Functional Design Report

MassDOT Project File No. 608037

Groton Road (Route 40) @ Dunstable Road Intersection Improvements

Westford, Massachusetts

Prepared for: **Massachusetts Department of Transportation (MassDOT)**
Highway Division – District 3
403 Belmont Street
Worcester, Massachusetts 01604

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February 15, 2017

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I. INTRODUCTION

PURPOSE OF STUDY

TEC, Inc. has been retained by the Town of Westford, Massachusetts to prepare roadway and traffic improvement plans for Groton Road (Route 40) in the vicinity of the intersection of Groton Road / Dunstable Road in Westford, Massachusetts. The proposed improvements are needed to address existing safety and operational deficiencies regarding the intersection geometry, conflicting turning movements, multi-modal accommodations, and delays.

The Northern Middlesex Council of Governments (NMCOG), under Contract with the Massachusetts Highway Department (now the Massachusetts Department of Transportation [MassDOT]), previously completed a Route 40 Traffic Study[1] in 2005, which examined traffic congestion and safety issues along the corridor to guide the Town of Westford in planning future growth and development in this area. Since 2005, intersection delays and congestion have increased due to population growth and the construction of various commercial and residential developments.

This Functional Design Report (FDR) pertains to the following roadway and intersection improvements in the vicinity of the intersection of Groton Road / Dunstable Road:

- Installation of a fully-actuated traffic signal at the intersection of Groton Road / Dunstable Road with vehicular, pedestrian and bicycle control;
- Construction of exclusive left-turn lanes along both the Groton Road eastbound and westbound approaches at Dunstable Road to accommodate the 95th percentile queues;
- Realignment of Dunstable Road, south of Groton Road, to provide improved alignment across intersection;

[1] *Route 40 Traffic Study – Westford, Massachusetts*; Northern Middlesex Council of Governments; Lowell, Massachusetts; 2005

- Minor alterations to curb radii to accommodate improved Town of Westford emergency vehicle access and egress through the intersection of Groton Road / Dunstable Road;
- Minor box widening along Groton Road, within the limits-of-work, to provide a consistent cross-section along the corridor;
- Construction of a new 2,670-foot asphalt sidewalk along the southerly side of Groton Road, between Crocker Road to the west and the Long Sought-for Pond public access to the east;
- Construction of a new 235-foot asphalt sidewalk along the westerly side of Dunstable Road, north of the intersection;
- Installation of new subsurface stormwater drainage infrastructure within the project limits;
- Striping of new pavement markings and installation of new Manual on Uniform Traffic Control Devices (MUTCD) compliant regulatory and warning signs throughout the project limits;
- Construction of a new mid-block crosswalk across Groton Road at the reconstructed Long Sought-for Pond parking area;
- Construction of new Americans with Disabilities Act (ADA) / Architecture Access Board (AAB) accessible curb ramps, where necessary, along Groton Road and Dunstable Road; and
- A mill and overlay of Groton Road and Dunstable Road within the project limits.

This report satisfies the requirements for the 25 percent design process as specified by the MassDOT - Highway Division. Included are a review of existing and future traffic conditions with and without the proposed geometric and traffic signal improvements, a signal warrant analysis, a safety analyses, intersection capacity and queue analyses, and a description of the proposed improvements to the intersection of Groton Road / Dunstable Road. This study examines a 10-year design horizon from the date of the predicted project permitting (year 2027) for future traffic-volume projections and includes an evaluation of the future year conditions without improvements and with improvements. The findings and recommendations for the improvements are based on the detailed traffic impact analyses included in this report.

II. EXISTING CONDITIONS

TRAFFIC STUDY AREA

A comprehensive field inventory of existing traffic conditions on the study area roadways was conducted during various site visits by TEC, Inc. staff. The field investigations consisted of land survey, existing roadway geometrics, study area safety concerns, and intersection operating characteristics. The study area was selected to contain the major roadways providing local access to the project site and the adjacent commercial driveways immediately north and west of the intersection. The study area intersections included as part of the traffic impact analysis are listed below.

Traffic Impact Study Area Intersections

1. Groton Road (Route 40) / Dunstable Road
2. Groton Road (Route 40) / BP Gas Station East Driveway
3. Groton Road (Route 40) / BP Gas Station West Driveway
4. Dunstable Road / BP Gas Station North Driveway

The traffic impact study area intersections are shown graphically in Figure 1.

GEOMETRY

The field inventory included collection of existing roadway geometrics, pedestrian and bicycle accommodations, traffic-volumes, sight distances, and safety data for the existing study area. A description of the existing roadway and intersection inventory is provided below.

Roadways

Groton Road (Route 40)

Groton Road, signed as Massachusetts State Route 40, generally runs in an east-west direction and is maintained by the Town of Westford. The roadway is classified as an urban principal arterial roadway and provides regional connection through the northern portion of Westford between Groton Town Center to the west and Vinyl Square / North Chelmsford Center to the east. The roadway also provides regional connection to/from US Route 3 (Northwest Expressway), approximately 2.5 miles to the east of Groton Road's intersection with Dunstable

Road. Groton Road is designated as a primary evacuation route for both Westford and Groton by the Northeast Homeland Security Regional Advisory Council (NERAC).

Groton Road is approximately 28 to 33-feet wide in the vicinity of Dunstable Road with marked shoulders. Directional flow along Groton Road is separated by a marked centerline. The posted speed limit is 40 miles per hour (MPH); however the 85th percentile speed was measured by Automatic Traffic Recorder (ATR)[2] at 42 MPH entering the intersection westbound and 40 MPH entering the intersection eastbound. Land uses along Groton Road include: residential, retail, office, and light commercial uses.

Dunstable Road

Dunstable Road generally runs in a northwest-southeast direction and is maintained by the Town of Westford. For the purposes of this FDR, the cardinal direction of Dunstable Road will be north-south. The roadway is classified as an urban minor arterial roadway north of Groton Road and an urban collector south of Groton Road. Dunstable Road provides regional connection through the northern portion of Westford and Depot Street to the south, and Dunstable Town Center to the north.

Dunstable Road is approximately 30-feet wide north of Groton Road and approximately 20-feet wide south of Groton Road. There is no posted speed limit along Dunstable Road south of Groton Road; however it is assumed that the speed limit is 30 MPH. The 85th percentile speed was measured by ATR at 30 MPH entering the intersection from the south. The posted speed limit north of Groton Road is 30 MPH; with an 85th percentile speed entering the intersection of 32 MPH. Land uses along Dunstable Road include primarily residential uses.

Existing Intersections

Groton Road (Route 40) / Dunstable Road

Dunstable Road intersects Groton Road to form a four-legged, two-way STOP-controlled unsignalized intersection. Both the Dunstable Road northbound and southbound approaches are under STOP-control, while the Groton Road eastbound and westbound approaches are free-flowing. A flashing warning beacon, which was installed in 2008, is suspended above the intersection to supplement the STOP-control and cautionary free-flowing characteristics. All four intersection approaches consist of a single general purpose travel lane. Directional flow along both Dunstable Road and Groton Road is separated by a marked double-yellow centerline, and edge-lines are provided to mark shoulders. No sidewalks or crosswalks are provided at the intersection.

[2] Note that 85th percentile speeds measured by ATR are lower than the actual 85th percentile speed. ATRs collected speed data for all vehicles on the roadway and therefore also collect speeds for vehicles within a progression not choosing their own speed. When this is the case, the 85th percentile speed is typically equal or higher than the ATR speed value.

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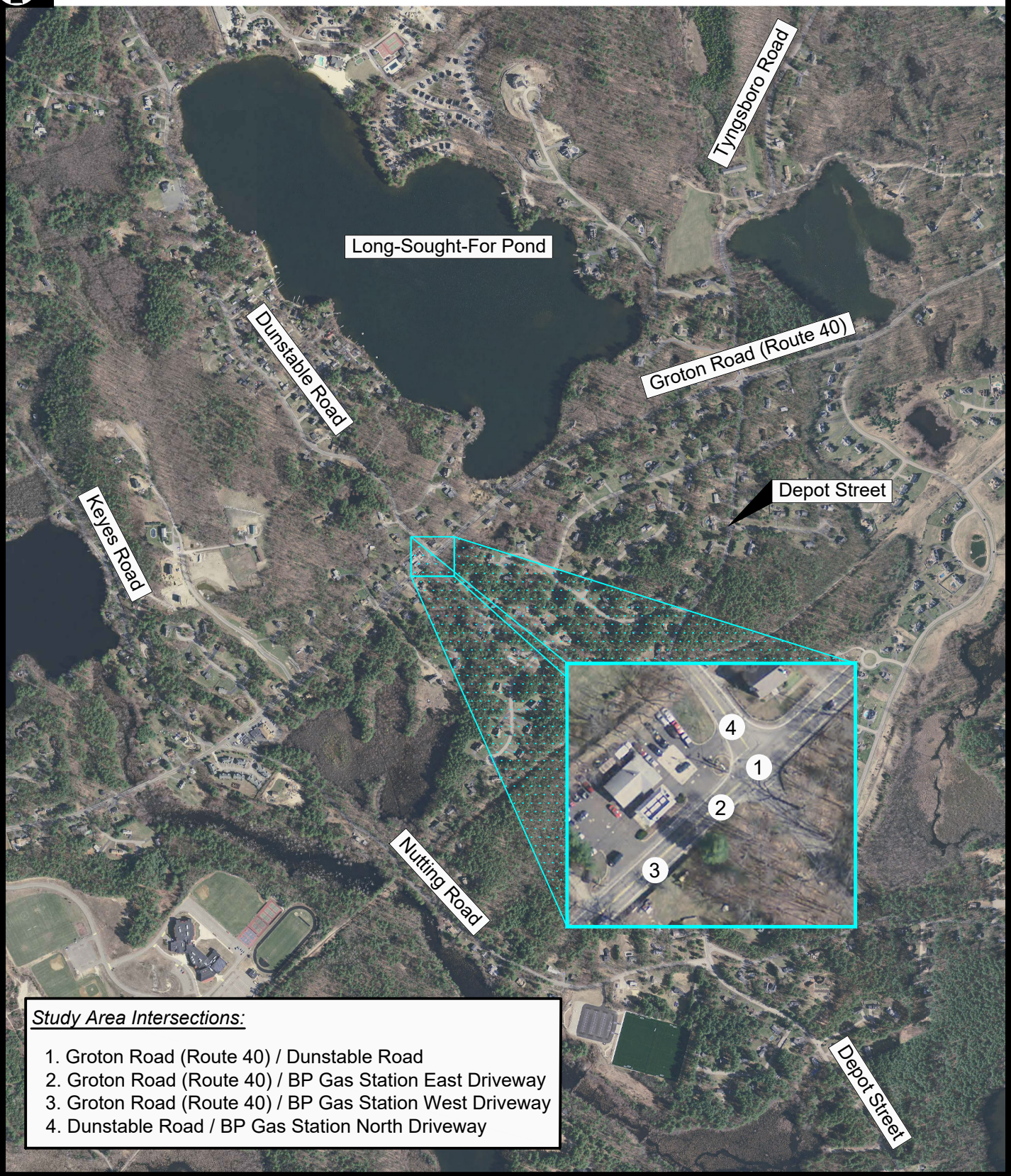
1" = 1,000'



Study Area Intersections:

1. Groton Road (Route 40) / Dunstable Road
2. Groton Road (Route 40) / BP Gas Station East Driveway
3. Groton Road (Route 40) / BP Gas Station West Driveway
4. Dunstable Road / BP Gas Station North Driveway

Figure 1

Project Location Map & Study Area Intersections

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A BP gas station is located on the northwest corner of the intersection of Groton Road / Dunstable Road. The gas station provides a 20-foot curb-cut along the Dunstable Road southbound approach and two extensive curb-cuts (±40-feet wide) along the Groton Road approach. The two curb-cuts are separated by a raised landscaped island that is offset from the roadway by 7-feet.

PUBLIC TRANSPORTATION

Lowell Regional Transit Authority (LRTA) provides bus service within the Town of Westford. However, there are currently no Lowell Regional Transit Authority (LRTA) bus routes that travel along Groton Road or provide service to the intersection of Groton Road / Dunstable Road.

ENVIRONMENTAL AND HISTORICAL CONCERNS

For Federally-funded projects, MassDOT requires a review of the environmental impacts associated with construction near the BP gas station and any potentially historic homes as part of the Categorical Exclusion (CE) required for the National Environmental Policy Act (NEPA) review process with FHWA. The following sections describe in detail the existing environmental and historical zones in the vicinity of the proposed improvements.

Certified Vernal Pools

As described in the Wetland Delineation Report submitted by Rimmer Environmental Consulting, LLC and dated April 15, 2014, a certified vernal pool exists at the southwesterly corner of the intersection. TEC has coordinated with the National Heritage Endangered Species Program (NHESP) as part of the 25% Design process to evaluate opportunities to improve stormwater management.

Wetlands

Wetland resource areas were delineated by a wetlands scientist at Rimmer Environmental Consulting, LLC in April 2014 and Bordering Vegetated Wetlands (BVW) are present on the south side of the intersection of Groton Road on both sides of Dunstable Road. TEC has evaluated potential stormwater management solutions to improve water quality throughout the project limits, which is discussed further in Section VII of this FDR.

Impaired Water Bodies

Stormwater runoff from the intersection of Groton Road / Dunstable Road outlets to Stony Brook; which is registered as an impaired water body. TEC has evaluated potential stormwater management solutions to improve water quality throughout the project limits, which is discussed further in Section VII of this FDR.

Historical Sites

The property on the northeast corner of the intersection (#270 Groton Road) is registered as a historical property. Improvements as part of the project have been designed to limit work on the property to grading modifications in the vicinity of the intersection's northeast corner.

Hazardous Materials

There have been three (3) reports of hazardous materials entering adjacent properties within the limits of the project. All three reports have been closed at this time. The Special Provisions includes specifications for an on-site Licensed Site Professional and appropriate methods for any removal and disposal of any contaminated soils that are encountered.

III. TRAFFIC VOLUMES

Traffic volume data for this report was obtained from Manual Turning Movement Counts (TMCs) and supplemented with ATR counts conducted at the study area intersection. The details of the data collection effort for this project are described below.

TRAFFIC COUNTS

Turning Movement Counts

In order to establish existing traffic-volume conditions at the study area intersection, manual TMCs were conducted at the study area intersections on Thursday, February 2, 2017 during a 10-hour period. This period included the weekday morning (7:00 AM – 9:00 AM) and weekday evening (4:00 PM – 6:00 PM) peak periods, while school was in regular session. A detailed summary of the TMCs, partitioned into 15-minute intervals, is provided within Appendix A.

Automatic Traffic Recorder Counts

ATR counts were conducted on Thursday March 20, 2014 to Saturday March 22, 2014 to gather daily traffic-volume, speed, and vehicle classification data during a continuous 72-hour time period. The ATRs were conducted at the following locations within the vicinity of the roadway and intersection improvements:

- Groton Road (Route 40) east of Dunstable Road
- Groton Road (Route 40) west of Dunstable Road
- Dunstable Road north of Groton Road (Route 40)
- Dunstable Road south of Groton Road (Route 40)

A summary of the weekday ATR traffic volume data is presented in Table 1. A detailed summary of the ATR data, partitioned into 15-minute intervals, is provided within Appendix B.

Table 1 – Existing Weekday Traffic Volume Summary[a]

Location	Weekday Traffic Volume[a]	Weekday Morning Peak Hour			Weekday Evening Peak Hour		
		Traffic Volume[b]	K Factor[c]	Directional Distribution[d]	Traffic Volume	K Factor	Directional Distribution
Groton Road (east of Dunstable Road)	10,637	981	9.2	56.0% EB	984	9.3	54.5% WB
Groton Road (west of Dunstable Road)	10,066	747	7.4	58.4% EB	910	9.0	52.2% WB
Dunstable Road (north of Groton Road)	2,887	264	9.1	83.0% SB	296	10.3	73.6% NB
Dunstable Road (south of Groton Road)	1,405	158	11.2	79.1% SB	155	11.0	68.4% NB

[a] Daily traffic expressed in vehicles per day
[b] Hourly traffic expressed in vehicles per hour
[c] Percent of daily traffic volumes which occurs during the peak hour
[d] Percent of peak-hour volume in the predominant direction of travel

In 2014, Groton Road carries approximately 10,640 vehicles per day (VPD) on an average weekday east of Dunstable Road and approximately 10,065 VPD on an average weekday west of Dunstable Road. The majority of vehicles along Groton Road are travelling eastbound in the weekday morning peak period and westbound during the weekday evening peak period. This is consistent with commuter flows travelling to / from US Route 3 Interchange 33 east of the intersection.

In 2014, Dunstable Road carries approximately 2,890 VPD on an average weekday north of Groton Road and approximately 1,405 VPD on an average weekday south of Groton Road. The majority of vehicles along Dunstable Road north of Groton Road are travelling southbound in the weekday morning peak period and northbound during the weekday evening peak period. This is consistent with commuter flows travelling to / from US Route 3 Interchange 33 east of the intersection. South of the intersection, the majority of vehicles along Dunstable Road are travelling southbound in the weekday morning peak period and northbound during the weekday evening peak period. This suggests that Dunstable Road south of Groton Road is used as a cut-through roadway to/from Groton Road and Westford Town Center. It also suggests that commuter flow to/from US Route 3 may likely be utilizing Depot Street or Oak Hill Road to/from Westford Town Center.

SEASONAL ADJUSTMENTS

In accordance with MassDOT standards, traffic-volumes are typically adjusted to average-month conditions. To evaluate the potential for seasonal fluctuation of traffic volumes on roadways near the site, TEC reviewed historic seasonal adjustment factors published by MassDOT for permanent counts stations in neighboring Chelmsford. These published values indicated that weekday traffic volumes in February are 4.2 percent lower than average-month conditions. Therefore, the February 2017 traffic counts were upwardly adjusted by 4.2 percent to reflect a conservative analysis scenario. The compiled seasonal adjustment data is provided in Appendix C. The resulting 2017 Base Year traffic-volumes are shown graphically in Figure 2.

Not to Scale

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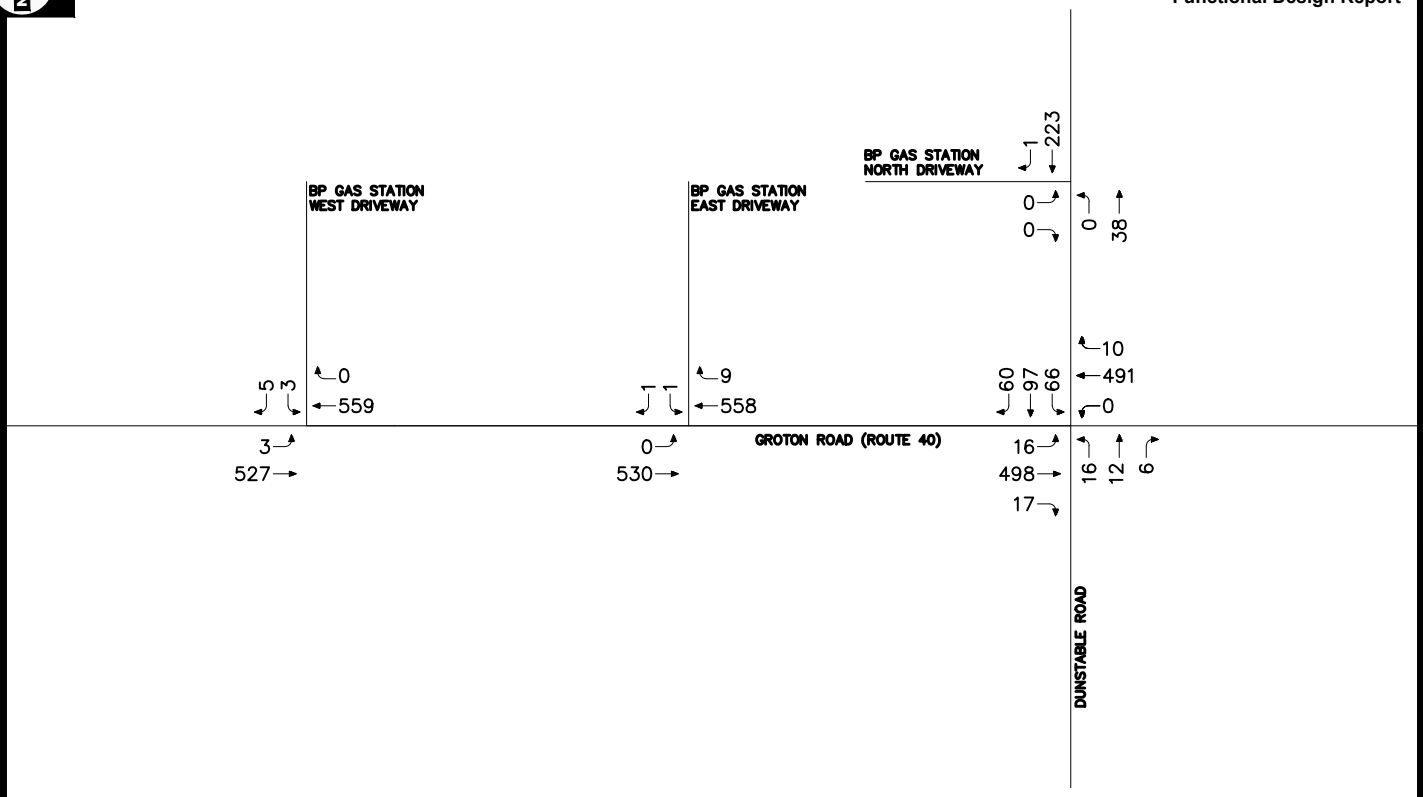
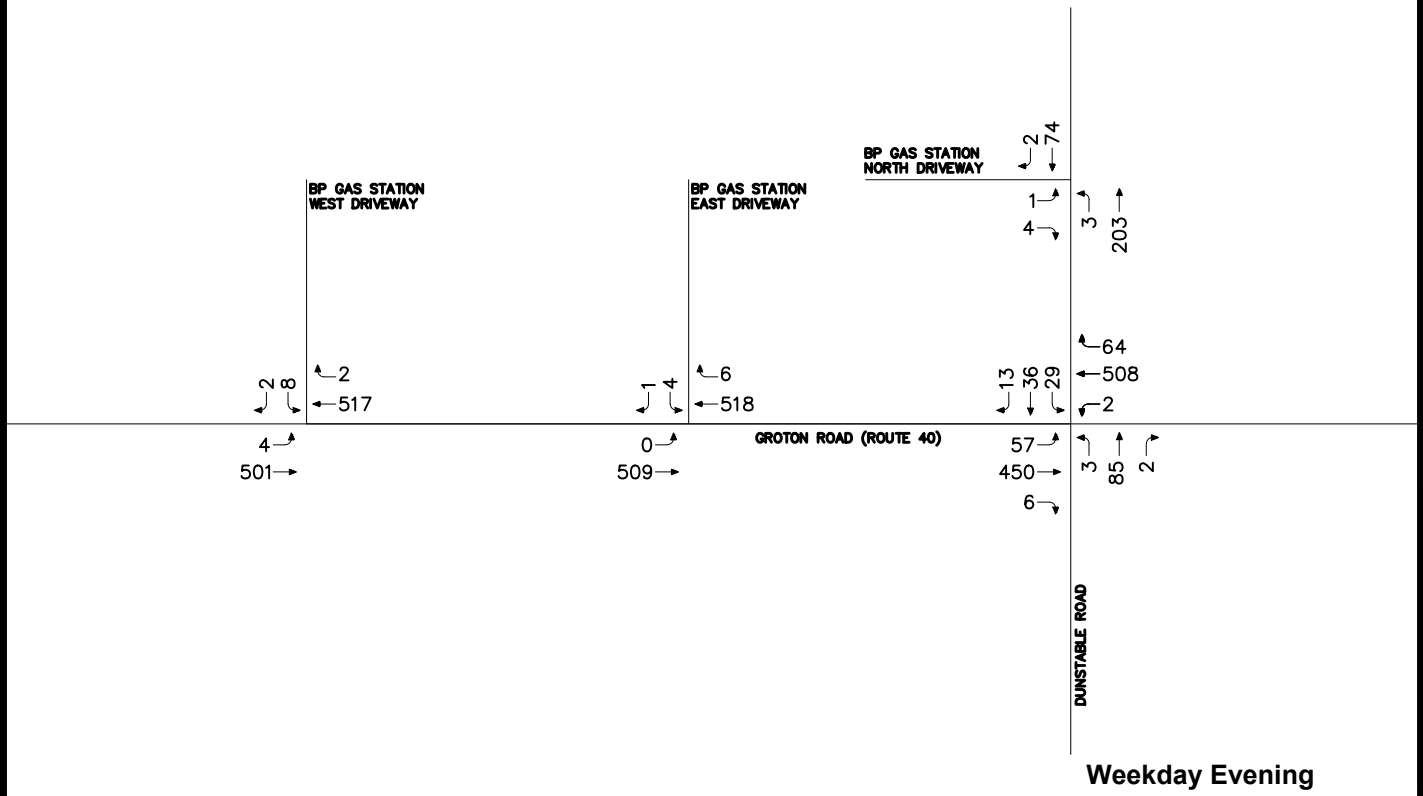


Weekday Morning



Weekday Evening

Figure 2

2017 Base Year Conditions
Weekday Morning and
Weekday Evening
Peak Hour Traffic Volumes

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FUTURE YEAR CONDITIONS

To determine traffic-volumes under future year conditions, baseline traffic volumes in the study area were projected to the year 2027. Traffic volumes on the roadway network at that time would include existing traffic, new traffic due to general background traffic growth, and traffic related to specific developments by others expected to be completed by 2027. Consideration of these factors resulted in the development of the 2027 Future Condition traffic volumes.

Background Traffic Growth

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 ambient growth rate for the area roadways and applies that percentage to all mainline and side street traffic volumes. 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, the drawback of this procedure is that the potential growth in population and development external to the study area would not be accounted for in the traffic projections.

To provide a conservative analysis framework, both procedures were used.

General Ambient Growth

Traffic-volume data compiled by MassDOT at count stations in the area were reviewed in order to determine traffic growth trends. Traffic-volumes at two locations along Route 40 in Chelmsford[3] and Groton[4] were examined. Based on the MassDOT traffic volume data, traffic volumes in the area have been increasing at an average rate of 1.1 percent per year since 2006. Therefore, a 1.1 percent per year compounded annual background traffic growth rate was used to account for potential future traffic growth external to the study area and presently unforeseen development. Count station data have been included in Appendix D.

Specific Developments by Others

TEC coordinated with the Town of Westford Planning Department to identify nearby private / public development projects that are either in the planning process or were recently approved by the Planning Board. After discussions with Town officials and review of recently approved projects, TEC was informed of six (6) specific developments or future projects that are anticipated to contribute new traffic to the intersection of Groton Road / Dunstable Road, which are described in detail below:

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[3] MassDOT Permanent Count Station 4047 – Chelmsford - Groton Road (Route 40) – at Westford Town Line
[4] MassDOT Permanent Count Station 4037 – Groton - Lowell Road (Route 40) – at Westford Town Line

- *St. Augustine Drive* – This residential subdivision project, recently constructed, includes nine (9) residential lots including a tenth lot which houses a utility facility. A portion of this project had been occupied at the time the traffic counts were collected. Occupancy of the remaining units on St. Augustine Drive is anticipated to contribute a negligible amount of traffic to the roadway network and therefore was not included in the traffic-volumes.
- *Spalding Hill Estates* – This subdivision project, the definitive subdivision plan currently pending with the Planning Board, includes the construction of 31 additional residential lots to supplement the 10 recently constructed residential lots off of St. Augustine Road. An updated traffic study for this project is currently being conducted by Parsons Brinkerhoff but was not complete at the time of FDR submittal. TEC therefore estimated the site-generated trips for the development based on standard rates published in the Institute of Transportation Engineers (ITE) publication *Trip Generation, 9th Edition* for Land Use Code (LUC) 210 – Single Family Detached Housing. Vehicle trips were distributed along the roadway network based upon a gravity model using 2000 U.S. Census Journey–to-Home data for residents residing in the Town of Westford.
- *Stony Brook Housing Phase II* – This project, which was in the construction phase at the time of traffic count collection, includes the construction of 36 apartment units along Farmer's Way near Stonybrook Middle School. Access along Farmer's Way is provided to/from Groton Road west of Dunstable Road. This development is currently completed and occupied. TEC estimated the site-generated trips for the development based on ITE trip rates for LUC 220 – Apartment. Vehicle trips were distributed along the roadway network based upon a gravity model using 2000 U.S. Census Journey–to-Home data for residents residing in the Town of Westford.
- *Oak Hill Office Development* – This project is currently in the pre-design phase, with current ownership of the land for sale. The project was previously approved to contain a two-story, 10,000 square foot (SF) office development to be located at 124 Oak Hill Road immediately north of the existing Rapid Refill gas station and convenience store. The Town of Westford believes that the overall square footage of the development may go down; however, to provide a conservative analysis, it was assumed that the proposed office space would be occupied by a medical or dental office development similar to adjacent land uses. TEC estimated the site-generated trips for the development based on ITE trip rates for LUC 720 – Medical-Dental Office Building. Vehicle trips were distributed along the roadway network based upon a gravity model using 2000 U.S. Census Journey-to-Work data for workers commuting to the Town of Westford.
- *#540 Groton Road Development* – As proposed, the project consists of constructing an asphalt manufacturing facility with an average daily production of approximately 1,000 tons along the northerly side of Groton Road near the Chelmsford / Westford Town Line. After reviewing the Traffic Impact

Assessment[5] prepared for the project, it was determined that the project will result in negligible increases in traffic along Groton Road west of the site. A special permit has been approved and issued by the Town of Westford to allow for no more than 400 trips per day for the entire site for all activities. This cap applies to the existing uses in place. The permit is currently in litigation by abutters and the Town of Chelmsford and is pending a ruling.

- *#497 Groton Road* – The site is currently under construction of a previously vacant lot. The project consists of constructing a 7,000 SF of marine and small vehicle engine retail development with driveway access on Groton Road. TEC estimated the site-generated trips for the development based on ITE trip rates for LUC 110 – General Light Industrial. Vehicle trips were distributed along the roadway network based upon a gravity model using 2000 U.S. Census Journey-to-Work data for workers commuting to the Town of Westford.

The resulting "Specific Development by Others" traffic-volumes are illustrated in Figure 3 for the weekday morning and weekday evening peak hours. Detailed trip generation and distribution information for specific other development projects is provided in Appendix E.

Future Year with Existing Geometry Traffic Volumes

The 2027 Future Year with Existing Geometry traffic volumes were obtained by applying a 1.1 percent compounded annual growth rate to the 2017 Base Year Condition traffic volumes and adding traffic to be generated by specific developments by others. The resulting 2027 Future Year with Existing Geometry Traffic Volume network is presented in Figure 4.

Redistribution of BP Gas Station Driveway Trips

As a result of the restriping along Groton Road to provide for adequate left-turn lane storage for the proposed traffic signal and to increase vehicle safety, the easterly full access/egress driveway will be closed and the remaining driveways will be adjusted to better accommodate delivery vehicles. Vehicles will be diverted to the secondary site driveway along Dunstable Road in order to access the proposed traffic signal. The redistribution of vehicle trips associated with the diversion is presented in Figure 5.

Future Year with Proposed Geometry Traffic Volumes

The 2027 Future Year with Proposed Geometry traffic volumes were estimated by adding the Redistribution of BP Gas Station Driveway traffic volumes to the 2027 Future Year with Existing Geometry traffic volumes. The resulting 2027 Future Year with Proposed Geometry Traffic Volume network is presented in Figure 6.

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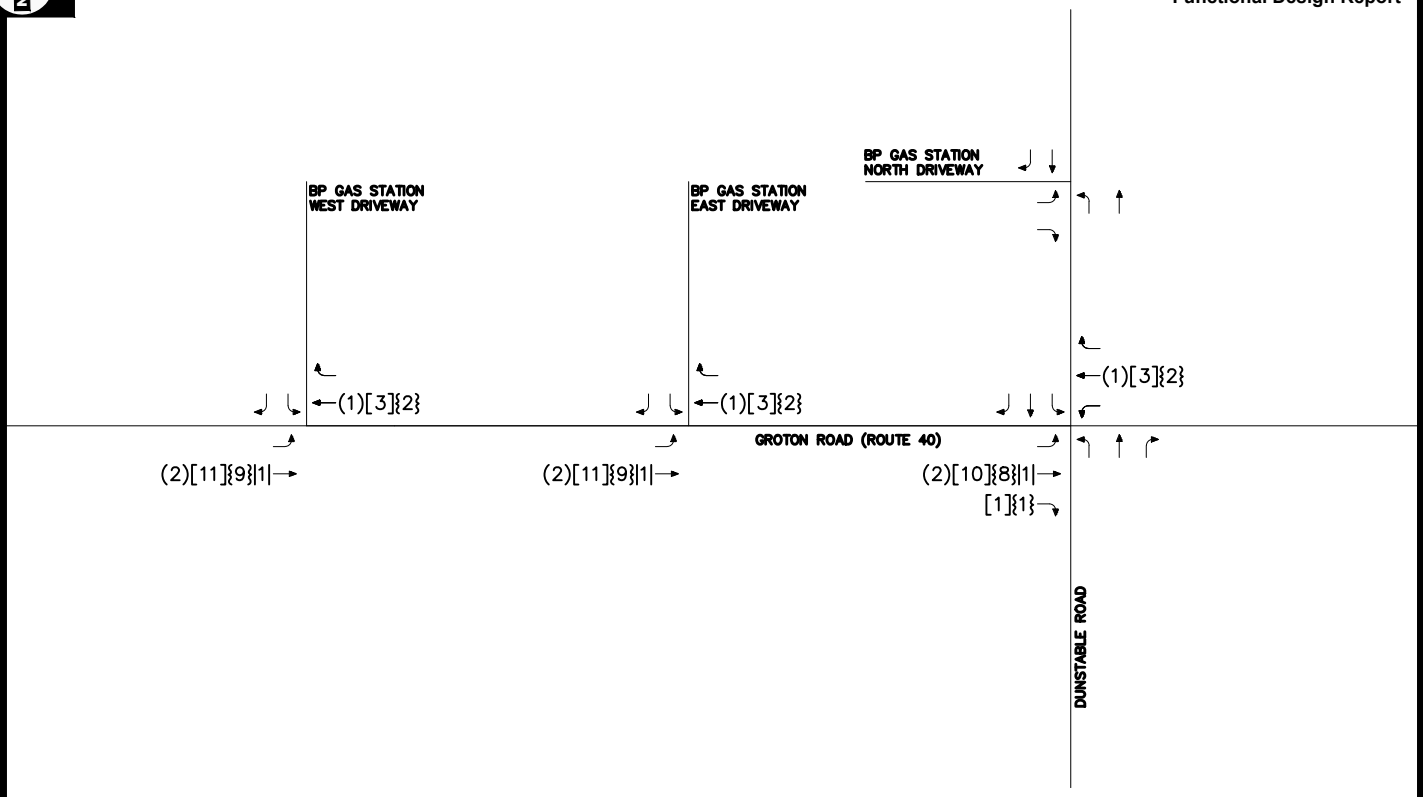
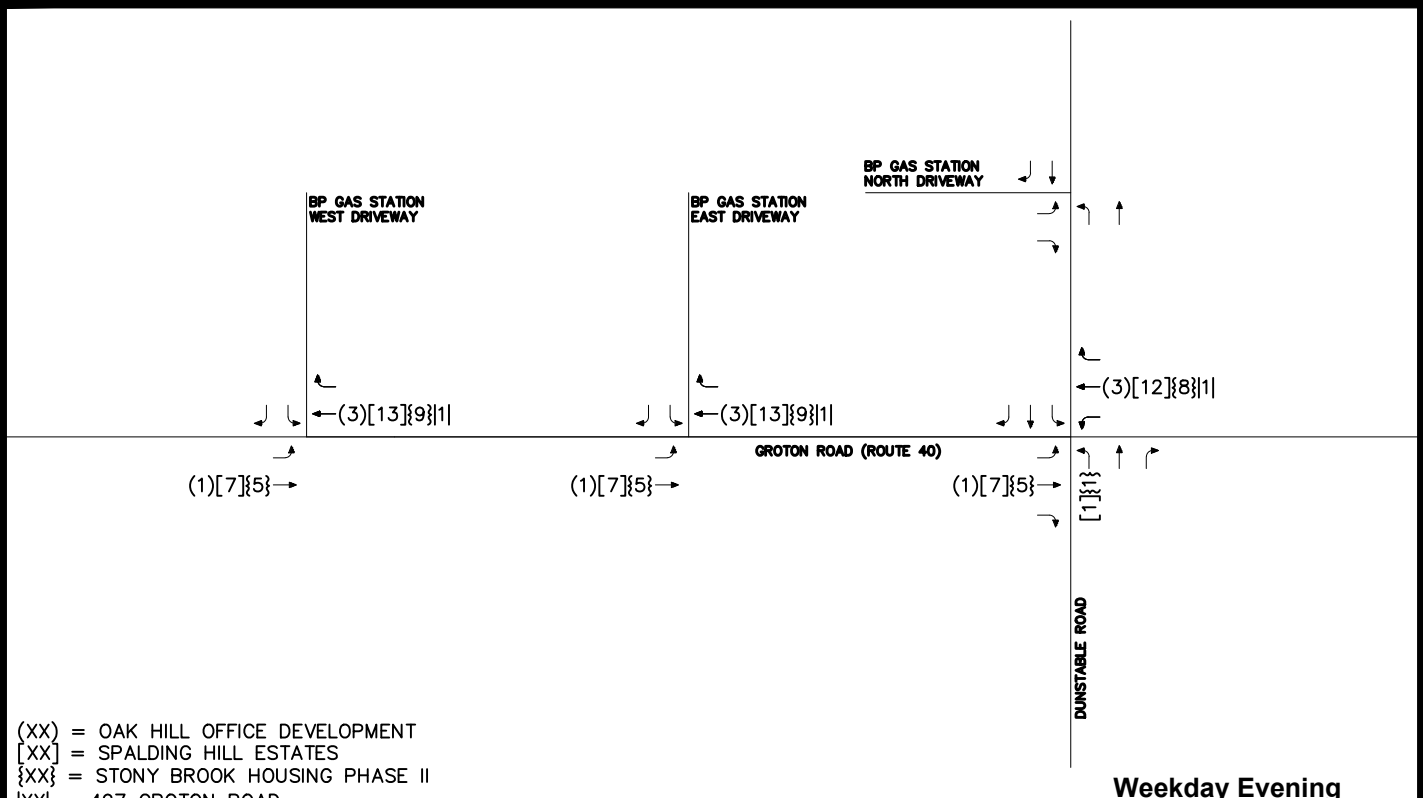
[5] *Traffic Impact Assessment – Proposed Asphalt Manufacturing Facility – Westford, Massachusetts;* Greenman-Pedersen, Inc.; Nashua, New Hampshire; April 2009



Weekday Morning



(XX) = OAK HILL OFFICE DEVELOPMENT
[XX] = SPALDING HILL ESTATES
{XX} = STONY BROOK HOUSING PHASE II
|XX| = 497 GROTON ROAD

Weekday Evening

Figure 3

Specific Developments by Other Weekday Morning and Weekday Evening Peak Hour Traffic Volumes

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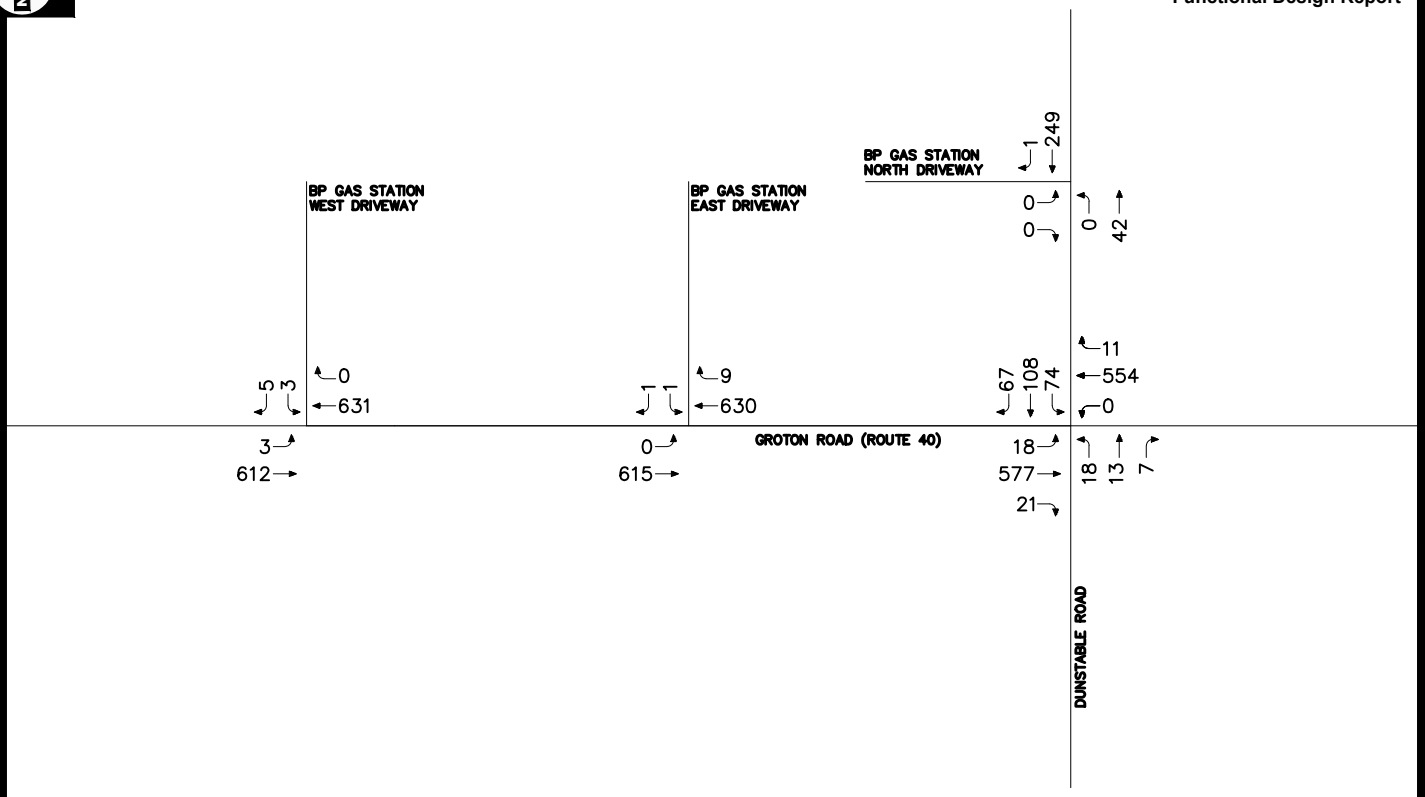
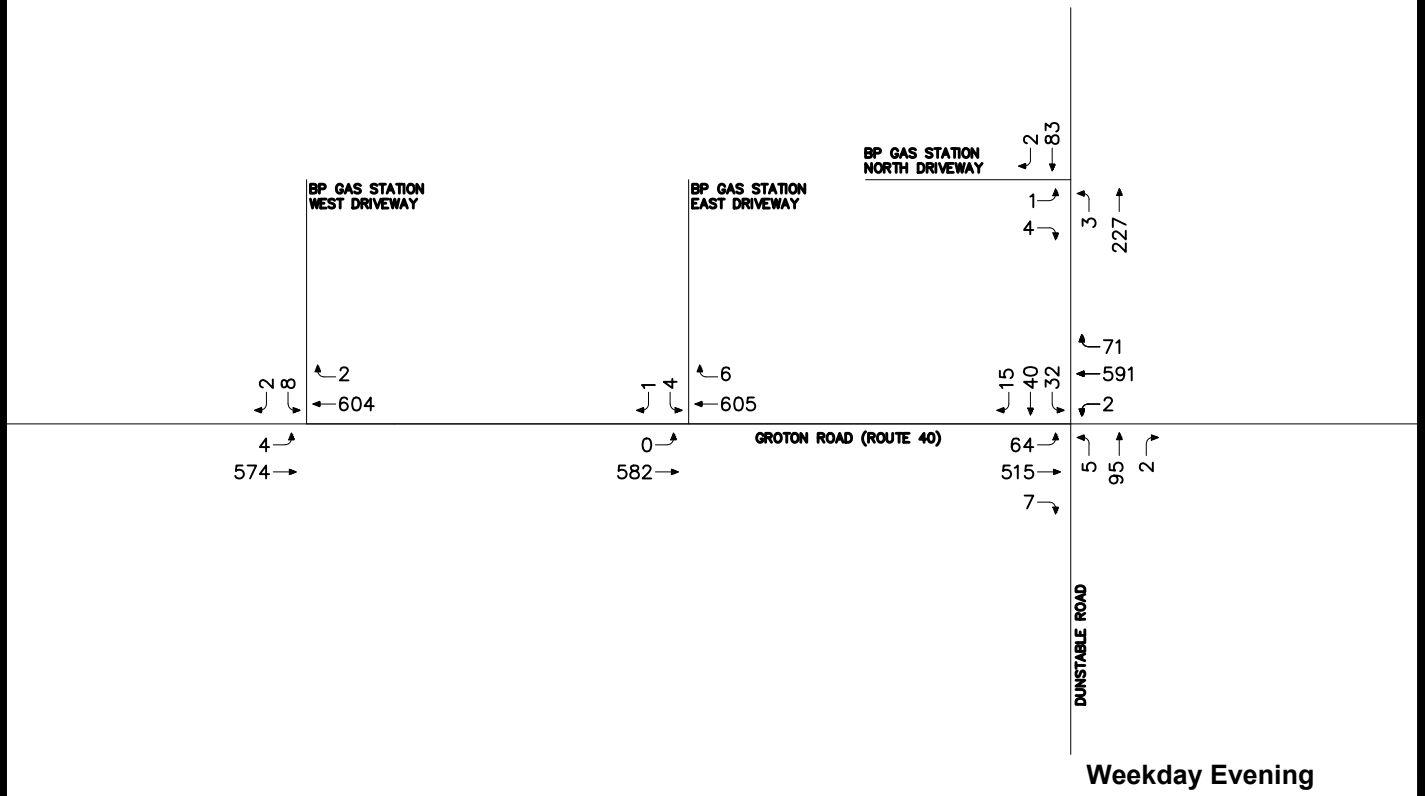


Weekday Morning



Weekday Evening

Figure 4

2027 Future Year w/ Existing Geometry Weekday Morning and Weekday Evening Peak Hour Traffic Volumes

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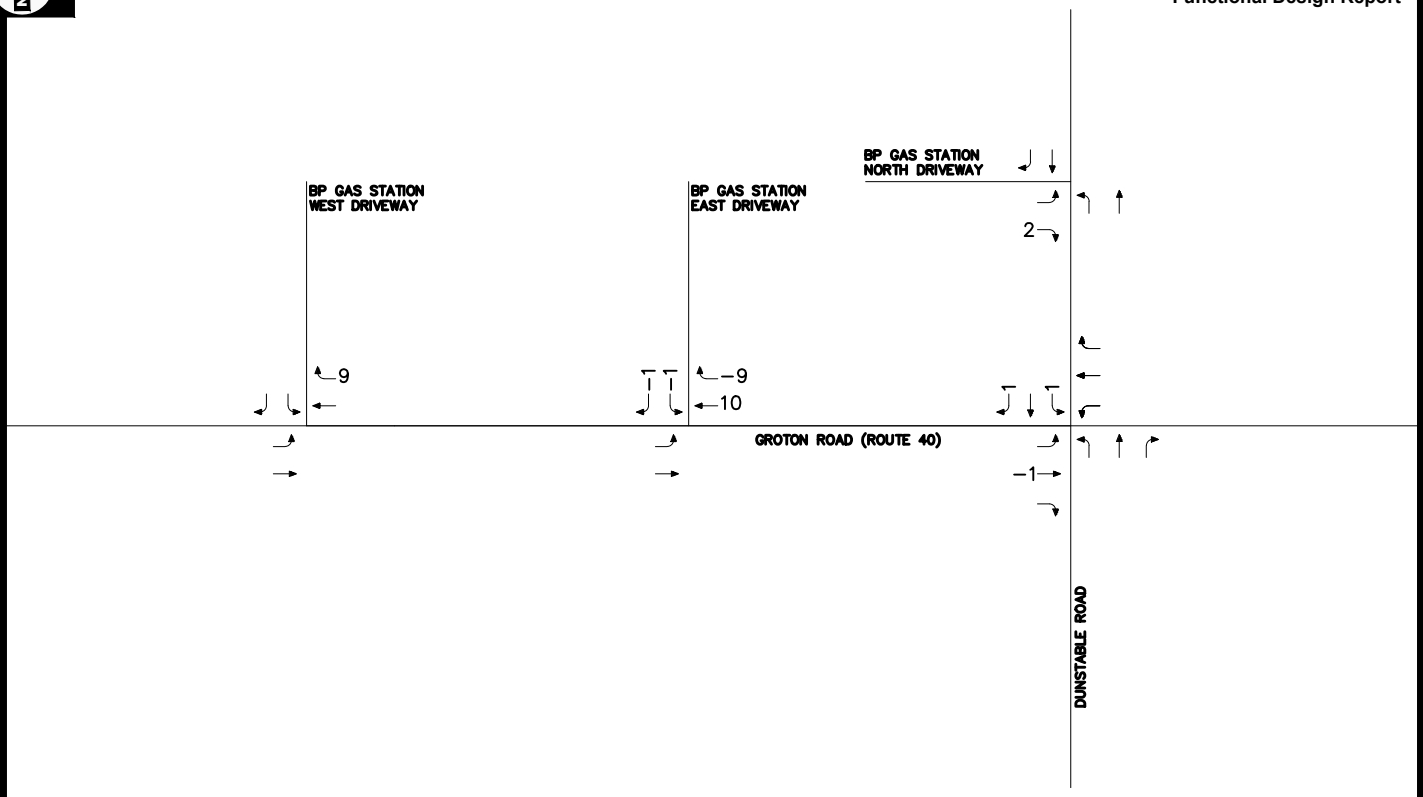
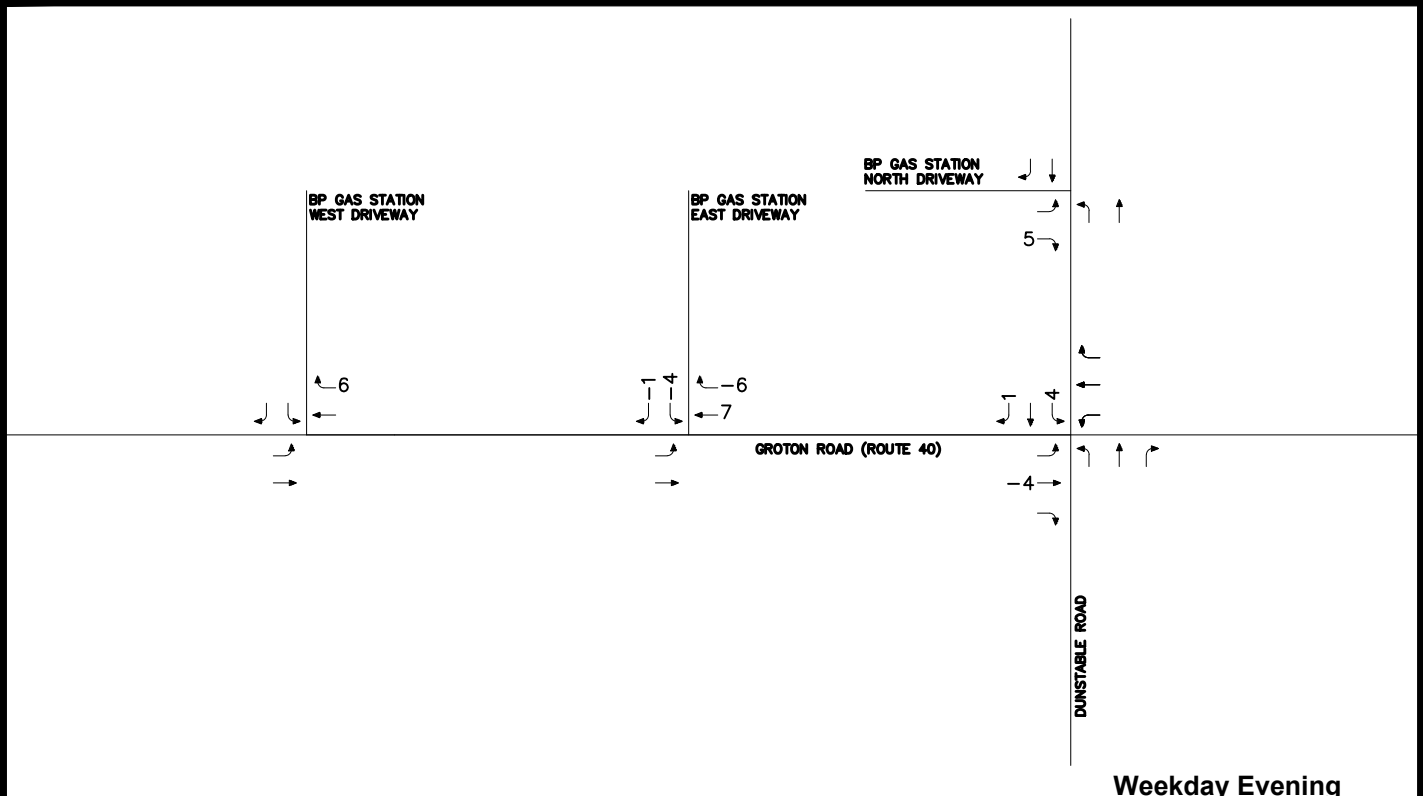


Weekday Morning



Weekday Evening

Figure 5

Redsitribution of Driveway Trips
Weekday Morning and
Weekday Evening
Peak Hour Traffic Volumes

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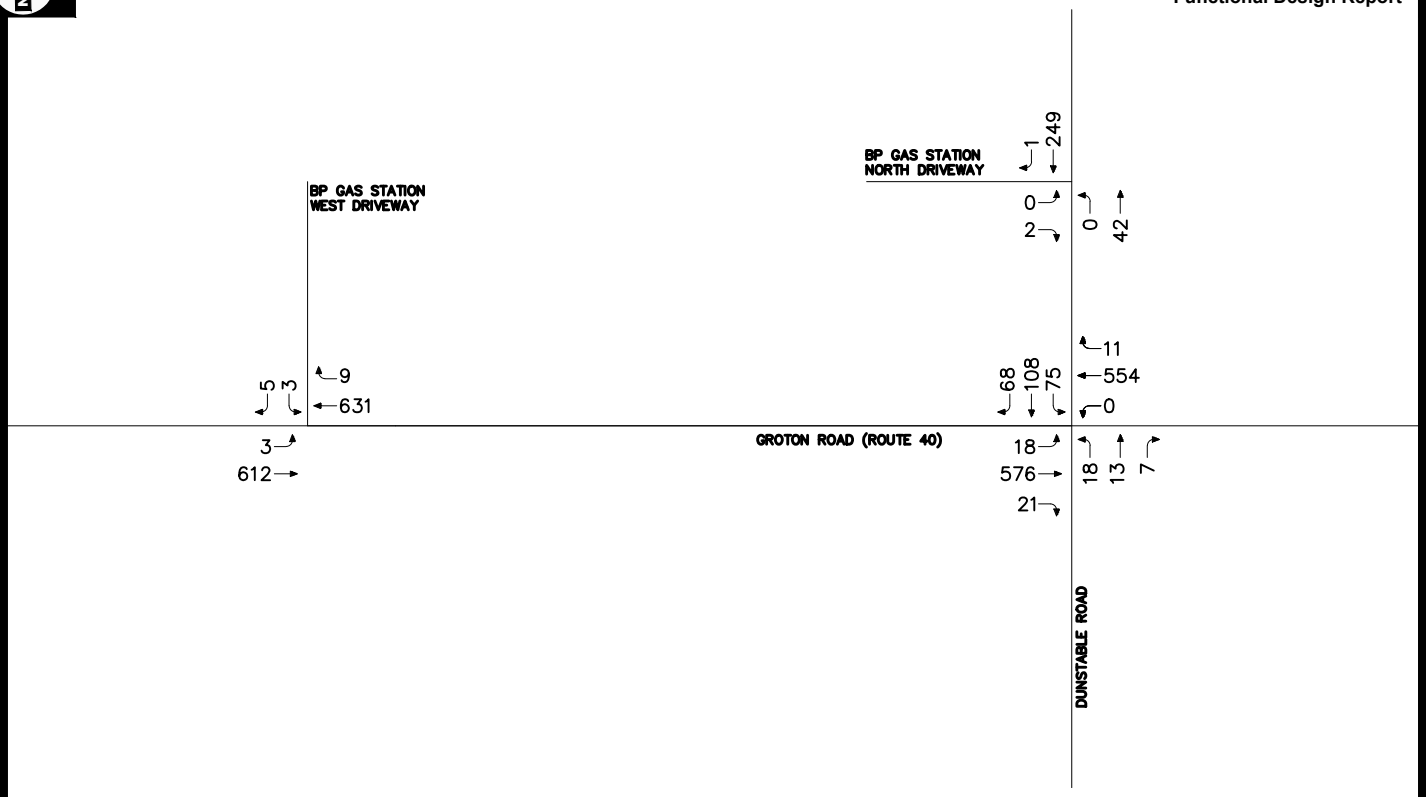
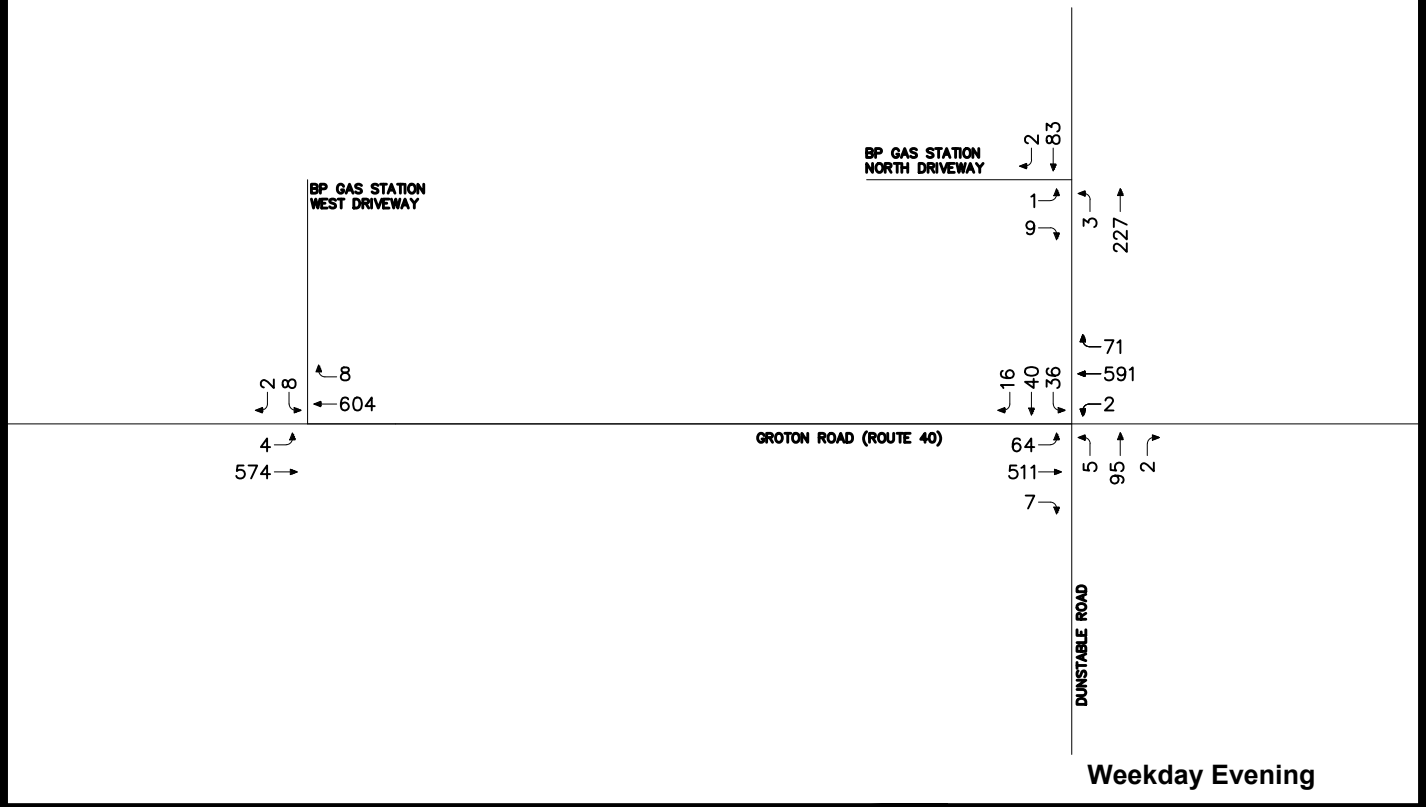


Weekday Morning



Weekday Evening

Figure 6

2027 Future Year w/ Proposed Geometry Weekday Morning and Weekday Evening Peak Hour Traffic Volumes

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IV. SAFETY ANALYSIS

A comprehensive traffic safety analysis was conducted for the intersection of Groton Road / Dunstable Road and associated crash cluster. The traffic safety analysis included an evaluation of sight distance, the compilation and examination of study intersection crash data, a general safety review with consideration given to items on the MassDOT Safety Review Prompt List, and the hosting of the Road Safety Audit (RSA) meeting. Details of each step in the traffic safety analysis are described in the following section.

SIGHT DISTANCE

TEC, Inc. visited the site on multiple occasions in March and April 2014 to measure the available sight distances at the intersection of Groton Road / Dunstable Road. The available sight distances were compared to minimum requirements established by the American Association of State Highway and Transportation Officials (AASHTO).

Sight distance represents the length of roadway that is visible to a driver traveling within the roadway. Two types of sight distance are typically evaluated for driveways and intersections: stopping sight distance (SSD) and intersection sight distance (ISD). SSD is the minimum distance required for a driver traveling along a roadway to perceive an object in the roadway and stop safely in advance of the object when traveling on a wet pavement surface. SSD is measured from an eye height of 3.5 feet to an object height of two feet above the ground, which is equivalent to a driver viewing the taillight of a vehicle ahead. SSD is measured along the centerline of the travel lane approaching the driveway or intersection.

ISD represents the length of the roadway visible to a driver waiting to exit a driveway or minor street. Minimum ISD requirements are based on the distance required for a driver to exit a minor street onto a major street without requiring an approaching vehicle to reduce its speed from the design speed to less than 70 percent of the design speed. ISD is measured from an eye height of 3.5 feet to an object height of 3.5 feet, and is measured from a distance 15 feet off the edge of the travel-way of the major roadway to represent a driver waiting to exit a driveway or minor roadway.

SSD is typically considered the critical sight distance, as it represents the minimum distance required for safe stopping, while ISD represents an acceptable speed reduction for approaching

vehicles. The ISD, however, must be at least equal to the minimum required SSD in order to prevent a driver from entering the roadway when an approaching vehicle is too close to safely stop. The guidance provided by AASHTO states:

> *"If the available sight distance for an entering or crossing vehicle is at least equal to the appropriate stopping sight distance for the major road, then drivers have sufficient sight distance to anticipate and avoid collisions. However, in some cases, this may require a major-road vehicle to stop or slow to accommodate the maneuver by a minor-road vehicle. To enhance traffic operations, intersection sight distances that exceed stopping sight distances are desirable along the major road."*

Tables 2 and 3 provide a summary of the available stopping and intersection sight distances at the intersection of Groton Road / Dunstable Road, respectively.

Table 2 – Stopping Sight Distance Measurements

Approach / Direction	Design Speed [a]	Minimum Required	Measured Stopping Sight Distance
Groton Road approaching Dunstable Road:			
Eastbound	40 mph	315 FT [c]	435 FT
Westbound	42 mph	310 FT [b]	620 FT

[a] Assumed based on collected 85th percentile speed.
[b] Average grade on approach approximately 3.5% uphill.
[c] Average grade on approach approximately 2.5% downhill.

Table 3 – Intersection Sight Distance Measurements

Approach / Direction	Design Speed [a]	Minimum Desired Left Turn	Minimum Desired Right Turn	Measured Intersection Sight Distance
Dunstable Road NB at Groton Road:				
Looking East	42 mph	420 FT [b]	--	620 FT
Looking West	40 mph	445 FT [c]	385 FT [c]	430 FT
Dunstable Road SB at Groton Road:				
Looking East	42 mph	420 FT [b]	365 FT [b]	645 FT
Looking West	40 mph	445 FT [c]	--	470 FT

[a] Assumed based on collected 85th percentile speed.
[b] Average grade on approach approximately 3.5% uphill.
[c] Average grade on approach approximately 2.5% downhill.

As shown in Tables 2 and 3, the available SSD at the intersection of Groton Road / Dunstable Road exceed AASHTO's minimum recommendations for safe operations. ISD looking west from the Dunstable Road northbound approach is slightly less than the minimum desired ISD under Case B1 (Left-turn from STOP); however the approach does meet the minimum required sight distance.

CRASH DATA

Crash reports for the study area intersections were compiled and analyzed for the most recent consecutive five year period (2009-2013) on file with the Town of Westford Police Department at the time of the recent RSA. Supplemental crash data was also acquired for the most recent completed crash year (2014) on file with MassDOT subsequent to the RSA meeting. The motor

vehicle crash data was reviewed to determine crash trends in the study area. A summary of the vehicle crash data and rates is provided in Table 4.

Road Safety Audit

In August 2005, the Transportation Act entitled the Safe, Accountable, Flexible, Efficient Transportation Act - A Legacy for Users (SAFETEA-LU) was passed. This act provides guidance and funding for the implementation of a State Highway Safety Improvement Program (HSIP). As part of this program, all states are required to develop a Strategic Highway Safety Plan (SHSP). The MassDOT guidelines require a RSA to be conducted where HSIP-eligible crash clusters are present within the study area of a 25% Design and FDR. An intersection is defined as HSIP-eligible if the intersection is within the top 5 percent of clusters in its respective Regional Planning Commission (RPC) boundaries based on Equivalent Property Damage Only (EPDO). EPDO rates crashes based on the crash severity. Based on the crash data information from the NMCOG, the Dunstable Road crash cluster did meet the threshold for 2010-2012 HSIP-eligibility, as confirmed by MassDOT. Therefore, an RSA[6] was conducted for the intersection of Groton Road / Dunstable Road. A copy of the RSA, approved by MassDOT on April 25, 2014, is presented in Appendix F. At the present time, the intersection is not designated as HSIP-eligible for the most active years of designation (2012-2014).

Crash Rate Worksheets

In addition to examining the number of crashes at the study area locations, a crash rate was calculated to compare occurrence of crashes to the volume of traffic passing through the intersection.

The crash rate per million entering vehicles (MEV) was calculated using the evening peak hour volumes from the TMCs, a calculated K-factor obtained from ATR counts, and the total years of analyzed crash data. The crash rates at each of the study area intersections were compared to the statewide and district-wide averages published by MassDOT in February 2016 to determine the significance of the crash occurrence. The statewide average is 0.58 crashes per MEV for unsignalized intersections, while the District 3 average is 0.65 crashes per MEV for unsignalized intersections.

The crash rate per million vehicle miles traveled (MVMT) was calculated by using the average daily traffic volume and the length of the roadway segment in miles, and the total years of analyzed crash data. The crash rate at the study area roadway segment was compared to the statewide averages published by MassDOT in December 2016 to determine the significance of the crash occurrence. The statewide average for the urban principal arterial roadway is 0.76 crashes per MVMT.

Crash data and crash rate calculations can be found in Appendix G.

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[6] *Groton Road (Route 40) / Dunstable Road – Westford, Massachusetts - Road Safety Audit*; TEC, Inc.; Lawrence, Massachusetts; April 25, 2014

Collision Diagrams

In conjunction with the RSA that was conducted for Groton Road / Dunstable Road, a collision diagram was prepared to determine crash patterns and highlight the need for additional safety improvements at the study area intersection. These diagrams consist of Town of Westford Police Department crash data (2009 – 2013) utilized in the RSA. These collision diagrams are presented in Figure G-1. Additional crashes noted in the MassDOT Crash Portal, subsequent to the RSA (2014 crashes) were not included in the collision diagrams as their reported location within the intersection could not be verified.

Crash History Summary

The intersection of Groton Road / Dunstable Road is considered HSIP-eligible. Crash reports for this intersection were provided by NMCOG for the period of January 2009 to December 2012 and supplemented by the Town of Westford Police Department crash reports for the period of January 2013 to December 2013. Additional 2014 crashes, post-RSA, were compiled based on the MassDOT online crash portal database. The data shows a total of 61 reported crashes (10.17 per year) at the intersection during the six-year study period. The crash rate for this intersection is significantly higher (3.5 times higher) than the statewide and district-wide averages for unsignalized intersections, with 2.19 crashes per MEV. (*Note: The crash rate has been slightly adjusted from the rate reported in the RSA*).

There were fourteen (14) rear-end crashes (23%) at the intersection over the six-year study period. Of the locatable rear-end crashes, approximately 71 percent (10 of 14) occurred on the Groton Road eastbound approach to the intersection, of which four (4) crashes were the result of motorists following too closely. Two (2) of the rear-end crashes occurred on the westbound approach of Groton Road to the BP gas station curb-cut as vehicles attempted to exit the gas station.

There were ten (10) single vehicle crashes (16%) at the intersection over the six-year study period. Of the locatable single vehicle crashes, more than half (6 of 10) occurred during the night between 7:00 PM and 1:00 AM.

There were thirty-one (31) angled crashes (51%) at the intersection over the six-year period which represents the vast majority of crashes at the intersection of Groton Road / Dunstable Road. Of the locatable single crashes, approximately 61 percent (19 of 31) of these angled crashes were a result of failing to yield the right-of-way to the operator along Groton Road according to the narratives provided. All angled crashes at the intersection occurred during periods of daylight between 6:50 AM and 7:05 PM. Only one (1) of the angled crashes resulted in a non-fatal injury. Eighteen (18) of the angled crashes involved a vehicle exiting Dunstable Road southbound north of the intersection.

The crash data noted five (5) crashes that occurred along Groton Road at one of the two BP gas station driveways which both are within 170 feet of the Groton Road / Dunstable Road intersection. These crashes included two (2) rear-end crashes (as previously mentioned), one (1) single vehicle crash, and two (2) angled crashes.

Table 4 – Crash Data Summary

Parameter		Groton Road (Route 40) / Dunstable Road	Groton Road (Route 40) / Crocker Drive	Groton Road (Route 40) between Crocker Drive and Blades Road
Crash Year	2009	8	0	1
	2010	12	0	2
	2011	15	2	2
	2012	10	1	0
	2013	8	1	1
	2014	8	1	2
	TOTAL	***61***	***5***	***8***
	Average Annual	***10.17***	***0.83***	***1.33***
	Rate per MEV	***2.19***	***-***	***0.57***
Manner of Crash	Angle	31	1	0
	Rear-end	14	3	3
	Single Vehicle	10	0	4
	Head-On	2	0	0
	Sideswipe	2	1	0
	Not Reported	2	0	1
	TOTAL	***61***	***5***	***8***
Road Surface Conditions	Dry	44	3	6
	Wet	14	2	1
	Snow / Ice / Slush	2	0	1
	Other / Unknown	1	0	0
	TOTAL	***61***	***5***	***8***
Injury Status (Crash Severity)	Prop Damage	49	5	7
	Non-Fatal Injury	12	0	0
	Not Reported	0	0	1
	TOTAL	***61***	***5***	***8***
Day of Week	Monday-Friday	47	5	6
	Saturday-Sunday	14	0	2
	TOTAL	***61***	***5***	***8***
Time of Day	6:00AM-9:00AM	10	0	1
	9:00AM-3:00PM	22	1	3
	3:00PM-6:00PM	16	1	1
	6:00PM-6:00AM	13	3	3
	TOTAL	***61***	***5***	***8***

The intersection of Groton Road / Crocker Drive experienced less than one (1) crash per year over the six–year (2009-2014) study period indicating that no apparent crash trend exists. The crash rate for this intersection was not calculated due to the lack of traffic volumes information at this intersection; however, the crash rate is expected to be lower than the statewide and District-wide averages.

