TRAFFIC IMPACT AND ACCESS STUDY

THE VILLAGE AT SUDBURY STATION 40B DEVELOPMENT

Hudson Road
Sudbury, Massachusetts

Prepared for:
Sudbury Station, LLC

December 2015

MDM TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers

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Prepared for:
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Naples, Florida

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MDM

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EXECUTIVE SUMMARY

MDM Transportation Consultants, Inc. (MDM) has prepared this Traffic Impact and Access Study (TIAS) for a proposed 40B residential development referred to as The Village at Sudbury Station ("Sudbury Station") in Sudbury, Massachusetts. This report documents existing operational and safety-related characteristics of roadways serving the development Site, estimates future year operating characteristics of these roadways independent of the development, estimates development-related trip generation, and identifies incremental impacts of Site-related traffic. Access improvements are identified for the development to meet operational needs of the Site and the adjacent roadways.

This TIAS has been prepared in accordance with requirements and standards for the preparation of traffic studies as jointly issued by the Commonwealth of Massachusetts Executive Office of Energy & Environmental Affairs/Massachusetts Department of Transportation (EEA/MassDOT).

E.1 PROJECT DESCRIPTION

The Site comprises approximately 38 acres bounded by Concord Road and Hudson Road in Sudbury, Massachusetts. The Site is comprised of mostly wooded undeveloped property. The proximity of the Site in relation to the regional transportation system is shown in **Figure 1**.

The proposed Site programming consists of developing the Site to include ten residential buildings, a clubhouse and a maintenance building providing a net total of 250 residential apartment units. On-site parking is planned to include 245 surface parking spaces and 256 garage spaces for a total of 501 total spaces, representing a parking supply ratio of 2.0 spaces per apartment unit. Primary Site access/egress will be provided along Hudson Road just east of Peakham Road; secondary access/egress will be provided via Peter's Way (currently a paper street) which is located just south of Candy Hill Road. The Site Plan also envisions a future path connection to the immediately adjacent Bruce Freeman Rail Trail.

E.2 STUDY AREA

This TIAS evaluates transportation characteristics of roadways and intersections that provide a primary means of access to the Site, and that are likely to sustain a measurable level of traffic impact from the development. The study area includes the following primary intersections:

- Hudson Road at Concord Road (Signalized)
- Hudson Road at Peakham Road
- Hudson Road at Connector Road
- Concord Road at Connector Road
- Hudson Road at Proposed Site Driveway
- Concord Road at Proposed Site Driveway

E.3 SUMMARY OF ANALYSIS AND FINDINGS

Capacity analyses were conducted for each study area intersection to quantify existing and future year traffic operations with and without the development for the weekday morning and weekday evening peak hours. These time periods represent the highest activity periods of the proposed project and the adjacent roadway system.

Under existing conditions the study intersections generally operate below capacity at an overall LOS D or better during the weekday morning and weekday evening peak hours, noting however that the Concord Road southbound approach to the Route 27 signal experiences longer delays and queues. This intersection is the subject of ongoing improvements by the Town that include the Concord Road re-alignment, new pedestrian infrastructure and signal timing improvements. While these improvements are expected to enhance operations and safety, they are not expected to fully address the Concord Road delays entirely; however, ample capacity will be available along Hudson Road and other movements through the intersection and (as described more fully herein) will provide ample capacity to accommodate projected area growth including traffic for the proposed Sudbury Station development. MDM also notes that operations for unsignalized movements from side streets onto Hudson Road (for instance, Peakham Road) are below capacity based on measured delays and are expected to adequately accommodate projected area traffic growth including the proposed Sudbury Station development.

The analyses presented in this TIAS are based on industry-standard trip rates published by the Institute of Transportation Engineers (ITE) and are applied to the proposed apartment development. On this basis, the proposed development is estimated to generate approximately 126 vehicle trips during the weekday morning peak hour (25 entering and 101 exiting) and 155 vehicle trips during the weekday evening peak hour (101 entering and 54 exiting). On a daily basis, the development is estimated to generate approximately 1,638 vehicle trips on a weekday. Comparison of ITE-based trip estimates for the apartments to observed/empirical characteristics of similar facilities in Massachusetts indicates that the ITE-based estimates are conservatively high (approximately 18 percent higher than empirical data).

Under Build conditions, capacity analyses indicate the following key findings:

- The signalized intersection of Concord Road and Hudson Road will continue to operate at LOS D or better overall during the weekday morning and weekday evening peak hours. The proposed Sudbury Station development is projected to add only a modest amount of new traffic to this location (a 2 to 3 percent change), resulting in overall delay increase of 4 seconds or less. Since the Hudson Road driveway is expected to serve as the primary point of access/egress based on "shortest path" trip assignment, the change in traffic on Concord Road toward the signal will be negligible (5 vehicles or less) and will not materially deteriorate operations.

- The proposed Hudson Road (Route 27) Site Driveway is projected to operate below capacity, consistent with observations and measurements taken at other similar volume intersections (Peakham Road and TI Sale Driveway) with traffic LOS A operations along Hudson Road. Turns from the driveway onto Hudson Road will be accommodated in separate left- and right-turn lanes.

- The proposed Concord Road Site Driveway, which will serve as a lower volume secondary driveway for the development, is also projected to operate below capacity at LOS C or better operation and unimpeded traffic flow along Concord Road. The occasional influence of traffic queues from the Route 27 signal are being addressed in part by the ongoing improvements by the Town but are not expected to be of any material consequence to operations at this driveway as it is a low-volume location and an alternative (Hudson Road) driveway is available.

- Impacts to the Peakham Road intersection are expected to be modest, with traffic from Sudbury Station accounting for only a 1 percent change in traffic volume during peak hours (a level that falls within normal day-to-day fluctuation in volume independent of the project). Field observation as outlined in *Section 4.2.3* indicate that the ample capacity exists at the Hudson Road intersection with Peakham Road to accommodate the modest peak hour traffic volumes associated with the proposed Sudbury Station development.

- The Connector Road intersections with Hudson Road and Concord Road will continue to operate below capacity at LOS D or better during the weekday morning and weekday evening peak hours.

E.4 RECOMMENDATIONS AND CONCLUSIONS

The proposed residential development represents a modest traffic generator that is not projected to materially deteriorate traffic operations at area intersections. The Site is also most proximate to the Route 27/Concord Road intersection which is currently being improved by the Town to enhance operations and safety and that is shown in this traffic evaluation to sustain no change in operation as a result of the project. Recommendations are therefore focused on site access and integration of proposed driveways with existing roadways along Hudson Road and Concord Road including pedestrian improvements.

MDM recommends access-related improvements aimed at enhancing traffic operations and/or travel and pedestrian safety including the following:

- STOP signs (R1-1) and STOP line pavement markings are recommended on the driveway approaches to Hudson Road and Concord Road. The signs and pavement markings shall be compliant with the Manual on Uniform Traffic Control Devices (MUTCD).

- Plantings (shrubs, bushes) and structures (walls, fences, etc.) should be maintained at a height of 2 feet or less within the sight lines in vicinity of the Site driveway intersections with Hudson Road and Concord Road to provide unobstructed sight lines. Existing vegetation and structures within these driveway sight lines should be cleared, removed or trimmed/maintained with grading modifications as necessary to ensure minimum recommended sight line requirements are met or exceeded.

- The Hudson Road driveway design features should provide alignment, lane widths and curb radii designed to achieve (a) approximate perpendicular orientation with Hudson Road; (b) separate left- and right-turn lanes approaching Hudson Road; (c) a single ingress lane with 16-foot dimension and (d) minimum 25-foot curb radii to accommodate standard SU-30 design vehicles and emergency response vehicles. Driveway grading and orientation should provide unimpeded sight lines that meet or exceed minimum recommended stopping sight distance presented herein. The Applicant should connect the proposed sidewalk along the Site Driveway with the existing sidewalks along Hudson Road and Peakham Road. A marked crosswalk and ADA compliant ramps are recommended across Hudson Road at its intersection with Peakham Road to accommodate this connection.

- The Concord Road driveway design (Peter's Way) should provide alignment, lane widths and curb radii designed to achieve (a) approximate perpendicular orientation with Concord Road; (b) a single wider lane approaching Concord Road (approximately 16 feet) so as to allow bypass of occasional left-turns onto Concord Road; (c) a single ingress lane with minimum 16-foot dimension and (d) minimum 25-foot curb radii to accommodate standard SU-30 design vehicles and emergency response vehicles. Driveway grading and orientation should provide unimpeded

sight lines that meet or exceed minimum recommended stopping sight distance presented herein. The Applicant proposes to connect the proposed sidewalk along Peter's Way with the existing sidewalk along Concord Road. Enhancement of the existing pedestrian crossing near Candy Hill Road to include ADA-compliant ramps and MUTCD-compliant advance warning signs is also recommended subject to Town approvals.

In summary, trip generation for the development is projected to be moderate. MDM finds that incremental traffic associated with the proposed development is not expected to materially impact operating conditions at the study intersections. The study intersections exhibit below-average crash rates based on historic crash data; safety countermeasures are therefore not warranted. Likewise, with clearing and re-grading associated with the construction of the driveways, the available sight lines at the site driveways intersections with Hudson Road and Concord Road will exceed the recommended sight line requirements from AASHTO. Access-related and pedestrian improvements have been recommended that are aimed at enhancing traffic operations and/or travel safety and pedestrian mobility.

1.0 INTRODUCTION

MDM Transportation Consultants, Inc. (MDM) has prepared this Traffic Impact and Access Study (TIAS) for a proposed 40B residential development referred to as The Village at Sudbury Station ("Sudbury Station") in Sudbury, Massachusetts. This report documents existing operational and safety-related characteristics of roadways serving the development Site, estimates future year operating characteristics of these roadways independent of the development, estimates development-related trip generation, and identifies incremental impacts of Site-related traffic. Access improvements are identified for the development to meet operational needs of the Site and the adjacent roadways.

This TIAS has been prepared in accordance with requirements and standards for the preparation of traffic studies as jointly issued by the Commonwealth of Massachusetts Executive Office of Energy & Environmental Affairs/ Massachusetts Department of Transportation (EEA/MassDOT).

1.1 PROPOSED DEVELOPMENT

The Site comprises approximately 38 acres bounded by Concord Road and Hudson Road in Sudbury, Massachusetts. The Site is comprised of mostly wooded undeveloped property. The proximity of the Site in relation to the regional transportation system is shown in **Figure 1**.

The proposed Site programming consists of developing the Site to include ten residential buildings, a clubhouse and a maintenance building providing a net total of 250 residential apartment units. On-site parking is planned to include 245 surface parking spaces and 256 garage spaces for a total of 501 total spaces, representing a parking supply ratio of 2.0 spaces per apartment unit. Primary Site access/egress will be provided along Hudson Road just east of Peakham Road; secondary access/egress will be provided via Peter's Way (currently a paper street) which is located just south of Candy Hill Road. The Site Plan also envisions a future path connection to the immediately adjacent Bruce Freeman Rail Trail. The preliminary Site layout plan prepared by The Cecil Group is presented in **Figure 2**.

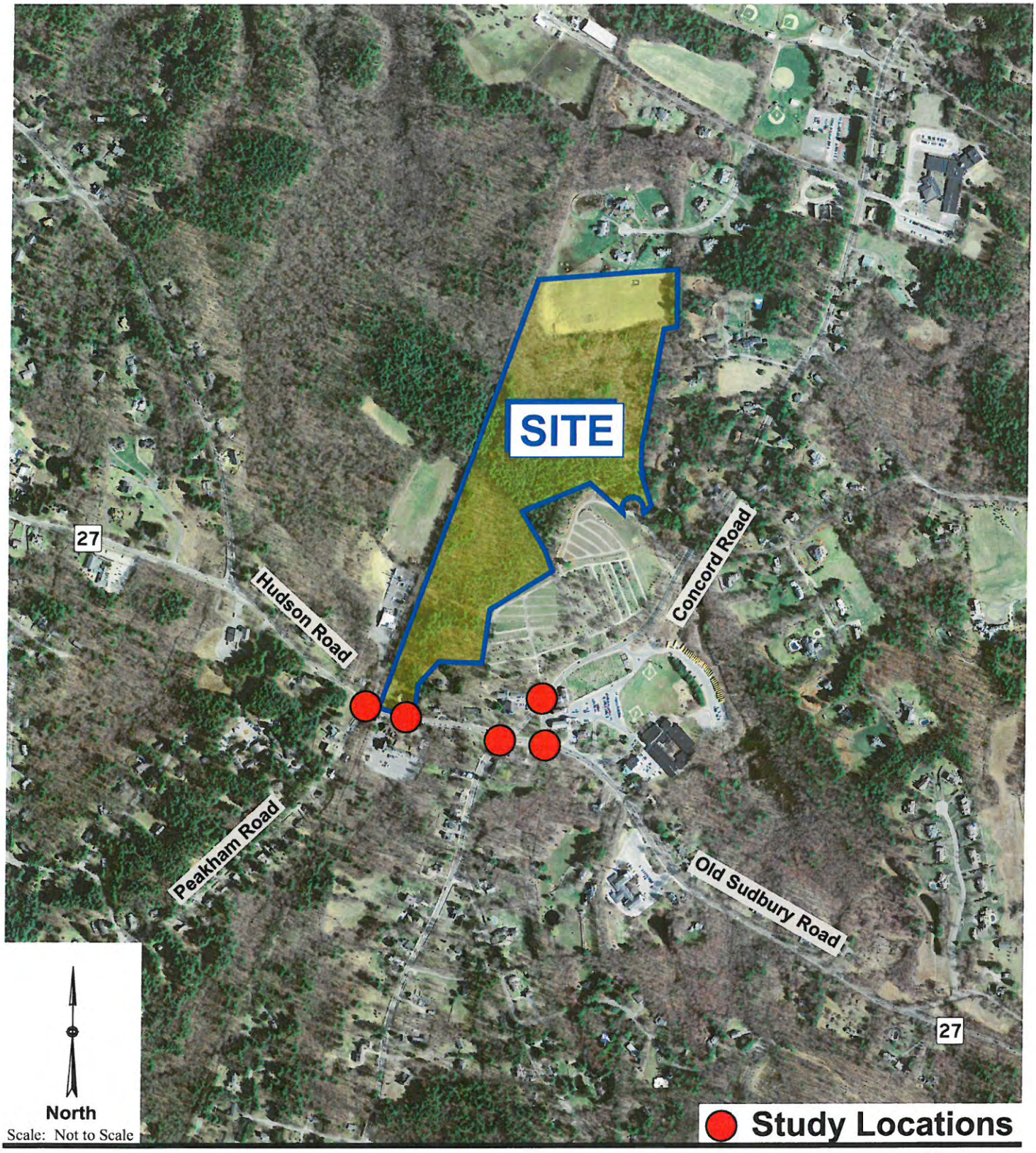

Figure 1

Site Location

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Date: November 2015
Dwg No. 814 TIAS.dwg

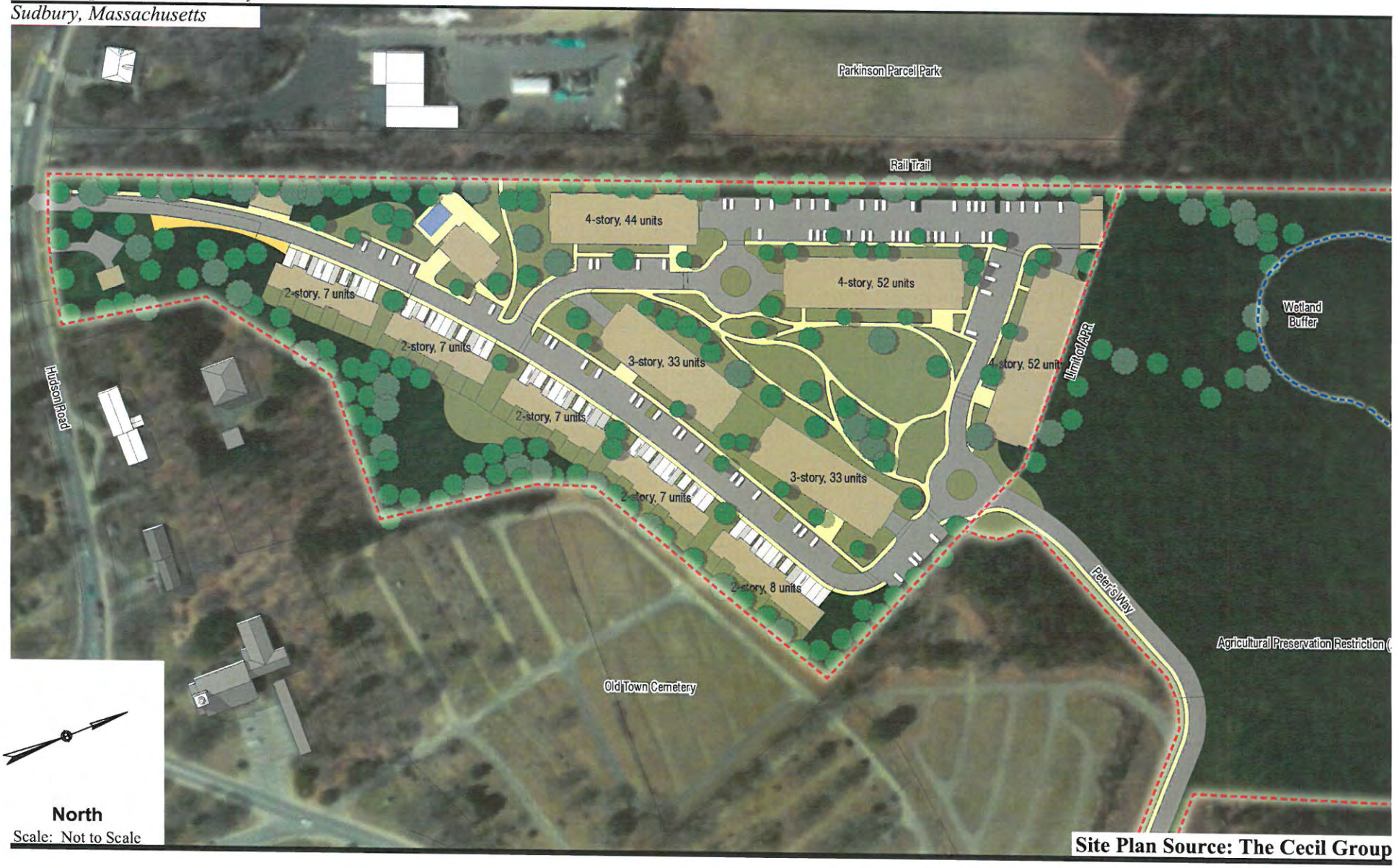

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Figure 2

Preliminary Site Layout

Date: November 2015
Dwg No. 814 TIAS.dwg

1.2 STUDY METHODOLOGY

This transportation impact and access evaluation is conducted in accordance with EEA/MassDOT guidelines, and consists of several steps. The first step documents existing conditions in the transportation study area including an inventory of roadway geometry, observed traffic volumes, public transportation, and safety characteristics. Next, future year traffic conditions are forecast that account for other planned area developments, normal area growth, and development-related traffic increases. The third step quantifies operating characteristics of the study intersection. Specific attention is given to the incremental impacts of the proposed development. Finally, improvements are identified to address specific development-related requirements as needed.

1.3 STUDY AREA

This TIAS evaluates transportation characteristics of roadways and intersections that provide a primary means of access to the Site, and that are likely to sustain a measurable level of traffic impact from the development. The study area includes the following intersections:

- Hudson Road at Concord Road (Signalized)
- Hudson Road at Peakham Road
- Hudson Road at Connector Road
- Concord Road at Connector Road
- Hudson Road at Proposed Site Driveway
- Concord Road at Proposed Site Driveway

2.0 BASELINE CONDITIONS

In order to provide a basis for quantifying the transportation impacts of the development, the Baseline roadway system and the baseline traffic operations of study area roadways were reviewed. This section describes the existing traffic characteristics and operations of roadways and intersection within the study area. Specifically, this section presents an overview of the traffic data collection program, baseline traffic volumes, safety issues and public transportation systems serving the area.

2.1 STUDY AREA ROADWAY NETWORK

The study area roadways and intersection are described briefly in this section. A general description of the physical roadway and intersection features is provided. The study area includes roadways under local jurisdiction. The study area and intersection are depicted in **Figure 1**.

2.1.1 Roadways

Route 27

Route 27 (Hudson Road/Old Sudbury Road) is generally an east-west roadway under local jurisdiction within the study area. Route 27 is classified by the Massachusetts Department of Transportation (MassDOT) as an Urban Principle Arterial roadway and provides a connection between Route 117 to the north and Route 20 to the south. Route 27 provides a single travel lane in each direction separated by a double yellow centerline with additional turn lanes provide at its major intersections including at Concord Road. A sidewalk is provided along the southern side of Route 27 in the immediate project area. There is a mix of land uses along Hudson Road/Old Sudbury Road in the study area that includes residential homes, Sudbury Town Square Plaza, Town of Sudbury Town Hall, Peter Noyes School, Sudbury Housing Authority, Sudbury Police and Fire Departments, and Ti-Sales.

Concord Road

Concord Road is generally a north-south roadway under local jurisdiction within the study area. Concord Road is classified by the MassDOT as an Urban Minor Arterial roadway and provides a connection between 117 to the north and Route 20 to the south. Concord Road provides a single travel lane in each direction within the study area with additional travel lanes provided at its major intersections. A sidewalk is provided along the eastern side of Concord Road connecting with the sidewalk system along Route 27 (Hudson Road/Old Sudbury Road). A sidewalk is also provided along the western side of Concord Road from Peters Way to the north. A crosswalk is provided at the Candy Hill Road intersection with Concord Road to provide a connection to/from the Peter Noyes School. Land use along Concord Road in the study area is a mix of residential and commercial.

Peakham Road

Peakham Road is generally a north-south roadway under local jurisdiction within the study area. Concord Road is classified by the MassDOT as an Urban Collector roadway and provides a connection between Route 27 (Hudson Road) to the north and Route 20 to the south. Peakham Road provides a single travel lane in each direction within the study area. Sidewalks are provided along the western side of Peakham Road near its intersection with Hudson Road. Land use along Peakham Road is primarily residential uses.

2.1.2 Intersections

Route 27 at Concord Road

Concord Road meets Route 27 (Hudson Road) to form a four-legged, signalized intersection under local jurisdiction. This intersection is currently being reconstructed and improved by the Town to improve operations, safety and pedestrian accommodation as described in more detail under Section 3.1. The eastbound Hudson Road approach provides exclusive left turn lane, a through travel lane, and a channelized right turn lane. The westbound Old Sudbury Road approach provides an exclusive left turn lane and a shared through/right turn lane. The Concord Road northbound approach provides an exclusive left turn lane and a shared through/right travel lane. The Hudson Road southbound approach provides a single shared left/through/right travel lane. Land uses at the intersection include three churches, the Town of Sudbury Town Hall and a residential home.

Route 27 at Peakham Road

Peakham Road meets Route 27 (Hudson Road) to form a four-legged, unsignalized intersection under local jurisdiction. The Peakham Road northbound approach provides exclusive left and right turn lanes under "STOP" sign control. The Ti-Sales driveway southbound approach provides a single lane approach under "STOP" sign control. The eastbound Hudson Road approach provides a single lane approach while the westbound approach operates as an

exclusive left turn lane and shared through/right turn lane. Land uses at the intersection include Ti-Sales, Sudbury Housing Authority and a residential home.

2.2 BASELINE TRAFFIC VOLUMES

Traffic-volume data used in this study were obtained by mechanical and manual methods in September 2014 and December 2014. Automatic traffic recorder counts (ATRs) were conducted along Hudson Road and Concord Road while manual turning movement counts (TMCs) were conducted at the existing study intersections. Traffic data were collected during the weekday morning (7:00 to 9:00 AM) and weekday evening (4:00 to 6:00 PM) peak periods. These hours represent the combination of busiest activity periods of the Site and adjacent roadway network.

2.2.1 Daily Traffic

Daily traffic volumes along Hudson Road and Concord Road in the Site vicinity were collected in September 2014 and December 2014 is summarized in **Table 1** and included in the **Appendix**.

TABLE 1
BASELINE TRAFFIC VOLUME SUMMARY

Time Period	Daily Volume (vpd)[1]	Percent Daily Traffic[2]	Peak Hour Volume (vph)[3]	Peak Flow Direction[4]	Peak Hour Directional Volume (vph)
Hudson Road west of Concord Road					
Weekday Morning Peak Hour	21,150	7%	1,480	70% EB	1,038
Weekday Evening Peak Hour	21,150	8%	1,727	66% WB	1,140
Concord Road north of Hudson Road					
Weekday Morning Peak Hour	9,260	10%	960	58% SB	558
Weekday Evening Peak Hour	9,260	7%	690	51% SB	351

[1]Two-way daily traffic expressed in vehicles per day without seasonal adjustment.
[2]The percent of daily traffic that occurs during the peak hour.
[3]Two-way peak-hour volume expressed in vehicles per hour.
[4]EB = Eastbound, WB = Westbound, NB = Northbound, SB = Southbound

As summarized in **Table 1**,

- *Hudson Road.* The weekday daily traffic volume on Hudson Road adjacent to the Site was approximately 21,150 vehicles per day (vpd) during a typical weekday. Peak hour traffic flow on Hudson Road ranges from approximately 1,480 to 1,727 vehicles per hour (vph) adjacent to the Site which represents 7 to 8 percent of daily traffic flow. The traffic flow on Hudson Road is generally significantly higher in the eastbound direction during the weekday morning peak hour and significantly higher in the westbound direction during the weekday evening peak hour. The travel pattern is consistent with commuter traffic relative to major travel routes in the area.

- *Concord Road.* The weekday daily traffic volume on Concord Road adjacent to the Site was approximately 9,260 vehicles per day (vpd) during a typical weekday. Peak hour traffic flow on Concord Road ranges from approximately 690 to 960 vehicles per hour (vph) adjacent to the Site which represents 7 to 10 percent of daily traffic flow. The traffic flow on Concord Road is generally higher in the southbound direction during both the weekday morning peak hour and weekday evening peak hour.

2.2.2 *Peak-Hour Traffic*

Peak-hour traffic volumes at the study area intersection were collected in the month of December. Comparison of the traffic count data maintained by MassDOT for nearby permanent count stations indicates that December is representative of slightly below-average volume conditions. Therefore, a seasonal adjustment (3 percent increase) was made to observed traffic volumes collected in December to represent average traffic conditions. Manual turning movement counts (TMCs) were conducted during the weekday morning (7:00 to 9:00 AM) and weekday evening (4:00 to 6:00 PM) peak periods. Permanent count station data is provided in the **Appendix**. The resulting Baseline weekday morning and weekday evening peak hour traffic volume networks for study intersections are depicted in **Figure 3** and **Figure 4**.

2.3 *MEASURED TRAVEL SPEEDS*

Vehicle speeds were obtained for Hudson Road and Concord Road using a radar-equipped ATR during the months of September and December. **Table 2** summarizes the average and 85th percentile speeds the streets adjacent to the Site. This speed data provides a basis for determining appropriate sight lines for the proposed driveways. Field data are provided in the **Appendix**.

TABLE 2
SPEED STUDY RESULTS

Travel Direction	Travel Speeds		
	Posted[1]	Mean[2]	85th Percentile[3]
Hudson Road west of Concord Road			
Eastbound	30	26	33
Westbound	30	28	33
Concord Road north of Hudson Road			
Northbound	35	32	38
Southbound	35	38	42

[1] Regulatory Speed Limit (mph)
[2] Arithmetic mean (mph)
[3] The speed at or below which 85 percent of the vehicles are traveling

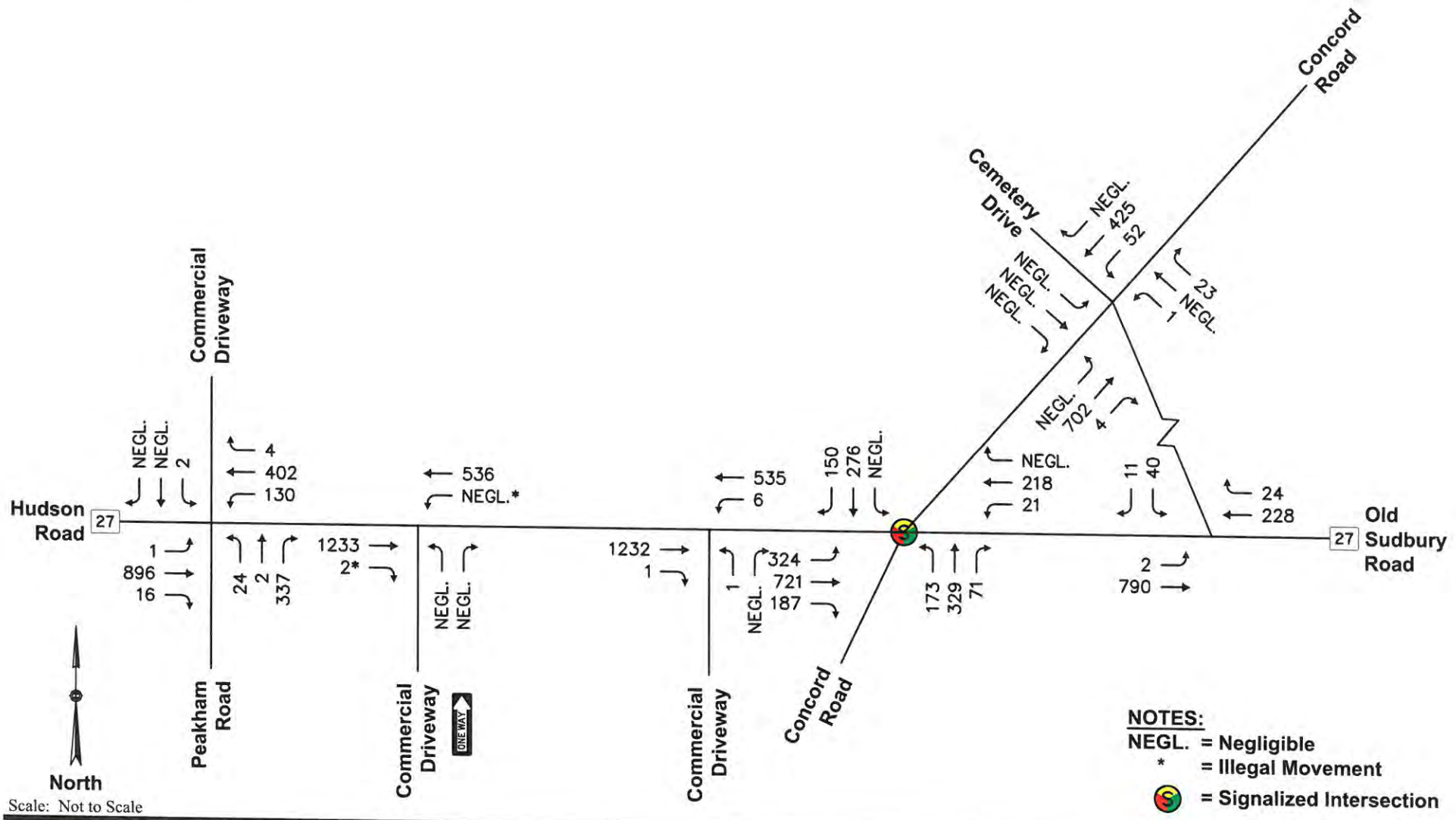

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Figure 3

Baseline Condition
Weekday Morning Peak Hour Traffic Volumes
(7:15 - 8:15am)

Date: November 2015
Dwg No. 814 TIAS.dwg

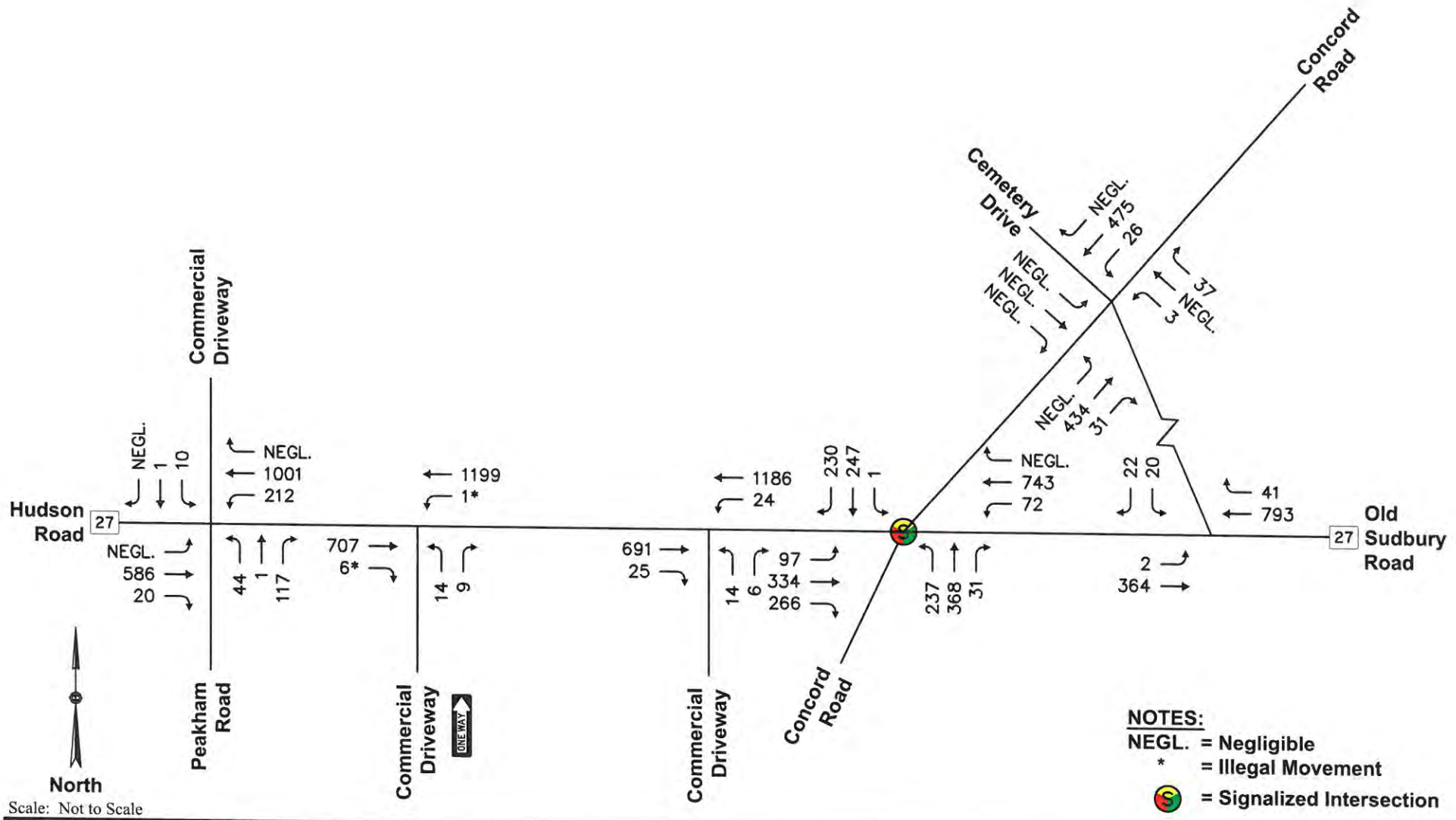

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Figure 4

Baseline Condition
Weekday Evening Peak Hour Traffic Volumes
(5:00 - 6:00 pm)

Date: November 2015
Dwg No. 814 TIAS.dwg

As summarized in **Table 2,**

- *Hudson Road.* The mean (average) travel speed on Hudson Road traveling eastbound is 26 mph and the 85th percentile travel speed is 33 mph. In the westbound direction, the mean travel speed is 28 mph and the 85th percentile travel speed is 33 mph.

- *Concord Road.* The mean (average) travel speed on Concord Road traveling northbound is 32 mph and the 85th percentile travel speed is 38 mph. In the southbound direction, the mean travel speed is 38 mph and the 85th percentile travel speed is 42 mph.

2.4 SAFETY

In order to identify crash trends and safety characteristics for study area intersections, crash data were obtained from MassDOT for the Town of Sudbury for the four-year period 2010 through 2013 (the most recent data currently available from MassDOT). Crash data for the study intersections is summarized in **Table 3** with detailed data provided in the **Appendix.**

Crash rates were calculated for the study area intersections as reported in **Table 3**. This rate quantifies the number of crashes per million entering vehicles. MassDOT has determined the official District 3 (which includes the Town of Sudbury) crash rate to be 0.66 for unsignalized intersections and 0.89 for signalized intersections. This rate represents MassDOT's "average" crash experience for District 3 communities and serves as a basis for comparing reported crash rates for the study intersections. Where calculated crash rates notably exceed the district average, some form of safety countermeasures may be warranted.

TABLE 3
INTERSECTION CRASH SUMMARY
2010 THROUGH 2013[1]

Data Category	STUDY LOCATIONS	
	Hudson Road at Concord Road/ Old Sudbury Road	Hudson Road at Peakham Road
Traffic Control	Signalized	Unsignalized
Crash Rate[2]	**0.55**	**0.43**
MassDOT Avg. Rate[3]	0.89	0.66
Year:		
2010	5	2
2011	9	4
2012	8	4
2013	4	1
Total	**26**	**11**
Type:		
Angle	14	7
Rear-End	7	2
Head-On	0	0
Sideswipe	3	2
Single Vehicle	2	0
Other/Unknown	0	0
Severity:		
P. Damage Only	22	9
Personal Injury	4	2
Fatality	0	0
Conditions:		
Dry	20	6
Wet	5	4
Snow	1	1
Time:		
7:00 to 9:00 AM	5	2
4:00 to 6:00 PM	2	5
Rest of Day	19	4

[1] Source: MassDOT Crash Database
[2] Crashes per million entering vehicles
[3] District 3 Average Crash Rate

As summarized in **Table 3**:

- *Hudson Road at Concord Road/Old Sudbury Road*: A total of twenty six (26) crashes were reported for the Hudson Road signalized intersection with Concord Road. The resulting crash rate of 0.55 is lower than the District 3 average. The reported crashes included seventeen (17) angle/ sideswipe type collisions, seven (7) rear-end type collision and two (2) single vehicle collisions. Eighty-five percent (85%) of the crashes resulted in property-damage only, generally indicative of low-speed crashes. No fatalities or pedestrian-related incidents were reported during the study period. MDM notes that the Final Report for the Sudbury Town Center Improvement Plan prepared by The Cecil Group in March 2008 indicated an above average crash rate for the intersection based on crash data between 2002 and 2006. In response, the Town is currently implementing improvements at this intersection that will enhance operations and safety including pedestrian accommodation. Specifically, the improvements will address a number of historical issues including but not limited to intersection geometry, traffic signal visibility, traffic signal timing and clearance phases, increased corner radii, storage lanes, and pedestrian accommodations.

- *Hudson Road at Peakham Road:* A total of eleven (11) crashes were reported at or near the Hudson Road unsignalized intersection with Peakham Road. The resulting crash rate of 0.43 is lower than the District 3 average. The reported crashes included two (2) rear-end type collisions and nine (9) angle/ sideswipe type collisions. Eighty-two percent (82%) of the crashes resulted in property-damage only, generally indicative of low-speed crashes. No fatalities or pedestrian-related incidents were reported during the study period.

In summary, based on extensive review of MassDOT crash data, the study intersections all experienced crash rates that are below the MassDOT District 3 averages. No additional safety countermeasures are warranted beyond those currently underway by the Town based on the review of the crash records and associated crash rates.

2.6 SIGHT LINE ANALYSIS

An evaluation of sight lines was conducted at the proposed Site driveway locations to ensure that minimum recommended sight lines are available at the proposed Site driveway intersections with Concord Road and Hudson Road. The evaluation documents existing sight lines for vehicles as they relate to Concord Road and Hudson Road with comparison to recommended guidelines.

The American Association of State Highway and Transportation Officials' (AASHTO) standards[1] reference two types of sight distance which are relevant at the proposed Site driveway intersection: stopping sight distance (SSD) and intersection sight distance (ISD). Sight lines for critical vehicle movements at the proposed Site driveway intersections were compared to minimum SSD and ISD recommendations for the travel speeds in the Site vicinity.

Stopping Sight Distance

Sight distance is the length of roadway visible to the motorist to a fixed object. The minimum sight distance available on a roadway should be sufficiently long enough to enable a below-average operator, traveling at or near a regulatory speed limit, to stop safely before reaching a stationary object in its path, in this case, a vehicle exiting onto Hudson Road or Concord Road. The SSD criteria are defined by AASHTO based on design and operating speeds, anticipated driver behavior and vehicle performance, as well as physical roadway conditions. SSD includes the length of roadway traveled during the perception and reaction time of a driver to an object, and the distance traveled during brake application on wet level pavement. Adjustment factors are applied to account for roadway grades when applicable.

SSD was estimated in the field using AASHTO standards for driver's eye (3.5 feet) and object height equivalent to the taillight height of a passenger car (2.0 feet) for the eastbound and westbound Hudson Road approaches to the proposed Site driveway and for the northbound and southbound Concord Road approaches to the proposed Site driveway. **Table 4** presents a summary of the available SSD as they relate to Hudson Road and Concord Road and AASHTO's recommended SSD.

[1] *A policy on Geometric Design of Highways and Streets,* American Association of State Highway and Transportation Officials (AASHTO), 2011.

TABLE 4
STOPPING SIGHT DISTANCE SUMMARY
APPROACH TO SITE DRIVEWAY

Approach/ Travel Direction	Available SSD	AASHTO Recommended[1]	
		Posted Speed[2]	85th Percentile Speed[3]
Hudson Road			
Eastbound	520± Feet	200 Feet	230 Feet
Westbound	650± Feet	200 Feet	230 Feet
Concord Road			
Northbound	400± Feet	250 Feet	280 Feet
Southbound	600± Feet	250 Feet	325 Feet

[1]Recommended sight distance based on AASHTO, A Policy on Geometric Design of Highways and Streets. Based on driver height of eye of 3.5 feet to object height of 2.0 feet.
[2]Posted Speed on Hudson Road: 30 mph EB, 30 mph WB, on Concord Road 35 mph NB, 35 mph SB.
[3]85th Percentile travel speed on Hudson Road 33 mph EB, 33 mph WB, on Concord Road 38 mph NB, 42 mph SB

As summarized in **Table 4** analysis results indicate that with clearing and re-grading associated with the installation of the proposed driveways the available sight lines will exceed AASHTO's recommended SSD criteria for both travel directions along Hudson Road and Concord Road based on the observed travel speeds.

Intersection Sight Distance

Clear sight lines provide sufficient sight distance for a stopped driver on a minor-road approach to depart from the intersection and enter or cross the major road. As stated under AASHTO's Intersection Sight Distance (ISD) considerations, "*...If the available sight distance for an entering ...vehicle is at least equal to the appropriate stopping sight distance for the major road, then drivers have sufficient sight distance to avoid collisions...To enhance traffic operations, intersection sight distances that exceed stopping sight distances are desirable along the major road.*" AASHTO's ISD criteria are defined into several "cases". For the unsignalized Site driveway locations which are proposed to be under STOP sign control, the ISD in question relates to the ability to turn left or turn right from the proposed driveways at their intersections with Hudson Road and Concord Road.

Available ISD was estimated in the field using AASHTO standards for driver's eye height (3.5 feet), object height (3.5 feet) and driver eye position (assumed as 8 feet from the edge of the travel way based on proposed driveway design) for the eastbound and westbound directions along Hudson Road and for the northbound and southbound travel directions along Concord Road. **Table 5** presents a summary of the available ISD for the departures from the Site driveways and AASHTO's minimum recommended as well as ideal ISD criteria.

TABLE 5
INTERSECTION SIGHT DISTANCE SUMMARY
SITE DRIVEWAY DEPARTURES

View Direction	Available ISD	AASHTO Minimum[1] 85th Percentile Speed[2]	AASHTO Ideal[1] Posted Speed[3]
Hudson Road			
Looking East (Right Turn)	650± Feet	230 Feet	290 Feet
Looking West (Left-Turn)	520± Feet	230 Feet	335 Feet
Concord Road			
Looking North (Right Turn)	600± Feet	325 Feet	335 Feet
Looking South (Left-Turn)	400± Feet	280 Feet	390 Feet

[1]Recommended sight distance based on AASHTO, A Policy on Geometric Design of Highways and Streets. Based on driver height of eye of 3.5 feet and an object height of 3.5 feet and adjustments for roadway grade if required. Minimum value as noted represents SSD per AASHTO guidance.
[2]Posted Speed on Hudson Road: 30 mph EB, 30 mph WB, on Concord Road 35 mph NB, 35 mph SB.
[3]85th Percentile travel speed on Hudson Road 33 mph EB, 33 mph WB, on Concord Road 38 mph NB, 42 mph SB.

