

# Traffic Impact and Access Study The Pointe at Hills Farm Shrewsbury, Massachusetts

November 2015

## PRESENTED TO

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**Smart Growth Design, LLC**

## PRESENTED BY

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## EXECUTIVE SUMMARY

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Tetra Tech has completed a Traffic Impact and Access Study for the proposed Pointe at Hills Farm project, a residential development to be located on Route 20 in Shrewsbury, MA (the project). The project consists of two sites located at the two intersections of Route 20 and Stoney Hill Road (east and west). Phase I is located at 440 Hartford Turnpike adjacent to the Route 20/Stoney Hill Road (west) intersection and includes 180 apartment units and 270 parking spaces. Phase II of the project is located at 526 Hartford Turnpike adjacent to the Route 20/Stoney Hill Road (east) intersection and includes 100 apartment units and 151 parking spaces. For purposes of this study it is assumed that Phase I and Phase II will be constructed at the same time.

Conceptual level designs for site access, intersection improvements and pedestrian accommodations were developed through coordination with Town of Shrewsbury and MassDOT officials. During this process, the potential for traffic signal control of the Route 20/Stoney Hill Road (west) intersection was evaluated and discussed with MassDOT. It was determined that the intersection does not meet MassDOT's requirements for a traffic signal. However, the intersection will be reevaluated after the project is complete. If the requirements for signalization are met after the project is completed, and both MassDOT and the Town of Shrewsbury support installation of a traffic signal at the intersection, the proponent would be willing to fund the design of traffic signal and provide a fair-share contribution towards construction.

Mitigation for the project includes improvements to the Route 20/Stoney Hill Road (west) intersection, access on Route 20 and Stoney Hill Road for both Phase I and Phase II sites, a comprehensive Traffic Demand Management plan and traffic monitoring. With the mitigation proposed by the proponent, the project would improve pedestrian accommodations in the area and improve safety at the Route 20/Stoney Hill Road (west) intersection.

Key findings of the traffic study are as follows:

- **Traffic Volumes.** The weekday daily traffic on Route 20 between the two sites is 22,685 vehicles per day with approximately 8 to 9 percent of traffic occurring during peak hours.
- **Safety.** Five years of MassDOT and four years of Shrewsbury Police Department crash data were reviewed for the two Route 20/Stoney Hill Road intersections. The MassDOT data shows that both intersections have crash rates lower than average for unsignalized intersections.

The Shrewsbury Police Department data indicates that over the four year period, three collisions occurred at the westerly Stoney Hill Road intersection and two collisions occurred at the easterly Stoney Hill Road intersection.

- **Driveway Sight Lines.** Adequate stopping sight distance is provided at all driveways. Vehicles approaching the site driveways, on Route 20 or Stoney Hill Road (east/west), have sufficient sight lines to detect, react and stop for vehicles exiting the site driveways. Adequate intersection sight distance is also provided at the site driveways and exceeds minimum sight line requirements. Vegetation on the Phase II site will need to be maintained to provide adequate sight lines.
- **Stoney Hill Road Operations.** Delays experienced by motorists exiting from Stoney Hill Road onto Route 20 and vehicle queues on Stoney Hill Road were measured during the weekday morning and afternoon peak periods. In the morning, the wait time for vehicles exiting from Stoney Hill Road onto Route 20 averaged less than 30 seconds. In the afternoon, the average wait time was approximately 10 to 20 seconds. When a queue did form on either Stoney Hill Road approach, the average queue was only one or two vehicles.
- **Project Trips.** The two phase project will generate approximately 1,950 daily trips of which 145 will occur during the morning peak hour and 190 will occur during the afternoon peak hour.

In the morning, Phase I of the project will increase the number of vehicles on the Stoney Hill Road (west) approach to Route 20 by approximately 47 vehicles, or less than one vehicle a minute. Phase II will increase the number of vehicles on the Stoney Hill Road (east) approach to Route 20 by approximately 24 vehicles.

- **Route 20 Improvements.** The conceptual design of safety improvements along Route 20 were developed in accordance with the standards of MassDOT's *Project Development & Design Guide* (MassDOT, 2006).

## 1.0 INTRODUCTION

Tetra Tech has prepared a traffic impact and access study associated with the proposed residential development located at 440 and 526 Hartford Turnpike (Route 20) in Shrewsbury, Massachusetts. As shown in Figure 1, the project consists of two parcels of land located along the southerly side of Route 20. Phase I of the project is located at 440 Hartford Turnpike adjacent to the Route 20/Stoney Hill Road (west) intersection. Phase II of the project is located at 526 Hartford Turnpike adjacent to the Route 20/Stoney Hill Road (east) intersection. The distance along Route 20 between the two sites is approximately 2,000 feet. It is envisioned that Phase I and Phase II will be constructed at the same time.

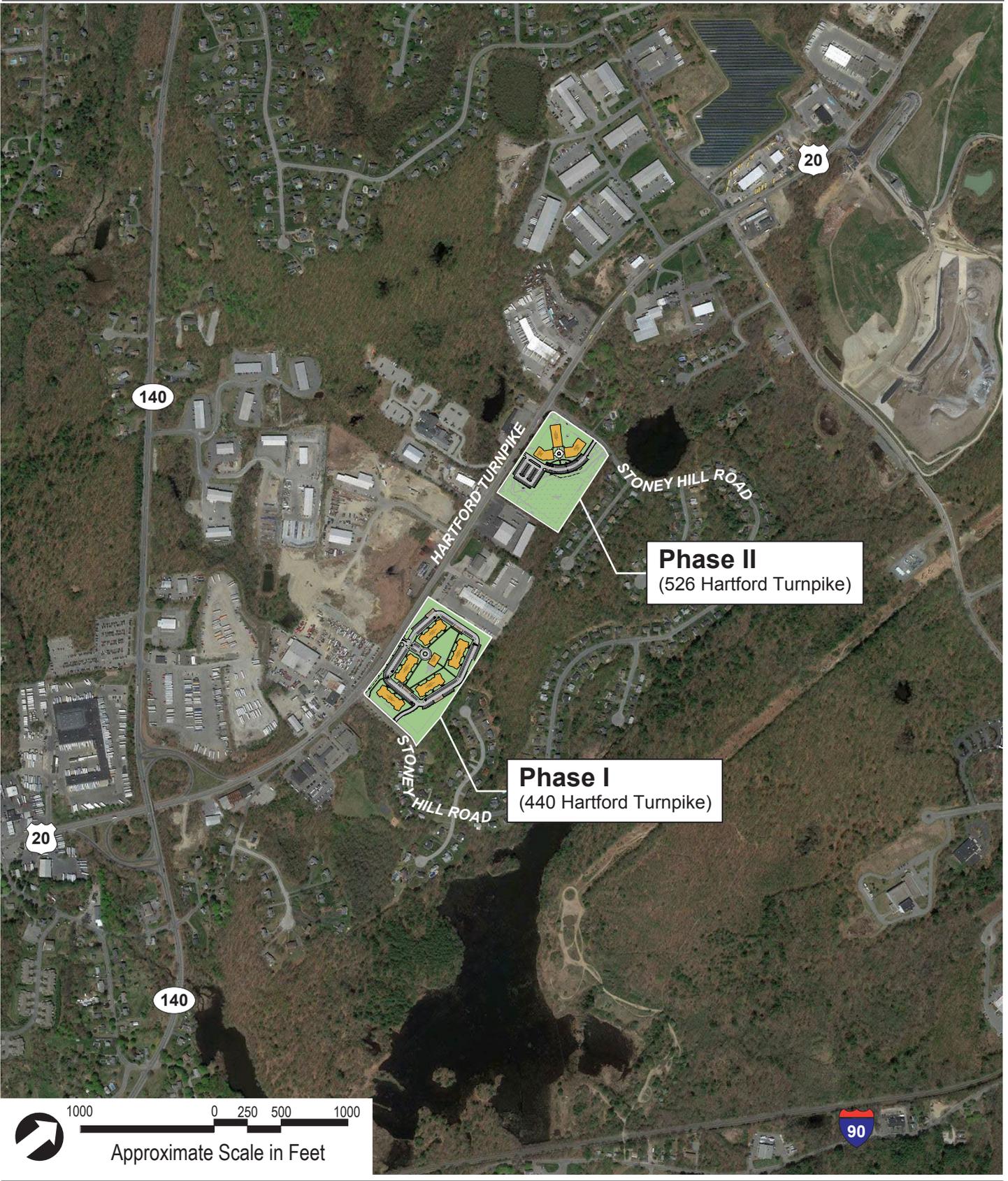
The proposed residential development under study, known as The Pointe at Hills Farm, is comprised of apartment buildings on two sites. Each site is designed with two access driveways: one on Route 20 and the other one on Stoney Hill Road. The project is set back from Hartford Turnpike and Stoney Hill Road, with a clubhouse building located at both sites.

Phase I of the proposed development (440 Hartford Turnpike), as shown on Figure 2, consists of 180 apartment units and approximately 270 parking spaces. Access to the property will be via a right in/right out driveway on the south side of Route 20, approximately 470 feet east of Stoney Hill Road and an unsignalized driveway which will intersect the east side of Stoney Hill Road, approximately 300 feet south of Route 20.

Phase II of the proposed development (526 Hartford Turnpike), as shown on Figure 3, consists of 100 apartment units and approximately 151 parking spaces. Access to the property will be via a full access driveway on the south side of Route 20, approximately 400 feet west of Stoney Hill Road and an unsignalized driveway which will intersect the west side of Stoney Hill Road, approximately 400 feet south of Route 20.

The intersections evaluated in this study are shown on Figure 4.

The conceptual designs for access to each site have been presented to the Massachusetts Department of Transportation (MassDOT) and Town of Shrewsbury officials, who indicated a general approval of the concepts. As part of the Access Permit process required for both sites, MassDOT will conduct a more substantial review of the project's proposed access and mitigation.

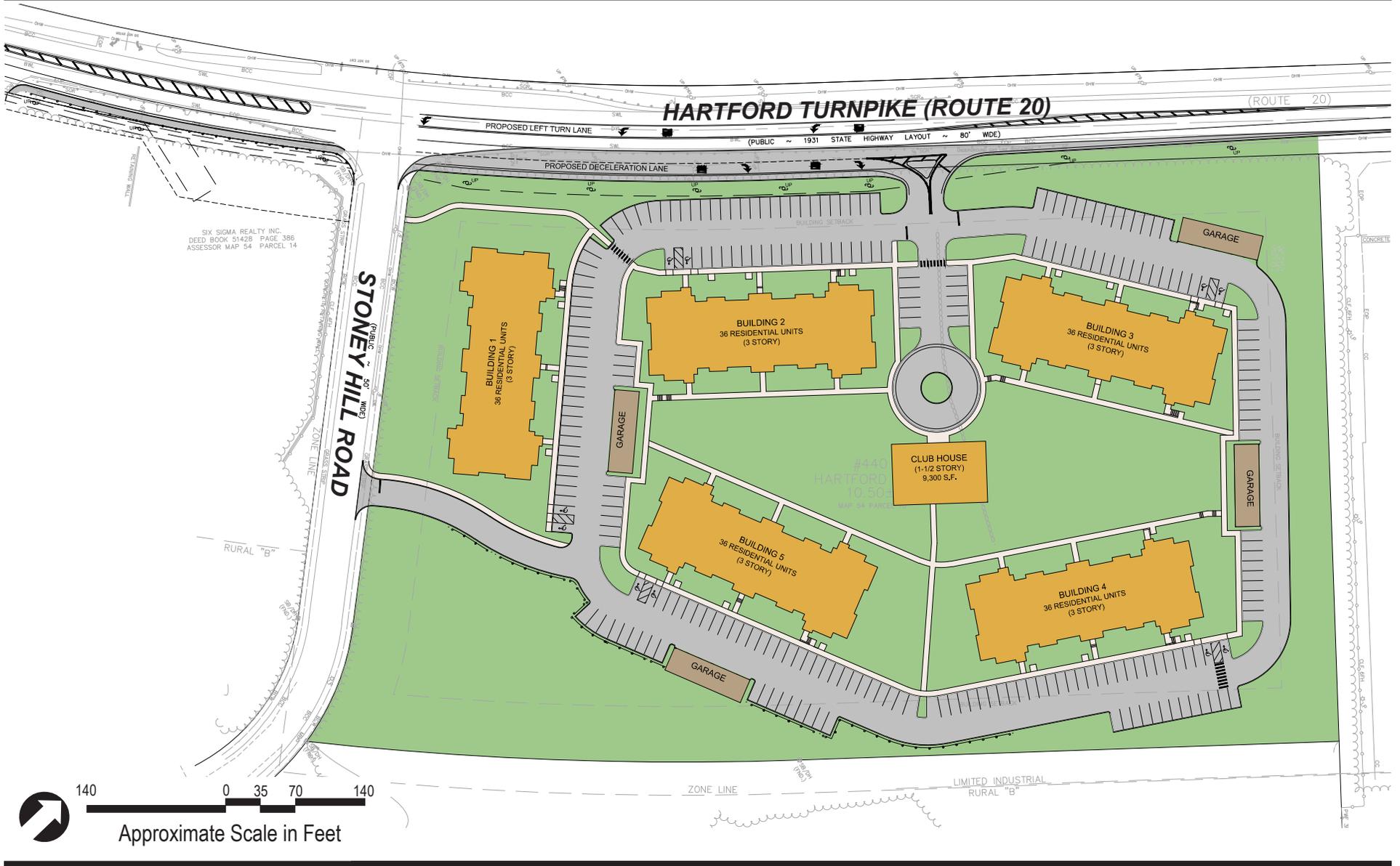


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Site Location Map



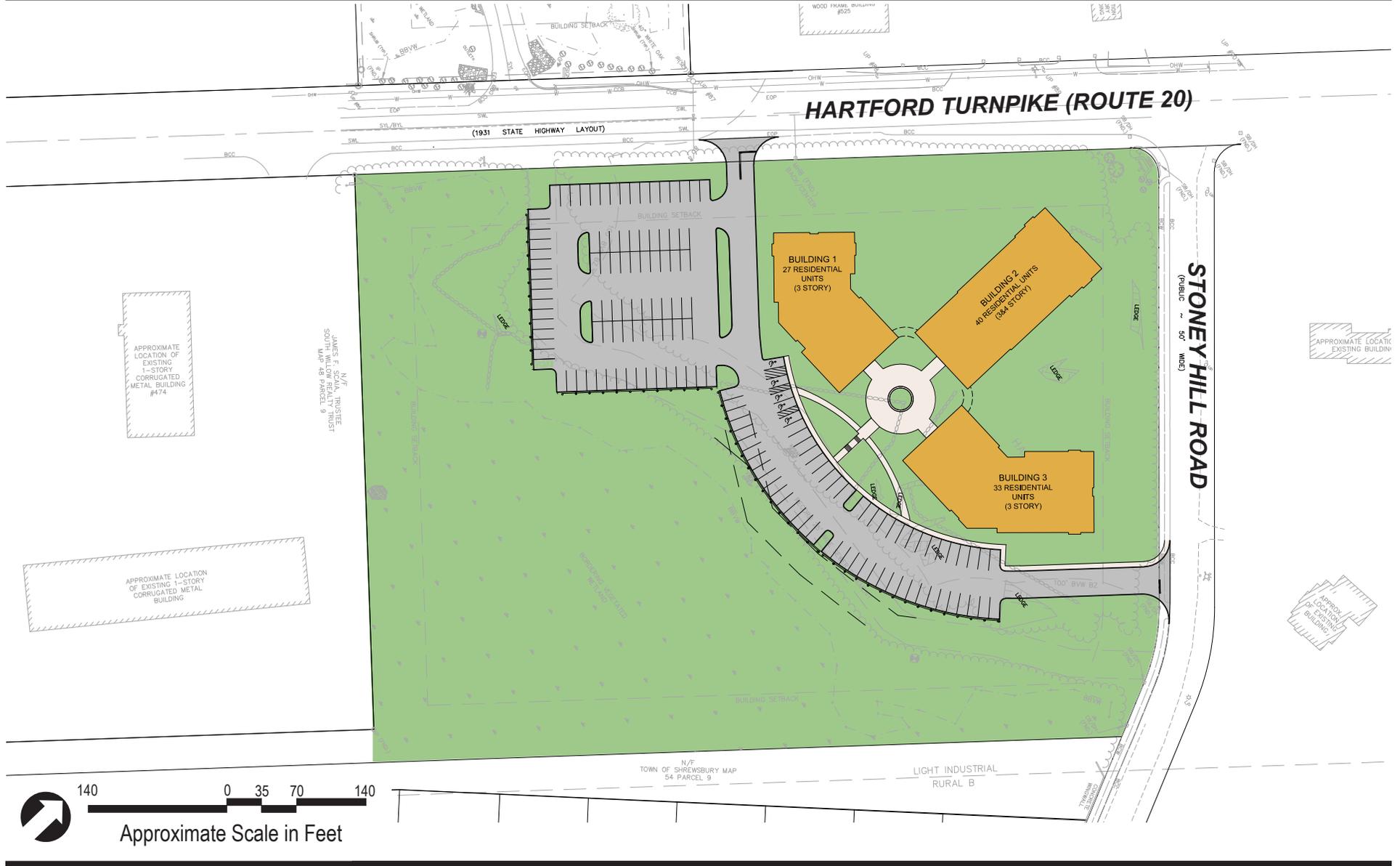
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Phase I Site Plan  
(440 Hartford Turnpike)

Figure  
**2**



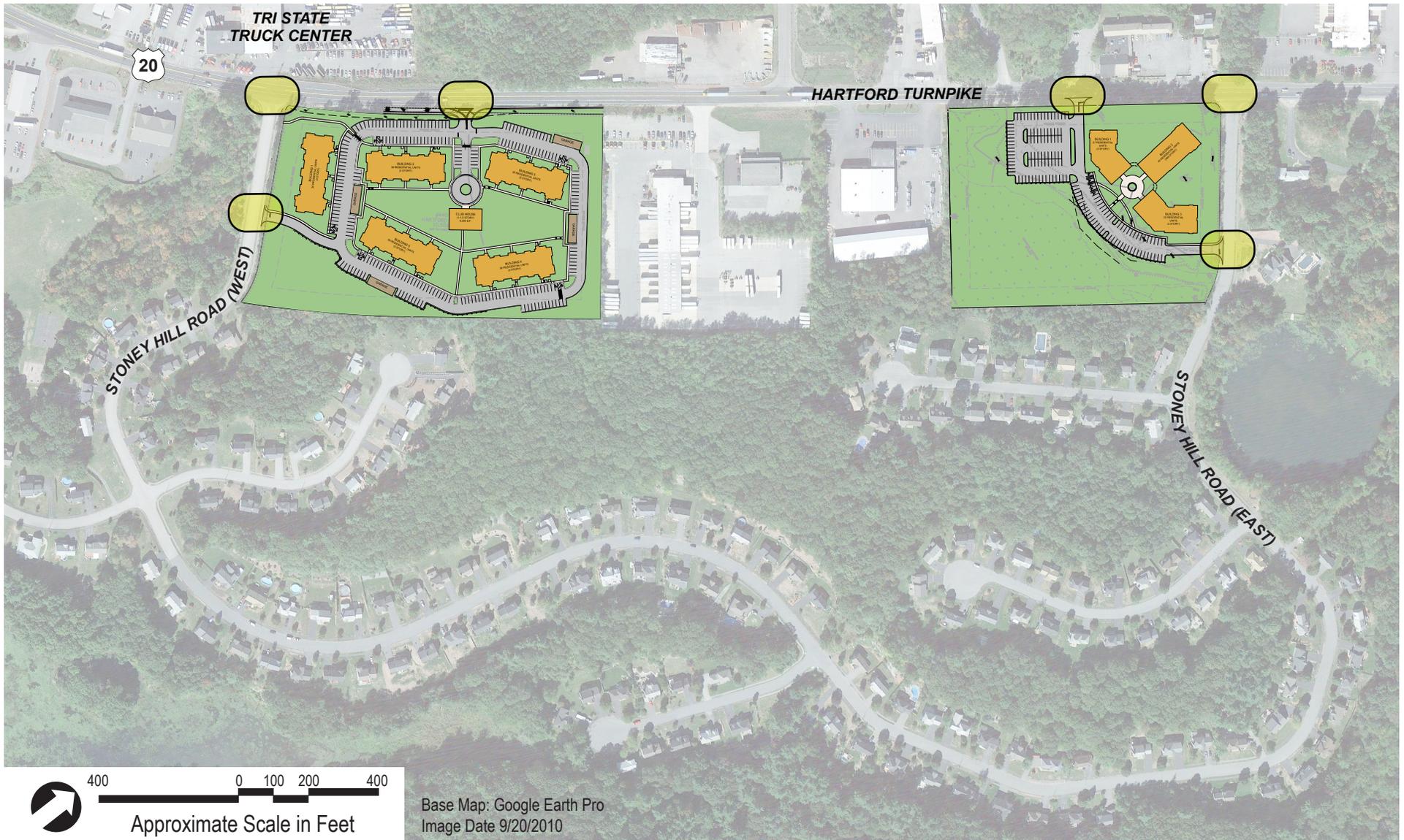
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Phase II Site Plan  
(526 Hartford Turnpike)

Figure  
**3**



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Legend	
	Study Area Intersections

Study Area

Figure  
4

## 2.0 EXISTING CONDITIONS

Evaluation of the transportation impacts associated with the proposed development requires an understanding of the existing transportation system in the study area including roadway geometrics, traffic control, transit, bicycle and pedestrian accommodations, peak hour traffic volumes and crash history. A summary of this information is provided below.

### 2.1 ROADWAY AND INTERSECTION DESCRIPTIONS

Roadway classification and jurisdiction along with the lane configurations at the study intersections are shown on Figure 5 and described more fully below.

**Hartford Turnpike (Route 20).** Route 20 in Shrewsbury is classified as an urban principal arterial under the jurisdiction of MassDOT. Within the study area, Route 20 typically consists of a single travel lane and wide shoulder in each direction. However, along a segment of steep grades, the cross-section varies. On eastbound Route 20, beginning at a point approximately 340 feet west of Stoney Hill Road (west) and ending approximately 1,100 feet east of Stoney Hill Road (west), an auxiliary climbing lane is provided to accommodate slower moving trucks on the upward grade (approximately 6 percent). In the westbound direction the shoulder widens for approximately 160 feet to provide a deceleration lane at the Tri-State driveway located opposite Stoney Hill Road (west).

In the vicinity of the study area, land uses along Route 20 are mainly commercial with a residential neighborhood located on the south side of Route 20. A 50 mph speed limit is posted on the eastbound direction of Route 20

A speed survey conducted on Route 20, between its two intersections with Stoney Hill Road, from April 15, 2014 to April 16, 2014, indicates that the average travel speed direction is approximately 45 miles per hour. The speed at which 85 percent of all measured vehicles traveled at or below is 55 miles per hour. The speed survey data is provided in Appendix A.

**Stoney Hill Road.** Stoney Hill Road is classified as a local roadway and is under local jurisdiction. It has a horseshoe configuration forming two intersections (approximately one-half mile apart) with the southeasterly side of Route 20. Stoney Hill Road has a two-lane cross-section, with one lane in each direction and a posted speed limit of 30 miles per hour. Land use along this roadway is residential.

Speed surveys conducted south of Route 20 on Stoney Hill Road (west) and Stoney Hill Road (east) from April 15, 2014 to April 16, 2014 indicates that the average travel speed ranges from 24 to 29 mph with 85 percent of all measured vehicles traveling 33 mph or below. The speed survey data is provided in Appendix A.

**Route 20/Stoney Hill Road (west).** The west end of Stoney Hill Road intersects the southeast side of Route 20 to form an unsignalized intersection. In the vicinity of Stoney Hill Road (west), Route 20 has an uphill grade of approximately 5 percent in the eastbound direction. A wide driveway allowing only one-way traffic onto a property occupied by Tri-State, a trucking company, forms the fourth approach to the intersection. The eastbound Route 20 approach consists of a shared left/through lane and an auxiliary lane used by trucks climbing the hill. Observations conducted at the intersection indicate that the auxiliary lane is also used by non-truck traffic and by vehicles turning right onto Stoney Hill Road. Route 20 westbound consists of a shared left/through lane and a widened shoulder which accommodates vehicles decelerating and turning right onto the trucking company property.

**Route 20/Stoney Hill Road (east).** Stoney Hill Road (east) intersects Route 20 to form an unsignalized T-intersection. The Route 20 approaches consist of a travel lane and shoulder. Stoney Hill Road provides a one lane approach to the intersection.



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### Legend

- Urban Principal Arterial Roadway under MassDOT Jurisdiction
- Local Roadway under Town of Shrewsbury Jurisdiction
- \* Auxiliary/Truck climbing lane used as a through/right turn lane

Shrewsbury, Massachusetts

Existing  
 Roadway Conditions

Figure  
**5**

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## 2.2 BICYCLE AND PEDESTRIAN ACCOMMODATIONS

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Within the study area bicycle and pedestrian accommodations are limited. Sidewalks exist on both sides of Stoney Hill Road along its entire length. There are no sidewalks on Route 20. Bicycle accommodations are not provided on any of the study area roadways.

## 2.3 PUBLIC TRANSIT

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The study area is located approximately 1.5 to 2 miles from the Grafton MBTA Commuter Rail Station which is serviced by the Worcester/Framingham Commuter Rail Line. Both the towns of Shrewsbury and Grafton are served by the Worcester Regional Transit Authority (WRTA). Bus Route B travels north/south through Grafton and services the Grafton MBTA Commuter Rail Station. However, none of the approximately 28 existing WRTA bus routes provides a connection from Route 20 to the Grafton MBTA station.

## 2.4 EXISTING TRAFFIC VOLUMES

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Both weekday daily and peak hour traffic counts were conducted to determine existing traffic conditions in the study area. The counts were obtained on Tuesday, April 14, 2014, Wednesday, April 15, 2014 and Thursday, November 6, 2014. The peak hour turning movement counts were obtained in November during the weekday morning and afternoon commuter periods to coincide with the peak demand periods of site traffic. The peak period (7:00 a.m. to 9:00 a.m. and 4:00 p.m. to 6:00 p.m.) traffic counts included passenger vehicles, trucks, bicyclists and pedestrians. Daily traffic volumes were measured using Automatic Traffic Recorders (ATRs) on Route 20, east of Stoney Hill Road (west). The traffic count data and adjustment factors are provided in Appendix B. Factors used to adjust the count data are described below.

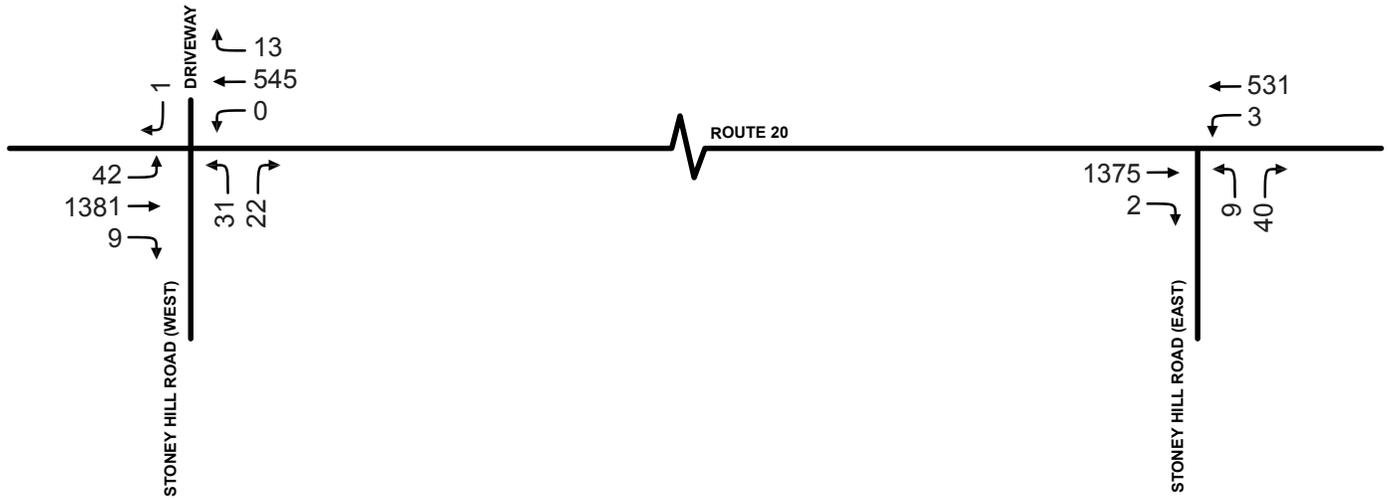
**Annual Growth Adjustment.** MassDOT historic traffic counts obtained from permanent count station 307 located on Route 9, east of Northborough indicates an increase in traffic levels of approximately 0.3 percent per year in traffic volumes since 2008. To estimate existing 2015 peak hour traffic volumes, the 2014 data was increased by a conservative factor of 1.005.

**Average Annual Adjustments.** In order to determine if the traffic counts obtained in November 2014 needed to be adjusted seasonally to reflect average annual conditions, Tetra Tech again analyzed data from permanent count station 307. The data at this location indicate that during the month of November 2012, the monthly average daily traffic volumes (MADT) were approximately two percent higher than the 2012 average annual traffic volumes (AADT). Therefore, for this study traffic volumes were not adjusted (decreased) to reflect average annual conditions, resulting in a conservative analysis.

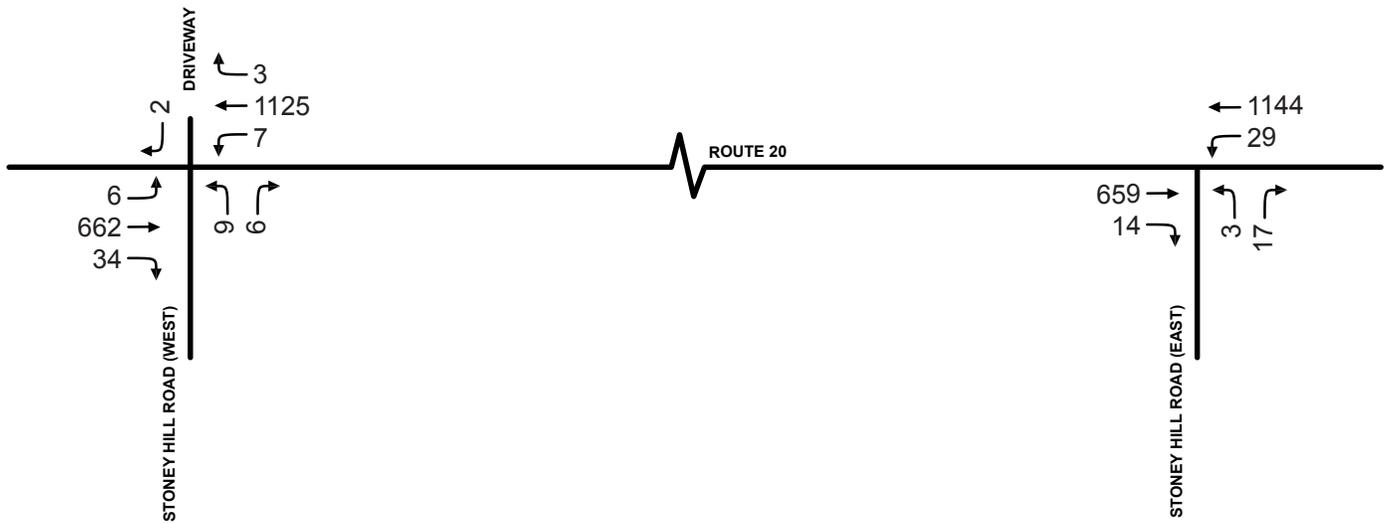
Figure 6 depicts the existing weekday morning and afternoon peak hour traffic volumes. The morning peak hour generally occurred from 7:30 a.m. to 8:30 a.m. The afternoon peak hour generally occurred from 5:00 p.m. to 6:00 p.m. During both peak periods, no pedestrians or bicycles were observed at the two intersections under study.

Trucks represented approximately 7 percent of eastbound traffic during both peak hours. For westbound traffic, trucks accounted for approximately 14 percent of traffic during the morning peak hour and 2 percent during the afternoon peak hour.

The daily traffic volume data indicates that Route 20 carries approximately 22,685 vehicles per day (24 hours), of which 1,960 vehicles (9 percent) occur during the morning peak hour and 1,805 vehicles (8 percent) occur during the afternoon peak hour.



AM Peak Hour



PM Peak Hour



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2015 Existing AM & PM Peak Hour Traffic Volumes **Figure 6**

## 2.5 STONEY HILL ROAD DELAY AND QUEUING STUDY

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In initial meetings with local residents, long delays for motorists exiting from Stoney Hill Road onto Route 20 were reported. In order to quantify the delays experienced by residents, as well as the vehicle queue lengths at the two Stoney Hill Road intersections, delay and queue measurements were performed on Tuesday, February 24, 2015 from 7:00 a.m. to 9:00 a.m. and from 4:00 p.m. to 6:00 p.m. Although the snowbanks were high along Route 20, travel lanes and roadway shoulders were clear and dry. The weather was good. The delay to motorists is the difference between the time the vehicle enters the back of the queue (or more commonly, arrived at the Stop bar) on Stoney Hill Road and when the vehicle enters Route 20. The delay study data and photos of the intersections taken when the study was conducted are provided in Appendix C.

The number of vehicles exiting from Stoney Hill Road on Tuesday, February 24, 2015 was consistent with the number of vehicles exiting on Thursday, November 6, 2014. Thus, the snow banks along Route 20 did not affect traffic volumes. However, the challenging driving conditions resulting from the snowbanks may have increased delays to motorists existing from Stoney Hill Road. Therefore, the delay measurements were obtained under difficult conditions and are considered as conservative measurements.

Summarized in Table 1, the data is organized in several ways including delays and vehicle queues for i) the full two hour count period, ii) the one hour when traffic is heaviest on Stoney Hill Road and iii) the one hour when the combined traffic of Route 20 and Stoney Hill Road is at its peak level (per the November 2014 traffic count data).

At the Route 20/Stoney Hill Road (west) intersection, the longest delays and queues occurred from 7:30 a.m. to 8:30 a.m. and from 4:00 p.m. to 5:00 p.m. During those periods, the average delay experienced by all motorists turning from Stoney Hill Road (west) onto Route 20 was approximately 28 seconds during the morning peak hour and 20 seconds during the afternoon peak hour. Generally only one vehicle at a time was observed waiting to turn onto Route 20. The maximum vehicle queue observed was three vehicles.

At the Route 20/Stoney Hill Road (east) Driveway, the longest delays and queues occurred from 7:30 a.m. to 8:30 p.m. and from 5:00 p.m. to 6:00 p.m. During those periods, the average delay experienced by all motorists turning from Stoney Hill Road (east) onto Route 20 was approximately 27 seconds during the morning peak hour and 11 seconds during the evening peak hour. The maximum vehicle queue observed was four vehicles.

Although both Stoney Hill Road legs provide only one lane as it approaches Route 20, a separate analysis was provided for vehicles turning left onto Route 20. For left turning vehicles, the delays were longer and averaged during the morning peak hour 40 seconds on the west approach and 32 seconds on the east approach. In the afternoon, the average delay for left turning vehicles was 26 seconds on the west approach and 34 seconds on the east approach.

The longest delay occurred on the west approach at approximately 8:10 a.m. when three vehicles waited over two minutes before an acceptable gap in Route 20 traffic occurred in which to turn.

**Table 1 Stoney Hill Road Delay Study**

	All Vehicles			Left Turning Vehicles		
	Total 2 Hour Period	Stoney Hill Road Peak Hour	Intersection Peak Hour	Total 2 Hour Period	Stoney Hill Road Peak Hour	Intersection Peak Hour
<b>Stoney Hill Road (WEST)</b>						
<b><u>Morning</u></b>	<b>7:00 a.m. to 9:00 a.m.</b>	<b>7:00 a.m. to 8:00 a.m.</b>	<b>7:30 a.m. to 8:30 a.m.</b>	<b>7:00 a.m. to 9:00 a.m.</b>	<b>7:00 a.m. to 8:00 a.m.</b>	<b>7:30 a.m. to 8:30 a.m.</b>
Total Vehicles	91	58	49	57	33	31
Average Delay (sec.)	24	14	28	33	20	40
Maximum Delay (min:sec.)	2:47	1:58	2:47	2:47	1:58	2:47
Average Queue (vehicle)	1	1	1			
Maximum Queue (vehicle)	3	3	3			
<b><u>Afternoon</u></b>	<b>4:00 p.m. to 6:00 p.m.</b>	<b>4:00 p.m. to 5:00 p.m.</b>	<b>5:00 p.m. to 6:00 p.m.</b>	<b>4:00 p.m. to 6:00 p.m.</b>	<b>4:00 p.m. to 5:00 p.m.</b>	<b>5:00 p.m. to 6:00 p.m.</b>
Total Vehicles	24	15	9	17	10	7
Average Delay (sec.)	16	20	10	20	26	11
Maximum Delay (sec.)	59	59	32	59	59	32
Average Queue (vehicle)	1	1	1			
Maximum Queue (vehicle)	2	2	2			
<b>Stoney Hill Road (EAST)</b>						
<b><u>Morning</u></b>	<b>7:00 a.m. to 9:00 a.m.</b>	<b>7:00 a.m. to 8:00 a.m.</b>	<b>7:30 a.m. to 8:30 a.m.</b>	<b>7:00 a.m. to 9:00 a.m.</b>	<b>7:00 a.m. to 8:00 a.m.</b>	<b>7:30 a.m. to 8:30 a.m.</b>
Total Vehicles	96	53	48	22	15	9
Average Delay (sec.)	22	22	27	25	25	32
Maximum Delay (min:sec.)	1:24	1:24	1:24	1:24	1:24	1:24
Average Queue (vehicle)	1	1	2			
Maximum Queue (vehicle)	4	4	4			
<b><u>Afternoon</u></b>	<b>4:00 p.m. to 6:00 p.m.</b>	<b>5:00 p.m. to 6:00 p.m.</b>	<b>5:00 p.m. to 6:00 p.m.</b>	<b>4:00 p.m. to 6:00 p.m.</b>	<b>5:00 p.m. to 6:00 p.m.</b>	<b>5:00 p.m. to 6:00 p.m.</b>
Total Vehicles	42	23	23	10	5	5
Average Delay (sec.)	10	11	11	24	34	34
Maximum Delay (sec.)	57	57	57	57	57	57
Average Queue (vehicle)	1	1	1			
Maximum Queue (vehicle)	1	1	1			

## 3.0 FUTURE CONDITIONS

This study considers future conditions for a seven-year planning horizon, consistent with State requirements for the preparation of traffic impact studies. Traffic volumes for the future analysis year are a combination of existing volumes, background traffic growth and any specific development project-related traffic. The 2022 No-Build scenario is first considered, which provides an analysis of future conditions without the proposed project in place. Finally, the 2022 Build scenario is considered, which provides an analysis of future conditions with project generated traffic.

### 3.1 NO-BUILD TRAFFIC VOLUMES

Future 2022 No-Build traffic volumes are a combination of existing 2015 traffic and traffic from background growth. Projections of No-Build traffic volumes consider traffic growth within the study area and changes in traffic patterns associated with any proposed roadway improvements.

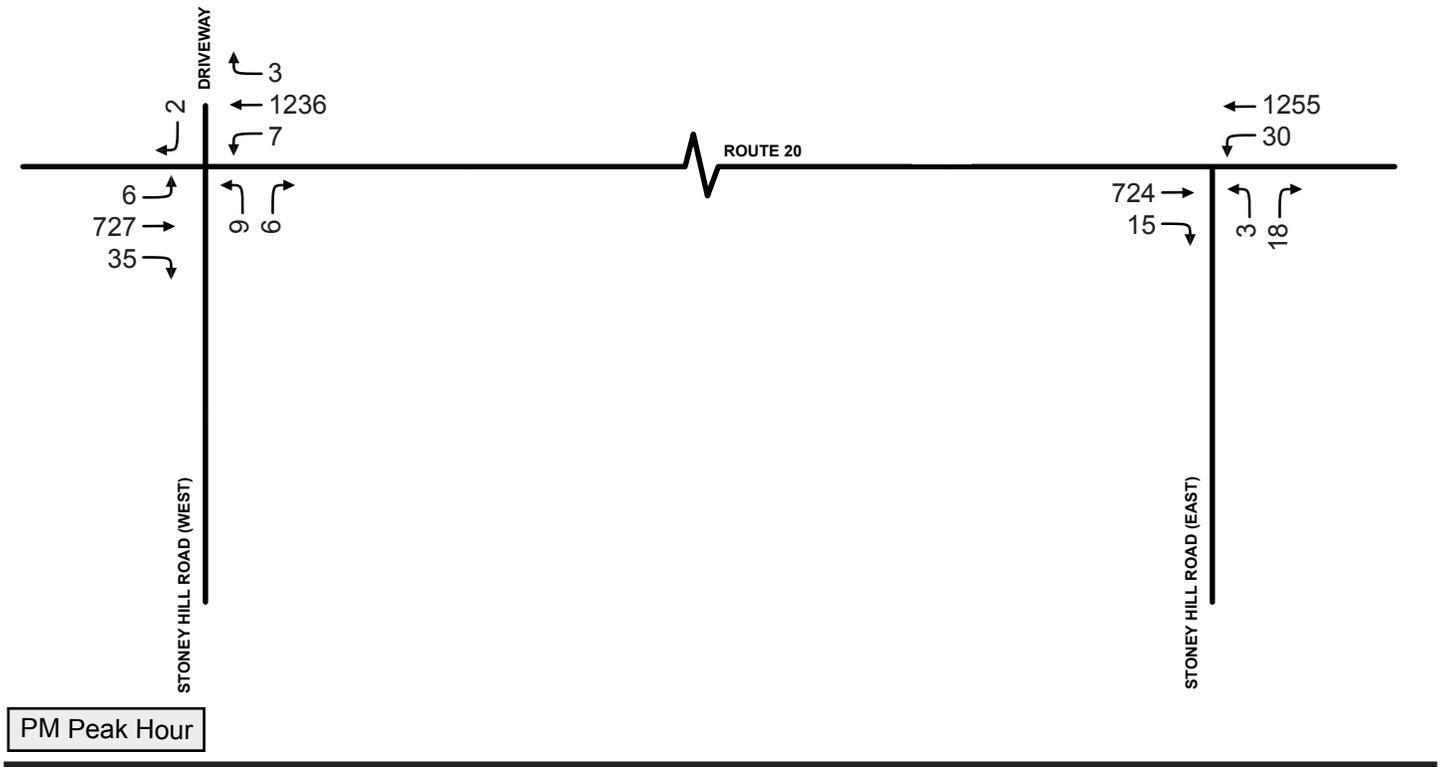
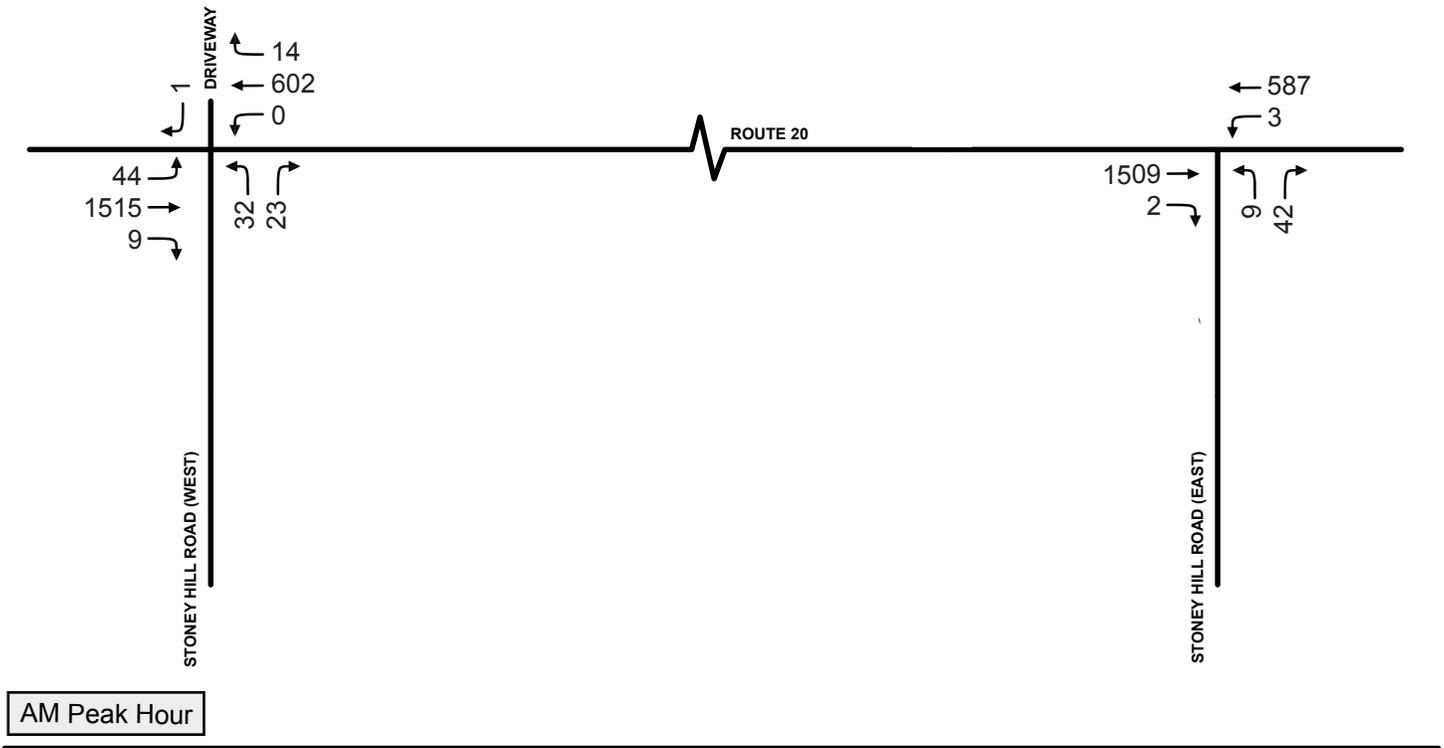
Background traffic growth is independent of the proposed development. Background growth generally considers two factors: general traffic growth rate and specific land developments in the immediate area.

**General Traffic Growth Rate.** As noted above in Section 2.0, traffic levels in the area have been increasing at a rate of approximately 0.3 percent per year. Therefore, to provide a conservative analysis of traffic conditions in the future, an annual growth rate of 0.5 percent per year is assumed.

**Land Development.** The Towns of Shrewsbury and Grafton were contacted to determine if proposed developments which may affect traffic along Route 20 in the vicinity of the site. Developments within 1.5 miles of the project site, and which have received local approvals are listed in Table 2. Table 2 includes the size, location and current status. Trip generation calculations and trip assignments for site specific development are provided in Appendix D.

The convenience store/gas station located at 604 Hartford Turnpike is currently open. However, when the counts were obtained in November 2014 it was under construction. Therefore, trips associated with this project were assigned to the study area.

Applying the 0.5 percent annual growth rate to the 2015 existing traffic volumes for seven years and adding trips generated by the background development projects listed in Table 2 resulted in the 2022 No-Build traffic networks. The resulting 2022 No-Build weekday peak hour traffic volumes are presented in Figure 7 for the weekday morning and afternoon peak hours.



**Table 2 Off-Site Developments**

Name	Location	Type	Size	Status	Traffic Source
Convenience Store/Gas Station	604 Hartford Turnpike	Mixed-use fuel facility	Store 3,500 sf. Site 2.1 acres	Occupied	<i>Traffic Impact and Access Study</i> (MDM, Sept. 2013)
Altec, Inc.	Fortune Boulevard	Manufacturing	50,000 sf.	Under Construction	<i>Technical Memorandum</i> (Conley Assoc, March 2014)
Garage Buildings (Mechanics)	360 Hartford Turnpike	Auto services	5,000 – 8,000 sf (each building)	Approved	<i>ITE Trip Generation Manual*</i>
Boston Medical Products	Chestnut Street	Office, Manufacturing, Warehouse	49,000 s.f.	Approved	<i>Traffic Impact and Access Study</i> (Conley Assoc., December 2013)

\*LUC 942 Automobile Care Center

## 3.2 PROJECT TRAFFIC

### 3.2.1 Trip Generation

As required by the March 2014 guidelines for preparation of a traffic study, trip rates obtained from the Institute of Transportation Engineers (ITE) publication *Trip Generation*, 9th Edition, 2012 will be used to estimate trip generation for proposed apartment project.

Occasionally, local officials and/or residents express concerns that the trip rates contained in *Trip Generation*, which are developed from data collected throughout the United States, may not be applicable to local conditions. To address this potential concern, and to determine if the *Trip Generation* trip rates are appropriate for Shrewsbury, trip rates for the existing Stoney Hill Road neighborhood were calculated from traffic count data obtained in November 2014 and then compared to trip data provided in *Trip Generation* for Land Use Code 210 – Single Family Detached Housing. Table 3 provides a summary of this comparison. The data indicates that the actual (measured) weekday peak hour trip rates for the Stoney Hill Road neighborhood are less than the rates in *Trip Generation*. In other words, if the *Trip Generation* trip rates were applied to the 180 houses located along Stoney Hill Road, the number of calculated trips would be greater than measured in November 2014. Specifically, the Stoney Hill Road neighborhood has trip rates at 16 percent and 33 percent less than the trip rates reported in *Trip Generation* for the weekday morning and afternoon peak hours, respectively.

Therefore, it is concluded that the trip rates provided in *Trip Generation* are conservative and appropriate to use to estimate the trip characteristic for the proposed project in Shrewsbury.

**Table 3 Stoney Hill Road Neighborhood Trip Characteristics**

	Inbound	Outbound	Total
<b><u>Morning Peak Hour</u></b>			
Trips (total of both Stoney Hill Road legs) <sup>1</sup>	13	102	115
<b>Measured Trip Rate per House<sup>2</sup></b>	<b>0.07</b>	<b>0.57</b>	<b>0.64</b>
ITE Trip Rate <sup>3</sup>	0.19	0.57	0.76
<b><u>Afternoon Peak Hour</u></b>			
Trips (total both Stoney Hill Road legs) <sup>1</sup>	84	35	119
<b>Measured Trip Rate per House<sup>2</sup></b>	<b>0.47</b>	<b>0.19</b>	<b>0.66</b>
ITE Trip Rate <sup>3</sup>	0.62	0.37	0.99

<sup>1</sup>Based on traffic count data obtained on Thursday, November 6, 2014

<sup>2</sup>Trip rate calculated by dividing trips by 180 houses.

<sup>3</sup>Vehicle trips per Dwelling Unit calculated from *Trip Generation* (9<sup>th</sup> Edition, Institute of Transportation Engineers), Land Use Code 210 Single-Family Detached Housing equations.

Trip generation for the proposed project was determined by applying trip rates obtained from *Trip Generation* for Land Use Code 220 – Apartments. Trip generation was calculated individually for each site and then totaled to estimate the project trips. Table 4 presents the trip generation estimates for the proposed project. As shown in Table 4 the project will generate approximately 1,944 daily trips of which 145 will occur during the morning peak hour and 190 will occur during the afternoon peak hour. Trip generation calculations are provided in Appendix E.

**Table 4 Project Trip Generation**

	Phase I – 180 units (Westerly Site)	Phase II – 100 units (Easterly Site)	Total
<b>Weekday Daily</b>	1,214	730	<b>1,944</b>
<b>Morning Peak Hour</b>			
Enter	18	11	<b>29</b>
<u>Exit</u>	<u>74</u>	<u>42</u>	<b>116</b>
Total	92	53	<b>145</b>
<b>Afternoon Peak Hour</b>			
Enter	76	47	<b>123</b>
<u>Exit</u>	<u>41</u>	<u>26</u>	<b>67</b>
Total	117	73	<b>190</b>

Source: *Trip Generation*, 9<sup>th</sup> Edition, Institute of Transportation Engineers, Land Use Code 220 Apartment

To provide a conservative analysis of the project’s impact on the study area, it will be assumed that all of the trips shown in Table 4, would be generated by vehicles (145 in the morning peak hour and 190 in the afternoon peak hour). However, based on data obtained from the 2010 American Community Survey 5-year Summary File (2006 – 2010) the mode share for employees who live in Shrewsbury is: 89 percent drive alone, 7 percent carpool, 2 percent use public transit, 1 percent walk, 0 percent bicycle and 1 percent other. Therefore, it is likely that the actual vehicle trips generated by the project would be approximately 7 percent less than the trips shown in Table 4. Applying the Shrewsbury mode share portions to the project’s total trips results in the transit, bus and pedestrian trips summarized in Table 5.

**Table 5 Mode Share Projections for Project Site**

Mode Share <sup>1</sup>	Total Trips	Drive Alone	Car-pool	Rapid Transit	Bus or Trolley	Bicycle	Walked	Other	Total Vehicle Trips <sup>2</sup>
		89.4%	7.1%	1.3%	0.3%	0.1%	1.0%	0.8%	
<b>Weekday Daily</b>	1,944	1,738	138	25	6	2	19	16	1,807
<b>Morning Peak Hour</b>									
Enter	29	26	2	0	0	0	0	0	27
Exit	116	104	8	2	0	0	1	1	108
Total	145	130	10	2	0	0	1	1	135
<b>Afternoon Peak Hour</b>									
Enter	123	110	9	2	0	0	1	1	115
Exit	67	60	5	1	0	0	1	1	63
Total	190	170	14	3	0	0	2	2	178

<sup>1</sup>Source: 2010 Census Transportation Planning Products, based on 2010 American Community Survey 5-year Summary File

<sup>2</sup>Drive-Alone trips plus 50% of carpool trips.

### 3.2.2 Trip Distribution

The distribution of project trips through the study area was based on an analysis of Journey to Work data for residents of Shrewsbury and traffic count data obtained in the vicinity of the site.

Tetra Tech worked with the Central Massachusetts Regional Planning Commission (CMRPC) to obtain Journey to Work data for residents of Shrewsbury. Data was provided which included the number of Shrewsbury residents which work within each of the CMRPC communities. In total, approximately 62 percent of all Shrewsbury workers, over 16 years of age, work within CMRPC communities, with the remaining 38 percent distributed as follows:

- Worcester County, north of CMRPC - 2 percent,
- Massachusetts, east of Worcester County - 34 percent
- Massachusetts, west of Worcester County - 1 percent
- Out of State - 1 percent

A gravity model was created based on the journey to work information provided by the CMRPC and is provided in Appendix E. The data indicated that approximately 44 percent of peak period traffic would arrive from/depart to points east and 56 percent of peak period traffic would arrive from/depart to points west.

Analysis of peak hour count data obtained at the two Stoney Hill Road intersections indicates that during the morning peak hour 61 percent of outbound traffic was headed to points east and 39 percent of outbound traffic was headed to points west. During the afternoon peak hour 43 percent of inbound traffic arrived from points east and 57 of inbound traffic arrived from points west. The afternoon count data is consistent with the gravity model created from the Journey to Work data. The observed difference in traffic distribution between the morning and afternoon peak hours is attributed to higher non-work related trips which could be occurring during the morning peak hour. For example, it is possible that a portion of the 61 percent of vehicles leaving in the morning and proceeding east (as compared to the 43 percent returning from the east in the late afternoon) may be traveling to local schools via South Street.

Table 6 provides a summary of the traffic distribution patterns based on the gravity model and based on existing peak hour Stoney Hill Road traffic volumes.

**Table 6 Project Distribution Summary**

	To/From East	To/From West
Gravity Model	44%	56%
Stoney Hill Road Morning Outbound Trips	61%	39%
Stoney Hill Road Afternoon Inbound Trips	43%	57%

Based on the above, it was determined that the actual traffic patterns measured at the Stoney Hill Road neighborhood best predict the distribution of site generated traffic. The morning and afternoon distribution patterns, shown on Figures 8 and 9, were applied to the trips generated by the proposed project, to be located on Stoney Hill Road.

The weekday morning and afternoon project trips assignments to the study area roadway network are shown on Figure 10. The Phase I component of the project would increase traffic on the Stoney Hill Road (west) approach to Route 20 by approximately 47 vehicles during the morning peak hour and 25 vehicles during the afternoon peak hour. The Phase II component of the project would increase traffic on the Stoney Hill Road (east) approach to Route 20 by approximately 24 vehicles during the morning peak hour and 15 vehicles during the afternoon peak hour. For both peak hours, this represents increases of less than one vehicle per minute on the Stoney Hill Road approaches to Route 20.

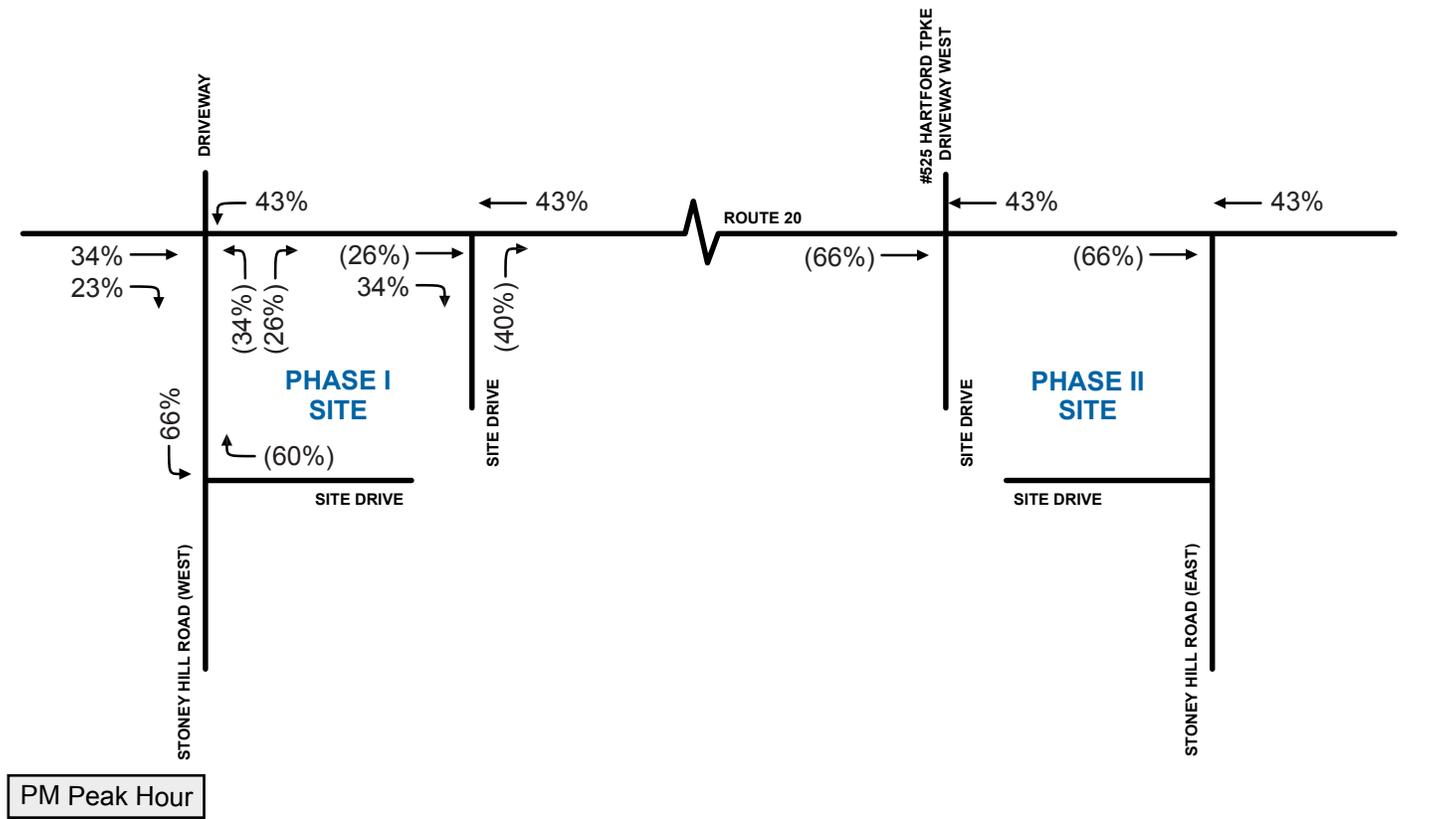
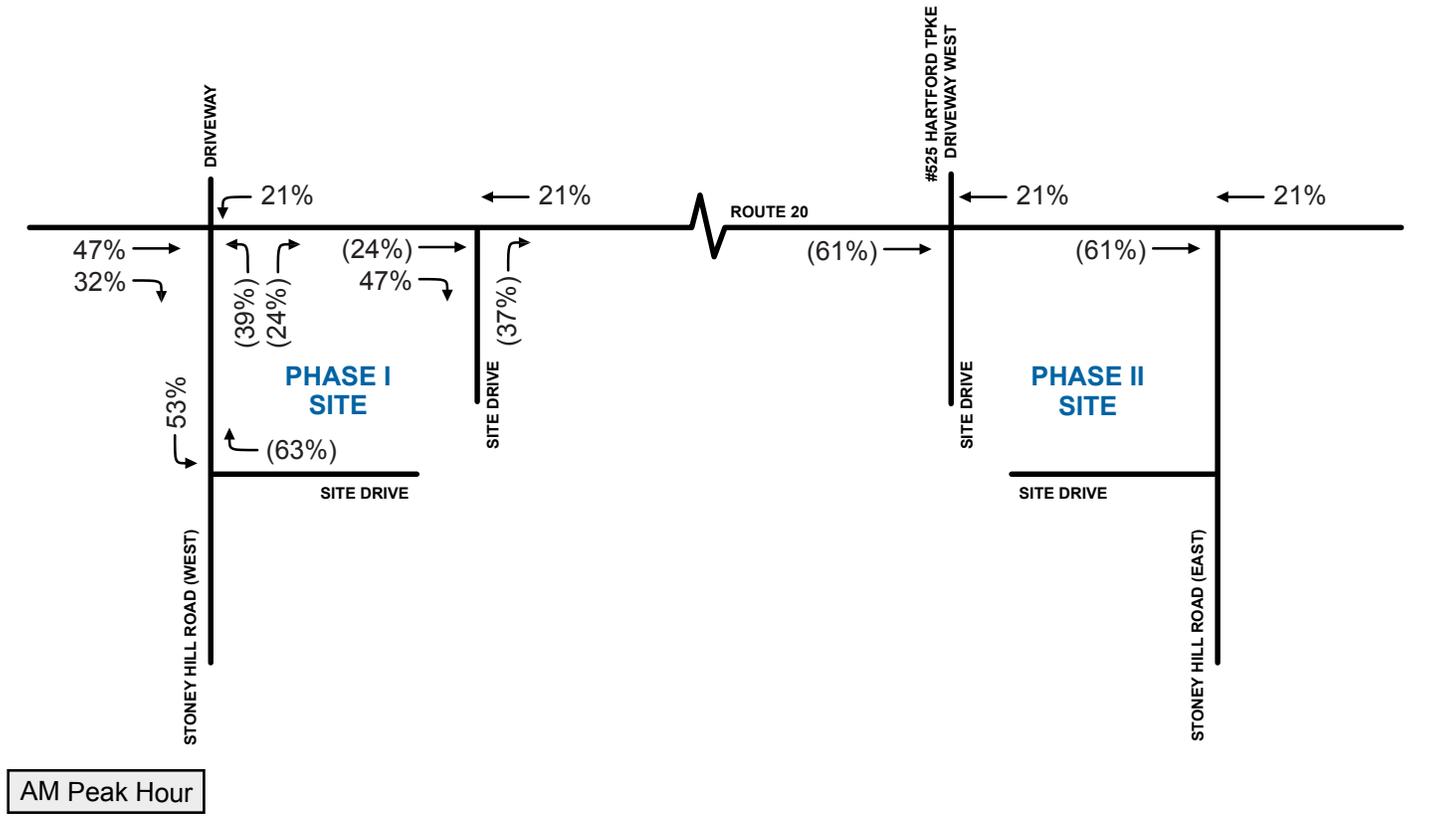
### 3.3 BUILD TRAFFIC VOLUMES

The projected site-generated trips illustrated in Figure 10 were combined with the 2022 No-Build traffic volumes presented in Figure 7 to estimate the 2022 Build volumes. The 2022 Build traffic volumes for the weekday morning and afternoon peak hours are illustrated on Figure 11.

