0	0	1	2	0	1	0	0	0	0	0	0	0	4	42	44
02:00	0	0	0	0	0	3	0	0	0	0	0	0	0	0	3	39	39
03:00	0	0	0	1	0	0	1	0	0	0	0	0	0	0	2	43	44
04:00	0	0	0	1	1	1	0	0	0	0	0	0	0	0	3	37	39
05:00	0	0	0	0	3	4	0	0	0	0	0	0	0	0	7	38	39
06:00	0	0	0	1	3	10	10	0	0	0	0	0	0	0	24	43	44
07:00	**2**	0	0	4	12	31	9	**1**	0	0	0	0	0	0	59	40	43
08:00	0	0	0	3	25	30	9	1	**1**	0	0	0	0	0	69	40	44
09:00	0	0	**1**	1	23	30	8	0	1	0	0	0	0	0	64	39	43
10:00	0	0	1	4	**31**	39	8	0	0	0	0	0	0	0	83	39	42
11:00	0	**1**	1	**10**	30	**44**	**14**	0	0	0	0	0	0	0	**100**	39	43
12 PM	2	**1**	**1**	3	32	37	11	1	0	0	0	0	0	0	88	39	43
13:00	0	0	0	3	41	37	12	1	**1**	0	0	0	0	0	95	39	43
14:00	2	0	0	**4**	52	63	15	**2**	0	0	0	0	0	0	138	39	43
15:00	**3**	0	1	4	55	83	22	1	0	0	0	0	0	0	169	39	43
16:00	0	0	1	4	**66**	**92**	**32**	0	0	0	0	0	0	0	**195**	40	43
17:00	0	0	0	2	59	89	16	1	0	0	0	0	0	0	167	39	42
18:00	0	0	0	2	27	68	20	0	0	0	0	0	0	0	117	40	43
19:00	0	0	0	3	24	19	10	0	0	0	0	0	0	0	56	40	43
20:00	0	0	0	2	14	25	5	0	0	0	0	0	0	0	46	39	42
21:00	0	0	0	1	6	9	6	1	1	0	0	0	0	0	24	43	49
22:00	1	0	0	1	4	5	3	1	0	**1**	0	0	0	0	16	44	55
23:00	0	0	0	0	3	4	1	0	0	0	0	0	0	0	8	39	43
Total	10	2	6	55	513	725	213	10	4	2	0	0	0	0	1540		
Percent	0.6%	0.1%	0.4%	3.6%	33.3%	47.1%	13.8%	0.6%	0.3%	0.1%	0.0%	0.0%	0.0%	0.0%			
AM Peak	07:00	11:00	09:00	11:00	10:00	11:00	11:00	07:00	08:00	00:00					11:00		
Vol.	2	1	1	10	31	44	14	1	1	1					100		
PM Peak	15:00	12:00	12:00	14:00	16:00	16:00	16:00	14:00	13:00	22:00					16:00		
Vol.	3	1	1	4	66	92	32	2	1	1					195		

Vanasse & Associates
35 New England Business Center Dr, Suite 140
Andover, MA 01810

Vanasse & Associates
Location: Longley Road
Location: At Site Drive
City: Groton, MA

Site Code: 00868505

Northbound

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
08/13/20	0	0	0	0	0	**2**	0	0	0	0	0	0	0	0	2	39	39
01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	*
02:00	0	0	**1**	**1**	0	1	0	0	0	0	0	0	0	0	**3**	37	39
03:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	*
04:00	0	0	0	0	**2**	0	0	0	0	0	0	0	0	0	2	34	34
05:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	*
06:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
07:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
08:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
09:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
12 PM	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
13:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
14:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
15:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
16:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
17:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
18:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
19:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
20:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
21:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
22:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
23:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Total	0	0	1	1	2	3	0	0	0	0	0	0	0	0	7		
Percent	0.0%	0.0%	14.3%	14.3%	28.6%	42.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak			02:00	02:00	04:00	00:00									02:00		
Vol.			1	1	2	2									3		
PM Peak Vol.																	
Grand Total	28	8	22	109	1158	1904	532	51	8	3	0	0	0	0	3823		
Percent	0.7%	0.2%	0.6%	2.9%	30.3%	49.8%	13.9%	1.3%	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%			

15th Percentile :	31 MPH
50th Percentile :	36 MPH
85th Percentile :	40 MPH
95th Percentile :	43 MPH

Statistics

10 MPH Pace Speed :	31-40 MPH
Number in Pace :	3062
Percent in Pace :	80.1%
Number of Vehicles > 30 MPH :	3656
Percent of Vehicles > 30 MPH :	95.6%
Mean Speed(Average) :	37 MPH

Vanasse & Associates
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Andover, MA 01810

Vanasse & Associates
Location: Longley Road
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Site Code: 00868505

Southbound

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
08/10/20	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
01:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
02:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
03:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
04:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
05:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
06:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
07:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
08:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
09:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
12 PM	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
13:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
14:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
15:00	0	0	0	2	16	32	**32**	**10**	1	0	0	0	0	0	93	44	48
16:00	0	0	0	4	**20**	**41**	27	8	1	0	0	0	0	0	**101**	43	47
17:00	0	**2**	0	**5**	14	31	32	8	1	0	0	0	0	0	93	44	47
18:00	0	0	**2**	0	5	34	25	6	1	0	0	0	0	0	73	44	47
19:00	0	0	0	3	8	14	15	0	1	0	0	0	0	0	41	43	44
20:00	0	0	0	0	4	12	6	4	**2**	0	0	0	0	0	28	47	51
21:00	0	0	0	1	0	11	6	3	0	0	0	0	0	0	21	44	48
22:00	0	0	0	0	1	6	0	1	0	**1**	0	0	0	0	9	48	57
23:00	0	0	0	1	0	3	1	0	0	0	0	0	0	0	5	41	43
Total	0	2	2	16	68	184	144	40	7	1	0	0	0	0	464		
Percent	0.0%	0.4%	0.4%	3.4%	14.7%	39.7%	31.0%	8.6%	1.5%	0.2%	0.0%	0.0%	0.0%	0.0%			
AM Peak																	
Vol.																	
PM Peak		17:00	18:00	17:00	16:00	16:00	15:00	15:00	20:00	22:00					16:00		
Vol.		2	2	5	20	41	32	10	2	1					101		

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Southbound

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
08/11/20	0	0	0	0	0	0	1	2	0	0	0	0	0	0	3	48	49
01:00	0	0	0	0	0	1	1	0	0	0	0	0	0	0	2	43	44
02:00	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	54	54
03:00	0	0	0	0	1	4	1	1	0	0	0	0	0	0	7	44	48
04:00	0	0	0	0	2	10	4	1	2	0	0	0	0	0	19	45	52
05:00	0	0	0	1	9	24	23	10	0	0	0	0	0	0	67	44	48
06:00	0	0	0	2	13	48	51	13	2	0	0	0	0	0	129	44	48
07:00	0	0	0	1	**20**	**57**	**74**	**17**	**3**	0	0	0	0	0	**172**	44	48
08:00	0	0	0	3	20	45	40	12	1	**1**	0	0	0	0	122	44	48
09:00	**1**	0	**2**	4	17	40	34	10	1	0	0	0	0	0	109	44	47
10:00	1	0	1	**6**	18	25	30	6	1	1	0	0	0	0	89	44	47
11:00	0	**2**	0	3	11	34	32	6	1	0	0	0	0	0	89	44	47
12 PM	0	0	0	2	12	42	35	9	**5**	**1**	0	0	0	0	106	44	50
13:00	0	0	0	1	14	35	28	10	1	0	0	0	0	0	89	44	48
14:00	0	**1**	0	1	13	52	23	11	1	0	0	0	0	0	102	44	48
15:00	**1**	0	0	1	14	41	36	**16**	0	0	0	0	0	0	109	44	48
16:00	0	0	**2**	**3**	**21**	29	**39**	11	1	0	0	0	0	0	106	44	48
17:00	0	1	0	2	15	**59**	24	14	0	1	0	0	0	0	**116**	44	48
18:00	0	0	1	0	12	26	23	10	2	0	0	0	0	0	74	45	49
19:00	0	0	0	1	12	19	13	7	1	0	0	0	0	0	53	45	48
20:00	0	0	0	3	7	10	7	2	0	0	0	0	0	0	29	43	46
21:00	0	0	0	1	4	6	7	1	0	0	0	0	0	0	19	43	45
22:00	0	0	0	0	4	4	0	1	1	1	0	0	0	0	11	51	57
23:00	0	0	0	0	4	1	5	0	0	0	0	0	0	0	10	43	44
Total	3	4	6	35	243	612	531	170	24	5	0	0	0	0	1633		
Percent	0.2%	0.2%	0.4%	2.1%	14.9%	37.5%	32.5%	10.4%	1.5%	0.3%	0.0%	0.0%	0.0%	0.0%			
AM Peak	09:00	11:00	09:00	10:00	07:00	07:00	07:00	07:00	07:00	08:00					07:00		
Vol.	1	2	2	6	20	57	74	17	3	1					172		
PM Peak	15:00	14:00	16:00	16:00	16:00	17:00	16:00	15:00	12:00	12:00					17:00		
Vol.	1	1	2	3	21	59	39	16	5	1					116		

Vanasse & Associates
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Vanasse & Associates
Location: Longley Road
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City: Groton, MA