The results of the ISD analysis presented in **Table 5** indicate that the available sight lines looking east and west from the proposed Site driveway onto Hudson Road and looking north and south from the proposed Site driveway onto Concord Road will exceed the recommended minimum as well as ideal AASHTO sight line criteria assuming recommended clearing and grading associated with the installation of proposed driveways. MDM recommends that any new plantings (shrubs, bushes) or physical landscape features to be located within the driveway sight lines should also be maintained at a height of 2 feet or less above the adjacent existing roadway grade to ensure unobstructed lines of sight.

3.0 FUTURE CONDITIONS

Evaluation of the proposed development impacts requires the establishment of a future baseline analysis condition. This section estimates future roadway and traffic conditions with and without the proposed development. To be consistent with EEA/MassDOT guidelines, a five-year planning horizon was selected.

To determine the impact of Site-generated traffic volumes on the roadway network under future conditions, baseline traffic volumes in the study area were projected to a future year condition. Traffic volumes on the roadway network at that time, in the absence of the development (that is, the No-Build condition), would include existing traffic, new traffic due to general background traffic growth, and traffic related to specific development by others that is currently under review at the local and/or state level. Consideration of these factors resulted in the development of No-Build traffic volumes. Anticipated Site-generated traffic volumes were then superimposed upon these No-Build traffic-flow networks to develop future Build conditions.

The following sections provide an overview of planned roadway improvements in the study area, the future No-Build traffic volumes and projected Build traffic volumes.

3.1 PLANNED AREA IMPROVEMENTS

This section provides (a) a review of roadway improvements at the signalized Route 27 intersection with Concord Road which are the subject of ongoing improvements by the Town, and (b) a description of planned rail trail improvements for the rail property that adjoins the Site on its westerly border.

Route 27 at Concord Road

The improvements include the re-alignment of Hudson Road and Concord Road, new pedestrian infrastructure and signal timing improvements. The roadway improvements include widening along Route 27 to accommodate the improved roadway alignment and

pedestrian accommodations. Improvement plans (see **Appendix**) developed by the town as part of the design review process anticipates the following intersections improvements when complete:

- Replace the traffic signal controller and based mounted cabinet including foundation and concrete pad.
- Install all new traffic signal equipment including but not limited to traffic signal posts, a traffic signal mast arm, traffic signal heads, traffic signal wiring and pull-boxed, conduit and wire loop detection.
- Provide fully actuated traffic signal operation with an optimized traffic signal timing plan.
- Install pedestrian crossings and ADA compliant ramps on the Hudson Road westbound approach and Concord Road northbound approach.
- Install pedestrian traffic signal heads, push buttons and provide an exclusive pedestrian push button activated traffic signal phase.
- Install all new reflectorized thermoplastic pavement markings through the project limits.
- In general, all the roadway signs within the project limits will be removed and stacked and replaced. Supplemental signage will be installed as required.
- On-street parking will be formalized on the western side of the Connector Roadway.

As the majority of the traffic signal equipment and lane widening has been completed, the above improvements are assumed to be in place under Baseline and future No-Build/Build conditions.

Bruce Freeman Rail Trail (Phase 2D)

The Site abuts the future Bruce Freeman Rail Trail (BFRT) which is a multi-use recreational trial through the communities of Lowell, Chelmsford, Westford, Carlisle, Acton, Concord, Sudbury, and Framingham, MA. The Sudbury section (Phase 2D) will connect Phase 2C which is currently being permitted by the State at the Concord/Sudbury Town Line to the north and travel approximately 5 miles southward immediately adjacent to the Site. Recent discussions with MassDOT indicate that the proponent of Phase 2D is the Town of Sudbury which is responsible for the initial design; however, the project is in the very early planning stages, is currently unfunded and no initial design plans have been developed by the Town or submitted to MassDOT. The Sudbury Station Applicant has designed the Site to compliment the future BFRT and the Site Plan envisions a future path connection connecting the Site to the future trail.

3.2 BACKGROUND TRAFFIC GROWTH

Background traffic includes demand generated by other planned developments in the area as well as demand increases caused by external factors. External factors are general increases in traffic not attributable to a specific development and are determined using historical data.

3.2.1 Historical Area Growth

Nearby permanent count station data published by MassDOT indicates a declining (-0.7 percent per year) growth rate. For purposes of this evaluation, a 0.5 percent compounded annual growth rate was used (2.5 percent increase over a 5-year horizon). This growth rate is higher than historic rates and is also expected to account for any small fluctuation in hourly traffic as may occur from time to time in the study area and traffic associated with other potential small developments or vacancies in the area. MassDOT permanent count station data and background growth calculations are provided in the **Attachments.**

3.2.2 Background Development-Related Growth

Development of future No-Build traffic volumes also considers traffic generated through the study area from other specific area developments. Review of Massachusetts Environmental Policy Act (MEPA) files and consultation with the Town of Sudbury Planning Staff indicates that there is one Site-specific development project in the area that may increase baseline traffic at the study intersections as follows:

- ***Sudbury Town Square (29 Hudson Road)***: This mixed-use project includes 29,300± sf of commercial space. The project includes two access/egress points along Hudson Road between Concord Road and Peakham Road. At the time of the traffic counts the buildings were only partially occupied with vacancies of 14,080± sf of general office space, 8,000± sf of medical office space and 3,410 sf of specialty retail. Therefore, traffic associated full occupancy of this development was estimated using ITE Trip Generation[2] and distributed on the traffic volume networks based on existing travel patterns. The Site-specific trip tracings are provided in the **Appendix**.

3.3 NO-BUILD TRAFFIC VOLUMES

To account for future traffic growth along the corridor, the 0.5 percent annual growth rate was applied to existing traffic volumes over a five-year period, as well as traffic associated with remaining build-out of Sudbury Town Square. Future 2020 No-Build traffic volumes are displayed in **Figure 5** and **Figure 6**.

[2]*Trip Generation*, Ninth Edition; Institute of Transportation Engineers; Washington, DC; 2012.

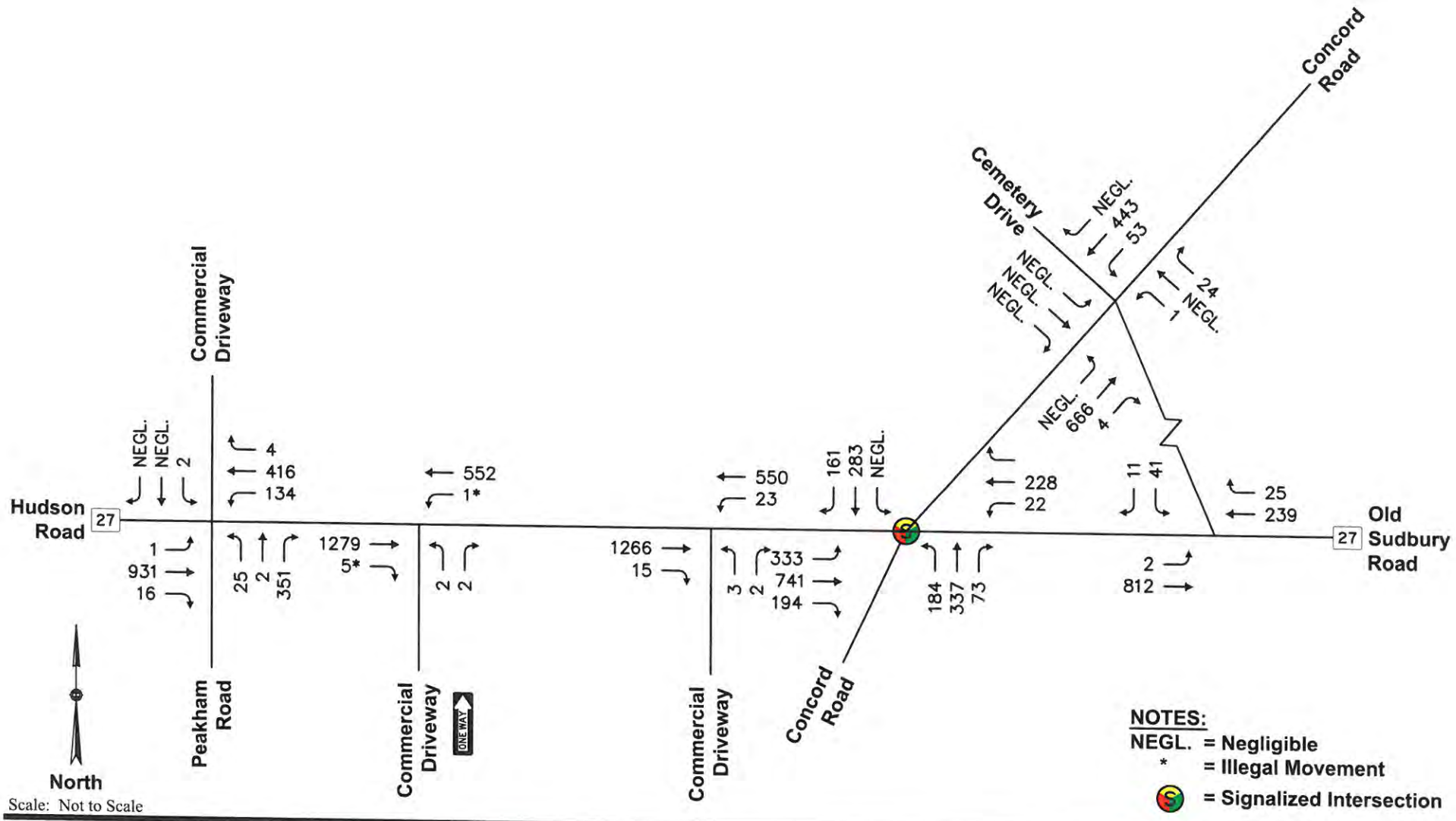

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Figure 5

2020 No-Build Condition
Weekday Morning Peak Hour Traffic Volumes
(7:15 - 8:15am)

Date: November 2015
Dwg No. 814 TIAS.dwg

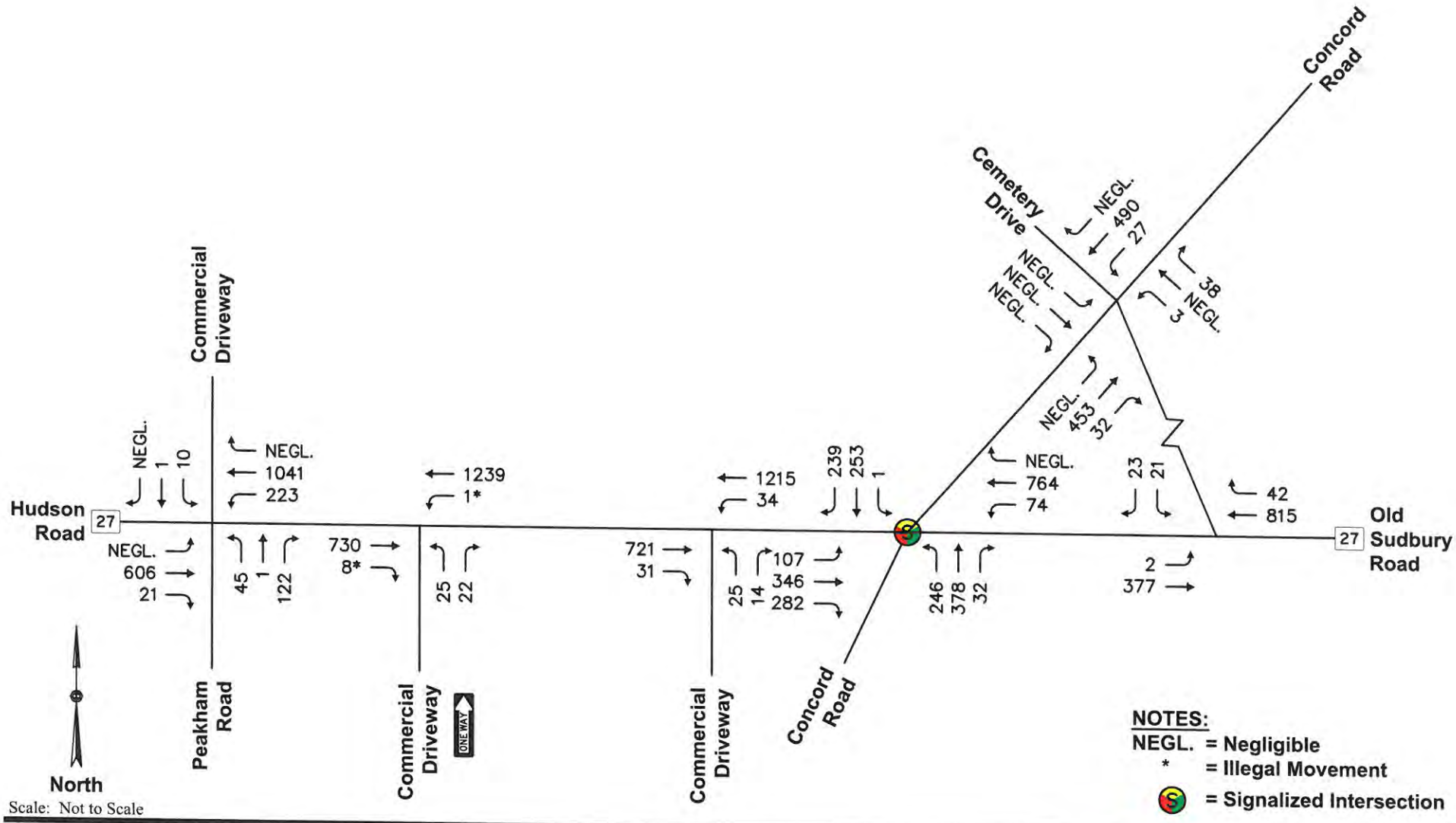

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Figure 6

2020 No-Build Condition
Weekday Evening Peak Hour Traffic Volumes
(5:00 - 6:00 pm)

Date: November 2015
Dwg No. 814 TIAS.dwg

3.4 SITE-GENERATED TRAFFIC – ITE BASIS

Future Build condition traffic volumes were developed by estimating the number of peak-hour trips expected to be generated by the proposed development and distributing this additional traffic onto the local roadway network. These future development-related trips were added to future No-Build traffic volumes to evaluate future traffic operations with the proposed residential development in place. The methodology utilized to estimate the future trip-generation characteristics of the proposed development are summarized below. In accordance with EEA/MassDOT guidelines, the traffic generated by the proposed development was estimated using trip rates published in ITE's *Trip Generation* for the Land Use Code (LUC) based on trip rates for Apartments (LUC 220).

Table 6 presents the trip-generation estimates for the proposed development based on ITE methodology and EEA/MassDOT guidelines.

TABLE 6
TRIP-GENERATION SUMMARY[1]

Peak Hour/Direction	Site Trips (Apartments)[2]
Weekday Morning Peak Hour:	
Entering	25
Exiting	101
Total	126
Weekday Evening Peak Hour:	
Entering	101
Exiting	54
Total	155
Weekday Daily (24 hours)	1,638

[1]Source: ITE *Trip Generation*, Ninth Edition; 2012.
[2]ITE LUC 220 – Apartment applied to 250 units.

Based on industry-standard trip rates, the proposed development is estimated to generate approximately 126 vehicle trips during the weekday morning peak hour (25 entering and 101 exiting) and 155 vehicle trips during the weekday evening peak hour (101 entering and 54 exiting). On a daily basis, the development is estimated to generate approximately 1,638 vehicle trips on a weekday.

3.5 EMPIRICAL TRIP GENERATION DATA

Trip generation estimates for the project are estimated based on well-established trip rates and methodology as published by the ITE for individual land uses. As a point of reference and comparison, empirically-derived trip generation characteristics the residential apartments are provided based on surveys of similar operating facilities in Massachusetts. Detailed empirically based trip generation worksheets are provided in the **Appendix**.

Table 7 present a summary of empirically-derived trip generation rates for similar sized residential apartment complex facilities located in Burlington, Waltham and Braintree Massachusetts applied to the proposed 250-unit development. In summary, comparison of ITE-based trip estimates for the residential component of the site to observed/empirical characteristics of similar facilities in Massachusetts indicates that the ITE-based estimates are conservatively high (approximately 18 percent higher than empirical data). Regardless, analyses presented in this TIAS are based on the conservatively higher ITE trip rates to present a conservative (worst case) condition.

TABLE 7
TRIP-GENERATION COMPARISON – APARTMENTS

Peak Hour/ Direction of Travel	*Trip Generation (ITE)*[1]	*Trip Generation (Empirical)*[2]	*Difference (ITE vs Empirical)*
Weekday Morning Peak Hour:			
Entering	25	16	**+9**
Exiting	101	87	**+14**
Total	126	103	**+23**
Weekday Evening Peak Hour:			
Entering	101	86	**+15**
Exiting	54	41	**+13**
Total	155	127	**+28**

[1]Based on ITE LUC 220 (Apartment) trip rates applied to 250 units

[2]Based on observed empirical trip generation rates for existing rental apartment complexes with similar unit counts located in Burlington, Waltham and Braintree Massachusetts; see Appendices.

3.6 TRIP DISTRIBUTION AND ASSIGNMENT

The directional distribution of development-generated trips on the roadway network is a function of a number of variables including area population centers and the efficiency of these roadways leading to the Site. US Census Journey-to-work data and existing area travel patterns serve as the primary bases for determining the trip distribution pattern for the proposed development. Trip distribution calculations for the Site are summarized in **Table 8** with supporting calculations provided in the **Appendix.**

TABLE 8
TRIP-DISTRIBUTION PATTERNS

Roadway Segment (To/From)	Residential[2]
Old Sudbury Road (East)	45%
Hudson Road (West)	15%
Concord Road (North)	15%
Concord Road (South)	20%
Peakham Road	5%
TOTAL	**100%**

[1]Journey to Work Census 2010 data for residents of Sudbury.

Development-related trips for the Site were assigned to the roadway network using the ITE trip-generation estimates shown in **Table 7** and the distribution patterns presented in the **Table 8**. New development-related trips at each intersection for the weekday morning and weekday evening peak hours are quantified in **Figure 8** and **Figure 9**, respectively.

3.7 BUILD TRAFFIC VOLUMES

Future Build condition traffic volumes were arrived at by adding development-specific traffic volumes to the 2020 No-Build conditions. The 2020 Build condition traffic-volume networks for the weekday morning and weekday evening peak hours are displayed in **Figure 10** and **Figure 11**, respectively.

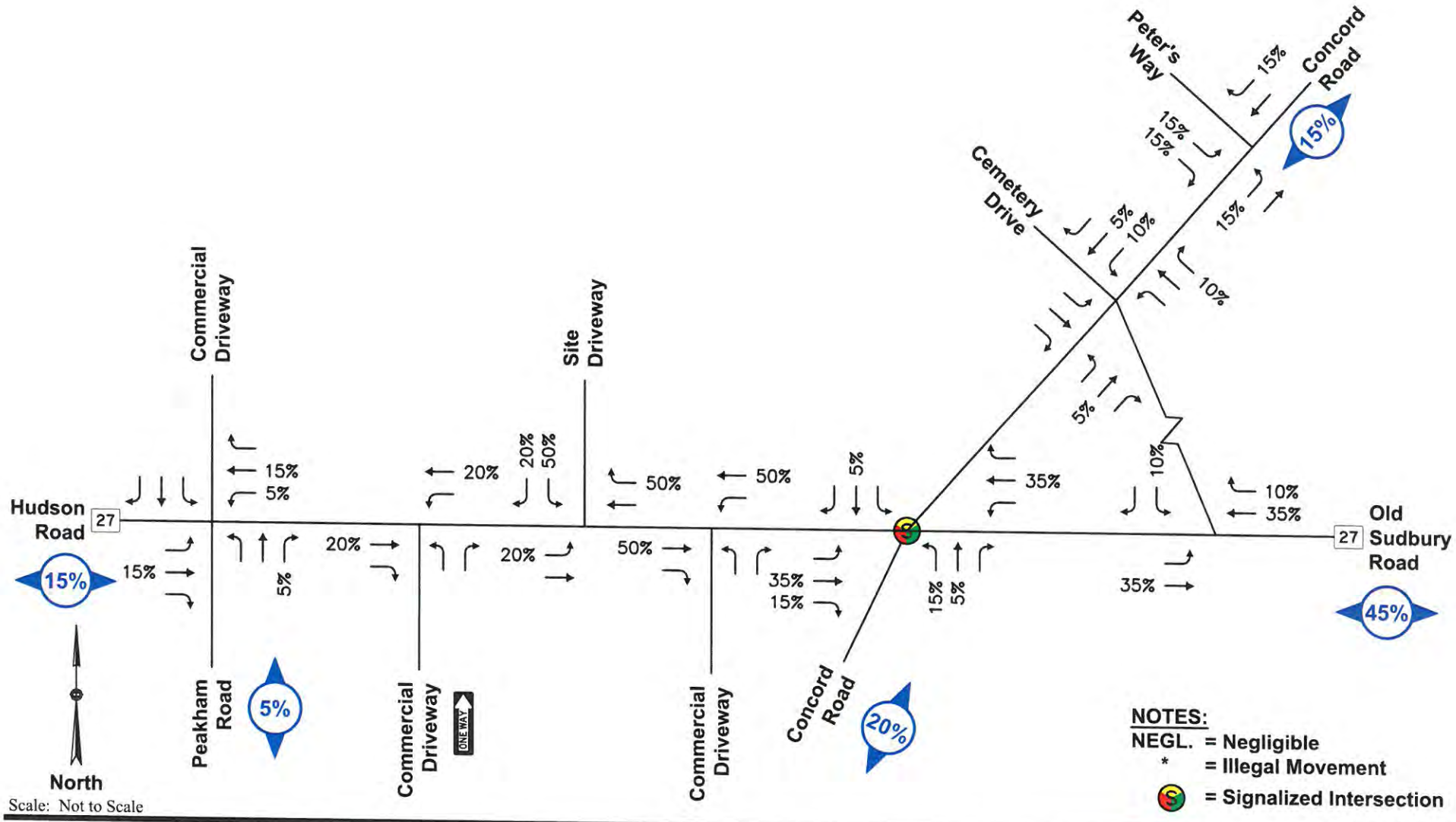

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Figure 7

Trip Distribution

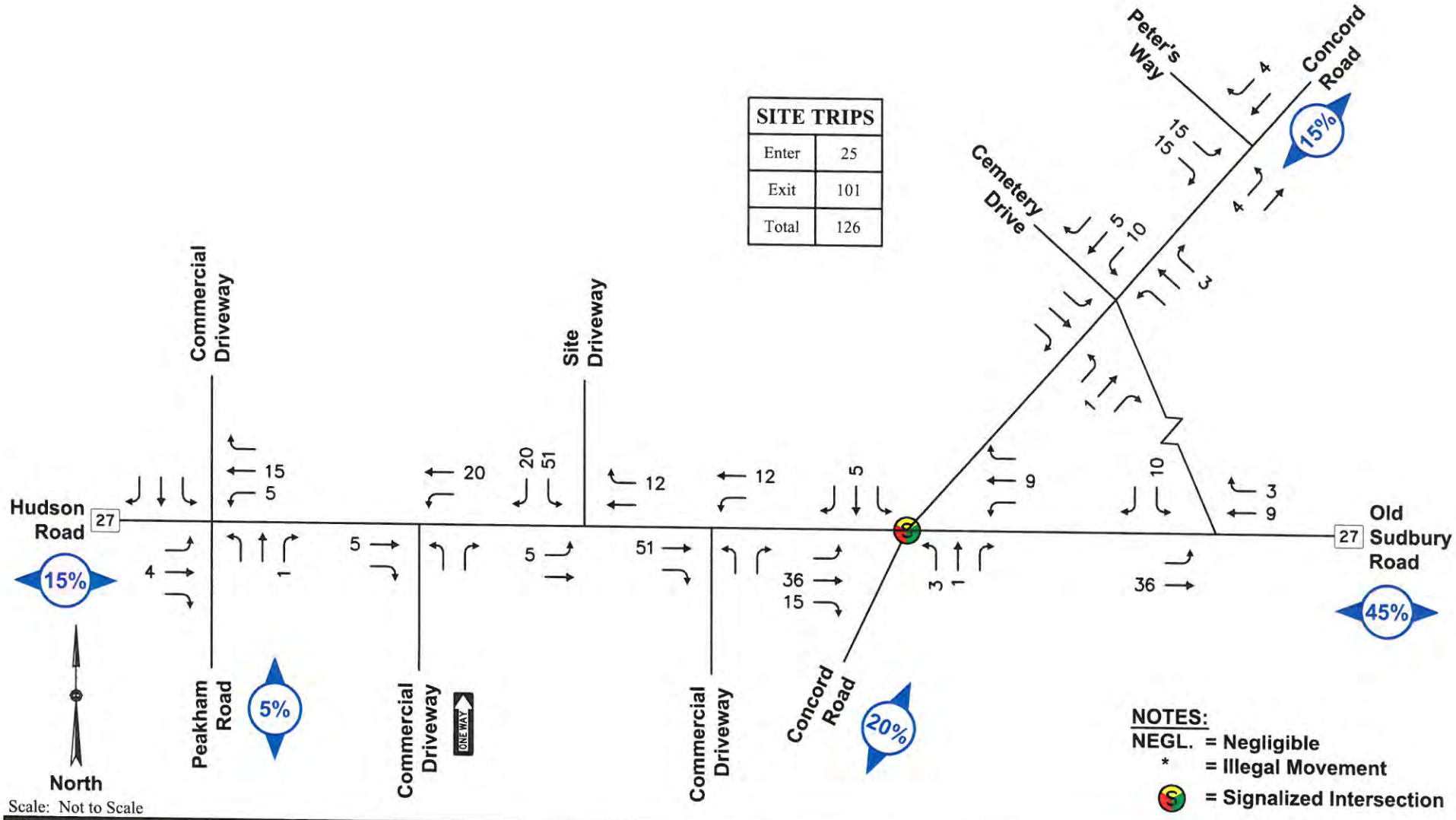

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Figure 8

Site-Generated Trips
Weekday Morning Peak Hour Traffic Volumes
(250 Apartments)

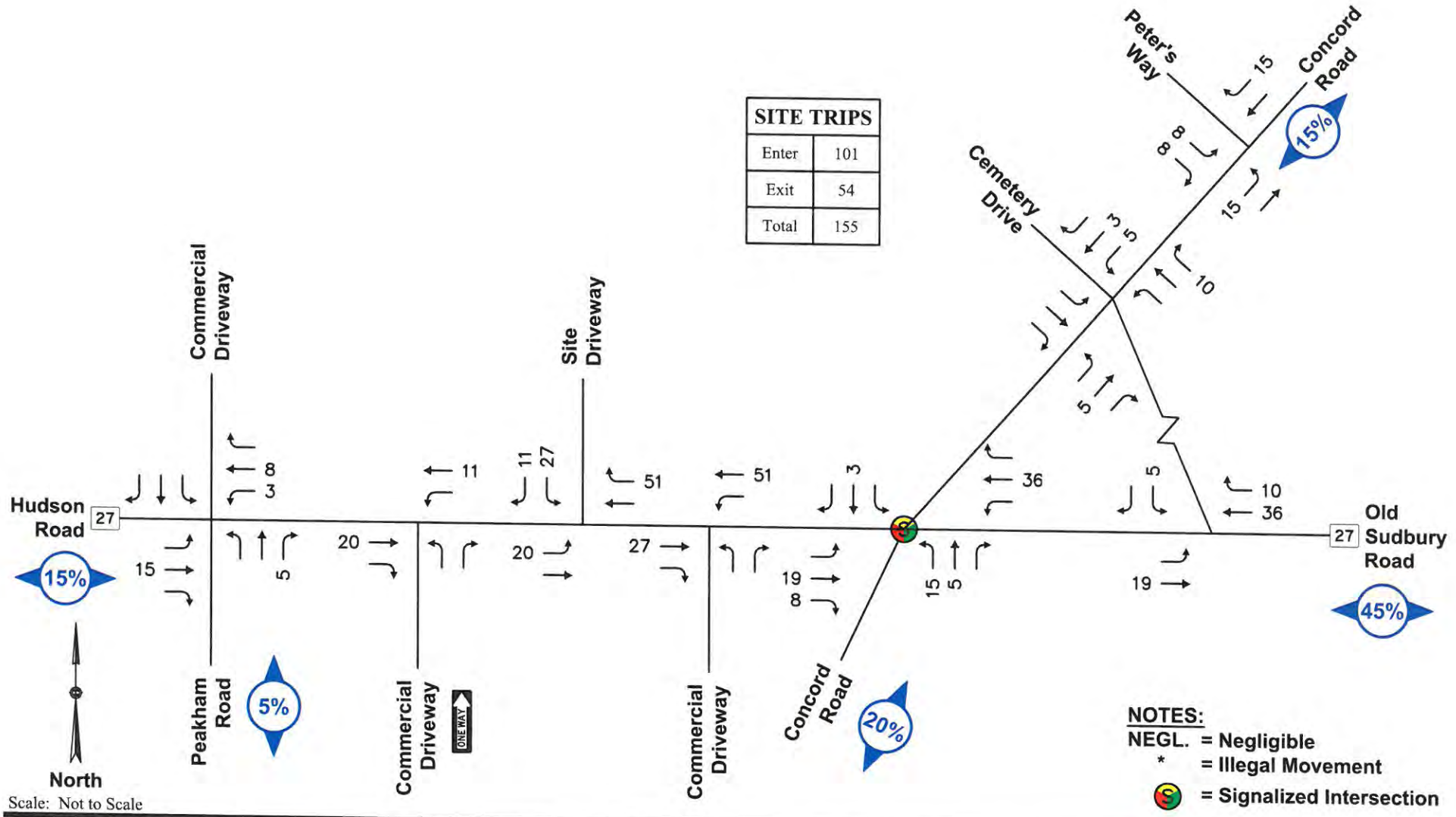

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Figure 9

Site-Generated Trips
Weekday Evening Peak Hour Traffic Volumes
(250 Apartments)

Date: November 2015
Dwg No. 814 TIAS.dwg

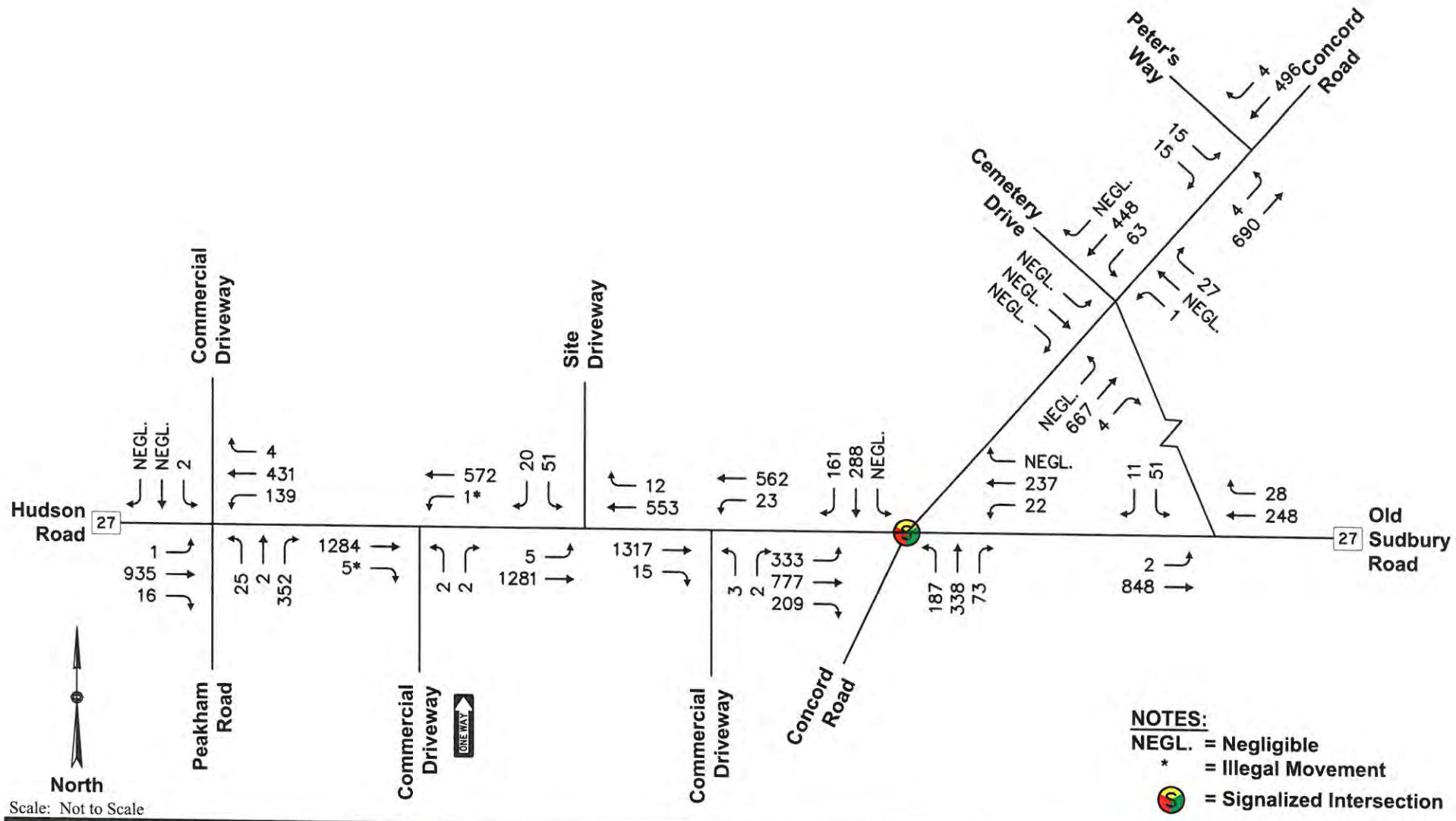

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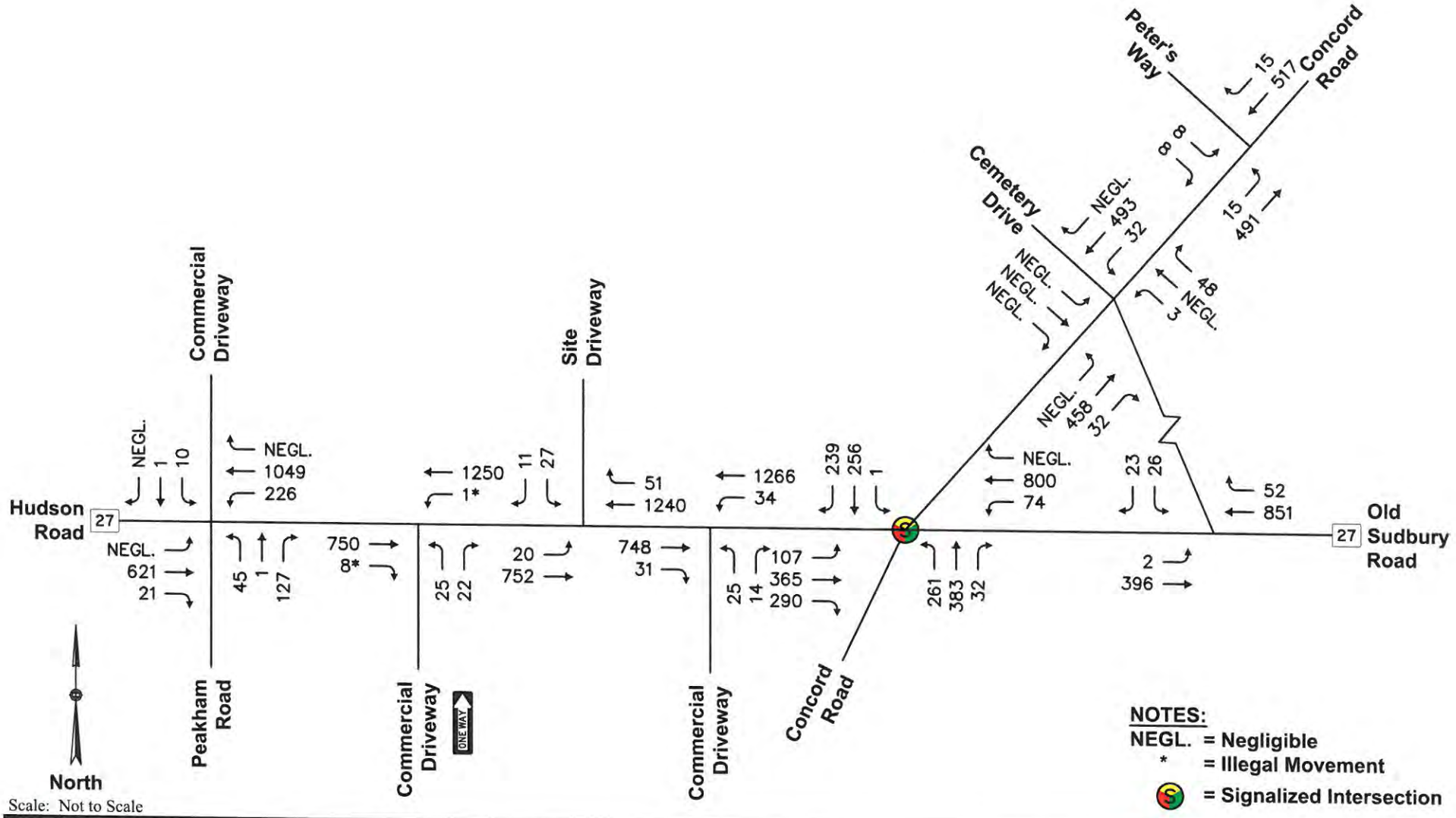
Figure 10

2020 Build Condition
Weekday Morning Peak Hour Traffic Volumes
(7:15 - 8:15am)

Date: November 2015
Dwg No. 814 TIAS.dwg



MDM TRANSPORTATION CONSULTANTS, INC.
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Figure 11

2020 Build Condition
Weekday Evening Peak Hour Traffic Volumes
(5:00 - 6:00 pm)

Date: November 2015
Dwg No. 814 TIAS.dwg

4.0 TRAFFIC OPERATIONS ANALYSIS

Intersection capacity analyses for the primary study intersections are presented in this section for the Baseline, No-Build, and Build traffic-volume conditions. Capacity analyses, conducted in accordance with EEA/MassDOT guidelines, provide an index of how well the roadway facilities serve the traffic demands placed upon them. The operational results provide the basis for recommended access and roadway improvements in the following section.

4.1 CAPACITY ANALYSIS PROCEDURES

Capacity analysis of intersections is developed using the Synchro® computer software, which implements the methods of the 2010 Highway Capacity Manual (HCM). The resulting analysis presents a level-of-service (LOS) designation for individual intersection movements. The LOS is a letter designation that provides a qualitative measure of operating conditions based on several factors including roadway geometry, speeds, ambient traffic volumes, traffic controls, and driver characteristics. Since the LOS of a traffic facility is a function of the traffic flows placed upon it, such a facility may operate at a wide range of LOS, depending on the time of day, day of week, or period of year. A range of six levels of service are defined on the basis of average delay, ranging from LOS A (the least delay) to LOS F (delays greater than 50 seconds for unsignalized movements and 80 seconds for signalized movements). The specific control delays and associated LOS designations are presented in the **Appendix.**

4.2 INTERSECTION CAPACITY ANALYSIS RESULTS

Capacity analysis results for the weekday morning and weekday evening peak hour capacity analysis results for the study intersections are described below, with detailed analysis results presented in the **Appendix**.

4.2.1 Level of Service Analysis

The capacity analysis results for the intersections in the study area are summarized in **Table 9** and **Table 10** for the weekday morning and weekday evening peak hours, respectively. Detailed analysis results are presented in the **Appendix**.

TABLE 9
INTERSECTION CAPACITY ANALYSIS RESULTS
WEEKDAY MORNING PEAK HOUR

		Baseline			2020 No-Build			2020 Build		
Intersection	Approach	v/c[1]	Delay[2]	LOS[3]	v/c	Delay	LOS	v/c	Delay	LOS
Route 27 at	Eastbound	0.86	25	C	0.88	28	C	0.92	30	C
Concord Road	Westbound	0.54	31	C	0.56	31	C	0.57	31	C
	Northbound	0.77	26	C	0.83	29	C	0.85	30	C
	Southbound	0.89	48	D	0.91	51	D	0.93	54	D
	OVERALL	**0.89**	**30**	**C**	**0.91**	**33**	**C**	**0.93**	**34**	**C**
Route 27 at	Eastbound	0.00	<5	A	0.00	<5	A	0.00	<5	A
Peakham Road/Ti-	Westbound	0.20	<5	A	0.22	<5	A	0.23	<5	A
Sales[5]	Northbound	>1.0	>50 (<20)	F (C)	>1.0	>1.0 (<35)	F (C)	0.62	>50 (<35)	F (C)
	Southbound	0.00	<5	A	0.00	<5	A	0.00	<5	A
Route 27 at	Eastbound L/T	0.00	<5	A	0.00	<5	A	0.00	<5	A
Connector Road	Southbound L/R	0.21	22	C	0.23	24	C	0.30	28	D
Concord Road at	NB L/T/R	0.00	<5	A	0.00	<5	A	0.00	<5	A
Connector Road	SB L/T/R	0.06	<5	A	0.06	<5	A	0.08	<5	A
	EB LTR	0.00	<5	A	0.00	<5	A	0.00	<5	A
	WB LTR	0.06	15	B	0.07	15	B	0.08	15	B
Route 27 at	Eastbound L/T	n/a[4]	n/a	n/a	n/a[4]	n/a	n/a	0.01	<5	A
Site Driveway[5]	SB Egress L	n/a	n/a	n/a	n/a	n/a	n/a	0.76	>50 (<35)	F (D)
	SB Egress R	n/a	n/a	n/a	n/a	n/a	n/a	0.04	12	B
Concord Road at	Northbound L/T	n/a[4]	n/a	n/a	n/a[4]	n/a	n/a	0.00	<5	A
Site Driveway	EB Egress L/R	n/a	n/a	n/a	n/a	n/a	n/a	0.11	20	C

NB=Northbound; SB=Southbound; EB=Eastbound; WB=Westbound; L=left; R=right; T=through

[1] Volume-to-capacity ratio

[2] Average control delay per vehicle (in seconds)

[3] Level of service

[4] n/a = not applicable

[5] Values in parenthesis () represent actual measured delay/operations based on field observation as described under Section 4.2.3 and better reflect actual/projected values. Refer to Section 4.2.3 for detailed discussion.

TABLE 10
INTERSECTION CAPACITY ANALYSIS RESULTS
WEEKDAY EVENING PEAK HOUR

Intersection	Approach	Baseline			2020 No-Build			2020 Build		
		v/c[1]	Delay[2]	LOS[3]	v/c	Delay	LOS	v/c	Delay	LOS
Route 27 at Concord Road	Eastbound	0.57	11	B	0.64	12	B	0.64	12	B
	Westbound	0.92	43	D	0.95	47	D	0.97	52	D
	Northbound	0.85	36	D	0.92	41	D	0.98	48	D
	Southbound	>1.0	>80	F	>1.0	>80	F	>1.0	>80	F
	OVERALL	**>1.0**	**42**	**D**	**>1.0**	**50**	**D**	**>1.0**	**54**	**D**
Route 27 at Peakham Road/Ti-Sales	Eastbound	0.00	<5	A	0.00	<5	A	0.00	<5	A
	Westbound	0.23	<5	A	0.24	<5	A	0.25	<5	A
	Northbound	>1.0	>50 (<20)	F(C)	>1.0	>50 (<35)	F (D)	>1.0	>50 (<35)	F (D)
	Southbound	0.71	>50 (<30)	F (D)	0.95	>50 (<35)	F (D)	>1.0	>50 (<35)	F (D)
Route 27 at Connector Road	Eastbound L/T	0.00	<5	A	0.00	<5	A	0.00	<5	A
	Southbound L/R	0.15	19	C	0.16	20	C	0.20	23	C
Concord Road at Connector Road	NB L/T/R	0.00	<5	A	0.00	<5	A	0.00	<5	A
	SB L/T/R	0.02	<5	A	0.03	<5	A	0.03	<5	A
	EB LTR	0.00	<5	A	0.00	<5	A	0.00	<5	A
	WB LTR	0.08	12	B	0.08	13	B	0.10	13	B
Route 27 at Site Driveway	Eastbound L/T	n/a[4]	n/a	n/a	n/a[4]	n/a	n/a	0.04	<5	A
	SB Egress L	n/a	n/a	n/a	n/a	n/a	n/a	0.59	>50 (<35)	F (D)
	SB Egress R	n/a	n/a	n/a	n/a	n/a	n/a	0.06	25	D
Concord Road at Site Driveway	Northbound L/T	n/a[4]	n/a	n/a	n/a[4]	n/a	n/a	0.02	<5	A
	EB Egress L/R	n/a	n/a	n/a	n/a	n/a	n/a	0.05	17	C

NB=Northbound; SB=Southbound; EB=Eastbound; WB=Westbound; L=left; R=right; T=through

[1] Volume-to-capacity ratio

[2] Average control delay per vehicle (in seconds)

[3] Level of service

[4] n/a = not applicable

[5] Values in parenthesis () represent actual measured delay/operations based on field observation as described under Section 4.2.3 and better reflect actual/projected values. Refer to Section 4.2.3 for detailed discussion.