Table 7 provides a summary of the total entering volumes for the 2022 weekday peak hours for the study intersections. The project will increase traffic at the Route 20/Stoney Hill Road intersections by approximately 80 to 90 trips during the morning peak hour and by approximately 110 to 140 trips during the afternoon peak hour. These volumes represent a four to seven percent increase over the morning and afternoon No-Build levels.

**Table 7 Traffic Volume Comparison**

Intersection	Morning Peak Hour				Afternoon Peak Hour			
	No-Build	Project Trips	Build	Change	No-Build	Project Trips	Build	Change
<b>Route 20/Stoney Hill Rd (west)</b>	2,240	90	2,330	4.0%	2,031	137	2,168	6.7%
<b>Route 20/Stoney Hill Rd (east)</b>	2,152	83	2,235	3.9%	2,045	106	2,151	5.2%

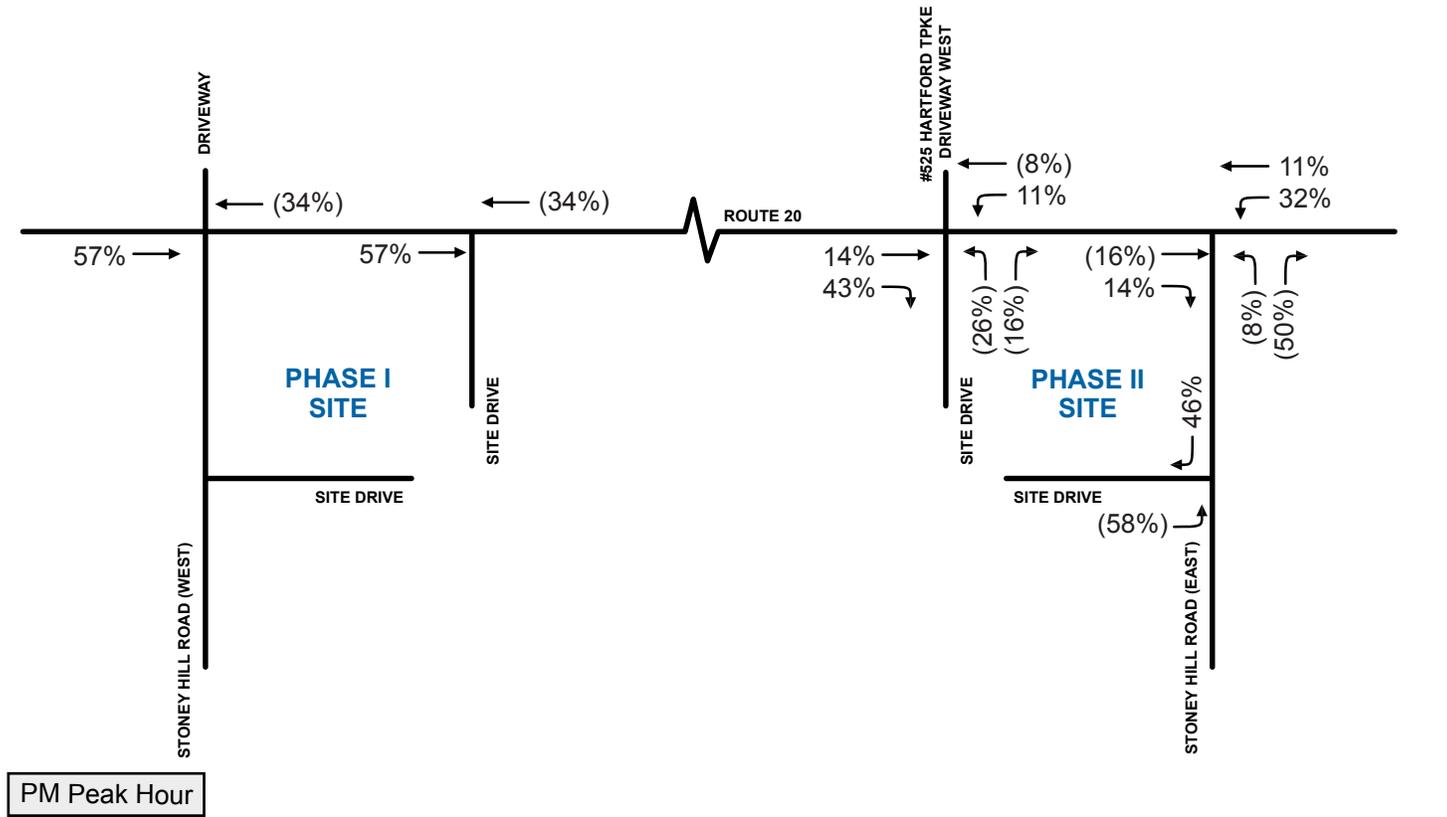
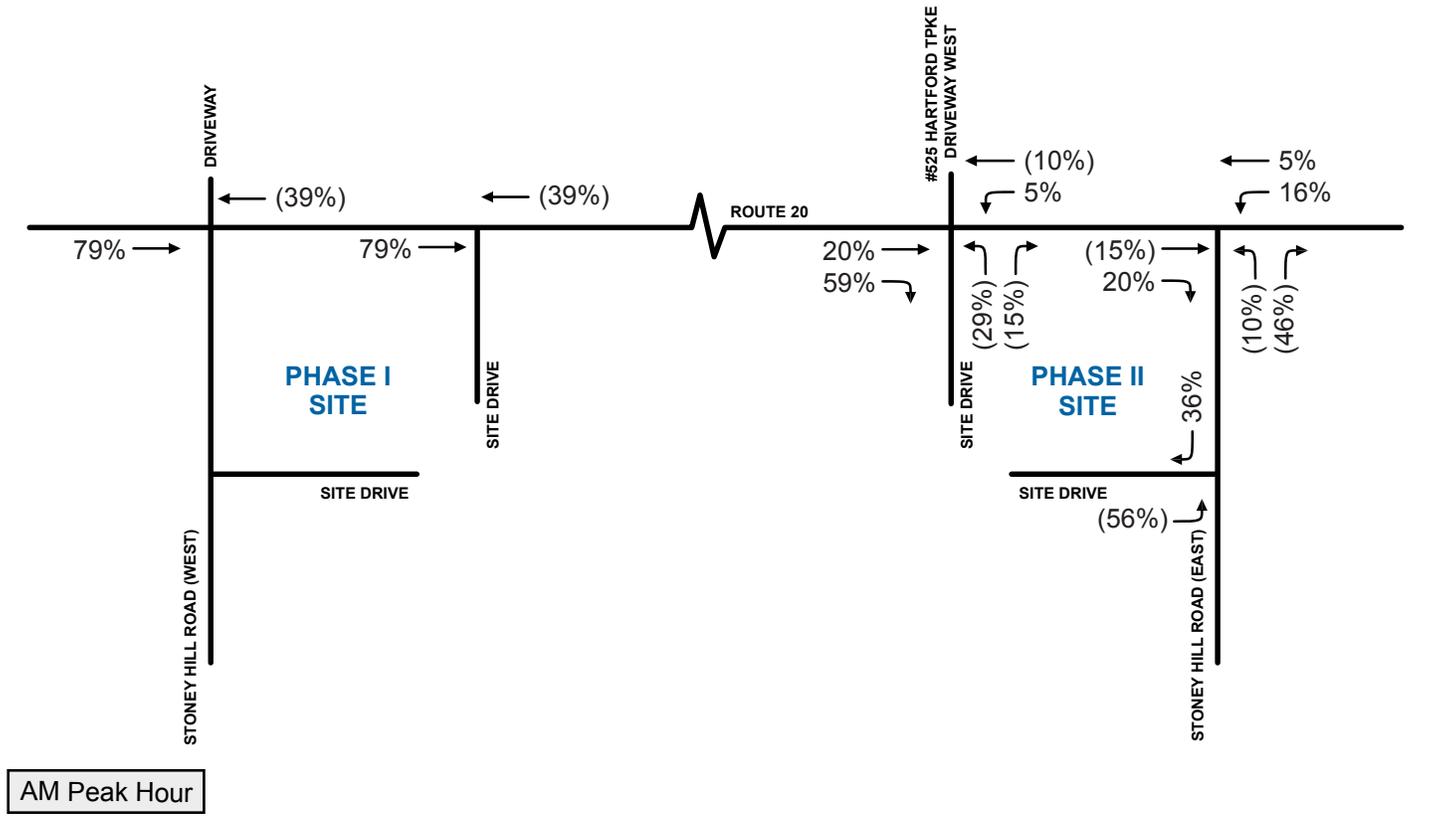


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 Marlborough, MA 01752  
 508.786.2200  
 www.tetratech.com



Shrewsbury, Massachusetts

Trip Distribution (Phase I)

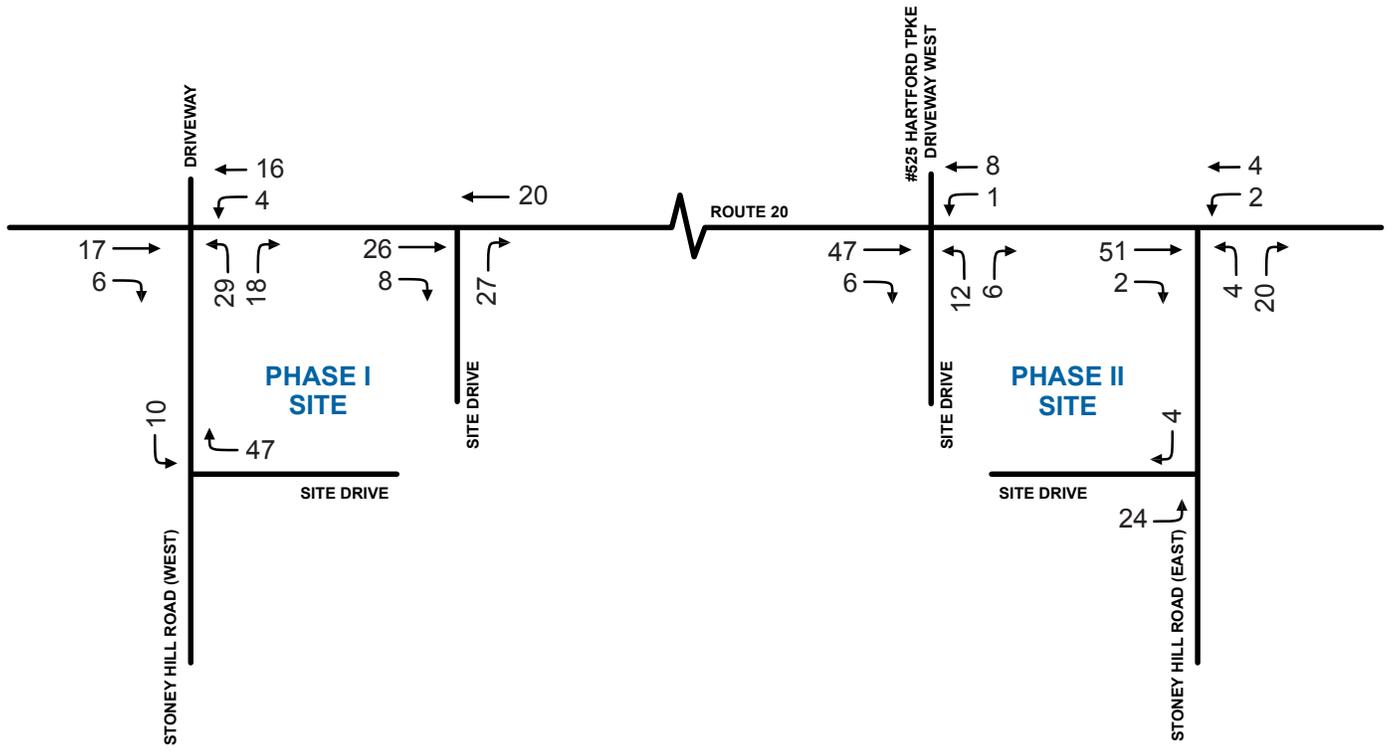


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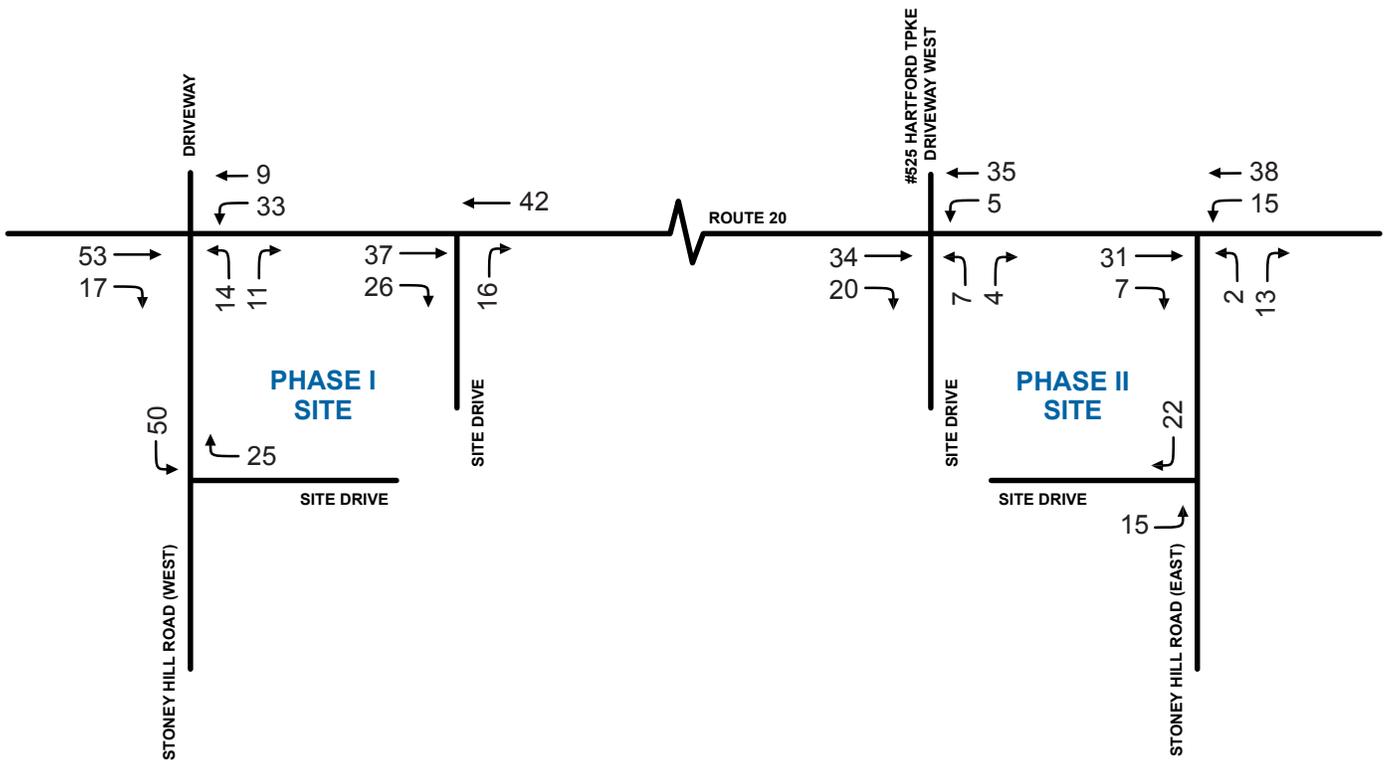


Shrewsbury, Massachusetts

Trip Distribution (Phase II)



AM Peak Hour



PM Peak Hour

Shrewsbury, Massachusetts

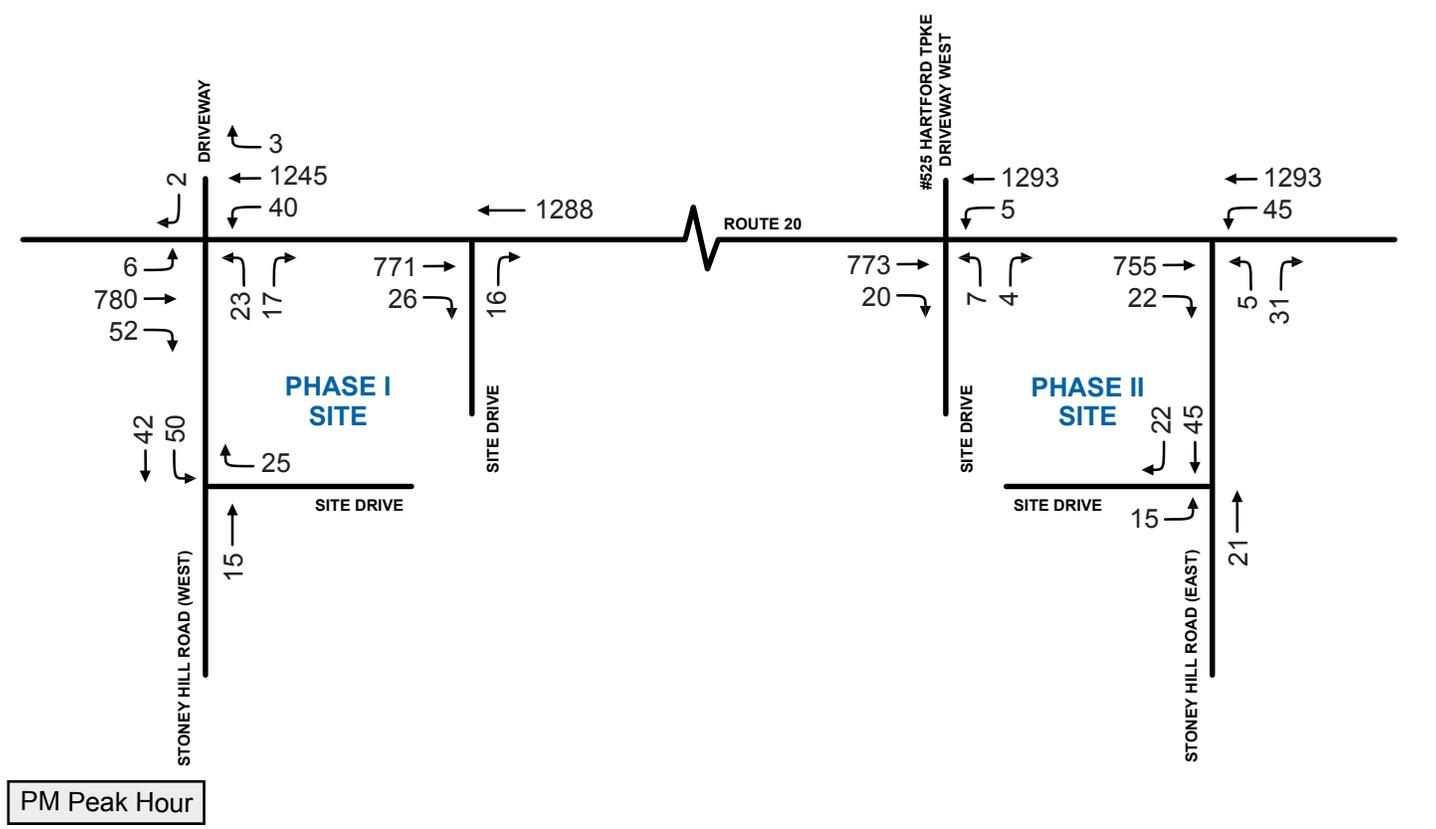
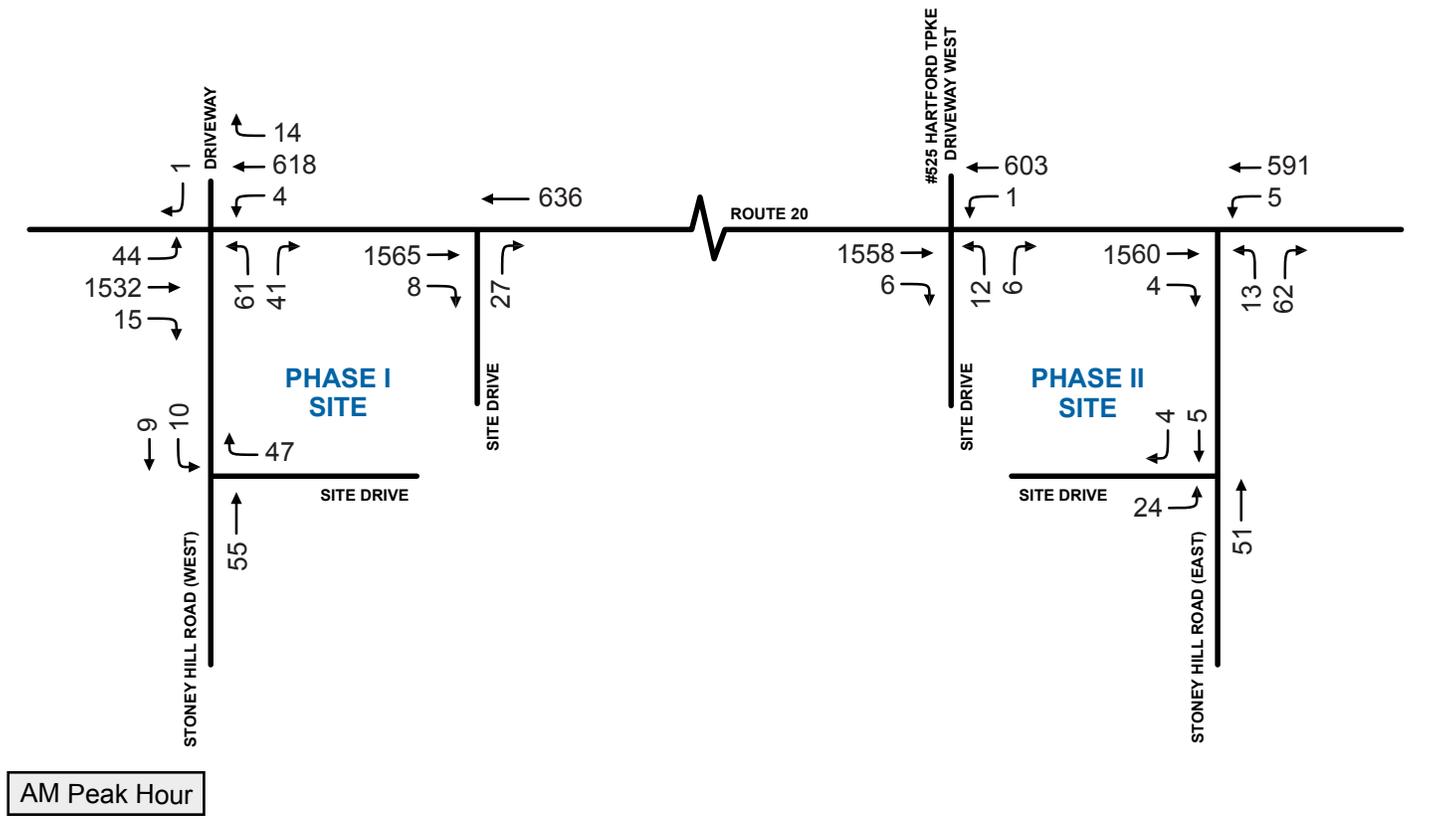


Not To Scale

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Project Trips

Figure  
**10**



### 3.4 PROJECT RELATED ROADWAY IMPROVEMENTS

Roadway improvements within the study area are proposed by the Proponent at the westerly intersection of Route 20 and Stoney Hill Road as well as along Route 20 and Stoney Hill Road to accommodate the four site driveways as described in detail below. Both sites will be designed to accommodate bicycles, pedestrians and appropriate turning radius for emergency vehicles.

All site driveways will be designed to provide both Intersection and Stopping Sight Distance in accordance with current American Association of State Highway and Transportation Officials (AASHTO) standards. Detailed information regarding sight lines at the site driveways is provided in Section 5.0 Safety.

#### 3.4.1 Phase I (440 Hartford Turnpike) Project Site Access

Phase I of the proposed development (440 Hartford Turnpike), as shown on Figure 2, consists of 180 apartment units and approximately 270 parking spaces. Access to the property will be via a right in/right out driveway on the south side of Route 20 and an unsignalized driveway which will intersect the east side of Stoney Hill Road. Improvements are also proposed at the Route 20/Stoney Hill Road (west) intersection.

**Stoney Hill Road (west)/Phase I Site Driveway.** The main access to the west site will be located along Stoney Hill Road (west), approximately 300 feet south of Route 20. Full access will be provided from this new unsignalized intersection. The Stoney Hill Road northbound and southbound approaches will each be comprised of a single lane. The site driveway will also provide a single lane for left and right turns and will operate under STOP control.

**Route 20/Phase I Site Driveway.** The site driveway accesses eastbound Route 20 via a right-in and right-out configuration. It will be located approximately 470 feet east of Stoney Hill Road (west). Separation of the right-in and right-out movements will be provided by a raised island and pavement markings. As requested by MassDOT, the eastbound approach includes a through lane, auxiliary climbing lane, 410-foot long deceleration lane and five-foot-wide shoulder. Along the shoulder, granite curbing will be installed and a five-foot-wide area will be graded for future sidewalk installation by the Town.

**Route 20/Stoney Hill Road (west).** The proponent coordinated with the MassDOT, who has jurisdiction of Route 20 in the town of Shrewsbury, regarding site access design. As part of this process, MassDOT requested that an exclusive left turn lane on the Route 20 westbound approach to Stoney Hill Road (west) be constructed.

The need for the left turn lane at Stoney Hill Road was confirmed by an assessment based on the criteria of the *Project Development and Design Guide* (MassDOT 2006). For a two lane roadway with a design speed of 55 miles per hour, the criteria as described in Exhibit 6-23 of the Guide is summarized below in Table 8. Also, shown in Table 8 is the projected 2022 Build condition afternoon peak hour volumes for the eastbound and westbound approaches of the Route 20/Stoney Hill Road (west) intersection. The projected 2022 peak hour volumes at the Route 20/Stoney Hill Road (west) intersection exceeds the criteria for a left turn lane at an unsignalized intersection.

**Table 8 Left Turn Lane Criteria and Projected 2022 Build PM Peak Hour Volumes**

	Criteria <sup>1</sup> (vph)	Projected 2022 Build PM Peak Hour Volume (vph)
Opposing Traffic (eastbound)	800	838
Advancing Traffic (westbound)	255 with 5 percent left turns (13 left turns) <sup>1</sup>	1,288 with 3 percent left turns (40 left turns)

<sup>1</sup>Average of criteria for design speeds of 50 mph and 60 mph.

The proposed left turn lane and Route 20 Phase I Site Driveway deceleration lane will require approximately 27 feet of roadway widening along the south side of Route 20 between Stoney Hill Road and the Site Driveway, a distance of approximately 470 feet. The proponent will bestow to the MassDOT sufficient property to accommodate this roadway widening. It is estimated that the state highway layout in this area would increase from approximately 80 feet to 92 feet. No changes to the north side of Route 20 will be required.

At the request of the Town of Shrewsbury pedestrian accommodations along Route 20 have been incorporated into the proposed project. The design of Route 20/Stoney Hill Road (west) intersection includes approximately 300 feet of new sidewalk along the south side of Route 20 from Stoney Hill Road to the Stoney Hill Plaza. The proponent will facilitate the acquisition of property required to accommodate the new sidewalk. Additionally, along the Route 20 frontage of the Phase I site (approximately 890 feet), preparations for a future sidewalk will be incorporated into the design of the Route 20 improvements described above. The conceptual design for improvements along Route 20 are shown on Figure 12.

### 3.4.2 Phase II (526 Hartford Turnpike) Project Site Access

Phase II of the proposed development (526 Hartford Turnpike), as shown on Figure 3, consists of 100 apartment units and approximately 151 parking spaces. Access to the property will be via a full access driveway on the south side of Route 20 and an unsignalized driveway which will intersect the west side of Stoney Hill Road, south of Route 20.

The conceptual design for access at this site has been developed in coordination with MassDOT. MassDOT has indicated a preliminary acceptance of the concept plan.

**Route 20/Phase II Site Driveway.** Full access will be provided at the site driveway intersection with Route 20. The proposed site driveway is located opposite an existing driveway on the south side of Route 20 and approximately 400 feet west of Stoney Hill Road (east). The four approaches to this intersection will consist of one general purpose lane. The site driveway will operate under STOP control.

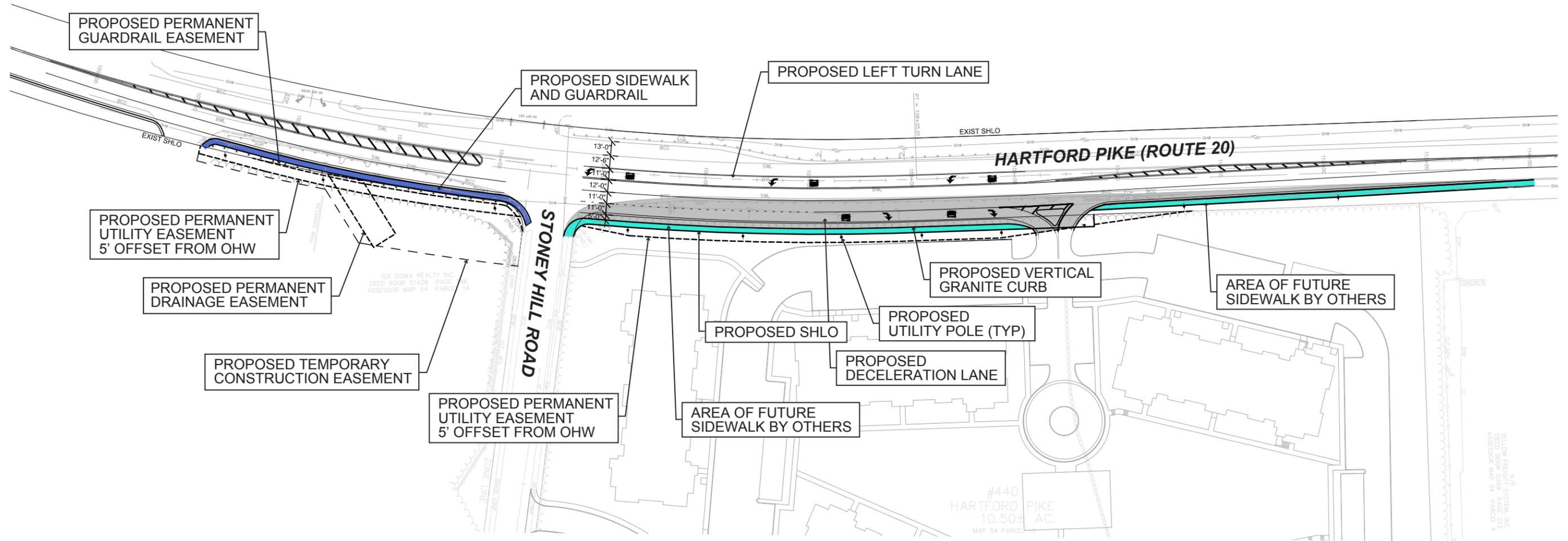
**Stoney Hill Road (east)/Phase II Site Driveway.** A second site access driveway will intersect the west side of Stoney Hill Road, approximately 400 feet south of Route 20. Full access will be provided from this new unsignalized intersection. The three approaches to this intersection will each consist of one general purpose lane. The site driveway will operate under STOP control.

More rigorous reviews of the proposed Route 20 Site Driveways and improvements to the Route 20/Stoney Hill Road (west) will be conducted with the submission of the Access Permit application to MassDOT.

### 3.4.3 Alternative Improvements Considered

Based on comments received by the proponent at early meetings with the Town, it was requested that traffic signal control be considered for the Route 20/Stoney Hill Road (west) intersection. To address this comment, the intersection was evaluated in accordance with criteria set by the MassDOT for installation of a traffic signal on State Highway.

MassDOT's criteria for implementation of a traffic signal is contained in the 2009 Edition of the Manual on Uniform Traffic Control Devices (MUTCD) published by the Federal Highway Administration. The MUTCD describes nine warrants, each with a different set of criteria on which to justify the installation of a traffic signal. MassDOT specifically requires that the criteria of Warrant 1 – Eight-Hour Vehicular Volume be met as justification for a traffic signal on state highway. For the Route 20/Stoney Hill Road (west) intersection, the criteria is that for eight hours in one day (not necessarily contiguous), the total volume on Route 20 (both directions) must exceed 525 vehicles



Legend	
	Roadway Widening
	Future Sidewalk
	New Sidewalk
	OHW Overhead Wire
	SHLO State Highway Layout

per hour, and for that same hour, the total volume on the Stoney Hill Road approach to Route 20 (northbound only) must exceed 53 vehicles per hour. The signal warrant analysis is provided in Appendix F. Only two hours meet the criteria of Warrant 1 (525 vph on Route 20 and 53 vph on Stoney Hill Road). As traffic volumes for eight hours need to meet the criteria, the intersection, with the additional traffic generated by the proposed project, does not meet the MassDOT requirements for installation of a traffic signal.

Traffic signals are difficult to justify on state highway at locations in which the minor street services either residential or office development. In these cases, traffic volumes on the minor street approach are typically high enough in only one or two hours to meet the criteria of the warrant. Occasionally, MassDOT may allow installation of a traffic signal if traffic volumes in at least six of the eight hours meet the criteria, and if there are other circumstances which would be improved by a traffic signal, such as a safety issue or long delays for motorist on the minor street. The Route 20/Stoney Hill Road (west) intersection meets the criteria for only two hours, the average delays are not excessive and it does not have a high crash rate (see Section 4.0 Intersection Capacity Analyses and Section 5.0 Safety Analysis). Therefore, it is unlikely that MassDOT would allow installation of a traffic signal at this location.

Additionally, the installation of a traffic signal at this location is further complicated by the steep grades on Route 20 which may result in safety issues during winter conditions.

As described below in Section 6.0 Mitigation, the Route 20/Stoney Hill Road (west) intersection will be monitored after the project is completed. If future traffic volumes are more than 10 percent greater than predicted, another traffic signal warrant analysis will be performed. If the traffic signal is warranted, and desired by MassDOT and the Town of Shrewsbury, the proponent will provide funding for the design of a traffic signal and a fair-share contribution towards construction.

## 4.0 INTERSECTION CAPACITY ANALYSIS

### 4.1 LEVEL OF SERVICE

**Intersections.** Intersection operating levels of service are calculated following the methodologies defined in the 2010 *Highway Capacity Manual* for signalized and unsignalized intersections. For both signalized and unsignalized intersections, the operating Level of Service (LOS) is based on travel delays. Delays can be measured in the field but generally are calculated as a function of traffic volume, peaking characteristic of traffic flow, percentage of heavy vehicles in the traffic stream, type of traffic control, number of travel lanes and lane use, intersection approach grades, pedestrian activity, and signal timing, phasing, and progression where applicable.

For this study, delays were both measured in the field and calculated.

The specific criteria applied per the 2010 *Highway Capacity Manual* are summarized in Table 9. The calculated average delay per vehicle for signalized intersections applies to all vehicles entering the intersection and under control of the traffic signal. For unsignalized intersections, it is assumed that through movements on the main street have the right-of-way and are not delayed by side street traffic. Consequently, the total delay values in Table 9 for unsignalized intersections apply only to the major street left-turn movements and the minor street intersection movements, which must yield to oncoming traffic.

SYNCHRO 8.0 software was used to analyze peak hour operations at the study intersections. SYNCHRO 8.0 is a windows-based analysis tool that follows the procedures defined in the 2010 *Highway Capacity Manual*.

**Table 9 Intersection Level of Service Criteria**

Level of Service <sup>1</sup>	Average Delay per Vehicle (Seconds)	
	Signalized Intersections	Unsignalized Intersections
A	≤10.0	≤10.0
B	10.1 to 20.0	10.1 to 15.0
C	20.1 to 35.0	15.1 to 25.0
D	35.1 to 55.0	25.1 to 35.0
E	55.1 to 80.0	35.1 to 50.0
F	>80.0	>50.0

Source: *Highway Capacity Manual* (Transportation Research Board, National Research Council, Washington, DC, 2010)

<sup>1</sup>Level of service presented is for v/c ratios less than 1.0. If the v/c ratio is greater than or equal to 1.0, then the level of service is F regardless of the delay.

### 4.2 INTERSECTION OPERATING CONDITIONS

The procedures described above were used to determine peak hour levels of service at the study area intersection locations for the existing, no-build and build conditions. The capacity analysis worksheets are provided in Appendix G and the results are summarized in Table 10 for the morning peak hour and Table 11 for the afternoon peak hour. Tables 10 and 11 present the level of service, delay, volume to capacity ratio values and the 95th percentile queue lengths as determined by SYNCHRO. The 95th-percentile queue is defined in the *Highway Capacity Manual Applications Guidebook* (Transportation Research Board, 2003) “to be the queue length (in vehicles) that has only a 5-percent probability of being exceeded during the analysis time period.”

**Table 10 Intersection Level of Service Summary – Weekday Morning Peak Hour**

	2015 Existing				2022 No Build				2022 Build			
	v/c <sup>1</sup>	Delay <sup>2</sup>	LOS <sup>3</sup>	95 <sup>th</sup> Q <sup>4</sup>	v/c	Delay	LOS	95 <sup>th</sup> Q	v/c	Delay	LOS	95 <sup>th</sup> Q
<b>Rte. 20/Stoney Hill Rd. (west)</b>												
EB L/T/R	0.05	9	A	5	0.05	9	A	5	0.06	9	A	5
WB L/T/R	0	0	A	0	0	0	A	0	0	0	A	0
WB L		n/a				n/a			0.01	14	B	0
NB L/T/R	>1.2	>120	F	193	>1.2	>120	F	208	>1.2	>120	F	388
SB L/T/R	0.01	13	B	0	0.00	13	B	0	0.00	13	B	0
<b>Rte. 20/Phase I Site Dr. (west)</b>												
EB T									0	0	A	0
EB R		n/a				n/a			0	0	A	0
WB T									0	0	A	0
NB R									0.10	18	C	8
<b>Rte. 20/Phase II Site Dr. (east)</b>												
EB L/T/R									0	0	A	0
WB L/T/R		n/a				n/a			0	15	B	0
NB L/T/R									0.58	>120	F	50
SB L/T/R									0	0	A	0
<b>Rte. 20/Stoney Hill Rd. (east)</b>												
EB T/R	0.00	0	A	0	0	0	A	0	0	0	A	0
WB L/T	0.01	15	B	0	0.01	16	C	0	0.02	17	C	3
NB L/T/R	0.44	58	F	48	0.61	93	F	73	0.97	>120	F	135
<b>Stoney Hill Rd. (west)/Site Dr.</b>												
NB T/R									0	0	A	0
SB L/T		n/a				n/a			0.01	7	A	0
WB L/R									0.05	9	A	5
<b>Stoney Hill Rd. (east)/Site Dr.</b>												
NB L/T									0	0	A	0
SB T/R		n/a				n/a			0	0	A	0
EB L/R									0.03	9	A	3

n/a = not applicable,

<sup>1</sup>Delay = Average delay per vehicle (seconds) <sup>2</sup>v/c = Volume to capacity ratio <sup>3</sup>LOS = Level of Service <sup>4</sup>95<sup>th</sup> percentile queue (feet)

The analyses conducted with SYNCHRO shows that during both peak hours the Stoney Hill Road (west) approach to Route 20 operates at LOS F. By 2022, with or without the proposed project and improvements, the approach would continue to operate at LOS F. The Stoney Hill Road (east) approach to Route 20 operates at LOS F during the morning peak hour and LOS D during the afternoon peak hour. By 2022, the LOS F condition would remain during the morning peak hour and in the afternoon the level of service would drop to LOS E with the addition of project traffic. The intersections of the new site driveways with Route 20 and Stoney Hill Road would generally operate at LOS C or better with the exception of the Route 20/Phase II Site Driveway intersection. The analyses indicates that the driveway would operate at LOS F conditions during both peak hours.

SYNCHRO software is the industry standard for impact analyses and is required for analysis work submitted to the MassDOT. However, it is known to overestimate volume to capacity ratios at unsignalized intersections which often results in the software providing unrealistic delay values or even no delay values for various turning movements. Table 12 provides a comparison of the existing average vehicle delays modeled by Synchro and the results of the delay study described in Section 2.5. The table also provides the level of service results based on

the criteria presented in Table 9. As seen in Table 12, the actual existing delays at the unsignalized intersections of Stoney Hill Road at Route 20 are significantly less than calculated by Synchro and the level of service is better than modeled by Synchro. Therefore, the Synchro generated results presented in Tables 10 and 11 for the STOP sign controlled approaches are reported as required, but should be considered as overstated.

**Table 11 Intersection Level of Service Summary – Weekday Afternoon Peak Hour**

	2015 Existing				2022 No Build				2022 Build			
	v/c <sup>1</sup>	Delay <sup>2</sup>	LOS <sup>3</sup>	95 <sup>th</sup> Q <sup>4</sup>	v/c	Delay	LOS	95 <sup>th</sup> Q	v/c	Delay	LOS	95 <sup>th</sup> Q
<b>Rte. 20/Stoney Hill Rd. (west)</b>												
EB L/T/R	0.02	13	B	0	0.02	14	B	0	0.02	14	B	0
WB L/T/R	0.01	9	A	0	0.01	10	A	0	0	0	A	0
WB L		n/a				n/a			0.06	10	B	5
NB L/T/R	0.46	>120	F	43	0.36	>120	F	33	>1.2	>120	F	113
SB L/T/R	0.08	43	E	5	0.02	44	E	3	0.02	44	E	3
<b>Rte. 20/Phase I Site Dr. (west)</b>												
EB T									0	0	A	0
EB R		n/a				n/a			0	0	A	0
WB T									0	0	A	0
NB R									0.03	11	B	3
<b>Rte. 20/Phase II Site Dr. (east)</b>												
EB L/T/R									0	0	A	0
WB L/T/R		n/a				n/a			0.01	10	A	0
NB L/T/R									0.29	>120	F	25
SB L/T/R									0	0	A	0
<b>Rte. 20/Stoney Hill Rd. (east)</b>												
EB T/R	0	0	A	0	0	0	A	0	0	0	A	0
WB L/T	0.04	9	A	3	0.04	10	A	3	0.06	10	A	5
NB L/T/R	0.16	27	D	15	0.13	29	D	10	0.27	39	E	25
<b>Stoney Hill Rd. (west)/Site Dr.</b>												
NB T/R									0	0	A	0
SB L/T		n/a				n/a			0.03	7	A	3
WB L/R									0.03	9	A	3
<b>Stoney Hill Rd. (east)/Site Dr.</b>												
NB L/T									0	0	A	0
SB T/R		n/a				n/a			0	0	A	0
EB L/R									0.02	9	A	3

n/a = not applicable

<sup>1</sup>Delay = Average delay per vehicle (seconds) <sup>2</sup>v/c = Volume to capacity ratio <sup>3</sup>LOS = Level of Service <sup>4</sup>95<sup>th</sup> percentile queue (feet)

**Table 12 Existing Stoney Hill Road Delays and LOS (Synchro Model vs. Actual)**

Approach to Route 20	AM Peak Hour		PM Peak Hour	
	Synchro (sec.)	Actual (sec.)	Synchro (sec.)	Actual (sec.)
<b>Stoney Hill Rd (west)</b>	+120 (LOS F)	28 (LOS D)	+120 (LOS F)	10 (LOS A)
<b>Stoney Hill Rd (east)</b>	58 (LOS F)	27 (LOS D)	27 (LOS D)	11 (LOS B)

## 5.0 SAFETY

Existing crash data at the study intersections and sight distance analysis at the four proposed site driveways were evaluated as a part of a safety analysis conducted for the proposed project.

### 5.1 CRASH HISTORY

Crash data was obtained from both the MassDOT and the Shrewsbury Police Department for the study area intersections as well as for the segment of Route 20 between the two Stoney Hill Road intersections. In accordance with current standards for preparing a traffic study, MassDOT crash data is reviewed, and for locations which average more than three collisions per year, local police data is reviewed and collision diagrams are prepared to identify potential safety issues at the subject intersection.

As presented below, the MassDOT data indicates that none of the study locations experience three or more collisions per year or has a higher than average crash rate. However, based on concerns expressed by local officials and residents at initial meetings regarding safety, a more comprehensive approach was taken and both the MassDOT and Shrewsbury Police data were reviewed and analyzed.

#### 5.1.1 MassDOT Crash Data

MassDOT crash data for the most recent five years available (2009, 2010, 2011, 2012 and 2013) were reviewed for the study area intersections and for the segment of Route 20 between the two Stoney Hill Road intersections. The crash data, including the crash rate calculations, are provided in Appendix H and summarized in Table 13.

**Route 20/Stoney Hill Road (west)/Tri State Truck Inbound Driveway.** Of the 12 collisions which occurred at this intersection, only three were described as specifically occurring at, or near, Stoney Hill Road. The remaining nine collisions were reported as occurring at Tri-State Trucking or at an address associated with Tri-State Trucking. The north leg of the Route 20/Stoney Hill Road (west) intersection is the inbound Tri-State driveway. The Tri-State outbound driveway is located approximately 250 feet west of the Stoney Hill Road intersection. To the extent it was possible to determine from the data, only collisions which occurred at the inbound Tri-State driveway were assumed to have occurred at the intersection. In some cases, there was not sufficient data to identify which driveway the collision occurred. In these cases collisions were conservatively assumed to have occurred at the intersection.

The intersection averaged approximately 2.4 collisions per year with the last four years averaging two collisions per year. Of the 12 reported collisions 17 percent involved personal injuries and 33 percent occurred during peak commuting hours. Rear-end collisions accounted for almost half of the collisions.

The crash rate for this intersection, calculated in accordance with MassDOT methodology, is 0.29 accidents per million entering vehicles, lower than both the MassDOT state-wide average of 0.60 crashes per million entering vehicles and the MassDOT District 3 average of 0.66 crashes per million entering vehicles for unsignalized intersections.

**Route 20/Stoney Hill Road (east).** At the easterly intersection of Route 20 and Stoney Hill Road, six crashes occurred between the years 2009 and 2013. Three collisions occurred during the morning commuting period (7:00 a.m. to 9:00 a.m.) and one during the afternoon commuting period (4:00 p.m. and 6:00 p.m.). The calculated crash rate at this intersection was 0.14 crashes per million entering vehicles, which is lower than both the District 3 and the statewide average crash rates for unsignalized intersections.

Table 13 Crash Summary (2009 – 2013)

	Rt. 20 / Stoney Hill Rd. (west)	Rt. 20 / Stoney Hill Rd. (east)	Rt. 20 Segment (between Stoney Hill Rd Intersections)
<b>Year</b>			
2009	4	1	3
2010	2	1	4
2011	2	2	0
2012	2	0	3
<u>2013</u>	<u>2</u>	<u>2</u>	<u>4</u>
<b>Total</b>	<b>12</b>	<b>6</b>	<b>14</b>
<b>Type</b>			
Angle	4	3	3
Rear-end	5	3	5
Head-on	0	0	0
Sideswipe	0	0	4
Single Vehicle	1	0	2
Rear-to-Rear	1	0	0
<u>Unknown</u>	<u>1</u>	<u>0</u>	<u>0</u>
<b>Total</b>	<b>12</b>	<b>6</b>	<b>14</b>
<b>Severity</b>			
Property	10	3	8
Non-Fatal Injury	2	2	6
Fatality	0	0	0
<u>Unknown</u>	<u>0</u>	<u>1</u>	<u>0</u>
<b>Total</b>	<b>12</b>	<b>6</b>	<b>14</b>
<b>Collision With</b>			
Pedestrians	0	0	0
Bicyclists	0	0	0
<u>Vehicles Only</u>	<u>12</u>	<u>6</u>	<u>14</u>
<b>Total</b>	<b>12</b>	<b>6</b>	<b>14</b>
<b>Weather</b>			
Clear	6	2	9
Cloudy	4	1	3
Rain	1	3	0
Snow	0	0	0
Sleet	0	0	0
Fog	0	0	0
<u>Unknown</u>	<u>1</u>	<u>0</u>	<u>2</u>
<b>Total</b>	<b>12</b>	<b>6</b>	<b>14</b>
<b>Time</b>			
7:00 am to 9:00 am	1	3	3
9:00 am to 4:00 pm	6	1	6
4:00 pm to 6:00 pm	3	1	3
<u>6:00 pm to 7:00 am</u>	<u>2</u>	<u>1</u>	<u>2</u>
<b>Total</b>	<b>12</b>	<b>6</b>	<b>14</b>
<b>Crash Rates</b>			
Statewide Rate	0.60	0.60	3.35
District Rate	0.66	0.66	-
<b>Measured Rate</b>	<b>0.29</b>	<b>0.14</b>	<b>0.70</b>

Source: MassDOT

**Route 20 Segment.** Fourteen crashes occurred on the 2,500 feet long segment of Route 20 between the two Stoney Hill Road intersections. Rear-end and sideswipe type collisions were the most common types of crashes. Of the fourteen crashes reported, five were rear-end collisions and four were sideswipe collisions. The remaining four crashes were split between angle and single vehicle type of collisions. Six collisions involved personal injury.

The crash rate for the roadway segment is 0.65 crashes per million vehicle miles traveled (MVMT), lower than the MassDOT state-wide average for similarly classified roadways. Route 20 has a Federal Functional Classification of *Urban Principal Arterial*. MassDOT reports the average crash rate in 2012 for *Principal Arterial – Urban* was 3.35 crashes per MVMT.

### 5.1.2 Town of Shrewsbury Police Department Crash Data

The Town of Shrewsbury Police Department (SPD) provided both Police Reports and Incident Reports for collisions which occurred along Route 20 from January 1, 2011 through December 31, 2014. In total, 51 reports were provided by the SPD of which 17 were determined as occurring in the vicinity of the Stoney Hill Road intersections or on Route 20 between the Stoney Hill Road intersections and 2 were determined as occurring at the outbound driveway at Tri-State Truck (411 Hartford Turnpike). The remaining 32 reports which indicated crash locations such as Hebert Candies, Pete's Tire Barn or Stoney Hill Road Plaza which are outside the study limits and consequently were omitted from this evaluation.

The SPD reports generally provided detailed information related to the location of the crash, travel directions of each vehicle prior to the collision and a written description of the crash. This information was used to prepare a collision diagram depicting the location of each crash. The collision diagram is shown in Figure 13 and detailed crash data for each collision is provided in Appendix H. Triangle symbols on the diagram represent collisions in which only an Incident Report was provided. Detailed crash information was not provided in Incident Reports.

Overall, inattention was cited as a contributing factor for approximately 25 percent of the collisions. Failure to yield right of way or to keep right were cited in 15 percent of the collisions.

**Route 20/Stoney Hill Road (west).** Three collisions occurred at the westerly Stoney Hill Road intersection at which police officers were present. The collisions are described below. The collision number refers to its position on Figure 13.

- Collision #2 occurred on January 27, 2011 and did not result in personal injury. A motorist was stopped in the westbound lane due to stopped traffic ahead and was hit by a second driver who was charged with Operating Under the Influence (OUI).
- Collision #3 occurred on January 19, 2012. A motorist turning left into Tri-State was hit by a second driver. It was suggested in the report that the turning vehicle shifted unexpectedly from the auxiliary lane into the eastbound through lane in order to make the left turn into Tri-State. There were no injuries associated with the crash.
- Collisions #6 occurred on July 6, 2011. A motorist waiting to turn left onto Stoney Hill Road was hit by a vehicle whose driver was looking at a GPS system. This accident resulted in personal injuries.

**Route 20/Stoney Hill Road (east).** At the easterly Stoney Hill Road intersection two collisions were reported.

- Collision #19 was assumed to have occurred at the easterly Stoney Hill Road intersection as Tri State Trucking was not mentioned in the report (Tri-State was mentioned in Collisions #2 and #6). On March 28, 2013 a motorist exited from Stoney Hill Road (the turn type was not specified) in front of a vehicle traveling east on Route 20. The motorist on Route 20 was injured in the collision.

- Collision #18 occurred on December 13, 2014. The location reported for this collision is #525 Hartford Turnpike which is located opposite Stoney Hill Road (east). It involved a vehicle who spun out of control due to an unexpected object located in the road. There were no injuries and the driver at fault was driving with a suspended license.

**Route 20 Segment.** Eleven collisions occurred in the four year study period on Route 20 between the two Stone Hill Road intersections. Police officers were present at seven of the eleven collisions and incident reports were filed for the other four collisions. Of the seven collisions at which police officers responded, three occurred at 495 Hartford Turnpike (Liberty Church) and all were rear-end crashes.

## 5.2 SIGHT DISTANCE ANALYSES

Stopping sight distance and intersection sight distance analyses were conducted at the project's driveways in accordance with the methodology contained in A Policy on Geometric Design of Highways and Streets, 6th Edition, 2011, American Association of State and Highway Transportation Officials (AASHTO). Sight distance calculations are provided in Appendix I.

### 5.2.1 Methodology and Definitions

Travel speed measurements were taken in the vicinity of the two parcels on Route 20 and on Stoney Hill Road. The data was obtained for a two day period beginning Tuesday, April 15, 2014. The speed data is necessary to determine if the measured sight lines are adequate.

#### Stopping Sight Distance (SSD)

- Definition. Stopping sight distance (SSD) is the length of roadway ahead which is visible to the driver. The minimum sight distance available on a roadway should be sufficiently long enough to enable a vehicle to stop before reaching a stationary object in its path. SSD includes the length of roadway traveled during the perception and reaction time of a driver to an object in a road, and the distance traveled during braking. Stopping sight distance criteria are defined by AASHTO<sup>1</sup> based on design speeds, anticipated driver behavior and vehicle performance, as well as physical roadway conditions.
- Measurement Criteria. Per AASHTO guidelines, the stopping sight lines are measured with an eye height 3.5 feet above the road surface. The distance at which a 2-foot tall object located in the road is visible is measured for each approach to the study location.
- AASHTO Recommendation. The stopping sight distance recommendation for the major road approach to the intersection is based on the measured 85<sup>th</sup> percentile travel speed and approach grade.

#### Intersection Sight Distance (ISD)

- Definition. Intersection sight distance (ISD) is the length of roadway which is visible to a driver stopped on a minor road (or driveway) approach to an intersection. More specifically, AASHTO indicates that intersection sight distance should be long enough for drivers exiting a driveway to accelerate from a stop and complete the required maneuver without unduly interfering with traffic on the major street.

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<sup>1</sup> A Policy on Geometric Design of Highways and Streets, 6<sup>th</sup> Edition, (American Association of State Highway and Transportation Officials, 2011)

- Measurement Criteria. Per AASHTO guidelines, the intersection sight lines are measured on the minor approach with an eye height 3.5 feet above the road surface and 14.5 feet from the edge of traveled way on the major street. The distance at which a 3.5 foot tall vehicle is visible is measured.
- AASHTO Recommendation. The intersection sight distance recommendation for a left turn maneuver is based on the 85th percentile travel speeds on the major street and the approach grade on the minor street. The desirable intersection sight distance exceeds the stopping sight distance. However, AASHTO indicates that “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”. In other words, ISD can be at a minimum equal to SSD.

### 5.2.2 Phase I (440 Hartford Turnpike)

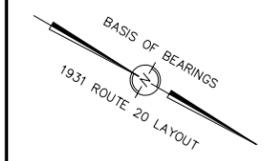
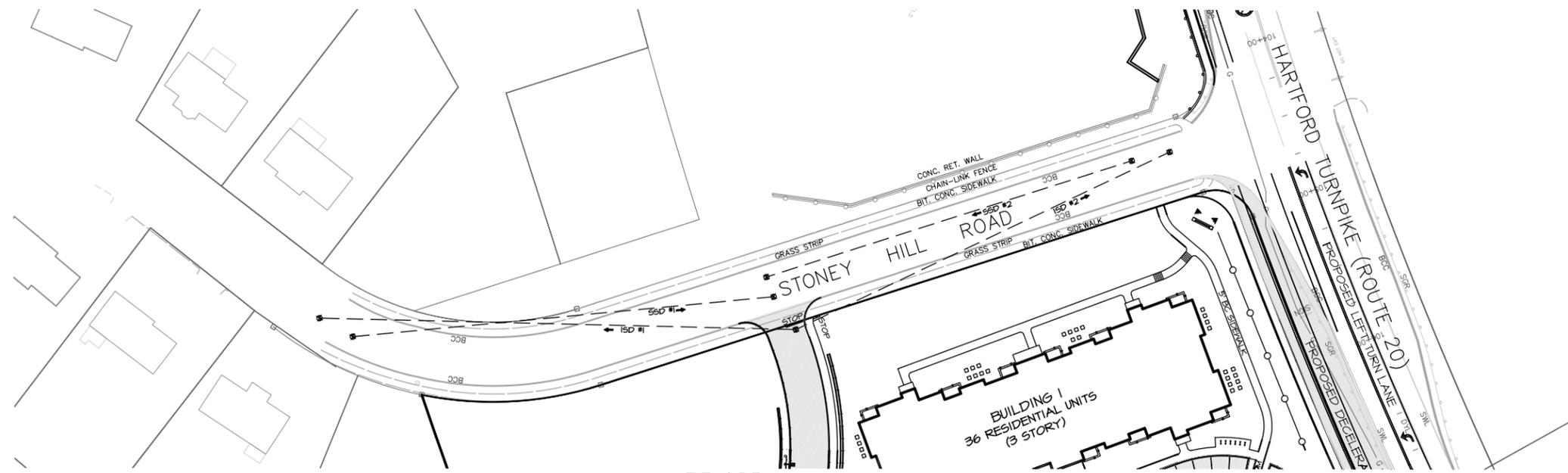
The speed data indicates that in the vicinity of the Phase I (west) parcel, the 85<sup>th</sup> percentile travel speed along Route 20 in the eastbound travel direction is approximately 55 mph. Along Stoney Hill Road, the 85<sup>th</sup> percentile travel speed is 33 mph northbound and 32 mph southbound.

The 85<sup>th</sup> percentile travel speeds and average grades along Route 20 and Stoney Hill Road along with the calculated AASHTO desirable and recommended sight lines for these grades and the measured speeds are provided in Table 14.

The SSD and ISD measured at the proposed Route 20 driveway both exceed AASHTO criteria. The SSD and ISD for the Stoney Hill Road (west)/Site Driveway intersection were determined by measurements taken from the proposed site plan and sight line profiles as shown on Figure 14. The SSD at the Stoney Hill Road driveway exceeds AASHTO criteria. The ISD to the north is 260 feet, which exceeds the SSD or minimum, and is equivalent to 74 percent of the desirable sight line of 353 feet. The ISD to the south is 300 feet, which exceeds the SSD or minimum, and is equivalent to 82 percent of the desirable sight line of requirement of 364 feet. Thus, if a vehicle did pull out of the Stoney Hill Road driveway unexpectedly, a vehicle proceeding towards the driveway from either direction would have sufficient time to either decelerate or even come to a stop.