The Groton Road segment between Crocker Drive and Blades Road experienced less than two (2) crashes per year over the six-year (2009-2014) study period indicating that no apparent crash trend exists. The crash rate for this roadway is lower than the statewide average. Of these crashes, half (4 out of 8) were single vehicle crashes.

GENERAL SAFETY REVIEW

TEC performed multiple field visits in to confirm safety-related concerns and to identify additional items contributing to safety issues within the study area. TEC utilized the MassDOT Safety Prompt List to identify many safety-related concerns with the existing layout of the study area intersection. These concerns, as noted in the prior RSA conducted by TEC, Inc., are summarized below:

- *Traffic Control Violations / Failure to Yield the Right-of-Way* - Approximately two-thirds (19 of 31) of these angled crashes were a result of failing to yield the right-of-way to the operator along Groton Road according to the narratives provided by the Westford Police Department. Many drivers attempted to enter the traffic flow along Groton Road and were immediately struck by an oncoming, free-flowing vehicle. Although STOP signs are provided on the Dunstable Road approach and vehicles generally comply and stop, many advance into the intersection without proper caution.

  Several audit participants acknowledged frequent "courtesy" extended to the drivers exiting the side street; where one driver with the right-of-way, waves the side street driver to proceed even when the right-of-way may not be with that driver. This may cause the side street driver to pull out without consideration of other mainline vehicles on Groton Road. In addition, it was suggested that extending "courtesy" to the drivers exiting the side street may result in rear-end crashes for vehicles along Groton Road who are unaware of the aforementioned "courtesy."

- *Peak Hour Commuter Congestion* – Groton Road serves as a major commuter artery to/from US Route 3 to the east. Traffic volumes in the area generally increase during the weekday morning and weekday evening peak periods are cause a steady and constant flow of traffic. With no controlled intersections to the immediate east or west of the Groton Road / Dunstable Road intersection, gaps in the constant flow are not regularly occurring during the peak periods. This lack of gaps adds to queues and increase driver frustration on the STOP controlled streets and many residential driveways.

- *Queuing* – During the weekday morning and weekday evening peak commuter periods, audit participants noted that it was not uncommon for six to ten vehicles to queue on Dunstable Road southbound north of the intersection. On occasion, queued vehicles honk their horns in frustration. Queuing puts a perceived pressure on the driver at the front of the queue and causes the occasional quick judgment to enter the intersection.

  Stopping sight distance along Dunstable Road approaching the intersection may be insufficient around the horizontal curvature to allow adequate distance for a driver to perceive and react to the back of queue extending from the Groton Road intersection. Although no rear-end or single vehicle crashes were reported

along this approach as a result of queuing or congestion, the potential of queuing or unexpected traffic congestion remains a safety concern.

- *Dunstable Road Approach Alignment* – The Dunstable Road approaches to Groton Road are slightly offset, and therefore vehicles exiting the Dunstable Road approaches do not have a direct path to access the opposing Dunstable Road receiving lane. These movements may be difficult for unfamiliar users attempting to cross Groton Road. During multiple field visits, vehicles were observed encroaching over the double-yellow centerline (DYCL) prior to completing the maneuver into the appropriate receiving lane. No head-on crashes have occurred during the study period in the north-south direction; however the alignment was still identified as a safety issue.

  Multiple audit participants described how vehicles travelling southbound on Dunstable Road will utilize the roadway as two lanes for which some motorists may be confused to which lane is acting as the through lane if a left-turning vehicle has not properly indicated a left-turn signal. As vehicles attempting to travel straight across the intersection are far-left up against the DYCL, it becomes more difficult to track across the intersection. The side-by-side vehicles on the approach presents a safety issue because of the limited sight distance, especially if the adjacent vehicle is a larger vehicle that blocks the driver's view.

- *Proximity of Adjacent BP Driveways* – Two driveways to the adjacent BP gas station located on the northwest corner of the intersection provide access/egress to/from Groton Road. A third curb-cut is provided along Dunstable Road north of the intersection. These driveways along Groton Road are both within 170 feet of the intersection providing additional conflict points and minimal separation distance from the intersection. Five (5) crashes that occurred within the study area involved or resulted from a vehicle entering or exiting one of the BP gas station driveways.

  Town of Westford representatives noted that the separated curb-cuts were established approximately 15 years ago. Previously, the pavement was open on both Groton Road and Dunstable Road.

- *BP Gas Station Driveways Entering Movements* - The owner of the BP gas station noted that vehicles will sometimes enter the Dunstable Road driveway straight from Groton Road westbound without performing the appropriate legal turning maneuvers (right-turn onto Dunstable Road then left-turn into driveway). While making this maneuver, vehicles entering the driveway cross the path of vehicles approaching the STOP line on Dunstable Road southbound. This provides a potential for conflicts with vehicles travelling southbound on Dunstable Road who may be queued or approaching the intersection with limited visibility of the driveway and turning traffic due to vegetation and curves restricting sight distances.

- *BP Gas Station Driveways for Cut-Through Traffic* - It was also mentioned that the gas station driveways are used as a "cut-through" for southbound vehicles along Dunstable Road turning into the gas station only to turn left out of the gas station onto Groton Road. This indicates there are limited gaps within Groton Road traffic and an increase frustration level with queued vehicles.

- *Visibility and Sight Distance* – Audit participants noted several challenges in regards to sight distance on all four approaches to the intersection, including:
    - *Set Back STOP Lines* – STOP lines along Dunstable Road are set back 15 feet from the edge of travel-way along Groton Road. This forces vehicles to pull-up beyond the STOP bar to view Groton Road to the east and west before proceeding.
    - *Shrubbery Along North Edge of Groton Road* – There are shrubbery/bushes located within the curb-cut island for the BP gas station and inside the granite/wood fence to the #270 Groton Road property. In season, bushes may provide obstruction to intersection sight lines from Dunstable Road southbound for smaller vehicles.
    - *Gas Station Sign* – The existing BP gas station sign may block sightlines for larger vehicles on Dunstable Road southbound looking west.
    - *Wooden Fence (Private)* – A wooden fence at #259 Groton Road, west of the intersection, blocks the view for vehicles exiting Dunstable Road northbound looking west if not pulled-up to the edge of travel-way.
    - *Summer Village Sign / Flashing Beacon Pole* – The southeast corner of the intersection includes multiple obstructions, including: a guardrail, a sign for the "Summer Homes" development along Dunstable Road north of the intersection, and the pole for the flashing warning beacon. These obstructions block the view of Dunstable Road northbound traffic looking east. In season, the vegetation tree line also contributes to sight line concerns on this corner.
    - *BP Northerly Site Driveway* – Sight lines exiting the BP Gas Station driveway looking north are heavily restricted by the horizontal curvature in the roadway and an existing tree on the westerly edge of roadway. The audit team observed that a majority of patrons to the BP Gas Station enter and exit the site from the Groton Road curb-cuts.
- *Roadway Profile / Grades* – Throughout the Town of Westford, Groton Road is a rolling throughway with multiple horizontal curves and multiple crest/sag vertical curves. Crest vertical curves are present both immediately east and west of the intersection with Dunstable Road which are limiting factors for sightlines from Dunstable Road. It was observed during the audit field visit that passenger vehicles are hidden in the sag curve to the east of the intersection. The steep grade on Dunstable Road northbound also contributes to delay for vehicles turning onto Groton Road.
- *Dunstable Road Tree within Right-Of-Way* – Immediately south of Groton Road along the easterly edge of Dunstable Road, a large tree (>4' diameter) encroaches into the right-of-way. Although the STOP sign on the approach is visible further upstream and a second STOP sign is placed on the opposing edge

of pavement, the tree temporarily blocks the STOP sign from a point approximately 200-feet to 100-feet from the painted STOP bar.

Immediately north of Groton Road along the westerly edge of Dunstable Road, a large tree (>4' diameter) encroaches into the right-of-way and completely blocks the view of the intersection upstream on horizontal curvature of the roadway. These two trees on either side of Groton Road contribute to the side-street alignment offset at Groton Road.

- *By-Passing Stopped Traffic* – Groton Road eastbound, west of Dunstable Road, includes a 12-foot travel lane with a 1.5-foot shoulder. The roadway cross-section does not allow for sufficient room for through vehicles to by-pass stopped turning vehicles within the free-flowing condition. Eight (10) rear-end crashes were identified on the Groton Road eastbound approach as the front vehicle was stopped in traffic presumably turning left. These included crashes as a result of attempting to by-pass the stopped vehicle, following too closely, and driver inattention.

  It was mentioned during the audit field visit that some of these rear-end crashes could be related to the gas station driveways. A vehicle slowing to turn into the gas station driveway could be perceived by a following vehicle as turning onto Dunstable Road. This creates the potential for crash in the following drivers does not anticipate the turning vehicle to slow so abruptly to turn into the driveway.

- *Pavement and Surface Conditions* – The Town of Westford Highway Department indicated that Groton Road was last paved in 2000. Dunstable Road has recently been paved. There are several locations, especially near the edge-lines, where pavement is fragmented. An audit participant noted that the age of pavement may be a factor in many crashes that occurred on wet pavement.

  Vehicles travelling northbound on Dunstable Road were observed spinning wheels upon acceleration after STOP. This may be a result of the wet pavement at the time of observation in addition to the presence of gravel and sand on the edge-lines of Groton Road.

  Both Groton Road and Dunstable Road lack a constant and noticeable edge line, whether pavement to soil or pavement to curbing. Where no curbing exists along most of the approaches to the intersection, annual debris build-up and broken pavement have resulted in an inconsistent roadway width. In addition, there is pavement scouring from open pavement runoff.

- *Stormwater Drainage and Ponding* – Stormwater drainage structures have been in place prior to the Dunstable Road southbound widening and the BP gas station separated curb-cuts. As a result the drainage structures along Dunstable Road southbound are offset 4-feet from the curb line. Based on the existing roadway crowning, the curb line acts as a gutter for Dunstable Road stormwater by-passing the existing catch basin north of the BP gas station curb-cut. The stormwater continues to the catch basin near the edge line of Groton Road, which is also 5-feet from the curb line. Minor ponding was observed near this catch basin. The crash data indicated that 23 percent of crashes during the study period involved wet surface roadway.

- *Utility Poles within Pavement* – There is currently a utility pole outside the existing curb line along the northerly edge of Groton Road, west of the intersection, in front of the BP gas station raised landscaped island, and offset 7-feet from the travel-way. The utility pole is not within the existing path of travel along Groton Road; however the pole does provide an obstruction to any user who has even a minor crossover of the existing edge line. Although no crashes indicated the placement of this utility pole as a contributing factor, the current placement poses potential future safety risks.
- *Solar Glare* – Narratives from the motor vehicle crash reports and field observations indicate that solar glare may be an issue along the Groton Road east-west corridor and the southbound approach of Dunstable Road. Although the roadway is bordered by extensive vegetation and trees, solar glare increases at the intersection of Groton Road / Dunstable Road as a result of the set-back of vegetation from the roadway based on the adjacent development. Three (3) crashes defined solar glare as a contributing factor.
- *Advanced Warning Signage* - Advanced warning signs were recently installed along Groton Road [W2-1 – Intersection Warning] and along Dunstable Road [W3-1 - STOP ahead] by MassDOT in 2013. The *MUTCD*[7] indicates:

  > *"Warning signs should be placed so that they provide an adequate perception-reaction time (PRT)….Warning signs should not be placed too far in advance of the condition, such that drivers might forget the warning because of other driving distractions…" (MUTCD –Sect 2C.05 ¶03)*

  The advance STOP warning signage on the Dunstable Road southbound approach is approximately 325 feet from the STOP line and may be too far back from the intersection to provide a memorable message.

  In addition, the Dunstable Road northbound approach has three (3) separate advanced STOP warning signs. This includes two (2) signs directly opposing one another approximately 160 feet from the intersection and one (1) approximately 400 feet south of the intersection, bolted to an adjacent tree. Since the additional advance warning signage has been implemented, there is no clear indication that a reduction in crashes has occurred.
- *STOP Sign Locations* – The MUTCD Section 2A.16 indicates that the outer edge of roadside signage at a minor crossroad intersection should be a minimum of 6 feet offset from the edge of pavement. The edges of STOP signs on both the northbound and southbound approaches to the intersection are located within the 6 foot minimum zone and slightly over-hang into the roadway. Although the crash occurrence does not indicate that the lateral offset of the STOP signs is a

[7] *Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD)*; United States Department of Transportation' Washington, D.C., 2009

contributing factor to crashes, the current signage offset may contribute to the existing sight line constraints.

- *Driver* – Audit participants and crash reports indicated several challenges in regards to the driver at the intersection, including:
    - *Driver Inattention* - Multiple crashes were a result of driver inattention or distracted driving. Nine (9) of the crashes reported over the study period were listed as directly caused by inattention, distracted driving, or cell phone use. Many other crashes, as described in the narrative, had driver inattention characteristics as a contributing factor to the crash.
    - *Driver Indecision* – During the audit field visit, participants observed driver hesitation between two vehicles stopped on each Dunstable Road approach to the intersection trying to determine who had the right-of-way. This wasted valuable time in the "gap" of traffic along Groton Road.
- *Traffic Patterns* – Several audit participants suggested that potential crashes along Groton Road may be a result of increased unfamiliar traffic to the roadways. This includes increased cut-through traffic between US Route 3 in Tyngsboro (Interchange 34) to Interstate 495 in both Westford (Interchange 32) and Littleton (Interchange 31), increased passenger car and heavy vehicle traffic between US Route 3 (Interchange 33) to Devens, and the new seasonal home development along Dunstable Road north of the intersection. Traffic volumes have also increased due to an increase in school traffic, which may be a result of the municipal fees associated with school busing. Although the crash data did not specify the unfamiliar user as the cause to these crashes, unfamiliarity with the roadway may be a contributing factor in some crashes.

  It was noted during the audit field visit that some drivers avoid the intersection and use adjacent signalized intersections, such as Groton Road / Tyngsboro Road / Depot Street, to avoid the turning movements in and out of Dunstable Road.
- *Pedestrian and Bicyclist Accommodations* - The intersection of Groton Road / Dunstable Road lacks any accommodations for pedestrian and bicycle users. No sidewalks are present along either Groton Road or Dunstable Road in the vicinity of the intersection. In addition, with narrow roadway shoulders, there are poor accommodations for bicyclists. Although pedestrian traffic is typically limited at the intersection, bicycle traffic has increased considerably in recent years as reported by Town of Westford officials. No crashes at the intersection involved a pedestrian or a bicyclist.
- *Speed Regulations* – There are currently no speed regulations along Groton Road on file with the Town of Westford or MassDOT.

V. TRAFFIC WARRANTS

MUTCD SIGNAL WARRANTS

A traffic signal warrant analysis was conducted at the study area intersection of Groton Road / Dunstable Road using hourly traffic volumes based on seasonally adjusted TMCs conducted in February 2017. For purposes of the analysis, Groton Road was considered to be the "major street" volume, while Dunstable Road was considered to be the "minor street".

Signal Warrant Analyses

The *MUTCD* contains eight warrants for evaluating the need for installation of a traffic signal. The two multi-hour volume-related warrants were evaluated to determine whether a traffic signal is warranted for the Groton Road / Dunstable Road intersection. These warrants include:

- Warrant 1: Eight-Hour Vehicular Volume
- Warrant 2: Four-Hour Vehicular Volume

In order to analyze traffic signal warrants at the intersection of Groton Road / Dunstable Road, the following assumptions were included:

- *85th Percentile Speed greater than 40 MPH along Groton Road* – As noted in the ATR counts collected in March 2014, vehicle speeds along Groton Road eastbound and westbound entering the intersection were measured with an 85th percentile speed at or greater than 40 MPH during free-flow conditions (this is different than 85th percentile speed noted on ATR count sheet); and
- *Right-turn Reduction* - Right-turns exiting minor street approaches can generally be discounted at a traffic signal due to the lesser conflict seen between right-turns on minor-streets and major-street traffic. At the intersection of Groton Road / Dunstable Road, a 50% reduction for right-turns was applied to the Dunstable Road southbound approach based on the potential for a lesser vehicle conflict for right-turning vehicles. It should be noted that during peak periods of the day, the through and left-turn volume on the Dunstable Road southbound approach accounts for the overwhelming majority of the traffic volume.

Therefore, a 50% reduction of right-turns may be conservative. No reduction was applied to Dunstable Road northbound as the project is proposed to contain a 'No Turn on Red' restriction.

Based on a 2018 Opening Year Condition, the intersection of Groton Road / Dunstable Road meets the traditional criteria for Warrant 1 and Warrant 2. The signal warrant analysis worksheets are included in Appendix H.

LEFT-TURN LANE WARRANTS

Warrant Analysis

A left-turn lane warrant analysis was conducted for the intersection of Groton Road / Dunstable Road using hourly traffic volumes based on TMCs conducted in January 2017. The potential left-turn lane was analyzed under both unsignalized and signalized intersection conditions.

The *MassHighway Project Development and Design Guide*[8] define left-turn lane volume warrants at unsignalized and signalized intersections based on the Transportation Research Board's (TRB) publication, the *Highway Capacity Manual (HCM) 2010*[9]. The criteria are based on the operating speed of the roadway, the opposing volume, and the percent of left-turning vehicles for the advancing vehicle volume. Based on the signalized operating conditions on Groton Road, the traffic volumes do not warrant the construction of a left-turn lane on Groton Road eastbound and westbound.

The *HCM 2010* also indicates that exclusive left-turn lanes at signalized intersections should be installed where exclusive left-turn phasing is provided. As a protected-permitted left-turn phase has been proposed on the Groton Road eastbound approach, a left-turn lane is recommended for the Groton Road eastbound approach. To provide a symmetric cross-section across Groton Road, an exclusive left-turn lane has been proposed on the opposing Groton Road westbound approach. The left-turn lanes have been designed to extend for its full length of the 95th percentile queue and deceleration length under traffic signal control. As stated in the RSA, the construction of exclusive left-turn lanes along Groton Road in both the eastbound and westbound directions will assist in the reduction of rear-end crashes for vehicles that unexpectedly stop to make turning movements onto Dunstable Road by providing a separate lane for left-turns to decelerate and wait for a gap.

An excerpt from the *MassHighway Project Development and Design Guide* noting the criteria for the introduction of a left-turn lane by traffic volume is provided in Appendix I.

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[8] *MassHighway Project Development and Design Guide*, MassHighway (now Massachusetts Department of Transportation (MassDOT) – Highway Division); Boston, Massachusetts, 2006

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

VI. TRAFFIC IMPACT 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 2017 Base Year Conditions, 2027 Future Year with Existing Geometry, and 2027 Future Year with Proposed Geometry. 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. Synchro 9.0 software was used to perform the analysis.

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.[10] 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 the worst.

Since the level of service of a traffic facility is a function of the traffic flows placed upon it, such a facility may operate at a wide range of levels of service, depending on the time of day, day of week, or period of year.

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

Queue Length Analysis

Vehicle queue analyses are a direct measurement of an intersections ability to process vehicles under various traffic control and volume scenarios and lane use arrangements.

The vehicle queue analysis was performed using the Synchro 9.0 intersection capacity analysis software which is also based upon the methodology and procedures presented in the *HCM 2010*. Synchro reports the 95th percentile queues for unsignalized intersections and both the 50th (average) and 95th percentile vehicle queues for signalized intersections, which are based on the number of vehicles that experience a delay of six seconds or more at an intersection and is a function of the traffic signal timing; vehicle arrival patterns during the analysis period; and the saturation flow rate. The 50th percentile or average vehicle queue is the average number of vehicles that are projected to be delayed by six seconds or more at the intersection under study 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.

PARAMETERS FOR TRAFFIC IMPACT ANALYSIS

Unsignalized Intersections

The levels of service of two-way STOP-controlled unsignalized intersections are determined by application of a procedure described in the *HCM 2010*. 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 *HCM 2010*. Table 5 summarizes the relationship between level of service and average control delay.

Table 5 – Level-of-Service Criteria for Unsignalized Intersections[a]

Level of Service (v/c ≤ 1.0)	Level of Service (v/c > 1.0)	Average Control Delay (seconds per vehicle)	Description
A	F	≤10.0	LOS A represents a condition with little or no control delay to minor street traffic.
B	F	10.1 to 15.0	LOS B represents a condition with short control delays to minor street traffic.
C	F	15.1 to 25.0	LOS C represents a condition with average control delays to minor street traffic.
D	F	25.1 to 35.0	LOS D represents a condition with long control delays to minor street traffic.
E	F	35.1 to 50.0	LOS E represents operating conditions at or near capacity level, with very long control delays to minor street traffic.
F	F	>50.0	LOS F represents a condition where minor street demand volume exceeds capacity of an approach lane, with excessive control delays resulting.

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

Signalized Intersections

LOS for signalized intersections is calculated using the operational analysis methodology of the *HCM 2010*. This method assesses the effects of signal type, timing, phasing, progression; vehicle mix; and geometrics on delay. LOS designations are based on the criterion of control or signal delay per vehicle. Control or signal delay can be related to driver discomfort, frustration, and fuel consumption, and includes initial deceleration delay approaching the traffic signal, queue move-up time, stopped delay and final acceleration delay. Table 6 summarizes the relationship between LOS and control delay. The tabulated control delay criterion may be applied in assigning LOS designations to individual lane groups, to individual intersection approaches, or to entire intersections.

Table 6 – Level-of-Service Criteria for Signalized Intersections[(a)]

Level of Service (v/c ≤ 1.0)	Level of Service (v/c > 1.0)	Average Control Delay (seconds per vehicle)	Description
A	F	≤10.0	LOS A describes operations with very low control delay; most vehicles do not stop at all.
B	F	10.1 to 20.0	LOS B describes operations with relatively low control delay. However, more vehicles stop than LOS A.
C	F	20.1 to 35.0	LOS C describes operations with higher control delays. Individual cycle failures may begin to appear. The number of vehicles stopping is significant at this level, although many still pass through the intersection without stopping.
D	F	35.1 to 55.0	LOS D describes operations with control delay in the range where the influence of congestion becomes more noticeable. Many vehicles stop and individual cycle failures are noticeable, whereby motorists are not able to get through the signal on one cycle.
E	F	55.1 to 80.0	LOS E describes operations with high control delay values. Individual cycle failures are frequent occurrences.
F	F	>80.0	LOS F describes operations with high control delay values that often occur with over-saturation. Poor progression and long cycle lengths may also be major contributing causes to such delay levels.

[a] Source: *Highway Capacity Manual 2010*; Transportation Research Board; Washington D.C.; 2010; page 18-6

TRAFFIC IMPACT ANALYSIS RESULTS

Capacity and queue analyses were conducted for 2017 Base Year, 2027 Future Year with Existing Geometry, and the 2027 Future Year with Proposed Geometry conditions for the intersections within the study area. The results of the intersection capacity and queue analysis are summarized in Table 7. The capacity analysis worksheets are provided in Appendix J.

Traffic along Dunstable Road currently experiences long delays and poor levels of service at the intersection with Groton Road during the weekday morning and weekday evening peak periods. Geometric and signal control improvements are recommended at this intersection as mitigation for the proposed development, which are described in Section VII. Under 2017 Future Year Proposed Geometry and 2027 Future Year Proposed Geometry conditions with the implementation of traffic signal control and geometric improvements, the intersection of Groton Road (Route 40) / Dunstable Road is anticipated to operate at acceptable levels-of-service (LOS

B or better) during the weekday morning and weekday evening peak periods. V/C ratios are expected to be well below 1.00, indicating that there will be adequate capacity to accommodate the anticipated traffic volumes through intersection.

Operations along the BP Gas Station Driveways are anticipated to operate at acceptable levels-of-service (LOS D or better) during the 2027 Future Year with Proposed Geometry Conditions.

Table 7 – Intersection Capacity and Queue Analysis Summary

	2017 Base Year				2027 Future Year Existing Geometry				2027 Future Year Proposed Geometry			
Intersection / Lane Group	**V/C[a]**	**Delay[b]**	**LOS[c]**	**Queue[d]**	**V/C**	**Delay**	**LOS**	**Queue**	**V/C**	**Delay**	**LOS**	**Queue**
Groton Road / Dunstable Road												
Weekday Morning Peak Period												
Groton Road EB approach	0.02	9.2	A	<25	0.03	9.5	A	<25	-	-	-	-
Groton Road EBL	-	-	-	-	-	-	-	-	0.07	8.5	A	<25/<25
Groton Road EB T/R	-	-	-	-	-	-	-	-	0.63	6.6	A	146/211
Groton Road WB approach	0.00	0.0	A	<25	0.00	0.0	A	<25	-	-	-	-
Groton Road WBL	-	-	-	-	-	-	-	-	0.00	0.0	A	<25/<25
Groton Road WB T/R	-	-	-	-	-	-	-	-	0.79	11.5	B	150/299
Dunstable Road NB approach	0.54	89.7	F	<25	>2.0	809.8	F	<25	0.12	16.0	B	<25/40
Dunstable Road SB approach	1.35	236.5	F	<25	>2.0	530.4	F	<25	0.63	19.2	B	56/252
Overall Intersection	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**10.9**	**B**	**-**
Weekday Evening Peak Period												
Groton Road EB approach	0.07	9.2	A	<25	0.09	9.6	A	<25	**-**	**-**	**-**	**-**
Groton Road EBL	-	-	-	-	**-**	**-**	**-**	**-**	0.18	7.6	A	<25/<25
Groton Road EB T/R	-	-	-	-	**-**	**-**	**-**	**-**	0.53	6.1	A	75/255
Groton Road WB approach	0.00	8.4	A	<25	0.00	8.6	A	<25	**-**	**-**	**-**	**-**
Groton Road WBL	-	-	-	-	**-**	**-**	**-**	**-**	0.00	6.0	A	<25/<25
Groton Road WB T/R	-	-	-	-	**-**	**-**	**-**	**-**	0.82	10.6	B	229/395
Dunstable Road NB approach	0.78	86.4	F	<25	1.24	242.7	F	<25	0.40	20.2	C	43/88
Dunstable Road SB approach	1.12	212.7	F	<25	-	-	-	-	0.39	20.3	C	38/76
Overall Intersection	-	-	-	-	**-**	**-**	**-**	**-**	**-**	**10.3**	**B**	**-**
Groton Road / BP Gas Station East Driveway												
Weekday Morning Peak Period												
Groton Road EB approach	0.00	0.0	A	<25	0.00	0.0	A	<25	-	-	-	-
BP East Driveway SB approach	0.02	21.4	C	<25	0.02	26.1	D	<25	-	-	-	-
Weekday Evening Peak Period												
Groton Road EB approach	0.00	0.0	A	<25	0.00	0.0	A	<25	-	-	-	-
BP East Driveway SB approach	0.03	20.7	C	<25	0.04	25.2	D	<25	-	-	-	-
Groton Road / BP Gas Station West Driveway												
Weekday Morning Peak Period												
Groton Road EB approach	0.00	9.3	A	<25	0.01	9.6	A	<25	0.01	9.0	A	<25
BP West Driveway SB approach	0.07	20.6	C	<25	0.08	24.9	C	<25	0.13	27.5	D	<25
Weekday Evening Peak Period												
Groton Road EB approach	0.01	8.7	A	<25	0.01	9.0	A	<25	0.01	9.0	A	<25
BP West Driveway SB approach	0.10	21.9	C	<25	0.13	27.2	D	<25	0.13	27.6	D	<25
Dunstable Road / BP Gas Station North Driveway												
Weekday Morning Peak Period												
BP North Driveway EB approach	0.00	0.0	A	<25	0.00	0.0	A	<25	0.00	9.7	A	<25
Dunstable Road NB approach	0.00	0.0	A	<25	0.00	0.0	A	<25	0.00	0.0	A	<25
Weekday Evening Peak Period												
BP North Driveway EB approach	0.01	9.2	A	<25	0.01	9.3	A	<25	0.03	9.1	A	<25
Dunstable Road NB approach	0.00	7.4	A	<25	0.00	7.4	A	<25	0.00	7.4	A	<25

[a] Volume-to-capacity ratio
[b] Delay expressed in seconds per vehicle (average)
[c] Level of service
[d] 50th / 95th Percentile Queue for signalized intersections [95th Percentile Queue for unsignalized intersections only]

VII. PROPOSED IMPROVEMENTS

After having evaluated the operations and safety of the study area intersections and roadways, TEC prepared the plans for geometric and signalization improvements at the intersection of Groton Road / Dunstable Road; and along Groton Road between Crocker Road to the west and the Long Sought-for Pond parking area. The following section provides a summary of measures that are proposed in order to improve the existing and future operations and safety of the study area for drivers, pedestrian, and bicyclists. The proposed measures are discussed in the following paragraphs and are graphically depicted in the 25% Design Submission Plans. The section also provides an overview of those improvement measures presented in the RSA that were not included as part of the roadway improvement design.

The main features of the improvements are as follows:

- Installation of a fully-actuated traffic signal at the intersection of Groton Road / Dunstable Road with vehicular, pedestrian and bicycle control;
- Construction of exclusive left-turn lanes along both the Groton Road eastbound and westbound approaches at Dunstable Road to accommodate the 95th percentile queues;
- Realignment of Dunstable Road, south of Groton Road, to provide improved alignment across intersection;
- Minor alterations to curb radii to accommodate improved Town of Westford emergency vehicle access and egress through the intersection of Groton Road / Dunstable Road;
- Minor box widening along Groton Road, within the limits-of-work, to provide a consistent cross-section along the corridor;
- Construction of a new 2,670-foot asphalt sidewalk along the southerly side of Groton Road, between Crocker Road to the west and the Long Sought-for Pond public access to the east;
- Construction of a new 235-foot asphalt sidewalk along the westerly side of Dunstable Road, north of the intersection;

- Installation of new subsurface stormwater drainage infrastructure within the project limits;
- Striping of new pavement markings and installation of new Manual on Uniform Traffic Control Devices (MUTCD) compliant regulatory and warning signs throughout the project limits;
- Construction of a new mid-block crosswalk across Groton Road at the reconstructed Long Sought-for Pond parking area;
- Construction of new Americans with Disabilities Act (ADA) / Architecture Access Board (AAB) accessible curb ramps, where necessary, along Groton Road and Dunstable Road; and
- A mill and overlay of Groton Road and Dunstable Road within the project limits.

CONSISTENCY WITH ROAD SAFETY AUDIT FINDINGS

Based on the *MassDOT – Highway Division Road Safety Audit Guidelines*[11], the designer should work with the roadway owner, in this case the Town of Westford, on implementing the short-term, low-cost improvements/maintenance items that have been identified as "Potential Safety Enhancements" in the Groton Road / Dunstable Road RSA completed by TEC, Inc. on April 25, 2014. In addition, attempts should be made to incorporate all medium and long-term countermeasures into the 25% design. Any recommendations that cannot be incorporated into the design should clearly be explained within this FDR.

Based on the proposed traffic signal installation and minor widening at this intersection, multiple safety enhancement recommendations as prescribed in the RSA have been superseded by superior improvements. They are as follows:

- Consider installation of a roundabout (see additional information in the following sections);
- Move the mast arm shaft for the flashing beacon back away from the roadway edge to improve sight lines for Dunstable Road northbound vehicles looking to the east;
- Consider installation of pavement markings to Dunstable Road through intersection to improve vehicle tracking across intersection; and
- Widen the BP gas station raised landscape island to encompass the utility pole within the Groton Road curb line.

All other safety enhancement improvements as defined by the RSA have been incorporated into the intersection improvements. The following items were identified in the RSA and are to be considered be the Town of Westford and MassDOT independent of this design process:

[11] *Road Safety Audit Guidelines*; Massachusetts Department of Transportation – Highway Division; Boston, Massachusetts; February 15, 2011

- TEC has not included the relocation of the BP Gas Station pedestal signage at the corner of the intersection. Prior to finalization of the PS&E Design Submission, formal discussions between the Town of Westford and the BP Gas Station will be conducted to investigate the transfer of signage from the pedestal post at the intersection to an electronic sign on the fueling station canopy or another prominent location;
- Although the profiles of Groton Road and Dunstable Road will be slightly adjusted as part of the project, the general vertical alignment will be generally consistent with existing profile conditions;
- The Town of Westford should utilize online social networks (such as Twitter) to inform the public on intersection crashes, advisories, and speed,
- MassDOT and the Town of Westford should conduct a speed study to establish a legal speed limit on Groton Road to allow for easier enforcement, and
- The Town of Westford Police Department should investigate increasing enforcement of traffic control measures and continue speed enforcement in the vicinity of the Groton Road / Dunstable Road intersection.

DESIGN EXCEPTIONS

Design Exception for Pedestrian and Bicycle Accommodations

TEC, Inc. and the Town of Westford requested the design exception to facilitate the construction of this transportation improvement project as shown in the 25% Design plans to improve pedestrian, bicyclist, and vehicular safety. A Design Exception Report (DER), prepared by TEC, Inc., was submitted to MassDOT on February 10, 2017.

A design exception for this project is sought for the following criteria:

- ***Arterial Lane and Shoulder Width -*** *MassDOT Engineering Directive E-14-001 indicates that the design criteria for arterial lane widths and right shoulders for non-3R projects along non-freeway NHS roadways shall be 12-foot and 8-foot wide, respectively.* This design exception is sought for the following locations:
    a. Groton Road (between Crocker Road and Long Sought-for Pond)
    b. Dunstable Road (Shoulder Width Only between #38 Dunstable Road and Groton Road)
- ***Vertical Alignment -*** *MassDOT Engineering Directive E-14-001 indicates that the design criteria for roadways with crest vertical curves shall have a rate of vertical curvature (K) be greater or equal to 44 for a design speed of 40 MPH and 19 for a design speed of 30 MPH. The design criteria for roadways with sag vertical curves shall have a rate of vertical curvature (K) be greater or equal to 64 for a design speed of 40 MPH and 37 for a design speed of 30 MPH.* This design exception is sought for the following locations:
    a. Groton Road (40 MPH), within project limits
    b. Dunstable Road (30 MPH), within project limits

- ***Sidewalk Presence*** **-** MassDOT's *Engineering Directive (E-14-001)* indicates that, "*For projects in urbanized areas on roadways where pedestrians are legally allowed, sidewalks shall be provided on both sides of the roadway (See P-13-0001, Section 2E."* This design exception is sought for the following locations:
    - Groton Road (between Crocker Road and Long Sought-for Pond)
    - Dunstable Road (between #38 Dunstable Road and point 200-feet south of Groton Road)
- ***Bicycle Accommodation*** **-** MassDOT's *Engineering Directive* indicates that, "*For all freeways, arterials, and collectors where bicycles are legally allowed, a paved outside shoulder or designated bicycle lane shall be provided on both sides of the roadway."* This design exception is sought for the following locations:
    - Groton Road (between Crocker Road and Long Sought-for Pond)
    - Dunstable Road (between #38 Dunstable Road and point 200-feet south of Groton Road)

PROPOSED IMPROVEMENTS

Roundabout Alternative

As prescribed by the *MassDOT – Highway Division Traffic and Safety Engineering 25% Design Submission Guidelines*[12], a roundabout was considered to address the operational and safety control of traffic at the intersection of Groton Road / Dunstable Road. Information provided in the *National Cooperative Highway Research Program (NCHRP) Report 672 (Roundabouts: An Informational Guide)*[13] was utilized in this evaluation. *Report 672* provides planning-level comparisons of different types of roundabouts (mini to multilane) and the corresponding best-fit roadway characteristics.

After considering the positive and negative impacts for the inclusion of a roundabout as an alternative for intersection improvements, TEC found that a roundabout is neither a suitable nor the appropriate option for this location. This decision was based upon engineering judgment as defined within the following limitations:

- Significant utility impacts would be necessary including the relocation of several utility poles, several drainage structures, and a residential well at #270 Groton Road;
- Significant right-of-way impacts and takings would be necessary on the BP property and a historically bound property at #270 Groton Road located on the northeast corner;

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[12] *Traffic and Safety Engineering 25% Design Submission Guidelines*; Massachusetts Department of Transportation – Highway Division; Boston, Massachusetts; Revised February 15, 2011, page 6 of 9

[13] *NCHRP Report 672 - Roundabouts: An Informational Guide, 2nd Edition*; National Cooperative Highway Research Program – Transportation Research Board; Washington, D.C.; 2010

- Easements into the existing BP gas station property would make it difficult for a gasoline tanker vehicle to access the area of underground gasoline storage tanks based on potential turning radii; and
- Potential impacts to a certified vernal pool off the southwest corner of the intersection as registered with the NHESP.

Proposed Traffic Control Modifications

The intersection of Groton Road / Dunstable Road is currently unsignalized and provides free movement for the Groton Road approaches and STOP-control on the Dunstable Road approaches. The Dunstable Road approaches experiences LOS F during the weekday morning and evening peak periods. To improve the capacity, level of service, and overall safety for the entire intersection, a warranted fully-actuated traffic signal will be installed. Protected-permitted left-turn phases will be included in the signal timing for the Groton Road left-turns to alleviate the potential extensive queues during the peak periods. With signalization, all movements at the intersection are expected to operate at LOS B or better during the weekday peak periods.

The use of the flashing yellow arrow (FYA) for permissive left turns is to be implemented for the permissive left-turn movements along Groton Road.

Clearance intervals for each movement have been calculated based on guidance provided in the *MassDOT Guidance on Calculating Clearance Intervals at Traffic Signals Interoffice Memorandum*[14]. The methodology is based upon clearance interval calculations guidance provided in the *MUTCD* and the *NCHRP Report 731 (Guidance for Yellow and All-Red Intervals at Signalized Intersections)*[15]. Pedestrian clearance intervals have also been calculated based on the MassDOT guidelines. Clearance interval calculations are provided in Appendix K.

Vehicle and bicycle detection is proposed to be conducted by a single omni-directional camera system which has the ability to input approach detector zones on multiple approaches. Bicycle detection pavement markings will be striped within the appropriate lanes. As previously stated, an exclusive pedestrian signal phase has been integrated into the signal timing and phasing scheme. Accessible pedestrian signal (APS) equipment has been incorporated into the design including audible warning devices to be attached to the pedestrian signal housings and vibratory pedestrian push buttons. Emergency vehicle pre-emption has also been incorporated into the traffic signal design.

Modified Geometry

Groton Road, between Crocker Road and the Long Sought-for Pond parking area, will be slightly widened to provide a 26-foot cross-section that has been design. The roadway will slightly

[14] *MassDOT Guidance on Calculating Clearance Intervals at Traffic Signals – Interoffice Memorandum*; Massachusetts Department of Transportation – Highway Division; Boston, Massachusetts; Issued January 8, 2013

[15] *NCHRP Report 731 – Guidance for Yellow and All-Red Intervals at Signalized Intersections*; National Cooperative Highway Research Program – Transportation Research Board; Washington, D.C.; 2012

widen to provide 10-foot exclusive left-turn lanes along Groton Road at Dunstable Road. Storage for the left-turn lanes has been designed to accommodate the 95th percentile queues expected in the turn lanes and provide for deceleration.

The alignment of Dunstable Road south of the intersection will be shifted to align with the opposing Dunstable Road approach. This will eliminate the significant offset for the opposing approaches under existing conditions.

Curb radii at the intersection of Groton Road / Dunstable Road will be altered to improve emergency vehicle access. TEC, Inc. was provided with a template for the Town of Westford Ladder Fire Apparatus to establish appropriate radii so that the vehicle will be allowed to negotiate all corner turns at the intersection without crossing the double yellow centerline into the opposing traffic lane.

The project will provide new striping of new pavement markings and installation of new *MUTCD* compliant regulatory and warning signs throughout the project limits.

Access Management

Access/egress to/from all BP Gas Station driveways within the limits of work will be maintained with the following exceptions:

- The BP Gas Station East Driveway will be closed as part of the Project. Entering and exiting vehicles will be rerouted to one of the two additional full access/egress BP Gas Station Driveways along both Groton Road and Dunstable Road.

Although access and egress to/from the BP Gas Station East Driveway will be restricted, the curb-cut width at the remaining driveways has been design to allow access to delivery and tanker vehicles.

Pedestrian and Bicycle Accommodations

The proposed sidewalk and bicycle improvements will create a more pedestrian- and bicycle-friendly area with streetscape improvements. The sidewalks will be designed to encourage walking. The following lists the scope of sidewalk work and bicycle accommodations.

Scope of Sidewalk Work

- Approximately 2,670-feet of 5-foot asphalt sidewalk will be constructed along the south side of Groton Road between Crocker Road and the Long Sought-for Pond parking area. The sidewalk will be constructed with 6-inch high granite curb to provide vertical separation between vehicular and pedestrian traffic;
- Approximately 235-feet of 5-foot asphalt sidewalk will be reconstructed along the west side of Dunstable Road, north of Groton Road. The sidewalk will be constructed with 6-inch high granite curb to provide vertical separation between vehicular and pedestrian traffic;

- Crosswalks with appropriate crosswalk signage will be striped across the Dunstable Road northbound and Groton Road eastbound approaches to the signalized intersection;
- A new crosswalk will be striped across Groton Road at the Long Sought-for Pond parking area with appropriate crosswalk signage and yield pavement markings; and
- ADA/AAB-compliant accessible ramps will be installed at all crossing locations.

Scope of Bicycle Accommodations

- Although the cross-section of both the Groton Road and Dunstable Road corridors do not support formal bicycle accommodations, bicycle traffic signal detection has been incorporated within the design.

Overall, the proposed sidewalk and bicycle infrastructure will greatly improve pedestrian and bicycle access along both Groton Road and Dunstable Road.

Slope Work

The Project will include significant slope work along the northerly and southerly sides of Groton Road work support the construction of the 5-foot sidewalk and the minor box widening to provide a consistent cross-section throughout the corridor. The slope work, generally a modified rock slope, will be necessary to limit impacts to private property and wetland resource areas.

Stormwater and Drainage

Stormwater infrastructure along the Groton Road and Dunstable Road corridors, within the limits-of-work, will be replaced as part of the project. TEC has coordinated with the Town of Westford to provide a sufficient stormwater system in order to satisfy the needs of the Town. Upon further completion of the design process, TEC and the Town will be further evaluating the location of potential stormwater management measures; including drainage basins located on the southeast corner of the Groton Road / Dunstable Road intersection. These measures will be reviewed with MassDOT upon further progression of the design plans.

VIII. CONCLUSION

This FDR pertains to the following roadway and intersection improvements for the intersection of Groton Road / Dunstable Road:

- Installation of a fully-actuated traffic signal at the intersection of Groton Road / Dunstable Road with vehicular, pedestrian and bicycle control;
- Construction of exclusive left-turn lanes along both the Groton Road eastbound and westbound approaches at Dunstable Road to accommodate the 95th percentile queues;
- Realignment of Dunstable Road, south of Groton Road, to provide improved alignment across intersection;
- Minor alterations to curb radii to accommodate improved Town of Westford emergency vehicle access and egress through the intersection of Groton Road / Dunstable Road;
- Minor box widening along Groton Road, within the limits-of-work, to provide a consistent cross-section along the corridor;
- Construction of a new 2,670-foot asphalt sidewalk along the southerly side of Groton Road, between Crocker Road to the west and the Long Sought-for Pond public access to the east;
- Construction of a new 235-foot asphalt sidewalk along the westerly side of Dunstable Road, north of the intersection;
- Installation of new subsurface stormwater drainage infrastructure within the project limits;
- Striping of new pavement markings and installation of new Manual on Uniform Traffic Control Devices (MUTCD) compliant regulatory and warning signs throughout the project limits;
- Construction of a new mid-block crosswalk across Groton Road at the reconstructed Long Sought-for Pond parking area;

- Construction of new Americans with Disabilities Act (ADA) / Architecture Access Board (AAB) accessible curb ramps, where necessary, along Groton Road and Dunstable Road; and
- A mill and overlay of Groton Road and Dunstable Road within the project limits.

The overall vehicular, pedestrian and bicycle improvements along Groton Road will improve traffic safety by providing missing sidewalk connections, providing striped and controlled crossing opportunities across Groton Road and Dunstable Road, and providing an improved intersection control through a traffic signal.

Traffic along Dunstable Road currently experiences long delays and poor levels of service at the intersection with Groton Road during the weekday morning and weekday evening peak periods. Geometric and signal control improvements are recommended at this intersection as mitigation for the proposed development, which are described in Section VII. Under 2017 Future Year Proposed Geometry and 2027 Future Year Proposed Geometry conditions with the implementation of traffic signal control and geometric improvements, the intersection of Groton Road (Route 40) / Dunstable Road is anticipated to operate at acceptable levels-of-service (LOS B or better) during the weekday morning and weekday evening peak periods. V/C ratios are expected to be well below 1.00, indicating that there will be adequate capacity to accommodate the anticipated traffic volumes through intersection.

Operations along the BP Gas Station Driveways are anticipated to operate at acceptable levels-of-service (LOS D or better) during the 2027 Future Year with Proposed Geometry Conditions.

Appendix A

Turning Movement Count (TMC) Data Sheets

N/S: Dunstable Road
E/W: Groton Road (Route 40)
City, State: Westford, MA
Client: TEC/ S. Gregorio

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

File Name : 175467 A
Site Code : T0519.02
Start Date : 1/24/2017
Page No : 1

Groups Printed- Cars - Heavy Vehicles

	Dunstable Road From North				Groton Road (Route 40) From East				Dunstable Road From South				Groton Road (Route 40) From West				
Start Time	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Int. Total
06:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:00 AM	0	0	0	0	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	0	0	0	0
07:30 AM	0	0	0	0	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	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00 AM	6	15	7	0	1	35	1	0	0	2	1	0	4	77	1	0	150
08:15 AM	6	14	10	0	2	33	0	0	1	1	0	0	3	95	4	0	169
08:30 AM	9	16	20	0	6	43	0	0	1	1	0	0	0	67	1	0	164
08:45 AM	6	8	14	0	2	43	0	0	1	3	0	0	2	88	5	0	172
Total	27	53	51	0	11	154	1	0	3	7	1	0	9	327	11	0	655
09:00 AM	2	12	15	0	3	36	1	0	0	2	0	0	0	61	1	0	133
09:15 AM	6	7	10	0	4	36	0	0	0	3	1	0	3	83	0	0	153
09:30 AM	3	9	16	0	0	42	1	0	0	3	2	0	3	59	0	0	138
09:45 AM	5	8	9	0	3	41	0	0	0	1	0	0	0	68	6	0	141
Total	16	36	50	0	10	155	2	0	0	9	3	0	6	271	7	0	565
10:00 AM	3	8	9	0	3	31	0	0	0	4	0	0	1	58	8	0	125
10:15 AM	5	9	9	0	3	29	0	0	0	0	0	0	1	71	2	0	129
10:30 AM	2	8	7	0	3	33	0	0	0	5	2	0	3	40	6	0	109
10:45 AM	4	7	4	0	7	27	1	0	1	2	0	0	3	45	0	0	101
Total	14	32	29	0	16	120	1	0	1	11	2	0	8	214	16	0	464
Grand Total	57	121	130	0	37	429	4	0	4	27	6	0	23	812	34	0	1684
Apprch %	18.5	39.3	42.2	0	7.9	91.3	0.9	0	10.8	73	16.2	0	2.6	93.4	3.9	0	
Total %	3.4	7.2	7.7	0	2.2	25.5	0.2	0	0.2	1.6	0.4	0	1.4	48.2	2	0	
Cars	54	117	128	0	33	396	4	0	4	21	5	0	21	793	32	0	1608
% Cars	94.7	96.7	98.5	0	89.2	92.3	100	0	100	77.8	83.3	0	91.3	97.7	94.1	0	95.5
Heavy Vehicles	3	4	2	0	4	33	0	0	0	6	1	0	2	19	2	0	76
% Heavy Vehicles	5.3	3.3	1.5	0	10.8	7.7	0	0	0	22.2	16.7	0	8.7	2.3	5.9	0	4.5

	Dunstable Road From North					Groton Road (Route 40) From East					Dunstable Road From South					Groton Road (Route 40) From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 10:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 08:00 AM																					
08:00 AM	6	15	7	0	28	1	35	1	0	37	0	2	1	0	3	4	77	1	0	82	150
08:15 AM	6	14	10	0	30	2	33	0	0	35	1	1	0	0	2	3	95	4	0	102	169
08:30 AM	9	16	20	0	45	6	43	0	0	49	1	1	0	0	2	0	67	1	0	68	164
08:45 AM	6	8	14	0	28	2	43	0	0	45	1	3	0	0	4	2	88	5	0	95	172
Total Volume	27	53	51	0	131	11	154	1	0	166	3	7	1	0	11	9	327	11	0	347	655
% App. Total	20.6	40.5	38.9	0		6.6	92.8	0.6	0		27.3	63.6	9.1	0		2.6	94.2	3.2	0		
PHF	.750	.828	.638	.000	.728	.458	.895	.250	.000	.847	.750	.583	.250	.000	.688	.563	.861	.550	.000	.850	.952
Cars	26	51	51	0	128	10	141	1	0	152	3	5	1	0	9	9	325	10	0	344	633
% Cars	96.3	96.2	100	0	97.7	90.9	91.6	100	0	91.6	100	71.4	100	0	81.8	100	99.4	90.9	0	99.1	96.6
Heavy Vehicles	1	2	0	0	3	1	13	0	0	14	0	2	0	0	2	0	2	1	0	3	22
% Heavy Vehicles	3.7	3.8	0	0	2.3	9.1	8.4	0	0	8.4	0	28.6	0	0	18.2	0	0.6	9.1	0	0.9	3.4

PRECISION DATA INDUSTRIES, LLC
46 Morton Street, Framingham, MA 01702
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N/S: Dunstable Road
E/W: Groton Road (Route 40)
City, State: Westford, MA
Client: TEC/ S. Gregorio

File Name : 175467 A
Site Code : T0519.02
Start Date : 1/24/2017
Page No : 1

Groups Printed- Cars

	Dunstable Road From North				Groton Road (Route 40) From East				Dunstable Road From South				Groton Road (Route 40) From West				
Start Time	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Int. Total
06:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:00 AM	0	0	0	0	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	0	0	0	0
07:30 AM	0	0	0	0	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	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00 AM	5	14	7	0	1	34	1	0	0	2	1	0	4	77	1	0	147
08:15 AM	6	14	10	0	2	31	0	0	1	1	0	0	3	94	4	0	166
08:30 AM	9	15	20	0	6	39	0	0	1	0	0	0	0	67	1	0	158
08:45 AM	6	8	14	0	1	37	0	0	1	2	0	0	2	87	4	0	162
Total	26	51	51	0	10	141	1	0	3	5	1	0	9	325	10	0	633
09:00 AM	2	12	15	0	3	32	1	0	0	2	0	0	0	59	1	0	127
09:15 AM	6	7	10	0	4	34	0	0	0	1	0	0	2	82	0	0	146
09:30 AM	3	9	15	0	0	37	1	0	0	2	2	0	3	58	0	0	130
09:45 AM	5	8	8	0	1	41	0	0	0	1	0	0	0	66	6	0	136
Total	16	36	48	0	8	144	2	0	0	6	2	0	5	265	7	0	539
10:00 AM	2	7	9	0	3	29	0	0	0	4	0	0	1	56	7	0	118
10:15 AM	4	8	9	0	3	24	0	0	0	0	0	0	0	66	2	0	116
10:30 AM	2	8	7	0	3	31	0	0	0	4	2	0	3	39	6	0	105
10:45 AM	4	7	4	0	6	27	1	0	1	2	0	0	3	42	0	0	97
Total	12	30	29	0	15	111	1	0	1	10	2	0	7	203	15	0	436
Grand Total	54	117	128	0	33	396	4	0	4	21	5	0	21	793	32	0	1608
Apprch %	18.1	39.1	42.8	0	7.6	91.5	0.9	0	13.3	70	16.7	0	2.5	93.7	3.8	0	
Total %	3.4	7.3	8	0	2.1	24.6	0.2	0	0.2	1.3	0.3	0	1.3	49.3	2	0	

	Dunstable Road From North					Groton Road (Route 40) From East					Dunstable Road From South					Groton Road (Route 40) From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 10:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 08:00 AM																					
08:00 AM	5	14	7	0	26	1	34	1	0	36	0	2	1	0	3	4	77	1	0	82	147
08:15 AM	6	14	10	0	30	2	31	0	0	33	1	1	0	0	2	3	94	4	0	101	166
08:30 AM	9	15	20	0	44	6	39	0	0	45	1	0	0	0	1	0	67	1	0	68	158
08:45 AM	6	8	14	0	28	1	37	0	0	38	1	2	0	0	3	2	87	4	0	93	162
Total Volume	26	51	51	0	128	10	141	1	0	152	3	5	1	0	9	9	325	10	0	344	633
% App. Total	20.3	39.8	39.8	0		6.6	92.8	0.7	0		33.3	55.6	11.1	0		2.6	94.5	2.9	0		
PHF	.722	.850	.638	.000	.727	.417	.904	.250	.000	.844	.750	.625	.250	.000	.750	.563	.864	.625	.000	.851	.953

N/S: Dunstable Road
E/W: Groton Road (Route 40)
City, State: Westford, MA
Client: TEC/ S. Gregorio

PRECISION DATA INDUSTRIES, LLC
46 Morton Street, Framingham, MA 01702
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Email: datarequests@pdillc.com

File Name : 175467 A
Site Code : T0519.02
Start Date : 1/24/2017
Page No : 1

Groups Printed- Heavy Vehicles

	Dunstable Road From North				Groton Road (Route 40) From East				Dunstable Road From South				Groton Road (Route 40) From West				
Start Time	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Int. Total
06:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:00 AM	0	0	0	0	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	0	0	0	0
07:30 AM	0	0	0	0	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	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00 AM	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	3
08:15 AM	0	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	3
08:30 AM	0	1	0	0	0	4	0	0	0	1	0	0	0	0	0	0	6
08:45 AM	0	0	0	0	1	6	0	0	0	1	0	0	0	1	1	0	10
Total	1	2	0	0	1	13	0	0	0	2	0	0	0	2	1	0	22
09:00 AM	0	0	0	0	0	4	0	0	0	0	0	0	0	2	0	0	6
09:15 AM	0	0	0	0	0	2	0	0	0	2	1	0	1	1	0	0	7
09:30 AM	0	0	1	0	0	5	0	0	0	1	0	0	0	1	0	0	8
09:45 AM	0	0	1	0	2	0	0	0	0	0	0	0	0	2	0	0	5
Total	0	0	2	0	2	11	0	0	0	3	1	0	1	6	0	0	26
10:00 AM	1	1	0	0	0	2	0	0	0	0	0	0	0	2	1	0	7
10:15 AM	1	1	0	0	0	5	0	0	0	0	0	0	1	5	0	0	13
10:30 AM	0	0	0	0	0	2	0	0	0	1	0	0	0	1	0	0	4
10:45 AM	0	0	0	0	1	0	0	0	0	0	0	0	0	3	0	0	4
Total	2	2	0	0	1	9	0	0	0	1	0	0	1	11	1	0	28
Grand Total	3	4	2	0	4	33	0	0	0	6	1	0	2	19	2	0	76
Apprch %	33.3	44.4	22.2	0	10.8	89.2	0	0	0	85.7	14.3	0	8.7	82.6	8.7	0	
Total %	3.9	5.3	2.6	0	5.3	43.4	0	0	0	7.9	1.3	0	2.6	25	2.6	0	

	Dunstable Road From North					Groton Road (Route 40) From East					Dunstable Road From South					Groton Road (Route 40) From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 10:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 09:30 AM																					
09:30 AM	0	0	1	0	1	0	5	0	0	5	0	1	0	0	1	0	1	0	0	1	8
09:45 AM	0	0	1	0	1	2	0	0	0	2	0	0	0	0	0	0	2	0	0	2	5
10:00 AM	1	1	0	0	2	0	2	0	0	2	0	0	0	0	0	0	2	1	0	3	7
10:15 AM	1	1	0	0	2	0	5	0	0	5	0	0	0	0	0	1	5	0	0	6	13
Total Volume	2	2	2	0	6	2	12	0	0	14	0	1	0	0	1	1	10	1	0	12	33
% App. Total	33.3	33.3	33.3	0		14.3	85.7	0	0		0	100	0	0		8.3	83.3	8.3	0		
PHF	.500	.500	.500	.000	.750	.250	.600	.000	.000	.700	.000	.250	.000	.000	.250	.250	.500	.250	.000	.500	.635

N/S: Dunstable Road
E/W: Groton Road (Route 40)
City, State: Westford, MA
Client: TEC/ S. Gregorio

PRECISION DATA INDUSTRIES, LLC
46 Morton Street, Framingham, MA 01702
Office: 508-875-0100 Fax: 508-875-0118
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File Name : 175467 A
Site Code : T0519.02
Start Date : 1/24/2017
Page No : 1

Groups Printed- Peds and Bikes

	Dunstable Road From North					Groton Road (Route 40) From East					Dunstable Road From South					Groton Road (Route 40) From West					
Start Time	Right	Thru	Left	Peds EB	Peds WB	Right	Thru	Left	Peds SB	Peds NB	Right	Thru	Left	Peds WB	Peds EB	Right	Thru	Left	Peds NB	Peds SB	Int. Total
06:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:00 AM	0	0	0	0	0	0	0	0	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	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	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	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00 AM	0	0	0	0	0	0	0	0	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	0	0	0	0	0	0	0	0
08:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:45 AM	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Total	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
10:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Apprch %	0	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total %	0	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	

	Dunstable Road From North						Groton Road (Route 40) From East						Dunstable Road From South						Groton Road (Route 40) From West						
Start Time	Right	Thru	Left	Peds EB	Peds WB	App. Total	Right	Thru	Left	Peds SB	Peds NB	App. Total	Right	Thru	Left	Peds WB	Peds EB	App. Total	Right	Thru	Left	Peds NB	Peds SB	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 10:45 AM - Peak 1 of 1																									
Peak Hour for Entire Intersection Begins at 09:00 AM																									
09:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:45 AM	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Total Volume	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
% App. Total	0	0	0	0	0		0	100	0	0	0		0	0	0	0	0		0	0	0	0	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.250	.000	.000	.000	.250	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.250

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N/S: Dunstable Road
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City, State: Westford, MA
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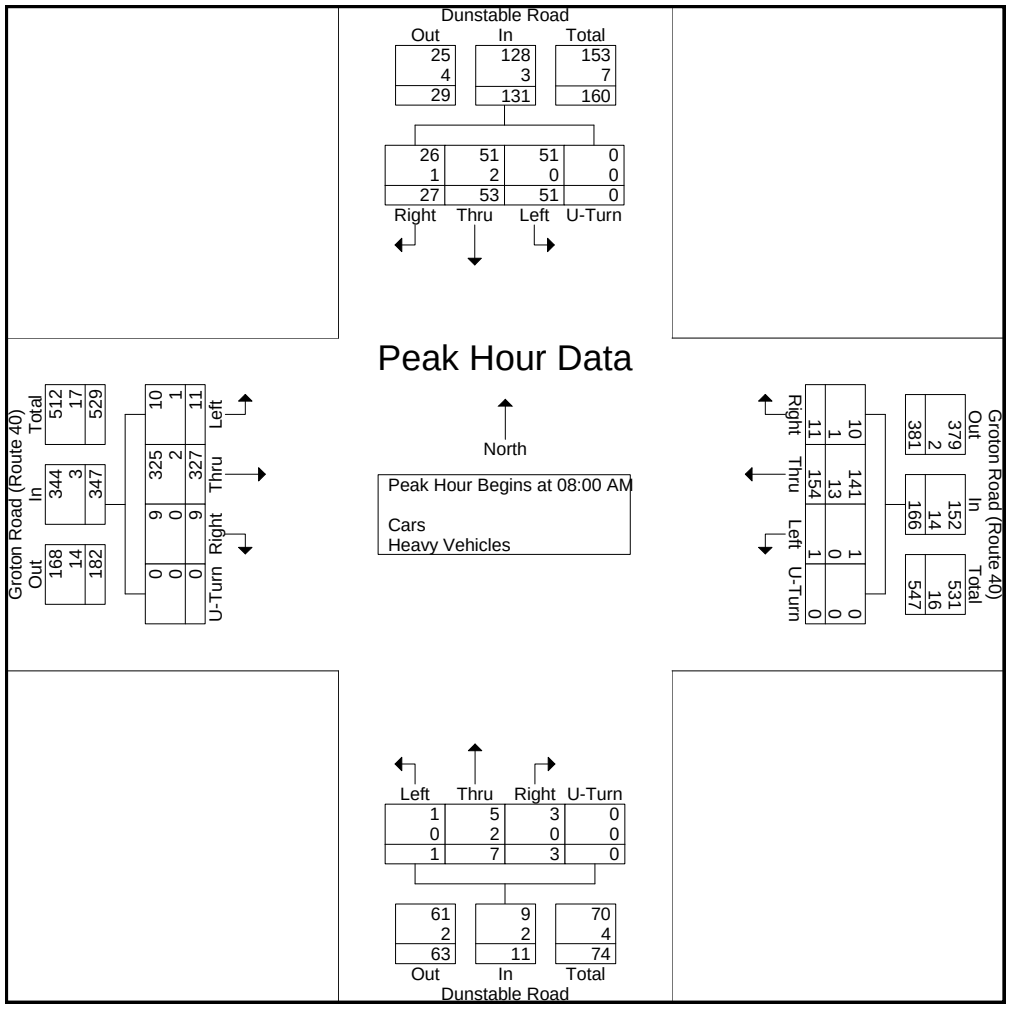
File Name : 175467 A
Site Code : T0519.02
Start Date : 1/24/2017
Page No : 1

	Dunstable Road From North					Groton Road (Route 40) From East					Dunstable Road From South					Groton Road (Route 40) From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 10:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 08:00 AM																					
08:00 AM	6	15	7	0	28	1	35	1	0	37	0	2	1	0	3	4	77	1	0	82	150
08:15 AM	6	14	10	0	30	2	33	0	0	35	1	1	0	0	2	3	95	4	0	102	169
08:30 AM	9	16	20	0	45	6	43	0	0	49	1	1	0	0	2	0	67	1	0	68	164
08:45 AM	6	8	14	0	28	2	43	0	0	45	1	3	0	0	4	2	88	5	0	95	172
Total Volume	27	53	51	0	131	11	154	1	0	166	3	7	1	0	11	9	327	11	0	347	655
% App. Total	20.6	40.5	38.9	0		6.6	92.8	0.6	0		27.3	63.6	9.1	0		2.6	94.2	3.2	0		
PHF	.750	.828	.638	.000	.728	.458	.895	.250	.000	.847	.750	.583	.250	.000	.688	.563	.861	.550	.000	.850	.952
Cars	26	51	51	0	128	10	141	1	0	152	3	5	1	0	9	9	325	10	0	344	633
% Cars	96.3	96.2	100	0	97.7	90.9	91.6	100	0	91.6	100	71.4	100	0	81.8	100	99.4	90.9	0	99.1	96.6
Heavy Vehicles	1	2	0	0	3	1	13	0	0	14	0	2	0	0	2	0	2	1	0	3	22
% Heavy Vehicles	3.7	3.8	0	0	2.3	9.1	8.4	0	0	8.4	0	28.6	0	0	18.2	0	0.6	9.1	0	0.9	3.4



N/S: Dunstable Road
E/W: Groton Road (Route 40)
City, State: Westford, MA
Client: TEC/ S. Gregorio

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

File Name : 175467 AA
Site Code : T0519.02
Start Date : 1/24/2017
Page No : 1

Groups Printed- Cars - Heavy Vehicles

	Dunstable Road From North				Groton Road (Route 40) From East				Dunstable Road From South				Groton Road (Route 40) From West				
Start Time	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Int. Total
02:00 PM	0	2	6	0	10	56	2	0	0	2	1	0	2	42	5	0	128
02:15 PM	1	7	7	0	6	49	1	0	1	6	0	0	3	57	1	0	139
02:30 PM	2	7	7	0	4	61	0	0	1	4	2	0	1	56	3	0	148
02:45 PM	2	6	4	0	11	62	3	0	0	3	2	0	1	43	4	0	141
Total	5	22	24	0	31	228	6	0	2	15	5	0	7	198	13	0	556
03:00 PM	2	3	10	0	8	57	1	0	0	6	2	0	1	48	2	0	140
03:15 PM	2	5	9	0	9	64	0	0	0	13	1	0	2	54	6	0	165
03:30 PM	4	9	10	0	9	75	1	0	0	9	0	0	0	71	9	0	197
03:45 PM	1	3	10	0	12	73	2	0	0	10	0	0	1	69	7	0	188
Total	9	20	39	0	38	269	4	0	0	38	3	0	4	242	24	0	690
04:00 PM	6	5	3	0	19	85	1	0	2	11	1	0	1	84	5	0	223
04:15 PM	4	3	2	0	7	75	1	0	0	11	0	0	1	60	9	0	173
04:30 PM	5	4	5	0	18	88	0	0	0	15	0	0	2	64	10	0	211
04:45 PM	4	6	5	0	17	84	3	0	0	10	0	0	0	77	5	0	211
Total	19	18	15	0	61	332	5	0	2	47	1	0	4	285	29	0	818
05:00 PM	1	8	6	0	11	80	1	0	2	21	2	0	0	74	7	0	213
05:15 PM	4	2	6	0	18	84	2	0	1	27	2	0	2	71	10	0	229
05:30 PM	2	5	9	0	16	75	0	0	0	15	0	0	1	69	5	0	197
05:45 PM	0	1	5	0	7	77	0	0	1	20	1	0	2	71	10	0	195
Total	7	16	26	0	52	316	3	0	4	83	5	0	5	285	32	0	834
06:00 PM	0	4	6	0	13	83	0	0	1	12	1	0	0	58	4	0	182
06:15 PM	2	9	2	0	9	90	4	0	3	18	1	0	4	54	6	0	202
06:30 PM	2	2	4	0	12	72	1	0	0	8	0	0	1	50	4	0	156
06:45 PM	3	6	5	0	9	51	2	0	0	13	2	0	0	40	1	0	132
Total	7	21	17	0	43	296	7	0	4	51	4	0	5	202	15	0	672
Grand Total	47	97	121	0	225	1441	25	0	12	234	18	0	25	1212	113	0	3570
Apprch %	17.7	36.6	45.7	0	13.3	85.2	1.5	0	4.5	88.6	6.8	0	1.9	89.8	8.4	0	
Total %	1.3	2.7	3.4	0	6.3	40.4	0.7	0	0.3	6.6	0.5	0	0.7	33.9	3.2	0	
Cars	46	96	120	0	224	1426	25	0	12	234	18	0	24	1184	113	0	3522
% Cars	97.9	99	99.2	0	99.6	99	100	0	100	100	100	0	96	97.7	100	0	98.7
Heavy Vehicles	1	1	1	0	1	15	0	0	0	0	0	0	1	28	0	0	48
% Heavy Vehicles	2.1	1	0.8	0	0.4	1	0	0	0	0	0	0	4	2.3	0	0	1.3

	Dunstable Road From North					Groton Road (Route 40) From East					Dunstable Road From South					Groton Road (Route 40) From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 06:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:30 PM																					
04:30 PM	5	4	5	0	14	18	88	0	0	106	0	15	0	0	15	2	64	10	0	76	211
04:45 PM	4	6	5	0	15	17	84	3	0	104	0	10	0	0	10	0	77	5	0	82	211
05:00 PM	1	8	6	0	15	11	80	1	0	92	2	21	2	0	25	0	74	7	0	81	213
05:15 PM	4	2	6	0	12	18	84	2	0	104	1	27	2	0	30	2	71	10	0	83	229
Total Volume	14	20	22	0	56	64	336	6	0	406	3	73	4	0	80	4	286	32	0	322	864
% App. Total	25	35.7	39.3	0		15.8	82.8	1.5	0		3.8	91.2	5	0		1.2	88.8	9.9	0		
PHF	.700	.625	.917	.000	.933	.889	.955	.500	.000	.958	.375	.676	.500	.000	.667	.500	.929	.800	.000	.970	.943
Cars	14	20	22	0	56	64	333	6	0	403	3	73	4	0	80	4	280	32	0	316	855
% Cars	100	100	100	0	100	100	99.1	100	0	99.3	100	100	100	0	100	100	97.9	100	0	98.1	99.0
Heavy Vehicles	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	6	0	0	6	9
% Heavy Vehicles	0	0	0	0	0	0	0.9	0	0	0.7	0	0	0	0	0	0	2.1	0	0	1.9	1.0

PRECISION DATA INDUSTRIES, LLC
46 Morton Street, Framingham, MA 01702
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N/S: Dunstable Road
E/W: Groton Road (Route 40)
City, State: Westford, MA
Client: TEC/ S. Gregorio

File Name : 175467 AA
Site Code : T0519.02
Start Date : 1/24/2017
Page No : 1

Groups Printed- Cars

	Dunstable Road From North				Groton Road (Route 40) From East				Dunstable Road From South				Groton Road (Route 40) From West				
Start Time	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Int. Total
02:00 PM	0	2	6	0	9	56	2	0	0	2	1	0	2	37	5	0	122
02:15 PM	1	6	7	0	6	49	1	0	1	6	0	0	3	57	1	0	138
02:30 PM	2	7	6	0	4	61	0	0	1	4	2	0	1	55	3	0	146
02:45 PM	1	6	4	0	11	61	3	0	0	3	2	0	1	42	4	0	138
Total	4	21	23	0	30	227	6	0	2	15	5	0	7	191	13	0	544
03:00 PM	2	3	10	0	8	53	1	0	0	6	2	0	1	46	2	0	134
03:15 PM	2	5	9	0	9	64	0	0	0	13	1	0	1	53	6	0	163
03:30 PM	4	9	10	0	9	75	1	0	0	9	0	0	0	70	9	0	196
03:45 PM	1	3	10	0	12	73	2	0	0	10	0	0	1	66	7	0	185
Total	9	20	39	0	38	265	4	0	0	38	3	0	3	235	24	0	678
04:00 PM	6	5	3	0	19	85	1	0	2	11	1	0	1	83	5	0	222
04:15 PM	4	3	2	0	7	74	1	0	0	11	0	0	1	59	9	0	171
04:30 PM	5	4	5	0	18	88	0	0	0	15	0	0	2	62	10	0	209
04:45 PM	4	6	5	0	17	83	3	0	0	10	0	0	0	75	5	0	208
Total	19	18	15	0	61	330	5	0	2	47	1	0	4	279	29	0	810
05:00 PM	1	8	6	0	11	78	1	0	2	21	2	0	0	73	7	0	210
05:15 PM	4	2	6	0	18	84	2	0	1	27	2	0	2	70	10	0	228
05:30 PM	2	5	9	0	16	75	0	0	0	15	0	0	1	69	5	0	197
05:45 PM	0	1	5	0	7	74	0	0	1	20	1	0	2	70	10	0	191
Total	7	16	26	0	52	311	3	0	4	83	5	0	5	282	32	0	826
06:00 PM	0	4	6	0	13	82	0	0	1	12	1	0	0	56	4	0	179
06:15 PM	2	9	2	0	9	88	4	0	3	18	1	0	4	54	6	0	200
06:30 PM	2	2	4	0	12	72	1	0	0	8	0	0	1	49	4	0	155
06:45 PM	3	6	5	0	9	51	2	0	0	13	2	0	0	38	1	0	130
Total	7	21	17	0	43	293	7	0	4	51	4	0	5	197	15	0	664
Grand Total	46	96	120	0	224	1426	25	0	12	234	18	0	24	1184	113	0	3522
Apprch %	17.6	36.6	45.8	0	13.4	85.1	1.5	0	4.5	88.6	6.8	0	1.8	89.6	8.6	0	
Total %	1.3	2.7	3.4	0	6.4	40.5	0.7	0	0.3	6.6	0.5	0	0.7	33.6	3.2	0	