As summarized in **Table 9** and **Table 10**:

- *Route 27 at Concord Road:* Under future No-Build and Build conditions, capacity analyses indicate that the signalized intersection of Route 27 at Concord Road will operate at overall LOS D or better during the weekday morning and weekday evening peak hours. The project will contribute modest traffic increases at this location (a 2 to 3 percent change) and will therefore will result in only an overall increase in delay of 4 seconds or less with no change in operations relative to No Build conditions. Since the Hudson Road driveway is expected to serve as the primary point of access/egress based on "shortest path" trip assignment, the change in traffic on Concord Road toward the signal will be negligible (5 vehicles or less) and will not materially deteriorate operations.

- *Route 27 at Peakham Road:* Impacts to the Peakham Road intersection are expected to be modest, with traffic from Sudbury Station accounting for only a 1 percent change in traffic volume during peak hours (a level that falls within normal day-to-day fluctuation in volume independent of the project). Field observation as outlined in *Section 4.2.3* indicate that the ample capacity exists at the Hudson Road intersection with Peakham Road to accommodate the modest peak hour traffic volumes associated with the proposed Sudbury Station development, with projected LOS D or better operation.

- *Route 27 and Concord Road at Connector Road:* Under future Build conditions, capacity analyses indicates that the Connector Road approaches to Route 27 and Concord Road will operate under capacity at LOS D or better during the weekday morning and weekday evening peak hours.

- *Route 27 at Proposed Site Driveway:* The proposed Hudson Road (Route 27) Site Driveway is projected to operate below capacity, consistent with observations and measurements taken at other similar volume intersections (Peakham Road and Ti Sale Driveway) with traffic LOS A operations along Hudson Road. Turns from the driveway onto Hudson Road will be accommodated in separate left- and right-turn lanes. Based on observation and field measurement of delays documented under *Section 4.2.3*, MDM anticipates delays of less than 35 seconds which correlate to LOS D or better operation.

- *Concord Road at Proposed Site Driveway:* Under future Build conditions, Proposed Site Driveway approach to Concord Road will operate under capacity at LOS C or better during the peak hours. Mainline travel along Concord Road will continue to operate unimpeded with minimal delay. The occasional influence of traffic queues from the Route 27 signal are being addressed in part by the ongoing improvements by the Town but are not expected to be of any material consequence to operations at this driveway as it is a low-volume location and an alternative (Hudson Road) driveway is available.

In summary, the proposed development does not result in any significant change in operations along Route 27 and Concord Road compared to No-Build conditions. Furthermore,

access/egress improvements as outlined in the Conclusions and Recommendations section of this report will enhance safety and operations with regards to the development.

4.2.2 Vehicle Queue Analysis

Vehicle queue results are presented for the signalized Route 27 and Concord Road intersection. These vehicle queues are compared to available storage lengths, which are defined as lengths of exclusive turn lanes or the distance to the nearest major intersection for through lanes. Vehicle queue results from the capacity analysis are summarized in **Table 11**. Detailed worksheets of the queuing analysis are provided in the **Appendix**.

TABLE 11
VEHICLE QUEUE ANALYSIS SUMMARY
ROUTE 27 AT CONCORD ROAD

		2020 No-Build		2020 Build	
Approach	Storage Length (feet)	Average Queue Length[1]	95th Percentile Queue Length[1]	Average Queue Length	95th Percentile Queue Length
Weekday Morning Peak Hour					
Eastbound L	400±	116	238	116	241
Eastbound T	>1500	333	556	360	599
Eastbound R	80±	Negl	Negl	Negl	Negl
Westbound L	200±	9	31	9	32
Westbound T	>1500	104	173	109	180
Northbound L	400±	66	169	67	173
Northbound T	>1500	160	250	160	252
Southbound L/T/R	>1500	218	401	223	409
Weekday Evening Peak Hour					
Eastbound L	400±	33	91	33	93
Eastbound T	>1500	123	183	131	194
Eastbound R	80±	Negl	Negl	Negl	Negl
Westbound L	200±	30	62	30	62
Westbound T	>1500	461	705	497	756
Northbound L	400±	117	262	125	286
Northbound T	>1500	207	304	210	308
Southbound L/T/R	>1500	360	563	364	567

[1]Average and 95th percentile queue lengths are reported in feet per lane.
Negl=Negligible

As presented in **Table 11,** average and 95th percentile vehicle queues at the signalized study intersection of Concord Road at Hudson Road will be contained within available storage lanes during peak hours.

4.2.3 DELAY STUDY

MDM conducted a Stop Sign Delay study for the Peakham Road and the Ti-Sales Driveway approaches to Hudson Road. The delay study involves measuring the actual average delay (in seconds) for vehicles turning left and right onto Hudson Road during the weekday morning and weekday evening peak hours and recording the maximum vehicle queues (in vehicles).

A comparison of the actual average vehicle delay observed in the field to the calculated delay results provided by HCM methodology reveals that the HCM methodology produces an overly conservative delay analysis for the conditions on Peakham Road and The Ti-Sales Site Driveway as summarized in **Table 12** below.

TABLE 12
AVERAGE VEHICLE DELAY COMPARISON
BASELINE CONDITIONS

	Calculated Results[1]			Observed Results[2]		
Time Period/Approach	Average Vehicle Delay (seconds)	Maximum Vehicle Queue (vehicles)	LOS	Average Vehicle Delay (seconds)	Maximum Vehicle Queue (vehicles)	LOS
Peakham Road at Hudson Road						
AM Peak Hour	147	16	F	20	10	C
PM Peak Hour	273	6	F	16	5	C
Ti-Sales Driveway at Hudson Road						
AM Peak Hour	<5	<1	A	17	1	C
PM Peak Hour	440	2	F	27	4	D

[1]Based on Highway Capacity Manual methodology.
[2]Based on field data collected on December 17, 2014.

As shown in **Table 12**, the delay study indicates the following:

- *Peakham Road approach to Hudson Road.* The Peakham Road approach to Hudson Road currently operates with average delays ranging from 16 to 20 seconds during the weekday morning and evening peak hours, respectively. This delay corresponds to level of service (LOS) C operations which represent a condition with modest control delays to side street traffic. Consequently, it is the opinion of MDM that the project will have a nominal impact on operations at the Hudson Road intersection with Peakham Road given the modest traffic volume increase of 5 or fewer turns (1 vehicle every 12 minutes) from the proposed Development exiting Peakham Road onto Concord Road during the peak hours.

- *Ti-Sales Driveway at Hudson Road.* Ti-Sales Driveway approach to Hudson Road currently operates with average delays ranging from 17 to 27 seconds during the weekday morning and evening peak hours, respectively. This delay corresponds to LOS C and LOS D operations which represent a condition with modest control delays to side street traffic.

In summary, MDM finds that a comparison of the actual (measured) vehicle delay those calculated using the HCM methodology reveals that the HCM methodology produces an overly conservative delay analysis for the conditions on Peakham Road and the Ti-Sales Driveway. Given the existing performance of side street operations along this section of Hudson Road (LOS D or better with delays of less than 35 seconds) the modest driveway volume of less than 60 left-turn vehicles per hour approaching Hudson Road (representing less than 1 additional left turn per minute), the driveway is expected to operate below capacity with average delays that are consistent with LOS D or better operation.

5.0 RECOMMENDATIONS AND CONCLUSIONS

The proposed residential development represents a modest traffic generator that is not projected to materially deteriorate traffic operations at area intersections. The Site is also most proximate to the Route 27/Concord Road intersection which is currently being improved by the Town to enhance operations and safety and that is shown in this traffic evaluation to sustain no change in operation as a result of the project. Recommendations are therefore focused on site access and integration of proposed driveways with existing roadways along Hudson Road and Concord Road including pedestrian improvements.

5.1 ACCESS IMPROVEMENTS

The proposed residential development represents a modest traffic generator that is not projected to materially deteriorate traffic operations at area intersections. The Site is also most proximate to the Route 27/Concord Road intersection which is currently being improved by the Town to enhance operations and safety and that is shown in this traffic evaluation to sustain no change in operation as a result of the project. Recommendations are therefore focused on site access and integration of proposed driveways with existing roadways along Hudson Road and Concord Road including pedestrian improvements.

MDM recommends access-related improvements aimed at enhancing traffic operations and/or travel and pedestrian safety including the following:

- STOP signs (R1-1) and STOP line pavement markings are recommended on the driveway approaches to Hudson Road and Concord Road. The signs and pavement markings shall be compliant with the Manual on Uniform Traffic Control Devices (MUTCD).

- Plantings (shrubs, bushes) and structures (walls, fences, etc.) should be maintained at a height of 2 feet or less within the sight lines in vicinity of the Site driveway intersections with Hudson Road and Concord Road to provide unobstructed sight lines. Existing vegetation and structures within these driveway sight lines should be cleared, removed or trimmed/maintained with grading modifications as necessary to ensure minimum recommended sight line requirements are met or exceeded.

- Recommended access and pedestrian improvements at the Hudson Road driveway location are shown conceptually in **Figure 12**. The Hudson Road driveway design features should provide alignment, lane widths and curb radii designed to achieve (a) approximate perpendicular orientation with Hudson Road; (b) separate left- and right-turn lanes approaching Hudson Road; (c) a single ingress lane with 16-foot dimension and (d) minimum 25-foot curb radii to accommodate standard SU-30 design vehicles and emergency response vehicles. Driveway grading and orientation should provide unimpeded sight lines that meet or exceed minimum recommended stopping sight distance presented herein. The Applicant should connect the proposed sidewalk along the Site Driveway with the existing sidewalks along Hudson Road and Peakham Road. A marked crosswalk and ADA compliant ramps are recommended across Hudson Road at its intersection with Peakham Road to accommodate this connection.

- Recommended access and pedestrian improvements at the Concord Road driveway (Peter's Way) location are shown conceptually in **Figure 13**. The Concord Road driveway design (Peter's Way) should provide alignment, lane widths and curb radii designed to achieve (a) approximate perpendicular orientation with Concord Road; (b) a single wider lane approaching Concord Road (approximately 16 feet) so as to allow bypass of occasional left-turns onto Concord Road; (c) a single ingress lane with minimum 16-foot dimension and (d) minimum 25-foot curb radii to accommodate standard SU-30 design vehicles and emergency response vehicles. Driveway grading and orientation should provide unimpeded sight lines that meet or exceed minimum recommended stopping sight distance presented herein. The Applicant proposes to connect the proposed sidewalk along Peter's Way with the existing sidewalk along Concord Road. Enhancement of the existing pedestrian crossing near Candy Hill Road to include ADA-compliant ramps and MUTCD-compliant advance warning signs is also recommended subject to Town approvals.

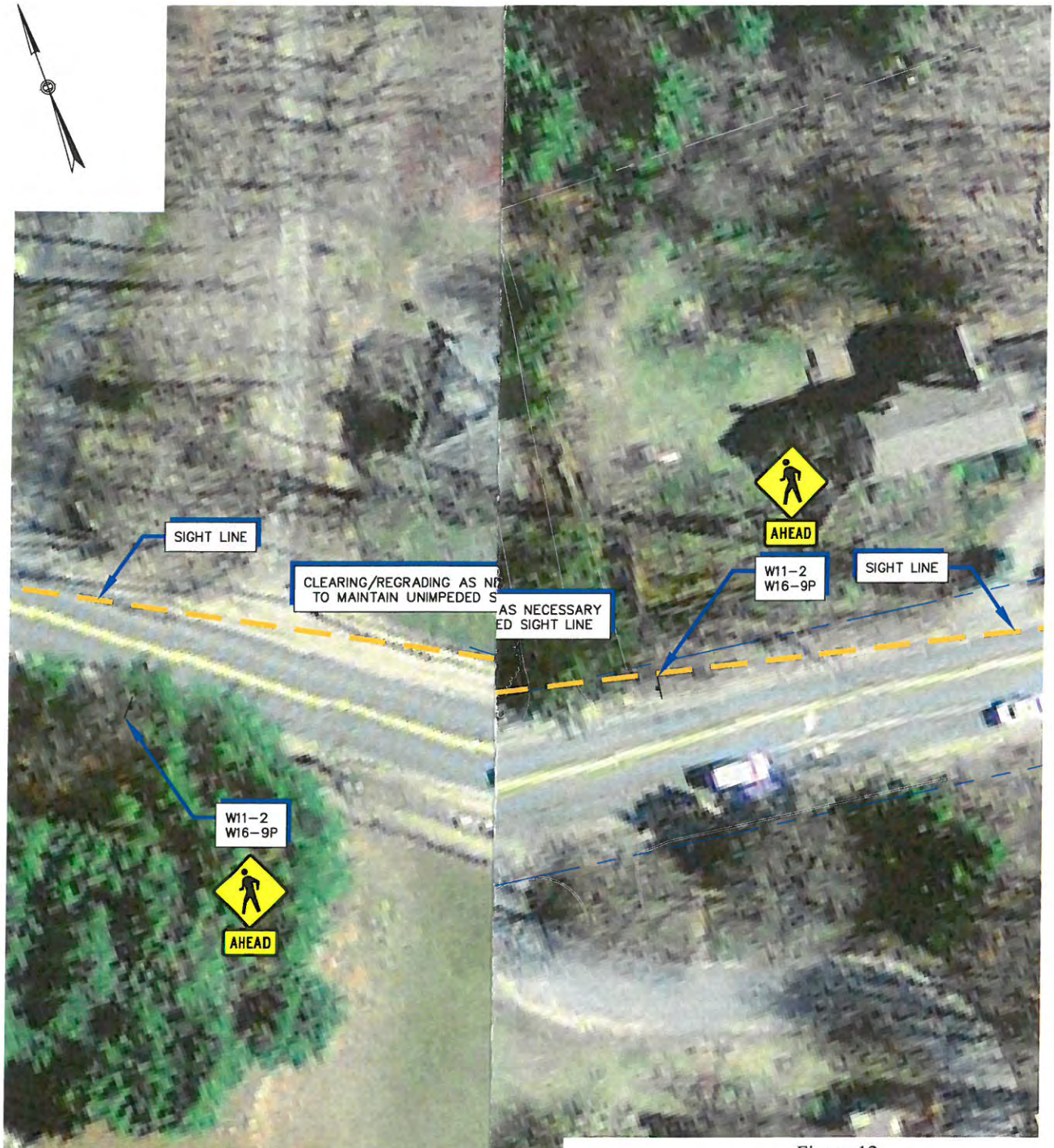


Figure 12

NOTES

1. THIS PLAN INTENDED FOR DISCUSSION PURPOSES ONLY; IT IS NOT FOR CONSTRUCTION.
2. FINAL DESIGN IS SUBJECT TO FIELD SURVEY BY OTHERS.
3. PROPERTY LINES AND ACCESS LINE LOCATIONS ARE APPROXIMATE ONLY AND ARE SUBJECT TO DEED AND TITLE RECORDS.
4. BASE PLAN SOURCE: SULLIVAN, CONNORS & ASSOCIATES AND USGS COLOR ORTHO IMAGERY.

80 FEET

Conceptual Access/Egress Plan

HUDSON ROAD
SUDBURY, MASSACHUSETTS
PREPARED FOR:
SUDBURY STATION, LLC
2134 SEVILLA WAY
NAPLES, FLORIDA 34109

MDM TRANSPORTATION CONSULTANTS, INC.
PLANNERS & ENGINEERS
28 Lord Road, Suite 280
Marlborough, MA 01752
Tel: (508) 303-0370
Fax: (508) 303-0371

DATE: January 21, 2016	SCALE: As Noted	
PROJECT No. 814	File: 814 Concept Plan (1-21-2016).dwg	Sheet 1 of 1

Figure 13

NOTES

1. THIS PLAN INTENDED FOR DISCUSSION PURPOSES ONLY; IT IS NOT FOR CONSTRUCTION.
2. FINAL DESIGN IS SUBJECT TO FIELD SURVEY BY OTHERS.
3. PROPERTY LINES AND ACCESS LINE LOCATIONS ARE APPROXIMATE ONLY AND ARE SUBJECT TO DEED AND TITLE RECORDS.
4. BASE PLAN SOURCE: SULLIVAN, CONNORS & ASSOCIATES AND USGS COLOR ORTHO IMAGERY.

Conceptual Access/Egress Plan

HUDSON ROAD
SUDBURY, MASSACHUSETTS
PREPARED FOR:
SUDBURY STATION, LLC
2134 SEVILLA WAY
NAPLES, FLORIDA 34109

MDM TRANSPORTATION CONSULTANTS, INC.
PLANNERS & ENGINEERS
28 Lord Road, Suite 280
Marlborough, MA 01752
Tel: (508) 303-0370
Fax: (508) 303-0371

DATE: January 21, 2016	SCALE: As Noted	
PROJECT No. 814	File: 814 Concept Plan (1-21-2016).dwg	Sheet 1 of 1

5.2 CONCLUSIONS

In summary, trip generation for the development is projected to be moderate. MDM finds that incremental traffic associated with the proposed development is not expected to materially impact operating conditions at the study intersections. The study intersections exhibit below-average crash rates based on historic crash data; safety countermeasures are therefore not warranted. Likewise, with clearing and re-grading associated with the construction of the driveways, the available sight lines at the site driveways intersections with Hudson Road and Concord Road will exceed the recommended sight line requirements from AASHTO. Access-related and pedestrian improvements have been recommended that are aimed at enhancing traffic operations and/or travel safety and pedestrian mobility.

Attachments

- □ Traffic Volume Data
- □ Seasonal/Yearly Growth Data
- □ Intersection Crash Data
- □ Speed Data
- □ Sight Line Analysis
- □ Planned Area Improvements
- □ Trip Generation Data
- □ Trip Distribution Calculations
- □ Intersection Delay Study
- □ Capacity Analyses

□ Traffic Volume Data

MDM TRANSPORTATION CONSULTANTS, INC.

E/W: Hudson Road (Route 27)
30 Hudson Road
Sudbury, MA

28 Lord Road, Suite 280
Marlborough, MA
www.mdmtrans.com

Site Code: 81400001
Station ID:
814 HUDSON RD - VOLUME

Latitude: 0' 0.0000 Undefined

Start	17-Dec-14	Westbound		Hour Totals		Eastbound		Hour Totals		Combined Totals	
Time	Wed	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
12:00		27	124			9	161				
12:15		19	129			3	160				
12:30		15	135			6	153				
12:45		12	154	73	542	4	147	22	621	95	1163
01:00		4	147			10	157				
01:15		11	138			5	139				
01:30		6	153			3	123				
01:45		6	161	27	599	2	126	20	545	47	1144
02:00		5	145			4	123				
02:15		2	177			3	124				
02:30		4	151			3	109				
02:45		5	191	16	664	4	152	14	508	30	1172
03:00		3	196			3	169				
03:15		2	195			2	177				
03:30		2	244			4	126				
03:45		1	235	8	870	4	146	13	618	21	1488
04:00		1	240			4	152				
04:15		0	256			8	153				
04:30		4	266			16	131				
04:45		6	253	11	1015	20	155	48	591	59	1606
05:00		6	242			31	155				
05:15		8	285			55	159				
05:30		14	289			81	148				
05:45		15	277	43	1093	106	169	273	631	316	1724
06:00		22	265			185	160				
06:15		44	283			216	120				
06:30		54	240			241	129				
06:45		65	245	185	1033	267	118	909	527	1094	1560
07:00		66	198			265	116				
07:15		123	180			276	111				
07:30		136	164			267	87				
07:45		129	139	454	681	200	70	1008	384	1462	1065
08:00		109	124			223	60				
08:15		82	112			249	47				
08:30		108	130			246	43				
08:45		153	134	452	500	198	37	916	187	1368	687
09:00		118	120			209	54				
09:15		105	110			189	33				
09:30		106	76			177	33				
09:45		99	101	428	407	187	32	762	152	1190	559
10:00		93	85			162	33				
10:15		82	82			155	36				
10:30		95	53			158	31				
10:45		102	43	372	263	163	20	638	120	1010	383
11:00		90	39			147	17				
11:15		118	30			142	11				
11:30		121	30			135	11				
11:45		121	19	450	118	142	9	566	48	1016	166
Total		2519	7785			5189	4932			7708	12717
Percent		24.4%	75.6%			51.3%	48.7%			37.7%	62.3%

MDM TRANSPORTATION CONSULTANTS, INC.

E/W: Hudson Road (Route 27)
30 Hudson Road
Sudbury, MA

28 Lord Road, Suite 280
Marlborough, MA
www.mdmtrans.com

Site Code: 81400001
Station ID:
814 HUDSON RD - VOLUME

Latitude: 0' 0.0000 Undefined

Start	18-Dec-14	Westbound		Hour Totals		Eastbound		Hour Totals		Combined Totals	
Time	Thu	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
12:00		19	148			10	114				
12:15		20	136			6	148				
12:30		21	125			3	151				
12:45		7	138	67	547	2	121	21	534	88	1081
01:00		6	104			5	148				
01:15		8	143			4	122				
01:30		7	157			7	135				
01:45		2	184	23	588	2	122	18	527	41	1115
02:00		2	174			1	141				
02:15		0	152			3	175				
02:30		2	155			2	177				
02:45		1	186	5	667	4	138	10	631	15	1298
03:00		2	239			9	141				
03:15		3	207			0	181				
03:30		0	259			3	125				
03:45		0	264	5	969	6	167	18	614	23	1583
04:00		1	258			6	165				
04:15		4	245			8	158				
04:30		3	273			16	145				
04:45		7	266	15	1042	23	158	53	626	68	1668
05:00		9	263			33	142				
05:15		7	291			63	146				
05:30		10	290			85	174				
05:45		24	260	50	1104	152	161	333	623	383	1727
06:00		21	279			173	151				
06:15		47	283			243	127				
06:30		48	253			254	138				
06:45		78	233	194	1048	278	137	948	553	1142	1601
07:00		66	197			283	133				
07:15		131	182			276	120				
07:30		124	166			265	98				
07:45		119	151	440	696	214	81	1038	432	1478	1128
08:00		105	127			222	48				
08:15		100	118			219	62				
08:30		105	139			258	58				
08:45		166	112	476	496	196	49	895	217	1371	713
09:00		136	127			202	55				
09:15		115	126			208	31				
09:30		113	139			202	43				
09:45		97	90	461	482	195	46	807	175	1268	657
10:00		99	80			175	32				
10:15		90	106			156	30				
10:30		94	67			164	17				
10:45		104	60	387	313	164	28	659	107	1046	420
11:00		103	50			136	17				
11:15		124	35			149	12				
11:30		122	28			149	9				
11:45		133	24	482	137	135	13	569	51	1051	188
Total		2605	8089			5369	5090			7974	13179
Percent		24.4%	75.6%			51.3%	48.7%			37.7%	62.3%

MDM TRANSPORTATION CONSULTANTS, INC.

Concord Road
North of Town Center
Sudbury, MA

28 Lord Road, Suite 280
Marlborough, MA
www.mdmtrans.com

Site Code: 00000800
Station ID:
PROP - CONCORD RD SUDBURY VOLUME

Latitude: 0' 0.0000 Undefined

Start	10-Sep-14	Northbound		Hour Totals		Southbound		Hour Totals		Combined Totals	
Time	Wed	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
12:00		1	68			5	81				
12:15		3	79			1	59				
12:30		3	80			2	78				
12:45		0	81	7	308	2	65	10	283	17	591
01:00		1	118			0	87				
01:15		2	51			0	71				
01:30		2	82			0	79				
01:45		1	103	6	354	0	72	0	309	6	663
02:00		1	80			0	62				
02:15		3	71			1	73				
02:30		1	65			0	56				
02:45		0	61	5	277	0	55	1	246	6	523
03:00		1	70			0	87				
03:15		0	76			0	86				
03:30		0	91			0	62				
03:45		0	76	1	313	3	66	3	301	4	614
04:00		1	91			1	93				
04:15		0	76			2	81				
04:30		4	83			2	85				
04:45		5	95	10	345	5	85	10	344	20	689
05:00		2	103			11	58				
05:15		13	105			22	90				
05:30		8	100			14	85				
05:45		10	102	33	410	26	91	73	324	106	734
06:00		20	69			36	84				
06:15		28	66			62	92				
06:30		39	59			95	90				
06:45		48	49	135	243	110	66	303	332	438	575
07:00		61	80			125	62				
07:15		120	70			162	60				
07:30		104	89			135	52				
07:45		96	97	381	336	93	57	515	231	896	567
08:00		71	64			111	45				
08:15		79	53			99	43				
08:30		84	36			104	43				
08:45		68	52	302	205	89	49	403	180	705	385
09:00		112	37			86	33				
09:15		77	34			84	26				
09:30		86	41			63	33				
09:45		54	22	329	134	52	34	285	126	614	260
10:00		64	24			66	32				
10:15		55	25			62	25				
10:30		64	22			62	12				
10:45		57	14	240	85	61	20	251	89	491	174
11:00		53	28			70	14				
11:15		78	6			50	10				
11:30		77	6			50	3				
11:45		53	3	261	43	67	2	237	29	498	72
Total		1710	3053			2091	2794			3801	5847
Percent		35.9%	64.1%			42.8%	57.2%			39.4%	60.6%

MDM TRANSPORTATION CONSULTANTS, INC.

Concord Road
North of Town Center
Sudbury, MA

28 Lord Road, Suite 280
Marlborough, MA
www.mdmtrans.com

Site Code: 00000800
Station ID:
PROP - CONCORD RD SUDBURY VOLUME

Latitude: 0' 0.0000 Undefined

Start Time	11-Sep-14 Thu	Northbound Morning	Northbound Afternoon	Hour Totals Morning	Hour Totals Afternoon	Southbound Morning	Southbound Afternoon	Hour Totals Morning	Hour Totals Afternoon	Combined Totals Morning	Combined Totals Afternoon
12:00		4	62			0	49				
12:15		2	62			1	66				
12:30		1	66			2	62				
12:45		1	74	8	264	2	56	5	233	13	497
01:00		4	63			1	65				
01:15		0	71			0	68				
01:30		1	54			0	69				
01:45		0	82	5	270	2	56	3	258	8	528
02:00		1	77			0	58				
02:15		1	62			1	65				
02:30		0	94			0	84				
02:45		1	87	3	320	0	90	1	297	4	617
03:00		0	90			0	77				
03:15		0	69			0	68				
03:30		0	81			0	90				
03:45		1	38	1	278	0	71	0	306	1	584
04:00		0	79			2	85				
04:15		2	101			1	83				
04:30		2	79			2	77				
04:45		3	94	7	353	3	83	8	328	15	681
05:00		1	97			12	79				
05:15		9	126			20	91				
05:30		6	58			20	87				
05:45		9	58	25	339	26	94	78	351	103	690
06:00		21	53			42	78				
06:15		30	46			73	74				
06:30		47	64			95	65				
06:45		59	82	157	245	120	54	330	271	487	516
07:00		72	86			131	49				
07:15		110	76			195	61				
07:30		113	66			129	48				
07:45		104	61	399	289	103	38	558	196	957	485
08:00		74	33			108	59				
08:15		85	36			115	35				
08:30		96	71			98	26				
08:45		88	23	343	163	106	40	427	160	770	323
09:00		89	34			85	47				
09:15		68	22			70	42				
09:30		76	17			89	24				
09:45		73	21	306	94	53	24	297	137	603	231
10:00		74	16			52	15				
10:15		57	7			54	10				
10:30		48	14			58	17				
10:45		54	8	233	45	67	10	231	52	464	97
11:00		71	19			54	11				
11:15		64	10			68	6				
11:30		69	4			65	9				
11:45		65	5	269	38	59	4	246	30	515	68
Total		1756	2698			2184	2619			3940	5317
Percent		39.4%	60.6%			45.5%	54.5%			42.6%	57.4%

MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA

N/S: Old Concord Road
W: Hudson Road
E: Old Sudbury Road
Sudbury, MA

File Name : 814 Concord Road at Hudson Road AM
Site Code : 00000814
Start Date : 12/17/2014
Page No : 1

Groups Printed- Passenger Vehicles - Heavy Vehicles

	Concord Road From North					Old Sudbury Road From East					Concord Road From South					Hudson Road From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	16	35	0	0	51	0	39	3	0	42	8	75	36	0	119	41	166	103	0	310	522
07:15 AM	40	63	0	0	103	0	47	6	0	53	18	103	29	0	150	45	175	116	0	336	642
07:30 AM	46	66	0	0	112	0	60	3	0	63	9	95	45	0	149	46	175	88	0	309	633
07:45 AM	41	69	0	0	110	0	54	5	0	59	24	67	43	0	134	37	179	57	0	273	576
Total	143	233	0	0	376	0	200	17	0	217	59	340	153	0	552	169	695	364	0	1228	2373
08:00 AM	16	70	0	0	86	0	46	6	0	52	18	54	47	0	119	54	171	54	0	279	536
08:15 AM	15	77	0	0	92	0	31	2	0	33	14	68	40	0	122	52	145	62	0	259	506
08:30 AM	21	63	0	0	84	0	55	11	0	66	29	77	44	0	150	47	145	72	0	264	564
08:45 AM	15	60	0	0	75	0	90	36	0	126	65	63	53	0	181	45	163	68	0	276	658
Total	67	270	0	0	337	0	222	55	0	277	126	262	184	0	572	198	624	256	0	1078	2264
Grand Total	210	503	0	0	713	0	422	72	0	494	185	602	337	0	1124	367	1319	620	0	2306	4637
Apprch %	29.5	70.5	0	0		0	85.4	14.6	0		16.5	53.6	30	0		15.9	57.2	26.9	0		
Total %	4.5	10.8	0	0	15.4	0	9.1	1.6	0	10.7	4	13	7.3	0	24.2	7.9	28.4	13.4	0	49.7	
Passenger Vehicles	192	490	0	0	682	0	393	70	0	463	177	582	324	0	1083	360	1298	589	0	2247	4475
% Passenger Vehicles	91.4	97.4	0	0	95.7	0	93.1	97.2	0	93.7	95.7	96.7	96.1	0	96.4	98.1	98.4	95	0	97.4	96.5
Heavy Vehicles	18	13	0	0	31	0	29	2	0	31	8	20	13	0	41	7	21	31	0	59	162
% Heavy Vehicles	8.6	2.6	0	0	4.3	0	6.9	2.8	0	6.3	4.3	3.3	3.9	0	3.6	1.9	1.6	5	0	2.6	3.5

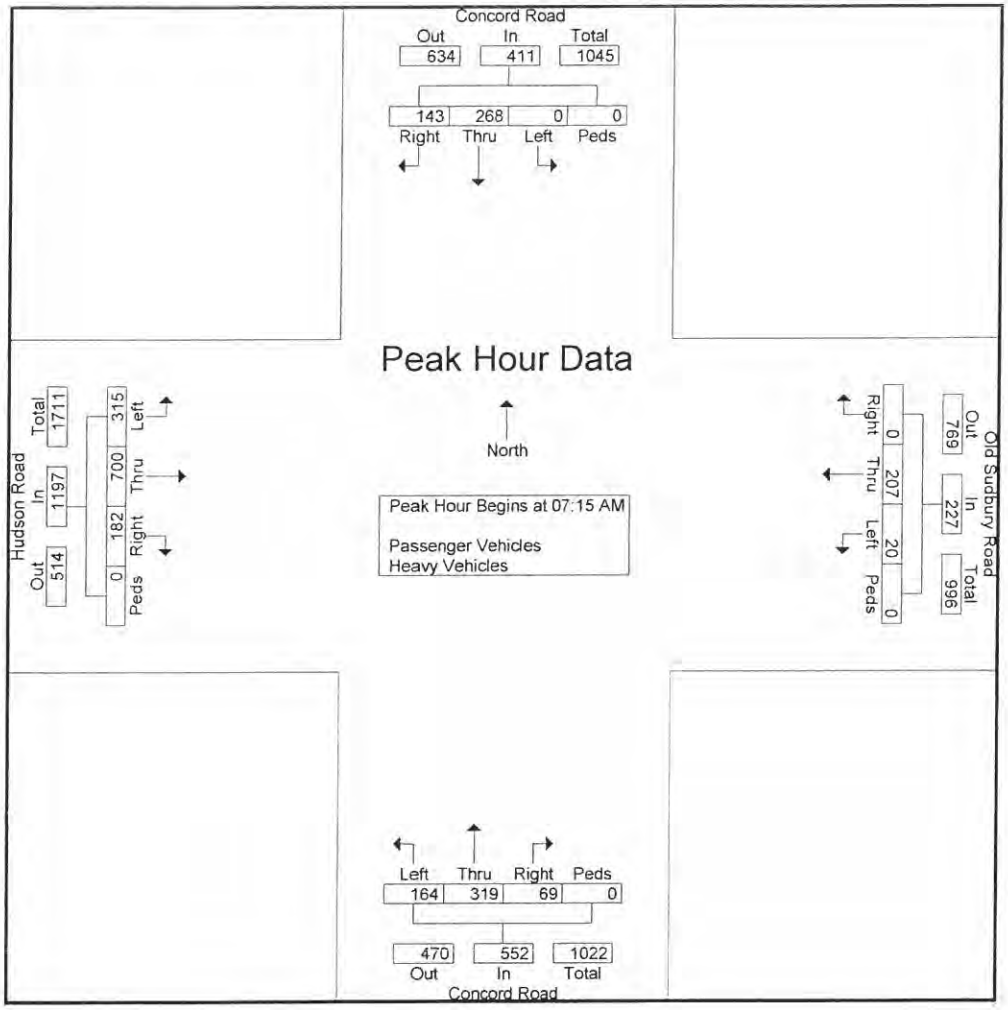
	Concord Road From North					Old Sudbury Road From East					Concord Road From South					Hudson Road From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:15 AM																					
07:15 AM	40	63	0	0	103	0	47	**6**	0	53	18	**103**	29	0	**150**	45	175	**116**	0	**336**	**642**
07:30 AM	**46**	66	0	0	**112**	0	**60**	3	0	**63**	9	95	45	0	149	46	175	88	0	309	633
07:45 AM	41	69	0	0	110	0	54	5	0	59	**24**	67	43	0	134	37	**179**	57	0	273	576
08:00 AM	16	**70**	0	0	86	0	46	6	0	52	18	54	**47**	0	119	**54**	171	54	0	279	536
Total Volume	143	268	0	0	411	0	207	20	0	227	69	319	164	0	552	182	700	315	0	1197	2387
% App. Total	34.8	65.2	0	0		0	91.2	8.8	0		12.5	57.8	29.7	0		15.2	58.5	26.3	0		
PHF	.777	.957	.000	.000	.917	.000	.863	.833	.000	.901	.719	.774	.872	.000	.920	.843	.978	.679	.000	.891	.930

MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA

N/S: Old Concord Road
W: Hudson Road
E: Old Sudbury Road
Sudbury, MA

File Name : 814 Concord Road at Hudson Road AM
Site Code : 00000814
Start Date : 12/17/2014
Page No : 2



MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA

N: Driveway
S: Peakham Road
E/W: Hudson Road
Sudbury, MA

File Name : 814 Peakham at Hudson 715-815am
Site Code : 00814001
Start Date : 12/17/2014
Page No : 1

Groups Printed- Passenger Vehicles - Heavy Vehicles

	Driveway From North					Hudson Road From East					Peakham Road From South					Hudson Road From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:15 AM	0	0	1	0	1	0	73	54	0	127	105	0	5	0	110	1	225	0	0	226	464
07:30 AM	0	0	0	0	0	2	114	36	0	152	99	0	4	1	104	4	205	0	0	209	465
07:45 AM	0	0	1	0	1	0	109	22	0	131	77	2	8	0	87	4	200	1	0	205	424
Total	0	0	2	0	2	2	296	112	0	410	281	2	17	1	301	9	630	1	0	640	1353
08:00 AM	0	0	0	0	0	2	94	14	0	110	38	0	6	0	44	7	219	0	0	226	380
Grand Total	0	0	2	0	2	4	390	126	0	520	319	2	23	1	345	16	849	1	0	866	1733
Apprch %	0	0	100	0		0.8	75	24.2	0		92.5	0.6	6.7	0.3		1.8	98	0.1	0		
Total %	0	0	0.1	0	0.1	0.2	22.5	7.3	0	30	18.4	0.1	1.3	0.1	19.9	0.9	49	0.1	0	50	
Passenger Vehicles	0	0	2	0	2	4	360	117	0	481	308	2	21	1	332	15	834	1	0	850	1665
% Passenger Vehicles																					
Heavy Vehicles	0	0	0	0	0	0	30	9	0	39	11	0	2	0	13	1	15	0	0	16	68
% Heavy Vehicles	0	0	0	0	0	0	7.7	7.1	0	7.5	3.4	0	8.7	0	3.8	6.2	1.8	0	0	1.8	3.9

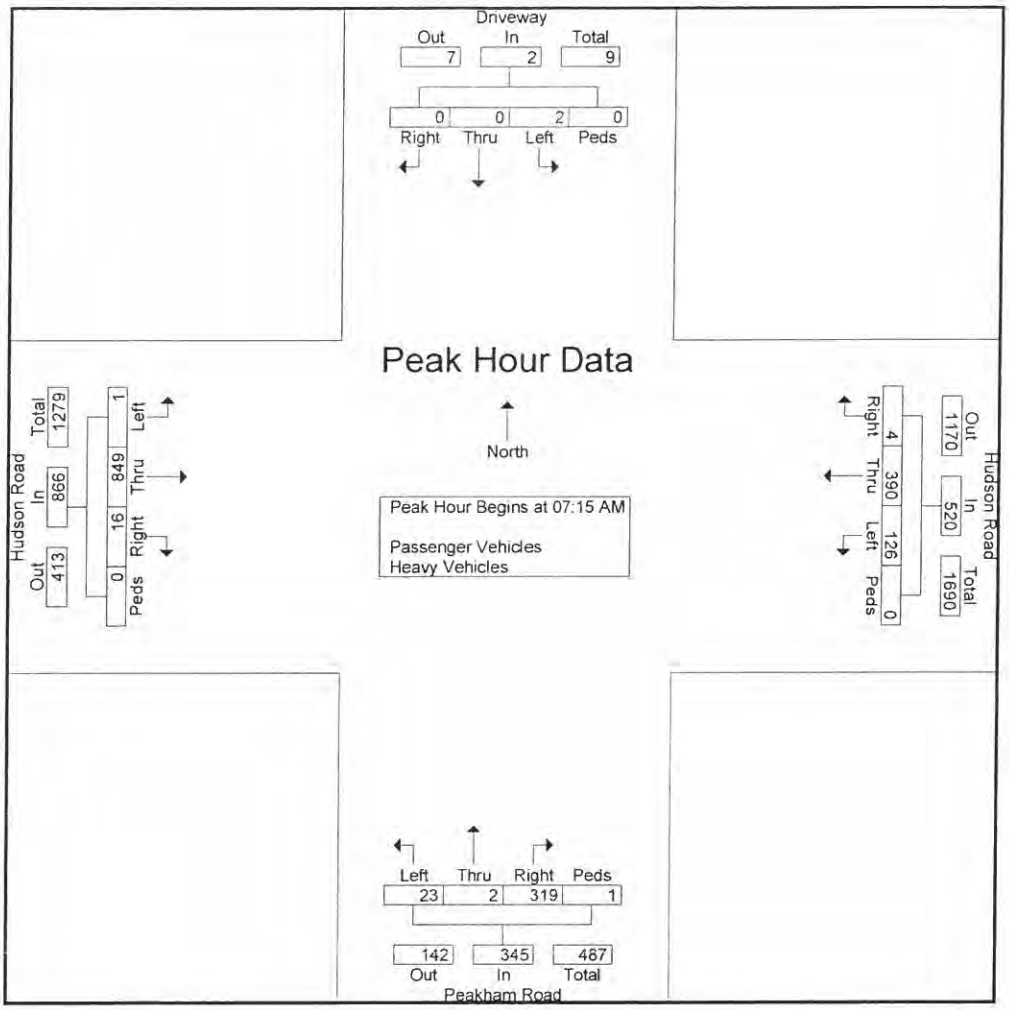
	Driveway From North					Hudson Road From East					Peakham Road From South					Hudson Road From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:15 AM to 08:00 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:15 AM																					
07:15 AM	0	0	**1**	0	**1**	0	73	**54**	0	127	**105**	0	5	0	**110**	1	**225**	0	0	**226**	464
07:30 AM	0	0	0	0	0	**2**	**114**	36	0	**152**	99	0	4	**1**	104	4	205	0	0	209	**465**
07:45 AM	0	0	1	0	1	0	109	22	0	131	77	**2**	**8**	0	87	4	200	**1**	0	205	424
08:00 AM	0	0	0	0	0	2	94	14	0	110	38	0	6	0	44	**7**	219	0	0	226	380
Total Volume	0	0	2	0	2	4	390	126	0	520	319	2	23	1	345	16	849	1	0	866	1733
% App. Total	0	0	100	0		0.8	75	24.2	0		92.5	0.6	6.7	0.3		1.8	98	0.1	0		
PHF	.000	.000	.500	.000	.500	.500	.855	.583	.000	.855	.760	.250	.719	.250	.784	.571	.943	.250	.000	.958	.932

MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA

N: Driveway
S: Peakham Road
E/W: Hudson Road
Sudbury, MA

File Name : 814 Peakham at Hudson 715-815am
Site Code : 00814001
Start Date : 12/17/2014
Page No : 2



MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA

N: Connector Road
E/W: Old Sudbury Road
Sudbury, MA

File Name : 814 Connector road at Old Sudbury Road AM
Site Code : 81400002
Start Date : 12/23/2014
Page No : 1

Groups Printed- Passenger Vehicles

	Connector Road From North				Old Sudbury Road From East				Old Sudbury Road From West				
Start Time	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Int. Total
07:15 AM	2	4	0	6	3	0	0	3	0	1	0	1	10
07:30 AM	6	10	0	16	5	0	0	5	0	1	0	1	22
07:45 AM	3	11	0	14	7	0	0	7	0	0	0	0	21
Total	11	25	0	36	15	0	0	15	0	2	0	2	53
08:00 AM	0	14	0	14	8	0	0	8	0	0	0	0	22
Grand Total	11	39	0	50	23	0	0	23	0	2	0	2	75
Apprch %	22	78	0		100	0	0		0	100	0		
Total %	14.7	52	0	66.7	30.7	0	0	30.7	0	2.7	0	2.7	