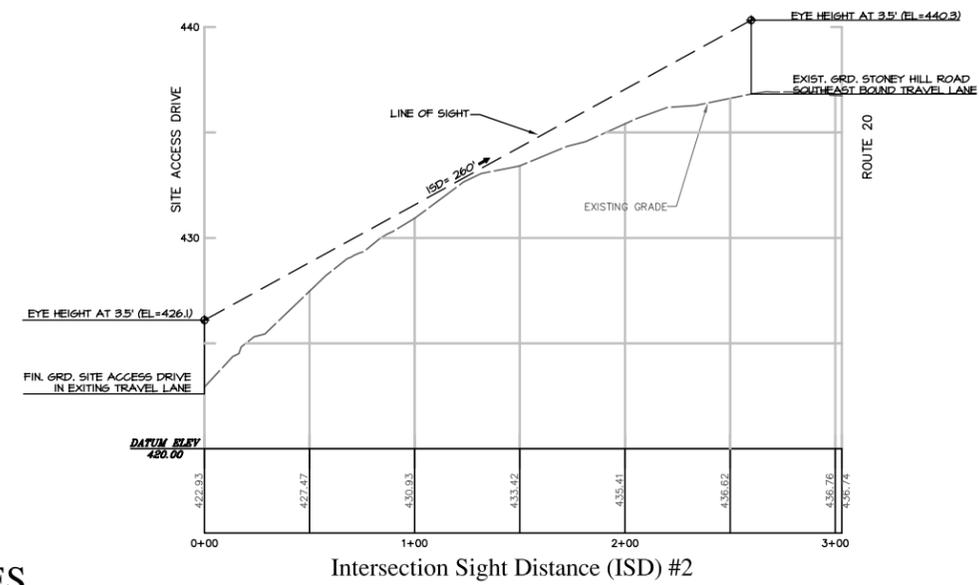
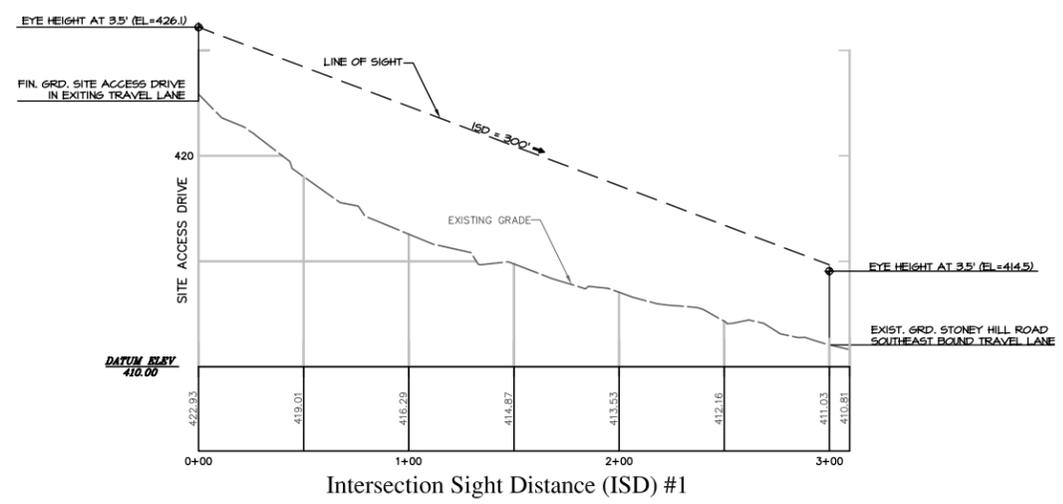
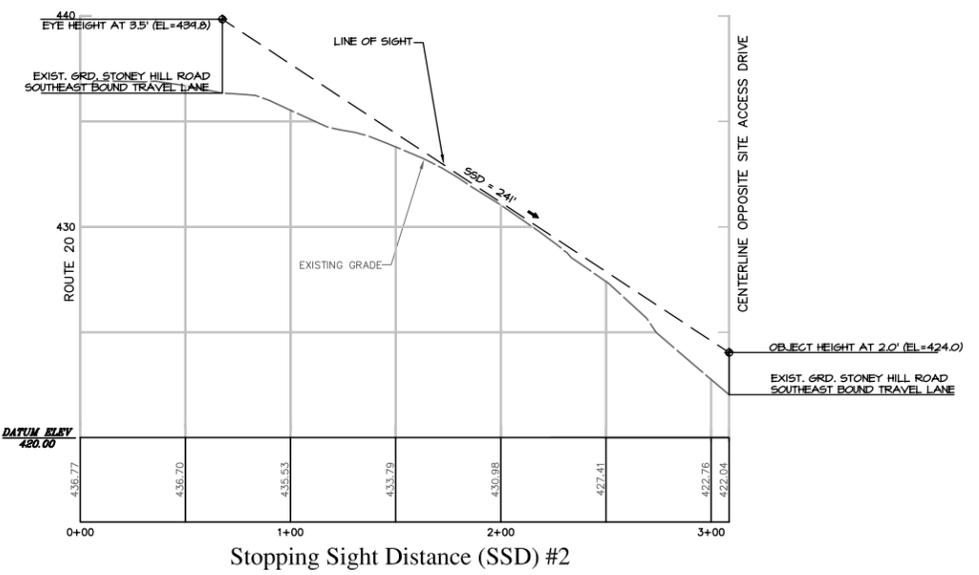
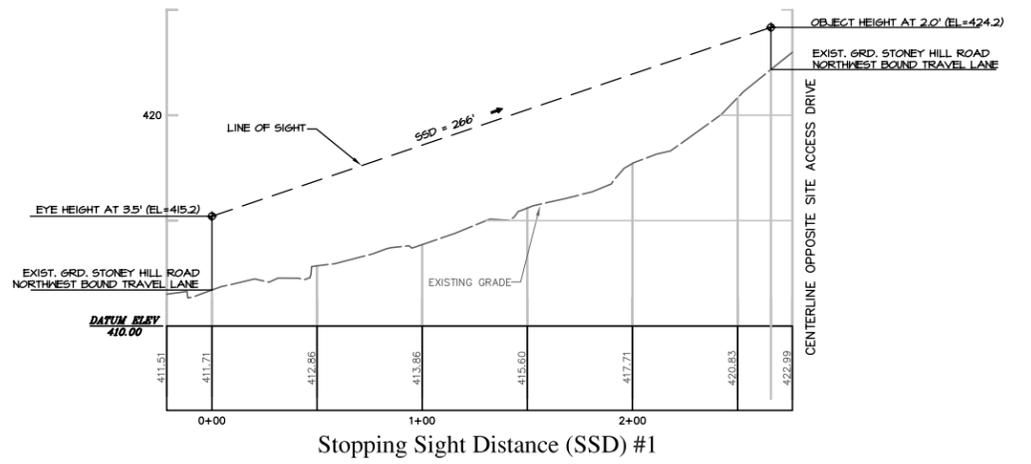
**Table 14 Phase I (west) Sight Distance Measurements (SSD and ISD)**

Intersection	85 <sup>th</sup> Percentile Speed (mph)	Approx. Grade	AASHTO Desirable (feet)	AASHTO Minimum (feet)	Measured Distance (feet)	Meets AASHTO Desirable	Meets AASHTO Minimum
<b>Route 20/Phase I Site Driveway (Rt. In/Rt. Out)</b>							
<i>Stopping Distance</i>							
From the West	55	+5%	456	NA	+700	Yes	
<i>Intersection Sight Distance</i>							
To the West	55		566	456	+700	Yes	
<b>Stoney Hill Road/Site Driveway</b>							
<i>Stopping Distance</i>							
From the North	32	-5%	233	NA	241	Yes	
From the South	33	+4%	216	NA	266	Yes	
<i>Intersection Sight Distance</i>							
To the North	32		353	233	260	No	Yes
To the South	33		364	216	300	No	Yes



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TITLE:

**LINE OF SIGHT PROFILES (PHASE I)**  
**THE POINTE AT HILLS FARM**  
Shrewsbury, MA (Worcester County)  
COMPREHENSIVE PERMIT

DATE: 10/28/15 SCALE: 1" = 40' (H)  
1" = 4' (V)

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### 5.2.3 Phase II (526 Hartford Turnpike)

The speed data indicates that in the vicinity of East Parcel the 85<sup>th</sup> percentile travel speed along Route 20 is approximately 51 mph in the eastbound travel direction and 50 mph in the westbound travel direction. Along Stoney Hill Road, the 85<sup>th</sup> percentile travel speeds is approximately 32 mph in the northbound travel direction and 29 mph in the southbound travel direction.

The 85<sup>th</sup> percentile travel speeds and average grades along Route 20 and Stoney Hill Road along with the calculated AASHTO desirable and recommended sight lines for these grades and the measured speeds are provided in Table 15.

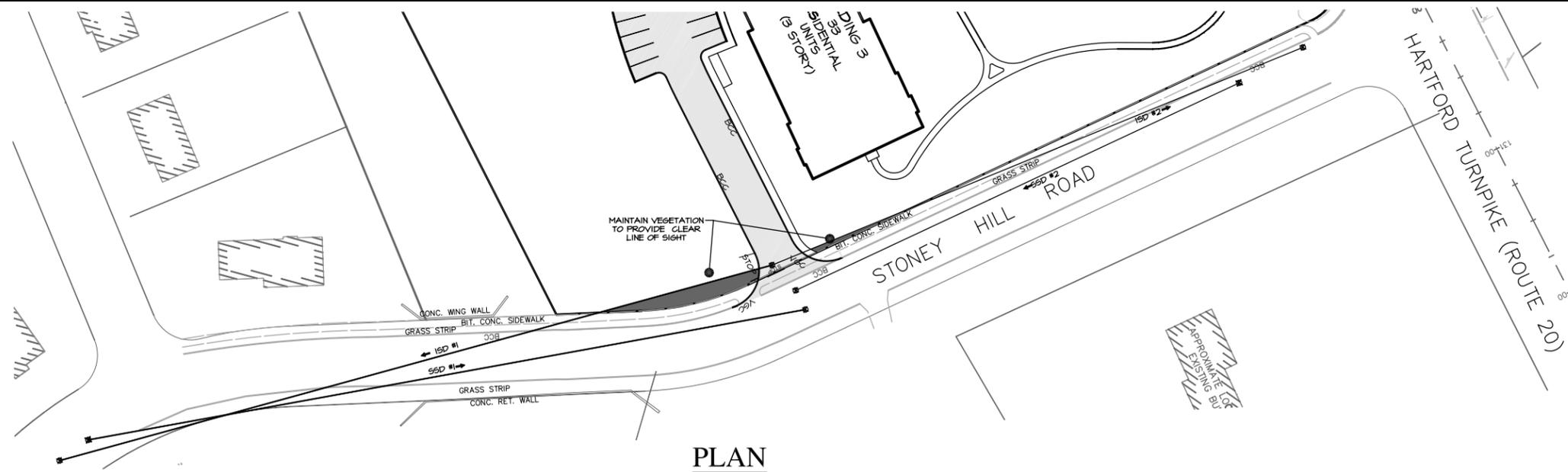
The SSD and ISD measured at the proposed Route 20 driveway both exceed AASHTO criteria. The SSD and ISD for the Stoney Hill Road (east)/Site Driveway intersection were determined by measurements taken from the proposed site plan and sight line profiles as shown on Figure 15. Both the SSD and ISD at the Stoney Hill Road driveway meets or exceeds AASHTO criteria.

As seen on Figure 15, to provide adequate sight lines, vegetation would need to be cleared along the project's frontage, starting from the site driveway and continuing to the south for a distance of approximately 100 feet (1 to 12 feet wide) and continuing to the north for a distance of approximately 60 feet (1 to 5 feet wide).

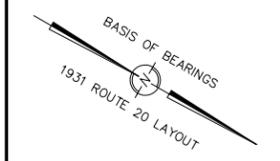
**Table 15 Phase II (east) Sight Distance Measurements (SSD and ISD)**

Intersection	85 <sup>th</sup> Percentile Speed (mph)	Approx. Grade	AASHTO Desirable (feet)	AASHTO Minimum (feet)	Measured Distance (feet)	Meets AASHTO Desirable	Meets AASHTO Minimum
<b>Route 20 Driveway Site</b>							
<u>Stopping Distance</u>							
From the West	51	2%	423	NA	>700	Yes	
From the East	50	-2%	438	NA	>700	Yes	
<u>Intersection Sight Distance</u>							
To the West	51		590	423	>700	Yes	
To the East	50		579	438	>700	Yes	
<b>Stoney Hill Road Driveway</b>							
<u>Stopping Distance</u>							
From the North	29	-3%	195	NA	282	Yes	
From the South	32	+4%	206	NA	455	Yes	
<u>Intersection Sight Distance</u>							
To the North	29		320	195	358*	Yes	
To the South	32		353	206	461*	Yes	

\*with clearing of vegetation

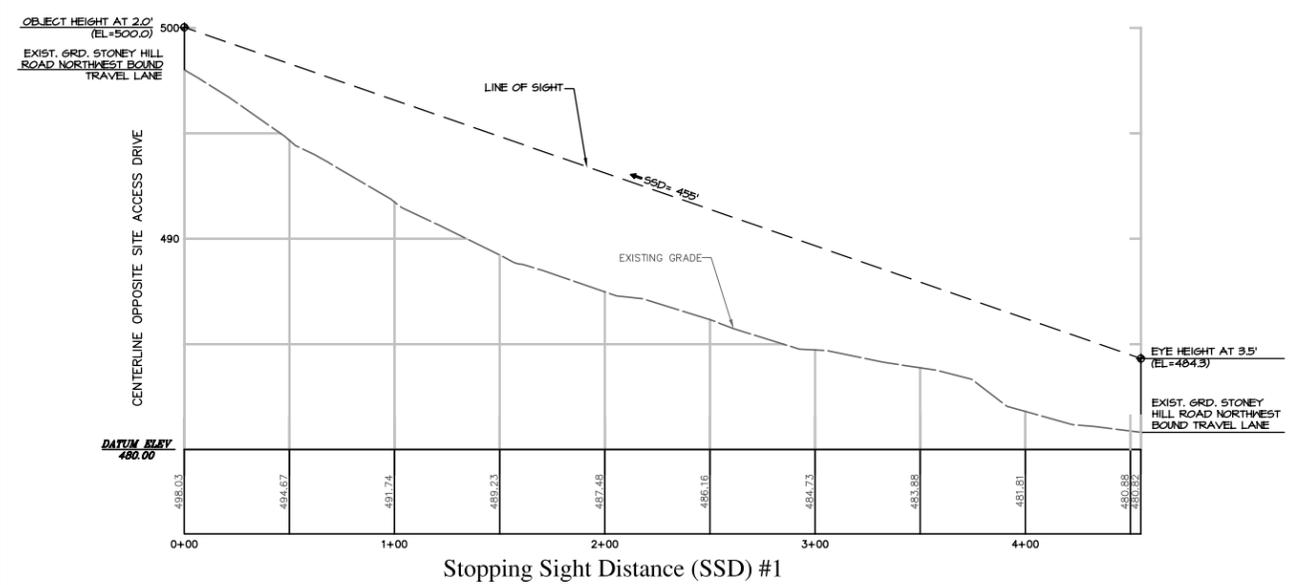


PLAN

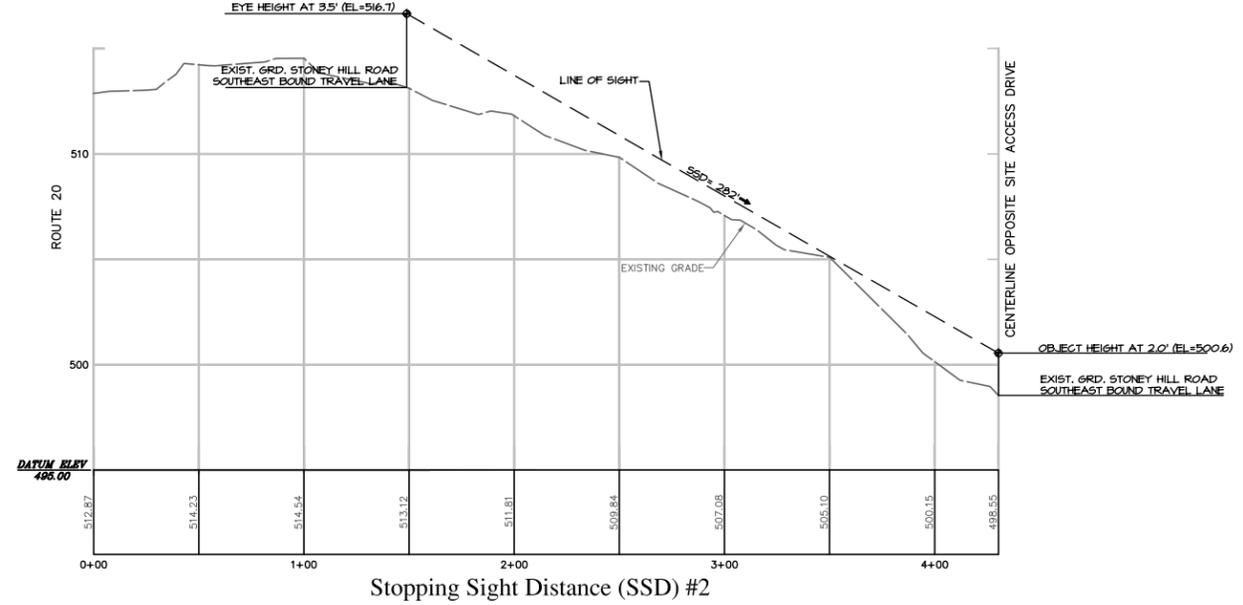


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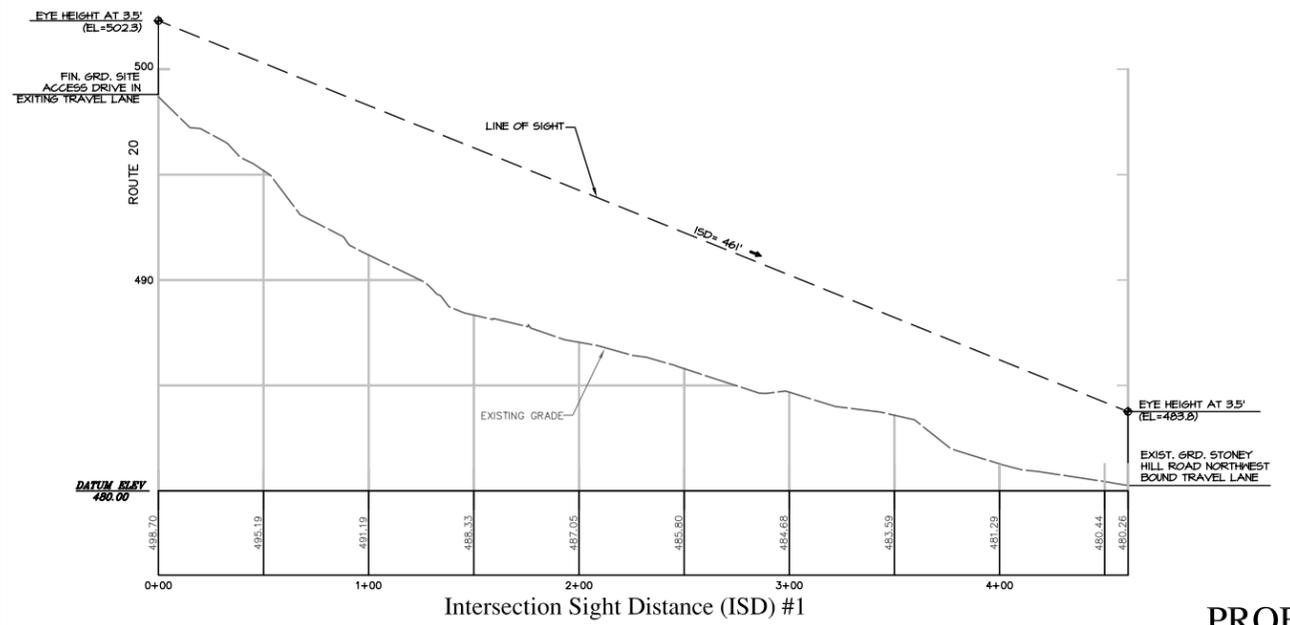
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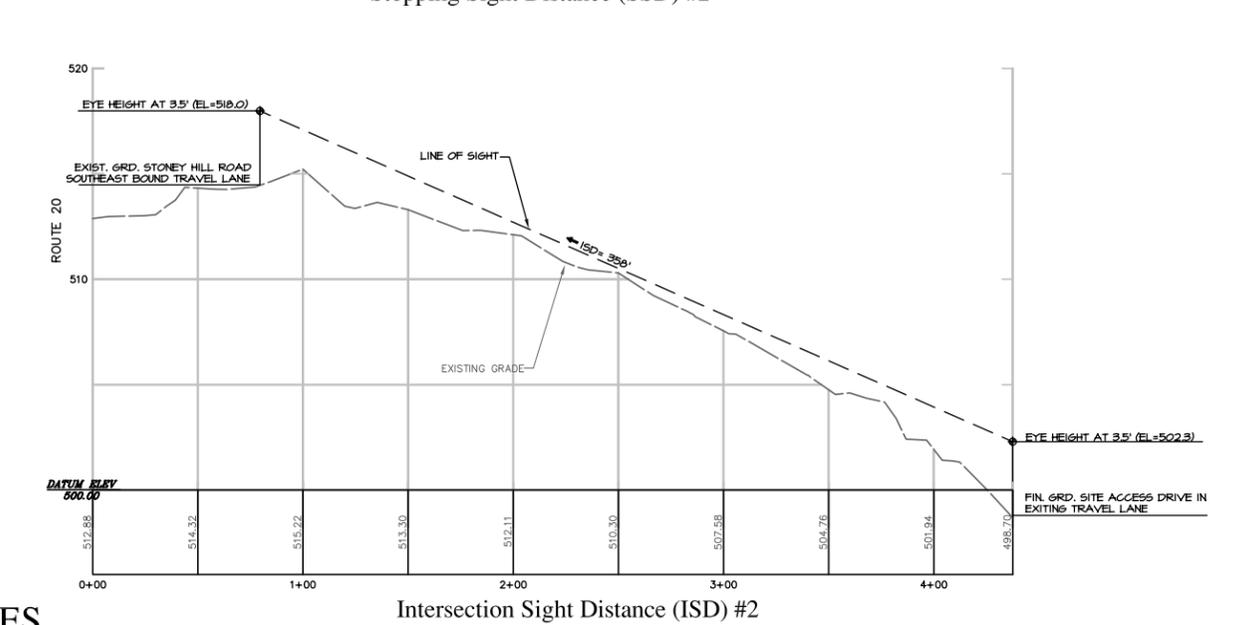
Stopping Sight Distance (SSD) #1



Stopping Sight Distance (SSD) #2



Intersection Sight Distance (ISD) #1



Intersection Sight Distance (ISD) #2

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DATE: 10/28/15 SCALE: 1" = 40' (H), 1" = 4' (V)

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## 6.0 MITIGATION

The proposed traffic mitigation for The Pointe at Hills Farm consists of three key components including improvements to Route 20 at Stoney Hill Road (west), a Transportation Demand Management plan and a Traffic Monitoring Program.

Additionally, to provide adequate sight lines at the Phase II Stoney Hill Road site driveway, vegetation will be cleared as shown on Figure 15.

### 6.1 IMPROVEMENTS TO ROUTE 20/STONEY HILL ROAD (WEST)

The improvements to the Route 20/Stoney Hill Road (west) intersection are described above in Section 3.4.1 Phase I (440 Hartford Avenue Turnpike) Project Site Access and are shown on Figure 12. As requested by MassDOT a 470 foot long exclusive left turn lane on Route 20 westbound will be constructed as mitigation for the proposed project.

### 6.2 TRANSPORTATION DEMAND MANAGEMENT PLAN

The Transportation Demand Management Plan for the proposed residential project includes five components:

- 1) On-site Fitness Centers
- 2) Designation of an On-site Transportation Coordinator
- 3) Parking Management
- 4) On-site Pedestrian and Bicycle Accommodations
- 5) Public Transit

**On-site Fitness Centers.** On-site fitness centers will be provided at both Phase I and Phase II in the project's club houses. Access to the fitness centers will be limited to residents of The Pointe at Hills Farms. As residents will have the option of joining the on-site fitness centers, trips between the project site and off-site fitness facilities will be minimized.

**Transportation Coordinator.** A resident or the development's leasing agent will be designated to serve as the Transportation Coordinator and will be responsible for promoting the TDM program. The transportation coordinator will provide a periodic newsletter or bulletin concerning commuting options to residents.

**Parking Management.** An Electric Vehicle Charging Station will be provided at the Phase I and Phase II sites.

**On-site Pedestrian and Bicycle Accommodations.** The Pointe at Hills Farm driveways will be designed as low speed facilities and will accommodate both automobiles and bicycles. The site's proposed pedestrian accommodations, shown on Figures 2 and 3 include traffic calming measures such as marked crosswalks and non-linear roadway alignments. Secure bicycle racks will be installed at specific locations that are convenient to the uses within the project in order to encourage bicycle travel to/from and within the development.

**Public Transit.** The project sites are located approximately 1.5 to 2 miles from the Grafton MBTA Commuter Rail Station which is serviced by the Worcester/Framingham Commuter Rail. Both the towns of Shrewsbury and Grafton are served by the Worcester Regional Transit Authority (WRTA). However, none of the approximately 28 existing WRTA bus routes provides a connection from Route 20 to the MBTA station in Grafton. The proponent will actively work with and encourage the WRTA to provide service between Stoney Hill Road and the Grafton MBTA Commuter Rail Station.

Additionally, a review of Journey to Work data indicates that a significant volume of Shrewsbury residents work in communities serviced by the WRTA, including 18 percent who live and work in Shrewsbury, 22 percent who work

in Worcester and 9 percent who work in Westborough. As the proposed project would increase housing units in the site environs to approximately 460 units (280 project units in addition to approximately 180 located in the vicinity of Stoney Hill Road), the proponent will also actively work with the WRTA to improve connections between Stoney Hill Road and these communities.

## 6.3 TRAFFIC MONITORING PLAN

---

The proponent proposes to conduct the following traffic monitoring program approximately 6 months after the project is fully constructed. After the initial 6-month period, the monitoring program will be subsequently carried out on an annual basis for two years. The results of each year's monitoring program will be summarized in a report format and provided to MassDOT and Town of Shrewsbury officials. The monitoring program will include the following counts and data calculations.

TMC counts will be performed at the following intersections during the weekday morning and afternoon peak hours. These volumes will be compared to the projections from the traffic study to determine how traffic volumes have changed due to the project:

- Route 20/Stoney Hill Road (west)
- Route 20/Stoney Hill Road (east)
- Route 20/Site Drive (west)
- Route 20/Site Drive (east)
- Stoney Hill Road (west)/Site Drive
- Stoney Hill Road (east)/Site Drive

If the data indicates that at any location, traffic volumes are more than 10 percent greater than predicted in the study, a traffic signal warrant analysis will be performed. If a traffic signal is warranted, and desired by MassDOT and the Town of Shrewsbury, the proponent will provide funding for the design of a traffic signal and a fair-share contribution towards construction.

P:\76351\143-76351-15001\Docs\Reports\10-29-2015 FINAL TIS.docx

**Appendix A**  
**Speed Survey Data**



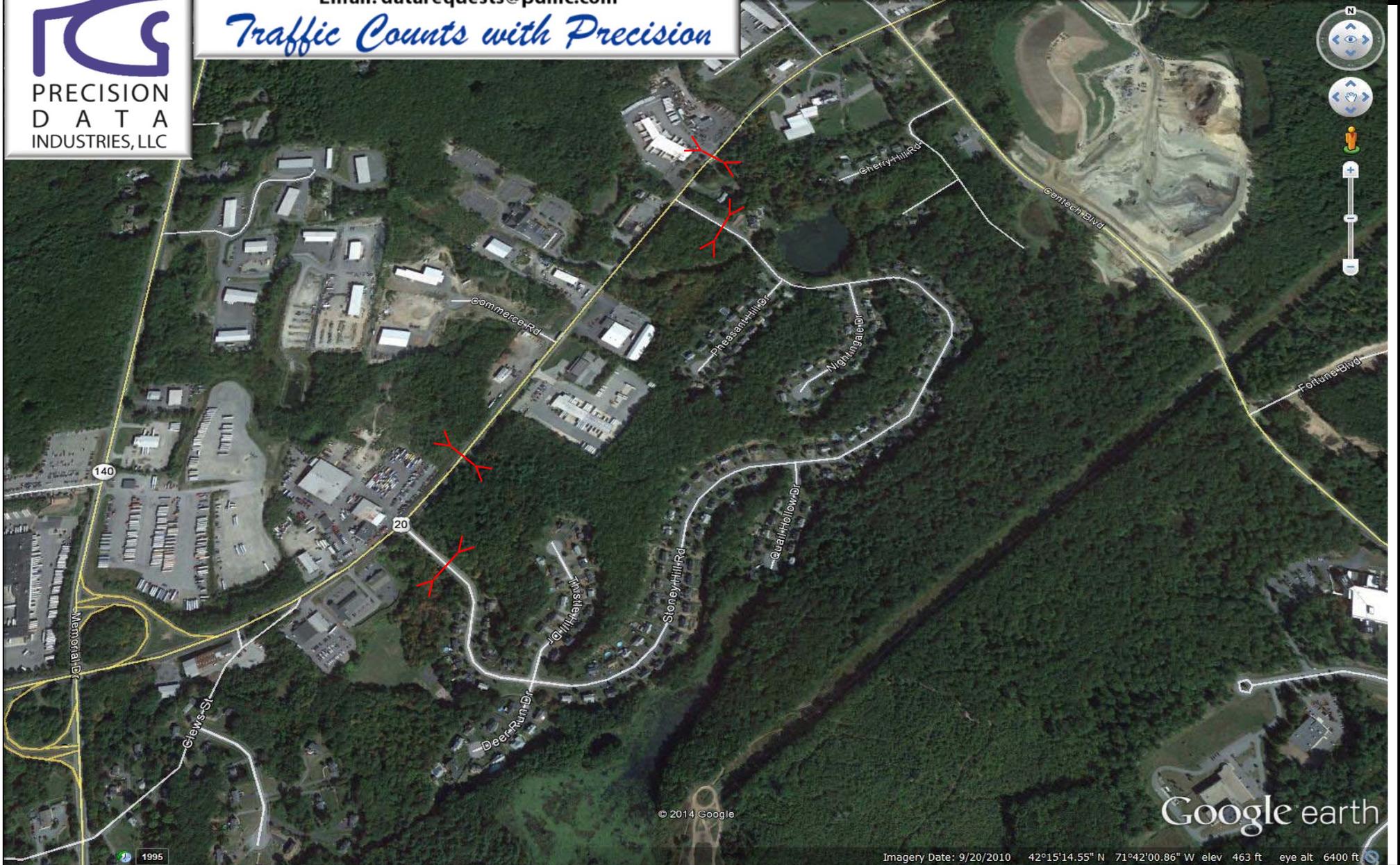
PRECISION  
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Office: 508.481.3999 Fax: 508.545.1234

Email: [datarequests@pdillc.com](mailto:datarequests@pdillc.com)

*Traffic Counts with Precision*



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Google earth

Imagery Date: 9/20/2010 42°15'14.55" N 71°42'00.86" W elev 463 ft eye alt 6400 ft

Client:

Tetra Tech Rizzo

Engineer:

N. Doherty

Site Code:

Date:

Tues 4/15 thru Wed 4/16/14

PDI Job Number:

143843

City, State:

Shrewbury, MA



PRECISION  
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Hartford Turnpike (Route 20)  
east of Stoney Hill Road (East Access)  
City, State: Shrewsbury, MA  
Client: Tetra Tech Rizzo/ N. Doherty

143843 A Speed  
Site Code: TBA

EB

Start Time	1	15	20	25	30	35	40	45	50	55	60	65	70	Total	85th % ile	Ave Speed
04/15/																
14	0	0	0	0	1	2	15	20	15	11	3	0	0	67	55	49
01:00	0	0	0	0	0	3	5	15	13	6	3	0	0	45	55	50
02:00	1	2	1	3	2	6	13	13	18	6	0	0	0	65	53	43
03:00	1	4	0	0	0	5	5	13	19	16	5	4	0	72	58	48
04:00	0	1	1	1	0	3	5	31	46	25	14	2	1	130	58	51
05:00	0	3	1	0	2	10	19	87	139	76	20	6	1	364	56	51
06:00	4	4	4	13	40	96	215	250	172	64	9	2	0	873	52	45
07:00	11	21	31	124	129	206	280	273	121	32	2	0	0	1230	48	39
08:00	2	3	23	35	125	244	357	329	93	15	0	0	0	1226	47	41
09:00	2	1	4	8	37	98	300	238	99	23	0	0	0	810	49	44
10:00	1	0	8	11	18	78	179	224	106	21	8	0	0	654	50	45
11:00	6	4	6	4	18	40	144	223	122	31	9	0	0	607	51	45
12 PM	2	4	2	7	28	61	157	212	102	26	3	1	0	605	50	45
13:00	1	3	4	15	16	79	180	199	96	29	5	0	0	627	50	44
14:00	1	2	4	4	15	61	186	211	107	26	11	0	0	628	51	45
15:00	3	2	6	6	13	47	184	209	97	16	4	0	0	587	50	45
16:00	3	3	4	6	16	48	190	212	105	13	1	0	0	601	50	44
17:00	2	5	5	12	14	64	196	219	102	28	6	0	0	653	50	44
18:00	6	11	11	6	11	37	93	143	104	28	4	2	1	457	52	44
19:00	1	0	0	2	4	26	76	110	76	19	4	1	0	319	52	46
20:00	0	1	1	1	7	17	61	89	47	8	1	1	0	234	51	46
21:00	0	0	0	0	4	11	32	52	47	21	0	0	0	167	53	48
22:00	0	0	0	0	1	9	24	29	33	21	4	1	1	123	55	49
23:00	2	0	0	0	4	3	30	37	22	2	2	1	0	103	51	45
Total	49	74	116	258	505	1254	2946	3438	1901	563	118	21	4	11247		
%	0.4%	0.7%	1.0%	2.3%	4.5%	11.1%	26.2%	30.6%	16.9%	5.0%	1.0%	0.2%	0.0%			
AM Peak	07:00	07:00	07:00	07:00	07:00	08:00	08:00	08:00	06:00	05:00	05:00	05:00	04:00	07:00		
Vol.	11	21	31	124	129	244	357	329	172	76	20	6	1	1230		
PM Peak	18:00	18:00	18:00	13:00	12:00	13:00	17:00	17:00	14:00	13:00	14:00	18:00	18:00	17:00		
Vol.	6	11	11	15	28	79	196	219	107	29	11	2	1	653		

Stats  
 15th Percentile : 36 MPH  
 50th Percentile : 44 MPH  
 85th Percentile : 51 MPH  
 95th Percentile : 55 MPH

Mean Speed(Average) : 44 MPH  
 10 MPH Pace Speed : 41-50 MPH  
 Number in Pace : 6012  
 Percent in Pace : 53.5%  
 Number of Vehicles > 50 MPH : 2120  
 Percent of Vehicles > 50 MPH : 18.9%



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east of Stoney Hill Road (East Access)  
City, State: Shrewsbury, MA  
Client: Tetra Tech Rizzo/ N. Doherty

143843 A Speed  
Site Code: TBA

EB

Start Time	1	15	20	25	30	35	40	45	50	55	60	65	70	Total	85th % ile	Ave Speed
04/16/														9999		
14	0	0	0	1	1	1	16	15	16	9	3	1	0	63	55	49
01:00	0	0	0	0	0	3	3	11	12	5	5	0	0	39	58	51
02:00	0	1	0	0	1	5	19	16	9	6	1	0	0	58	53	46
03:00	2	0	1	0	1	6	8	12	5	4	11	4	2	56	61	47
04:00	1	0	2	0	0	1	8	11	20	31	14	<b>20</b>	<b>29</b>	137	62	54
05:00	0	3	0	0	2	15	33	102	137	<b>52</b>	18	3	0	365	55	50
06:00	3	9	16	28	33	80	188	277	<b>153</b>	44	<b>21</b>	0	0	852	51	44
07:00	8	23	41	115	229	<b>300</b>	<b>328</b>	233	87	19	2	1	0	<b>1386</b>	46	38
08:00	87	134	<b>270</b>	<b>272</b>	245	145	30	0	0	0	0	0	0	1183	33	24
09:00	<b>146</b>	<b>185</b>	215	197	<b>246</b>	105	9	1	0	0	0	0	0	1104	32	22
10:00	3	3	31	34	83	124	218	251	98	17	2	0	0	864	49	42
11:00	0	0	2	2	12	53	208	<b>279</b>	137	29	3	0	0	725	51	46
12 PM	0	0	0	0	7	45	163	248	<b>170</b>	38	7	1	0	679	52	47
13:00	4	1	3	2	16	58	157	243	154	<b>46</b>	3	0	0	687	52	46
14:00	<b>5</b>	4	6	<b>11</b>	11	69	187	247	140	28	4	0	0	<b>712</b>	51	45
15:00	2	3	2	4	12	<b>70</b>	<b>189</b>	202	147	27	7	0	<b>1</b>	666	51	45
16:00	5	7	8	4	9	35	143	231	154	37	<b>9</b>	1	1	644	52	46
17:00	5	<b>9</b>	<b>17</b>	10	<b>25</b>	54	157	<b>258</b>	118	36	4	0	0	693	51	44
18:00	1	4	5	5	15	33	127	187	122	31	8	1	0	539	52	46
19:00	0	0	2	3	5	14	76	125	130	31	8	0	0	394	53	48
20:00	3	0	1	8	8	39	75	91	53	12	1	0	0	291	51	44
21:00	0	3	0	0	2	13	59	74	43	13	2	0	0	209	52	46
22:00	0	0	0	0	1	11	23	59	42	14	3	0	1	154	53	48
23:00	0	0	0	0	0	4	18	29	34	11	3	1	0	100	54	49
Total	275	389	622	696	964	1283	2442	3202	1981	540	139	33	34	12600		
%	2.2%	3.1%	4.9%	5.5%	7.7%	10.2%	19.4%	25.4%	15.7%	4.3%	1.1%	0.3%	0.3%			
AM Peak	09:00	09:00	08:00	08:00	09:00	07:00	07:00	11:00	06:00	05:00	06:00	04:00	04:00	07:00		
Vol.	146	185	270	272	246	300	328	279	153	52	21	20	29	1386		
PM Peak	14:00	17:00	17:00	14:00	17:00	15:00	15:00	17:00	12:00	13:00	16:00	12:00	15:00	14:00		
Vol.	5	9	17	11	25	70	189	258	170	46	9	1	1	712		

Stats

15th Percentile : 25 MPH  
 50th Percentile : 42 MPH  
 85th Percentile : 50 MPH  
 95th Percentile : 55 MPH

Mean Speed(Average) : 40 MPH  
 10 MPH Pace Speed : 42-51 MPH  
 Number in Pace : 5302  
 Percent in Pace : 42.2%  
 Number of Vehicles > 50 MPH : 2165  
 Percent of Vehicles > 50 MPH : 17.2%



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Hartford Turnpike (Route 20)  
east of Stoney Hill Road (East Access)  
City, State: Shrewsbury, MA  
Client: Tetra Tech Rizzo/ N. Doherty

143843 A Speed  
Site Code: TBA

WB

Start Time	14	15	19	20	24	25	29	30	34	35	39	40	44	45	49	50	54	55	59	60	64	65	69	70	9999	Total	85th % ile	Ave Speed	
04/15/																													
14	0	0	0	0	0	0	1	4	19	33	25	3	0	0	85	57	52												
01:00	0	0	0	0	0	0	0	5	12	17	4	4	0	0	42	56	51												
02:00	0	0	2	0	0	0	0	1	18	15	6	0	1	0	43	54	49												
03:00	0	0	0	0	0	0	0	1	6	12	5	3	1	0	28	58	53												
04:00	0	0	0	0	1	2	5	5	15	10	1	0	0	39	56	50													
05:00	0	2	1	1	0	1	5	12	40	22	5	0	0	89	57	51													
06:00	0	2	2	4	1	3	45	104	95	35	7	0	0	298	54	48													
07:00	1	0	6	2	7	36	84	175	113	18	3	0	0	445	51	46													
08:00	1	1	0	4	9	35	148	162	50	16	1	0	0	427	49	45													
09:00	0	5	1	1	5	33	133	189	94	19	2	3	0	485	51	46													
10:00	2	4	4	1	5	36	136	173	94	11	2	0	0	468	50	45													
11:00	0	2	3	2	3	52	192	224	92	18	4	0	0	592	50	45													
12 PM	0	2	6	4	9	35	126	292	152	31	4	1	0	662	51	47													
13:00	0	2	3	8	13	37	180	245	125	24	6	0	1	644	51	46													
14:00	0	0	4	2	8	78	166	287	115	27	2	0	0	689	50	46													
15:00	0	2	8	15	78	114	295	353	94	9	0	1	0	969	48	43													
16:00	1	11	11	25	23	96	342	403	86	6	1	0	0	1005	48	43													
17:00	0	9	10	12	51	209	383	282	93	6	1	0	0	1056	48	42													
18:00	0	5	8	6	14	61	224	346	114	20	1	0	0	799	50	45													
19:00	0	1	0	3	5	25	134	259	121	15	3	0	0	566	51	46													
20:00	1	3	2	0	9	26	138	200	63	19	1	0	0	462	50	45													
21:00	3	6	1	1	1	13	61	145	92	27	7	1	0	358	53	47													
22:00	1	1	0	0	1	6	32	87	89	12	2	0	0	231	53	48													
23:00	0	1	0	0	2	4	24	80	60	13	2	0	0	186	53	48													
Total	10	59	72	91	245	903	2864	4078	1874	398	65	8	1	10668															
%	0.1%	0.6%	0.7%	0.9%	2.3%	8.5%	26.8%	38.2%	17.6%	3.7%	0.6%	0.1%	0.0%																
AM Peak	10:00	09:00	07:00	06:00	08:00	11:00	11:00	11:00	07:00	06:00	06:00	09:00	11:00																
Vol.	2	5	6	4	9	52	192	224	113	35	7	3	592																
PM Peak	21:00	16:00	16:00	16:00	15:00	17:00	17:00	16:00	12:00	12:00	21:00	12:00	13:00	17:00															
Vol.	3	11	11	25	78	209	383	403	152	31	7	1	1	1056															

Stats  
 15th Percentile : 38 MPH  
 50th Percentile : 45 MPH  
 85th Percentile : 50 MPH  
 95th Percentile : 54 MPH

Mean Speed(Average) : 45 MPH  
 10 MPH Pace Speed : 41-50 MPH  
 Number in Pace : 6557  
 Percent in Pace : 61.5%  
 Number of Vehicles > 50 MPH : 1878  
 Percent of Vehicles > 50 MPH : 17.6%

Hartford Turnpike (Route 20)  
 east of Stoney Hill Road (East Access)  
 City, State: Shrewsbury, MA  
 Client: Tetra Tech Rizzo/ N. Doherty



PRECISION  
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 Email: datarequests@pdillc.com

143843 A Speed  
 Site Code: TBA

WB

Start Time	1	15	20	25	30	35	40	45	50	55	60	65	70	Total	85th % ile	Ave Speed
	14	19	24	29	34	39	44	49	54	59	64	69	9999			
04/16/																
14	0	0	0	0	0	2	14	32	22	10	3	4	1	88	55	49
01:00	0	0	0	0	0	0	3	8	15	5	5	1	0	37	59	52
02:00	0	0	0	0	0	1	7	10	8	3	0	0	0	29	53	48
03:00	0	0	0	0	0	0	0	5	4	1	1	1	13	25	58	52
04:00	0	0	1	0	0	0	1	5	0	5	1	1	24	38	59	50
05:00	0	1	0	0	0	1	11	19	26	24	9	1	0	92	58	51
06:00	0	0	1	2	5	11	24	90	88	25	3	0	0	249	53	48
07:00	0	4	4	4	5	27	94	138	110	23	1	2	0	412	52	46
08:00	5	5	53	19	22	58	108	70	4	1	0	0	0	345	45	36
09:00	7	4	73	15	25	37	65	33	8	0	0	0	0	267	44	33
10:00	0	6	3	9	29	86	192	174	73	6	0	0	0	578	49	43
11:00	4	1	0	3	7	57	189	255	114	24	1	0	0	655	50	45
12 PM	0	6	1	5	18	34	203	255	116	24	2	1	0	665	50	45
13:00	0	1	1	2	7	64	202	299	113	18	1	0	0	708	50	45
14:00	0	2	1	10	6	56	233	354	103	17	2	0	0	784	49	45
15:00	0	1	6	2	9	62	314	401	124	23	2	0	1	945	49	45
16:00	1	3	9	16	47	150	364	406	103	8	0	0	0	1107	48	43
17:00	5	4	10	24	53	193	383	325	119	9	1	0	0	1126	48	42
18:00	0	3	3	12	31	62	163	394	199	25	0	0	0	892	51	46
19:00	1	1	0	2	8	40	133	317	169	34	4	0	0	709	51	47
20:00	1	2	5	9	6	23	94	240	123	15	3	0	0	521	51	46
21:00	2	10	3	0	1	12	58	160	135	34	5	0	0	420	53	47
22:00	3	1	3	1	0	4	37	83	83	42	8	2	0	267	55	49
23:00	0	0	0	0	0	0	22	46	80	37	7	0	0	192	56	51
Total	29	55	177	135	279	980	2914	4119	1939	413	59	13	39	11151		
%	0.3%	0.5%	1.6%	1.2%	2.5%	8.8%	26.1%	36.9%	17.4%	3.7%	0.5%	0.1%	0.3%			
AM Peak	09:00	10:00	09:00	08:00	10:00	10:00	10:00	11:00	11:00	06:00	05:00	00:00	04:00	11:00		
Vol.	7	6	73	19	29	86	192	255	114	25	9	4	24	655		
PM Peak	17:00	21:00	17:00	17:00	17:00	17:00	17:00	16:00	18:00	22:00	22:00	22:00	15:00	17:00		
Vol.	5	10	10	24	53	193	383	406	199	42	8	2	1	1126		

Stats

15th Percentile : 38 MPH  
 50th Percentile : 45 MPH  
 85th Percentile : 50 MPH  
 95th Percentile : 54 MPH

Mean Speed(Average) : 45 MPH  
 10 MPH Pace Speed : 41-50 MPH  
 Number in Pace : 6648  
 Percent in Pace : 59.8%  
 Number of Vehicles > 50 MPH : 1974  
 Percent of Vehicles > 50 MPH : 17.8%

Hartford Turnpike (Route 20)  
 east of Stoney Hill Road (West Access)  
 City, State: Shrewsbury, MA  
 Client: Tetra Tech Rizzo/ N. Doherty



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143843 B Speed  
 Site Code: TBA

WB

Start Time	14	15	19	20	24	25	29	30	34	35	39	40	44	45	49	50	54	55	59	60	64	65	69	70	9999	Total	85th % ile	Ave Speed	
04/15/																													
14	0	0	0	0	0	0	0	0	0	1	3	13	42	27	9	0	0	95	58	53									
01:00	0	0	0	0	0	0	0	0	0	2	4	14	18	13	2	0	53	56	51										
02:00	0	0	0	0	0	0	0	0	0	0	1	11	13	13	8	1	47	60	54										
03:00	0	0	0	0	0	0	0	0	0	2	1	4	14	4	5	1	31	59	53										
04:00	0	0	0	0	0	0	0	0	0	0	7	9	10	13	6	0	45	59	52										
05:00	0	1	0	0	0	0	0	0	1	4	16	31	33	11	1	0	98	58	53										
06:00	0	0	0	0	0	0	0	0	8	26	124	108	26	1	0	0	293	53	49										
07:00	0	0	0	0	0	2	18	97	215	134	23	2	0	1	0	1	492	52	47										
08:00	0	0	0	2	14	45	109	186	97	17	1	0	0	0	0	471	51	46											
09:00	0	0	0	1	13	41	139	198	118	10	1	1	0	0	0	522	51	46											
10:00	0	0	1	2	9	53	142	178	85	8	1	0	0	0	0	479	50	45											
11:00	0	0	0	3	5	40	159	255	117	19	2	1	0	0	0	601	51	46											
12 PM	0	0	0	1	3	21	130	296	178	31	8	0	0	0	0	668	52	48											
13:00	0	0	3	16	7	37	159	239	165	18	3	0	1	0	0	648	51	46											
14:00	0	0	0	0	9	63	177	269	123	30	7	0	1	0	0	679	51	46											
15:00	2	0	6	15	29	167	320	303	124	13	2	0	1	0	0	982	49	43											
16:00	0	0	0	0	7	108	412	403	100	1	0	0	0	0	0	1031	48	44											
17:00	0	0	0	1	43	184	381	363	112	4	0	0	0	0	0	1088	48	43											
18:00	0	0	0	0	5	74	219	354	122	9	2	0	0	0	0	785	50	45											
19:00	0	0	0	0	6	21	145	238	128	10	4	0	0	0	0	552	51	47											
20:00	0	0	0	0	2	8	68	161	165	46	12	0	1	0	0	463	54	49											
21:00	0	0	0	0	0	9	51	137	122	31	5	1	1	0	0	357	53	49											
22:00	0	0	0	0	0	1	24	79	86	30	4	1	0	0	0	225	54	50											
23:00	0	0	0	0	0	2	10	25	58	45	32	9	9	0	0	190	60	54											
Total	2	1	10	41	154	906	2788	4090	2270	474	128	16	15	10895															
%	0.0%	0.0%	0.1%	0.4%	1.4%	8.3%	25.6%	37.5%	20.8%	4.4%	1.2%	0.1%	0.1%																
AM Peak		05:00	10:00	11:00	08:00	10:00	11:00	11:00	07:00	05:00	05:00	02:00	07:00	11:00															
Vol.		1	1	3	14	53	159	255	134	33	11	1	1	601															
PM Peak	15:00		15:00	13:00	17:00	17:00	16:00	16:00	12:00	20:00	23:00	23:00	23:00	17:00															
Vol.	2		6	16	43	184	412	403	178	46	32	9	9	1088															

Stats

15th Percentile : 39 MPH  
 50th Percentile : 45 MPH  
 85th Percentile : 51 MPH  
 95th Percentile : 55 MPH

Mean Speed(Average) : 46 MPH  
 10 MPH Pace Speed : 42-51 MPH  
 Number in Pace : 6674  
 Percent in Pace : 61.3%  
 Number of Vehicles > 50 MPH : 2307  
 Percent of Vehicles > 50 MPH : 21.2%



PRECISION  
D A T A  
INDUSTRIES, LLC

P.O. Box 301 Berlin, MA 01503  
Office: 508.481.3999 Fax: 508.545.1234  
Email: datarequests@pdillc.com

Hartford Turnpike (Route 20)  
east of Stoney Hill Road (West Access)  
City, State: Shrewsbury, MA  
Client: Tetra Tech Rizzo/ N. Doherty

143843 B Speed  
Site Code: TBA

WB

Start Time	1	15	20	25	30	35	40	45	50	55	60	65	70	Total	85th % ile	Ave Speed
	14	19	24	29	34	39	44	49	54	59	64	69	9999			
04/16/																
14	0	0	0	0	0	2	7	5	26	19	19	11	6	95	62	55
01:00	0	0	0	0	1	1	5	4	12	6	6	1	9	45	60	52
02:00	0	0	0	0	0	2	2	9	9	4	4	0	0	30	58	51
03:00	0	0	0	0	0	0	5	5	2	4	7	4	0	27	63	54
04:00	0	0	0	0	0	0	3	5	10	15	5	1	0	39	59	54
05:00	0	0	0	0	0	1	2	21	27	25	16	9	1	102	61	54
06:00	0	0	0	0	0	4	10	36	78	66	49	11	2	256	60	54
07:00	0	0	0	0	3	15	69	114	159	97	12	1	1	471	56	50
08:00	4	1	82	9	8	13	48	121	81	11	1	0	1	380	51	40
09:00	7	0	77	21	12	21	77	68	34	5	0	0	0	322	48	37
10:00	2	0	0	0	7	46	164	207	163	28	4	0	0	621	52	46
11:00	0	0	0	0	5	21	116	297	173	35	5	0	1	653	52	48
12 PM	0	0	0	0	9	37	130	253	191	50	9	0	0	679	53	48
13:00	0	0	0	0	2	14	139	287	230	38	2	0	0	712	52	48
14:00	0	0	0	0	13	55	169	302	215	25	3	0	0	782	51	47
15:00	0	0	0	0	0	21	187	428	282	29	1	1	0	949	52	48
16:00	0	0	0	0	1	33	265	540	247	30	2	0	0	1118	51	47
17:00	0	0	0	0	8	48	259	531	269	25	0	0	0	1140	51	47
18:00	1	0	0	0	2	18	123	375	298	45	1	0	0	863	52	48
19:00	0	0	0	0	1	9	94	284	254	54	2	1	0	699	53	49
20:00	0	0	0	0	0	4	64	264	210	43	5	1	0	591	53	49
21:00	0	0	0	0	0	3	21	113	172	93	12	1	0	415	56	51
22:00	0	0	0	0	0	1	5	35	116	85	15	7	1	265	57	54
23:00	0	0	0	0	1	2	9	30	75	62	18	1	0	198	58	53
Total	14	1	159	30	73	371	1973	4334	3333	894	198	50	22	11452		
%	0.1%	0.0%	1.4%	0.3%	0.6%	3.2%	17.2%	37.8%	29.1%	7.8%	1.7%	0.4%	0.2%			
AM Peak	09:00	08:00	08:00	09:00	09:00	10:00	10:00	11:00	11:00	07:00	06:00	00:00	01:00	11:00		
Vol.	7	1	82	21	12	46	164	297	173	97	49	11	9	653		
PM Peak	18:00				14:00	14:00	16:00	16:00	18:00	21:00	23:00	22:00	22:00	17:00		
Vol.	1				13	55	265	540	298	93	18	7	1	1140		

Stats

15th Percentile : 41 MPH  
 50th Percentile : 47 MPH  
 85th Percentile : 53 MPH  
 95th Percentile : 57 MPH

Mean Speed(Average) : 48 MPH  
 10 MPH Pace Speed : 44-53 MPH  
 Number in Pace : 7209  
 Percent in Pace : 63.1%  
 Number of Vehicles > 50 MPH : 3580  
 Percent of Vehicles > 50 MPH : 31.3%

Hartford Turnpike (Route 20)  
 east of Stoney Hill Road (West Access)  
 City, State: Shrewsbury, MA  
 Client: Tetra Tech Rizzo/ N. Doherty



PRECISION  
 D A T A  
 INDUSTRIES, LLC  
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143843 B Speed  
 Site Code: TBA

EB

Start Time	1	15	20	25	30	35	40	45	50	55	60	65	70	Total	85th % ile	Ave Speed
04/15/																
14	0	0	0	0	0	1	14	18	16	16	3	1	0	69	56	50
01:00	0	0	0	0	2	2	9	11	14	6	3	1	0	48	56	49
02:00	0	0	0	2	1	6	8	7	16	17	4	1	0	62	57	50
03:00	0	0	0	0	0	4	5	16	19	15	6	2	1	68	58	51
04:00	0	0	0	0	0	5	10	22	40	34	11	7	1	130	58	52
05:00	0	0	0	0	3	7	13	49	125	112	51	10	3	373	59	54
06:00	0	0	0	1	4	13	77	285	343	99	25	7	1	855	54	50
07:00	0	0	0	0	11	25	140	427	416	128	25	3	1	1176	54	49
08:00	0	0	0	0	5	19	131	416	451	120	29	7	2	1180	54	50
09:00	0	0	0	0	5	34	139	324	171	77	14	3	1	768	53	48
10:00	0	0	0	1	3	27	104	235	170	75	13	4	1	633	54	49
11:00	0	0	0	0	2	16	62	189	200	77	25	5	4	580	55	50
12 PM	0	1	0	0	1	26	108	205	148	72	24	2	3	590	54	49
13:00	0	0	2	1	13	21	126	197	129	57	31	11	10	598	54	48
14:00	1	0	0	0	8	17	95	210	156	84	36	5	9	621	55	49
15:00	1	1	0	2	1	33	104	180	143	61	15	4	3	548	54	48
16:00	0	0	0	0	2	15	116	246	162	49	7	1	0	598	53	48
17:00	0	0	1	0	2	24	104	219	207	57	8	4	0	626	53	49
18:00	0	0	0	0	0	15	85	150	135	44	12	0	0	441	54	49
19:00	0	0	0	0	6	22	63	112	92	21	5	0	0	321	52	47
20:00	0	0	0	0	5	8	52	87	62	19	2	2	1	238	53	48
21:00	0	0	0	2	6	8	36	67	40	10	2	0	0	171	52	47
22:00	0	0	0	2	2	4	26	42	29	17	6	2	0	130	55	48
23:00	0	0	0	0	1	3	9	18	31	22	4	6	12	106	57	51
Total	2	2	3	11	83	355	1636	3732	3315	1289	361	88	53	10930		
%	0.0%	0.0%	0.0%	0.1%	0.8%	3.2%	15.0%	34.1%	30.3%	11.8%	3.3%	0.8%	0.5%			
AM Peak Vol.				2	11	34	140	427	451	128	51	10	4	1180		
PM Peak Vol.	14:00	12:00	13:00	15:00	13:00	15:00	13:00	16:00	17:00	14:00	14:00	13:00	23:00	17:00		
	1	1	2	2	13	33	126	246	207	84	36	11	12	626		

Stats

- 15th Percentile : 42 MPH
- 50th Percentile : 48 MPH
- 85th Percentile : 54 MPH
- 95th Percentile : 58 MPH
  
- Mean Speed(Average) : 49 MPH
- 10 MPH Pace Speed : 45-54 MPH
- Number in Pace : 6572
- Percent in Pace : 60.4%
- Number of Vehicles > 50 MPH : 4224
- Percent of Vehicles > 50 MPH : 38.8%

Hartford Turnpike (Route 20)  
 east of Stoney Hill Road (West Access)  
 City, State: Shrewsbury, MA  
 Client: Tetra Tech Rizzo/ N. Doherty



PRECISION  
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143843 B Speed  
 Site Code: TBA

EB

Start Time	1	15	20	25	30	35	40	45	50	55	60	65	70	Total	85th % ile	Ave Speed
04/16/														9999		
14	0	0	0	0	1	2	2	10	16	9	8	5	6	59	61	53
01:00	0	0	0	0	3	2	1	5	12	7	3	4	5	42	59	51
02:00	0	0	1	1	2	3	10	17	19	5	1	1	0	60	53	47
03:00	0	0	2	1	1	3	5	8	10	9	12	7	1	59	62	52
04:00	0	0	0	0	1	10	16	20	33	36	9	4	3	132	58	51
05:00	0	0	0	0	0	10	31	67	101	104	41	13	2	369	59	53
06:00	0	0	0	0	3	11	52	143	299	<b>215</b>	<b>97</b>	<b>30</b>	4	854	59	53
07:00	1	6	8	17	23	61	<b>163</b>	<b>355</b>	<b>434</b>	208	46	15	1	<b>1338</b>	55	49
08:00	115	72	164	65	69	<b>94</b>	91	182	160	46	14	0	1	1073	50	32
09:00	<b>151</b>	<b>103</b>	<b>195</b>	<b>85</b>	<b>80</b>	53	74	84	59	20	6	0	0	910	44	25
10:00	0	2	2	2	11	42	111	254	256	83	31	7	2	803	54	49
11:00	0	0	0	0	1	16	82	231	216	101	30	6	2	685	55	50
12 PM	0	0	0	0	4	15	67	202	<b>250</b>	<b>106</b>	27	2	1	674	55	50
13:00	0	<b>2</b>	0	0	2	9	69	200	250	101	19	4	1	657	55	50
14:00	0	0	<b>2</b>	0	6	9	73	243	228	87	30	10	2	690	55	50
15:00	0	0	0	0	2	<b>18</b>	<b>88</b>	204	226	78	27	7	1	651	55	50
16:00	<b>1</b>	0	0	0	1	10	65	193	219	98	29	9	2	627	55	50
17:00	0	0	0	0	1	5	80	<b>253</b>	233	87	28	3	1	<b>691</b>	55	50
18:00	0	0	0	0	2	10	57	155	217	97	<b>32</b>	<b>14</b>	5	589	56	51
19:00	0	0	0	0	1	10	50	124	122	64	13	5	3	392	55	50
20:00	0	0	0	<b>1</b>	<b>8</b>	7	38	79	77	34	9	1	1	255	55	49
21:00	0	0	0	1	3	9	32	48	78	35	9	2	1	218	55	50
22:00	0	0	0	0	2	3	6	38	50	38	12	3	<b>10</b>	162	57	52
23:00	0	1	0	0	0	5	11	16	39	21	7	3	0	103	57	51
Total	268	186	374	173	227	417	1274	3131	3604	1689	540	155	55	12093		
%	2.2%	1.5%	3.1%	1.4%	1.9%	3.4%	10.5%	25.9%	29.8%	14.0%	4.5%	1.3%	0.5%			
AM Peak	09:00	09:00	09:00	09:00	09:00	08:00	07:00	07:00	07:00	06:00	06:00	06:00	00:00	07:00		
Vol.	151	103	195	85	80	94	163	355	434	215	97	30	6	1338		
PM Peak	16:00	13:00	14:00	20:00	20:00	15:00	15:00	17:00	12:00	12:00	18:00	18:00	22:00	17:00		
Vol.	1	2	2	1	8	18	88	253	250	106	32	14	10	691		

Stats

15th Percentile : 37 MPH  
 50th Percentile : 48 MPH  
 85th Percentile : 55 MPH  
 95th Percentile : 59 MPH

Mean Speed(Average) : 46 MPH  
 10 MPH Pace Speed : 46-55 MPH  
 Number in Pace : 6183  
 Percent in Pace : 51.4%  
 Number of Vehicles > 50 MPH : 5026  
 Percent of Vehicles > 50 MPH : 41.8%

Stoney Hill Road (East Access)  
 south of Hartford Turnpike (Route 20)  
 City, State: Shrewsbury, MA  
 Client: Tetra Tech Rizzo/ N. Doherty