Site Code: 00868505

Southbound

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
08/12/20	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2	49	49
01:00	0	0	0	1	1	0	0	0	0	0	0	0	0	0	2	33	34
02:00	0	0	0	0	1	1	0	1	0	0	0	0	0	0	3	47	49
03:00	0	0	0	0	1	0	4	0	0	0	0	0	0	0	5	44	44
04:00	0	0	0	1	3	6	4	1	0	0	0	0	0	0	15	43	46
05:00	0	0	0	1	4	28	31	7	1	0	0	0	0	0	72	44	48
06:00	0	0	0	2	20	45	46	12	1	0	0	0	0	0	126	44	47
07:00	0	0	0	5	20	**63**	**57**	14	**2**	0	0	0	0	0	**161**	44	47
08:00	0	0	**4**	**9**	27	45	37	**21**	2	**1**	0	0	0	0	146	45	48
09:00	0	0	1	6	**29**	61	21	6	1	0	0	0	0	0	125	42	45
10:00	0	**1**	0	2	17	36	35	7	2	0	0	0	0	0	100	44	47
11:00	0	1	2	6	22	45	26	4	0	0	0	0	0	0	106	42	44
12 PM	0	**1**	**2**	**8**	16	38	25	8	4	0	0	0	0	0	102	44	49
13:00	0	0	1	1	11	34	32	7	1	**1**	0	0	0	0	88	44	48
14:00	0	0	2	2	13	**50**	24	7	**5**	0	0	0	0	0	103	44	49
15:00	**1**	0	0	2	20	41	37	**9**	2	0	0	0	0	**1**	113	44	48
16:00	0	0	1	0	**21**	47	**50**	1	0	0	0	0	0	0	**120**	43	44
17:00	0	1	0	7	15	43	28	9	0	0	0	0	0	0	103	43	47
18:00	0	0	0	0	7	25	14	4	3	0	0	0	0	0	53	44	50
19:00	0	0	0	3	7	23	14	7	1	0	0	0	0	0	55	44	48
20:00	0	0	0	1	7	5	16	2	2	0	0	0	0	0	33	44	50
21:00	0	0	0	0	1	5	4	1	0	0	0	0	0	0	11	44	47
22:00	1	0	0	0	1	4	4	0	0	0	0	0	0	0	10	43	44
23:00	0	0	0	0	0	1	2	0	0	0	0	0	0	0	3	43	44
Total	2	4	13	57	264	646	511	130	27	2	0	0	0	1	1657		
Percent	0.1%	0.2%	0.8%	3.4%	15.9%	39.0%	30.8%	7.8%	1.6%	0.1%	0.0%	0.0%	0.0%	0.1%			
AM Peak		10:00	08:00	08:00	09:00	07:00	07:00	08:00	07:00	08:00					07:00		
Vol.		1	4	9	29	63	57	21	2	1					161		
PM Peak	15:00	12:00	12:00	12:00	16:00	14:00	16:00	15:00	14:00	13:00				15:00	16:00		
Vol.	1	1	2	8	21	50	50	9	5	1				1	120		

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Southbound

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
08/13/20	0	0	0	0	0	0	0	**2**	0	0	0	0	0	0	2	49	49
01:00	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	44	44
02:00	0	0	0	0	0	1	2	0	**1**	0	0	0	0	0	4	52	54
03:00	0	0	0	0	0	1	2	0	0	0	0	0	0	0	3	43	44
04:00	0	0	0	0	**2**	2	3	0	0	0	0	0	0	0	7	43	44
05:00	0	0	0	0	2	**12**	**6**	1	1	0	0	0	0	0	**22**	43	49
06:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
07:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
08:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
09:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
12 PM	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
13:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
14:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
15:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
16:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
17:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
18:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
19:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
20:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
21:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
22:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
23:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Total	0	0	0	0	4	16	14	3	2	0	0	0	0	0	39		
Percent	0.0%	0.0%	0.0%	0.0%	10.3%	41.0%	35.9%	7.7%	5.1%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak					04:00	05:00	05:00	00:00	02:00						05:00		
Vol.					2	12	6	2	1						22		
PM Peak																	
Vol.																	
Grand Total	5	10	21	108	579	1458	1200	343	60	8	0	0	0	1	3793		
Percent	0.1%	0.3%	0.6%	2.8%	15.3%	38.4%	31.6%	9.0%	1.6%	0.2%	0.0%	0.0%	0.0%	0.0%			

15th Percentile :	33 MPH
50th Percentile :	39 MPH
85th Percentile :	44 MPH
95th Percentile :	48 MPH

Statistics

10 MPH Pace Speed :	36-45 MPH
Number in Pace :	2658
Percent in Pace :	70.1%
Number of Vehicles > 30 MPH :	3649
Percent of Vehicles > 30 MPH :	96.2%
Mean Speed(Average) :	40 MPH

Vanasse & Associates

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Location: Sand Hill Road
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Westbound

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
08/10/20	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
01:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
02:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
03:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
04:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
05:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
06:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
07:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
08:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
09:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
12 PM	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
13:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
14:00	0	0	1	3	**11**	0	0	0	0	0	0	0	0	0	15	33	34
15:00	0	0	0	**10**	9	**5**	0	0	0	0	0	0	0	0	**24**	36	38
16:00	0	0	1	7	2	3	0	0	0	0	0	0	0	0	13	36	38
17:00	0	**1**	**4**	4	8	0	0	0	0	0	0	0	0	0	17	33	34
18:00	0	0	2	6	5	0	**1**	0	0	0	0	0	0	0	14	33	41
19:00	0	0	1	1	3	0	0	0	0	0	0	0	0	0	5	33	34
20:00	0	0	0	1	2	0	0	0	0	0	0	0	0	0	3	33	34
21:00	0	0	0	4	1	1	0	0	0	0	0	0	0	0	6	35	38
22:00	0	0	0	2	1	2	0	0	0	0	0	0	0	0	5	38	39
23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	*
Total	0	1	9	38	42	11	1	0	0	0	0	0	0	0	102		
Percent	0.0%	1.0%	8.8%	37.3%	41.2%	10.8%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak																	
Vol.																	
PM Peak		17:00	17:00	15:00	14:00	15:00	18:00								15:00		
Vol.		1	4	10	11	5	1								24		

Vanasse & Associates

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

Vanasse & Associates
Location: Sand Hill Road
Location: At Site Drive
City: Groton, MA

Site Code: 00868504

Westbound

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
08/11/20	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	0	0	0	0	0	0	0	0	0	0	*	*
05:00	0	0	0	0	3	0	0	0	0	0	0	0	0	0	3	34	34
06:00	0	0	0	0	2	1	0	0	0	0	0	0	0	0	3	37	39
07:00	0	0	**1**	0	3	2	**1**	0	0	0	0	0	0	0	7	39	43
08:00	0	0	0	7	**8**	1	0	0	0	0	0	0	0	0	16	34	35
09:00	0	0	0	6	3	**5**	0	0	0	0	0	0	0	0	14	37	39
10:00	0	0	1	7	5	1	0	0	0	0	0	0	0	0	14	33	36
11:00	**1**	0	0	**10**	5	2	0	0	0	0	0	0	0	0	**18**	34	37
12 PM	**1**	0	1	5	6	2	0	0	0	0	0	0	0	0	15	34	38
13:00	0	**1**	**3**	4	**8**	**4**	0	0	0	0	0	0	0	0	**20**	36	38
14:00	0	0	0	1	8	1	0	0	0	0	0	0	0	0	10	34	37
15:00	0	0	0	2	5	0	0	0	0	0	0	0	0	0	7	33	34
16:00	0	0	2	5	8	3	0	0	0	0	0	0	0	0	18	35	38
17:00	0	0	0	6	8	3	**1**	0	0	0	0	0	0	0	18	37	40
18:00	0	0	1	4	3	0	1	0	0	0	0	0	0	0	9	34	42
19:00	0	0	0	**7**	2	0	0	0	0	0	0	0	0	0	9	31	33
20:00	0	0	0	2	2	0	0	0	0	0	0	0	0	0	4	33	34
21:00	0	0	0	3	1	0	0	0	0	0	0	0	0	0	4	32	33
22:00	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	44	44
23:00	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	29	29
Total	2	1	9	70	80	25	4	0	0	0	0	0	0	0	191		
Percent	1.0%	0.5%	4.7%	36.6%	41.9%	13.1%	2.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	11:00		07:00	11:00	08:00	09:00	07:00								11:00		
Vol.	1		1	10	8	5	1								18		
PM Peak	12:00	13:00	13:00	19:00	13:00	13:00	17:00								13:00		
Vol.	1	1	3	7	8	4	1								20		

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Westbound

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
08/12/20	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	1	0	0	0	0	0	0	0	0	0	1	34	34
03:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	*
04:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	*
05:00	0	0	0	1	1	0	0	0	0	0	0	0	0	0	2	33	34
06:00	0	0	1	1	3	0	0	0	0	0	0	0	0	0	5	33	34
07:00	0	0	0	3	4	**1**	0	0	0	0	0	0	0	0	8	34	38
08:00	0	0	1	5	7	0	0	0	0	0	0	0	0	0	13	33	34
09:00	0	0	**1**	6	**8**	1	0	0	0	0	0	0	0	0	16	34	35
10:00	**1**	0	**2**	6	7	0	0	0	0	0	0	0	0	0	16	33	34
11:00	0	**1**	1	**7**	8	0	0	0	0	0	0	0	0	0	**17**	33	34
12 PM	0	0	2	3	5	1	0	0	0	0	0	0	0	0	11	34	37
13:00	0	0	0	5	9	1	0	0	0	0	0	0	0	0	15	34	36
14:00	0	0	1	9	5	3	0	0	0	0	0	0	0	0	18	35	38
15:00	0	0	1	3	**10**	**4**	0	0	0	0	0	0	0	0	18	36	38
16:00	0	**2**	1	**11**	9	1	0	0	0	0	0	0	0	0	**24**	33	34
17:00	0	2	0	7	3	2	0	0	0	0	0	0	0	0	14	34	38
18:00	0	0	1	5	5	2	0	0	0	0	0	0	0	0	13	35	38
19:00	**1**	0	**3**	4	5	0	0	0	0	0	0	0	0	0	13	33	34
20:00	0	0	3	4	4	1	0	0	0	0	0	0	0	0	12	33	36
21:00	0	0	1	0	3	0	0	0	0	0	0	0	0	0	4	34	34
22:00	0	0	0	1	3	0	0	0	0	0	0	0	0	0	4	34	34
23:00	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	34	34
Total	2	5	19	81	101	17	0	0	0	0	0	0	0	0	225		
Percent	0.9%	2.2%	8.4%	36.0%	44.9%	7.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	10:00	11:00	10:00	11:00	09:00	07:00									11:00		
Vol.	1	1	2	7	8	1									17		
PM Peak	19:00	16:00	19:00	16:00	15:00	15:00									16:00		
Vol.	1	2	3	11	10	4									24		