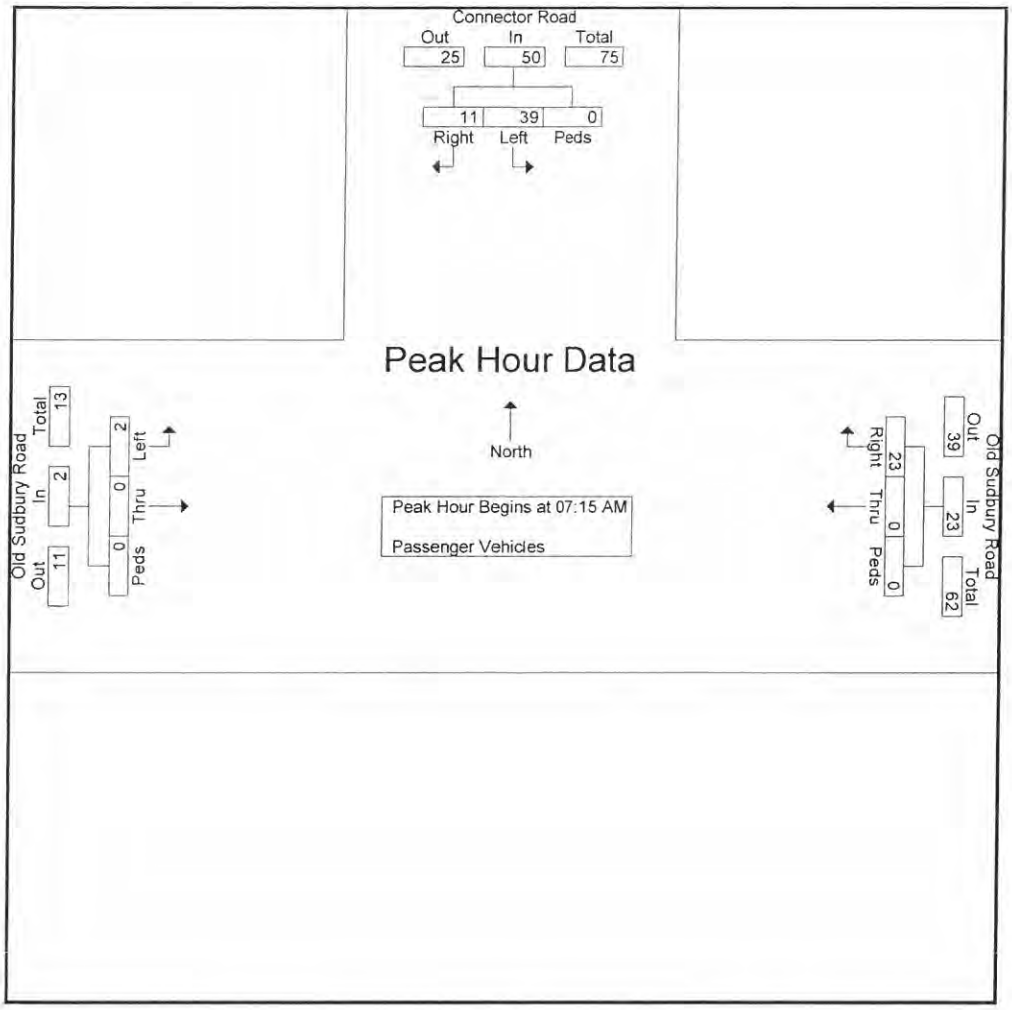
	Connector Road From North				Old Sudbury Road From East				Old Sudbury Road From West				
Start Time	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:15 AM to 08:00 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:15 AM													
07:15 AM	2	4	0	6	3	0	0	3	0	**1**	0	**1**	10
07:30 AM	**6**	10	0	**16**	5	0	0	5	0	1	0	1	**22**
07:45 AM	3	11	0	14	7	0	0	7	0	0	0	0	21
08:00 AM	0	**14**	0	14	**8**	0	0	**8**	0	0	0	0	22
Total Volume	11	39	0	50	23	0	0	23	0	2	0	2	75
% App. Total	22	78	0		100	0	0		0	100	0		
PHF	.458	.696	.000	.781	.719	.000	.000	.719	.000	.500	.000	.500	.852

MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA

N: Connector Road
E/W: Old Sudbury Road
Sudbury, MA

File Name : 814 Connector road at Old Sudbury Road AM
Site Code : 81400002
Start Date : 12/23/2014
Page No : 2



MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA

N: Cementary Drive
S: Connector Road
E/W: Concord Road
Sudbury, MA

File Name : 814 Connector Road at Concord Road AM
Site Code : 08140001
Start Date : 12/23/2014
Page No : 1

Groups Printed- Passenger Vehicles - Heavy Vehicles

	Cementary Drive From North					Concord Road From East					Connector Road From South					Concord Road From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:15 AM	0	0	0	0	0	0	0	6	0	6	4	0	1	0	5	0	0	0	0	0	11
07:30 AM	0	0	0	0	0	0	0	16	0	16	6	0	0	0	6	1	0	0	0	1	23
07:45 AM	0	0	0	0	0	0	0	13	0	13	6	0	0	0	6	1	0	0	0	1	20
Total	0	0	0	0	0	0	0	35	0	35	16	0	1	0	17	2	0	0	0	2	54
08:00 AM	0	0	0	0	0	0	0	15	0	15	6	0	0	0	6	2	0	0	0	2	23
Grand Total	0	0	0	0	0	0	0	50	0	50	22	0	1	0	23	4	0	0	0	4	77
Apprch %	0	0	0	0		0	0	100	0		95.7	0	4.3	0		100	0	0	0		
Total %	0	0	0	0	0	0	0	64.9	0	64.9	28.6	0	1.3	0	29.9	5.2	0	0	0	5.2	
Passenger Vehicles	0	0	0	0	0	0	0	50	0	50	22	0	1	0	23	4	0	0	0	4	77
% Passenger Vehicles																					
Heavy Vehicles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Heavy Vehicles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

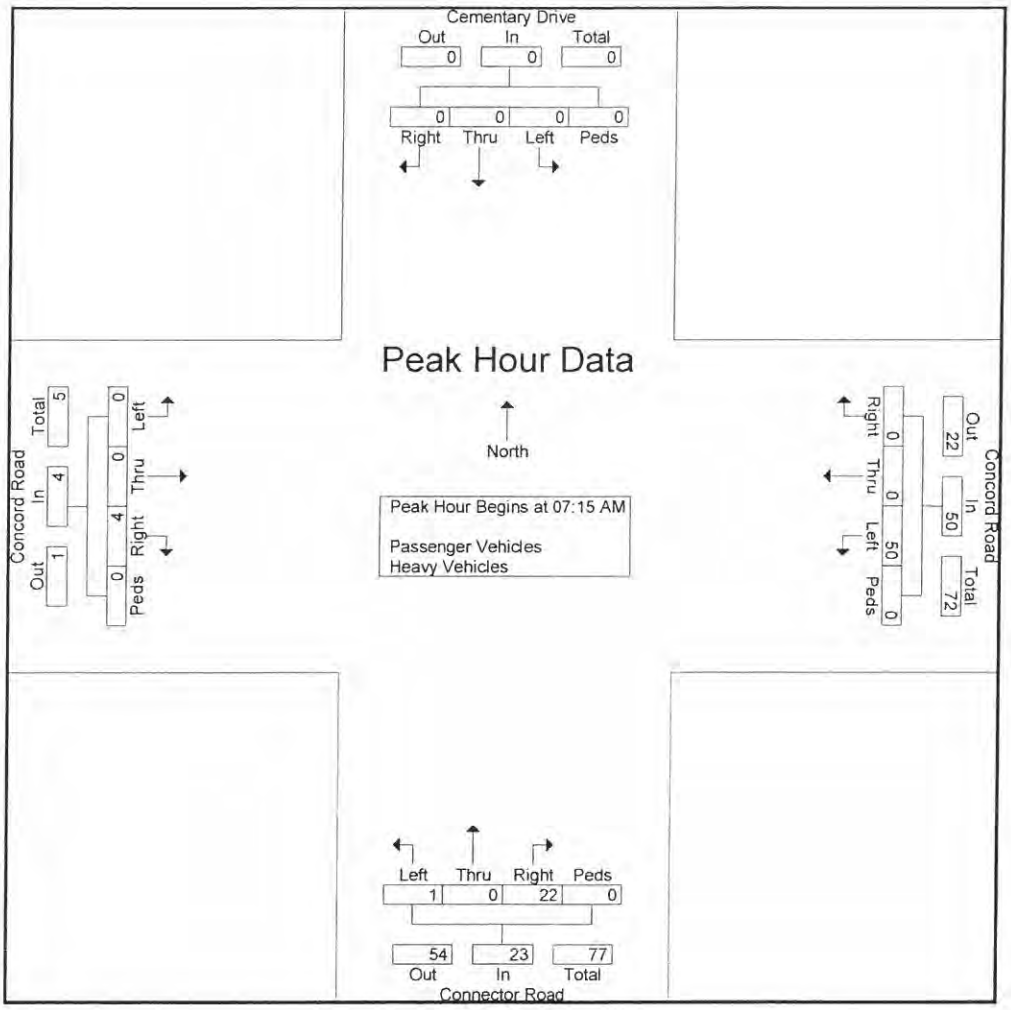
	Cementary Drive From North					Concord Road From East					Connector Road From South					Concord Road From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:15 AM to 08:00 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:15 AM																					
07:15 AM	0	0	0	0	0	0	0	6	0	6	4	0	**1**	0	5	0	0	0	0	0	11
07:30 AM	0	0	0	0	0	0	0	**16**	0	**16**	**6**	0	0	0	**6**	1	0	0	0	1	**23**
07:45 AM	0	0	0	0	0	0	0	13	0	13	6	0	0	0	6	1	0	0	0	1	20
08:00 AM	0	0	0	0	0	0	0	15	0	15	6	0	0	0	6	**2**	0	0	0	**2**	23
Total Volume	0	0	0	0	0	0	0	50	0	50	22	0	1	0	23	4	0	0	0	4	77
% App. Total	0	0	0	0		0	0	100	0		95.7	0	4.3	0		100	0	0	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.781	.000	.781	.917	.000	.250	.000	.958	.500	.000	.000	.000	.500	.837

MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA

N: Cementary Drive
S: Connector Road
E/W: Concord Road
Sudbury, MA

File Name : 814 Connector Road at Concord Road AM
Site Code : 08140001
Start Date : 12/23/2014
Page No : 2



MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA

N: Site Driveway
S: 29 Hudson Road Driveway
E/W: Hudson Road
Sudbury, MA

File Name : 814 29 Hudson Road Site Driveway AM
Site Code : 81400001
Start Date : 12/23/2014
Page No : 1

Groups Printed- Passenger Vehicles - Heavy Vehicles

	Site Driveway From North					Hudson Road From East					29 Hudson Road Site Driveway From South					Hudson Road From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:15 AM	0	0	0	0	0	0	0	3	0	3	0	0	0	0	0	0	0	0	0	0	3
*** BREAK ***																					
07:45 AM	0	0	0	0	0	0	0	1	0	1	0	0	1	0	1	1	0	0	0	1	3
Total	0	0	0	0	0	0	0	4	0	4	0	0	1	0	1	1	0	0	0	1	6
08:00 AM	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	2
Grand Total	0	0	0	0	0	0	0	6	0	6	0	0	1	0	1	1	0	0	0	1	8
Apprch %	0	0	0	0		0	0	100	0		0	0	100	0		100	0	0	0		
Total %	0	0	0	0	0	0	0	75	0	75	0	0	12.5	0	12.5	12.5	0	0	0	12.5	
Passenger Vehicles	0	0	0	0	0	0	0	4	0	4	0	0	1	0	1	1	0	0	0	1	6
% Passenger Vehicles																					
Heavy Vehicles	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	2
% Heavy Vehicles	0	0	0	0	0	0	0	33.3	0	33.3	0	0	0	0	0	0	0	0	0	0	25

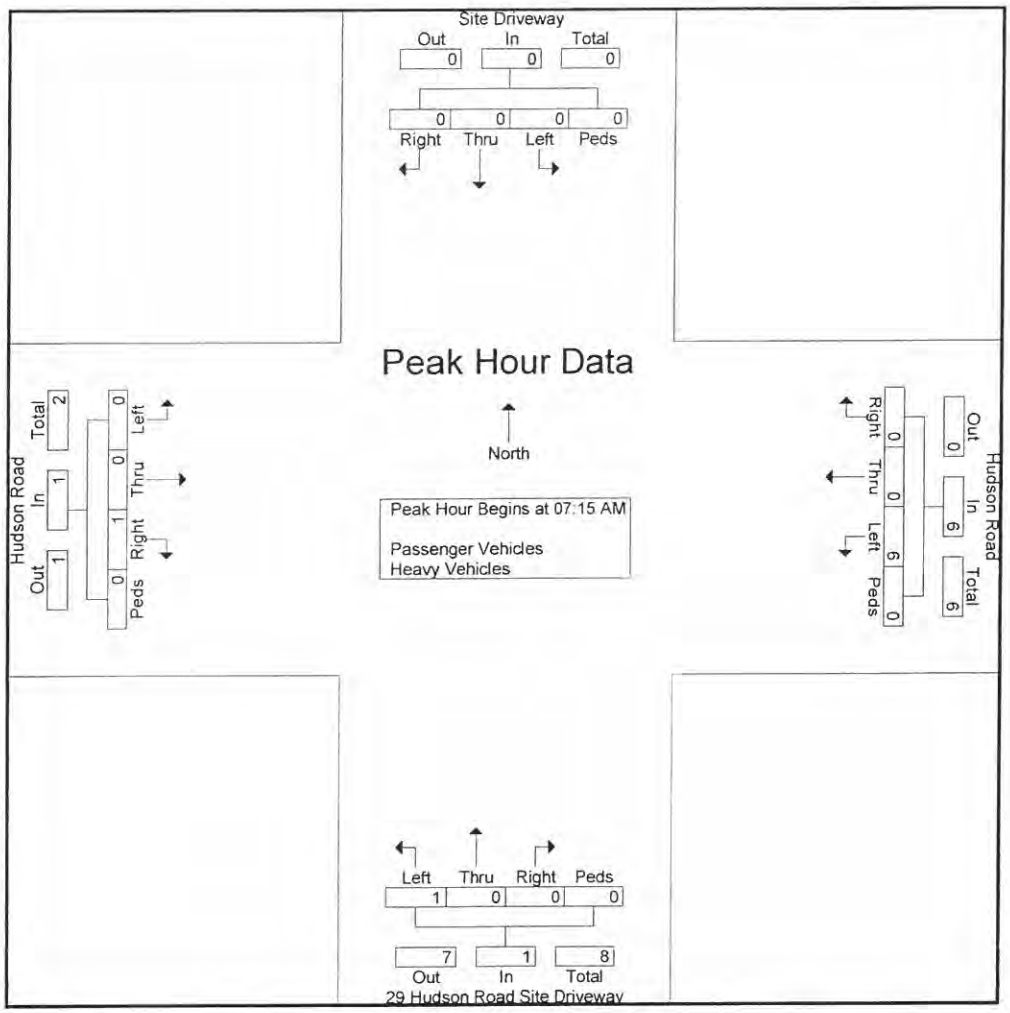
	Site Driveway From North					Hudson Road From East					29 Hudson Road Site Driveway From South					Hudson Road From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:15 AM to 08:00 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:15 AM																					
07:15 AM	0	0	0	0	0	0	0	**3**	0	**3**	0	0	0	0	0	0	0	0	0	0	**3**
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	1	0	1	0	0	**1**	0	**1**	**1**	0	0	0	**1**	3
08:00 AM	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	2
Total Volume	0	0	0	0	0	0	0	6	0	6	0	0	1	0	1	1	0	0	0	1	8
% App. Total	0	0	0	0		0	0	100	0		0	0	100	0		100	0	0	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.500	.000	.500	.000	.000	.250	.000	.250	.250	.000	.000	.000	.250	.667

MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA

N: Site Driveway
S: 29 Hudson Road Driveway
E/W: Hudson Road
Sudbury, MA

File Name : 814 29 Hudson Road Site Driveway AM
Site Code : 81400001
Start Date : 12/23/2014
Page No : 2



MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA

S: 29 Hudson Road Western Drive
E/W: Hudson Road
Sudbury, MA

File Name : 814 29 Hudson Road Western Driveway AM
Site Code : 8140003_
Start Date : 12/23/2014
Page No : 1

Groups Printed- Passenger Vehicles - Heavy Vehicles

	From East				From South				From West				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
*** BREAK ***													
07:45 AM	0	0	0	0	0	0	0	0	1	0	0	1	1
Total	0	0	0	0	0	0	0	0	1	0	0	1	1
08:00 AM	0	0	0	0	0	0	0	0	1	0	0	1	1
Grand Total	0	0	0	0	0	0	0	0	2	0	0	2	2
Apprch %	0	0	0		0	0	0		100	0	0		
Total %	0	0	0	0	0	0	0	0	100	0	0	100	
Passenger Vehicles	0	0	0	0	0	0	0	0	2	0	0	2	2
% Passenger Vehicles	0	0	0	0	0	0	0	0	100	0	0	100	100
Heavy Vehicles	0	0	0	0	0	0	0	0	0	0	0	0	0
% Heavy Vehicles	0	0	0	0	0	0	0	0	0	0	0	0	0

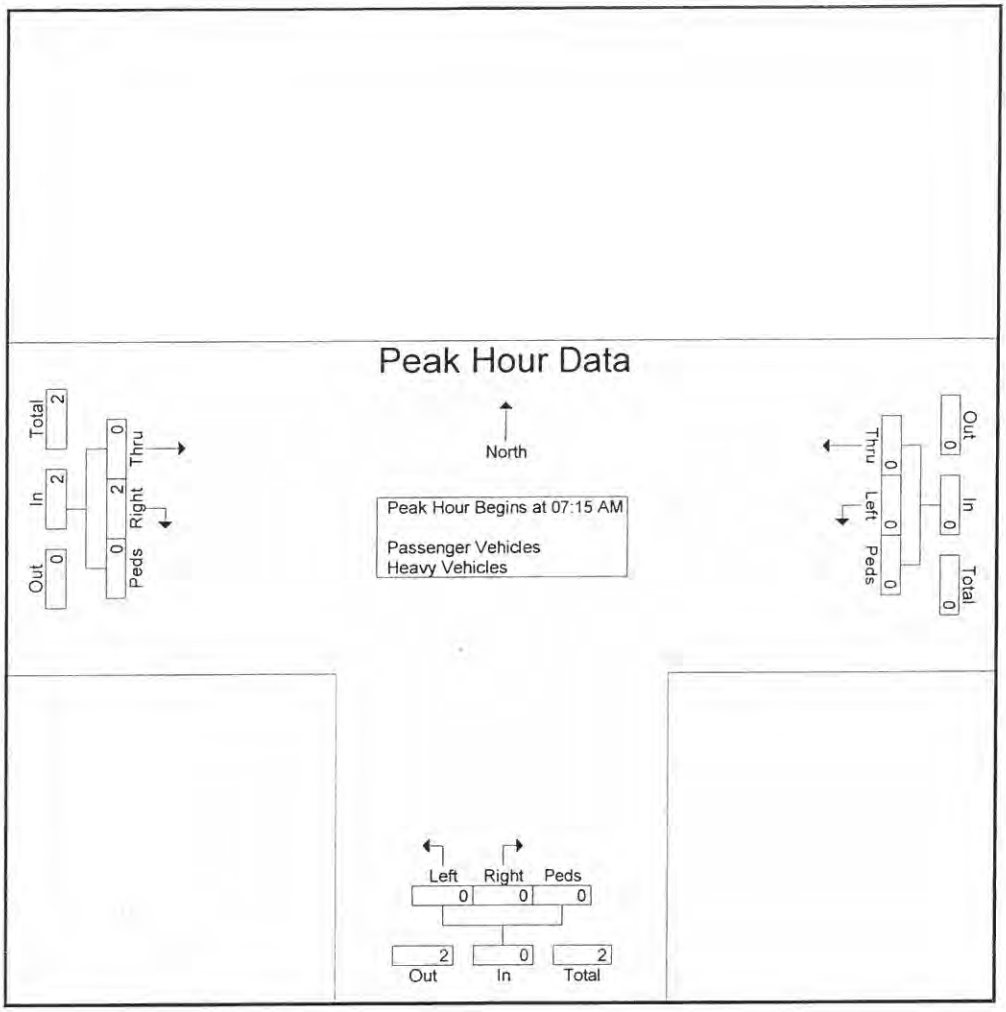
	From East				From South				From West				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:15 AM to 08:00 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:15 AM													
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	1	0	0	1	1
08:00 AM	0	0	0	0	0	0	0	0	1	0	0	1	1
Total Volume	0	0	0	0	0	0	0	0	2	0	0	2	2
% App. Total	0	0	0		0	0	0		100	0	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.500	.000	.000	.500	.500

MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA

S: 29 Hudson Road Western Drive
E/W: Hudson Road
Sudbury, MA

File Name : 814 29 Hudson Road Western Driveway AM
Site Code : 8140003_
Start Date : 12/23/2014
Page No : 2



MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA

N/S: Concord Road
W: Hudson Road
E: Old Sudbury Road
Sudbury, MA

File Name : 814 Concord Road at Hudson Road PM
Site Code : 81400003
Start Date : 12/17/2014
Page No : 1

Groups Printed- Passenger Vehicles - Heavy Vehicles

	Concord Road From North					Old Sudbury Road From East					Concord Road From South					Hudson Road From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
04:00 PM	43	77	0	0	120	0	154	16	0	170	7	77	63	0	147	62	72	25	0	159	596
04:15 PM	37	69	0	0	106	0	171	10	0	181	11	77	58	0	146	68	57	25	0	150	583
04:30 PM	46	61	1	0	108	1	161	14	0	176	11	66	69	0	146	71	53	18	0	142	572
04:45 PM	36	65	1	0	102	0	143	14	0	157	5	57	66	0	128	78	64	14	0	156	543
Total	162	272	2	0	436	1	629	54	0	684	34	277	256	0	567	279	246	82	0	607	2294
05:00 PM	56	60	0	0	116	0	184	14	0	198	6	98	50	0	154	61	67	25	0	153	621
05:15 PM	57	63	0	0	120	0	176	23	0	199	10	76	63	0	149	61	82	20	0	163	631
05:30 PM	63	47	1	0	111	0	192	14	0	206	6	102	60	0	168	65	73	20	0	158	643
05:45 PM	47	70	0	0	117	0	169	19	0	188	8	81	57	0	146	66	96	23	0	185	636
Total	223	240	1	0	464	0	721	70	0	791	30	357	230	0	617	253	318	88	0	659	2531
Grand Total	385	512	3	0	900	1	1350	124	0	1475	64	634	486	0	1184	532	564	170	0	1266	4825
Apprch %	42.8	56.9	0.3	0		0.1	91.5	8.4	0		5.4	53.5	41	0		42	44.5	13.4	0		
Total %	8	10.6	0.1	0	18.7	0	28	2.6	0	30.6	1.3	13.1	10.1	0	24.5	11	11.7	3.5	0	26.2	
Passenger Vehicles	383	508	3	0	894	1	1342	122	0	1465	64	631	479	0	1174	525	549	166	0	1240	4773
% Passenger Vehicles	99.5	99.2	100	0	99.3	100	99.4	98.4	0	99.3	100	99.5	98.6	0	99.2	98.7	97.3	97.6	0	97.9	98.9
Heavy Vehicles	2	4	0	0	6	0	8	2	0	10	0	3	7	0	10	7	15	4	0	26	52
% Heavy Vehicles	0.5	0.8	0	0	0.7	0	0.6	1.6	0	0.7	0	0.5	1.4	0	0.8	1.3	2.7	2.4	0	2.1	1.1

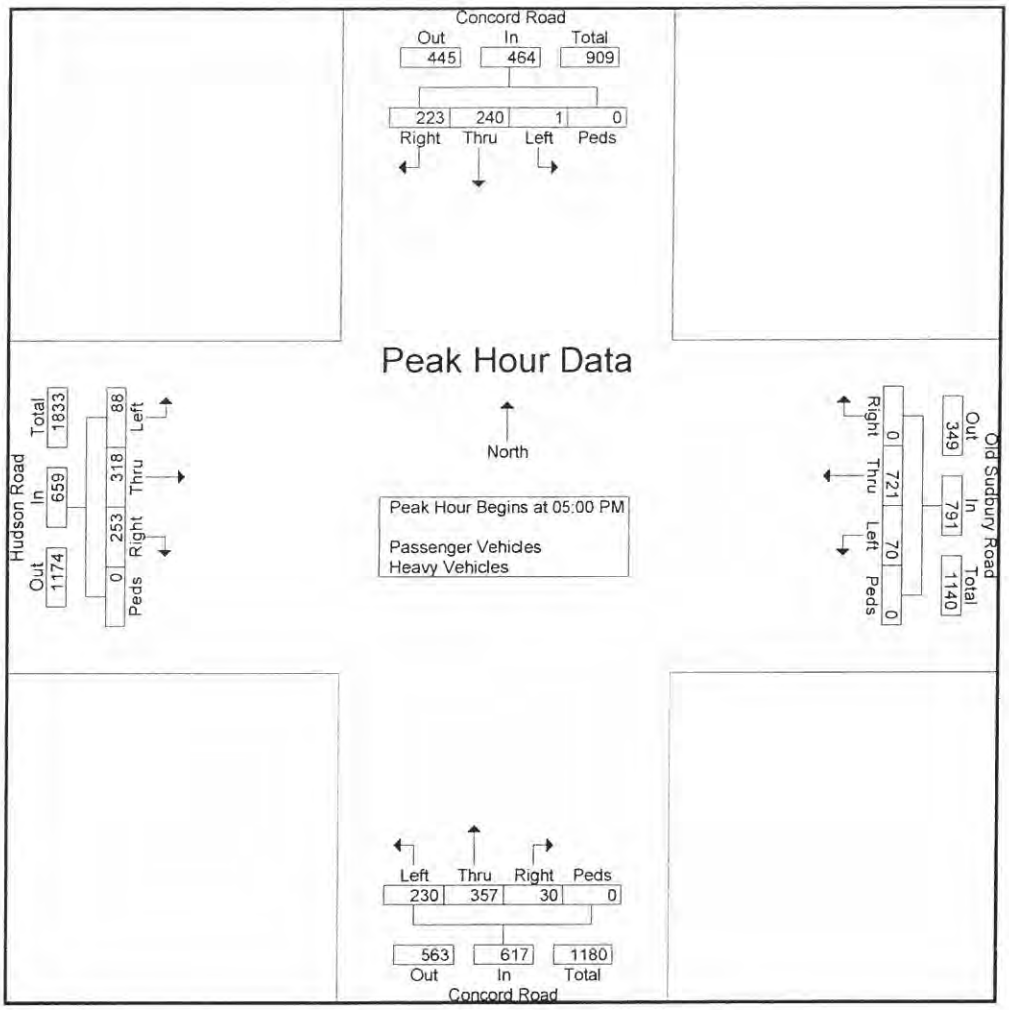
	Concord Road From North					Old Sudbury Road From East					Concord Road From South					Hudson Road From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	56	60	0	0	116	0	184	14	0	198	6	98	50	0	154	61	67	**25**	0	153	621
05:15 PM	57	63	0	0	**120**	0	176	**23**	0	199	**10**	76	**63**	0	149	61	82	20	0	163	631
05:30 PM	**63**	47	**1**	0	111	0	**192**	14	0	**206**	6	**102**	60	0	**168**	65	73	20	0	158	**643**
05:45 PM	47	**70**	0	0	117	0	169	19	0	188	8	81	57	0	146	**66**	**96**	23	0	**185**	636
Total Volume	223	240	1	0	464	0	721	70	0	791	30	357	230	0	617	253	318	88	0	659	2531
% App. Total	48.1	51.7	0.2	0		0	91.2	8.8	0		4.9	57.9	37.3	0		38.4	48.3	13.4	0		
PHF	.885	.857	.250	.000	.967	.000	.939	.761	.000	.960	.750	.875	.913	.000	.918	.958	.828	.880	.000	.891	.984

MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA

N/S: Concord Road
W: Hudson Road
E: Old Sudbury Road
Sudbury, MA

File Name : 814 Concord Road at Hudson Road PM
Site Code : 81400003
Start Date : 12/17/2014
Page No : 2



MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA

N: Driveway
S: Peakham Road
E/W: Hudson Road
Sudbury, MA

File Name : 814 Peakham at Hudson Road 5-6pm
Site Code : 81400000
Start Date : 12/17/2014
Page No : 1

Groups Printed- Passenger Vehicles - Heavy Vehicles

	Driveway From North					Hudson Road From East					Peakham Road From South					Hudson Road From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
05:00 PM	0	1	10	0	11	0	253	47	0	300	25	1	14	0	40	6	138	0	0	144	495
05:15 PM	0	0	0	0	0	0	226	52	0	278	34	0	11	0	45	2	143	0	0	145	468
05:30 PM	0	0	0	0	0	0	258	59	0	317	25	0	12	0	37	6	129	0	0	135	489
05:45 PM	0	0	0	0	0	0	220	45	0	265	30	0	6	0	36	5	159	0	0	164	465
Total	0	1	10	0	11	0	957	203	0	1160	114	1	43	0	158	19	569	0	0	588	1917
Grand Total	0	1	10	0	11	0	957	203	0	1160	114	1	43	0	158	19	569	0	0	588	1917
Apprch %	0	9.1	90.9	0		0	82.5	17.5	0		72.2	0.6	27.2	0		3.2	96.8	0	0		
Total %	0	0.1	0.5	0	0.6	0	49.9	10.6	0	60.5	5.9	0.1	2.2	0	8.2	1	29.7	0	0	30.7	
Passenger Vehicles	0	0	10	0	10	0	953	203	0	1156	114	0	42	0	156	19	563	0	0	582	1904
% Passenger Vehicles																					
Heavy Vehicles	0	1	0	0	1	0	4	0	0	4	0	1	1	0	2	0	6	0	0	6	13
% Heavy Vehicles	0	100	0	0	9.1	0	0.4	0	0	0.3	0	100	2.3	0	1.3	0	1.1	0	0	1	0.7

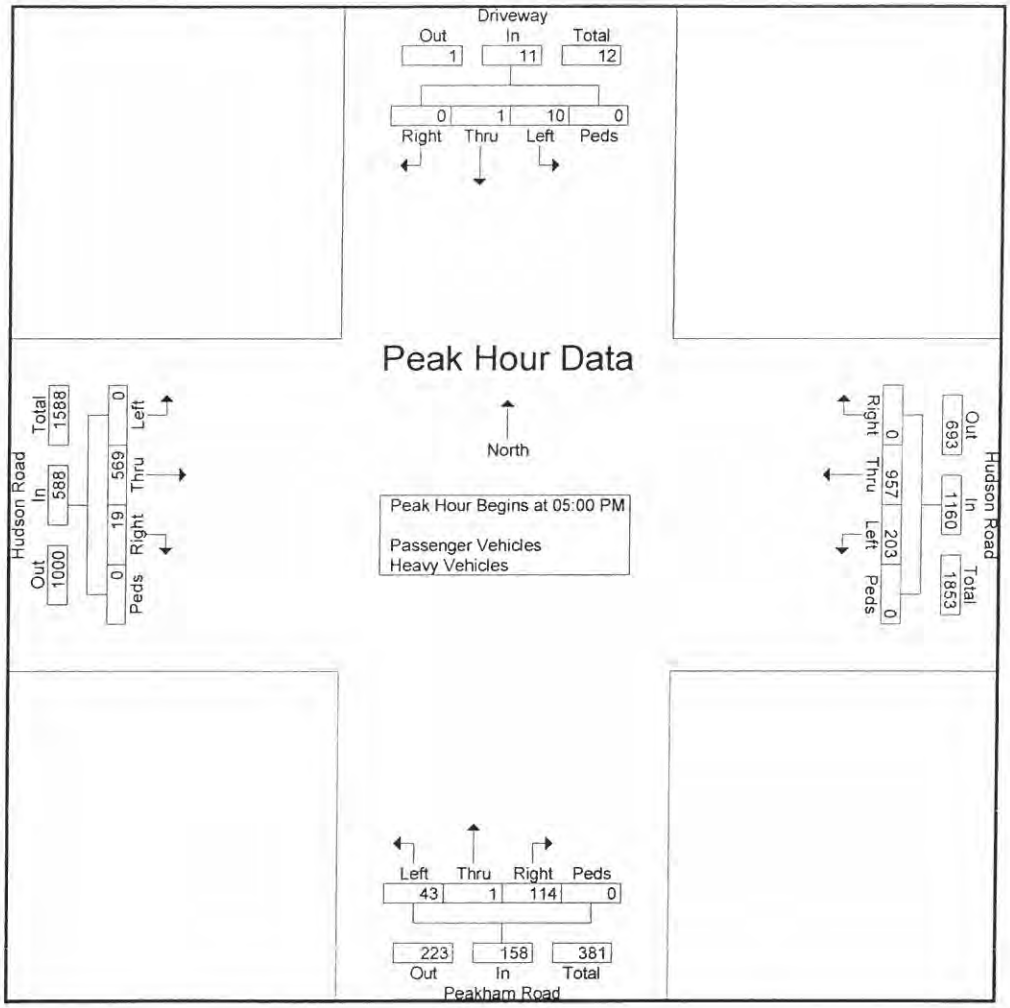
	Driveway From North					Hudson Road From East					Peakham Road From South					Hudson Road From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 05:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	0	**1**	**10**	0	**11**	0	253	47	0	300	25	**1**	**14**	0	40	**6**	138	0	0	144	**495**
05:15 PM	0	0	0	0	0	0	226	52	0	278	**34**	0	11	0	**45**	2	143	0	0	145	468
05:30 PM	0	0	0	0	0	0	**258**	**59**	0	**317**	25	0	12	0	37	6	129	0	0	135	489
05:45 PM	0	0	0	0	0	0	220	45	0	265	30	0	6	0	36	5	**159**	0	0	**164**	465
Total Volume	0	1	10	0	11	0	957	203	0	1160	114	1	43	0	158	19	569	0	0	588	1917
% App. Total	0	9.1	90.9	0		0	82.5	17.5	0		72.2	0.6	27.2	0		3.2	96.8	0	0		
PHF	.000	.250	.250	.000	.250	.000	.927	.860	.000	.915	.838	.250	.768	.000	.878	.792	.895	.000	.000	.896	.968

MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA

N: Driveway
S: Peakham Road
E/W: Hudson Road
Sudbury, MA

File Name : 814 Peakham at Hudson Road 5-6pm
Site Code : 81400000
Start Date : 12/17/2014
Page No : 2



MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA

N: Connector Road
E/W: Old Sudbury Road
Sudbury, MA

File Name : 814 Connector Road at Old Sudbury PM
Site Code : 81400004
Start Date : 12/23/2014
Page No : 1

Groups Printed- Passenger Vehicles

	Connector Road From North				Old Sudbury Road From East				Old Sudbury Road From West				
Start Time	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Int. Total
05:00 PM	2	4	0	6	7	0	0	7	0	0	0	0	13
05:15 PM	5	5	0	10	7	0	0	7	0	0	0	0	17
05:30 PM	7	5	0	12	14	0	0	14	0	1	0	1	27
05:45 PM	7	5	0	12	12	0	0	12	0	1	0	1	25
Total	21	19	0	40	40	0	0	40	0	2	0	2	82
Grand Total	21	19	0	40	40	0	0	40	0	2	0	2	82
Apprch %	52.5	47.5	0		100	0	0		0	100	0		
Total %	25.6	23.2	0	48.8	48.8	0	0	48.8	0	2.4	0	2.4	

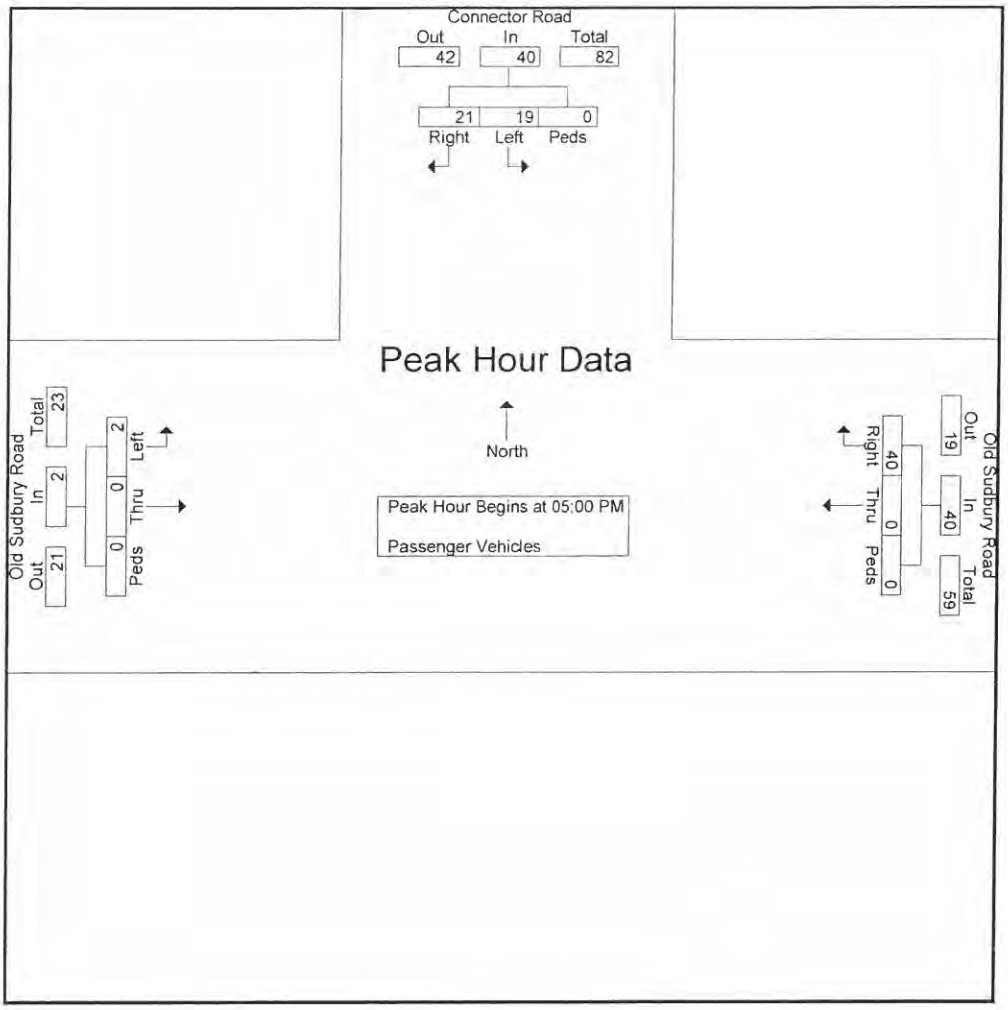
	Connector Road From North				Old Sudbury Road From East				Old Sudbury Road From West				
Start Time	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 05:00 PM to 05:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 05:00 PM													
05:00 PM	2	4	0	6	7	0	0	7	0	0	0	0	13
05:15 PM	5	**5**	0	10	7	0	0	7	0	0	0	0	17
05:30 PM	**7**	5	0	**12**	**14**	0	0	**14**	0	**1**	0	**1**	**27**
05:45 PM	7	5	0	12	12	0	0	12	0	1	0	1	25
Total Volume	21	19	0	40	40	0	0	40	0	2	0	2	82
% App. Total	52.5	47.5	0		100	0	0		0	100	0		
PHF	.750	.950	.000	.833	.714	.000	.000	.714	.000	.500	.000	.500	.759

MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA

N: Connector Road
E/W: Old Sudbury Road
Sudbury, MA

File Name : 814 Connector Road at Old Sudbury PM
Site Code : 81400004
Start Date : 12/23/2014
Page No : 2



MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA

N: Cemetery Drive
S: Connector Road
E/W: Concord Road
Sudbury, MA

File Name : 814 Connector at Concord PM
Site Code : 08140003
Start Date : 12/23/2014
Page No : 1

Groups Printed- Passenger Vehicles - Heavy Vehicles

	Cemetery Drive From North					Concord Road From East					Connector Road From South					Concord Road From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
05:00 PM	0	0	0	0	0	0	0	3	0	3	7	0	0	0	7	2	0	0	0	2	12
05:15 PM	0	0	0	0	0	0	0	6	0	6	6	0	1	0	7	7	0	0	0	7	20
05:30 PM	0	0	0	0	0	0	0	7	0	7	13	0	1	0	14	11	0	0	0	11	32
05:45 PM	0	0	0	0	0	0	0	9	0	9	10	0	1	0	11	10	0	0	0	10	30
Total	0	0	0	0	0	0	0	25	0	25	36	0	3	0	39	30	0	0	0	30	94
Grand Total	0	0	0	0	0	0	0	25	0	25	36	0	3	0	39	30	0	0	0	30	94
Apprch %	0	0	0	0		0	0	100	0		92.3	0	7.7	0		100	0	0	0		
Total %	0	0	0	0	0	0	0	26.6	0	26.6	38.3	0	3.2	0	41.5	31.9	0	0	0	31.9	
Passenger Vehicles	0	0	0	0	0	0	0	25	0	25	35	0	3	0	38	30	0	0	0	30	93
% Passenger Vehicles																					
Heavy Vehicles	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1
% Heavy Vehicles	0	0	0	0	0	0	0	0	0	0	2.8	0	0	0	2.6	0	0	0	0	0	1.1

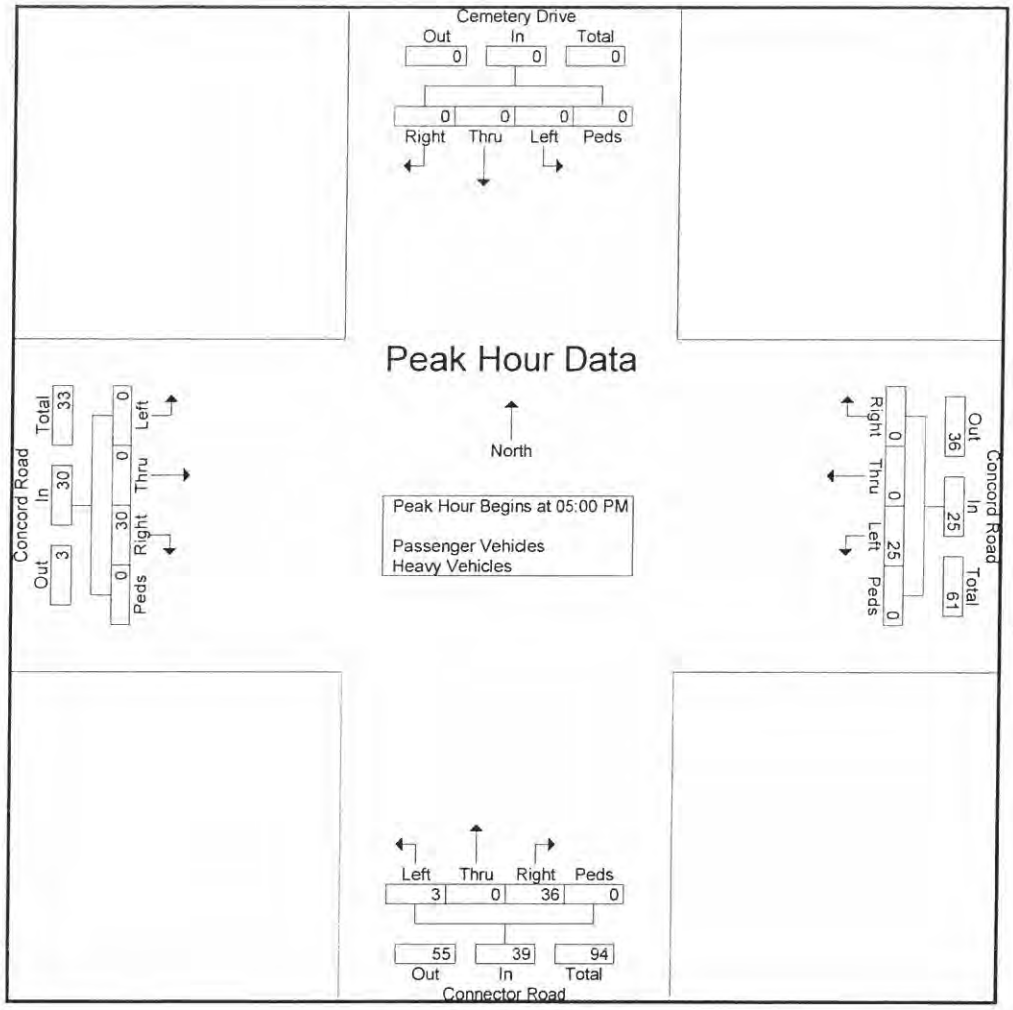
	Cemetery Drive From North					Concord Road From East					Connector Road From South					Concord Road From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 05:00 PM to 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	0	0	3	0	3	7	0	0	0	7	2	0	0	0	2	12
05:15 PM	0	0	0	0	0	0	0	6	0	6	6	0	**1**	0	7	7	0	0	0	7	20
05:30 PM	0	0	0	0	0	0	0	7	0	7	**13**	0	1	0	**14**	**11**	0	0	0	**11**	**32**
05:45 PM	0	0	0	0	0	0	0	**9**	0	**9**	10	0	1	0	11	10	0	0	0	10	30
Total Volume	0	0	0	0	0	0	0	25	0	25	36	0	3	0	39	30	0	0	0	30	94
% App. Total	0	0	0	0		0	0	100	0		92.3	0	7.7	0		100	0	0	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.694	.000	.694	.692	.000	.750	.000	.696	.682	.000	.000	.000	.682	.734

MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA

N: Cemetery Drive
S: Connector Road
E/W: Concord Road
Sudbury, MA

File Name : 814 Connector at Concord PM
Site Code : 08140003
Start Date : 12/23/2014
Page No : 2



MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA

N: Site Driveway
S: 29 Hudson Road Site Driveway
E/W: 29 Hudson Road
Sudbury, MA

File Name : 814 29 Hudson Road Site Driveway PM
Site Code : 81400002
Start Date : 12/23/2014
Page No : 1

Groups Printed- Passenger Vehicles - Heavy Vehicles

	From North					From East					From South					From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
05:00 PM	0	0	0	0	0	0	0	5	0	5	2	0	5	0	7	3	0	0	0	3	15
05:15 PM	0	0	0	0	0	0	0	6	0	6	0	0	2	0	2	5	0	0	0	5	13
05:30 PM	0	0	0	0	0	0	0	6	0	6	4	0	4	0	8	6	0	0	0	6	20
05:45 PM	0	0	0	0	0	0	0	6	0	6	0	0	3	0	3	10	0	0	0	10	19
Total	0	0	0	0	0	0	0	23	0	23	6	0	14	0	20	24	0	0	0	24	67
Grand Total	0	0	0	0	0	0	0	23	0	23	6	0	14	0	20	24	0	0	0	24	67
Apprch %	0	0	0	0		0	0	100	0		30	0	70	0		100	0	0	0		
Total %	0	0	0	0	0	0	0	34.3	0	34.3	9	0	20.9	0	29.9	35.8	0	0	0	35.8	
Passenger Vehicles	0	0	0	0	0	0	0	23	0	23	6	0	14	0	20	24	0	0	0	24	67
% Passenger Vehicles																					
Heavy Vehicles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Heavy Vehicles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

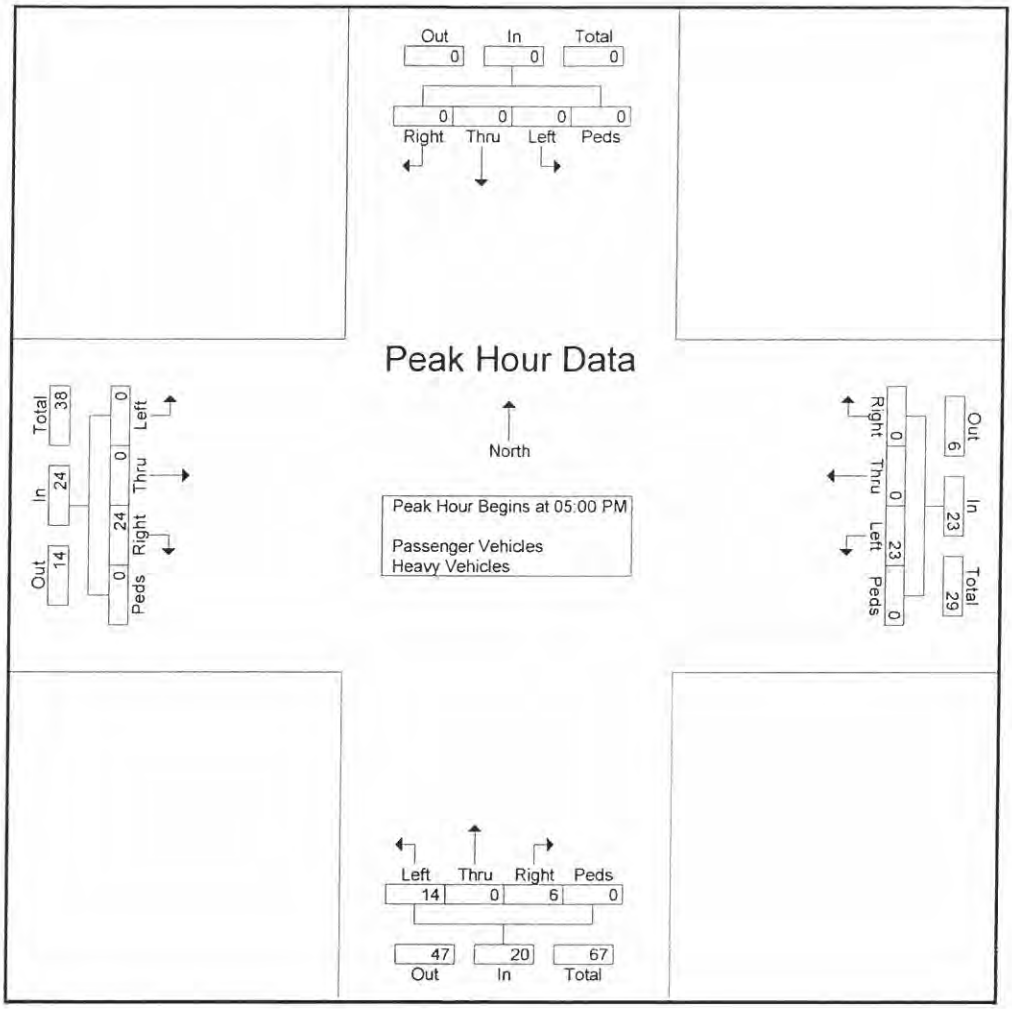
	From North					From East					From South					From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 05:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	0	0	0	0	0	0	0	5	0	5	2	0	**5**	0	7	3	0	0	0	3	15
05:15 PM	0	0	0	0	0	0	0	**6**	0	**6**	0	0	2	0	2	5	0	0	0	5	13
05:30 PM	0	0	0	0	0	0	0	6	0	6	**4**	0	4	0	**8**	6	0	0	0	6	**20**
05:45 PM	0	0	0	0	0	0	0	6	0	6	0	0	3	0	3	**10**	0	0	0	**10**	19
Total Volume	0	0	0	0	0	0	0	23	0	23	6	0	14	0	20	24	0	0	0	24	67
% App. Total	0	0	0	0		0	0	100	0		30	0	70	0		100	0	0	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.958	.000	.958	.375	.000	.700	.000	.625	.600	.000	.000	.000	.600	.838

MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA

N: Site Driveway
S: 29 Hudson Road Site Driveway
E/W: 29 Hudson Road
Sudbury, MA

File Name : 814 29 Hudson Road Site Driveway PM
Site Code : 81400002
Start Date : 12/23/2014
Page No : 2



MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA

S: 29 Hudson Road Western Driveway
E/W: Hudson Road
Sudbury, MA

File Name : 814 29 Hudson Road Western Driveway PM
Site Code : 81400004
Start Date : 12/23/2014
Page No : 1

Groups Printed- Passenger Vehicles - Heavy Vehicles

	From East				From South				From West				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
05:00 PM	0	0	0	0	2	3	0	5	4	0	0	4	9
05:15 PM	0	1	0	1	1	5	0	6	1	0	0	1	8
05:30 PM	0	0	0	0	2	4	0	6	0	0	0	0	6
05:45 PM	0	0	0	0	4	2	0	6	1	0	0	1	7
Total	0	1	0	1	9	14	0	23	6	0	0	6	30
Grand Total	0	1	0	1	9	14	0	23	6	0	0	6	30
Apprch %	0	100	0		39.1	60.9	0		100	0	0		
Total %	0	3.3	0	3.3	30	46.7	0	76.7	20	0	0	20	
Passenger Vehicles	0	1	0	1	9	14	0	23	6	0	0	6	30
% Passenger Vehicles	0	100	0	100	100	100	0	100	100	0	0	100	100
Heavy Vehicles	0	0	0	0	0	0	0	0	0	0	0	0	0
% Heavy Vehicles	0	0	0	0	0	0	0	0	0	0	0	0	0

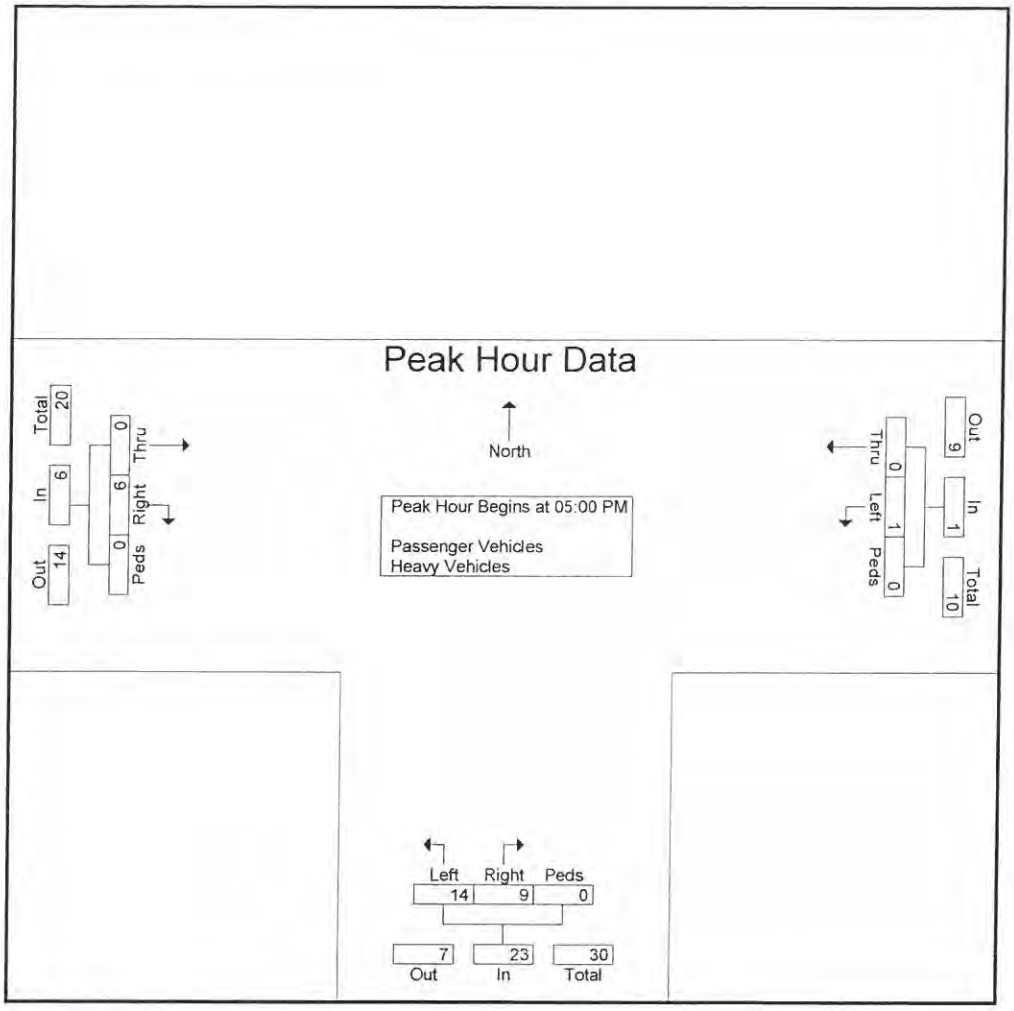
	From East				From South				From West				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 05:00 PM to 05:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 05:00 PM													
05:00 PM	0	0	0	0	2	3	0	5	**4**	0	0	**4**	**9**
05:15 PM	0	**1**	0	**1**	1	**5**	0	**6**	1	0	0	1	8
05:30 PM	0	0	0	0	2	4	0	6	0	0	0	0	6
05:45 PM	0	0	0	0	**4**	2	0	6	1	0	0	1	7
Total Volume	0	1	0	1	9	14	0	23	6	0	0	6	30
% App. Total	0	100	0		39.1	60.9	0		100	0	0		
PHF	.000	.250	.000	.250	.563	.700	.000	.958	.375	.000	.000	.375	.833

MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA

S: 29 Hudson Road Western Driveway
E/W: Hudson Road
Sudbury, MA

File Name : 814 29 Hudson Road Western Driveway PM
Site Code : 81400004
Start Date : 12/23/2014
Page No : 2



□ Seasonal/Yearly Growth Data

SECTION I - CONTINUOUS COUNTING STATION MONTHLY AVERAGE DAILY TRAFFIC

STATION 403 - CONCORD - RTE.2 - 0.2 km EAST OF CONCORD ROTARY

YR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR	December Adjustment to Year
06	44,150	43,659	46,395	45,607	46,453	49,481	43,449	45,449	45,925	49,000	44,963	*43,417*	45,662	1.05
	-5%	-4%	-5%	-2%	1%	-1%	2%	0%	-1%	0%	-4%	-4%	-2%	
07	41,988	41,749	43,930	44,696	46,932	49,031	44,131	45,508	45,546	49,000	43,366	41,478	44,780	1.08
	2%	2%	-1%	2%	-3%	-3%	-1%	-4%	-1%	-5%	-3%	-4%	-1%	
08	43,000	42,665	43,583	45,399	45,662	47,666	43,805	43,567	45,196	46,795	42,144	39,843	44,110	1.11
	-3%	-2%	7%	11%	1%	-2%	-1%	-9%	-10%	-1%	3%	11%	0%	
10	41,546	41,883	46,472	50,492	45,910	46,524	43,534	39,595	40,709	46,285	43,576	44,350	44,240	1.00
	-6%	-4%	-6%	-12%	0%	-1%	0%	9%	10%	-2%	-1%	-5%	-2%	
11	39,037	40,138	43,732	44,191	45,777	46,145	43,496	43,117	44,740	45,508	43,282	42,043	43,434	1.03
	6%	5%	-2%	0%	0%	-1%	-7%	4%	0%	-1%	-1%	-1%	0%	
12	41,311	42,111	43,069	44,294	45,759	45,640	40,408	44,775	44,720	44,904	42,980	41,701	43,473	1.04
	1%	-7%	-2%	-3%	-3%	-1%	4%	-3%	-1%	0%	-1%	3%	-1%	
13	41,792	39,095	42,007	42,993	44,222	44,984	41,995	43,310	44,422	45,062	42,684	42,773	42,945	1.00
												Growth	**-0.88%**	1.05 Sub Average

STATION 307 - WESTBOROUGH - RTE.9 - EAST OF NORTHBOROUGH T.L.

YR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR	
06	44,301	44,854	50,326	51,170	51,729	52,438	48,052	50,270	50,998	50,194	50,043	*50,032*	49,534	0.99
	7%	5%	-2%	-4%	-3%	-1%	10%	4%	-4%	1%	-1%	-6%	0%	
07	47,505	47,283	49,268	49,136	*50,000*	*52,000*	*53,000*	52,322	49,031	50,571	49,662	47,007	49,732	1.06
	-4%	-2%	-3%	1%	1%	-4%	-8%	-7%	-1%	-3%	-4%	-1%	-3%	
08	45,614	46,112	47,829	49,816	*50,518*	*49,936*	*48,629*	48,759	48,531	49,009	47,490	46,696	48,245	1.03
	-3%	1%	-3%	-2%	-2%	0%	-2%	-3%	-2%	-1%	0%	2%	-1%	
09	44,103	46,434	46,455	49,049	*49,474*	*49,934*	*47,638*	47,056	47,762	48,663	47,379	47,564	47,626	1.00
	-1%	0%	2%	0%	0%	1%	-1%	1%	1%	1%	2%	2%	1%	
11	43,244	46,150	48,016	48,943	*49,781*	*50,525*	*46,812*	48,234	48,825	49,198	49,151	49,888	48,231	0.97
	7%	2%	1%	-1%	1%	-1%	3%	4%	0%	2%	2%	-5%	1%	
12	46,381	46,883	48,608	48,662	*50,126*	*49,961*	*48,380*	49,941	48,882	50,056	50,015	47,600	48,791	1.03
												Growth	**-0.48%**	1.01 Sub Average

Average Adjusment Factor 1.03

MADT

ITALICS = ESTIMATED DATA

□ Intersection Crash Data

Moving Massachusetts Forward

massDOT Highway

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Sudbury, MA COUNT DATE : Dec. 17, 2014

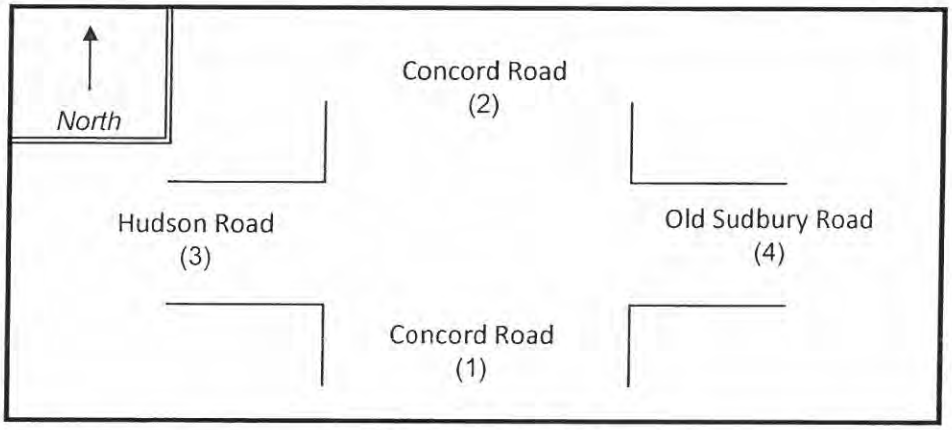
DISTRICT : 3 UNSIGNALIZED : [ ] SIGNALIZED : [X]

~ INTERSECTION DATA ~

MAJOR STREET : Hudson Road/ Old Sudbury Road

MINOR STREET(S) : Concord Road

INTERSECTION DIAGRAM (Label Approaches)



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	NB	SB	EB	WB		
PEAK HOURLY VOLUMES (PM) :	636	478	680	815		2,609

" K " FACTOR : **0.08**

INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **32,613**

TOTAL # OF CRASHES : 26

OF YEARS : 4

AVERAGE # OF CRASHES PER YEAR (**A**) : **6.50**

CRASH RATE CALCULATION : 0.55

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

Comments : MassDOT District 3 Avgs: Signalized = 0.89, Unsignalized = 0.66

Project Title & Date: 814- Sudbury, MA

Moving Massachusetts Forward
massDOT Highway

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Sudbury, MA COUNT DATE : Dec. 17, 2014

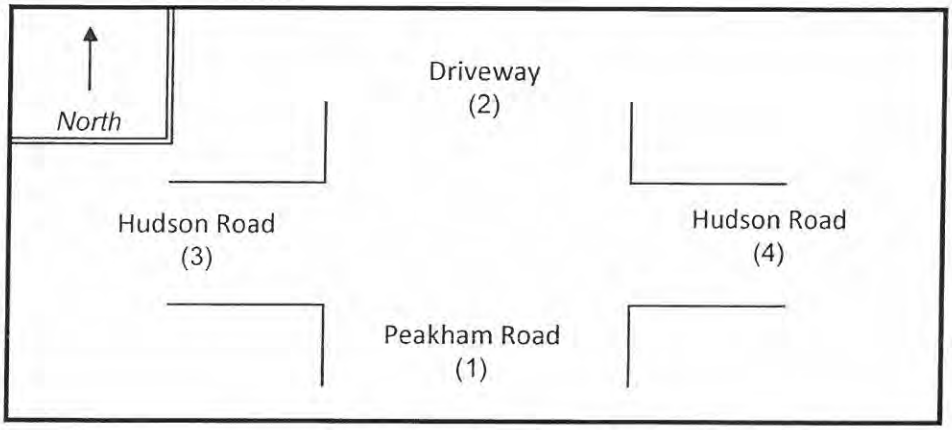
DISTRICT : 3 UNSIGNALIZED : X SIGNALIZED :

~ INTERSECTION DATA ~

MAJOR STREET : Hudson Road

MINOR STREET(S) : Peakham Road/Driveway

INTERSECTION DIAGRAM (Label Approaches)



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	NB	SB	EB	WB		
PEAK HOURLY VOLUMES (PM) :	162	11	606	611		**1,390**

" K " FACTOR : **0.08** INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **17,375**

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

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

Comments : MassDOT District 3 Avgs: Signalized = 0.89, Unsignalized = 0.66

Project Title & Date: 814- Sudbury, MA

massDOT

MassDOT Crash Report for Sudbury for the year 2010

Crash Number	City/Town Name	Crash Date	Crash Time	Crash Severity	Number of Vehicles	Total Nonfatal Injuries	Total Fatal Injuries	Manner of Collision	Vehicle Action Prior to Crash	Vehicle Travel Directions	Most Harmful Events	Vehicle Configuration	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
Concord Road at Hudson road/Old Sudbury Road																							
2830138	SUDBURY	22-Jul-2010	8:58 AM	Property damage only (none injured)	2	0	0	Angle	V1: Backing / V2:Travelling straight ahead	V1:Northbound / V2:Westbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Light truck(van, mini-van, panel, pickup, sport utility) with only four tires / V2:Not reported	Dry	Daylight	Clear/Clear	CONCORD ROAD / HUDSON ROAD						207204.547	903583.0001
2888526	SUDBURY	09-Dec-2010	10:18 AM	Property damage only (none injured)	2	0	0	Angle	V1: Travelling straight ahead / V2:Travelling straight ahead	V1:Southbound / V2:Northbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Light truck(van, mini-van, panel, pickup, sport utility) with only four tires / V2:Passenger car	Dry	Daylight	Clear	CONCORD ROAD / OLD SUDBURY ROAD Rte 27 S / HUDSON ROAD						207204.547	903583.0001
2906463	SUDBURY	26-Apr-2010	11:42 AM	Non-fatal injury	1	1	0	Single vehicle crash	V1: Slowing or stopped in traffic	V1:Westbound	V1: Collision with motor vehicle in traffic	V1: Passenger car	Wet	Daylight	Rain	OLD SUDBURY ROAD / CONCORD ROAD						207204.547	903583.0001
2888750	SUDBURY	19-Nov-2010	9:10 AM	Property damage only (none injured)	2	0	0	Sideswipe, same direction	V1: Travelling straight ahead / V2:Travelling straight ahead	V1:Eastbound / V2:Eastbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Passenger car / V2:Passenger car	Dry	Daylight	Clear	15 HUDSON ROAD / CONCORD ROAD						207204.547	903583.0001
2577563	SUDBURY	20-Jan-2010	10:53 PM	Property damage only (none injured)	2	0	0	Angle	V1: Turning right / V2:Travelling straight ahead	V1:Westbound / V2:Westbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Not reported / V2:Not reported	Dry	Dark - unknown roadway lighting	Cloudy	OLD SUDBURY ROAD Rte 27 N / CONCORD ROAD Rte 27						207204.547	903583.0001
Hudson Road at Peakham Road																							
2725055	SUDBURY	13-Nov-2010	12:01 PM	Not Reported	1	0	0	Angle	V1: Slowing or stopped in traffic	V1:Not reported	V1: Not reported	V1: Not reported	Dry	Daylight	Clear	PEAKHAM ROAD / HUDSON ROAD						206901.9592	903621.8125
2830139	SUDBURY	01-Aug-2010	5:05 PM	Property damage only (none injured)	2	0	0	Angle	V1: Turning left / V2:Turning left	V1:Northbound / V2:Westbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Passenger car / V2:Light truck(van, mini-van, panel, pickup, sport utility) with only four tires	Dry	Daylight	Cloudy	Rte 27 / HUDSON ROAD / PEAKHAM ROAD						206901.9592	903621.8125

MassDOT

MassDOT Crash Report for Sudbury for the year 2011

Crash Number	City/Town Name	Crash Date	Crash Time	Crash Severity	Number of Vehicles	Total Nonfatal Injuries	Total Fatal Injuries	Manner of Collision	Vehicle Action Prior to Crash	Vehicle Travel Directions	Most Harmful Events	Vehicle Configuration	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
Concord Road at Hudson road/Old Sudbury Road																							
2735314	SUDBURY	30-Mar-11	8:31 AM	Property damage only (none injured)	2	0	0	Sideswipe, same direction	V1: Slowing or stopped in traffic / V2:Travelling straight ahead	V1:Eastbound / V2:Eastbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Passenger car / V2:Passenger car	Dry	Daylight	Clear	HUDSON ROAD / CONCORD ROAD						207204.547	903563.0001
2869281	SUDBURY	17-Jan-2011	12:01 PM	Non-fatal injury	2	1	0	Angle	V1: Turning left / V2:Travelling straight ahead	V1: Southbound / V2:Westbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Light truck(van, mini-van, panel, pickup, sport utility) with only four tires / V2:Not reported	Wet	Daylight	Clear	HUDSON ROAD / OLD SUDBURY ROAD						207204.547	903563.0001
2733619	SUDBURY	03-Jun-2011	4:42 PM	Property damage only (none injured)	2	0	0	Angle	V1: Turning left / V2:Travelling straight ahead	V1:Northbound / V2:Eastbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Light truck(van, mini-van, panel, pickup, sport utility) with only four tires / V2:Passenger car	Dry	Daylight	Clear	HUDSON ROAD Rte 27 E / CONCORD ROAD						207204.547	903563.0001
2699490	SUDBURY	05-Feb-2011	1:43 PM	Property damage only (none injured)	2	0	0	Angle	V1: Turning left / V2:Travelling straight ahead	V1:Southbound / V2:Northbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Not reported / V2:Not reported	Dry	Daylight	Cloudy	HUDSON ROAD Rte 27 S / CONCORD ROAD / Rte 27						207204.547	903563.0001
2733415	SUDBURY	24-May-2011	11:32 AM	Property damage only (none injured)	2	0	0	Angle	V1: Turning left / V2:Slowing or stopped in traffic	V1:Eastbound / V2:Westbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Passenger car / V2:Light truck(van, mini-van, panel, pickup, sport utility) with only four tires	Dry	Daylight	Cloudy	OLD SUDBURY ROAD Rte 27 W / CONCORD ROAD						207204.547	903563.0001
2921132	SUDBURY	01-Nov-2011	9:06 AM	Property damage only (none injured)	2	0	0	Rear-end	V1: Slowing or stopped in traffic / V2:Travelling straight ahead	V1:Westbound / V2:Westbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Light truck(van, mini-van, panel, pickup, sport utility) with only four tires / V2:Light truck(van, mini-van, panel, pickup, sport utility) with only four tires	Dry	Daylight	Cloudy	10 HUDSON ROAD Rte 27 W						207134.8041	903584.2731
2919635	SUDBURY	05-Dec-2011	8:18 AM	Property damage only (none injured)	2	0	0	Rear-end	V1: Travelling straight ahead / V2:Travelling straight ahead	V1:Not reported / V2:Southbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Passenger car / V2:Passenger car	Wet	Daylight	Clear/Cloudy	310 CONCORD ROAD						207208.4228	903565.1029
2706860	SUDBURY	18-Jan-2011	11:32 AM	Property damage only (none injured)	2	0	0	Rear-end	V1: Slowing or stopped in traffic / V2:Travelling straight ahead	V1:Southbound / V2:Southbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Bus (seats for more than 15 people, including driver) / V2:Light truck(van, mini-van, panel, pickup, sport utility) with only four tires	Snow	Daylight	Snow	327 CONCORD ROAD						207314.4158	903627.5402
2915395	SUDBURY	18-Nov-2011	8:48 PM	Property damage only (none injured)	2	0	0	Angle	V1: Slowing or stopped in traffic / V2:Travelling straight ahead	V1:Southbound / V2:Westbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Light truck(van, mini-van, panel, pickup, sport utility) with only four tires / V2:Light truck(van, mini-van, panel, pickup, sport utility) with only four tires	Dry	Dark - roadway not lighted	Clear	OLD SUDBURY ROAD Rte 27 W / CONCORD ROAD						207204.547	903563
Hudson Road at Peakham Road																							
2735273	SUDBURY	10-Feb-2011	5:16 PM	Property damage only (none injured)	2	0	0	Angle	V1: Turning left / V2:Travelling straight ahead	V1:Northbound / V2:Eastbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Passenger car / V2:Passenger car	Dry	Dusk	Clear	Rte 27 / HUDSON ROAD / PEAKHAM ROAD						206981.9532	903621.8129
2915288	SUDBURY	23-Sep-2011	4:15 PM	Property damage only (none injured)	2	0	0	Rear-end	V1: Slowing or stopped in traffic / V2:Slowing or stopped in traffic	V1:Westbound / V2:Westbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Passenger car / V2:Light truck(van, mini-van, panel, pickup, sport utility) with only four tires	Wet	Daylight	Rain	HUDSON ROAD Rte 27 W / PEAKHAM ROAD						206981.9532	903621.8129
2924635	SUDBURY	04-Oct-2011	8:41 PM	Property damage only (none injured)	2	0	0	Angle	V1: Turning left / V2:Turning left	V1:Eastbound / V2:Eastbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Passenger car / V2:Passenger car	Wet	Dark - lighted roadway	Cloudy/Rain	HUDSON ROAD Rte 27 N / PEAKHAM ROAD						206981.9532	903621.8129
2915276	SUDBURY	12-Sep-2011	9:06 AM	Property damage only (none injured)	2	0	0	Angle	V1: Travelling straight ahead / V2:Turning left	V1:Eastbound / V2:Northbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Passenger car / V2:Passenger car	Dry	Daylight	Clear/Cloudy	HUDSON ROAD / PEAKHAM ROAD						206981.9532	903621.8129

massDOT

MassDOT Crash Report for Sudbury for the year 2012

Crash Number	City/Town Name	Crash Date	Crash Time	Crash Severity	Number of Vehicles	Total Nonfatal Injuries	Total Fatal Injuries	Manner of Collision	Vehicle Action Prior to Crash	Vehicle Travel Directions	Most Harmful Events	Vehicle Configuration	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
Concord Road at Hudson Road/Old Sudbury Road																							
3291733	SUDBURY	21-Sep-2012	5:11 PM	Property damage only (none injured)	2	0	0	Angle	V1: Travelling straight ahead / V2 Turning left	V1 Westbound / V2 Northbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Passenger car / V2 Passenger car	Dry	Dark - lighted roadway	Clear	HUDSON ROAD / CONCORD ROAD						207204.547	903563.0001
3291520	SUDBURY	29-Sep-12	7:35 AM	Non-fatal injury	3	1	0	Rear-end	V1: Slowing or stopped in traffic / V2: Slowing or stopped in traffic / V3: Travelling straight ahead	V1 Eastbound / V2 Eastbound / V3 Eastbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic / V3: Collision with motor vehicle in traffic	V1: Passenger car / V2 Passenger car / V3 Passenger car	Dry	Daylight	Clear	HUDSON ROAD / CONCORD ROAD / OLD SUDBURY ROAD						207204.547	903563.0001
3356335	SUDBURY	21-Dec-2012	1:39 PM	Property damage only (none injured)	2	0	0	Angle	V1: Travelling straight ahead / V2 Turning left	V1 Northbound / V2 Northbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Passenger car / V2 Passenger car	Wet	Daylight	Rain	OLD SUDBURY ROAD Rte 27 N / CONCORD ROAD / HUDSON ROAD						207204.547	903563.0001
3299014	SUDBURY	02-Jul-2012	9:03 AM	Non-fatal injury	1	1	0	Single vehicle crash	V1: Travelling straight ahead	V1 Southbound	V1: Collision with cyclist (bicycle, tricycle, unicycle, pedal car)	V1: Light truck(van, mini-van, panel, pickup, sport utility) with only four tires	Not reported	Daylight	Clear	182 feet S from intersection 300 CONCORD ROAD / OLD SUDBURY ROAD Rte 27 S				P2 Pedalcyclist (bicycle, tricycle, unicycle, pedal car)	207204.547	903563.0001
3054433	SUDBURY	18-Feb-2012	6:13 PM	Property damage only (none injured)	3	0	0	Rear-end	V1: Turning left / V2: Slowing or stopped in traffic / V3 Travelling straight ahead	V1 Eastbound / V2 Eastbound / V3 Eastbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic / V3: Collision with motor vehicle in traffic	V1: Light truck(van, mini-van, panel, pickup, sport utility) with only four tires / V2 Passenger car / V3 Light truck(van, mini-van, panel, pickup, sport utility) with only four tires	Wet	Dark - unknown roadway lighting	Rain	372 OLD SUDBURY ROAD					207278.6643	903562.9877
3336551	SUDBURY	12-Oct-2012	4:14 PM	Property damage only (none injured)	2	0	0	Angle	V1: Travelling straight ahead / V2 Turning left	V1 Northbound / V2 Eastbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Passenger car / V2 Passenger car	Dry	Daylight	Clear	328 CONCORD ROAD						207266.4215	903645.5107
3351238	SUDBURY	03-Apr-2012	8:47 AM	Property damage only (none injured)	3	0	0	Rear-end	V1: Travelling straight ahead / V2 Travelling straight ahead / V3 Not reported	V1 Eastbound / V2 Eastbound / V3 Not reported	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic / V3: Not reported	V1: Passenger car / V2 Passenger car / V3 Not reported	Dry	Daylight	Cloudy	46 HUDSON ROAD Rte 27 E						206869.7173	903687.3125
3338330	SUDBURY	17-Oct-2012	10:12 AM	Property damage only (none injured)	2	0	0	Angle	V1: Turning left / V2 Travelling straight ahead	V1 Northbound / V2 Eastbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Light truck(van, mini-van, panel, pickup, sport utility) with only four tires / V2 Light truck(van, mini-van, panel, pickup, sport utility) with only four tires	Dry	Daylight	Clear/Clear	CONCORD ROAD Rte 27 / HUDSON ROAD Rte 27						207204.547	903563.0001
Hudson Road at Peakham Road																							
3245806	SUDBURY	14-Jun-2012	1:21 PM	Non-fatal injury	2	1	0	Sideswipe, opposite direction	V1: Travelling straight ahead / V2 Travelling straight ahead	V1 Westbound / V2 Eastbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Light truck(van, mini-van, panel, pickup, sport utility) with only four tires / V2 Passenger car	Dry	Daylight	Clear/Clear	HUDSON ROAD Rte 27 W / PEAKHAM ROAD				20 feet W from TI SALES		206961.9532	903621.8125
3245780	SUDBURY	04-Jun-2012	4:18 PM	Property damage only (none injured)	3	0	0	Rear-end	V1: Travelling straight ahead / V2 Travelling straight ahead / V3 Travelling straight ahead	V1 Westbound / V2 Westbound / V3 Westbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic / V3: Collision with motor vehicle in traffic	V1: Light truck(van, mini-van, panel, pickup, sport utility) with only four tires / V2 Light truck(van, mini-van, panel, pickup, sport utility) with only four tires / V3 Passenger car	Wet	Daylight	Cloudy/Rain	HUDSON ROAD Rte 27 W / PEAKHAM ROAD						206961.9532	903621.8125
3246273	SUDBURY	21-Jun-2012	10:00 AM	Non-fatal injury	1	1	0	Angle	V1: Turning right	V1 Westbound	V1: Collision with cyclist (bicycle, tricycle, unicycle, pedal car)	V1: Passenger car	Dry	Daylight	Clear	36 HUDSON ROAD Rte 27 W / PEAKHAM ROAD				P2 Pedalcyclist (bicycle, tricycle, unicycle, pedal car)	206961.9532	903621.8125

massDOT

MassDOT Crash Report for Sudburyfor the year 2013

Crash Number	City/Town Name	Crash Date	Crash Time	Crash Severity	Number of Vehicles	Total Nonfatal Injuries	Total Fatal Injuries	Manner of Collision	Vehicle Action Prior to Crash	Vehicle Travel Directions	Most Harmful Events	Vehicle Configuration	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
Concord Road at Hudson Road/Old Sudbury Road																					
3515935	SUDBURY	10-Jun-2013	9:14 AM	Property damage only (none injured)	2	0	0	Angle	V1: Travelling straight ahead / V2: Not reported	V1: Northbound / V2: Not reported	V1: Collision with motor vehicle in traffic / V2: Not reported	V1: Light truck(van, mini-van, panel, pickup, sport utility) with only four tires / V2: Unknown vehicle configuration	Dry	Daylight	Cloudy	CONCORD ROAD / HUDSON ROAD / OLD SUDBURY ROAD					
3390671	SUDBURY	13-Mar-2013	7:15 AM	Property damage only (none injured)	2	0	0	Rear-end	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1: Westbound / V2: Westbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Bus (seats for more than 15 people, including driver) / V2: Light truck(van, mini-van, panel, pickup, sport utility) with only four tires	Dry	Daylight	Clear	HUDSON ROAD / CONCORD ROAD					
3741303	SUDBURY	07-Dec-2013	6:55 PM	Property damage only (none injured)	2	0	0	Sideswipe, opposite direction	V1: Travelling straight ahead / V2: Travelling straight ahead	V1: Westbound / V2: Eastbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Passenger car / V2: Light truck(van, mini-van, panel, pickup, sport utility) with only four tires	Dry	Dark - lighted roadway	Clear		10 HUDSON ROAD Rte 27 W				
3399029	SUDBURY	22-Feb-2013	7:40 AM	Property damage only (none injured)	2	0	0	Angle	V1: Travelling straight ahead / V2: Turning left	V1: Eastbound / V2: Northbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Light truck(van, mini-van, panel, pickup, sport utility) with only four tires / V2: Light truck(van, mini-van, panel, pickup, sport utility) with only four tires	Dry	Daylight	Clear		293 OLD SUDBURY ROAD				
Hudson Road at Peakham Road																					
3401058	SUDBURY	22-Jan-2013	7:27 AM	Non-fatal injury	2	2	0	Angle	V1: Travelling straight ahead / V2: Travelling straight ahead	V1: Westbound / V2: Northbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Passenger car / V2: Light truck(van, mini-van, panel, pickup, sport utility) with only four tires	Snow	Daylight	Clear	HUDSON ROAD / PEAKHAM ROAD					

□ Speed Data

MDM TRANSPORTATION CONSULTANTS, INC.

E/W: Huddson Road (Route 27)
30 Hudson Road
Sudbury, MA

28 Lord Road, Suite 280
Marlborough, MA
www.mdmtrans.com

Site Code: 07680002
Station ID:
814 HUDSON RD - SPEED

Latitude: 0' 0.0000 Undefined

Eastbound

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent
12/17/14	0	0	0	5	13	3	1	0	0	0	0	0	0	0	22	36
01:00	0	0	1	4	10	3	2	0	0	0	0	0	0	0	20	38
02:00	0	0	0	0	5	9	0	0	0	0	0	0	0	0	14	38
03:00	0	0	1	1	8	2	1	0	0	0	0	0	0	0	13	37
04:00	1	0	1	5	22	13	6	0	0	0	0	0	0	0	48	39
05:00	2	0	5	59	141	62	2	2	0	0	0	0	0	0	273	37
06:00	39	63	173	318	267	48	1	0	0	0	0	0	0	0	909	33
07:00	149	242	323	253	89	4	1	0	0	0	0	0	0	0	1061	28
08:00	200	260	187	157	105	6	1	0	0	0	0	0	0	0	916	29
09:00	61	95	144	247	189	26	0	0	0	0	0	0	0	0	762	32
10:00	21	13	60	237	253	51	3	0	0	0	0	0	0	0	638	34
11:00	26	23	69	194	205	48	1	0	0	0	0	0	0	0	566	34
12 PM	38	34	85	233	185	43	3	0	0	0	0	0	0	0	621	33
13:00	23	15	82	198	198	28	0	0	1	0	0	0	0	0	545	33
14:00	27	18	66	194	166	36	1	0	0	0	0	0	0	0	508	33
15:00	20	22	71	241	231	32	1	0	0	0	0	0	0	0	618	33
16:00	28	27	94	239	182	21	0	0	0	0	0	0	0	0	591	33
17:00	37	55	138	269	117	15	0	0	0	0	0	0	0	0	631	31
18:00	23	19	72	207	178	26	2	0	0	0	0	0	0	0	527	33
19:00	22	12	52	149	126	23	0	0	0	0	0	0	0	0	384	33
20:00	3	5	12	63	83	20	1	0	0	0	0	0	0	0	187	34
21:00	6	3	8	51	71	11	2	0	0	0	0	0	0	0	152	34
22:00	5	2	7	38	50	15	3	0	0	0	0	0	0	0	120	34
23:00	0	0	4	10	20	11	3	0	0	0	0	0	0	0	48	38
Total	731	908	1655	3372	2914	556	35	2	1	0	0	0	0	0	10174	

Statistics		
	10 MPH Pace Speed :	26-35 MPH
	85th Percentile :	33 MPH
	95th Percentile :	35 MPH
	Number of Vehicles > 30 MPH :	3508
	Percent of Vehicles > 30 MPH :	34.5%
	Mean Speed(Average) :	27 MPH

MDM TRANSPORTATION CONSULTANTS, INC.

E/W: Huddson Road (Route 27)
30 Hudson Road
Sudbury, MA

28 Lord Road, Suite 280
Marlborough, MA
www.mdmtrans.com

Site Code: 07680002
Station ID:
814 HUDSON RD - SPEED

Latitude: 0' 0.0000 Undefined

Eastbound

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent
12/18/14	0	0	1	1	13	5	1	0	0	0	0	0	0	0	21	37
01:00	1	0	4	4	5	3	1	0	0	0	0	0	0	0	18	37
02:00	1	0	0	2	5	2	0	0	0	0	0	0	0	0	10	36
03:00	0	0	2	2	10	4	0	0	0	0	0	0	0	0	18	36
04:00	0	0	0	11	29	12	1	0	0	0	0	0	0	0	53	37
05:00	1	1	22	104	140	58	6	1	0	0	0	0	0	0	333	36
06:00	119	203	213	267	135	11	0	0	0	0	0	0	0	0	948	30
07:00	210	335	293	150	48	2	0	0	0	0	0	0	0	0	1038	26
08:00	314	314	207	50	8	2	0	0	0	0	0	0	0	0	895	23
09:00	137	123	118	231	178	19	1	0	0	0	0	0	0	0	807	32
10:00	12	17	68	230	282	49	1	0	0	0	0	0	0	0	659	34
11:00	22	16	83	212	192	41	3	0	0	0	0	0	0	0	569	33
12 PM	21	9	47	186	230	38	3	0	0	0	0	0	0	0	534	34
13:00	14	16	43	172	233	47	2	0	0	0	0	0	0	0	527	34
14:00	17	36	82	219	231	45	1	0	0	0	0	0	0	0	631	33
15:00	30	32	77	213	220	42	0	0	0	0	0	0	0	0	614	33
16:00	32	43	109	251	170	19	2	0	0	0	0	0	0	0	626	32
17:00	21	34	129	273	149	17	0	0	0	0	0	0	0	0	623	32
18:00	36	24	70	239	167	17	0	0	0	0	0	0	0	0	553	33
19:00	33	17	52	155	153	22	0	0	0	0	0	0	0	0	432	33
20:00	14	10	13	70	91	19	0	0	0	0	0	0	0	0	217	34
21:00	11	0	7	58	75	24	0	0	0	0	0	0	0	0	175	34
22:00	3	2	6	18	52	24	2	0	0	0	0	0	0	0	107	37
23:00	4	0	3	9	25	9	1	0	0	0	0	0	0	0	51	36
Total	1053	1232	1649	3127	2841	531	25	1	0	0	0	0	0	0	10459	

Statistics

10 MPH Pace Speed :	26-35 MPH
85th Percentile :	33 MPH
95th Percentile :	35 MPH
Number of Vehicles > 30 MPH :	3398
Percent of Vehicles > 30 MPH :	32.5%
Mean Speed(Average) :	26 MPH

Stats

Mean Speed(Average) :	26 MPH
85th Percentile :	33 MPH
95th Percentile :	35 MPH
Number of Vehicles > 30 MPH :	6906
Percent of Vehicles > 30 MPH :	33.5%

MDM TRANSPORTATION CONSULTANTS, INC.