	Dunstable Road From North					Groton Road (Route 40) From East					Dunstable Road From South					Groton Road (Route 40) From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 06:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:30 PM																					
04:30 PM	5	4	5	0	14	18	88	0	0	106	0	15	0	0	15	2	62	10	0	74	209
04:45 PM	4	6	5	0	15	17	83	3	0	103	0	10	0	0	10	0	75	5	0	80	208
05:00 PM	1	8	6	0	15	11	78	1	0	90	2	21	2	0	25	0	73	7	0	80	210
05:15 PM	4	2	6	0	12	18	84	2	0	104	1	27	2	0	30	2	70	10	0	82	228
Total Volume	14	20	22	0	56	64	333	6	0	403	3	73	4	0	80	4	280	32	0	316	855
% App. Total	25	35.7	39.3	0		15.9	82.6	1.5	0		3.8	91.2	5	0		1.3	88.6	10.1	0		
PHF	.700	.625	.917	.000	.933	.889	.946	.500	.000	.950	.375	.676	.500	.000	.667	.500	.933	.800	.000	.963	.938

N/S: Dunstable Road
E/W: Groton Road (Route 40)
City, State: Westford, MA
Client: TEC/ S. Gregorio

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File Name : 175467 AA
Site Code : T0519.02
Start Date : 1/24/2017
Page No : 1

Groups Printed- Heavy Vehicles

	Dunstable Road From North				Groton Road (Route 40) From East				Dunstable Road From South				Groton Road (Route 40) From West				
Start Time	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Int. Total
02:00 PM	0	0	0	0	1	0	0	0	0	0	0	0	0	5	0	0	6
02:15 PM	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
02:30 PM	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	2
02:45 PM	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	3
Total	1	1	1	0	1	1	0	0	0	0	0	0	0	7	0	0	12
03:00 PM	0	0	0	0	0	4	0	0	0	0	0	0	0	2	0	0	6
03:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2
03:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
03:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3
Total	0	0	0	0	0	4	0	0	0	0	0	0	1	7	0	0	12
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
04:15 PM	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	2
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
04:45 PM	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0	0	3
Total	0	0	0	0	0	2	0	0	0	0	0	0	0	6	0	0	8
05:00 PM	0	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	3
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:45 PM	0	0	0	0	0	3	0	0	0	0	0	0	0	1	0	0	4
Total	0	0	0	0	0	5	0	0	0	0	0	0	0	3	0	0	8
06:00 PM	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0	0	3
06:15 PM	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2
06:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
06:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
Total	0	0	0	0	0	3	0	0	0	0	0	0	0	5	0	0	8
Grand Total	1	1	1	0	1	15	0	0	0	0	0	0	1	28	0	0	48
Apprch %	33.3	33.3	33.3	0	6.2	93.8	0	0	0	0	0	0	3.4	96.6	0	0	
Total %	2.1	2.1	2.1	0	2.1	31.2	0	0	0	0	0	0	2.1	58.3	0	0	

	Dunstable Road From North					Groton Road (Route 40) From East					Dunstable Road From South					Groton Road (Route 40) From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 06:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 02:30 PM																					
02:30 PM	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	2
02:45 PM	1	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	3
03:00 PM	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	0	2	0	0	2	6
03:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2	2
Total Volume	1	0	1	0	2	0	5	0	0	5	0	0	0	0	0	1	5	0	0	6	13
% App. Total	50	0	50	0		0	100	0	0		0	0	0	0		16.7	83.3	0	0		
PHF	.250	.000	.250	.000	.500	.000	.313	.000	.000	.313	.000	.000	.000	.000	.000	.250	.625	.000	.000	.750	.542

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File Name : 175467 AA
Site Code : T0519.02
Start Date : 1/24/2017
Page No : 1

Groups Printed- Peds and Bikes

	Dunstable Road From North					Groton Road (Route 40) From East					Dunstable Road From South					Groton Road (Route 40) From West					
Start Time	Right	Thru	Left	Peds EB	Peds WB	Right	Thru	Left	Peds SB	Peds NB	Right	Thru	Left	Peds WB	Peds EB	Right	Thru	Left	Peds NB	Peds SB	Int. Total
02:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
02:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
03:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:00 PM	0	0	0	0	0	0	0	0	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	0	0	0	0	0	0	0	0
04:30 PM	0	0	0	0	0	0	0	0	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	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:00 PM	0	0	0	0	0	0	0	0	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	0	0	0	0	0	0	0	0
05:30 PM	0	0	0	0	0	0	0	0	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	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Apprch %	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0	0	
Total %	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0	0	

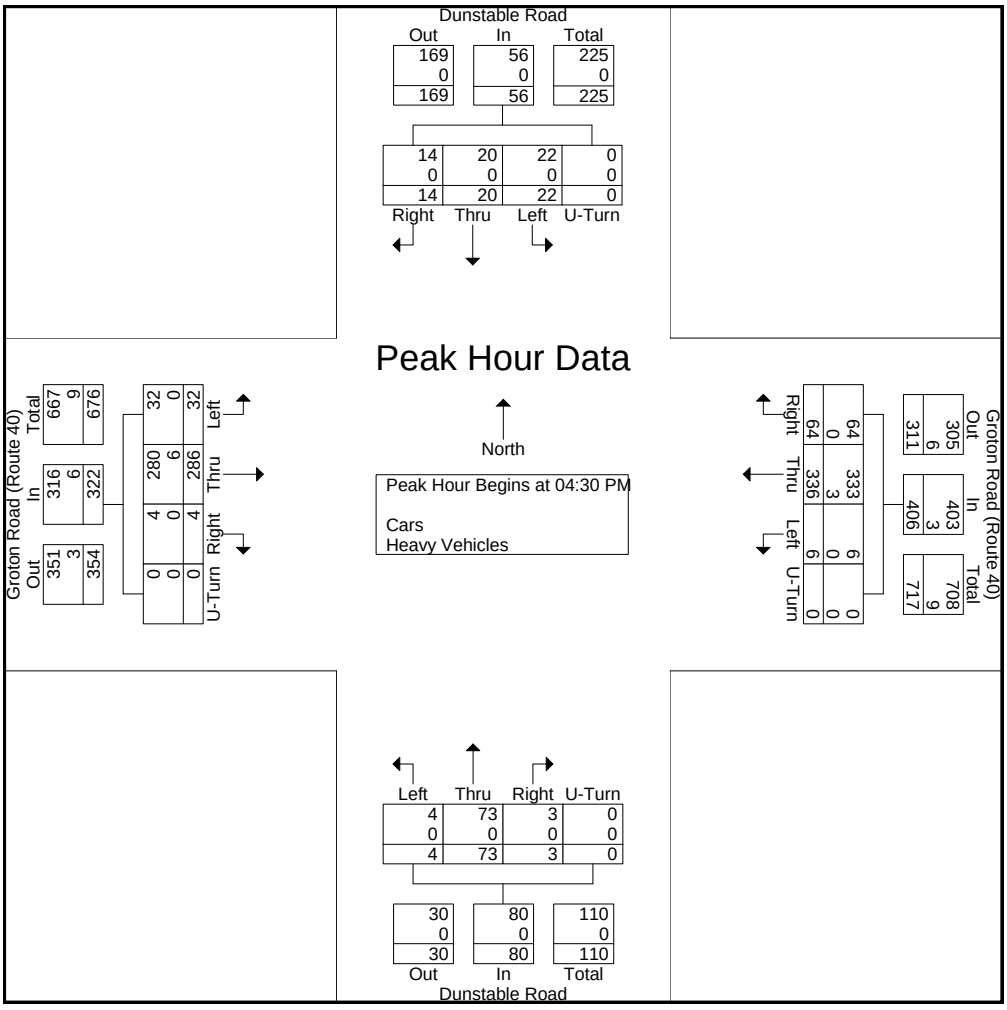
	Dunstable Road From North						Groton Road (Route 40) From East						Dunstable Road From South						Groton Road (Route 40) From West						
Start Time	Right	Thru	Left	Peds EB	Peds WB	App. Total	Right	Thru	Left	Peds SB	Peds NB	App. Total	Right	Thru	Left	Peds WB	Peds EB	App. Total	Right	Thru	Left	Peds NB	Peds SB	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 06:45 PM - Peak 1 of 1																									
Peak Hour for Entire Intersection Begins at 02:00 PM																									
02:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1
02:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1
% App. Total	0	0	0	0	0		0	0	0	0	0		0	0	0	100	0		0	0	0	0	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.250	.000	.250	.000	.000	.000	.000	.000	.000	.250

N/S: Dunstable Road
E/W: Groton Road (Route 40)
City, State: Westford, MA
Client: TEC/ S. Gregorio

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

File Name : 175467 AA
Site Code : T0519.02
Start Date : 1/24/2017
Page No : 1

	Dunstable Road From North					Groton Road (Route 40) From East					Dunstable Road From South					Groton Road (Route 40) From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 06:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:30 PM																					
04:30 PM	5	4	5	0	14	18	88	0	0	106	0	15	0	0	15	2	64	10	0	76	211
04:45 PM	4	6	5	0	15	17	84	3	0	104	0	10	0	0	10	0	77	5	0	82	211
05:00 PM	1	8	6	0	15	11	80	1	0	92	2	21	2	0	25	0	74	7	0	81	213
05:15 PM	4	2	6	0	12	18	84	2	0	104	1	27	2	0	30	2	71	10	0	83	229
Total Volume	14	20	22	0	56	64	336	6	0	406	3	73	4	0	80	4	286	32	0	322	864
% App. Total	25	35.7	39.3	0		15.8	82.8	1.5	0		3.8	91.2	5	0		1.2	88.8	9.9	0		
PHF	.700	.625	.917	.000	.933	.889	.955	.500	.000	.958	.375	.676	.500	.000	.667	.500	.929	.800	.000	.970	.943
Cars	14	20	22	0	56	64	333	6	0	403	3	73	4	0	80	4	280	32	0	316	855
% Cars	100	100	100	0	100	100	99.1	100	0	99.3	100	100	100	0	100	100	97.9	100	0	98.1	99.0
Heavy Vehicles	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	6	0	0	6	9
% Heavy Vehicles	0	0	0	0	0	0	0.9	0	0	0.7	0	0	0	0	0	0	2.1	0	0	1.9	1.0



Appendix B

Automatic Traffic Recorder (ATR) Counts

Innovative Data, LLC

PO Box 468
Belchertown, Massachusetts
innovativedatallc.com or 1.413.668.5094

Location: Dunstable Road
Location: North of Groton Road
Location: Westford, Massachusetts
Client: The Engineering Corp.

Start Time	20-Mar-14 Thu	Northbound A.M.	Northbound P.M.	Southbound A.M.	Southbound P.M.	Combined A.M.	Combined P.M.	21-Mar- Fri	Northbound A.M.	Northbound P.M.	Southbound A.M.	Southbound P.M.	Combined A.M.	Combined P.M.
12:00		5	15	0	10	5	25		6	22	0	14	6	36
12:15		3	21	0	16	3	37		4	16	3	19	7	35
12:30		1	9	1	14	2	23		5	16	0	14	5	30
12:45		1	9	0	12	1	21		2	20	0	14	2	34
01:00		3	17	0	13	3	30		2	16	1	11	3	27
01:15		1	16	0	17	1	33		4	19	4	13	8	32
01:30		0	18	1	9	1	27		0	11	2	10	2	21
01:45		0	13	1	15	1	28		0	17	0	19	0	36
02:00		0	20	0	17	0	37		1	29	0	12	1	41
02:15		1	15	2	13	3	28		0	24	0	14	0	38
02:30		0	30	0	20	0	50		0	30	0	16	0	46
02:45		0	27	1	19	1	46		1	32	0	***32***	1	64
03:00		0	29	0	13	0	42		1	31	0	***23***	1	54
03:15		0	37	0	21	0	58		0	35	0	***33***	0	68
03:30		0	34	1	16	1	50		0	35	2	***26***	2	61
03:45		0	29	1	***17***	1	46		0	30	2	16	2	46
04:00		0	27	3	***28***	3	55		1	36	2	20	3	56
04:15		0	30	4	***16***	4	46		0	39	5	16	5	55
04:30		0	22	6	***25***	6	47		0	34	5	27	5	61
04:45		0	35	1	12	1	47		1	45	4	21	5	66
05:00		3	50	5	12	8	62		0	44	3	18	3	62
05:15		2	***53***	14	13	16	***66***		0	***49***	15	18	15	***67***
05:30		2	***55***	17	25	19	***80***		1	***48***	23	10	24	***58***
05:45		2	***54***	21	18	23	***72***		1	***44***	24	23	25	***67***
06:00		1	***56***	23	22	24	***78***		5	***52***	18	22	23	***74***
06:15		4	48	26	17	30	65		1	36	27	19	28	55
06:30		5	39	36	11	41	50		3	38	44	17	47	55
06:45		6	56	42	25	48	81		6	30	37	12	43	42
07:00		8	30	***60***	18	68	48		7	26	58	16	***65***	42
07:15		11	24	***46***	22	***57***	46		14	22	***53***	14	***67***	36
07:30		12	23	***61***	9	***73***	32		15	24	***46***	14	***61***	38
07:45		12	29	***52***	8	***64***	37		10	19	***48***	9	***58***	28
08:00		10	29	60	5	***70***	34		6	14	***59***	13	65	27
08:15		10	30	46	11	56	41		6	21	46	10	52	31
08:30		10	15	49	21	59	36		7	19	49	5	56	24
08:45		8	18	32	18	40	36		13	8	31	7	44	15
09:00		9	13	32	1	41	14		9	26	31	5	40	31
09:15		11	16	24	5	35	21		8	13	37	7	45	20
09:30		10	11	22	4	32	15		12	10	22	11	34	21
09:45		13	15	17	6	30	21		12	9	18	6	30	15
10:00		4	10	20	8	24	18		9	12	11	8	20	20
10:15		9	8	19	6	28	14		7	13	13	8	20	21
10:30		10	4	20	1	30	5		12	11	12	5	24	16
10:45		***13***	8	15	2	28	10		11	6	18	1	29	7
11:00		***13***	9	11	5	24	14		***14***	10	12	2	26	12
11:15		***15***	6	22	4	37	10		***9***	5	12	4	21	9
11:30		***12***	6	14	3	26	9		***19***	6	10	3	29	9
11:45		11	6	11	0	22	6		***14***	2	10	1	24	3
Total		251	1174	839	623	1090	1797		259	1154	817	658	1076	1812
Day Total		1425		1462		2887			1413		1475		2888	
% Total		8.7%	40.7%	29.1%	21.6%				9.0%	40.0%	28.3%	22.8%		
Peak		10:45	05:15	07:00	03:45	07:15	05:15		11:00	05:15	07:15	02:45	07:00	05:15
Vol.		53	218	219	86	264	296		56	193	206	114	251	266
P.H.F.		0.883	0.973	0.898	0.768	0.904	0.925		0.737	0.928	0.873	0.864	0.937	0.899

Innovative Data, LLC

PO Box 468
Belchertown, Massachusetts
innovativedatallc.com or 1.413.668.5094

Location: Dunstable Road
Location: North of Groton Road
Location: Westford, Massachusetts
Client: The Engineering Corp.

Start Time	22-Mar-14 Sat	Northbound A.M.	Northbound P.M.	Southbound A.M.	Southbound P.M.	Combined A.M.	Combined P.M.	23-Mar- Sun	Northbound A.M.	Northbound P.M.	Southbound A.M.	Southbound P.M.	Combined A.M.	Combined P.M.
12:00		6	18	1	22	7	40		0	*	0	*	0	*
12:15		3	27	1	23	4	50		*	*	*	*	*	*
12:30		1	30	3	19	4	49		*	*	*	*	*	*
12:45		1	19	0	24	1	43		*	*	*	*	*	*
01:00		3	11	0	12	3	23		*	*	*	*	*	*
01:15		1	21	1	27	2	48		*	*	*	*	*	*
01:30		2	21	1	17	3	38		*	*	*	*	*	*
01:45		0	20	0	19	0	39		*	*	*	*	*	*
02:00		1	30	1	18	2	48		*	*	*	*	*	*
02:15		1	24	1	13	2	37		*	*	*	*	*	*
02:30		0	21	1	18	1	39		*	*	*	*	*	*
02:45		0	14	0	15	0	29		*	*	*	*	*	*
03:00		0	19	0	17	0	36		*	*	*	*	*	*
03:15		0	17	1	17	1	34		*	*	*	*	*	*
03:30		0	22	1	***26***	1	***48***		*	*	*	*	*	*
03:45		0	***25***	0	***27***	0	***52***		*	*	*	*	*	*
04:00		0	***29***	1	***25***	1	***54***		*	*	*	*	*	*
04:15		0	***25***	0	***24***	0	***49***		*	*	*	*	*	*
04:30		0	***24***	3	12	3	36		*	*	*	*	*	*
04:45		0	21	2	24	2	45		*	*	*	*	*	*
05:00		1	28	0	16	1	44		*	*	*	*	*	*
05:15		0	22	1	13	1	35		*	*	*	*	*	*
05:30		2	16	5	19	7	35		*	*	*	*	*	*
05:45		0	29	5	18	5	47		*	*	*	*	*	*
06:00		1	17	7	17	8	34		*	*	*	*	*	*
06:15		2	23	3	16	5	39		*	*	*	*	*	*
06:30		6	16	4	12	10	28		*	*	*	*	*	*
06:45		4	17	5	20	9	37		*	*	*	*	*	*
07:00		6	12	14	12	20	24		*	*	*	*	*	*
07:15		15	22	8	7	23	29		*	*	*	*	*	*
07:30		6	15	16	13	22	28		*	*	*	*	*	*
07:45		9	10	16	11	25	21		*	*	*	*	*	*
08:00		10	11	10	11	20	22		*	*	*	*	*	*
08:15		9	15	13	6	22	21		*	*	*	*	*	*
08:30		4	6	15	9	19	15		*	*	*	*	*	*
08:45		6	13	14	9	20	22		*	*	*	*	*	*
09:00		10	15	28	0	38	15		*	*	*	*	*	*
09:15		7	14	15	10	22	24		*	*	*	*	*	*
09:30		10	7	29	10	39	17		*	*	*	*	*	*
09:45		10	12	20	8	30	20		*	*	*	*	*	*
10:00		20	17	27	7	47	24		*	*	*	*	*	*
10:15		11	11	19	6	30	17		*	*	*	*	*	*
10:30		14	15	***29***	5	***43***	20		*	*	*	*	*	*
10:45		13	6	***18***	5	***31***	11		*	*	*	*	*	*
11:00		***21***	7	***21***	6	***42***	13		*	*	*	*	*	*
11:15		***19***	6	***31***	9	***50***	15		*	*	*	*	*	*
11:30		***11***	4	13	8	24	12		*	*	*	*	*	*
11:45		***23***	8	22	4	45	12		*	*	*	*	*	*
Total		269	832	426	686	695	1518		0	0	0	0	0	0
Day Total		1101		1112		2213			0		0		0	
% Total		12.2%	37.6%	19.2%	31.0%				0.0%	0.0%	0.0%	0.0%		
Peak		11:00	03:45	10:30	03:30	10:30	03:30							
Vol.		74	103	99	102	166	203							
P.H.F.		0.804	0.888	0.798	0.944	0.830	0.940							

ADT	ADT 2,662	AADT 2,662

Innovative Data, LLC

PO Box 468
Belchertown, Massachusetts
innovativedatallc.com or 1.413.668.5094

Location: Dunstable Road
Location: North of Groton Road
Location: Westford, Massachusetts
Client: The Engineering Corp.

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	Pace Speed	Number in Pace
03/20/14	0	1	3	6	0	0	0	0	0	0	0	0	0	0	10	21-30	8
01:00	0	0	3	1	0	0	0	0	0	0	0	0	0	0	4	19-28	4
02:00	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	19-28	1
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	3	5	1	0	0	0	0	0	0	0	0	0	9	23-32	7
06:00	0	**3**	3	8	2	0	0	0	0	0	0	0	0	0	16	22-31	10
07:00	**1**	2	11	25	3	**1**	0	0	0	0	0	0	0	0	43	22-31	32
08:00	1	0	12	15	**10**	0	0	0	0	0	0	0	0	0	38	23-32	26
09:00	0	1	**13**	23	6	0	0	0	0	0	0	0	0	0	43	22-31	33
10:00	0	2	10	19	5	0	0	0	0	0	0	0	0	0	36	23-32	26
11:00	1	2	9	**29**	10	0	0	0	0	0	0	0	0	0	**51**	24-33	37
12 PM	2	1	9	28	14	0	0	0	0	0	0	0	0	0	54	24-33	39
13:00	0	1	13	39	10	1	0	0	0	0	0	0	0	0	64	23-32	50
14:00	0	3	14	60	14	1	0	0	0	0	0	0	0	0	92	23-32	73
15:00	**5**	1	23	79	20	1	0	0	0	0	0	0	0	0	129	23-32	97
16:00	1	3	15	68	22	**5**	0	0	0	0	0	0	0	0	114	24-33	85
17:00	5	4	**35**	120	**46**	2	0	0	0	0	0	0	0	0	**212**	24-33	157
18:00	3	0	30	**125**	40	1	0	0	0	0	0	0	0	0	199	24-33	159
19:00	0	**5**	23	61	17	0	0	0	0	0	0	0	0	0	106	23-32	80
20:00	0	1	23	59	7	2	0	0	0	0	0	0	0	0	92	23-32	75
21:00	0	1	12	33	9	0	0	0	0	0	0	0	0	0	55	23-32	43
22:00	0	0	4	21	5	0	0	0	0	0	0	0	0	0	30	24-33	26
23:00	1	0	5	13	8	0	0	0	0	0	0	0	0	0	27	25-34	19
Total	20	31	273	838	249	14	0	0	0	0	0	0	0	0	1425		
Percent	1.4%	2.2%	19.2%	58.8%	17.5%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	07:00	06:00	09:00	11:00	08:00	07:00									11:00		
Vol.	1	3	13	29	10	1									51		
PM Peak	15:00	19:00	17:00	18:00	17:00	16:00									17:00		
Vol.	5	5	35	125	46	5									212		

Innovative Data, LLC

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Location: Dunstable Road
Location: North of Groton Road
Location: Westford, Massachusetts
Client: The Engineering Corp.

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	Pace Speed	Number in Pace
03/21/14	0	0	2	10	5	0	0	0	0	0	0	0	0	0	17	24-33	14
01:00	0	0	3	3	0	0	0	0	0	0	0	0	0	0	6	22-31	5
02:00	0	0	1	0	1	0	0	0	0	0	0	0	0	0	2	27-36	1
03:00	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	19-28	1
04:00	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	15-24	2
05:00	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2	20-29	2
06:00	0	0	6	7	2	0	0	0	0	0	0	0	0	0	15	21-30	12
07:00	**1**	**2**	6	33	4	0	0	0	0	0	0	0	0	0	46	23-32	37
08:00	0	0	4	16	**10**	**2**	0	0	0	0	0	0	0	0	32	24-33	24
09:00	0	0	5	29	7	0	0	0	0	0	0	0	0	0	41	24-33	35
10:00	0	2	10	18	9	0	0	0	0	0	0	0	0	0	39	23-32	27
11:00	1	2	**11**	**35**	7	0	0	0	0	0	0	0	0	0	**56**	23-32	43
12 PM	0	**3**	13	46	12	0	0	0	0	0	0	0	0	0	74	24-33	57
13:00	0	0	16	35	10	1	**1**	0	0	0	0	0	0	0	63	23-32	49
14:00	1	1	21	67	23	**2**	0	0	0	0	0	0	0	0	115	24-33	88
15:00	1	0	21	81	27	1	0	0	0	0	0	0	0	0	131	24-33	105
16:00	3	2	18	86	**44**	1	0	0	0	0	0	0	0	0	154	25-34	118
17:00	**5**	2	14	**121**	41	1	1	0	0	0	0	0	0	0	**185**	24-33	147
18:00	1	2	**23**	98	31	0	1	0	0	0	0	0	0	0	156	24-33	124
19:00	1	1	19	58	12	0	0	0	0	0	0	0	0	0	91	23-32	73
20:00	0	2	13	37	10	0	0	0	0	0	0	0	0	0	62	23-32	48
21:00	0	0	13	35	10	0	0	0	0	0	0	0	0	0	58	23-32	47
22:00	0	0	11	25	6	0	0	0	0	0	0	0	0	0	42	22-31	34
23:00	0	0	5	13	5	0	0	0	0	0	0	0	0	0	23	23-32	18
Total	14	19	237	856	276	8	3	0	0	0	0	0	0	0	1413		
Percent	1.0%	1.3%	16.8%	60.6%	19.5%	0.6%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	07:00	07:00	11:00	11:00	08:00	08:00									11:00		
Vol.	1	2	11	35	10	2									56		
PM Peak	17:00	12:00	18:00	17:00	16:00	14:00	13:00								17:00		
Vol.	5	3	23	121	44	2	1								185		

Innovative Data, LLC

PO Box 468
Belchertown, Massachusetts
innovativedatallc.com or 1.413.668.5094

Location: Dunstable Road
Location: North of Groton Road
Location: Westford, Massachusetts
Client: The Engineering Corp.

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	Pace Speed	Number in Pace
03/22/14	0	0	1	9	1	0	0	0	0	0	0	0	0	0	11	23-32	10
01:00	0	0	3	2	1	0	0	0	0	0	0	0	0	0	6	21-30	5
02:00	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2	20-29	2
03:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	*
04:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	*
05:00	0	1	1	0	0	0	0	0	**1**	0	0	0	0	0	3	14-23	2
06:00	0	1	3	8	1	0	0	0	0	0	0	0	0	0	13	21-30	10
07:00	**4**	0	**12**	14	6	0	0	0	0	0	0	0	0	0	36	22-31	22
08:00	0	0	3	17	9	0	0	0	0	0	0	0	0	0	29	24-33	24
09:00	1	1	4	23	8	0	0	0	0	0	0	0	0	0	37	25-34	28
10:00	1	**3**	9	30	14	**1**	0	0	0	0	0	0	0	0	58	25-34	40
11:00	2	1	10	**43**	**17**	1	0	0	0	0	0	0	0	0	**74**	24-33	56
12 PM	1	2	18	**59**	14	0	0	0	0	0	0	0	0	0	94	23-32	74
13:00	1	2	12	36	21	1	0	0	0	0	0	0	0	0	73	25-34	52
14:00	0	2	6	53	**26**	**2**	0	0	0	0	0	0	0	0	89	25-34	71
15:00	0	1	11	55	16	0	0	0	0	0	0	0	0	0	83	24-33	69
16:00	0	**5**	**31**	54	9	0	0	0	0	0	0	0	0	0	**99**	22-31	76
17:00	**2**	2	24	54	12	1	0	0	0	0	0	0	0	0	95	23-32	71
18:00	0	1	22	36	13	1	0	0	0	0	0	0	0	0	73	23-32	54
19:00	0	1	11	38	8	1	0	0	0	0	0	0	0	0	59	23-32	47
20:00	0	1	13	26	5	0	0	0	0	0	0	0	0	0	45	22-31	36
21:00	0	1	12	25	9	1	0	0	0	0	0	0	0	0	48	23-32	35
22:00	0	1	8	33	6	1	0	0	0	0	0	0	0	0	49	23-32	40
23:00	0	1	7	11	5	1	0	0	0	0	0	0	0	0	25	22-31	17
Total	12	27	221	628	201	11	0	0	1	0	0	0	0	0	1101		
Percent	1.1%	2.5%	20.1%	57.0%	18.3%	1.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	07:00	10:00	07:00	11:00	11:00	10:00			05:00						11:00		
Vol.	4	3	12	43	17	1			1						74		
PM Peak	17:00	16:00	16:00	12:00	14:00	14:00									16:00		
Vol.	2	5	31	59	26	2									99		
Total	46	77	731	2322	726	33	3	0	1	0	0	0	0	0	3939		
Percent	1.2%	2.0%	18.6%	58.9%	18.4%	0.8%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			

15th Percentile : 22 MPH
50th Percentile : 27 MPH
85th Percentile : 31 MPH
95th Percentile : 34 MPH

Stats

10 MPH Pace Speed : 23-32 MPH
Number in Pace : 2994
Percent in Pace : 76.0%
Number of Vehicles > 40 MPH : 7
Percent of Vehicles > 40 MPH : 0.2%
Mean Speed(Average) : 27 MPH

Innovative Data, LLC

PO Box 468
Belchertown, Massachusetts
innovativedatallc.com or 1.413.668.5094

Location: Dunstable Road
Location: North of Groton Road
Location: Westford, Massachusetts
Client: The Engineering Corp.

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	Pace Speed	Number in Pace
03/20/14	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	19-28	1
01:00	0	1	0	1	0	0	0	0	0	0	0	0	0	0	2	13-22	1
02:00	0	0	2	0	1	0	0	0	0	0	0	0	0	0	3	15-24	2
03:00	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2	20-29	2
04:00	0	0	3	7	4	0	0	0	0	0	0	0	0	0	14	24-33	11
05:00	0	0	8	34	15	0	0	0	0	0	0	0	0	0	57	24-33	46
06:00	0	4	24	85	14	0	0	0	0	0	0	0	0	0	127	23-32	103
07:00	**30**	**12**	**44**	109	24	0	0	0	0	0	0	0	0	0	**219**	23-32	128
08:00	4	2	24	**110**	**46**	1	0	0	0	0	0	0	0	0	187	24-33	144
09:00	0	3	16	48	28	0	0	0	0	0	0	0	0	0	95	25-34	70
10:00	3	1	7	41	22	0	0	0	0	0	0	0	0	0	74	25-34	56
11:00	0	2	6	31	17	**2**	0	0	0	0	0	0	0	0	58	25-34	43
12 PM	2	0	8	30	11	1	0	0	0	0	0	0	0	0	52	24-33	39
13:00	1	**2**	4	30	17	0	0	0	0	0	0	0	0	0	54	25-34	41
14:00	1	2	4	38	22	1	**1**	0	0	0	0	0	0	0	69	25-34	53
15:00	**3**	0	9	40	13	**2**	0	0	0	0	0	0	0	0	67	24-33	50
16:00	1	1	6	**49**	**23**	1	0	0	0	0	0	0	0	0	**81**	25-34	65
17:00	1	1	11	41	13	1	0	0	0	0	0	0	0	0	68	24-33	52
18:00	2	1	**18**	42	10	2	0	0	0	0	0	0	0	0	75	23-32	55
19:00	0	0	10	36	10	1	0	0	0	0	0	0	0	0	57	23-32	46
20:00	0	0	12	33	10	0	0	0	0	0	0	0	0	0	55	23-32	44
21:00	0	0	2	10	2	2	0	0	0	0	0	0	0	0	16	22-31	12
22:00	2	0	0	11	4	0	0	0	0	0	0	0	0	0	17	26-35	12
23:00	1	0	5	6	0	0	0	0	0	0	0	0	0	0	12	21-30	9
Total	51	32	223	835	306	14	1	0	0	0	0	0	0	0	1462		
Percent	3.5%	2.2%	15.3%	57.1%	20.9%	1.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	07:00	07:00	07:00	08:00	08:00	11:00									07:00		
Vol.	30	12	44	110	46	2									219		
PM Peak	15:00	13:00	18:00	16:00	16:00	15:00	14:00								16:00		
Vol.	3	2	18	49	23	2	1								81		

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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	Pace Speed	Number in Pace
03/21/14	0	0	1	2	0	0	0	0	0	0	0	0	0	0	3	21-30	3
01:00	0	0	0	4	3	0	0	0	0	0	0	0	0	0	7	26-35	6
02:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	*
03:00	0	0	1	2	1	0	0	0	0	0	0	0	0	0	4	24-33	3
04:00	0	1	1	7	6	**1**	0	0	0	0	0	0	0	0	16	27-36	11
05:00	0	3	1	39	21	1	0	0	0	0	0	0	0	0	65	25-34	52
06:00	**2**	**5**	12	72	34	1	0	0	0	0	0	0	0	0	126	25-34	95
07:00	2	4	**34**	122	**42**	1	0	0	0	0	0	0	0	0	**205**	24-33	158
08:00	0	3	22	**123**	36	1	0	0	0	0	0	0	0	0	185	24-33	152
09:00	1	1	11	62	33	0	0	0	0	0	0	0	0	0	108	25-34	86
10:00	0	0	6	24	24	0	0	0	0	0	0	0	0	0	54	25-34	43
11:00	1	2	8	24	8	1	0	0	0	0	0	0	0	0	44	23-32	31
12 PM	0	2	12	27	17	**3**	0	0	0	0	0	0	0	0	61	25-34	41
13:00	0	1	3	34	14	1	0	0	0	0	0	0	0	0	53	25-34	44
14:00	**2**	1	8	36	24	3	0	0	0	0	0	0	0	0	74	25-34	53
15:00	1	0	**22**	**53**	21	1	0	0	0	0	0	0	0	0	**98**	23-32	74
16:00	2	1	6	51	23	1	0	0	0	0	0	0	0	0	84	25-34	66
17:00	1	0	2	38	**28**	0	0	0	0	0	0	0	0	0	69	25-34	58
18:00	1	0	8	50	10	1	0	0	0	0	0	0	0	0	70	24-33	59
19:00	0	**3**	6	32	12	0	0	0	0	0	0	0	0	0	53	25-34	40
20:00	0	0	5	23	6	1	0	0	0	0	0	0	0	0	35	24-33	29
21:00	0	0	3	15	11	0	0	0	0	0	0	0	0	0	29	26-35	23
22:00	0	0	1	13	8	0	0	0	0	0	0	0	0	0	22	25-34	19
23:00	0	1	2	4	3	0	0	0	0	0	0	0	0	0	10	26-35	6
Total	13	28	175	857	385	17	0	0	0	0	0	0	0	0	1475		
Percent	0.9%	1.9%	11.9%	58.1%	26.1%	1.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	06:00	06:00	07:00	08:00	07:00	04:00									07:00		
Vol.	2	5	34	123	42	1									205		
PM Peak	14:00	19:00	15:00	15:00	17:00	12:00									15:00		
Vol.	2	3	22	53	28	3									98		

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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	Pace Speed	Number in Pace
03/22/14	0	0	0	2	2	1	0	0	0	0	0	0	0	0	5	26-35	4
01:00	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2	20-29	2
02:00	0	0	1	1	1	0	0	0	0	0	0	0	0	0	3	24-33	2
03:00	0	0	0	1	1	0	0	0	0	0	0	0	0	0	2	24-33	2
04:00	0	1	0	2	2	1	0	0	0	0	0	0	0	0	6	29-38	3
05:00	1	0	2	6	2	0	0	0	0	0	0	0	0	0	11	25-34	7
06:00	0	0	3	10	6	0	0	0	0	0	0	0	0	0	19	24-33	15
07:00	1	0	3	29	20	1	0	0	0	0	0	0	0	0	54	25-34	43
08:00	0	0	4	22	24	2	0	0	0	0	0	0	0	0	52	26-35	41
09:00	0	1	11	49	**31**	0	0	0	0	0	0	0	0	0	92	25-34	73
10:00	0	3	8	**51**	27	**4**	0	0	0	0	0	0	0	0	**93**	25-34	70
11:00	**2**	**4**	**15**	41	24	1	0	0	0	0	0	0	0	0	87	24-33	59
12 PM	0	0	**15**	46	27	0	0	0	0	0	0	0	0	0	**88**	25-34	68
13:00	0	1	8	46	20	0	0	0	0	0	0	0	0	0	75	24-33	61
14:00	0	0	10	35	18	1	0	0	0	0	0	0	0	0	64	24-33	50
15:00	**3**	**2**	12	42	**28**	0	0	0	0	0	0	0	0	0	87	25-34	62
16:00	0	0	12	**50**	22	1	0	0	0	0	0	0	0	0	85	24-33	68
17:00	2	1	7	37	17	1	**1**	0	0	0	0	0	0	0	66	25-34	49
18:00	0	1	11	35	16	**2**	0	0	0	0	0	0	0	0	65	24-33	49
19:00	0	1	4	27	11	0	0	0	0	0	0	0	0	0	43	24-33	35
20:00	0	0	5	21	8	1	0	0	0	0	0	0	0	0	35	24-33	28
21:00	0	0	3	16	7	2	0	0	0	0	0	0	0	0	28	25-34	21
22:00	0	1	3	13	5	0	1	0	0	0	0	0	0	0	23	24-33	17
23:00	0	0	7	12	7	1	0	0	0	0	0	0	0	0	27	22-31	19
Total	9	16	144	596	326	19	2	0	0	0	0	0	0	0	1112		
Percent	0.8%	1.4%	12.9%	53.6%	29.3%	1.7%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	11:00	11:00	11:00	10:00	09:00	10:00									10:00		
Vol.	2	4	15	51	31	4									93		
PM Peak	15:00	15:00	12:00	16:00	15:00	18:00	17:00								12:00		
Vol.	3	2	15	50	28	2	1								88		
Total	73	76	542	2288	1017	50	3	0	0	0	0	0	0	0	4049		
Percent	1.8%	1.9%	13.4%	56.5%	25.1%	1.2%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			

15th Percentile :	23 MPH
50th Percentile :	27 MPH
85th Percentile :	32 MPH
95th Percentile :	34 MPH

Stats

10 MPH Pace Speed :	24-33 MPH
Number in Pace :	3043
Percent in Pace :	75.2%
Number of Vehicles > 40 MPH :	8
Percent of Vehicles > 40 MPH :	0.2%
Mean Speed(Average) :	28 MPH

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Location: Dunstable Road
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Client: The Engineering Corp.

Northbound, 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	Pace Speed	Number in Pace
03/20/14	0	1	3	7	0	0	0	0	0	0	0	0	0	0	11	21-30	9
01:00	0	1	3	2	0	0	0	0	0	0	0	0	0	0	6	21-30	4
02:00	0	0	2	1	1	0	0	0	0	0	0	0	0	0	4	19-28	3
03:00	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2	20-29	2
04:00	0	0	3	7	4	0	0	0	0	0	0	0	0	0	14	24-33	11
05:00	0	0	11	39	16	0	0	0	0	0	0	0	0	0	66	24-33	53
06:00	0	7	27	93	16	0	0	0	0	0	0	0	0	0	143	23-32	113
07:00	**31**	**14**	**55**	**134**	27	1	0	0	0	0	0	0	0	0	**262**	23-32	159
08:00	5	2	36	125	**56**	1	0	0	0	0	0	0	0	0	225	24-33	169
09:00	0	4	29	71	34	0	0	0	0	0	0	0	0	0	138	24-33	102
10:00	3	3	17	60	27	0	0	0	0	0	0	0	0	0	110	24-33	80
11:00	1	4	15	60	27	**2**	0	0	0	0	0	0	0	0	109	24-33	80
12 PM	4	1	17	58	25	1	0	0	0	0	0	0	0	0	106	24-33	77
13:00	1	3	17	69	27	1	0	0	0	0	0	0	0	0	118	24-33	90
14:00	1	**5**	18	98	36	2	**1**	0	0	0	0	0	0	0	161	24-33	124
15:00	**8**	1	32	119	33	3	0	0	0	0	0	0	0	0	196	24-33	146
16:00	2	4	21	117	45	**6**	0	0	0	0	0	0	0	0	195	24-33	150
17:00	6	5	46	161	**59**	3	0	0	0	0	0	0	0	0	**280**	24-33	209
18:00	5	1	**48**	**167**	50	3	0	0	0	0	0	0	0	0	274	24-33	213
19:00	0	5	33	97	27	1	0	0	0	0	0	0	0	0	163	23-32	126
20:00	0	1	35	92	17	2	0	0	0	0	0	0	0	0	147	23-32	119
21:00	0	1	14	43	11	2	0	0	0	0	0	0	0	0	71	23-32	55
22:00	2	0	4	32	9	0	0	0	0	0	0	0	0	0	47	24-33	38
23:00	2	0	10	19	8	0	0	0	0	0	0	0	0	0	39	23-32	27
Total	71	63	496	1673	555	28	1	0	0	0	0	0	0	0	2887		
Percent	2.5%	2.2%	17.2%	57.9%	19.2%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	07:00	07:00	07:00	07:00	08:00	11:00									07:00		
Vol.	31	14	55	134	56	2									262		
PM Peak	15:00	14:00	18:00	18:00	17:00	16:00	14:00								17:00		
Vol.	8	5	48	167	59	6	1								280		

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Northbound, 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	Pace Speed	Number in Pace
03/21/14	0	0	3	12	5	0	0	0	0	0	0	0	0	0	20	25-34	16
01:00	0	0	3	7	3	0	0	0	0	0	0	0	0	0	13	24-33	10
02:00	0	0	1	0	1	0	0	0	0	0	0	0	0	0	2	27-36	1
03:00	0	0	1	3	1	0	0	0	0	0	0	0	0	0	5	24-33	4
04:00	0	1	3	7	6	1	0	0	0	0	0	0	0	0	18	25-34	12
05:00	0	3	1	41	21	1	0	0	0	0	0	0	0	0	67	25-34	54
06:00	2	5	18	79	36	1	0	0	0	0	0	0	0	0	141	24-33	105
07:00	**3**	**6**	**40**	**155**	**46**	1	0	0	0	0	0	0	0	0	**251**	24-33	194
08:00	0	3	26	139	46	**3**	0	0	0	0	0	0	0	0	217	24-33	176
09:00	1	1	16	91	40	0	0	0	0	0	0	0	0	0	149	25-34	121
10:00	0	2	16	42	33	0	0	0	0	0	0	0	0	0	93	25-34	69
11:00	2	4	19	59	15	1	0	0	0	0	0	0	0	0	100	23-32	74
12 PM	0	**5**	25	73	29	3	0	0	0	0	0	0	0	0	135	24-33	99
13:00	0	1	19	69	24	2	**1**	0	0	0	0	0	0	0	116	24-33	91
14:00	3	2	29	103	47	**5**	0	0	0	0	0	0	0	0	189	24-33	140
15:00	2	0	**43**	134	48	2	0	0	0	0	0	0	0	0	229	24-33	179
16:00	5	3	24	137	67	2	0	0	0	0	0	0	0	0	238	25-34	184
17:00	**6**	2	16	**159**	**69**	1	1	0	0	0	0	0	0	0	**254**	25-34	204
18:00	2	2	31	148	41	1	1	0	0	0	0	0	0	0	226	24-33	183
19:00	1	4	25	90	24	0	0	0	0	0	0	0	0	0	144	24-33	112
20:00	0	2	18	60	16	1	0	0	0	0	0	0	0	0	97	24-33	76
21:00	0	0	16	50	21	0	0	0	0	0	0	0	0	0	87	24-33	69
22:00	0	0	12	38	14	0	0	0	0	0	0	0	0	0	64	24-33	51
23:00	0	1	7	17	8	0	0	0	0	0	0	0	0	0	33	24-33	24
Total	27	47	412	1713	661	25	3	0	0	0	0	0	0	0	2888		
Percent	0.9%	1.6%	14.3%	59.3%	22.9%	0.9%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	07:00	07:00	07:00	07:00	07:00	08:00									07:00		
Vol.	3	6	40	155	46	3									251		
PM Peak	17:00	12:00	15:00	17:00	17:00	14:00	13:00								17:00		
Vol.	6	5	43	159	69	5	1								254		

Innovative Data, LLC

PO Box 468
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innovativedatallc.com or 1.413.668.5094

Location: Dunstable Road
Location: North of Groton Road
Location: Westford, Massachusetts
Client: The Engineering Corp.

Northbound, 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	Pace Speed	Number in Pace
03/22/14	0	0	1	11	3	1	0	0	0	0	0	0	0	0	16	25-34	13
01:00	0	0	3	4	1	0	0	0	0	0	0	0	0	0	8	23-32	6
02:00	0	0	1	3	1	0	0	0	0	0	0	0	0	0	5	24-33	4
03:00	0	0	0	1	1	0	0	0	0	0	0	0	0	0	2	24-33	2
04:00	0	1	0	2	2	1	0	0	0	0	0	0	0	0	6	29-38	3
05:00	1	1	3	6	2	0	0	0	**1**	0	0	0	0	0	14	21-30	8
06:00	0	1	6	18	7	0	0	0	0	0	0	0	0	0	32	24-33	24
07:00	**5**	0	15	43	26	1	0	0	0	0	0	0	0	0	90	24-33	62
08:00	0	0	7	39	33	2	0	0	0	0	0	0	0	0	81	26-35	64
09:00	1	2	15	72	39	0	0	0	0	0	0	0	0	0	129	25-34	101
10:00	1	**6**	17	81	**41**	**5**	0	0	0	0	0	0	0	0	151	25-34	110
11:00	4	5	**25**	**84**	41	2	0	0	0	0	0	0	0	0	**161**	24-33	115
12 PM	1	2	33	**105**	41	0	0	0	0	0	0	0	0	0	182	24-33	141
13:00	1	3	20	82	41	1	0	0	0	0	0	0	0	0	148	24-33	113
14:00	0	2	16	88	**44**	**3**	0	0	0	0	0	0	0	0	153	25-34	121
15:00	3	3	23	97	44	0	0	0	0	0	0	0	0	0	170	24-33	130
16:00	0	**5**	**43**	104	31	1	0	0	0	0	0	0	0	0	**184**	23-32	140
17:00	**4**	3	31	91	29	2	**1**	0	0	0	0	0	0	0	161	23-32	118
18:00	0	2	33	71	29	3	0	0	0	0	0	0	0	0	138	23-32	102
19:00	0	2	15	65	19	1	0	0	0	0	0	0	0	0	102	24-33	82
20:00	0	1	18	47	13	1	0	0	0	0	0	0	0	0	80	23-32	63
21:00	0	1	15	41	16	3	0	0	0	0	0	0	0	0	76	24-33	56
22:00	0	2	11	46	11	1	1	0	0	0	0	0	0	0	72	24-33	56
23:00	0	1	14	23	12	2	0	0	0	0	0	0	0	0	52	23-32	36
Total	21	43	365	1224	527	30	2	0	1	0	0	0	0	0	2213		
Percent	0.9%	1.9%	16.5%	55.3%	23.8%	1.4%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	07:00	10:00	11:00	11:00	10:00	10:00			05:00						11:00		
Vol.	5	6	25	84	41	5			1						161		
PM Peak	17:00	16:00	16:00	12:00	14:00	14:00	17:00								16:00		
Vol.	4	5	43	105	44	3	1								184		
Total	119	153	1273	4610	1743	83	6	0	1	0	0	0	0	0	7988		
Percent	1.5%	1.9%	15.9%	57.7%	21.8%	1.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			

15th Percentile : 23 MPH
50th Percentile : 27 MPH
85th Percentile : 31 MPH
95th Percentile : 34 MPH

Stats

10 MPH Pace Speed : 24-33 MPH
Number in Pace : 6035
Percent in Pace : 75.6%
Number of Vehicles > 40 MPH : 16
Percent of Vehicles > 40 MPH : 0.2%
Mean Speed(Average) : 28 MPH

Innovative Data, LLC

PO Box 468
Belchertown, Massachusetts
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Location: Dunstable Road
Location: North of Groton Road
Location: Westford, Massachusetts
Client: The Engineering Corp.

Northbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classed	Total
03/20/14	0	8	2	0	0	0	0	0	0	0	0	0	0	0	10
01:00	0	3	1	0	0	0	0	0	0	0	0	0	0	0	4
02:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
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	6	3	0	0	0	0	0	0	0	0	0	0	0	9
06:00	0	11	4	1	0	0	0	0	0	0	0	0	0	0	16
07:00	0	28	10	2	2	0	0	0	0	0	0	0	0	1	43
08:00	0	29	6	1	0	1	0	0	0	0	0	0	0	1	38
09:00	0	32	7	1	2	1	0	0	0	0	0	0	0	0	43
10:00	0	25	8	0	3	0	0	0	0	0	0	0	0	0	36
11:00	0	37	10	0	3	0	0	0	0	0	0	0	0	1	51
12 PM	0	42	8	0	3	0	0	0	0	0	0	0	0	1	54
13:00	0	48	11	0	5	0	0	0	0	0	0	0	0	0	64
14:00	0	74	14	3	0	0	0	1	0	0	0	0	0	0	92
15:00	1	93	28	1	2	0	0	0	0	0	0	0	0	4	129
16:00	0	84	25	1	3	0	0	0	0	0	0	0	0	1	114
17:00	0	183	23	0	4	0	0	1	0	0	0	0	0	1	212
18:00	0	172	23	0	1	0	0	0	0	0	0	0	0	3	199
19:00	0	90	16	0	0	0	0	0	0	0	0	0	0	0	106
20:00	0	80	11	0	1	0	0	0	0	0	0	0	0	0	92
21:00	0	52	3	0	0	0	0	0	0	0	0	0	0	0	55
22:00	0	26	4	0	0	0	0	0	0	0	0	0	0	0	30
23:00	0	22	4	0	0	0	0	0	0	0	0	0	0	1	27
Total	1	1146	221	10	29	2	0	2	0	0	0	0	0	14	1425
Percent	0.1%	80.4%	15.5%	0.7%	2.0%	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	1.0%	
AM Peak		11:00	07:00	07:00	10:00	08:00								07:00	
Vol.		37	10	2	3	1								1	
PM Peak	15:00	17:00	15:00	14:00	13:00			14:00						15:00	
Vol.	1	183	28	3	5			1						4	

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Client: The Engineering Corp.

Northbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classed	Total
03/21/14	0	16	1	0	0	0	0	0	0	0	0	0	0	0	17
01:00	0	6	0	0	0	0	0	0	0	0	0	0	0	0	6
02:00	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
03:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
04:00	0	1	1	0	0	0	0	0	0	0	0	0	0	0	2
05:00	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
06:00	0	10	5	0	0	0	0	0	0	0	0	0	0	0	15
07:00	0	24	18	2	1	0	0	0	0	0	0	0	0	1	46
08:00	0	28	2	2	0	0	0	0	0	0	0	0	0	0	32
09:00	0	31	8	0	2	0	0	0	0	0	0	0	0	0	41
10:00	0	29	8	0	1	0	0	1	0	0	0	0	0	0	39
11:00	0	46	5	1	4	0	0	0	0	0	0	0	0	0	56
12 PM	0	62	10	0	2	0	0	0	0	0	0	0	0	0	74
13:00	0	50	11	0	2	0	0	0	0	0	0	0	0	0	63
14:00	0	94	16	3	1	0	0	0	0	0	0	0	0	1	115
15:00	0	104	22	1	3	0	0	0	0	0	0	0	0	1	131
16:00	1	124	22	0	3	0	0	1	0	0	0	0	0	3	154
17:00	0	156	24	0	0	0	0	0	0	0	0	0	0	5	185
18:00	0	134	19	0	2	0	0	0	0	0	0	0	0	1	156
19:00	0	76	11	0	3	0	0	0	0	0	0	0	0	1	91
20:00	0	57	5	0	0	0	0	0	0	0	0	0	0	0	62
21:00	0	48	10	0	0	0	0	0	0	0	0	0	0	0	58
22:00	0	38	4	0	0	0	0	0	0	0	0	0	0	0	42
23:00	0	19	4	0	0	0	0	0	0	0	0	0	0	0	23
Total	1	1158	206	9	24	0	0	2	0	0	0	0	0	13	1413
Percent	0.1%	82.0%	14.6%	0.6%	1.7%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.9%	
AM Peak		11:00	07:00	07:00	11:00			10:00						07:00	
Vol.		46	18	2	4			1						1	
PM Peak	16:00	17:00	17:00	14:00	15:00			16:00						17:00	
Vol.	1	156	24	3	3			1						5	

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Client: The Engineering Corp.

Northbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classed	Total
03/22/14	0	11	0	0	0	0	0	0	0	0	0	0	0	0	11
01:00	0	5	1	0	0	0	0	0	0	0	0	0	0	0	6
02:00	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
03:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:00	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
06:00	0	7	5	0	1	0	0	0	0	0	0	0	0	0	13
07:00	0	21	11	1	1	0	0	0	0	0	0	0	0	2	36
08:00	0	22	5	0	2	0	0	0	0	0	0	0	0	0	29
09:00	0	33	2	0	1	0	0	0	0	0	0	0	0	1	37
10:00	0	44	12	0	1	0	0	0	0	0	0	0	0	1	58
11:00	0	59	11	0	1	1	0	0	0	0	0	0	0	2	74
12 PM	0	78	16	0	0	0	0	0	0	0	0	0	0	0	94
13:00	0	60	12	0	1	0	0	0	0	0	0	0	0	0	73
14:00	0	73	13	0	3	0	0	0	0	0	0	0	0	0	89
15:00	0	72	10	0	1	0	0	0	0	0	0	0	0	0	83
16:00	0	87	9	0	3	0	0	0	0	0	0	0	0	0	99
17:00	0	78	14	0	1	0	0	0	0	0	0	0	0	2	95
18:00	0	62	10	0	1	0	0	0	0	0	0	0	0	0	73
19:00	0	53	6	0	0	0	0	0	0	0	0	0	0	0	59
20:00	0	40	5	0	0	0	0	0	0	0	0	0	0	0	45
21:00	0	43	4	0	1	0	0	0	0	0	0	0	0	0	48
22:00	0	46	3	0	0	0	0	0	0	0	0	0	0	0	49
23:00	0	21	4	0	0	0	0	0	0	0	0	0	0	0	25
Total	0	920	153	1	18	1	0	0	0	0	0	0	0	8	1101
Percent	0.0%	83.6%	13.9%	0.1%	1.6%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.7%	
AM Peak		11:00	10:00	07:00	08:00	11:00								07:00	
Vol.		59	12	1	2	1								2	
PM Peak		16:00	12:00		14:00									17:00	
Vol.		87	16		3									2	
Grand Total	2	3224	580	20	71	3	0	4	0	0	0	0	0	35	3939
Percent	0.1%	81.8%	14.7%	0.5%	1.8%	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.9%	

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Southbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classed	Total
03/20/14	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
01:00	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2
02:00	0	2	1	0	0	0	0	0	0	0	0	0	0	0	3
03:00	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
04:00	0	9	4	0	1	0	0	0	0	0	0	0	0	0	14
05:00	0	42	13	0	2	0	0	0	0	0	0	0	0	0	57
06:00	0	97	28	0	2	0	0	0	0	0	0	0	0	0	127
07:00	1	172	32	0	3	0	0	1	0	0	0	0	0	10	219
08:00	0	156	24	0	3	0	0	1	0	0	0	0	0	3	187
09:00	0	74	19	0	2	0	0	0	0	0	0	0	0	0	95
10:00	1	56	11	0	3	0	0	0	0	0	0	0	0	3	74
11:00	0	48	6	0	3	1	0	0	0	0	0	0	0	0	58
12 PM	0	38	10	0	2	0	0	0	0	0	0	0	0	2	52
13:00	0	39	11	0	2	0	0	1	0	0	0	0	0	1	54
14:00	0	52	17	0	0	0	0	0	0	0	0	0	0	0	69
15:00	0	49	12	1	2	0	0	0	0	0	0	0	0	3	67
16:00	0	67	10	0	3	0	0	0	0	0	0	0	0	1	81
17:00	0	55	10	0	2	0	0	0	0	0	0	0	0	1	68
18:00	0	60	9	0	3	0	0	1	0	0	0	0	0	2	75
19:00	0	49	8	0	0	0	0	0	0	0	0	0	0	0	57
20:00	0	48	7	0	0	0	0	0	0	0	0	0	0	0	55
21:00	0	12	4	0	0	0	0	0	0	0	0	0	0	0	16
22:00	0	14	1	0	0	0	0	0	0	0	0	0	0	2	17
23:00	0	10	1	0	0	0	0	0	0	0	0	0	0	1	12
Total	2	1152	240	1	33	1	0	4	0	0	0	0	0	29	1462
Percent	0.1%	78.8%	16.4%	0.1%	2.3%	0.1%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%	
AM Peak	07:00	07:00	07:00		07:00	11:00		07:00						07:00	
Vol.	1	172	32		3	1		1						10	
PM Peak		16:00	14:00	15:00	16:00			13:00						15:00	
Vol.		67	17	1	3			1						3	

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Southbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classed	Total
03/21/14	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
01:00	0	7	0	0	0	0	0	0	0	0	0	0	0	0	7
02:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:00	0	2	2	0	0	0	0	0	0	0	0	0	0	0	4
04:00	0	14	2	0	0	0	0	0	0	0	0	0	0	0	16
05:00	0	44	18	0	3	0	0	0	0	0	0	0	0	0	65
06:00	0	94	27	0	3	0	0	0	0	0	0	0	0	2	126
07:00	0	162	39	0	2	0	0	1	0	0	0	0	0	1	205
08:00	0	152	27	0	4	0	0	1	0	0	0	0	0	1	185
09:00	0	94	10	0	1	0	0	1	0	0	0	0	0	2	108
10:00	0	48	6	0	0	0	0	0	0	0	0	0	0	0	54
11:00	0	35	5	0	3	0	0	0	0	0	0	0	0	1	44
12 PM	0	48	13	0	0	0	0	0	0	0	0	0	0	0	61
13:00	0	46	7	0	0	0	0	0	0	0	0	0	0	0	53
14:00	0	61	9	0	2	0	0	0	0	0	0	0	0	2	74
15:00	1	74	19	0	2	0	0	1	0	0	0	0	0	1	98
16:00	0	69	12	0	1	0	0	0	0	0	0	0	0	2	84
17:00	0	59	8	0	1	0	0	0	0	0	0	0	0	1	69
18:00	0	56	13	0	0	0	0	0	0	0	0	0	0	1	70
19:00	0	44	9	0	0	0	0	0	0	0	0	0	0	0	53
20:00	0	29	5	0	1	0	0	0	0	0	0	0	0	0	35
21:00	0	23	6	0	0	0	0	0	0	0	0	0	0	0	29
22:00	0	21	0	0	1	0	0	0	0	0	0	0	0	0	22
23:00	0	9	1	0	0	0	0	0	0	0	0	0	0	0	10
Total	1	1194	238	0	24	0	0	4	0	0	0	0	0	14	1475
Percent	0.1%	80.9%	16.1%	0.0%	1.6%	0.0%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.9%	
AM Peak		07:00	07:00		08:00			07:00						06:00	
Vol.		162	39		4			1						2	
PM Peak	15:00	15:00	15:00		14:00			15:00						14:00	
Vol.	1	74	19		2			1						2	

Innovative Data, LLC

PO Box 468
Belchertown, Massachusetts
innovativedatallc.com or 1.413.668.5094

Location: Dunstable Road
Location: North of Groton Road
Location: Westford, Massachusetts
Client: The Engineering Corp.

Southbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classed	Total
03/22/14	0	5	0	0	0	0	0	0	0	0	0	0	0	0	5
01:00	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
02:00	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
03:00	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
04:00	0	5	1	0	0	0	0	0	0	0	0	0	0	0	6
05:00	0	8	2	0	0	0	0	0	0	0	0	0	0	1	11
06:00	0	16	3	0	0	0	0	0	0	0	0	0	0	0	19
07:00	0	45	5	1	2	0	0	0	0	0	0	0	0	1	54
08:00	0	42	7	0	3	0	0	0	0	0	0	0	0	0	52
09:00	0	85	6	0	1	0	0	0	0	0	0	0	0	0	92
10:00	0	81	10	0	2	0	0	0	0	0	0	0	0	0	93
11:00	0	68	16	0	0	1	0	0	0	0	0	0	0	2	87
12 PM	0	73	14	0	1	0	0	0	0	0	0	0	0	0	88
13:00	0	63	12	0	0	0	0	0	0	0	0	0	0	0	75
14:00	0	52	12	0	0	0	0	0	0	0	0	0	0	0	64
15:00	0	65	16	0	2	0	0	1	0	0	0	0	0	3	87
16:00	0	73	11	0	1	0	0	0	0	0	0	0	0	0	85
17:00	1	52	8	0	3	0	0	0	0	0	0	0	0	2	66
18:00	0	55	10	0	0	0	0	0	0	0	0	0	0	0	65
19:00	0	38	4	0	1	0	0	0	0	0	0	0	0	0	43
20:00	0	30	5	0	0	0	0	0	0	0	0	0	0	0	35
21:00	0	25	3	0	0	0	0	0	0	0	0	0	0	0	28
22:00	0	19	4	0	0	0	0	0	0	0	0	0	0	0	23
23:00	0	22	5	0	0	0	0	0	0	0	0	0	0	0	27
Total	1	929	154	1	16	1	0	1	0	0	0	0	0	9	1112
Percent	0.1%	83.5%	13.8%	0.1%	1.4%	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.8%	
AM Peak		09:00	11:00	07:00	08:00	11:00								11:00	
Vol.		85	16	1	3	1								2	
PM Peak	17:00	12:00	15:00		17:00			15:00						15:00	
Vol.	1	73	16		3			1						3	
Grand Total	4	3275	632	2	73	2	0	9	0	0	0	0	0	52	4049
Percent	0.1%	80.9%	15.6%	0.0%	1.8%	0.0%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	1.3%	

Innovative Data, LLC

PO Box 468
Belchertown, Massachusetts
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Location: Dunstable Road
Location: North of Groton Road
Location: Westford, Massachusetts
Client: The Engineering Corp.

Northbound, Southbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classed	Total
03/20/14	0	9	2	0	0	0	0	0	0	0	0	0	0	0	11
01:00	0	3	3	0	0	0	0	0	0	0	0	0	0	0	6
02:00	0	3	1	0	0	0	0	0	0	0	0	0	0	0	4
03:00	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
04:00	0	9	4	0	1	0	0	0	0	0	0	0	0	0	14
05:00	0	48	16	0	2	0	0	0	0	0	0	0	0	0	66
06:00	0	108	32	1	2	0	0	0	0	0	0	0	0	0	143
07:00	1	200	42	2	5	0	0	1	0	0	0	0	0	11	262
08:00	0	185	30	1	3	1	0	1	0	0	0	0	0	4	225
09:00	0	106	26	1	4	1	0	0	0	0	0	0	0	0	138
10:00	1	81	19	0	6	0	0	0	0	0	0	0	0	3	110
11:00	0	85	16	0	6	1	0	0	0	0	0	0	0	1	109
12 PM	0	80	18	0	5	0	0	0	0	0	0	0	0	3	106
13:00	0	87	22	0	7	0	0	1	0	0	0	0	0	1	118
14:00	0	126	31	3	0	0	0	1	0	0	0	0	0	0	161
15:00	1	142	40	2	4	0	0	0	0	0	0	0	0	7	196
16:00	0	151	35	1	6	0	0	0	0	0	0	0	0	2	195
17:00	0	238	33	0	6	0	0	1	0	0	0	0	0	2	280
18:00	0	232	32	0	4	0	0	1	0	0	0	0	0	5	274
19:00	0	139	24	0	0	0	0	0	0	0	0	0	0	0	163
20:00	0	128	18	0	1	0	0	0	0	0	0	0	0	0	147
21:00	0	64	7	0	0	0	0	0	0	0	0	0	0	0	71
22:00	0	40	5	0	0	0	0	0	0	0	0	0	0	2	47
23:00	0	32	5	0	0	0	0	0	0	0	0	0	0	2	39
Total	3	2298	461	11	62	3	0	6	0	0	0	0	0	43	2887
Percent	0.1%	79.6%	16.0%	0.4%	2.1%	0.1%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	1.5%	
AM Peak	07:00	07:00	07:00	07:00	10:00	08:00		07:00						07:00	
Vol.	1	200	42	2	6	1		1						11	
PM Peak	15:00	17:00	15:00	14:00	13:00			13:00						15:00	
Vol.	1	238	40	3	7			1						7	

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Location: Dunstable Road
Location: North of Groton Road
Location: Westford, Massachusetts
Client: The Engineering Corp.

Northbound, Southbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classed	Total
03/21/14	0	19	1	0	0	0	0	0	0	0	0	0	0	0	20
01:00	0	13	0	0	0	0	0	0	0	0	0	0	0	0	13
02:00	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
03:00	0	3	2	0	0	0	0	0	0	0	0	0	0	0	5
04:00	0	15	3	0	0	0	0	0	0	0	0	0	0	0	18
05:00	0	46	18	0	3	0	0	0	0	0	0	0	0	0	67
06:00	0	104	32	0	3	0	0	0	0	0	0	0	0	2	141
07:00	0	186	57	2	3	0	0	1	0	0	0	0	0	2	251
08:00	0	180	29	2	4	0	0	1	0	0	0	0	0	1	217
09:00	0	125	18	0	3	0	0	1	0	0	0	0	0	2	149
10:00	0	77	14	0	1	0	0	1	0	0	0	0	0	0	93
11:00	0	81	10	1	7	0	0	0	0	0	0	0	0	1	100
12 PM	0	110	23	0	2	0	0	0	0	0	0	0	0	0	135
13:00	0	96	18	0	2	0	0	0	0	0	0	0	0	0	116
14:00	0	155	25	3	3	0	0	0	0	0	0	0	0	3	189
15:00	1	178	41	1	5	0	0	1	0	0	0	0	0	2	229
16:00	1	193	34	0	4	0	0	1	0	0	0	0	0	5	238
17:00	0	215	32	0	1	0	0	0	0	0	0	0	0	6	254
18:00	0	190	32	0	2	0	0	0	0	0	0	0	0	2	226
19:00	0	120	20	0	3	0	0	0	0	0	0	0	0	1	144
20:00	0	86	10	0	1	0	0	0	0	0	0	0	0	0	97
21:00	0	71	16	0	0	0	0	0	0	0	0	0	0	0	87
22:00	0	59	4	0	1	0	0	0	0	0	0	0	0	0	64
23:00	0	28	5	0	0	0	0	0	0	0	0	0	0	0	33
Total	2	2352	444	9	48	0	0	6	0	0	0	0	0	27	2888
Percent	0.1%	81.4%	15.4%	0.3%	1.7%	0.0%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.9%	
AM Peak		07:00	07:00	07:00	11:00			07:00						06:00	
Vol.		186	57	2	7			1						2	
PM Peak	15:00	17:00	15:00	14:00	15:00			15:00						17:00	
Vol.	1	215	41	3	5			1						6	

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Location: Dunstable Road
Location: North of Groton Road
Location: Westford, Massachusetts
Client: The Engineering Corp.

Northbound, Southbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classed	Total
03/22/14	0	16	0	0	0	0	0	0	0	0	0	0	0	0	16
01:00	0	7	1	0	0	0	0	0	0	0	0	0	0	0	8
02:00	0	5	0	0	0	0	0	0	0	0	0	0	0	0	5
03:00	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
04:00	0	5	1	0	0	0	0	0	0	0	0	0	0	0	6
05:00	0	11	2	0	0	0	0	0	0	0	0	0	0	1	14
06:00	0	23	8	0	1	0	0	0	0	0	0	0	0	0	32
07:00	0	66	16	2	3	0	0	0	0	0	0	0	0	3	90
08:00	0	64	12	0	5	0	0	0	0	0	0	0	0	0	81
09:00	0	118	8	0	2	0	0	0	0	0	0	0	0	1	129
10:00	0	125	22	0	3	0	0	0	0	0	0	0	0	1	151
11:00	0	127	27	0	1	2	0	0	0	0	0	0	0	4	161
12 PM	0	151	30	0	1	0	0	0	0	0	0	0	0	0	182
13:00	0	123	24	0	1	0	0	0	0	0	0	0	0	0	148
14:00	0	125	25	0	3	0	0	0	0	0	0	0	0	0	153
15:00	0	137	26	0	3	0	0	1	0	0	0	0	0	3	170
16:00	0	160	20	0	4	0	0	0	0	0	0	0	0	0	184
17:00	1	130	22	0	4	0	0	0	0	0	0	0	0	4	161
18:00	0	117	20	0	1	0	0	0	0	0	0	0	0	0	138
19:00	0	91	10	0	1	0	0	0	0	0	0	0	0	0	102
20:00	0	70	10	0	0	0	0	0	0	0	0	0	0	0	80
21:00	0	68	7	0	1	0	0	0	0	0	0	0	0	0	76
22:00	0	65	7	0	0	0	0	0	0	0	0	0	0	0	72
23:00	0	43	9	0	0	0	0	0	0	0	0	0	0	0	52
Total	1	1849	307	2	34	2	0	1	0	0	0	0	0	17	2213
Percent	0.0%	83.6%	13.9%	0.1%	1.5%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.8%	
AM Peak		11:00	11:00	07:00	08:00	11:00								11:00	
Vol.		127	27	2	5	2								4	
PM Peak	17:00	16:00	12:00		16:00			15:00						17:00	
Vol.	1	160	30		4			1						4	
Grand Total	6	6499	1212	22	144	5	0	13	0	0	0	0	0	87	7988
Percent	0.1%	81.4%	15.2%	0.3%	1.8%	0.1%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	1.1%	

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PO Box 468
Belchertown, Massachusetts
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Location: Dunstable Road
Location: South of Groton Road
Location: Westford, Massachusetts
Client: The Engineering Corp.