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Westbound

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
08/13/20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	*
01:00	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	39	39
02:00	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	34	34
03:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	*
04:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	*
05:00	0	0	0	1	2	0	0	0	0	0	0	0	0	0	3	33	34
06:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
07:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
08:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
09:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
12 PM	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
13:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
14:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
15:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
16:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
17:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
18:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
19:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
20:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
21:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
22:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
23:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Total	0	0	0	1	3	1	0	0	0	0	0	0	0	0	5		
Percent	0.0%	0.0%	0.0%	20.0%	60.0%	20.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak				05:00	05:00	01:00									05:00		
Vol.				1	2	1									3		
PM Peak																	
Vol.																	
Grand Total	4	7	37	190	226	54	5	0	0	0	0	0	0	0	523		
Percent	0.8%	1.3%	7.1%	36.3%	43.2%	10.3%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			

15th Percentile :	25 MPH
50th Percentile :	30 MPH
85th Percentile :	34 MPH
95th Percentile :	38 MPH

Statistics

10 MPH Pace Speed :	26-35 MPH
Number in Pace :	416
Percent in Pace :	79.5%
Number of Vehicles > 30 MPH :	285
Percent of Vehicles > 30 MPH :	54.5%
Mean Speed(Average) :	31 MPH

Vanasse & Associates
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Andover, MA 01810

Vanasse & Associates
Location: Sand Hill Road
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Eastbound

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
08/10/20	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
01:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
02:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
03:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
04:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
05:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
06:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
07:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
08:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
09:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
12 PM	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
13:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
14:00	1	0	**3**	4	10	4	0	0	0	0	0	0	0	0	**22**	35	38
15:00	**2**	0	0	4	**13**	2	0	0	0	0	0	0	0	0	21	34	37
16:00	0	0	2	5	8	2	**1**	0	0	0	0	0	0	0	18	35	40
17:00	1	0	3	**10**	6	1	0	0	0	0	0	0	0	0	21	33	34
18:00	0	0	0	3	6	**5**	0	0	0	0	0	0	0	0	14	37	39
19:00	0	0	0	5	9	2	0	0	0	0	0	0	0	0	16	34	37
20:00	0	**1**	0	2	1	2	0	0	0	0	0	0	0	0	6	37	39
21:00	0	0	0	2	3	0	0	0	0	0	0	0	0	0	5	33	34
22:00	0	0	0	1	0	0	1	0	0	0	0	0	0	0	2	43	44
23:00	0	0	0	1	1	0	0	0	0	0	0	0	0	0	2	33	34
Total	4	1	8	37	57	18	2	0	0	0	0	0	0	0	127		
Percent	3.1%	0.8%	6.3%	29.1%	44.9%	14.2%	1.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak Vol.																	
PM Peak Vol.	15:00 2	20:00 1	14:00 3	17:00 10	15:00 13	18:00 5	16:00 1								14:00 22		

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Eastbound

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
08/11/20	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	34	34
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	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	1	2	2	0	0	0	0	0	0	0	0	5	38	39
07:00	**2**	0	1	3	1	2	1	0	0	0	0	0	0	0	10	38	42
08:00	0	0	**5**	7	3	0	0	0	0	0	0	0	0	0	15	31	33
09:00	2	0	0	**9**	**12**	1	**2**	0	0	0	0	0	0	0	**26**	34	41
10:00	0	**1**	1	1	8	1	1	0	0	0	0	0	0	0	13	35	41
11:00	0	0	2	4	8	**3**	1	0	0	0	0	0	0	0	18	37	40
12 PM	0	**1**	**5**	6	5	5	0	0	0	0	0	0	0	0	22	36	38
13:00	0	0	2	5	9	3	1	0	0	0	0	0	0	0	20	36	40
14:00	1	0	0	4	6	4	0	0	0	0	0	0	0	0	15	37	39
15:00	0	0	2	4	**16**	2	0	0	0	0	0	0	0	0	**24**	34	36
16:00	0	0	0	3	8	**7**	2	0	0	0	0	0	0	0	20	39	42
17:00	1	0	1	3	13	2	**3**	0	0	0	0	0	0	0	23	38	43
18:00	**4**	0	0	**7**	7	1	0	**1**	0	0	0	0	0	0	20	34	45
19:00	0	0	0	5	8	1	1	0	0	0	0	0	0	0	15	34	41
20:00	0	0	1	2	5	1	0	0	0	0	0	0	0	0	9	34	37
21:00	0	1	4	0	3	1	0	0	0	0	0	0	0	0	9	34	37
22:00	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2	39	39
23:00	0	0	0	2	0	2	0	0	0	0	0	0	0	0	4	38	39
Total	10	3	24	66	115	40	12	1	0	0	0	0	0	0	271		
Percent	3.7%	1.1%	8.9%	24.4%	42.4%	14.8%	4.4%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	07:00	10:00	08:00	09:00	09:00	11:00	09:00								09:00		
Vol.	2	1	5	9	12	3	2								26		
PM Peak	18:00	12:00	12:00	18:00	15:00	16:00	17:00	18:00							15:00		
Vol.	4	1	5	7	16	7	3	1							24		

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Eastbound

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
08/12/20	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	39	39
01:00	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	24	24
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	0	0	0	0	0	0	0	0	0	0	*	*
05:00	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	34	34
06:00	0	0	0	0	1	2	0	0	0	0	0	0	0	0	3	38	39
07:00	0	0	0	4	2	**4**	0	0	0	0	0	0	0	0	10	38	39
08:00	0	0	**4**	2	**8**	1	**1**	0	0	0	0	0	0	0	16	34	40
09:00	**1**	0	2	3	7	0	0	0	0	0	0	0	0	0	13	33	34
10:00	0	**1**	4	4	6	2	0	0	0	0	0	0	0	0	**17**	34	37
11:00	0	1	2	**8**	4	2	0	0	0	0	0	0	0	0	17	34	37
12 PM	0	0	0	**8**	5	4	0	0	0	0	0	0	0	0	17	36	38
13:00	0	**1**	2	4	4	2	**2**	0	0	0	0	0	0	0	15	39	43
14:00	0	0	1	5	**13**	2	0	0	0	0	0	0	0	0	**21**	34	37
15:00	0	0	1	5	5	2	1	0	0	0	0	0	0	0	14	37	41
16:00	0	0	1	4	12	2	2	0	0	0	0	0	0	0	21	37	42
17:00	0	0	1	4	8	1	0	0	0	0	0	0	0	0	14	34	36
18:00	**3**	0	1	2	9	**5**	0	0	0	0	0	0	0	0	20	37	39
19:00	2	0	**3**	1	10	0	1	0	0	0	0	0	0	0	17	34	40
20:00	0	0	0	8	2	2	1	0	0	0	0	0	0	0	13	37	41
21:00	0	0	0	0	3	0	0	0	0	0	0	0	0	0	3	34	34
22:00	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2	34	34
23:00	0	0	0	2	0	1	0	0	0	0	0	0	0	0	3	37	39
Total	6	3	23	64	102	33	8	0	0	0	0	0	0	0	239		
Percent	2.5%	1.3%	9.6%	26.8%	42.7%	13.8%	3.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	09:00	10:00	08:00	11:00	08:00	07:00	08:00								10:00		
Vol.	1	1	4	8	8	4	1								17		
PM Peak	18:00	13:00	19:00	12:00	14:00	18:00	13:00								14:00		
Vol.	3	1	3	8	13	5	2								21		

Vanasse & Associates
35 New England Business Center Dr, Suite 140
Andover, MA 01810

Vanasse & Associates
Location: Sand Hill Road
Location: At Site Drive
City: Groton, MA

Site Code: 00868504

Eastbound

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent	95th Percent
08/13/20	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	34	34
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	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	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
07:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
08:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
09:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
12 PM	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
13:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
14:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
15:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
16:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
17:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
18:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
19:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
20:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
21:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
22:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
23:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Total	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1		
Percent	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak					00:00										00:00		
Vol.					1										1		
PM Peak																	
Vol.																	
Grand Total	20	7	55	167	275	91	22	1	0	0	0	0	0	0	638		
Percent	3.1%	1.1%	8.6%	26.2%	43.1%	14.3%	3.4%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			

15th Percentile :	25 MPH
50th Percentile :	31 MPH
85th Percentile :	36 MPH
95th Percentile :	39 MPH

Statistics

10 MPH Pace Speed :	26-35 MPH
Number in Pace :	442
Percent in Pace :	69.3%
Number of Vehicles > 30 MPH :	389
Percent of Vehicles > 30 MPH :	61.0%
Mean Speed(Average) :	31 MPH

MASSDOT CRASH RATE WORKSHEETS AND HIGH CRASH LOCATION MAPPING

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Groton COUNT DATE : Aug-20

DISTRICT : 3 UNSIGNALIZED : X SIGNALIZED :