28 Lord Road, Suite 280
Marlborough, MA
www.mdmtrans.com

E/W: Huddson Road (Route 27)
30 Hudson Road
Sudbury, MA

Site Code: 07680002
Station ID:
814 HUDSON RD - SPEED

Latitude: 0' 0.0000 Undefined

Westbound

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent
12/17/14	0	0	0	24	39	8	2	0	0	0	0	0	0	0	73	34
01:00	0	0	1	6	13	7	0	0	0	0	0	0	0	0	27	37
02:00	0	0	0	4	6	5	1	0	0	0	0	0	0	0	16	38
03:00	0	0	0	0	7	1	0	0	0	0	0	0	0	0	8	34
04:00	0	0	1	3	4	2	1	0	0	0	0	0	0	0	11	38
05:00	1	1	1	9	27	4	0	0	0	0	0	0	0	0	43	34
06:00	1	2	20	63	81	18	0	0	0	0	0	0	0	0	185	34
07:00	7	13	97	160	134	13	3	0	0	0	0	0	0	0	427	33
08:00	7	11	70	215	138	10	1	0	0	0	0	0	0	0	452	32
09:00	4	12	56	178	156	22	0	0	0	0	0	0	0	0	428	33
10:00	1	7	31	141	172	20	0	0	0	0	0	0	0	0	372	33
11:00	1	12	28	176	209	24	0	0	0	0	0	0	0	0	450	33
12 PM	9	34	39	187	228	41	4	0	0	0	0	0	0	0	542	34
13:00	13	27	80	231	231	16	1	0	0	0	0	0	0	0	599	33
14:00	27	31	78	218	284	25	1	0	0	0	0	0	0	0	664	33
15:00	17	72	130	345	276	30	0	0	0	0	0	0	0	0	870	33
16:00	51	116	234	417	191	6	0	0	0	0	0	0	0	0	1015	31
17:00	81	129	414	392	75	2	0	0	0	0	0	0	0	0	1093	28
18:00	21	164	293	431	118	6	0	0	0	0	0	0	0	0	1033	29
19:00	5	23	107	354	175	17	0	0	0	0	0	0	0	0	681	32
20:00	0	4	33	261	189	13	0	0	0	0	0	0	0	0	500	33
21:00	6	5	34	202	150	9	1	0	0	0	0	0	0	0	407	33
22:00	1	3	6	123	120	9	1	0	0	0	0	0	0	0	263	33
23:00	1	1	7	37	59	13	0	0	0	0	0	0	0	0	118	34
Total	254	667	1760	4177	3082	321	16	0	0	0	0	0	0	0	10277	

Statistics

10 MPH Pace Speed :	26-35 MPH
85th Percentile :	33 MPH
95th Percentile :	34 MPH
Number of Vehicles > 30 MPH :	3419
Percent of Vehicles > 30 MPH :	33.3%
Mean Speed(Average) :	28 MPH

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30 Hudson Road
Sudbury, MA

28 Lord Road, Suite 280
Marlborough, MA
www.mdmtrans.com

Site Code: 07680002
Station ID:
814 HUDSON RD - SPEED

Latitude: 0' 0.0000 Undefined

Westbound

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent
12/18/14	0	0	0	11	44	11	1	0	0	0	0	0	0	0	67	35
01:00	0	0	0	7	11	4	1	0	0	0	0	0	0	0	23	36
02:00	0	0	0	1	3	1	0	0	0	0	0	0	0	0	5	36
03:00	0	0	0	2	2	0	1	0	0	0	0	0	0	0	5	41
04:00	0	0	0	2	11	1	1	0	0	0	0	0	0	0	15	34
05:00	1	0	0	17	29	3	0	0	0	0	0	0	0	0	50	34
06:00	1	16	31	75	60	11	0	0	0	0	0	0	0	0	194	33
07:00	6	9	113	219	84	9	0	0	0	0	0	0	0	0	440	31
08:00	2	19	97	211	131	15	1	0	0	0	0	0	0	0	476	32
09:00	8	9	69	195	156	23	1	0	0	0	0	0	0	0	461	33
10:00	1	10	27	126	195	28	0	0	0	0	0	0	0	0	387	34
11:00	2	12	38	187	214	29	0	0	0	0	0	0	0	0	482	33
12 PM	1	31	62	185	234	32	2	0	0	0	0	0	0	0	547	33
13:00	2	8	29	229	281	39	0	0	0	0	0	0	0	0	588	34
14:00	5	32	85	247	259	37	2	0	0	0	0	0	0	0	667	33
15:00	24	97	231	399	204	13	1	0	0	0	0	0	0	0	969	31
16:00	40	136	296	394	168	8	0	0	0	0	0	0	0	0	1042	30
17:00	43	107	348	484	118	4	0	0	0	0	0	0	0	0	1104	29
18:00	22	156	318	426	118	8	0	0	0	0	0	0	0	0	1048	29
19:00	12	39	120	328	184	11	2	0	0	0	0	0	0	0	696	32
20:00	1	4	36	259	187	9	0	0	0	0	0	0	0	0	496	33
21:00	0	6	41	238	185	12	0	0	0	0	0	0	0	0	482	33
22:00	1	4	35	109	148	16	0	0	0	0	0	0	0	0	313	33
23:00	2	2	2	32	81	17	1	0	0	0	0	0	0	0	137	34
Total	174	697	1978	4383	3107	341	14	0	0	0	0	0	0	0	10694	

Statistics		
	10 MPH Pace Speed :	26-35 MPH
	85th Percentile :	32 MPH
	95th Percentile :	34 MPH
	Number of Vehicles > 30 MPH :	3462
	Percent of Vehicles > 30 MPH :	32.4%
	Mean Speed(Average) :	28 MPH

Stats		
	Mean Speed(Average) :	28 MPH
	85th Percentile :	33 MPH
	95th Percentile :	34 MPH
	Number of Vehicles > 30 MPH :	6881
	Percent of Vehicles > 30 MPH :	32.8%

MDM TRANSPORTATION CONSULTANTS, INC.

28 Lord Road, Suite 280
Marlborough, MA
www.mdmtrans.com

Concord Road
North of Town Center
Sudbury, MA

Site Code: 00000800
Station ID:
PROP - CONCORD RD SUDBURY SPEED

Latitude: 0' 0.0000 Undefined

Northbound

Start	1	16	21	26	31	36	41	46	51	56	61	66	71	76		85th
Time	15	20	25	30	35	40	45	50	55	60	65	70	75	999	Total	Percent
09/10/14	0	0	0	0	0	6	1	0	0	0	0	0	0	0	7	39
01:00	0	0	0	0	1	3	2	0	0	0	0	0	0	0	6	42
02:00	0	0	0	0	2	2	1	0	0	0	0	0	0	0	5	41
03:00	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	49
04:00	0	0	0	0	2	4	3	1	0	0	0	0	0	0	10	44
05:00	0	2	0	0	9	12	9	1	0	0	0	0	0	0	33	42
06:00	8	0	3	2	37	65	17	2	0	1	0	0	0	0	135	39
07:00	10	8	7	30	202	114	10	0	0	0	0	0	0	0	381	37
08:00	11	3	3	9	123	131	20	2	0	0	0	0	0	0	302	39
09:00	17	4	4	7	155	127	15	0	0	0	0	0	0	0	329	38
10:00	6	10	5	7	96	106	8	0	1	0	0	0	0	1	240	38
11:00	3	3	3	9	94	130	17	2	0	0	0	0	0	0	261	39
12 PM	11	9	6	4	110	150	17	1	0	0	0	0	0	0	308	39
13:00	51	23	30	37	116	93	4	0	0	0	0	0	0	0	354	37
14:00	8	10	6	9	123	105	16	0	0	0	0	0	0	0	277	38
15:00	12	6	7	13	140	125	10	0	0	0	0	0	0	0	313	38
16:00	4	10	4	13	152	147	14	1	0	0	0	0	0	0	345	38
17:00	20	18	9	41	173	133	15	1	0	0	0	0	0	0	410	38
18:00	235	8	0	0	0	0	0	0	0	0	0	0	0	0	243	13
19:00	12	14	12	25	142	119	11	1	0	0	0	0	0	0	336	38
20:00	6	3	3	7	92	83	11	0	0	0	0	0	0	0	205	38
21:00	3	0	0	6	64	47	14	0	0	0	0	0	0	0	134	39
22:00	1	3	1	1	31	38	9	1	0	0	0	0	0	0	85	39
23:00	2	0	0	0	18	21	2	0	0	0	0	0	0	0	43	38
Total	420	134	103	220	1882	1761	226	14	1	1	0	0	0	1	4763	

Statistics		
	10 MPH Pace Speed :	31-40 MPH
	85th Percentile :	38 MPH
	95th Percentile :	40 MPH
	Number of Vehicles > 30 MPH :	3886
	Percent of Vehicles > 30 MPH :	81.6%
	Mean Speed(Average) :	32 MPH

MDM TRANSPORTATION CONSULTANTS, INC.

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Station ID:
PROP - CONCORD RD SUDBURY SPEED

Latitude: 0' 0.0000 Undefined

Northbound

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent
09/11/14	0	0	1	0	1	4	2	0	0	0	0	0	0	0	8	42
01:00	0	0	0	0	1	3	1	0	0	0	0	0	0	0	5	41
02:00	0	0	0	0	0	3	0	0	0	0	0	0	0	0	3	39
03:00	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	44
04:00	0	0	0	0	1	3	3	0	0	0	0	0	0	0	7	43
05:00	0	0	0	0	9	10	4	1	1	0	0	0	0	0	25	42
06:00	1	5	2	2	45	86	14	2	0	0	0	0	0	0	157	39
07:00	9	8	6	35	214	122	5	0	0	0	0	0	0	0	399	37
08:00	5	6	4	15	162	136	14	1	0	0	0	0	0	0	343	38
09:00	7	8	3	11	135	126	16	0	0	0	0	0	0	0	306	38
10:00	5	4	5	11	79	111	17	1	0	0	0	0	0	0	233	39
11:00	4	4	2	8	98	133	19	1	0	0	0	0	0	0	269	39
12 PM	4	6	4	14	113	113	10	0	0	0	0	0	0	0	264	38
13:00	6	4	3	11	117	120	9	0	0	0	0	0	0	0	270	38
14:00	11	5	6	18	166	106	8	0	0	0	0	0	0	0	320	38
15:00	111	25	24	32	64	20	2	0	0	0	0	0	0	0	278	33
16:00	34	18	22	32	115	117	15	0	0	0	0	0	0	0	353	38
17:00	133	7	10	17	91	68	13	0	0	0	0	0	0	0	339	37
18:00	129	15	9	11	46	32	3	0	0	0	0	0	0	0	245	34
19:00	10	7	0	4	127	125	14	2	0	0	0	0	0	0	289	38
20:00	1	3	5	9	76	59	9	1	0	0	0	0	0	0	163	38
21:00	0	1	0	1	38	49	5	0	0	0	0	0	0	0	94	39
22:00	1	1	0	1	14	25	3	0	0	0	0	0	0	0	45	39
23:00	3	0	0	0	12	14	9	0	0	0	0	0	0	0	38	41
Total	474	127	106	232	1724	1585	196	9	1	0	0	0	0	0	4454	

Statistics	
10 MPH Pace Speed :	31-40 MPH
85th Percentile :	38 MPH
95th Percentile :	39 MPH
Number of Vehicles > 30 MPH :	3515
Percent of Vehicles > 30 MPH :	78.9%
Mean Speed(Average) :	32 MPH

MDM TRANSPORTATION CONSULTANTS, INC.

28 Lord Road, Suite 280
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Site Code: 00000800
Station ID:
PROP - CONCORD RD SUDBURY SPEED

Latitude: 0' 0.0000 Undefined

Southbound

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent
09/10/14	0	0	0	0	4	2	4	0	0	0	0	0	0	0	10	43
01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*
02:00	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	39
03:00	0	1	0	0	0	0	2	0	0	0	0	0	0	0	3	43
04:00	1	0	0	0	1	3	1	4	0	0	0	0	0	0	10	48
05:00	0	0	1	0	5	37	27	3	0	0	0	0	0	0	73	43
06:00	2	0	3	7	29	159	99	4	0	0	0	0	0	0	303	42
07:00	5	5	16	24	118	258	79	9	1	0	0	0	0	0	515	40
08:00	6	0	3	5	54	220	112	3	0	0	0	0	0	0	403	42
09:00	2	3	5	11	50	150	54	9	1	0	0	0	0	0	285	41
10:00	2	1	4	5	41	127	63	7	1	0	0	0	0	0	251	42
11:00	1	3	4	2	35	128	56	7	1	0	0	0	0	0	237	42
12 PM	2	1	9	4	28	151	84	4	0	0	0	0	0	0	283	42
13:00	5	4	8	18	47	164	56	7	0	0	0	0	0	0	309	41
14:00	2	2	7	5	29	136	58	6	0	0	1	0	0	0	246	42
15:00	2	1	1	7	33	157	93	7	0	0	0	0	0	0	301	42
16:00	1	4	10	3	54	169	90	13	0	0	0	0	0	0	344	42
17:00	2	3	5	19	38	186	68	3	0	0	0	0	0	0	324	41
18:00	6	8	23	18	63	160	53	1	0	0	0	0	0	0	332	40
19:00	3	2	6	8	15	131	60	6	0	0	0	0	0	0	231	42
20:00	1	2	2	3	41	99	30	2	0	0	0	0	0	0	180	40
21:00	1	1	5	6	36	59	18	0	0	0	0	0	0	0	126	39
22:00	1	0	3	1	12	46	26	0	0	0	0	0	0	0	89	42
23:00	0	0	0	1	6	11	10	1	0	0	0	0	0	0	29	43
Total	45	41	115	147	739	2554	1143	96	4	0	1	0	0	0	4885	

Statistics	
10 MPH Pace Speed :	36-45 MPH
85th Percentile :	42 MPH
95th Percentile :	44 MPH
Number of Vehicles > 30 MPH :	4537
Percent of Vehicles > 30 MPH :	92.9%
Mean Speed(Average) :	38 MPH

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Site Code: 00000800
Station ID:
PROP - CONCORD RD SUDBURY SPEED

Latitude: 0' 0.0000 Undefined

Southbound

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	85th Percent
09/11/14	0	0	0	0	1	1	3	0	0	0	0	0	0	0	5	43
01:00	0	0	0	0	0	2	1	0	0	0	0	0	0	0	3	42
02:00	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	39
03:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*
04:00	1	0	0	0	0	6	1	0	0	0	0	0	0	0	8	39
05:00	0	1	0	0	10	28	31	8	0	0	0	0	0	0	78	44
06:00	1	0	0	2	28	150	130	18	1	0	0	0	0	0	330	43
07:00	2	8	23	21	98	326	79	1	0	0	0	0	0	0	558	39
08:00	1	2	6	8	69	222	107	12	0	0	0	0	0	0	427	42
09:00	2	2	4	4	49	159	68	7	2	0	0	0	0	0	297	42
10:00	1	2	6	10	18	119	68	7	0	0	0	0	0	0	231	42
11:00	2	0	4	6	29	97	98	10	0	0	0	0	0	0	246	43
12 PM	2	3	9	5	23	126	57	8	0	0	0	0	0	0	233	42
13:00	0	3	6	4	45	136	60	4	0	0	0	0	0	0	258	42
14:00	1	1	8	5	45	157	78	2	0	0	0	0	0	0	297	42
15:00	4	6	6	10	85	145	47	3	0	0	0	0	0	0	306	40
16:00	5	5	4	10	34	173	90	6	1	0	0	0	0	0	328	42
17:00	1	2	8	16	70	173	73	6	0	2	0	0	0	0	351	41
18:00	1	1	10	12	49	142	52	4	0	0	0	0	0	0	271	41
19:00	1	3	6	5	27	95	54	5	0	0	0	0	0	0	196	42
20:00	1	0	6	7	36	88	21	1	0	0	0	0	0	0	160	39
21:00	0	3	2	6	29	70	24	3	0	0	0	0	0	0	137	41
22:00	1	2	0	0	4	28	15	1	1	0	0	0	0	0	52	43
23:00	1	1	0	2	5	8	11	0	2	0	0	0	0	0	30	43
Total	28	45	108	133	754	2452	1168	106	7	2	0	0	0	0	4803	

Statistics	
10 MPH Pace Speed :	36-45 MPH
85th Percentile :	42 MPH
95th Percentile :	44 MPH
Number of Vehicles > 30 MPH :	4489
Percent of Vehicles > 30 MPH :	93.5%
Mean Speed(Average) :	38 MPH

□ Sight Line Analysis

Stopping Sight Distance

Site Driveway at Route 27
Posted Speed Limit

		SPEED (MPH)	BRAKE REACTION DISTANCE (FT)	BRAKING DISTANCE (FT)	CALCULATED STOPPING SIGHT DISTANCE (FT)
Direction 1	EB	30	110.25	86.4	196.6
Direction 2	WB	30	110.25	86.4	196.6

INPUTS	Direction 1	Direction 2
Travel Direction	EB	WB
Speed	30	30
t	2.5	2.5
a	11.2	11.2

Stopping Sight Distance (SSD) - Source: AASHTO

SSD = Reaction Distance + Brake Distance

Reaction Distance = 1.47 x t x V

Brake Distance = 1.075 x V^2 / a

Where:
t = reaction time (sec)
V = travel speed (mph)
a - deceleration rate (ft/sec^2)

Stopping Sight Distance

Site Driveway at Route 27
85th Percentile Observed Travel Speeds

		SPEED (MPH)	BRAKE REACTION DISTANCE (FT)	BRAKING DISTANCE (FT)	CALCULATED STOPPING SIGHT DISTANCE (FT)
Direction 1	EB	33	121.275	104.5	225.8
Direction 2	WB	33	121.275	104.5	225.8

INPUTS	Direction 1	Direction 2
Travel Direction	EB	WB
Speed	33	33
t	2.5	2.5
a	11.2	11.2

Stopping Sight Distance (SSD) - Source: AASHTO

SSD = Reaction Distance + Brake Distance

Reaction Distance = 1.47 x t x V

Brake Distance = 1.075 x V^2 / a

Where:
t = reaction time (sec)
V = travel speed (mph)
a - deceleration rate (ft/sec^2)

Stopping Sight Distance

Site Driveway (Peter's Way) at Concord Road
Posted Speed Limit

		SPEED (MPH)	BRAKE REACTION DISTANCE (FT)	BRAKING DISTANCE (FT)	CALCULATED STOPPING SIGHT DISTANCE (FT)
Direction 1	NB	35	128.625	117.6	246.2
Direction 2	SB	35	128.625	117.6	246.2

INPUTS	Direction 1	Direction 2
Travel Direction	NB	SB
Speed	35	35
t	2.5	2.5
a	11.2	11.2

Stopping Sight Distance (SSD) - Source: AASHTO

SSD = Reaction Distance + Brake Distance

Reaction Distance = 1.47 x t x V

Brake Distance = 1.075 x V^2 / a

Where:
t = reaction time (sec)
V = travel speed (mph)
a - deceleration rate (ft/sec^2)

Stopping Sight Distance

Site Driveway (Peter's Way) at Concord Road
85th Percentile Observed Travel Speeds

		SPEED (MPH)	BRAKE REACTION DISTANCE (FT)	BRAKING DISTANCE (FT)	CALCULATED STOPPING SIGHT DISTANCE (FT)
Direction 1	NB	38	139.65	138.6	278.2
Direction 2	SB	42	154.35	169.3	323.7

INPUTS	Direction 1	Direction 2
Travel Direction	NB	SB
Speed	38	42
t	2.5	2.5
a	11.2	11.2

Stopping Sight Distance (SSD) - Source: AASHTO

SSD = Reaction Distance + Brake Distance

Reaction Distance = 1.47 x t x V

Brake Distance = 1.075 x V^2 / a

Where:
t = reaction time (sec)
V = travel speed (mph)
a - deceleration rate (ft/sec^2)

Intersection Sight Distance Calculations

Source: *A Policy on Geometric Design of Highways and Street, 6th Edition;* AASHTO; 2011.

ISD = 1.47 * V * t

V = speed
t = time gap

t = 7.5 s for a passenger car for Left Turn from a Stop
t = 6.5 s for a passenger car for Right Turn from a Stop

Posted (Advisory) Speed Limit

Proposed Site Driveway ISD = 1.47 * 35 * 7.5 = 386 ft SAY 390
(left-turn from a stop)

Proposed Site Driveway ISD = 1.47 * 35 * 6.5 = 334 ft SAY 335 ft
(right-turn from a stop)

Intersection Sight Distance Calculations

Source: *A Policy on Geometric Design of Highways and Street, 6th Edition;* AASHTO: 2011

ISD = 1.47 * V * t

V = speed
t = time gap

t = 7.5 s for a passenger car for Left Turn from a Stop
t = 6.5 s for a passenger car for Right Turn from a Stop

Posted (Advisory) Speed Limit

Proposed Site Driveway ISD = 1.47 * 30 * 7.5 = 331 ft SAY 335 ft
(left-turn from a stop)

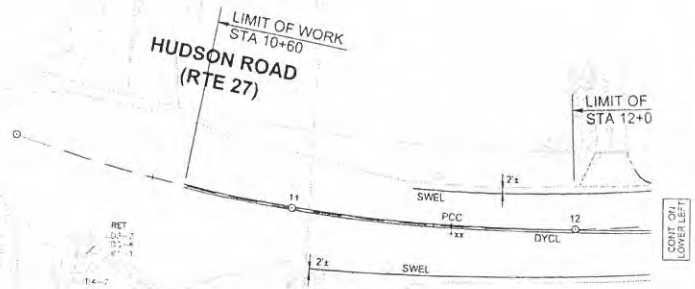
Proposed Site Driveway ISD = 1.47 * 30 * 6.5 = 287 ft SAY 290 ft
(right-turn from a stop)

□ Planned Area Improvements

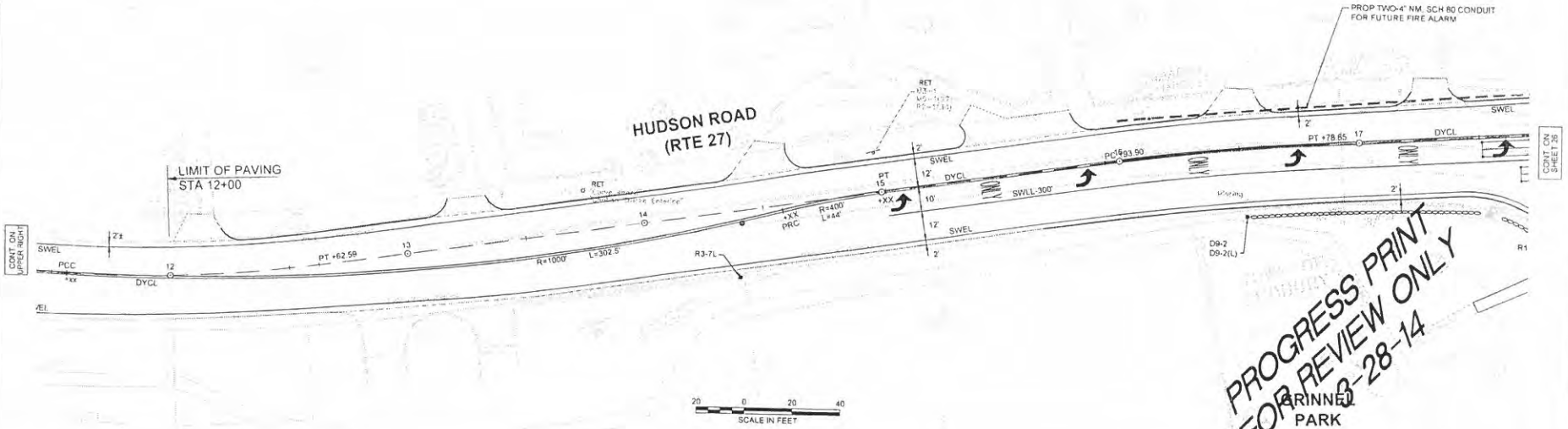
SUDBURY
RTE 27 AT CONCORD RD
TRAFFIC PLANS
SHEET 25 OF XX

CONSTRUCTION NOTES

1. ALL PAVEMENT MARKINGS SHALL BE REFLECTORIZED THERMOPLASTIC.
2. WHERE EXISTING PAVEMENT MARKINGS ARE DIFFERENT THAN PROPOSED MARKINGS SHOWN, REMOVE BY AN APPROVED METHOD.
3. ALL EXISTING SIGNS WITHIN THE PROJECT LIMITS SHALL BE R&S UNLESS OTHERWISE NOTED.



PEAKHAM ROAD



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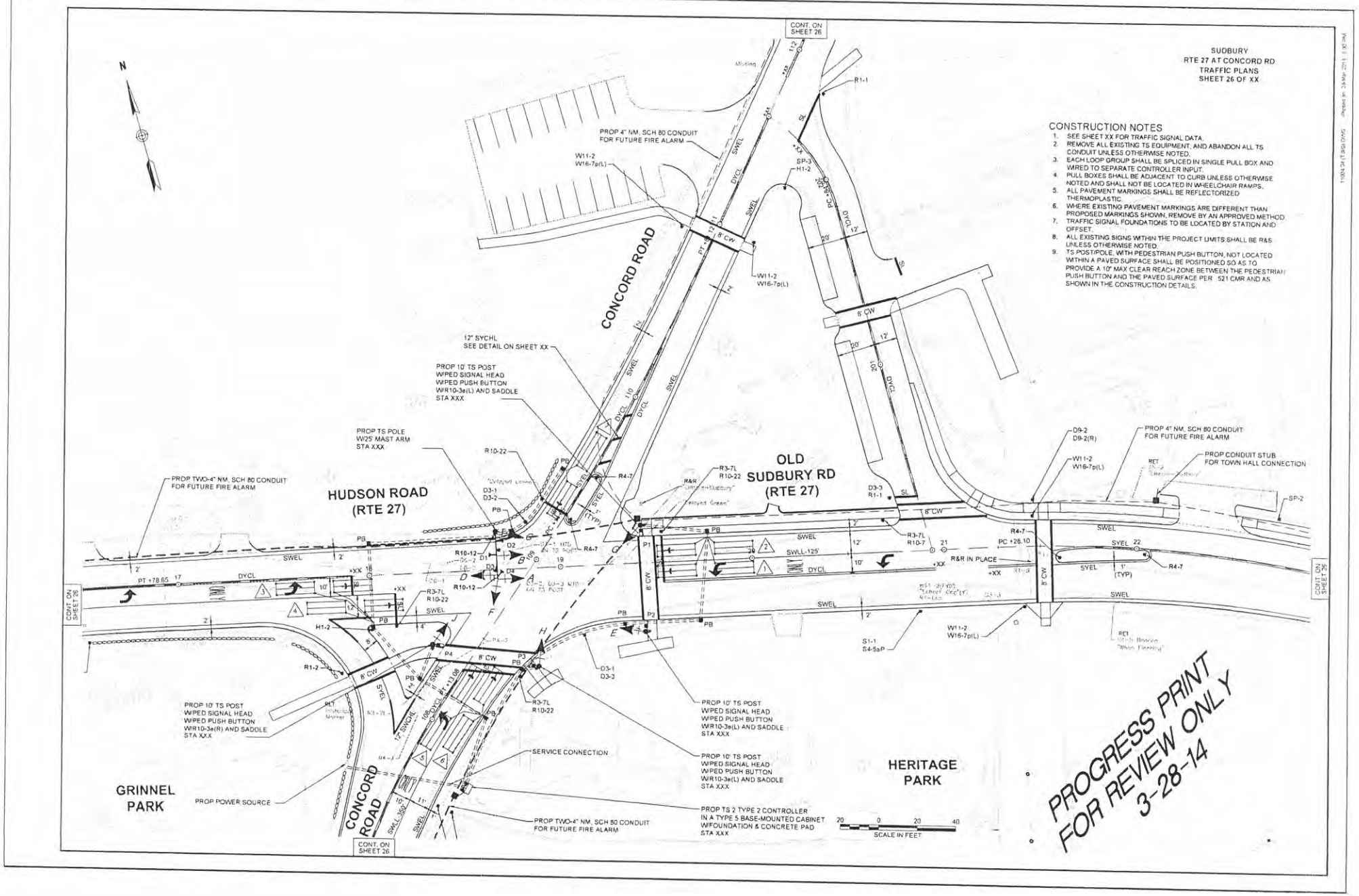
GRINNELL
PARK


SUDBURY
RTE 27 AT CONCORD RD
TRAFFIC PLANS
SHEET 26 OF XX
CONSTRUCTION NOTES
1. SEE SHEET XX FOR TRAFFIC SIGNAL DATA.
2. REMOVE ALL EXISTING TS EQUIPMENT, AND ABANDON ALL TS CONDUIT UNLESS OTHERWISE NOTED.
3. EACH LOOP GROUP SHALL BE SPLICED IN SINGLE PULL BOX AND WIRED TO SEPARATE CONTROLLER INPUT.
4. PULL BOXES SHALL BE ADJACENT TO CURB UNLESS OTHERWISE NOTED AND SHALL NOT BE LOCATED IN WHEELCHAIR RAMPS.
5. ALL PAVEMENT MARKINGS SHALL BE REFLECTORIZED THERMOPLASTIC.
6. WHERE EXISTING PAVEMENT MARKINGS ARE DIFFERENT THAN PROPOSED MARKINGS SHOWN, REMOVE BY AN APPROVED METHOD
7. TRAFFIC SIGNAL FOUNDATIONS TO BE LOCATED BY STATION AND OFFSET.
8. ALL EXISTING SIGNS WITHIN THE PROJECT LIMITS SHALL BE R&S UNLESS OTHERWISE NOTED.
9. TS POST/POLE, WITH PEDESTRIAN PUSH BUTTON, NOT LOCATED WITHIN A PAVED SURFACE SHALL BE POSITIONED SO AS TO PROVIDE A 10' MAX CLEAR REACH ZONE BETWEEN THE PEDESTRIAN PUSH BUTTON AND THE PAVED SURFACE PER 521 CMR AND AS SHOWN IN THE CONSTRUCTION DETAILS.
CONT. ON SHEET 26
CONCORD ROAD
HUDSON ROAD (RTE 27)
OLD SUDBURY RD (RTE 27)
GRINNEL PARK
HERITAGE PARK
PROP 4" NM, SCH 80 CONDUIT FOR FUTURE FIRE ALARM
PROP 10' TS POST W/PED SIGNAL HEAD W/PED PUSH BUTTON WR10-3e(L) AND SADDLE STA XXX
PROP TS POLE W/25' MAST ARM STA XXX
PROP TWO-4" NM, SCH 80 CONDUIT FOR FUTURE FIRE ALARM
12" SYCHL SEE DETAIL ON SHEET XX
PROP 10' TS POST W/PED SIGNAL HEAD W/PED PUSH BUTTON WR10-3e(R) AND SADDLE STA XXX
PROP POWER SOURCE
SERVICE CONNECTION
PROP TS 2 TYPE 2 CONTROLLER IN A TYPE 5 BASE-MOUNTED CABINET W/FOUNDATION & CONCRETE PAD STA XXX
PROP CONDUIT STUB FOR TOWN HALL CONNECTION
R&R IN PLACE
SCALE IN FEET
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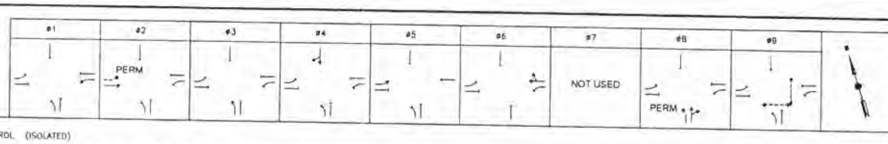


SEQUENCE AND TIMING FOR FULL ACTUATED CONTROL (ISOLATED)

APPROACH	DIRECTION	HOUSING	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	FLASH
OLD SUDBURY ROAD	WB	A	←G−	←Y−	←R−	←R−	←R−	←R−	←R−	←R−	←R−	←R−	←R−	←R−	←R−	←R−	←R−	←R−	←R−	←R−				←R−	←R−	←R−	←R−	←R−	←R−	←FR−
OLD SUDBURY ROAD	WB	B,C	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	G	Y	R				R	R	R	R	R	R	FY
HUDSON ROAD	EB	D	R	R	R	G	Y	R	R	R	R	R	R	R	←G− R	←Y− R	R	R	R	R				R	R	R	R	R	R	FY
HUDSON ROAD	EB	E	R	R	R	G	Y	R	R	R	R	R	R	R	R	R	R	R	R	R				R	R	R	R	R	R	FY
CONCORD ROAD	NB	F	R	R	R	R	R	R	←G− R	←Y− R	R	R	R	R	R	R	R	R	R	R				G	Y	R	R	R	R	FR
CONCORD ROAD	NB	G	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R				G	Y	R	R	R	R	FR
CONCORD ROAD	SB	H,J	R	R	R	R	R	R	R	R	R	G	Y	R	R	R	R	R	R	R				R	R	R	R	R	R	FR
PEDESTRIAN X-ING	NB-SB	P1-P2	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW				DW	DW	DW	W/FDW	DW	DW	OUT
PEDESTRIAN X-ING	EB-WB	P3-P4	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW				DW	DW	DW	W/FDW	DW	DW	OUT

TIMING IN SECONDS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
MINIMUM GREEN (INITIAL)	4			10			6			8			6			10						8			–			CONFLICT FLASH OPERATION ONLY
PASSAGE TIME (VEHICLE)	2			2.5			2.5			2			2.5			2						2.5			–			
MAXIMUM 1	X			X			X			X			X			X						X			–			
MAXIMUM 2	X			X			X			X			X			X						X			–			
YELLOW CLEARANCE		X			X			X			X			X			X						X			3		
RED CLEARANCE			X			X			X			X			X			X						X			1	
PEDESTRIAN WALK																									7			
PEDESTRIAN CLEARANCE																									12			

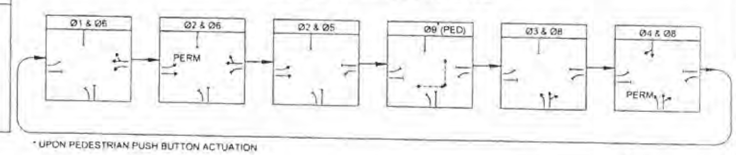
	#1	#2	#3	#4	#5	#6	#7	#8	#9
DETECTOR MEMORY	NON-LOCK	NON-LOCK	NON-LOCK	NON-LOCK	NON-LOCK	NON-LOCK		NON-LOCK	LOCK
RECALL	OFF	SOFT	OFF	OFF	OFF	SOFT		OFF	OFF

COORDINATION DATA			COORDINATION PHASE SPLIT TIMES								
TIMING PLAN	CYCLE	OFFSET	#1	#2	#3	#4	#5	#6	#7	#8	#9
MODE											

NOTES:
1. AUTOMATIC FLASHING OPERATION PER 2009 M.U.T.C.D., AS AMENDED.
2. * UPON PEDESTRIAN PUSH BUTTON ACTUATION
3. PERM = PERMISSIVE
4. Ø4 & Ø8 DUAL ENTRY
5. MAXIMUM 1 = NORMAL OPERATION
6. MAXIMUM 2 = NOT USED
7. STOP AND GO OPERATION FOR 24 HOURS PER DAY. FLASHING OPERATION FOR EMERGENCY ONLY.
8. DURING PEDESTRIAN INTERVAL, FDW THROUGH YELLOW OPERATION SHALL NOT BE IN EFFECT.

SEQUENCE & TIMING NOTES:
1. IF THE ASSIGNED RIGHT OF WAY FOR ANY TRAFFIC MOVEMENT IS TO REMAIN IN EFFECT DURING THE NEXT CALLED PHASE. THE SIGNAL INDICATIONS FOR THAT TRAFFIC MOVEMENT WILL NOT CHANGE DURING THE CLEARANCE INTERVAL.
2. THE RIGHT OF WAY MAY BE ASSIGNED TO ANY PHASE OR ANY COMBINATION OF NON-CONFLICTING PHASES.
3. IF CALLS EXIST ON ALL PHASES, THE ASSIGNMENT OF RIGHT OF WAY SHALL BE IN ACCORDANCE WITH THE PREFERENTIAL PHASE SEQUENCE.
4. IF THE ASSIGNED RIGHT-OF-WAY FOR ANY TRAFFIC MOVEMENT IS TO CHANGE DURING THE NEXT CALLED PHASE, THE SIGNAL INDICATION FOR THAT MOVEMENT WILL DISPLAY THE APPROPRIATE CLEARANCE INTERVALS.

PREFERENTIAL PHASE SEQUENCE



* UPON PEDESTRIAN PUSH BUTTON ACTUATION

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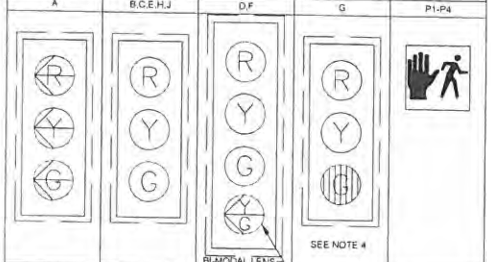
SIGNAL HEAD DATA



NOTES:
1. ALL SIGNAL HEADS SHALL BE RIGID MOUNTED.
2. ALL SIGNAL HEADS SHALL BE EQUIPPED WITH 5"± LOUVERED BACKPLATES. ALL BACKPLATES SHALL CONTAIN A 2" WIDE YELLOW REFLECTIVE BORDER.
3. ALL SIGNAL HEADS SHALL BE EQUIPPED WITH TUNNEL VISORS.
4. SIGNAL HEAD G SHALL BE EQUIPPED WITH GEOMETRICALLY PROGRAMMABLE LOUVERS IN THE GREEN INDICATION, SET TO A 42° VIEW ANGLE.
5. ALL SIGNAL DISPLAYS SHALL BE EQUIPPED WITH L.E.D. MODULES.

LOOP DETECTOR DATA

DETECTOR NO.	NO. SECTION/ SIZE	NO. OF TURNS	OPERATIONS	DELAY /EXT	CALL PHASE	LOOP CONNECTION
1	2-6'X20' QUADRUPOLE	2-4-2	PRESENCE	2 SEC DELAY	Ø1	SERIES
2	2-6'X20' QUADRUPOLE	2-4-2	PRESENCE	0	Ø6	SERIES
3	2-6'X20' QUADRUPOLE	2-4-2	PRESENCE	2 SEC DELAY	Ø5 (SEE NOTE 2)	SERIES
4	2-6'X20' QUADRUPOLE	2-4-2	PRESENCE	0	Ø7	SERIES
5	2-6'X20' QUADRUPOLE	2-4-2	PRESENCE	2 SEC DELAY	Ø3 (SEE NOTE 3)	SERIES
6	2-6'X20' QUADRUPOLE	2-4-2	PRESENCE	0	Ø8	SERIES
7	2-6'X20' QUADRUPOLE	2-4-2	PRESENCE	0	Ø4	SERIES

NOTES:
1. DELAY AND EXTENSION TIMINGS SHALL BE PROGRAMMED IN THE CONTROLLER ONLY.
2. LOOP GROUP 3 SHALL CALL/EXTEND Ø2, THEN SWITCH TO CALL/EXTEND Ø5.
3. LOOP GROUP 5 SHALL CALL/EXTEND Ø3, THEN SWITCH TO CALL/EXTEND Ø8.

PRE-EMPTION PHASING & PRIORITY

DETECTOR & PRIORITY	PRE-EMPT PHASE ASSIGNMENT	MOVEMENT	VEHICLE PHASE ASSIGNMENT
D1	1		Ø2&Ø5
D2	2		Ø1&Ø6
D3	3		Ø3&Ø8
D4	4		Ø4

EMERGENCY VEHICLE PRE-EMPTION OPERATION
1. EMERGENCY VEHICLE PRE-EMPTION SIGNALS SHALL BE OPTICALLY TRANSMITTED BY OPTICAL EMITTERS MOUNTED IN EMERGENCY VEHICLES AND RECEIVED BY OPTICAL DETECTORS LOCATED AT THIS INTERSECTION.
2. PRE-EMPTION SIGNALS SHALL BE SERVICED ON A PRIORITY BASIS WITH DETECTORS D1, D2, D3 OR D4 ASSIGNED DESCENDING PRIORITIES AS FOLLOWS (D1 HIGHEST AND D4 LOWEST).
3. IN RESPONSE TO A PRE-EMPTION SIGNAL RECEIVED AT AN INTERSECTION BY OPTICAL DETECTOR D1 (OR D2, D3, D4) THE CONTROLLER SHALL HOLD OR ADVANCE TO AND HOLD IN EMERGENCY VEHICLE PRE-EMPTION PHASE #1 (OR #2, #3, #4) GREEN FOR A MINIMUM OF TEN (10) SECONDS OR UNTIL PRE-EMPTION SIGNAL CEASES. THE CONTROLLER SHALL THEN TIME PRE-EMPTION PHASE CLEARANCES FOR THE ASSOCIATED PHASE(S) AS SHOWN IN THE SEQUENCE AND TIMING CHART AND SERVICE SUBSEQUENT EMERGENCY VEHICLE PRE-EMPTION PHASES AS NECESSARY.
4. MINIMUM GREEN AND NORMAL VEHICLE CLEARANCE SHALL BE PROVIDED ON PHASES THAT ARE TO BE TERMINATED BY PRE-EMPTION DEMAND.
5. PRE-EMPTION STROBE SHALL BE ILLUMINATED WHENEVER ANY EMERGENCY VEHICLE PRE-EMPTION GREEN IS ON.

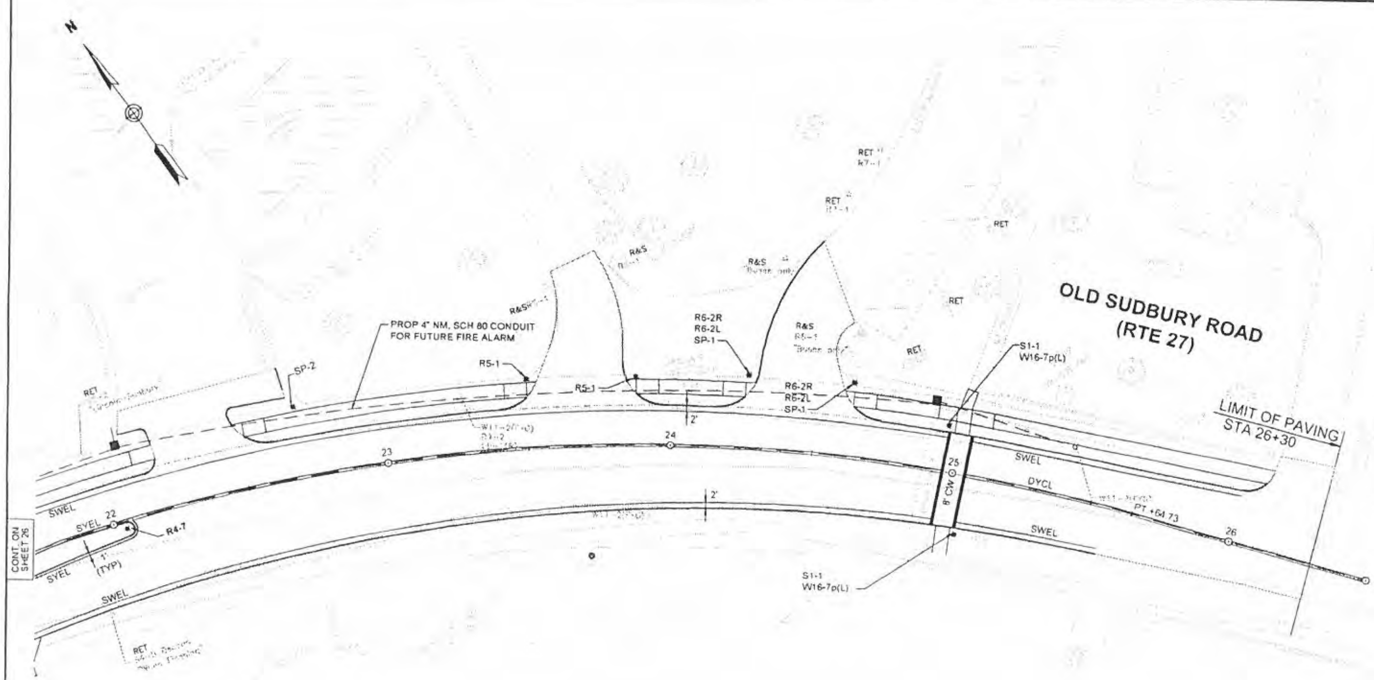
LIST OF MAJOR ITEMS REQUIRED

HUDSON ROAD/OLD SUDBURY ROAD (ROUTE 27) AT CONCORD ROAD

PAY ITEM	QUANTITY	DESCRIPTION
816.01	1	8Ø TS 2 TYPE 2 CONTROLLER IN A TYPE 5 BASE MOUNTED CABINET INCLUDING FOUNDATION AND CONCRETE PAD
	X	TS 25' MAST ARM TYPE 2, HEAVY LOADING, STEEL, INCL. FOUNDATION
	X	TS POST 10' STANDARD INCL. FOUNDATION
	X	SIGNAL HEAD, 3-SECTION, 12" LENSES
	X	SIGNAL HEAD, 4-SECTION, 12" LENSES
	X	PEDESTRIAN SIGNAL HEAD (L.E.D.)
	X	PEDESTRIAN PUSH BUTTON WR10-3e(L) AND SIGN SADDLE
	X	PEDESTRIAN PUSH BUTTON WR10-3e(R) AND SIGN SADDLE
	X	TYPE C, 2-CHANNEL CARD RACK LOOP DETECTOR AMPLIFIER
	X	WIRE LOOP DETECTOR
	X	EMERGENCY PRE-EMPTION OPTICAL DETECTORS & DETECTOR CABLE
	X	EMERGENCY PRE-EMPTION 4 CHANNEL PHASE SELECTOR
	X	EMERGENCY PRE-EMPTION SYSTEM CHASSIS
	X	EMERGENCY PRE-EMPTION STROBE (WHITE LENS)
	X	SERVICE CONNECTION (UNDERGROUND)
811.31	X	PULL BOX-12"x12"
804.3	X	3" NM CONDUIT, SCHEDULE 40

PLUS NECESSARY DUCT, CABLE, LABOR, MISCELLANEOUS MATERIAL AND EQUIPMENT TO COMPLETE THE INSTALLATION AND PROVIDE AN OPERATING TRAFFIC CONTROL SIGNAL.