Start Time	20-Mar-14 Thu	Northbound A.M.	Northbound P.M.	Southbound A.M.	Southbound P.M.	Combined A.M.	Combined P.M.	21-Mar- Fri	Northbound A.M.	Northbound P.M.	Southbound A.M.	Southbound P.M.	Combined A.M.	Combined P.M.
12:00		3	7	0	3	3	10		2	9	0	6	2	15
12:15		1	11	0	9	1	20		0	11	0	10	0	21
12:30		2	1	1	3	3	4		2	4	0	6	2	10
12:45		1	6	0	7	1	13		1	7	0	9	1	16
01:00		1	8	0	8	1	16		1	4	1	6	2	10
01:15		0	8	0	10	0	18		0	6	1	4	1	10
01:30		0	8	0	4	0	12		0	6	1	5	1	11
01:45		0	5	0	10	0	15		0	9	0	8	0	17
02:00		0	7	0	12	0	19		1	10	1	12	2	22
02:15		0	3	0	2	0	5		0	13	0	7	0	20
02:30		0	13	0	11	0	24		0	16	0	10	0	26
02:45		0	16	1	8	1	24		1	15	0	***15***	1	30
03:00		1	13	0	6	1	19		1	19	1	***13***	2	32
03:15		0	17	0	13	0	30		0	13	0	***15***	0	28
03:30		0	17	2	10	2	27		0	14	1	***13***	1	27
03:45		0	8	1	9	1	17		0	11	0	12	0	23
04:00		0	11	0	7	0	18		0	12	0	13	0	25
04:15		1	13	1	15	2	28		1	28	4	10	5	38
04:30		0	15	0	17	0	32		0	17	0	9	0	26
04:45		0	18	0	5	0	23		1	22	0	6	1	28
05:00		0	20	1	4	1	24		0	13	0	14	0	27
05:15		0	***24***	2	***9***	2	***33***		1	***15***	5	5	6	***20***
05:30		2	***26***	7	***12***	9	***38***		0	***24***	4	10	4	***34***
05:45		3	***29***	8	***15***	11	***44***		2	***22***	3	10	5	***32***
06:00		2	***27***	9	***13***	11	***40***		4	***24***	5	16	9	***40***
06:15		1	18	8	7	9	25		1	14	8	6	9	20
06:30		2	23	10	10	12	33		1	19	15	7	16	26
06:45		1	19	23	17	24	36		2	12	16	7	18	19
07:00		5	17	16	9	21	26		***8***	8	22	5	30	13
07:15		***13***	13	***30***	9	***43***	22		***9***	11	***27***	5	***36***	16
07:30		***5***	8	***34***	2	***39***	10		***9***	11	***23***	8	***32***	19
07:45		***7***	12	***32***	2	***39***	14		***7***	12	***23***	2	***30***	14
08:00		***8***	12	***29***	3	***37***	15		7	4	***32***	6	***39***	10
08:15		5	16	22	7	27	23		1	9	24	5	25	14
08:30		9	5	25	10	34	15		3	10	24	3	27	13
08:45		1	9	16	10	17	19		5	2	20	3	25	5
09:00		3	5	19	4	22	9		5	14	16	4	21	18
09:15		2	10	11	4	13	14		3	7	13	4	16	11
09:30		5	7	10	2	15	9		1	3	7	6	8	9
09:45		12	9	7	1	19	10		8	1	5	4	13	5
10:00		2	6	12	4	14	10		4	2	4	3	8	5
10:15		3	4	9	2	12	6		7	6	9	4	16	10
10:30		6	3	10	0	16	3		4	4	8	2	12	6
10:45		5	3	7	1	12	4		4	2	6	1	10	3
11:00		9	4	4	2	13	6		6	3	5	1	11	4
11:15		2	4	6	3	8	7		4	1	10	1	14	2
11:30		7	1	7	1	14	2		5	2	4	0	9	2
11:45		9	3	12	0	21	3		8	2	4	0	12	2
Total		139	542	392	332	531	874		130	503	352	331	482	834
Day Total		681		724		1405			633		683		1316	
% Total		9.9%	38.6%	27.9%	23.6%				9.9%	38.2%	26.7%	25.2%		
Peak		07:15	05:15	07:15	05:15	07:15	05:15		07:00	05:15	07:15	02:45	07:15	05:15
Vol.		33	106	125	49	158	155		33	85	105	56	137	126
P.H.F.		0.635	0.914	0.919	0.721	0.919	0.881		0.917	0.885	0.820	0.933	0.878	0.788

Innovative Data, LLC

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Location: Dunstable Road
Location: South of Groton Road
Location: Westford, Massachusetts
Client: The Engineering Corp.

Start Time	22-Mar-14 Sat	Northbound A.M.	Northbound P.M.	Southbound A.M.	Southbound P.M.	Combined A.M.	Combined P.M.	23-Mar- Sun	Northbound A.M.	Northbound P.M.	Southbound A.M.	Southbound P.M.	Combined A.M.	Combined P.M.
12:00		5	12	1	14	6	26		0	*	0	*	0	*
12:15		2	16	1	7	3	23		*	*	*	*	*	*
12:30		0	12	0	6	0	18		*	*	*	*	*	*
12:45		0	8	0	14	0	22		*	*	*	*	*	*
01:00		3	4	1	9	4	13		*	*	*	*	*	*
01:15		0	***13***	0	16	0	***29***		*	*	*	*	*	*
01:30		1	***12***	0	7	1	***19***		*	*	*	*	*	*
01:45		0	***13***	0	12	0	***25***		*	*	*	*	*	*
02:00		0	***12***	0	7	0	***19***		*	*	*	*	*	*
02:15		0	12	1	7	1	19		*	*	*	*	*	*
02:30		0	10	0	7	0	17		*	*	*	*	*	*
02:45		0	6	0	8	0	14		*	*	*	*	*	*
03:00		0	6	0	8	0	14		*	*	*	*	*	*
03:15		0	3	0	7	0	10		*	*	*	*	*	*
03:30		0	9	2	***10***	2	19		*	*	*	*	*	*
03:45		0	11	0	***16***	0	27		*	*	*	*	*	*
04:00		0	12	0	***11***	0	23		*	*	*	*	*	*
04:15		0	10	0	***13***	0	23		*	*	*	*	*	*
04:30		0	12	2	6	2	18		*	*	*	*	*	*
04:45		0	15	0	12	0	27		*	*	*	*	*	*
05:00		0	11	0	9	0	20		*	*	*	*	*	*
05:15		0	10	0	10	0	20		*	*	*	*	*	*
05:30		1	5	3	10	4	15		*	*	*	*	*	*
05:45		0	12	0	7	0	19		*	*	*	*	*	*
06:00		1	4	3	4	4	8		*	*	*	*	*	*
06:15		2	14	3	7	5	21		*	*	*	*	*	*
06:30		3	4	4	7	7	11		*	*	*	*	*	*
06:45		4	2	3	8	7	10		*	*	*	*	*	*
07:00		3	3	3	6	6	9		*	*	*	*	*	*
07:15		3	10	4	7	7	17		*	*	*	*	*	*
07:30		2	11	5	10	7	21		*	*	*	*	*	*
07:45		1	7	6	4	7	11		*	*	*	*	*	*
08:00		2	4	6	3	8	7		*	*	*	*	*	*
08:15		3	6	5	4	8	10		*	*	*	*	*	*
08:30		3	4	7	3	10	7		*	*	*	*	*	*
08:45		6	7	4	2	10	9		*	*	*	*	*	*
09:00		6	1	16	4	22	5		*	*	*	*	*	*
09:15		5	7	8	5	13	12		*	*	*	*	*	*
09:30		9	3	8	6	17	9		*	*	*	*	*	*
09:45		8	4	***13***	5	21	9		*	*	*	*	*	*
10:00		9	7	***12***	3	21	10		*	*	*	*	*	*
10:15		6	10	***12***	1	18	11		*	*	*	*	*	*
10:30		***12***	4	***10***	4	***22***	8		*	*	*	*	*	*
10:45		***7***	3	11	5	***18***	8		*	*	*	*	*	*
11:00		***10***	4	13	2	***23***	6		*	*	*	*	*	*
11:15		***8***	2	13	3	***21***	5		*	*	*	*	*	*
11:30		1	3	8	4	9	7		*	*	*	*	*	*
11:45		9	5	13	2	22	7		*	*	*	*	*	*
Total		135	375	201	342	336	717		0	0	0	0	0	0
Day Total		510		543		1053			0		0		0	
% Total		12.8%	35.6%	19.1%	32.5%				0.0%	0.0%	0.0%	0.0%		
Peak		10:30	01:15	09:45	03:30	10:30	01:15							
Vol.		37	50	47	50	84	92							
P.H.F.		0.771	0.781	0.904	0.781	0.913	0.793							

ADT ADT 1,258 AADT 1,258

Innovative Data, LLC

PO Box 468
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Location: Dunstable Road
Location: South of Groton Road
Location: Westford, Massachusetts
Client: The Engineering Corp.

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	Pace Speed	Number in Pace
03/20/14	0	1	3	3	0	0	0	0	0	0	0	0	0	0	7	21-30	5
01:00	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	14-23	1
02:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	*
03:00	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	14-23	1
04:00	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	14-23	1
05:00	0	0	1	4	0	0	0	0	0	0	0	0	0	0	5	22-31	5
06:00	0	1	2	3	0	0	0	0	0	0	0	0	0	0	6	22-31	4
07:00	**2**	**5**	**8**	**12**	3	0	0	0	0	0	0	0	0	0	**30**	22-31	16
08:00	0	3	8	11	1	0	0	0	0	0	0	0	0	0	23	21-30	16
09:00	0	4	6	10	2	0	0	0	0	0	0	0	0	0	22	21-30	14
10:00	0	0	3	12	1	0	0	0	0	0	0	0	0	0	16	23-32	14
11:00	2	2	4	12	**7**	0	0	0	0	0	0	0	0	0	27	25-34	16
12 PM	0	2	5	14	4	0	0	0	0	0	0	0	0	0	25	22-31	18
13:00	**1**	4	9	10	5	0	0	0	0	0	0	0	0	0	29	22-31	16
14:00	1	1	11	20	6	0	0	0	0	0	0	0	0	0	39	23-32	28
15:00	0	2	21	23	7	**2**	0	0	0	0	0	0	0	0	55	22-31	39
16:00	1	1	13	29	11	2	0	0	0	0	0	0	0	0	57	23-32	40
17:00	1	5	**28**	50	**15**	0	0	0	0	0	0	0	0	0	**99**	22-31	71
18:00	0	2	22	**56**	7	0	0	0	0	0	0	0	0	0	87	23-32	71
19:00	0	2	16	26	6	0	0	0	0	0	0	0	0	0	50	22-31	38
20:00	0	**6**	12	23	1	0	0	0	0	0	0	0	0	0	42	21-30	30
21:00	0	3	13	15	0	0	0	0	0	0	0	0	0	0	31	21-30	24
22:00	0	2	1	12	1	0	0	0	0	0	0	0	0	0	16	24-33	12
23:00	0	0	2	6	4	0	0	0	0	0	0	0	0	0	12	26-35	9
Total	8	46	191	351	81	4	0	0	0	0	0	0	0	0	681		
Percent	1.2%	6.8%	28.0%	51.5%	11.9%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	07:00	07:00	07:00	07:00	11:00										07:00		
Vol.	2	5	8	12	7										30		
PM Peak	13:00	20:00	17:00	18:00	17:00	15:00									17:00		
Vol.	1	6	28	56	15	2									99		

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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	Pace Speed	Number in Pace
03/21/14	0	0	1	1	3	0	0	0	0	0	0	0	0	0	5	26-35	4
01:00	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	19-28	1
02:00	0	0	1	0	1	0	0	0	0	0	0	0	0	0	2	27-36	1
03:00	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	19-28	1
04:00	0	0	1	1	0	0	0	0	0	0	0	0	0	0	2	19-28	2
05:00	0	0	1	1	1	0	0	0	0	0	0	0	0	0	3	24-33	2
06:00	0	0	4	4	0	0	0	0	0	0	0	0	0	0	8	21-30	7
07:00	**1**	**5**	**17**	8	2	0	0	0	0	0	0	0	0	0	**33**	19-28	22
08:00	0	0	3	10	3	0	0	0	0	0	0	0	0	0	16	24-33	13
09:00	0	0	5	6	**5**	**1**	0	0	0	0	0	0	0	0	17	22-31	11
10:00	0	0	6	8	4	1	0	0	0	0	0	0	0	0	19	23-32	13
11:00	0	2	2	**15**	4	0	0	0	0	0	0	0	0	0	23	25-34	17
12 PM	0	0	10	14	7	0	0	0	0	0	0	0	0	0	31	22-31	23
13:00	0	0	11	11	3	0	0	0	0	0	0	0	0	0	25	21-30	20
14:00	**3**	5	20	23	2	1	0	0	0	0	0	0	0	0	54	21-30	35
15:00	0	2	19	27	7	**2**	0	0	0	0	0	0	0	0	57	22-31	41
16:00	2	2	21	**40**	**13**	1	0	0	0	0	0	0	0	0	**79**	22-31	56
17:00	2	5	19	36	12	0	0	0	0	0	0	0	0	0	74	23-32	49
18:00	2	5	**23**	31	7	1	0	0	0	0	0	0	0	0	69	22-31	46
19:00	2	**7**	11	18	4	0	0	0	0	0	0	0	0	0	42	21-30	24
20:00	0	2	7	15	1	0	0	0	0	0	0	0	0	0	25	22-31	19
21:00	0	2	6	14	3	0	0	0	0	0	0	0	0	0	25	23-32	18
22:00	0	0	0	13	1	0	0	0	0	0	0	0	0	0	14	24-33	14
23:00	0	1	2	3	2	0	0	0	0	0	0	0	0	0	8	22-31	5
Total	12	38	190	301	85	7	0	0	0	0	0	0	0	0	633		
Percent	1.9%	6.0%	30.0%	47.6%	13.4%	1.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	07:00	07:00	07:00	11:00	09:00	09:00									07:00		
Vol.	1	5	17	15	5	1									33		
PM Peak	14:00	19:00	18:00	16:00	16:00	15:00									16:00		
Vol.	3	7	23	40	13	2									79		

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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	Pace Speed	Number in Pace
03/22/14	0	0	2	3	2	0	0	0	0	0	0	0	0	0	7	24-33	5
01:00	0	0	2	1	1	0	0	0	0	0	0	0	0	0	4	19-28	3
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	1	0	0	0	0	0	0	0	0	0	0	1	19-28	1
06:00	0	1	2	6	1	0	0	0	0	0	0	0	0	0	10	24-33	7
07:00	0	1	1	6	1	0	0	0	0	0	0	0	0	0	9	23-32	7
08:00	0	1	3	6	4	0	0	0	0	0	0	0	0	0	14	25-34	9
09:00	0	0	**9**	10	**9**	0	0	0	0	0	0	0	0	0	28	22-31	19
10:00	**2**	**2**	8	**16**	5	**1**	0	0	0	0	0	0	0	0	**34**	23-32	21
11:00	0	0	9	14	5	0	0	0	0	0	0	0	0	0	28	23-32	21
12 PM	**2**	**3**	12	23	**8**	0	0	0	0	0	0	0	0	0	48	23-32	31
13:00	0	2	7	25	8	0	0	0	0	0	0	0	0	0	42	23-32	32
14:00	1	0	11	21	7	0	0	0	0	0	0	0	0	0	40	22-31	30
15:00	0	0	6	20	3	0	0	0	0	0	0	0	0	0	29	23-32	25
16:00	0	0	**17**	**28**	4	0	0	0	0	0	0	0	0	0	**49**	22-31	41
17:00	1	1	7	21	8	0	0	0	0	0	0	0	0	0	38	24-33	28
18:00	0	0	8	11	5	0	0	0	0	0	0	0	0	0	24	22-31	18
19:00	0	0	12	15	4	0	0	0	0	0	0	0	0	0	31	22-31	24
20:00	0	0	8	12	1	0	0	0	0	0	0	0	0	0	21	21-30	18
21:00	0	1	3	10	1	0	0	0	0	0	0	0	0	0	15	22-31	12
22:00	0	3	6	14	1	0	0	0	0	0	0	0	0	0	24	22-31	17
23:00	0	1	5	6	2	0	0	0	0	0	0	0	0	0	14	21-30	10
Total	6	16	138	269	80	1	0	0	0	0	0	0	0	0	510		
Percent	1.2%	3.1%	27.1%	52.7%	15.7%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	10:00	10:00	09:00	10:00	09:00	10:00									10:00		
Vol.	2	2	9	16	9	1									34		
PM Peak	12:00	12:00	16:00	16:00	12:00										16:00		
Vol.	2	3	17	28	8										49		
Total	26	100	519	921	246	12	0	0	0	0	0	0	0	0	1824		
Percent	1.4%	5.5%	28.5%	50.5%	13.5%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			

15th Percentile :	20 MPH
50th Percentile :	26 MPH
85th Percentile :	30 MPH
95th Percentile :	33 MPH

Stats

10 MPH Pace Speed :	22-31 MPH
Number in Pace :	1292
Percent in Pace :	70.8%
Number of Vehicles > 40 MPH :	1
Percent of Vehicles > 40 MPH :	0.1%
Mean Speed(Average) :	26 MPH

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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	Pace Speed	Number in Pace
03/20/14	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	19-28	1
01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	*
02:00	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	19-28	1
03:00	1	0	1	1	0	0	0	0	0	0	0	0	0	0	3	24-33	1
04:00	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	19-28	1
05:00	0	**2**	6	9	1	0	0	0	0	0	0	0	0	0	18	21-30	13
06:00	0	0	13	29	8	0	0	0	0	0	0	0	0	0	50	22-31	40
07:00	**4**	0	**17**	**56**	**33**	**2**	0	0	0	0	0	0	0	0	**112**	25-34	81
08:00	2	1	13	52	23	1	0	0	0	0	0	0	0	0	92	24-33	69
09:00	3	1	12	19	12	0	0	0	0	0	0	0	0	0	47	24-33	29
10:00	0	0	9	22	7	0	0	0	0	0	0	0	0	0	38	23-32	30
11:00	0	0	6	17	5	1	0	0	0	0	0	0	0	0	29	23-32	23
12 PM	0	1	2	14	5	0	0	0	0	0	0	0	0	0	22	25-34	17
13:00	**1**	**2**	7	16	6	0	0	0	0	0	0	0	0	0	32	24-33	21
14:00	0	0	5	18	8	2	0	0	0	0	0	0	0	0	33	24-33	25
15:00	0	0	3	**27**	7	1	0	0	0	0	0	0	0	0	38	24-33	32
16:00	0	1	7	27	9	0	0	0	0	0	0	0	0	0	44	24-33	35
17:00	0	2	**8**	17	9	**4**	0	0	0	0	0	0	0	0	40	23-32	25
18:00	0	0	7	27	**11**	1	**1**	0	0	0	0	0	0	0	**47**	25-34	36
19:00	1	0	4	12	4	1	0	0	0	0	0	0	0	0	22	25-34	15
20:00	0	0	4	22	4	0	0	0	0	0	0	0	0	0	30	23-32	26
21:00	0	0	2	7	1	1	0	0	0	0	0	0	0	0	11	23-32	9
22:00	0	0	1	5	1	0	0	0	0	0	0	0	0	0	7	22-31	6
23:00	0	0	0	5	1	0	0	0	0	0	0	0	0	0	6	24-33	6
Total	12	10	127	405	155	14	1	0	0	0	0	0	0	0	724		
Percent	1.7%	1.4%	17.5%	55.9%	21.4%	1.9%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	07:00	05:00	07:00	07:00	07:00	07:00									07:00		
Vol.	4	2	17	56	33	2									112		
PM Peak	13:00	13:00	17:00	15:00	18:00	17:00	18:00								18:00		
Vol.	1	2	8	27	11	4	1								47		

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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	Pace Speed	Number in Pace
03/21/14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	*
01:00	0	0	0	2	1	0	0	0	0	0	0	0	0	0	3	24-33	3
02:00	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	14-23	1
03:00	0	**1**	0	1	0	0	0	0	0	0	0	0	0	0	2	13-22	1
04:00	0	0	0	3	0	**1**	0	0	0	0	0	0	0	0	4	24-33	3
05:00	0	0	1	7	3	1	0	0	0	0	0	0	0	0	12	26-35	9
06:00	0	0	1	30	13	0	0	0	0	0	0	0	0	0	44	25-34	39
07:00	0	0	13	46	**35**	1	0	0	0	0	0	0	0	0	95	25-34	74
08:00	0	1	**15**	**57**	27	0	0	0	0	0	0	0	0	0	**100**	24-33	79
09:00	0	1	9	20	10	1	0	0	0	0	0	0	0	0	41	24-33	29
10:00	0	0	5	13	9	0	0	0	0	0	0	0	0	0	27	25-34	21
11:00	0	1	3	11	7	1	0	0	0	0	0	0	0	0	23	25-34	16
12 PM	0	0	6	16	7	**2**	0	0	0	0	0	0	0	0	31	24-33	23
13:00	0	1	6	9	7	0	0	0	0	0	0	0	0	0	23	25-34	15
14:00	0	0	7	23	**14**	0	0	0	0	0	0	0	0	0	44	25-34	34
15:00	0	0	7	**36**	10	0	0	0	0	0	0	0	0	0	**53**	24-33	45
16:00	**4**	**2**	5	22	5	0	0	0	0	0	0	0	0	0	38	24-33	24
17:00	0	1	**8**	23	4	2	**1**	0	0	0	0	0	0	0	39	23-32	29
18:00	0	0	7	19	8	2	0	0	0	0	0	0	0	0	36	24-33	27
19:00	1	0	3	9	6	1	0	0	0	0	0	0	0	0	20	26-35	13
20:00	0	0	5	11	1	0	0	0	0	0	0	0	0	0	17	22-31	15
21:00	0	0	5	6	7	0	0	0	0	0	0	0	0	0	18	26-35	12
22:00	0	1	2	4	3	0	0	0	0	0	0	0	0	0	10	26-35	6
23:00	0	1	0	0	1	0	0	0	0	0	0	0	0	0	2	13-22	1
Total	5	10	109	368	178	12	1	0	0	0	0	0	0	0	683		
Percent	0.7%	1.5%	16.0%	53.9%	26.1%	1.8%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak		03:00	08:00	08:00	07:00	04:00									08:00		
Vol.		1	15	57	35	1									100		
PM Peak	16:00	16:00	17:00	15:00	14:00	12:00	17:00								15:00		
Vol.	4	2	8	36	14	2	1								53		

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PO Box 468
Belchertown, Massachusetts
innovativedatallc.com or 1.413.668.5094

Location: Dunstable Road
Location: South of Groton Road
Location: Westford, Massachusetts
Client: The Engineering Corp.

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	Pace Speed	Number in Pace
03/22/14	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	15-24	2
01:00	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	19-28	1
02:00	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	19-28	1
03:00	1	0	0	0	1	0	0	0	0	0	0	0	0	0	2	5-14	1
04:00	0	0	0	1	1	0	0	0	0	0	0	0	0	0	2	24-33	2
05:00	0	**1**	1	1	0	0	0	0	0	0	0	0	0	0	3	14-23	2
06:00	0	0	0	9	3	1	0	0	0	0	0	0	0	0	13	24-33	11
07:00	0	0	3	9	6	0	0	0	0	0	0	0	0	0	18	24-33	14
08:00	0	0	2	12	8	0	0	0	0	0	0	0	0	0	22	25-34	18
09:00	0	0	7	19	**18**	1	0	0	0	0	0	0	0	0	45	25-34	34
10:00	0	0	**11**	19	15	0	0	0	0	0	0	0	0	0	45	25-34	32
11:00	**2**	1	7	**21**	14	**2**	0	0	0	0	0	0	0	0	**47**	25-34	31
12 PM	0	**3**	**9**	18	11	0	0	0	0	0	0	0	0	0	41	24-33	27
13:00	0	1	9	24	10	0	0	0	0	0	0	0	0	0	**44**	24-33	33
14:00	0	0	2	17	10	0	0	0	0	0	0	0	0	0	29	25-34	24
15:00	0	0	4	**26**	11	0	0	0	0	0	0	0	0	0	41	25-34	34
16:00	0	1	5	18	**17**	1	0	0	0	0	0	0	0	0	42	26-35	31
17:00	0	1	6	22	5	1	**1**	0	0	0	0	0	0	0	36	24-33	27
18:00	0	0	5	15	4	**2**	0	0	0	0	0	0	0	0	26	23-32	20
19:00	0	2	2	16	7	0	0	0	0	0	0	0	0	0	27	25-34	20
20:00	0	1	3	5	3	0	0	0	0	0	0	0	0	0	12	22-31	8
21:00	0	1	0	14	4	1	0	0	0	0	0	0	0	0	20	25-34	16
22:00	0	1	3	6	2	1	0	0	0	0	0	0	0	0	13	24-33	8
23:00	0	1	0	7	3	0	0	0	0	0	0	0	0	0	11	25-34	9
Total	3	14	81	281	153	10	1	0	0	0	0	0	0	0	543		
Percent	0.6%	2.6%	14.9%	51.7%	28.2%	1.8%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	11:00	05:00	10:00	11:00	09:00	11:00									11:00		
Vol.	2	1	11	21	18	2									47		
PM Peak		12:00	12:00	15:00	16:00	18:00	17:00								13:00		
Vol.		3	9	26	17	2	1								44		
Total	20	34	317	1054	486	36	3	0	0	0	0	0	0	0	1950		
Percent	1.0%	1.7%	16.3%	54.1%	24.9%	1.8%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			

15th Percentile :	23 MPH
50th Percentile :	27 MPH
85th Percentile :	32 MPH
95th Percentile :	34 MPH

Stats

10 MPH Pace Speed :	24-33 MPH
Number in Pace :	1448
Percent in Pace :	74.3%
Number of Vehicles > 40 MPH :	7
Percent of Vehicles > 40 MPH :	0.4%
Mean Speed(Average) :	28 MPH

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Client: The Engineering Corp.

Northbound, 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	Pace Speed	Number in Pace
03/20/14	0	1	3	4	0	0	0	0	0	0	0	0	0	0	8	20-29	6
01:00	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	14-23	1
02:00	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	19-28	1
03:00	1	0	2	1	0	0	0	0	0	0	0	0	0	0	4	22-31	2
04:00	0	0	1	1	0	0	0	0	0	0	0	0	0	0	2	19-28	2
05:00	0	2	7	13	1	0	0	0	0	0	0	0	0	0	23	22-31	17
06:00	0	1	15	32	8	0	0	0	0	0	0	0	0	0	56	22-31	44
07:00	**6**	**5**	**25**	**68**	**36**	**2**	0	0	0	0	0	0	0	0	**142**	24-33	95
08:00	2	4	21	63	24	1	0	0	0	0	0	0	0	0	115	24-33	83
09:00	3	5	18	29	14	0	0	0	0	0	0	0	0	0	69	23-32	42
10:00	0	0	12	34	8	0	0	0	0	0	0	0	0	0	54	23-32	44
11:00	2	2	10	29	12	1	0	0	0	0	0	0	0	0	56	24-33	38
12 PM	0	3	7	28	9	0	0	0	0	0	0	0	0	0	47	24-33	35
13:00	**2**	6	16	26	11	0	0	0	0	0	0	0	0	0	61	23-32	37
14:00	1	1	16	38	14	2	0	0	0	0	0	0	0	0	72	23-32	52
15:00	0	2	24	50	14	3	0	0	0	0	0	0	0	0	93	23-32	69
16:00	1	2	20	56	20	2	0	0	0	0	0	0	0	0	101	23-32	75
17:00	1	**7**	**36**	67	**24**	**4**	0	0	0	0	0	0	0	0	**139**	23-32	95
18:00	0	2	29	**83**	18	1	**1**	0	0	0	0	0	0	0	134	23-32	107
19:00	1	2	20	38	10	1	0	0	0	0	0	0	0	0	72	22-31	53
20:00	0	6	16	45	5	0	0	0	0	0	0	0	0	0	72	22-31	55
21:00	0	3	15	22	1	1	0	0	0	0	0	0	0	0	42	21-30	32
22:00	0	2	2	17	2	0	0	0	0	0	0	0	0	0	23	24-33	18
23:00	0	0	2	11	5	0	0	0	0	0	0	0	0	0	18	24-33	15
Total	20	56	318	756	236	18	1	0	0	0	0	0	0	0	1405		
Percent	1.4%	4.0%	22.6%	53.8%	16.8%	1.3%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	07:00	07:00	07:00	07:00	07:00	07:00									07:00		
Vol.	6	5	25	68	36	2									142		
PM Peak	13:00	17:00	17:00	18:00	17:00	17:00	18:00								17:00		
Vol.	2	7	36	83	24	4	1								139		

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Northbound, Southbound

Start	1	16	21	26	31	36	41	46	51	56	61	66	71	76		Pace	Number
Time	15	20	25	30	35	40	45	50	55	60	65	70	75	999	Total	Speed	in Pace
03/21/14	0	0	1	1	3	0	0	0	0	0	0	0	0	0	5	26-35	4
01:00	0	0	0	3	1	0	0	0	0	0	0	0	0	0	4	24-33	4
02:00	0	0	2	0	1	0	0	0	0	0	0	0	0	0	3	15-24	2
03:00	0	1	0	2	0	0	0	0	0	0	0	0	0	0	3	20-29	2
04:00	0	0	1	4	0	1	0	0	0	0	0	0	0	0	6	22-31	5
05:00	0	0	2	8	4	1	0	0	0	0	0	0	0	0	15	25-34	11
06:00	0	0	5	34	13	0	0	0	0	0	0	0	0	0	52	24-33	44
07:00	**1**	**5**	**30**	54	**37**	1	0	0	0	0	0	0	0	0	**128**	24-33	86
08:00	0	1	18	**67**	30	0	0	0	0	0	0	0	0	0	116	24-33	92
09:00	0	1	14	26	15	**2**	0	0	0	0	0	0	0	0	58	24-33	40
10:00	0	0	11	21	13	1	0	0	0	0	0	0	0	0	46	24-33	33
11:00	0	3	5	26	11	1	0	0	0	0	0	0	0	0	46	24-33	34
12 PM	0	0	16	30	14	2	0	0	0	0	0	0	0	0	62	23-32	45
13:00	0	1	17	20	10	0	0	0	0	0	0	0	0	0	48	22-31	34
14:00	3	5	27	46	16	1	0	0	0	0	0	0	0	0	98	23-32	65
15:00	0	2	26	**63**	17	2	0	0	0	0	0	0	0	0	110	23-32	85
16:00	**6**	4	26	62	**18**	1	0	0	0	0	0	0	0	0	**117**	23-32	80
17:00	2	6	27	59	16	2	**1**	0	0	0	0	0	0	0	113	23-32	78
18:00	2	5	**30**	50	15	**3**	0	0	0	0	0	0	0	0	105	22-31	72
19:00	3	**7**	14	27	10	1	0	0	0	0	0	0	0	0	62	22-31	36
20:00	0	2	12	26	2	0	0	0	0	0	0	0	0	0	42	22-31	34
21:00	0	2	11	20	10	0	0	0	0	0	0	0	0	0	43	23-32	30
22:00	0	1	2	17	4	0	0	0	0	0	0	0	0	0	24	24-33	20
23:00	0	2	2	3	3	0	0	0	0	0	0	0	0	0	10	26-35	5
Total	17	48	299	669	263	19	1	0	0	0	0	0	0	0	1316		
Percent	1.3%	3.6%	22.7%	50.8%	20.0%	1.4%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	07:00	07:00	07:00	08:00	07:00	09:00									07:00		
Vol.	1	5	30	67	37	2									128		
PM Peak	16:00	19:00	18:00	15:00	16:00	18:00	17:00								16:00		
Vol.	6	7	30	63	18	3	1								117		

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Northbound, 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	Pace Speed	Number in Pace
03/22/14	0	0	4	3	2	0	0	0	0	0	0	0	0	0	9	23-32	6
01:00	0	0	2	2	1	0	0	0	0	0	0	0	0	0	5	21-30	4
02:00	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	19-28	1
03:00	1	0	0	0	1	0	0	0	0	0	0	0	0	0	2	5-14	1
04:00	0	0	0	1	1	0	0	0	0	0	0	0	0	0	2	24-33	2
05:00	0	1	1	2	0	0	0	0	0	0	0	0	0	0	4	24-33	2
06:00	0	1	2	15	4	1	0	0	0	0	0	0	0	0	23	24-33	18
07:00	0	1	4	15	7	0	0	0	0	0	0	0	0	0	27	25-34	20
08:00	0	1	5	18	12	0	0	0	0	0	0	0	0	0	36	25-34	27
09:00	0	0	16	29	**27**	1	0	0	0	0	0	0	0	0	73	25-34	52
10:00	**2**	**2**	**19**	**35**	20	1	0	0	0	0	0	0	0	0	**79**	23-32	53
11:00	2	1	16	35	19	**2**	0	0	0	0	0	0	0	0	75	24-33	51
12 PM	**2**	**6**	21	41	19	0	0	0	0	0	0	0	0	0	89	23-32	58
13:00	0	3	16	**49**	18	0	0	0	0	0	0	0	0	0	86	24-33	65
14:00	1	0	13	38	17	0	0	0	0	0	0	0	0	0	69	24-33	53
15:00	0	0	10	46	14	0	0	0	0	0	0	0	0	0	70	24-33	58
16:00	0	1	**22**	46	**21**	1	0	0	0	0	0	0	0	0	**91**	24-33	67
17:00	1	2	13	43	13	1	**1**	0	0	0	0	0	0	0	74	23-32	55
18:00	0	0	13	26	9	**2**	0	0	0	0	0	0	0	0	50	23-32	37
19:00	0	2	14	31	11	0	0	0	0	0	0	0	0	0	58	23-32	43
20:00	0	1	11	17	4	0	0	0	0	0	0	0	0	0	33	22-31	25
21:00	0	2	3	24	5	1	0	0	0	0	0	0	0	0	35	24-33	27
22:00	0	4	9	20	3	1	0	0	0	0	0	0	0	0	37	22-31	26
23:00	0	2	5	13	5	0	0	0	0	0	0	0	0	0	25	24-33	17
Total	9	30	219	550	233	11	1	0	0	0	0	0	0	0	1053		
Percent	0.9%	2.8%	20.8%	52.2%	22.1%	1.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	10:00	10:00	10:00	10:00	09:00	11:00									10:00		
Vol.	2	2	19	35	27	2									79		
PM Peak	12:00	12:00	16:00	13:00	16:00	18:00	17:00								16:00		
Vol.	2	6	22	49	21	2	1								91		
Total	46	134	836	1975	732	48	3	0	0	0	0	0	0	0	3774		
Percent	1.2%	3.6%	22.2%	52.3%	19.4%	1.3%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			

15th Percentile :	21 MPH
50th Percentile :	27 MPH
85th Percentile :	31 MPH
95th Percentile :	34 MPH

Stats

10 MPH Pace Speed :	23-32 MPH
Number in Pace :	2695
Percent in Pace :	71.4%
Number of Vehicles > 40 MPH :	8
Percent of Vehicles > 40 MPH :	0.2%
Mean Speed(Average) :	27 MPH

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Northbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classed	Total
03/20/14	0	7	0	0	0	0	0	0	0	0	0	0	0	0	7
01:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
02:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
04:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
05:00	0	3	2	0	0	0	0	0	0	0	0	0	0	0	5
06:00	0	5	1	0	0	0	0	0	0	0	0	0	0	0	6
07:00	0	22	3	2	1	0	0	0	0	0	0	0	0	2	30
08:00	0	19	2	0	2	0	0	0	0	0	0	0	0	0	23
09:00	0	17	4	0	0	1	0	0	0	0	0	0	0	0	22
10:00	0	13	1	0	2	0	0	0	0	0	0	0	0	0	16
11:00	1	17	5	1	1	0	0	0	0	0	0	0	0	2	27
12 PM	0	17	7	0	1	0	0	0	0	0	0	0	0	0	25
13:00	0	23	4	1	0	0	0	0	0	0	0	0	0	1	29
14:00	0	31	6	2	0	0	0	0	0	0	0	0	0	0	39
15:00	0	41	9	1	4	0	0	0	0	0	0	0	0	0	55
16:00	0	47	8	0	1	0	0	0	0	0	0	0	0	1	57
17:00	0	87	11	0	1	0	0	0	0	0	0	0	0	0	99
18:00	0	79	8	0	0	0	0	0	0	0	0	0	0	0	87
19:00	0	44	6	0	0	0	0	0	0	0	0	0	0	0	50
20:00	0	37	4	0	1	0	0	0	0	0	0	0	0	0	42
21:00	0	31	0	0	0	0	0	0	0	0	0	0	0	0	31
22:00	0	11	4	0	1	0	0	0	0	0	0	0	0	0	16
23:00	0	10	2	0	0	0	0	0	0	0	0	0	0	0	12
Total	1	564	87	7	15	1	0	0	0	0	0	0	0	6	681
Percent	0.1%	82.8%	12.8%	1.0%	2.2%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.9%	
AM Peak	11:00	07:00	11:00	07:00	08:00	09:00								07:00	
Vol.	1	22	5	2	2	1								2	
PM Peak		17:00	17:00	14:00	15:00									13:00	
Vol.		87	11	2	4									1	

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Northbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classed	Total
03/21/14	0	5	0	0	0	0	0	0	0	0	0	0	0	0	5
01:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
02:00	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
03:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
04:00	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
05:00	0	2	1	0	0	0	0	0	0	0	0	0	0	0	3
06:00	0	7	1	0	0	0	0	0	0	0	0	0	0	0	8
07:00	0	24	6	1	1	0	0	0	0	0	0	0	0	1	33
08:00	0	12	2	1	1	0	0	0	0	0	0	0	0	0	16
09:00	0	14	2	0	1	0	0	0	0	0	0	0	0	0	17
10:00	0	15	3	0	0	0	0	1	0	0	0	0	0	0	19
11:00	0	21	0	1	1	0	0	0	0	0	0	0	0	0	23
12 PM	0	26	5	0	0	0	0	0	0	0	0	0	0	0	31
13:00	0	18	6	0	1	0	0	0	0	0	0	0	0	0	25
14:00	1	44	6	1	1	0	0	0	0	0	0	0	0	1	54
15:00	0	45	9	1	2	0	0	0	0	0	0	0	0	0	57
16:00	0	64	12	0	1	0	0	0	0	0	0	0	0	2	79
17:00	0	66	8	0	0	0	0	0	0	0	0	0	0	0	74
18:00	0	60	6	0	2	0	0	0	0	0	0	1	0	0	69
19:00	0	37	4	0	0	0	0	0	0	0	0	0	0	1	42
20:00	0	22	3	0	0	0	0	0	0	0	0	0	0	0	25
21:00	0	20	5	0	0	0	0	0	0	0	0	0	0	0	25
22:00	0	13	1	0	0	0	0	0	0	0	0	0	0	0	14
23:00	0	6	2	0	0	0	0	0	0	0	0	0	0	0	8
Total	1	527	82	5	11	0	0	1	0	0	0	1	0	5	633
Percent	0.2%	83.3%	13.0%	0.8%	1.7%	0.0%	0.0%	0.2%	0.0%	0.0%	0.0%	0.2%	0.0%	0.8%	
AM Peak		07:00	07:00	07:00	07:00			10:00						07:00	
Vol.		24	6	1	1			1						1	
PM Peak	14:00	17:00	16:00	14:00	15:00							18:00		16:00	
Vol.	1	66	12	1	2							1		2	

Innovative Data, LLC

PO Box 468
Belchertown, Massachusetts
innovativedatallc.com or 1.413.668.5094

Location: Dunstable Road
Location: South of Groton Road
Location: Westford, Massachusetts
Client: The Engineering Corp.

Northbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classed	Total
03/22/14	0	7	0	0	0	0	0	0	0	0	0	0	0	0	7
01:00	0	4	0	0	0	0	0	0	0	0	0	0	0	0	4
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	1	0	0	0	0	0	0	0	0	0	0	0	0	1
06:00	0	4	5	0	1	0	0	0	0	0	0	0	0	0	10
07:00	0	4	3	1	1	0	0	0	0	0	0	0	0	0	9
08:00	0	12	2	0	0	0	0	0	0	0	0	0	0	0	14
09:00	0	25	3	0	0	0	0	0	0	0	0	0	0	0	28
10:00	0	28	5	0	1	0	0	0	0	0	0	0	0	0	34
11:00	0	22	6	0	0	0	0	0	0	0	0	0	0	0	28
12 PM	0	41	6	0	0	0	0	0	0	0	0	0	0	1	48
13:00	0	30	11	0	1	0	0	0	0	0	0	0	0	0	42
14:00	0	36	4	0	0	0	0	0	0	0	0	0	0	0	40
15:00	0	24	5	0	0	0	0	0	0	0	0	0	0	0	29
16:00	0	45	3	0	1	0	0	0	0	0	0	0	0	0	49
17:00	0	34	3	0	0	0	0	0	0	0	0	0	0	1	38
18:00	0	24	0	0	0	0	0	0	0	0	0	0	0	0	24
19:00	0	27	4	0	0	0	0	0	0	0	0	0	0	0	31
20:00	0	17	4	0	0	0	0	0	0	0	0	0	0	0	21
21:00	0	15	0	0	0	0	0	0	0	0	0	0	0	0	15
22:00	0	23	1	0	0	0	0	0	0	0	0	0	0	0	24
23:00	0	11	3	0	0	0	0	0	0	0	0	0	0	0	14
Total	0	434	68	1	5	0	0	0	0	0	0	0	0	2	510
Percent	0.0%	85.1%	13.3%	0.2%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	
AM Peak		10:00	11:00	07:00	06:00										
Vol.		28	6	1	1										
PM Peak		16:00	13:00		13:00									12:00	
Vol.		45	11		1									1	
Grand Total	2	1525	237	13	31	1	0	1	0	0	0	1	0	13	1824
Percent	0.1%	83.6%	13.0%	0.7%	1.7%	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%	0.1%	0.0%	0.7%	

Innovative Data, LLC

PO Box 468
Belchertown, Massachusetts
innovativedatallc.com or 1.413.668.5094

Location: Dunstable Road
Location: South of Groton Road
Location: Westford, Massachusetts
Client: The Engineering Corp.

Southbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classed	Total
03/20/14	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:00	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
03:00	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
04:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
05:00	0	12	5	0	1	0	0	0	0	0	0	0	0	0	18
06:00	0	38	12	0	0	0	0	0	0	0	0	0	0	0	50
07:00	0	91	15	1	2	1	0	0	0	0	0	0	0	2	112
08:00	0	79	8	1	2	0	0	0	0	0	0	0	0	2	92
09:00	0	36	8	1	0	1	0	0	0	0	0	0	0	1	47
10:00	0	30	6	0	2	0	0	0	0	0	0	0	0	0	38
11:00	0	24	3	1	0	1	0	0	0	0	0	0	0	0	29
12 PM	0	18	3	0	1	0	0	0	0	0	0	0	0	0	22
13:00	0	21	9	0	0	1	0	0	0	0	0	0	0	1	32
14:00	0	22	11	0	0	0	0	0	0	0	0	0	0	0	33
15:00	0	31	4	1	2	0	0	0	0	0	0	0	0	0	38
16:00	0	37	6	0	1	0	0	0	0	0	0	0	0	0	44
17:00	0	33	7	0	0	0	0	0	0	0	0	0	0	0	40
18:00	0	42	5	0	0	0	0	0	0	0	0	0	0	0	47
19:00	0	20	1	0	1	0	0	0	0	0	0	0	0	0	22
20:00	0	27	2	0	1	0	0	0	0	0	0	0	0	0	30
21:00	0	9	2	0	0	0	0	0	0	0	0	0	0	0	11
22:00	0	6	1	0	0	0	0	0	0	0	0	0	0	0	7
23:00	0	5	1	0	0	0	0	0	0	0	0	0	0	0	6
Total	0	586	110	5	13	4	0	0	0	0	0	0	0	6	724
Percent	0.0%	80.9%	15.2%	0.7%	1.8%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.8%	
AM Peak		07:00	07:00	07:00	07:00	07:00								07:00	
Vol.		91	15	1	2	1								2	
PM Peak		18:00	14:00	15:00	15:00	13:00								13:00	
Vol.		42	11	1	2	1								1	

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Location: Dunstable Road
Location: South of Groton Road
Location: Westford, Massachusetts
Client: The Engineering Corp.

Southbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classed	Total
03/21/14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01:00	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
02:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
03:00	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
04:00	0	4	0	0	0	0	0	0	0	0	0	0	0	0	4
05:00	0	8	4	0	0	0	0	0	0	0	0	0	0	0	12
06:00	0	37	7	0	0	0	0	0	0	0	0	0	0	0	44
07:00	0	79	14	1	1	0	0	0	0	0	0	0	0	0	95
08:00	0	84	14	1	1	0	0	0	0	0	0	0	0	0	100
09:00	0	35	6	0	0	0	0	0	0	0	0	0	0	0	41
10:00	0	25	2	0	0	0	0	0	0	0	0	0	0	0	27
11:00	0	20	2	0	1	0	0	0	0	0	0	0	0	0	23
12 PM	0	29	2	0	0	0	0	0	0	0	0	0	0	0	31
13:00	0	15	7	0	1	0	0	0	0	0	0	0	0	0	23
14:00	0	38	4	0	1	1	0	0	0	0	0	0	0	0	44
15:00	0	48	5	0	0	0	0	0	0	0	0	0	0	0	53
16:00	0	30	4	0	0	0	0	0	0	0	0	0	0	4	38
17:00	0	33	5	0	1	0	0	0	0	0	0	0	0	0	39
18:00	0	31	5	0	0	0	0	0	0	0	0	0	0	0	36
19:00	0	16	3	0	0	0	0	0	0	0	0	0	0	1	20
20:00	0	15	2	0	0	0	0	0	0	0	0	0	0	0	17
21:00	0	15	3	0	0	0	0	0	0	0	0	0	0	0	18
22:00	0	9	0	0	1	0	0	0	0	0	0	0	0	0	10
23:00	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
Total	0	579	89	2	7	1	0	0	0	0	0	0	0	5	683
Percent	0.0%	84.8%	13.0%	0.3%	1.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.7%	
AM Peak		08:00	07:00	07:00	07:00										
Vol.		84	14	1	1										
PM Peak		15:00	13:00		13:00	14:00								16:00	
Vol.		48	7		1	1								4	

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Location: Dunstable Road
Location: South of Groton Road
Location: Westford, Massachusetts
Client: The Engineering Corp.

Southbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classed	Total
03/22/14	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
01:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
02:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
03:00	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
04:00	0	1	1	0	0	0	0	0	0	0	0	0	0	0	2
05:00	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
06:00	0	10	3	0	0	0	0	0	0	0	0	0	0	0	13
07:00	0	15	3	0	0	0	0	0	0	0	0	0	0	0	18
08:00	0	17	4	0	1	0	0	0	0	0	0	0	0	0	22
09:00	0	41	3	0	1	0	0	0	0	0	0	0	0	0	45
10:00	0	38	7	0	0	0	0	0	0	0	0	0	0	0	45
11:00	0	38	7	0	0	0	0	0	0	0	0	0	0	2	47
12 PM	1	34	6	0	0	0	0	0	0	0	0	0	0	0	41
13:00	0	35	9	0	0	0	0	0	0	0	0	0	0	0	44
14:00	0	24	4	0	1	0	0	0	0	0	0	0	0	0	29
15:00	0	32	8	0	1	0	0	0	0	0	0	0	0	0	41
16:00	0	37	5	0	0	0	0	0	0	0	0	0	0	0	42
17:00	1	31	3	0	1	0	0	0	0	0	0	0	0	0	36
18:00	0	24	2	0	0	0	0	0	0	0	0	0	0	0	26
19:00	0	26	1	0	0	0	0	0	0	0	0	0	0	0	27
20:00	0	10	2	0	0	0	0	0	0	0	0	0	0	0	12
21:00	0	18	2	0	0	0	0	0	0	0	0	0	0	0	20
22:00	0	11	2	0	0	0	0	0	0	0	0	0	0	0	13
23:00	0	9	2	0	0	0	0	0	0	0	0	0	0	0	11
Total	2	460	74	0	5	0	0	0	0	0	0	0	0	2	543
Percent	0.4%	84.7%	13.6%	0.0%	0.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	
AM Peak		09:00	10:00		08:00									11:00	
Vol.		41	7		1									2	
PM Peak	12:00	16:00	13:00		14:00										
Vol.	1	37	9		1										
Grand Total	2	1625	273	7	25	5	0	0	0	0	0	0	0	13	1950
Percent	0.1%	83.3%	14.0%	0.4%	1.3%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.7%	

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Location: Dunstable Road
Location: South of Groton Road
Location: Westford, Massachusetts
Client: The Engineering Corp.

Northbound, Southbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classed	Total
03/20/14	0	8	0	0	0	0	0	0	0	0	0	0	0	0	8
01:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
02:00	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
03:00	0	4	0	0	0	0	0	0	0	0	0	0	0	0	4
04:00	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
05:00	0	15	7	0	1	0	0	0	0	0	0	0	0	0	23
06:00	0	43	13	0	0	0	0	0	0	0	0	0	0	0	56
07:00	0	113	18	3	3	1	0	0	0	0	0	0	0	4	142
08:00	0	98	10	1	4	0	0	0	0	0	0	0	0	2	115
09:00	0	53	12	1	0	2	0	0	0	0	0	0	0	1	69
10:00	0	43	7	0	4	0	0	0	0	0	0	0	0	0	54
11:00	1	41	8	2	1	1	0	0	0	0	0	0	0	2	56
12 PM	0	35	10	0	2	0	0	0	0	0	0	0	0	0	47
13:00	0	44	13	1	0	1	0	0	0	0	0	0	0	2	61
14:00	0	53	17	2	0	0	0	0	0	0	0	0	0	0	72
15:00	0	72	13	2	6	0	0	0	0	0	0	0	0	0	93
16:00	0	84	14	0	2	0	0	0	0	0	0	0	0	1	101
17:00	0	120	18	0	1	0	0	0	0	0	0	0	0	0	139
18:00	0	121	13	0	0	0	0	0	0	0	0	0	0	0	134
19:00	0	64	7	0	1	0	0	0	0	0	0	0	0	0	72
20:00	0	64	6	0	2	0	0	0	0	0	0	0	0	0	72
21:00	0	40	2	0	0	0	0	0	0	0	0	0	0	0	42
22:00	0	17	5	0	1	0	0	0	0	0	0	0	0	0	23
23:00	0	15	3	0	0	0	0	0	0	0	0	0	0	0	18
Total	1	1150	197	12	28	5	0	0	0	0	0	0	0	12	1405
Percent	0.1%	81.9%	14.0%	0.9%	2.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.9%	
AM Peak	11:00	07:00	07:00	07:00	08:00	09:00								07:00	
Vol.	1	113	18	3	4	2								4	
PM Peak		18:00	17:00	14:00	15:00	13:00								13:00	
Vol.		121	18	2	6	1								2	

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Location: Westford, Massachusetts
Client: The Engineering Corp.

Northbound, Southbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classed	Total
03/21/14	0	5	0	0	0	0	0	0	0	0	0	0	0	0	5
01:00	0	4	0	0	0	0	0	0	0	0	0	0	0	0	4
02:00	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
03:00	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
04:00	0	6	0	0	0	0	0	0	0	0	0	0	0	0	6
05:00	0	10	5	0	0	0	0	0	0	0	0	0	0	0	15
06:00	0	44	8	0	0	0	0	0	0	0	0	0	0	0	52
07:00	0	103	20	2	2	0	0	0	0	0	0	0	0	1	128
08:00	0	96	16	2	2	0	0	0	0	0	0	0	0	0	116
09:00	0	49	8	0	1	0	0	0	0	0	0	0	0	0	58
10:00	0	40	5	0	0	0	0	1	0	0	0	0	0	0	46
11:00	0	41	2	1	2	0	0	0	0	0	0	0	0	0	46
12 PM	0	55	7	0	0	0	0	0	0	0	0	0	0	0	62
13:00	0	33	13	0	2	0	0	0	0	0	0	0	0	0	48
14:00	1	82	10	1	2	1	0	0	0	0	0	0	0	1	98
15:00	0	93	14	1	2	0	0	0	0	0	0	0	0	0	110
16:00	0	94	16	0	1	0	0	0	0	0	0	0	0	6	117
17:00	0	99	13	0	1	0	0	0	0	0	0	0	0	0	113
18:00	0	91	11	0	2	0	0	0	0	0	0	1	0	0	105
19:00	0	53	7	0	0	0	0	0	0	0	0	0	0	2	62
20:00	0	37	5	0	0	0	0	0	0	0	0	0	0	0	42
21:00	0	35	8	0	0	0	0	0	0	0	0	0	0	0	43
22:00	0	22	1	0	1	0	0	0	0	0	0	0	0	0	24
23:00	0	8	2	0	0	0	0	0	0	0	0	0	0	0	10
Total	1	1106	171	7	18	1	0	1	0	0	0	1	0	10	1316
Percent	0.1%	84.0%	13.0%	0.5%	1.4%	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%	0.1%	0.0%	0.8%	
AM Peak		07:00	07:00	07:00	07:00			10:00						07:00	
Vol.		103	20	2	2			1						1	
PM Peak	14:00	17:00	16:00	14:00	13:00	14:00						18:00		16:00	
Vol.	1	99	16	1	2	1						1		6	

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Location: Dunstable Road
Location: South of Groton Road
Location: Westford, Massachusetts
Client: The Engineering Corp.

Northbound, Southbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classed	Total
03/22/14	0	9	0	0	0	0	0	0	0	0	0	0	0	0	9
01:00	0	5	0	0	0	0	0	0	0	0	0	0	0	0	5
02:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
03:00	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
04:00	0	1	1	0	0	0	0	0	0	0	0	0	0	0	2
05:00	0	4	0	0	0	0	0	0	0	0	0	0	0	0	4
06:00	0	14	8	0	1	0	0	0	0	0	0	0	0	0	23
07:00	0	19	6	1	1	0	0	0	0	0	0	0	0	0	27
08:00	0	29	6	0	1	0	0	0	0	0	0	0	0	0	36
09:00	0	66	6	0	1	0	0	0	0	0	0	0	0	0	73
10:00	0	66	12	0	1	0	0	0	0	0	0	0	0	0	79
11:00	0	60	13	0	0	0	0	0	0	0	0	0	0	2	75
12 PM	1	75	12	0	0	0	0	0	0	0	0	0	0	1	89
13:00	0	65	20	0	1	0	0	0	0	0	0	0	0	0	86
14:00	0	60	8	0	1	0	0	0	0	0	0	0	0	0	69
15:00	0	56	13	0	1	0	0	0	0	0	0	0	0	0	70
16:00	0	82	8	0	1	0	0	0	0	0	0	0	0	0	91
17:00	1	65	6	0	1	0	0	0	0	0	0	0	0	1	74
18:00	0	48	2	0	0	0	0	0	0	0	0	0	0	0	50
19:00	0	53	5	0	0	0	0	0	0	0	0	0	0	0	58
20:00	0	27	6	0	0	0	0	0	0	0	0	0	0	0	33
21:00	0	33	2	0	0	0	0	0	0	0	0	0	0	0	35
22:00	0	34	3	0	0	0	0	0	0	0	0	0	0	0	37
23:00	0	20	5	0	0	0	0	0	0	0	0	0	0	0	25
Total	2	894	142	1	10	0	0	0	0	0	0	0	0	4	1053
Percent	0.2%	84.9%	13.5%	0.1%	0.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	
AM Peak		09:00	11:00	07:00	06:00									11:00	
Vol.		66	13	1	1									2	
PM Peak	12:00	16:00	13:00		13:00									12:00	
Vol.	1	82	20		1									1	
Grand Total	4	3150	510	20	56	6	0	1	0	0	0	1	0	26	3774
Percent	0.1%	83.5%	13.5%	0.5%	1.5%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.7%	

Innovative Data, LLC

PO Box 468
Belchertown, Massachusetts
innovativedatallc.com or 1.413.668.5094

Location: Groton Road (Route 40)
Location: East of Dunstable
Location: Westford, Massachusetts
Client: The Engineering Corp.

Start	20-Mar-14	Westbound		Eastbound		Combined		21-Mar-	Westbound		Eastbound		Combined	
Time	Thu	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	Fri	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
12:00		8	66	9	65	17	131		16	63	12	63	28	126
12:15		6	57	7	58	13	115		17	69	7	71	24	140
12:30		5	77	6	55	11	132		2	69	1	68	3	137
12:45		3	62	2	58	5	120		11	80	3	64	14	144
01:00		11	54	1	69	12	123		4	80	1	64	5	144
01:15		4	54	2	70	6	124		5	66	6	67	11	133
01:30		0	71	4	60	4	131		5	70	3	62	8	132
01:45		2	59	3	48	5	107		4	86	1	78	5	164
02:00		3	72	3	69	6	141		2	95	2	98	4	193
02:15		2	75	3	76	5	151		3	73	2	113	5	186
02:30		2	85	1	68	3	153		3	90	4	86	7	176
02:45		2	91	3	91	5	182		3	97	2	107	5	204
03:00		1	112	1	103	2	215		0	109	2	102	2	211
03:15		1	126	1	105	2	231		3	105	0	86	3	191
03:30		2	113	3	90	5	203		2	124	1	103	3	227
03:45		6	113	2	103	8	216		3	125	7	106	10	231
04:00		6	122	7	107	13	229		8	118	6	***124***	14	242
04:15		2	127	9	107	11	234		2	112	15	***119***	17	231
04:30		4	118	14	***103***	18	221		3	102	11	***118***	14	220
04:45		8	124	11	***112***	19	***236***		11	***136***	20	***107***	31	***243***
05:00		9	***135***	21	***103***	30	***238***		7	***140***	16	93	23	***233***
05:15		14	***135***	43	***131***	57	***266***		16	***131***	38	108	54	***239***
05:30		17	***142***	49	102	66	***244***		18	***141***	50	101	68	***242***
05:45		19	***138***	57	88	76	226		17	120	58	114	75	234
06:00		26	135	54	110	80	245		29	133	44	78	73	211
06:15		40	135	62	73	102	208		30	118	71	102	101	220
06:30		59	86	83	75	142	161		53	113	98	96	151	209
06:45		76	112	104	69	180	181		67	102	89	88	156	190
07:00		***128***	89	103	63	***231***	152		***98***	82	112	67	***210***	149
07:15		***123***	88	142	51	***265***	139		***139***	88	129	75	***268***	163
07:30		***101***	85	***178***	46	***279***	131		***86***	76	***165***	55	***251***	131
07:45		***80***	74	***126***	33	***206***	107		***99***	66	***135***	36	***234***	102
08:00		66	65	***119***	22	185	87		78	66	***128***	41	206	107
08:15		80	63	***144***	40	224	103		69	83	***131***	36	200	119
08:30		48	55	126	23	174	78		58	67	158	31	216	98
08:45		76	61	112	29	188	90		52	56	113	30	165	86
09:00		69	59	107	24	176	83		75	68	103	21	178	89
09:15		53	56	85	18	138	74		58	74	89	25	147	99
09:30		40	46	93	12	133	58		58	48	103	23	161	71
09:45		39	36	61	23	100	59		44	55	84	26	128	81
10:00		46	28	67	8	113	36		59	47	69	25	128	72
10:15		46	23	59	12	105	35		49	35	59	21	108	56
10:30		43	19	59	15	102	34		54	40	91	21	145	61
10:45		41	15	51	11	92	26		54	20	68	16	122	36
11:00		59	22	51	16	110	38		54	16	66	16	120	32
11:15		52	19	92	6	144	25		58	34	97	15	155	49
11:30		41	13	63	11	104	24		73	32	63	15	136	47
11:45		49	12	55	6	104	18		58	15	64	12	122	27
Total		1618	3724	2458	2837	4076	6561		1717	3935	2597	3193	4314	7128
Day Total		5342		5295		10637			5652		5790		11442	
% Total		15.2%	35.0%	23.1%	26.7%				15.0%	34.4%	22.7%	27.9%		
Peak		07:00	05:00	07:30	04:30	07:00	04:45		07:00	04:45	07:30	04:00	07:00	04:45
Vol.		432	550	567	449	981	984		422	548	559	468	963	957
P.H.F.		0.844	0.968	0.796	0.857	0.879	0.925		0.759	0.972	0.847	0.944	0.898	0.985

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Location: Groton Road (Route 40)
Location: East of Dunstable
Location: Westford, Massachusetts
Client: The Engineering Corp.

Start Time	22-Mar-14 Sat	Westbound A.M.	Westbound P.M.	Eastbound A.M.	Eastbound P.M.	Combined A.M.	Combined P.M.	23-Mar- Sun	Westbound A.M.	Westbound P.M.	Eastbound A.M.	Eastbound P.M.	Combined A.M.	Combined P.M.
12:00		23	77	14	***102***	37	179		0	*	0	*	0	*
12:15		18	68	11	***113***	29	181		*	*	*	*	*	*
12:30		7	104	10	***99***	17	203		*	*	*	*	*	*
12:45		6	83	4	***98***	10	181		*	*	*	*	*	*
01:00		13	77	2	89	15	166		*	*	*	*	*	*
01:15		5	74	3	93	8	167		*	*	*	*	*	*
01:30		1	102	6	85	7	187		*	*	*	*	*	*
01:45		6	103	5	65	11	168		*	*	*	*	*	*
02:00		7	101	2	79	9	180		*	*	*	*	*	*
02:15		6	105	0	82	6	187		*	*	*	*	*	*
02:30		1	104	6	70	7	174		*	*	*	*	*	*
02:45		5	98	1	79	6	177		*	*	*	*	*	*
03:00		0	91	1	88	1	179		*	*	*	*	*	*
03:15		1	***103***	1	66	2	169		*	*	*	*	*	*
03:30		2	***118***	1	85	3	***203***		*	*	*	*	*	*
03:45		4	***111***	1	73	5	***184***		*	*	*	*	*	*
04:00		5	***102***	7	96	12	***198***		*	*	*	*	*	*
04:15		3	84	7	90	10	***174***		*	*	*	*	*	*
04:30		2	83	3	88	5	171		*	*	*	*	*	*
04:45		3	84	6	74	9	158		*	*	*	*	*	*
05:00		5	86	2	81	7	167		*	*	*	*	*	*
05:15		1	79	16	72	17	151		*	*	*	*	*	*
05:30		7	82	15	97	22	179		*	*	*	*	*	*
05:45		7	91	17	80	24	171		*	*	*	*	*	*
06:00		7	99	20	85	27	184		*	*	*	*	*	*
06:15		9	82	17	72	26	154		*	*	*	*	*	*
06:30		25	68	27	68	52	136		*	*	*	*	*	*
06:45		9	67	35	54	44	121		*	*	*	*	*	*
07:00		14	65	52	64	66	129		*	*	*	*	*	*
07:15		25	67	36	50	61	117		*	*	*	*	*	*
07:30		21	67	41	45	62	112		*	*	*	*	*	*
07:45		45	62	52	39	97	101		*	*	*	*	*	*
08:00		25	55	48	36	73	91		*	*	*	*	*	*
08:15		43	63	52	28	95	91		*	*	*	*	*	*
08:30		30	45	61	22	91	67		*	*	*	*	*	*
08:45		39	62	65	28	104	90		*	*	*	*	*	*
09:00		45	56	79	23	124	79		*	*	*	*	*	*
09:15		41	39	83	24	124	63		*	*	*	*	*	*
09:30		35	42	88	18	123	60		*	*	*	*	*	*
09:45		46	62	97	21	143	83		*	*	*	*	*	*
10:00		53	57	101	19	154	76		*	*	*	*	*	*
10:15		42	44	89	20	131	64		*	*	*	*	*	*
10:30		57	36	93	16	150	52		*	*	*	*	*	*
10:45		59	43	***107***	16	166	59		*	*	*	*	*	*
11:00		***66***	28	***98***	21	***164***	49		*	*	*	*	*	*
11:15		***82***	36	***104***	18	***186***	54		*	*	*	*	*	*
11:30		***75***	18	***109***	17	***184***	35		*	*	*	*	*	*
11:45		***98***	17	74	15	***172***	32		*	*	*	*	*	*
Total		1129	3490	1769	2863	2898	6353		0	0	0	0	0	0
Day Total		4619		4632		9251			0		0		0	
% Total		12.2%	37.7%	19.1%	30.9%				0.0%	0.0%	0.0%	0.0%		
Peak		11:00	03:15	10:45	12:00	11:00	03:30							
Vol.		321	434	418	412	706	759							
P.H.F.		0.819	0.919	0.959	0.912	0.949	0.935							

ADT	ADT 10,436	AADT 10,436

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Location: Groton Road (Route 40)
Location: East of Dunstable
Location: Westford, Massachusetts
Client: The Engineering Corp.

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	Pace Speed	Number in Pace
03/20/14	0	0	0	2	5	8	7	0	0	0	0	0	0	0	22	35-44	14
01:00	2	0	0	2	6	6	1	0	0	0	0	0	0	0	17	29-38	10
02:00	0	0	0	2	0	4	2	1	0	0	0	0	0	0	9	37-46	5
03:00	1	0	1	1	0	6	1	0	0	0	0	0	0	0	10	35-44	6
04:00	0	0	0	0	4	9	5	1	1	0	0	0	0	0	20	34-43	14
05:00	0	0	0	3	11	35	9	1	0	0	0	0	0	0	59	33-42	45
06:00	11	**4**	4	13	37	83	42	5	1	**1**	0	0	0	0	201	34-43	117
07:00	**28**	3	**10**	**24**	**98**	**173**	**85**	9	2	0	0	0	0	0	**432**	33-42	252
08:00	15	0	0	13	55	117	59	11	0	0	0	0	0	0	270	34-43	167
09:00	5	0	0	17	43	75	51	6	**3**	1	0	0	0	0	201	34-43	120
10:00	2	1	2	8	23	67	58	15	0	0	0	0	0	0	176	36-45	113
11:00	4	0	1	12	32	59	72	**19**	2	0	0	0	0	0	201	36-45	119
12 PM	6	0	3	15	43	98	78	18	1	0	0	0	0	0	262	35-44	161
13:00	3	0	0	7	39	92	75	22	0	0	0	0	0	0	238	35-44	154
14:00	10	**2**	3	17	59	136	78	17	0	**1**	0	0	0	0	323	34-43	201
15:00	25	2	4	29	104	161	122	17	0	0	0	0	0	0	464	34-43	264
16:00	24	0	5	35	81	177	**144**	**23**	**2**	0	0	0	0	0	491	35-44	288
17:00	**29**	1	**10**	63	**140**	**204**	92	11	0	0	0	0	0	0	**550**	32-41	313
18:00	15	0	5	**67**	134	156	80	11	0	0	0	0	0	0	468	32-41	267
19:00	3	2	3	26	90	131	74	6	1	0	0	0	0	0	336	33-42	212
20:00	4	1	4	20	44	100	60	11	0	0	0	0	0	0	244	34-43	151
21:00	3	0	1	10	39	87	50	6	1	0	0	0	0	0	197	34-43	131
22:00	1	0	0	3	14	28	31	7	1	0	0	0	0	0	85	35-44	54
23:00	0	0	0	4	18	16	22	6	0	0	0	0	0	0	66	35-44	37
Total	191	16	56	393	1119	2028	1298	223	15	3	0	0	0	0	5342		
Percent	3.6%	0.3%	1.0%	7.4%	20.9%	38.0%	24.3%	4.2%	0.3%	0.1%	0.0%	0.0%	0.0%	0.0%			
AM Peak	07:00	06:00	07:00	07:00	07:00	07:00	07:00	11:00	09:00	06:00					07:00		
Vol.	28	4	10	24	98	173	85	19	3	1					432		
PM Peak	17:00	14:00	17:00	18:00	17:00	17:00	16:00	16:00	16:00	14:00					17:00		
Vol.	29	2	10	67	140	204	144	23	2	1					550		

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Location: Groton Road (Route 40)
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Client: The Engineering Corp.

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	Pace Speed	Number in Pace
03/21/14	0	0	0	2	8	21	11	4	0	0	0	0	0	0	46	34-43	31
01:00	0	0	0	3	3	6	6	0	0	0	0	0	0	0	18	35-44	11
02:00	0	0	0	2	0	1	8	0	0	0	0	0	0	0	11	38-47	9
03:00	1	0	1	0	0	2	4	0	0	0	0	0	0	0	8	35-44	5
04:00	0	0	0	1	5	10	7	1	0	0	0	0	0	0	24	35-44	16
05:00	3	0	0	0	5	28	16	6	0	0	0	0	0	0	58	35-44	39
06:00	3	0	0	1	30	66	72	6	**1**	0	0	0	0	0	179	36-45	124
07:00	**23**	2	0	**26**	**83**	**161**	**108**	**19**	0	0	0	0	0	0	**422**	34-43	248
08:00	14	0	**3**	11	63	105	47	14	0	0	0	0	0	0	257	33-42	155
09:00	9	0	0	13	50	106	50	7	0	0	0	0	0	0	235	34-43	151
10:00	2	0	1	13	45	89	51	15	0	0	0	0	0	0	216	34-43	137
11:00	4	**3**	3	20	55	82	66	9	1	0	0	0	0	0	243	34-43	141
12 PM	6	1	4	20	61	112	63	14	0	0	0	0	0	0	281	33-42	171
13:00	18	0	7	26	70	100	74	7	0	0	0	0	0	0	302	34-43	165
14:00	18	3	8	34	78	132	67	**15**	0	0	0	0	0	0	355	33-42	197
15:00	20	0	14	33	127	161	100	7	**1**	0	0	0	0	0	463	33-42	268
16:00	**22**	0	2	27	108	**206**	87	15	1	0	0	0	0	0	468	33-42	295
17:00	20	0	**21**	54	**149**	178	**104**	5	1	0	0	0	0	0	**532**	32-41	302
18:00	18	**8**	12	**69**	129	136	87	6	1	0	0	0	0	0	466	32-41	243
19:00	8	0	8	13	82	127	66	8	0	0	0	0	0	0	312	33-42	199
20:00	4	0	1	15	72	121	51	8	0	0	0	0	0	0	272	33-42	182
21:00	4	0	1	23	68	95	46	8	0	0	0	0	0	0	245	32-41	153
22:00	2	0	1	6	32	55	37	8	1	0	0	0	0	0	142	34-43	89
23:00	1	0	2	9	10	36	31	7	0	0	0	**1**	0	0	97	36-45	61
Total	200	17	89	421	1333	2136	1259	189	7	0	0	1	0	0	5652		
Percent	3.5%	0.3%	1.6%	7.4%	23.6%	37.8%	22.3%	3.3%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	07:00	11:00	08:00	07:00	07:00	07:00	07:00	07:00	06:00						07:00		
Vol.	23	3	3	26	83	161	108	19	1						422		
PM Peak	16:00	18:00	17:00	18:00	17:00	16:00	17:00	14:00	15:00			23:00			17:00		
Vol.	22	8	21	69	149	206	104	15	1			1			532		

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Client: The Engineering Corp.

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	Pace Speed	Number in Pace
03/22/14	1	0	0	2	8	16	22	5	0	0	0	0	0	0	54	37-46	34
01:00	0	0	0	0	4	10	9	2	0	0	0	0	0	0	25	36-45	17
02:00	0	0	0	1	3	6	8	1	0	0	0	0	0	0	19	35-44	13
03:00	0	0	1	0	0	4	2	0	0	0	0	0	0	0	7	36-45	5
04:00	0	0	0	0	2	6	2	2	1	0	0	0	0	0	13	34-43	8
05:00	0	0	0	2	3	8	3	3	0	**1**	0	0	0	0	20	34-43	11
06:00	1	0	0	2	12	20	10	5	0	0	0	0	0	0	50	33-42	31
07:00	3	0	2	5	14	37	34	10	0	0	0	0	0	0	105	35-44	64
08:00	4	0	0	4	32	41	45	9	**2**	0	0	0	0	0	137	35-44	80
09:00	3	0	1	3	37	73	42	8	0	0	0	0	0	0	167	34-43	111
10:00	7	0	0	15	37	78	66	7	1	0	0	0	0	0	211	35-44	131
11:00	**12**	**1**	**6**	**21**	**46**	**119**	**100**	**16**	0	0	0	0	0	0	**321**	35-44	196
12 PM	6	0	1	21	**80**	108	95	19	2	0	0	0	0	0	332	34-43	194
13:00	**14**	0	6	20	51	126	113	25	1	0	0	0	0	0	356	35-44	213
14:00	11	1	**8**	10	62	**151**	**141**	24	0	0	0	0	0	0	408	35-44	262
15:00	9	**3**	2	23	77	146	134	**27**	1	**1**	0	0	0	0	**423**	35-44	256
16:00	10	0	2	9	69	140	103	18	1	0	**1**	0	0	0	353	35-44	225
17:00	7	0	3	29	74	122	81	20	1	1	0	0	0	0	338	34-43	197
18:00	6	3	3	**30**	69	122	72	11	0	0	0	0	0	0	316	34-43	189
19:00	4	0	2	20	58	110	57	8	2	0	0	0	0	0	261	33-42	166
20:00	0	0	1	10	33	101	66	11	**3**	0	0	0	0	0	225	35-44	155
21:00	3	0	3	19	56	71	39	8	0	0	0	0	0	0	199	32-41	119
22:00	1	0	1	15	25	90	41	6	1	0	0	0	0	0	180	34-43	124
23:00	1	0	0	5	25	39	26	3	0	0	0	0	0	0	99	34-43	64
Total	103	8	42	266	877	1744	1311	248	16	3	1	0	0	0	4619		
Percent	2.2%	0.2%	0.9%	5.8%	19.0%	37.8%	28.4%	5.4%	0.3%	0.1%	0.0%	0.0%	0.0%	0.0%			
AM Peak	11:00	11:00	11:00	11:00	11:00	11:00	11:00	11:00	08:00	05:00					11:00		
Vol.	12	1	6	21	46	119	100	16	2	1					321		
PM Peak	13:00	15:00	14:00	18:00	12:00	14:00	14:00	15:00	20:00	15:00	16:00				15:00		
Vol.	14	3	8	30	80	151	141	27	3	1	1				423		
Total	494	41	187	1080	3329	5908	3868	660	38	6	1	1	0	0	15613		
Percent	3.2%	0.3%	1.2%	6.9%	21.3%	37.8%	24.8%	4.2%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%			

15th Percentile : 29 MPH
50th Percentile : 37 MPH
85th Percentile : 42 MPH
95th Percentile : 45 MPH

Stats

10 MPH Pace Speed : 34-43 MPH
Number in Pace : 9312
Percent in Pace : 59.6%
Number of Vehicles > 40 MPH : 4694
Percent of Vehicles > 40 MPH : 30.1%
Mean Speed(Average) : 36 MPH

Innovative Data, LLC

PO Box 468
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Location: Groton Road (Route 40)
Location: East of Dunstable
Location: Westford, Massachusetts
Client: The Engineering Corp.