PRECISION  
 D A T A  
 INDUSTRIES, LLC  
 P.O. Box 301 Berlin, MA 01503  
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143843 C Speed  
 Site Code: TBA

NB	14	15	19	20	24	25	29	30	34	35	39	40	44	45	49	50	54	55	59	60	64	65	69	70	9999	Total	85th % ile	Ave Speed	
04/15/																													
14	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	0	0	*	*
01:00	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	0	0	*	*
02:00	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	0	0	*	*
03:00	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	0	0	*	*
04:00	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	28	27	
05:00	0	0	3	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	30	26	
06:00	0	2	6	13	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27	30	26	
07:00	<b>2</b>	<b>1</b>	<b>14</b>	<b>26</b>	<b>14</b>	<b>1</b>	<b>0</b>	<b>58</b>	<b>31</b>	<b>26</b>																			
08:00	0	<b>4</b>	<b>11</b>	<b>16</b>	<b>10</b>	<b>3</b>	<b>0</b>	<b>44</b>	<b>32</b>	<b>26</b>																			
09:00	0	0	4	8	7	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	33	29	
10:00	0	0	4	12	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	29	26	
11:00	2	1	4	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	25	18	
12 PM	<b>1</b>	<b>4</b>	<b>2</b>	<b>9</b>	<b>6</b>	<b>0</b>	<b>22</b>	<b>30</b>	<b>24</b>																				
13:00	1	1	1	9	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	31	25	
14:00	0	0	4	4	4	<b>2</b>	<b>0</b>	<b>14</b>	<b>34</b>	<b>28</b>																			
15:00	0	0	0	5	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	32	29	
16:00	0	0	<b>6</b>	<b>7</b>	<b>4</b>	<b>0</b>	<b>17</b>	<b>30</b>	<b>26</b>																				
17:00	0	0	3	<b>16</b>	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	<b>25</b>	<b>31</b>	<b>28</b>	
18:00	0	0	2	10	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	31	28	
19:00	0	1	2	9	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	29	26	
20:00	0	1	3	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	29	23	
21:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	18	15	
22:00	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	23	22	
23:00	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	22	19	
Total	6	17	72	151	75	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	332			
%	1.8%	5.1%	21.7%	45.5%	22.6%	3.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%				
AM Peak	07:00	08:00	07:00	07:00	07:00	08:00																					07:00		
Vol.	2	4	14	26	14	3																					58		
PM Peak	12:00	12:00	16:00	17:00	12:00	14:00																					17:00		
Vol.	1	4	6	16	6	2																					25		

Stats

15th Percentile : 19 MPH  
 50th Percentile : 26 MPH  
 85th Percentile : 31 MPH  
 95th Percentile : 34 MPH

Mean Speed(Average) : 26 MPH  
 10 MPH Pace Speed : 23-32 MPH  
 Number in Pace : 217  
 Percent in Pace : 65.4%  
 Number of Vehicles > 25 MPH : 191  
 Percent of Vehicles > 25 MPH : 57.4%

Stoney Hill Road (East Access)  
 south of Hartford Turnpike (Route 20)  
 City, State: Shrewsbury, MA  
 Client: Tetra Tech Rizzo/ N. Doherty



PRECISION  
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143843 C Speed  
 Site Code: TBA

NB

Start Time	14	15	19	20	24	25	29	30	34	35	39	40	44	45	49	50	54	55	59	60	64	65	69	70	9999	Total	85th % ile	Ave Speed	
04/16/																													
14	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	27	24	
01:00	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	0	*	*	
02:00	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	0	*	*	
03:00	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	0	*	*	
04:00	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	27	24		
05:00	0	0	0	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	27	25		
06:00	0	0	0	5	11	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	31	27		
07:00	0	1	0	9	20	22	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	55	32	28		
08:00	0	3	0	12	17	13	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	49	32	27		
09:00	0	0	0	8	7	6	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23	32	28		
10:00	1	0	0	6	8	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	31	25		
11:00	0	0	0	0	6	4	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	35	31		
12 PM	1	0	0	3	4	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	32	26		
13:00	0	0	0	2	6	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	34	29		
14:00	0	0	0	3	7	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	33	29		
15:00	5	1	0	3	6	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	30	20		
16:00	0	0	0	8	11	3	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27	34	28		
17:00	0	2	0	1	10	10	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	33	28		
18:00	0	1	0	9	9	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27	31	26		
19:00	0	0	0	10	11	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	29	26		
20:00	0	0	0	2	6	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	31	27		
21:00	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	28	27		
22:00	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	28	27		
23:00	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	7	8	85	147	100	26	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	374				
%	1.9%	2.1%	22.7%	39.3%	26.7%	7.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%					
AM Peak	10:00	08:00	08:00	07:00	07:00	08:00	09:00																			07:00			
Vol.	1	3	12	20	22	4	1																			55			
PM Peak	15:00	17:00	19:00	16:00	17:00	16:00																				16:00			
Vol.	5	2	10	11	10	5																				27			

Stats

15th Percentile : 20 MPH  
 50th Percentile : 26 MPH  
 85th Percentile : 32 MPH  
 95th Percentile : 35 MPH

Mean Speed(Average) : 27 MPH  
 10 MPH Pace Speed : 23-32 MPH  
 Number in Pace : 235  
 Percent in Pace : 62.8%  
 Number of Vehicles > 25 MPH : 234  
 Percent of Vehicles > 25 MPH : 62.5%

Stoney Hill Road (East Access)  
 south of Hartford Turnpike (Route 20)  
 City, State: Shrewsbury, MA  
 Client: Tetra Tech Rizzo/ N. Doherty



PRECISION  
 D A T A  
 INDUSTRIES, LLC  
 P.O. Box 301 Berlin, MA 01503  
 Office: 508.481.3999 Fax: 508.545.1234  
 Email: datarequests@pdillc.com

143843 C Speed  
 Site Code: TBA

SB	Start Time	14	15	19	20	24	25	29	30	34	35	39	40	44	45	49	50	54	55	59	60	64	65	69	70	9999	Total	85th % ile	Ave Speed	
	04/15/14	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	23	22	
	01:00	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	33	32	
	02:00	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	0	*	*	
	03:00	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	23	22	
	04:00	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	0	*	*	
	05:00	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	28	27	
	06:00	0	0	0	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	26	24	
	07:00	0	0	0	4	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	29	25	
	08:00	0	1	0	4	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	28	24	
	09:00	0	0	0	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	27	24	
	10:00	0	1	0	2	3	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	33	26	
	11:00	0	1	0	8	6	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	30	25	
	12 PM	0	0	0	6	6	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	31	26	
	13:00	0	3	0	4	7	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	29	24	
	14:00	0	2	0	4	8	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	29	25	
	15:00	0	0	0	5	13	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	29	26	
	16:00	0	0	0	12	16	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31	28	26	
	17:00	0	5	0	18	25	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	52	28	24	
	18:00	1	0	0	15	21	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	44	29	25	
	19:00	0	2	0	9	15	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32	30	25	
	20:00	0	1	0	6	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	28	24	
	21:00	1	0	0	6	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	27	22	
	22:00	0	0	0	4	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	27	24	
	23:00	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	23	22	
	Total	2	16	0	119	146	42	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	327			
	%	0.6%	4.9%	0%	36.4%	44.6%	12.8%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%					
	AM Peak		08:00		11:00		11:00		11:00		10:00																	11:00		
	Vol.		1		8		6		5		1																	20		
	PM Peak	18:00	17:00		17:00		17:00		18:00		14:00																	17:00		
	Vol.	1	5		18		25		7		1																	52		

Stats

15th Percentile : 19 MPH  
 50th Percentile : 24 MPH  
 85th Percentile : 29 MPH  
 95th Percentile : 32 MPH

Mean Speed(Average) : 25 MPH  
 10 MPH Pace Speed : 21-30 MPH  
 Number in Pace : 235  
 Percent in Pace : 71.9%  
 Number of Vehicles > 25 MPH : 144  
 Percent of Vehicles > 25 MPH : 44.1%

Stoney Hill Road (East Access)  
 south of Hartford Turnpike (Route 20)  
 City, State: Shrewsbury, MA  
 Client: Tetra Tech Rizzo/ N. Doherty



PRECISION  
 D A T A  
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143843 C Speed  
 Site Code: TBA

SB	Start Time	1	15	20	25	30	35	40	45	50	55	60	65	70	Total	85th % ile	Ave Speed
		14	19	24	29	34	39	44	49	54	59	64	69	70	9999		
04/16/	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*	*
	01:00	0	0	1	0	0	0	0	0	0	0	0	0	0	1	23	22
	02:00	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	*	*
	04:00	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	1	28	27
	06:00	0	1	3	2	1	0	0	0	0	0	0	0	0	7	28	23
	07:00	0	0	0	2	0	0	0	0	0	0	0	0	0	2	28	27
	08:00	0	0	1	3	2	1	0	0	0	0	0	0	0	7	34	29
	09:00	0	0	4	4	2	0	0	0	0	0	0	0	0	10	30	26
	10:00	0	1	3	1	0	0	0	0	0	0	0	0	0	5	25	21
	11:00	0	0	4	2	3	0	0	0	0	0	0	0	0	9	31	26
	12 PM	0	0	4	12	3	0	0	0	0	0	0	0	0	19	29	27
	13:00	0	0	3	9	4	0	0	0	0	0	0	0	0	16	31	27
	14:00	0	1	5	11	3	0	0	0	0	0	0	0	0	20	29	26
	15:00	0	1	5	15	7	0	0	0	0	0	0	0	0	28	30	27
	16:00	0	1	8	21	1	0	0	0	0	0	0	0	0	31	28	25
	17:00	0	0	15	35	4	0	0	0	0	0	0	0	0	54	28	26
	18:00	0	3	23	26	2	0	0	0	0	0	0	0	0	54	27	24
	19:00	0	4	10	23	4	0	0	0	0	0	0	0	0	41	28	25
	20:00	0	3	12	15	3	0	0	0	0	0	0	0	0	33	28	24
	21:00	0	2	3	4	1	2	0	0	0	0	0	0	0	12	33	25
	22:00	0	1	3	2	0	0	0	0	0	0	0	0	0	6	26	22
	23:00	0	0	1	1	0	0	0	0	0	0	0	0	0	2	27	24
	Total	0	18	108	189	40	3	0	0	0	0	0	0	0	358		
	%	0.0%	5.0%	30.2%	52.8%	11.2%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM	Peak		06:00	09:00	09:00	11:00	08:00								09:00		
	Vol.		1	4	4	3	1								10		
PM	Peak		19:00	18:00	17:00	15:00	21:00								17:00		
	Vol.		4	23	35	7	2								54		

Stats  
 15th Percentile : 20 MPH  
 50th Percentile : 25 MPH  
 85th Percentile : 29 MPH  
 95th Percentile : 32 MPH

Mean Speed(Average) : 25 MPH  
 10 MPH Pace Speed : 21-30 MPH  
 Number in Pace : 267  
 Percent in Pace : 74.6%  
 Number of Vehicles > 25 MPH : 170  
 Percent of Vehicles > 25 MPH : 47.5%

Stoney Hill Road (West Access)  
 south of Hartford Turnpike (Route 20)  
 City, State: Shrewsbury, MA  
 Client: Tetra Tech Rizzo/ N. Doherty



PRECISION  
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 INDUSTRIES, LLC

P.O. Box 301 Berlin, MA 01503  
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 Email: datarequests@pdillc.com

143843 D Speed  
 Site Code: TBA

NB

Start Time	14	15	19	20	24	25	29	30	34	35	39	40	44	45	49	50	54	55	59	60	64	65	69	70	9999	Total	85th % ile	Ave Speed
04/15/14	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	28	27
01:00	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	0	*	*
02:00	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	0	*	*
03:00	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	0	*	*
04:00	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	28	27
05:00	0	0	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	27	25
06:00	0	0	3	12	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	31	28
07:00	0	0	11	23	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	53	31	28
08:00	0	0	7	20	10	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	39	32	28
09:00	0	0	2	13	5	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23	33	29
10:00	0	0	1	2	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	33	29
11:00	0	0	2	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	29	26
12 PM	0	0	2	6	5	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	35	30
13:00	0	0	6	7	8	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	32	28
14:00	2	0	0	5	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	31	23
15:00	0	0	2	5	9	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	33	30
16:00	0	0	3	15	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	29	27
17:00	0	0	1	5	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	32	29
18:00	0	0	3	8	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	31	27
19:00	0	0	4	4	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	32	28
20:00	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	28	25
21:00	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	31	27
22:00	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	0	*	*
23:00	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	0	*	*
Total	2	0	52	139	83	12	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	290		
%	0.7%	0.0%	17.9%	47.9%	28.6%	4.1%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak			07:00	07:00	07:00	09:00																				07:00		
Vol.			11	23	19	3																				53		
PM Peak	14:00		13:00	16:00	15:00	12:00	12:00																			13:00		
Vol.	2		6	15	9	2	1																			22		

Stats  
 15th Percentile : 22 MPH  
 50th Percentile : 27 MPH  
 85th Percentile : 32 MPH  
 95th Percentile : 34 MPH

Mean Speed(Average) : 28 MPH  
 10 MPH Pace Speed : 23-32 MPH  
 Number in Pace : 209  
 Percent in Pace : 72.1%  
 Number of Vehicles > 25 MPH : 198  
 Percent of Vehicles > 25 MPH : 68.1%

Stoney Hill Road (West Access)  
 south of Hartford Turnpike (Route 20)  
 City, State: Shrewsbury, MA  
 Client: Tetra Tech Rizzo/ N. Doherty



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143843 D Speed  
 Site Code: TBA

NB

Start Time	14	15	19	20	24	25	29	30	34	35	39	40	44	45	49	50	54	55	59	60	64	65	69	70	9999	Total	85th % ile	Ave Speed	
04/16/																													
14	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	0	0	*	*
01:00	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	0	0	*	*
02:00	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	43	42	
03:00	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	0	*	*	
04:00	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	27	24	
05:00	0	0	1	4	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	32	28	
06:00	0	1	2	5	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	32	28		
07:00	0	0	3	12	21	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	34	30		
08:00	0	1	3	11	21	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	33	30		
09:00	0	0	2	8	5	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	32	29		
10:00	0	1	0	4	7	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	35	30		
11:00	0	0	1	4	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	32	29		
12 PM	2	0	0	2	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	33	23		
13:00	0	0	5	2	7	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	34	29		
14:00	0	0	3	2	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	33	29		
15:00	0	0	2	2	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	35	30		
16:00	0	0	4	6	13	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26	34	30		
17:00	1	0	0	13	6	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	34	29		
18:00	0	1	3	8	8	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23	34	29		
19:00	0	0	3	4	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	32	28		
20:00	0	1	3	4	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	31	25		
21:00	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	32	29		
22:00	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	33	32		
23:00	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	3	5	36	94	129	26	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	296				
%	1.0%	1.7%	12.2%	31.8%	43.6%	8.8%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%					
AM Peak		06:00	07:00	07:00	07:00	07:00	02:00																			07:00			
Vol.		1	3	12	21	4	1																			40			
PM Peak	12:00	18:00	13:00	17:00	16:00	17:00	16:00																			16:00			
Vol.	2	1	5	13	13	4	1																			26			

Stats  
 15th Percentile : 23 MPH  
 50th Percentile : 29 MPH  
 85th Percentile : 33 MPH  
 95th Percentile : 36 MPH

Mean Speed(Average) : 29 MPH  
 10 MPH Pace Speed : 25-34 MPH  
 Number in Pace : 201  
 Percent in Pace : 67.9%  
 Number of Vehicles > 25 MPH : 234  
 Percent of Vehicles > 25 MPH : 79.0%

Stoney Hill Road (West Access)  
 south of Hartford Turnpike (Route 20)  
 City, State: Shrewsbury, MA  
 Client: Tetra Tech Rizzo/ N. Doherty



PRECISION  
 D A T A  
 INDUSTRIES, LLC

P.O. Box 301 Berlin, MA 01503  
 Office: 508.481.3999 Fax: 508.545.1234  
 Email: datarequests@pdillc.com

143843 D Speed  
 Site Code: TBA

SB

Start Time	14	15	19	20	24	25	29	30	34	35	39	40	44	45	49	50	54	55	59	60	64	65	69	70	9999	Total	85th % ile	Ave Speed	
04/15/14	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	23	22	
01:00	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	0	*	*	
02:00	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	0	*	*	
03:00	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	0	*	*	
04:00	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	0	*	*	
05:00	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	32	27	
06:00	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	28	27	
07:00	0	0	3	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	32	28	
08:00	0	0	1	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	34	29	
09:00	0	0	0	8	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	29	28	
10:00	0	0	4	3	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	35	28	
11:00	0	0	4	8	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	30	27	
12 PM	0	0	2	10	4	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	34	29	
13:00	0	1	4	10	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	29	25	
14:00	0	1	3	8	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	31	27	
15:00	0	2	4	12	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	29	25	
16:00	1	0	4	17	9	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32	31	27	
17:00	0	0	8	17	8	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34	31	27	
18:00	0	1	8	16	12	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	39	32	28	
19:00	0	0	3	12	11	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27	32	29	
20:00	0	1	2	8	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	28	25	
21:00	0	0	1	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	32	29	
22:00	0	0	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	30	26	
23:00	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	27	24	
Total	1	6	56	142	73	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	289			
%	0.3%	2.1%	19.4%	49.1%	25.3%	3.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%				
AM Peak Vol.			10:00	09:00	07:00	10:00																					11:00		
PM Peak Vol.	16:00	15:00	17:00	16:00	18:00	12:00																					18:00		
	1	2	8	17	12	3																					39		

Stats

15th Percentile : 21 MPH  
 50th Percentile : 26 MPH  
 85th Percentile : 31 MPH  
 95th Percentile : 34 MPH

Mean Speed(Average) : 27 MPH  
 10 MPH Pace Speed : 23-32 MPH  
 Number in Pace : 206  
 Percent in Pace : 71.3%  
 Number of Vehicles > 25 MPH : 185  
 Percent of Vehicles > 25 MPH : 63.9%

Stoney Hill Road (West Access)  
 south of Hartford Turnpike (Route 20)  
 City, State: Shrewsbury, MA  
 Client: Tetra Tech Rizzo/ N. Doherty



PRECISION  
 D A T A  
 INDUSTRIES, LLC  
 P.O. Box 301 Berlin, MA 01503  
 Office: 508.481.3999 Fax: 508.545.1234  
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143843 D Speed  
 Site Code: TBA

SB

Start Time	14	15	19	20	24	25	29	30	34	35	39	40	44	45	49	50	54	55	59	60	64	65	69	70	9999	Total	85th % ile	Ave Speed
04/16/14	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	31	27
01:00	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	0	*	*
02:00	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	38	37
03:00	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	0	*	*
04:00	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	0	*	*
05:00	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	28	27
06:00	0	0	0	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	27	25
07:00	1	1	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	27	20
08:00	0	0	2	6	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	34	29
09:00	0	1	0	4	5	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	36	31
10:00	0	0	2	6	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	31	27
11:00	0	0	0	3	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	35	30
12 PM	0	1	3	4	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	32	26
13:00	0	0	1	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	33	30
14:00	0	0	2	14	6	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23	31	28
15:00	0	3	1	15	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31	31	27
16:00	0	0	3	13	6	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	33	29
17:00	0	0	6	23	12	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	44	32	28
18:00	0	0	6	23	12	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	44	32	28
19:00	1	1	1	11	11	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26	32	27
20:00	0	0	2	13	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	31	28
21:00	0	0	2	7	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	34	28
22:00	0	0	1	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	32	28
23:00	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	23	22
Total	2	7	38	154	87	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	312		
%	0.6%	2.2%	12.2%	49.4%	27.9%	7.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	07:00	07:00	06:00	08:00	09:00	09:00																				09:00		
Vol.	1	1	2	6	5	6																				16		
PM Peak	19:00	15:00	17:00	17:00	15:00	16:00																				17:00		
Vol.	1	3	6	23	12	3																				44		

Stats

15th Percentile : 22 MPH  
 50th Percentile : 27 MPH  
 85th Percentile : 32 MPH  
 95th Percentile : 35 MPH

Mean Speed(Average) : 28 MPH  
 10 MPH Pace Speed : 24-33 MPH  
 Number in Pace : 221  
 Percent in Pace : 70.8%  
 Number of Vehicles > 25 MPH : 220  
 Percent of Vehicles > 25 MPH : 70.5%

**Appendix B**  
**Traffic Volume Count Data**

## Massachusetts Highway Department 307: Monthly Hourly Volume for April 2012

**Location ID:** 307 **Seasonal Factor Group:** U3  
**County:** WORCESTER **Daily Factor Group:**  
**Functional Class:** 3 **Axle Factor Group:** U3  
**Location:** BOSTON WORCESTER TURNPIKE **Growth Factor Group:**

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	TOTAL	
1	534	335	218	98	85	160	392	690	990	1449	2161	2662	3367	3474	3389	3509	3167	2674	2303	1620	1209	852	583	418	36339	
2	207	108	119	118	239	760	2041	3410	3769	2849	2475	2656	3215	3114	3158	3621	3803	4171	3241	2390	1704	1285	869	567	49889	
3																										
4	288	139	174	110	229	781	2146	3524	3934	3242	2693	2942	3628	3314	3364	3759	4154	4259	3686	2651	2041	1536	997	663	54254	
5	297	170	163	148	229	765	2213	3540	3834	3001	2769	3179	3826	3361	3456	3675	4063	4125	3583	2698	2155	1558	1122	693	54623	
6	384	225	201	139	222	698	1856	3018	3485	3065	3088	3417	3734	3837	4044	4302	4320	4160	3594	2890	2258	1761	1268	951	56917	
7	575	289	188	139	148	276	733	1305	1935	2430	2744	2851	3226	3845	3883	3935	3654	3314	2974	2435	1884	1664	1124	925	46476	
8	502	234	166	95	90	123	368	502	709	1169	1826	2330	2782	2358	2098	2039	1942	1979	2093	2122	1630	1056	627	449	29289	
9	167	105	106	110	220	753	2079	3392	3790	2872	2593	2770	3202	3102	3248	3414	3925	4113	3174	2253	1699	1239	774	547	49647	
10	262	167	168	106	241	793	2225	3575	4016	3042	2597	2806	3251	3160	3310	3616	3945	4088	3458	2497	1716	1425	871	591	51926	
11	262	169	168	126	226	768	2113	3519	3861	2992	2593	2829	3473	3145	3270	3691	4113	4117	3516	2511	1987	1402	949	608	52408	
12	301	166	175	140	219	765	2166	3535	3918	3101	2723	3043	3615	3219	3227	3622	4000	4197	3415	2588	1915	1450	998	686	53184	
13	321	188	201	121	210	753	2015	3470	3592	3162	2819	3222	3503	3505	3610	3900	4032	3961	3600	2888	2199	1761	1241	943	55217	
14	460	308	201	127	144	352	789	1377	1911	2330	2878	3127	3378	3817	3698	3682	3334	3161	2838	2540	1977	1564	1180	903	46076	
15	451	242	206	112	91	160	463	718	1065	1494	2228	2884	3264	3217	3208	3358	3190	2742	2465	1955	1408	1041	643	504	37109	
16	266	165	116	123	233	640	1670	2697	3081	2684	2585	2881	3343	3113	3150	3300	3368	3587	2975	2186	1693	1244	841	524	46465	
17	268	146	147	132	212	731	2060	3315	3736	2821	2732	2914	3448	3245	3347	3576	3847	4098	3292	2517	1852	1441	941	642	51460	
18	334	177	139	134	215	746	1964	3278	3569	3143	2691	2961	3483	3357	3385	3788	3886	3944	3494	2505	1917	1398	1009	676	52193	
19	349	164	200	124	225	735	1989	3324	3667	3048	2765	3182	3707	3459	3348	3918	4022	3918	3455	2619	2009	1500	1039	654	53420	
20	308	187	200	107	218	681	1959	3123	3387	2970	2836	3346	3652	3617	3687	3770	3932	4105	3444	2891	2062	1739	1235	909	54365	
21	538	264	240	134	148	299	806	1301	1752	2239	2794	3160	3469	3679	3786	3475	3420	3292	2971	2665	2037	1705	1275	926	46375	
22	548	276	193	127	103	162	407	750	987	1432	2135	2735	3249	3374	3353	3155	2640	2224	1967	1536	1064	824	548	480	34269	
23	211	108	116	99	242	703	1952	3190	3495	2807	2365	2687	3262	3022	3207	3419	3897	4162	3267	2306	1681	1268	753	546	48765	
24	240	136	142	105	231	824	2264	3544	3898	3004	2606	2784	3419	3260	3188	3597	3935	3890	3476	2445	1900	1451	939	585	51863	
25	307	149	143	134	233	768	2167	3571	3930	2993	2654	2953	3485	3202	3342	3706	3987	4118	3526	2676	1786	1438	999	629	52896	
26	324	170	178	116	227	824	2241	3602	3659	3195	2709	3101	3609	3430	3453	3811	4102	4099	3618	2511	1946	1553	1025	701	54204	
27	322	202	182	149	244	726	2084	3481	3736	2900	2940	3338	3817	3624	3727	3971	4149	4098	3786	2919	2217	1745	1323	1079	56759	
28	538	268	195	118	138	313	767	1405	1997	2451	2926	3103	3496	3872	3870	3862	3671	3377	3130	2555	1902	1680	1236	1326	48196	
29	538	284	199	116	90	174	419	741	1135	1611	2296	2920	3335	3279	3507	3447	3076	2864	2375	1770	1430	943	655	735	37939	
30																										

Source: <http://mhd.ms2soft.com/tcdfs/tsearch.asp?loc=Mhd&mod=tcdfs>

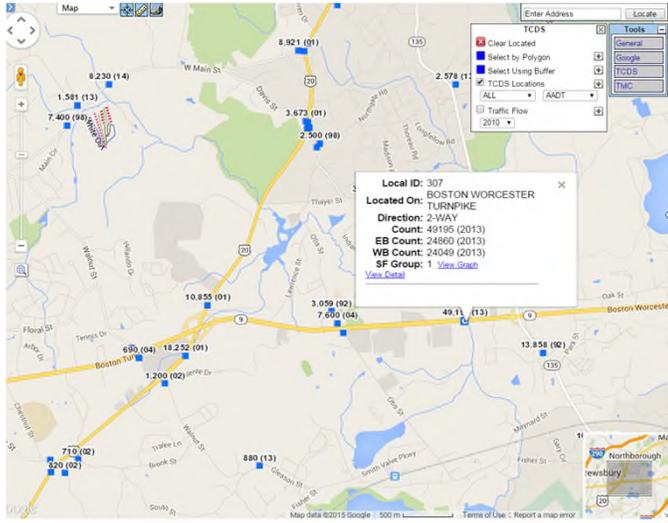
April MADT	
Sat. Ave.	47016
Sun. Ave.	34459
Mon. Ave.	49434
Tues. Ave.	51750
Wed. Ave.	52938
Thurs. Ave.	53858
Fri. Ave.	55815
<b>Monthly Ave.</b>	<b>49324</b>

**AADT MassDC 49008**

No Adjustment Required



**Growth Rate Calculation**  
 Station 307 - Route 9, east of Northborough



Growth Rate Calc.	
2008	48,288
2012	49,008
years	4
Annual	0.37%

2008 358 counts

Transportation Data Management System

Location: 307 - Year: 2008

Total Counts: 358

Select Year: 2008

Directions: 2-WAY

AAADT = 48,288

Transportation Data Management System

Location ID	307	MPO ID	
Type	SPOT	HPMS ID	32801101350
On NHS		On HPMS	Yes
LRS ID		LRS Loc Pt.	
SF Group	U3	Route Type	
AF Group	U3	Route	
GF Group	U3		
QC Group	Perm		
Functl Class	(3) Rural minor arterial or urban principal arterial	Milepost	
Located On	BOSTON WORCESTER TURNPIKE		
Loc On Alias	EAST OF NORTHBOROUGH		

Year	AAADT	DHV-30	K %	D %	PA	BC	Src
2008	48,288						
2007	49,742						
2006	48,028						
2005	50,569						
2004	51,457						

2012 344 counts

Transportation Data Management System

Location: 307 - Year: 2012

Total Counts: 344

Select Year: 2012

Directions: 2-WAY

AAADT = 49,008

Transportation Data Management System

Location ID	307	MPO ID	
Type	SPOT	HPMS ID	32801101350
On NHS		On HPMS	Yes
LRS ID		LRS Loc Pt.	
SF Group	U3	Route Type	
AF Group	U3	Route	
GF Group	U3		
QC Group	Perm		
Functl Class	(3) Rural minor arterial or urban principal arterial	Milepost	
Located On	BOSTON WORCESTER TURNPIKE		
Loc On Alias	EAST OF NORTHBOROUGH		

Year	AAADT	DHV-30	K %	D %	PA	BC	Src
2013	49,195	4,259	9	56			
2012	49,008	4,234	9	55			
2011	48,234	4,274	9	58			
2010	48,089						
2009	44,001	4,064	9	57			

Hartford Turnpike (Route 20)  
 east of Stoney Hill Road (West Access)  
 City, State: Shrewsbury, MA  
 Client: Tetra Tech Rizzo/ N. Doherty



PRECISION  
 D A T A  
 INDUSTRIES, LLC  
 P.O. Box 301 Berlin, MA 01503  
 Office: 508.481.3999 Fax: 508.545.1234  
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143843 B Volume  
 Site Code: TBA

Start Time	WB		EB		Combin ed		15-Apr-14 Tue			
	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.				
12:00	32	178	22	142	54	320				
12:15	20	157	19	134	39	291				
12:30	25	179	20	146	45	325				
12:45	18	154	8	69	26	322	1258			
01:00	13	167	10	137	23	304				
01:15	18	166	11	156	29	322				
01:30	13	152	14	143	27	295				
01:45	9	163	13	48	162	325	1246			
02:00	13	156	12	121	25	277				
02:15	8	194	16	161	24	355				
02:30	10	159	16	176	26	335				
02:45	16	170	18	62	163	333	1300			
03:00	8	201	11	140	19	341				
03:15	9	244	12	119	21	363				
03:30	6	263	21	147	27	410				
03:45	8	274	24	68	142	416	1530			
04:00	4	259	21	128	25	387				
04:15	16	258	28	149	44	407				
04:30	14	256	41	157	55	413				
04:45	11	258	40	130	164	422	1629			
05:00	15	280	47	163	62	443				
05:15	20	275	74	169	94	444				
05:30	37	302	105	139	142	441				
05:45	26	231	147	373	155	386	1714			
06:00	62	213	129	120	191	333				
06:15	70	214	159	129	229	343				
06:30	75	198	241	88	316	286				
06:45	86	160	326	855	104	412	1148	1226		
07:00	101	137	242	95	343	232				
07:15	119	151	286	79	405	230				
07:30	130	146	322	78	452	224				
07:45	142	118	326	1176	69	468	1668	187	873	
08:00	106	135	324	68	430	203				
08:15	120	119	283	62	403	181				
08:30	123	116	302	55	425	171				
08:45	122	93	271	1180	53	393	1651	146	701	
09:00	152	121	207	40	359	161				
09:15	123	93	204	45	327	138				
09:30	126	76	163	39	289	115				
09:45	121	67	194	768	47	315	1290	114	528	
10:00	92	77	177	26	269	103				
10:15	125	67	151	29	276	96				
10:30	129	46	154	40	283	86				
10:45	133	35	151	633	35	284	1112	70	355	
11:00	132	44	129	35	261	79				
11:15	159	62	162	22	321	84				
11:30	161	39	149	26	310	65				
11:45	149	45	140	580	23	289	1181	68	296	
Total	3227	7668	5942	4988	9169	12656				
Percent	35.2%	60.6%	64.8%	39.4%						
Day Total		10895		10930		21825				
Peak	11:00	-	04:45	-	07:15	-	04:45	-	-	-
Vol.	601	-	1115	-	1258	-	653	-	1755	-
P.H.F.	0.933	-	0.923	-	0.965	-	0.928	-	0.938	-

Hartford Turnpike (Route 20)  
 east of Stoney Hill Road (West Access)  
 City, State: Shrewsbury, MA  
 Client: Tetra Tech Rizzo/ N. Doherty



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143843 B Volume  
 Site Code: TBA

Start Time	WB		EB		Combin ed		16-Apr-14 Wed
	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	
12:00	33	175	20	176	53	351	
12:15	25	162	11	171	36	333	
12:30	21	180	18	168	39	348	
12:45	16	162	10	159	26	321	1353
01:00	12	182	10	143	22	325	
01:15	9	183	6	170	15	353	
01:30	15	170	12	173	27	343	
01:45	9	177	14	171	23	348	1369
02:00	7	179	13	151	20	330	
02:15	9	201	13	161	22	362	
02:30	8	198	13	195	21	393	
02:45	6	204	21	183	27	387	1472
03:00	6	209	8	149	14	358	
03:15	4	230	12	165	16	395	
03:30	8	264	16	164	24	428	
03:45	9	246	23	173	32	419	1600
04:00	7	278	30	140	37	418	
04:15	7	262	24	166	31	428	
04:30	11	283	37	153	48	436	
04:45	14	295	41	168	55	463	1745
05:00	14	319	49	174	63	493	
05:15	20	289	71	176	91	465	
05:30	32	267	106	168	138	435	
05:45	36	265	143	173	179	438	1831
06:00	48	250	134	185	182	435	
06:15	52	233	165	138	217	371	
06:30	73	199	257	144	330	343	
06:45	83	181	298	122	381	303	1452
07:00	96	181	317	120	413	301	
07:15	99	198	318	96	417	294	
07:30	138	171	370	80	508	251	
07:45	138	149	333	1338	96	245	1091
08:00	153	172	350	76	503	248	
08:15	100	186	296	73	396	259	
08:30	65	120	233	52	298	172	
08:45	62	113	194	1073	54	167	846
09:00	61	133	160	61	221	194	
09:15	61	109	220	58	281	167	
09:30	101	99	281	55	382	154	
09:45	99	74	249	910	44	118	633
10:00	139	77	232	39	371	116	
10:15	160	58	194	30	354	88	
10:30	160	61	192	41	352	102	
10:45	162	69	185	803	52	121	427
11:00	157	55	181	32	338	87	
11:15	165	60	179	22	344	82	
11:30	176	44	160	32	336	76	
11:45	155	39	165	685	17	56	301
Total	3041	8411	6384	5709	9425	14120	
Percent	32.3%	59.6%	67.7%	40.4%			
Day Total		11452		12093		23545	
Peak	10:45	-	04:30	-	07:15	-	04:30
Vol.	660	-	1186	-	1371	-	1857
P.H.F.	0.938	-	0.929	-	0.926	-	0.942



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N/S: Driveway/ Stoney Hill Road (West)  
E/W: Hartford Turnpike (Route 20)  
City, State: Shrewsbury, MA  
Client: Tetra Tech Rizzo/ N. Landron

File Name : 144157 A  
Site Code : TBA  
Start Date : 11/6/2014  
Page No : 1

Groups Printed- Cars - Heavy Vehicles

Start Time	Driveway From North				Hartford Turnpike (Route 20) From East				Stoney Hill Road (West) From South				Hartford Turnpike (Route 20) From West				Int. Total
	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	
07:00 AM	1	0	0	0	1	108	0	0	3	0	8	0	2	290	9	0	422
07:15 AM	1	0	0	0	1	122	0	0	6	0	9	0	4	306	6	0	455
07:30 AM	0	0	0	0	2	122	0	0	9	0	9	0	3	334	6	0	485
07:45 AM	0	0	0	0	3	127	0	0	5	0	4	0	2	361	10	0	512
Total	2	0	0	0	7	479	0	0	23	0	30	0	11	1291	31	0	1874
08:00 AM	0	0	0	0	4	133	0	0	3	0	8	0	2	357	17	0	524
08:15 AM	1	0	0	0	4	160	0	0	5	0	10	0	2	322	9	0	513
08:30 AM	0	0	0	0	4	154	0	0	1	0	6	0	1	302	6	0	474
08:45 AM	1	0	0	0	4	146	0	0	4	0	4	0	1	249	4	0	413
Total	2	0	0	0	16	593	0	0	13	0	28	0	6	1230	36	0	1924
Grand Total	4	0	0	0	23	1072	0	0	36	0	58	0	17	2521	67	0	3798
Apprch %	100	0	0	0	2.1	97.9	0	0	38.3	0	61.7	0	0.7	96.8	2.6	0	
Total %	0.1	0	0	0	0.6	28.2	0	0	0.9	0	1.5	0	0.4	66.4	1.8	0	
Cars	4	0	0	0	19	926	0	0	35	0	58	0	12	2339	62	0	3455
% Cars	100	0	0	0	82.6	86.4	0	0	97.2	0	100	0	70.6	92.8	92.5	0	91
Heavy Vehicles	0	0	0	0	4	146	0	0	1	0	0	0	5	182	5	0	343
% Heavy Vehicles	0	0	0	0	17.4	13.6	0	0	2.8	0	0	0	29.4	7.2	7.5	0	9

Start Time	Driveway From North					Hartford Turnpike (Route 20) From East					Stoney Hill Road (West) From South					Hartford Turnpike (Route 20) From West					Int. Total
	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	0	0	0	0	0	2	122	0	0	124	9	0	9	0	18	3	334	6	0	343	485
07:45 AM	0	0	0	0	0	3	127	0	0	130	5	0	4	0	9	2	361	10	0	373	512
08:00 AM	0	0	0	0	0	4	133	0	0	137	3	0	8	0	11	2	357	17	0	376	524
08:15 AM	1	0	0	0	1	4	160	0	0	164	5	0	10	0	15	2	322	9	0	333	513
Total Volume	1	0	0	0	1	13	542	0	0	555	22	0	31	0	53	9	1374	42	0	1425	2034
% App. Total	100	0	0	0		2.3	97.7	0	0		41.5	0	58.5	0		0.6	96.4	2.9	0		
PHF	.250	.000	.000	.000	.250	.813	.847	.000	.000	.846	.611	.000	.775	.000	.736	.750	.952	.618	.000	.947	.970
Cars	1	0	0	0	1	12	466	0	0	478	21	0	31	0	52	7	1273	38	0	1318	1849
% Cars	100	0	0	0	100	92.3	86.0	0	0	86.1	95.5	0	100	0	98.1	77.8	92.6	90.5	0	92.5	90.9
Heavy Vehicles	0	0	0	0	0	1	76	0	0	77	1	0	0	0	1	2	101	4	0	107	185
% Heavy Vehicles	0	0	0	0	0	7.7	14.0	0	0	13.9	4.5	0	0	0	1.9	22.2	7.4	9.5	0	7.5	9.1



PRECISION  
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N/S: Driveway/ Stoney Hill Road (West)  
E/W: Hartford Turnpike (Route 20)  
City, State: Shrewsbury, MA  
Client: Tetra Tech Rizzo/ N. Landron

File Name : 144157 A  
Site Code : TBA  
Start Date : 11/6/2014  
Page No : 1

Groups Printed- Cars

Start Time	Driveway From North				Hartford Turnpike (Route 20) From East				Stoney Hill Road (West) From South				Hartford Turnpike (Route 20) From West				Int. Total
	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	
07:00 AM	1	0	0	0	1	96	0	0	3	0	8	0	1	279	9	0	398
07:15 AM	1	0	0	0	0	108	0	0	6	0	9	0	2	288	6	0	420
07:30 AM	0	0	0	0	1	109	0	0	8	0	9	0	3	309	6	0	445
07:45 AM	0	0	0	0	3	108	0	0	5	0	4	0	2	336	10	0	468
Total	2	0	0	0	5	421	0	0	22	0	30	0	8	1212	31	0	1731
08:00 AM	0	0	0	0	4	118	0	0	3	0	8	0	1	327	14	0	475
08:15 AM	1	0	0	0	4	131	0	0	5	0	10	0	1	301	8	0	461
08:30 AM	0	0	0	0	3	133	0	0	1	0	6	0	1	278	6	0	428
08:45 AM	1	0	0	0	3	123	0	0	4	0	4	0	1	221	3	0	360
Total	2	0	0	0	14	505	0	0	13	0	28	0	4	1127	31	0	1724
Grand Total	4	0	0	0	19	926	0	0	35	0	58	0	12	2339	62	0	3455
Apprch %	100	0	0	0	2	98	0	0	37.6	0	62.4	0	0.5	96.9	2.6	0	
Total %	0.1	0	0	0	0.5	26.8	0	0	1	0	1.7	0	0.3	67.7	1.8	0	

Start Time	Driveway From North					Hartford Turnpike (Route 20) From East					Stoney Hill Road (West) From South					Hartford Turnpike (Route 20) From West					Int. Total
	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	0	0	0	0	0	1	109	0	0	110	8	0	9	0	17	3	309	6	0	318	445
07:45 AM	0	0	0	0	0	3	108	0	0	111	5	0	4	0	9	2	336	10	0	348	468
08:00 AM	0	0	0	0	0	4	118	0	0	122	3	0	8	0	11	1	327	14	0	342	475
08:15 AM	1	0	0	0	1	4	131	0	0	135	5	0	10	0	15	1	301	8	0	310	461
Total Volume	1	0	0	0	1	12	466	0	0	478	21	0	31	0	52	7	1273	38	0	1318	1849
% App. Total	100	0	0	0		2.5	97.5	0	0		40.4	0	59.6	0		0.5	96.6	2.9	0		
PHF	.250	.000	.000	.000	.250	.750	.889	.000	.000	.885	.656	.000	.775	.000	.765	.583	.947	.679	.000	.947	.973



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E/W: Hartford Turnpike (Route 20)  
City, State: Shrewsbury, MA  
Client: Tetra Tech Rizzo/ N. Landron

File Name : 144157 A  
Site Code : TBA  
Start Date : 11/6/2014  
Page No : 1

Groups Printed- Heavy Vehicles

Start Time	Driveway From North				Hartford Turnpike (Route 20) From East				Stoney Hill Road (West) From South				Hartford Turnpike (Route 20) From West				Int. Total
	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	
07:00 AM	0	0	0	0	0	12	0	0	0	0	0	0	1	11	0	0	24
07:15 AM	0	0	0	0	1	14	0	0	0	0	0	0	2	18	0	0	35
07:30 AM	0	0	0	0	1	13	0	0	1	0	0	0	0	25	0	0	40
07:45 AM	0	0	0	0	0	19	0	0	0	0	0	0	0	25	0	0	44
Total	0	0	0	0	2	58	0	0	1	0	0	0	3	79	0	0	143
08:00 AM	0	0	0	0	0	15	0	0	0	0	0	0	1	30	3	0	49
08:15 AM	0	0	0	0	0	29	0	0	0	0	0	0	1	21	1	0	52
08:30 AM	0	0	0	0	1	21	0	0	0	0	0	0	0	24	0	0	46
08:45 AM	0	0	0	0	1	23	0	0	0	0	0	0	0	28	1	0	53
Total	0	0	0	0	2	88	0	0	0	0	0	0	2	103	5	0	200
Grand Total	0	0	0	0	4	146	0	0	1	0	0	0	5	182	5	0	343
Apprch %	0	0	0	0	2.7	97.3	0	0	100	0	0	0	2.6	94.8	2.6	0	
Total %	0	0	0	0	1.2	42.6	0	0	0.3	0	0	0	1.5	53.1	1.5	0	

Start Time	Driveway From North					Hartford Turnpike (Route 20) From East					Stoney Hill Road (West) From South					Hartford Turnpike (Route 20) From West					Int. Total
	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 08:00 AM																					
08:00 AM	0	0	0	0	0	0	15	0	0	15	0	0	0	0	0	<b>1</b>	<b>30</b>	<b>3</b>	0	<b>34</b>	49
08:15 AM	0	0	0	0	0	0	<b>29</b>	0	0	<b>29</b>	0	0	0	0	0	1	21	1	0	23	52
08:30 AM	0	0	0	0	0	<b>1</b>	21	0	0	22	0	0	0	0	0	0	24	0	0	24	46
08:45 AM	0	0	0	0	0	1	23	0	0	24	0	0	0	0	0	0	28	1	0	29	<b>53</b>
Total Volume	0	0	0	0	0	2	88	0	0	90	0	0	0	0	0	2	103	5	0	110	200
% App. Total	0	0	0	0	0	2.2	97.8	0	0		0	0	0	0	0	1.8	93.6	4.5	0		
PHF	.000	.000	.000	.000	.000	.500	.759	.000	.000	.776	.000	.000	.000	.000	.000	.500	.858	.417	.000	.809	.943



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City, State: Shrewsbury, MA  
Client: Tetra Tech Rizzo/ N. Landron

File Name : 144157 A  
Site Code : TBA  
Start Date : 11/6/2014  
Page No : 1

Groups Printed- Peds and Bicycles

Start Time	Driveway From North					Hartford Turnpike (Route 20) From East					Stoney Hill Road (West) From South					Hartford Turnpike (Route 20) From West					Int. Total
	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	
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
Grand Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apprch %	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total %																					

Start Time	Driveway From North						Hartford Turnpike (Route 20) From East						Stoney Hill Road (West) From South						Hartford Turnpike (Route 20) From West						Int. Total			
	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				
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																												
Peak Hour for Entire Intersection Begins at 07:00 AM																												
07:00 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	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	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	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	0	0	0	0	0	0	0
Total Volume	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	0	0	0
% App. Total	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	0	0	0
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000



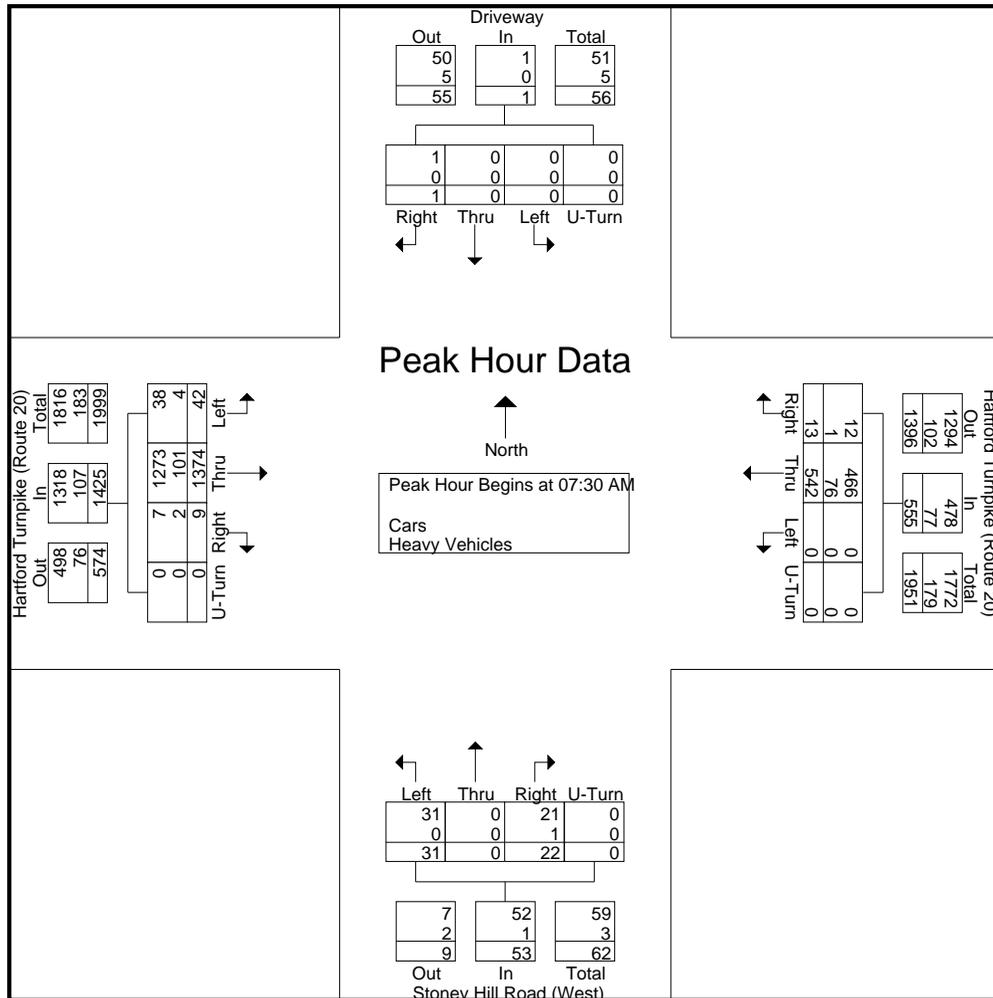
PRECISION  
D A T A  
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P.O. Box 301 Berlin, MA 01503  
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Email: datarequests@pdillc.com

N/S: Driveway/ Stoney Hill Road (West)  
E/W: Hartford Turnpike (Route 20)  
City, State: Shrewsbury, MA  
Client: Tetra Tech Rizzo/ N. Landron

File Name : 144157 A  
Site Code : TBA  
Start Date : 11/6/2014  
Page No : 1

Start Time	Driveway From North					Hartford Turnpike (Route 20) From East					Stoney Hill Road (West) From South					Hartford Turnpike (Route 20) From West					Int. Total
	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	0	0	0	0	0	2	122	0	0	124	9	0	9	0	18	3	334	6	0	343	485
07:45 AM	0	0	0	0	0	3	127	0	0	130	5	0	4	0	9	2	361	10	0	373	512
08:00 AM	0	0	0	0	0	4	133	0	0	137	3	0	8	0	11	2	357	17	0	376	524
08:15 AM	1	0	0	0	1	4	160	0	0	164	5	0	10	0	15	2	322	9	0	333	513
Total Volume	1	0	0	0	1	13	542	0	0	555	22	0	31	0	53	9	1374	42	0	1425	2034
% App. Total	100	0	0	0	0	2.3	97.7	0	0	0	41.5	0	58.5	0	0	0.6	96.4	2.9	0	0	0
PHF	.250	.000	.000	.000	.250	.813	.847	.000	.000	.846	.611	.000	.775	.000	.736	.750	.952	.618	.000	.947	.970
Cars	1	0	0	0	1	12	466	0	0	478	21	0	31	0	52	7	1273	38	0	1318	1849
% Cars	100	0	0	0	100	92.3	86.0	0	0	86.1	95.5	0	100	0	98.1	77.8	92.6	90.5	0	92.5	90.9
Heavy Vehicles	0	0	0	0	0	1	76	0	0	77	1	0	0	0	1	2	101	4	0	107	185
% Heavy Vehicles	0	0	0	0	0	7.7	14.0	0	0	13.9	4.5	0	0	0	1.9	22.2	7.4	9.5	0	7.5	9.1





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N/S: Driveway/ Stoney Hill Road (West)  
E/W: Hartford Turnpike (Route 20)  
City, State: Shrewsbury, MA  
Client: Tetra Tech Rizzo/ N. Landron

File Name : 144157 AA  
Site Code : TBA  
Start Date : 11/6/2014  
Page No : 1

Groups Printed- Cars - Heavy Vehicles

Start Time	Driveway From North				Hartford Turnpike (Route 20) From East				Stoney Hill Road (West) From South				Hartford Turnpike (Route 20) From West				Int. Total
	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	
04:00 PM	0	0	0	0	1	257	2	0	0	0	0	0	6	164	1	0	431
04:15 PM	0	0	0	0	2	274	1	0	1	0	2	0	4	156	3	0	443
04:30 PM	0	0	0	0	0	277	0	0	0	0	3	0	5	155	4	0	444
04:45 PM	1	0	0	0	2	238	1	0	1	0	3	0	4	147	1	0	398
Total	1	0	0	0	5	1046	4	0	2	0	8	0	19	622	9	0	1716
05:00 PM	0	0	0	0	2	279	0	0	1	0	1	0	6	185	2	0	476
05:15 PM	2	0	0	0	0	320	4	0	4	0	2	0	7	147	1	0	487
05:30 PM	0	0	0	0	1	266	2	0	1	0	4	0	5	183	3	0	465
05:45 PM	0	0	0	0	0	254	1	0	0	0	2	0	16	144	0	0	417
Total	2	0	0	0	3	1119	7	0	6	0	9	0	34	659	6	0	1845
Grand Total	3	0	0	0	8	2165	11	0	8	0	17	0	53	1281	15	0	3561
Apprch %	100	0	0	0	0.4	99.1	0.5	0	32	0	68	0	3.9	95	1.1	0	
Total %	0.1	0	0	0	0.2	60.8	0.3	0	0.2	0	0.5	0	1.5	36	0.4	0	
Cars	1	0	0	0	6	2105	10	0	8	0	16	0	53	1181	11	0	3391
% Cars	33.3	0	0	0	75	97.2	90.9	0	100	0	94.1	0	100	92.2	73.3	0	95.2
Heavy Vehicles	2	0	0	0	2	60	1	0	0	0	1	0	0	100	4	0	170
% Heavy Vehicles	66.7	0	0	0	25	2.8	9.1	0	0	0	5.9	0	0	7.8	26.7	0	4.8

Start Time	Driveway From North					Hartford Turnpike (Route 20) From East					Stoney Hill Road (West) From South					Hartford Turnpike (Route 20) From West					Int. Total
	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	0	0	0	0	0	2	279	0	0	281	1	0	1	0	2	6	<b>185</b>	2	0	<b>193</b>	476
05:15 PM	2	0	0	0	2	0	<b>320</b>	4	0	<b>324</b>	4	0	2	0	6	7	147	1	0	155	<b>487</b>
05:30 PM	0	0	0	0	0	1	266	2	0	269	1	0	4	0	5	5	183	3	0	191	465
05:45 PM	0	0	0	0	0	0	254	1	0	255	0	0	2	0	2	<b>16</b>	144	0	0	160	417
Total Volume	2	0	0	0	2	3	1119	7	0	1129	6	0	9	0	15	34	659	6	0	699	1845
% App. Total	100	0	0	0		0.3	99.1	0.6	0		40	0	60	0		4.9	94.3	0.9	0		
PHF	.250	.000	.000	.000	.250	.375	.874	.438	.000	.871	.375	.000	.563	.000	.625	.531	.891	.500	.000	.905	.947
Cars	0	0	0	0	0	2	1094	7	0	1103	6	0	9	0	15	34	611	4	0	649	1767
% Cars	0	0	0	0	0	66.7	97.8	100	0	97.7	100	0	100	0	100	100	92.7	66.7	0	92.8	95.8
Heavy Vehicles	2	0	0	0	2	1	25	0	0	26	0	0	0	0	0	0	48	2	0	50	78
% Heavy Vehicles	100	0	0	0	100	33.3	2.2	0	0	2.3	0	0	0	0	0	0	7.3	33.3	0	7.2	4.2



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N/S: Driveway/ Stoney Hill Road (West)  
E/W: Hartford Turnpike (Route 20)  
City, State: Shrewsbury, MA  
Client: Tetra Tech Rizzo/ N. Landron

File Name : 144157 AA  
Site Code : TBA  
Start Date : 11/6/2014  
Page No : 1

Groups Printed- Cars

Start Time	Driveway From North				Hartford Turnpike (Route 20) From East				Stoney Hill Road (West) From South				Hartford Turnpike (Route 20) From West				Int. Total
	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	
04:00 PM	0	0	0	0	1	246	1	0	0	0	0	0	6	148	1	0	403
04:15 PM	0	0	0	0	1	262	1	0	1	0	2	0	4	143	3	0	417
04:30 PM	0	0	0	0	0	270	0	0	0	0	3	0	5	143	3	0	424
04:45 PM	1	0	0	0	2	233	1	0	1	0	2	0	4	136	0	0	380
Total	1	0	0	0	4	1011	3	0	2	0	7	0	19	570	7	0	1624
05:00 PM	0	0	0	0	1	266	0	0	1	0	1	0	6	172	2	0	449
05:15 PM	0	0	0	0	0	315	4	0	4	0	2	0	7	136	0	0	468
05:30 PM	0	0	0	0	1	263	2	0	1	0	4	0	5	173	2	0	451
05:45 PM	0	0	0	0	0	250	1	0	0	0	2	0	16	130	0	0	399
Total	0	0	0	0	2	1094	7	0	6	0	9	0	34	611	4	0	1767
Grand Total	1	0	0	0	6	2105	10	0	8	0	16	0	53	1181	11	0	3391
Apprch %	100	0	0	0	0.3	99.2	0.5	0	33.3	0	66.7	0	4.3	94.9	0.9	0	
Total %	0	0	0	0	0.2	62.1	0.3	0	0.2	0	0.5	0	1.6	34.8	0.3	0	

Start Time	Driveway From North					Hartford Turnpike (Route 20) From East					Stoney Hill Road (West) From South					Hartford Turnpike (Route 20) From West					Int. Total
	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	0	0	0	0	0	1	266	0	0	267	1	0	1	0	2	6	172	2	0	180	449
05:15 PM	0	0	0	0	0	0	315	4	0	319	4	0	2	0	6	7	136	0	0	143	468
05:30 PM	0	0	0	0	0	1	263	2	0	266	1	0	4	0	5	5	173	2	0	180	451
05:45 PM	0	0	0	0	0	0	250	1	0	251	0	0	2	0	2	16	130	0	0	146	399
Total Volume	0	0	0	0	0	2	1094	7	0	1103	6	0	9	0	15	34	611	4	0	649	1767
% App. Total	0	0	0	0	0	0.2	99.2	0.6	0		40	0	60	0		5.2	94.1	0.6	0		
PHF	.000	.000	.000	.000	.000	.500	.868	.438	.000	.864	.375	.000	.563	.000	.625	.531	.883	.500	.000	.901	.944



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N/S: Driveway/ Stoney Hill Road (West)  
E/W: Hartford Turnpike (Route 20)  
City, State: Shrewsbury, MA  
Client: Tetra Tech Rizzo/ N. Landron

File Name : 144157 AA  
Site Code : TBA  
Start Date : 11/6/2014  
Page No : 1

Groups Printed- Heavy Vehicles

Start Time	Driveway From North				Hartford Turnpike (Route 20) From East				Stoney Hill Road (West) From South				Hartford Turnpike (Route 20) From West				Int. Total
	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	
04:00 PM	0	0	0	0	0	11	1	0	0	0	0	0	0	16	0	0	28
04:15 PM	0	0	0	0	1	12	0	0	0	0	0	0	0	13	0	0	26
04:30 PM	0	0	0	0	0	7	0	0	0	0	0	0	0	12	1	0	20
04:45 PM	0	0	0	0	0	5	0	0	0	0	1	0	0	11	1	0	18
Total	0	0	0	0	1	35	1	0	0	0	1	0	0	52	2	0	92
05:00 PM	0	0	0	0	1	13	0	0	0	0	0	0	0	13	0	0	27
05:15 PM	2	0	0	0	0	5	0	0	0	0	0	0	0	11	1	0	19
05:30 PM	0	0	0	0	0	3	0	0	0	0	0	0	0	10	1	0	14
05:45 PM	0	0	0	0	0	4	0	0	0	0	0	0	0	14	0	0	18
Total	2	0	0	0	1	25	0	0	0	0	0	0	0	48	2	0	78
Grand Total	2	0	0	0	2	60	1	0	0	0	1	0	0	100	4	0	170
Apprch %	100	0	0	0	3.2	95.2	1.6	0	0	0	100	0	0	96.2	3.8	0	
Total %	1.2	0	0	0	1.2	35.3	0.6	0	0	0	0.6	0	0	58.8	2.4	0	

Start Time	Driveway From North					Hartford Turnpike (Route 20) From East					Stoney Hill Road (West) From South					Hartford Turnpike (Route 20) From West					Int. Total
	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:00 PM																					
04:00 PM	0	0	0	0	0	0	11	<b>1</b>	0	12	0	0	0	0	0	0	<b>16</b>	0	0	<b>16</b>	<b>28</b>
04:15 PM	0	0	0	0	0	<b>1</b>	<b>12</b>	0	0	<b>13</b>	0	0	0	0	0	0	13	0	0	13	26
04:30 PM	0	0	0	0	0	0	7	0	0	7	0	0	0	0	0	0	12	<b>1</b>	0	13	20
04:45 PM	0	0	0	0	0	0	5	0	0	5	0	0	<b>1</b>	0	<b>1</b>	0	11	1	0	12	18
Total Volume	0	0	0	0	0	1	35	1	0	37	0	0	1	0	1	0	52	2	0	54	92
% App. Total	0	0	0	0	0	2.7	94.6	2.7	0		0	0	100	0		0	96.3	3.7	0		
PHF	.000	.000	.000	.000	.000	.250	.729	.250	.000	.712	.000	.000	.250	.000	.250	.000	.813	.500	.000	.844	.821



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City, State: Shrewsbury, MA  
Client: Tetra Tech Rizzo/ N. Landron

File Name : 144157 AA  
Site Code : TBA  
Start Date : 11/6/2014  
Page No : 1

Groups Printed- Peds and Bicycles

Start Time	Driveway From North					Hartford Turnpike (Route 20) From East					Stoney Hill Road (West) From South					Hartford Turnpike (Route 20) From West					Int. Total
	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	
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	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
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	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
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	0
Total %	0	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Start Time	Driveway From North						Hartford Turnpike (Route 20) From East						Stoney Hill Road (West) From South						Hartford Turnpike (Route 20) From West						Int. Total					
	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						
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																														
Peak Hour for Entire Intersection Begins at 04:30 PM																														
04:30 PM	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	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	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	0	0	0	0	0	0	0	0	
05:15 PM	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	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	0	0	0	0	1	
% App. Total	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	.000	.000	.000	.250	.250	