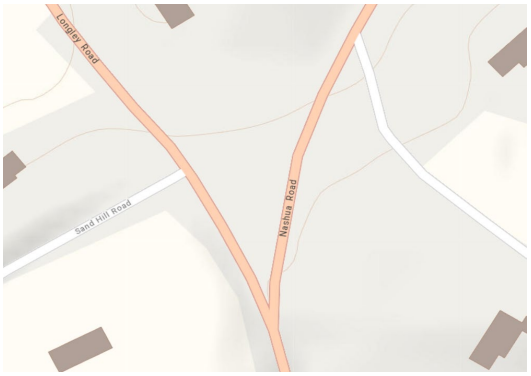
~ INTERSECTION DATA ~

MAJOR STREET : Longley Road

MINOR STREET(S) : Sand Hill Road

INTERSECTION DIAGRAM
(Label Approaches)

↑ *North*



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	EB	NB	SB			
PEAK HOURLY VOLUMES (PM) :	29	194	134			**357**

" K " FACTOR : **0.090** INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **3,967**

TOTAL # OF CRASHES : 1 # OF YEARS : 5 AVERAGE # OF CRASHES PER YEAR (**A**) : **0.20**

CRASH RATE CALCULATION : **0.14** RATE = $\frac{(A * 1{,}000{,}000)}{(V * 365)}$

Comments : Below Statewide and District Crash Rates

Project Title & Date: Proposed Bio Lab Facility

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Groton COUNT DATE : Aug-20

DISTRICT : 3 UNSIGNALIZED : X SIGNALIZED :

~ INTERSECTION DATA ~

MAJOR STREET : Longley Road

MINOR STREET(S) : Nashua Road

INTERSECTION DIAGRAM (Label Approaches)

PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	WB	NB	SB			
PEAK HOURLY VOLUMES (PM) :	86	251	139			**476**

" K " FACTOR : **0.090** INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **5,289**

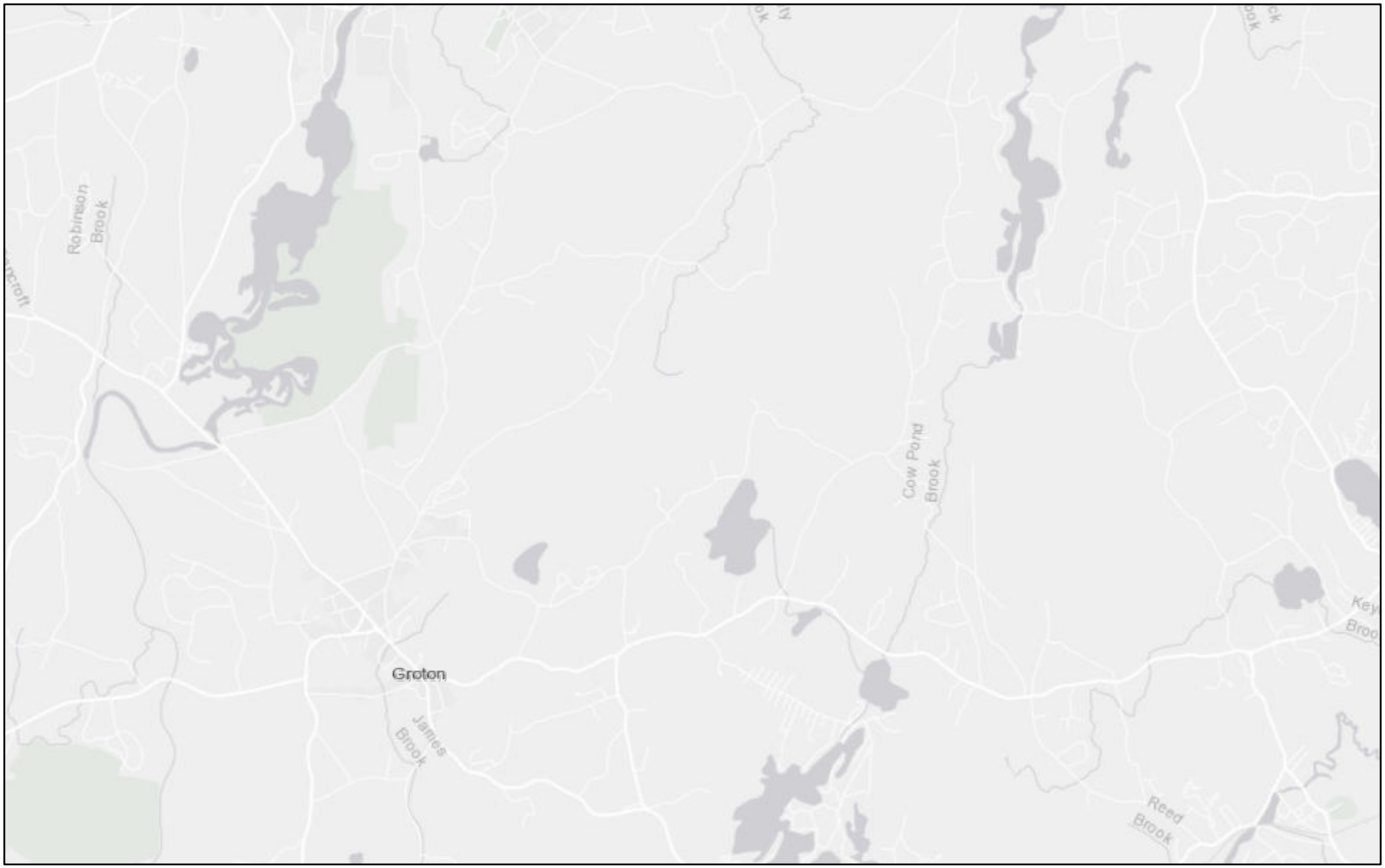
TOTAL # OF CRASHES : 1 # OF YEARS : 5 AVERAGE # OF CRASHES PER YEAR (**A**) : **0.20**

CRASH RATE CALCULATION : **0.10** RATE = $\frac{(A * 1{,}000{,}000)}{(V * 365)}$

Comments : Below Statewide and District Crash Rates

Project Title & Date: Proposed Bio Lab Facility

GeoDOT Map



8/28/2020, 5:25:49 PM

1:72,224

0 0.45 0.9 1.8 mi

0 0.5 1 2 km

GENERAL BACKGROUND TRAFFIC GROWTH

General Background Traffic Growth - Daily Traffic Volumes

CITY/TOWN	ROUTE/STREET	LOCATION	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average Annual
Dunstable	Groton Street	at Groton Town Line										3,309	*3,296*	**-0.39%**
Groton	Chicopee Row	at Dunstable Town Line				2,340	2,350	*2,423*	*2,479*	*2,633*	*2,678*	*2,686*	*2,675*	**2.30%**
Groton	Hollis Street	North of Route 119				4,166	4,188	*4,318*	*4,417*	*4,691*	*4,771*	*4,785*	*4,766*	**2.30%**
Groton	Longley Road	at Pepperell Town Line				2,480	2,492	*2,569*	*2,628*	*2,791*	*2,838*	*2,847*	*2,836*	**2.30%**
Groton	Main Street	at Pepperell Town Line						13,135				*14,275*	*14,332*	**1.42%**
Pepperell	Nashua Road	at Groton Town Line				958	963	*993*	*1,016*	*1,079*	*1,097*	*1,100*	*1,096*	**2.30%**
Pepperell	River Road	North of Main Street						5,564	*5,508*			*5,871*	*5,848*	**0.77%**
Groton	Main Street	West of Route 119				3,054	2,845	*3,239*	*3,275*	*3,318*	3,348	*3,395*	*3,409*	**2.11%**
Groton	Main Street	North of Pleasant Street					12,760	*13,462*	*13,610*	*13,787*	12,859	*13,039*	*13,091*	**-0.02%**
Groton	Main Street	West of School Street	14,111	13,912	13,135	13,288	13,356	*14,091*	*14,246*	*14,431*	15,112	*15,324*	*15,385*	**1.27%**
														1.44%

TRIP-GENERATION CALCULATIONS

Land Use: 252
Senior Adult Housing—Attached

Description

Senior adult housing consists of attached independent living developments, including retirement communities, age-restricted housing, and active adult communities. These developments may include limited social or recreational services. However, they generally lack centralized dining and onsite medical facilities. Residents in these communities live independently, are typically active (requiring little to no medical supervision) and may or may not be retired. Senior adult housing—detached (Land Use 251), congregate care facility (Land Use 253), assisted living (Land Use 254), and continuing care retirement community (Land Use 255) are related uses.

Additional Data

Time-of-day distribution data for this land use are presented in Appendix A. For the one general urban/suburban site with data, the overall highest vehicle volumes during the AM and PM on a weekday were counted between 11:45 a.m. and 12:45 p.m. and 12:00 and 1:00 p.m., respectively.

The sites were surveyed in the 1980s, the 1990s, and the 2000s in Alberta (CAN), California, Illinois, New Hampshire, New Jersey, New York, and Pennsylvania.