SUDBURY
RTE 27 AT CONCORD RD
TRAFFIC PLANS
SHEET 28 OF XX



CONSTRUCTION NOTES
1. ALL PAVEMENT MARKINGS SHALL BE REFLECTORIZED THERMOPLASTIC.
2. WHERE EXISTING PAVEMENT MARKINGS ARE DIFFERENT THAN PROPOSED MARKINGS SHOWN, REMOVE BY AN APPROVED METHOD.
3. ALL EXISTING SIGNS WITHIN THE PROJECT LIMITS SHALL BE R&S UNLESS OTHERWISE NOTED.
4. RETAIN ALL EXISTING SIGNS UNLESS OTHERWISE NOTED.

20 0 20 40
SCALE IN FEET

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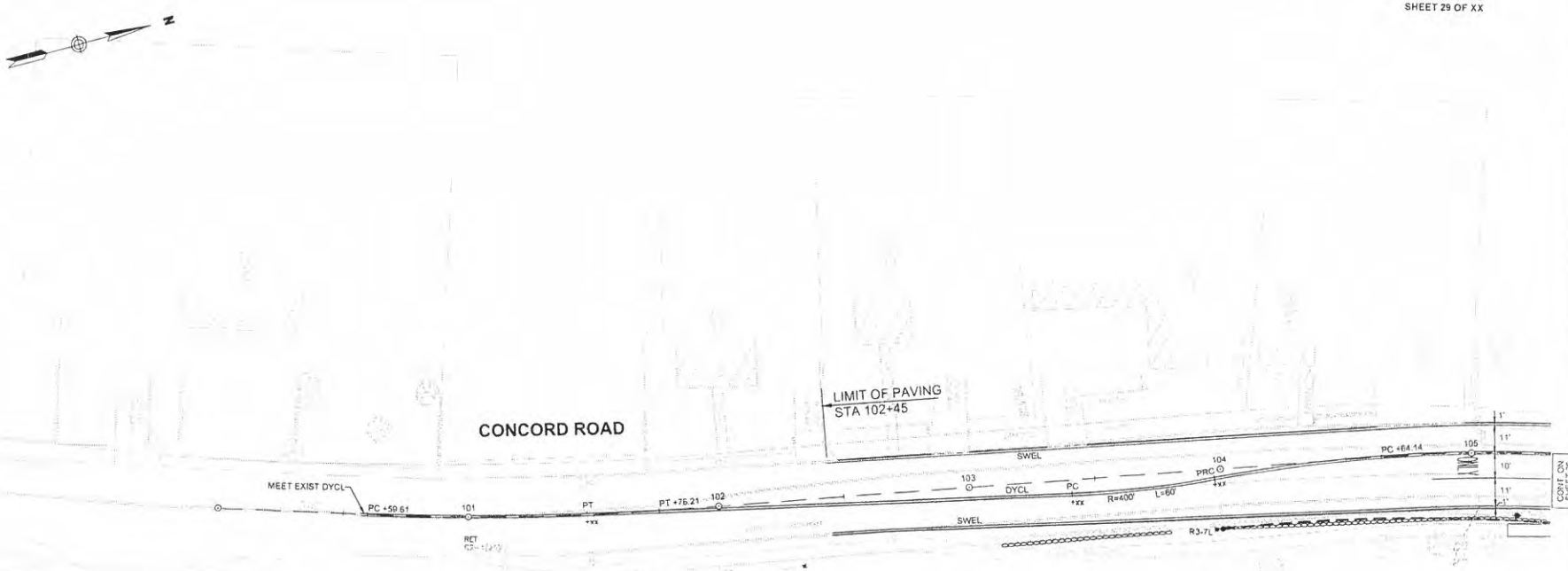
SUDBURY
RTE 27 AT CONCORD RD
TRAFFIC PLANS
SHEET 29 OF XX



GOODMAN'S HILL ROAD

CONSTRUCTION NOTES
1. ALL PAVEMENT MARKINGS SHALL BE REFLECTORIZED THERMOPLASTIC.
2. WHERE EXISTING PAVEMENT MARKINGS ARE DIFFERENT THAN PROPOSED MARKINGS SHOWN, REMOVE BY AN APPROVED METHOD.
3. ALL EXISTING SIGNS WITHIN THE PROJECT LIMITS SHALL BE R&S UNLESS OTHERWISE NOTED.
4. RETAIN ALL EXISTING SIGNS UNLESS OTHERWISE NOTED.

20 0 20 40
SCALE IN FEET

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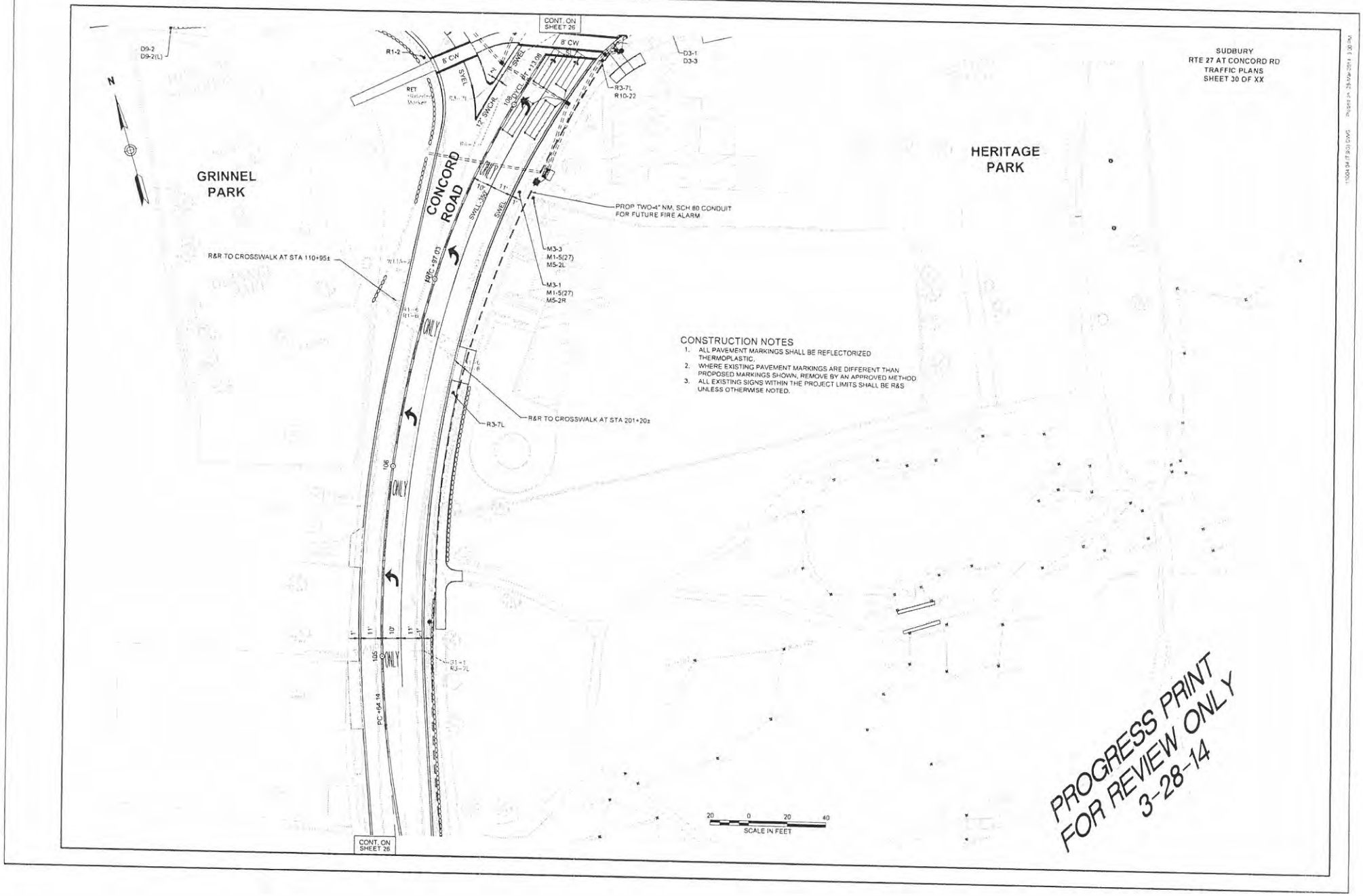
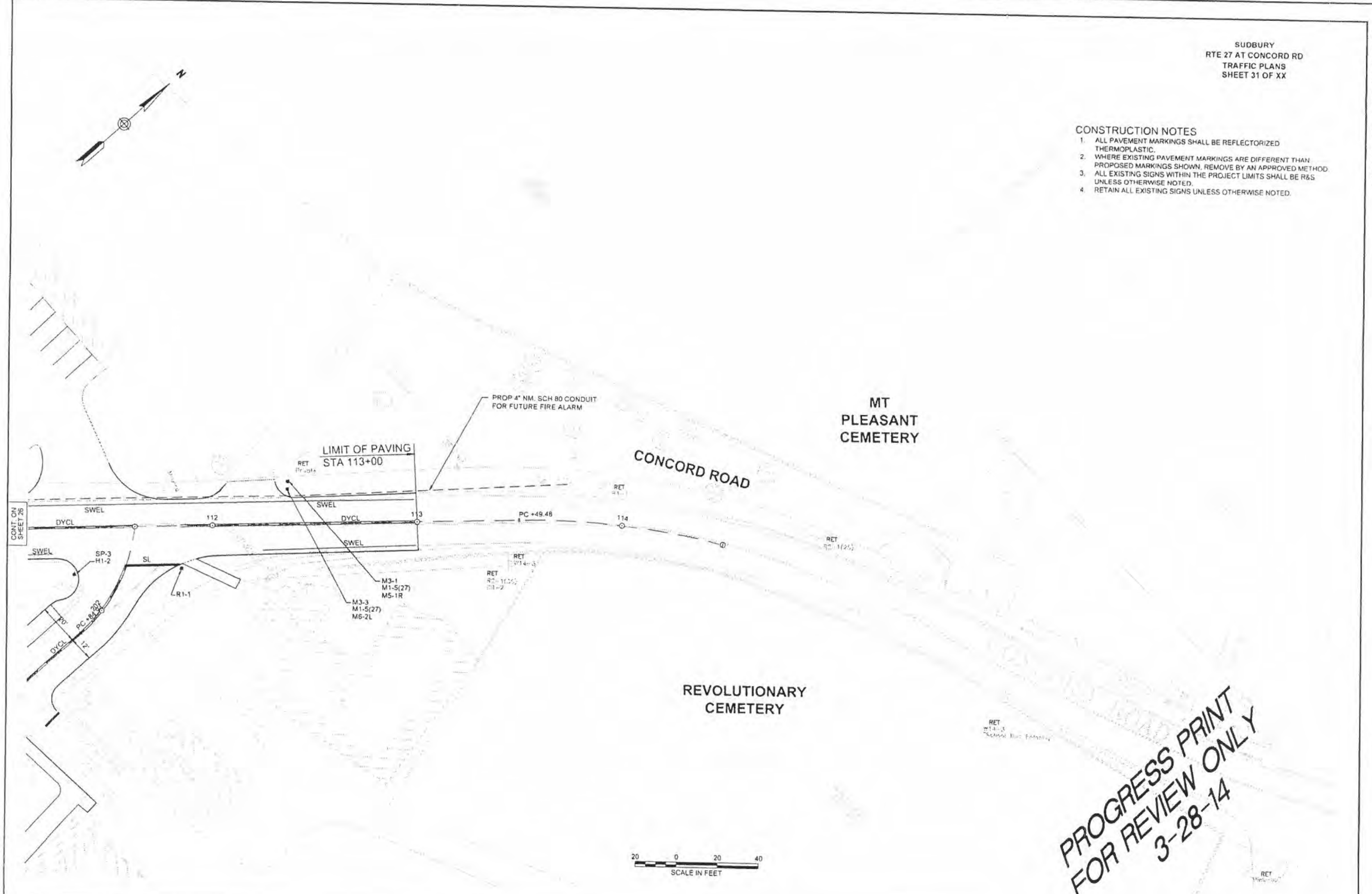
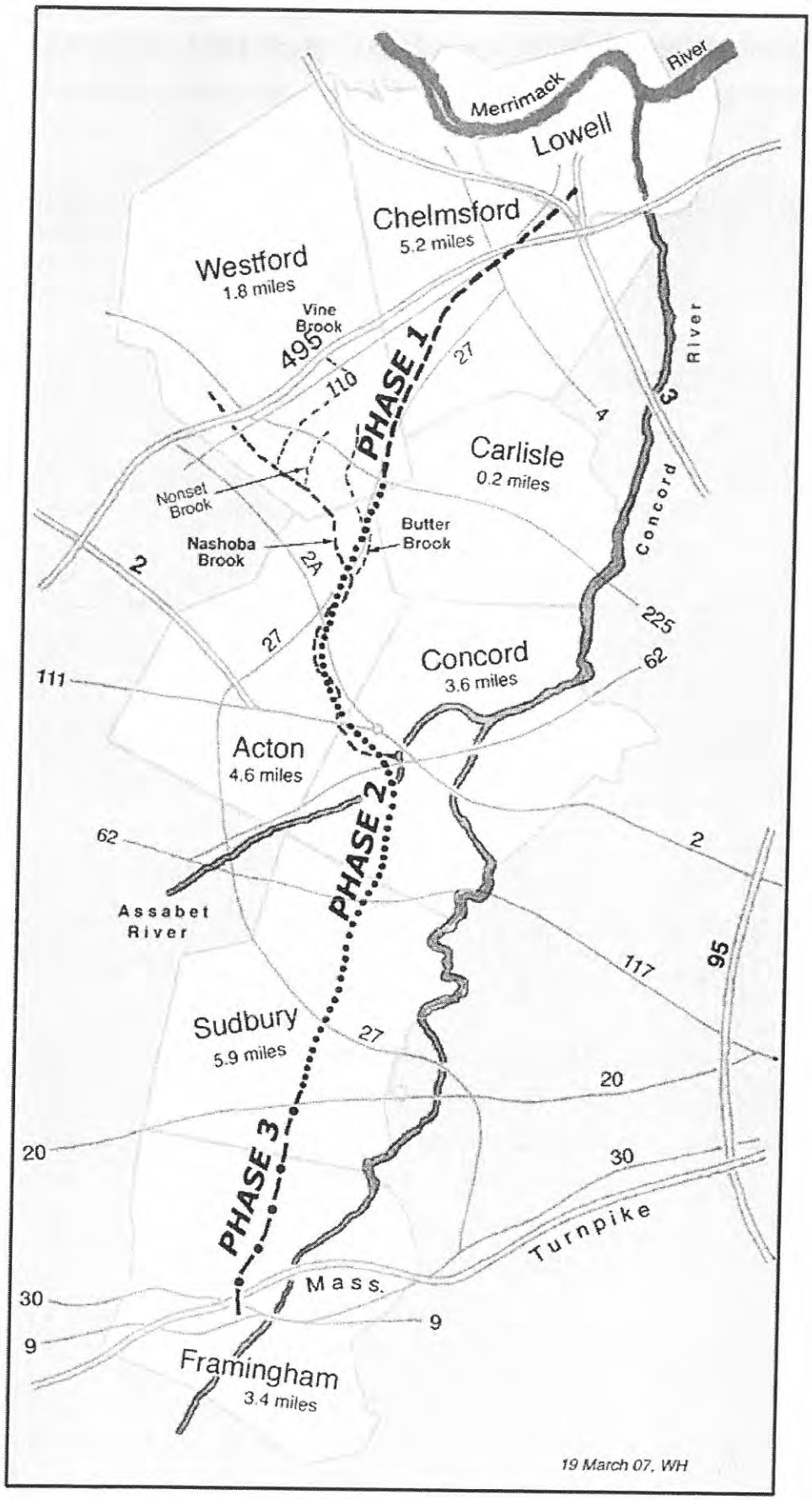

SUDBURY
RTE 27 AT CONCORD RD
TRAFFIC PLANS
SHEET 30 OF XX
GRINNEL PARK
HERITAGE PARK
CONCORD ROAD
CONT. ON SHEET 26
CONT. ON SHEET 26
D9-2
D9-2(L)
R1-2
8' CW
D3-1
D3-3
R3-7L
R10-22
PROP TWO-4" NM, SCH 80 CONDUIT FOR FUTURE FIRE ALARM
M3-3
M1-5(27)
M5-2L
M3-1
M1-5(27)
M5-2R
R&R TO CROSSWALK AT STA 110+95±
R&R TO CROSSWALK AT STA 201+20±
R3-7L
ONLY
CONSTRUCTION NOTES
1. ALL PAVEMENT MARKINGS SHALL BE REFLECTORIZED THERMOPLASTIC.
2. WHERE EXISTING PAVEMENT MARKINGS ARE DIFFERENT THAN PROPOSED MARKINGS SHOWN, REMOVE BY AN APPROVED METHOD.
3. ALL EXISTING SIGNS WITHIN THE PROJECT LIMITS SHALL BE R&S UNLESS OTHERWISE NOTED.
20 0 20 40
SCALE IN FEET
PROGRESS PRINT
FOR REVIEW ONLY
3-28-14

SUDBURY
RTE 27 AT CONCORD RD
TRAFFIC PLANS
SHEET 31 OF XX

CONSTRUCTION NOTES
1. ALL PAVEMENT MARKINGS SHALL BE REFLECTORIZED THERMOPLASTIC.
2. WHERE EXISTING PAVEMENT MARKINGS ARE DIFFERENT THAN PROPOSED MARKINGS SHOWN, REMOVE BY AN APPROVED METHOD.
3. ALL EXISTING SIGNS WITHIN THE PROJECT LIMITS SHALL BE R&S UNLESS OTHERWISE NOTED.
4. RETAIN ALL EXISTING SIGNS UNLESS OTHERWISE NOTED.




Merrimack River
Lowell
Chelmsford
5.2 miles
Westford
1.8 miles
Vine Brook
495
110
PHASE 1
27
4
3
Carlisle
0.2 miles
Concord River
Nonset Brook
Butter Brook
Nashoba Brook
2A
2
225
27
Concord
3.6 miles
62
111
Acton
4.6 miles
PHASE 2
62
2
Assabet River
117
95
Sudbury
5.9 miles
27
20
20
30
PHASE 3
Turnpike
Mass.
30
9
9
Framingham
3.4 miles
19 March 07, WH

□ Trip Generation Data

Institute of Transportation Engineers (ITE) 9th Edition
Land Use Code (LUC) 220 - Apartment

Average Vehicle Trips Ends vs: Dwelling Units
Independent Variable (X): 250

Average Weekday Daily

T = 6.06 * (X) + 123.56
T = 6.06 * 250 + (123.56)
T = 1638.56
T = 1,638 vehicle trips
with 50% (**819** vpd) entering and 50% (**819** vpd) exiting.

Weekday Morning Peak Hour Of Adjacent Street Traffic

T = 0.49 * (X) + 3.73
T = 0.49 * 250 + (3.73)
T = 126.23
T = 126 vehicle trips
with 20% (**25** vph) entering and 80% (**101** vph) exiting.

Weekday Evening Peak Hour Of Adjacent Street Traffic

T = 0.55 * (X) + 17.65
T = 0.55 * 250 + (17.65)
T = 155.15
T = 155 vehicle trips
with 65% (**101** vph) entering and 35% (**54** vph) exiting.

Saturday Daily

T = 7.85 * (X) - 256.19
T = 7.85 * 250 - (256.19)
T = 1706.31
T = 1,706 vehicle trips
with 50% (**853** vpd) entering and 50% (**853** vpd) exiting.

Saturday Midday Peak Hour Of Generator

T = 0.41 * (X) + 19.23
T = 0.41 * 250 + (19.23)
T = 121.73
T = 122 vehicle trips
with 50% (**61** vph) entering and 50% (**61** vph) exiting.

Institute of Transportation Engineers (ITE) 9th Edition
Land Use Code (LUC) 720 - Medical-Dental Office Building

Average Vehicle Trips Ends vs: 1000 Sq. Feet Gross Floor Area
Independent Variable (X): 8.00

Average Weekday Daily

T = 36.13 * (X)
T = 36.13 * 8.00
T = 289.04
T = 290 vehicle trips
with 50% (145 vpd) entering and 50% (145 vpd) exiting.

Weekday Morning Peak Hour Of Adjacent Street Traffic

T = 2.39* (X)
T = 2.39* 8.00
T = 19.12
T = 19 vehicle trips
with 79% (15 vpd) entering and 21% (4 vpd) exiting.

Weekday Evening Peak Hour Of Adjacent Street Traffic

T = 3.57* (X)
T = 3.57* 8.00
T = 28.56
T = 29 vehicle trips
with 28% (8 vpd) entering and 72% (21 vpd) exiting.

Saturday Daily

T = 8.96 * (X) (Small Sample Size - Use with Caution)
T = 8.96 * 8
T = 71.68
T = 72 vehicle trips
with 50% (36 vpd) entering and 50% (36 vpd) exiting.

Saturday Midday Peak Hour Of Generator

T = 3.63 * (X) (Small Sample Size - Use with Caution)
T = 3.63 * 8
T = 29.04
T = 29 vehicle trips
with 57% (17 vph) entering and 43% (12 vph) exiting.

Institute of Transportation Engineers (ITE) 9th Edition
Land Use Code (LUC) 826 - Specialty Retail Center

Average Vehicle Trips Ends vs: 1,000 Sq. Feet Gross Leasable Area
Independent Variable (X): 3.41

Average Weekday Daily

T = 44.32 * (X) (Small Sample Size - Use with Caution)
T = 44.32 * 3.413
T = 151.26
T = 152 vehicle trips
with 50% (76 vpd) entering and 50% (76 vpd) exiting.

Weekday Morning Peak Hour Of Adjacent Street Traffic

ITE LUC 820 Weekday Morning Trip Rate / ITE LUC 820 Weekday Evening Trip Rate = ITE LUC 826 Weekday Morning Trip Rate / ITE LUC 826 Weekday Evening Trip Rate

$\frac{0.96}{3.73} = \frac{(Y)}{2.71}$ Y = 0.69747989

T = Y * 3.4
T = 2.3805
T = 2 vehicle trips
with 62% (1 vph) entering and 38% (1 vph) exiting.

(same distribution split as ITE LUC 820 during the weekday morning peak hour of adjacent street traffic)

Weekday Evening Peak Hour Of Adjacent Street Traffic

T = 2.71 * (X) (Small Sample Size - Use with Caution)
T = 2.71 * 3.4
T = 9.25
T = 9 vehicle trips
with 44% (4 vph) entering and 56% (5 vph) exiting.

Saturday Daily

T = 42.040 * (X) (Small Sample Size - Use with Caution)
T = 42.040 * 3.413
T = 143.48
T = 144 vehicle trips
with 50% (72 vpd) entering and 50% (72 vpd) exiting.

Saturday Midday Peak Hour

ITE LUC 820 Saturday Midday Trip Rate / ITE LUC 820 Saturday Daily Trip Rate = ITE LUC 826 Saturday Midday Trip Rate / ITE LUC 826 Saturday Daily Trip Rate

$\frac{4.82}{49.97} = \frac{(Y)}{42.04}$ Y = 4.05508905

T = Y * 3.4
T = 13.84
T = 14 vehicle trips
with 52% (7 vph) entering and 48% (7 vph) exiting.

(same distribution split as ITE LUC 820 during the Saturday midday peak hour of generator)

Summary

Pass-By: 0.25

	Total	Pass-By	Net New
PM			
In	4	1	3
Out	5	1	4
Total	9	2	7
Sat			
In	7	2	5
Out	7	2	5
Total	14	3	10
Daily			
In	76	19	57
Out	76	19	57
Total	152	38	114
Sat Daily			
In	72	18	54
Out	72	18	54
Total	144	36	108

Institute of Transportation Engineers (ITE) 9th Edition
Land Use Code (LUC) 710 - General Office Building

Average Vehicle Trips Ends vs: 1000 Sq. Feet Gross Floor Area
Independent Variable (X): 14.08

Average Weekday Daily

T = 11.03 * (X)
T = 11.03 * 14.08
T = 155.27
T = 156 vehicle trips
with 50% (**78** vpd) entering and 50% (**78** vpd) exiting.

Weekday Morning Peak Hour Of Adjacent Street Traffic

T = 1:56 * (X)
T = 1.56 * 14.08
T = 21.96
T = 22 vehicle trips
with 88% (**19** vph) entering and 12% (**3** vph) exiting.

Weekday Evening Peak Hour Of Adjacent Street Traffic

T = 1.49 * (X)
T = 1.49 * 14.08
T = 20.97
T = 21 vehicle trips
with 17% (**4** vph) entering and 83% (**17** vph) exiting.

Saturday Daily

T = 2.46 * (x)
T = 2.46 * 14.08
T = 34.63
T = 34 vehicle trips
with 50% (**17** vpd) entering and 50% (**17** vpd) exiting.

Saturday Midday Peak Hour Of Generator

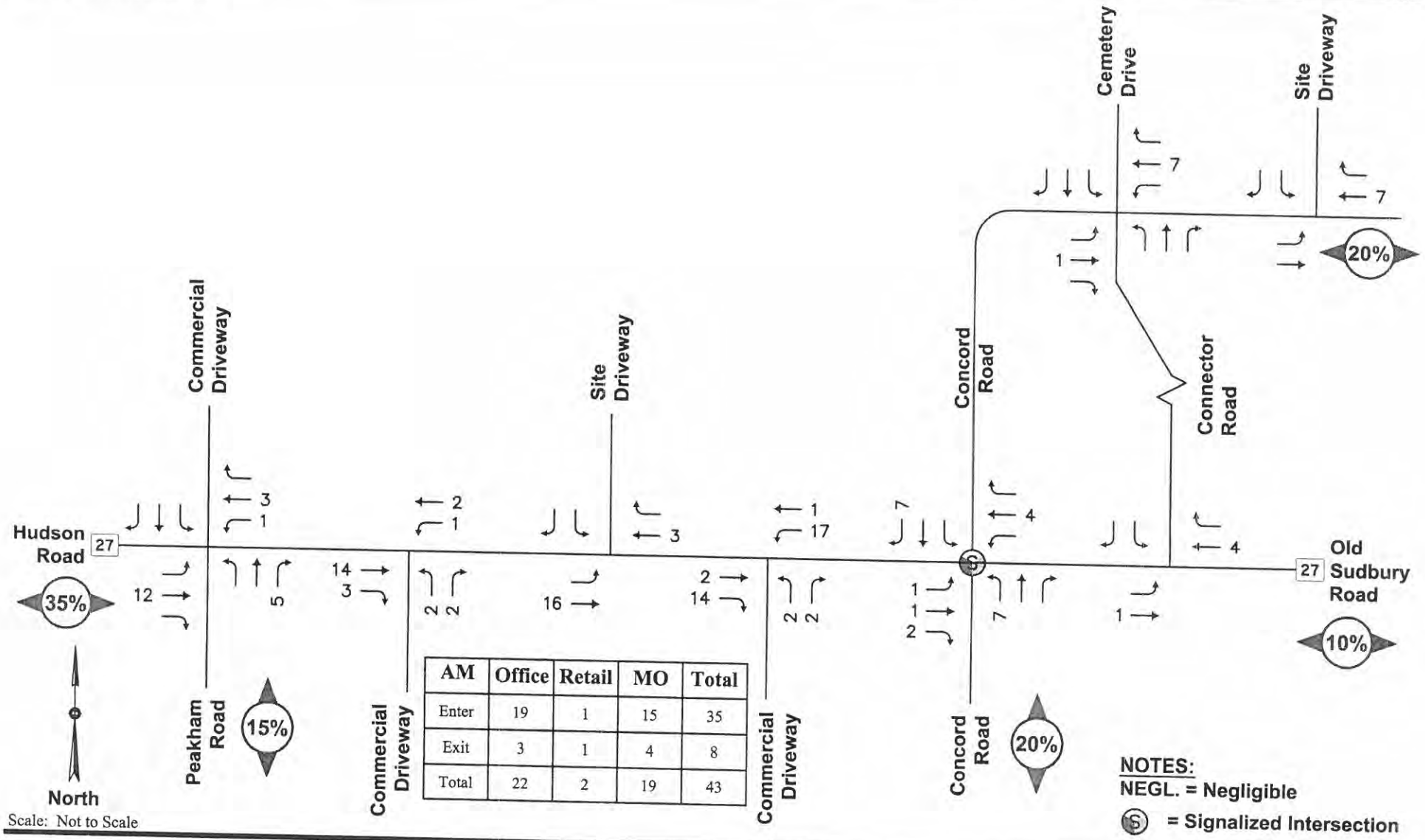
T = 0.43 * (X)
T = 0.43 * 14.08
T = 6.05
T = 6 vehicle trips
with 54% (**3** vph) entering and 46% (**3** vph) exiting.

□ Trip Distribution Calculations

County to Workplace MCD/County Flows for the United States and Puerto Rico Sorted by Reside

For more information on sampling and estimation methods, confidentiality protection, and sampling and nonsampling errors, see

%	Number	Residence	Workplace	To/From Routes (By Population)										
				Concord Street (North)		Concord Street (South)		Hudson Road (East)		Hudson Road (West)		Peakham Road (South)		Regional Total	
		MCD	MCD												
20.9%	1,620	Sudbury town	Sudbury town	25%	5.2%	40.0%	8.4%		0.0%	25.0%	5.2%	10.0%	2.1%	20.9%	100%
12.4%	959	Sudbury town	Boston city		0.0%		0.0%	100%	12.4%		0.0%		0.0%	12.4%	100.0%
5.9%	459	Sudbury town	Framingham town		0.0%	100%	5.9%		0.0%		0.0%		0.0%	5.9%	100.0%
4.7%	365	Sudbury town	Waltham city	25%	1.2%		0.0%	75%	3.5%		0.0%		0.0%	4.7%	100.0%
4.7%	361	Sudbury town	Cambridge city		0.0%		0.0%	100%	4.7%		0.0%		0.0%	4.7%	100.0%
4.1%	315	Sudbury town	Marlborough city		0.0%		0.0%		0.0%	50%	2.0%	50.0%	2.0%	4.1%	100.0%
3.7%	290	Sudbury town	Lexington town	50%	1.9%		0.0%	50%	1.9%		0.0%		0.0%	3.7%	100.0%
2.7%	206	Sudbury town	Natick town		0.0%	50%	1.3%	50%	1.3%		0.0%		0.0%	2.7%	100.0%
2.5%	194	Sudbury town	Newton city		0.0%		0.0%	100%	2.5%		0.0%		0.0%	2.5%	100.0%
2.4%	184	Sudbury town	Burlington town	25%	0.6%		0.0%	75%	1.8%		0.0%		0.0%	2.4%	100.0%
2.2%	168	Sudbury town	Concord town	100%	2.2%		0.0%		0.0%		0.0%		0.0%	2.2%	100.0%
1.9%	146	Sudbury town	Maynard town		0.0%		0.0%		0.0%	100%	1.9%		0.0%	1.9%	100.0%
1.8%	138	Sudbury town	Woburn city	50%	0.9%		0.0%	50%	0.9%		0.0%		0.0%	1.8%	100.0%
1.7%	129	Sudbury town	Weston town		0.0%	50%	0.8%	50%	0.8%		0.0%		0.0%	1.7%	100.0%
1.6%	120	Sudbury town	Wayland town		0.0%	50%	0.8%	50%	0.8%		0.0%		0.0%	1.6%	100.0%
1.5%	119	Sudbury town	Hudson town		0.0%		0.0%	100%	1.5%		0.0%		0.0%	1.5%	100.0%
1.4%	107	Sudbury town	Wellesley town		0.0%		0.0%	100%	1.4%		0.0%		0.0%	1.4%	100.0%
1.3%	104	Sudbury town	Brookline town		0.0%		0.0%	100%	1.3%		0.0%		0.0%	1.3%	100.0%
1.3%	99	Sudbury town	Westborough town		0.0%		0.0%		0.0%	50%	0.6%	50.0%	0.6%	1.3%	100.0%
1.2%	93	Sudbury town	Bedford town	50%	0.6%		0.0%	50%	0.6%		0.0%		0.0%	1.2%	100.0%
1.2%	93	Sudbury town	Worcester city		0.0%		0.0%		0.0%	100%	1.2%		0.0%	1.2%	100.0%
1.1%	83	Sudbury town	Acton town		0.0%		0.0%		0.0%	100%	1.1%		0.0%	1.1%	100.0%
0.8%	63	Sudbury town	Lowell city		0.0%		0.0%	25%	0.2%	75%	0.6%		0.0%	0.8%	100.0%
0.8%	61	Sudbury town	Needham town		0.0%		0.0%	100%	0.8%		0.0%		0.0%	0.8%	100.0%
0.8%	60	Sudbury town	Canton town		0.0%		0.0%	100%	0.8%		0.0%		0.0%	0.8%	100.0%
0.7%	54	Sudbury town	Wakefield town	50%	0.3%		0.0%	50%	0.3%		0.0%		0.0%	0.7%	100.0%
0.7%	54	Sudbury town	Southborough town		0.0%	50%	0.3%		0.0%		0.0%	50.0%	0.3%	0.7%	100.0%
0.6%	48	Sudbury town	Belmont town	50%	0.3%		0.0%	50%	0.3%		0.0%		0.0%	0.6%	100.0%
0.6%	47	Sudbury town	Billerica town	25%	0.2%		0.0%	75%	0.5%		0.0%		0.0%	0.6%	100.0%
0.6%	45	Sudbury town	Somerville city	50%	0.3%		0.0%	50%	0.3%		0.0%		0.0%	0.6%	100.0%
0.6%	43	Sudbury town	Chelmsford town		0.0%		0.0%		0.0%	100%	0.6%		0.0%	0.6%	100.0%
0.88					13.7%		17.6%		38.7%		13.2%		5.1%	88.3%	
					15.5%		19.9%		43.8%		15.0%		5.8%		100.0%
			SAY		15%		20%		45%		15%		5%		100%



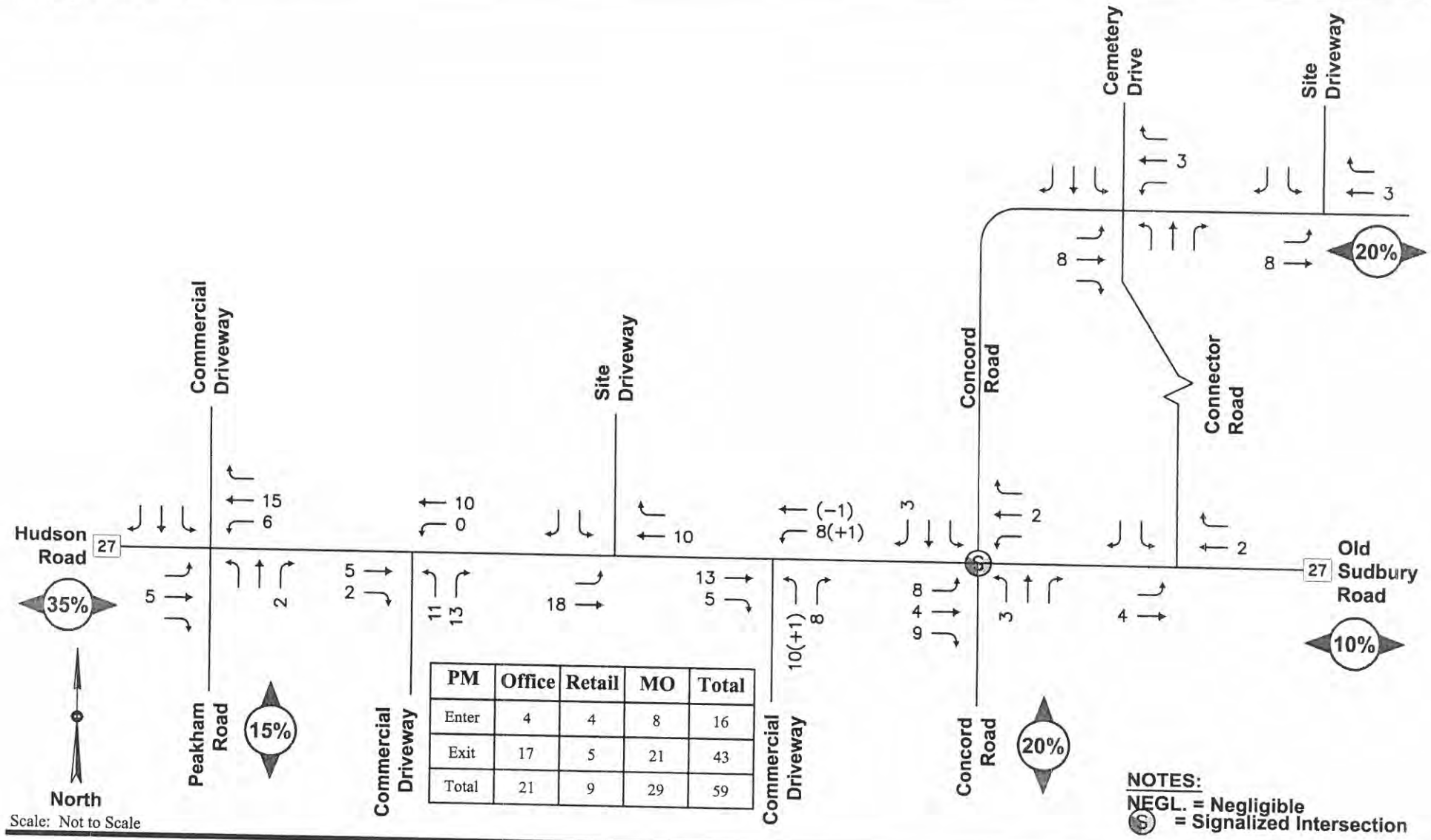
AM	Office	Retail	MO	Total
Enter	19	1	15	35
Exit	3	1	4	8
Total	22	2	19	43

MDM TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers

Attachments

Site-Generated Trips
Weekday Morning Peak Hour Traffic Volumes
(29 Hudson Road)

Date: November 2015
Dwg No. 814 TIAS.dwg



PM	Office	Retail	MO	Total
Enter	4	4	8	16
Exit	17	5	21	43
Total	21	9	29	59

MDM TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers

Attachments

Site-Generated Trips
Weekday Evening Peak Hour Traffic Volumes
(29 Hudson Road)

Date: November 2015
Dwg No. 814 TIAS.dwg

□ Intersection Delay Study

MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280

Stop Delay Study
Peakham Road at Rte 27
Sudbury, MA

File Name : 814 Peakham Rd AM Delay Study
Site Code : 814
Start Date : 12/17/2014
Page No : 1

Summary Information:

7:15:00 AM - 8:15:00 AM	Peakham Road
Total Vehicle Count:	349
Delayed Vehicle Count:	349
Through Vehicle Count:	0
Average Stopped Time:	19.56
Maximum Stopped Time:	57
Min. Secs. for Delay:	0
Average Queue:	1.90
Queue Density:	2.81
Maximum Queue:	10
Delay in Vehicle Hour:	1.90
Total Delay:	6828

MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280

Delay Study
Peakham Road at Rte 27
Sudbury, MA

File Name : 814 Peakham Rd PM Delay Study
Site Code : 814
Start Date : 12/17/2015
Page No : 1

Summary Information:

5:00:00 PM - 6:00:00 PM	Peakham Road
Total Vehicle Count:	156
Delayed Vehicle Count:	156
Through Vehicle Count:	0
Average Stopped Time:	16.31
Maximum Stopped Time:	99
Min. Secs. for Delay:	0
Average Queue:	0.71
Queue Density:	1.58
Maximum Queue:	5
Delay in Vehicle Hour:	0.71
Total Delay:	2544

MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280

Stop Delay Study
Ti-Sales Driveway
at Rte 27
Sudbury, MA

File Name : 814 Ti-Sales Driveway AM Delay
Site Code : 814
Start Date : 12/17/2014
Page No : 1

Summary Information:

7:15:00 AM - 8:15:00 AM	Ti-Sales Driveway
Total Vehicle Count:	2
Delayed Vehicle Count:	2
Through Vehicle Count:	0
Average Stopped Time:	16.5
Maximum Stopped Time:	29
Min. Secs. for Delay:	4
Average Queue:	0
Maximum Queue:	1
Total Delay:	33

MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280

Delay Study
Ti-Sales Driveway
at Rte 27
Sudbury, MA

File Name : 814 Ti-Sales Driveway PM Delay
Site Code : 814
Start Date : 12/17/2015
Page No : 1

Summary Information:

5:00:00 PM - 6:00:00 PM	Ti-Sales Driveway
Total Vehicle Count:	11
Delayed Vehicle Count:	11
Through Vehicle Count:	0
Average Stopped Time:	26.55
Maximum Stopped Time:	103
Min. Secs. for Delay:	0
Average Queue:	1
Maximum Queue:	1
Total Delay:	292

□ Capacity Analyses

LEVEL OF SERVICE METHODOLOGY

Capacity analysis of intersections is developed using the Synchro® computer software, which implements the methods of the 2010 Highway Capacity Manual (HCM). The resulting analysis presents a level-of-service (LOS) designation for individual intersection movements and (for signalized intersections) for the entire intersection. The LOS is a letter designation that provides a qualitative measure of operating conditions based on several factors including roadway geometry, speeds, ambient traffic volumes, traffic controls, and driver characteristics. Since the LOS of a traffic facility is a function of the traffic flows placed upon it, such a facility may operate at a wide range of LOS, depending on the time of day, day of week, or period of year. A range of six levels of service are defined on the basis of average delay, ranging from LOS A (the least delay) to LOS F (delays greater than 50 seconds for unsignalized movements, and greater than 80 seconds for signalized movements).

Signalized Intersection Performance Measures

The six LOS designations for signalized intersections may be described as follows:

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

The LOS for signalized intersections are calculated using the operational analysis methodology of the 2010 *Highway Capacity Manual*.[1] This method assesses the effects of signal type, timing, phasing, and progression; vehicle mix; and geometrics on delay. LOS designations are based on the criterion of control or signal delay per vehicle. Control or signal delay is a measure of driver discomfort, frustration, and fuel consumption, and includes initial deceleration delay approaching the traffic signal, queue move-up time, stopped delay and final acceleration delay. **Table A1** summarizes the relationship between LOS and control delay. The tabulated control delay criterion may be applied in assigning LOS designations to individual lane groups, to individual intersection approaches, or to entire intersections.

Table A1
LEVEL-OF-SERVICE CRITERIA
FOR SIGNALIZED INTERSECTIONS[1]

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

[1]Source: *Highway Capacity Manual 2010;* Transportation Research Board; Washington, DC; 2010.

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

Unsignalized Intersection Performance Measures

The six LOS designations for unsignalized intersections may be described as follows:

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

The LOS designations of unsignalized intersections are determined by application of a procedure described in the 2010 *Highway Capacity Manual.*[2] LOS is measured in terms of average control delay. Mathematically, control delay is a function of the capacity and degree of saturation of the lane group and/or approach under study and is a quantification of motorist delay associated with traffic control devices such as traffic signals and STOP signs. Control delay includes the effects of initial deceleration delay approaching a STOP sign, stopped delay, queue move-up time, and final acceleration delay from a stopped condition. Definitions for LOS at unsignalized intersections are also given in the *Highway Capacity Manual 2010.* **Table A2** summarizes the relationship between LOS and average control delay.

Table A2
LEVEL-OF-SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS[1]

Average Control Delay (seconds per vehicle)	Level of Service	
	v/c ≤ 1	v/c > 1
≤ 10.0	A	F
10.1 to 15.0	B	F
15.1 to 25.0	C	F
25.1 to 35.0	D	F
35.1 to 50.0	E	F
>50.0	F	F

[1]Source: *Highway Capacity Manual 2010,* Transportation Research Board; Washington, DC; 2010.