Eastbound

Start	1	16	21	26	31	36	41	46	51	56	61	66	71	76		Pace	Number
Time	15	20	25	30	35	40	45	50	55	60	65	70	75	999	Total	Speed	in Pace
03/20/14	0	0	1	6	10	7	0	0	0	0	0	0	0	0	24	29-38	17
01:00	0	0	1	3	3	2	0	0	**1**	0	0	0	0	0	10	26-35	6
02:00	0	0	1	2	4	2	1	0	0	0	0	0	0	0	10	29-38	6
03:00	0	0	0	1	3	3	0	0	0	0	0	0	0	0	7	32-41	5
04:00	0	0	3	12	11	13	2	0	0	0	0	0	0	0	41	29-38	24
05:00	0	0	6	28	76	58	2	0	0	0	0	0	0	0	170	30-39	124
06:00	13	3	10	53	108	109	7	0	0	0	0	0	0	0	303	30-39	192
07:00	**33**	**4**	**20**	74	**251**	162	5	0	0	0	0	0	0	0	**549**	30-39	363
08:00	13	1	1	**83**	216	**179**	7	**1**	0	0	0	0	0	0	501	30-39	356
09:00	1	0	7	49	119	158	12	0	0	0	0	0	0	0	346	31-40	251
10:00	3	0	6	29	68	115	**14**	1	0	0	0	0	0	0	236	31-40	165
11:00	3	2	5	28	81	131	10	1	0	0	0	0	0	0	261	31-40	189
12 PM	8	0	4	24	86	103	11	0	0	0	0	0	0	0	236	31-40	166
13:00	5	0	3	20	101	107	11	0	0	0	0	0	0	0	247	31-40	184
14:00	12	0	**12**	**39**	117	112	10	**2**	0	0	0	0	0	0	304	31-40	201
15:00	17	0	1	34	173	155	**20**	1	0	0	0	0	0	0	401	31-40	285
16:00	**29**	0	2	28	168	**187**	15	0	0	0	0	0	0	0	**429**	31-40	301
17:00	29	0	0	37	**174**	172	11	1	0	0	0	0	0	0	424	31-40	294
18:00	17	0	1	35	114	143	17	0	0	0	0	0	0	0	327	31-40	223
19:00	5	0	0	21	81	75	10	1	0	0	0	0	0	0	193	31-40	138
20:00	0	0	3	22	44	39	6	0	0	0	0	0	0	0	114	30-39	77
21:00	2	0	0	5	38	25	7	0	0	0	0	0	0	0	77	30-39	56
22:00	1	0	1	4	11	21	8	0	0	0	0	0	0	0	46	33-42	30
23:00	0	0	3	4	12	16	3	1	0	0	0	0	0	0	39	32-41	25
Total	191	10	91	641	2069	2094	189	9	1	0	0	0	0	0	5295		
Percent	3.6%	0.2%	1.7%	12.1%	39.1%	39.5%	3.6%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	07:00	07:00	07:00	08:00	07:00	08:00	10:00	08:00	01:00						07:00		
Vol.	33	4	20	83	251	179	14	1	1						549		
PM Peak	16:00		14:00	14:00	17:00	16:00	15:00	14:00							16:00		
Vol.	29		12	39	174	187	20	2							429		

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Location: Groton Road (Route 40)
Location: East of Dunstable
Location: Westford, Massachusetts
Client: The Engineering Corp.

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	Pace Speed	Number in Pace
03/21/14	0	0	0	3	10	8	2	0	0	0	0	0	0	0	23	31-40	16
01:00	0	0	0	4	3	3	1	0	0	0	0	0	0	0	11	26-35	7
02:00	0	0	0	2	5	2	0	1	0	0	0	0	0	0	10	27-36	7
03:00	0	0	2	1	1	6	0	0	0	0	0	0	0	0	10	32-41	7
04:00	0	0	3	10	6	26	6	1	0	0	0	0	0	0	52	33-42	32
05:00	4	0	2	31	42	76	7	0	0	0	0	0	0	0	162	31-40	106
06:00	6	0	6	50	90	139	11	0	0	0	0	0	0	0	302	31-40	206
07:00	**20**	**4**	**18**	**91**	**215**	182	11	0	0	0	0	0	0	0	**541**	30-39	355
08:00	13	1	2	87	214	**200**	**13**	0	0	0	0	0	0	0	530	30-39	371
09:00	8	0	3	55	146	158	8	1	0	0	0	0	0	0	379	31-40	271
10:00	2	0	3	24	118	130	9	1	0	0	0	0	0	0	287	31-40	221
11:00	6	0	3	24	110	134	11	**2**	0	0	0	0	0	0	290	31-40	215
12 PM	4	0	4	28	117	99	**14**	0	0	0	0	0	0	0	266	30-39	193
13:00	13	0	0	35	106	105	12	0	0	0	0	0	0	0	271	31-40	184
14:00	**24**	**4**	6	49	**186**	121	12	**2**	0	0	0	0	0	0	404	30-39	269
15:00	16	1	2	44	131	191	12	0	0	0	0	0	0	0	397	31-40	281
16:00	20	0	2	32	181	**221**	12	0	0	0	0	0	0	0	**468**	31-40	347
17:00	24	0	3	35	157	190	6	1	0	0	0	0	0	0	416	31-40	297
18:00	21	2	**12**	**58**	164	102	5	0	0	0	0	0	0	0	364	30-39	237
19:00	6	0	3	31	97	89	7	0	0	0	0	0	0	0	233	30-39	165
20:00	4	0	2	17	60	51	4	0	0	0	0	0	0	0	138	30-39	98
21:00	2	0	1	9	35	40	8	0	0	0	0	0	0	0	95	31-40	67
22:00	2	0	0	6	34	35	6	0	0	0	0	0	0	0	83	31-40	61
23:00	0	0	0	3	19	28	8	0	0	0	0	0	0	0	58	32-41	43
Total	195	12	77	729	2247	2336	185	9	0	0	0	0	0	0	5790		
Percent	3.4%	0.2%	1.3%	12.6%	38.8%	40.3%	3.2%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	07:00	07:00	07:00	07:00	07:00	08:00	08:00	11:00							07:00		
Vol.	20	4	18	91	215	200	13	2							541		
PM Peak	14:00	14:00	18:00	18:00	14:00	16:00	12:00	14:00							16:00		
Vol.	24	4	12	58	186	221	14	2							468		

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Location: Groton Road (Route 40)
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Location: Westford, Massachusetts
Client: The Engineering Corp.

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	Pace Speed	Number in Pace
03/22/14	1	0	1	4	10	22	1	0	0	0	0	0	0	0	39	32-41	29
01:00	0	0	0	3	2	10	1	0	0	0	0	0	0	0	16	33-42	12
02:00	0	0	0	0	3	5	1	0	0	0	0	0	0	0	9	33-42	7
03:00	0	0	0	0	2	1	1	0	0	0	0	0	0	0	4	29-38	3
04:00	0	0	1	4	6	11	1	0	0	0	0	0	0	0	23	31-40	16
05:00	2	0	3	5	17	22	1	0	0	0	0	0	0	0	50	31-40	34
06:00	1	0	1	7	30	50	10	0	0	0	0	0	0	0	99	32-41	73
07:00	6	**1**	1	22	37	95	**19**	0	0	0	0	0	0	0	181	33-42	121
08:00	2	0	2	31	69	104	17	**1**	0	0	0	0	0	0	226	31-40	157
09:00	6	0	**5**	49	137	140	10	0	0	0	0	0	0	0	347	31-40	247
10:00	8	1	5	**51**	142	172	11	0	0	0	0	0	0	0	**390**	31-40	279
11:00	**12**	0	4	29	**143**	**178**	18	1	0	0	0	0	0	0	385	31-40	281
12 PM	12	0	3	**41**	**141**	**200**	15	0	0	0	0	0	0	0	**412**	31-40	300
13:00	17	0	2	26	120	157	10	0	0	0	0	0	0	0	332	31-40	238
14:00	**21**	0	3	20	77	168	21	0	0	0	0	0	0	0	310	32-41	214
15:00	12	0	3	36	89	146	**26**	0	0	0	0	0	0	0	312	32-41	209
16:00	14	**2**	**5**	36	117	154	20	0	0	0	0	0	0	0	348	31-40	237
17:00	16	0	4	32	92	159	26	**1**	0	0	0	0	0	0	330	32-41	221
18:00	9	0	2	23	113	120	12	0	0	0	0	0	0	0	279	31-40	204
19:00	1	0	1	12	88	88	8	0	0	0	0	0	0	0	198	31-40	157
20:00	0	2	1	16	33	58	3	0	0	**1**	0	0	0	0	114	31-40	82
21:00	3	0	2	9	35	35	2	0	0	0	0	0	0	0	86	31-40	61
22:00	0	1	0	10	24	25	11	0	0	0	0	0	0	0	71	31-40	45
23:00	1	0	2	10	31	25	2	0	0	0	0	0	0	0	71	30-39	51
Total	144	7	51	476	1558	2145	247	3	0	1	0	0	0	0	4632		
Percent	3.1%	0.2%	1.1%	10.3%	33.6%	46.3%	5.3%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	11:00	07:00	09:00	10:00	11:00	11:00	07:00	08:00							10:00		
Vol.	12	1	5	51	143	178	19	1							390		
PM Peak	14:00	16:00	16:00	12:00	12:00	12:00	15:00	17:00		20:00					12:00		
Vol.	21	2	5	41	141	200	26	1		1					412		
Total	530	29	219	1846	5874	6575	621	21	1	1	0	0	0	0	15717		
Percent	3.4%	0.2%	1.4%	11.7%	37.4%	41.8%	4.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			

15th Percentile :	28 MPH
50th Percentile :	34 MPH
85th Percentile :	38 MPH
95th Percentile :	40 MPH

Stats

10 MPH Pace Speed :	31-40 MPH
Number in Pace :	10946
Percent in Pace :	69.6%
Number of Vehicles > 40 MPH :	1322
Percent of Vehicles > 40 MPH :	8.4%
Mean Speed(Average) :	33 MPH

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Location: Groton Road (Route 40)
Location: East of Dunstable
Location: Westford, Massachusetts
Client: The Engineering Corp.

Westbound, Eastbound

Start	1	16	21	26	31	36	41	46	51	56	61	66	71	76		Pace	Number
Time	15	20	25	30	35	40	45	50	55	60	65	70	75	999	Total	Speed	in Pace
03/20/14	0	0	1	8	15	15	7	0	0	0	0	0	0	0	46	31-40	28
01:00	2	0	1	5	9	8	1	0	1	0	0	0	0	0	27	30-39	15
02:00	0	0	1	4	4	6	3	1	0	0	0	0	0	0	19	31-40	10
03:00	1	0	1	2	3	9	1	0	0	0	0	0	0	0	17	32-41	11
04:00	0	0	3	12	15	22	7	1	1	0	0	0	0	0	61	31-40	35
05:00	0	0	6	31	87	93	11	1	0	0	0	0	0	0	229	31-40	163
06:00	24	**7**	14	66	145	192	49	5	1	**1**	0	0	0	0	504	31-40	297
07:00	**61**	7	**30**	**98**	**349**	**335**	**90**	9	2	0	0	0	0	0	**981**	31-40	593
08:00	28	1	1	96	271	296	66	12	0	0	0	0	0	0	771	31-40	503
09:00	6	0	7	66	162	233	63	6	**3**	1	0	0	0	0	547	32-41	361
10:00	5	1	8	37	91	182	72	16	0	0	0	0	0	0	412	33-42	263
11:00	7	2	6	40	113	190	82	**20**	2	0	0	0	0	0	462	33-42	287
12 PM	14	0	7	39	129	201	89	18	1	0	0	0	0	0	498	33-42	307
13:00	8	0	3	27	140	199	86	22	0	0	0	0	0	0	485	32-41	315
14:00	22	**2**	**15**	56	176	248	88	19	0	**1**	0	0	0	0	627	32-41	384
15:00	42	2	5	63	277	316	142	18	0	0	0	0	0	0	865	32-41	529
16:00	53	0	7	63	249	364	**159**	**23**	**2**	0	0	0	0	0	920	32-41	554
17:00	**58**	1	10	100	**314**	**376**	103	12	0	0	0	0	0	0	**974**	31-40	603
18:00	32	0	6	**102**	248	299	97	11	0	0	0	0	0	0	795	31-40	489
19:00	8	2	3	47	171	206	84	7	1	0	0	0	0	0	529	32-41	345
20:00	4	1	7	42	88	139	66	11	0	0	0	0	0	0	358	32-41	216
21:00	5	0	1	15	77	112	57	6	1	0	0	0	0	0	274	33-42	178
22:00	2	0	1	7	25	49	39	7	1	0	0	0	0	0	131	35-44	82
23:00	0	0	3	8	30	32	25	7	0	0	0	0	0	0	105	32-41	60
Total	382	26	147	1034	3188	4122	1487	232	16	3	0	0	0	0	10637		
Percent	3.6%	0.2%	1.4%	9.7%	30.0%	38.8%	14.0%	2.2%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	07:00	06:00	07:00	07:00	07:00	07:00	07:00	11:00	09:00	06:00					07:00		
Vol.	61	7	30	98	349	335	90	20	3	1					981		
PM Peak	17:00	14:00	14:00	18:00	17:00	17:00	16:00	16:00	16:00	14:00					17:00		
Vol.	58	2	15	102	314	376	159	23	2	1					974		

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Location: Groton Road (Route 40)
Location: East of Dunstable
Location: Westford, Massachusetts
Client: The Engineering Corp.

Westbound, 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	Pace Speed	Number in Pace
03/21/14	0	0	0	5	18	29	13	4	0	0	0	0	0	0	69	33-42	45
01:00	0	0	0	7	6	9	7	0	0	0	0	0	0	0	29	34-43	16
02:00	0	0	0	4	5	3	8	1	0	0	0	0	0	0	21	38-47	10
03:00	1	0	3	1	1	8	4	0	0	0	0	0	0	0	18	36-45	10
04:00	0	0	3	11	11	36	13	2	0	0	0	0	0	0	76	34-43	48
05:00	7	0	2	31	47	104	23	6	0	0	0	0	0	0	220	32-41	139
06:00	9	0	6	51	120	205	83	6	**1**	0	0	0	0	0	481	33-42	306
07:00	**43**	**6**	**18**	**117**	**298**	**343**	**119**	**19**	0	0	0	0	0	0	**963**	31-40	570
08:00	27	1	5	98	277	305	60	14	0	0	0	0	0	0	787	31-40	517
09:00	17	0	3	68	196	264	58	8	0	0	0	0	0	0	614	31-40	411
10:00	4	0	4	37	163	219	60	16	0	0	0	0	0	0	503	32-41	348
11:00	10	3	6	44	165	216	77	11	1	0	0	0	0	0	533	32-41	347
12 PM	10	1	8	48	178	211	77	14	0	0	0	0	0	0	547	32-41	353
13:00	31	0	7	61	176	205	86	7	0	0	0	0	0	0	573	32-41	339
14:00	42	7	14	83	264	253	79	**17**	0	0	0	0	0	0	759	31-40	452
15:00	36	1	16	77	258	352	**112**	7	**1**	0	0	0	0	0	860	32-41	545
16:00	42	0	4	59	289	**427**	99	15	1	0	0	0	0	0	936	32-41	633
17:00	**44**	0	**24**	89	**306**	368	110	6	1	0	0	0	0	0	**948**	31-40	595
18:00	39	**10**	24	**127**	293	238	92	6	1	0	0	0	0	0	830	30-39	476
19:00	14	0	11	44	179	216	73	8	0	0	0	0	0	0	545	32-41	355
20:00	8	0	3	32	132	172	55	8	0	0	0	0	0	0	410	32-41	276
21:00	6	0	2	32	103	135	54	8	0	0	0	0	0	0	340	32-41	219
22:00	4	0	1	12	66	90	43	8	1	0	0	0	0	0	225	32-41	145
23:00	1	0	2	12	29	64	39	7	0	0	0	**1**	0	0	155	34-43	98
Total	395	29	166	1150	3580	4472	1444	198	7	0	0	1	0	0	11442		
Percent	3.5%	0.3%	1.5%	10.1%	31.3%	39.1%	12.6%	1.7%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	07:00	07:00	07:00	07:00	07:00	07:00	07:00	07:00	06:00						07:00		
Vol.	43	6	18	117	298	343	119	19	1						963		
PM Peak	17:00	18:00	17:00	18:00	17:00	16:00	15:00	14:00	15:00			23:00			17:00		
Vol.	44	10	24	127	306	427	112	17	1			1			948		

Innovative Data, LLC

PO Box 468
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Location: Groton Road (Route 40)
Location: East of Dunstable
Location: Westford, Massachusetts
Client: The Engineering Corp.

Westbound, 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	Pace Speed	Number in Pace
03/22/14	2	0	1	6	18	38	23	5	0	0	0	0	0	0	93	34-43	58
01:00	0	0	0	3	6	20	10	2	0	0	0	0	0	0	41	35-44	28
02:00	0	0	0	1	6	11	9	1	0	0	0	0	0	0	28	34-43	19
03:00	0	0	1	0	2	5	3	0	0	0	0	0	0	0	11	34-43	8
04:00	0	0	1	4	8	17	3	2	1	0	0	0	0	0	36	32-41	23
05:00	2	0	3	7	20	30	4	3	0	**1**	0	0	0	0	70	32-41	44
06:00	2	0	1	9	42	70	20	5	0	0	0	0	0	0	149	32-41	103
07:00	9	**1**	3	27	51	132	53	10	0	0	0	0	0	0	286	34-43	179
08:00	6	0	2	35	101	145	62	10	**2**	0	0	0	0	0	363	32-41	229
09:00	9	0	6	52	174	213	52	8	0	0	0	0	0	0	514	31-40	348
10:00	15	1	5	**66**	179	250	77	7	1	0	0	0	0	0	601	32-41	389
11:00	**24**	1	**10**	50	**189**	**297**	**118**	**17**	0	0	0	0	0	0	**706**	32-41	447
12 PM	18	0	4	**62**	**221**	308	110	19	2	0	0	0	0	0	**744**	32-41	483
13:00	31	0	8	46	171	283	123	25	1	0	0	0	0	0	688	33-42	420
14:00	**32**	1	**11**	30	139	**319**	**162**	24	0	0	0	0	0	0	718	34-43	455
15:00	21	**3**	5	59	166	292	160	**27**	1	**1**	0	0	0	0	735	33-42	445
16:00	24	2	7	45	186	294	123	18	1	0	**1**	0	0	0	701	33-42	442
17:00	23	0	7	61	166	281	107	21	1	1	0	0	0	0	668	32-41	413
18:00	15	3	5	53	182	242	84	11	0	0	0	0	0	0	595	32-41	384
19:00	5	0	3	32	146	198	65	8	2	0	0	0	0	0	459	32-41	315
20:00	0	2	2	26	66	159	69	11	**3**	1	0	0	0	0	339	34-43	226
21:00	6	0	5	28	91	106	41	8	0	0	0	0	0	0	285	31-40	179
22:00	1	1	1	25	49	115	52	6	1	0	0	0	0	0	251	34-43	165
23:00	2	0	2	15	56	64	28	3	0	0	0	0	0	0	170	32-41	110
Total	247	15	93	742	2435	3889	1558	251	16	4	1	0	0	0	9251		
Percent	2.7%	0.2%	1.0%	8.0%	26.3%	42.0%	16.8%	2.7%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	11:00	07:00	11:00	10:00	11:00	11:00	11:00	11:00	08:00	05:00					11:00		
Vol.	24	1	10	66	189	297	118	17	2	1					706		
PM Peak	14:00	15:00	14:00	12:00	12:00	14:00	14:00	15:00	20:00	15:00	16:00				12:00		
Vol.	32	3	11	62	221	319	162	27	3	1	1				744		
Total	1024	70	406	2926	9203	12483	4489	681	39	7	1	1	0	0	31330		
Percent	3.3%	0.2%	1.3%	9.3%	29.4%	39.8%	14.3%	2.2%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%			

15th Percentile : 28 MPH
50th Percentile : 35 MPH
85th Percentile : 40 MPH
95th Percentile : 44 MPH

Stats

10 MPH Pace Speed : 32-41 MPH
Number in Pace : 19637
Percent in Pace : 62.7%
Number of Vehicles > 40 MPH : 6013
Percent of Vehicles > 40 MPH : 19.2%
Mean Speed(Average) : 35 MPH

Innovative Data, LLC

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Location: Groton Road (Route 40)
Location: East of Dunstable
Location: Westford, Massachusetts
Client: The Engineering Corp.

Westbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classed	Total
03/20/14	0	18	3	0	1	0	0	0	0	0	0	0	0	0	22
01:00	1	9	3	1	1	0	0	0	0	0	0	0	0	2	17
02:00	0	5	2	0	2	0	0	0	0	0	0	0	0	0	9
03:00	1	5	2	0	0	1	0	0	0	0	0	0	0	1	10
04:00	0	13	3	0	3	1	0	0	0	0	0	0	0	0	20
05:00	0	40	13	1	4	0	0	0	0	1	0	0	0	0	59
06:00	3	133	30	0	22	1	1	1	0	0	0	0	0	10	201
07:00	1	292	87	5	18	2	0	0	0	0	0	0	0	27	432
08:00	0	164	69	1	17	0	0	1	2	1	0	0	0	15	270
09:00	0	118	54	7	17	0	0	0	0	0	0	0	0	5	201
10:00	0	109	48	0	15	1	0	0	0	1	0	0	0	2	176
11:00	0	126	45	3	17	2	0	2	2	0	0	0	0	4	201
12 PM	1	176	52	2	22	0	1	1	0	1	0	0	0	6	262
13:00	1	142	65	3	21	1	0	1	1	0	0	0	0	3	238
14:00	1	219	69	4	18	2	0	0	0	0	0	0	0	10	323
15:00	4	308	94	7	24	2	0	0	0	0	0	0	0	25	464
16:00	0	336	103	0	25	0	0	2	1	0	0	0	0	24	491
17:00	2	395	100	1	23	0	0	1	0	0	0	0	0	28	550
18:00	4	367	64	0	15	2	0	0	0	1	0	0	0	15	468
19:00	0	251	66	0	15	1	0	0	0	0	0	0	0	3	336
20:00	0	182	43	0	15	0	0	0	0	0	0	0	0	4	244
21:00	0	154	30	0	9	0	0	1	0	0	0	0	0	3	197
22:00	0	75	7	0	2	0	0	0	0	0	0	0	0	1	85
23:00	0	53	9	0	4	0	0	0	0	0	0	0	0	0	66
Total	19	3690	1061	35	310	16	2	10	6	5	0	0	0	188	5342
Percent	0.4%	69.1%	19.9%	0.7%	5.8%	0.3%	0.0%	0.2%	0.1%	0.1%	0.0%	0.0%	0.0%	3.5%	
AM Peak	06:00	07:00	07:00	09:00	06:00	07:00	06:00	11:00	08:00	05:00				07:00	
Vol.	3	292	87	7	22	2	1	2	2	1				27	
PM Peak	15:00	17:00	16:00	15:00	16:00	14:00	12:00	16:00	13:00	12:00				17:00	
Vol.	4	395	103	7	25	2	1	2	1	1				28	

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Westbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classed	Total
03/21/14	0	34	9	1	2	0	0	0	0	0	0	0	0	0	46
01:00	0	14	3	0	1	0	0	0	0	0	0	0	0	0	18
02:00	0	8	2	0	1	0	0	0	0	0	0	0	0	0	11
03:00	1	2	3	0	1	0	0	0	0	0	0	0	0	1	8
04:00	0	14	3	1	3	3	0	0	0	0	0	0	0	0	24
05:00	0	40	11	0	4	0	0	0	0	0	0	0	0	3	58
06:00	0	123	34	0	16	2	1	0	0	0	0	0	0	3	179
07:00	1	289	79	6	21	1	1	0	0	0	0	0	0	24	422
08:00	1	165	46	4	21	2	1	2	1	0	0	0	0	14	257
09:00	0	131	63	7	22	1	0	1	0	1	0	0	0	9	235
10:00	0	123	62	5	20	0	0	1	2	1	0	0	0	2	216
11:00	0	167	43	4	22	2	1	0	0	0	0	0	0	4	243
12 PM	0	169	74	7	18	0	0	6	0	0	0	0	0	7	281
13:00	1	193	71	5	18	0	0	0	0	0	0	0	0	14	302
14:00	0	230	81	2	19	3	0	1	1	0	0	0	0	18	355
15:00	1	279	112	7	39	1	0	3	1	0	0	0	0	20	463
16:00	1	334	84	1	22	1	0	3	0	0	0	0	0	22	468
17:00	0	394	92	1	19	3	0	2	1	0	0	0	0	20	532
18:00	3	351	80	1	13	0	0	1	0	0	0	0	0	17	466
19:00	1	237	55	0	11	0	0	0	0	0	0	0	0	8	312
20:00	0	217	46	0	5	0	0	0	0	0	0	0	0	4	272
21:00	0	186	42	0	13	0	0	0	0	0	0	0	0	4	245
22:00	0	113	22	0	5	0	0	0	0	0	0	0	0	2	142
23:00	1	77	15	1	2	0	0	0	0	0	0	0	0	1	97
Total	11	3890	1132	53	318	19	4	20	6	2	0	0	0	197	5652
Percent	0.2%	68.8%	20.0%	0.9%	5.6%	0.3%	0.1%	0.4%	0.1%	0.0%	0.0%	0.0%	0.0%	3.5%	
AM Peak	03:00	07:00	07:00	09:00	09:00	04:00	06:00	08:00	10:00	09:00				07:00	
Vol.	1	289	79	7	22	3	1	2	2	1				24	
PM Peak	18:00	17:00	15:00	12:00	15:00	14:00		12:00	14:00					16:00	
Vol.	3	394	112	7	39	3		6	1					22	

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Client: The Engineering Corp.

Westbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classed	Total
03/22/14	0	40	7	0	6	0	0	0	0	0	0	0	0	1	54
01:00	0	16	7	1	1	0	0	0	0	0	0	0	0	0	25
02:00	0	13	3	0	3	0	0	0	0	0	0	0	0	0	19
03:00	0	4	3	0	0	0	0	0	0	0	0	0	0	0	7
04:00	0	11	1	0	1	0	0	0	0	0	0	0	0	0	13
05:00	0	14	4	0	2	0	0	0	0	0	0	0	0	0	20
06:00	0	29	13	1	6	0	0	0	0	0	0	0	0	1	50
07:00	0	73	27	0	1	0	0	1	0	0	0	0	0	3	105
08:00	0	88	33	0	12	0	0	0	0	0	0	0	0	4	137
09:00	0	125	30	0	7	0	0	0	1	0	0	0	0	4	167
10:00	1	145	41	0	13	3	0	1	0	0	0	0	0	7	211
11:00	2	212	68	0	23	3	0	1	0	0	0	0	0	12	321
12 PM	3	226	72	0	24	1	0	0	0	0	0	0	0	6	332
13:00	0	252	71	0	19	0	0	0	0	0	0	0	0	14	356
14:00	0	302	72	0	21	2	0	0	0	0	0	0	0	11	408
15:00	2	329	66	1	15	0	0	1	0	0	0	0	0	9	423
16:00	1	261	65	0	15	1	0	0	0	0	0	0	0	10	353
17:00	2	256	62	0	10	1	0	0	0	0	0	0	0	7	338
18:00	4	230	58	0	17	0	0	0	1	0	0	0	0	6	316
19:00	0	195	48	0	14	0	0	0	0	0	0	0	0	4	261
20:00	0	181	36	0	8	0	0	0	0	0	0	0	0	0	225
21:00	0	156	36	1	3	0	0	0	0	0	0	0	0	3	199
22:00	0	141	31	0	6	0	0	1	0	0	0	0	0	1	180
23:00	0	81	15	0	2	0	0	0	0	0	0	0	0	1	99
Total	15	3380	869	4	229	11	0	5	2	0	0	0	0	104	4619
Percent	0.3%	73.2%	18.8%	0.1%	5.0%	0.2%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	2.3%	
AM Peak	11:00	11:00	11:00	01:00	11:00	10:00		07:00	09:00					11:00	
Vol.	2	212	68	1	23	3		1	1					12	
PM Peak	18:00	15:00	12:00	15:00	12:00	14:00		15:00	18:00					13:00	
Vol.	4	329	72	1	24	2		1	1					14	
Grand Total	45	10960	3062	92	857	46	6	35	14	7	0	0	0	489	15613
Percent	0.3%	70.2%	19.6%	0.6%	5.5%	0.3%	0.0%	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%	3.1%	

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Eastbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classed	Total
03/20/14	0	21	3	0	0	0	0	0	0	0	0	0	0	0	24
01:00	0	8	1	0	1	0	0	0	0	0	0	0	0	0	10
02:00	0	8	2	0	0	0	0	0	0	0	0	0	0	0	10
03:00	0	4	3	0	0	0	0	0	0	0	0	0	0	0	7
04:00	0	31	9	0	1	0	0	0	0	0	0	0	0	0	41
05:00	0	146	23	0	1	0	0	0	0	0	0	0	0	0	170
06:00	3	238	44	2	8	1	0	1	0	0	0	0	0	6	303
07:00	3	446	60	2	4	2	0	1	2	0	0	0	0	29	549
08:00	0	440	38	2	6	2	0	0	0	0	0	0	0	13	501
09:00	1	297	41	0	2	1	0	2	1	0	0	0	0	1	346
10:00	1	199	24	2	5	2	0	0	0	0	0	0	0	3	236
11:00	1	206	41	2	5	2	0	1	0	0	0	0	0	3	261
12 PM	0	182	35	2	4	3	0	0	2	0	0	0	0	8	236
13:00	0	194	36	1	6	3	0	2	0	0	0	0	0	5	247
14:00	0	240	30	9	11	1	0	1	0	0	0	0	0	12	304
15:00	3	313	57	4	3	3	0	1	0	0	0	0	0	17	401
16:00	3	341	48	1	3	3	0	1	0	0	0	0	0	29	429
17:00	6	343	42	0	2	1	0	0	1	0	0	0	0	29	424
18:00	1	271	34	0	2	1	0	0	1	0	0	0	0	17	327
19:00	0	171	16	0	1	0	0	0	0	0	0	0	0	5	193
20:00	0	103	9	0	1	0	0	0	1	0	0	0	0	0	114
21:00	0	71	3	0	0	1	0	0	0	0	0	0	0	2	77
22:00	1	42	2	0	0	0	0	0	0	0	0	0	0	1	46
23:00	0	34	4	0	1	0	0	0	0	0	0	0	0	0	39
Total	23	4349	605	27	67	26	0	10	8	0	0	0	0	180	5295
Percent	0.4%	82.1%	11.4%	0.5%	1.3%	0.5%	0.0%	0.2%	0.2%	0.0%	0.0%	0.0%	0.0%	3.4%	
AM Peak	06:00	07:00	07:00	06:00	06:00	07:00		09:00	07:00					07:00	
Vol.	3	446	60	2	8	2		2	2					29	
PM Peak	17:00	17:00	15:00	14:00	14:00	12:00		13:00	12:00					16:00	
Vol.	6	343	57	9	11	3		2	2					29	

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Eastbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classed	Total
03/21/14	0	22	1	0	0	0	0	0	0	0	0	0	0	0	23
01:00	0	11	0	0	0	0	0	0	0	0	0	0	0	0	11
02:00	0	9	1	0	0	0	0	0	0	0	0	0	0	0	10
03:00	0	9	1	0	0	0	0	0	0	0	0	0	0	0	10
04:00	0	43	9	0	0	0	0	0	0	0	0	0	0	0	52
05:00	0	134	23	0	0	0	0	0	1	0	0	0	0	4	162
06:00	0	238	50	1	4	1	0	1	1	0	0	0	0	6	302
07:00	4	443	59	3	7	2	0	1	2	0	0	0	0	20	541
08:00	2	449	50	4	8	4	0	0	0	0	0	0	0	13	530
09:00	1	316	46	1	5	2	0	0	0	0	0	0	0	8	379
10:00	0	237	42	0	4	1	0	1	0	0	0	0	0	2	287
11:00	1	235	32	3	7	3	0	0	1	2	0	0	0	6	290
12 PM	0	213	39	1	5	2	0	1	1	0	0	0	0	4	266
13:00	2	219	31	2	1	2	0	1	0	0	0	0	0	13	271
14:00	1	318	42	7	14	2	0	0	0	0	0	0	0	20	404
15:00	1	303	69	3	3	2	0	0	0	0	0	0	0	16	397
16:00	3	386	50	1	2	4	0	0	2	0	0	0	0	20	468
17:00	1	347	39	0	4	0	0	1	0	0	0	0	0	24	416
18:00	3	298	40	0	2	2	0	1	0	0	0	0	0	18	364
19:00	1	203	22	0	1	0	0	0	0	0	0	0	0	6	233
20:00	0	122	12	0	0	0	0	0	0	0	0	0	0	4	138
21:00	0	82	10	0	1	0	0	0	0	0	0	0	0	2	95
22:00	0	77	4	0	0	0	0	0	0	0	0	0	0	2	83
23:00	0	55	3	0	0	0	0	0	0	0	0	0	0	0	58
Total	20	4769	675	26	68	27	0	7	8	2	0	0	0	188	5790
Percent	0.3%	82.4%	11.7%	0.4%	1.2%	0.5%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	3.2%	
AM Peak	07:00	08:00	07:00	08:00	08:00	08:00		06:00	07:00	11:00				07:00	
Vol.	4	449	59	4	8	4		1	2	2				20	
PM Peak	16:00	16:00	15:00	14:00	14:00	16:00		12:00	16:00					17:00	
Vol.	3	386	69	7	14	4		1	2					24	

Innovative Data, LLC

PO Box 468
Belchertown, Massachusetts
innovativedatallc.com or 1.413.668.5094

Location: Groton Road (Route 40)
Location: East of Dunstable
Location: Westford, Massachusetts
Client: The Engineering Corp.

Eastbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classed	Total
03/22/14	0	36	2	0	0	0	0	0	0	0	0	0	0	1	39
01:00	0	16	0	0	0	0	0	0	0	0	0	0	0	0	16
02:00	0	8	0	0	1	0	0	0	0	0	0	0	0	0	9
03:00	0	4	0	0	0	0	0	0	0	0	0	0	0	0	4
04:00	0	19	3	0	1	0	0	0	0	0	0	0	0	0	23
05:00	0	39	9	0	0	0	0	0	0	0	0	0	0	2	50
06:00	0	81	16	0	0	1	0	0	0	0	0	0	0	1	99
07:00	0	158	15	0	1	0	0	0	1	0	0	0	0	6	181
08:00	0	201	19	0	3	0	0	0	1	0	0	0	0	2	226
09:00	0	307	35	0	0	0	0	0	0	0	0	0	0	5	347
10:00	2	348	28	1	1	1	0	0	1	0	0	0	0	8	390
11:00	3	336	31	0	2	1	0	0	0	0	0	0	0	12	385
12 PM	2	354	41	0	1	2	0	0	0	0	0	0	0	12	412
13:00	2	263	47	0	3	0	0	0	0	0	0	0	0	17	332
14:00	2	261	25	0	1	0	0	0	0	0	0	0	0	21	310
15:00	2	273	24	0	1	0	0	0	0	0	0	0	0	12	312
16:00	4	300	29	0	1	0	0	0	0	0	0	0	0	14	348
17:00	2	296	15	0	0	0	0	1	0	0	0	0	0	16	330
18:00	0	250	19	0	0	0	0	0	0	0	0	0	0	10	279
19:00	0	171	25	0	1	0	0	0	0	0	0	0	0	1	198
20:00	0	103	10	0	1	0	0	0	0	0	0	0	0	0	114
21:00	0	77	5	0	1	0	0	0	0	0	0	0	0	3	86
22:00	0	64	7	0	0	0	0	0	0	0	0	0	0	0	71
23:00	0	68	2	0	0	0	0	0	0	0	0	0	0	1	71
Total	19	4033	407	1	19	5	0	1	3	0	0	0	0	144	4632
Percent	0.4%	87.1%	8.8%	0.0%	0.4%	0.1%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	3.1%	
AM Peak	11:00	10:00	09:00	10:00	08:00	06:00			07:00					11:00	
Vol.	3	348	35	1	3	1			1					12	
PM Peak	16:00	12:00	13:00		13:00	12:00		17:00						14:00	
Vol.	4	354	47		3	2		1						21	
Grand Total	62	13151	1687	54	154	58	0	18	19	2	0	0	0	512	15717
Percent	0.4%	83.7%	10.7%	0.3%	1.0%	0.4%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	3.3%	

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Location: Groton Road (Route 40)
Location: East of Dunstable
Location: Westford, Massachusetts
Client: The Engineering Corp.

Westbound, Eastbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classed	Total
03/20/14	0	39	6	0	1	0	0	0	0	0	0	0	0	0	46
01:00	1	17	4	1	2	0	0	0	0	0	0	0	0	2	27
02:00	0	13	4	0	2	0	0	0	0	0	0	0	0	0	19
03:00	1	9	5	0	0	1	0	0	0	0	0	0	0	1	17
04:00	0	44	12	0	4	1	0	0	0	0	0	0	0	0	61
05:00	0	186	36	1	5	0	0	0	0	1	0	0	0	0	229
06:00	6	371	74	2	30	2	1	2	0	0	0	0	0	16	504
07:00	4	738	147	7	22	4	0	1	2	0	0	0	0	56	981
08:00	0	604	107	3	23	2	0	1	2	1	0	0	0	28	771
09:00	1	415	95	7	19	1	0	2	1	0	0	0	0	6	547
10:00	1	308	72	2	20	3	0	0	0	1	0	0	0	5	412
11:00	1	332	86	5	22	4	0	3	2	0	0	0	0	7	462
12 PM	1	358	87	4	26	3	1	1	2	1	0	0	0	14	498
13:00	1	336	101	4	27	4	0	3	1	0	0	0	0	8	485
14:00	1	459	99	13	29	3	0	1	0	0	0	0	0	22	627
15:00	7	621	151	11	27	5	0	1	0	0	0	0	0	42	865
16:00	3	677	151	1	28	3	0	3	1	0	0	0	0	53	920
17:00	8	738	142	1	25	1	0	1	1	0	0	0	0	57	974
18:00	5	638	98	0	17	3	0	0	1	1	0	0	0	32	795
19:00	0	422	82	0	16	1	0	0	0	0	0	0	0	8	529
20:00	0	285	52	0	16	0	0	0	1	0	0	0	0	4	358
21:00	0	225	33	0	9	1	0	1	0	0	0	0	0	5	274
22:00	1	117	9	0	2	0	0	0	0	0	0	0	0	2	131
23:00	0	87	13	0	5	0	0	0	0	0	0	0	0	0	105
Total	42	8039	1666	62	377	42	2	20	14	5	0	0	0	368	10637
Percent	0.4%	75.6%	15.7%	0.6%	3.5%	0.4%	0.0%	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%	3.5%	
AM Peak	06:00	07:00	07:00	07:00	06:00	07:00	06:00	11:00	07:00	05:00				07:00	
Vol.	6	738	147	7	30	4	1	3	2	1				56	
PM Peak	17:00	17:00	15:00	14:00	14:00	15:00	12:00	13:00	12:00	12:00				17:00	
Vol.	8	738	151	13	29	5	1	3	2	1				57	

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Location: Groton Road (Route 40)
Location: East of Dunstable
Location: Westford, Massachusetts
Client: The Engineering Corp.

Westbound, Eastbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classed	Total
03/21/14	0	56	10	1	2	0	0	0	0	0	0	0	0	0	69
01:00	0	25	3	0	1	0	0	0	0	0	0	0	0	0	29
02:00	0	17	3	0	1	0	0	0	0	0	0	0	0	0	21
03:00	1	11	4	0	1	0	0	0	0	0	0	0	0	1	18
04:00	0	57	12	1	3	3	0	0	0	0	0	0	0	0	76
05:00	0	174	34	0	4	0	0	0	1	0	0	0	0	7	220
06:00	0	361	84	1	20	3	1	1	1	0	0	0	0	9	481
07:00	5	732	138	9	28	3	1	1	2	0	0	0	0	44	963
08:00	3	614	96	8	29	6	1	2	1	0	0	0	0	27	787
09:00	1	447	109	8	27	3	0	1	0	1	0	0	0	17	614
10:00	0	360	104	5	24	1	0	2	2	1	0	0	0	4	503
11:00	1	402	75	7	29	5	1	0	1	2	0	0	0	10	533
12 PM	0	382	113	8	23	2	0	7	1	0	0	0	0	11	547
13:00	3	412	102	7	19	2	0	1	0	0	0	0	0	27	573
14:00	1	548	123	9	33	5	0	1	1	0	0	0	0	38	759
15:00	2	582	181	10	42	3	0	3	1	0	0	0	0	36	860
16:00	4	720	134	2	24	5	0	3	2	0	0	0	0	42	936
17:00	1	741	131	1	23	3	0	3	1	0	0	0	0	44	948
18:00	6	649	120	1	15	2	0	2	0	0	0	0	0	35	830
19:00	2	440	77	0	12	0	0	0	0	0	0	0	0	14	545
20:00	0	339	58	0	5	0	0	0	0	0	0	0	0	8	410
21:00	0	268	52	0	14	0	0	0	0	0	0	0	0	6	340
22:00	0	190	26	0	5	0	0	0	0	0	0	0	0	4	225
23:00	1	132	18	1	2	0	0	0	0	0	0	0	0	1	155
Total	31	8659	1807	79	386	46	4	27	14	4	0	0	0	385	11442
Percent	0.3%	75.7%	15.8%	0.7%	3.4%	0.4%	0.0%	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%	3.4%	
AM Peak	07:00	07:00	07:00	07:00	08:00	08:00	06:00	08:00	07:00	11:00				07:00	
Vol.	5	732	138	9	29	6	1	2	2	2				44	
PM Peak	18:00	17:00	15:00	15:00	15:00	14:00		12:00	16:00					17:00	
Vol.	6	741	181	10	42	5		7	2					44	

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Location: Groton Road (Route 40)
Location: East of Dunstable
Location: Westford, Massachusetts
Client: The Engineering Corp.

Westbound, Eastbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classed	Total
03/22/14	0	76	9	0	6	0	0	0	0	0	0	0	0	2	93
01:00	0	32	7	1	1	0	0	0	0	0	0	0	0	0	41
02:00	0	21	3	0	4	0	0	0	0	0	0	0	0	0	28
03:00	0	8	3	0	0	0	0	0	0	0	0	0	0	0	11
04:00	0	30	4	0	2	0	0	0	0	0	0	0	0	0	36
05:00	0	53	13	0	2	0	0	0	0	0	0	0	0	2	70
06:00	0	110	29	1	6	1	0	0	0	0	0	0	0	2	149
07:00	0	231	42	0	2	0	0	1	1	0	0	0	0	9	286
08:00	0	289	52	0	15	0	0	0	1	0	0	0	0	6	363
09:00	0	432	65	0	7	0	0	0	1	0	0	0	0	9	514
10:00	3	493	69	1	14	4	0	1	1	0	0	0	0	15	601
11:00	5	548	99	0	25	4	0	1	0	0	0	0	0	24	706
12 PM	5	580	113	0	25	3	0	0	0	0	0	0	0	18	744
13:00	2	515	118	0	22	0	0	0	0	0	0	0	0	31	688
14:00	2	563	97	0	22	2	0	0	0	0	0	0	0	32	718
15:00	4	602	90	1	16	0	0	1	0	0	0	0	0	21	735
16:00	5	561	94	0	16	1	0	0	0	0	0	0	0	24	701
17:00	4	552	77	0	10	1	0	1	0	0	0	0	0	23	668
18:00	4	480	77	0	17	0	0	0	1	0	0	0	0	16	595
19:00	0	366	73	0	15	0	0	0	0	0	0	0	0	5	459
20:00	0	284	46	0	9	0	0	0	0	0	0	0	0	0	339
21:00	0	233	41	1	4	0	0	0	0	0	0	0	0	6	285
22:00	0	205	38	0	6	0	0	1	0	0	0	0	0	1	251
23:00	0	149	17	0	2	0	0	0	0	0	0	0	0	2	170
Total	34	7413	1276	5	248	16	0	6	5	0	0	0	0	248	9251
Percent	0.4%	80.1%	13.8%	0.1%	2.7%	0.2%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	2.7%	
AM Peak	11:00	11:00	11:00	01:00	11:00	10:00		07:00	07:00					11:00	
Vol.	5	548	99	1	25	4		1	1					24	
PM Peak	12:00	15:00	13:00	15:00	12:00	12:00		15:00	18:00					14:00	
Vol.	5	602	118	1	25	3		1	1					32	
Grand Total	107	24111	4749	146	1011	104	6	53	33	9	0	0	0	1001	31330
Percent	0.3%	77.0%	15.2%	0.5%	3.2%	0.3%	0.0%	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%	3.2%	

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Location: Groton Road (Route 40)
Location: West of Dunstable
Location: Westford, Massachusetts
Client: The Engineering Corp.

Start	20-Mar-14	Eastbound		Westbound		Combined		21-Mar-	Eastbound		Westbound		Combined	
Time	Thu	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	Fri	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
12:00		1	63	5	48	6	111		1	66	3	75	4	141
12:15		2	64	3	44	5	108		4	66	2	60	6	126
12:30		4	56	1	68	5	124		1	62	4	67	5	129
12:45		3	50	3	55	6	105		1	75	4	79	5	154
01:00		3	75	3	68	6	143		2	107	1	89	3	196
01:15		2	72	2	79	4	151		5	114	3	66	8	180
01:30		1	72	2	73	3	145		1	92	3	85	4	177
01:45		3	82	2	88	5	170		2	100	3	93	5	193
02:00		1	99	2	96	3	195		3	103	0	104	3	207
02:15		1	112	1	125	2	237		0	82	3	104	3	186
02:30		4	93	2	106	6	199		0	102	1	103	1	205
02:45		2	108	5	99	7	207		6	103	3	108	9	211
03:00		4	95	7	119	11	214		4	***128***	7	107	11	***235***
03:15		5	105	1	114	6	219		12	***121***	2	117	14	***238***
03:30		11	***107***	4	116	15	223		7	***108***	3	97	10	***205***
03:45		9	***111***	8	116	17	***227***		16	***107***	11	***131***	27	***238***
04:00		21	***111***	10	119	31	***230***		15	104	8	***125***	23	229
04:15		33	***125***	14	***118***	47	***243***		27	118	18	***114***	45	232
04:30		43	106	21	***120***	64	***226***		40	93	23	***123***	63	216
04:45		46	93	22	***118***	68	211		46	106	28	115	74	221
05:00		42	107	29	***121***	71	228		34	86	32	113	66	199
05:15		49	78	40	113	89	191		65	104	38	107	103	211
05:30		68	77	67	81	135	158		78	98	63	104	141	202
05:45		93	76	75	96	168	172		76	88	68	96	144	184
06:00		91	65	***146***	79	***237***	144		99	62	***121***	76	***220***	138
06:15		***143***	43	***146***	84	***289***	127		***118***	66	***163***	75	***281***	141
06:30		***162***	46	***110***	73	***272***	119		***161***	51	***96***	66	***257***	117
06:45		***116***	34	***85***	65	***201***	99		***117***	30	***92***	53	***209***	83
07:00		***97***	24	87	54	184	78		***105***	35	90	59	195	94
07:15		135	39	91	52	226	91		118	29	69	73	187	102
07:30		106	20	57	50	163	70		144	36	65	58	209	94
07:45		98	28	76	58	174	86		108	28	47	53	155	81
08:00		108	22	64	49	172	71		85	19	84	56	169	75
08:15		73	18	48	51	121	69		77	22	52	69	129	91
08:30		81	10	39	43	120	53		85	24	55	46	140	70
08:45		56	20	36	30	92	50		76	25	39	50	115	75
09:00		55	9	46	26	101	35		65	27	52	47	117	74
09:15		51	11	42	19	93	30		56	24	47	30	103	54
09:30		60	14	39	21	99	35		89	19	52	38	141	57
09:45		42	10	42	10	84	20		61	16	53	17	114	33
10:00		48	13	53	17	101	30		65	16	50	9	115	25
10:15		83	4	49	16	132	20		90	13	52	32	142	45
10:30		59	9	39	8	98	17		63	14	68	26	131	40
10:45		54	6	49	9	103	15		59	11	55	15	114	26
11:00		69	13	62	13	131	26		66	14	55	23	121	37
11:15		48	5	49	14	97	19		63	11	70	15	133	26
11:30		52	3	74	1	126	4		66	7	64	7	130	14
11:45		50	4	60	11	110	15		60	5	75	6	135	11
Total		2388	2607	1918	3153	4306	5760		2542	2937	1997	3381	4539	6318
Day Total		4995		5071		10066			5479		5378		10857	
% Total		23.7%	25.9%	19.1%	31.3%				23.4%	27.1%	18.4%	31.1%		
Peak		06:15	03:30	06:00	04:15	06:00	03:45		06:15	03:00	06:00	03:45	06:00	03:00
Vol.		518	454	487	477	999	926		501	464	472	493	967	916
P.H.F.		0.799	0.908	0.834	0.986	0.864	0.953		0.778	0.906	0.724	0.941	0.860	0.962

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Location: Groton Road (Route 40)
Location: West of Dunstable
Location: Westford, Massachusetts
Client: The Engineering Corp.

Start Time	22-Mar-14 Sat	Eastbound A.M.	Eastbound P.M.	Westbound A.M.	Westbound P.M.	Combined A.M.	Combined P.M.	23-Mar- Sun	Eastbound A.M.	Eastbound P.M.	Westbound A.M.	Westbound P.M.	Combined A.M.	Combined P.M.
12:00		2	88	12	75	14	163		0	*	0	*	0	*
12:15		3	85	5	79	8	164		*	*	*	*	*	*
12:30		6	81	1	98	7	179		*	*	*	*	*	*
12:45		5	60	6	91	11	151		*	*	*	*	*	*
01:00		3	75	8	89	11	164		*	*	*	*	*	*
01:15		0	77	5	96	5	173		*	*	*	*	*	*
01:30		5	67	2	105	7	172		*	*	*	*	*	*
01:45		1	71	4	98	5	169		*	*	*	*	*	*
02:00		2	86	0	81	2	167		*	*	*	*	*	*
02:15		1	65	2	***100***	3	***165***		*	*	*	*	*	*
02:30		3	75	4	***109***	7	***184***		*	*	*	*	*	*
02:45		3	64	6	***108***	9	***172***		*	*	*	*	*	*
03:00		5	87	4	***91***	9	***178***		*	*	*	*	*	*
03:15		7	79	3	75	10	154		*	*	*	*	*	*
03:30		2	82	2	65	4	147		*	*	*	*	*	*
03:45		4	68	3	88	7	156		*	*	*	*	*	*
04:00		2	***83***	4	79	6	162		*	*	*	*	*	*
04:15		15	***72***	1	75	16	147		*	*	*	*	*	*
04:30		14	***88***	8	75	22	163		*	*	*	*	*	*
04:45		13	***77***	7	82	20	159		*	*	*	*	*	*
05:00		18	82	9	97	27	179		*	*	*	*	*	*
05:15		16	62	9	75	25	137		*	*	*	*	*	*
05:30		28	67	22	61	50	128		*	*	*	*	*	*
05:45		36	53	7	62	43	115		*	*	*	*	*	*
06:00		45	64	14	61	59	125		*	*	*	*	*	*
06:15		39	49	20	57	59	106		*	*	*	*	*	*
06:30		35	40	24	61	59	101		*	*	*	*	*	*
06:45		47	33	43	58	90	91		*	*	*	*	*	*
07:00		52	25	23	55	75	80		*	*	*	*	*	*
07:15		43	29	35	52	78	81		*	*	*	*	*	*
07:30		55	22	32	51	87	73		*	*	*	*	*	*
07:45		66	23	41	55	107	78		*	*	*	*	*	*
08:00		69	27	53	40	122	67		*	*	*	*	*	*
08:15		75	18	34	34	109	52		*	*	*	*	*	*
08:30		76	14	46	40	122	54		*	*	*	*	*	*
08:45		96	18	46	52	142	70		*	*	*	*	*	*
09:00		93	17	55	46	148	63		*	*	*	*	*	*
09:15		83	17	41	45	124	62		*	*	*	*	*	*
09:30		79	26	57	32	136	58		*	*	*	*	*	*
09:45		***105***	13	57	39	162	52		*	*	*	*	*	*
10:00		***93***	16	61	25	154	41		*	*	*	*	*	*
10:15		***94***	15	71	34	165	49		*	*	*	*	*	*
10:30		***101***	12	67	19	168	31		*	*	*	*	*	*
10:45		74	14	***95***	14	169	28		*	*	*	*	*	*
11:00		101	16	***76***	22	***177***	38		*	*	*	*	*	*
11:15		99	9	***64***	16	***163***	25		*	*	*	*	*	*
11:30		98	8	***98***	10	***196***	18		*	*	*	*	*	*
11:45		94	5	76	16	***170***	21		*	*	*	*	*	*
Total		2006	2324	1363	2988	3369	5312		0	0	0	0	0	0
Day Total		4330		4351		8681			0		0		0	
% Total		23.1%	26.8%	15.7%	34.4%				0.0%	0.0%	0.0%	0.0%		
Peak		09:45	04:00	10:45	02:15	11:00	02:15							
Vol.		393	320	333	408	706	699							
P.H.F.		0.936	0.909	0.849	0.936	0.901	0.950							

ADT	ADT 9,867	AADT 9,867

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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	Pace Speed	Number in Pace
03/20/14	0	0	0	1	4	2	2	0	**1**	0	0	0	0	0	10	29-38	6
01:00	0	1	0	2	1	4	1	0	0	0	0	0	0	0	9	31-40	5
02:00	0	0	1	1	3	1	2	0	0	0	0	0	0	0	8	29-38	4
03:00	0	0	0	4	7	15	2	1	0	0	0	0	0	0	29	32-41	20
04:00	1	0	1	13	62	52	13	1	0	0	0	0	0	0	143	31-40	103
05:00	8	1	11	18	74	113	25	2	0	0	0	0	0	0	252	32-41	167
06:00	**33**	9	**33**	**60**	**179**	169	28	1	0	0	0	0	0	0	**512**	31-40	299
07:00	15	**15**	11	30	144	**181**	36	3	1	0	0	0	0	0	436	31-40	281
08:00	12	1	16	37	65	132	**50**	**5**	0	0	0	0	0	0	318	33-42	185
09:00	8	0	3	15	56	87	36	3	0	0	0	0	0	0	208	32-41	131
10:00	5	2	4	13	71	112	34	3	0	0	0	0	0	0	244	32-41	167
11:00	8	4	8	8	57	101	32	0	1	0	0	0	0	0	219	32-41	143
12 PM	7	0	5	14	74	103	27	3	0	0	0	0	0	0	233	32-41	158
13:00	12	6	**14**	38	102	103	25	0	**1**	0	0	0	0	0	301	31-40	180
14:00	8	3	12	**41**	**154**	145	**47**	2	0	0	0	0	0	0	412	31-40	269
15:00	**24**	2	11	31	109	**189**	44	**8**	0	0	0	0	0	0	418	32-41	263
16:00	24	**8**	3	39	143	181	35	2	0	0	0	0	0	0	**435**	31-40	279
17:00	12	1	4	25	94	162	36	4	0	0	0	0	0	0	338	32-41	230
18:00	8	2	5	13	54	81	24	1	0	0	0	0	0	0	188	32-41	120
19:00	4	0	0	19	38	38	10	2	0	0	0	0	0	0	111	31-40	68
20:00	1	0	1	8	19	25	14	2	0	0	0	0	0	0	70	32-41	42
21:00	0	0	0	0	10	21	9	4	0	0	0	0	0	0	44	33-42	31
22:00	0	0	0	0	7	17	4	4	0	0	0	0	0	0	32	32-41	23
23:00	0	0	0	2	9	9	3	2	0	0	0	0	0	0	25	32-41	16
Total	190	55	143	432	1536	2043	539	53	4	0	0	0	0	0	4995		
Percent	3.8%	1.1%	2.9%	8.6%	30.8%	40.9%	10.8%	1.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	06:00	07:00	06:00	06:00	06:00	07:00	08:00	08:00	00:00						06:00		
Vol.	33	15	33	60	179	181	50	5	1						512		
PM Peak	15:00	16:00	13:00	14:00	14:00	15:00	14:00	15:00	13:00						16:00		
Vol.	24	8	14	41	154	189	47	8	1						435		

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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	Pace Speed	Number in Pace
03/21/14	0	0	0	0	3	2	2	0	0	0	0	0	0	0	7	31-40	5
01:00	0	1	0	0	5	3	0	1	0	0	0	0	0	0	10	30-39	7
02:00	0	0	1	0	2	3	3	0	0	0	0	0	0	0	9	34-43	6
03:00	0	0	1	1	7	14	11	5	0	0	0	0	0	0	39	35-44	24
04:00	4	0	1	2	22	58	37	4	0	0	0	0	0	0	128	35-44	87
05:00	5	3	5	20	48	123	46	3	0	0	0	0	0	0	253	33-42	167
06:00	**19**	**10**	17	**58**	**146**	**195**	48	2	0	0	0	0	0	0	**495**	31-40	301
07:00	13	0	**23**	55	141	187	**51**	5	0	0	0	0	0	0	475	31-40	295
08:00	16	0	9	30	78	151	35	4	0	0	0	0	0	0	323	32-41	206
09:00	8	0	2	12	82	114	47	**6**	0	0	0	0	0	0	271	32-41	179
10:00	3	0	4	19	70	137	40	4	0	0	0	0	0	0	277	33-42	193
11:00	10	1	5	29	67	101	37	5	0	0	0	0	0	0	255	32-41	153
12 PM	6	0	7	23	77	121	29	**6**	0	0	0	0	0	0	269	32-41	179
13:00	10	**6**	**35**	**53**	**149**	130	26	3	0	0	0	0	0	**1**	413	30-39	249
14:00	19	3	10	33	91	171	**60**	3	0	0	0	0	0	0	390	33-42	239
15:00	19	4	11	33	122	**220**	51	4	0	0	0	0	0	0	**464**	32-41	306
16:00	**21**	4	9	34	119	192	39	2	**1**	0	0	0	0	0	421	32-41	273
17:00	9	6	17	50	130	127	36	1	0	0	0	0	0	0	376	31-40	230
18:00	7	2	2	24	64	86	23	1	0	0	0	0	0	0	209	32-41	133
19:00	4	0	0	4	52	50	16	2	0	0	0	0	0	0	128	31-40	90
20:00	0	0	0	7	23	41	15	4	0	0	0	0	0	0	90	32-41	61
21:00	0	0	1	10	18	42	11	3	1	0	0	0	0	0	86	33-42	57
22:00	0	0	2	2	12	25	11	2	0	0	0	0	0	0	54	33-42	37
23:00	0	0	0	3	9	17	5	2	1	0	0	0	0	0	37	33-42	24
Total	173	40	162	502	1537	2310	679	72	3	0	0	0	0	1	5479		
Percent	3.2%	0.7%	3.0%	9.2%	28.1%	42.2%	12.4%	1.3%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	06:00	06:00	07:00	06:00	06:00	06:00	07:00	09:00							06:00		
Vol.	19	10	23	58	146	195	51	6							495		
PM Peak	16:00	13:00	13:00	13:00	13:00	15:00	14:00	12:00	16:00					13:00	15:00		
Vol.	21	6	35	53	149	220	60	6	1					1	464		

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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	Pace Speed	Number in Pace
03/22/14	0	0	1	2	2	8	2	1	0	0	0	0	0	0	16	34-43	10
01:00	0	0	0	1	1	4	3	0	0	0	0	0	0	0	9	36-45	6
02:00	0	2	1	0	3	2	1	0	0	0	0	0	0	0	9	31-40	4
03:00	0	0	0	1	3	9	3	1	**1**	0	0	0	0	0	18	34-43	12
04:00	0	0	1	2	8	22	11	0	0	0	0	0	0	0	44	34-43	32
05:00	0	0	0	0	22	40	27	8	1	0	0	0	0	0	98	34-43	65
06:00	4	0	1	9	21	68	53	**10**	0	0	0	0	0	0	166	35-44	109
07:00	4	0	3	22	50	83	45	9	0	0	0	0	0	0	216	33-42	129
08:00	5	0	**18**	29	89	126	45	4	0	0	0	0	0	0	316	32-41	198
09:00	**12**	3	10	34	85	157	54	5	0	0	0	0	0	0	360	32-41	223
10:00	5	2	4	8	105	**176**	**55**	7	0	0	0	0	0	0	362	32-41	259
11:00	10	**4**	14	**40**	**110**	160	51	3	0	0	0	0	0	0	**392**	32-41	245
12 PM	**13**	0	3	15	**84**	143	52	4	0	0	0	0	0	0	314	33-42	207
13:00	11	2	3	10	53	137	**69**	5	0	0	0	0	0	0	290	34-43	193
14:00	11	**3**	4	10	63	141	52	**6**	0	0	0	0	0	0	290	33-42	193
15:00	10	3	**9**	12	83	**144**	50	5	0	0	0	0	0	0	316	32-41	208
16:00	12	2	6	**18**	71	140	69	2	0	0	0	0	0	0	**320**	34-43	203
17:00	8	2	2	12	66	129	41	4	0	0	0	0	0	0	264	33-42	180
18:00	3	1	1	9	51	93	23	5	0	0	0	0	0	0	186	32-41	132
19:00	3	0	0	7	26	52	9	2	0	0	0	0	0	0	99	32-41	70
20:00	2	0	4	1	31	28	9	2	0	0	0	0	0	0	77	31-40	52
21:00	2	0	0	6	15	29	18	3	0	0	0	0	0	0	73	34-43	45
22:00	0	0	0	7	18	24	7	1	0	0	0	0	0	0	57	31-40	39
23:00	0	0	0	1	7	18	9	3	0	0	0	0	0	0	38	34-43	26
Total	115	24	85	256	1067	1933	758	90	2	0	0	0	0	0	4330		
Percent	2.7%	0.6%	2.0%	5.9%	24.6%	44.6%	17.5%	2.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	09:00	11:00	08:00	11:00	11:00	10:00	10:00	06:00	03:00						11:00		
Vol.	12	4	18	40	110	176	55	10	1						392		
PM Peak	12:00	14:00	15:00	16:00	12:00	15:00	13:00	14:00							16:00		
Vol.	13	3	9	18	84	144	69	6							320		
Total	478	119	390	1190	4140	6286	1976	215	9	0	0	0	0	1	14804		
Percent	3.2%	0.8%	2.6%	8.0%	28.0%	42.5%	13.3%	1.5%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%			

15th Percentile :	28 MPH
50th Percentile :	35 MPH
85th Percentile :	40 MPH
95th Percentile :	43 MPH

Stats

10 MPH Pace Speed :	32-41 MPH
Number in Pace :	9422
Percent in Pace :	63.6%
Number of Vehicles > 40 MPH :	2638
Percent of Vehicles > 40 MPH :	17.8%
Mean Speed(Average) :	34 MPH

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Westbound

Start	1	16	21	26	31	36	41	46	51	56	61	66	71	76		Pace	Number
Time	15	20	25	30	35	40	45	50	55	60	65	70	75	999	Total	Speed	in Pace
03/20/14	0	0	0	1	8	3	0	0	0	0	0	0	0	0	12	30-39	10
01:00	3	0	1	0	2	3	0	0	0	0	0	0	0	0	9	34-43	3
02:00	5	0	1	1	3	0	0	0	0	0	0	0	0	0	10	5-14	5
03:00	1	0	0	3	10	5	1	0	0	0	0	0	0	0	20	29-38	14
04:00	0	1	2	18	35	10	1	0	0	0	0	0	0	0	67	28-37	49
05:00	14	4	2	30	117	41	3	0	0	0	0	0	0	0	211	29-38	145
06:00	**24**	**5**	**10**	**62**	**268**	**113**	5	0	0	0	0	0	0	0	**487**	29-38	345
07:00	24	1	6	38	160	79	3	0	0	0	0	0	0	0	311	30-39	210
08:00	7	0	5	14	84	68	9	0	0	0	0	0	0	0	187	31-40	133
09:00	7	1	6	15	65	67	8	0	0	0	0	0	0	0	169	31-40	115
10:00	8	1	7	14	57	93	**10**	0	0	0	0	0	0	0	190	32-41	131
11:00	10	1	5	17	114	88	10	0	0	0	0	0	0	0	245	30-39	175
12 PM	9	0	2	11	71	112	10	0	0	0	0	0	0	0	215	32-41	159
13:00	16	0	8	20	149	102	12	**1**	0	0	0	0	0	0	308	30-39	217
14:00	19	0	**11**	**39**	179	163	**15**	0	0	0	0	0	0	0	426	31-40	297
15:00	22	1	6	28	204	**191**	12	1	0	0	0	0	0	0	465	31-40	339
16:00	**26**	0	6	33	**252**	155	3	0	0	0	0	0	0	0	**475**	30-39	352
17:00	14	0	7	23	225	135	7	0	0	0	0	0	0	0	411	30-39	316
18:00	6	0	5	25	183	81	1	0	0	0	0	0	0	0	301	30-39	239
19:00	5	1	1	18	101	86	2	0	0	0	0	0	0	0	214	31-40	164
20:00	4	1	0	11	86	63	8	0	0	0	0	0	0	0	173	30-39	131
21:00	0	**2**	1	3	20	45	5	0	0	0	0	0	0	0	76	32-41	59
22:00	0	0	0	3	18	24	5	0	0	0	0	0	0	0	50	32-41	38
23:00	0	0	0	1	22	14	2	0	0	0	0	0	0	0	39	31-40	32
Total	224	19	92	428	2433	1741	132	2	0	0	0	0	0	0	5071		
Percent	4.4%	0.4%	1.8%	8.4%	48.0%	34.3%	2.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	06:00	06:00	06:00	06:00	06:00	06:00	10:00								06:00		
Vol.	24	5	10	62	268	113	10								487		
PM Peak	16:00	21:00	14:00	14:00	16:00	15:00	14:00	13:00							16:00		
Vol.	26	2	11	39	252	191	15	1							475		

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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	Pace Speed	Number in Pace
03/21/14	0	0	1	1	6	5	0	0	0	0	0	0	0	0	13	30-39	10
01:00	0	0	0	0	3	7	0	0	0	0	0	0	0	0	10	32-41	9
02:00	0	0	0	1	2	4	0	0	0	0	0	0	0	0	7	33-42	5
03:00	0	0	0	3	12	7	1	0	0	0	0	0	0	0	23	30-39	18
04:00	3	1	2	15	36	20	0	0	0	0	0	0	0	0	77	29-38	52
05:00	3	1	1	19	106	68	3	0	0	0	0	0	0	0	201	30-39	156
06:00	**15**	**7**	**19**	**62**	**229**	**134**	6	0	0	0	0	0	0	0	**472**	30-39	326
07:00	12	1	9	30	139	73	7	0	0	0	0	0	0	0	271	30-39	189
08:00	8	2	7	21	112	77	3	0	0	0	0	0	0	0	230	30-39	166
09:00	5	0	3	19	97	67	**13**	0	0	0	0	0	0	0	204	30-39	146
10:00	6	4	5	13	105	82	10	0	0	0	0	0	0	0	225	31-40	162
11:00	13	2	1	38	120	76	13	**1**	0	0	0	0	0	0	264	30-39	175
12 PM	7	0	8	45	129	85	6	**1**	0	0	0	0	0	0	281	30-39	196
13:00	15	3	7	31	164	106	7	0	0	0	0	0	0	0	333	30-39	236
14:00	22	**5**	9	**49**	206	120	8	0	0	0	0	0	0	0	419	30-39	287
15:00	**29**	2	9	31	216	156	**9**	0	0	0	0	0	0	0	452	30-39	317
16:00	18	4	**12**	25	**233**	**177**	8	0	0	0	0	0	0	0	**477**	31-40	353
17:00	10	0	6	42	232	121	9	0	0	0	0	0	0	0	420	30-39	319
18:00	14	4	4	21	142	82	3	0	0	0	0	0	0	0	270	30-39	194
19:00	6	1	1	17	146	67	5	0	0	0	0	0	0	0	243	30-39	191
20:00	2	0	1	24	122	69	3	0	0	0	0	0	0	0	221	30-39	174
21:00	0	0	0	13	60	55	3	1	0	0	0	0	0	0	132	31-40	103
22:00	1	0	1	2	35	41	1	1	0	0	0	0	0	0	82	31-40	67
23:00	1	0	2	4	17	26	1	0	0	0	0	0	0	0	51	31-40	38
Total	190	37	108	526	2669	1725	119	4	0	0	0	0	0	0	5378		
Percent	3.5%	0.7%	2.0%	9.8%	49.6%	32.1%	2.2%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	06:00	06:00	06:00	06:00	06:00	06:00	09:00	11:00							06:00		
Vol.	15	7	19	62	229	134	13	1							472		
PM Peak	15:00	14:00	16:00	14:00	16:00	16:00	15:00	12:00							16:00		
Vol.	29	5	12	49	233	177	9	1							477		

Innovative Data, LLC

PO Box 468
Belchertown, Massachusetts
innovativedatallc.com or 1.413.668.5094

Location: Groton Road (Route 40)
Location: West of Dunstable
Location: Westford, Massachusetts
Client: The Engineering Corp.