Source Numbers

272, 501, 576, 602, 703, 734, 741, 902, 970

Senior Adult Housing - Attached
(252)

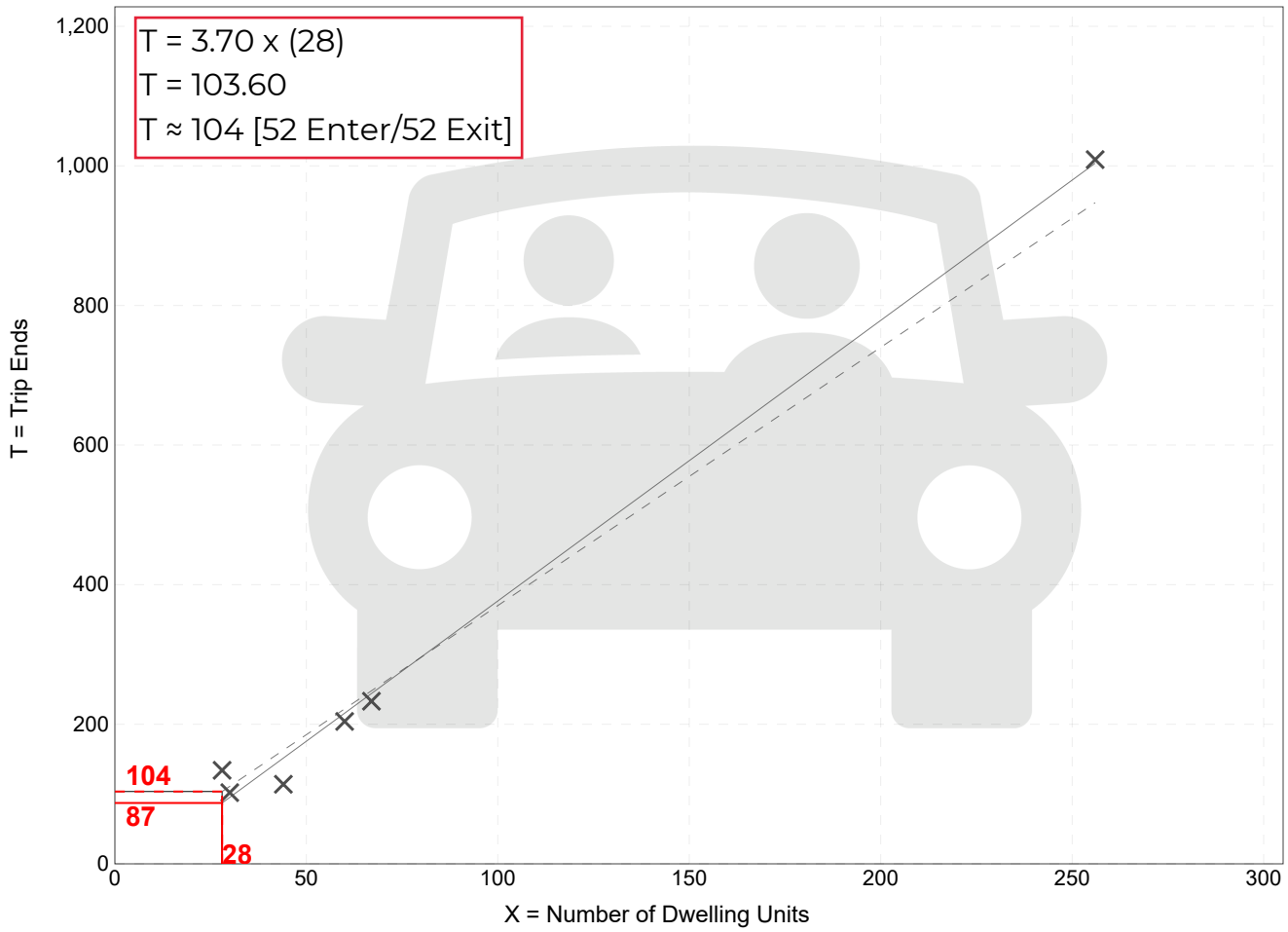
Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday**

Setting/Location: **General Urban/Suburban**
Number of Studies: 6
Avg. Num. of Dwelling Units: 81
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
3.70	2.59 - 4.79	0.53

Data Plot and Equation



Fitted Curve Equation: T = 4.02(X) - 25.37

R^2= 0.99

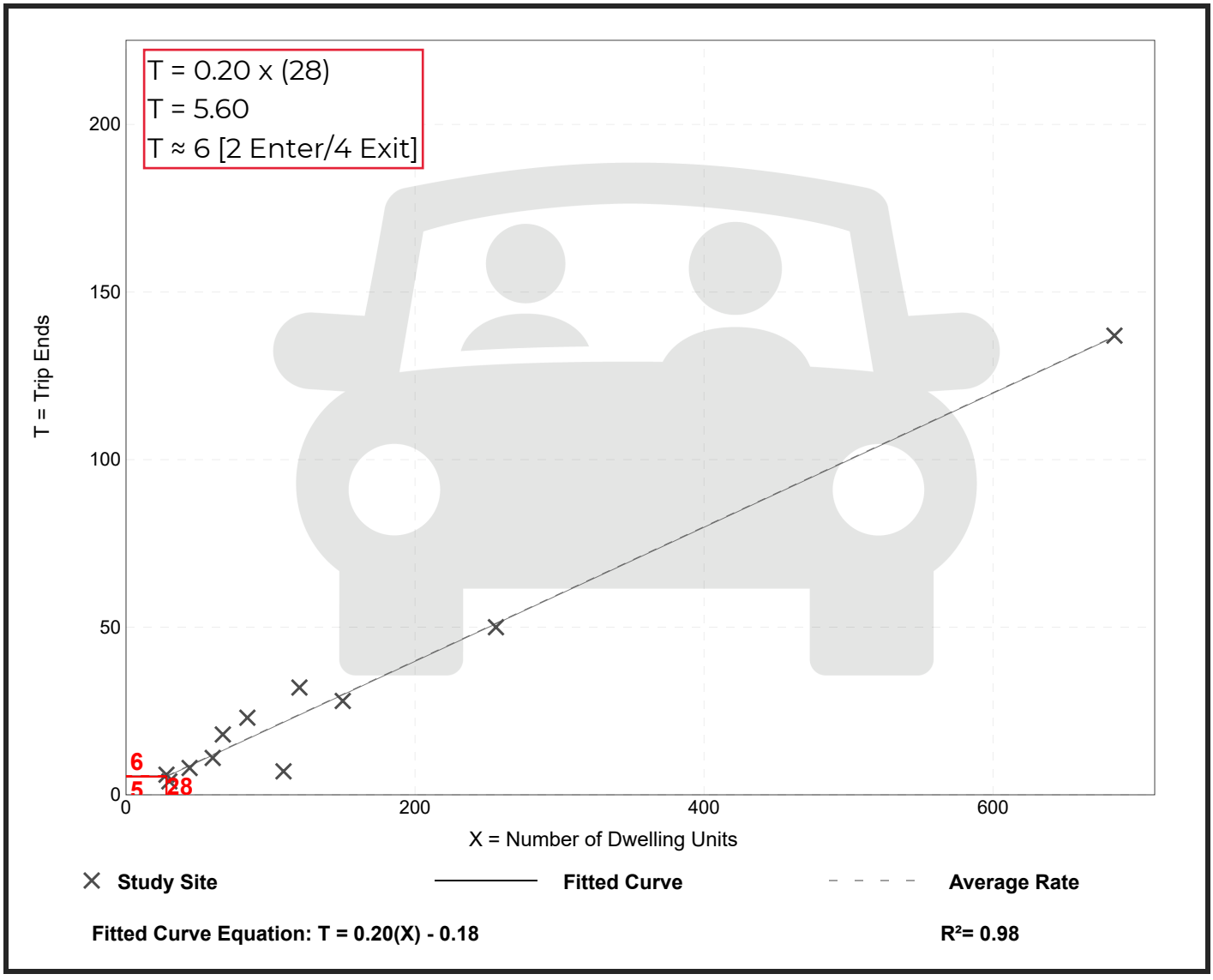
Senior Adult Housing - Attached
(252)

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:	11
Avg. Num. of Dwelling Units:	148
Directional Distribution:	35% entering, 65% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.20	0.06 - 0.27	0.05

Data Plot and Equation



Fitted Curve Equation: T = 0.20(X) - 0.18

R^2= 0.98

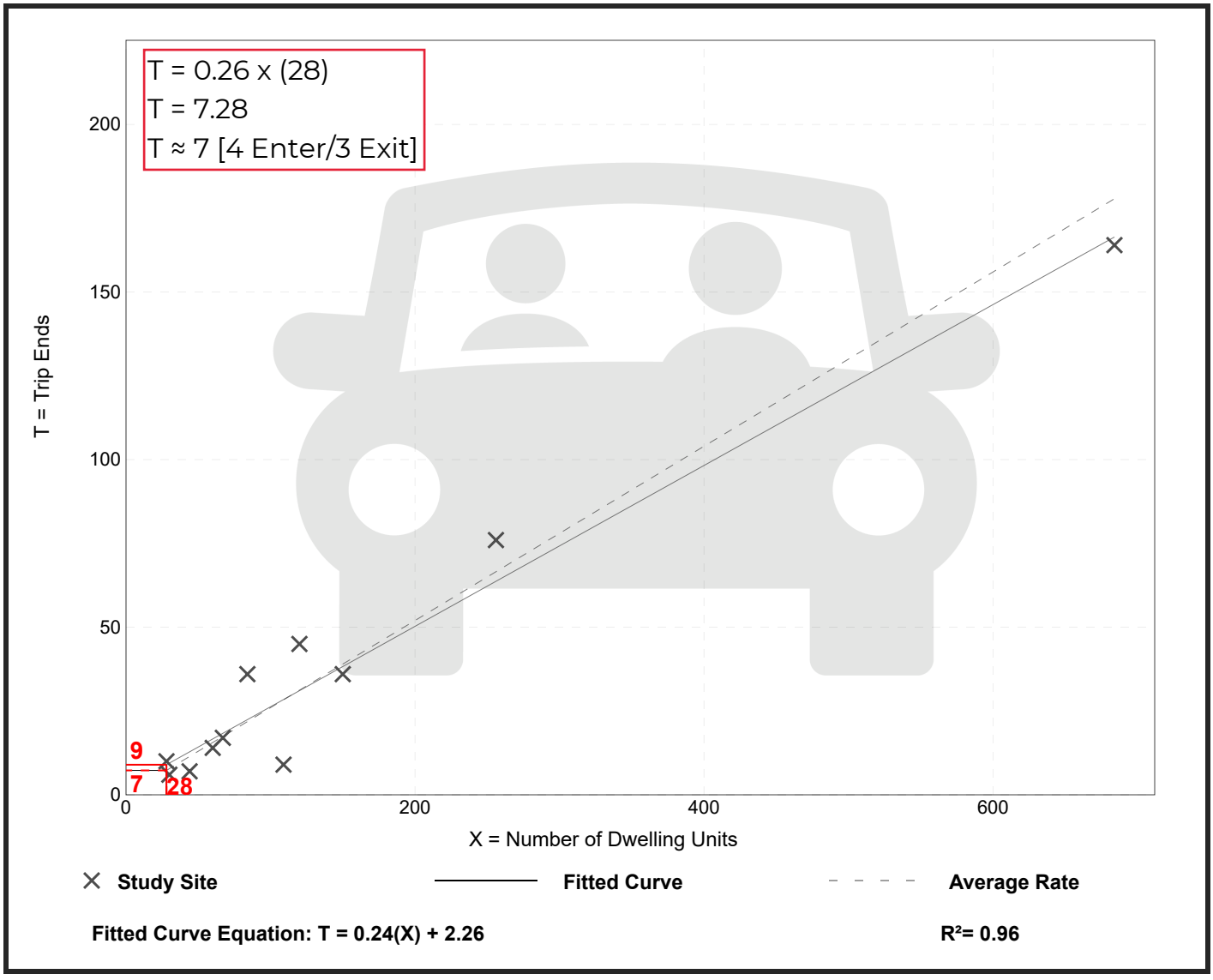
Senior Adult Housing - Attached
(252)