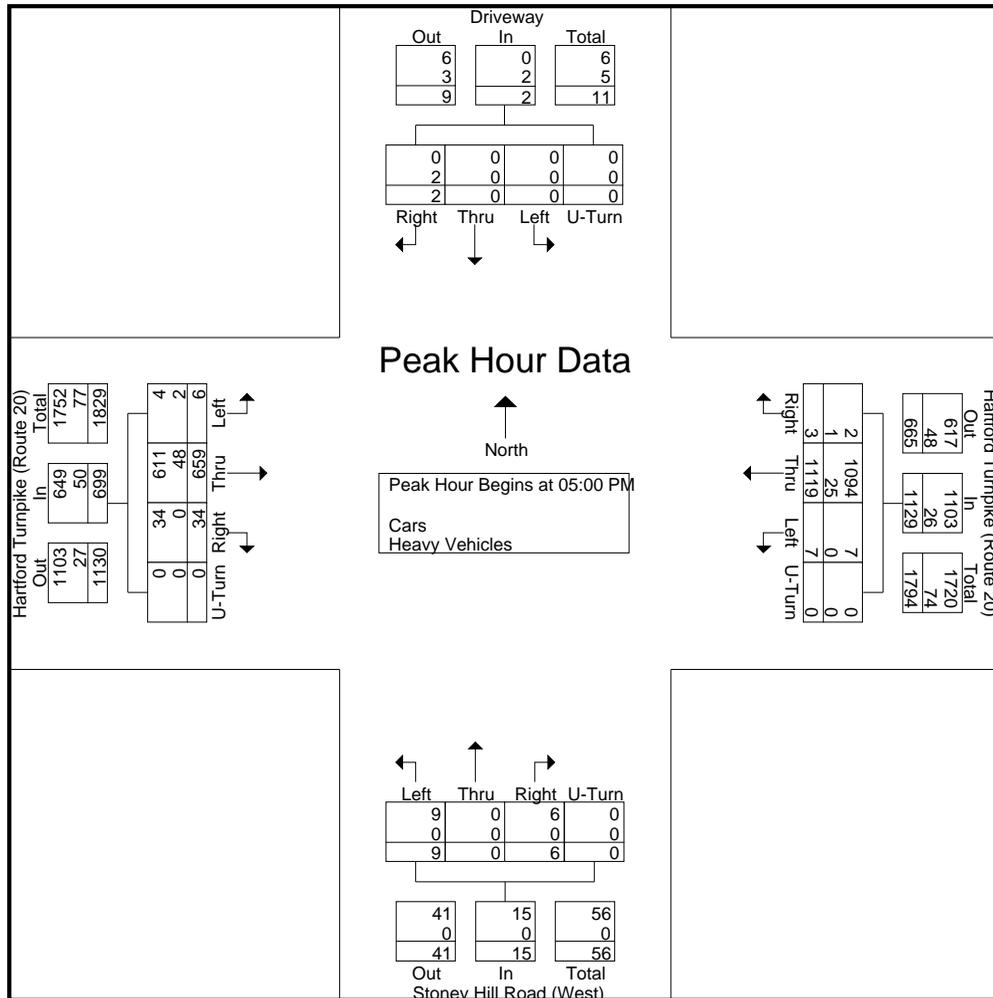


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Page No : 1

Start Time	Driveway From North					Hartford Turnpike (Route 20) From East					Stoney Hill Road (West) From South					Hartford Turnpike (Route 20) From West					Int. Total
	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	0	0	0	0	0	2	279	0	0	281	1	0	1	0	2	6	185	2	0	193	476
05:15 PM	2	0	0	0	2	0	320	4	0	324	4	0	2	0	6	7	147	1	0	155	487
05:30 PM	0	0	0	0	0	1	266	2	0	269	1	0	4	0	5	5	183	3	0	191	465
05:45 PM	0	0	0	0	0	0	254	1	0	255	0	0	2	0	2	16	144	0	0	160	417
Total Volume	2	0	0	0	2	3	1119	7	0	1129	6	0	9	0	15	34	659	6	0	699	1845
% App. Total	100	0	0	0	0	0.3	99.1	0.6	0	0	40	0	60	0	0	4.9	94.3	0.9	0	0	
PHF	.250	.000	.000	.000	.250	.375	.874	.438	.000	.871	.375	.000	.563	.000	.625	.531	.891	.500	.000	.905	.947
Cars	0	0	0	0	0	2	1094	7	0	1103	6	0	9	0	15	34	611	4	0	649	1767
% Cars	0	0	0	0	0	66.7	97.8	100	0	97.7	100	0	100	0	100	100	92.7	66.7	0	92.8	95.8
Heavy Vehicles	2	0	0	0	2	1	25	0	0	26	0	0	0	0	0	0	48	2	0	50	78
% Heavy Vehicles	100	0	0	0	100	33.3	2.2	0	0	2.3	0	0	0	0	0	0	7.3	33.3	0	7.2	4.2





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File Name : 144157 B  
Site Code : TBA  
Start Date : 11/6/2014  
Page No : 1

S: Stoney Hill Road (East)  
E/W: Hartford Turnpike (Route 20)  
City, State: Shrewsbury, MA  
Client: Tetra Tech Rizzo/ N. Landron

Groups Printed- Cars - Heavy Vehicles

Start Time	Hartford Turnpike (Route 20) From East			Stoney Hill Road (East) From South			Hartford Turnpike (Route 20) From West			Int. Total
	Thru	Left	U-Turn	Right	Left	U-Turn	Right	Thru	U-Turn	
07:00 AM	100	1	0	10	6	0	2	280	0	399
07:15 AM	125	1	0	11	1	0	1	292	0	431
07:30 AM	122	0	0	11	1	0	0	329	0	463
07:45 AM	121	0	0	7	5	0	0	366	0	499
Total	468	2	0	39	13	0	3	1267	0	1792
08:00 AM	131	2	0	11	2	0	1	344	0	491
08:15 AM	154	1	0	11	1	0	0	329	1	497
08:30 AM	150	0	0	11	2	0	0	296	0	459
08:45 AM	139	6	0	4	2	0	1	244	0	396
Total	574	9	0	37	7	0	2	1213	1	1843
Grand Total	1042	11	0	76	20	0	5	2480	1	3635
Apprch %	99	1	0	79.2	20.8	0	0.2	99.8	0	
Total %	28.7	0.3	0	2.1	0.6	0	0.1	68.2	0	
Cars	911	10	0	70	20	0	5	2308	1	3325
% Cars	87.4	90.9	0	92.1	100	0	100	93.1	100	91.5
Heavy Vehicles	131	1	0	6	0	0	0	172	0	310
% Heavy Vehicles	12.6	9.1	0	7.9	0	0	0	6.9	0	8.5

Start Time	Hartford Turnpike (Route 20) From East				Stoney Hill Road (East) From South				Hartford Turnpike (Route 20) From West				Int. Total
	Thru	Left	U-Turn	App. Total	Right	Left	U-Turn	App. Total	Right	Thru	U-Turn	App. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:30 AM													
07:30 AM	122	0	0	122	11	1	0	12	0	329	0	329	463
07:45 AM	121	0	0	121	7	5	0	12	0	366	0	366	499
08:00 AM	131	2	0	133	11	2	0	13	1	344	0	345	491
08:15 AM	154	1	0	155	11	1	0	12	0	329	1	330	497
Total Volume	528	3	0	531	40	9	0	49	1	1368	1	1370	1950
% App. Total	99.4	0.6	0		81.6	18.4	0		0.1	99.9	0.1		
PHF	.857	.375	.000	.856	.909	.450	.000	.942	.250	.934	.250	.936	.977
Cars	460	2	0	462	37	9	0	46	1	1278	1	1280	1788
% Cars	87.1	66.7	0	87.0	92.5	100	0	93.9	100	93.4	100	93.4	91.7
Heavy Vehicles	68	1	0	69	3	0	0	3	0	90	0	90	162
% Heavy Vehicles	12.9	33.3	0	13.0	7.5	0	0	6.1	0	6.6	0	6.6	8.3



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S: Stoney Hill Road (East)  
E/W: Hartford Turnpike (Route 20)  
City, State: Shrewsbury, MA  
Client: Tetra Tech Rizzo/ N. Landron

File Name : 144157 B  
Site Code : TBA  
Start Date : 11/6/2014  
Page No : 1

Groups Printed- Cars

Start Time	Hartford Turnpike (Route 20) From East			Stoney Hill Road (East) From South			Hartford Turnpike (Route 20) From West			Int. Total
	Thru	Left	U-Turn	Right	Left	U-Turn	Right	Thru	U-Turn	
07:00 AM	91	1	0	9	6	0	2	268	0	377
07:15 AM	110	1	0	11	1	0	1	275	0	399
07:30 AM	111	0	0	9	1	0	0	309	0	430
07:45 AM	104	0	0	7	5	0	0	345	0	461
Total	416	2	0	36	13	0	3	1197	0	1667
08:00 AM	116	1	0	11	2	0	1	314	0	445
08:15 AM	129	1	0	10	1	0	0	310	1	452
08:30 AM	131	0	0	9	2	0	0	268	0	410
08:45 AM	119	6	0	4	2	0	1	219	0	351
Total	495	8	0	34	7	0	2	1111	1	1658
Grand Total	911	10	0	70	20	0	5	2308	1	3325
Apprch %	98.9	1.1	0	77.8	22.2	0	0.2	99.7	0	
Total %	27.4	0.3	0	2.1	0.6	0	0.2	69.4	0	

Start Time	Hartford Turnpike (Route 20) From East				Stoney Hill Road (East) From South				Hartford Turnpike (Route 20) From West				Int. Total
	Thru	Left	U-Turn	App. Total	Right	Left	U-Turn	App. Total	Right	Thru	U-Turn	App. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:30 AM													
07:30 AM	111	0	0	111	9	1	0	10	0	309	0	309	430
07:45 AM	104	0	0	104	7	5	0	12	0	345	0	345	461
08:00 AM	116	1	0	117	11	2	0	13	1	314	0	315	445
08:15 AM	129	1	0	130	10	1	0	11	0	310	1	311	452
Total Volume	460	2	0	462	37	9	0	46	1	1278	1	1280	1788
% App. Total	99.6	0.4	0		80.4	19.6	0		0.1	99.8	0.1		
PHF	.891	.500	.000	.888	.841	.450	.000	.885	.250	.926	.250	.928	.970



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S: Stoney Hill Road (East)  
E/W: Hartford Turnpike (Route 20)  
City, State: Shrewsbury, MA  
Client: Tetra Tech Rizzo/ N. Landron

File Name : 144157 B  
Site Code : TBA  
Start Date : 11/6/2014  
Page No : 1

Groups Printed- Heavy Vehicles

Start Time	Hartford Turnpike (Route 20) From East			Stoney Hill Road (East) From South			Hartford Turnpike (Route 20) From West			Int. Total
	Thru	Left	U-Turn	Right	Left	U-Turn	Right	Thru	U-Turn	
07:00 AM	9	0	0	1	0	0	0	12	0	22
07:15 AM	15	0	0	0	0	0	0	17	0	32
07:30 AM	11	0	0	2	0	0	0	20	0	33
07:45 AM	17	0	0	0	0	0	0	21	0	38
Total	52	0	0	3	0	0	0	70	0	125
08:00 AM	15	1	0	0	0	0	0	30	0	46
08:15 AM	25	0	0	1	0	0	0	19	0	45
08:30 AM	19	0	0	2	0	0	0	28	0	49
08:45 AM	20	0	0	0	0	0	0	25	0	45
Total	79	1	0	3	0	0	0	102	0	185
Grand Total	131	1	0	6	0	0	0	172	0	310
Apprch %	99.2	0.8	0	100	0	0	0	100	0	
Total %	42.3	0.3	0	1.9	0	0	0	55.5	0	

Start Time	Hartford Turnpike (Route 20) From East				Stoney Hill Road (East) From South				Hartford Turnpike (Route 20) From West				Int. Total
	Thru	Left	U-Turn	App. Total	Right	Left	U-Turn	App. Total	Right	Thru	U-Turn	App. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 08:00 AM													
08:00 AM	15	1	0	16	0	0	0	0	0	30	0	30	46
08:15 AM	25	0	0	25	1	0	0	1	0	19	0	19	45
08:30 AM	19	0	0	19	2	0	0	2	0	28	0	28	49
08:45 AM	20	0	0	20	0	0	0	0	0	25	0	25	45
Total Volume	79	1	0	80	3	0	0	3	0	102	0	102	185
% App. Total	98.8	1.2	0		100	0	0		0	100	0		
PHF	.790	.250	.000	.800	.375	.000	.000	.375	.000	.850	.000	.850	.944





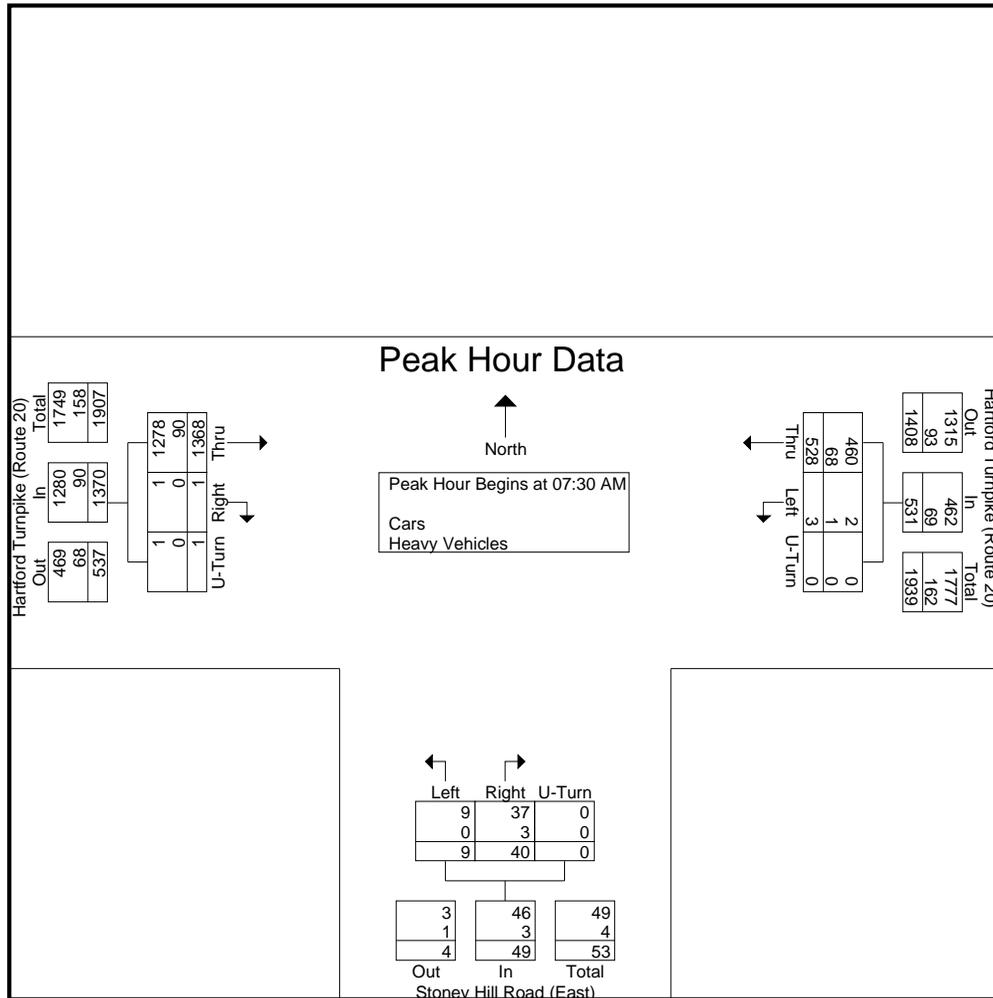
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File Name : 144157 B  
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Start Date : 11/6/2014  
Page No : 1

S: Stoney Hill Road (East)  
E/W: Hartford Turnpike (Route 20)  
City, State: Shrewsbury, MA  
Client: Tetra Tech Rizzo/ N. Landron

Start Time	Hartford Turnpike (Route 20) From East				Stoney Hill Road (East) From South				Hartford Turnpike (Route 20) From West				Int. Total
	Thru	Left	U-Turn	App. Total	Right	Left	U-Turn	App. Total	Right	Thru	U-Turn	App. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:30 AM													
07:30 AM	122	0	0	122	11	1	0	12	0	329	0	329	463
07:45 AM	121	0	0	121	7	5	0	12	0	366	0	366	499
08:00 AM	131	2	0	133	11	2	0	13	1	344	0	345	491
08:15 AM	154	1	0	155	11	1	0	12	0	329	1	330	497
Total Volume	528	3	0	531	40	9	0	49	1	1368	1	1370	1950
% App. Total	99.4	0.6	0		81.6	18.4	0		0.1	99.9	0.1		
PHF	.857	.375	.000	.856	.909	.450	.000	.942	.250	.934	.250	.936	.977
Cars	460	2	0	462	37	9	0	46	1	1278	1	1280	1788
% Cars	87.1	66.7	0	87.0	92.5	100	0	93.9	100	93.4	100	93.4	91.7
Heavy Vehicles	68	1	0	69	3	0	0	3	0	90	0	90	162
% Heavy Vehicles	12.9	33.3	0	13.0	7.5	0	0	6.1	0	6.6	0	6.6	8.3





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Page No : 1

S: Stoney Hill Road (East)  
E/W: Hartford Turnpike (Route 20)  
City, State: Shrewsbury, MA  
Client: Tetra Tech Rizzo/ N. Landron

Groups Printed- Cars - Heavy Vehicles

Start Time	Hartford Turnpike (Route 20) From East			Stoney Hill Road (East) From South			Hartford Turnpike (Route 20) From West			Int. Total
	Thru	Left	U-Turn	Right	Left	U-Turn	Right	Thru	U-Turn	
04:00 PM	249	6	0	1	2	0	7	149	0	414
04:15 PM	279	1	0	5	0	0	0	160	0	445
04:30 PM	273	5	0	3	1	0	2	147	0	431
04:45 PM	231	8	0	6	1	0	2	146	0	394
Total	1032	20	0	15	4	0	11	602	0	1684
05:00 PM	292	4	0	2	0	0	5	184	0	487
05:15 PM	321	10	0	7	1	0	4	151	0	494
05:30 PM	275	4	0	4	2	0	3	178	0	466
05:45 PM	250	11	0	4	0	0	2	143	0	410
Total	1138	29	0	17	3	0	14	656	0	1857
Grand Total	2170	49	0	32	7	0	25	1258	0	3541
Apprch %	97.8	2.2	0	82.1	17.9	0	1.9	98.1	0	
Total %	61.3	1.4	0	0.9	0.2	0	0.7	35.5	0	
Cars	2112	48	0	32	6	0	25	1170	0	3393
% Cars	97.3	98	0	100	85.7	0	100	93	0	95.8
Heavy Vehicles	58	1	0	0	1	0	0	88	0	148
% Heavy Vehicles	2.7	2	0	0	14.3	0	0	7	0	4.2

Start Time	Hartford Turnpike (Route 20) From East				Stoney Hill Road (East) From South				Hartford Turnpike (Route 20) From West				Int. Total
	Thru	Left	U-Turn	App. Total	Right	Left	U-Turn	App. Total	Right	Thru	U-Turn	App. Total	
05:00 PM	292	4	0	296	2	0	0	2	5	184	0	189	487
05:15 PM	321	10	0	331	7	1	0	8	4	151	0	155	494
05:30 PM	275	4	0	279	4	2	0	6	3	178	0	181	466
05:45 PM	250	11	0	261	4	0	0	4	2	143	0	145	410
Total Volume	1138	29	0	1167	17	3	0	20	14	656	0	670	1857
% App. Total	97.5	2.5	0		85	15	0		2.1	97.9	0		
PHF	.886	.659	.000	.881	.607	.375	.000	.625	.700	.891	.000	.886	.940
Cars	1116	29	0	1145	17	3	0	20	14	616	0	630	1795
% Cars	98.1	100	0	98.1	100	100	0	100	100	93.9	0	94.0	96.7
Heavy Vehicles	22	0	0	22	0	0	0	0	0	40	0	40	62
% Heavy Vehicles	1.9	0	0	1.9	0	0	0	0	0	6.1	0	6.0	3.3

Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1

Peak Hour for Entire Intersection Begins at 05:00 PM



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City, State: Shrewsbury, MA  
Client: Tetra Tech Rizzo/ N. Landron

File Name : 144157 BB  
Site Code : TBA  
Start Date : 11/6/2014  
Page No : 1

Groups Printed- Cars

Start Time	Hartford Turnpike (Route 20) From East			Stoney Hill Road (East) From South			Hartford Turnpike (Route 20) From West			Int. Total
	Thru	Left	U-Turn	Right	Left	U-Turn	Right	Thru	U-Turn	
04:00 PM	236	6	0	1	1	0	7	132	0	383
04:15 PM	270	1	0	5	0	0	0	149	0	425
04:30 PM	264	5	0	3	1	0	2	138	0	413
04:45 PM	226	7	0	6	1	0	2	135	0	377
Total	996	19	0	15	3	0	11	554	0	1598
05:00 PM	282	4	0	2	0	0	5	172	0	465
05:15 PM	315	10	0	7	1	0	4	140	0	477
05:30 PM	274	4	0	4	2	0	3	171	0	458
05:45 PM	245	11	0	4	0	0	2	133	0	395
Total	1116	29	0	17	3	0	14	616	0	1795
Grand Total	2112	48	0	32	6	0	25	1170	0	3393
Apprch %	97.8	2.2	0	84.2	15.8	0	2.1	97.9	0	
Total %	62.2	1.4	0	0.9	0.2	0	0.7	34.5	0	

Start Time	Hartford Turnpike (Route 20) From East				Stoney Hill Road (East) From South				Hartford Turnpike (Route 20) From West				Int. Total
	Thru	Left	U-Turn	App. Total	Right	Left	U-Turn	App. Total	Right	Thru	U-Turn	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 05:00 PM													
05:00 PM	282	4	0	286	2	0	0	2	5	172	0	177	465
05:15 PM	315	10	0	325	7	1	0	8	4	140	0	144	477
05:30 PM	274	4	0	278	4	2	0	6	3	171	0	174	458
05:45 PM	245	11	0	256	4	0	0	4	2	133	0	135	395
Total Volume	1116	29	0	1145	17	3	0	20	14	616	0	630	1795
% App. Total	97.5	2.5	0		85	15	0		2.2	97.8	0		
PHF	.886	.659	.000	.881	.607	.375	.000	.625	.700	.895	.000	.890	.941



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City, State: Shrewsbury, MA  
Client: Tetra Tech Rizzo/ N. Landron

File Name : 144157 BB  
Site Code : TBA  
Start Date : 11/6/2014  
Page No : 1

Groups Printed- Heavy Vehicles

Start Time	Hartford Turnpike (Route 20) From East			Stoney Hill Road (East) From South			Hartford Turnpike (Route 20) From West			Int. Total
	Thru	Left	U-Turn	Right	Left	U-Turn	Right	Thru	U-Turn	
04:00 PM	13	0	0	0	1	0	0	17	0	31
04:15 PM	9	0	0	0	0	0	0	11	0	20
04:30 PM	9	0	0	0	0	0	0	9	0	18
04:45 PM	5	1	0	0	0	0	0	11	0	17
Total	36	1	0	0	1	0	0	48	0	86
05:00 PM	10	0	0	0	0	0	0	12	0	22
05:15 PM	6	0	0	0	0	0	0	11	0	17
05:30 PM	1	0	0	0	0	0	0	7	0	8
05:45 PM	5	0	0	0	0	0	0	10	0	15
Total	22	0	0	0	0	0	0	40	0	62
Grand Total	58	1	0	0	1	0	0	88	0	148
Apprch %	98.3	1.7	0	0	100	0	0	100	0	
Total %	39.2	0.7	0	0	0.7	0	0	59.5	0	

Start Time	Hartford Turnpike (Route 20) From East				Stoney Hill Road (East) From South				Hartford Turnpike (Route 20) From West				Int. Total
	Thru	Left	U-Turn	App. Total	Right	Left	U-Turn	App. Total	Right	Thru	U-Turn	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 04:00 PM													
04:00 PM	13	0	0	13	0	1	0	1	0	17	0	17	31
04:15 PM	9	0	0	9	0	0	0	0	0	11	0	11	20
04:30 PM	9	0	0	9	0	0	0	0	0	9	0	9	18
04:45 PM	5	1	0	6	0	0	0	0	0	11	0	11	17
Total Volume	36	1	0	37	0	1	0	1	0	48	0	48	86
% App. Total	97.3	2.7	0		0	100	0		0	100	0		
PHF	.692	.250	.000	.712	.000	.250	.000	.250	.000	.706	.000	.706	.694



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Client: Tetra Tech Rizzo/ N. Landron

File Name : 144157 BB  
Site Code : TBA  
Start Date : 11/6/2014  
Page No : 1

Groups Printed- Peds and Bicycles

Start Time	Hartford Turnpike (Route 20) From East				Stoney Hill Road (East) From South				Hartford Turnpike (Route 20) From West				Int. Total
	Thru	Left	Peds SB	Peds NB	Right	Left	Peds WB	Peds EB	Right	Thru	Peds NB	Peds SB	
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
04:15 PM	0	0	0	0	0	0	0	0	0	0	1	0	1
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	1	0	1
05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
05:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	0	0	0	0	0	0	0	0	1	0	1
Apprch %	0	0	0	0	0	0	0	0	0	0	100	0	
Total %	0	0	0	0	0	0	0	0	0	0	100	0	

Start Time	Hartford Turnpike (Route 20) From East					Stoney Hill Road (East) From South					Hartford Turnpike (Route 20) From West					Int. Total
	Thru	Left	Peds SB	Peds NB	App. Total	Right	Left	Peds WB	Peds EB	App. Total	Right	Thru	Peds NB	Peds SB	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																
Peak Hour for Entire Intersection Begins at 04:00 PM																
04:00 PM	0	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	1	0	1	1
04:30 PM	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
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1
% App. Total	0	0	0	0	0	0	0	0	0	0	0	0	100	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.250	.000	.250	.250



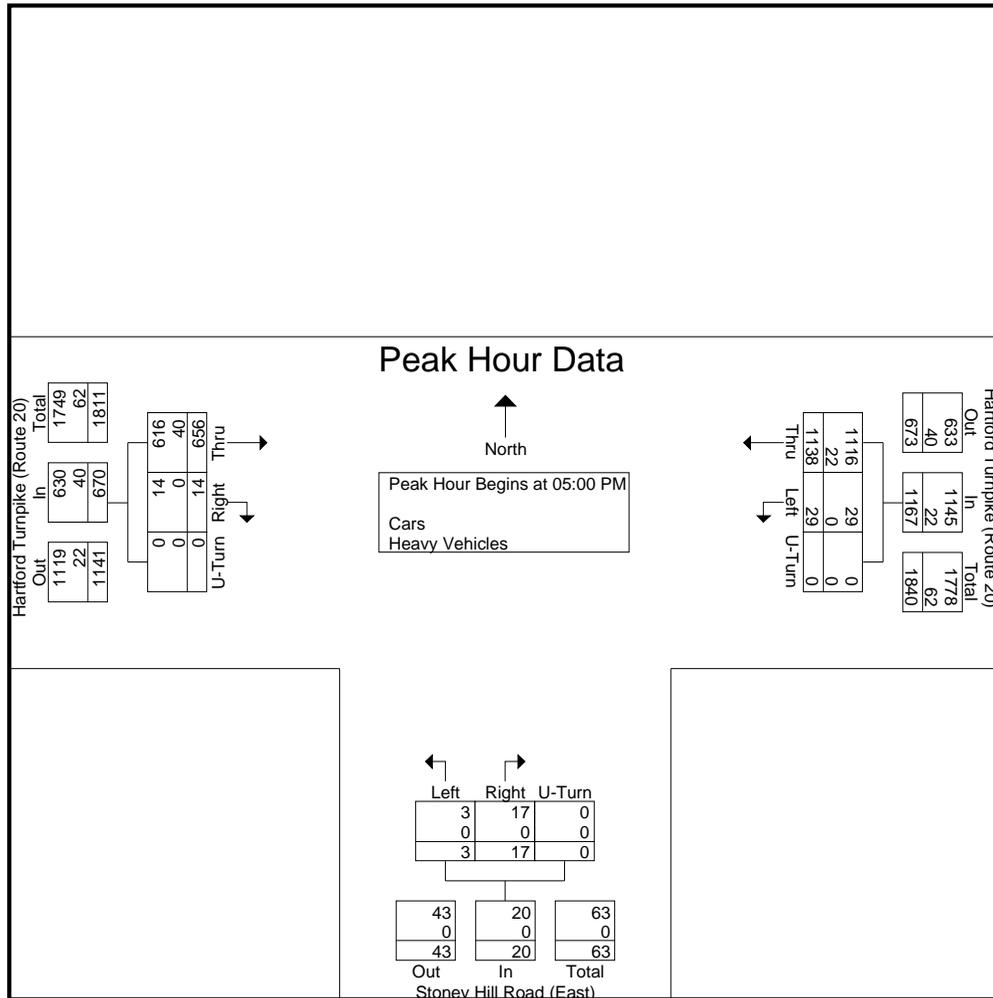
PRECISION  
DATA  
INDUSTRIES, LLC

P.O. Box 301 Berlin, MA 01503  
Office: 508.481.3999 Fax: 508.545.1234  
Email: datarequests@pdillc.com

S: Stoney Hill Road (East)  
E/W: Hartford Turnpike (Route 20)  
City, State: Shrewsbury, MA  
Client: Tetra Tech Rizzo/ N. Landron

File Name : 144157 BB  
Site Code : TBA  
Start Date : 11/6/2014  
Page No : 1

Start Time	Hartford Turnpike (Route 20) From East				Stoney Hill Road (East) From South				Hartford Turnpike (Route 20) From West				Int. Total
	Thru	Left	U-Turn	App. Total	Right	Left	U-Turn	App. Total	Right	Thru	U-Turn	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 05:00 PM													
05:00 PM	292	4	0	296	2	0	0	2	5	184	0	189	487
05:15 PM	321	10	0	331	7	1	0	8	4	151	0	155	494
05:30 PM	275	4	0	279	4	2	0	6	3	178	0	181	466
05:45 PM	250	11	0	261	4	0	0	4	2	143	0	145	410
Total Volume	1138	29	0	1167	17	3	0	20	14	656	0	670	1857
% App. Total	97.5	2.5	0		85	15	0		2.1	97.9	0		
PHF	.886	.659	.000	.881	.607	.375	.000	.625	.700	.891	.000	.886	.940
Cars	1116	29	0	1145	17	3	0	20	14	616	0	630	1795
% Cars	98.1	100	0	98.1	100	100	0	100	100	93.9	0	94.0	96.7
Heavy Vehicles	22	0	0	22	0	0	0	0	0	40	0	40	62
% Heavy Vehicles	1.9	0	0	1.9	0	0	0	0	0	6.1	0	6.0	3.3

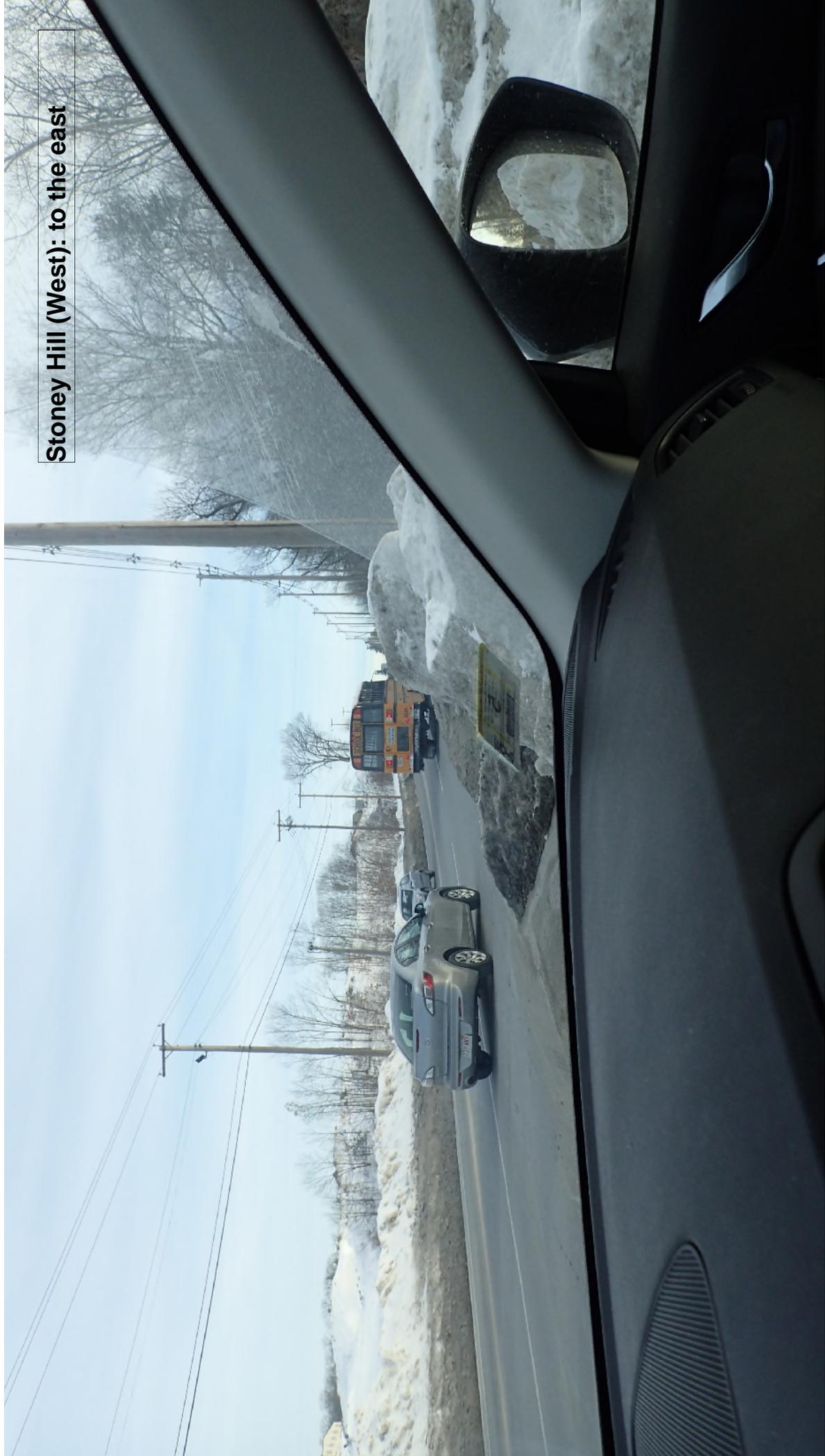


**Appendix C**  
**Stoney Hill Road Delay Study**

Stoney Hill (West): to the west



Stoney Hill (West): to the east



**STONEY HILL WEST  
MORNING  
COMBINED**

City, State: Shrewsbury, MA  
Date: Tuesday 2/24/2015  
Time: 7:00am-9:00am  
PDI File# 154278 B  
Client: Tetra Tech Rizzo/ N. Doherty  
Client #: TBD

Exiting Stoney Hill Road (West) onto Route 20

Vehicle #	Entered Queue	Left Queue	Delay in sec.	Queue Length	Exiting Turn	Vehicle Class	Total 15 Min.	2 Hour Total
1	7:00:12 AM	7:00:13 AM	00:01	1	Right	Car		Total Vehicles 91
2	7:01:00 AM	7:01:12 AM	00:12	1	Left	Car		Ave Stopped Time 0:00:24
3	7:05:47 AM	7:05:48 AM	00:01	1	Left	Car		Max Stopped Time 02:47
4	7:06:14 AM	7:06:15 AM	00:01	1	Right	Car		Average Queue 1.2
5	7:07:35 AM	7:08:12 AM	00:37	1	Left	Car		Max Queue 3.0
6	7:09:17 AM	7:09:22 AM	00:05	1	Left	Car		
7	7:10:28 AM	7:10:47 AM	00:19	1	Left	Car		<b>Stoney Hill Road Peak Hour (7:00 - 8:00)</b>
8	7:10:41 AM	7:10:51 AM	00:10	2	Left	Car		Total Vehicles 58
9	7:10:57 AM	7:10:57 AM	00:00	1	Right	Car		Ave Stopped Time 0:00:14
10	7:12:23 AM	7:12:23 AM	00:00	1	Right	Car		Max Stopped Time 01:58
11	7:13:07 AM	7:13:18 AM	00:11	1	Left	Car		Average Queue 1.2
12	7:13:29 AM	7:13:37 AM	00:08	1	Right	Car		Max Queue 3.0
13	7:14:17 AM	7:14:21 AM	00:04	1	Right	Car		
14	7:14:25 AM	7:14:30 AM	00:05	1	Right	Car		<b>Intersection Peak Hour (7:30 - 8:30)</b>
15	7:14:26 AM	7:14:33 AM	00:07	2	Left	Car	15	Total Vehicles 49
16	7:16:04 AM	7:16:27 AM	00:23	1	Left	Car		Ave Stopped Time 0:00:28
17	7:17:20 AM	7:17:21 AM	00:01	1	Left	Car		Max Stopped Time 02:47
18	7:17:36 AM	7:17:42 AM	00:06	1	Left	Car		Average Queue 1.3
19	7:18:06 AM	7:18:08 AM	00:02	1	Left	Car		Max Queue 3.0
20	7:18:14 AM	7:18:16 AM	00:02	1	Left	Car		
21	7:18:21 AM	7:18:26 AM	00:05	1	Left	Car		
22	7:20:48 AM	7:20:54 AM	00:06	1	Right	Car		
23	7:23:42 AM	7:23:59 AM	00:17	1	Left	Car		
24	7:23:56 AM	7:23:59 AM	00:03	2	Right	Car		
25	7:25:58 AM	7:26:05 AM	00:07	1	Right	Car		
26	7:27:02 AM	7:27:11 AM	00:09	1	Left	Car		
27	7:27:36 AM	7:27:43 AM	00:07	1	Right	Car		
28	7:29:27 AM	7:31:25 AM	01:58	1	Left	Car	13	
29	7:31:31 AM	7:31:32 AM	00:01	1	Left	Car		
30	7:32:20 AM	7:32:30 AM	00:10	1	Right	Car		
31	7:32:42 AM	7:33:33 AM	00:51	1	Left	Car		
32	7:32:55 AM	7:33:17 AM	00:22	2	Right	Car		
33	7:33:30 AM	7:33:52 AM	00:22	3	Left	Car		
34	7:33:38 AM	7:34:03 AM	00:25	2	Left	Car		
35	7:34:34 AM	7:34:34 AM	00:00	1	Right	Car		
36	7:34:54 AM	7:35:13 AM	00:19	1	Left	Car		
37	7:37:31 AM	7:37:33 AM	00:02	1	Right	Car		
38	7:37:37 AM	7:38:00 AM	00:23	1	Left	Car		
39	7:40:30 AM	7:40:46 AM	00:16	1	Right	Car		
40	7:40:33 AM	7:40:54 AM	00:21	2	Right	Car		
41	7:41:06 AM	7:41:07 AM	00:01	1	Right	Car		
42	7:41:38 AM	7:41:58 AM	00:20	1	Left	Car		
43	7:42:16 AM	7:42:31 AM	00:15	1	Left	Car		
44	7:42:22 AM	7:43:19 AM	00:57	2	Left	Car		
45	7:43:33 AM	7:43:41 AM	00:08	1	Right	Car		
46	7:43:57 AM	7:43:59 AM	00:02	1	Right	Car	18	
47	7:44:54 AM	7:45:30 AM	00:36	1	Left	Car		
48	7:45:26 AM	7:45:41 AM	00:15	2	Left	Car		
49	7:47:36 AM	7:47:38 AM	00:02	1	Right	Car		
50	7:47:53 AM	7:47:57 AM	00:04	1	Right	Car		
51	7:48:03 AM	7:48:05 AM	00:02	1	Right	Car		
52	7:48:23 AM	7:48:30 AM	00:07	1	Left	Car		
53	7:51:20 AM	7:51:21 AM	00:01	1	Right	Car		
54	7:51:35 AM	7:51:44 AM	00:09	1	Left	Car		
55	7:52:53 AM	7:53:04 AM	00:11	1	Left	Car		
56	7:56:18 AM	7:57:05 AM	00:47	1	Left	Car		
57	7:58:37 AM	7:59:21 AM	00:44	1	Right	Car		
58	7:59:15 AM	7:59:36 AM	00:21	2	Left	Car	12	
59	8:00:23 AM	8:00:36 AM	00:13	1	Left	Car		
60	8:01:48 AM	8:02:12 AM	00:24	1	Right	Car		
61	8:06:32 AM	8:06:36 AM	00:04	1	Left	Car		
62	8:07:22 AM	8:07:50 AM	00:28	1	Left	Car		
63	8:07:24 AM	8:08:26 AM	01:02	2	Left	Car		
64	8:09:51 AM	8:12:38 AM	02:47	1	Left	Car		
65	8:10:19 AM	8:12:13 AM	01:54	2	Left	Car		
66	8:10:39 AM	8:12:45 AM	02:06	3	Left	Car	8	
67	8:18:56 AM	8:19:00 AM	00:04	1	Right	Car		
68	8:19:55 AM	8:19:57 AM	00:02	1	Right	Car		
69	8:20:00 AM	8:20:01 AM	00:01	1	Right	Car		
70	8:21:49 AM	8:21:50 AM	00:01	1	Left	Car		
71	8:22:08 AM	8:22:47 AM	00:39	1	Left	Car		
72	8:22:10 AM	8:23:25 AM	01:15	2	Left	Car		
73	8:23:29 AM	8:23:31 AM	00:02	1	Left	Car		
74	8:24:05 AM	8:25:18 AM	01:13	1	Left	Car		
75	8:25:21 AM	8:26:35 AM	01:14	1	Left	Car		
76	8:26:39 AM	8:27:07 AM	00:28	1	Left	Car		
77	8:28:44 AM	8:29:28 AM	00:44	1	Left	Car	11	
78	8:30:44 AM	8:30:54 AM	00:10	1	Left	Car		
79	8:33:06 AM	8:33:19 AM	00:13	1	Right	Car		
80	8:33:38 AM	8:34:42 AM	01:04	1	Left	Car		
81	8:33:49 AM	8:34:20 AM	00:31	2	Right	Car		
82	8:36:31 AM	8:37:00 AM	00:29	1	Left	Car		
83	8:37:46 AM	8:37:53 AM	00:07	1	Left	Car		
84	8:43:06 AM	8:43:06 AM	00:00	1	Right	Car		
85	8:43:52 AM	8:43:52 AM	00:00	1	Right	Car	8	
86	8:44:19 AM	8:45:58 AM	01:39	1	Left	Car		
87	8:46:00 AM	8:47:01 AM	01:01	1	Right	Car		
88	8:51:42 AM	8:51:45 AM	00:03	1	Left	Car		
89	8:53:59 AM	8:54:39 AM	00:40	1	Left	Car		
90	8:54:56 AM	8:55:40 AM	00:44	1	Left	Car		
91	8:58:33 AM	8:59:23 AM	00:50	1	Left	Car	6	

City, State: Shrewsbury, MA  
Date: Tuesday 2/24/2015  
Time: 7:00am-9:00am  
PDI File# 154278 B  
Client: Tetra Tech Rizzo/ N. Doherty  
Client #: TBD

Exiting Stoney Hill Road (West) onto Route 20

Vehicle #	Entered Queue	Left Queue	Delay in sec.	Queue Length	Exiting Turn	Vehicle Class	Total 15 Min.	
2	7:01:00 AM	7:01:12 AM	00:12	1	Left	Car		<b>2 Hour Total</b>
3	7:05:47 AM	7:05:48 AM	00:01	1	Left	Car		Left Turns 57
5	7:07:35 AM	7:08:12 AM	00:37	1	Left	Car		Ave Stopped Time 0:00:33
6	7:09:17 AM	7:09:22 AM	00:05	1	Left	Car		Max Stopped Time 0:02:47
7	7:10:28 AM	7:10:47 AM	00:19	1	Left	Car		Average Queue 1.2
8	7:10:41 AM	7:10:51 AM	00:10	2	Left	Car		Max Queue 3.0
11	7:13:07 AM	7:13:18 AM	00:11	1	Left	Car		Right Turns 34
15	7:14:26 AM	7:14:33 AM	00:07	2	Left	Car	8	Ave Stopped Time 0:00:09
1	7:00:12 AM	7:00:13 AM	00:01	1	Right	Car		Max Stopped Time 0:01:01
4	7:06:14 AM	7:06:15 AM	00:01	1	Right	Car		Average Queue 1.1
9	7:10:57 AM	7:10:57 AM	00:00	1	Right	Car		Max Queue 2.0
10	7:12:23 AM	7:12:23 AM	00:00	1	Right	Car		
12	7:13:29 AM	7:13:37 AM	00:08	1	Right	Car		
13	7:14:17 AM	7:14:21 AM	00:04	1	Right	Car		
14	7:14:25 AM	7:14:30 AM	00:05	1	Right	Car	7	<b>Stoney Hill Road Peak Hour (7:00 - 8:00)</b>
16	7:16:04 AM	7:16:27 AM	00:23	1	Left	Car		Left Turns 33
17	7:17:20 AM	7:17:21 AM	00:01	1	Left	Car		Ave Stopped Time 0:00:20
18	7:17:36 AM	7:17:42 AM	00:06	1	Left	Car		Max Stopped Time 0:01:58
19	7:18:06 AM	7:18:08 AM	00:02	1	Left	Car		Average Queue 1.2
20	7:18:14 AM	7:18:16 AM	00:02	1	Left	Car		Max Queue 3.0
21	7:18:21 AM	7:18:26 AM	00:05	1	Left	Car		Right Turns 25
23	7:23:42 AM	7:23:59 AM	00:17	1	Left	Car		Ave Stopped Time 0:00:07
26	7:27:02 AM	7:27:11 AM	00:09	1	Left	Car		Max Stopped Time 00:44
28	7:29:27 AM	7:31:25 AM	01:58	1	Left	Car	9	Average Queue 1.1
22	7:20:48 AM	7:20:54 AM	00:06	1	Right	Car		Max Queue 2.0
24	7:23:56 AM	7:23:59 AM	00:03	2	Right	Car		
25	7:25:58 AM	7:26:05 AM	00:07	1	Right	Car		
27	7:27:36 AM	7:27:43 AM	00:07	1	Right	Car	4	<b>Intersection Peak Hour (7:30 - 8:30)</b>
29	7:31:31 AM	7:31:32 AM	00:01	1	Left	Car		Left Turns 31
31	7:32:42 AM	7:33:33 AM	00:51	1	Left	Car		Ave Stopped Time 0:00:40
33	7:33:30 AM	7:33:52 AM	00:22	3	Left	Car		Max Stopped Time 02:47
34	7:33:38 AM	7:34:03 AM	00:25	2	Left	Car		Average Queue 1.4
36	7:34:54 AM	7:35:13 AM	00:19	1	Left	Car		Max Queue 3.0
38	7:37:37 AM	7:38:00 AM	00:23	1	Left	Car		
42	7:41:38 AM	7:41:58 AM	00:20	1	Left	Car		Right Turns 18
43	7:42:16 AM	7:42:31 AM	00:15	1	Left	Car		Ave Stopped Time 0:00:09
44	7:42:22 AM	7:43:19 AM	00:57	2	Left	Car		Max Stopped Time 00:44
47	7:44:54 AM	7:45:30 AM	00:36	1	Left	Car	10	Average Queue 1.1
30	7:32:20 AM	7:32:30 AM	00:10	1	Right	Car		Max Queue 2.0
32	7:32:55 AM	7:33:17 AM	00:22	2	Right	Car		
35	7:34:34 AM	7:34:34 AM	00:00	1	Right	Car		
37	7:37:31 AM	7:37:33 AM	00:02	1	Right	Car		
39	7:40:30 AM	7:40:46 AM	00:16	1	Right	Car		
40	7:40:33 AM	7:40:54 AM	00:21	2	Right	Car		
41	7:41:06 AM	7:41:07 AM	00:01	1	Right	Car		
45	7:43:33 AM	7:43:41 AM	00:08	1	Right	Car		
46	7:43:57 AM	7:43:59 AM	00:02	1	Right	Car	9	
48	7:45:26 AM	7:45:41 AM	00:15	2	Left	Car		
52	7:48:23 AM	7:48:30 AM	00:07	1	Left	Car		
54	7:51:35 AM	7:51:44 AM	00:09	1	Left	Car		
55	7:52:53 AM	7:53:04 AM	00:11	1	Left	Car		
56	7:56:18 AM	7:57:05 AM	00:47	1	Left	Car		
58	7:59:15 AM	7:59:36 AM	00:21	2	Left	Car	6	
49	7:47:36 AM	7:47:38 AM	00:02	1	Right	Car		
50	7:47:53 AM	7:47:57 AM	00:04	1	Right	Car		
51	7:48:03 AM	7:48:05 AM	00:02	1	Right	Car		
53	7:51:20 AM	7:51:21 AM	00:01	1	Right	Car		
57	7:58:37 AM	7:59:21 AM	00:44	1	Right	Car	5	
59	8:00:23 AM	8:00:36 AM	00:13	1	Left	Car		
61	8:06:32 AM	8:06:36 AM	00:04	1	Left	Car		
62	8:07:22 AM	8:07:50 AM	00:28	1	Left	Car		
63	8:07:24 AM	8:08:26 AM	01:02	2	Left	Car		
64	8:09:51 AM	8:12:38 AM	02:47	1	Left	Car		
65	8:10:19 AM	8:12:13 AM	01:54	2	Left	Car		
66	8:10:39 AM	8:12:45 AM	02:06	3	Left	Car	7	** This car cut around the car in front to take the left
60	8:01:48 AM	8:02:12 AM	00:24	1	Right	Car	1	
70	8:21:49 AM	8:21:50 AM	00:01	1	Left	Car		
71	8:22:08 AM	8:22:47 AM	00:39	1	Left	Car		
72	8:22:10 AM	8:23:25 AM	01:15	2	Left	Car		
73	8:23:29 AM	8:23:31 AM	00:02	1	Left	Car		
74	8:24:05 AM	8:25:18 AM	01:13	1	Left	Car		
75	8:25:21 AM	8:26:35 AM	01:14	1	Left	Car		
76	8:26:39 AM	8:27:07 AM	00:28	1	Left	Car		
77	8:28:44 AM	8:29:28 AM	00:44	1	Left	Car	8	
67	8:18:56 AM	8:19:00 AM	00:04	1	Right	Car		
68	8:19:55 AM	8:19:57 AM	00:02	1	Right	Car		
69	8:20:00 AM	8:20:01 AM	00:01	1	Right	Car	3	
78	8:30:44 AM	8:30:54 AM	00:10	1	Left	Car		
80	8:33:38 AM	8:34:42 AM	01:04	1	Left	Car		
82	8:36:31 AM	8:37:00 AM	00:29	1	Left	Car		
83	8:37:46 AM	8:37:53 AM	00:07	1	Left	Car		
86	8:44:19 AM	8:45:58 AM	01:39	1	Left	Car	5	
79	8:33:06 AM	8:33:19 AM	00:13	1	Right	Car		
81	8:33:49 AM	8:34:20 AM	00:31	2	Right	Car		
84	8:43:06 AM	8:43:06 AM	00:00	1	Right	Car		
85	8:43:52 AM	8:43:52 AM	00:00	1	Right	Car	4	
88	8:51:42 AM	8:51:45 AM	00:03	1	Left	Car		
89	8:53:59 AM	8:54:39 AM	00:40	1	Left	Car		
90	8:54:56 AM	8:55:40 AM	00:44	1	Left	Car		
91	8:58:33 AM	8:59:23 AM	00:50	1	Left	Car	4	
87	8:46:00 AM	8:47:01 AM	01:01	1	Right	Car	1	

Stoney Hill Road (West) @ Hartford Turnpike (Route 20)  
 Queue/Delay Study

**STONEY HILL WEST  
 AFTERNOON  
 COMBINED**

City, State: Shrewsbury, MA  
 Date: Tuesday 2/24/2015  
 Time: 4:00pm-6:00pm  
 PDI File# 154278 B  
 Client: Tetra Tech Rizzo/ N. Doherty  
 Client #: TBD

Exiting Stoney Hill Road (West) onto Route 20

Vehicle #	Entered Queue	Left Queue	Delay in sec.	Queue Length	Exiting Turn	Vehicle Class	Total 15 Min.
1	4:04:24 PM	4:04:30 PM	00:06	1	Right	Car	
2	4:04:54 PM	4:05:02 PM	00:08	1	Right	Car	
3	4:05:06 PM	4:05:14 PM	00:08	1	Left	Car	
4	4:05:11 PM	4:05:29 PM	00:18	2	Right	Car	
5	4:06:58 PM	4:07:46 PM	00:48	1	Left	Fed Ex Truck	5
6	4:20:39 PM	4:20:48 PM	00:09	1	Left	Car	
7	4:25:12 PM	4:25:16 PM	00:04	1	Left	Car	
8	4:28:33 PM	4:28:33 PM	00:00	1	Right	Car	3
9	4:39:08 PM	4:39:15 PM	00:07	1	Left	Car	
10	4:42:12 PM	4:43:11 PM	00:59	1	Left	Car	2
11	4:45:37 PM	4:46:27 PM	00:50	1	Left	Car	
12	4:48:45 PM	4:49:36 PM	00:51	1	Left	Car	
13	4:54:18 PM	4:54:29 PM	00:11	1	Left	Car	
14	4:55:17 PM	4:55:34 PM	00:17	1	Left	Car	
15	4:58:31 PM	4:58:33 PM	00:02	1	Right	Car	5
16	5:08:33 PM	5:08:34 PM	00:01	1	Left	Car	1
17	5:24:51 PM	5:24:56 PM	00:05	1	Right	Car	
18	5:26:41 PM	5:26:45 PM	00:04	1	Right	UPS Truck	
19	5:27:06 PM	5:27:16 PM	00:10	1	Left	Car	
20	5:27:10 PM	5:27:18 PM	00:08	2	Left	Car	4
21	5:35:31 PM	5:35:42 PM	00:11	1	Left	Car	
22	5:44:16 PM	5:44:48 PM	00:32	1	Left	Car	2
23	5:45:19 PM	5:45:25 PM	00:06	1	Left	Car	
24	5:45:49 PM	5:46:00 PM	00:11	1	Left	Car	2

**2 Hour Total**

Total Vehicles 24  
 Ave Stopped Time 0:00:16  
 Max Stopped Time 00:59  
 Average Queue 1.1  
 Max Queue 2.0

**Stoney Hill Road Peak Hour (4:00 - 5:00)**

Total Vehicles 15  
 Ave Stopped Time 0:00:20  
 Max Stopped Time 00:59  
 Average Queue 1.1  
 Max Queue 2.0

**Intersection Peak Hour (5:00 - 6:00)**

Total Vehicles 9  
 Ave Stopped Time 0:00:10  
 Max Stopped Time 00:32  
 Average Queue 1.1  
 Max Queue 2.0

**STONEY HILL WEST  
 AFTERNOON  
 LT and RTs**

City, State: Shrewsbury, MA  
 Date: Tuesday 2/24/2015  
 Time: 4:00pm-6:00pm  
 PDI File# 154278 B  
 Client: Tetra Tech Rizzo/ N. Doherty  
 Client #: TBD

**Exiting Stoney Hill Road (West) onto Route 20**

Vehicle #	Entered Queue	Left Queue	Delay in sec.	Queue Length	Exiting Turn	Vehicle Class	Total 15 Min.
3	4:05:06 PM	4:05:14 PM	00:08	1	Left	Car	
5	4:06:58 PM	4:07:46 PM	00:48	1	Left	Fed Ex Truck	2
1	4:04:24 PM	4:04:30 PM	00:06	1	Right	Car	
2	4:04:54 PM	4:05:02 PM	00:08	1	Right	Car	
4	4:05:11 PM	4:05:29 PM	00:18	2	Right	Car	3
6	4:20:39 PM	4:20:48 PM	00:09	1	Left	Car	
7	4:25:12 PM	4:25:16 PM	00:04	1	Left	Car	2
8	4:28:33 PM	4:28:33 PM	00:00	1	Right	Car	1
9	4:39:08 PM	4:39:15 PM	00:07	1	Left	Car	
10	4:42:12 PM	4:43:11 PM	00:59	1	Left	Car	2
11	4:45:37 PM	4:46:27 PM	00:50	1	Left	Car	
12	4:48:45 PM	4:49:36 PM	00:51	1	Left	Car	
13	4:54:18 PM	4:54:29 PM	00:11	1	Left	Car	
14	4:55:17 PM	4:55:34 PM	00:17	1	Left	Car	4
15	4:58:31 PM	4:58:33 PM	00:02	1	Right	Car	1
16	5:08:33 PM	5:08:34 PM	00:01	1	Left	Car	1
19	5:27:06 PM	5:27:16 PM	00:10	1	Left	Car	
20	5:27:10 PM	5:27:18 PM	00:08	2	Left	Car	2
17	5:24:51 PM	5:24:56 PM	00:05	1	Right	Car	
18	5:26:41 PM	5:26:45 PM	00:04	1	Right	UPS Truck	2
21	5:35:31 PM	5:35:42 PM	00:11	1	Left	Car	1
22	5:44:16 PM	5:44:48 PM	00:32	1	Left	Car	
23	5:45:19 PM	5:45:25 PM	00:06	1	Left	Car	
24	5:45:49 PM	5:46:00 PM	00:11	1	Left	Car	3

**2 Hour Total**

Left Turns	17
Ave Stopped Time	0:00:20
Max Stopped Time	0:00:59
Average Queue	1.1
Max Queue	2.0
Right Turns	7
Ave Stopped Time	0:00:06
Max Stopped Time	0:00:18
Average Queue	1.1
Max Queue	2.0

**Stoney Hill Road Peak Hour (4:00 - 5:00)**

Left Turns	10
Ave Stopped Time	0:00:26
Max Stopped Time	00:59
Average Queue	1.0
Max Queue	1.0
Right Turns	5
Ave Stopped Time	0:00:07
Max Stopped Time	00:18
Average Queue	1.2
Max Queue	2.0

24

**Intersection Peak Hour (5:00 - 6:00)**

Left Turns	7
Ave Stopped Time	0:00:11
Max Stopped Time	00:32
Average Queue	1.1
Max Queue	2.0
Right Turns	2
Ave Stopped Time	0:00:05
Max Stopped Time	00:05
Average Queue	1.0
Max Queue	1.0

Stoney Hill (East): to the west



**Stoney Hill (East): to the east**



Stoney Hill Road (East) @ Hartford Turnpike (Route 20)  
 Queue/Delay Study

**STONEY HILL EAST  
 MORNING  
 COMBINED**

City, State: Shrewsbury, MA  
 Date: Tuesday 2/24/2015  
 Time: 7:00am-9:00am  
 PDI File# 154278 A  
 Client: Tetra Tech Rizzo/N. Doherty  
 Client #: TBD