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	Pace Speed	Number in Pace
03/22/14	0	0	0	2	11	11	0	0	0	0	0	0	0	0	24	31-40	20
01:00	0	0	0	1	8	9	1	0	0	0	0	0	0	0	19	32-41	15
02:00	0	0	2	3	6	1	0	0	0	0	0	0	0	0	12	28-37	8
03:00	0	0	0	2	5	4	1	0	0	0	0	0	0	0	12	31-40	8
04:00	0	1	0	4	10	3	1	**1**	0	0	0	0	0	0	20	29-38	13
05:00	0	0	0	5	27	14	1	0	0	0	0	0	0	0	47	30-39	38
06:00	1	0	1	12	46	36	5	0	0	0	0	0	0	0	101	30-39	74
07:00	4	0	4	13	44	58	8	0	0	0	0	0	0	0	131	31-40	90
08:00	5	3	6	18	74	67	6	0	0	0	0	0	0	0	179	31-40	123
09:00	**11**	**4**	**7**	21	95	67	5	0	0	0	0	0	0	0	210	30-39	140
10:00	8	1	3	24	**146**	106	6	0	0	0	0	0	0	0	294	30-39	222
11:00	10	2	6	**29**	145	**112**	**10**	0	0	0	0	0	0	0	**314**	30-39	225
12 PM	13	3	**7**	**34**	123	148	15	0	0	0	0	0	0	0	343	31-40	236
13:00	11	**6**	7	19	130	**196**	**19**	0	0	0	0	0	0	0	388	32-41	284
14:00	10	0	7	22	**154**	189	15	**1**	0	0	0	0	0	0	**398**	31-40	300
15:00	6	1	6	15	125	155	10	0	**1**	0	0	0	0	0	319	31-40	245
16:00	**16**	1	3	26	124	126	14	1	0	0	0	0	0	0	311	31-40	216
17:00	8	0	4	19	148	109	7	0	0	0	0	0	0	0	295	30-39	225
18:00	7	0	0	19	117	88	6	0	0	0	0	0	0	0	237	30-39	180
19:00	3	0	1	15	99	91	3	1	0	0	0	0	0	0	213	31-40	167
20:00	1	0	2	13	85	60	5	0	0	0	0	0	0	0	166	30-39	130
21:00	1	0	1	10	97	49	4	0	0	0	0	0	0	0	162	30-39	132
22:00	0	0	1	10	49	31	1	0	0	0	0	0	0	0	92	30-39	73
23:00	0	0	0	3	26	31	4	0	0	0	0	0	0	0	64	31-40	51
Total	115	22	68	339	1894	1761	147	4	1	0	0	0	0	0	4351		
Percent	2.6%	0.5%	1.6%	7.8%	43.5%	40.5%	3.4%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	09:00	09:00	09:00	11:00	10:00	11:00	11:00	04:00							11:00		
Vol.	11	4	7	29	146	112	10	1							314		
PM Peak	16:00	13:00	12:00	12:00	14:00	13:00	13:00	14:00	15:00						14:00		
Vol.	16	6	7	34	154	196	19	1	1						398		
Total	529	78	268	1293	6996	5227	398	10	1	0	0	0	0	0	14800		
Percent	3.6%	0.5%	1.8%	8.7%	47.3%	35.3%	2.7%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			

15th Percentile : 28 MPH
50th Percentile : 33 MPH
85th Percentile : 38 MPH
95th Percentile : 40 MPH

Stats

10 MPH Pace Speed : 30-39 MPH
Number in Pace : 10681
Percent in Pace : 72.2%
Number of Vehicles > 40 MPH : 959
Percent of Vehicles > 40 MPH : 6.5%
Mean Speed(Average) : 33 MPH

Innovative Data, LLC

PO Box 468
Belchertown, Massachusetts
innovativedatallc.com or 1.413.668.5094

Location: Groton Road (Route 40)
Location: West of Dunstable
Location: Westford, Massachusetts
Client: The Engineering Corp.

Eastbound, 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	Pace Speed	Number in Pace
03/20/14	0	0	0	2	12	5	2	0	**1**	0	0	0	0	0	22	29-38	16
01:00	3	1	1	2	3	7	1	0	0	0	0	0	0	0	18	32-41	8
02:00	5	0	2	2	6	1	2	0	0	0	0	0	0	0	18	29-38	6
03:00	1	0	0	7	17	20	3	1	0	0	0	0	0	0	49	31-40	33
04:00	1	1	3	31	97	62	14	1	0	0	0	0	0	0	210	30-39	147
05:00	22	5	13	48	191	154	28	2	0	0	0	0	0	0	463	30-39	300
06:00	**57**	14	**43**	**122**	**447**	**282**	33	1	0	0	0	0	0	0	**999**	30-39	640
07:00	39	**16**	17	68	304	260	39	3	1	0	0	0	0	0	747	31-40	484
08:00	19	1	21	51	149	200	**59**	**5**	0	0	0	0	0	0	505	32-41	312
09:00	15	1	9	30	121	154	44	3	0	0	0	0	0	0	377	32-41	243
10:00	13	3	11	27	128	205	44	3	0	0	0	0	0	0	434	32-41	298
11:00	18	5	13	25	171	189	42	0	1	0	0	0	0	0	464	31-40	313
12 PM	16	0	7	25	145	215	37	3	0	0	0	0	0	0	448	32-41	317
13:00	28	6	22	58	251	205	37	1	**1**	0	0	0	0	0	609	31-40	396
14:00	27	3	**23**	**80**	333	308	**62**	2	0	0	0	0	0	0	838	31-40	566
15:00	46	3	17	59	313	**380**	56	**9**	0	0	0	0	0	0	883	31-40	598
16:00	**50**	**8**	9	72	**395**	336	38	2	0	0	0	0	0	0	**910**	31-40	626
17:00	26	1	11	48	319	297	43	4	0	0	0	0	0	0	749	31-40	538
18:00	14	2	10	38	237	162	25	1	0	0	0	0	0	0	489	30-39	352
19:00	9	1	1	37	139	124	12	2	0	0	0	0	0	0	325	30-39	232
20:00	5	1	1	19	105	88	22	2	0	0	0	0	0	0	243	31-40	172
21:00	0	2	1	3	30	66	14	4	0	0	0	0	0	0	120	32-41	89
22:00	0	0	0	3	25	41	9	4	0	0	0	0	0	0	82	32-41	61
23:00	0	0	0	3	31	23	5	2	0	0	0	0	0	0	64	31-40	48
Total	414	74	235	860	3969	3784	671	55	4	0	0	0	0	0	10066		
Percent	4.1%	0.7%	2.3%	8.5%	39.4%	37.6%	6.7%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	06:00	07:00	06:00	06:00	06:00	06:00	08:00	08:00	00:00						06:00		
Vol.	57	16	43	122	447	282	59	5	1						999		
PM Peak	16:00	16:00	14:00	14:00	16:00	15:00	14:00	15:00	13:00						16:00		
Vol.	50	8	23	80	395	380	62	9	1						910		

Innovative Data, LLC

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Location: Groton Road (Route 40)
Location: West of Dunstable
Location: Westford, Massachusetts
Client: The Engineering Corp.

Eastbound, 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	Pace Speed	Number in Pace
03/21/14	0	0	1	1	9	7	2	0	0	0	0	0	0	0	20	32-41	14
01:00	0	1	0	0	8	10	0	1	0	0	0	0	0	0	20	32-41	15
02:00	0	0	1	1	4	7	3	0	0	0	0	0	0	0	16	32-41	11
03:00	0	0	1	4	19	21	12	5	0	0	0	0	0	0	62	32-41	38
04:00	7	1	3	17	58	78	37	4	0	0	0	0	0	0	205	32-41	125
05:00	8	4	6	39	154	191	49	3	0	0	0	0	0	0	454	32-41	308
06:00	**34**	**17**	**36**	**120**	**375**	**329**	54	2	0	0	0	0	0	0	**967**	30-39	618
07:00	25	1	32	85	280	260	58	5	0	0	0	0	0	0	746	31-40	479
08:00	24	2	16	51	190	228	38	4	0	0	0	0	0	0	553	31-40	365
09:00	13	0	5	31	179	181	**60**	**6**	0	0	0	0	0	0	475	31-40	321
10:00	9	4	9	32	175	219	50	4	0	0	0	0	0	0	502	32-41	350
11:00	23	3	6	67	187	177	50	6	0	0	0	0	0	0	519	31-40	322
12 PM	13	0	15	68	206	206	35	**7**	0	0	0	0	0	0	550	31-40	368
13:00	25	**9**	**42**	84	313	236	33	3	0	0	0	0	0	**1**	746	30-39	485
14:00	41	8	19	82	297	291	**68**	3	0	0	0	0	0	0	809	31-40	512
15:00	**48**	6	20	64	338	**376**	60	4	0	0	0	0	0	0	**916**	31-40	615
16:00	39	8	21	59	352	369	47	2	**1**	0	0	0	0	0	898	31-40	623
17:00	19	6	23	**92**	**362**	248	45	1	0	0	0	0	0	0	796	30-39	547
18:00	21	6	6	45	206	168	26	1	0	0	0	0	0	0	479	31-40	324
19:00	10	1	1	21	198	117	21	2	0	0	0	0	0	0	371	30-39	278
20:00	2	0	1	31	145	110	18	4	0	0	0	0	0	0	311	30-39	230
21:00	0	0	1	23	78	97	14	4	1	0	0	0	0	0	218	31-40	158
22:00	1	0	3	4	47	66	12	3	0	0	0	0	0	0	136	32-41	102
23:00	1	0	2	7	26	43	6	2	1	0	0	0	0	0	88	32-41	62
Total	363	77	270	1028	4206	4035	798	76	3	0	0	0	0	1	10857		
Percent	3.3%	0.7%	2.5%	9.5%	38.7%	37.2%	7.4%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	06:00	06:00	06:00	06:00	06:00	06:00	09:00	09:00							06:00		
Vol.	34	17	36	120	375	329	60	6							967		
PM Peak	15:00	13:00	13:00	17:00	17:00	15:00	14:00	12:00	16:00					13:00	15:00		
Vol.	48	9	42	92	362	376	68	7	1					1	916		

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Client: The Engineering Corp.

Eastbound, 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	Pace Speed	Number in Pace
03/22/14	0	0	1	4	13	19	2	1	0	0	0	0	0	0	40	31-40	29
01:00	0	0	0	2	9	13	4	0	0	0	0	0	0	0	28	32-41	20
02:00	0	2	3	3	9	3	1	0	0	0	0	0	0	0	21	30-39	11
03:00	0	0	0	3	8	13	4	1	**1**	0	0	0	0	0	30	32-41	20
04:00	0	1	1	6	18	25	12	1	0	0	0	0	0	0	64	33-42	40
05:00	0	0	0	5	49	54	28	8	1	0	0	0	0	0	145	32-41	96
06:00	5	0	2	21	67	104	58	**10**	0	0	0	0	0	0	267	33-42	165
07:00	8	0	7	35	94	141	53	9	0	0	0	0	0	0	347	32-41	217
08:00	10	3	**24**	47	163	193	51	4	0	0	0	0	0	0	495	31-40	319
09:00	**23**	**7**	17	55	180	224	59	5	0	0	0	0	0	0	570	31-40	356
10:00	13	3	7	32	251	**282**	**61**	7	0	0	0	0	0	0	656	31-40	472
11:00	20	6	20	**69**	**255**	272	61	3	0	0	0	0	0	0	**706**	31-40	467
12 PM	26	3	10	**49**	207	291	67	4	0	0	0	0	0	0	657	32-41	440
13:00	22	**8**	10	29	183	**333**	**88**	5	0	0	0	0	0	0	678	32-41	466
14:00	21	3	11	32	**217**	330	67	**7**	0	0	0	0	0	0	**688**	32-41	486
15:00	16	4	**15**	27	208	299	60	5	**1**	0	0	0	0	0	635	32-41	450
16:00	**28**	3	9	44	195	266	83	3	0	0	0	0	0	0	631	32-41	410
17:00	16	2	6	31	214	238	48	4	0	0	0	0	0	0	559	31-40	397
18:00	10	1	1	28	168	181	29	5	0	0	0	0	0	0	423	31-40	308
19:00	6	0	1	22	125	143	12	3	0	0	0	0	0	0	312	31-40	236
20:00	3	0	6	14	116	88	14	2	0	0	0	0	0	0	243	31-40	181
21:00	3	0	1	16	112	78	22	3	0	0	0	0	0	0	235	31-40	170
22:00	0	0	1	17	67	55	8	1	0	0	0	0	0	0	149	30-39	111
23:00	0	0	0	4	33	49	13	3	0	0	0	0	0	0	102	32-41	75
Total	230	46	153	595	2961	3694	905	94	3	0	0	0	0	0	8681		
Percent	2.6%	0.5%	1.8%	6.9%	34.1%	42.6%	10.4%	1.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	09:00	09:00	08:00	11:00	11:00	10:00	10:00	06:00	03:00						11:00		
Vol.	23	7	24	69	255	282	61	10	1						706		
PM Peak	16:00	13:00	15:00	12:00	14:00	13:00	13:00	14:00	15:00						14:00		
Vol.	28	8	15	49	217	333	88	7	1						688		
Total	1007	197	658	2483	11136	11513	2374	225	10	0	0	0	0	1	29604		
Percent	3.4%	0.7%	2.2%	8.4%	37.6%	38.9%	8.0%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			

15th Percentile :	28 MPH
50th Percentile :	34 MPH
85th Percentile :	39 MPH
95th Percentile :	42 MPH

Stats

10 MPH Pace Speed :	31-40 MPH
Number in Pace :	19906
Percent in Pace :	67.2%
Number of Vehicles > 40 MPH :	3596
Percent of Vehicles > 40 MPH :	12.1%
Mean Speed(Average) :	34 MPH

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Location: Groton Road (Route 40)
Location: West of Dunstable
Location: Westford, Massachusetts
Client: The Engineering Corp.

Eastbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classed	Total
03/20/14	0	3	6	0	1	0	0	0	0	0	0	0	0	0	10
01:00	0	7	2	0	0	0	0	0	0	0	0	0	0	0	9
02:00	0	5	2	0	1	0	0	0	0	0	0	0	0	0	8
03:00	0	20	6	0	3	0	0	0	0	0	0	0	0	0	29
04:00	0	99	37	0	6	0	0	0	0	0	0	0	0	1	143
05:00	0	174	53	2	12	1	0	2	0	0	0	0	0	8	252
06:00	3	378	76	5	12	4	0	1	2	0	0	0	0	31	512
07:00	1	343	65	5	7	2	1	1	0	0	0	0	0	11	436
08:00	0	232	65	0	4	2	0	2	1	0	0	0	0	12	318
09:00	0	146	45	1	8	1	0	0	0	0	0	0	0	7	208
10:00	0	164	58	4	9	3	0	1	0	0	0	0	0	5	244
11:00	1	150	44	6	7	1	0	1	2	0	0	0	0	7	219
12 PM	0	163	46	1	12	4	0	0	0	0	0	0	0	7	233
13:00	0	214	49	11	14	0	0	2	0	0	0	0	0	11	301
14:00	0	293	90	5	9	5	0	2	0	0	0	0	0	8	412
15:00	1	312	67	5	7	2	0	0	0	0	0	0	0	24	418
16:00	4	345	51	0	8	2	0	1	1	1	0	0	0	22	435
17:00	2	262	55	1	5	1	0	0	1	0	0	0	0	11	338
18:00	0	149	29	0	2	0	0	0	0	0	0	0	0	8	188
19:00	1	88	14	0	3	0	0	0	1	0	0	0	0	4	111
20:00	0	59	9	0	0	1	0	0	0	0	0	0	0	1	70
21:00	0	42	2	0	0	0	0	0	0	0	0	0	0	0	44
22:00	0	27	2	0	3	0	0	0	0	0	0	0	0	0	32
23:00	0	21	4	0	0	0	0	0	0	0	0	0	0	0	25
Total	13	3696	877	46	133	29	1	13	8	1	0	0	0	178	4995
Percent	0.3%	74.0%	17.6%	0.9%	2.7%	0.6%	0.0%	0.3%	0.2%	0.0%	0.0%	0.0%	0.0%	3.6%	
AM Peak	06:00	06:00	06:00	11:00	05:00	06:00	07:00	05:00	06:00					06:00	
Vol.	3	378	76	6	12	4	1	2	2					31	
PM Peak	16:00	16:00	14:00	13:00	13:00	14:00		13:00	16:00	16:00				15:00	
Vol.	4	345	90	11	14	5		2	1	1				24	

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Belchertown, Massachusetts
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Location: Groton Road (Route 40)
Location: West of Dunstable
Location: Westford, Massachusetts
Client: The Engineering Corp.

Eastbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classed	Total
03/21/14	0	7	0	0	0	0	0	0	0	0	0	0	0	0	7
01:00	0	9	1	0	0	0	0	0	0	0	0	0	0	0	10
02:00	0	6	3	0	0	0	0	0	0	0	0	0	0	0	9
03:00	0	27	10	0	2	0	0	0	0	0	0	0	0	0	39
04:00	0	93	27	1	3	0	0	0	0	0	0	0	0	4	128
05:00	0	170	56	3	16	3	0	0	1	0	0	0	0	4	253
06:00	2	376	80	4	10	3	0	1	2	0	0	0	0	17	495
07:00	3	360	75	6	13	4	0	2	0	0	0	0	0	12	475
08:00	1	228	70	1	6	2	0	2	0	0	0	0	0	13	323
09:00	1	186	59	0	13	3	0	1	0	0	0	0	0	8	271
10:00	1	191	62	7	7	2	0	1	1	2	0	0	0	3	277
11:00	0	175	54	3	7	2	0	3	1	0	0	0	0	10	255
12 PM	0	198	52	2	7	4	0	1	0	0	0	0	0	5	269
13:00	1	304	66	12	20	1	0	0	0	0	0	0	0	9	413
14:00	4	262	86	4	12	2	0	0	1	0	0	0	0	19	390
15:00	3	346	76	1	15	4	0	1	0	0	0	0	0	18	464
16:00	2	324	61	1	9	1	0	1	0	0	0	0	0	22	421
17:00	0	288	71	0	6	1	0	2	0	0	0	0	0	8	376
18:00	2	161	35	1	2	1	0	0	0	0	0	0	0	7	209
19:00	1	102	19	0	2	0	0	0	0	0	0	0	0	4	128
20:00	1	74	13	1	1	0	0	0	0	0	0	0	0	0	90
21:00	0	73	13	0	0	0	0	0	0	0	0	0	0	0	86
22:00	0	50	4	0	0	0	0	0	0	0	0	0	0	0	54
23:00	0	31	6	0	0	0	0	0	0	0	0	0	0	0	37
Total	22	4041	999	47	151	33	0	15	6	2	0	0	0	163	5479
Percent	0.4%	73.8%	18.2%	0.9%	2.8%	0.6%	0.0%	0.3%	0.1%	0.0%	0.0%	0.0%	0.0%	3.0%	
AM Peak	07:00	06:00	06:00	10:00	05:00	07:00		11:00	06:00	10:00				06:00	
Vol.	3	376	80	7	16	4		3	2	2				17	
PM Peak	14:00	15:00	14:00	13:00	13:00	12:00		17:00	14:00					16:00	
Vol.	4	346	86	12	20	4		2	1					22	

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Location: Groton Road (Route 40)
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Location: Westford, Massachusetts
Client: The Engineering Corp.

Eastbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classed	Total
03/22/14	0	16	0	0	0	0	0	0	0	0	0	0	0	0	16
01:00	0	7	1	0	1	0	0	0	0	0	0	0	0	0	9
02:00	0	8	1	0	0	0	0	0	0	0	0	0	0	0	9
03:00	0	13	3	1	1	0	0	0	0	0	0	0	0	0	18
04:00	0	31	12	0	1	0	0	0	0	0	0	0	0	0	44
05:00	0	68	26	0	3	1	0	0	0	0	0	0	0	0	98
06:00	1	125	26	0	7	0	0	2	1	0	0	0	0	4	166
07:00	0	165	39	1	6	0	0	0	1	0	0	0	0	4	216
08:00	1	249	52	0	9	0	0	0	0	0	0	0	0	5	316
09:00	0	280	64	2	4	2	0	0	0	0	0	0	0	8	360
10:00	1	295	51	0	8	1	0	1	0	0	0	0	0	5	362
11:00	3	294	78	1	8	0	0	0	0	0	0	0	0	8	392
12 PM	0	238	58	0	6	2	0	0	0	0	0	0	0	10	314
13:00	1	218	49	1	10	1	0	0	0	0	0	0	0	10	290
14:00	1	231	41	0	5	1	0	0	0	0	0	0	0	11	290
15:00	4	256	44	0	2	0	0	0	0	0	0	0	0	10	316
16:00	1	264	41	0	0	1	0	1	0	0	0	0	0	12	320
17:00	0	216	39	0	3	0	0	0	0	0	0	0	0	6	264
18:00	0	152	28	0	2	1	0	0	0	0	0	0	0	3	186
19:00	0	78	17	0	1	0	0	0	0	0	0	0	0	3	99
20:00	0	63	11	0	1	0	0	0	0	0	0	0	0	2	77
21:00	0	62	9	0	0	0	0	0	0	0	0	0	0	2	73
22:00	0	53	4	0	0	0	0	0	0	0	0	0	0	0	57
23:00	0	31	6	0	1	0	0	0	0	0	0	0	0	0	38
Total	13	3413	700	6	79	10	0	4	2	0	0	0	0	103	4330
Percent	0.3%	78.8%	16.2%	0.1%	1.8%	0.2%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	2.4%	
AM Peak	11:00	10:00	11:00	09:00	08:00	09:00		06:00	06:00					09:00	
Vol.	3	295	78	2	9	2		2	1					8	
PM Peak	15:00	16:00	12:00	13:00	13:00	12:00		16:00						16:00	
Vol.	4	264	58	1	10	2		1						12	
Grand Total	48	11150	2576	99	363	72	1	32	16	3	0	0	0	444	14804
Percent	0.3%	75.3%	17.4%	0.7%	2.5%	0.5%	0.0%	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%	3.0%	

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Location: Groton Road (Route 40)
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Location: Westford, Massachusetts
Client: The Engineering Corp.

Westbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classed	Total
03/20/14	0	9	3	0	0	0	0	0	0	0	0	0	0	0	12
01:00	0	5	1	0	0	0	0	0	0	0	0	0	0	3	9
02:00	0	4	1	0	0	0	0	0	0	0	0	0	0	5	10
03:00	0	14	4	0	0	1	0	0	0	0	0	0	0	1	20
04:00	0	55	10	0	0	0	0	0	1	1	0	0	0	0	67
05:00	1	156	41	0	2	1	0	1	0	0	0	0	0	9	211
06:00	1	402	46	5	4	4	0	1	0	0	0	0	0	24	487
07:00	0	234	43	1	5	1	0	1	2	0	0	0	0	24	311
08:00	1	134	35	4	6	0	0	0	0	0	0	0	0	7	187
09:00	0	125	30	0	6	0	0	0	0	1	0	0	0	7	169
10:00	1	144	27	3	2	2	0	1	2	0	0	0	0	8	190
11:00	2	187	37	1	6	0	0	1	0	1	0	0	0	10	245
12 PM	0	160	35	2	7	1	0	0	1	0	0	0	0	9	215
13:00	0	247	33	4	6	2	0	0	0	0	0	0	0	16	308
14:00	2	335	59	5	5	1	0	2	0	0	0	0	0	17	426
15:00	3	376	60	0	2	0	0	0	1	0	0	0	0	23	465
16:00	1	397	50	1	0	0	0	0	0	0	0	0	0	26	475
17:00	7	355	32	0	1	1	0	0	0	1	0	0	0	14	411
18:00	0	256	38	0	1	0	0	0	0	0	0	0	0	6	301
19:00	1	182	24	0	2	0	0	0	0	0	0	0	0	5	214
20:00	3	150	17	0	0	0	0	1	0	0	0	0	0	2	173
21:00	0	73	2	0	1	0	0	0	0	0	0	0	0	0	76
22:00	0	45	5	0	0	0	0	0	0	0	0	0	0	0	50
23:00	0	33	5	0	0	1	0	0	0	0	0	0	0	0	39
Total	23	4078	638	26	56	15	0	8	7	4	0	0	0	216	5071
Percent	0.5%	80.4%	12.6%	0.5%	1.1%	0.3%	0.0%	0.2%	0.1%	0.1%	0.0%	0.0%	0.0%	4.3%	
AM Peak	11:00	06:00	06:00	06:00	08:00	06:00		05:00	07:00	04:00				06:00	
Vol.	2	402	46	5	6	4		1	2	1				24	
PM Peak	17:00	16:00	15:00	14:00	12:00	13:00		14:00	12:00	17:00				16:00	
Vol.	7	397	60	5	7	2		2	1	1				26	

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Westbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classed	Total
03/21/14	0	12	1	0	0	0	0	0	0	0	0	0	0	0	13
01:00	0	9	1	0	0	0	0	0	0	0	0	0	0	0	10
02:00	0	4	3	0	0	0	0	0	0	0	0	0	0	0	7
03:00	0	15	4	0	0	3	0	0	1	0	0	0	0	0	23
04:00	0	60	14	0	0	0	0	0	0	0	0	0	0	3	77
05:00	2	160	35	0	1	0	0	0	0	0	0	0	0	3	201
06:00	1	394	51	4	4	1	1	0	0	0	0	0	0	16	472
07:00	0	208	39	2	6	3	0	1	0	0	0	0	0	12	271
08:00	1	155	48	4	10	2	0	0	1	1	0	0	0	8	230
09:00	0	156	30	2	6	1	0	0	2	1	0	0	0	6	204
10:00	0	180	28	3	7	1	0	0	0	0	0	0	0	6	225
11:00	1	196	40	5	6	0	0	3	0	0	0	0	0	13	264
12 PM	0	222	41	2	8	1	0	0	0	0	0	0	0	7	281
13:00	1	264	36	3	8	2	0	3	2	0	0	0	0	14	333
14:00	0	305	75	5	11	1	0	3	0	0	0	0	0	19	419
15:00	1	357	59	0	3	1	0	1	1	0	0	0	0	29	452
16:00	2	403	48	1	2	1	0	0	1	0	0	0	0	19	477
17:00	0	371	38	0	1	0	0	0	0	0	0	0	0	10	420
18:00	0	233	23	0	0	0	0	0	0	0	0	0	0	14	270
19:00	0	226	11	0	0	0	0	0	0	0	0	0	0	6	243
20:00	0	201	17	0	1	0	0	0	0	0	0	0	0	2	221
21:00	0	125	7	0	0	0	0	0	0	0	0	0	0	0	132
22:00	0	73	7	0	1	0	0	0	0	0	0	0	0	1	82
23:00	0	42	8	0	0	0	0	0	0	0	0	0	0	1	51
Total	9	4371	664	31	75	17	1	11	8	2	0	0	0	189	5378
Percent	0.2%	81.3%	12.3%	0.6%	1.4%	0.3%	0.0%	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%	3.5%	
AM Peak	05:00	06:00	06:00	11:00	08:00	03:00	06:00	11:00	09:00	08:00				06:00	
Vol.	2	394	51	5	10	3	1	3	2	1				16	
PM Peak	16:00	16:00	14:00	14:00	14:00	13:00		13:00	13:00					15:00	
Vol.	2	403	75	5	11	2		3	2					29	

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Westbound

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03/22/14	0	20	3	0	1	0	0	0	0	0	0	0	0	0	24
01:00	0	15	4	0	0	0	0	0	0	0	0	0	0	0	19
02:00	0	9	3	0	0	0	0	0	0	0	0	0	0	0	12
03:00	0	11	1	0	0	0	0	0	0	0	0	0	0	0	12
04:00	0	17	3	0	0	0	0	0	0	0	0	0	0	0	20
05:00	0	33	13	0	0	1	0	0	0	0	0	0	0	0	47
06:00	0	86	12	1	1	0	0	0	0	0	0	0	0	1	101
07:00	0	105	21	0	1	0	0	0	0	0	0	0	0	4	131
08:00	0	154	17	0	1	0	0	0	1	0	0	0	0	6	179
09:00	0	175	21	0	3	1	0	0	0	0	0	0	0	10	210
10:00	1	238	46	0	1	1	0	0	0	0	0	0	0	7	294
11:00	1	257	44	0	1	1	0	1	0	0	0	0	0	9	314
12 PM	3	292	35	0	1	0	0	0	0	0	0	0	0	12	343
13:00	0	339	35	0	3	0	0	0	1	0	0	0	0	10	388
14:00	4	348	35	0	1	0	0	0	0	0	0	0	0	10	398
15:00	3	289	18	0	3	0	0	0	0	0	0	0	0	6	319
16:00	2	270	23	0	1	0	0	0	0	0	0	0	0	15	311
17:00	3	253	31	0	0	0	0	0	0	0	0	0	0	8	295
18:00	0	204	24	0	2	0	0	0	0	0	0	0	0	7	237
19:00	0	197	13	0	0	0	0	0	0	0	0	0	0	3	213
20:00	0	155	9	0	1	0	0	0	0	0	0	0	0	1	166
21:00	0	150	10	0	1	0	0	0	0	0	0	0	0	1	162
22:00	0	89	3	0	0	0	0	0	0	0	0	0	0	0	92
23:00	0	57	6	0	1	0	0	0	0	0	0	0	0	0	64
Total	17	3763	430	1	23	4	0	1	2	0	0	0	0	110	4351
Percent	0.4%	86.5%	9.9%	0.0%	0.5%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.5%	
AM Peak	10:00	11:00	10:00	06:00	09:00	05:00		11:00	08:00					09:00	
Vol.	1	257	46	1	3	1		1	1					10	
PM Peak	14:00	14:00	12:00		13:00				13:00					16:00	
Vol.	4	348	35		3				1					15	
Grand Total	49	12212	1732	58	154	36	1	20	17	6	0	0	0	515	14800
Percent	0.3%	82.5%	11.7%	0.4%	1.0%	0.2%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	3.5%	

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Eastbound, Westbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classed	Total
03/20/14	0	12	9	0	1	0	0	0	0	0	0	0	0	0	22
01:00	0	12	3	0	0	0	0	0	0	0	0	0	0	3	18
02:00	0	9	3	0	1	0	0	0	0	0	0	0	0	5	18
03:00	0	34	10	0	3	1	0	0	0	0	0	0	0	1	49
04:00	0	154	47	0	6	0	0	0	1	1	0	0	0	1	210
05:00	1	330	94	2	14	2	0	3	0	0	0	0	0	17	463
06:00	4	780	122	10	16	8	0	2	2	0	0	0	0	55	999
07:00	1	577	108	6	12	3	1	2	2	0	0	0	0	35	747
08:00	1	366	100	4	10	2	0	2	1	0	0	0	0	19	505
09:00	0	271	75	1	14	1	0	0	0	1	0	0	0	14	377
10:00	1	308	85	7	11	5	0	2	2	0	0	0	0	13	434
11:00	3	337	81	7	13	1	0	2	2	1	0	0	0	17	464
12 PM	0	323	81	3	19	5	0	0	1	0	0	0	0	16	448
13:00	0	461	82	15	20	2	0	2	0	0	0	0	0	27	609
14:00	2	628	149	10	14	6	0	4	0	0	0	0	0	25	838
15:00	4	688	127	5	9	2	0	0	1	0	0	0	0	47	883
16:00	5	742	101	1	8	2	0	1	1	1	0	0	0	48	910
17:00	9	617	87	1	6	2	0	0	1	1	0	0	0	25	749
18:00	0	405	67	0	3	0	0	0	0	0	0	0	0	14	489
19:00	2	270	38	0	5	0	0	0	1	0	0	0	0	9	325
20:00	3	209	26	0	0	1	0	1	0	0	0	0	0	3	243
21:00	0	115	4	0	1	0	0	0	0	0	0	0	0	0	120
22:00	0	72	7	0	3	0	0	0	0	0	0	0	0	0	82
23:00	0	54	9	0	0	1	0	0	0	0	0	0	0	0	64
Total	36	7774	1515	72	189	44	1	21	15	5	0	0	0	394	10066
Percent	0.4%	77.2%	15.1%	0.7%	1.9%	0.4%	0.0%	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%	3.9%	
AM Peak	06:00	06:00	06:00	06:00	06:00	06:00	07:00	05:00	06:00	04:00				06:00	
Vol.	4	780	122	10	16	8	1	3	2	1				55	
PM Peak	17:00	16:00	14:00	13:00	13:00	14:00		14:00	12:00	16:00				16:00	
Vol.	9	742	149	15	20	6		4	1	1				48	

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Eastbound, Westbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classed	Total
03/21/14	0	19	1	0	0	0	0	0	0	0	0	0	0	0	20
01:00	0	18	2	0	0	0	0	0	0	0	0	0	0	0	20
02:00	0	10	6	0	0	0	0	0	0	0	0	0	0	0	16
03:00	0	42	14	0	2	3	0	0	1	0	0	0	0	0	62
04:00	0	153	41	1	3	0	0	0	0	0	0	0	0	7	205
05:00	2	330	91	3	17	3	0	0	1	0	0	0	0	7	454
06:00	3	770	131	8	14	4	1	1	2	0	0	0	0	33	967
07:00	3	568	114	8	19	7	0	3	0	0	0	0	0	24	746
08:00	2	383	118	5	16	4	0	2	1	1	0	0	0	21	553
09:00	1	342	89	2	19	4	0	1	2	1	0	0	0	14	475
10:00	1	371	90	10	14	3	0	1	1	2	0	0	0	9	502
11:00	1	371	94	8	13	2	0	6	1	0	0	0	0	23	519
12 PM	0	420	93	4	15	5	0	1	0	0	0	0	0	12	550
13:00	2	568	102	15	28	3	0	3	2	0	0	0	0	23	746
14:00	4	567	161	9	23	3	0	3	1	0	0	0	0	38	809
15:00	4	703	135	1	18	5	0	2	1	0	0	0	0	47	916
16:00	4	727	109	2	11	2	0	1	1	0	0	0	0	41	898
17:00	0	659	109	0	7	1	0	2	0	0	0	0	0	18	796
18:00	2	394	58	1	2	1	0	0	0	0	0	0	0	21	479
19:00	1	328	30	0	2	0	0	0	0	0	0	0	0	10	371
20:00	1	275	30	1	2	0	0	0	0	0	0	0	0	2	311
21:00	0	198	20	0	0	0	0	0	0	0	0	0	0	0	218
22:00	0	123	11	0	1	0	0	0	0	0	0	0	0	1	136
23:00	0	73	14	0	0	0	0	0	0	0	0	0	0	1	88
Total	31	8412	1663	78	226	50	1	26	14	4	0	0	0	352	10857
Percent	0.3%	77.5%	15.3%	0.7%	2.1%	0.5%	0.0%	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%	3.2%	
AM Peak	06:00	06:00	06:00	10:00	07:00	07:00	06:00	11:00	06:00	10:00				06:00	
Vol.	3	770	131	10	19	7	1	6	2	2				33	
PM Peak	14:00	16:00	14:00	13:00	13:00	12:00		13:00	13:00					15:00	
Vol.	4	727	161	15	28	5		3	2					47	

Innovative Data, LLC

PO Box 468
Belchertown, Massachusetts
innovativedatallc.com or 1.413.668.5094

Location: Groton Road (Route 40)
Location: West of Dunstable
Location: Westford, Massachusetts
Client: The Engineering Corp.

Eastbound, Westbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classed	Total
03/22/14	0	36	3	0	1	0	0	0	0	0	0	0	0	0	40
01:00	0	22	5	0	1	0	0	0	0	0	0	0	0	0	28
02:00	0	17	4	0	0	0	0	0	0	0	0	0	0	0	21
03:00	0	24	4	1	1	0	0	0	0	0	0	0	0	0	30
04:00	0	48	15	0	1	0	0	0	0	0	0	0	0	0	64
05:00	0	101	39	0	3	2	0	0	0	0	0	0	0	0	145
06:00	1	211	38	1	8	0	0	2	1	0	0	0	0	5	267
07:00	0	270	60	1	7	0	0	0	1	0	0	0	0	8	347
08:00	1	403	69	0	10	0	0	0	1	0	0	0	0	11	495
09:00	0	455	85	2	7	3	0	0	0	0	0	0	0	18	570
10:00	2	533	97	0	9	2	0	1	0	0	0	0	0	12	656
11:00	4	551	122	1	9	1	0	1	0	0	0	0	0	17	706
12 PM	3	530	93	0	7	2	0	0	0	0	0	0	0	22	657
13:00	1	557	84	1	13	1	0	0	1	0	0	0	0	20	678
14:00	5	579	76	0	6	1	0	0	0	0	0	0	0	21	688
15:00	7	545	62	0	5	0	0	0	0	0	0	0	0	16	635
16:00	3	534	64	0	1	1	0	1	0	0	0	0	0	27	631
17:00	3	469	70	0	3	0	0	0	0	0	0	0	0	14	559
18:00	0	356	52	0	4	1	0	0	0	0	0	0	0	10	423
19:00	0	275	30	0	1	0	0	0	0	0	0	0	0	6	312
20:00	0	218	20	0	2	0	0	0	0	0	0	0	0	3	243
21:00	0	212	19	0	1	0	0	0	0	0	0	0	0	3	235
22:00	0	142	7	0	0	0	0	0	0	0	0	0	0	0	149
23:00	0	88	12	0	2	0	0	0	0	0	0	0	0	0	102
Total	30	7176	1130	7	102	14	0	5	4	0	0	0	0	213	8681
Percent	0.3%	82.7%	13.0%	0.1%	1.2%	0.2%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	2.5%	
AM Peak	11:00	11:00	11:00	09:00	08:00	09:00		06:00	06:00					09:00	
Vol.	4	551	122	2	10	3		2	1					18	
PM Peak	15:00	14:00	12:00	13:00	13:00	12:00		16:00	13:00					16:00	
Vol.	7	579	93	1	13	2		1	1					27	
Grand Total	97	23362	4308	157	517	108	2	52	33	9	0	0	0	959	29604
Percent	0.3%	78.9%	14.6%	0.5%	1.7%	0.4%	0.0%	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%	3.2%	

Appendix C

Seasonal Adjustment Data

Seasonal Adjustment

Project: T0519.02 - Groton Road (Route 40) @ Dunstable Road - Functional Design Report - Westford, Massachusetts
Date: December 29, 2016
Analyst: TEC, Inc. / Eric R. Paquette, E.I.T.
Source: MassDOT Permanent Count Station 3210 and 3895

STATION 4114 - CHELMSFORD - LOWELL CONNECTOR - SOUTH OF RTE. I-495

YR	JAN	**FEB**	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR	**February Seasonal Adjustment**
06	24,000	**24,426**	26,340	24,316	24,030	24,620	23,036	23,217	24,200	25,148	25,140	23,281	24,313	-0.5%
07	23,503	**24,074**	25,046	24,685	25,137	24,905	23,225	24,568	24,868	26,610	24,930	24,633	24,682	2.5%
08	26,823	**24,798**	26,000	26,021	25,223	24,987	24,237	23,980	25,730	26,585	24,120	24,000	25,209	1.6%
09	23,134	**24,965**	25,163	25,832	24,792	25,548	24,720	23,857	26,189	27,028	25,256	24,945	25,119	0.6%

February Seasonal Adjustment: 1.1%

STATION 4170 - CHELMSFORD - RTE. I-495 - NORTH OF RTE. 4

YR	JAN	**FEB**	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR	**February Seasonal Adjustment**
06	100,000	**102,000**	102,000	104,000	103,243	108,638	117,000	117,356	105,105	102,950	98,868	92,481	104,470	2.4%
07	91,950	**94,873**	94,099	95,258	103,802	109,192	113,808	120,103	106,428	105,467	95,598	88,019	101,550	6.6%
08	82,908	**89,494**	95,000	96,549	99,670	104,487	107,612	111,258	103,346	101,899	92,885	86,352	97,622	8.3%
09	86,006	**89,523**	88,806	97,307	98,894	105,468	111,003	112,512	103,316	100,554	94,083	90,186	98,138	8.8%

February Seasonal Adjustment: 6.5%

February Seasonal Adjustment: 3.8%

Appendix D

Annual Growth Rate Data

Average Daily Traffic Summary Table

Project: T0519.02 - Groton Road (Route 40) @ Dunstable Road - Functional Design Report - Westford, Massachusetts
Date: December 29, 2016
Analyst: TEC, Inc. / Eric R. Paquette, E.I.T.
Source: MassDOT Permanent Count Stations 4037, 4047

STA.	TOWN	ROUTE/STREET	LOCATION	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Amb. Growth
4047	Chelmsford	Groton Road (Route 40)	at Westford T.L.	13,100	12,854	12,900	13,800	13,627	12,997	13,411	14,149	13,701	14,458	1.18%
4037	Groton	Lowell Road (Route 40)	at Westford T.L.	4,600	4,500	4,200	4,600	4,694	5,599	4,784	5,047	4,842		1.11%

Average = **1.1%**

Appendix E

Specific Development by Others

Site Generated Trip Assessment

Project: T0519.02 - Groton Road @ Dunstable Road FDR - Westford, Massachusetts
Develop: MOB Office Building
Date: June 11, 2014
Analyst: TEC, Inc. / Samuel W. Gregorio, P.E.
Source: Institute of Transportation Engineers - *Trip Generation, 9th Edition*

Institute of Transportation Engineers (ITE)
Land Use Code (LUC) 720 - Medical-Dental Office Building

Average Vehicle Trips Ends vs: 1000 SF Gross Floor Area
Independent Variable (X): 10

AVERAGE WEEKDAY DAILY

T = 36.13 * (X)
T = 36.13 * (10)
T = **362** vehicle trips
with 50% (181 vpd) entering and 50% (181 vpd) exiting.

WEEKDAY MORNING PEAK HOUR OF ADJACENT STREET TRAFFIC

T = 2.39 * (X)
T = 2.39 * (10)
T = **24** vehicle trips
with 79% (19 vpd) entering and 21% (5 vpd) exiting.

WEEKDAY EVENING PEAK HOUR OF ADJACENT STREET TRAFFIC

T = 3.57 * (X)
T = 3.57 * (10)
T = **36** vehicle trips
with 28% (10 vpd) entering and 72% (26 vpd) exiting.

SATURDAY DAILY

T = 8.96 * (X)
T = 8.96 * (10)
T = **90** vehicle trips
with 50% (45 vpd) entering and 50% (45 vpd) exiting.

SATURDAY MIDDAY PEAK HOUR OF GENERATOR

T = 3.63 * (X)
T = 3.63 * (10)
T = **36** vehicle trips
with 57% (21 vph) entering and 43% (15 vph) exiting.

Trip Distribution Gravity Model - Residence to Workplace

Project: T0519.02 - Groton Road (Route 40) @ Dunstable Road FDR - Westford, Massachusetts
Development: MOB Office Building
Date: June 11, 2014
Analyst: TEC, Inc. / Samuel W. Gregorio, P.E.
Source: United States Census Bureau, 2000

					Major Route							Distribution						
Residence	**Workplace State-County-MCD Name**	**Number of Residents in Commuter Flow**	**% of Total Workers**	**% of Distributed Workers**	Groton Road from West	Groton Road from East	Dunstable Road from North	Oak Hill Road from South	Tynsboro to/from North	Depot to/from South	Check	Groton Road from West	Groton Road from East	Dunstable Road from North	Oak Hill Road from South	Tynsboro to/from North	Depot to/from South	Check
Westford town Middlesex Co. MA	Westford, MA	2307	19.4%	31.8%	5%	5%	2%	10%	3%	75%	100%	1.591%	1.591%	0.636%	3.181%	0.954%	23.859%	31.81%
Lowell city Middlesex Co. MA	Westford, MA	944	8.0%	13.0%		100%					100%	0.000%	13.017%	0.000%	0.000%	0.000%	0.000%	13.02%
Chelmsford town Middlesex Co. MA	Westford, MA	694	5.8%	9.6%		70%		30%			100%	0.000%	6.699%	0.000%	2.871%	0.000%	0.000%	9.57%
Nashua city Hillsborough Co. NH	Westford, MA	554	4.7%	7.6%		100%					100%	0.000%	7.639%	0.000%	0.000%	0.000%	0.000%	7.64%
Tyngsbor. town Middlesex Co. MA	Westford, MA	296	2.5%	4.1%		75%			25%		100%	0.000%	3.061%	0.000%	0.000%	1.020%	0.000%	4.08%
Dracut town Middlesex Co. MA	Westford, MA	287	2.4%	4.0%		100%					100%	0.000%	3.958%	0.000%	0.000%	0.000%	0.000%	3.96%
Groton town Middlesex Co. MA	Westford, MA	257	2.2%	3.5%	100%						100%	3.544%	0.000%	0.000%	0.000%	0.000%	0.000%	3.54%
Billerica town Middlesex Co. MA	Westford, MA	251	2.1%	3.5%		100%					100%	0.000%	3.461%	0.000%	0.000%	0.000%	0.000%	3.46%
Littleton town Middlesex Co. MA	Westford, MA	251	2.1%	3.5%				33%		67%	100%	0.000%	0.000%	0.000%	1.142%	0.000%	2.319%	3.46%
Acton town Middlesex Co. MA	Westford, MA	245	2.1%	3.4%				33%		67%	100%	0.000%	0.000%	0.000%	1.115%	0.000%	2.264%	3.38%
Pepperell town Middlesex Co. MA	Westford, MA	204	1.7%	2.8%	75%		25%				100%	2.110%	0.000%	0.703%	0.000%	0.000%	0.000%	2.81%
Ayer town Middlesex Co. MA	Westford, MA	203	1.7%	2.8%	100%						100%	2.799%	0.000%	0.000%	0.000%	0.000%	0.000%	2.80%
Fitchburg city Worcester Co. MA	Westford, MA	182	1.5%	2.5%	25%					75%	100%	0.627%	0.000%	0.000%	0.000%	0.000%	1.882%	2.51%
Leominster city Worcester Co. MA	Westford, MA	168	1.4%	2.3%	25%					75%	100%	0.579%	0.000%	0.000%	0.000%	0.000%	1.737%	2.32%
Boston city Suffolk Co. MA	Westford, MA	146	1.2%	2.0%		100%					100%	0.000%	2.013%	0.000%	0.000%	0.000%	0.000%	2.01%
Lawrence city Essex Co. MA	Westford, MA	145	1.2%	2.0%		100%					100%	0.000%	1.999%	0.000%	0.000%	0.000%	0.000%	2.00%
Marlbor. city Middlesex Co. MA	Westford, MA	118	1.0%	1.6%						100%	100%	0.000%	0.000%	0.000%	0.000%	0.000%	1.627%	1.63%
TOTALS		**7,252**	**61.1%**	**100.0%**								**11.25%**	**43.44%**	**1.34%**	**8.31%**	**1.97%**	**33.69%**	**100.00%**
General Assumptions:				**SAY**								**11.0%**	**44.0%**	**1.0%**	**8.0%**	**2.0%**	**34.0%**	**100.00%**

Site Generated Trip Assessment

Project: T0519.02 - Groton Road @ Dunstable Road FDR - Westford, Massachusetts
Develop: Spaulding Hill Estates
Date: June 11, 2014
Analyst: TEC, Inc. / Samuel W. Gregorio, P.E.
Source: Institute of Transportation Engineers - *Trip Generation, 9th Edition*

Institute of Transportation Engineers (ITE)
Land Use Code (LUC) 210 - Single Family Detached Housing

Average Vehicle Trips Ends vs: Dwelling Units
Independent Variable (X): 31

AVERAGE WEEKDAY DAILY

T = 9.52 * (X)
T = 9.52 * (31)
T = **296** vehicle trips
with 50% (148 vpd) entering and 50% (148 vpd) exiting.

WEEKDAY MORNING PEAK HOUR OF ADJACENT STREET TRAFFIC

T = 0.75 * (X)
T = 0.75 * (31)
T = **24** vehicle trips
with 25% (6 vpd) entering and 75% (18 vpd) exiting.

WEEKDAY EVENING PEAK HOUR OF ADJACENT STREET TRAFFIC

T = 1.00 * (X)
T = 1.00 * (31)
T = **32** vehicle trips
with 63% (20 vpd) entering and 37% (12 vpd) exiting.

SATURDAY DAILY

T = 9.91 * (X)
T = 9.91 * (31)
T = **308** vehicle trips
with 50% (154 vpd) entering and 50% (154 vpd) exiting.

SATURDAY MIDDAY PEAK HOUR OF GENERATOR

T = 0.93 * (X)
T = 0.93 * (31)
T = **28** vehicle trips
with 54% (15 vph) entering and 46% (13 vph) exiting.

Trip Distribution Gravity Model - Residence to Workplace

Project: T0519.02 - Groton Road (Route 40) @ Dunstable Road FDR - Westford, Massachusetts
Development: Spaulding Estates - St. Augustine Road
Date: June 11, 2014
Analyst: TEC, Inc. / Samuel W. Gregorio, P.E.
Source: United States Census Bureau, 2000

					Major Route						Distribution						
Residence	**Workplace State-County-MCD Name**	**Number of Residents in Commuter Flow**	**% of Total Westford Residents**	**% of Distributed Residents**	Groton Road from West	Groton Road from East	Keyes Road from North	Dunstable Road from North	Dunstable Road from South	Nutting Road from South	Groton Road from West	Groton Road from East	Keyes Road from North	Dunstable Road from North	Dunstable Road from South	Nutting Road from South	Check
Westford, MA	Westford town Middlesex Co. MA	2307	21.5%	27.7%	5%	15%	5%		15%	60%	1.383%	4.149%	1.383%	0.000%	4.149%	16.595%	27.66%
Westford, MA	Chelmsford town Middlesex Co. MA	801	7.5%	9.6%		70%				30%	0.000%	6.722%	0.000%	0.000%	0.000%	2.881%	9.60%
Westford, MA	Lowell city Middlesex Co. MA	500	4.7%	6.0%		100%					0.000%	5.994%	0.000%	0.000%	0.000%	0.000%	5.99%
Westford, MA	Boston city Suffolk Co. MA	424	3.9%	5.1%		100%					0.000%	5.083%	0.000%	0.000%	0.000%	0.000%	5.08%
Westford, MA	Bedford town Middlesex Co. MA	419	3.9%	5.0%		100%					0.000%	5.023%	0.000%	0.000%	0.000%	0.000%	5.02%
Westford, MA	Billerica town Middlesex Co. MA	386	3.6%	4.6%		100%					0.000%	4.628%	0.000%	0.000%	0.000%	0.000%	4.63%
Westford, MA	Concord town Middlesex Co. MA	345	3.2%	4.1%	67%					33%	2.771%	0.000%	0.000%	0.000%	0.000%	1.365%	4.14%
Westford, MA	Burlington town Middlesex Co. MA	333	3.1%	4.0%		100%					0.000%	3.992%	0.000%	0.000%	0.000%	0.000%	3.99%
Westford, MA	Acton town Middlesex Co. MA	330	3.1%	4.0%	67%					33%	2.651%	0.000%	0.000%	0.000%	0.000%	1.306%	3.96%
Westford, MA	Andover town Essex Co. MA	289	2.7%	3.5%		100%					0.000%	3.465%	0.000%	0.000%	0.000%	0.000%	3.46%
Westford, MA	Waltham city Middlesex Co. MA	286	2.7%	3.4%		100%					0.000%	3.429%	0.000%	0.000%	0.000%	0.000%	3.43%
Westford, MA	Cambridge city Middlesex Co. MA	279	2.6%	3.3%		100%					0.000%	3.345%	0.000%	0.000%	0.000%	0.000%	3.34%
Westford, MA	Lexington town Middlesex Co. MA	241	2.2%	2.9%		100%					0.000%	2.889%	0.000%	0.000%	0.000%	0.000%	2.89%
Westford, MA	Tewksbury town Middlesex Co. MA	237	2.2%	2.8%		100%					0.000%	2.841%	0.000%	0.000%	0.000%	0.000%	2.84%
Westford, MA	Nashua city Hillsborough Co. NH	216	2.0%	2.6%		80%	20%				0.000%	2.072%	0.518%	0.000%	0.000%	0.000%	2.59%
Westford, MA	Littleton town Middlesex Co. MA	184	1.7%	2.2%	100%						2.206%	0.000%	0.000%	0.000%	0.000%	0.000%	2.21%
Westford, MA	Woburn city Middlesex Co. MA	151	1.4%	1.8%		100%					0.000%	1.810%	0.000%	0.000%	0.000%	0.000%	1.81%
Westford, MA	Marlbor. city Middlesex Co. MA	150	1.4%	1.8%	67%					33%	1.205%	0.000%	0.000%	0.000%	0.000%	0.593%	1.80%
Westford, MA	Framingham town Middlesex Co. MA	122	1.1%	1.5%	67%					33%	0.980%	0.000%	0.000%	0.000%	0.000%	0.483%	1.46%
Westford, MA	Wilmington town Middlesex Co. MA	117	1.1%	1.4%		100%					0.000%	1.403%	0.000%	0.000%	0.000%	0.000%	1.40%
Westford, MA	Tyngsbor. town Middlesex Co. MA	113	1.1%	1.4%		100%					0.000%	1.355%	0.000%	0.000%	0.000%	0.000%	1.35%
Westford, MA	Westbor. town Worcester Co. MA	111	1.0%	1.3%	67%					33%	0.892%	0.000%	0.000%	0.000%	0.000%	0.439%	1.33%
TOTALS		**8,341**	**77.6%**	**100.0%**							**12.09%**	**58.20%**	**1.90%**	**0.00%**	**4.15%**	**23.66%**	**100.00%**
General Assumptions:				**SAY**							**12.0%**	**58.0%**	**2.0%**	**0.0%**	**4.0%**	**24.0%**	**100.00%**

Site Generated Trip Assessment

Project: T0519.02 - Groton Road @ Dunstable Road FDR - Westford, Massachusetts
Develop: Stony Brook II Residential Development
Date: June 11, 2014
Analyst: TEC, Inc. / Samuel W. Gregorio, P.E.
Source: Institute of Transportation Engineers - *Trip Generation, 9th Edition*

Institute of Transportation Engineers (ITE)
Land Use Code (LUC) 220 - Apartment

Average Vehicle Trips Ends vs: Dwelling Units
Independent Variable (X): 36

AVERAGE WEEKDAY DAILY

T = 6.65 * (X)
T = 6.65 * (36)
T = **240** vehicle trips
with 50% (120 vpd) entering and 50% (120 vpd) exiting.

WEEKDAY MORNING PEAK HOUR OF ADJACENT STREET TRAFFIC

T = 0.51 * (X)
T = 0.51 * (36)
T = **18** vehicle trips
with 20% (4 vpd) entering and 80% (14 vpd) exiting.

WEEKDAY EVENING PEAK HOUR OF ADJACENT STREET TRAFFIC

T = 0.62 * (X)
T = 0.62 * (36)
T = **22** vehicle trips
with 65% (14 vpd) entering and 35% (8 vpd) exiting.

SATURDAY DAILY

T = 6.39 * (X)
T = 6.39 * (36)
T = **230** vehicle trips
with 50% (115 vpd) entering and 50% (115 vpd) exiting.

SATURDAY MIDDAY PEAK HOUR OF GENERATOR

T = 0.52 * (X)
T = 0.52 * (36)
T = **18** vehicle trips
with 50% (9 vph) entering and 50% (9 vph) exiting.

Trip Distribution Gravity Model - Residence to Workplace

Project: T0519.02 - Groton Road (Route 40) @ Dunstable Road FDR - Westford, Massachusetts
Development: Stony Brook II - Farmer's Way
Date: June 11, 2014
Analyst: TEC, Inc. / Samuel W. Gregorio, P.E.
Source: United States Census Bureau, 2000

					Major Route					Distribution					
Residence	**Workplace State-County-MCD Name**	**Number of Residents in Commuter Flow**	**% of Total Westford Residents**	**% of Distributed Residents**	Groton Road from West	Groton Road from East	Dunstable Road from North	Dunstable Road from South	Nutting Road from South	Groton Road from West	Groton Road from East	Dunstable Road from North	Dunstable Road from South	Nutting Road from South	Check
Westford, MA	Westford town Middlesex Co. MA	2307	21.5%	27.7%	5%	15%	5%	15%	60%	1.383%	4.149%	1.383%	4.149%	16.595%	27.66%
Westford, MA	Chelmsford town Middlesex Co. MA	801	7.5%	9.6%		70%			30%	0.000%	6.722%	0.000%	0.000%	2.881%	9.60%
Westford, MA	Lowell city Middlesex Co. MA	500	4.7%	6.0%		100%				0.000%	5.994%	0.000%	0.000%	0.000%	5.99%
Westford, MA	Boston city Suffolk Co. MA	424	3.9%	5.1%		100%				0.000%	5.083%	0.000%	0.000%	0.000%	5.08%
Westford, MA	Bedford town Middlesex Co. MA	419	3.9%	5.0%		100%				0.000%	5.023%	0.000%	0.000%	0.000%	5.02%
Westford, MA	Billerica town Middlesex Co. MA	386	3.6%	4.6%		100%				0.000%	4.628%	0.000%	0.000%	0.000%	4.63%
Westford, MA	Concord town Middlesex Co. MA	345	3.2%	4.1%	67%				33%	2.771%	0.000%	0.000%	0.000%	1.365%	4.14%
Westford, MA	Burlington town Middlesex Co. MA	333	3.1%	4.0%		100%				0.000%	3.992%	0.000%	0.000%	0.000%	3.99%
Westford, MA	Acton town Middlesex Co. MA	330	3.1%	4.0%	67%				33%	2.651%	0.000%	0.000%	0.000%	1.306%	3.96%
Westford, MA	Andover town Essex Co. MA	289	2.7%	3.5%		100%				0.000%	3.465%	0.000%	0.000%	0.000%	3.46%
Westford, MA	Waltham city Middlesex Co. MA	286	2.7%	3.4%		100%				0.000%	3.429%	0.000%	0.000%	0.000%	3.43%
Westford, MA	Cambridge city Middlesex Co. MA	279	2.6%	3.3%		100%				0.000%	3.345%	0.000%	0.000%	0.000%	3.34%
Westford, MA	Lexington town Middlesex Co. MA	241	2.2%	2.9%		100%				0.000%	2.889%	0.000%	0.000%	0.000%	2.89%
Westford, MA	Tewksbury town Middlesex Co. MA	237	2.2%	2.8%		100%				0.000%	2.841%	0.000%	0.000%	0.000%	2.84%
Westford, MA	Nashua city Hillsborough Co. NH	216	2.0%	2.6%		80%	20%			0.000%	2.072%	0.518%	0.000%	0.000%	2.59%
Westford, MA	Littleton town Middlesex Co. MA	184	1.7%	2.2%	100%					2.206%	0.000%	0.000%	0.000%	0.000%	2.21%
Westford, MA	Woburn city Middlesex Co. MA	151	1.4%	1.8%		100%				0.000%	1.810%	0.000%	0.000%	0.000%	1.81%
Westford, MA	Marlbor. city Middlesex Co. MA	150	1.4%	1.8%	67%				33%	1.205%	0.000%	0.000%	0.000%	0.593%	1.80%
Westford, MA	Framingham town Middlesex Co. MA	122	1.1%	1.5%	67%				33%	0.980%	0.000%	0.000%	0.000%	0.483%	1.46%
Westford, MA	Wilmington town Middlesex Co. MA	117	1.1%	1.4%		100%				0.000%	1.403%	0.000%	0.000%	0.000%	1.40%
Westford, MA	Tyngsbor. town Middlesex Co. MA	113	1.1%	1.4%		100%				0.000%	1.355%	0.000%	0.000%	0.000%	1.35%
Westford, MA	Westbor. town Worcester Co. MA	111	1.0%	1.3%	67%				33%	0.892%	0.000%	0.000%	0.000%	0.439%	1.33%
TOTALS		**8,341**	**77.6%**	**100.0%**						**12.09%**	**58.20%**	**1.90%**	**4.15%**	**23.66%**	**100.00%**
General Assumptions:				**SAY**						**12.0%**	**58.0%**	**2.0%**	**4.0%**	**24.0%**	**100.00%**

Re-Occupancy of Existing Industrial Space

Project: T0519.02 - Groton Road @ Dunstable Road FDR - Westford, Massachusetts
Develop: 497 Groton Road
Date: January 9, 2017
Analyst: TEC, Inc. / Douglas S. Halpert, E.I.T.
Source: Institute of Transportation Engineers - Trip Generation , 9th Edition

ITE Land Use Code (LUC) 110 - General Light Industrial

Average Vehicle Trips Ends vs: 1000 Sq. Feet Gross Floor Area
Independent Variable (X): 7.00

AVERAGE WEEKDAY DAILY

T = 6.970 * (X)
T = 6.970 * 7.00
T = **48** vehicle trips
with 50% (24 vpd) entering and 50% (24 vpd) exiting.

WEEKDAY MORNING PEAK HOUR OF ADJACENT STREET TRAFFIC

T = 0.920 * (X)
T = 0.920 * 7.00
T = **6** vehicle trips
with 88% (6 vph) entering and 12% (0 vph) exiting.

WEEKDAY EVENING PEAK HOUR OF ADJACENT STREET TRAFFIC

T = 0.970 * (X)
T = 0.970 * 7.00
T = **7** vehicle trips
with 12% (1 vph) entering and 88% (6 vph) exiting.

SATURDAY DAILY

T = 1.320 * (X)
T = 1.320 * 7.00
T = **10** vehicle trips
with 50% (5 vpd) entering and 50% (5 vpd) exiting.

SATURDAY MIDDAY PEAK HOUR OF GENERATOR

T = 0.140 * (X)
T = 0.140 * 7.00
T = **1** vehicle trips
with 47% (0 vph) entering and 53% (1 vph) exiting.

Appendix F

Road Safety Audit

ROAD SAFETY AUDIT

Groton Road (Route 40) at Dunstable Road

Town of Westford

April 25, 2014

Prepared For:
MassDOT

On Behalf Of:
Town of Westford

Prepared By:
TEC, Inc.
65 Glenn Street
Lawrence, MA 01843

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Background

The Town of Westford, Massachusetts is currently planning improvements along the Groton Road (Route 40) corridor, specifically at the intersection with Dunstable Road, in an effort to address existing operational and safety concerns. In conjunction with the preliminary design (pre-25% Design) stage and Functional Design Report (FDR) for these improvements, TEC, Inc. is submitting this Road Safety Audit (RSA) report for the intersection of Groton Road (Route 40) / Dunstable Road. The purpose of the RSA is to observe, identify, and report all safety issues and identify future opportunities for safety enhancement improvements for all roadway users. This includes identifying both short-term and long-term safety improvements which can be implemented through general maintenance, immediate installation/removal, or could potentially be incorporated into the defined future improvement project.

In August 2005, the Transportation Act entitled the "Safe, Accountable, Flexible, Efficient Transportation Act - A Legacy for Users" (SAFETEA-LU) was passed. This act provides guidance and funding for the implementation of a State Highway Safety Improvement Program (HSIP). As part of this program, all states are required to develop a Strategic Highway Safety Plan (SHSP). The Massachusetts Department of Transportation (MassDOT) guidelines require an RSA to be conducted where HSIP-eligible crash clusters are present within the study area of a transportation improvement project, prior to commencing or finalizing a 25% Design and FDR. An intersection is defined as HSIP-eligible if the intersection is within the top 5% of clusters in its respective Regional Planning Commission (RPC) boundaries based on Equivalent Property Damage Only (EPDO). EPDO rates crashes based on the collision severity. Based on the *published* MassDOT database, the intersection of Groton Road / Dunstable Road is NOT recognized as an HSIP-eligible intersection; however, based on the most updated crash data information from the respective RPC, the Northern Middlesex Council of Governments (NMCOG), the intersection does meet the threshold for HSIP-eligibility, as confirmed by MassDOT.

An RSA, as defined by the Federal Highway Administration (FHWA), is the *formal safety performance examination of an existing or future road or intersection by an independent, multidisciplinary team.* This RSA was conducted during the preliminary design (pre-25% Design) stage of intersection and corridor improvements along Groton Road in Westford, Massachusetts in order to incorporate safety-related design features early in the design process. The scale of the improvements at this location is projected to include, but not limited to: minor roadway widening, mill and overlay of pavement, restriping of pavement markings, the installation of a fully-actuated traffic signal (if warranted), and traffic sign improvements. Elements of the RSA will be considered for incorporation into the roadway improvement project as the design is advanced through the MassDOT and Town of Westford design development process.

Project Data

TEC, Inc. of Lawrence, Massachusetts is the prime traffic safety investigation consultant in an RSA for the intersection of Groton Road (Route 40) / Dunstable Road in Westford, Massachusetts. The RSA was conducted on Monday, March 31, 2014 at 1:00 PM, with the pre- and post-audit meetings held at the Westford Town Hall in Westford, Massachusetts. A copy of the RSA agenda can be found in

Appendix A. TEC has also conducted various other field visits to the audit location as part of its FDR and pre-25% Design work.

As presented in Table 1, the audit team consisted of a cross-section of state, regional, and local engineering, planning, enforcement, maintenance and emergency response professionals and was assembled in conjunction with input from MassDOT's Traffic Safety Management Unit. Contact information for all participating audit team members is provided in Appendix B.

Table 1. Participating Audit Team Members

Audit Team Member	Agency/Affiliation
Paul Starratt, P.E.	Town of Westford Engineering
Jeremy Downs, P.E.	Town of Westford Engineering
Jeffrey Morrissette	Town of Westford Planning
Chip Barrett	Town of Westford Highway Department
Lt. Don Parsons	Town of Westford Fire Department
Capt. Mark Chambers	Town of Westford Police Department
Justin Howard	Northern Middlesex Council of Governments (NMCOG)
Mike Mauro	Northern Middlesex Council of Governments (NMCOG)
Lisa Schletzbaum	Massachusetts Department of Transportation – Traffic Safety
Corey O'Connor, E.I.T.	Massachusetts Department of Transportation – Traffic Safety
Nithin Krishna	Massachusetts Department of Transportation – Traffic Safety
Lola Campbell	Massachusetts Department of Transportation – District 3
Samuel W. Gregorio, E.I.T.	TEC, Inc.
Mikel C. Myers, P.E.	TEC, Inc.
Kerri K. Racki	TEC, Inc.

Audit participants were provided with materials to review prior to the audit meeting. The materials included a summary of collision data, collision diagrams (See Appendix), a summary of the type and severity of collisions, and speed data. Participants were encouraged to visit the site prior to the audit and were urged to consider elements on MassDOT's Safety Review Prompt List.

On the day of the audit, a pre-audit meeting was held at the Westford Town Hall to discuss the project's background, the audit process, review the distributed materials, and discuss the some of the issues that Team members had observed individually. The audit site walk consisted of field observations at the audit intersection. Handwritten notes and photographs documented the observations made by audit team members during the site walk. Following the audit site walk, a post-audit meeting was held at Westford Town Hall where the Team confirmed the observations made in the field and offered solutions to enhance the safety of areas noted in the site walk and pre-audit meeting.

Project Location and Description

The Road Safety Audit was conducted at the intersection of Groton Road (Route 40) / Dunstable Road in the Town of Westford, Massachusetts. A Study Area Location Map is provided in Figure 1.

Groton Road (Route 40)

Groton Road, signed as Massachusetts State Route 40, generally runs in an east-west direction and is maintained by the Town of Westford. The roadway is classified as an urban principal arterial roadway and provides regional connection through the northern portion of Westford between Groton Town Center to the west and Vinyl Square / North Chelmsford Center to the east. The roadway also provides regional connection to US Route 3 (Northwest Expressway) approximately 2.5 miles to the east of Groton Road's intersection with Dunstable Road. Groton Road is designated as a primary evacuation route for both Westford and Groton by the Northeast Homeland Security Regional Advisory Council (NERAC).

Groton Road is approximately 32-feet wide in the vicinity of Dunstable Road with varying 1- to 4-foot shoulders. Directional flow along Groton Road is separated by marked centerline. The posted speed limit is 40 miles per hour (mph) and the 85th percentile speed of existing traffic was measured at 40 mph. No speed regulations for the roadway are on file with the Town of Westford or MassDOT. In the vicinity of Dunstable Road, Groton Road has multiple horizontal and vertical roadway curves. Land uses along Groton Road include: residential, light retail, and light commercial uses.

Dunstable Road

Dunstable Road generally runs in a northwest-southeast direction and is maintained by the Town of Westford. The roadway is classified as an urban minor arterial roadway north of Groton Road and an urban collector south of Groton Road. Dunstable Road provides regional connection through the northern portion of Westford between Depot Street to the south and Dunstable Town Center to the north.

Dunstable Road is approximately 30-feet wide immediately north of Groton Road and approximately 20-feet wide south of Groton Road. There is no posted speed limit along Dunstable Road south of Groton Road; however it is assumed that the speed limit is 30 mph due to nature of roadway settlement. The posted speed limit north of Groton Road is 30 mph. The 85th percentile speed of existing traffic was measured at 31 mph both north and south of the intersection with Groton Road. Land uses along Dunstable Road include primarily residential uses.

Groton Road (Route 40) @ Dunstable Road

Dunstable Road intersects Groton Road to form a four-way unsignalized intersection. Both the Dunstable Road northbound and southbound approaches are under STOP-control while the Groton Road eastbound and westbound approaches are free-flowing. A flashing warning beacon is suspended above the intersection to supplement the two-way STOP-control and cautionary free-flowing characteristics. All four intersection approaches consist of a single general purpose travel lane. Directional flow along Groton Road is separated by a marked double-yellow centerline with edge-lines providing marked shoulders. Directional flow along Dunstable Road is also separated by a marked double-yellow centerline

with edge-lines providing marked shoulders north of the intersection. Many of the pavements markings are faded. No sidewalks or crosswalks are provided at the intersection.

A BP gas station is located on the northwest corner of the intersection of Groton Road / Dunstable Road. The gas station provides a 20-foot curb-cut along the Dunstable Road southbound approach and two extensive curb-cuts (±40-feet wide) along the Groton Road eastbound approach. The two curb-cuts are separated by a raised landscaped island that is offset from the roadway by 7-feet. Utility poles are present along the Groton Road northerly curb-line.

The intersection of Groton Road / Dunstable Road is abutted by multiple wetland and water resource areas, including a National Heritage Endangered Species Program (NHESP) certified vernal pool on the southwest corner of the intersection and a wetland on the southeast corner of the intersection.

Automatic Traffic Recorder Count Data

Traffic Volumes

Automatic Traffic Recorder (ATR) counts were conducted on Groton Road (Route 40) and on Dunstable Road on Thursday March 20 to Saturday March 22, 2013 to gather daily traffic-volume data for the study area roadways during a continuous 72-hour time period. A summary of the weekday ATR traffic data is presented in Table 2.

Table 2. Existing Traffic Volume Summary

Location	Weekday Traffic Volume[a]	Weekday Morning Peak Hour			Weekday Evening Peak Hour		
		Traffic Volume[b]	K Factor[c]	Directional Distribution[d]	Traffic Volume	K Factor	Directional Distribution
Groton Road (east of Dunstable Road)	10,637	981	9.2	56.0% EB	984	9.3	54.5% WB
Groton Road (west of Dunstable Road)	10,066	747	7.4	58.4% EB	910	9.0	52.2% WB
Dunstable Road (north of Groton Road)	2,887	264	9.1	83.0% SB	296	10.3	73.6% NB
Dunstable Road (south of Groton Road)	1,405	158	11.2	79.1% SB	155	11.0	68.4% NB

[a]Daily traffic expressed in vehicles per day.
[b]Expressed in vehicles per hour.
[c]Percent of daily traffic volumes which occurs during the peak hour.
[d]Percent of peak-hour volume in the predominant direction of travel.
EB – eastbound; WB = westbound; NB = northbound; SB = southbound

Groton Road (Route 40) carries approximately 10,640 vehicles per day (vpd) on an average weekday east of Dunstable Road and approximately 10,065 vpd on an average weekday west of Dunstable Road. The majority of vehicles along Groton Road (Route 40) are travelling eastbound in the weekday morning peak period and westbound during the weekday evening peak period. This is consistent with commuter flows travelling to / from US Route 3 Interchange 33 east of the intersection.