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:	11
Avg. Num. of Dwelling Units:	148
Directional Distribution:	55% entering, 45% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.26	0.08 - 0.43	0.08

Data Plot and Equation



Fitted Curve Equation: T = 0.24(X) + 2.26

R^2= 0.96

COMPARATIVE 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

Graph Look Up

Query | Filter

DATA SOURCE:
Trip Gen Manual, 10th Ed + Supplement

SEARCH BY LAND USE CODE:
220

LAND USE GROUP:
(200-299) Residential

LAND USE :
220 - Multifamily Housing (Low-Rise)

LAND USE SUBCATEGORY:
All Sites

INDEPENDENT VARIABLE (IV):
Dwelling Units

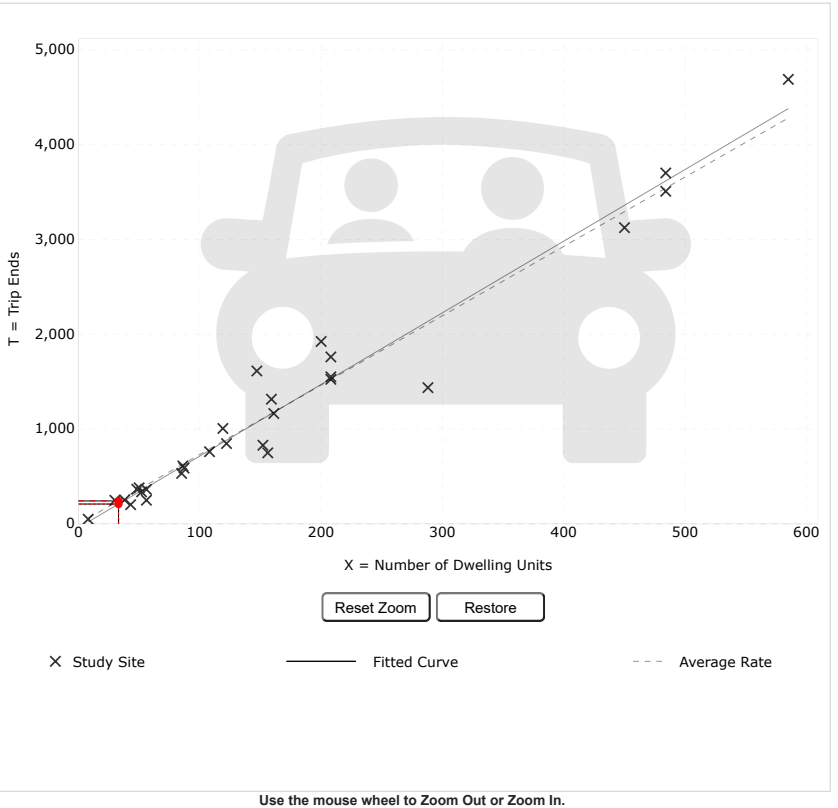
TIME PERIOD:
Weekday

SETTING/LOCATION:
General Urban/Suburban

TRIP TYPE:
Vehicle

ENTER IV VALUE TO CALCULATE TRIPS:
33 Calculate

Data Plot and Equation



Use the mouse wheel to Zoom Out or Zoom In.
Hover the mouse pointer on data points to view X and T values.

DATA STATISTICS

Land Use:
Multifamily Housing (Low-Rise) (220) Click for more details

Independent Variable:
Dwelling Units

Time Period:
Weekday

Setting/Location:
General Urban/Suburban

Trip Type:
Vehicle

Number of Studies:
29

Avg. Num. of Dwelling Units:
168

Average Rate:
7.32

Range of Rates:
4.45 - 10.97

Standard Deviation:
1.31

Fitted Curve Equation:
T = 7.56(X) - 40.86

R^2:
0.96

Directional Distribution:
50% entering, 50% exiting

Calculated Trip Ends:
Average Rate: 242 (Total), 121 (Entry), 121 (Exit)
Fitted Curve: 209 (Total), 104 (Entry), 105 (Exit)

Graph Look Up

Query | Filter

DATA SOURCE:
Trip Gen Manual, 10th Ed + Supplement

SEARCH BY LAND USE CODE:
220

LAND USE GROUP:
(200-299) Residential

LAND USE :
220 - Multifamily Housing (Low-Rise)

LAND USE SUBCATEGORY:
All Sites

INDEPENDENT VARIABLE (IV):
Dwelling Units

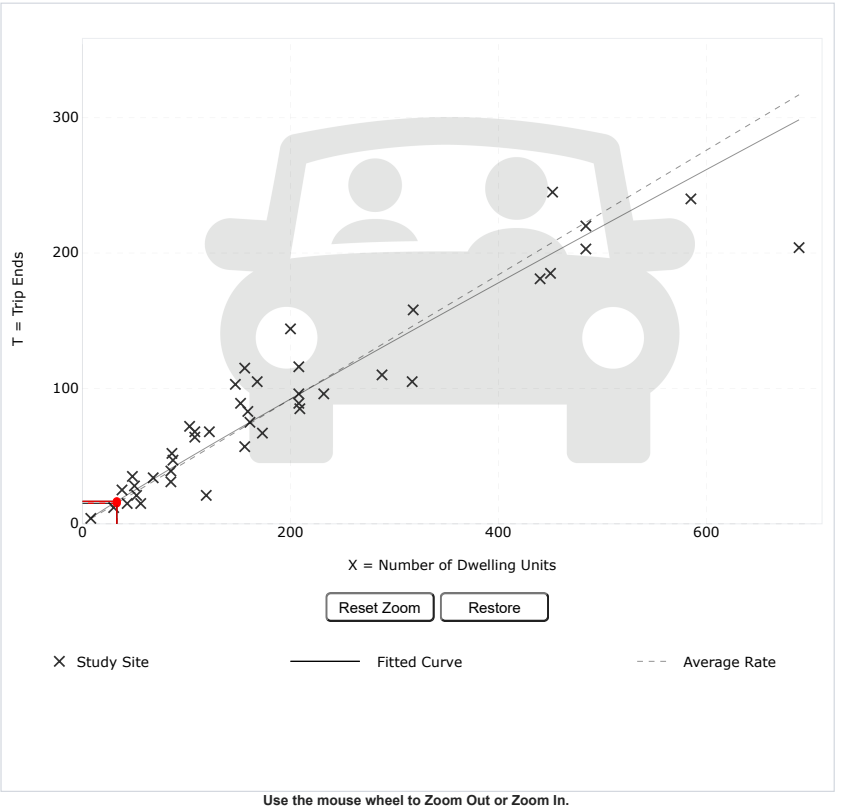
TIME PERIOD:
Weekday, Peak Hour of Adjacent Street Traffic

SETTING/LOCATION:
General Urban/Suburban

TRIP TYPE:
Vehicle

ENTER IV VALUE TO CALCULATE TRIPS:
33 Calculate

Data Plot and Equation



Use the mouse wheel to Zoom Out or Zoom In.
Hover the mouse pointer on data points to view X and T values.