**Exiting Stoney Hill Road (East) onto Route 20**

Vehicle #	Entered Queue	Left Queue	Delay in sec.	Queue Length	Exiting Turn	Vehicle Class	Total 15 Min.
1	7:01:58 AM	7:02:00 AM	00:02	1	Right	Car	
2	7:02:05 AM	7:02:10 AM	00:05	1	Left	Car	
3	7:02:13 AM	7:02:21 AM	00:08	1	Right	Car	
4	7:02:26 AM	7:02:45 AM	00:19	1	Left	Car	
5	7:03:45 AM	7:03:50 AM	00:05	1	Right	Car	
6	7:03:51 AM	7:03:58 AM	00:07	1	Right	Car	
7	7:04:28 AM	7:04:47 AM	00:19	1	Left	Car	
8	7:05:10 AM	7:05:19 AM	00:09	1	Right	Car	
9	7:05:30 AM	7:05:47 AM	00:17	1	Right	Car	
10	7:06:57 AM	7:06:59 AM	00:02	1	Right	Car	
11	7:07:11 AM	7:07:12 AM	00:01	1	Right	Car	
12	7:08:34 AM	7:08:50 AM	00:16	1	Right	Car	
13	7:08:58 AM	7:09:00 AM	00:02	1	Right	School Bus	
14	7:09:12 AM	7:09:43 AM	00:31	1	Left	Car	
15	7:10:23 AM	7:10:36 AM	00:13	1	Right	Car	
16	7:10:54 AM	7:11:04 AM	00:10	1	Right	Car	
17	7:11:16 AM	7:11:32 AM	00:16	1	Left	Car	
18	7:11:59 AM	7:12:13 AM	00:14	1	Left	Car	
19	7:14:58 AM	7:15:05 AM	00:07	1	Right	Car	19
20	7:20:08 AM	7:21:05 AM	00:57	1	Right	Car	
21	7:23:29 AM	7:23:31 AM	00:02	1	Left	Car	
22	7:23:49 AM	7:24:31 AM	00:42	1	Right	Car	
23	7:25:33 AM	7:26:17 AM	00:44	1	Left	Car	
24	7:27:31 AM	7:27:33 AM	00:02	1	Right	Car	
25	7:27:42 AM	7:27:53 AM	00:11	1	Right	MiniVan-Bus	
26	7:28:13 AM	7:28:20 AM	00:07	1	Left	Car	
27	7:28:34 AM	7:29:05 AM	00:31	1	Right	School Bus	
28	7:29:58 AM	7:30:10 AM	00:12	1	Right	Car	9
29	7:30:15 AM	7:31:39 AM	01:24	1	Left	Car	
30	7:30:32 AM	7:30:48 AM	00:16	2	Right	Car	
31	7:32:01 AM	7:32:46 AM	00:45	1	Left	Car	
32	7:33:29 AM	7:33:41 AM	00:12	1	Right	Car	
33	7:37:30 AM	7:37:54 AM	00:24	1	Right	School Bus	
34	7:37:31 AM	7:38:01 AM	00:30	2	Right	Car	
35	7:37:33 AM	7:38:18 AM	00:45	3	Right	Car	
36	7:37:45 AM	7:38:29 AM	00:44	4	Left	Car	
37	7:39:56 AM	7:40:04 AM	00:08	1	Right	Car	
38	7:40:45 AM	7:41:00 AM	00:15	1	Left	Car	
39	7:41:12 AM	7:41:44 AM	00:32	1	Right	Car	
40	7:43:08 AM	7:43:44 AM	00:36	1	Right	Car	
41	7:43:28 AM	7:44:10 AM	00:42	2	Right	Car	13
42	7:45:19 AM	7:46:04 AM	00:45	1	Right	Car	
43	7:45:21 AM	7:46:17 AM	00:56	2	Right	Car	
44	7:45:37 AM	7:46:27 AM	00:50	3	Right	Car	
45	7:47:35 AM	7:48:00 AM	00:25	1	Right	Car	
46	7:47:52 AM	7:48:18 AM	00:26	2	Right	Car	
47	7:48:26 AM	7:49:05 AM	00:39	1	Right	Car	
48	7:50:18 AM	7:50:26 AM	00:08	1	Left	Car	
49	7:51:06 AM	7:51:15 AM	00:09	1	Right	Car	
50	7:52:50 AM	7:53:18 AM	00:28	1	Right	Car	
51	7:53:01 AM	7:53:25 AM	00:24	2	Left	Car	
52	7:53:32 AM	7:53:33 AM	00:01	1	Right	Car	
53	7:54:20 AM	7:54:39 AM	00:19	1	Right	Car	12
54	8:02:46 AM	8:02:56 AM	00:10	1	Right	Car	
55	8:04:02 AM	8:04:13 AM	00:11	1	Right	Car	
56	8:04:37 AM	8:05:01 AM	00:24	1	Right	Car	
57	8:04:44 AM	8:05:25 AM	00:41	2	Right	Car	
58	8:07:39 AM	8:07:56 AM	00:17	1	Right	Car	
59	8:08:31 AM	8:08:49 AM	00:18	1	Left	Car	
60	8:08:38 AM	8:08:54 AM	00:16	2	Right	Car	
61	8:10:15 AM	8:10:23 AM	00:08	1	Right	Car	
62	8:10:17 AM	8:10:46 AM	00:29	2	Right	Car	
63	8:12:05 AM	8:13:07 AM	01:02	1	Right	Car	
64	8:14:25 AM	8:14:32 AM	00:07	1	Right	Car	11
65	8:19:56 AM	8:19:59 AM	00:03	1	Right	Car	
66	8:19:58 AM	8:20:04 AM	00:06	2	Right	Car	
67	8:20:09 AM	8:20:52 AM	00:43	1	Left	Car	
68	8:23:25 AM	8:23:45 AM	00:20	1	Right	Car	
69	8:23:39 AM	8:24:12 AM	00:33	2	Right	School Bus	
70	8:23:45 AM	8:24:26 AM	00:41	2	Right	Car	
71	8:23:46 AM	8:24:33 AM	00:47	3	Right	Car	
72	8:24:23 AM	8:24:56 AM	00:33	3	Right	Car	
73	8:27:04 AM	8:27:10 AM	00:06	1	Left	Car	
74	8:27:21 AM	8:27:22 AM	00:01	1	Right	Car	
75	8:27:47 AM	8:28:24 AM	00:37	1	Right	Car	
76	8:29:13 AM	8:29:34 AM	00:21	1	Right	Car	12
77	8:32:15 AM	8:32:16 AM	00:01	1	Right	School Bus	
78	8:32:22 AM	8:32:24 AM	00:02	1	Right	Car	
79	8:32:29 AM	8:32:30 AM	00:01	1	Right	Car	
80	8:37:12 AM	8:37:55 AM	00:43	1	Left	Car	
81	8:38:20 AM	8:38:55 AM	00:35	1	Right	Car	
82	8:38:22 AM	8:39:43 AM	01:21	2	Right	Car	
83	8:39:32 AM	8:39:50 AM	00:18	2	Right	Car	
84	8:42:22 AM	8:42:31 AM	00:09	1	Right	Car	
85	8:43:37 AM	8:43:38 AM	00:01	1	Right	Car	
86	8:44:07 AM	8:44:19 AM	00:12	1	Right	Car	10
87	8:46:01 AM	8:46:38 AM	00:37	1	Right	Car	
88	8:47:39 AM	8:47:47 AM	00:08	1	Right	Car	
89	8:49:02 AM	8:49:26 AM	00:24	1	Left	Car	
90	8:50:37 AM	8:50:50 AM	00:13	1	Right	Car	
91	8:50:43 AM	8:50:54 AM	00:11	2	Right	Car	
92	8:52:49 AM	8:52:52 AM	00:03	1	Right	Car	
93	8:53:06 AM	8:53:44 AM	00:38	1	Right	Car	
94	8:55:58 AM	8:56:12 AM	00:14	1	Left	Car	
95	8:57:36 AM	8:57:50 AM	00:14	1	Right	Car	
96	8:59:23 AM	8:59:41 AM	00:18	1	Left	Car	10

<b>2 Hour Total</b>	
Total Vehicles	96
Ave Stopped Time	0:00:22
Max Stopped Time	01:24
Average Queue	1.3
Max Queue	4.0
<b>Stoney Hill Road Peak Hour (7:00 to 8:00)</b>	
Total Vehicles	53
Ave Stopped Time	0:00:22
Max Stopped Time	01:24
Average Queue	1.2
Max Queue	4.0
<b>Intersection Peak Hour (7:30 - 8:30)</b>	
Total Vehicles	48
Ave Stopped Time	0:00:27
Max Stopped Time	01:24
Average Queue	1.5
Max Queue	4.0

**STONEY HILL EAST**  
**MORNING**  
**LT and RTs**

City, State: Shrewsbury, MA  
 Date: Tuesday 2/24/2015  
 Time: 7:00am-9:00am  
 PDI File# 154278 A  
 Client: Tetra Tech Rizzo/ N. Doherty  
 Client #: TBD

Exiting Stoney Hill Road (East) onto Route 20

Vehicle #	Entered Queue	Left Queue	Delay in sec.	Queue Length	Exiting Turn	Vehicle Class	Total 15 Min.
2	7:02:05 AM	7:02:10 AM	00:05	1	Left	Car	
4	7:02:26 AM	7:02:45 AM	00:19	1	Left	Car	
7	7:04:28 AM	7:04:47 AM	00:19	1	Left	Car	
14	7:09:12 AM	7:09:43 AM	00:31	1	Left	Car	
17	7:11:16 AM	7:11:32 AM	00:16	1	Left	Car	
18	7:11:59 AM	7:12:13 AM	00:14	1	Left	Car	6
1	7:01:58 AM	7:02:00 AM	00:02	1	Right	Car	
3	7:02:13 AM	7:02:21 AM	00:08	1	Right	Car	
5	7:03:45 AM	7:03:50 AM	00:05	1	Right	Car	
6	7:03:51 AM	7:03:58 AM	00:07	1	Right	Car	
8	7:05:10 AM	7:05:19 AM	00:09	1	Right	Car	
9	7:05:30 AM	7:05:47 AM	00:17	1	Right	Car	
10	7:06:57 AM	7:06:59 AM	00:02	1	Right	Car	
11	7:07:11 AM	7:07:12 AM	00:01	1	Right	Car	
12	7:08:34 AM	7:08:50 AM	00:16	1	Right	Car	
13	7:08:58 AM	7:09:00 AM	00:02	1	Right	School Bus	
15	7:10:23 AM	7:10:36 AM	00:13	1	Right	Car	
16	7:10:54 AM	7:11:04 AM	00:10	1	Right	Car	
19	7:14:58 AM	7:15:05 AM	00:07	1	Right	Car	13
21	7:23:29 AM	7:23:31 AM	00:02	1	Left	Car	
23	7:25:33 AM	7:26:17 AM	00:44	1	Left	Car	
26	7:28:13 AM	7:28:20 AM	00:07	1	Left	Car	3
20	7:20:08 AM	7:21:05 AM	00:57	1	Right	Car	
22	7:23:49 AM	7:24:31 AM	00:42	1	Right	Car	
24	7:27:31 AM	7:27:33 AM	00:02	1	Right	Car	
25	7:27:42 AM	7:27:53 AM	00:11	1	Right	MiniVan-Bus	
27	7:28:34 AM	7:29:05 AM	00:31	1	Right	School Bus	
28	7:29:58 AM	7:30:10 AM	00:12	1	Right	Car	6
29	7:30:15 AM	7:31:39 AM	01:24	1	Left	Car	
31	7:32:01 AM	7:32:46 AM	00:45	1	Left	Car	
36	7:37:45 AM	7:38:29 AM	00:44	4	Left	Car	
38	7:40:45 AM	7:41:00 AM	00:15	1	Left	Car	4
30	7:30:32 AM	7:30:48 AM	00:16	2	Right	Car	
32	7:33:29 AM	7:33:41 AM	00:12	1	Right	Car	
33	7:37:30 AM	7:37:54 AM	00:24	1	Right	School Bus	
34	7:37:31 AM	7:38:01 AM	00:30	2	Right	Car	
35	7:37:33 AM	7:38:18 AM	00:45	3	Right	Car	
37	7:39:56 AM	7:40:04 AM	00:08	1	Right	Car	
39	7:41:12 AM	7:41:44 AM	00:32	1	Right	Car	
40	7:43:08 AM	7:43:44 AM	00:36	1	Right	Car	
41	7:43:28 AM	7:44:10 AM	00:42	2	Right	Car	9
48	7:50:18 AM	7:50:26 AM	00:08	1	Left	Car	
51	7:53:01 AM	7:53:25 AM	00:24	2	Left	Car	2
42	7:45:19 AM	7:46:04 AM	00:45	1	Right	Car	
43	7:45:21 AM	7:46:17 AM	00:56	2	Right	Car	
44	7:45:37 AM	7:46:27 AM	00:50	3	Right	Car	
45	7:47:35 AM	7:48:00 AM	00:25	1	Right	Car	
46	7:47:52 AM	7:48:18 AM	00:26	2	Right	Car	
47	7:48:26 AM	7:49:05 AM	00:39	1	Right	Car	
49	7:51:06 AM	7:51:15 AM	00:09	1	Right	Car	
50	7:52:50 AM	7:53:18 AM	00:28	1	Right	Car	
52	7:53:32 AM	7:53:33 AM	00:01	1	Right	Car	
53	7:54:20 AM	7:54:39 AM	00:19	1	Right	Car	10
59	8:08:31 AM	8:08:49 AM	00:18	1	Left	Car	1
54	8:02:46 AM	8:02:56 AM	00:10	1	Right	Car	
55	8:04:02 AM	8:04:13 AM	00:11	1	Right	Car	
56	8:04:37 AM	8:05:01 AM	00:24	1	Right	Car	
57	8:04:44 AM	8:05:25 AM	00:41	2	Right	Car	
58	8:07:39 AM	8:07:56 AM	00:17	1	Right	Car	
60	8:08:38 AM	8:08:54 AM	00:16	2	Right	Car	
61	8:10:15 AM	8:10:23 AM	00:08	1	Right	Car	
62	8:10:17 AM	8:10:46 AM	00:29	2	Right	Car	
63	8:12:05 AM	8:13:07 AM	01:02	1	Right	Car	
64	8:14:25 AM	8:14:32 AM	00:07	1	Right	Car	10
67	8:20:09 AM	8:20:52 AM	00:43	1	Left	Car	
73	8:27:04 AM	8:27:10 AM	00:06	1	Left	Car	2
65	8:19:56 AM	8:19:59 AM	00:03	1	Right	Car	
66	8:19:58 AM	8:20:04 AM	00:06	2	Right	Car	
68	8:23:25 AM	8:23:45 AM	00:20	1	Right	Car	
69	8:23:39 AM	8:24:12 AM	00:33	2	Right	School Bus	
70	8:23:45 AM	8:24:26 AM	00:41	2	Right	Car	
71	8:23:46 AM	8:24:33 AM	00:47	3	Right	Car	
72	8:24:23 AM	8:24:56 AM	00:33	3	Right	Car	
74	8:27:21 AM	8:27:22 AM	00:01	1	Right	Car	
75	8:27:47 AM	8:28:24 AM	00:37	1	Right	Car	
76	8:29:13 AM	8:29:34 AM	00:21	1	Right	Car	10
80	8:37:12 AM	8:37:55 AM	00:43	1	Left	Car	1
77	8:32:15 AM	8:32:16 AM	00:01	1	Right	School Bus	
78	8:32:22 AM	8:32:24 AM	00:02	1	Right	Car	
79	8:32:29 AM	8:32:30 AM	00:01	1	Right	Car	
81	8:38:20 AM	8:38:55 AM	00:35	1	Right	Car	
82	8:38:22 AM	8:39:43 AM	01:21	2	Right	Car	
83	8:39:32 AM	8:39:50 AM	00:18	2	Right	Car	
84	8:42:22 AM	8:42:31 AM	00:09	1	Right	Car	
85	8:43:37 AM	8:43:38 AM	00:01	1	Right	Car	
86	8:44:07 AM	8:44:19 AM	00:12	1	Right	Car	9
89	8:49:02 AM	8:49:26 AM	00:24	1	Left	Car	
94	8:55:58 AM	8:56:12 AM	00:14	1	Left	Car	
96	8:59:23 AM	8:59:41 AM	00:18	1	Left	Car	3
87	8:46:01 AM	8:46:38 AM	00:37	1	Right	Car	
88	8:47:39 AM	8:47:47 AM	00:08	1	Right	Car	
90	8:50:37 AM	8:50:50 AM	00:13	1	Right	Car	
91	8:50:43 AM	8:50:54 AM	00:11	2	Right	Car	
92	8:52:49 AM	8:52:52 AM	00:03	1	Right	Car	
93	8:53:06 AM	8:53:44 AM	00:38	1	Right	Car	
95	8:57:36 AM	8:57:50 AM	00:14	1	Right	Car	7

**2 Hour Total**

Left Turns	22
Ave Stopped Time	0:00:25
Max Stopped Time	0:01:24
Average Queue	1.2
Max Queue	4.0
Right Turns	74
Ave Stopped Time	0:00:21
Max Stopped Time	0:01:21
Average Queue	1.3
Max Queue	3.0

**Stoney Hill Road Peak Hour (7:00 to 8:00)**

Left Turns	15
Ave Stopped Time	0:00:25
Max Stopped Time	0:01:24
Average Queue	1.3
Max Queue	4.0
Right Turns	38
Ave Stopped Time	0:00:21
Max Stopped Time	0:00:57
Average Queue	1.2
Max Queue	3.0

**Intersection Peak Hour (7:30 - 8:30)**

Left Turns	9
Ave Stopped Time	0:00:32
Max Stopped Time	0:01:24
Average Queue	1.4
Max Queue	4.0
Right Turns	39
Ave Stopped Time	0:00:26
Max Stopped Time	0:01:02
Average Queue	1.5
Max Queue	3.0

Stoney Hill Road (East) @ Hartford Turnpike (Route 20)

Queue/Delay Study

City, State: Shrewsbury, MA

Date: Tuesday 2/24/2015

Time: 4:00pm-6:00pm

PDI File# 154278 A

Client: Tetra Tech Rizzo/ N. Doherty

Client #: TBD

**STONEY HILL EAST  
AFTERNOON  
COMBINED**

Exiting Stoney Hill Road (East) onto Route 20

Vehicle #	Entered Queue	Left Queue	Delay in sec.	Queue Length	Exiting Turn	Vehicle Class	Total 15 Min.
1	4:09:17 PM	4:09:18 PM	00:01	1	Right	School Bus	
2	4:10:10 PM	4:10:14 PM	00:04	1	Right	Car	
3	4:11:35 PM	4:11:42 PM	00:07	1	Right	Car	3
4	4:15:52 PM	4:15:53 PM	00:01	1	Right	Car	
5	4:16:15 PM	4:16:25 PM	00:10	1	Right	Car	
6	4:17:52 PM	4:17:55 PM	00:03	1	Left	School Bus	
7	4:18:23 PM	4:18:25 PM	00:02	1	Right	Car	
8	4:21:57 PM	4:21:59 PM	00:02	1	Right	Car	
9	4:29:51 PM	4:30:00 PM	00:09	1	Right	Car	6
10	4:30:10 PM	4:30:19 PM	00:09	1	Right	Car	
11	4:39:26 PM	4:39:36 PM	00:10	1	Left	Car	
12	4:39:43 PM	4:39:43 PM	00:00	1	Right	Car	
13	4:40:56 PM	4:41:06 PM	00:10	1	Right	Car	
14	4:41:26 PM	4:42:17 PM	00:51	1	Left	Car	
15	4:42:23 PM	4:42:29 PM	00:06	1	Left	Car	
16	4:43:24 PM	4:43:30 PM	00:06	1	Right	Car	
17	4:43:34 PM	4:43:37 PM	00:03	1	Left	Car	8
18	4:51:28 PM	4:51:53 PM	00:25	1	Right	Car	
19	4:58:24 PM	4:58:25 PM	00:01	1	Right	Car	2
20	5:06:05 PM	5:07:02 PM	00:57	1	Left	Car	
21	5:07:16 PM	5:07:22 PM	00:06	1	Left	Car	
22	5:10:34 PM	5:10:35 PM	00:01	1	Right	Car	
23	5:11:02 PM	5:11:03 PM	00:01	1	Right	Car	
24	5:14:13 PM	5:14:25 PM	00:12	1	Right	Car	5
25	5:22:14 PM	5:22:16 PM	00:02	1	Right	Car	
26	5:23:05 PM	5:23:06 PM	00:01	1	Right	Car	
27	5:25:38 PM	5:25:46 PM	00:08	1	Right	Car	3
28	5:33:25 PM	5:33:26 PM	00:01	1	Right	Car	
29	5:33:56 PM	5:34:14 PM	00:18	1	Left	Car	
30	5:36:19 PM	5:36:23 PM	00:04	1	Right	Car	
31	5:36:43 PM	5:36:44 PM	00:01	1	Right	Car	
32	5:41:24 PM	5:41:51 PM	00:27	1	Right	Car	5
33	5:46:47 PM	5:46:48 PM	00:01	1	Right	Car	
34	5:47:08 PM	5:47:08 PM	00:00	1	Right	Car	
35	5:47:51 PM	5:47:57 PM	00:06	1	Right	Car	
36	5:48:02 PM	5:48:07 PM	00:05	1	Right	Car	
37	5:48:56 PM	5:48:56 PM	00:00	1	Right	car	
38	5:50:35 PM	5:50:35 PM	00:00	1	Right	Car	
39	5:51:51 PM	5:52:26 PM	00:35	1	Left	Car	
40	5:54:29 PM	5:54:30 PM	00:01	1	Right	Car	
41	5:58:20 PM	5:58:23 PM	00:03	1	Right	Car	
42	5:59:40 PM	6:00:34 PM	00:54	1	Left	Car	10

**2 Hour Total**

Total Vehicles	42
Ave Stopped Time	0:00:10
Max Stopped Time	00:57
Average Queue	1.0
Max Queue	1.0

**Stoney Hill Road Peak Hour (5:00 - 6:00)**

Total Vehicles	23
Ave Stopped Time	0:00:11
Max Stopped Time	00:57
Average Queue	1.0
Max Queue	1.0

**Intersection Peak Hour (5:00 - 6:00)**

Total Vehicles	23
Ave Stopped Time	0:00:11
Max Stopped Time	00:57
Average Queue	1.0
Max Queue	1.0

**STONEY HILL EAST  
AFTERNOON  
LT and RTs**

City, State: Shrewsbury, MA  
Date: Tuesday 2/24/2015  
Time: 4:00pm-6:00pm  
PDI File# 154278 A  
Client: Tetra Tech Rizzo/ N. Doherty  
Client #: TBD

Exiting Stoney Hill Road (East) onto Route 20

Vehicle #	Entered Queue	Left Queue	Delay in sec.	Queue Length	Exiting Turn	Vehicle Class	Total 15 Min.
1	4:09:17 PM	4:09:18 PM	00:01	1	Right	School Bus	
2	4:10:10 PM	4:10:14 PM	00:04	1	Right	Car	
3	4:11:35 PM	4:11:42 PM	00:07	1	Right	Car	3
6	4:17:52 PM	4:17:55 PM	00:03	1	Left	School Bus	1
4	4:15:52 PM	4:15:53 PM	00:01	1	Right	Car	
5	4:16:15 PM	4:16:25 PM	00:10	1	Right	Car	
7	4:18:23 PM	4:18:25 PM	00:02	1	Right	Car	
8	4:21:57 PM	4:21:59 PM	00:02	1	Right	Car	
9	4:29:51 PM	4:30:00 PM	00:09	1	Right	Car	5
11	4:39:26 PM	4:39:36 PM	00:10	1	Left	Car	
14	4:41:26 PM	4:42:17 PM	00:51	1	Left	Car	
15	4:42:23 PM	4:42:29 PM	00:06	1	Left	Car	
17	4:43:34 PM	4:43:37 PM	00:03	1	Left	Car	4
10	4:30:10 PM	4:30:19 PM	00:09	1	Right	Car	
12	4:39:43 PM	4:39:43 PM	00:00	1	Right	Car	
13	4:40:56 PM	4:41:06 PM	00:10	1	Right	Car	
16	4:43:24 PM	4:43:30 PM	00:06	1	Right	Car	4
18	4:51:28 PM	4:51:53 PM	00:25	1	Right	Car	
19	4:58:24 PM	4:58:25 PM	00:01	1	Right	Car	2
20	5:08:05 PM	5:07:02 PM	00:57	1	Left	Car	
21	5:07:16 PM	5:07:22 PM	00:06	1	Left	Car	2
22	5:10:34 PM	5:10:35 PM	00:01	1	Right	Car	
23	5:11:02 PM	5:11:03 PM	00:01	1	Right	Car	
24	5:14:13 PM	5:14:25 PM	00:12	1	Right	Car	3
25	5:22:14 PM	5:22:16 PM	00:02	1	Right	Car	
26	5:23:05 PM	5:23:06 PM	00:01	1	Right	Car	
27	5:25:38 PM	5:25:46 PM	00:08	1	Right	Car	3
29	5:33:56 PM	5:34:14 PM	00:18	1	Left	Car	1
28	5:33:25 PM	5:33:26 PM	00:01	1	Right	Car	
30	5:36:19 PM	5:36:23 PM	00:04	1	Right	Car	
31	5:36:43 PM	5:36:44 PM	00:01	1	Right	Car	
32	5:41:24 PM	5:41:51 PM	00:27	1	Right	Car	4
39	5:51:51 PM	5:52:26 PM	00:35	1	Left	Car	
42	5:59:40 PM	6:00:34 PM	00:54	1	Left	Car	2
33	5:46:47 PM	5:46:48 PM	00:01	1	Right	Car	
34	5:47:08 PM	5:47:08 PM	00:00	1	Right	Car	
35	5:47:51 PM	5:47:57 PM	00:06	1	Right	Car	
36	5:48:02 PM	5:48:07 PM	00:05	1	Right	Car	
37	5:48:56 PM	5:48:56 PM	00:00	1	Right	car	
38	5:50:35 PM	5:50:35 PM	00:00	1	Right	Car	
40	5:54:29 PM	5:54:30 PM	00:01	1	Right	Car	
41	5:58:20 PM	5:58:23 PM	00:03	1	Right	Car	8

**2 Hour Total**

Left Turns	10
Ave Stopped Time	0:00:24
Max Stopped Time	0:00:57
Average Queue	1.0
Max Queue	1.0
Right Turns	32
Ave Stopped Time	0:00:05
Max Stopped Time	0:00:27
Average Queue	1.0
Max Queue	1.0

**Stoney Hill Road Peak Hour (5:00 - 6:00)**

Left Turns	5
Ave Stopped Time	0:00:34
Max Stopped Time	0:00:57
Average Queue	1.0
Max Queue	1.0
Right Turns	18
Ave Stopped Time	0:00:04
Max Stopped Time	0:00:27
Average Queue	1.0
Max Queue	1.0

**Intersection Peak Hour (5:00 - 6:00)**

Left Turns	5
Ave Stopped Time	0:00:34
Max Stopped Time	0:00:57
Average Queue	1.0
Max Queue	1.0
Right Turns	18
Ave Stopped Time	0:00:04
Max Stopped Time	0:00:27
Average Queue	1.0
Max Queue	1.0

**Appendix D**  
**No-Build Backup**

Station: 307  
 Location: Rt. 9, East of Northborough  
 Year: 2012

Station: 307  
 Location: Rt. 9, East of Northborough

INTERVAL:60-MIN						
Time	60-min Interval				Hourly Count	% Diff
	1st	2nd	3rd	4th		
0:00-1:00	-	-	-	-	382	-39.9
1:00-2:00	-	-	-	-	207	-14
2:00-3:00	-	-	-	-	174	-5.3
3:00-4:00	-	-	-	-	131	-0.8
4:00-5:00	-	-	-	-	213	14.8
5:00-6:00	-	-	-	-	634	26.4
6:00-7:00	-	-	-	-	1609	23.9
7:00-8:00	-	-	-	-	2614	27.1
8:00-9:00	-	-	-	-	2970	23.9
9:00-10:00	-	-	-	-	2641	17.6
10:00-11:00	-	-	-	-	2610	0.2
11:00-12:00	-	-	-	-	2970	-2.2
12:00-13:00	-	-	-	-	3435	1.8
13:00-14:00	-	-	-	-	3358	-3.9
14:00-15:00	-	-	-	-	3422	-1.7
15:00-16:00	-	-	-	-	3624	3.1
16:00-17:00	-	-	-	-	3702	12
17:00-18:00	-	-	-	-	3647	13.4
18:00-19:00	-	-	-	-	3139	13.8
19:00-20:00	-	-	-	-	2386	10.3
20:00-21:00	-	-	-	-	1801	17.6
21:00-22:00	-	-	-	-	1431	4.8
22:00-23:00	-	-	-	-	995	-2.2
23:00-24:00	-	-	-	-	706	4.6
<b>Total</b>	Counts = 343				48813	9.2

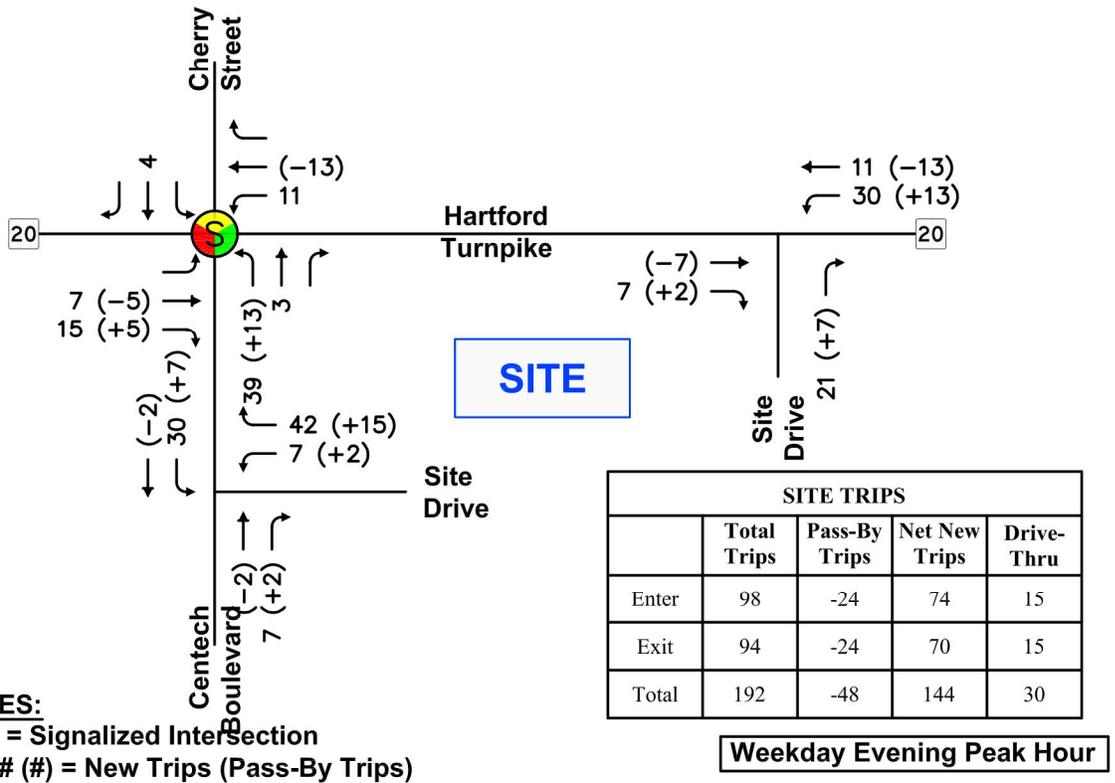
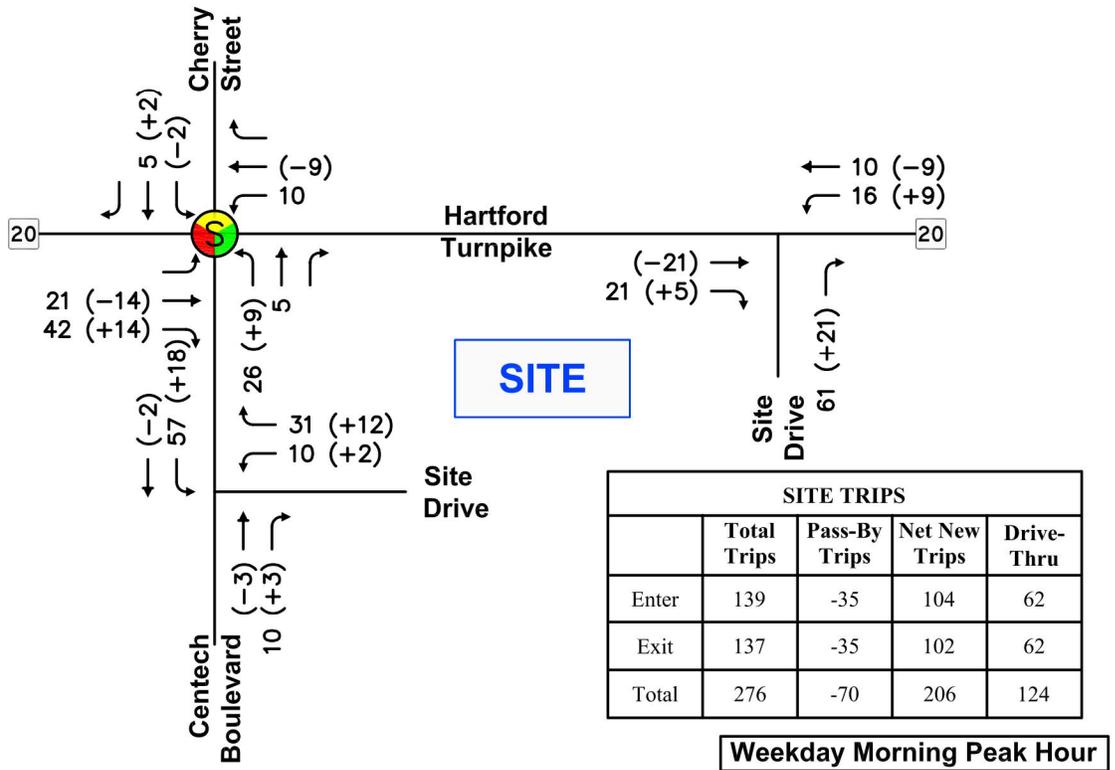
YEAR 2012	YEAR 2008
382	751
207	371
174	209
131	163
213	159
634	224
1609	655
2614	1696
2970	2667
2641	2882
2610	2535
2970	2542
3435	2896
3358	3363
3422	3282
3624	3372
3702	3599
3647	3687
3139	3679
2386	3082
1801	2311
1431	1750
995	1383
706	1008
48813	48266

Count Criteria

Local Id	307
Start Date	1/1/2012
End Date	12/31/2012
Aggregation	Average
Include Abnormal	FALSE
Selected Days	Monday Tuesday Wednesday Thursday Friday Saturday Sunday

GROWTH RATE PER YEAR	1.003
----------------------	-------

# **Off-Site Development Data**



North

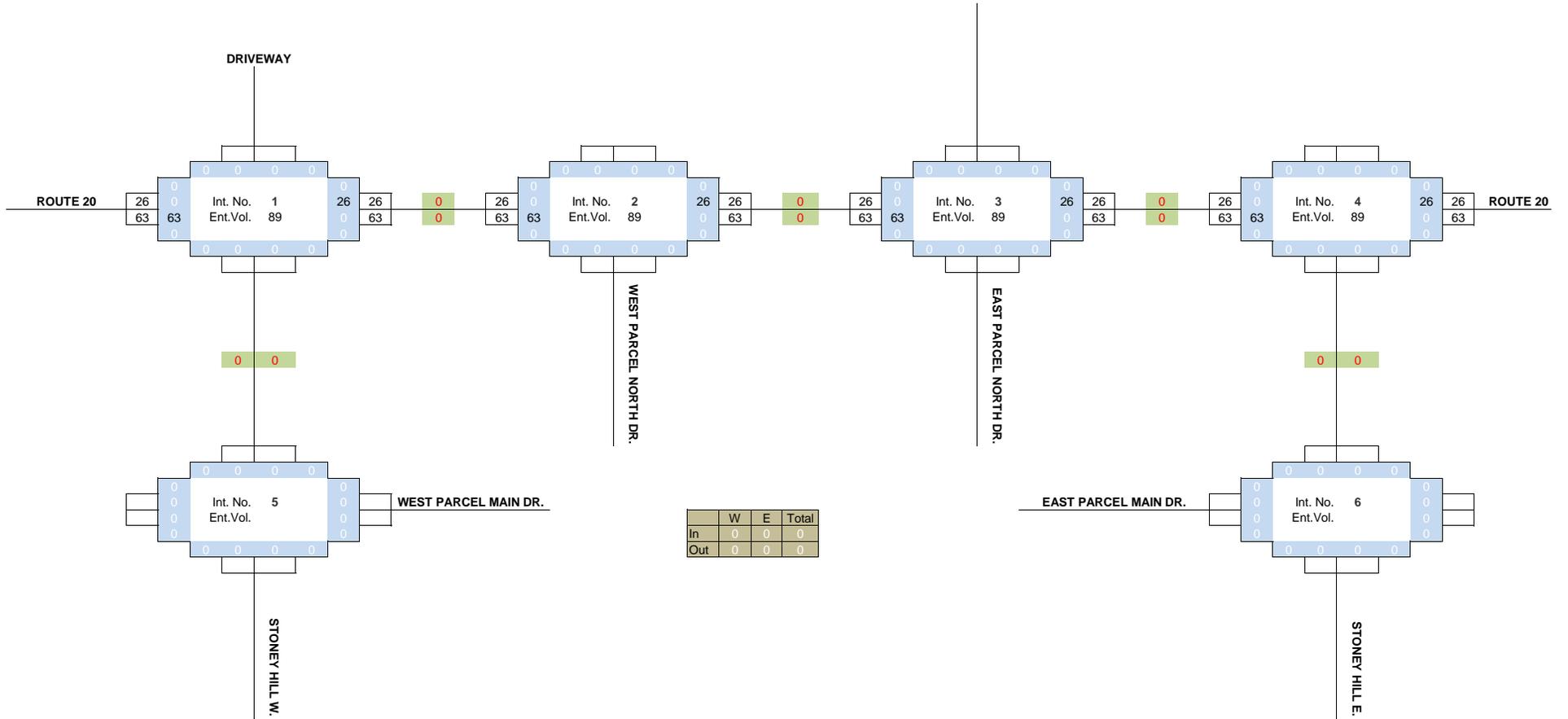
Scale: Not to Scale

**NOTES:**

- = Signalized Intersection
- # (#) = New Trips (Pass-By Trips)

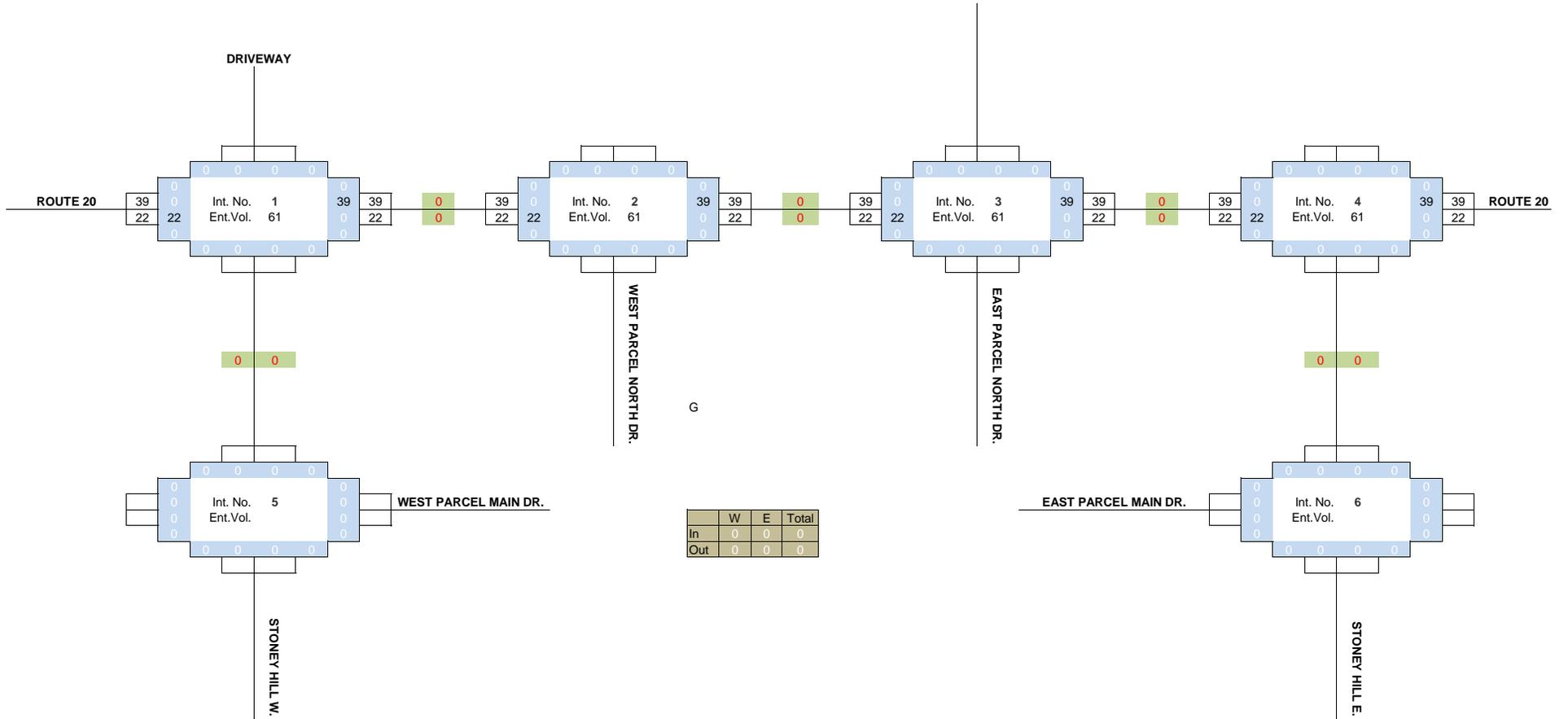
**Figure 7**

Sheet	Column	Description
Data	8	Gas Station/ Car Wash Trips AM



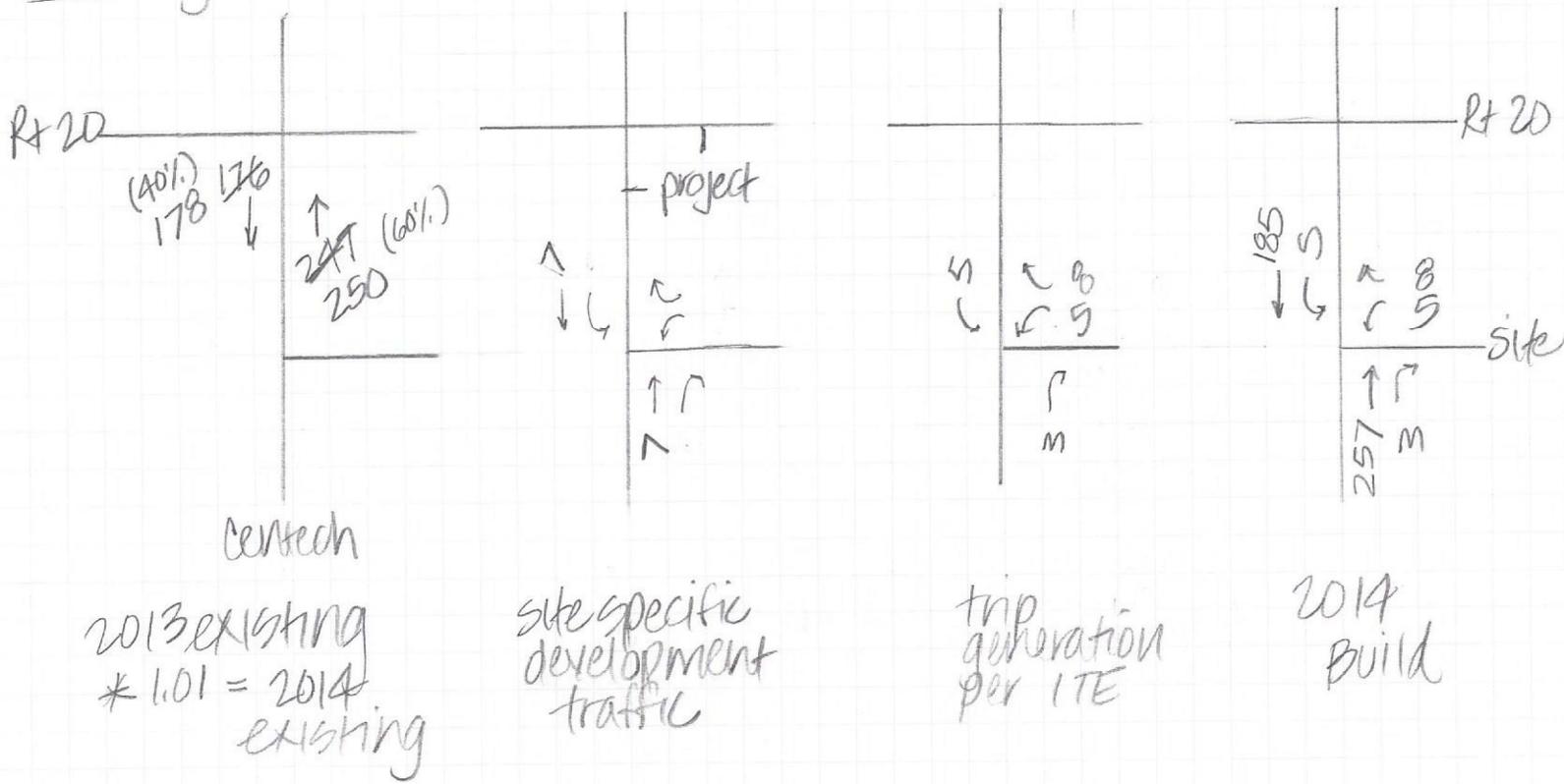
	W	E	Total
In	0	0	0
Out	0	0	0

Sheet	Column	Description
Data	9	Gas Station/ Car Wash Trips PM

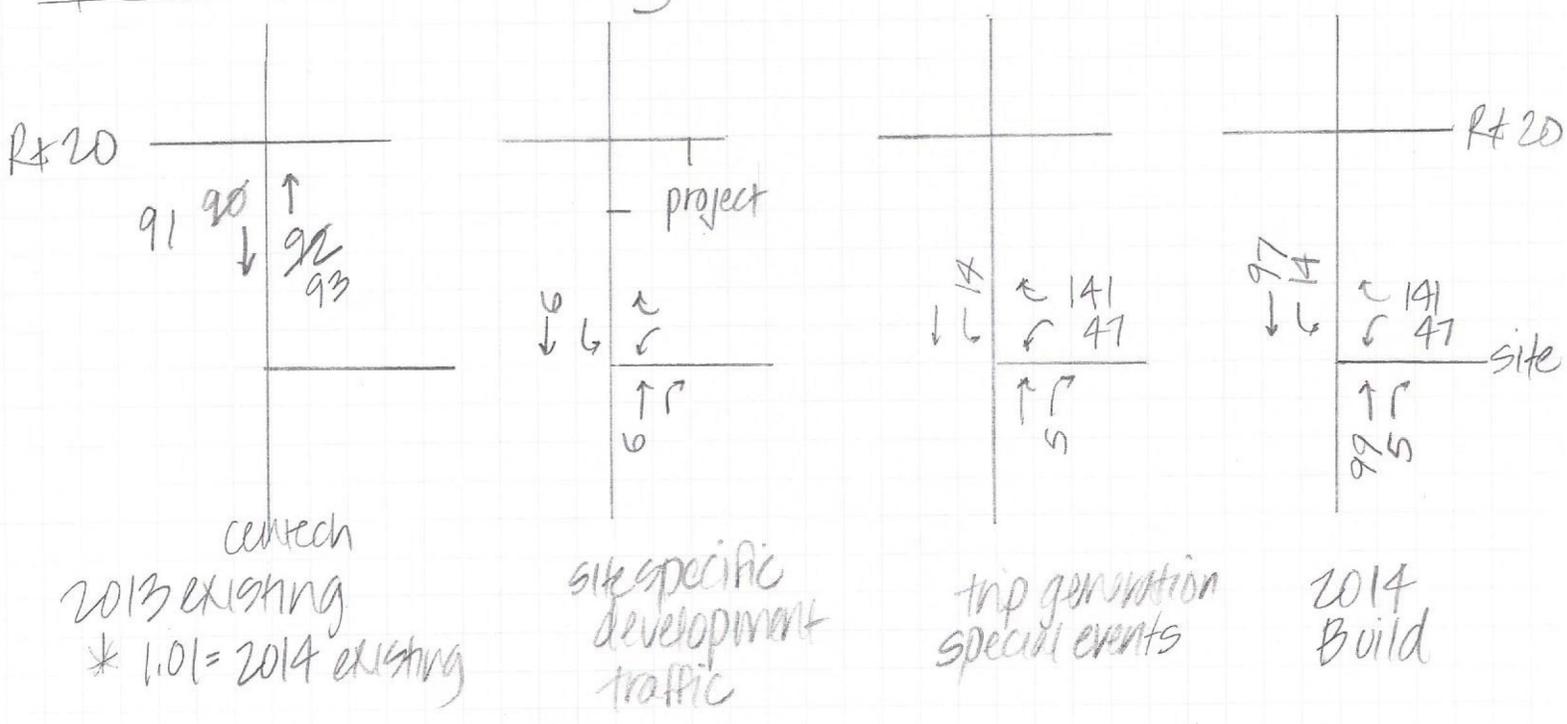


	W	E	Total
In	0	0	0
Out	0	0	0

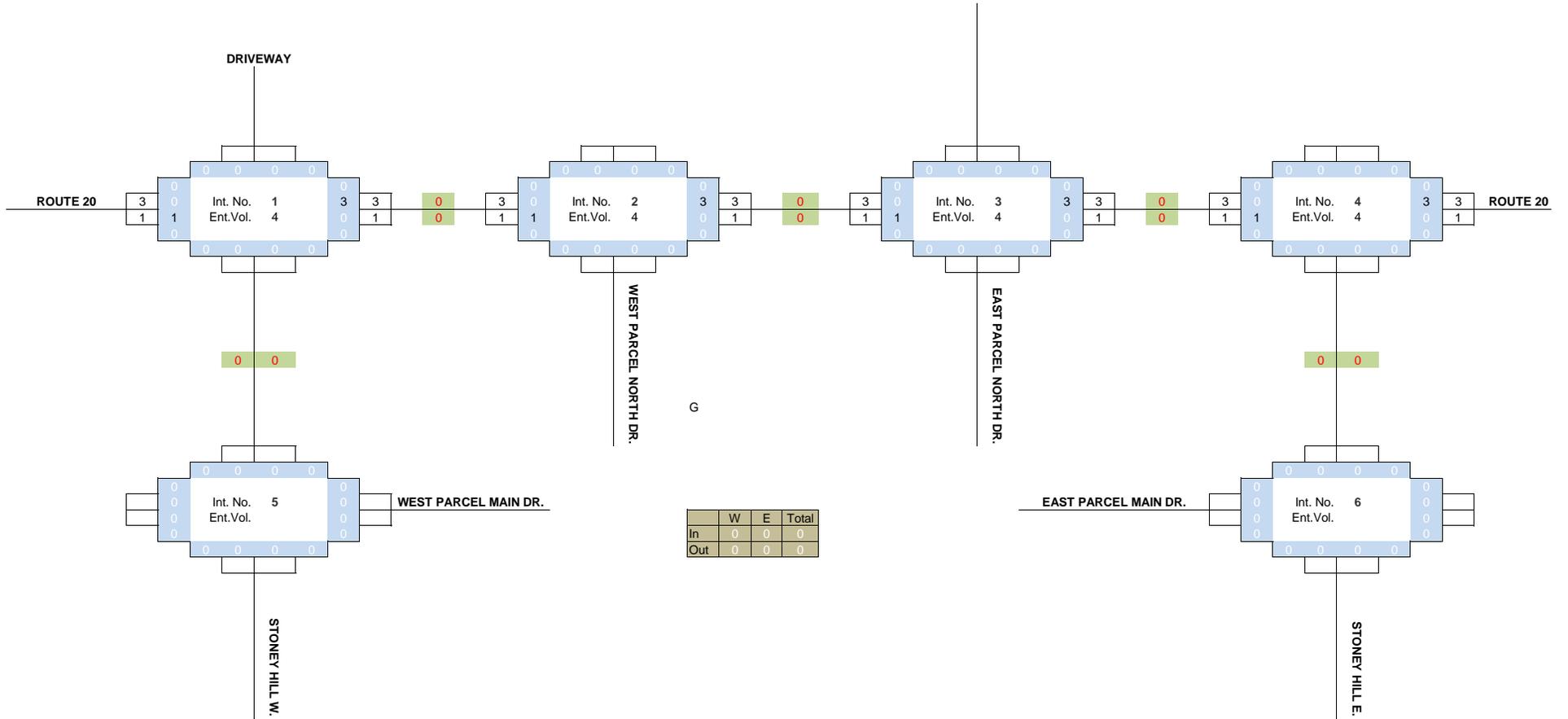
Weekday PM :



Special event Saturday



Sheet	Column	Description
Data	11	Altec Trips PM



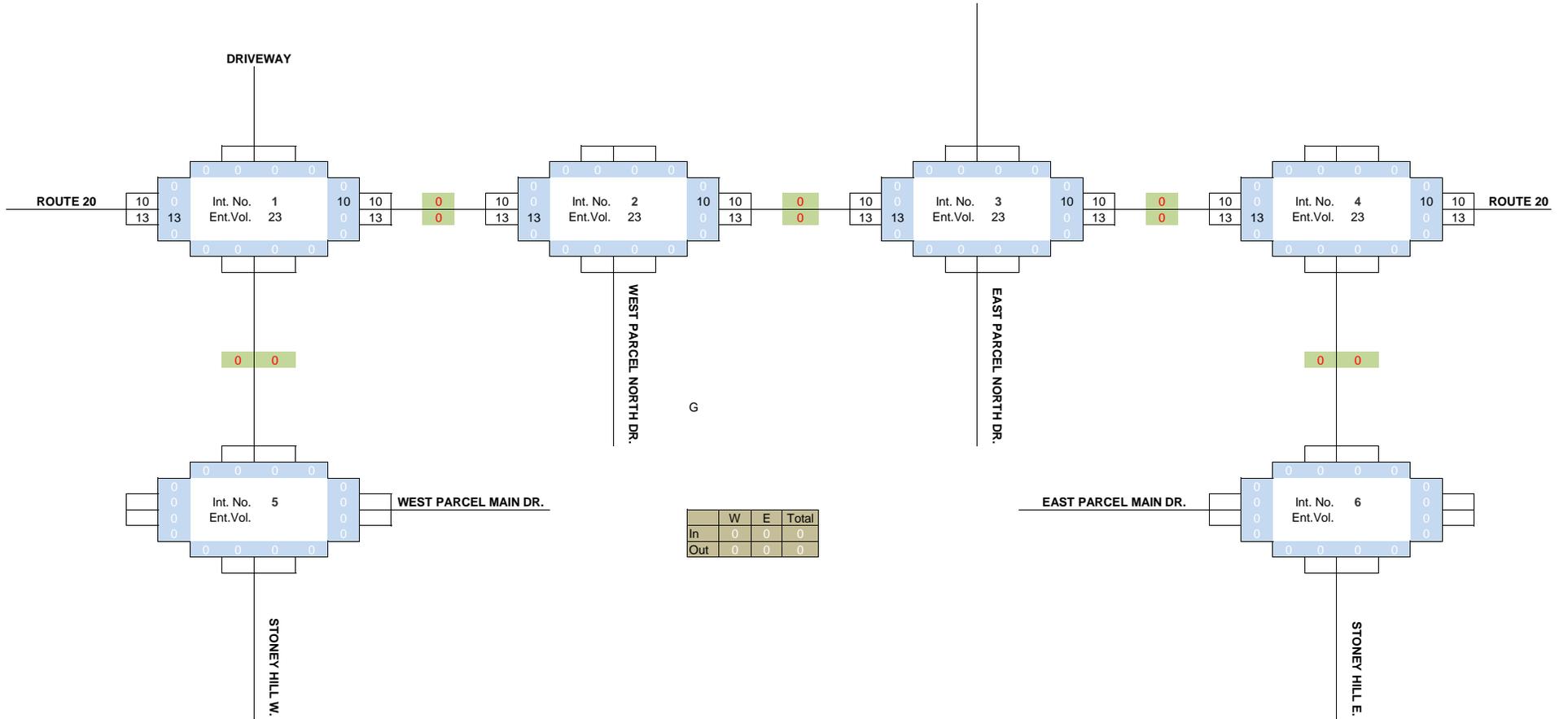
**TRIP GENERATION CALCULATIONS - PROPOSED 3 GARAGE SERVICES BLDGS @ 360 HARTFORD TPKE, SHREWSBURY**

Land Use Code 942- Automobile Care Center						Size: 24 KSF		
Time Period	R <sup>2</sup> Value	Use Equation or Rate?	Equation	Rate	Percent Enter	In	Out	Total
Weedkay Daily		Rate		2.25	66%	36	18	54
AM Street Peak Hour of Adjacent Street Traffic	0.83	Equation	T=2.41(x)+11.79	3.11	48%	34	36	70
PM Street Peak Hour of Adjacent Street Traffic	0.65	Rate	T = 1.63(x)+20.05	2.83	56%	38	30	68
AM Street Peak Hour of Generator	0.71	Rate	T = 2.15(x)+22.82	3.51	49%	41	43	84
PM Street Peak Hour of Generator		Rate	Not Given	23.72	50%	285	284	569
Saturday Daily		Rate	Not Given	11.88	50%	143	142	285
Sunday Daily		Rate	Not Given					

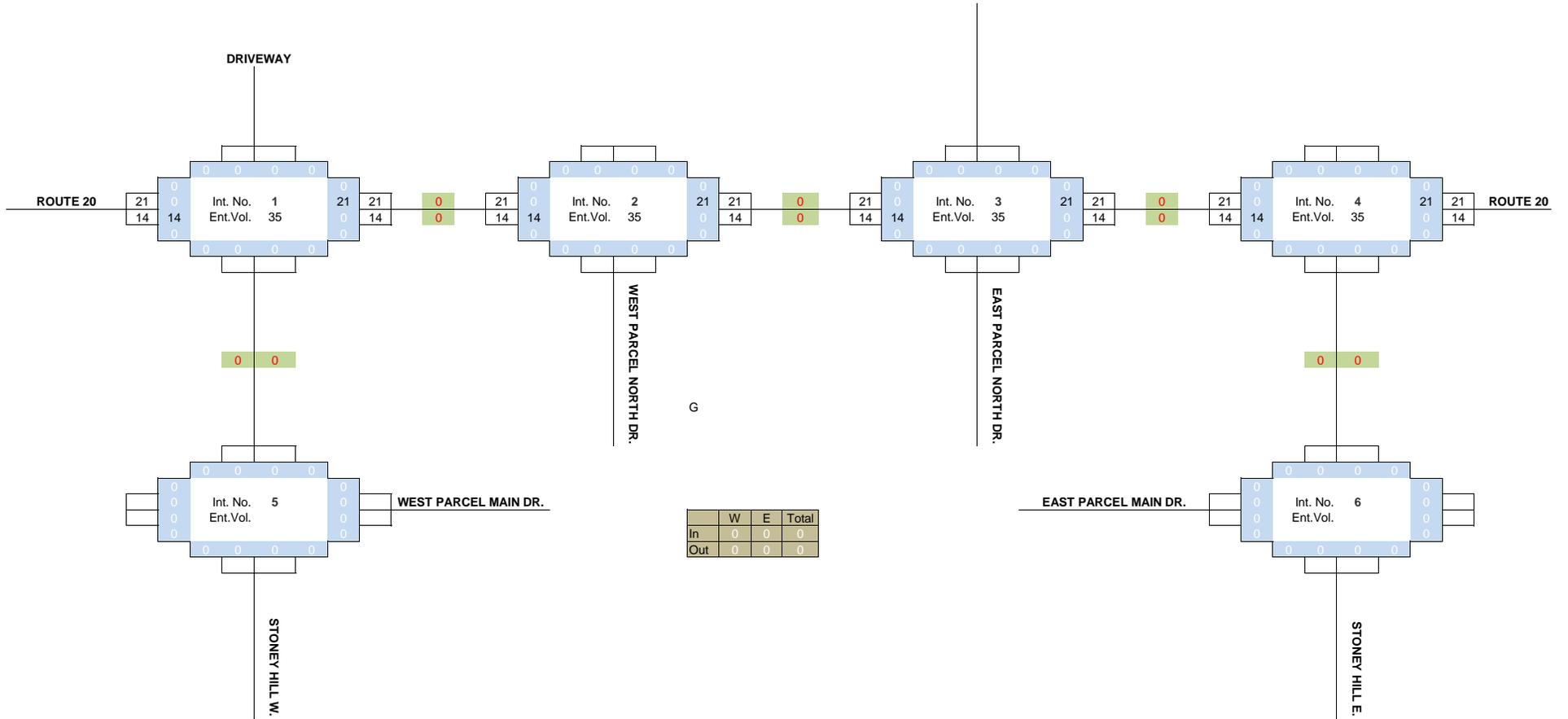
Note: If R2 is greater than or equal to 0.75 the equation is used to calculate trips, otherwise the rate is used.

Source: Trip Generation, Ninth Edition, (Institute of Transportation Engineers, 2012).