Dunstable Road carries approximately 2,890 vpd on an average weekday north of Groton Road (Route 40) and approximately 1,405 vpd on an average weekday south of Groton Road (Route 40). The majority of vehicles along Dunstable Road north of Groton Road (Route 40) are travelling southbound in the

weekday morning peak period and northbound during the weekday evening peak period. This is consistent with commuter flows travelling to / from US Route 3 Interchange 33 east of the intersection. South of the intersection, the majority of vehicles along Dunstable Road are travelling southbound in the weekday morning peak period and northbound during the weekday evening peak period. This suggests that Dunstable Road south of Groton Road (Route 40) is used as a cut-through roadway to/from Groton Road (Route 40) and Westford Town Center. It also suggests that commuter flow to/from US Route 3 may likely be utilizing Depot Street or Oak Hill Road to/from Westford Town Center.

The traffic volume counts showed little or no pedestrian and bicycle traffic during the 72-hour continuous study period. Audit participants noted that there is traditionally little to no pedestrian traffic along Groton Road or Dunstable Road in this area; however, bicycle traffic is significant during the spring, summer, and fall and has been continuously increasing over the past few years.

Vehicle Speeds

Vehicle travel speeds on Groton Road (Route 40) and Dunstable Road on the approaches to the unsignalized intersection were collected as part of the ATRs in March 2014. Table 2 summarizes the measured travel speed data. Roadway surface conditions were dry and weather conditions were generally clear / cloudy during the collection of roadway speeds. Therefore, vehicle travel speeds can be assumed to be at or near prevailing conditions.

Table 3. Existing Vehicle Speed Summary

Location	Average Speed (mph)		85th Percentile Speed (mph)		% Vehicles > Speed Limit	
	EB or NB	WB or SB	EB or NB	WB or SB	EB or NB	WB or SB
Groton Road (east of Dunstable Road)	33	36	38	42	8.4%	30.1%
Groton Road (west of Dunstable Road)	34	33	40	38	17.8%	6.5%
Dunstable Road (north of Groton Road)	27	28	31	32	19.4%	26.4%
Dunstable Road (south of Groton Road)	26	28	30	32	14.1%	26.9%

The data shows that the average travel speeds on the approaches of Groton Road are consistently below the posted speed limit of 40 mph. The 85th percentile speed on these approaches was consistently approximately 40 mph. On both Groton Road approaches, the vehicle speeds exiting the intersection were higher than the vehicle speeds entering the intersection.

The data shows that the average travel speeds on the approaches of Dunstable Road, similar to Groton Road, are consistently below the posted speed limit of 30 mph. Although there is shown to be approximately 6 to 30 percent of vehicles operating above the speed limit, the 85th percentile speeds on these approaches were only slightly above the posted speed limit (32 mph vs. 30 mph).

Vehicle Classification

Vehicle classification was reviewed along Groton Road (Route 40) and Dunstable Road based on data collected within the ATR counts in March 2014. Table 3 summarizes the percent of heavy vehicles (trucks and buses) for the average weekday daily traffic.

Table 4. Existing Vehicle Classification Summary

Location	Weekday Daily HV%		Weekday Morning Peak Hour HV%		Weekday Evening Peak Hour HV%	
	EB or NB	WB or SB	EB or NB	WB or SB	EB or NB	WB or SB
Groton Road (east of Dunstable Road)	1.3%	1.4%	1.0%	1.7%	0.8%	0.5%
Groton Road (west of Dunstable Road)	2.0%	1.2%	1.9%	1.8%	1.7%	0.3%
Dunstable Road (north of Groton Road)	1.0%	0.4%	4.9%	0.5%	0.6%	0.0%
Dunstable Road (south of Groton Road)	1.2%	1.2%	3.8%	1.5%	0.0%	0.0%

Table 3 shows that the percent of daily heavy vehicles on Groton Road (Route 40) in the vicinity of the study area intersection ranges between 1.2 to 2.0 percent. On Dunstable Road, heavy vehicles represent 0.4 to 1.2 percent of total vehicles.

Truck and bus traffic accounted for approximately 1.0 to 1.9 percent of the total traffic volume during the weekday morning peak period and approximately 0.3 to 1.7 percent during the weekday evening peak period. Along Dunstable Road, truck and bus traffic accounted for approximately 0.5 to 4.9 percent of the total traffic volume during the weekday morning peak period and approximately 0.0 to 0.6 percent during the weekday evening peak period. A majority of the weekday morning peak period heavy vehicle traffic was classified as buses (school buses).

Town of Westford staff noted during the audit meeting that Groton Road (Route 40) is utilized as a cut-through for heavy vehicles between US Route 3 and Devens. This includes many vehicle transports.

1" = 500'

Groton Road (Route 40) @ Dunstable Road - Westford, Massachusetts

Road Safety Audit

Figure 1

Audit Study Area Map

TEC, Inc.
65 Glenn Street | Lawrence, MA 01843
169 Ocean Blvd, Unit 101 | Hampton, NH 03842

Audit Observations

Prior to the RSA site walk, a pre-audit meeting was held at the Westford Town Hall. This pre-audit meeting included brief introductions, an overview of the project and RSA process, and a summary of volume, speed, and safety characteristics at the intersection of Groton Road (Route 40) / Dunstable Road. Audit participants then conducted a site walk as a group to observe the intersection. Each participant was advised to offer their concerns and comments related to safety issues at the study area intersection.

Based on these field observations and discussions, the RSA team determined that the intersection of Groton Road / Dunstable Road has several general concerns that may negatively impact safety. The following sections describe in more detail the safety issues identified during the RSA. Several of these require further evaluation and design work to develop appropriate safety enhancements. More specific safety challenges located at specific audit area intersections are also included.

Crash History

The intersection of Groton Road / Dunstable Road is considered HSIP-eligible. Collision data for this intersection was provided by NMCOG for the period of January 2009 to December 2012 and supplemented by the Town of Westford Police Department for the period of January 2013 to December 2013. The data shows a total of 53 reported collisions (10.6 per year) in the area of the intersection during the five-years of complete collision data. All but one (1) collision [*noted as Collision #8*] was locatable. The crash rate for this intersection is significantly higher (3.5 times higher) than the statewide and district-wide averages for unsignalized intersections with 2.32 crashes per MEV.

There were twelve (12) rear-end collisions (23%) at the intersection over the five-year study period. Of the locatable rear-end collisions, more than three-quarters (9 of 12) occurred on the Groton Road eastbound approach to the intersection, of which four (4) collisions were the result of motorists following too closely. Two (2) of the rear-end collisions occurred on the westbound approach of Groton Road to the BP gas station curb-cut as vehicles attempted to exit the gas station.

There were nine (9) single vehicle collisions (17%) at the intersection over the five-year study period. Of the locatable single vehicle collisions, more than half (5 of 9) occurred during the night between 7:00 PM and 1:00 AM.

There were twenty-nine (29) angled collisions (55%) at the intersection over the five-year period which represents the vast majority of collisions at the intersection of Groton Road / Dunstable Road. Approximately two-thirds (19 of 29) of these angled collisions were a result of failing to yield the right-of-way to the operator along Groton Road according to the narratives provided. All angled collisions at the intersection occurred during periods of daylight between 6:50 AM and 7:05 PM. Only one (1) of the angled collisions resulted in a non-fatal injury. Eighteen (18) of the angled collisions (62%) involved a vehicle exiting Dunstable Road southbound north of the intersection.

The crash data noted five (5) collisions that occurred along Groton Road at one of the two BP gas station driveways, which both are within 170 feet of the Groton Road / Dunstable Road intersection. These

collisions included two (2) rear-end crashes (as previously mentioned), one (1) single vehicle collision, and two (2) angled collisions.

Safety Concerns

The RSA team noted safety concerns at the intersection of Groton Road / Dunstable Road. Some specific safety related concerns are mentioned in multiple bullets within the summary. Based on these field observations and discussions, the RSA team determined that the intersection and approaches had the following issues that negatively impact safety:

- Traffic Control
- Dunstable Road Approach Alignment,
- Proximity of Adjacent BP Driveways,
- BP Gas Station Driveways Entering Movements,
- BP Gas Station Driveways for Cut-Through Traffic,
- Visibility and Sight Distance,
- Roadway Profiles / Grades,
- Dunstable Road Tree within Right-of-Way,
- By-Passing Stopped Traffic,
- Pavement and Surface Conditions,
- Stormwater Drainage and Ponding,
- Utility Poles within Pavement,
- Solar Glare,
- Advanced Warning Signage,
- STOP sign locations,
- Driver Inattention and Indecision,
- Traffic Patterns,
- Pedestrian and Bicyclist Accommodations, and
- Lack of Speed Regulations

The following provides a detailed summary of the identified safety concerns at the intersection:

- *Traffic Control* – The current unsignalized intersection of Groton Road / Dunstable Road is two-way STOP-controlled. Several safety concerns are related to the current traffic control at this intersection, including:
    - *Traffic Control Violations / Failure to Yield the Right-of-Way* - Approximately two-thirds (19 of 29) of these angled collisions were a result of failing to yield the right-of-way to the operator along Groton Road (Route 40) according to the narratives provided by the Westford Police Department. Many drivers attempted to enter the traffic flow along Groton Road (Route 40) and were immediately struck by an oncoming, free-flowing vehicle. Although STOP signs are provided on the Dunstable Road approach and vehicles generally comply and stop, many advance into the intersection without proper caution.

      Several audit participants acknowledged frequent "courtesy" extended to the drivers exiting the side street; where one driver with the right-of-way, waves the side street driver to proceed even when the right-of-way may not be with that driver. This may cause the side street driver to pull out without consideration of other mainline vehicles on Groton Road. In addition, it was

suggested that extending "courtesy" to the drivers exiting the side street may result in rear-end collisions for vehicles along Groton Road who are unaware of the aforementioned "courtesy."

- *Peak Hour Commuter Congestion* – Groton Road serves as a major commuter artery to/from US Route 3 to the east. Traffic volumes in the area generally increase during the weekday morning and weekday evening peak periods are cause a steady and constant flow of traffic. With no controlled intersections to the immediate east or west of the Groton Road / Dunstable Road intersection, gaps in the constant flow are not regularly occurring during the peak periods. This lack of gaps adds to queues and increase driver frustration on the STOP controlled streets and many residential driveways.
- *Queuing* – During the weekday morning and weekday evening peak commuter periods, audit participants noted that it was not uncommon for six to ten vehicles to queue on Dunstable Road southbound north of the intersection. On occasion, queued vehicles honk their horns in frustration. Queuing puts a perceived pressure on the driver at the front of the queue and causes the occasional quick judgment to enter the intersection.

  Stopping sight distance along Dunstable Road approaching the intersection may be insufficient around the horizontal curvature to allow adequate distance for a driver to perceive and react to the back of queue extending from the Groton Road intersection. Although no rear-end or single vehicle collisions were reported along this approach as a result of queuing or congestion, the potential of queuing or unexpected traffic congestion remains a safety concern.

- *Dunstable Road Approach Alignment* – The Dunstable Road approaches to Groton Road are slightly offset, and therefore vehicles exiting the Dunstable Road approaches do not have a direct path to access the opposing Dunstable Road receiving lane. These movements may be difficult for unfamiliar users attempting to cross Groton Road. During multiple field visits, vehicles were observed encroaching over the double-yellow centerline (DYCL) prior to completing the maneuver into the appropriate receiving lane. No head-on collisions have occurred during the study period in the north-south direction; however the alignment was still identified as a safety issue.

  Multiple audit participants described how vehicles travelling southbound on Dunstable Road will utilize the roadway as two lanes for which some motorists may be confused to which lane is acting as the through lane if a left-turning vehicle has not properly indicated a left-turn signal. As vehicles attempting to travel straight across the intersection are far-left up against the DYCL, it becomes more difficult to track across the intersection. The side-by-side vehicles on the approach presents a safety issue because of the limited sight distance, especially if the adjacent vehicle is a larger vehicle that blocks the driver's view.

Image 1: View of Roadway Alignment from Dunstable Road Southbound Approach

- *Proximity of Adjacent BP Driveways* – Two driveways to the adjacent BP gas station located on the northwest corner of the intersection provide access/egress to/from Groton Road. A third curb-cut is provided along Dunstable Road north of the intersection. These driveways along Groton Road are both within 170 feet of the intersection providing additional conflict points and minimal separation distance from the intersection. Five (5) collisions that occurred within the study area involved or resulted from a vehicle entering or exiting one of the BP gas station driveways.

  Town of Westford representatives noted that the separated curb-cuts were established approximately 15 years ago. Previously, the pavement was open on both Groton Road (Route 40) and Dunstable Road.

- *BP Gas Station Driveways Entering Movements* - The owner of the BP gas station noted that vehicles will sometimes enter the Dunstable Road driveway straight from Groton Road westbound without performing the appropriate legal turning maneuvers (right-turn onto Dunstable Road then left-turn into driveway). While making this maneuver, vehicles entering the driveway cross the path of vehicles approaching the STOP line on Dunstable Road southbound. This provides a potential for conflicts with vehicles travelling southbound on Dunstable Road who may be queued or approaching the intersection with limited visibility of the driveway and turning traffic due to vegetation and curves restricting sight distances.

- *BP Gas Station Driveways for Cut-Through Traffic* - It was also mentioned that the gas station driveways are used as a "cut-through" for southbound vehicles along Dunstable Road turning into the gas station only to turn left out of the gas station onto Groton Road. This indicates there are limited gaps within Groton Road traffic and an increase frustration level with queued vehicles.

Image 2: BP Gas Station Curb-cuts in Relation to Intersection of Groton Road / Dunstable Road

- *Visibility and Sight Distance* – Audit participants noted several challenges in regards to sight distance on all four approaches to the intersection, including:
    - *Set Back STOP Lines* – STOP lines along Dunstable Road are set back 15 feet from the edge of travel-way along Groton Road. This forces vehicles to pull-up beyond the STOP bar to view Groton Road to the east and west before proceeding.
    - *Shrubbery Along North Edge of Groton Road* – There are shrubbery/bushes located within the curb-cut island for the BP gas station and inside the granite/wood fence to the #270 Groton Road property. In season, bushes may provide obstruction to intersection sight lines from Dunstable Road southbound for smaller vehicles.

Image 3: View of Bushes within Sightline from Dunstable Road Southbound

- *Gas Station Sign* – The existing BP gas station sign may block sightlines for larger vehicles on Dunstable Road southbound looking west.
- *Wooden Fence (Private)* – A wooden fence at #259 Groton Road, west of the intersection, blocks the view for vehicles exiting Dunstable Road northbound looking west if not pulled-up to the edge of travel-way.

Image 4: View of Sight Line on Dunstable Road Northbound Looking West

- *Summer Village Sign / Flashing Beacon Pole* – The southeast corner of the intersection includes multiple obstructions, including: a guardrail, a sign for the "Summer Homes" development along Dunstable Road north of the intersection, and the pole for the flashing warning beacon. These obstructions block the view of Dunstable Road northbound traffic looking east. In season, the vegetation tree line also contributes to sight line concerns on this corner.
- *BP Northerly Site Driveway* – Sight lines exiting the BP Gas Station driveway looking north are heavily restricted by the horizontal curvature in the roadway and an existing tree on the westerly edge of roadway. The audit team observed that a majority of patrons to the BP Gas Station enter and exit the site from the Groton Road curb-cuts.

- *Roadway Profile / Grades* – Throughout the Town of Westford, Groton Road is a rolling throughway with multiple horizontal curves and multiple crest/sag vertical curves. Crest vertical curves are present both immediately east and west of the intersection with Dunstable Road which are limiting factors for sightlines from Dunstable Road. It was observed during the audit field visit that passenger vehicles are hidden in the sag curve to the east of the intersection. The steep grade on Dunstable Road northbound also contributes to delay for vehicles turning onto Groton Road.
- *Dunstable Road Tree within Right-Of-Way* – Immediately south of Groton Road along the easterly edge of Dunstable Road, a large tree (>4' diameter) encroaches into the right-of-way. Although the STOP sign on the approach is visible further upstream and a second STOP sign is placed on the opposing edge of pavement, the tree temporarily

blocks the STOP sign from a point approximately 200-feet to 100-feet from the painted STOP bar.

Immediately north of Groton Road along the westerly edge of Dunstable Road, a large tree (>4' diameter) encroaches into the right-of-way and completely blocks the view of the intersection upstream on horizontal curvature of the roadway. These two trees on either side of Groton Road contribute to the side-street alignment offset at Groton Road.

Image 5: View of Dunstable Road Northbound From Center of Travel Lane

- *By-Passing Stopped Traffic* – Groton Road eastbound, west of Dunstable Road, includes a 12-foot travel lane with a 1.5-foot shoulder. The roadway cross-section does not allow for sufficient room for through vehicles to by-pass stopped turning vehicles within the free-flowing condition. Eight (8) rear-end collisions were identified on the Groton Road eastbound approach as the front vehicle was stopped in traffic presumably turning left. These included collisions as a result of attempting to by-pass the stopped vehicle, following too closely, and driver inattention.

  It was mentioned during the audit field visit that some of these rear-end collisions could be related to the gas station driveways. A vehicle slowing to turn into the gas station driveway could be perceived by a following vehicle as turning onto Dunstable Road. This creates the potential for collision in the following drivers does not anticipate the turning vehicle to slow so abruptly to turn into the driveway.

- *Pavement and Surface Conditions* – The Town of Westford Highway Department indicated that Groton Road was last paved in 2000. Dunstable Road has recently been paved. There are several locations, especially near the edge-lines, where pavement is fragmented. An audit participant noted that the age of pavement may be a factor in many collisions that occurred on wet pavement.

  Vehicles travelling northbound on Dunstable Road were observed spinning wheels upon acceleration after STOP. This may be a result of the wet pavement at the time of observation in addition to the presence of gravel and sand on the edge-lines of Groton Road (Route 40).

Both Groton Road and Dunstable Road lack a constant and noticeable edge line, whether pavement to soil or pavement to curbing. Where no curbing exists along most of the approaches to the intersection, annual debris build-up and broken pavement have resulted in an inconsistent roadway width. In addition, there is pavement scouring from open pavement runoff.

- *Stormwater Drainage and Ponding* – Stormwater drainage structures have been in place prior to the Dunstable Road southbound widening and the BP gas station separated curb-cuts. As a result the drainage structures along Dunstable Road southbound are offset 4-feet from the curb line. Based on the existing roadway crowning, the curb line acts as a gutter for Dunstable Road stormwater by-passing the existing catch basin north of the BP gas station curb-cut. The stormwater continues to the catch basin near the edge line of Groton Road, which is also 5-feet from the curb line. Minor ponding was observed near this catch basin. The crash data indicated that 26% of collisions during the study period involved wet surface roadway.

Image 6: View of Stormwater By-Passing Catch Basin on Dunstable Road

- *Utility Poles within Pavement* – There is currently a utility pole outside the existing curb line along the northerly edge of Groton Road, west of the intersection, in front of the BP gas station raised landscaped island, and offset 7-feet from the travel-way. The utility pole is not within the existing path of travel along Groton Road (Route 40); however the pole does provide an obstruction to any user who has even a minor crossover of the existing edge line. Although no collisions indicated the placement of this utility pole as a contributing factor, the current placement poses potential future safety risks.
- *Solar Glare*– Narratives from the motor vehicle crash reports and field observations indicate that solar glare may be an issue along the Groton Road east-west corridor and the southbound approach of Dunstable Road. Although the roadway is bordered by extensive vegetation and trees, solar glare increases at the intersection of Groton Road / Dunstable Road as a result of the set-back of vegetation from the roadway based on the adjacent development. Two (2) collisions defined solar glare as a contributing factor.

- *Advanced Warning Signage* - Advanced warning signs were recently installed along Groton Road (Route 40) [W2-1 – Intersection Warning] and along Dunstable Road [W3-1 - STOP ahead] by MassDOT in 2013. The MUTCD Section 2C.05 indicates that advanced warning signage should be placed at appropriate locations to provide adequate perception-reaction time (PRT) without being too far in advance that the message being conveyed is forgotten. The advance STOP warning signage on the Dunstable Road southbound approach is approximately 325 feet from the STOP line and may be too far back from the intersection to provide a memorable message.

Image 7: Advanced Warning Signage Along Dunstable Road Southbound Approach

In addition, the Dunstable Road northbound approach has three (3) separate advanced STOP warning signs. This includes two (2) signs directly opposing one another approximately 160 feet from the intersection and one (1) approximately 400 feet south of the intersection, bolted to an adjacent tree. Since the additional advance warning signage has been implemented, there is no clear indication that a reduction in collisions has occurred.

- *STOP Sign Locations* – The MUTCD Section 2A.16 indicates that the outer edge of roadside signage at a minor crossroad intersection should be a minimum of 6 feet offset from the edge of pavement. The edges of STOP signs on both the northbound and southbound approaches to the intersection are located within the 6 foot minimum zone and slightly over-hang into the roadway. Although the collision occurrence does not indicate that the lateral offset of the STOP signs is a contributing factor to collisions, the current signage offset may contribute to the existing sight line constraints.
- *Driver* – Audit participants and collision reports indicated several challenges in regards to the driver at the intersection, including:
    - *Driver Inattention* - Multiple collisions were a result of driver inattention or distracted driving. Seven (7) of the collisions reported over the study period were listed as directly caused by inattention, distracted driving, or cell phone use. Many other collisions, as described in the narrative, had driver inattention characteristics as a contributing factor to the collision.

  - *Driver Indecision* – During the audit field visit, participants observed driver hesitation between two vehicles stopped on each Dunstable Road approach to the intersection trying to determine who had the right-of-way. This wasted valuable time in the "gap" of traffic along Groton Road.

- *Traffic Patterns* – Several audit participants suggested that potential crashes along Groton Road may be a result of increased unfamiliar traffic to the roadways. This includes increased cut-through traffic between US Route 3 in Tyngsboro (Interchange 34) to Interstate 495 in both Westford (Interchange 32) and Littleton (Interchange 31), increased passenger car and heavy vehicle traffic between US Route 3 (Interchange 33) to Devens, and the new seasonal home development along Dunstable Road north of the intersection. Traffic volumes have also increased due to an increase in school traffic, which may be a result of the municipal fees associated with school busing. Although the collision data did not specify the unfamiliar user as the cause to these collisions, unfamiliarity with the roadway may be a contributing factor in some collisions.

  It was noted during the audit field visit that some drivers avoid the intersection and use adjacent signalized intersections, such as Groton Road / Tyngsboro Road / Depot Street, to avoid the turning movements in and out of Dunstable Road.

- *Pedestrian and Bicyclist Accommodations* - The intersection of Groton Road / Dunstable Road lacks any accommodations for pedestrian and bicycle users. No sidewalks are present along either Groton Road (Route 40) or Dunstable Road in the vicinity of the intersection. In addition, with narrow roadway shoulders, there are poor accommodations for bicyclists. Although pedestrian traffic is typically limited at the intersection, bicycle traffic has increased considerably in recent years as reported by Town of Westford officials. No collisions at the intersection involved a pedestrian or a bicyclist.

- *Speed Regulations* – There are currently no speed regulations along Groton Road on file with the Town of Westford or MassDOT.

Potential Safety Enhancements

After the site visit, audit participants returned to the meeting location to discuss the safety issues and consider improvements. Audit participants were encouraged to consider both short and long term improvements for each issue. Each improvement considered has been categorized as short-term, midterm, or long-term based. Additionally, a cost category has been assigned to each improvement based on the definitions shown in Table 5.

Table 5. Estimated Time Frame and Cost Breakdown

Time Frame		Costs	
Short-Term	<1 year	Low	<$10,000
Mid-Term	1-3 years	Medium	$10,000 - $50,000
Long-Term	>3 years	High	>$50,000

The following improvements were suggested by audit participants to improve safety issues associated with the intersection of Groton Road (Route 40) / Dunstable Road.

- Consider improvement strategies related to traffic control. Two separate strategies were discussed during the audit:
  - Consider installation of a fully-actuated traffic signal. A traffic signal would provide protected turning movements and reduce the number of angled crashes at the intersection by creating less conflict between major-street and minor-street movements. The installation of a traffic signal will also assist in eliminating the need for gaps in traffic, and assist in the reduction of queues and driver frustration from the existing two-way STOP control. Investigation of traffic signal warrants should be conducted before proposing a traffic signal. Installation of a traffic signal is a long-term, high-cost improvement.
  - Consider construction of a roundabout. A roundabout traditionally lowers speed and calms traffic resulting in a reduction in major collisions. The installation of a roundabout will also assist in eliminating the need for gaps in traffic, and assist in the reduction of queues and driver frustration from the existing two-way STOP control. The construction of a roundabout may require significant takings of adjacent private properties and may require the relocation of underground fuel storage tanks at the BP gas station, relocation of a private well on the northeast corner of the intersection, may impact access to the BP gas station, and may affect potential wetland boundaries south of the intersection. A roundabout is a long-term, high-cost improvement.
- Consider realignment of Dunstable Road on both the northbound and southbound approaches to create improvement tracking for through vehicles and reduce encroachment into oncoming approach lanes. This will require the removal of several large trees (>4’ diameter) along Dunstable Road both north and south of the intersection. Realignment of Dunstable Road approaches may not be needed if a roundabout is

proposed as a change in intersection control. This safety enhancement is a long-term, high-cost improvement.

- Consider installation of pavement markings to Dunstable Road through the intersection to improve vehicle tracking across Groton Road. This safety enhancement is a short-term, low-cost improvement.
- Explore the closure or reconfiguration of the BP Gas Station curb-cuts to reduce the number of vehicle conflict points at and near the Groton Road / Dunstable Road intersection and reduce the number of cut-through maneuvers for queued vehicles along Dunstable Road. Investigate driveway restrictions to limit which vehicles may enter or exit certain driveways to prevent courtesy collisions with vehicle queued if a signal is installed. This safety enhancement is a long-term, medium-cost improvement.
- Remove or better maintain shrubbery/bushes within the BP Gas Station raised landscape island and on the property of #270 Groton Road. This will improve sightlines when the plants are in season. Vegetation and obstruction removal is a short-term, low-cost solution and should be conducted in coordination with the abutters.
- Trim and maintain vegetation along the southerly edge of Groton Road to provide better sightlines for vehicles exiting Dunstable Road from the south. In addition, remove or reset the "Summer Village" signage further back from the intersection. This will allow northbound traffic to view oncoming traffic without "creeping up" too far beyond the STOP bar. Sight triangles should be calculated for the intersection to make sure the brush and other potential obstructions are trimmed and maintained appropriately. Vegetation and obstruction removal is a short-term, low-cost solution and should be conducted in coordination with the Town of Westford and abutters.
- Move the mast arm shaft for the flashing beacon back away from the roadway edge to improve the sight lines for Dunstable Road northbound vehicles looking to the east. Similarly, be sure that if installing a new traffic signal that the mast arm shafts are not obstructing sight lines on this intersection corner. This improvement is a long-term, medium-cost improvement.
- Consider the removal or relocation of the BP Gas Station sign. It was noted that similar gas stations in Westford removed their signage from roadway sightlines and replaced the signage on the fueling station canopy allowing for continued viewing. Signage removal is a short-term, medium-cost solution and should be conducted in coordination with the property owner.
- Consider reconstruction of Groton Road to establish a more consistent profile and improve sight lines at the intersection and along the Groton Road corridor. Improving the grades and vertical curvature of Groton Road is a long-term, high-cost improvement.
- Consider reconstruction of Dunstable Road southbound approaching Groton Road to provide a consistent grade. Improving the grades and vertical curvature of Dunstable Road is a long-term, high-cost improvement.
- Remove the large shade trees (>4' diameter) within the Right-of-Way along both Dunstable Road northbound and southbound to improve sight lines to/from the intersection along the approaches. This safety enhancement is a mid-term, medium-cost improvement.

- Consider the construction of exclusive left-turn lanes along Groton Road in both the eastbound and westbound directions. This will assist in the reduction of rear-end crashes for vehicles that unexpectedly stop to make turning movements onto Dunstable Road by providing a separate lane for left-turns to decelerate and wait for a gap. This treatment may increase the number of courtesy crashes and angle crashes at the intersection if traffic control is to remain two-way STOP control. Investigation of left-turn lane warrants should be conducted before proposing left-turn lanes. This safety enhancement is a long-term, high-cost improvement.
- Mill and overlay Groton Road at the intersection with Dunstable Road. Consideration should also be given to mill and overlay the Groton Road corridor. This will improve vehicle traction on the intersection approaches during poor weather conditions and provide a consistent roadway edge line and correct the ponding issue. This improvement is a mid-term, high-cost improvement.
- Reconstruct the drainage system by locating catch basins along the existing or future roadway edge lines to improve stormwater drainage and remove unnecessary ponding at the BP Gas Station curb-cuts and at the corners to the intersection. This safety enhancement is a long-term, high-cost improvement.
- Reset the curbing and widen the BP Gas Station raised landscaped island adjacent to the fueling stations to encompass the utility pole within the Groton Road pavement. This will remove the obstruction from the potential path of travel and decrease the amount of impervious area in front of the BP Gas Station. This safety enhancement is a short-term, medium-cost improvement. *[This improvement may be subject to potential widening on Groton Road for auxiliary turn lanes]*
- If a traffic signal is implemented at the intersection and rear-end collisions are still prevalent, consider the installation of advanced electronic signage that conveys a message of "RED" signal ahead to motorists who cannot view the upcoming signal due to the rolling roadway profile. These signs are similar to the advance signage present at the intersection of Groton Road / Tyngsboro Road / Depot Street to the east. This safety enhancement is a long-term, mid-cost improvement (mid-cost due to potential conduit interconnect between electronic sign and the traffic signal).

- Examine the spacing and distances of the existing advance warning signage and reset signage as needed. The construction or installation of a roundabout or traffic signal will require new advanced signage and the recalculating of spacing and advanced distance based on PRT and queue lengths. Properly spaced advanced warning signs will increase traffic control compliance. This improvement is a short-term, low-cost improvement.
- Reset STOP signage on Dunstable Road to be compliant with MUTCD lateral offset standards. This improvement is subject to any change in intersection control and would be a short-term, low-cost improvement. *[Confirm proper lateral offset at all present and future signage at and near the intersection]*
- Consider adding pavement markings to the Dunstable Road southbound approach to formalize the lane(s) leading to the stop bar. This will prevent two cars next to each other attempting to go straight at the same time. It should be decided if one general purpose lane is sufficient or if an additional turning lane is warranted. Either way, lane use

markings may help to formalize lane usage. This improvement is a short-term, low-cost improvement.

- Reset STOP bar pavement markings along Dunstable Road closer to intersection to allow for maximum sightlines to/from Groton Road. STOP bars should be striped at a location that still provides a safe distance from the edge of travel-way and provide trucks the ability to turn from Groton Road onto Dunstable without encroaching into the Dunstable Road approach traffic. This improvement is a short-term, low-cost improvement.
- Consider the construction of sidewalks and bicycle shoulders/lanes along Groton Road and shared lane markings along Dunstable Road to improve multi-modal access through the intersection and comply with MassDOT's Healthy Transportation Policy Directive. The construction of sidewalks and bicycle shoulders/lanes will require the acquisition of additional Right-of-Way on private property and may result in significant environmental impacts to adjacent wetlands and water resource areas. This safety enhancement is a long-term, high-cost improvement.
- The Town of Westford should consider utilizing its online public social networking accounts to educate the public on the intersection; such as crash history, advisories, and speed. This is a low-cost, short-term education tool.
- Conduct a speed study to establish a legal speed limit on Groton Road to allow for easier enforcement. Based on current traffic speeds collected by ATR counts, the posted speed limit may not change from its current 40 MPH. Conducting a speed study is a short-term, low-cost measure and should be conducted by the Town of Westford Police Department who have jurisdiction.
- Increase enforcement of traffic control measures at the intersection of Groton Road / Dunstable Road. Continue enforcement of the 40 MPH speed limit along Groton Road. Enforcement of traffic controls is a short-term, low cost improvement and should be conducted by the Town of Westford Police Department who have jurisdiction.

Summary of Road Safety Audit

Based on the observations and discussions, the RSA team identified safety issues at the intersection of Groton Road (Route 40) / Dunstable Road. Further evaluation and design work may be necessary to develop safety enhancements to the roadway and intersections. The safety issues are summarized in Table 6.

For each safety issue, the RSA team has described the potential safety enhancement, its potential safety payoff, the estimated time frame for completion, the estimated construction cost, and the jurisdictional agency. The current scope of improvements will continue to be refined through coordination between the Project Team, the Town of Westford, and MassDOT. As design plans are in the 25% Design phase, all potential safety enhancements noted in this report will be incorporated into the design to the greatest extent possible or justification provided within the FDR or Design Exception Report as to why each item is not included.

The potential safety enhancements are summarized in Table 6. As the design plans progress, safety enhancements identified by the RSA will be incorporated into the design to the extent feasible based upon agreements between the Project Team, NMCOG, the Town of Westford and MassDOT.

Table 6. Potential Safety Enhancement Summary

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Responsibility
Traffic Control	Consider installation of a roundabout. This requires further study and may require the acquisition of substantial Right-of-Way.	High	Long-Term	High	Town
	Consider installation of a traffic signal. This requires further study.	High	Long-Term	High	Town
Dunstable Road Approach Alignment	Consider geometric modifications to Dunstable Road to improve alignment across Groton Road. Realignment of Dunstable Road approaches may not be needed if a roundabout is proposed.	Medium	Long-Term	High	Town
	Consider installation of pavement markings to Dunstable Road through intersection to improve vehicle tracking across Groton Road.	Medium	Short-Term	Low	Town
BP Gas Station Driveways	Consider site driveway closings, reconstruction or restrictions to reduce conflicts at the intersection and reduce cut-through traffic.	High	Long-Term	Medium	Town / BP Gas Station
Sight Lines and Visibility	Reset STOP bar pavement markings along Dunstable Road closer to the intersection while maintaining a safe distance from the edge of travel-way.	Low	Short-Term	Low	Town
	Remove or maintain shrubbery/bushes within the BP Gas Station landscaped island and along the #270 Groton Road property.	Medium	Short-Term	Low	Town
	Trim and maintain vegetation along the southerly edge of Groton Road.	Medium	Short-Term	Low	Town
	Consider relocation of BP Gas Station signage and replace with signage on fueling station canopy.	Medium	Short-Term	Mid	Town / BP Gas Station
	Move the mast arm shaft for the flashing beacon back away from the roadway edge to improve the sight lines for Dunstable Road northbound vehicles looking to the east.	Medium	Long-Term	Mid	Town

Table 7. Potential Safety Enhancement Summary

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Responsibility
Sight Lines and Visibility (Continued)	Consider relocation of BP Gas Station signage and replace with signage on fueling station canopy.	Medium	Short-Term	Mid	Town / BP Gas Station
Roadway Profiles and Grades	Reconsider regrading Groton Road to establish a more consistent profile and improve sightlines.	High	Long-Term	High	Town
	Reconsider regrading Dunstable Road southbound to establish a more consistent profile and improve sightlines.	High	Long-Term	High	Town
Dunstable Road Tree within Right-Of-Way	Remove the shade trees within the Right-of-Way along Dunstable Road both immediately north and south of Groton Road.	High	Mid-Term	Medium	Town
By-Passed Stopped Traffic	Consider the construction of exclusive left-turn lanes along Groton Road in the eastbound and westbound directions.	Medium	Long-Term	High	Town
Pavement Conditions	Mill and overlay Groton Road to improve traction on the intersection approaches during poor weather conditions and provide consistent roadway cross-slopes and edge lines.	Medium	Mid-Term	High	Town / Property Owners
Drainage	Reconstruct new drainage structures along the existing or future roadway edge.	Medium	Long-Term	High	Town
Utility Poles within Pavement	Widen the BP Gas Station raised landscaped island to encompass the utility pole within the Groton Road curb line.	Low	Short-Term	Medium	Town / BP Gas Station
Advanced Warning Signage	Consider the installation of advanced electronic traffic signal signage if a traffic signal is installed at the intersection.	Medium	Long-Term	High	Town
	Examine the spacing and distances of the existing advance warning signage and reset signage as needed. Remove and reset Dunstable Road SB advanced signage to a location closer to the intersection with Groton Road (Route 40).	Medium	Short-Term	Low	Town
	Remove third advanced STOP warning sign on Dunstable Road northbound approach (currently bolted to adjacent tree).	Low	Short-Term	Low	Town

Table 6. Potential Safety Enhancement Summary (Continued)

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Responsibility
Advanced Warning Signage (Continued)	Investigate the removal and replacement of ALL advanced warning signage based on appropriate visibility and queues for the potential installation of roundabout control or traffic signal control.	Medium	Long-Term	Low	Town
Lateral Offset of Signage	Reset STOP signage (pending no change in traffic control) on Dunstable Road to be compliant with MUTCD lateral offset standards.	Low	Short-Term	Low	Town
Pedestrian and Bicycle Accommodations	Consider installation of sidewalks along Groton Road and Dunstable Road and bicycle lanes / shoulders along Groton Road.	Medium	Long-Term	High	Town / Property Owners
Public Education	Utilize Town of Westford online social networks (such as Twitter) to inform public on intersection crashes, advisories, and speed.	Medium	Short-Term	Low	Town
Enforcement	Conduct a speed study to establish a legal speed limit on Groton Road to allow for easier enforcement. Based on current traffic speeds collected by ATR counts, the posted speed limit may not change from its current 40 MPH.	Medium	Short-Term	Low	Town / MassDOT
	Increase enforcement of traffic control measures and continue speed enforcement at intersection	Medium	Short-Term	Low-Cost	Town

Appendix G

Crash Data

Crash Data Summary Table

Groton Road and Dunstable Road - Westford, Massachusetts

1/1/2009 - 12/31/2013

Crash Diagram Reference	Crash Date	Day of Week	Time of Day	Manner of Collision	Light Condition	Weather Condition	Road Surface	Driver Conributing Code (by Narritive Description)	Crash Severity	Ages			Comments
										D1	D2	D3	
1	1/2/2009	Friday	4:27 PM	Rear-end	Dark-Lighted	Cloudy	Wet	Followed to closely	Property Damage Only	22	51		MV1 traveling behind MV2 slid on ice and was unable to stop before rear-ending MV2
2	2/5/2009	Thursday	7:10 PM	Angle	Dark-Lighted	Clear	Dry	Visibility Obstructed	Property Damage Only	28	49		MV2 did not see MV1 due to a snow bank in the way.
3	3/9/2009	Monday	8:06 AM	Angle	Daylight	Snow	Snow	No Improper Driving	Property Damage Only	64	21		Operator of MV1 attemped to stop at the intersection but was unable to do so and collided with MV2. Snowy roads made it difficult to stop.
4	5/8/2009	Friday	2:12 PM	Rear-end	Daylight	Clear	Dry	Inattention	Property Damage Only	54	46		MV1 stopped in a line of trffic on Groton Road. Operator of MV2 stated she was distracted and failed to stop in time to avoid MV1.
5	7/2/2009	Thursday	2:30 PM	Angle	Daylight	Snow	Wet	Inattention	Non-Fatal Injury	46	23		MV1 was traveling north and drove into the lane of traffic of MV2. This caused MV2 to strike the side of MV1.
6	7/8/2009	Wednesday	5:42 PM	Angle	Daylight	Rain	Wet	Disregarded Traffic Controls	Non-Fatal Injury	66	39	42	Operator of MV3 stated that he thought he stopped at the stop sign. Operator of MV1 saw MV3 and slowed down, then started to speed up. MV3 came through the stop sign and then hit MV1 which caused MV1 to collide with MV2.
7	11/25/2009	Wednesday	12:05 PM	Angle	Daylight	Rain	Wet	Failed to yield to right-of-way	Property Damage Only	17	17		MV1 did not see MV2 traveling east which resulted in a collision.
8	12/19/2009	Saturday	9:35 AM	Unknown	Unknown	Unknown	Unknown	Unknown	Property Damage Only	62	34		Incident only. Drivers exchanged information no officer needed.
9	1/9/2010	Saturday	1:55 PM	Angle	Daylight	Clear	Dry	Failed to yield to right-of-way	Property Damage Only	43	50		MV2 made a complete stop at the intersection. Operator of MV1 saw MV2 come out at the last minute and did not have enough time to stop. MV2 stated there were multiple cars making turns and did not see MV1 traveling straight until it was too late.
10	2/18/2010	Thursday	7:17 PM	Single Vehicle	Dark-Lighted	Clear	Dry	No Improper Driving	Property Damage Only	66			MV1 was headed west near # 270 Groton Road when deer ran out into the road.
11	3/24/2010	Wednesday	8:07 AM	Rear-end	Daylight	Clear	Dry	Inattention	Property Damage Only	65	49		MV1 was stopped in a line of traffic due to a school bus that had its lights flashing and stop sign out by the BP gas station. MV2 didn't realize that the cars were stopped and misjudged her timing and distance and struck MV1.
12	5/21/2010	Friday	5:10 PM	Rear-end	Daylight	Clear	Dry	Excessive Speed	Property Damage Only	42	19		MV2 was traveling behind MV1 and was traveling too fast and too close. MV1 slowed down when approaching the intersection causing MV2 to strike the back of MV1.
13	6/11/2010	Friday	3:30 PM	Angle	Daylight	Clear	Dry	Failed to yield to right-of-way	Property Damage Only	61	49		MV1 stopped at the intersection at the stop sign then pulled out in front of MV2. Intersection is controlled by blinking yellow light on Groton Road and by blinking red light on Dunstable Road.
14	6/24/2010	Thursday	11:19 AM	Single Vehicle	Daylight	Clear	Dry	No Improper Driving / Following too close	Property Damage Only	38			Unknown vehicle traveling in front of MV1 slammed on the brakes for a flashing yellow light causing MV1 to crash into a support pole.
15	7/8/2010	Thursday	3:36 PM	Angle	Daylight	Clear	Dry	Failed to yield to right-of-way	Property Damage Only	47	50		MV2 attempting to cross the road after stopping at a stop sign collided with MV3 (MV1 is a motorcycle pulling a trailer).
16	7/9/2010	Friday	3:09 PM	Angle	Daylight	Clear	Dry	Failed to yield to right-of-way	Property Damage Only	21	23		Both MV1 and MV2 drove into the road and both operators stated that a white van blocked MV1's view which resulted in the crash.
17	7/16/2010	Friday	9:32 PM	Single Vehicle	Dark-Lighted	Fog, Smog	Wet	Vehicle Malfunction	Property Damage Only	18			Operator of MV1 stated he noticed a vibration in the steering wheel right before he lost control and hit a tree stump.

Crash Data Summary Table

Groton Road and Dunstable Road - Westford, Massachusetts

1/1/2009 - 12/31/2013

Crash Diagram Reference	Crash Date	Day of Week	Time of Day	Manner of Collision	Light Condition	Weather Condition	Road Surface	Driver Conributing Code (by Narritive Description)	Crash Severity	Ages			Comments
										D1	D2	D3	
18	7/16/2010	Friday	10:35 PM	Single Vehicle	Dark-Lighted	Rain	Wet	Operating in erratic/egressive manner	Property Damage Only	54			Operator of MV1 states that he came around the corner, sneezed, refocused his eyes and then hit a utility pole.
19	10/18/2010	Monday	9:26 AM	Angle	Daylight	Clear	Dry	Disregarded Traffic Controls	Non-Fatal Injury	51	45		MV1 and MV2 were both traveling slow and MV1 tried to swerve out of the way to avoid contact. Operator of MV2 was cited for a stop sign violation.
20	12/31/2010	Friday	1:47 PM	Single Vehicle	Daylight	Clear	Dry	Failed to yield to right-of-way	Property Damage Only	47			An uninvolved vehicle was attempting to make a left hand turn into the gas station almost colliding with MV1. MV1 avoided contact but struck a fence post and rock wall.
21	1/5/2011	Wednesday	9:31 PM	Single Vehicle	Dark-Lighted	Clear	Dry	Operating in erratic/egressive manner	Property Damage Only	21			Operator of MV1 glanced down at the radio and lost control of the vehicle. MV1 went across the east bound travel lane into a rock wall and a tree.
22	2/4/2011	Friday	7:31 AM	Angle	Daylight	Clear	Dry	Failed to yield to right-of-way	Property Damage Only	29	17		Operator of MV2 was making a left hand turn out of the BP gas station and struck MV1. Operator of MV2 stated he was waved on by another driver and that's why he entered the roadway.
23	2/6/2011	Sunday	9:44 AM	Angle	Daylight	Other	Wet	Failed to yield to right-of-way	Property Damage Only	51	43		Operator of MV1 violated a stop sign which resulted in the crash.
24	3/3/2011	Thursday	6:51 AM	Angle	Daylight	Clear	Dry	Failed to yield to right-of-way	Property Damage Only	39	57		MV1 stated that he had stopped at the stop sign then entered the intersection. MV2 collided with MV1 in the intersection; speed may have been a factor.
25	3/25/2011	Friday	8:07 AM	Angle	Daylight	Clear	Dry	Distracted	Non-Fatal Injury	58	50		MV1 was exiting from the gas station onto Groton Road. MV2 (motorcycle) traveling east on Groton Road was struck by MV1 who didn't see the motorcycle.
26	4/2/2011	Saturday	4:45 PM	Angle	Daylight	Cloudy	Dry	Failed to yield to right-of-way	Property Damage Only	20	81		MV2 ws stopped at the stop sign when he decided to cross the street and put himself in the path of MV1 which caused a collision.
27	5/19/2011	Thursday	6:12 PM	Angle	Daylight	Rain	Wet	Failed to yield to right-of-way	Property Damage Only	33	29		Operator of MV2 stated that he did not see MV1 due to a blind spot in his vehicle. While attempting to cross the road he drove into MV1's path resulting in the crash.
28	6/6/2011	Monday	4:18 PM	Angle	Daylight	Clear	Dry	Failed to yield to right-of-way	Property Damage Only	60			MV1 was attempting to make a left hand turn onto Dunstable Road. Uninvolved vehicle pulled out infront of MV1. Operator of MV1 tried to avoid contact and lost control and hit a granite fence post in front of 266 Groton Road.
29	7/19/2011	Tuesday	1:23 PM	Head-On	Daylight	Clear	Dry	Failed to yield to right-of-way	Property Damage Only	48	18		MV1 was traveling east on Groton Road. MV2 was stopped at the stop sign and then failed to make a safe lane change while crossing Groton Road causing MV2 to strike MV1.
30	7/23/2011	Saturday	4:27 PM	Single Vehicle	Daylight	Clear	Dry	Cellular Telephone Use	Non-Fatal Injury	33			Driver was distracted by her cell phone ringing and drove off of the right side of the road.
31	9/7/2011	Wednesday	7:02 PM	Rear-end	Dusk	Rain	Wet	Followed to closely	Property Damage Only	46	17		MV1 was waiting for a vehicle in front of it to turn when MV2 slid on the wet ground and struck MV1.
32	9/16/2011	Friday	4:13 PM	Angle	Daylight	Clear	Dry	Failure to Signal Turn	Property Damage Only	50	42		MV2 had its left turn signal on when MV1 attempted to go around to the right. MV2 then decided to take a right turn and caused a collision.
33	10/25/2011	Tuesday	3:39 PM	Angle	Daylight	Clear	Dry	Glare	Non-Fatal Injury	31	18		MV2 had limited visiblity due to glare.

Crash Data Summary Table

Groton Road and Dunstable Road - Westford, Massachusetts

1/1/2009 - 12/31/2013

Crash Diagram Reference	Crash Date	Day of Week	Time of Day	Manner of Collision	Light Condition	Weather Condition	Road Surface	Driver Conributing Code (by Narritive Description)	Crash Severity	Ages			Comments
										D1	D2	D3	
34	12/14/2011	Wednesday	6:09 PM	Rear-end	Dark-Lighted	Clear	Dry	Followed to closely	Non-Fatal Injury	69	19		MV1 slowed down due to vehicles crossing the intersection. MV2 stated he took his eyes off of the roadway to talk to his sister and when he looked back it was too late to stop.
35	12/29/2011	Thursday	3:17 PM	Rear-end	Dusk	Clear	Dry	Followed to closely	Property Damage Only	55	47	18	MV3 failed to stop and collided with MV2 who then collided with MV1
36	1/1/2012	Sunday	10:31 AM	Angle	Daylight	Clear	Dry	Glare	Non-Fatal Injury	52	48		MV2 may have had limited visiblity due to glare.
37	1/7/2012	Saturday	2:24 PM	Rear-end	Daylight	Cloudy	Dry	Operating in erratic/egressive manner	Non-Fatal Injury	29	60		MV1 was stopped on Groton Road to turn left onto Dunstable Road. MV2 (motorcycle) tried to go around MV1 but instead rear ended it.
38	1/13/2012	Friday	2:13 PM	Rear-end	Daylight	Clear	Wet	Followed to closely	Property Damage Only	52	64		MV2 was traveling east on Groton Road, while waiting to turn left onto Dunstable Road MV1 crashed into MV2.
39	5/9/2012	Wednesday	8:46 AM	Angle	Daylight	Rain	Wet	Failed to yield to right-of-way	Property Damage Only	40	29		MV1 was entering traffic, MV1 did not see MV2 and MV2 was unable to avoid the collision with MV1.
40	5/15/2012	Tuesday	2:30 PM	Rear-end	Daylight	Rain	Dry	Followed to closely	Property Damage Only	17	52		MV2 rear-ended MV1.
41	7/17/2012	Tuesday	7:06 AM	Angle	Daylight	Clear	Dry	Failed to yield to right-of-way	Property Damage Only	43	67		MV2 cut across the road resulting is MV1 colliding with MV2. Operator of MV2 advised that she had stopped and looked both ways but did not see MV1 until it was too late.
42	8/4/2012	Saturday	2:22 PM	Angle	Daylight	Clear	Dry	Failed to yield to right-of-way	Non-Fatal Injury	17	48		MV2 had stopped and looked both ways before proceeding through the intersection but did not see MV1.
43	8/25/2012	Saturday	12:17 AM	Single Vehicle	Dark-Lighted	Clear	Dry	Operating in erratic/egressive manner	Non-Fatal Injury	44			MV1 was trveling south when it hit telephone pole 12 on Dunstable Road.
44	12/1/2012	Saturday	12:40 PM	Rear-end	Daylight	Snow	Wet	Followed to closely	Property Damage Only	29	41		MV1 stopped quickly in response to a vehicle in front that also had to stop quickly.
45	12/2/2012	Sunday	9:49 AM	Single Vehicle	Daylight	Cloudy	Wet	Vehicle Malfunction	Property Damage Only	25			MV1 drove off of the road into ditch near #238 Groton Road due to a flat tire.
46	1/17/2013	Thursday	7:43 AM	Angle	Daylight	Clear	Dry	Failed to yield to right-of-way	Property Damage Only	50	53		MV2 went around unknown MV at STOP line who was turning left, proceeded into interesection and did not see MV 1.
47	6/19/2013	Wednesday	7:04 PM	Angle	Daylight	Clear	Dry	Failed to yield to right-of-way	Property Damage Only	52	22		MV2 travelling south on Dunstable Road slowing for blinking red flasher. MV2 pulls into Groton Road and causes collisions with MV1.
48	8/8/2013	Thursday	8:40 PM	Angle	Dusk	Clear	Dry	Driver Inattention / Failed to yield to right-of-way	Property Damage Only	19	25		MV1 drving west on Groton Road when MV2 pulls out from Dunstable Road SB in attempt to turn left. MV1 and MV2 collide.
49	10/7/2013	Monday	7:46 AM	Angle	Daylight	Cloudy	Wet	Failed to yield to right-of-way / Inattention	Property Damage Only	49	51		MV1 travelling east on Groton Road struck by MV2 entering from Dunstable Road southbound.
50	10/13/2013	Sunday	4:43 PM	Angle	Daylight	Clear	Dry	Failed to yield to right-of-way	Property Damage Only	29	22		MV1 travelling west on Groton Road struck by MV2 entering from Dunstable Road southbound after stopping.
51	10/20/2013	Sunday	1:54 PM	Angle	Daylight	Clear	Dry	Failed to yield to right-of-way / Inattentior	Property Damage Only	19	64		MV1 travelling east on Groton Road. MV2 stopped on Dunstable Road southbound proceeds into intersection attempting to travel straight across. MV1 crashes into MV2. MV2 complains of solar glare.
52	11/5/2013	Tuesday	8:59 AM	Other	Daylight	Clear	Dry	Failed to yield to right-of-way / Failure to s	Property Damage Only	60	33		MV1 travelling west on Groton Road comes to abrupt stop as MV2 enters intersection from Dunstable Road southbound. No collision. Unsecured lumber from MV1 falls on hood of MV2.
53	11/21/2013	Thursday	2:37 PM	Rear-end	Daylight	Clear	Dry	Inattention	Property Damage Only	17	24		MV1 stopped in traffic on Groton Road struck in rear by MV2. MV2 produced 60 feet skid mark.

Crash Date	Crash Time	Day of Week	Crash Severity	Number of NonFatal Injuries	Number of Fatal Injuries	Number of Vehicles	Manner of Collision	Vehicle Action Prior to Crash	Vehicle Travel Directions	Most Harmful Events	Vehicle Configuration	Road Surface	Ambient Light	Weather Condition	Driver Contributing Codes	Roadway	Distance And Direction From Intersection	Near Intersection Roadway	Landmark
1/8/2014	3:02 PM	Wednesday	Property damage only (none injured)	0	0	2	Angle	V1: Travelling straight ahead / V2:Travelling straight ahead	V1:E / V2:N	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	V1:(Passenger car) V2:(Passenger car)	Dry	Daylight	Clear	D1:(No improper driving) D2:(Disregarded traffic signs, signals, road markings),(Glare)	GROTON RD / DUNSTABLE RD			
1/3/2014	11:22 PM	Friday	Property damage only (none injured)	0	0	1	Single vehicle crash	V1: Travelling straight ahead	V1:S	V1:(Collision with curb)	V1:(Passenger car)	Ice	Dark - lighted roadway	Clear	D1:(No improper driving)	DUNSTABLE RD	15 feet N of	GROTON ROAD Rte 40	BP GAS STATION
6/12/2014	11:44 AM	Thursday	Non-fatal injury	1	0	2	Sideswipe, same direction	V1: Turning left / V2:Travelling straight ahead	V1:W / V2:W	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	V1:(Passenger car) V2:(Passenger car)	Dry	Daylight	Cloudy	D1:(No improper driving) D2:(Inattention),(Swerving or avoiding due to wind, slippery surface, vehicle, object, non-motorist in roadway, etc)	GROTON RD / DUNSTABLE RD			
8/9/2014	2:38 PM	Saturday	Property damage only (none injured)	0	0	2	Head-on	V1: Travelling straight ahead / V2:Travelling straight ahead	V1:W / V2:N	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	V1:(Passenger car) V2:(Passenger car)	Dry	Daylight	Clear	D1:(No improper driving) D2:(Failed to yield right of way)	GROTON RD Rte 40 / DUNSTABLE RD			
10/30/2014	4:03 PM	Thursday	Property damage only (none injured)	0	0	2	Rear-end	V1: Slowing or stopped in traffic / V2:Backing	V1:S / V2:N	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	V1:(Passenger car) V2:(Single-unit truck (3-or-more axles))	Dry	Daylight	Clear	D1:(No improper driving) D2:(Inattention)	GROTON ROAD / DUNSTABLE ROAD			
11/28/2014	7:28 PM	Friday	Property damage only (none injured)	0	0	2	Sideswipe, same direction	V1: Travelling straight ahead / V2:Travelling straight ahead	V1:N / V2:E	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	V1:(Passenger car) V2:(Light truck(van, mini-van, panel, pickup, sport utility) with only four tires)	Dry	Dark - lighted roadway	Clear	D1:(Failed to yield right of way),(No improper driving) D2:(No improper driving)	GROTON RD / DUNSTABLE RD			
12/15/2014	2:40 PM	Monday	Property damage only (none injured)	0	0	3	Angle	V1: Travelling straight ahead / V2:Turning left / V3:Turning left	V1:E / V2:W / V3:W	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic) V3:(Collision with motor vehicle in traffic)	V1:(Light truck(van, mini-van, panel, pickup, sport utility) with only four tires) V2:(Passenger car) V3:(Passenger car)	Dry	Daylight	Clear	D1:(Distracted) D2:(Distracted)	GROTON RD / DUNSTABLE RD			
12/17/2014	3:41 PM	Wednesday	Property damage only (none injured)	0	0	2	Rear-end	V1: Slowing or stopped in traffic / V2:Travelling straight ahead	V1:E / V2:E	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	V1:(Passenger car) V2:(Passenger car)	Dry	Daylight	Cloudy	D1:(No improper driving) D2:(Inattention)	GROTON RD Rte 40 E / DUNSTABLE RD			

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : WESTFORD, MASSACHUSETTS COUNT DATE : MARCH 2014

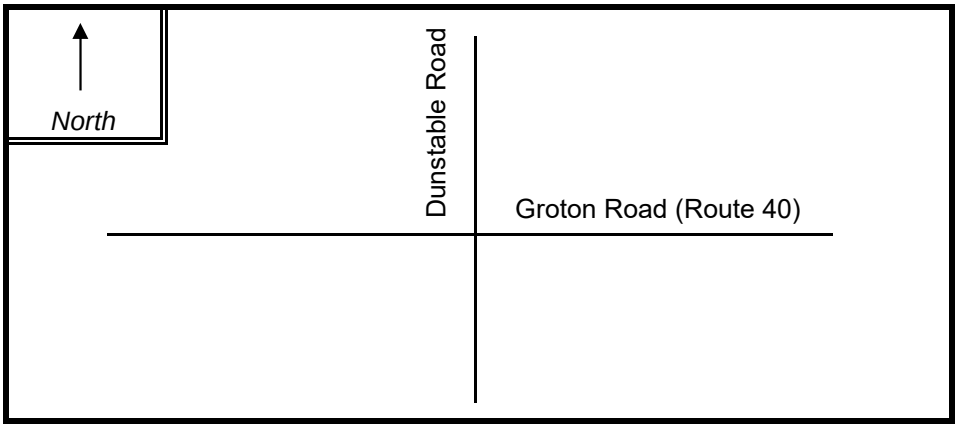
DISTRICT : 3 UNSIGNALIZED : **YES** SIGNALIZED : NO

~ INTERSECTION DATA ~

MAJOR STREET : GROTON ROAD (ROUTE 40)

MINOR STREET(S) : DUNSTABLE ROAD

INTERSECTION DIAGRAM
(Label Approaches)



Peak Hour Volumes

APPROACH :	1	2	3	4	5	**Total Entering Vehicles**
DIRECTION :	NB	SB	EB	WB		
VOLUMES (PM) :	78	66	488	525		**1,157**

" K " FACTOR : **0.091** APPROACH ADT : **12,714** **ADT** = TOTAL VOL/"K" FACT.

TOTAL # OF CRASHES : 61 # OF YEARS : 6 AVERAGE # OF CRASHES (**A**) : **10.17**

CRASH RATE CALCULATION : **2.19** RATE = $\frac{(A * 1{,}000{,}000)}{(ADT * 365)}$

Comments : K DETERMINED FROM ATRS ON GROTON ROAD

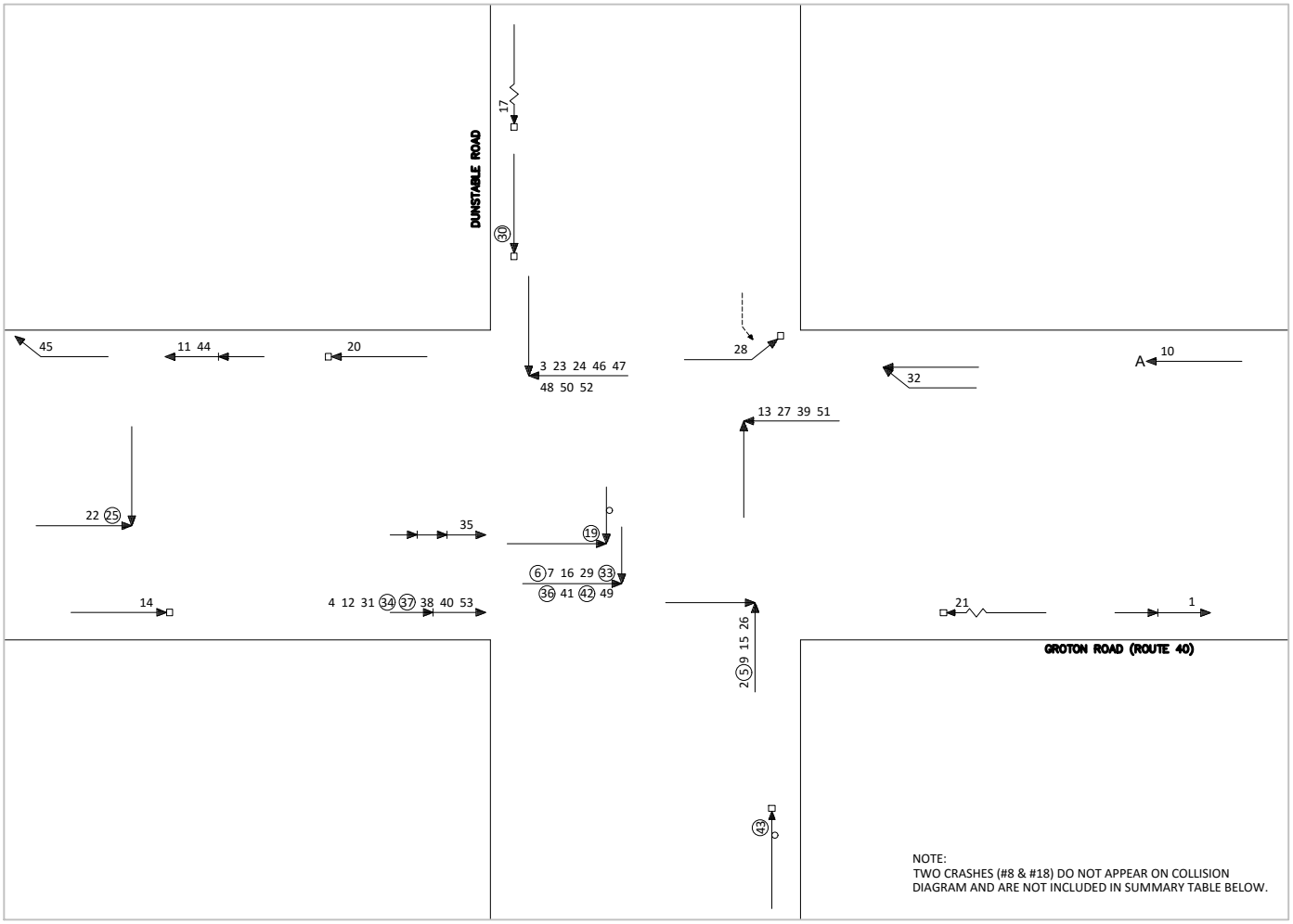
Project Title & Date: GROTON ROAD (ROUTE 40) @ DUNSTABLE ROAD FDR - WESTFORD, MASSACHUSETTS

Not to Scale

Groton Road @ Dunstable Road Intersection Improvements - Westford, Massachusetts

Functional Design Report

LOCATION: Groton Road (Route 40) @ Dunstable Road
CITY/STATE: Westford, Massachsuetts
TIME PERIOD: 2009 - 2013
PREPARED BY: TEC, Inc. / Samuel W. Gregorio, P.E.
SOURCE: Westford Police Dept, NMCOG



LEGEND

- VEHICLE PATH
- BACKING VEHICLE
- SIDESWIPE COLLISION
- PEDESTRIAN COLLISION
- REAR-END COLLISION
- HEAD-ON COLLISION
- ANGLED COLLISION
- FIXED OBJECT COLLISION
- OVERTURNED VEHICLE
- OUT-OF-CONTROL VEHICLE
- FIXED OBJECT
- MOVEABLE OBJECT
- PARKED VEHICLE
- PERSONAL INJURY
- FATALITY
- A ANIMAL

SHOW FOR COLLISION

1. Approximate location of collision,
2. Direction of collision,
3. Type of collision and vehicles involved,
4. Time, Day, Date
5. Any other pertinent factors mentioned on the report.

SUMMARY OF CRASHES ON DIAGRAM [*no fatal collisions*]

	REAR-END	SIDESWIPE	HEAD-ON	ANGLED	SINGLE VEH	PED/BIKE	OTHER / UNK	TOTAL
PROPERTY DAMAGE ONLY	10	0	1	22	6	0	1	40
NON-FATAL INJURY	2	0	0	7	2	0	0	11
UNKNOWN / NOT REPORTED	0	0	0	0	0	0	0	0
TOTAL	12	0	1	29	8	0	1	51

Figure G-1

Collision Diagram
2009-2013 Collision Data

TEC, Inc.
65 Glenn Street | Lawrence, MA 01843 | (978) 794.1792
169 Ocean Blvd, Unit 101 | Hampton, NH 03842 | (603) 601.8154
www.TheEngineeringCorp.com

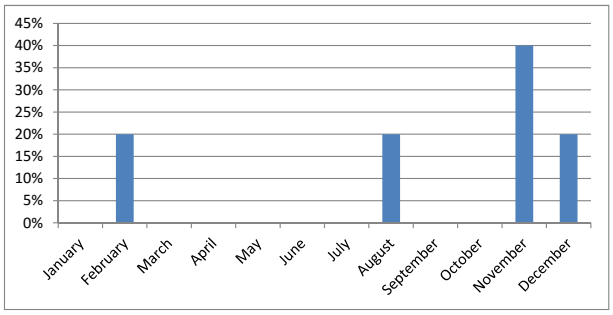
Crash Data Summary Tables
Groton Road @ Crocker Drive - Westford, MA
01/01/2009 - 12/31/2014

Collision Diagram	Crash Number	Crash Date	Crash Time	Ambient Light	Weather Condition	Road Surface	Number of Vehicles	Vehicle Travel Directions				Crash Severity	Number of NonFatal Injuries	Manner of Collision	Driver Contributing Codes	Detailed Narrative (from Crash Report)
								V1	V2	V3	V4					
1	2721059	2/11/2011	6:21 PM	Dark - Lighted	Clear	Dry	2	E	E			Property Damage Only	0	Angled	Failure to Yield Right-of-Way	MV1: traveling EB on Groton Rd; MV2: entering Groton Rd. MV2 hit MV1 while entering Groton Rd.
2	2828720	11/10/2011	2:31 PM	Daylight	Rain	Wet	2	W	W			Property Damage Only	0	Rear-end	Erratic / Aggressive / Reckless Driving	MV1 and MV2: traveling WB on Groton Rd. MV2 rear-ended MV1.
3	3344411	11/1/2012	4:02 PM	Daylight	Clear	Dry	3	N	W	E		Property Damage Only	0	Sideswipe	Not Reported	MV1: attempting to turn left onto Groton Rd; MV2: traveling WB on Groton Rd; MV3: slowing or stopped in traffic on Groton Rd EB lane.
4	3714357	12/31/2013	6:09 PM	Dark - Lighted	Rain	Wet	2	W	W			Property Damage Only	0	Rear-end	Inattention / Distracted	MV1: slowing or stopped in traffic on Groton Rd WB lane; MV2: traveling WB on Groton Rd. MV2 rear-ended MV1.
5	3928110	8/11/2014	6:36 PM	Daylight	Clear	Dry	3	E	E	E		Property Damage Only	0	Rear-end	Followed Too Closely	MV1 and MV2: slowing or stopped in traffic on Groton Rd EB lane; MV3: traveling EB on Groton Rd. MV3 rear-ended MV2 which caused MV2 to rear-end MV1.

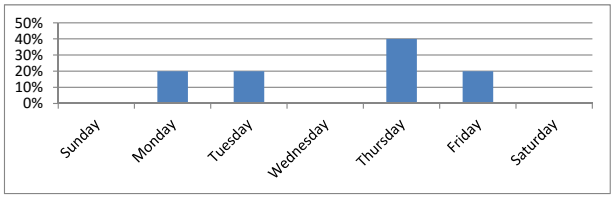
Crash Data Summary Tables
Groton Road @ Crocker Drive - Westford, MA
01/01/2009 - 12/31/2014

Groton Road @ Crocker Drive *5*

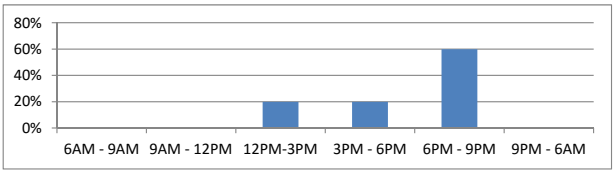
Month	#	%
January	0	0%
February	1	20%
March	0	0%
April	0	0%
May	0	0%
June	0	0%
July	0	0%
August	1	20%
September	0	0%
October	0	0%
November	2	40%
December	1	20%



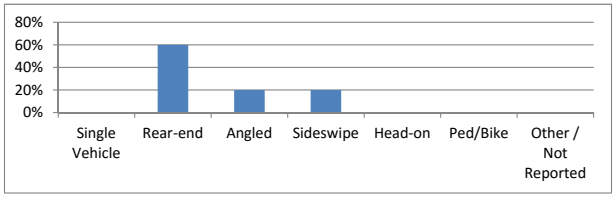
Day of Week	#	%
Sunday	0	0%
Monday	1	20%
Tuesday	1	20%
Wednesday	0	0%
Thursday	2	40%
Friday	1	20%
Saturday	0	0%



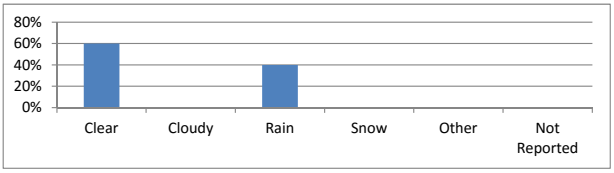
Time of Day	#	%
6AM - 9AM	0	0%
9AM - 12PM	0	0%
12PM-3PM	1	20%
3PM - 6PM	1	20%
6PM - 9PM	3	60%
9PM - 6AM	0	0%



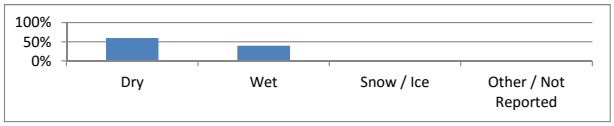
Manner of Collision	#	%
Single Vehicle	0	0%
Rear-end	3	60%
Angled	1	20%
Sideswipe	1	20%
Head-on	0	0%
Ped/Bike	0	0%
Other / Not Reported	0	0%



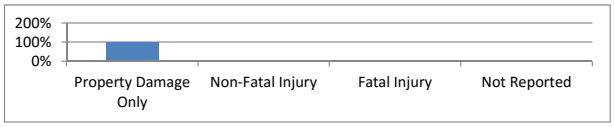
Weather Conditions	#	%
Clear	3	60%
Cloudy	0	0%
Rain	2	40%
Snow	0	0%
Other	0	0%
Not Reported	0	0%



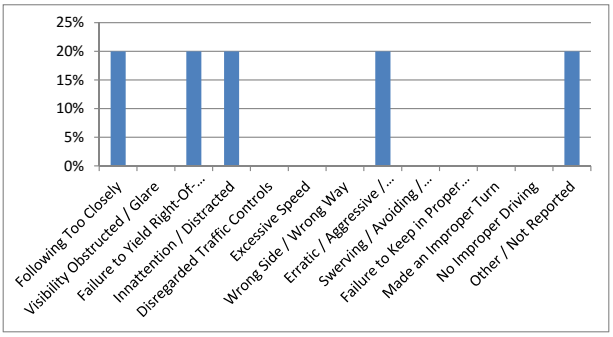
Road Surface	#	%
Dry	3	60%
Wet	2	40%
Snow / Ice	0	0%
Other / Not Reported	0	0%



Crash Severity	#	%
Property Damage Only	5	100%
Non-Fatal Injury	0	0%
Fatal Injury	0	0%
Not Reported	0	0%



Main Contributing Factor from Narrative	#	%
Following Too Closely	1	20%
Visibility Obstructed / Glare	0	0%
Failure to Yield Right-Of-Way	1	20%
Innattention / Distracted	1	20%
Disregarded Traffic Controls	0	0%
Excessive Speed	0	0%
Wrong Side / Wrong Way	0	0%
Erratic / Aggressive / Reckless Driving	1	20%
Swerving / Avoiding / Over-Steering / Over-Correcting	0	0%
Failure to Keep in Proper Lane	0	0%
Made an Improper Turn	0	0%
No Improper Driving	0	0%
Other / Not Reported	1	20%



1/17/2017

Crash Data Summary Tables

Groton Road Between Crocker Drive and Blades Road - Westford, MA

01/01/2009 - 12/31/2014

Collision Diagram	Crash Number	Crash Date	Crash Time	Ambient Light	Weather Condition	Road Surface	Number of Vehicles	Vehicle Travel Directions				Crash Severity	Number of NonFatal Injuries	Manner of Collision	Driver Contributing Codes	Detailed Narrative (from Crash Report)
								V1	V2	V3	V4					
1	2525092	9/30/2009	8:24 PM	Daylight	Cloudy	Dry	1	E				Property Damage Only	0	Single Vehicle	No Improper Driving	MV1: traveling EB on Groton Rd. MV1 collided with a deer while driving.
2	2584989	3/29/2010	4:36 PM	Daylight	Rain	Wet	2	E	E			Property Damage Only	0	Rear-end	Followed Too Closely	MV1 and MV2: traveling EB on Groton Rd. MV2 rear-ended MV1 when MV1 stopped/slowed to turn left.
3	2622331	6/24/2010	11:19 AM	Daylight	Clear	Dry	1	E				Property Damage Only	0	Single Vehicle	No Improper Driving	MV1: traveling EB on Groton Rd. MV1 collided with light pole or other post/support while driving.
4	275213	8/2/2011	11:03 AM	Daylight	Clear	Dry	3	W	W	W		Property Damage Only	0	Rear-end	Inattention / Distracted	MV1: attempting to turn left from Groton Rd; MV2: slowing or stopped in traffic on Groton Rd WB lane; MV3: traveling WB on Groton Rd. MV3 rea-ended MV2 which caused MV2 to rear-end MV1.
5	2752161	8/3/2011	5:08 PM	Daylight	Clear	Dry	2	W	W			Property Damage Only	0	Rear-end	Inattention / Distracted	MV1: slowing or stopped in traffic on Groton Rd WB lane; MV2: traveling WB on Groton Rd. MV2 rear-ended MV1.
6	3403597	3/2/2013	2:48 PM	Dark - Lighted	Clear	Dry	2					Not Reported	0	Not Reported	Not Reported	MV1: traveling on Groton Rd; MV2: parked on Groton Rd. MV1 collided with the parked MV2.
7	3732608	2/2/2014	10:18 PM	Dark - Lighted	Clear	Dry	1	E				Property Damage Only	0	Single Vehicle	No Improper Driving	MV1: traveling EB on Groton Rd. MV1 collided with a deer while driving.
8	3982243	12/9/2014	7:32 AM	Daylight	Rain	Ice	1					Property Damage Only	0	Single Vehicle	No Improper Driving	MV1: traveling on Groton Rd. MV1 struck a tree while driving.