DATA STATISTICS

Land Use:
Multifamily Housing (Low-Rise) (220) Click for more details

Independent Variable:
Dwelling Units

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

Setting/Location:
General Urban/Suburban

Trip Type:
Vehicle

Number of Studies:
42

Avg. Num. of Dwelling Units:
199

Average Rate:
0.46

Range of Rates:
0.18 - 0.74

Standard Deviation:
0.12

Fitted Curve Equation:
Ln(T) = 0.95 Ln(X) - 0.51

R^2:
0.90

Directional Distribution:
23% entering, 77% exiting

Calculated Trip Ends:
Average Rate: 15 (Total), 3 (Entry), 12 (Exit)
Fitted Curve: 17 (Total), 4 (Entry), 13 (Exit)

Graph Look Up

Query | Filter

DATA SOURCE:
Trip Gen Manual, 10th Ed + Supplement

SEARCH BY LAND USE CODE:
220

LAND USE GROUP:
(200-299) Residential

LAND USE :
220 - Multifamily Housing (Low-Rise)

LAND USE SUBCATEGORY:
All Sites

INDEPENDENT VARIABLE (IV):
Dwelling Units

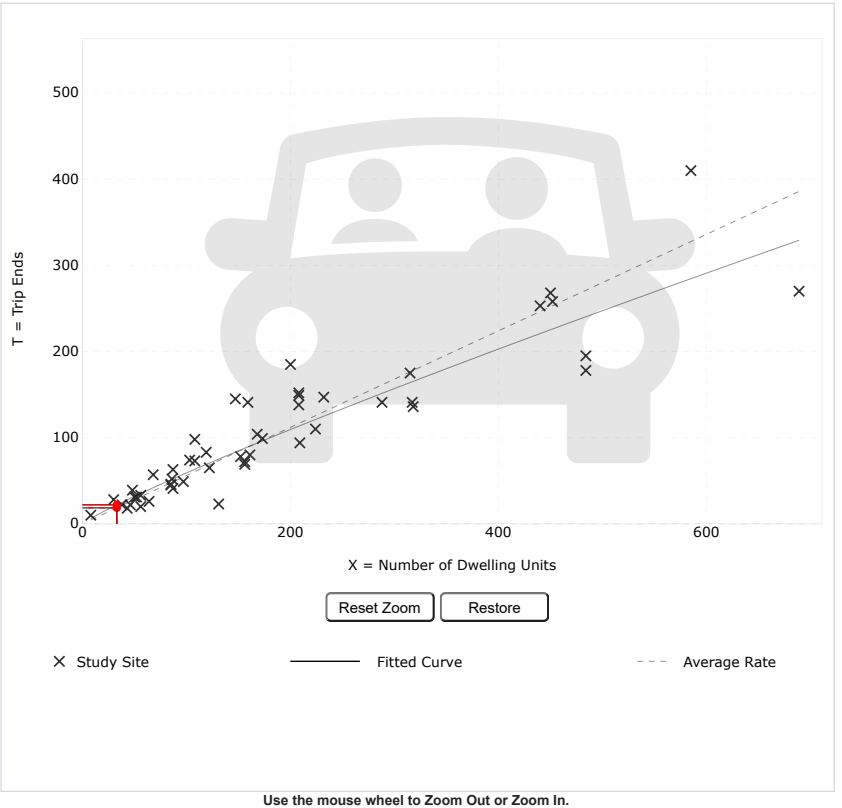
TIME PERIOD:
Weekday, Peak Hour of Adjacent Street Traffic

SETTING/LOCATION:
General Urban/Suburban

TRIP TYPE:
Vehicle

ENTER IV VALUE TO CALCULATE TRIPS:
33 Calculate

Data Plot and Equation



Use the mouse wheel to Zoom Out or Zoom In.
Hover the mouse pointer on data points to view X and T values.

DATA STATISTICS

Land Use:
Multifamily Housing (Low-Rise) (220) Click for more details

Independent Variable:
Dwelling Units

Time Period:
Weekday
Peak Hour of Adjacent Street Traffic
One Hour Between 4 and 6 p.m.

Setting/Location:
General Urban/Suburban

Trip Type:
Vehicle

Number of Studies:
50

Avg. Num. of Dwelling Units:
187

Average Rate:
0.56

Range of Rates:
0.18 - 1.25

Standard Deviation:
0.16

Fitted Curve Equation:
Ln(T) = 0.89 Ln(X) - 0.02

R^2:
0.86

Directional Distribution:
63% entering, 37% exiting

Calculated Trip Ends:
Average Rate: 18 (Total), 11 (Entry), 7 (Exit)
Fitted Curve: 22 (Total), 14 (Entry), 8 (Exit)

JOURNEY TO WORK TRIP DISTRIBUTION

Proposed Residential Development
Longley Road
Groton, MA

Residence	Workplace	Number	Longley Road (North)		Longley Road (South)		Sand Hill Road (West)		Nashua Road (East)	
Groton town	Groton town	1,038		0	50%	519	50%	519		0
Groton town	Westford town	381		0	100%	381		0		0
Groton town	Ayer town	228		0	100%	228		0		0
Groton town	Boston city	212		0	50%	106		0	50%	106
Groton town	Burlington town	203		0	50%	102		0	50%	102
Groton town	Nashua city	194	50%	97		0		0	50%	97
Groton town	Lowell city	177		0	50%	89		0	50%	89
Groton town	Chelmsford town	168		0	50%	84		0	50%	84
Groton town	Acton town	160		0	100%	160		0		0
Groton town	Cambridge city	132		0	50%	66		0	50%	66
Groton town	Concord town	126		0	100%	126		0		0
Groton town	Tyngsborough town	107		0		0		0	100%	107
Groton town	Tewksbury town	106		0	50%	53		0	50%	53
Groton town	Wilmington town	104		0	50%	52		0	50%	52
Groton town	Littleton town	102		0	100%	102		0		0
Groton town	Woburn city	96		0	50%	48		0	50%	48
Groton town	Bedford town	90		0	50%	45		0	50%	45
Groton town	Townsend town	81		0		0	100%	81		0
Groton town	Waltham city	80		0	50%	40		0	50%	40
Groton town	Billerica town	72		0	50%	36		0	50%	36
Groton town	Andover town	71		0	50%	36		0	50%	36
Groton town	Marlborough city	70		0	100%	70		0		0
Groton town	Boxborough town	61		0	100%	61		0		0
Groton town	Pepperell town	58	50%	29		0	50%	29		0
Groton town	Lexington town	57		0	50%	29		0	50%	29
Groton town	Worcester city	53		0	50%	27	50%	27		0
Groton town	Merrimack town	48	100%	48		0		0		0
Groton town	Ipswich town	46		0	50%	23		0	50%	23
Groton town	Sudbury town	44		0	100%	44		0		0
Groton town	Leominster city	37		0	50%	19	50%	19		0
Groton town	Framingham town	32		0	50%	16		0	50%	16
Groton town	Fitchburg city	31		0		0	100%	31		0
Groton town	Wakefield town	30		0		0		0	100%	30
Groton town	Southborough town	29		0	100%	29		0		0
Groton town	Bolton town	28		0	100%	28		0		0
Groton town	Weston town	26		0	100%	26		0		0
Groton town	Hopkinton town	24		0	100%	24		0		0
Groton town	Westborough town	22		0	100%	22		0		0
		4,624		174		2,688		705		1,057
				3.8%		58.1%		15.2%		22.9%
		SAY		5%		55%		15%		25%

CAPACITY ANALYSIS WORKSHEETS

Longley Road at Sand Hill Road
Longley Road at Nashua Street
Longley Road at the Project Site Roadway
Sand Hill Road at the Project Site Roadway

Longley Road at Sand Hill Road

Intersection	
Int Delay, s/veh	1.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	4	17	15	59	134	1
Future Vol, veh/h	4	17	15	59	134	1
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	57	57	72	72	88	88
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	7	30	21	82	152	1

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	277	153	153	0	-	0
Stage 1	153	-	-	-	-	-
Stage 2	124	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	717	898	1440	-	-	-
Stage 1	880	-	-	-	-	-
Stage 2	907	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	706	898	1440	-	-	-
Mov Cap-2 Maneuver	706	-	-	-	-	-
Stage 1	867	-	-	-	-	-
Stage 2	907	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.4	1.5	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1440	-	854	-	-
HCM Lane V/C Ratio	0.014	-	0.043	-	-
HCM Control Delay (s)	7.5	0	9.4	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	14	15	14	180	124	10
Future Vol, veh/h	14	15	14	180	124	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	72	72	88	88	90	90
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	19	21	16	205	138	11

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	381	144	149	0	-	0
Stage 1	144	-	-	-	-	-
Stage 2	237	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	625	909	1445	-	-	-
Stage 1	888	-	-	-	-	-
Stage 2	807	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	618	909	1445	-	-	-
Mov Cap-2 Maneuver	618	-	-	-	-	-
Stage 1	877	-	-	-	-	-
Stage 2	807	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	10.1	0.5	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1445	-	741	-	-
HCM Lane V/C Ratio	0.011	-	0.054	-	-
HCM Control Delay (s)	7.5	0	10.1	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0.2	-	-

Intersection	
Int Delay, s/veh	1.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	4	19	17	65	149	1
Future Vol, veh/h	4	19	17	65	149	1
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	57	57	72	72	88	88
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	7	33	24	90	169	1

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	308	170	170	0	-	0
Stage 1	170	-	-	-	-	-
Stage 2	138	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	688	879	1420	-	-	-
Stage 1	865	-	-	-	-	-
Stage 2	894	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	676	879	1420	-	-	-
Mov Cap-2 Maneuver	676	-	-	-	-	-
Stage 1	849	-	-	-	-	-
Stage 2	894	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.5	1.6	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1420	-	835	-	-
HCM Lane V/C Ratio	0.017	-	0.048	-	-
HCM Control Delay (s)	7.6	0	9.5	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0.1	-	0.2	-	-

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	16	17	16	200	138	11
Future Vol, veh/h	16	17	16	200	138	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	72	72	88	88	90	90
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	22	24	18	227	153	12

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	422	159	165	0	-	0
Stage 1	159	-	-	-	-	-
Stage 2	263	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	592	892	1426	-	-	-
Stage 1	875	-	-	-	-	-
Stage 2	786	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	584	892	1426	-	-	-
Mov Cap-2 Maneuver	584	-	-	-	-	-
Stage 1	863	-	-	-	-	-
Stage 2	786	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	10.4	0.6	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1426	-	710	-	-
HCM Lane V/C Ratio	0.013	-	0.065	-	-
HCM Control Delay (s)	7.6	0	10.4	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0.2	-	-

Intersection	
Int Delay, s/veh	1.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	4	20	18	65	149	1
Future Vol, veh/h	4	20	18	65	149	1
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	57	57	72	72	88	88
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	7	35	25	90	169	1