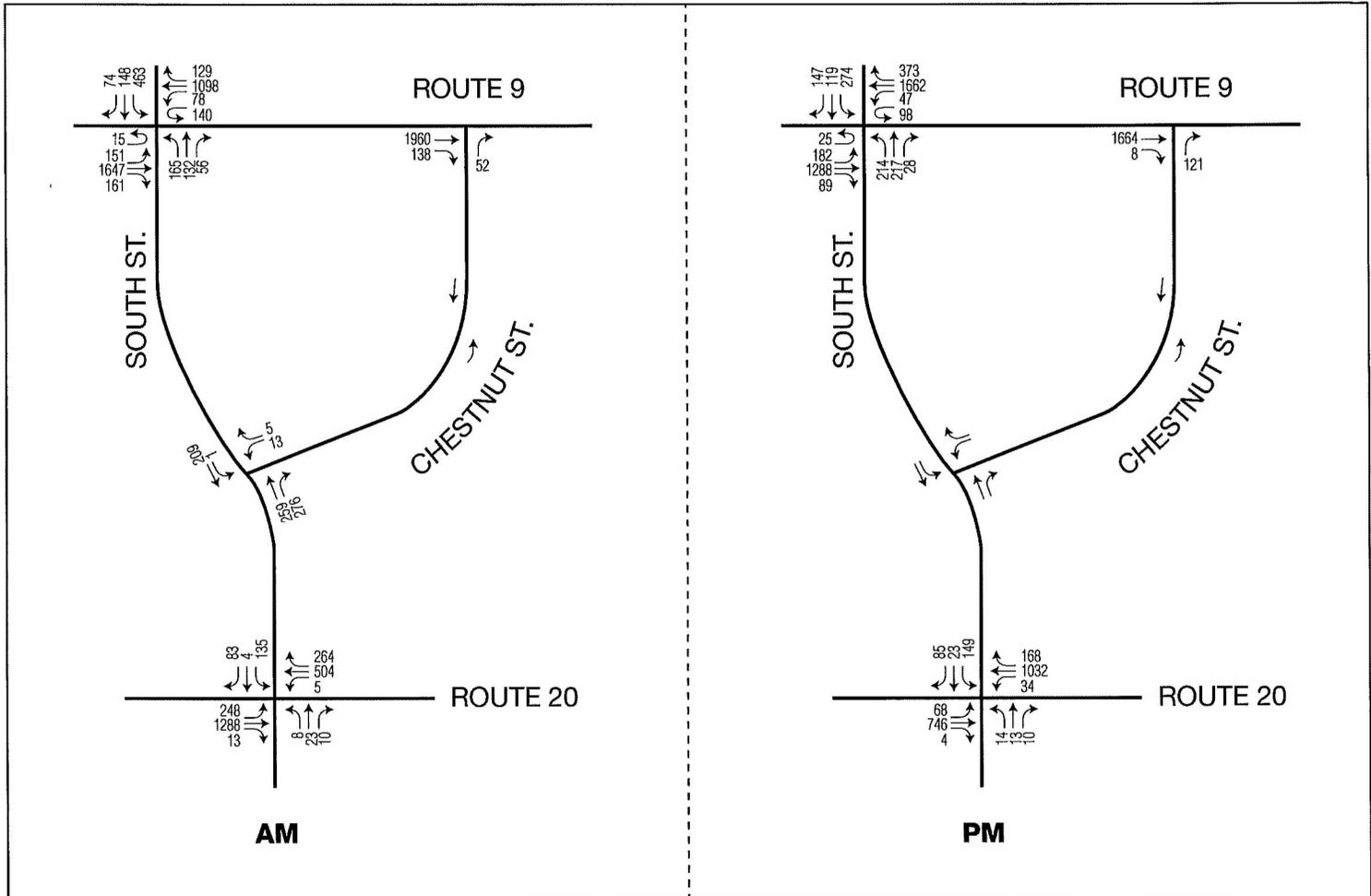
Sheet	Column	Description
Data	12	3 Garages Trips AM



Sheet	Column	Description
Data	13	3 Garages Trips PM



	W	E	Total
In	0	0	0
Out	0	0	0

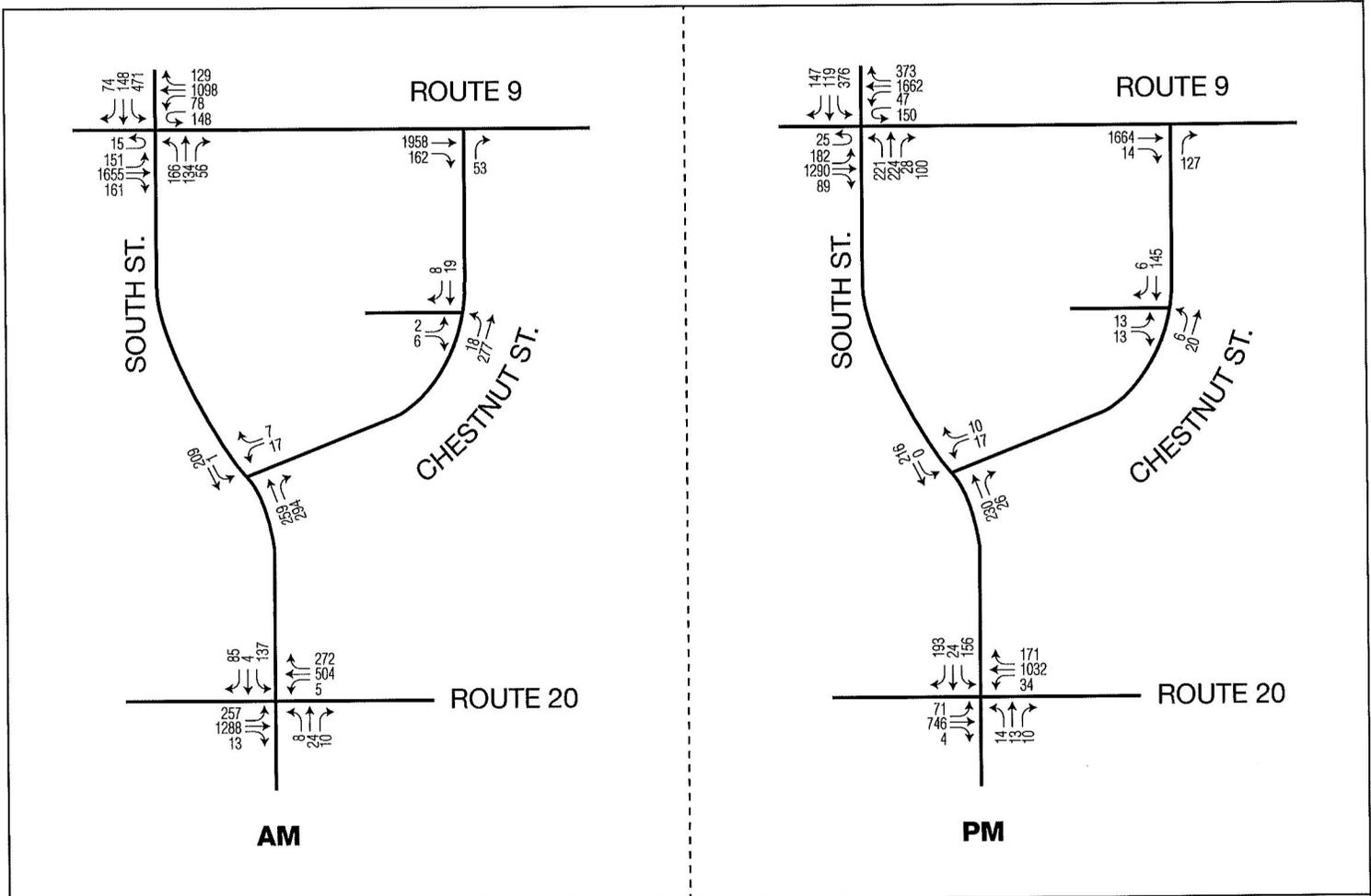


**CONLEY ASSOCIATES**  
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 Boston, MA 02129  
 (617) 742-5111  
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**FIGURE 2**  
**BOSTON MEDICAL PRODUCTS**  
**SHREWSBURY, MA**  
**2019 NO BUILD CONDITION**

PROJ. NO 1500 DATE: DEC 2013 NOT TO SCALE



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**FIGURE 3**  
**BOSTON MEDICAL PRODUCTS**  
**SHREWSBURY, MA**  
**2019 BUILD CONDITION**

PROJ. NO 1500 DATE: DEC 2013 NOT TO SCALE

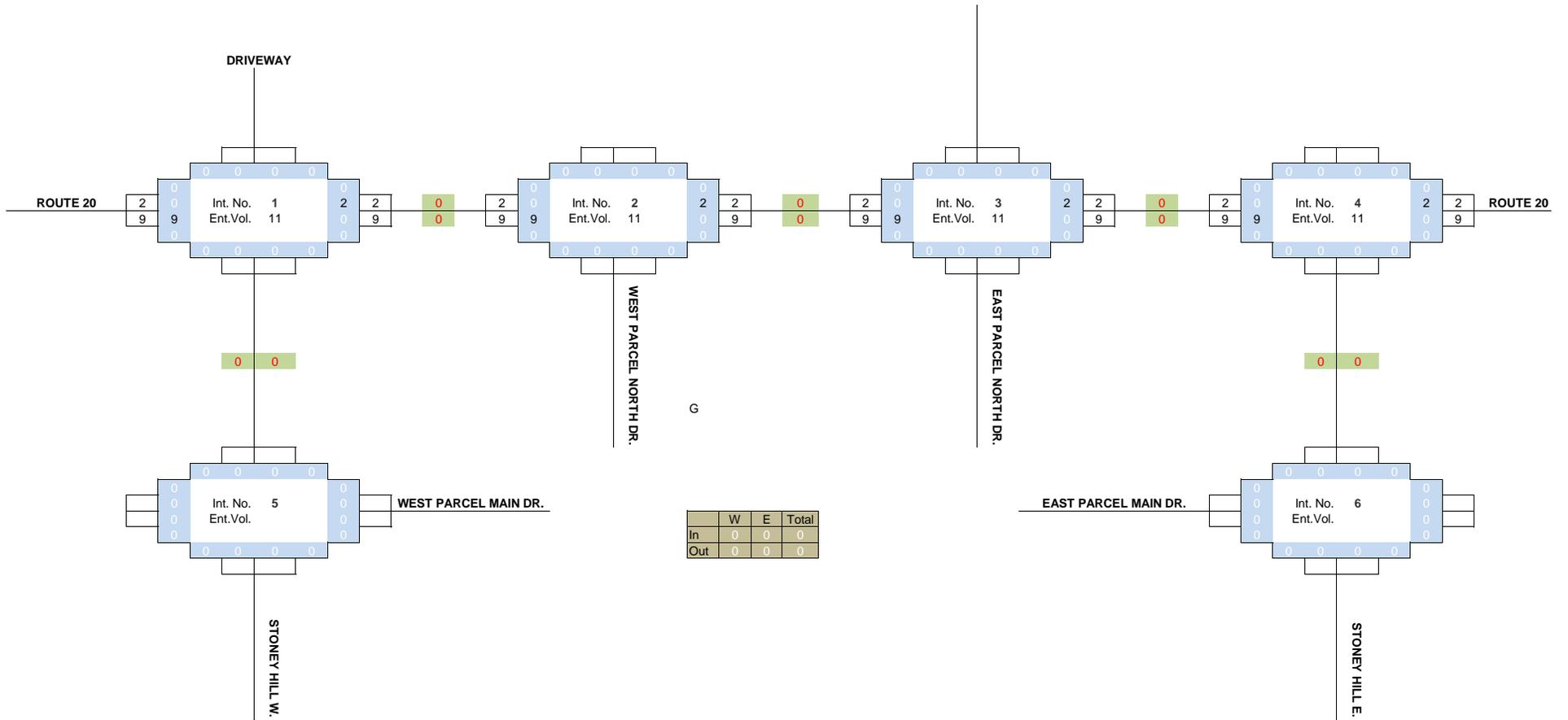
**Traffic Volume Calculations - AM Peak Hour**

	raw	seasonal 1.0265	existing 1.01	growth 1.05101	fairlawn	centech	storage NB	trips	B
<b>9/south</b>									
EB u-turn	14	14	15	15				15	0 15
EBL	139	143	144	151				151	0 151
EBT	1501	1541	1556	1636	6		5	1647	8 1655
EBR	148	152	153	161				161	0 161
NBL	151	155	157	165				165	1 166
NBT	121	124	125	132				132	2 134
NBR	51	52	53	56				56	0 56
WB u-turn	127	130	132	138			2	140	8 148
WBL	72	74	75	78				78	0 78
WBT	963	989	998	1049	46		3	1098	0 1098
WBR	118	121	122	129				129	0 129
SBL	425	436	441	463				463	8 471
SBT	136	140	141	148				148	0 148
SBR	68	70	71	74				74	0 74
<b>9/chestnut</b>									
EBT	1787	1834	1853	1947	6		7	1960	0 1960
EBR	127	130	132	138				138	24 162
NBR	48	49	50	52				52	1 53
<b>20/south</b>									
EBL	228	234	236	248				248	9 257
EBT	1126	1156	1167	1227			61	1288	0 1288
EBR	12	12	12	13				13	0 13
NBL	7	7	7	8				8	0 8
NBT	21	22	22	23				23	1 24
NBR	9	9	9	10				10	0 10
WBL	5	5	5	5				5	0 5
WBT	439	451	455	478			26	504	0 504
WBR	242	248	251	264				264	8 272
SBL	124	127	129	135				135	2 137
SBT	4	4	4	4				4	0 4
SBR	76	78	79	83				83	2 85
<b>south/chestnut</b>									
NBT	238	244	247	259				259	0 259
NBR	253	260	262	276				276	18 294
WBL	12	12	12	13				13	4 17
WBR	5	5	5	5				5	2 7
SBL	1	1	1	1				1	0 1
SBT	192	197	199	209				209	0 209
<b>chestnut/site</b>									
NBL	0	0	0	0				0	18 18
NBT	254	261	263	277				277	0 277
SBT	17	17	18	19				19	0 19
SBR	0	0	0	0				0	8 8
EBL	0	0	0	0				0	2 2
EBR	0	0	0	0				0	6 6

**Traffic Volume Calculations - PM peak hour**

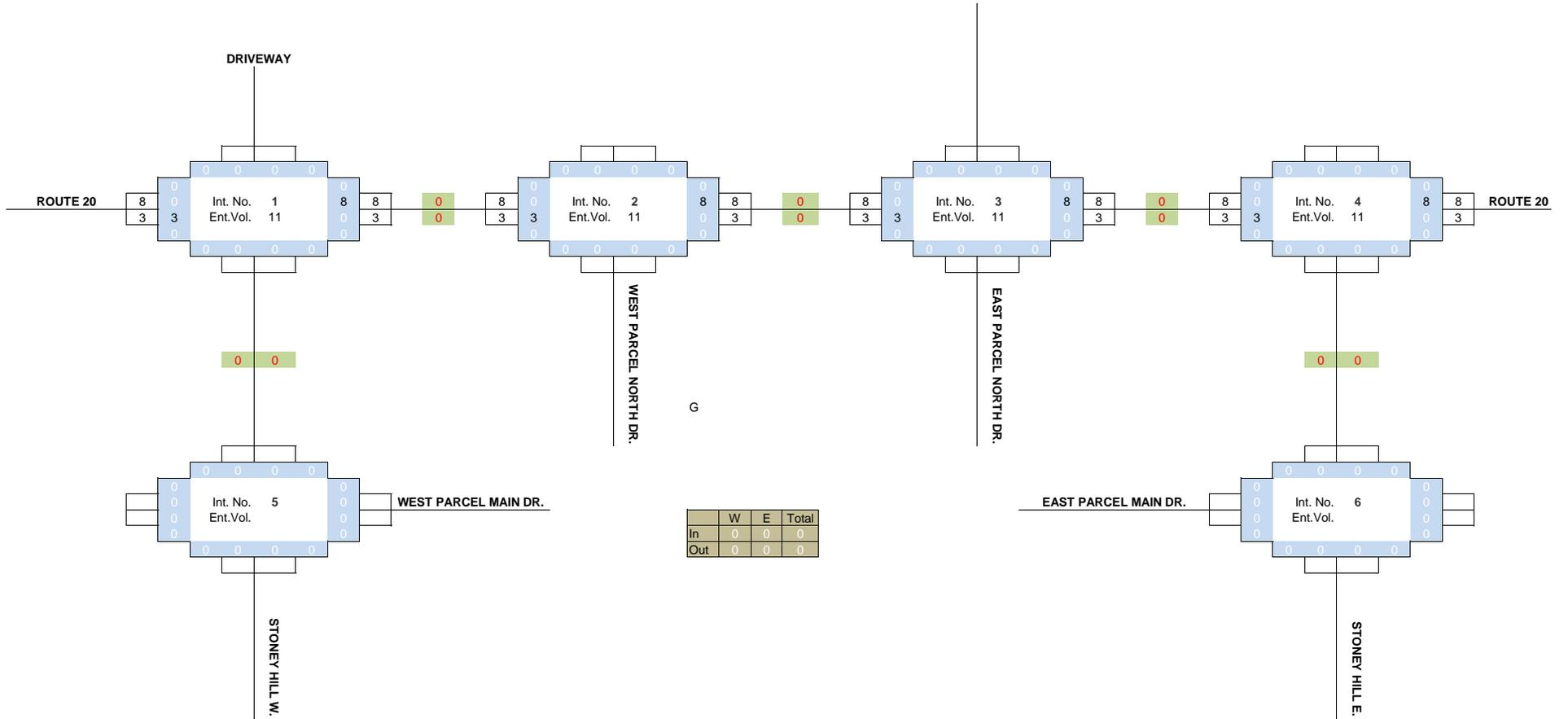
	raw	seasonal 1.0265	existing 1.01	growth 1.05101	fairlawn	centech	storage	NB	trips	B
<b>9/south</b>										
EB u-turn	23	24	24	25				25		25
EBL	167	171	173	182				182		182
EBT	1152	1183	1194	1255	29		4	1288	2	1290
EBR	82	84	85	89				89		89
NBL	196	201	203	214				214	7	221
NBT	199	204	206	217				217	7	224
NBR	26	27	27	28				28		28
WB u-turn	87	89	90	95			3	98	2	100
WBL	43	44	45	47				47		47
WBT	1517	1557	1573	1653	5		4	1662		1662
WBR	342	351	355	373				373		373
SBL	251	258	260	274				274	2	276
SBT	109	112	113	119				119		119
SBR	135	139	140	147				147		147
<b>9/chestnut</b>										
EBT	1497	1537	1552	1631	29		7	1667		1667
EBR	7	7	7	8				8	6	14
NBR	111	114	115	121				121	6	127
<b>20/south</b>										
EBL	62	64	64	68			0	68	3	71
EBT	665	683	689	725		21		746		746
EBR	4	4	4	4				4		4
NBL	13	13	13	14				14		14
NBT	12	12	12	13				13	0	13
NBR	9	9	9	10				10		10
WBL	31	32	32	34				34		34
WBT	919	943	953	1001		31		1032		1032
WBR	154	158	160	168			0	168	3	171
SBL	137	141	142	149			0	149	7	156
SBT	21	22	22	23			0	23	1	24
SBR	170	175	176	185			0	185	8	193
<b>south/chestnut</b>										
NBT	211	217	219	230			0	230		230
NBR	18	18	19	20				20	6	26
WBL	130	133	135	142				142	16	158
WBR	3	3	3	3				3	7	10
SBL	0	0	0	0				0		0
SBT	198	203	205	216			0	216		216
<b>chestnut/site</b>										
NBL	0	0	0	0				0	6	6
NBT	18	18	19	20				20		20
SBT	133	137	138	145				145		145
SBR	0	0	0	0				0	6	6
EBL	0	0	0	0				0	13	13
EBR	0	0	0	0				0	23	23

Sheet	Column	Description
Data	14	Boston Medical Products Trips AM



	W	E	Total
In	0	0	0
Out	0	0	0

Sheet	Column	Description
Data	15	Boston Medical Products Trips PM



**Appendix E**

**Trip Generation and Distribution Data**

**PROPOSED RESIDENTIAL DEVELOPMENTS - POINT AT HILL FARMS**

Land Use Code 220 - Apartment						Size: 180 DWELLING UNITS		
Time Period	R <sup>2</sup> Value	Use Equation or Rate?	Equation	Rate	Percent Enter	In	Out	Total
Weekday Daily	0.87	Equation	T=6.06(x)+123.56	6.65	50%	607	607	1214
AM Street Peak Hour	0.83	Equation	T=.49(x)+3.73	0.51	20%	18	74	92
PM Street Peak Hour	0.77	Equation	T=.55(x)+17.65	0.62	65%	76	41	117
Saturday Daily	0.85	Equation	T=7.85(x)-256.19	6.39	50%	579	578	1157
Saturday Peak Hour of Generator	0.56	Rate	T=.41(x)+19.23	0.52	54%	51	43	94
Sunday Daily	0.82	Equation	T=6.42(x)-101.12	5.86	50%	527	527	1054
Sunday Peak Hour of Generator		Rate		0.51	50%	46	46	92

Note: If R<sup>2</sup> is greater than or equal to 0.75 the equation is used to calculate trips, otherwise the rate is used.  
 Source: *Trip Generation, Ninth Edition*, (Institute of Transportation Engineers, 2012).

Land Use Code 220 - Apartment						Size: 100 DWELLING UNITS		
Time Period	R <sup>2</sup> Value	Use Equation or Rate?	Equation	Rate	Percent Enter	In	Out	Total
Weekday Daily	0.87	Equation	T=6.06(x)+123.56	6.65	50%	365	365	730
AM Street Peak Hour	0.83	Equation	T=.49(x)+3.73	0.51	20%	11	42	53
PM Street Peak Hour	0.77	Equation	T=.55(x)+17.65	0.62	65%	47	26	73
Saturday Daily	0.85	Equation	T=7.85(x)-256.19	6.39	50%	265	264	529
Saturday Peak Hour of Generator	0.56	Rate	T=.41(x)+19.23	0.52	54%	28	24	52
Sunday Daily	0.82	Equation	T=6.42(x)-101.12	5.86	50%	271	270	541
Sunday Peak Hour of Generator		Rate		0.51	50%	26	25	51

Note: If R<sup>2</sup> is greater than or equal to 0.75 the equation is used to calculate trips, otherwise the rate is used.  
 Source: *Trip Generation, Ninth Edition*, (Institute of Transportation Engineers, 2012).

	In	Out	Total
Weekday Daily	972	972	1944
AM Street Peak Hour	29	116	145
PM Street Peak Hour	123	67	190

**A102106 - Means of transportation (18) (Workers 16 years and over)**

Current date: 10/24/2014 11:20:23 AM (Eastern Daylight Time)

Measures - Workers 16 and Over																			
Means of Transportation 18 Output	means of transportation	truck, or van -- Drove	Car, truck, or van -- In a 2-person carpool	truck, or van -- In a 3-person	truck, or van -- In a 4-person	truck, or van -- In a 5-or-6-	truck, or van -- In a 7-or-	Bus or trolley bus	Streetcar or trolley car	Subway or elevated	Railroad	Ferryboat	Bicycle	Walked	Taxicab	Motorcycle	Other method	Worked at home	
	Estimate	Estimate	Estimate	Margin of Error	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	
TAZ 14271001, Worcester County, Massachusetts	570	540	15	29	0	0	0	0	0	0	20	0	0	0	0	0	0	0	
TAZ 14271002, Worcester County, Massachusetts	1,695	1,415	40	40	25	10	0	0	0	20	50	0	0	0	0	0	0	135	
TAZ 14271003, Worcester County, Massachusetts	830	740	40	33	15	0	0	0	0	0	15	0	0	0	0	0	0	25	
TAZ 14271004, Worcester County, Massachusetts	1,095	935	90	73	0	0	0	0	0	0	0	0	15	45	0	0	0	10	
TAZ 14271005, Worcester County, Massachusetts	655	525	50	31	0	0	0	15	0	0	15	0	0	20	0	0	0	35	
TAZ 14271006, Worcester County, Massachusetts	2,280	1,900	105	88	0	10	10	0	0	0	25	0	0	15	35	0	0	175	
TAZ 14271007, Worcester County, Massachusetts	1,255	1,150	70	62	0	0	0	0	0	0	0	0	0	0	0	0	0	30	
TAZ 14271008, Worcester County, Massachusetts	1,265	1,080	75	56	0	0	0	0	0	0	0	0	0	20	20	0	0	65	
TAZ 14271009, Worcester County, Massachusetts	1,610	1,465	80	77	0	0	0	15	0	0	15	0	0	0	0	15	25	0	
TAZ 14271010, Worcester County, Massachusetts	720	630	25	45	0	0	15	0	0	0	0	0	0	20	0	0	15	10	
TAZ 14271011, Worcester County, Massachusetts	765	670	50	33	10	0	0	0	0	0	15	0	0	10	0	0	0	10	
TAZ 14271012, Worcester County, Massachusetts	3,200	2,570	315	198	35	20	0	15	0	0	40	0	0	15	0	0	0	195	
TAZ 14271013, Worcester County, Massachusetts	1,510	1,335	80	72	0	0	0	0	0	0	10	0	0	25	0	0	40	20	

U.S. Census Bureau, American Community Survey 2006-2010 Five-year estimates. Special Tabulation: Census Transportation Planning

**Summary**

Means of Transportation 18	Total, means of transport	Car, truck, or van --	Car, truck, or van -- In a 2-person carpool	Car, truck, or van -- In a 3-person	Car, truck, or van -- In a 4-person	Car, truck, or van -- In a 5-or-6-	Car, truck, or van -- In a 7-or-	Bus or trolley bus	Streetcar or trolley car	Subway or elevated	Railroad	Ferryboat	Bicycle	Walked	Taxicab	Motorcycle	Other method	Worked at home
Shrewsbury - (Total less worked at home)	16,740	14,955	1,035	85	40	25	0	45	0	20	205	0	15	170	55	15	80	710
Percentage		89%	6%	1%	0%	0%	0%	0%	0%	0%	1%	0%	0%	1%	0%	0%	0%	
Combined Percentages		89.3%		7.1%				0.3%		1.3%		0.0%	0.1%	1.0%	0.3%	0.1%	0.5%	

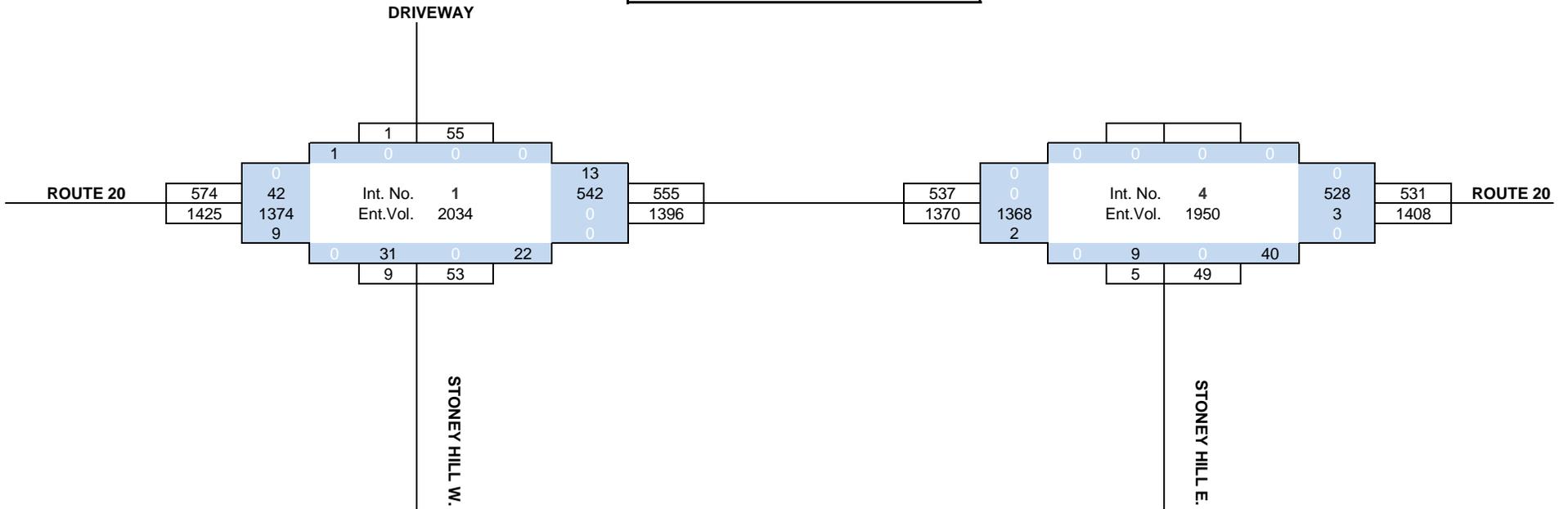
**THE POINTE AT HILLS FARM - SHREWSBURY  
GRAVITY MODEL FOR TRIP DISTRIBUTION**

City/Town of Workers	STATE	No. of commuters from Shrewsbury*	Portion of commuters	RT. 140 (TO/FROM SOUTH)	RT. 20 (TO/FROM WEST)	GRAFTON ST (FROM N.WEST)	RT. 140 (TO/FROM NORTH)	RT. 20 (TO/FROM EAST)	CENTECH BLVD. (TO/FROM S.EAST)
AUBURN	Massachusetts	235	1.35%				100%		
BARRE	Massachusetts	19	0.11%				95%		
BERLIN	Massachusetts	25	0.14%				25%	75%	
BOYLSTON	Massachusetts	135	0.78%				70%	30%	
CHARLTON	Massachusetts	10	0.06%				100%		
DUDLEY	Massachusetts	15	0.09%				100%		
EAST BROOKFIELD	Massachusetts	10	0.06%				100%		
GRAFTON	Massachusetts	184	1.06%	90%				5%	5%
HARDWICK	Massachusetts	10	0.06%				100%		
HOLDEN	Massachusetts	44	0.25%				50%		
LEICESTER	Massachusetts	45	0.26%				100%		
MILLBURY	Massachusetts	160	0.92%	50%			50%		
MILFORD	Massachusetts	250	1.44%	50%				50%	
NORTHBRIDGE	Massachusetts	45	0.26%	90%			10%		
NORTHBOROUGH	Massachusetts	470	2.70%				20%	80%	
OXFORD	Massachusetts	24	0.14%				100%		
PAXTON	Massachusetts	60	0.34%				80%		
RUTLAND	Massachusetts	10	0.06%				65%		
SHREWSBURY	Massachusetts	3,150	18.11%			1%	29%	50%	20%
SOUTHBRIDGE	Massachusetts	110	0.63%				100%		
SPENCER	Massachusetts	80	0.46%				100%		
STURBRIDGE	Massachusetts	30	0.17%				100%		
SUTTON	Massachusetts	65	0.37%	50%			50%		
UPTON	Massachusetts	45	0.26%	65%				35%	
UXBRIDGE	Massachusetts	15	0.09%	75%			25%		
WEBSTER	Massachusetts	15	0.09%				100%		
WEST BOYLSTON	Massachusetts	65	0.37%				25%		
WESTBOROUGH	Massachusetts	1,590	9.14%					75%	
WORCESTER	Massachusetts	3,795	21.81%				70%		
WORCESTER COUNTY, NORTH OF CMI	Massachusetts	348	2.00%				40%		
Mass, East of Worcester County	Massachusetts	5,946	34.18%	2%			3%	15%	80%
Mass, West of Worcester County	Massachusetts	130	0.75%				100%		
RHODE ISLAND	Rhode Island	84	0.48%				50%		
CONNECTICUT	Connecticut	65	0.37%				40%	10%	
NEW YORK	New York	10	0.06%				100%		
NEW HAMPSHIRE	New Hampshire	15	0.09%				100%		
MAINE	Maine	15	0.09%				50%	50%	
Remaining U.S.	Remaining U.S.	74	0.43%				50%	50%	
<b>TOTAL</b>		<b>17,398</b>	<b>100%</b>	<b>3.47%</b>	<b>28.88%</b>	<b>0.18%</b>	<b>23.82%</b>	<b>39.03%</b>	<b>4.62%</b>
<b>SAY:</b>				<b>3%</b>	<b>28%</b>	<b>1%</b>	<b>24%</b>	<b>39%</b>	<b>5%</b>
				<b>56% TO/FROM THE WEST</b>			<b>44% TO/FROM THE EAST</b>		

\*Source: Central Mass Regional Planning Commission

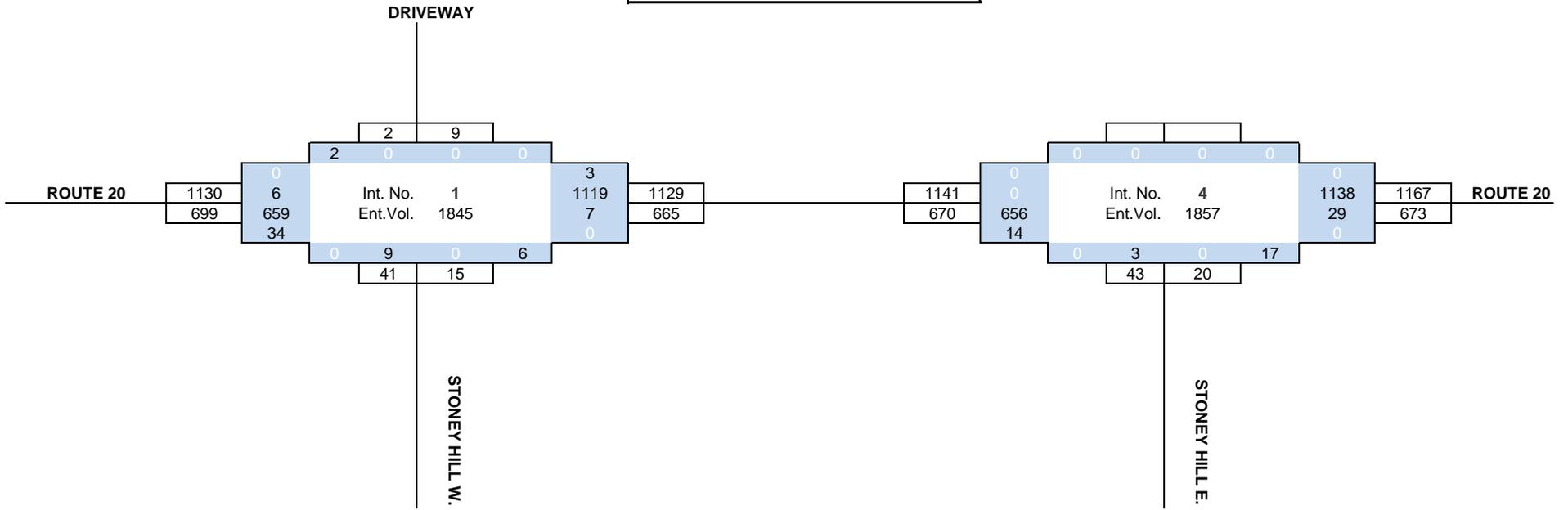
Sheet	Column	Description
Data	2	2014 EX AM RAW VOL

Inbound	From West	From East	Total
In	11	3	14
Percent	79%	21%	
Outbound	To West	To East	Total
Out	40	62	102
Percent	39%	61%	



Sheet	Column	Description
Data	5	2014 EX PM RAW VOL

Inbound	From West	From East	Total
In	48	36	84
Percent	57%	43%	
Outbound	To West	To East	Total
Out	12	23	35
Percent	34%	66%	



**Appendix F**  
**Traffic Signal Warrant Analysis**

**Standard:**

- 04 **The need for a traffic control signal shall be considered if an engineering study finds that one of the following conditions exist for each of any 8 hours of an average day:**
- A. The vehicles per hour given in both of the 100 percent columns of Condition A in Table 4C-1 exist on the major-street and the higher-volume minor-street approaches, respectively, to the intersection;
  - B. The vehicles per hour given in both of the 100 percent columns of Condition B in Table 4C-1 exist on the major-street and the higher-volume minor-street approaches, respectively, to the intersection.

In applying each condition the major-street and minor-street volumes shall be for the same 8 hours. On the minor street, the higher volume shall not be required to be on the same approach during each of these 8 hours.

**Option:**

- 05 If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 40 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, the traffic volumes in the 70 percent columns in Table 4C-1 may be used in place of the 100 percent columns.

**Guidance:**

- 06 *The combination of Conditions A and B is intended for application at locations where Condition A is not satisfied and Condition B is not satisfied and should be applied only after an adequate trial of other alternatives that could cause less delay and inconvenience to traffic has failed to solve the traffic problems.*

**Standard:**

- 07 **The need for a traffic control signal shall be considered if an engineering study finds that both of the following conditions exist for each of any 8 hours of an average day:**
- A. The vehicles per hour given in both of the 80 percent columns of Condition A in Table 4C-1 exist on the major-street and the higher-volume minor-street approaches, respectively, to the intersection; and
  - B. The vehicles per hour given in both of the 80 percent columns of Condition B in Table 4C-1 exist on the major-street and the higher-volume minor-street approaches, respectively, to the intersection.

These major-street and minor-street volumes shall be for the same 8 hours for each condition; however, the 8 hours satisfied in Condition A shall not be required to be the same 8 hours satisfied in Condition B. On the minor street, the higher volume shall not be required to be on the same approach during each of the 8 hours.

**Table 4C-1. Warrant 1, Eight-Hour Vehicular Volume**

**Condition A—Minimum Vehicular Volume**

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on higher-volume minor-street approach (one direction only)			
Major Street	Minor Street	100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	56% <sup>d</sup>	100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	56% <sup>c</sup>
1	1	500	400	350	280	150	120	105	84
2 or more	1	600	480	420	336	150	120	105	84
2 or more	2 or more	600	480	420	336	200	160	140	112
1	2 or more	500	400	350	280	200	160	140	112

**Condition B—Interruption of Continuous Traffic**

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on higher-volume minor-street approach (one direction only)			
Major Street	Minor Street	100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	56% <sup>d</sup>	100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	56% <sup>c</sup>
1	1	750	600	525	420	75	60	53	42
2 or more	1	900	720	630	504	75	60	53	42
2 or more	2 or more	900	720	630	504	100	80	70	56
1	2 or more	750	600	525	420	100	80	70	56

<sup>a</sup> Basic minimum hourly volume

<sup>b</sup> Used for combination of Conditions A and B after adequate trial of other remedial measures

<sup>c</sup> May be used when the major-street speed exceeds 40 mph or in an isolated community with a population of less than 10,000

<sup>d</sup> May be used for combination of Conditions A and B after adequate trial of other remedial measures when the major-street speed exceeds 40 mph or in an isolated community with a population of less than 10,000

### Traffic Signal Warrant Volumes at Route 20/Stoney Hill Road (west)

Hour	2014 Raw Counts			2015 Existing			Average East and West Legs Stoney Hill Road Temporal Distribution		Project Trips									2015 Existing + Project			
	Nov. 2014	Apr-14	Apr-14	Factor 1.005					Phase I Trips			Phase II Trips			Total Project Trips			Rte. 20	Rte. 20	Rte. 20	Stoney Hill Rd.
	Rte. 20	Rte. 20	Stoney Hill Rd.	Rte. 20	Rte. 20	Stoney Hill Rd.			EB	WB	NB	EB	WB	NB	EB	WB	NB	EB	WB	Total	NB
0:00	61	95	1	61	95	1	0%	0%	2	0	1	1	0	3	1	1	64	96	161	1	
1:00	52	49	0	52	49	0	0%	0%	1	0	0	0	0	1	0	0	53	49	103	0	
2:00	53	39	1	53	39	1	0%	0%	0	0	0	0	0	1	0	0	54	39	93	1	
3:00	70	29	0	70	29	0	0%	0%	0	0	0	0	0	1	0	0	71	29	100	0	
4:00	107	42	2	108	42	2	0%	0%	0	0	2	0	1	0	1	2	108	43	150	3	
5:00	419	100	8	421	101	8	0%	2%	2	0	9	1	3	3	4	9	424	104	528	16	
6:00	997	275	19	1002	276	19	2%	7%	7	2	25	4	9	12	11	25	1014	287	1301	44	
7:00	1324	482	47	1331	484	47	2%	16%	12	3	61	7	23	19	26	61	1349	510	1859	108	
8:00	1274	426	40	1280	428	40	3%	13%	13	4	51	8	19	21	23	51	1302	450	1752	91	
9:00	865	422	20	869	424	20	3%	6%	16	4	25	10	9	26	13	25	895	438	1333	44	
10:00	658	550	12	661	553	12	3%	5%	13	3	18	8	7	21	10	18	682	563	1245	29	
11:00	581	627	10	584	630	10	4%	3%	18	5	12	11	5	29	9	12	613	640	1253	22	
12:00	615	674	12	618	677	12	5%	5%	17	13	17	11	6	28	19	17	646	696	1342	29	
13:00	591	680	19	594	683	19	4%	5%	15	11	19	9	7	24	18	19	618	701	1319	39	
14:00	681	731	11	684	734	11	6%	4%	21	16	15	12	5	33	21	15	718	755	1472	25	
15:00	656	966	14	659	970	14	8%	4%	27	20	16	16	5	43	26	16	702	996	1698	29	
16:00	648	1075	23	651	1080	23	9%	7%	32	24	25	19	9	51	33	25	703	1113	1815	48	
17:00	707	1114	18	711	1120	18	14%	7%	50	37	24	30	8	79	46	24	790	1165	1955	42	
18:00	549	824	19	552	828	19	14%	6%	49	37	23	29	8	78	45	23	630	873	1502	41	
19:00	345	626	13	347	629	13	10%	5%	34	26	18	20	6	54	32	18	401	660	1061	31	
20:00	223	527	7	224	530	7	6%	2%	22	16	9	13	3	34	19	9	259	549	807	16	
21:00	203	386	4	204	388	4	3%	1%	11	8	3	6	1	17	9	3	221	397	618	6	
22:00	139	245	1	140	246	1	2%	0%	6	5	1	4	0	10	5	1	150	251	401	1	
23:00	91	194	0	91	195	0	1%	0%	2	1	1	1	0	3	2	1	94	197	291	1	
									Daily Trips	607		Daily Trips	365								
										In from West	In from East		In from West	In from East							
									AM Dist	79%	21%	AM Dist	79%	0%							
									PM Dist	57%	43%	PM Dist	57%	0%							
										Out (NB)			Out (WB)								
									AM Dist.	63%		AM Dist.		39%							
									PM Dist	60%		PM Dist		34%							

**PROPOSED RESIDENTIAL DEVELOPMENTS - POINT AT HILL FARMS**

Land Use Code 220 - Apartment						Size: 180 DWELLING UNITS		
Time Period	R <sup>2</sup> Value	Use Equation or Rate?	Equation	Rate	Percent Enter	In	Out	Total
Weekday Daily	0.87	Equation	T=6.06(x)+123.56	6.65	50%	607	607	1214
AM Street Peak Hour	0.83	Equation	T=.49(x)+3.73	0.51	20%	18	74	92
PM Street Peak Hour	0.77	Equation	T=.55(x)+17.65	0.62	65%	76	41	117
Saturday Daily	0.85	Equation	T=7.85(x)-256.19	6.39	50%	579	578	1157
Saturday Peak Hour of Generator	0.56	Rate	T=.41(x)+19.23	0.52	54%	51	43	94
Sunday Daily	0.82	Equation	T=6.42(x)-101.12	5.86	50%	527	527	1054
Sunday Peak Hour of Generator		Rate		0.51	50%	46	46	92

Note: If R<sup>2</sup> is greater than or equal to 0.75 the equation is used to calculate trips, otherwise the rate is used.  
 Source: *Trip Generation, Ninth Edition*, (Institute of Transportation Engineers, 2012).

Land Use Code 220 - Apartment						Size: 100 DWELLING UNITS		
Time Period	R <sup>2</sup> Value	Use Equation or Rate?	Equation	Rate	Percent Enter	In	Out	Total
Weekday Daily	0.87	Equation	T=6.06(x)+123.56	6.65	50%	365	365	730
AM Street Peak Hour	0.83	Equation	T=.49(x)+3.73	0.51	20%	11	42	53
PM Street Peak Hour	0.77	Equation	T=.55(x)+17.65	0.62	65%	47	26	73
Saturday Daily	0.85	Equation	T=7.85(x)-256.19	6.39	50%	265	264	529
Saturday Peak Hour of Generator	0.56	Rate	T=.41(x)+19.23	0.52	54%	28	24	52
Sunday Daily	0.82	Equation	T=6.42(x)-101.12	5.86	50%	271	270	541
Sunday Peak Hour of Generator		Rate		0.51	50%	26	25	51

Note: If R<sup>2</sup> is greater than or equal to 0.75 the equation is used to calculate trips, otherwise the rate is used.  
 Source: *Trip Generation, Ninth Edition*, (Institute of Transportation Engineers, 2012).

	In	Out	Total
Weekday Daily	972	972	1944
AM Street Peak Hour	29	116	145
PM Street Peak Hour	123	67	190

Hartford Turnpike (Route 20)  
 west of Stoney Hill Road (West)  
 City, State: Shrewsbury, MA  
 Client: Tetra Tech Rizzo/ N. Landron



PRECISION  
 D A T A  
 INDUSTRIES, LLC

P.O. Box 301 Berlin, MA 01503  
 Office: 508.481.3999 Fax: 508.545.1234  
 Email: datarequests@pdillc.com

144157 A Volume  
 Site Code: TBA

Start Time	EB		WB		Combin ed		06-Nov-14 Thu
	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	
12:00	17	168	43	173	60	341	
12:15	19	156	27	159	46	315	
12:30	14	150	19	163	33	313	
12:45	11	61 141	615 10	99 161	656 21	160 302	1271
01:00	7	135	13	171	20	306	
01:15	11	170	12	146	23	316	
01:30	16	138	15	166	31	304	
01:45	18	52 148	591 20	60 154	637 38	112 302	1228
02:00	17	149	11	191	28	340	
02:15	15	176	10	203	25	379	
02:30	12	177	12	163	24	340	
02:45	9	53 179	681 9	42 190	747 18	95 369	1428
03:00	12	150	9	237	21	387	
03:15	13	176	7	252	20	428	
03:30	19	159	9	300	28	459	
03:45	26	70 171	656 7	32 259	1048 33	102 430	1704
04:00	18	171	5	254	23	425	
04:15	19	163	16	272	35	435	
04:30	33	163	19	281	52	444	
04:45	37	107 151	648 13	53 242	1049 50	160 393	1697
05:00	54	191	15	281	69	472	
05:15	95	157	25	332	120	489	
05:30	111	198	22	273	133	471	
05:45	159	419 161	707 42	104 263	1149 201	523 424	1856
06:00	169	145	57	206	226	351	
06:15	206	137	69	232	275	369	
06:30	286	139	92	173	378	312	
06:45	336	997 128	549 103	321 187	798 439	1318 315	1347
07:00	297	98	117	164	414	262	
07:15	313	86	130	158	443	244	
07:30	344	73	131	152	475	225	
07:45	370	1324 88	345 131	509 125	599 501	1833 213	944
08:00	376	60	140	132	516	192	
08:15	333	66	168	140	501	206	
08:30	310	46	159	132	469	178	
08:45	255	1274 51	223 153	620 114	518 408	1894 165	741
09:00	216	57	122	93	338	150	
09:15	220	46	123	117	343	163	
09:30	220	53	123	75	343	128	
09:45	209	865 47	203 121	489 77	362 330	1354 124	565
10:00	156	33	134	72	290	105	
10:15	184	29	102	85	286	114	
10:30	166	36	166	60	332	96	
10:45	152	658 41	139 134	536 47	264 286	1194 88	403
11:00	156	19	169	47	325	66	
11:15	149	30	147	51	296	81	
11:30	116	18	159	54	275	72	
11:45	160	581 24	91 148	623 38	190 308	1204 62	281
Total	6461	5448	3488	8017	9949	13465	
Percent	64.9%	40.5%	35.1%	59.5%			
Day Total		11909		11505		23414	
Peak	07:30	- 05:00	- 11:00	- 05:00	- 07:30	- 05:00	- - -
Vol.	1423	- 707	- 623	- 1149	- 1993	- 1856	- - -
P.H.F.	0.946	0.893	0.922	0.865	0.966	0.949	

Hartford Turnpike (Route 20)  
 east of Stoney Hill Road (West Access)  
 City, State: Shrewsbury, MA  
 Client: Tetra Tech Rizzo/ N. Doherty



PRECISION  
 D A T A  
 INDUSTRIES, LLC

P.O. Box 301 Berlin, MA 01503  
 Office: 508.481.3999 Fax: 508.545.1234  
 Email: datarequests@pdillc.com

143843 B Volume  
 Site Code: TBA

Start Time	WB		EB		Combin ed		15-Apr-14 Tue			
	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.				
12:00	32	178	22	142	54	320				
12:15	20	157	19	134	39	291				
12:30	25	179	20	146	45	325				
12:45	18	154	8	69	26	322	1258			
01:00	13	167	10	137	23	304				
01:15	18	166	11	156	29	322				
01:30	13	152	14	143	27	295				
01:45	9	163	13	48	162	325	1246			
02:00	13	156	12	121	25	277				
02:15	8	194	16	161	24	355				
02:30	10	159	16	176	26	335				
02:45	16	170	18	62	163	333	1300			
03:00	8	201	11	140	19	341				
03:15	9	244	12	119	21	363				
03:30	6	263	21	147	27	410				
03:45	8	274	24	68	142	416	1530			
04:00	4	259	21	128	25	387				
04:15	16	258	28	149	44	407				
04:30	14	256	41	157	55	413				
04:45	11	258	40	130	164	422	1629			
05:00	15	280	47	163	62	443				
05:15	20	275	74	169	94	444				
05:30	37	302	105	139	142	441				
05:45	26	231	147	373	155	386	1714			
06:00	62	213	129	120	191	333				
06:15	70	214	159	129	229	343				
06:30	75	198	241	88	316	286				
06:45	86	160	326	855	104	412	1148	264	1226	
07:00	101	137	242	95	343	232				
07:15	119	151	286	79	405	230				
07:30	130	146	322	78	452	224				
07:45	142	118	326	1176	69	321	468	1668	187	873
08:00	106	135	324	68	430	203				
08:15	120	119	283	62	403	181				
08:30	123	116	302	55	425	171				
08:45	122	93	271	1180	53	238	393	1651	146	701
09:00	152	121	207	40	359	161				
09:15	123	93	204	45	327	138				
09:30	126	76	163	39	289	115				
09:45	121	67	194	768	47	171	315	1290	114	528
10:00	92	77	177	26	269	103				
10:15	125	67	151	29	276	96				
10:30	129	46	154	40	283	86				
10:45	133	35	151	633	35	130	284	1112	70	355
11:00	132	44	129	35	261	79				
11:15	159	62	162	22	321	84				
11:30	161	39	149	26	310	65				
11:45	149	45	140	580	23	106	289	1181	68	296
Total	3227	7668	5942	4988	9169	12656				
Percent	35.2%	60.6%	64.8%	39.4%						
Day Total		10895		10930		21825				
Peak	11:00	-	04:45	-	07:15	-	04:45	-	-	-
Vol.	601	-	1115	-	1258	-	653	-	1755	-
P.H.F.	0.933	-	0.923	-	0.965	-	0.928	-	0.938	-

Hartford Turnpike (Route 20)  
east of Stoney Hill Road (West Access)  
City, State: Shrewsbury, MA  
Client: Tetra Tech Rizzo/ N. Doherty



PRECISION  
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INDUSTRIES, LLC  
P.O. Box 301 Berlin, MA 01503  
Office: 508.481.3999 Fax: 508.545.1234  
Email: datarequests@pdillc.com

143843 B Volume  
Site Code: TBA

Start Time	WB		EB		Combin ed		16-Apr-14 Wed
	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	
12:00	33	175	20	176	53	351	
12:15	25	162	11	171	36	333	
12:30	21	180	18	168	39	348	
12:45	16	162	10	159	26	321	1353
01:00	12	182	10	143	22	325	
01:15	9	183	6	170	15	353	
01:30	15	170	12	173	27	343	
01:45	9	177	14	171	23	348	1369
02:00	7	179	13	151	20	330	
02:15	9	201	13	161	22	362	
02:30	8	198	13	195	21	393	
02:45	6	204	21	183	27	387	1472
03:00	6	209	8	149	14	358	
03:15	4	230	12	165	16	395	
03:30	8	264	16	164	24	428	
03:45	9	246	23	173	32	419	1600
04:00	7	278	30	140	37	418	
04:15	7	262	24	166	31	428	
04:30	11	283	37	153	48	436	
04:45	14	295	41	168	55	463	1745
05:00	14	319	49	174	63	493	
05:15	20	289	71	176	91	465	
05:30	32	267	106	168	138	435	
05:45	36	265	143	173	179	438	1831
06:00	48	250	134	185	182	435	
06:15	52	233	165	138	217	371	
06:30	73	199	257	144	330	343	
06:45	83	181	298	122	589	381	1110
07:00	96	181	317	120	413	301	1452
07:15	99	198	318	96	417	294	
07:30	138	171	370	80	508	251	
07:45	138	149	333	1338	96	471	1809
08:00	153	172	350	76	503	248	1091
08:15	100	186	296	73	396	259	
08:30	65	120	233	52	298	172	
08:45	62	113	194	1073	54	256	1453
09:00	61	133	160	61	221	194	846
09:15	61	109	220	58	281	167	
09:30	101	99	281	55	382	154	
09:45	99	74	249	910	44	348	1232
10:00	139	77	232	39	371	116	633
10:15	160	58	194	30	354	88	
10:30	160	61	192	41	352	102	
10:45	162	69	185	803	52	347	1424
11:00	157	55	181	32	338	87	427
11:15	165	60	179	22	344	82	
11:30	176	44	160	32	336	76	
11:45	155	39	165	685	17	320	1338
		198			103	56	301
Total	3041	8411	6384	5709	9425	14120	
Percent	32.3%	59.6%	67.7%	40.4%			
Day Total		11452		12093		23545	
Peak	10:45	-	04:30	-	07:15	-	04:30
Vol.	660	-	1186	-	1371	-	1857
P.H.F.	0.938	-	0.929	-	0.926	-	0.942

Stoney Hill Road (West Access)  
 south of Hartford Turnpike (Route 20)  
 City, State: Shrewsbury, MA  
 Client: Tetra Tech Rizzo/ N. Doherty



PRECISION  
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143843 D Volume  
 Site Code: TBA

Start Time	NB		SB		Combined		15-Apr-14 Tue			
	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.				
12:00	1	2	1	4	2	6				
12:15	0	4	0	6	0	10				
12:30	0	5	0	1	0	6				
12:45	0	1	5	16	0	1	35			
01:00	0	4	0	1	0	14				
01:15	0	6	0	2	0	8				
01:30	0	6	0	2	0	8				
01:45	0	0	6	22	0	3	39			
02:00	0	1	0	2	0	3				
02:15	0	2	0	7	0	9				
02:30	0	4	0	5	0	9				
02:45	0	0	3	10	0	7	28			
03:00	0	4	0	5	0	9				
03:15	0	9	0	5	0	14				
03:30	0	1	0	4	0	5				
03:45	0	0	3	17	0	10	38			
04:00	0	4	0	8	0	12				
04:15	0	9	0	10	0	19				
04:30	1	5	0	7	1	12				
04:45	0	1	2	20	0	9	52			
05:00	2	2	0	6	2	8				
05:15	3	4	1	8	4	12				
05:30	1	1	0	9	1	10				
05:45	1	7	5	12	2	16	46			
06:00	3	2	1	14	4	16				
06:15	2	9	0	8	2	17				
06:30	4	2	1	11	5	13				
06:45	11	20	1	14	11	7	53			
07:00	12	6	3	7	15	13				
07:15	10	2	5	6	15	8				
07:30	21	2	1	5	22	7				
07:45	10	53	3	13	4	13	40			
08:00	9	1	3	3	12	4				
08:15	9	1	3	5	12	6				
08:30	13	1	0	1	13	2				
08:45	8	39	0	3	8	3	15			
09:00	9	1	3	2	12	3				
09:15	4	0	2	3	6	3				
09:30	4	1	3	0	7	1				
09:45	6	23	1	3	7	1	8			
10:00	2	0	2	2	4	2				
10:15	1	0	2	0	3	0				
10:30	5	0	3	3	8	3				
10:45	0	8	0	0	3	0	5			
11:00	2	0	3	1	5	1				
11:15	1	0	4	0	5	0				
11:30	2	0	4	0	6	0				
11:45	3	8	0	0	7	1	2			
<b>Total</b>	<b>160</b>	<b>130</b>	<b>58</b>	<b>231</b>	<b>218</b>	<b>361</b>				
<b>Percent</b>	<b>73.4%</b>	<b>36.0%</b>	<b>26.6%</b>	<b>64.0%</b>						
<b>Day Total</b>		<b>290</b>		<b>289</b>		<b>579</b>				
<b>Peak Vol.</b>	<b>06:45</b>	<b>-</b>	<b>01:00</b>	<b>-</b>	<b>11:00</b>	<b>-</b>	<b>05:45</b>	<b>-</b>	<b>-</b>	<b>-</b>
<b>P.H.F.</b>	<b>0.643</b>	<b>-</b>	<b>0.917</b>	<b>-</b>	<b>0.938</b>	<b>-</b>	<b>0.786</b>	<b>-</b>	<b>0.750</b>	<b>-</b>

Stoney Hill Road (West Access)  
 south of Hartford Turnpike (Route 20)  
 City, State: Shrewsbury, MA  
 Client: Tetra Tech Rizzo/ N. Doherty



PRECISION  
 D A T A  
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143843 D Volume  
 Site Code: TBA

Start Time	NB		SB		Combined		16-Apr-14 Wed
	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	
12:00	0	3	1	2	1	5	
12:15	0	0	1	1	1	1	
12:30	0	2	0	2	0	4	
12:45	0	3	8	1	3	6	11
01:00	0	4	0	0	0	4	3
01:15	0	2	0	2	0	4	
01:30	0	4	0	2	0	6	
01:45	0	6	16	0	0	2	6
02:00	0	1	0	5	0	6	0
02:15	1	2	1	8	2	10	
02:30	0	5	0	6	0	11	
02:45	0	3	11	0	1	4	23
03:00	0	3	0	6	0	9	2
03:15	0	3	0	6	0	9	
03:30	0	1	0	8	0	9	
03:45	0	3	10	0	0	11	31
04:00	1	4	0	6	1	10	
04:15	1	9	0	4	1	13	
04:30	0	7	0	7	0	14	
04:45	0	6	26	0	0	8	25
05:00	0	5	0	11	0	16	2
05:15	3	5	0	8	3	13	
05:30	0	6	0	11	0	17	
05:45	5	8	24	1	1	14	44
06:00	2	8	0	15	2	23	9
06:15	4	6	1	10	5	16	
06:30	5	5	3	9	8	14	
06:45	6	4	23	1	5	10	44
07:00	12	3	2	8	14	11	22
07:15	10	3	3	5	13	8	
07:30	11	1	3	11	14	12	
07:45	7	5	12	0	8	2	26
08:00	6	7	2	12	8	19	48
08:15	14	2	2	5	16	7	
08:30	11	1	3	4	14	5	
08:45	9	1	11	5	12	1	22
09:00	6	1	6	6	12	7	52
09:15	7	2	5	0	12	2	
09:30	3	1	4	2	7	3	
09:45	0	0	4	1	16	4	12
10:00	4	0	1	2	5	2	32
10:15	6	1	3	2	9	3	
10:30	3	0	5	0	8	0	
10:45	2	0	1	2	11	1	5
11:00	5	0	1	0	6	0	26
11:15	3	0	2	1	5	1	
11:30	1	0	1	0	2	0	
11:45	2	0	0	1	3	0	1
Total	150	146	62	250	212	396	
Percent	70.8%	36.9%	29.2%	63.1%			
Day Total		296		312		608	
Peak Vol.	07:00	-	05:30	-	08:45	-	05:30
P.H.F.	0.833	-	0.875	-	0.833	-	0.848

**Appendix G**  
**Intersection Capacity Analyses**

Intersection													
Int Delay, s/veh	21.5												

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	42	1381	9	0	545	13	31	0	22	0	0	1
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									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	85	85	85	74	74	74	25	25	25
Heavy Vehicles, %	10	7	22	0	14	8	0	0	5	0	0	0
Mvmt Flow	44	1454	9	0	641	15	42	0	30	0	0	4

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	656	0	0	1463	0	0	2198	2203	732	1464	2201	649
Stage 1	-	-	-	-	-	-	1547	1547	-	649	649	-
Stage 2	-	-	-	-	-	-	651	656	-	815	1552	-
Critical Hdwy	4.2	-	-	4.1	-	-	7.3	6.5	6.975	7.3	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.5	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.5	5.5	-
Follow-up Hdwy	2.29	-	-	2.2	-	-	3.5	43.3475	-	3.5	4	3.3
Pot Cap-1 Maneuver	894	-	-	468	-	-	~ 29	45	359	99	45	473
Stage 1	-	-	-	-	-	-	122	177	-	462	469	-
Stage 2	-	-	-	-	-	-	461	465	-	342	176	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	894	-	-	468	-	-	~ 23	33	359	72	33	473
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 23	33	-	72	33	-
Stage 1	-	-	-	-	-	-	90	130	-	340	469	-
Stage 2	-	-	-	-	-	-	457	465	-	231	130	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1.3	0	\$ 645.2	12.7
HCM LOS			F	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	38	894	-	-	468	-	-	473
HCM Lane V/C Ratio	1.885	0.049	-	-	-	-	-	0.008
HCM Control Delay (s)	\$ 645.2	9.2	1.1	-	0	-	-	12.7
HCM Lane LOS	F	A	A	-	A	-	-	B
HCM 95th %tile Q(veh)	7.7	0.2	-	-	0	-	-	0

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

**Intersection**

Int Delay, s/veh 1.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	1375	2	3	531	9	40
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	94	94	86	86	94	94
Heavy Vehicles, %	7	0	33	13	0	8
Mvmt Flow	1463	2	3	617	10	43

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	1465
Stage 1	-	-	1464
Stage 2	-	-	624
Critical Hdwy	-	4.43	6.4
Critical Hdwy Stg 1	-	-	5.4
Critical Hdwy Stg 2	-	-	5.4
Follow-up Hdwy	-	2.497	3.5
Pot Cap-1 Maneuver	-	379	59
Stage 1	-	-	215
Stage 2	-	-	538
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	379	58
Mov Cap-2 Maneuver	-	-	58
Stage 1	-	-	215
Stage 2	-	-	532

Approach	EB	WB	NB
HCM Control Delay, s	0	0.1	57.7
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	118	-	-	379	-
HCM Lane V/C Ratio	0.442	-	-	0.009	-
HCM Control Delay (s)	57.7	-	-	14.6	0
HCM Lane LOS	F	-	-	B	A
HCM 95th %tile Q(veh)	1.9	-	-	0	-

Intersection													
Int Delay, s/veh	1.7												

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	6	662	34	7	1125	3	9	0	6	0	0	2
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									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	87	87	87	63	63	63	25	25	25
Heavy Vehicles, %	33	7	0	0	2	33	0	0	0	0	0	100
Mvmt Flow	7	727	37	8	1293	3	14	0	10	0	0	8

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1297	0	0	765	0	0	2074	2072	382	1688	2089	1295
Stage 1	-	-	-	-	-	-	759	759	-	1311	1311	-
Stage 2	-	-	-	-	-	-	1315	1313	-	377	778	-
Critical Hdwy	4.43	-	-	4.1	-	-	7.3	6.5	6.9	7.3	6.5	7.7
Critical Hdwy Stg 1	-	-	-	-	-	-	6.5	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.5	5.5	-
Follow-up Hdwy	2.497	-	-	2.2	-	-	3.5	4	3.3	3.5	4	4.25
Pot Cap-1 Maneuver	443	-	-	857	-	-	36	55	622	68	53	104
Stage 1	-	-	-	-	-	-	369	418	-	197	231	-
Stage 2	-	-	-	-	-	-	196	230	-	622	410	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	443	-	-	857	-	-	32	52	622	64	50	104
Mov Cap-2 Maneuver	-	-	-	-	-	-	32	52	-	64	50	-
Stage 1	-	-	-	-	-	-	359	406	-	191	223	-
Stage 2	-	-	-	-	-	-	175	222	-	595	399	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	0.1	123	42.5
HCM LOS			F	E

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	52	443	-	-	857	-	-	104
HCM Lane V/C Ratio	0.458	0.015	-	-	0.009	-	-	0.077
HCM Control Delay (s)	123	13.2	0.2	-	9.2	0	-	42.5
HCM Lane LOS	F	B	A	-	A	A	-	E
HCM 95th %tile Q(veh)	1.7	0	-	-	0	-	-	0.2