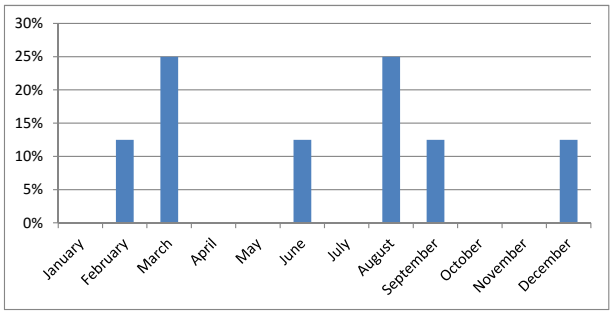
Crash Data Summary Tables

Groton Road Between Crocker Drive and Blades Road - Westford, MA

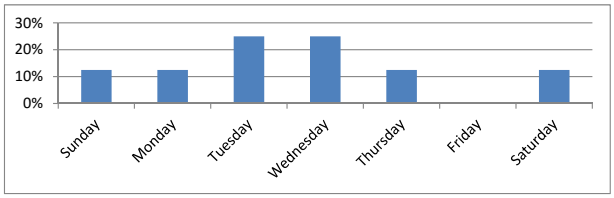
01/01/2009 - 12/31/2014

Groton Road Between Crocker Drive and Blades Road *8*

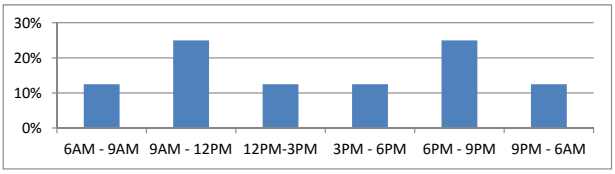
Month	#	%
January	0	0%
February	1	13%
March	2	25%
April	0	0%
May	0	0%
June	1	13%
July	0	0%
August	2	25%
September	1	13%
October	0	0%
November	0	0%
December	1	13%



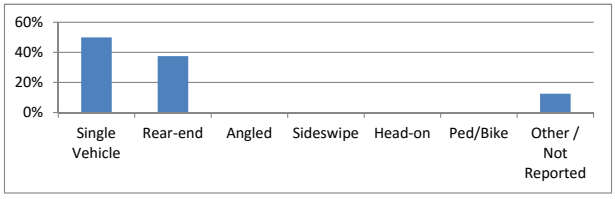
Day of Week	#	%
Sunday	1	13%
Monday	1	13%
Tuesday	2	25%
Wednesday	2	25%
Thursday	1	13%
Friday	0	0%
Saturday	1	13%



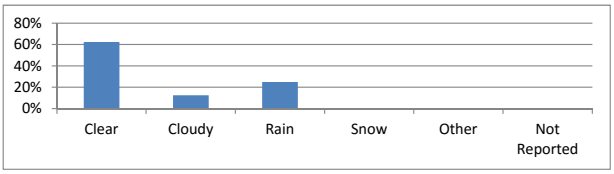
Time of Day	#	%
6AM - 9AM	1	13%
9AM - 12PM	2	25%
12PM-3PM	1	13%
3PM - 6PM	1	13%
6PM - 9PM	2	25%
9PM - 6AM	1	13%



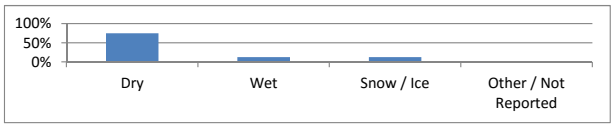
Manner of Collision	#	%
Single Vehicle	4	50%
Rear-end	3	38%
Angled	0	0%
Sideswipe	0	0%
Head-on	0	0%
Ped/Bike	0	0%
Other / Not Reported	1	13%



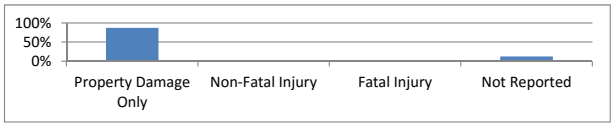
Weather Conditions	#	%
Clear	5	63%
Cloudy	1	13%
Rain	2	25%
Snow	0	0%
Other	0	0%
Not Reported	0	0%



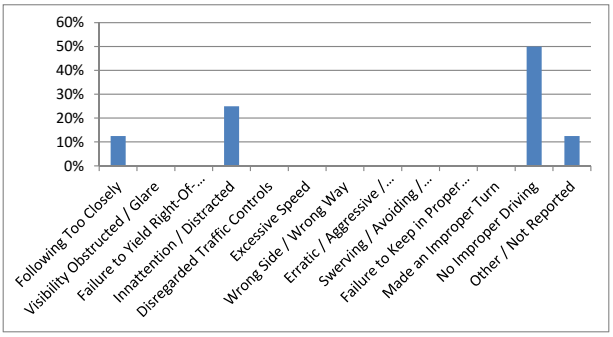
Road Surface	#	%
Dry	6	75%
Wet	1	13%
Snow / Ice	1	13%
Other / Not Reported	0	0%



Crash Severity	#	%
Property Damage Only	7	88%
Non-Fatal Injury	0	0%
Fatal Injury	0	0%
Not Reported	1	13%



Main Contributing Factor from Narrative	#	%
Following Too Closely	1	13%
Visibility Obstructed / Glare	0	0%
Failure to Yield Right-Of-Way	0	0%
Innattention / Distracted	2	25%
Disregarded Traffic Controls	0	0%
Excessive Speed	0	0%
Wrong Side / Wrong Way	0	0%
Erratic / Aggressive / Reckless Driving	0	0%
Swerving / Avoiding / Over-Steering / Over-Correcting	0	0%
Failure to Keep in Proper Lane	0	0%
Made an Improper Turn	0	0%
No Improper Driving	4	50%
Other / Not Reported	1	13%



SEGMENT CRASH RATE WORKSHEET

CITY/TOWN : WESTFORD, MASSACHUSETTS COUNT DATE : MARCH 2014

DISTRICT : 3

~ SEGMENT DATA ~

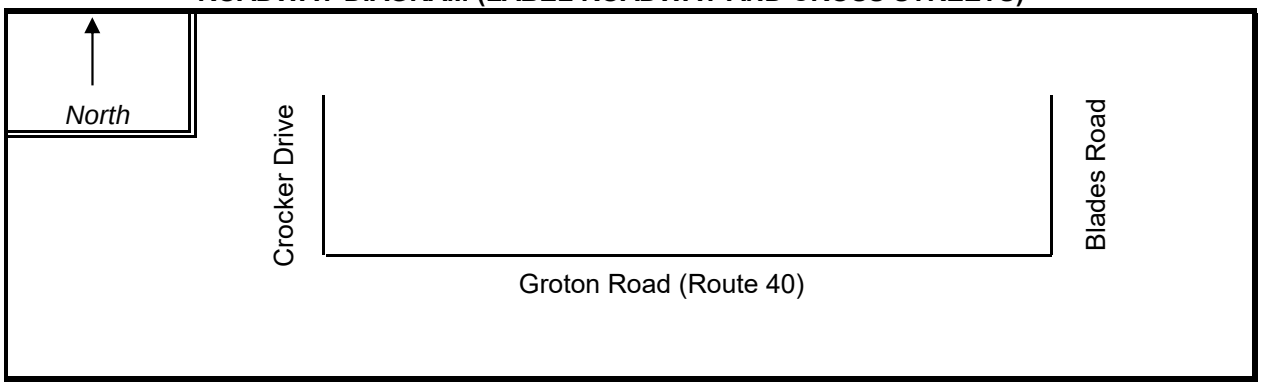
ROADWAY NAME: GROTON ROAD (ROUTE 40)

START POINT: Crocker Drive

END POINT: Blades Road

FUNCTIONAL CLASSIFICATION OF ROADWAY: Urban Principal Arterial

ROADWAY DIAGRAM (LABEL ROADWAY AND CROSS STREETS)



AVERAGE DAILY TRAFFIC

SEGMENT LENGTH IN MILES (**L**):	**0.5**
AVERAGE DAILY TRAFFIC VOLUME (**V**):	12,714

TOTAL # OF CRASHES:	8	# OF YEARS :	6	AVERAGE # OF CRASHES PER YEAR (**A**) :	**1.33**

CRASH RATE CALCULATION : **0.57**

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

Comments :

Project Title & Date: T0519.02 - Dunstable Road FDR 1/16/2017

Appendix H

MUTCD Traffic Signal Warrant Analysis

Project: Groton Road @ Dunstable Road Intersection Improvements
Town: Westford, MA
TEC # T0519.02
Analyst: TEC / Samuel W. Gregorio, P.E., PTOE

FEBRUARY 2017 RAW DATA INPUT

Time	VOLUMES Minor Dunstable NB (1)	Minor Dunstable SB (2)	Major Groton EB	Major Groton WB
6-7 AM	5	126	265	222
7-8 AM	33	186	511	483
8-9 AM	17	189	500	283
9-10 AM	11	115	314	234
10-11 AM	28	52	264	189
11-12 PM				
12-1 PM				
1-2 PM				
2-3 PM	47	66	374	390
3-4 PM	46	63	445	447
4-5 PM	79	65	448	509
5-6 PM	102	63	463	546
6-7 PM	86	50	281	469

SEASONALLY ADJUSTED DATA

Time	VOLUMES Minor Dunstable NB	Minor Dunstable SB	Major Groton EB	Major Groton WB
6-7 AM	5	131	275	230
7-8 AM	34	193	530	501
8-9 AM	18	196	519	294
9-10 AM	11	119	326	243
10-11 AM	29	54	274	196
11-12 PM				
12-1 PM				
1-2 PM				
2-3 PM	49	69	388	405
3-4 PM	48	65	462	464
4-5 PM	82	67	465	528
5-6 PM	106	65	481	567
6-7 PM	89	52	292	487

2018 OPENING YEAR ADJUSTED TRAFFIC VOLUMES

Time	VOLUMES Minor Dunstable NB	Minor Dunstable SB	Major Groton EB	Major Groton WB
6-7 AM	5	132	278	232
7-8 AM	34	195	535	506
8-9 AM	18	198	524	297
9-10 AM	11	120	329	245
10-11 AM	29	55	277	198
11-12 PM				
12-1 PM				
1-2 PM				
2-3 PM	49	70	392	409
3-4 PM	48	66	467	469
4-5 PM	83	68	470	533
5-6 PM	107	66	486	573
6-7 PM	90	53	295	492

Seasonal Adjustment: 3.8%

Annual Adjustment: 1.0%

1 - 100% of Right-turns included based on NTOR condition.
2 - 50% of Right-turns included based on high non-right-turn traffic

Project: Groton Road @ Dunstable Road Intersection Improvements
Town: Westford, MA
TEC # T0519.02
Analyst: TEC / Samuel W. Gregorio, P.E., PTOE

85th Percentile > 40 mph?	Y
Population < 10,000 people?	N

Warrant 1 - One of the Following Conditions Must Be Met for any 8 hours of an average day (Table 4C-1)

Individual Option:

Condition A: Minimum Vehicular Volume

70%

Street	Lanes	Minimum Volume	ATR Data 6-7 AM	7-8 AM	8-9 AM	9-10 AM	10-11 AM	11-12 PM	12-1 PM	1-2 PM	2-3 PM	3-4 PM	4-5 PM	5-6 PM	6-7 PM
Major	1	350	510	1041	821	574	475	0	0	0	801	936	1003	1059	787
Minor	1	105	132	195	198	120	55	0	0	0	70	66	83	107	90
		Met?	YES	YES	YES	YES	NO	NO	NO	NO	NO	NO	NO	YES	NO

OR

Condition B: Interruption of Continuous Traffic

70%

Street	Lanes	Minimum Volume	ATR Data 6-7 AM	7-8 AM	8-9 AM	9-10 AM	10-11 AM	11-12 PM	12-1 PM	1-2 PM	2-3 PM	3-4 PM	4-5 PM	5-6 PM	6-7 PM
Major	1	525	510	1041	821	574	475	0	0	0	801	936	1003	1059	787
Minor	1	53	132	195	198	120	55	0	0	0	70	66	83	107	90
		Met?	NO	YES	YES	YES	NO	NO	NO	NO	YES	YES	YES	YES	YES

Result:	YES

Combination Option:

Condition A: Minimum Vehicular Volume

56%

Street	Lanes	Minimum Volume	ATR Data 6-7 AM	7-8 AM	8-9 AM	9-10 AM	10-11 AM	11-12 PM	12-1 PM	1-2 PM	2-3 PM	3-4 PM	4-5 PM	5-6 PM	6-7 PM
Major	1	280	510	1041	821	574	475	0	0	0	801	936	1003	1059	787
Minor	1	84	132	195	198	120	55	0	0	0	70	66	83	107	90
		Met?	YES	YES	YES	YES	NO	NO	NO	NO	NO	NO	NO	YES	YES

AND

Condition B: Interruption of Continuous Traffic

56%

Street	Lanes	Minimum Volume	ATR Data 6-7 AM	7-8 AM	8-9 AM	9-10 AM	10-11 AM	11-12 PM	12-1 PM	1-2 PM	2-3 PM	3-4 PM	4-5 PM	5-6 PM	6-7 PM
Major	1	420	510	1041	821	574	475	0	0	0	801	936	1003	1059	787
Minor	1	42	132	195	198	120	55	0	0	0	70	66	83	107	90
		Met?	YES	YES	YES	YES	YES	NO	NO	NO	YES	YES	YES	YES	YES

Result:	NO

Project: Groton Road @ Dunstable Road Intersection Improvements
Town: Westford, MA
TEC # T0519.02
Analyst: TEC / Samuel W. Gregorio, P.E., PTOE

Warrant 2 - Four-Hour Vehicular Volume (must be met for any 4 hours of an average day)

Street	Lanes	Minimum Volume	ATR Data												
			6-7 AM	7-8 AM	8-9 AM	9-10 AM	10-11 AM	11-12 PM	12-1 PM	1-2 PM	2-3 PM	3-4 PM	4-5 PM	5-6 PM	6-7 PM
Major	1	Figure 4C-2	510	1041	821	574	475	0	0	0	801	936	1003	1059	787
Minor	1	Figure 4C-2	132	195	198	120	55	0	0	0	70	66	83	107	90
		Met?	YES	YES	YES	YES	NO	NO	NO	NO	YES	YES	YES	YES	YES

Result:	YES

Appendix I

MassDOT Left-turn Lane Warrant Analysis

Left-Turn Lane Volume Warrants

Project: T0519.02 - Groton Road (Route 40) @ Dunstable Road FDR - Westford, Massachusetts
Date: January 16, 2017
Analyst: TEC Inc. / Douglas S. Halpert, E.I.T.

Operating Speed	Opposing Volume	Advancing Motor Vehicle Volumes (veh/hr)			
		5% LT	10% LT	20% LT	30% LT
30 mph or less	800	370	265	195	185
	600	460	345	250	225
	400	570	430	305	275
	200	720	530	390	335
40 mph	800	330	240	180	160
	600	410	305	225	200
	400	510	380	275	245
	200	640	470	350	305
50 mph	800	280	210	165	135
	600	350	260	195	170
	400	430	320	240	210
	200	550	400	300	270
60 mph	800	230	170	125	115
	600	290	210	160	140
	400	365	270	200	175
	200	450	330	250	215

Groton Road (Route 40) @ Dunstable Road (Unsignalized)

2017 BASE YEAR RAW DATA INPUT

Time	Advancing Groton EB LT	Advancing Groton EB	% Left Turns	Opposing Groton WB	Warranted
6-7 AM			#DIV/0!		NO
7-8 AM	15	511	2.9%	483	NO
8-9 AM			#DIV/0!		NO
9-10 AM			#DIV/0!		NO
10-11 AM			#DIV/0!		NO
11-12 PM			#DIV/0!		NO
12-1 PM			#DIV/0!		NO
1-2 PM			#DIV/0!		NO
2-3 PM			#DIV/0!		NO
3-4 PM			#DIV/0!		NO
4-5 PM	55	495	11.1%	553	NO
5-6 PM			#DIV/0!		NO

Signalized Intersections:

Left-Turn Lane Configuration	Minimum Turn Volume
Single exclusive left-turn lane	100 veh/hr
Dual exclusive left-turn lane	300 veh/hr

Source: Massachusetts Highway Department Design Manual, 2006 Edition, Exhibit 6-23

Groton Road (Route 40) @ Dunstable Road (Signalized)

Westbound Left-Turn Lane Warranted? **NO**

Appendix J

Intersection Capacity and Queue Analysis

2017 Base Year Conditions

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	16	498	17	0	491	10	16	12	6	66	97	60
Future Volume (vph)	16	498	17	0	491	10	16	12	6	66	97	60
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.996			0.997			0.976			0.964	
Flt Protected		0.998						0.977			0.985	
Satd. Flow (prot)	0	1832	0	0	1920	0	0	1553	0	0	1770	0
Flt Permitted		0.998						0.977			0.985	
Satd. Flow (perm)	0	1832	0	0	1920	0	0	1553	0	0	1770	0
Adj. Flow (vph)	19	579	20	0	614	13	21	16	8	73	108	67
Lane Group Flow (vph)	0	618	0	0	627	0	0	45	0	0	248	0
Sign Control		Free			Free			Stop			Stop	

Intersection Summary

Control Type: Unsignalized

Intersection												
Int Delay, s/veh	40.9											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	16	498	17	0	491	10	16	12	6	66	97	60
Future Vol, veh/h	16	498	17	0	491	10	16	12	6	66	97	60
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	80	80	80	75	75	75	90	90	90
Heavy Vehicles, %	20	2	18	0	2	0	13	8	0	5	1	0
Mvmt Flow	19	579	20	0	614	13	21	16	8	73	108	67

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	626	0	0	599	0	0	1333	1252	589	1258	1256	620
Stage 1	-	-	-	-	-	-	626	626	-	620	620	-
Stage 2	-	-	-	-	-	-	707	626	-	638	636	-
Critical Hdwy	4.3	-	-	4.1	-	-	7.23	6.58	6.2	7.15	6.51	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.23	5.58	-	6.15	5.51	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.23	5.58	-	6.15	5.51	-
Follow-up Hdwy	2.38	-	-	2.2	-	-	3.617	4.072	3.3	3.545	4.009	3.3
Pot Cap-1 Maneuver	875	-	-	988	-	-	124	168	512	146	172	492
Stage 1	-	-	-	-	-	-	454	468	-	470	481	-
Stage 2	-	-	-	-	-	-	409	468	-	460	473	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	875	-	-	988	-	-	50	162	512	130	166	492
Mov Cap-2 Maneuver	-	-	-	-	-	-	50	162	-	130	166	-
Stage 1	-	-	-	-	-	-	439	453	-	454	481	-
Stage 2	-	-	-	-	-	-	274	468	-	422	457	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	0	89.7	236.5
HCM LOS			F	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	84	875	-	-	988	-	-	184
HCM Lane V/C Ratio	0.54	0.021	-	-	-	-	-	1.347
HCM Control Delay (s)	89.7	9.2	0	-	0	-	-	236.5
HCM Lane LOS	F	A	A	-	A	-	-	F
HCM 95th %tile Q(veh)	2.4	0.1	-	-	0	-	-	14.4

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	530	558	9	1	1
Future Volume (vph)	0	530	558	9	1	1
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.998		0.932	
Flt Protected					0.976	
Satd. Flow (prot)	0	1863	1922	0	1959	0
Flt Permitted					0.976	
Satd. Flow (perm)	0	1863	1922	0	1959	0
Adj. Flow (vph)	0	639	764	12	2	2
Lane Group Flow (vph)	0	639	776	0	4	0
Sign Control		Free	Free		Stop	

Intersection Summary

Control Type: Unsignalized

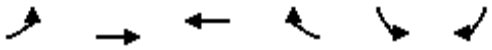
Intersection						
Int Delay, s/veh	0.1					

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	530	558	9	1	1
Future Vol, veh/h	0	530	558	9	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	83	83	73	73	50	50
Heavy Vehicles, %	0	2	2	0	0	0
Mvmt Flow	0	639	764	12	2	2

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	777	0	-	0	1410	771
Stage 1	-	-	-	-	771	-
Stage 2	-	-	-	-	639	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	848	-	-	-	154	403
Stage 1	-	-	-	-	460	-
Stage 2	-	-	-	-	530	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	848	-	-	-	154	403
Mov Cap-2 Maneuver	-	-	-	-	154	-
Stage 1	-	-	-	-	460	-
Stage 2	-	-	-	-	530	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	21.4
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	848	-	-	-	223
HCM Lane V/C Ratio	-	-	-	-	0.018
HCM Control Delay (s)	0	-	-	-	21.4
HCM Lane LOS	A	-	-	-	C
HCM 95th %tile Q(veh)	0	-	-	-	0.1



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	3	527	559	0	3	5
Future Volume (vph)	3	527	559	0	3	5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.916	
Flt Protected					0.982	
Satd. Flow (prot)	0	1863	1925	0	1937	0
Flt Permitted					0.982	
Satd. Flow (perm)	0	1863	1925	0	1937	0
Adj. Flow (vph)	4	635	776	0	6	10
Lane Group Flow (vph)	0	639	776	0	16	0
Sign Control		Free	Free		Stop	

Intersection Summary

Control Type: Unsignalized

Intersection						
Int Delay, s/veh	0.3					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	3	527	559	0	3	5
Future Vol, veh/h	3	527	559	0	3	5
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	83	83	72	72	50	50
Heavy Vehicles, %	0	2	2	0	0	0
Mvmt Flow	4	635	776	0	6	10

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	776	0	-	0	1418	776
Stage 1	-	-	-	-	776	-
Stage 2	-	-	-	-	642	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	849	-	-	-	152	401
Stage 1	-	-	-	-	457	-
Stage 2	-	-	-	-	528	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	849	-	-	-	151	401
Mov Cap-2 Maneuver	-	-	-	-	151	-
Stage 1	-	-	-	-	457	-
Stage 2	-	-	-	-	524	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	20.6
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	849	-	-	-	247
HCM Lane V/C Ratio	0.004	-	-	-	0.065
HCM Control Delay (s)	9.3	0	-	-	20.6
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0	-	-	-	0.2

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	0	0	38	223	1
Future Volume (vph)	0	0	0	38	223	1
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.999	
Flt Protected						
Satd. Flow (prot)	1773	0	0	1930	1772	0
Flt Permitted						
Satd. Flow (perm)	1773	0	0	1930	1772	0
Adj. Flow (vph)	0	0	0	54	248	1
Lane Group Flow (vph)	0	0	0	54	249	0
Sign Control	Stop			Free	Free	

Intersection Summary

Control Type: Unsignalized

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	0	0	38	223	1
Future Vol, veh/h	0	0	0	38	223	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	92	92	70	70	90	90
Heavy Vehicles, %	0	0	0	5	0	0
Mvmt Flow	0	0	0	54	248	1

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	302	248	249	0	-	0
Stage 1	248	-	-	-	-	-
Stage 2	54	-	-	-	-	-
Critical Hdwy	7.1	6.2	4.1	-	-	-
Critical Hdwy Stg 1	6.1	-	-	-	-	-
Critical Hdwy Stg 2	6.1	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	654	796	1328	-	-	-
Stage 1	760	-	-	-	-	-
Stage 2	963	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	654	796	1328	-	-	-
Mov Cap-2 Maneuver	654	-	-	-	-	-
Stage 1	760	-	-	-	-	-
Stage 2	963	-	-	-	-	-

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

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1328	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Control Delay (s)	0	-	0	-	-
HCM Lane LOS	A	-	A	-	-
HCM 95th %tile Q(veh)	0	-	-	-	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	57	450	6	2	508	64	3	85	2	29	36	13
Future Volume (vph)	57	450	6	2	508	64	3	85	2	29	36	13
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.998			0.985			0.998			0.977	
Flt Protected		0.994						0.998			0.982	
Satd. Flow (prot)	0	1865	0	0	1917	0	0	1750	0	0	1798	0
Flt Permitted		0.994						0.998			0.982	
Satd. Flow (perm)	0	1865	0	0	1917	0	0	1750	0	0	1798	0
Adj. Flow (vph)	64	506	7	2	598	75	4	105	2	38	47	17
Lane Group Flow (vph)	0	577	0	0	675	0	0	111	0	0	102	0
Sign Control		Free			Free			Stop			Stop	

Intersection Summary

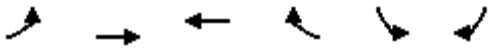
Control Type: Unsignalized

Intersection												
Int Delay, s/veh	21.8											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	57	450	6	2	508	64	3	85	2	29	36	13
Future Vol, veh/h	57	450	6	2	508	64	3	85	2	29	36	13
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	89	89	89	85	85	85	81	81	81	76	76	76
Heavy Vehicles, %	0	1	17	0	1	0	0	1	0	0	3	0
Mvmt Flow	64	506	7	2	598	75	4	105	2	38	47	17

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	673	0	0	512	0	0	1309	1315	509	1331	1280	635
Stage 1	-	-	-	-	-	-	637	637	-	640	640	-
Stage 2	-	-	-	-	-	-	672	678	-	691	640	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.51	6.2	7.1	6.53	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.51	-	6.1	5.53	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.51	-	6.1	5.53	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4.009	3.3	3.5	4.027	3.3
Pot Cap-1 Maneuver	927	-	-	1064	-	-	138	159	568	133	165	482
Stage 1	-	-	-	-	-	-	469	473	-	467	468	-
Stage 2	-	-	-	-	-	-	449	453	-	438	468	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	927	-	-	1064	-	-	93	143	568	50	149	482
Mov Cap-2 Maneuver	-	-	-	-	-	-	93	143	-	50	149	-
Stage 1	-	-	-	-	-	-	424	427	-	422	467	-
Stage 2	-	-	-	-	-	-	388	452	-	297	423	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1	0	86.4	212.7
HCM LOS			F	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	143	927	-	-	1064	-	-	92
HCM Lane V/C Ratio	0.777	0.069	-	-	0.002	-	-	1.116
HCM Control Delay (s)	86.4	9.2	0	-	8.4	0	-	212.7
HCM Lane LOS	F	A	A	-	A	A	-	F
HCM 95th %tile Q(veh)	4.8	0.2	-	-	0	-	-	6.9



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	509	518	6	4	1
Future Volume (vph)	0	509	518	6	4	1
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.998		0.966	
Flt Protected					0.964	
Satd. Flow (prot)	0	1900	1959	0	2005	0
Flt Permitted					0.964	
Satd. Flow (perm)	0	1900	1959	0	2005	0
Adj. Flow (vph)	0	599	589	7	6	2
Lane Group Flow (vph)	0	599	596	0	8	0
Sign Control		Free	Free		Stop	

Intersection Summary

Control Type: Unsignalized

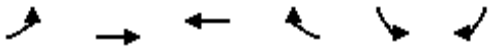
Intersection						
Int Delay, s/veh	0.1					

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	509	518	6	4	1
Future Vol, veh/h	0	509	518	6	4	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	85	85	88	88	63	63
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	0	599	589	7	6	2

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	595	0	-	0	1191	592
Stage 1	-	-	-	-	592	-
Stage 2	-	-	-	-	599	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	991	-	-	-	209	510
Stage 1	-	-	-	-	557	-
Stage 2	-	-	-	-	553	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	991	-	-	-	209	510
Mov Cap-2 Maneuver	-	-	-	-	209	-
Stage 1	-	-	-	-	557	-
Stage 2	-	-	-	-	553	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	20.7
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	991	-	-	-	237
HCM Lane V/C Ratio	-	-	-	-	0.033
HCM Control Delay (s)	0	-	-	-	20.7
HCM Lane LOS	A	-	-	-	C
HCM 95th %tile Q(veh)	0	-	-	-	0.1



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	4	501	517	2	8	2
Future Volume (vph)	4	501	517	2	8	2
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.972	
Flt Protected					0.962	
Satd. Flow (prot)	0	1900	1963	0	2014	0
Flt Permitted					0.962	
Satd. Flow (perm)	0	1900	1963	0	2014	0
Adj. Flow (vph)	5	583	594	2	19	5
Lane Group Flow (vph)	0	588	596	0	24	0
Sign Control		Free	Free		Stop	

Intersection Summary

Control Type: Unsignalized

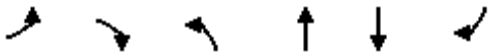
Intersection						
Int Delay, s/veh	0.5					

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	4	501	517	2	8	2
Future Vol, veh/h	4	501	517	2	8	2
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	86	86	87	87	42	42
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	5	583	594	2	19	5

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	597	0	-	0	1187	595
Stage 1	-	-	-	-	595	-
Stage 2	-	-	-	-	592	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	989	-	-	-	210	508
Stage 1	-	-	-	-	555	-
Stage 2	-	-	-	-	557	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	989	-	-	-	209	508
Mov Cap-2 Maneuver	-	-	-	-	209	-
Stage 1	-	-	-	-	555	-
Stage 2	-	-	-	-	553	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	21.9
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	989	-	-	-	237
HCM Lane V/C Ratio	0.005	-	-	-	0.1
HCM Control Delay (s)	8.7	0	-	-	21.9
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0	-	-	-	0.3



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	1	4	3	203	74	2
Future Volume (vph)	1	4	3	203	74	2
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.887				0.996	
Flt Protected	0.992			0.999		
Satd. Flow (prot)	1560	0	0	2025	1766	0
Flt Permitted	0.992			0.999		
Satd. Flow (perm)	1560	0	0	2025	1766	0
Adj. Flow (vph)	2	10	4	257	93	3
Lane Group Flow (vph)	12	0	0	261	96	0
Sign Control	Stop			Free	Free	

Intersection Summary

Control Type: Unsignalized

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	1	4	3	203	74	2
Future Vol, veh/h	1	4	3	203	74	2
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	42	42	79	79	80	80
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	2	10	4	257	93	3

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	359	94	95	0	-	0
Stage 1	94	-	-	-	-	-
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	644	968	1512	-	-	-
Stage 1	935	-	-	-	-	-
Stage 2	784	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	642	968	1512	-	-	-
Mov Cap-2 Maneuver	642	-	-	-	-	-
Stage 1	935	-	-	-	-	-
Stage 2	782	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.2	0.1	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1512	-	879	-	-
HCM Lane V/C Ratio	0.003	-	0.014	-	-
HCM Control Delay (s)	7.4	0	9.2	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

2027 Future Year with Existing Geometry

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	18	577	21	0	554	11	18	13	7	74	108	67
Future Volume (vph)	18	577	21	0	554	11	18	13	7	74	108	67
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.995			0.997			0.976			0.964	
Flt Protected		0.999						0.977			0.985	
Satd. Flow (prot)	0	1832	0	0	1920	0	0	1552	0	0	1770	0
Flt Permitted		0.999						0.977			0.985	
Satd. Flow (perm)	0	1832	0	0	1920	0	0	1552	0	0	1770	0
Adj. Flow (vph)	21	671	24	0	693	14	24	17	9	82	120	74
Lane Group Flow (vph)	0	716	0	0	707	0	0	50	0	0	276	0
Sign Control		Free			Free			Stop			Stop	

Intersection Summary

Control Type: Unsignalized

Intersection

Int Delay, s/veh 107.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	18	577	21	0	554	11	18	13	7	74	108	67
Future Vol, veh/h	18	577	21	0	554	11	18	13	7	74	108	67
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	80	80	80	75	75	75	90	90	90
Heavy Vehicles, %	20	2	18	0	2	0	13	8	0	5	1	0
Mvmt Flow	21	671	24	0	693	14	24	17	9	82	120	74

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	706	0	0	695	0	0	1522	1431	683	1437	1436	699
Stage 1	-	-	-	-	-	-	725	725	-	699	699	-
Stage 2	-	-	-	-	-	-	797	706	-	738	737	-
Critical Hdwy	4.3	-	-	4.1	-	-	7.23	6.58	6.2	7.15	6.51	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.23	5.58	-	6.15	5.51	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.23	5.58	-	6.15	5.51	-
Follow-up Hdwy	2.38	-	-	2.2	-	-	3.617	4.072	3.3	3.545	4.009	3.3
Pot Cap-1 Maneuver	815	-	-	910	-	-	91	131	453	109	134	443
Stage 1	-	-	-	-	-	-	400	421	-	426	443	-
Stage 2	-	-	-	-	-	-	364	430	-	405	426	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	815	-	-	910	-	-	~ 13	125	453	92	128	443
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 13	125	-	92	128	-
Stage 1	-	-	-	-	-	-	383	403	-	408	443	-
Stage 2	-	-	-	-	-	-	221	430	-	364	408	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	0	$ 809.8	$ 530.4
HCM LOS			F	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	25	815	-	-	910	-	-	138
HCM Lane V/C Ratio	2.027	0.026	-	-	-	-	-	2.005
HCM Control Delay (s)	$ 809.8	9.5	0	-	0	-	-	$ 530.4
HCM Lane LOS	F	A	A	-	A	-	-	F
HCM 95th %tile Q(veh)	6.2	0.1	-	-	0	-	-	22

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	615	630	9	1	1
Future Volume (vph)	0	615	630	9	1	1
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.998		0.932	
Flt Protected					0.976	
Satd. Flow (prot)	0	1863	1922	0	1959	0
Flt Permitted					0.976	
Satd. Flow (perm)	0	1863	1922	0	1959	0
Adj. Flow (vph)	0	741	863	12	2	2
Lane Group Flow (vph)	0	741	875	0	4	0
Sign Control		Free	Free		Stop	

Intersection Summary

Control Type: Unsignalized

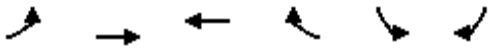
Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	615	630	9	1	1
Future Vol, veh/h	0	615	630	9	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	83	83	73	73	50	50
Heavy Vehicles, %	0	2	2	0	0	0
Mvmt Flow	0	741	863	12	2	2

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	875	0	-	0	1610	869
Stage 1	-	-	-	-	869	-
Stage 2	-	-	-	-	741	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	780	-	-	-	116	354
Stage 1	-	-	-	-	414	-
Stage 2	-	-	-	-	475	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	780	-	-	-	116	354
Mov Cap-2 Maneuver	-	-	-	-	116	-
Stage 1	-	-	-	-	414	-
Stage 2	-	-	-	-	475	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	26.1
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	780	-	-	-	175
HCM Lane V/C Ratio	-	-	-	-	0.023
HCM Control Delay (s)	0	-	-	-	26.1
HCM Lane LOS	A	-	-	-	D
HCM 95th %tile Q(veh)	0	-	-	-	0.1



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	3	612	631	0	3	5
Future Volume (vph)	3	612	631	0	3	5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.916	
Flt Protected					0.982	
Satd. Flow (prot)	0	1863	1925	0	1937	0
Flt Permitted					0.982	
Satd. Flow (perm)	0	1863	1925	0	1937	0
Adj. Flow (vph)	4	737	876	0	6	10
Lane Group Flow (vph)	0	741	876	0	16	0
Sign Control		Free	Free		Stop	

Intersection Summary

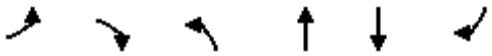
Control Type: Unsignalized

Intersection						
Int Delay, s/veh	0.2					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	3	612	631	0	3	5
Future Vol, veh/h	3	612	631	0	3	5
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	83	83	72	72	50	50
Heavy Vehicles, %	0	2	2	0	0	0
Mvmt Flow	4	737	876	0	6	10

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	876	0	-	0	1621	876
Stage 1	-	-	-	-	876	-
Stage 2	-	-	-	-	745	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	779	-	-	-	115	351
Stage 1	-	-	-	-	411	-
Stage 2	-	-	-	-	473	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	779	-	-	-	114	351
Mov Cap-2 Maneuver	-	-	-	-	114	-
Stage 1	-	-	-	-	411	-
Stage 2	-	-	-	-	469	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	24.9
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	779	-	-	-	197
HCM Lane V/C Ratio	0.005	-	-	-	0.081
HCM Control Delay (s)	9.6	0	-	-	24.9
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0	-	-	-	0.3



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	0	0	42	249	1
Future Volume (vph)	0	0	0	42	249	1
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	1773	0	0	1894	1773	0
Flt Permitted						
Satd. Flow (perm)	1773	0	0	1894	1773	0
Adj. Flow (vph)	0	0	0	60	277	1
Lane Group Flow (vph)	0	0	0	60	278	0
Sign Control	Stop			Free	Free	

Intersection Summary

Control Type: Unsignalized

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	0	0	42	249	1
Future Vol, veh/h	0	0	0	42	249	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	92	92	70	70	90	90
Heavy Vehicles, %	0	0	0	7	0	0
Mvmt Flow	0	0	0	60	277	1

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	337	277	278	0	-	0
Stage 1	277	-	-	-	-	-
Stage 2	60	-	-	-	-	-
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	663	767	1296	-	-	-
Stage 1	774	-	-	-	-	-
Stage 2	968	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	663	767	1296	-	-	-
Mov Cap-2 Maneuver	663	-	-	-	-	-
Stage 1	774	-	-	-	-	-
Stage 2	968	-	-	-	-	-

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

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1296	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Control Delay (s)	0	-	0	-	-
HCM Lane LOS	A	-	A	-	-
HCM 95th %tile Q(veh)	0	-	-	-	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	64	515	7	2	591	71	5	95	2	32	40	15
Future Volume (vph)	64	515	7	2	591	71	5	95	2	32	40	15
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.998			0.985			0.998			0.977	
Flt Protected		0.995						0.998			0.982	
Satd. Flow (prot)	0	1866	0	0	1917	0	0	1750	0	0	1798	0
Flt Permitted		0.995						0.998			0.982	
Satd. Flow (perm)	0	1866	0	0	1917	0	0	1750	0	0	1798	0
Adj. Flow (vph)	72	579	8	2	695	84	6	117	2	42	53	20
Lane Group Flow (vph)	0	659	0	0	781	0	0	125	0	0	115	0
Sign Control		Free			Free			Stop			Stop	

Intersection Summary

Control Type: Unsignalized

Intersection

Int Delay, s/veh 18.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	64	515	7	2	591	71	5	95	2	32	40	15
Future Vol, veh/h	64	515	7	2	591	71	5	95	2	32	40	15
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	89	89	89	85	85	85	81	81	81	76	76	76
Heavy Vehicles, %	0	1	17	0	1	0	0	1	0	0	3	0
Mvmt Flow	72	579	8	2	695	84	6	117	2	42	53	20

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	779	0	0	587	0	0	1504	1510	583	1528	1472	737
Stage 1	-	-	-	-	-	-	726	726	-	742	742	-
Stage 2	-	-	-	-	-	-	778	784	-	786	730	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.51	6.2	7.1	6.53	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.51	-	6.1	5.53	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.51	-	6.1	5.53	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4.009	3.3	3.5	4.027	3.3
Pot Cap-1 Maneuver	847	-	-	998	-	-	101	121	516	97	126	422
Stage 1	-	-	-	-	-	-	419	431	-	411	421	-
Stage 2	-	-	-	-	-	-	392	406	-	388	426	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	847	-	-	998	-	-	55	~ 105	516	-	110	422
Mov Cap-2 Maneuver	-	-	-	-	-	-	55	~ 105	-	-	110	-
Stage 1	-	-	-	-	-	-	366	377	-	359	419	-
Stage 2	-	-	-	-	-	-	325	404	-	232	372	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1.1	0	242.7	
HCM LOS			F	-

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	102	847	-	-	998	-	-	-
HCM Lane V/C Ratio	1.235	0.085	-	-	0.002	-	-	-
HCM Control Delay (s)	242.7	9.6	0	-	8.6	0	-	-
HCM Lane LOS	F	A	A	-	A	A	-	-
HCM 95th %tile Q(veh)	8.5	0.3	-	-	0	-	-	-

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	582	605	6	4	1
Future Volume (vph)	0	582	605	6	4	1
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.999		0.966	
Flt Protected					0.964	
Satd. Flow (prot)	0	1900	1961	0	2005	0
Flt Permitted					0.964	
Satd. Flow (perm)	0	1900	1961	0	2005	0
Adj. Flow (vph)	0	685	688	7	6	2
Lane Group Flow (vph)	0	685	695	0	8	0
Sign Control		Free	Free		Stop	

Intersection Summary

Control Type: Unsignalized

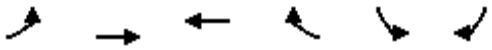
Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	582	605	6	4	1
Future Vol, veh/h	0	582	605	6	4	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	85	85	88	88	63	63
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	0	685	688	7	6	2

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	694	0	-	0	1376	691
Stage 1	-	-	-	-	691	-
Stage 2	-	-	-	-	685	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	911	-	-	-	162	448
Stage 1	-	-	-	-	501	-
Stage 2	-	-	-	-	504	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	911	-	-	-	162	448
Mov Cap-2 Maneuver	-	-	-	-	162	-
Stage 1	-	-	-	-	501	-
Stage 2	-	-	-	-	504	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	25.2
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	911	-	-	-	186
HCM Lane V/C Ratio	-	-	-	-	0.043
HCM Control Delay (s)	0	-	-	-	25.2
HCM Lane LOS	A	-	-	-	D
HCM 95th %tile Q(veh)	0	-	-	-	0.1



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	4	574	604	2	8	2
Future Volume (vph)	4	574	604	2	8	2
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.972	
Flt Protected					0.962	
Satd. Flow (prot)	0	1900	1963	0	2014	0
Flt Permitted					0.962	
Satd. Flow (perm)	0	1900	1963	0	2014	0
Adj. Flow (vph)	5	667	694	2	19	5
Lane Group Flow (vph)	0	672	696	0	24	0
Sign Control		Free	Free		Stop	

Intersection Summary

Control Type: Unsignalized

Intersection						
Int Delay, s/veh	0.5					

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	4	574	604	2	8	2
Future Vol, veh/h	4	574	604	2	8	2
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	86	86	87	87	42	42
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	5	667	694	2	19	5

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	697	0	-	0	1372	695
Stage 1	-	-	-	-	695	-
Stage 2	-	-	-	-	677	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	909	-	-	-	163	446
Stage 1	-	-	-	-	499	-
Stage 2	-	-	-	-	509	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	909	-	-	-	162	446
Mov Cap-2 Maneuver	-	-	-	-	162	-
Stage 1	-	-	-	-	499	-
Stage 2	-	-	-	-	504	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	27.2
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	909	-	-	-	186
HCM Lane V/C Ratio	0.005	-	-	-	0.128
HCM Control Delay (s)	9	0	-	-	27.2
HCM Lane LOS	A	A	-	-	D
HCM 95th %tile Q(veh)	0	-	-	-	0.4

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	1	4	3	227	83	2
Future Volume (vph)	1	4	3	227	83	2
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.887				0.996	
Flt Protected	0.992			0.999		
Satd. Flow (prot)	1560	0	0	2025	1766	0
Flt Permitted	0.992			0.999		
Satd. Flow (perm)	1560	0	0	2025	1766	0
Adj. Flow (vph)	2	10	4	287	104	3
Lane Group Flow (vph)	12	0	0	291	107	0
Sign Control	Stop			Free	Free	

Intersection Summary

Control Type: Unsignalized

Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	1	4	3	227	83	2
Future Vol, veh/h	1	4	3	227	83	2
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	42	42	79	79	80	80
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	2	10	4	287	104	3

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	400	105	106	0	-	0
Stage 1	105	-	-	-	-	-
Stage 2	295	-	-	-	-	-
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	610	955	1498	-	-	-
Stage 1	924	-	-	-	-	-
Stage 2	760	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	608	955	1498	-	-	-
Mov Cap-2 Maneuver	608	-	-	-	-	-
Stage 1	924	-	-	-	-	-
Stage 2	758	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.3	0.1	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1498	-	857	-	-
HCM Lane V/C Ratio	0.003	-	0.014	-	-
HCM Control Delay (s)	7.4	0	9.3	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

2027 Future Year with Proposed Geometry

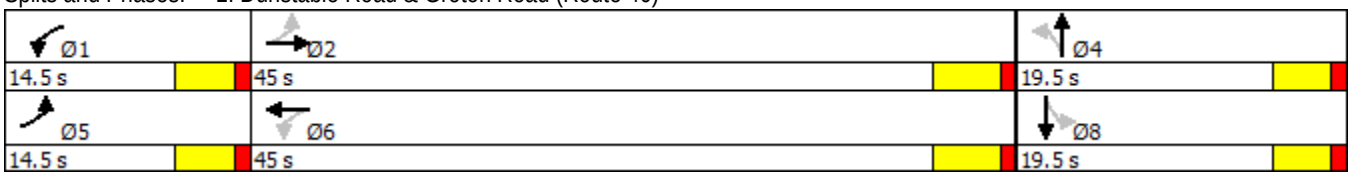
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	18	576	21	0	554	11	18	13	7	75	108	68
Future Volume (vph)	18	576	21	0	554	11	18	13	7	75	108	68
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	11	11	10	11	11	13	13	13	11	11	11
Storage Length (ft)	210		0	220		0	0		0	0		0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.995			0.997			0.976			0.963	
Flt Protected	0.950							0.977			0.985	
Satd. Flow (prot)	1404	1782	0	1773	1796	0	0	1718	0	0	1709	0
Flt Permitted	0.147							0.845			0.888	
Satd. Flow (perm)	217	1782	0	1773	1796	0	0	1486	0	0	1541	0
Right Turn on Red			No			No			No			Yes
Satd. Flow (RTOR)											21	
Link Speed (mph)		45			45			30			30	
Link Distance (ft)		175			1000			1000			70	
Travel Time (s)		2.7			15.2			22.7			1.6	
Peak Hour Factor	0.86	0.86	0.86	0.80	0.80	0.80	0.75	0.75	0.75	0.90	0.90	0.90
Heavy Vehicles (%)	20%	2%	18%	0%	2%	0%	13%	8%	0%	5%	1%	0%
Shared Lane Traffic (%)												
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases	5	2		1	6			4			8	
Permitted Phases	2			6			4			8		
Detector Phase	5	2		1	6		4	4		8	8	
Switch Phase												
Minimum Initial (s)	6.0	10.0		6.0	10.0		6.0	6.0		6.0	6.0	
Minimum Split (s)	10.5	15.0		10.5	15.0		10.5	10.5		10.5	10.5	
Total Split (s)	14.5	45.0		14.5	45.0		19.5	19.5		19.5	19.5	
Total Split (%)	18.4%	57.0%		18.4%	57.0%		24.7%	24.7%		24.7%	24.7%	
Maximum Green (s)	10.0	40.0		10.0	40.0		15.0	15.0		15.0	15.0	
Yellow Time (s)	3.5	4.0		3.5	4.0		3.5	3.5		3.5	3.5	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0			0.0	
Total Lost Time (s)	4.5	5.0		4.5	5.0			4.5			4.5	
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Recall Mode	None	Min		None	Min		None	None		None	None	

Intersection Summary

Area Type: Other
Cycle Length: 79
Actuated Cycle Length: 54.3
Natural Cycle: 65
Control Type: Actuated-Uncoordinated

Splits and Phases: 1: Dunstable Road & Groton Road (Route 40)



Lane Group	EBL	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	21	694	707	50	279
v/c Ratio	0.08	0.72	0.82	0.12	0.65
Control Delay	5.0	13.4	21.6	22.0	30.0
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	5.0	13.4	21.6	22.0	30.0
Queue Length 50th (ft)	3	146	150	9	56
Queue Length 95th (ft)	8	211	299	40	#252
Internal Link Dist (ft)		95	920	920	1
Turn Bay Length (ft)	210				
Base Capacity (vph)	356	1471	1397	446	477
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.06	0.47	0.51	0.11	0.58

Intersection Summary

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	18	576	21	0	554	11	18	13	7	75	108	68
Future Volume (veh/h)	18	576	21	0	554	11	18	13	7	75	108	68
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1583	1853	1900	1900	1863	1900	1976	1814	1976	1900	1864	1900
Adj Flow Rate, veh/h	21	670	24	0	692	14	24	17	9	83	120	76
Adj No. of Lanes	1	1	0	1	1	0	0	1	0	0	1	0
Peak Hour Factor	0.86	0.86	0.86	0.80	0.80	0.80	0.75	0.75	0.75	0.90	0.90	0.90
Percent Heavy Veh, %	20	2	2	0	2	2	8	8	8	1	1	1
Cap, veh/h	290	1065	38	420	870	18	224	144	57	175	171	94
Arrive On Green	0.03	0.60	0.60	0.00	0.48	0.48	0.21	0.21	0.21	0.21	0.21	0.21
Sat Flow, veh/h	1508	1778	64	1810	1820	37	557	684	273	385	815	449
Grp Volume(v), veh/h	21	0	694	0	0	706	50	0	0	279	0	0
Grp Sat Flow(s),veh/h/ln	1508	0	1841	1810	0	1857	1514	0	0	1650	0	0
Q Serve(g_s), s	0.3	0.0	12.1	0.0	0.0	15.9	0.0	0.0	0.0	5.9	0.0	0.0
Cycle Q Clear(g_c), s	0.3	0.0	12.1	0.0	0.0	15.9	1.2	0.0	0.0	7.9	0.0	0.0
Prop In Lane	1.00		0.03	1.00		0.02	0.48		0.18	0.30		0.27
Lane Grp Cap(c), veh/h	290	0	1103	420	0	888	425	0	0	440	0	0
V/C Ratio(X)	0.07	0.00	0.63	0.00	0.00	0.79	0.12	0.00	0.00	0.63	0.00	0.00
Avail Cap(c_a), veh/h	548	0	1482	781	0	1494	552	0	0	589	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	8.5	0.0	6.4	0.0	0.0	10.9	16.0	0.0	0.0	18.6	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.0	0.2	0.0	0.0	0.6	0.0	0.0	0.0	0.6	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	6.0	0.0	0.0	8.2	0.6	0.0	0.0	3.7	0.0	0.0
LnGrp Delay(d),s/veh	8.5	0.0	6.6	0.0	0.0	11.5	16.0	0.0	0.0	19.2	0.0	0.0
LnGrp LOS	A		A			B	B			B		
Approach Vol, veh/h		715			706			50			279	
Approach Delay, s/veh		6.7			11.5			16.0			19.2	
Approach LOS		A			B			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	0.0	34.8		14.9	6.0	28.8		14.9
Change Period (Y+Rc), s	4.5	5.0		4.5	4.5	5.0		4.5
Max Green Setting (Gmax), s	10.0	40.0		15.0	10.0	40.0		15.0
Max Q Clear Time (g_c+I1), s	0.0	14.1		3.2	2.3	17.9		9.9
Green Ext Time (p_c), s	0.0	6.1		1.0	0.0	5.9		0.6

Intersection Summary	
HCM 2010 Ctrl Delay	10.9
HCM 2010 LOS	B

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	3	612	631	9	3	5
Future Volume (vph)	3	612	631	9	3	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	11	11	16	16
Storage Length (ft)	135			0	0	0
Storage Lanes	1			0	1	0
Taper Length (ft)	25				25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.998		0.916	
Flt Protected	0.950				0.982	
Satd. Flow (prot)	1745	1801	1798	0	1937	0
Flt Permitted	0.950				0.982	
Satd. Flow (perm)	1745	1801	1798	0	1937	0
Link Speed (mph)		45	30		30	
Link Distance (ft)		729	175		60	
Travel Time (s)		11.0	4.0		1.4	
Peak Hour Factor	0.83	0.83	0.72	0.72	0.50	0.50
Heavy Vehicles (%)	0%	2%	2%	0%	0%	0%
Shared Lane Traffic (%)						
Sign Control		Free	Free		Stop	

Intersection Summary

Area Type: Other
Control Type: Unsignalized

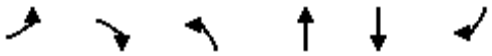
Intersection						
Int Delay, s/veh	0.2					

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	3	612	631	9	3	5
Future Vol, veh/h	3	612	631	9	3	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	135	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	83	83	72	72	50	50
Heavy Vehicles, %	0	2	2	0	0	0
Mvmt Flow	4	737	876	13	6	10

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	889	0	-	0	1628	883
Stage 1	-	-	-	-	883	-
Stage 2	-	-	-	-	745	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	771	-	-	-	113	348
Stage 1	-	-	-	-	408	-
Stage 2	-	-	-	-	473	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	771	-	-	-	112	348
Mov Cap-2 Maneuver	-	-	-	-	112	-
Stage 1	-	-	-	-	408	-
Stage 2	-	-	-	-	471	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	25.2
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	771	-	-	-	194
HCM Lane V/C Ratio	0.005	-	-	-	0.082
HCM Control Delay (s)	9.7	-	-	-	25.2
HCM Lane LOS	A	-	-	-	D
HCM 95th %tile Q(veh)	0	-	-	-	0.3



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	2	0	42	249	1
Future Volume (vph)	0	2	0	42	249	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	14	14	10	10
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.865					
Flt Protected						
Satd. Flow (prot)	1534	0	0	1930	1773	0
Flt Permitted						
Satd. Flow (perm)	1534	0	0	1930	1773	0
Link Speed (mph)	30			30	30	
Link Distance (ft)	60			70	853	
Travel Time (s)	1.4			1.6	19.4	
Peak Hour Factor	0.92	0.92	0.70	0.70	0.90	0.90
Heavy Vehicles (%)	0%	0%	0%	5%	0%	0%
Shared Lane Traffic (%)						
Sign Control	Stop			Free	Free	

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection						
Int Delay, s/veh	0.1					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	2	0	42	249	1
Future Vol, veh/h	0	2	0	42	249	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	92	92	70	70	90	90
Heavy Vehicles, %	0	0	0	5	0	0
Mvmt Flow	0	2	0	60	277	1

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	337	277	278	0	-	0
Stage 1	277	-	-	-	-	-
Stage 2	60	-	-	-	-	-
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	663	767	1296	-	-	-
Stage 1	774	-	-	-	-	-
Stage 2	968	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	663	767	1296	-	-	-
Mov Cap-2 Maneuver	663	-	-	-	-	-
Stage 1	774	-	-	-	-	-
Stage 2	968	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.7	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1296	-	767	-	-
HCM Lane V/C Ratio	-	-	0.003	-	-
HCM Control Delay (s)	0	-	9.7	-	-
HCM Lane LOS	A	-	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

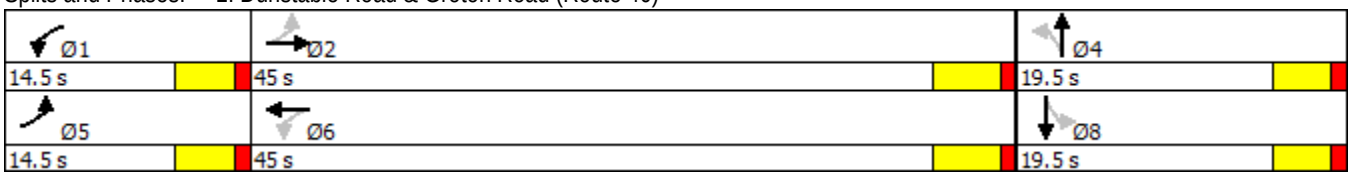
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	64	511	7	2	591	71	5	95	2	36	40	16
Future Volume (vph)	64	511	7	2	591	71	5	95	2	36	40	16
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	11	11	10	11	11	13	13	13	11	11	11
Storage Length (ft)	210		0	220		0	0		0	0		0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.998			0.984			0.998			0.977	
Flt Protected	0.950			0.950				0.998			0.981	
Satd. Flow (prot)	1685	1833	0	1685	1807	0	0	1955	0	0	1760	0
Flt Permitted	0.210			0.407				0.986			0.824	
Satd. Flow (perm)	372	1833	0	722	1807	0	0	1932	0	0	1479	0
Right Turn on Red			No			No			No			Yes
Satd. Flow (RTOR)											12	
Link Speed (mph)		45			45			30			30	
Link Distance (ft)		175			1000			1000			70	
Travel Time (s)		2.7			15.2			22.7			1.6	
Peak Hour Factor	0.89	0.89	0.89	0.85	0.85	0.85	0.81	0.81	0.81	0.76	0.76	0.76
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Shared Lane Traffic (%)												
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases	5	2		1	6			4			8	
Permitted Phases	2			6			4			8		
Detector Phase	5	2		1	6		4	4		8	8	
Switch Phase												
Minimum Initial (s)	6.0	10.0		6.0	10.0		6.0	6.0		6.0	6.0	
Minimum Split (s)	10.5	15.0		10.5	15.0		10.5	10.5		10.5	10.5	
Total Split (s)	14.5	45.0		14.5	45.0		19.5	19.5		19.5	19.5	
Total Split (%)	18.4%	57.0%		18.4%	57.0%		24.7%	24.7%		24.7%	24.7%	
Maximum Green (s)	10.0	40.0		10.0	40.0		15.0	15.0		15.0	15.0	
Yellow Time (s)	3.5	4.0		3.5	4.0		3.5	3.5		3.5	3.5	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0			0.0	
Total Lost Time (s)	4.5	5.0		4.5	5.0			4.5			4.5	
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Recall Mode	None	Min		None	Min		None	None		None	None	

Intersection Summary

Area Type: Other
Cycle Length: 79
Actuated Cycle Length: 56.3
Natural Cycle: 60
Control Type: Actuated-Uncoordinated

Splits and Phases: 1: Dunstable Road & Groton Road (Route 40)



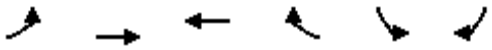
Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	72	582	2	779	125	121
v/c Ratio	0.17	0.45	0.00	0.68	0.38	0.46
Control Delay	4.2	7.7	3.5	15.7	29.0	29.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	4.2	7.7	3.5	15.7	29.0	29.9
Queue Length 50th (ft)	6	75	0	229	43	38
Queue Length 95th (ft)	20	255	2	395	88	76
Internal Link Dist (ft)		95		920	920	1
Turn Bay Length (ft)	210		220			
Base Capacity (vph)	530	1443	700	1337	584	455
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.14	0.40	0.00	0.58	0.21	0.27

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	64	511	7	2	591	71	5	95	2	36	40	16
Future Volume (veh/h)	64	511	7	2	591	71	5	95	2	36	40	16
Number	5	2	12	1	6	16	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1900	1900	1900	1900	1900	1976	1976	1976	1900	1900	1900
Adj Flow Rate, veh/h	72	574	8	2	695	84	6	117	2	47	53	21
Adj No. of Lanes	1	1	0	1	1	0	0	1	0	0	1	0
Peak Hour Factor	0.89	0.89	0.89	0.85	0.85	0.85	0.81	0.81	0.81	0.76	0.76	0.76
Percent Heavy Veh, %	0	0	0	0	0	0	0	0	0	0	0	0
Cap, veh/h	402	1092	15	495	849	103	84	226	4	169	106	36
Arrive On Green	0.08	0.58	0.58	0.00	0.51	0.51	0.12	0.12	0.12	0.12	0.12	0.12
Sat Flow, veh/h	1810	1869	26	1810	1663	201	47	1874	31	535	878	297
Grp Volume(v), veh/h	72	0	582	2	0	779	125	0	0	121	0	0
Grp Sat Flow(s),veh/h/ln	1810	0	1895	1810	0	1865	1952	0	0	1710	0	0
Q Serve(g_s), s	0.8	0.0	8.8	0.0	0.0	16.8	0.0	0.0	0.0	0.1	0.0	0.0
Cycle Q Clear(g_c), s	0.8	0.0	8.8	0.0	0.0	16.8	2.9	0.0	0.0	3.0	0.0	0.0
Prop In Lane	1.00		0.01	1.00		0.11	0.05		0.02	0.39		0.17
Lane Grp Cap(c), veh/h	402	0	1108	495	0	952	314	0	0	310	0	0
V/C Ratio(X)	0.18	0.00	0.53	0.00	0.00	0.82	0.40	0.00	0.00	0.39	0.00	0.00
Avail Cap(c_a), veh/h	640	0	1581	866	0	1555	685	0	0	611	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	7.5	0.0	6.0	6.0	0.0	9.9	19.8	0.0	0.0	19.8	0.0	0.0
Incr Delay (d2), s/veh	0.1	0.0	0.1	0.0	0.0	0.7	0.3	0.0	0.0	0.3	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	4.6	0.0	0.0	8.6	1.6	0.0	0.0	1.5	0.0	0.0
LnGrp Delay(d),s/veh	7.6	0.0	6.1	6.0	0.0	10.6	20.1	0.0	0.0	20.1	0.0	0.0
LnGrp LOS	A		A	A		B	C			C		
Approach Vol, veh/h		654			781			125			121	
Approach Delay, s/veh		6.3			10.5			20.1			20.1	
Approach LOS		A			B			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	4.7	33.0		10.3	8.2	29.5		10.3
Change Period (Y+Rc), s	4.5	5.0		4.5	4.5	5.0		4.5
Max Green Setting (Gmax), s	10.0	40.0		15.0	10.0	40.0		15.0
Max Q Clear Time (g_c+I1), s	2.0	10.8		4.9	2.8	18.8		5.0
Green Ext Time (p_c), s	0.0	6.0		0.6	0.0	5.6		0.6

Intersection Summary	
HCM 2010 Ctrl Delay	10.3
HCM 2010 LOS	B



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	4	574	604	8	8	2
Future Volume (vph)	4	574	604	8	8	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	11	11	11	16	16
Storage Length (ft)	135			0	0	0
Storage Lanes	1			0	1	0
Taper Length (ft)	25				25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.998		0.972	
Flt Protected	0.950				0.962	
Satd. Flow (prot)	1685	1837	1833	0	2014	0
Flt Permitted	0.950				0.962	
Satd. Flow (perm)	1685	1837	1833	0	2014	0
Link Speed (mph)		45	30		30	
Link Distance (ft)		729	175		60	
Travel Time (s)		11.0	4.0		1.4	
Peak Hour Factor	0.86	0.86	0.87	0.87	0.42	0.42
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%
Shared Lane Traffic (%)						
Sign Control		Free	Free		Stop	

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection						
Int Delay, s/veh	0.5					

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	4	574	604	8	8	2
Future Vol, veh/h	4	574	604	8	8	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	135	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	86	86	87	87	42	42
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	5	667	694	9	19	5

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	703	0	-	0	1376	699
Stage 1	-	-	-	-	699	-
Stage 2	-	-	-	-	677	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	904	-	-	-	162	443
Stage 1	-	-	-	-	497	-
Stage 2	-	-	-	-	509	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	904	-	-	-	161	443
Mov Cap-2 Maneuver	-	-	-	-	161	-
Stage 1	-	-	-	-	497	-
Stage 2	-	-	-	-	506	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	27.5
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	904	-	-	-	184
HCM Lane V/C Ratio	0.005	-	-	-	0.129
HCM Control Delay (s)	9	-	-	-	27.5
HCM Lane LOS	A	-	-	-	D
HCM 95th %tile Q(veh)	0	-	-	-	0.4

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	1	9	3	227	83	2
Future Volume (vph)	1	9	3	227	83	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	14	14	11	11
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.877				0.996	
Flt Protected	0.996			0.999		
Satd. Flow (prot)	1549	0	0	2025	1829	0
Flt Permitted	0.996			0.999		
Satd. Flow (perm)	1549	0	0	2025	1829	0
Link Speed (mph)	30			30	30	
Link Distance (ft)	60			70	853	
Travel Time (s)	1.4			1.6	19.4	
Peak Hour Factor	0.42	0.42	0.79	0.79	0.80	0.80
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%
Shared Lane Traffic (%)						
Sign Control	Stop			Free	Free	

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection	
Int Delay, s/veh	0.6

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	1	9	3	227	83	2
Future Vol, veh/h	1	9	3	227	83	2
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	42	42	79	79	80	80
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	2	21	4	287	104	3

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	400	105	106	0	-	0
Stage 1	105	-	-	-	-	-
Stage 2	295	-	-	-	-	-
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	610	955	1498	-	-	-
Stage 1	924	-	-	-	-	-
Stage 2	760	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	608	955	1498	-	-	-
Mov Cap-2 Maneuver	608	-	-	-	-	-
Stage 1	924	-	-	-	-	-
Stage 2	758	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.1	0.1	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1498	-	903	-	-
HCM Lane V/C Ratio	0.003	-	0.026	-	-
HCM Control Delay (s)	7.4	0	9.1	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

Appendix K

Clearance Interval Calculations

Clearance Interval Calculations

65 Glenn Street, Lawrence, MA 01843
169 Ocean Boulevard, Unit 101, PO Box 249, Hampton, NH 03842
TEL 978.794.1792 | FAX 978.794.1793 | TheEngineeringCorp.com

JOB:	Groton Road (Route 40) Intersection Improvements	JOB NUMBER:	T0519
LOCATION:	Westford, Massachusetts	DATE:	2/8/2017
TITLE:	Groton Road (Rotue 40) @ Dunstable Road	SHEET:	1 OF 2
CALCULATED BY:	Douglas S. Halpert, E.I.T.	CHECKED BY:	Samuel W. Gregorio, P.E., PTOE

Assumptions:
- t = 1 sec (driver reaction time)
- g = 32.2 ft/s^2 (acceleration due to gravity)
- a = 10.0 ft/s^2 (deceleration rate of vehicles)
- L = 20 ft (Length of a standard vehicle)

Definition of Input Values:
- S_{85} = (85th Percentile Speed of Roadway, mph)
- G = (Grade of approach, %)
- w = (distance from the departure STOP line to the far side of the farthest conflicting traffic lane, ft)
- P = (distance from the departure STOP line to the near side of the farthest conflicting crosswalk, ft)

Approach	*Input Values*		*Calculated Values*		
			Yellow Clearance (sec)	All Red Clearance (sec)	
				CW < 40 ft from farthest conflict	*CW ≥ 40 ft from farthest conflict*
Groton Road EBL	S_{85} = 35	mph	3.6	1.0	1.0
	G = 0	%			
	w = 80	ft			
	P = 80	ft			
Groton Road EB	S_{85} = 40	mph	3.9	1.0	1.0
	G = 0	%			
	w = 85	ft			
	P = 85	ft			
Groton Road WBL	S_{85} = 35	mph	3.6	1.0	1.0
	G = 0	%			
	w = 75	ft			
	P = 75	ft			
Groton Road WB	S_{85} = 40	mph	3.9	1.0	1.0
	G = 0	%			
	w = 80	ft			
	P = 80	ft			

**Updated based on MassDOT guidelines (January 8, 2013)*

Clearance Interval Calculations

65 Glenn Street, Lawrence, MA 01843
169 Ocean Boulevard, Unit 101, PO Box 249, Hampton, NH 03842
TEL 978.794.1792 | FAX 978.794.1793 | TheEngineeringCorp.com

JOB:	Groton Road (Route 40) Intersection Improvements	JOB NUMBER:	T0519
LOCATION:	Westford, Massachusetts	DATE:	2/8/2017
TITLE:	Groton Road (Rotue 40) @ Dunstable Road	SHEET:	2 OF 2
CALCULATED BY:	Douglas S. Halpert, E.I.T.	CHECKED BY:	Samuel W. Gregorio, P.E., PTOE

Assumptions:
- t = 1 sec (driver reaction time)
- g = 32.2 ft/s^2 (acceleration due to gravity)
- a = 10.0 ft/s^2 (deceleration rate of vehicles)
- L = 20 ft (Length of a standard vehicle)

Definition of Input Values:
- S_{85} = (85th Percentile Speed of Roadway, mph)
- G = (Grade of approach, %)
- w = (distance from the departure STOP line to the far side of the farthest conflicting traffic lane, ft)
- P = (distance from the departure STOP line to the near side of the farthest conflicting crosswalk, ft)

Approach	*Input Values*		*Calculated Values*		
			Yellow Clearance (sec)	All Red Clearance (sec)	
				CW < 40 ft from farthest conflict	*CW ≥ 40 ft from farthest conflict*
Dunstable Road NB	S_{85} = 32	mph	3.4	1.1	1.1
	G = 0	%			
	w = 80	ft			
	P = 80	ft			

Approach	*Input Values*		*Calculated Values*		
			Yellow Clearance (sec)	All Red Clearance (sec)	
				CW < 40 ft from farthest conflict	*CW ≥ 40 ft from farthest conflict*
Dunstable Road SB	S_{85} = 32	mph	3.4	1.0	1.0
	G = 0	%			
	w = 70	ft			
	P = 70	ft			

**Updated based on MassDOT guidelines (January 8, 2013)*