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	310	170	170	0	-	0
Stage 1	170	-	-	-	-	-
Stage 2	140	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	687	879	1420	-	-	-
Stage 1	865	-	-	-	-	-
Stage 2	892	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	674	879	1420	-	-	-
Mov Cap-2 Maneuver	674	-	-	-	-	-
Stage 1	849	-	-	-	-	-
Stage 2	892	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.5	1.6	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1420	-	837	-	-
HCM Lane V/C Ratio	0.018	-	0.05	-	-
HCM Control Delay (s)	7.6	0	9.5	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0.1	-	0.2	-	-

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	16	18	17	200	138	11
Future Vol, veh/h	16	18	17	200	138	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	72	72	88	88	90	90
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	22	25	19	227	153	12

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	424	159	165	0	-	0
Stage 1	159	-	-	-	-	-
Stage 2	265	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	591	892	1426	-	-	-
Stage 1	875	-	-	-	-	-
Stage 2	784	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	582	892	1426	-	-	-
Mov Cap-2 Maneuver	582	-	-	-	-	-
Stage 1	862	-	-	-	-	-
Stage 2	784	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	10.4	0.6	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1426	-	713	-	-
HCM Lane V/C Ratio	0.014	-	0.066	-	-
HCM Control Delay (s)	7.6	0	10.4	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0.2	-	-

Longley Road at Nashua Street

Intersection	
Int Delay, s/veh	2.6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	44	18	56	23	17	134
Future Vol, veh/h	44	18	56	23	17	134
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	80	80	65	65	91	91
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	55	23	86	35	19	147

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	289	104	0	0	121	0
Stage 1	104	-	-	-	-	-
Stage 2	185	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	706	956	-	-	1479	-
Stage 1	925	-	-	-	-	-
Stage 2	852	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	696	956	-	-	1479	-
Mov Cap-2 Maneuver	696	-	-	-	-	-
Stage 1	925	-	-	-	-	-
Stage 2	840	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.3	0	0.8
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	756	1479	-
HCM Lane V/C Ratio	-	-	0.103	0.013	-
HCM Control Delay (s)	-	-	10.3	7.5	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.3	0	-

Intersection	
Int Delay, s/veh	2.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	67	19	175	76	11	128
Future Vol, veh/h	67	19	175	76	11	128
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	94	94	91	91	89	89
Heavy Vehicles, %	0	0	1	0	0	1
Mvmt Flow	71	20	192	84	12	144

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	402	234	0	0	276	0
Stage 1	234	-	-	-	-	-
Stage 2	168	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	608	810	-	-	1299	-
Stage 1	810	-	-	-	-	-
Stage 2	867	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	602	810	-	-	1299	-
Mov Cap-2 Maneuver	602	-	-	-	-	-
Stage 1	810	-	-	-	-	-
Stage 2	858	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.6	0	0.6
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	638	1299	-
HCM Lane V/C Ratio	-	-	0.143	0.01	-
HCM Control Delay (s)	-	-	11.6	7.8	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.5	0	-

Intersection	
Int Delay, s/veh	2.6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	49	20	62	26	19	149
Future Vol, veh/h	49	20	62	26	19	149
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	80	80	65	65	91	91
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	61	25	95	40	21	164

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	321	115	0	0	135	0
Stage 1	115	-	-	-	-	-
Stage 2	206	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	677	943	-	-	1462	-
Stage 1	915	-	-	-	-	-
Stage 2	833	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	666	943	-	-	1462	-
Mov Cap-2 Maneuver	666	-	-	-	-	-
Stage 1	915	-	-	-	-	-
Stage 2	820	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.6	0	0.8
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	728	1462	-
HCM Lane V/C Ratio	-	-	0.118	0.014	-
HCM Control Delay (s)	-	-	10.6	7.5	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.4	0	-

Intersection	
Int Delay, s/veh	2.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	74	21	195	84	12	143
Future Vol, veh/h	74	21	195	84	12	143
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	94	94	91	91	89	89
Heavy Vehicles, %	0	0	1	0	0	1
Mvmt Flow	79	22	214	92	13	161

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	447	260	0	0	306	0
Stage 1	260	-	-	-	-	-
Stage 2	187	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	573	784	-	-	1266	-
Stage 1	788	-	-	-	-	-
Stage 2	850	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	567	784	-	-	1266	-
Mov Cap-2 Maneuver	567	-	-	-	-	-
Stage 1	788	-	-	-	-	-
Stage 2	841	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	12.2	0	0.6
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	604	1266	-
HCM Lane V/C Ratio	-	-	0.167	0.011	-
HCM Control Delay (s)	-	-	12.2	7.9	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.6	0	-

Intersection	
Int Delay, s/veh	2.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	49	21	62	26	20	149
Future Vol, veh/h	49	21	62	26	20	149
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	80	80	65	65	91	91
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	61	26	95	40	22	164

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	323	115	0	0	135	0
Stage 1	115	-	-	-	-	-
Stage 2	208	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	675	943	-	-	1462	-
Stage 1	915	-	-	-	-	-
Stage 2	832	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	664	943	-	-	1462	-
Mov Cap-2 Maneuver	664	-	-	-	-	-
Stage 1	915	-	-	-	-	-
Stage 2	818	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.6	0	0.9
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	729	1462	-
HCM Lane V/C Ratio	-	-	0.12	0.015	-
HCM Control Delay (s)	-	-	10.6	7.5	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.4	0	-

Intersection	
Int Delay, s/veh	2.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	74	22	195	84	13	143
Future Vol, veh/h	74	22	195	84	13	143
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	94	94	91	91	89	89
Heavy Vehicles, %	0	0	1	0	0	1
Mvmt Flow	79	23	214	92	15	161

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	451	260	0	0	306	0
Stage 1	260	-	-	-	-	-
Stage 2	191	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	570	784	-	-	1266	-
Stage 1	788	-	-	-	-	-
Stage 2	846	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	563	784	-	-	1266	-
Mov Cap-2 Maneuver	563	-	-	-	-	-
Stage 1	788	-	-	-	-	-
Stage 2	835	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	12.2	0	0.7
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	602	1266	-
HCM Lane V/C Ratio	-	-	0.17	0.012	-
HCM Control Delay (s)	-	-	12.2	7.9	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.6	0	-

Longley Road at the Project Site Roadway

Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	2	1	88	198	0
Future Vol, veh/h	0	2	1	88	198	0
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	65	65	91	91
Heavy Vehicles, %	2	2	0	0	0	0
Mvmt Flow	0	2	2	135	218	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	357	218	218	0	-	0
Stage 1	218	-	-	-	-	-
Stage 2	139	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.1	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.2	-	-	-
Pot Cap-1 Maneuver	641	822	1364	-	-	-
Stage 1	818	-	-	-	-	-
Stage 2	888	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	640	822	1364	-	-	-
Mov Cap-2 Maneuver	640	-	-	-	-	-
Stage 1	816	-	-	-	-	-
Stage 2	888	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.4	0.1	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1364	-	822	-	-
HCM Lane V/C Ratio	0.001	-	0.003	-	-
HCM Control Delay (s)	7.6	0	9.4	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	2	2	279	217	0
Future Vol, veh/h	0	2	2	279	217	0
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	91	91	89	89
Heavy Vehicles, %	2	2	0	1	1	0
Mvmt Flow	0	2	2	307	244	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	555	244	244	0	-	0
Stage 1	244	-	-	-	-	-
Stage 2	311	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.1	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.2	-	-	-
Pot Cap-1 Maneuver	493	795	1334	-	-	-
Stage 1	797	-	-	-	-	-
Stage 2	743	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	492	795	1334	-	-	-
Mov Cap-2 Maneuver	492	-	-	-	-	-
Stage 1	795	-	-	-	-	-
Stage 2	743	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.5	0.1	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1334	-	795	-	-
HCM Lane V/C Ratio	0.002	-	0.003	-	-
HCM Control Delay (s)	7.7	0	9.5	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Sand Hill Road at the Project Site Roadway

Intersection	
Int Delay, s/veh	0.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	23	0	1	18	1	1
Future Vol, veh/h	23	0	1	18	1	1
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	57	57	73	73	92	92
Heavy Vehicles, %	0	0	0	0	2	2
Mvmt Flow	40	0	1	25	1	1

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	40	0	67	40
Stage 1	-	-	-	-	40	-
Stage 2	-	-	-	-	27	-
Critical Hdwy	-	-	4.1	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.2	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1583	-	938	1031
Stage 1	-	-	-	-	982	-
Stage 2	-	-	-	-	996	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1583	-	937	1031
Mov Cap-2 Maneuver	-	-	-	-	937	-
Stage 1	-	-	-	-	982	-
Stage 2	-	-	-	-	995	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.4	8.7
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	982	-	-	1583	-
HCM Lane V/C Ratio	0.002	-	-	0.001	-
HCM Control Delay (s)	8.7	-	-	7.3	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0	-	-	0	-

Intersection	
Int Delay, s/veh	0.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	33	1	1	27	0	1
Future Vol, veh/h	33	1	1	27	0	1
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	72	72	89	89	92	92
Heavy Vehicles, %	0	0	0	0	2	2
Mvmt Flow	46	1	1	30	0	1

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	47	0	79	47
Stage 1	-	-	-	-	47	-
Stage 2	-	-	-	-	32	-
Critical Hdwy	-	-	4.1	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.2	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1573	-	924	1022
Stage 1	-	-	-	-	975	-
Stage 2	-	-	-	-	991	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1573	-	923	1022
Mov Cap-2 Maneuver	-	-	-	-	923	-
Stage 1	-	-	-	-	975	-
Stage 2	-	-	-	-	990	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.3	8.5
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	1022	-	-	1573	-
HCM Lane V/C Ratio	0.001	-	-	0.001	-
HCM Control Delay (s)	8.5	-	-	7.3	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0	-	-	0	-