**Intersection**

Int Delay, s/veh 0.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	659	14	29	1144	3	17
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	89	89	88	88	63	63
Heavy Vehicles, %	6	0	0	2	0	0
Mvmt Flow	740	16	33	1300	5	27

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	756
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.1
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.2
Pot Cap-1 Maneuver	-	-	864
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	864
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.2	26.9
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	196	-	-	864	-
HCM Lane V/C Ratio	0.162	-	-	0.038	-
HCM Control Delay (s)	26.9	-	-	9.3	0
HCM Lane LOS	D	-	-	A	A
HCM 95th %tile Q(veh)	0.6	-	-	0.1	-

Intersection												
Int Delay, s/veh	47.8											

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	44	1515	9	0	602	14	32	0	23	0	0	1
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									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	10	7	22	0	14	8	0	0	5	0	0	0
Mvmt Flow	48	1647	10	0	654	15	35	0	25	0	0	1

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	670	0	0	1657	0	0	2410	2417	828	1581	2414	662
Stage 1	-	-	-	-	-	-	1747	1747	-	662	662	-
Stage 2	-	-	-	-	-	-	663	670	-	919	1752	-
Critical Hdwy	4.2	-	-	4.1	-	-	7.3	6.5	6.975	7.3	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.5	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.5	5.5	-
Follow-up Hdwy	2.29	-	-	2.2	-	-	3.5	43.3475	-	3.5	4	3.3
Pot Cap-1 Maneuver	884	-	-	394	-	-	~ 20	33	310	82	33	465
Stage 1	-	-	-	-	-	-	91	141	-	454	462	-
Stage 2	-	-	-	-	-	-	454	459	-	296	141	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	884	-	-	394	-	-	~ 9	10	310	33	10	465
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 9	10	-	33	10	-
Stage 1	-	-	-	-	-	-	~ 28	44	-	140	462	-
Stage 2	-	-	-	-	-	-	453	459	-	84	44	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	3.2	0	\$ 1855.7	12.8
HCM LOS			F	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	15	884	-	-	394	-	-	465
HCM Lane V/C Ratio	3.986	0.054	-	-	-	-	-	0.002
HCM Control Delay (s)	\$ 1855.7	9.3	3	-	0	-	-	12.8
HCM Lane LOS	F	A	A	-	A	-	-	B
HCM 95th %tile Q(veh)	8.3	0.2	-	-	0	-	-	0

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

**Intersection**

Int Delay, s/veh 2.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	1509	2	3	587	9	42
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	7	0	33	13	0	8
Mvmt Flow	1640	2	3	638	10	46

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	1642
Stage 1	-	-	1641
Stage 2	-	-	645
Critical Hdwy	-	4.43	6.4
Critical Hdwy Stg 1	-	-	5.4
Critical Hdwy Stg 2	-	-	5.4
Follow-up Hdwy	-	2.497	3.5
Pot Cap-1 Maneuver	-	320	44
Stage 1	-	-	176
Stage 2	-	-	526
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	320	43
Mov Cap-2 Maneuver	-	-	43
Stage 1	-	-	176
Stage 2	-	-	518

Approach	EB	WB	NB
HCM Control Delay, s	0	0.1	92.9
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	91	-	-	320	-
HCM Lane V/C Ratio	0.609	-	-	0.01	-
HCM Control Delay (s)	92.9	-	-	16.4	0
HCM Lane LOS	F	-	-	C	A
HCM 95th %tile Q(veh)	2.9	-	-	0	-

Intersection													
Int Delay, s/veh	1.1												

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	6	727	35	7	1236	3	9	0	6	0	0	2
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									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	33	7	0	0	2	33	0	0	0	0	0	100
Mvmt Flow	7	790	38	8	1343	3	10	0	7	0	0	2

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1347	0	0	828	0	0	2183	2184	414	1768	2201	1345
Stage 1	-	-	-	-	-	-	822	822	-	1360	1360	-
Stage 2	-	-	-	-	-	-	1361	1362	-	408	841	-
Critical Hdwy	4.43	-	-	4.1	-	-	7.3	6.5	6.9	7.3	6.5	7.7
Critical Hdwy Stg 1	-	-	-	-	-	-	6.5	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.5	5.5	-
Follow-up Hdwy	2.497	-	-	2.2	-	-	3.5	4	3.3	3.5	4	4.25
Pot Cap-1 Maneuver	423	-	-	812	-	-	30	46	593	60	45	95
Stage 1	-	-	-	-	-	-	339	391	-	185	218	-
Stage 2	-	-	-	-	-	-	185	218	-	596	383	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	423	-	-	812	-	-	28	43	593	56	42	95
Mov Cap-2 Maneuver	-	-	-	-	-	-	28	43	-	56	42	-
Stage 1	-	-	-	-	-	-	328	379	-	179	209	-
Stage 2	-	-	-	-	-	-	174	209	-	571	371	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	0.1	124.9	43.8
HCM LOS			F	E

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	45	423	-	-	812	-	-	95
HCM Lane V/C Ratio	0.362	0.015	-	-	0.009	-	-	0.023
HCM Control Delay (s)	124.9	13.6	0.2	-	9.5	0	-	43.8
HCM Lane LOS	F	B	A	-	A	A	-	E
HCM 95th %tile Q(veh)	1.3	0	-	-	0	-	-	0.1

**Intersection**

Int Delay, s/veh 0.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	724	15	30	1255	3	18
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	6	0	0	2	0	0
Mvmt Flow	787	16	33	1364	3	20

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	803
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.1
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.2
Pot Cap-1 Maneuver	-	-	830
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	830
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.2	28.8
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	174	-	-	830	-
HCM Lane V/C Ratio	0.131	-	-	0.039	-
HCM Control Delay (s)	28.8	-	-	9.5	0
HCM Lane LOS	D	-	-	A	A
HCM 95th %tile Q(veh)	0.4	-	-	0.1	-

Intersection												
Int Delay, s/veh	295.6											

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	44	1532	15	4	618	14	61	0	41	0	0	1
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									
Storage Length	-	-	-	425	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	10	7	22	0	14	8	0	0	5	0	0	0
Mvmt Flow	48	1665	16	4	672	15	66	0	45	0	0	1

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	687	0	0	1682	0	0	2458	2465	841	1616	2465	679
Stage 1	-	-	-	-	-	-	1769	1769	-	688	688	-
Stage 2	-	-	-	-	-	-	689	696	-	928	1777	-
Critical Hdwy	4.2	-	-	4.1	-	-	7.3	6.5	6.975	7.3	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.5	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.5	5.5	-
Follow-up Hdwy	2.29	-	-	2.2	-	-	3.5	43.3475	-	3.5	4	3.3
Pot Cap-1 Maneuver	871	-	-	386	-	-	~ 19	31	304	77	31	455
Stage 1	-	-	-	-	-	-	88	138	-	440	450	-
Stage 2	-	-	-	-	-	-	439	446	-	292	137	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	871	-	-	386	-	-	~ 5	4	304	18	4	455
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 5	4	-	18	4	-
Stage 1	-	-	-	-	-	-	~ 12	19	-	61	445	-
Stage 2	-	-	-	-	-	-	433	441	-	35	19	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	3.9	0.1	\$ 6691.4	12.9
HCM LOS			F	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	8	871	-	-	386	-	-	455
HCM Lane V/C Ratio	13.859	0.055	-	-	0.011	-	-	0.002
HCM Control Delay (s)	\$ 6691.4	9.4	3.8	-	14.4	-	-	12.9
HCM Lane LOS	F	A	A	-	B	-	-	B
HCM 95th %tile Q(veh)	15.5	0.2	-	-	0	-	-	0

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

**Intersection**

Int Delay, s/veh 0.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	1565	8	0	636	0	27
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Stop
Storage Length	-	0	-	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	7	0	0	14	0	0
Mvmt Flow	1701	9	0	691	0	29

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	1701
Stage 1	-	-	1701
Stage 2	-	-	691
Critical Hdwy	-	4.1	6.6
Critical Hdwy Stg 1	-	-	5.8
Critical Hdwy Stg 2	-	-	5.4
Follow-up Hdwy	-	2.2	3.5
Pot Cap-1 Maneuver	-	379	33
Stage 1	-	-	136
Stage 2	-	-	501
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	379	33
Mov Cap-2 Maneuver	-	-	33
Stage 1	-	-	136
Stage 2	-	-	501

Approach	EB	WB	NB
HCM Control Delay, s	0	0	17.9
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	308	-	-	379	-
HCM Lane V/C Ratio	0.095	-	-	-	-
HCM Control Delay (s)	17.9	-	-	0	-
HCM Lane LOS	C	-	-	A	-
HCM 95th %tile Q(veh)	0.3	-	-	0	-

Intersection												
Int Delay, s/veh	1.7											

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	1558	6	1	603	0	12	0	6	0	0	0
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									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	7	0	0	13	0	0	0	0	0	0	0
Mvmt Flow	0	1693	7	1	655	0	13	0	7	0	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	655	0	0	1700	0	0	2355	2355	1697	2358	2358	655
Stage 1	-	-	-	-	-	-	1697	1697	-	658	658	-
Stage 2	-	-	-	-	-	-	658	658	-	1700	1700	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	942	-	-	380	-	-	25	36	116	25	36	470
Stage 1	-	-	-	-	-	-	118	150	-	457	464	-
Stage 2	-	-	-	-	-	-	457	464	-	118	149	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	942	-	-	380	-	-	25	36	116	24	36	470
Mov Cap-2 Maneuver	-	-	-	-	-	-	25	36	-	24	36	-
Stage 1	-	-	-	-	-	-	118	150	-	457	462	-
Stage 2	-	-	-	-	-	-	455	462	-	111	149	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	206.5	0
HCM LOS			F	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	34	942	-	-	380	-	-	-
HCM Lane V/C Ratio	0.575	-	-	-	0.003	-	-	-
HCM Control Delay (s)	206.5	0	-	-	14.5	0	-	0
HCM Lane LOS	F	A	-	-	B	A	-	A
HCM 95th %tile Q(veh)	2	0	-	-	0	-	-	-

**Intersection**

Int Delay, s/veh            6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	1560	4	5	591	13	62
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	7	0	33	13	0	8
Mvmt Flow	1696	4	5	642	14	67

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	1700
Stage 1	-	-	1698
Stage 2	-	-	653
Critical Hdwy	-	4.43	6.4
Critical Hdwy Stg 1	-	-	5.4
Critical Hdwy Stg 2	-	-	5.4
Follow-up Hdwy	-	2.497	3.5
Pot Cap-1 Maneuver	-	303	40
Stage 1	-	-	165
Stage 2	-	-	522
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	303	39
Mov Cap-2 Maneuver	-	-	39
Stage 1	-	-	165
Stage 2	-	-	508

Approach	EB	WB	NB
HCM Control Delay, s	0	0.1	178.2
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	84	-	-	303	-
HCM Lane V/C Ratio	0.97	-	-	0.018	-
HCM Control Delay (s)	178.2	-	-	17.1	0
HCM Lane LOS	F	-	-	C	A
HCM 95th %tile Q(veh)	5.4	-	-	0.1	-

**Intersection**

Int Delay, s/veh 4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	0	47	55	0	10	9
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	2	0	0	22
Mvmt Flow	0	51	60	0	11	10

Major/Minor	Minor1	Major1	Major2
Conflicting Flow All	92	60	0
Stage 1	60	-	-
Stage 2	32	-	-
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	913	1011	1556
Stage 1	968	-	-
Stage 2	996	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	907	1011	1556
Mov Cap-2 Maneuver	907	-	-
Stage 1	968	-	-
Stage 2	989	-	-

Approach	WB	NB	SB
HCM Control Delay, s	8.8	0	3.9
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	1011	1556	-
HCM Lane V/C Ratio	-	-	0.051	0.007	-
HCM Control Delay (s)	-	-	8.8	7.3	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0.2	0	-

**Intersection**

Int Delay, s/veh 2.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	24	0	0	51	5	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	26	0	0	55	5	4

Major/Minor	Minor2	Major1	Major2
Conflicting Flow All	63	8	10
Stage 1	8	-	-
Stage 2	55	-	-
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	948	1080	1623
Stage 1	1020	-	-
Stage 2	973	-	-
Platoon blocked, %			
Mov Cap-1 Maneuver	948	1080	1623
Mov Cap-2 Maneuver	948	-	-
Stage 1	1020	-	-
Stage 2	973	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.9	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1623	-	948	-	-
HCM Lane V/C Ratio	-	-	0.028	-	-
HCM Control Delay (s)	0	-	8.9	-	-
HCM Lane LOS	A	-	A	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

**Intersection**

Int Delay, s/veh 7.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	6	780	52	40	1245	3	23	0	17	0	0	2
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									
Storage Length	-	-	-	425	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	33	7	0	0	2	33	0	0	0	0	0	100
Mvmt Flow	7	848	57	43	1353	3	25	0	18	0	0	2

Major/Minor	Major1	Major2	Minor1	Minor2								
Conflicting Flow All	1357	0	0	904	0	0	2332	2332	452	1879	2359	1355
Stage 1	-	-	-	-	-	-	889	889	-	1442	1442	-
Stage 2	-	-	-	-	-	-	1443	1443	-	437	917	-
Critical Hdwy	4.43	-	-	4.1	-	-	7.3	6.5	6.9	7.3	6.5	7.7
Critical Hdwy Stg 1	-	-	-	-	-	-	6.5	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.5	5.5	-
Follow-up Hdwy	2.497	-	-	2.2	-	-	3.5	4	3.3	3.5	4	4.25
Pot Cap-1 Maneuver	419	-	-	761	-	-	~ 23	37	560	50	36	94
Stage 1	-	-	-	-	-	-	309	364	-	166	199	-
Stage 2	-	-	-	-	-	-	166	199	-	574	354	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	419	-	-	761	-	-	~ 21	34	560	45	33	94
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 21	34	-	45	33	-
Stage 1	-	-	-	-	-	-	298	352	-	160	188	-
Stage 2	-	-	-	-	-	-	153	188	-	536	342	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	0.3	\$ 389.5	44.2
HCM LOS			F	E

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	36	419	-	-	761	-	-	94
HCM Lane V/C Ratio	1.208	0.016	-	-	0.057	-	-	0.023
HCM Control Delay (s)	\$ 389.5	13.7	0.2	-	10	-	-	44.2
HCM Lane LOS	F	B	A	-	B	-	-	E
HCM 95th %tile Q(veh)	4.5	0	-	-	0.2	-	-	0.1

**Notes**

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

**Intersection**

Int Delay, s/veh 0.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	771	26	0	1288	0	16
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Stop
Storage Length	-	0	-	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	7	0	0	2	0	0
Mvmt Flow	838	28	0	1400	0	17

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	838
Stage 1	-	-	838
Stage 2	-	-	1400
Critical Hdwy	-	-	4.1
Critical Hdwy Stg 1	-	-	5.8
Critical Hdwy Stg 2	-	-	5.4
Follow-up Hdwy	-	-	2.2
Pot Cap-1 Maneuver	-	-	805
Stage 1	-	-	390
Stage 2	-	-	231
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	805
Mov Cap-2 Maneuver	-	-	42
Stage 1	-	-	390
Stage 2	-	-	231

Approach	EB	WB	NB
HCM Control Delay, s	0	0	11.3
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	589	-	-	805	-
HCM Lane V/C Ratio	0.03	-	-	-	-
HCM Control Delay (s)	11.3	-	-	0	-
HCM Lane LOS	B	-	-	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Intersection													
Int Delay, s/veh	0.6												

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	773	20	5	1293	0	7	0	4	0	0	0
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									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	6	0	0	2	0	0	0	0	0	0	0
Mvmt Flow	0	840	22	5	1405	0	8	0	4	0	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1405	0	0	862	0	0	2267	2267	851	2269	2278	1405
Stage 1	-	-	-	-	-	-	851	851	-	1416	1416	-
Stage 2	-	-	-	-	-	-	1416	1416	-	853	862	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	492	-	-	789	-	-	29	41	363	29	40	173
Stage 1	-	-	-	-	-	-	358	379	-	172	205	-
Stage 2	-	-	-	-	-	-	172	205	-	357	375	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	492	-	-	789	-	-	28	40	363	28	39	173
Mov Cap-2 Maneuver	-	-	-	-	-	-	28	40	-	28	39	-
Stage 1	-	-	-	-	-	-	358	379	-	172	199	-
Stage 2	-	-	-	-	-	-	167	199	-	353	375	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	121.8	0
HCM LOS			F	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	42	492	-	-	789	-	-	-
HCM Lane V/C Ratio	0.285	-	-	-	0.007	-	-	-
HCM Control Delay (s)	121.8	0	-	-	9.6	0	-	0
HCM Lane LOS	F	A	-	-	A	A	-	A
HCM 95th %tile Q(veh)	1	0	-	-	0	-	-	-

**Intersection**

Int Delay, s/veh 0.8

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	755	22	45	1293	5	31
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	6	0	0	2	0	0
Mvmt Flow	821	24	49	1405	5	34

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	845
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.1
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.2
Pot Cap-1 Maneuver	-	-	800
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	800
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.3	39.1
HCM LOS			E

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	144	-	-	800	-
HCM Lane V/C Ratio	0.272	-	-	0.061	-
HCM Control Delay (s)	39.1	-	-	9.8	0
HCM Lane LOS	E	-	-	A	A
HCM 95th %tile Q(veh)	1	-	-	0.2	-

**Intersection**

Int Delay, s/veh 4.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	0	25	15	0	50	42
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	0	27	16	0	54	46

Major/Minor	Minor1	Major1	Major2
Conflicting Flow All	170	16	0
Stage 1	16	-	-
Stage 2	154	-	-
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	825	1069	1615
Stage 1	1012	-	-
Stage 2	879	-	-
Platoon blocked, %			
Mov Cap-1 Maneuver	797	1069	1615
Mov Cap-2 Maneuver	797	-	-
Stage 1	1012	-	-
Stage 2	849	-	-

Approach	WB	NB	SB
HCM Control Delay, s	8.5	0	4
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	1069	1615	-
HCM Lane V/C Ratio	-	-	0.025	0.034	-
HCM Control Delay (s)	-	-	8.5	7.3	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0.1	-

**Intersection**

Int Delay, s/veh 1.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	15	0	0	21	45	22
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	16	0	0	23	49	24

Major/Minor	Minor2	Major1	Major2
Conflicting Flow All	84	61	73
Stage 1	61	-	-
Stage 2	23	-	-
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	923	1010	1540
Stage 1	967	-	-
Stage 2	1005	-	-
Platoon blocked, %			
Mov Cap-1 Maneuver	923	1010	1540
Mov Cap-2 Maneuver	923	-	-
Stage 1	967	-	-
Stage 2	1005	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1540	-	923	-	-
HCM Lane V/C Ratio	-	-	0.018	-	-
HCM Control Delay (s)	0	-	9	-	-
HCM Lane LOS	A	-	A	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

**Appendix H**  
**Crash Data**

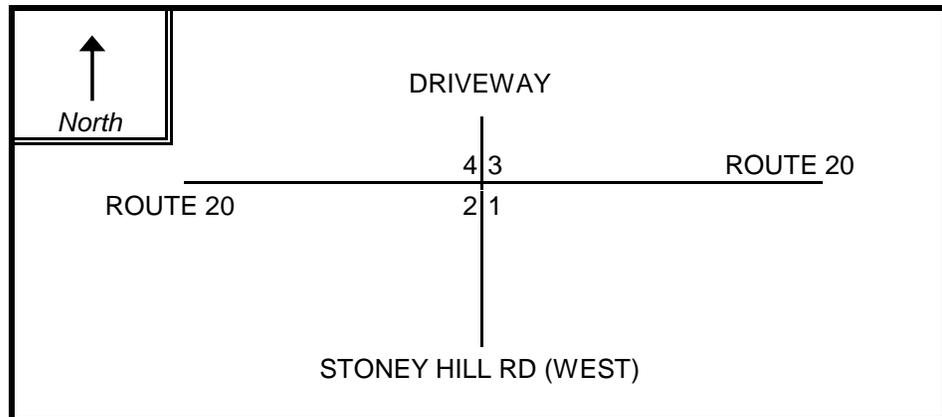
## INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : SHREWSBURY                      COUNT DATE : NOV-2014  
 DISTRICT :   3        UNSIGNALIZED :  X      SIGNALIZED :

~ INTERSECTION DATA ~

MAJOR STREET : ROUTE 20 - HARTFORD TURNPIKE  
 MINOR STREET(S) : STONEY HILL ROAD (WEST)  
DRIVEWAY

**INTERSECTION  
 DIAGRAM**  
 (Label Approaches)



**PEAK HOUR VOLUMES**

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	NB	EB	WB	SB		
PEAK HOURLY VOLUMES (PM) :	15	699	1,129	2		1,845

" K " FACTOR :       INTERSECTION ADT ( V ) = TOTAL DAILY APPROACH VOLUME :

TOTAL # OF CRASHES :       # OF YEARS :       AVERAGE # OF CRASHES PER YEAR ( A ) :

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

Comments : Based on MassDOT Crash Database

Project Title & Date: Pointe at Hill Farms / September 2015

## SEGMENT CRASH RATE WORKSHEET

CITY/TOWN : SHREWSBURY COUNT DATE : 4/15/2014

DISTRICT : \_\_\_\_\_

~ SEGMENT DATA ~

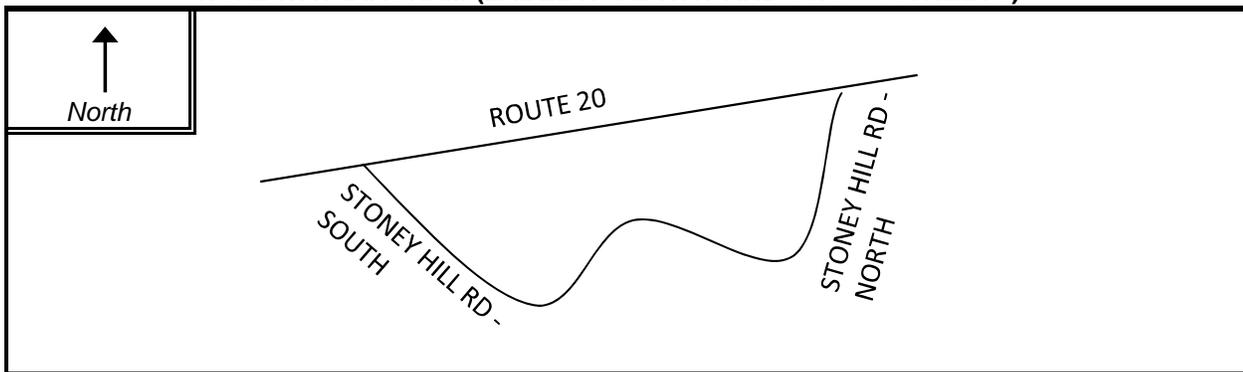
ROADWAY NAME: ROUTE 20 - HARTFORD TURNPIKE

START POINT: STONEY HILL ROAD (SOUTH)

END POINT: STONEY HILL ROAD (NORTH)

FUNCTIONAL CLASSIFICATION OF ROADWAY: URBAN PRINCIPAL ARTERIAL

ROADWAY DIAGRAM (LABEL ROADWAY AND CROSS STREETS)



AVERAGE DAILY TRAFFIC

SEGMENT LENGTH IN MILES ( L ): **0.48**

AVERAGE DAILY TRAFFIC VOLUME ( V ): 22,685

TOTAL # OF CRASHES: **14** # OF YEARS : **5** AVERAGE # OF CRASHES PER YEAR ( A ): **2.80**

CRASH RATE CALCULATION : **0.70**

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

Comments : Based on MassDOT Crash Database

Project Title & Date: Pointe at Hill Farms / September 2015



Route 20 (Between Stoney Hill Road Intersections)

Crash Number	City/Town Name	Crash Date	Crash Time	Crash Severity	Number of Vehicles	Total Nonfatal Injuries	Total Fatal Injuries	Manner of Collision	Vehicle Travel Directions	Road Surface Condition	Ambient Light	Weather Condition	At Roadway Intersection	Distance From Nearest Roadway Intersection	Distance from Nearest Milemarker	Distance from Nearest Exit	Distance from Nearest Landmark	Non Motorist Type	X	Y
2481011	SHREWSBURY	9-May-09	1:21 PM	Property damage only (none injured)	3	0	0	Rear-end	V1:Westbound / V2:Westbound / V3:Westbound	Dry	Daylight	Clear		455 HARTFORD TURNPIKE Rte 20 W					183186.9525	889394.8179
2509388	SHREWSBURY	12-Aug-09	4:34 PM	Property damage only (none injured)	2	0	0	Single vehicle crash	V1:Westbound / V2:Not reported	Dry	Daylight	Clear		476 HARTFORD TURNPIKE Rte 20 W					183295.2149	889562.9817
2548364	SHREWSBURY	20-Oct-09	6:48 AM	Property damage only (none injured)	2	0	0	Sideswipe, same direction	V1:Eastbound / V2:Eastbound	Dry	Daylight	Unknown		476 HARTFORD TURNPIKE Rte 20 W					183289.828	889554.661
2613452	SHREWSBURY	15-May-10	5:37 PM	Non-fatal injury	2	2	0	Rear-end	V1:Eastbound / V2:Eastbound	Dry	Daylight	Clear		495 HARTFORD TURNPIKE / Rte 20					183337.1736	889627.4366
2613464	SHREWSBURY	1-May-10	3:47 PM	Property damage only (none injured)	2	0	0	Single vehicle crash	V1:Eastbound / V2:Eastbound	Dry	Daylight	Clear		470 HARTFORD TURNPIKE / Rte 20					183226.5199	889456.5873
2630651	SHREWSBURY	9-Jul-10	2:57 PM	Property damage only (none injured)	2	0	0	Rear-end	V1:Westbound / V2:Eastbound	Dry	Daylight	Clear	HARTFORD TURNPIKE / STONEY HILL ROAD							
2668552	SHREWSBURY	17-Nov-10	3:30 PM	Non-fatal injury	2	1	0	Sideswipe, opposite direction	V1:Westbound / V2:Eastbound	Dry	Daylight	Cloudy		525 HARTFORD TURNPIKE / Rte 20					183386.718	889703.9882
3192030	SHREWSBURY	9-May-12	5:08 PM	Non-fatal injury	2	2	0	Angle	V1:Eastbound / V2:Northbound	Wet	Daylight	Cloudy		476 HARTFORD TURNPIKE						
3253515	SHREWSBURY	25-Aug-12	8:41 AM	Property damage only (none injured)	2	0	0	Angle	V1:Not reported / V2:Not reported	Dry	Dark - unknown roadway lighting	Clear		470 HARTFORD TURNPIKE / Rte 20			BARK AND MULCH			
3253785	SHREWSBURY	26-Aug-12	12:27 PM	Property damage only (none injured)	2	0	0	Rear-end	V1:Westbound / V2:Westbound	Dry	Daylight	Clear		420 HARTFORD TURNPIKE Rte 20 W						
3450324	SHREWSBURY	6-May-13	7:49 AM	Non-fatal injury	3	3	0	Sideswipe, opposite direction	V1:Westbound / V2:Eastbound / V3:Eastbound	Dry	Daylight	Clear		427 HARTFORD TURNPIKE Rte 20 W					182977.781172545	889101.336390188
3446260	SHREWSBURY	10-May-13	9:55 PM	Non-fatal injury	1	1	0	Sideswipe, same direction	V1:Westbound	Dry	Dark - lighted roadway	Cloudy		495 HARTFORD TURNPIKE Rte 20 W / STONEY HILL DRIVE					183316.303860264	889595.556102098
3714509	SHREWSBURY	27-Oct-13	11:11 AM	Property damage only (none injured)	3	0	0	Rear-end	V1:Westbound / V2:Westbound / V3:Westbound	Unknown	Daylight	Unknown		495 HARTFORD TURNPIKE Rte 20 W			LIBERTY CHURCH		183239.539713248	889476.929814583
3423083	SHREWSBURY	2-May-13	7:44 AM	Non-fatal injury	2	2	0	Angle	V1:Westbound / V2:Northbound	Dry	Daylight	Clear		495 HARTFORD TURNPIKE Rte 20 W					183305.1542	889578.3342

Source



**Crash Data STONEY HILL ROAD (EAST) @ HARTFORD AVENUE (ROUTE 20)**

Crash Number	City/Town Name	Crash Date	Crash Time	Crash Severity	Number of Vehicles	Total Nonfatal Injuries	Total Fatal Injuries	Manner of Collision	Vehicle Travel Directions	Road Surface Condition	Ambient Light	Weather Condition	At Roadway Intersection	Distance from Nearest Roadway Intersection	Distance from Nearest Milemarker	Distance from Nearest Exit	Distance from Nearest Landmark	Non Motorist Type	X Coordinate	Y Coordinate
2556896	SHREWSBURY	27-Sep-09	8:14 PM	Property damage only (none injured)	2	0	0	Angle	V1:Southbound / V2:Northbound	Dry	Dawn	Clear/Clear	HARTFORD TURNPIKE Rte 20 W / STONEY HILL DRIVE						183438.3436	889785.25
2684859	SHREWSBURY	27-Oct-10	8:34 AM	Unknown	2	0	0	Rear-end	V1:Eastbound / V2:Eastbound	Wet	Daylight	Rain	HARTFORD TURNPIKE Rte 20 E / STONEY HILL DRIVE						183438.3436	889785.25
2776995	SHREWSBURY	8-Sep-11	7:46 AM	Property damage only (none injured)	2	0	0	Angle	V1:Eastbound / V2:Northbound	Wet	Daylight	Rain	HARTFORD TURNPIKE Rte 20 W / STONEY HILL DRIVE						183438.3436	889785.25
2752302	SHREWSBURY	3-Aug-11	7:58 AM	Non-fatal injury	4	1	0	Rear-end	V1:Eastbound / V2:Eastbound / V3:Eastbound / V4:Eastbound	Dry	Daylight	Clear	100 feet E from Intersection STONEY HILL DRIVE						183454.8898	889811.4099
3404821	SHREWSBURY	28-Mar-13	2:21 PM	Non-fatal injury	2	1	0	Angle	V1:Eastbound / V2:Northbound	Dry	Daylight	Cloudy	HARTFORD TURNPIKE / HARTFORD TURNPIKE Rte 20 E / STONEY HILL ROAD							
3748690	SHREWSBURY	26-Nov-13	5:48 PM	Property damage only (none injured)	2	0	0	Rear-end	V1:Westbound / V2:Westbound	Wet	Dark - lighted roadway	Rain	HARTFORD TURNPIKE Rte 20 W / STONEY HILL DRIVE						183438.3436	889785.25

Source: MassDOT

**Crash Data STONEY HILL ROAD (WEST) @ HARTFORD AVENUE (ROUTE 20)**

Crash Number	City/Town Name	Crash Date	Crash Time	Crash Severity	Number of Vehicles	Total Nonfatal Injuries	Total Fatal Injuries	Manner of Collision	Vehicle Travel Directions	Road Surface Condition	Ambient Light	Weather Condition	At Roadway Intersection				Distance from Nearest Roadway Intersection	Distance from Nearest Milemarker	Distance from Nearest Exit	Distance from Nearest Landmark	Non Motorist Type	X Coordinate	Y Coordinate	
2468754	SHREWSBURY	27-Feb-09	9:28 AM	Property damage only (none injured)	2	0	0	Rear-to-rear	V1:Westbound / V2:Not reported	Sand, mud, dirt, oil, gravel	Daylight	Clear				411 HARTFORD TURNPIKE / Rte 20							183026.9735	889156.946
2548376	SHREWSBURY	13-Nov-09	4:50 PM	Property damage only (none injured)	2	0	0	Angle	V1:Eastbound / V2:Northbound	Dry	Dark - lighted roadway	Cloudy				408 HARTFORD TURNPIKE Rte 20 W							182950.5964	889075.6329
2557349	SHREWSBURY	13-Nov-09	5:44 PM	Property damage only (none injured)	2	0	0	Angle	V1:Westbound / V2:Westbound	Dry	Dark - lighted roadway	Cloudy				411 HARTFORD TURNPIKE Rte 20							182961.5252	889085.5616
2562426	SHREWSBURY	14-Nov-09	6:51 AM	Property damage only (none injured)	2	0	0	Angle	V1:Westbound / V2:Not reported	Water (standing, moving)	Dawn	Rain				430 HARTFORD TURNPIKE / STONEY HILL ROAD Rte 20							183011.1877	889138.6253
2586963	SHREWSBURY	6-Mar-10	10:50 AM	Property damage only (none injured)	2	0	0	Rear-end	V1:Eastbound / V2:Eastbound	Dry	Daylight	Clear				411 HARTFORD TURNPIKE							183011.1876	889138.6253
2648692	SHREWSBURY	30-Aug-10	2:01 AM	Non-fatal injury	1	1	0	Single vehicle crash	V1:Eastbound	Dry	Dark - lighted roadway	Clear				411 HARTFORD TURNPIKE							183002.4496	889127.967
2697644	SHREWSBURY	27-Jan-11	5:42 PM	Property damage only (none injured)	2	0	0	Rear-end	V1:Westbound / V2:Westbound	Wet	Dark - lighted roadway	Clear				411 HARTFORD TURNPIKE Rte 20 W				TRI STATE TRUCKING			183002.9114	889128.4951
2768163	SHREWSBURY	8-Jul-11	12:11 PM	Non-fatal injury	2	3	0	Rear-end	V1:Not reported / V2:Not reported	Not reported	Daylight	Cloudy/Clear	HARTFORD TURNPIKE Rte 20 W	STONEY HILL DRIVE						TRI STATE TRUCK			183011.1876	889138.6253
3120174	SHREWSBURY	19-Jan-12	11:19 AM	Property damage only (none injured)	3	0	0	Rear-end	V1:Eastbound / V2:Eastbound / V3:Eastbound	Dry	Daylight	Cloudy				411 HARTFORD TURNPIKE / Rte 20								
3126141	SHREWSBURY	13-Feb-12	8:03 AM	Property damage only (none injured)	2	0	0	Rear-end	V1:Eastbound / V2:Eastbound	Dry	Daylight	Clear				409 HARTFORD TURNPIKE Rte 20 E								
3409043	SHREWSBURY	6-Mar-13	11:03 AM	Property damage only (none injured)	3	0	0	Not reported	V1:Southbound / V2:Southbound / V3:Southbound	Not reported	Not reported	Not Reported	STONEY HILL DRIVE / HARTFORD TURNPIKE Rte 20 W										183011.1876	889138.6253
3587640	SHREWSBURY	5-Jun-13	3:30 PM	Property damage only (none injured)	2	0	0	Angle	V1:Eastbound / V2:Northbound	Dry	Daylight	Clear				HARTFORD TURNPIKE Rte 20 W / STONEY HILL DRIVE							183011.1876	889138.6253

The screenshot displays the MassDOT Road Inventory web application. The interface includes a navigation menu at the top with links for Home, GIS Maps And Data Products, Maps, Interactive Maps, and Road Inventory. Below the menu is a map of a road network. A popup window titled "Results:" is open, displaying the following data for a selected road segment:

Road Inventory	
Street Name:	HARTFORD TURNPIKE
City:	271
Route Key:	US20 EB
MassDOT District:	3
MPO:	Central Massachusetts
Functional Classification:	3
Federal Functional Classification:	3
Jurisdiction:	1
Urban Type:	1
Urbanized Area:	97291
NHS Status:	14
MHS:	0
Federal Aid Route#:	20
Facility Type:	1
# Of Travel Lanes:	2
Mileage Counted:	1
Road Inventory ID:	34639401
Road Segment ID:	346394

Below the data is a "Zoom to" link. The map interface also features a search bar, a "Tools" panel with "SELECT", "CONTACT US", and "HELP" buttons, and a legend for "BASEMAP", "ROAD TYPE", and "LEGEND".

Route 20 Classification based on MassDOT road inventory map above = Urban Principal Arterial Roadway

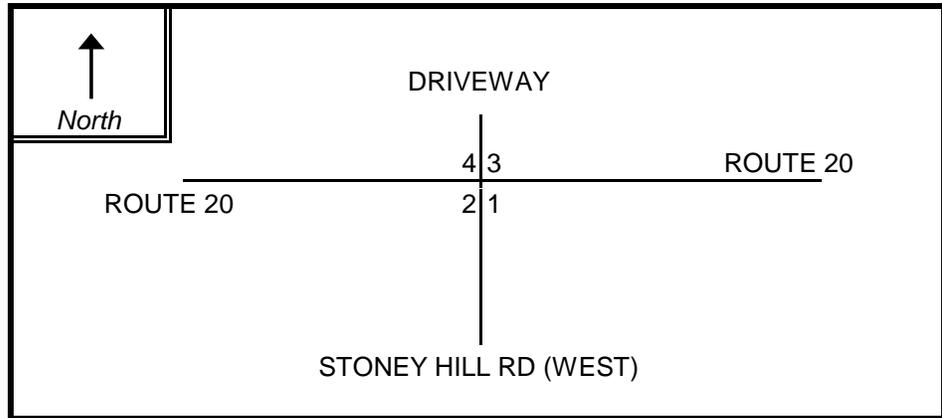
## INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : SHREWSBURY                      COUNT DATE : NOV-2014  
 DISTRICT :   3                        UNSIGNALIZED :                       SIGNALIZED :

~ INTERSECTION DATA ~

MAJOR STREET : ROUTE 20 - HARTFORD TURNPIKE  
 MINOR STREET(S) : STONEY HILL ROAD (WEST)  
DRIVEWAY

**INTERSECTION  
 DIAGRAM  
 (Label Approaches)**



**PEAK HOUR VOLUMES**

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	NB	EB	WB	SB		
PEAK HOURLY VOLUMES (PM) :	15	699	1,129	2		1,845

" K " FACTOR :                       INTERSECTION ADT ( V ) = TOTAL DAILY APPROACH VOLUME :

TOTAL # OF CRASHES :                       # OF YEARS :                       AVERAGE # OF CRASHES PER YEAR ( A ) :

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

Comments : Based on Shrewsbury Police Dept. Crash Reports  
 Project Title & Date: Pointe at Hill Farms / March 2015

## SEGMENT CRASH RATE WORKSHEET

CITY/TOWN : SHREWSBURY                      COUNT DATE : 4/15/2014

DISTRICT : \_\_\_\_\_

~ SEGMENT DATA ~

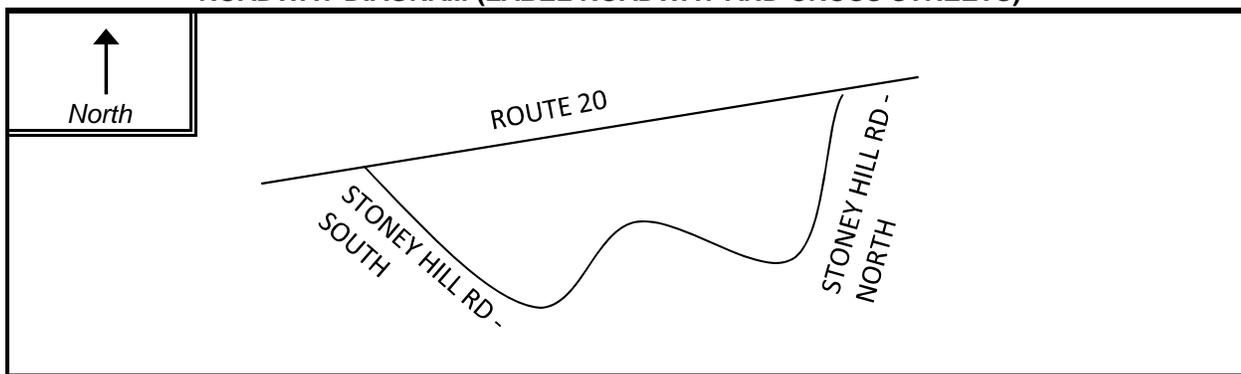
ROADWAY NAME: ROUTE 20 - HARTFORD TURNPIKE

START POINT: STONEY HILL ROAD (SOUTH)

END POINT: STONEY HILL ROAD (NORTH)

FUNCTIONAL CLASSIFICATION OF ROADWAY: URBAN PRINCIPAL ARTERIAL

**ROADWAY DIAGRAM (LABEL ROADWAY AND CROSS STREETS)**



**AVERAGE DAILY TRAFFIC**

SEGMENT LENGTH IN MILES ( L ): 0.48

AVERAGE DAILY TRAFFIC VOLUME ( V ): 22,685

TOTAL # OF CRASHES: 11                      4                      AVERAGE # OF CRASHES PER YEAR ( A ): 2.75

**CRASH RATE CALCULATION :**

**0.69**

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

Comments : Based on Shrewsbury Police Dept. Crash Reports

Project Title & Date: Pointe at Hill Farms / March 2015



**Crash Data Summary Table**  
Hartford Turnpike (Route 20)  
between Stoney Hill Road (East) and Stoney Hill Road (West)  
January 1, 2011 through December 31, 2014

Source: Shrewsbury Police Department Police and Incident Reports

Crash No.	Crash Location	Crash Date	Crash Day	Crash Time	Manner of Collision	Ambient Light	Weather Condition	Road Surface Condition	Driver Contributing Factor	Severity	Age (D1)	Age (D2)	Age (D3)	Comments
1	409 Hartford Tpke	24-Jul-12	Tues	1:56 PM	Angle	Daylight	Clear	Dry	Failed to Yield Right of Way	Non-fatal Injury	18	47		Veh 1 was traveling WB on Rt 20 when Veh 2 attempted to exit 409 Hartford Tpke and collided with Veh 1. Veh 2 stated that they did not see Veh 1.
2	411 Hartford Tpke	27-Jan-11	Thurs	5:42 PM	Rear-end	Dark - Lighted Roadway	Clear	Wet	Inattention	Property Damage Only	52	33		Veh 1 traveling WB stopped for traffic when Veh 2 could not stop in time and rear-ended Veh 1. Operator of Veh 2 had a revoked license and was arrested at the scene and it was determined that the operator of Veh 2 was operating under the influence of alcohol and drugs.
3	411 Hartford Tpke	19-Jan-12	Thurs	11:19 AM	Rear-end	Daylight	Cloudy	Dry	Inattention	Property Damage Only	59	52	20	Veh 1 was traveling EB on Rt 20 and attempted to turn left into 411 Hartford Tpke when Veh 2 rear-ended Veh 1 and Veh 3 rear-ended Veh 2. Operator of Veh 2 stated they were in the left travel lane when Veh 1 turned right then turned back to the left and put their directional on prior to the collision.
4	411 Hartford Tpke	6-Nov-12	Tues	5:23 PM	Sideswipe	Dark - Lighted Roadway	Cloudy	Dry	Visibility Obstructed	Non-fatal Injury	39	60		Veh 1 was traveling WB on Rt 20 when Veh 2 attempted to turn right exiting 411 Hartford Tpke onto Rt 20 WB and collided with Veh 1.
5	411 Hartford Tpke	7-Nov-12	Wed	4:57 PM	Unk.	Unk.	Unk.	Unk.	Unk.	Property Damage Only	Unk.	Unk.		Motor vehicle accident involving two vehicles reported with no injuries. No citations reported.
6	Hartford Tpke/Stoney Hill Rd/Tri-State Truck	6-Jul-11	Wed	12:11 PM	Rear-end	Daylight	Cloudy	Unk.	Inattention	Non-fatal Injury	16	19		Veh 1 traveling WB on Rt 20 was waiting to turn left into Stoney Hill Rd when Veh 2 rear-ended Veh 1 pushing it into a guard rail on Stoney Hill Rd. Operator of Veh 2 stated that they were looking at their GPS immediately prior to the crash.
7	427 Hartford Tpke	6-May-13	Mon	7:49 AM	Sideswipe/ Head-On	Daylight	Clear	Dry	Wrong side or wrong way	Non-fatal Injury	27	53	48	Veh 1 was traveling WB on Rt 20 and crossed over the double yellow centerline and sideswiped Veh 2 (traveling EB on Rt 20) and hit Veh 3 head-on (also traveling EB on Rt 20). The operator of Veh 1 was issued a citation for failure to keep right of a double solid yellow line.
8	455 Hartford Tpke	6-Jun-14	Fri	8:52 AM	Unk.	Unk. Dark - Unknown Roadway Lighting	Unk.	Unk.	Unk.	Property Damage Only	Unk.	Unk.	Unk.	Motor vehicle accident involving three vehicles reported. No citations reported.
9	470 Hartford Tpke	25-Aug-12	Sat	8:41 AM	Angle	Daylight	Clear	Dry	Inattention	Property Damage Only	97	Unk.		Veh 1 was traveling on Rt 20 EB and stopped to turn into 470 Hartford Tpke when Veh 2 struck Veh 1. Veh 2 stated that she didn't know Veh 1 was turning and tried to go around Veh 1 on the right striking Veh 1.
10	476 Hartford Tpke	9-May-12	Wed	5:08 PM	Angle	Daylight	Cloudy	Wet	Failed to Yield Right of Way/Inattention	Non-fatal Injury	70	31		Veh 1 was traveling EB on Rt 20 when Veh 2, attempting to turn left exiting 476 Hartford Tpke, struck Veh 1 causing Veh 1 to crash into a utility pole. Operator of Veh 2 did not have a valid driver's license.
11	476 Hartford Tpke	29-Nov-12	Thurs	8:52 AM	Unk.	Unk.	Unk.	Unk.	Unk.	Property Damage Only	Unk.	Unk.		Motor vehicle accident involving a street sweeper reported with no injuries. No citations reported.
12	476 Hartford Tpke	2-May-13	Thurs	7:44 AM	Angle	Daylight	Clear	Dry	Failed to Yield Right of Way	Non-fatal Injury	Unk.	22		Veh 2 was traveling EB on Rt 20 and stopped to allow a vehicle to exit 479 Hartford Tpke. Veh 2 then turned into the parking lot at 479 Hartford Tpke when they were struck by Veh 1 traveling WB on Rt 20. The operator of Veh 2 was issued a citation for failure to give way.
13	479 Hartford Tpke	26-Nov-13	Tues	5:28 PM	Unk.	Unk.	Unk.	Unk.	Unk.	Property Damage Only	Unk.	Unk.		Motor vehicle accident involving two vehicles reported. No citations reported.
14	495 Hartford Tpke	19-Jul-11	Tues	6:47 PM	Unk.	Unk.	Unk.	Unk.	Unk.	Property Damage Only	Unk.			Motor vehicle accident with no injury reported. No citations reported.
15	495 Hartford Tpke	27-Oct-13	Sun	11:11 AM	Rear-end	Daylight	Unk.	Unk.	No Improper Driving	Property Damage Only	27	42	23	Veh 1 and Veh 2 were traveling WB on Rt 20 and slowed for traffic stopped at the church driveway. Veh 3 was traveling WB on Rt 20 and rear-ended Veh 2 which in turn struck Veh 1. The operator of Veh 3 stated that they did not see the other vehicles until the last moment.
16	495 Hartford Tpke	7-Feb-14	Fri	7:40 AM	Rear-end	Daylight	Clear	Dry	No Improper Driving	Non-fatal Injury	28	40	79	Veh 1 was traveling EB on Rt 20 and slowed to a stop for traffic when Veh 2 rear-ended Veh 1 and Veh 3 rear-ended Veh 2.
17	495 Hartford Tpke	17-Sep-14	Wed	7:39 PM	Rear-end	Dark - Lighted Roadway	Clear	Wet	Followed too closely	Property Damage Only	35	42		Veh 1 was traveling on Rt 20 WB when he was rear-ended by Veh 2. The operator of Veh 2 states that Veh 1 stopped short on Rt 20 prior to the collision.
18	525 Hartford Tpke	13-Dec-14	Sat	4:54 AM	Angle	Dark - Lighted Roadway	Clear	Dry	Swerving or avoiding due to wind, slippery surface, vehicle, object, non-	Property Damage Only	55	23		Veh 2 was traveling WB on Rt 20 when the operator swerved to avoid a box in the road and lost control of the vehicle. Veh 1 was traveling EB on Rt 20 and struck Veh 1 as it spun out of control from the WB travel lane to the EB travel lane. The operator of Veh 2 was issued a citation for operating after license suspended.
19	Hartford Tpke/Stoney Hill Rd	28-Mar-13	Thurs	2:21 PM	Angle	Daylight	Cloudy	Dry	Failed to Yield Right of Way	Non-fatal Injury	42	70		Veh 1 was traveling EB on Rt 20 approaching Stoney Hill Road when Veh 2 exited Stoney Hill Rd and collided with Veh 1. The operator of Veh 2 was issued a citation for failure to yield at an intersection.

Source: Shrewsbury Police Department Reports

<sup>1</sup>Unk. = Unknown

**Appendix I**  
**Sight Distance Calculations**

## Location: Proposed Driveway @ Route 20 (Phase I) - Right-In/Right-out

### STOPPING SIGHT DISTANCE FROM THE WEST (ROUTE 20)

Inputs

V= speed, mph	V= 55	(85th percentile speed)
G=percent of grade/100	G= 5	
t=brake reaction time (2.5 sec)	t= 2.5	
a=deceleration rate, ft/sec <sup>2</sup>	a= 11.2	

Calculations

Break Reaction Distance	$1.47Vt$	202 feet	
Breaking Distance	$V^2/30((a/32.2)+G)$	253.5 feet	Measured
Stopping Sight Distance =	$1.47Vt + V^2/30((a/32.2)+G)$	456 feet	700+

Source: A Policy on Geometric Design of Highways and Streets, 2011, Sixth Edition, prepared by AASHTO, p. 3-4 to 3-5.

### INTERSECTION SIGHT DISTANCE - RIGHT FROM PROPOSED DRIVEWAY (MINOR APPROACH)

Inputs

V= design speed, mph	V= 55	(85th percentile speed)
t=time gap for minor road vehicle to enter the major road	t= 7.00	Assumes passenger car

Calculations

Int. Sight Distance =	$1.47Vt$	566 feet	Measured
			700+

Design Vehicle	Time Gap <sup>1</sup> , t (sec) Grades <math>\leq 3\%</math>	for	Grade of Minor Approach	Number of Additional Lanes to Cross	Adjusted Time Gap, t (sec)
passenger car	6.5		0%	1	7.00
single-unit truck	8.5		0%	0	8.50
combination truck	10.5		0%	0	10.50

**Notes:**

1. Time Gap values are applicable for major roads with grades 3 percent or less, no median and a minor street approach with a grade of 3 percent or less. Otherwise, the table values should be adjusted as follows:

\*If the minor street has an upward grade of more than 3 percent then add 0.1 sec. to t for each percent grade.

\*\*Increase t by .5 seconds (for passenger cars) or 0.7 seconds (for trucks) for each additional lane to be crossed and for narrow medians that cannot store the design vehicle.

\*\*\*If the major approach is a divided highway with a median not wide enough to store the design vehicle, then the median width should be converted to equivalent lanes.

Source: A Policy on Geometric Design of Highways and Streets, 2011, Sixth Edition, prepared by AASHTO, p. 9-37 to 9-41.

## Location: Proposed driveway @ Stoney Hill Road West (Phase I)

### STOPPING SIGHT DISTANCE FROM THE NORTH (STONEY HILL ROAD WEST)

Inputs

V=speed, mph	V=	32	(85th percentile speed)
G=percent of grade/100	G=	-5.3	
t=brake reaction time (2.5 sec)	t=	2.5	
a=deceleration rate, ft/sec <sup>2</sup>	a=	11.2	

Calculations

Break Reaction Distance	$1.47Vt$	118 feet
Breaking Distance	$V^2/30((a/32.2)+G)$	115.8 feet
Stopping Sight Distance =	$1.47Vt + V^2/30((a/32.2)+G)$	<b>233 feet</b>

### STOPPING SIGHT DISTANCE FROM THE SOUTH (STONEY HILL ROAD WEST)

Inputs

V=speed, mph	V=	33	(85th percentile speed)
G=percent of grade/100	G=	3.7	
t=brake reaction time (2.5 sec)	t=	2.5	
a=deceleration rate, ft/sec <sup>2</sup>	a=	11.2	

Calculations

Break Reaction Distance	$1.47Vt$	121 feet
Breaking Distance	$V^2/30((a/32.2)+G)$	94.3 feet
Stopping Sight Distance =	$1.47Vt + V^2/30((a/32.2)+G)$	<b>216 feet</b>

Source: A Policy on Geometric Design of Highways and Streets, 2011, Sixth Edition, prepared by AASHTO, p. 3-4 to 3-5.

### INTERSECTION SIGHT DISTANCE - LEFT FROM PROPOSED DRIVEWAY (MINOR APPROACH) - To the North

Inputs

V= design speed, mph	V=	32	(85th percentile speed)
t=time gap for minor road vehicle to enter the major road	t=	7.50	(assumes passenger car)

Calculations

Int. Sight Distance =	$1.47Vt$	<b>353 feet</b>
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Design Vehicle	Time Gap <sup>1</sup> , t (sec) for Grades <=3%	Grade of Minor Approach	Number of Additional Lanes to Cross	Adjusted Time Gap, t (sec)
passenger car	7.5	0%	0	7.50
single-unit truck	9.5	0%	0	9.50
combination truck	11.5	0%	0	11.50

### INTERSECTION SIGHT DISTANCE - LEFT FROM PROPOSED DRIVEWAY (MINOR APPROACH) - To the South

Inputs

V= design speed, mph	V=	33	(85th percentile speed)
t=time gap for minor road vehicle to enter the major road	t=	7.50	(assumes passenger car)

Calculations

Int. Sight Distance =	$1.47Vt$	<b>364 feet</b>
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Design Vehicle	Time Gap <sup>1</sup> , t (sec) for Grades <=3%	Grade of Minor Approach	Number of Additional Lanes to Cross	Adjusted Time Gap, t (sec)
passenger car	7.5	0%	0	7.50
single-unit truck	9.5	0%	0	9.50
combination truck	11.5	0%	0	11.50

#### Notes:

1. Time Gap values are applicable for major roads with grades 3 percent or less, no median and a minor street approach with a grade of 3 percent or less. Otherwise, the table values should be adjusted as follows:

\*\*If the minor street has an upward grade of more than 3 percent then add 0.2 sec. to t for each percent grade.

\*\*\*Increase t by .5 seconds (for passenger cars) or 0.7 seconds (for trucks) for every additional lane from the left, in excess of one, to be crossed by the turning vehicle.

\*\*\*\*If the major approach is a divided highway with a median not wide enough to store the design vehicle, then the median width should be converted to equivalent lanes.

## Location: Proposed Driveway @ Route 20 (Phase II)

### STOPPING SIGHT DISTANCE FROM THE WEST (ROUTE 20)

Inputs

V= speed, mph	V=	51	(85th percentile speed)
G= percent of grade/100	G=	2	
t= brake reaction time (2.5 sec)	t=	2.5	
a= deceleration rate, ft/sec <sup>2</sup>	a=	11.2	

Calculations

Break Reaction Distance	1.47Vt	187 feet	
Breaking Distance	$V^2/30((a/32.2)+G)$	235.7 feet	Measured
Stopping Sight Distance =	$1.47Vt + V^2/30((a/32.2)+G)$	423 feet	750+

### STOPPING SIGHT DISTANCE FROM THE EAST (ROUTE 20)

Inputs

V= speed, mph	V=	50	(85th percentile speed)
G= percent of grade/100	G=	-2	
t= brake reaction time (2.5 sec)	t=	2.5	
a= deceleration rate, ft/sec <sup>2</sup>	a=	11.2	

Calculations

Break Reaction Distance	1.47Vt	184 feet	
Breaking Distance	$V^2/30((a/32.2)+G)$	254.2 feet	Measured
Stopping Sight Distance =	$1.47Vt + V^2/30((a/32.2)+G)$	438 feet	750+

Source: A Policy on Geometric Design of Highways and Streets, 2011, Sixth Edition, prepared by AASHTO, p. 3-4 to 3-5.

### INTERSECTION SIGHT DISTANCE - LEFT FROM MINOR APPROACH (PROPOSED DRIVEWAY) - To the west (left)

Inputs

V= design speed, mph	V=	51	(85th percentile speed)
t= time gap for minor road vehicle to enter the major road	t=	7.88	(assumes passenger car)

Calculations

Int. Sight Distance =	1.47Vt	590 feet	Measured
			Left 750+

Design Vehicle	Time Gap <sup>1</sup> , t (sec) Grades <math>\leq 3\%</math>	for	Grade of Minor Approach	Number of Additional Lanes to Cross	Adjusted Time Gap, t (sec)
passenger car	7.5		0%	0.75	7.88
single-unit truck	9.5		0%	0	9.50
combination truck	11.5		0%	0	11.50

Assumed shoulder of approx. 9 ft.

### INTERSECTION SIGHT DISTANCE - LEFT FROM MINOR APPROACH (PROPOSED DRIVEWAY) - To the east (right)

Inputs

V= design speed, mph	V=	50	(85th percentile speed)
t= time gap for minor road vehicle to enter the major road	t=	7.88	(assumes passenger car)

Calculations

Int. Sight Distance =	1.47Vt	579 feet	Measured
			Right 750+

Design Vehicle	Time Gap <sup>1</sup> , t (sec) Grades <math>\leq 3\%</math>	for	Grade of Minor Approach	Number of Additional Lanes to Cross	Adjusted Time Gap, t (sec)
passenger car	7.5		0%	0.75	7.88
single-unit truck	9.5		0%	0	9.50
combination truck	11.5		0%	0	11.50

Assumed shoulder of approx. 9 ft.

Notes:

1. Time Gap values are applicable for major roads with grades 3 percent or less, no median and a minor street approach with a grade of 3 percent or less. Otherwise, the table values should be adjusted as follows:

\*If the minor street has an upward grade of more than 3 percent then add 0.2 sec. to t for each percent grade.

\*\*Increase t by .5 seconds (for passenger cars) or 0.7 seconds (for trucks) for every additional lane from the left, in excess of one, to be crossed by the turning vehicle.

\*\*\*If the major approach is a divided highway with a median not wide enough to store the design vehicle, then the median width should be converted to equivalent lanes.

Source: A Policy on Geometric Design of Highways and Streets, 2011, Sixth Edition, prepared by AASHTO, p. 9-37 to 9-41.

## Location: Proposed Driveway @ Stoney Hill Road (Phase II)

### STOPPING SIGHT DISTANCE FROM THE NORTH (STONEY HILL ROAD)

Inputs

V= speed, mph	V=	29	(85th percentile speed)
G= percent of grade/100	G=	-3.2	
t= brake reaction time (2.5 sec)	t=	2.5	
a= deceleration rate, ft/sec <sup>2</sup>	a=	11.2	

Calculations

Break Reaction Distance	$1.47Vt$	107 feet
Breaking Distance	$V^2/30((a/32.2)+G)$	88.8 feet
Stopping Sight Distance =	$1.47Vt + V^2/30((a/32.2)+G)$	<b>195 feet</b>

### STOPPING SIGHT DISTANCE FROM THE SOUTH (STONEY HILL ROAD)

Inputs

V= speed, mph	V=	32	(85th percentile speed)
G= percent of grade/100	G=	3.8	
t= brake reaction time (2.5 sec)	t=	2.5	
a= deceleration rate, ft/sec <sup>2</sup>	a=	11.2	

Calculations

Break Reaction Distance	$1.47Vt$	118 feet
Breaking Distance	$V^2/30((a/32.2)+G)$	88.5 feet
Stopping Sight Distance =	$1.47Vt + V^2/30((a/32.2)+G)$	<b>206 feet</b>

Source: A Policy on Geometric Design of Highways and Streets, 2011, Sixth Edition, prepared by AASHTO, p. 3-4 to 3-5.

### INTERSECTION SIGHT DISTANCE - LEFT FROM MINOR APPROACH (PROPOSED DRIVEWAY) - To the North

Inputs

V= design speed, mph	V=	29	(85th percentile speed)
t= time gap for minor road vehicle to enter the major road	t=	7.50	(assumes passenger car)

Calculations

Int. Sight Distance =	$1.47Vt$	<b>320 feet</b>
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Design Vehicle	Time Gap <sup>1</sup> , t (sec) Grades <math>\leq 3\%</math>	for	Grade of Minor Approach	Number of Additional Lanes to Cross	Adjusted Time Gap, t (sec)
passenger car	7.5		0%	0	7.50
single-unit truck	9.5		0%	0	9.50
combination truck	11.5		0%	0	11.50

### INTERSECTION SIGHT DISTANCE - LEFT FROM MINOR APPROACH (PROPOSED DRIVEWAY) - To the South

Inputs

V= design speed, mph	V=	32	(85th percentile speed)
t= time gap for minor road vehicle to enter the major road	t=	7.50	(assumes passenger car)

Calculations

Int. Sight Distance =	$1.47Vt$	<b>353 feet</b>
-----------------------	----------	-----------------

Design Vehicle	Time Gap <sup>1</sup> , t (sec) Grades <math>\leq 3\%</math>	for	Grade of Minor Approach	Number of Additional Lanes to Cross	Adjusted Time Gap, t (sec)
passenger car	7.5		0%	0	7.50
single-unit truck	9.5		0%	0	9.50
combination truck	11.5		0%	0	11.50

#### Notes:

1. Time Gap values are applicable for major roads with grades 3 percent or less, no median and a minor street approach with a grade of 3 percent or less. Otherwise, the table values should be adjusted as follows:

\*If the minor street has an upward grade of more than 3 percent then add 0.2 sec. to t for each percent grade.

\*\*Increase t by .5 seconds (for passenger cars) or 0.7 seconds (for trucks) for every additional lane from the left, in excess of one, to be crossed by the turning vehicle.

\*\*\*If the major approach is a divided highway with a median not wide enough to store the design vehicle, then the median width should be converted to equivalent lanes.

Source: A Policy on Geometric Design of Highways and Streets, 2011, Sixth Edition, prepared by AASHTO, p. 9-37 to 9-41.