[2] ibid

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	324	721	187	21	218	0	173	329	71	0	276	150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	14	16	10	14	14	10	14	14	16	16	16
Storage Length (ft)	350		50	0		0	400		0	0		0
Storage Lanes	1		1	1		0	1		0	0		0
Taper Length (ft)	100			25			100			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850					0.973			0.953	
Flt Protected	0.950			0.950			0.950					
Satd. Flow (prot)	1604	1987	1794	1636	1894	0	1620	1911	0	0	1952	0
Flt Permitted	0.374			0.231			0.167					
Satd. Flow (perm)	632	1987	1794	398	1894	0	285	1911	0	0	1952	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			232					16			33	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		550			240			1000			325	
Travel Time (s)		12.5			5.5			22.7			7.4	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	5%	2%	2%	3%	7%	0%	4%	3%	4%	0%	3%	9%
Adj. Flow (vph)	348	775	201	23	234	0	186	354	76	0	297	161
Shared Lane Traffic (%)												
Lane Group Flow (vph)	348	775	201	23	234	0	186	430	0	0	458	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		10			10			10			10	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.09	0.92	0.85	1.09	0.92	0.92	1.09	0.92	0.92	0.85	0.85	0.85
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2		1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100	20	20	100		20	100		20	100	
Trailing Detector (ft)	0	0	0	0	0		0	0		0	0	
Detector 1 Position(ft)	0	0	0	0	0		0	0		0	0	
Detector 1 Size(ft)	20	6	20	20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA	Free	Perm	NA		pm+pt	NA			NA	
Protected Phases	5	2			6		3	8			4	

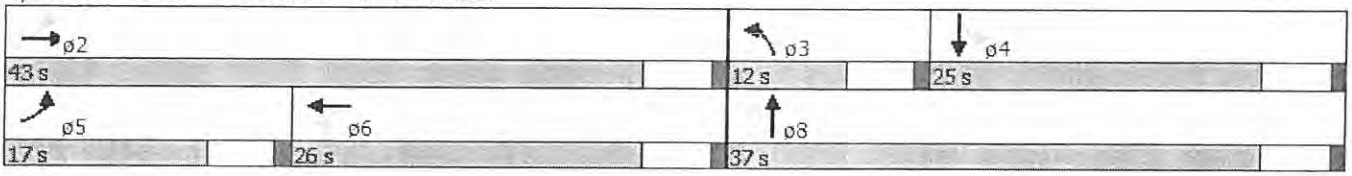
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	2		Free	6			8			4		
Detector Phase	5	2		6	6		3	8		4	4	
Switch Phase												
Minimum Initial (s)	6.0	10.0		10.0	10.0		6.0	8.0		8.0	8.0	
Minimum Split (s)	11.0	15.0		15.0	15.0		11.0	13.0		13.0	13.0	
Total Split (s)	17.0	43.0		26.0	26.0		12.0	37.0		25.0	25.0	
Total Split (%)	21.3%	53.8%		32.5%	32.5%		15.0%	46.3%		31.3%	31.3%	
Maximum Green (s)	12.0	38.0		21.0	21.0		7.0	32.0		20.0	20.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0			0.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0		5.0	5.0			5.0	
Lead/Lag	Lead			Lag	Lag		Lead			Lag	Lag	
Lead-Lag Optimize?	Yes			Yes	Yes		Yes			Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	Min		Min	Min		None	None		None	None	
Act Effct Green (s)	34.3	34.3	75.5	17.2	17.2		31.1	31.1			19.0	
Actuated g/C Ratio	0.45	0.45	1.00	0.23	0.23		0.41	0.41			0.25	
v/c Ratio	0.79	0.86	0.11	0.26	0.54		0.77	0.54			0.89	
Control Delay	29.9	29.9	0.1	31.5	30.6		40.5	19.9			47.6	
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Total Delay	29.9	29.9	0.1	31.5	30.6		40.5	19.9			47.6	
LOS	C	C	A	C	C		D	B			D	
Approach Delay		25.4			30.7			26.2			47.6	
Approach LOS		C			C			C			D	
90th %ile Green (s)	12.0	38.0		21.0	21.0		7.0	32.0		20.0	20.0	
90th %ile Term Code	Max	Max		Hold	Hold		Max	Hold		Max	Max	
70th %ile Green (s)	12.0	38.0		21.0	21.0		7.0	32.0		20.0	20.0	
70th %ile Term Code	Max	Max		Hold	Hold		Max	Hold		Max	Max	
50th %ile Green (s)	12.0	38.0		21.0	21.0		7.0	32.0		20.0	20.0	
50th %ile Term Code	Max	Max		Hold	Hold		Max	Hold		Max	Max	
30th %ile Green (s)	12.0	31.5		14.5	14.5		7.0	32.0		20.0	20.0	
30th %ile Term Code	Max	Gap		Hold	Hold		Max	Hold		Max	Max	
10th %ile Green (s)	11.8	26.8		10.0	10.0		7.0	27.2		15.2	15.2	
10th %ile Term Code	Gap	Hold		Min	Min		Max	Hold		Gap	Gap	
Queue Length 50th (ft)	111	318	0	9	98		61	155			207	
Queue Length 95th (ft)	#218	#530	0	30	165		#150	243			#379	
Internal Link Dist (ft)		470			160			920			245	
Turn Bay Length (ft)	350		50				400					
Base Capacity (vph)	443	1007	1794	111	531		242	825			545	
Starvation Cap Reductn	0	0	0	0	0		0	0			0	
Spillback Cap Reductn	0	0	0	0	0		0	0			0	
Storage Cap Reductn	0	0	0	0	0		0	0			0	
Reduced v/c Ratio	0.79	0.77	0.11	0.21	0.44		0.77	0.52			0.84	

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 75.5

Natural Cycle: 75
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.89
Intersection Signal Delay: 29.9
Intersection LOS: C
Intersection Capacity Utilization 108.2%
ICU Level of Service G
Analysis Period (min) 15
90th %ile Actuated Cycle: 80
70th %ile Actuated Cycle: 80
50th %ile Actuated Cycle: 80
30th %ile Actuated Cycle: 73.5
10th %ile Actuated Cycle: 64
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Concord Road & Route 27



Intersection

Int Delay, s/veh 29

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	1	896	16	130	402	4	24	2	337	2	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	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	40	-	0	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	1	-	-	1	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	0	2	6	7	8	0	9	0	3	0	0	0
Mvmt Flow	1	963	17	140	432	4	26	2	362	2	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	437	0	0	981	0	0	1688	1690	972	1689	1697	434
Stage 1	-	-	-	-	-	-	974	974	-	714	714	-
Stage 2	-	-	-	-	-	-	714	716	-	975	983	-
Critical Hdwy	4.1	-	-	4.17	-	-	7.19	6.5	6.23	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.19	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.19	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.263	-	-	3.581	4	3.327	3.5	4	3.3
Pot Cap-1 Maneuver	1134	-	-	684	-	-	71	94	~ 305	75	93	626
Stage 1	-	-	-	-	-	-	294	333	-	425	438	-
Stage 2	-	-	-	-	-	-	411	437	-	305	329	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1134	-	-	684	-	-	60	75	~ 305	-	74	626
Mov Cap-2 Maneuver	-	-	-	-	-	-	168	189	-	~ -191	141	-
Stage 1	-	-	-	-	-	-	293	332	-	424	348	-
Stage 2	-	-	-	-	-	-	327	348	-	-	328	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	2.8	140.6	
HCM LOS			F	-

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	169	305	1134	-	-	684	-	-	-
HCM Lane V/C Ratio	0.165	1.188	0.001	-	-	0.204	-	-	-
HCM Control Delay (s)	30.5	149.1	8.2	0	-	11.6	-	-	-
HCM Lane LOS	D	F	A	A	-	B	-	-	-
HCM 95th %tile Q(veh)	0.6	15.8	0	-	-	0.8	-	-	-

Notes

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

Intersection	
Int Delay, s/veh	1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	2	790	228	24	40	11
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	160	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	0	2	7	0	0	0
Mvmt Flow	2	849	245	26	43	12

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	271	0	-	0	1112	135
Stage 1	-	-	-	-	258	-
Stage 2	-	-	-	-	854	-
Critical Hdwy	4.1	-	-	-	6.6	6.9
Critical Hdwy Stg 1	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1304	-	-	-	219	895
Stage 1	-	-	-	-	767	-
Stage 2	-	-	-	-	421	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1304	-	-	-	218	895
Mov Cap-2 Maneuver	-	-	-	-	218	-
Stage 1	-	-	-	-	767	-
Stage 2	-	-	-	-	420	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	22.4
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1304	-	-	-	261
HCM Lane V/C Ratio	0.002	-	-	-	0.21
HCM Control Delay (s)	7.8	0	-	-	22.4
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0	-	-	-	0.8

Intersection

Int Delay, s/veh 0.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	0	0	1	0	23	0	649	4	52	425	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	0	0	0	0	0	0	0	3	0	0	3	0
Mvmt Flow	0	0	0	1	0	25	0	698	4	56	457	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1281	1271	457	1269	1269	700	457	0	0	702	0	0
Stage 1	569	569	-	700	700	-	-	-	-	-	-	-
Stage 2	712	702	-	569	569	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
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	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	144	169	608	147	170	443	1114	-	-	905	-	-
Stage 1	511	509	-	433	444	-	-	-	-	-	-	-
Stage 2	427	443	-	511	509	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	127	155	608	138	156	443	1114	-	-	905	-	-
Mov Cap-2 Maneuver	127	155	-	138	156	-	-	-	-	-	-	-
Stage 1	511	467	-	433	444	-	-	-	-	-	-	-
Stage 2	403	443	-	469	467	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	14.5	0	1
HCM LOS	A	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1114	-	-	-	406	905	-	-
HCM Lane V/C Ratio	-	-	-	-	0.064	0.062	-	-
HCM Control Delay (s)	0	-	-	0	14.5	9.2	0	-
HCM Lane LOS	A	-	-	A	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	-	0.2	0.2	-	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	97	334	266	72	743	0	237	368	31	1	247	230
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	14	16	10	14	14	10	14	14	16	16	16
Storage Length (ft)	350		50	0		0	400		0	0		0
Storage Lanes	1		1	1		0	1		0	0		0
Taper Length (ft)	100			25			100			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850					0.988			0.935	
Flt Protected	0.950			0.950			0.950					
Satd. Flow (prot)	1652	1968	1812	1652	2007	0	1668	2002	0	0	2003	0
Flt Permitted	0.091			0.556			0.158				0.999	
Satd. Flow (perm)	158	1968	1812	967	2007	0	277	2002	0	0	2001	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			185					5			42	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		550			240			1000			325	
Travel Time (s)		12.5			5.5			22.7			7.4	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles (%)	2%	3%	1%	2%	1%	0%	1%	0%	0%	0%	1%	0%
Adj. Flow (vph)	99	341	271	73	758	0	242	376	32	1	252	235
Shared Lane Traffic (%)												
Lane Group Flow (vph)	99	341	271	73	758	0	242	408	0	0	488	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		10			10			10			10	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.09	0.92	0.85	1.09	0.92	0.92	1.09	0.92	0.92	0.85	0.85	0.85
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2		1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100	20	20	100		20	100		20	100	
Trailing Detector (ft)	0	0	0	0	0		0	0		0	0	
Detector 1 Position(ft)	0	0	0	0	0		0	0		0	0	
Detector 1 Size(ft)	20	6	20	20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA	Free	Perm	NA		pm+pt	NA		Perm	NA	
Protected Phases	5	2			6		3	8			4	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	2		Free	6			8			4		
Detector Phase	5	2		6	6		3	8		4	4	
Switch Phase												
Minimum Initial (s)	6.0	10.0		10.0	10.0		6.0	8.0		8.0	8.0	
Minimum Split (s)	11.0	15.0		15.0	15.0		11.0	13.0		13.0	13.0	
Total Split (s)	11.0	58.0		47.0	47.0		17.0	42.0		25.0	25.0	
Total Split (%)	11.0%	58.0%		47.0%	47.0%		17.0%	42.0%		25.0%	25.0%	
Maximum Green (s)	6.0	53.0		42.0	42.0		12.0	37.0		20.0	20.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0			0.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0		5.0	5.0			5.0	
Lead/Lag	Lead			Lag	Lag		Lead			Lag	Lag	
Lead-Lag Optimize?	Yes			Yes	Yes		Yes			Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	Min		Min	Min		None	None		None	None	
Act Effct Green (s)	47.1	47.1	94.6	38.8	38.8		37.3	37.3			20.3	
Actuated g/C Ratio	0.50	0.50	1.00	0.41	0.41		0.39	0.39			0.21	
v/c Ratio	0.57	0.35	0.15	0.18	0.92		0.85	0.52			1.06	
Control Delay	26.2	15.0	0.2	19.9	45.0		51.5	26.1			93.8	
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Total Delay	26.2	15.0	0.2	19.9	45.0		51.5	26.1			93.8	
LOS	C	B	A	B	D		D	C			F	
Approach Delay		10.9			42.8			35.6			93.8	
Approach LOS		B			D			D			F	
90th %ile Green (s)	6.0	53.0		42.0	42.0		12.0	37.0		20.0	20.0	
90th %ile Term Code	Max	Hold		Max	Max		Max	Hold		Max	Max	
70th %ile Green (s)	6.0	53.0		42.0	42.0		12.0	37.0		20.0	20.0	
70th %ile Term Code	Max	Hold		Max	Max		Max	Hold		Max	Max	
50th %ile Green (s)	6.0	53.0		42.0	42.0		12.0	37.0		20.0	20.0	
50th %ile Term Code	Max	Hold		Max	Max		Max	Hold		Max	Max	
30th %ile Green (s)	6.0	52.1		41.1	41.1		12.0	37.0		20.0	20.0	
30th %ile Term Code	Max	Hold		Gap	Gap		Max	Hold		Max	Max	
10th %ile Green (s)	0.0	27.8		27.8	27.8		11.2	36.2		20.0	20.0	
10th %ile Term Code	Skip	Hold		Gap	Gap		Gap	Hold		Max	Max	
Queue Length 50th (ft)	30	118	0	29	440		112	200			~340	
Queue Length 95th (ft)	#66	176	0	60	#674		#250	295			#540	
Internal Link Dist (ft)		470			160			920			245	
Turn Bay Length (ft)	350		50				400					
Base Capacity (vph)	174	1118	1812	435	903		288	796			461	
Starvation Cap Reductn	0	0	0	0	0		0	0			0	
Spillback Cap Reductn	0	0	0	0	0		0	0			0	
Storage Cap Reductn	0	0	0	0	0		0	0			0	
Reduced v/c Ratio	0.57	0.31	0.15	0.17	0.84		0.84	0.51			1.06	

Intersection Summary

Area Type: Other
Cycle Length: 100
Actuated Cycle Length: 94.6

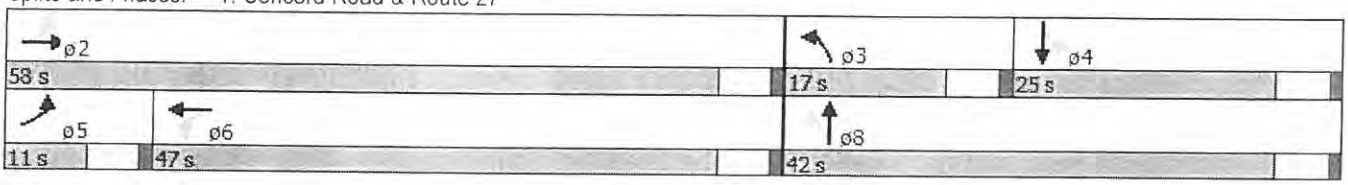
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 1.06
Intersection Signal Delay: 41.9
Intersection Capacity Utilization 109.5%
Analysis Period (min) 15
90th %ile Actuated Cycle: 100
70th %ile Actuated Cycle: 100
50th %ile Actuated Cycle: 100
30th %ile Actuated Cycle: 99.1
10th %ile Actuated Cycle: 74

Intersection LOS: D
ICU Level of Service H

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

Splits and Phases: 1: Concord Road & Route 27



Intersection	
Int Delay, s/veh	3.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	586	20	212	1001	0	44	1	117	10	1	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	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	40	-	0	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	1	-	-	1	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	97	97	97	97	97	97	97	97	97	97	97	97
Heavy Vehicles, %	0	1	0	0	0	0	2	100	0	0	100	0
Mvmt Flow	0	604	21	219	1032	0	45	1	121	10	1	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1032	0	0	625	0	0	2084	2083	614	2084	2094	1032
Stage 1	-	-	-	-	-	-	614	614	-	1469	1469	-
Stage 2	-	-	-	-	-	-	1470	1469	-	615	625	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.12	7.5	6.2	7.1	7.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	6.5	-	6.1	6.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	6.5	-	6.1	6.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.518	4.9	3.3	3.5	4.9	3.3
Pot Cap-1 Maneuver	681	-	-	966	-	-	~ 39	29	496	39	28	285
Stage 1	-	-	-	-	-	-	479	358	-	160	120	-
Stage 2	-	-	-	-	-	-	158	120	-	482	353	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	681	-	-	966	-	-	~ 32	22	496	24	22	285
Mov Cap-2 Maneuver	-	-	-	-	-	-	97	74	-	80	60	-
Stage 1	-	-	-	-	-	-	479	358	-	160	93	-
Stage 2	-	-	-	-	-	-	121	93	-	364	353	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	1.7	30.9	58.9
HCM LOS			D	F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	96	496	681	-	-	966	-	-	78
HCM Lane V/C Ratio	0.483	0.243	-	-	-	0.226	-	-	0.145
HCM Control Delay (s)	73.4	14.6	0	-	-	9.8	-	-	58.9
HCM Lane LOS	F	B	A	-	-	A	-	-	F
HCM 95th %tile Q(veh)	2.1	0.9	0	-	-	0.9	-	-	0.5

Notes

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

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	2	364	793	41	20	22
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	160	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	98	98	98	98	98	98
Heavy Vehicles, %	0	3	1	0	0	0
Mvmt Flow	2	371	809	42	20	22

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	851	0	-	0	1206	426
Stage 1	-	-	-	-	830	-
Stage 2	-	-	-	-	376	-
Critical Hdwy	4.1	-	-	-	6.6	6.9
Critical Hdwy Stg 1	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	796	-	-	-	191	582
Stage 1	-	-	-	-	394	-
Stage 2	-	-	-	-	699	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	796	-	-	-	190	582
Mov Cap-2 Maneuver	-	-	-	-	190	-
Stage 1	-	-	-	-	394	-
Stage 2	-	-	-	-	697	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	19.3
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	796	-	-	-	294
HCM Lane V/C Ratio	0.003	-	-	-	0.146
HCM Control Delay (s)	9.5	0	-	-	19.3
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0	-	-	-	0.5

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	0	0	3	0	37	0	434	31	26	475	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	98	98	98	98	98	98	98	98	98	98	98	98
Heavy Vehicles, %	0	0	0	0	0	3	0	0	0	0	1	0
Mvmt Flow	0	0	0	3	0	38	0	443	32	27	485	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1016	1012	485	997	997	459	485	0	0	474	0	0
Stage 1	538	538	-	459	459	-	-	-	-	-	-	-
Stage 2	478	474	-	538	538	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.23	4.1	-	-	4.1	-	-
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	3.5	4	3.3	3.5	4	3.327	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	218	241	586	225	246	600	1088	-	-	1099	-	-
Stage 1	531	526	-	586	570	-	-	-	-	-	-	-
Stage 2	572	561	-	531	526	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	199	233	586	219	238	600	1088	-	-	1099	-	-
Mov Cap-2 Maneuver	199	233	-	219	238	-	-	-	-	-	-	-
Stage 1	531	508	-	586	570	-	-	-	-	-	-	-
Stage 2	536	561	-	513	508	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	12.3	0	0.4
HCM LOS	A	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1088	-	-	-	531	1099	-	-
HCM Lane V/C Ratio	-	-	-	-	0.077	0.024	-	-
HCM Control Delay (s)	0	-	-	0	12.3	8.4	0	-
HCM Lane LOS	A	-	-	A	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	-	0.2	0.1	-	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	333	741	194	22	228	0	184	337	73	0	283	161
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	14	16	10	14	14	10	14	14	16	16	16
Storage Length (ft)	350		50	0		0	400		0	0		0
Storage Lanes	1		1	1		0	1		0	0		0
Taper Length (ft)	100			25			100			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850					0.973			0.951	
Flt Protected	0.950			0.950			0.950					
Satd. Flow (prot)	1604	1987	1794	1636	1894	0	1620	1911	0	0	1947	0
Flt Permitted	0.359			0.227			0.163					
Satd. Flow (perm)	606	1987	1794	391	1894	0	278	1911	0	0	1947	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			232					16			34	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		550			240			1000			325	
Travel Time (s)		12.5			5.5			22.7			7.4	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	5%	2%	2%	3%	7%	0%	4%	3%	4%	0%	3%	9%
Adj. Flow (vph)	358	797	209	24	245	0	198	362	78	0	304	173
Shared Lane Traffic (%)												
Lane Group Flow (vph)	358	797	209	24	245	0	198	440	0	0	477	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		10			10			10			10	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.09	0.92	0.85	1.09	0.92	0.92	1.09	0.92	0.92	0.85	0.85	0.85
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2		1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100	20	20	100		20	100		20	100	
Trailing Detector (ft)	0	0	0	0	0		0	0		0	0	
Detector 1 Position(ft)	0	0	0	0	0		0	0		0	0	
Detector 1 Size(ft)	20	6	20	20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA	Free	Perm	NA		pm+pt	NA			NA	
Protected Phases	5	2			6		3	8			4	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	2		Free	6			8			4		
Detector Phase	5	2		6	6		3	8		4	4	
Switch Phase												
Minimum Initial (s)	6.0	10.0		10.0	10.0		6.0	8.0		8.0	8.0	
Minimum Split (s)	11.0	15.0		15.0	15.0		11.0	13.0		13.0	13.0	
Total Split (s)	17.0	43.0		26.0	26.0		12.0	37.0		25.0	25.0	
Total Split (%)	21.3%	53.8%		32.5%	32.5%		15.0%	46.3%		31.3%	31.3%	
Maximum Green (s)	12.0	38.0		21.0	21.0		7.0	32.0		20.0	20.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0			0.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0		5.0	5.0			5.0	
Lead/Lag	Lead			Lag	Lag		Lead			Lag	Lag	
Lead-Lag Optimize?	Yes			Yes	Yes		Yes			Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	Min		Min	Min		None	None		None	None	
Act Effct Green (s)	34.7	34.7	76.3	17.6	17.6		31.5	31.5			19.5	
Actuated g/C Ratio	0.45	0.45	1.00	0.23	0.23		0.41	0.41			0.26	
v/c Ratio	0.83	0.88	0.12	0.27	0.56		0.83	0.55			0.91	
Control Delay	33.7	32.2	0.1	32.1	31.2		48.4	20.3			51.4	
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Total Delay	33.7	32.2	0.1	32.1	31.2		48.4	20.3			51.4	
LOS	C	C	A	C	C		D	C			D	
Approach Delay		27.7			31.2			29.0			51.4	
Approach LOS		C			C			C			D	
90th %ile Green (s)	12.0	38.0		21.0	21.0		7.0	32.0		20.0	20.0	
90th %ile Term Code	Max	Max		Max	Max		Max	Hold		Max	Max	
70th %ile Green (s)	12.0	38.0		21.0	21.0		7.0	32.0		20.0	20.0	
70th %ile Term Code	Max	Max		Hold	Hold		Max	Hold		Max	Max	
50th %ile Green (s)	12.0	38.0		21.0	21.0		7.0	32.0		20.0	20.0	
50th %ile Term Code	Max	Max		Hold	Hold		Max	Hold		Max	Max	
30th %ile Green (s)	12.0	33.1		16.1	16.1		7.0	32.0		20.0	20.0	
30th %ile Term Code	Max	Gap		Hold	Hold		Max	Hold		Max	Max	
10th %ile Green (s)	12.0	27.0		10.0	10.0		7.0	29.2		17.2	17.2	
10th %ile Term Code	Max	Hold		Min	Min		Max	Hold		Gap	Gap	
Queue Length 50th (ft)	116	333	0	9	104		66	160			218	
Queue Length 95th (ft)	#238	#556	0	31	173		#169	250			#401	
Internal Link Dist (ft)		470			160			920			245	
Turn Bay Length (ft)	350		50				400					
Base Capacity (vph)	433	995	1794	108	524		238	815			538	
Starvation Cap Reductn	0	0	0	0	0		0	0			0	
Spillback Cap Reductn	0	0	0	0	0		0	0			0	
Storage Cap Reductn	0	0	0	0	0		0	0			0	
Reduced v/c Ratio	0.83	0.80	0.12	0.22	0.47		0.83	0.54			0.89	

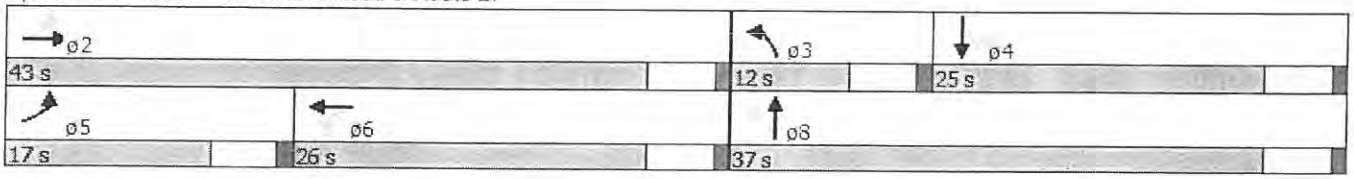
Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 76.3

Natural Cycle: 80
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.91
Intersection Signal Delay: 32.5
Intersection Capacity Utilization 110.9%
Analysis Period (min) 15
90th %ile Actuated Cycle: 80
70th %ile Actuated Cycle: 80
50th %ile Actuated Cycle: 80
30th %ile Actuated Cycle: 75.1
10th %ile Actuated Cycle: 66.2
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Intersection LOS: C
ICU Level of Service H

Splits and Phases: 1: Concord Road & Route 27



Intersection

Int Delay, s/veh 37.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	1	931	16	134	416	4	25	2	351	2	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	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	40	-	0	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	1	-	-	1	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	0	2	6	7	8	0	9	0	3	0	0	0
Mvmt Flow	1	1001	17	144	447	4	27	2	377	2	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	452	0	0	1018	0	0	1750	1752	1010	1751	1758	449
Stage 1	-	-	-	-	-	-	1012	1012	-	738	738	-
Stage 2	-	-	-	-	-	-	738	740	-	1013	1020	-
Critical Hdwy	4.1	-	-	4.17	-	-	7.19	6.5	6.23	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.19	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.19	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.263	-	-	3.581	4	3.327	3.5	4	3.3
Pot Cap-1 Maneuver	1119	-	-	662	-	-	64	86	~ 290	68	86	614
Stage 1	-	-	-	-	-	-	280	319	-	413	427	-
Stage 2	-	-	-	-	-	-	399	426	-	291	317	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1119	-	-	662	-	-	53	67	~ 290	-	67	614
Mov Cap-2 Maneuver	-	-	-	-	-	-	158	179	-	~ -203	130	-
Stage 1	-	-	-	-	-	-	279	318	-	412	334	-
Stage 2	-	-	-	-	-	-	312	333	-	-	316	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	2.9	182.7	
HCM LOS			F	-

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	159	290	1119	-	-	662	-	-	-
HCM Lane V/C Ratio	0.183	1.301	0.001	-	-	0.218	-	-	-
HCM Control Delay (s)	32.6	194.2	8.2	0	-	11.9	-	-	-
HCM Lane LOS	D	F	A	A	-	B	-	-	-
HCM 95th %tile Q(veh)	0.6	18.6	0	-	-	0.8	-	-	-

Notes

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

Intersection	
Int Delay, s/veh	1.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	2	812	239	25	41	11
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	160	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	0	2	7	0	0	0
Mvmt Flow	2	873	257	27	44	12

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	284	0	-	0	1147	142
Stage 1	-	-	-	-	270	-
Stage 2	-	-	-	-	877	-
Critical Hdwy	4.1	-	-	-	6.6	6.9
Critical Hdwy Stg 1	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1290	-	-	-	208	886
Stage 1	-	-	-	-	757	-
Stage 2	-	-	-	-	410	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1290	-	-	-	207	886
Mov Cap-2 Maneuver	-	-	-	-	207	-
Stage 1	-	-	-	-	757	-
Stage 2	-	-	-	-	409	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	23.8
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1290	-	-	-	247
HCM Lane V/C Ratio	0.002	-	-	-	0.226
HCM Control Delay (s)	7.8	0	-	-	23.8
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0	-	-	-	0.8

Intersection

Int Delay, s/veh 0.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	0	0	1	0	24	0	666	4	53	443	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	0	0	0	0	0	0	0	3	0	0	3	0
Mvmt Flow	0	0	0	1	0	26	0	716	4	57	476	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1321	1310	476	1308	1308	718	476	0	0	720	0	0
Stage 1	590	590	-	718	718	-	-	-	-	-	-	-
Stage 2	731	720	-	590	590	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
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	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	135	160	593	138	161	432	1097	-	-	891	-	-
Stage 1	497	498	-	423	436	-	-	-	-	-	-	-
Stage 2	416	435	-	497	498	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	118	146	593	129	147	432	1097	-	-	891	-	-
Mov Cap-2 Maneuver	118	146	-	129	147	-	-	-	-	-	-	-
Stage 1	497	455	-	423	436	-	-	-	-	-	-	-
Stage 2	391	435	-	454	455	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	14.8	0	1
HCM LOS	A	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1097	-	-	-	395	891	-	-
HCM Lane V/C Ratio	-	-	-	-	0.068	0.064	-	-
HCM Control Delay (s)	0	-	-	0	14.8	9.3	0	-
HCM Lane LOS	A	-	-	A	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	-	0.2	0.2	-	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	107	346	282	74	764	0	246	378	32	1	253	239
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	14	16	10	14	14	10	14	14	16	16	16
Storage Length (ft)	350		50	0		0	400		0	0		0
Storage Lanes	1		1	1		0	1		0	0		0
Taper Length (ft)	100			25			100			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850					0.988			0.935	
Flt Protected	0.950			0.950			0.950					
Satd. Flow (prot)	1652	1968	1812	1652	2007	0	1668	2002	0	0	2003	0
Flt Permitted	0.088			0.550			0.160				0.999	
Satd. Flow (perm)	153	1968	1812	956	2007	0	281	2002	0	0	2001	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			185					5			42	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		550			240			1000			325	
Travel Time (s)		12.5			5.5			22.7			7.4	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles (%)	2%	3%	1%	2%	1%	0%	1%	0%	0%	0%	1%	0%
Adj. Flow (vph)	109	353	288	76	780	0	251	386	33	1	258	244
Shared Lane Traffic (%)												
Lane Group Flow (vph)	109	353	288	76	780	0	251	419	0	0	503	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		10			10			10			10	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.09	0.92	0.85	1.09	0.92	0.92	1.09	0.92	0.92	0.85	0.85	0.85
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2		1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100	20	20	100		20	100		20	100	
Trailing Detector (ft)	0	0	0	0	0		0	0		0	0	
Detector 1 Position(ft)	0	0	0	0	0		0	0		0	0	
Detector 1 Size(ft)	20	6	20	20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA	Free	Perm	NA		pm+pt	NA		Perm	NA	
Protected Phases	5	2			6		3	8			4	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	2		Free	6			8			4		
Detector Phase	5	2		6	6		3	8		4	4	
Switch Phase												
Minimum Initial (s)	6.0	10.0		10.0	10.0		6.0	8.0		8.0	8.0	
Minimum Split (s)	11.0	15.0		15.0	15.0		11.0	13.0		13.0	13.0	
Total Split (s)	11.0	58.0		47.0	47.0		17.0	42.0		25.0	25.0	
Total Split (%)	11.0%	58.0%		47.0%	47.0%		17.0%	42.0%		25.0%	25.0%	
Maximum Green (s)	6.0	53.0		42.0	42.0		12.0	37.0		20.0	20.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0			0.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0		5.0	5.0			5.0	
Lead/Lag	Lead			Lag	Lag		Lead			Lag	Lag	
Lead-Lag Optimize?	Yes			Yes	Yes		Yes			Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	Min		Min	Min		None	None		None	None	
Act Effct Green (s)	51.4	51.4	98.5	40.4	40.4		37.1	37.1			20.0	
Actuated g/C Ratio	0.52	0.52	1.00	0.41	0.41		0.38	0.38			0.20	
v/c Ratio	0.64	0.34	0.16	0.19	0.95		0.92	0.55			1.14	
Control Delay	31.5	14.8	0.2	20.0	50.0		63.0	27.7			123.2	
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Total Delay	31.5	14.8	0.2	20.0	50.0		63.0	27.7			123.2	
LOS	C	B	A	C	D		E	C			F	
Approach Delay		11.6			47.4			41.0			123.2	
Approach LOS		B			D			D			F	
90th %ile Green (s)	6.0	53.0		42.0	42.0		12.0	37.0		20.0	20.0	
90th %ile Term Code	Max	Hold		Max	Max		Max	Hold		Max	Max	
70th %ile Green (s)	6.0	53.0		42.0	42.0		12.0	37.0		20.0	20.0	
70th %ile Term Code	Max	Hold		Max	Max		Max	Hold		Max	Max	
50th %ile Green (s)	6.0	53.0		42.0	42.0		12.0	37.0		20.0	20.0	
50th %ile Term Code	Max	Hold		Max	Max		Max	Hold		Max	Max	
30th %ile Green (s)	6.0	53.0		42.0	42.0		12.0	37.0		20.0	20.0	
30th %ile Term Code	Max	Hold		Max	Max		Max	Hold		Max	Max	
10th %ile Green (s)	6.0	45.3		34.3	34.3		12.0	37.0		20.0	20.0	
10th %ile Term Code	Max	Hold		Gap	Gap		Max	Hold		Max	Max	
Queue Length 50th (ft)	33	123	0	30	461		117	207			~360	
Queue Length 95th (ft)	#91	183	0	62	#705		#262	304			#563	
Internal Link Dist (ft)		470			160			920			245	
Turn Bay Length (ft)	350		50				400					
Base Capacity (vph)	171	1060	1812	408	856		274	755			440	
Starvation Cap Reductn	0	0	0	0	0		0	0			0	
Spillback Cap Reductn	0	0	0	0	0		0	0			0	
Storage Cap Reductn	0	0	0	0	0		0	0			0	
Reduced v/c Ratio	0.64	0.33	0.16	0.19	0.91		0.92	0.55			1.14	

Intersection Summary

Area Type: Other
Cycle Length: 100
Actuated Cycle Length: 98.5

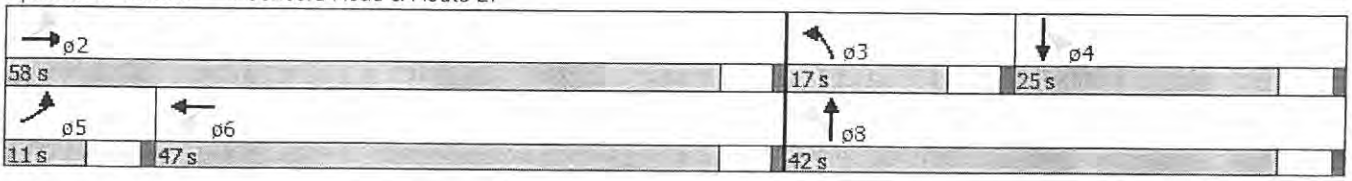
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 1.14
Intersection Signal Delay: 49.9
Intersection Capacity Utilization 112.6%
Analysis Period (min) 15
90th %ile Actuated Cycle: 100
70th %ile Actuated Cycle: 100
50th %ile Actuated Cycle: 100
30th %ile Actuated Cycle: 100
10th %ile Actuated Cycle: 92.3

Intersection LOS: D
ICU Level of Service H

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

Splits and Phases: 1: Concord Road & Route 27



Intersection

Int Delay, s/veh 4.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	606	21	223	1041	0	45	1	122	10	1	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	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	40	-	0	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	1	-	-	1	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	97	97	97	97	97	97	97	97	97	97	97	97
Heavy Vehicles, %	0	1	0	0	0	0	2	100	0	0	100	0
Mvmt Flow	0	625	22	230	1073	0	46	1	126	10	1	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1073	0	0	646	0	0	2170	2169	636	2169	2179	1073
Stage 1	-	-	-	-	-	-	636	636	-	1533	1533	-
Stage 2	-	-	-	-	-	-	1534	1533	-	636	646	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.12	7.5	6.2	7.1	7.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	6.5	-	6.1	6.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	6.5	-	6.1	6.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.518	4.9	3.3	3.5	4.9	3.3
Pot Cap-1 Maneuver	657	-	-	949	-	-	~ 34	25	481	34	25	270
Stage 1	-	-	-	-	-	-	466	348	-	147	110	-
Stage 2	-	-	-	-	-	-	146	110	-	469	344	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	657	-	-	949	-	-	~ 27	19	481	20	19	270
Mov Cap-2 Maneuver	-	-	-	-	-	-	88	66	-	68	52	-
Stage 1	-	-	-	-	-	-	466	348	-	147	83	-
Stage 2	-	-	-	-	-	-	109	83	-	345	344	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	1.8	35	70.5
HCM LOS			E	F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	87	481	657	-	-	949	-	-	66
HCM Lane V/C Ratio	0.545	0.261	-	-	-	0.242	-	-	0.172
HCM Control Delay (s)	87.6	15.1	0	-	-	10	-	-	70.5
HCM Lane LOS	F	C	A	-	-	B	-	-	F
HCM 95th %tile Q(veh)	2.4	1	0	-	-	0.9	-	-	0.6

Notes

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

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	2	377	815	42	21	23
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	160	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	98	98	98	98	98	98
Heavy Vehicles, %	0	3	1	0	0	0
Mvmt Flow	2	385	832	43	21	23

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	874	0	-	0	1242	437
Stage 1	-	-	-	-	853	-
Stage 2	-	-	-	-	389	-
Critical Hdwy	4.1	-	-	-	6.6	6.9
Critical Hdwy Stg 1	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	781	-	-	-	182	573
Stage 1	-	-	-	-	383	-
Stage 2	-	-	-	-	689	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	781	-	-	-	181	573
Mov Cap-2 Maneuver	-	-	-	-	181	-
Stage 1	-	-	-	-	383	-
Stage 2	-	-	-	-	687	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	20.2
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	781	-	-	-	282
HCM Lane V/C Ratio	0.003	-	-	-	0.159
HCM Control Delay (s)	9.6	0	-	-	20.2
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0	-	-	-	0.6

Intersection

Int Delay, s/veh 0.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	0	0	3	0	38	0	453	32	27	490	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	98	98	98	98	98	98	98	98	98	98	98	98
Heavy Vehicles, %	0	0	0	0	0	3	0	0	0	0	1	0
Mvmt Flow	0	0	0	3	0	39	0	462	33	28	500	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1053	1050	500	1034	1034	479	500	0	0	495	0	0
Stage 1	555	555	-	479	479	-	-	-	-	-	-	-
Stage 2	498	495	-	555	555	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.23	4.1	-	-	4.1	-	-
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	3.5	4	3.3	3.5	4	3.327	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	206	229	575	212	234	585	1075	-	-	1079	-	-
Stage 1	520	516	-	571	558	-	-	-	-	-	-	-
Stage 2	558	549	-	520	516	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	187	221	575	206	226	585	1075	-	-	1079	-	-
Mov Cap-2 Maneuver	187	221	-	206	226	-	-	-	-	-	-	-
Stage 1	520	497	-	571	558	-	-	-	-	-	-	-
Stage 2	521	549	-	501	497	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	12.6	0	0.4
HCM LOS	A	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1075	-	-	-	516	1079	-	-
HCM Lane V/C Ratio	-	-	-	-	0.081	0.026	-	-
HCM Control Delay (s)	0	-	-	0	12.6	8.4	0	-
HCM Lane LOS	A	-	-	A	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	-	0.3	0.1	-	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	333	777	209	22	237	0	187	338	73	0	288	161
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	14	16	10	14	14	10	14	14	16	16	16
Storage Length (ft)	350		50	0		0	400		0	0		0
Storage Lanes	1		1	1		0	1		0	0		0
Taper Length (ft)	100			25			100			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850					0.973			0.952	
Flt Protected	0.950			0.950			0.950					
Satd. Flow (prot)	1604	1987	1794	1636	1894	0	1620	1911	0	0	1950	0
Flt Permitted	0.352			0.217			0.162					
Satd. Flow (perm)	594	1987	1794	374	1894	0	276	1911	0	0	1950	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			232					16			33	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		550			240			1000			325	
Travel Time (s)		12.5			5.5			22.7			7.4	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	5%	2%	2%	3%	7%	0%	4%	3%	4%	0%	3%	9%
Adj. Flow (vph)	358	835	225	24	255	0	201	363	78	0	310	173
Shared Lane Traffic (%)												
Lane Group Flow (vph)	358	835	225	24	255	0	201	441	0	0	483	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		10			10			10			10	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.09	0.92	0.85	1.09	0.92	0.92	1.09	0.92	0.92	0.85	0.85	0.85
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2		1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100	20	20	100		20	100		20	100	
Trailing Detector (ft)	0	0	0	0	0		0	0		0	0	
Detector 1 Position(ft)	0	0	0	0	0		0	0		0	0	
Detector 1 Size(ft)	20	6	20	20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA	Free	Perm	NA		pm+pt	NA			NA	
Protected Phases	5	2			6		3	8			4	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	2		Free	6			8			4		
Detector Phase	5	2		6	6		3	8		4	4	
Switch Phase												
Minimum Initial (s)	6.0	10.0		10.0	10.0		6.0	8.0		8.0	8.0	
Minimum Split (s)	11.0	15.0		15.0	15.0		11.0	13.0		13.0	13.0	
Total Split (s)	17.0	43.0		26.0	26.0		12.0	37.0		25.0	25.0	
Total Split (%)	21.3%	53.8%		32.5%	32.5%		15.0%	46.3%		31.3%	31.3%	
Maximum Green (s)	12.0	38.0		21.0	21.0		7.0	32.0		20.0	20.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0			0.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0		5.0	5.0			5.0	
Lead/Lag	Lead			Lag	Lag		Lead			Lag	Lag	
Lead-Lag Optimize?	Yes			Yes	Yes		Yes			Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	Min		Min	Min		None	None		None	None	
Act Effct Green (s)	35.5	35.5	77.2	18.4	18.4		31.7	31.7			19.6	
Actuated g/C Ratio	0.46	0.46	1.00	0.24	0.24		0.41	0.41			0.25	
v/c Ratio	0.83	0.92	0.13	0.27	0.57		0.85	0.56			0.93	
Control Delay	34.3	36.0	0.1	32.4	31.1		51.9	20.6			54.1	
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Total Delay	34.3	36.0	0.1	32.4	31.1		51.9	20.6			54.1	
LOS	C	D	A	C	C		D	C			D	
Approach Delay		29.9			31.2			30.4			54.1	
Approach LOS		C			C			C			D	
90th %ile Green (s)	12.0	38.0		21.0	21.0		7.0	32.0		20.0	20.0	
90th %ile Term Code	Max	Max		Max	Max		Max	Hold		Max	Max	
70th %ile Green (s)	12.0	38.0		21.0	21.0		7.0	32.0		20.0	20.0	
70th %ile Term Code	Max	Max		Hold	Hold		Max	Hold		Max	Max	
50th %ile Green (s)	12.0	38.0		21.0	21.0		7.0	32.0		20.0	20.0	
50th %ile Term Code	Max	Max		Hold	Hold		Max	Hold		Max	Max	
30th %ile Green (s)	12.0	36.3		19.3	19.3		7.0	32.0		20.0	20.0	
30th %ile Term Code	Max	Gap		Hold	Hold		Max	Hold		Max	Max	
10th %ile Green (s)	12.0	27.5		10.5	10.5		7.0	30.0		18.0	18.0	
10th %ile Term Code	Max	Gap		Hold	Hold		Max	Hold		Gap	Gap	
Queue Length 50th (ft)	116	360	0	9	109		67	160			223	
Queue Length 95th (ft)	#241	#599	0	32	180		#173	252			#409	
Internal Link Dist (ft)		470			160			920			245	
Turn Bay Length (ft)	350		50				400					
Base Capacity (vph)	430	982	1794	102	517		236	805			532	
Starvation Cap Reductn	0	0	0	0	0		0	0			0	
Spillback Cap Reductn	0	0	0	0	0		0	0			0	
Storage Cap Reductn	0	0	0	0	0		0	0			0	
Reduced v/c Ratio	0.83	0.85	0.13	0.24	0.49		0.85	0.55			0.91	

Intersection Summary

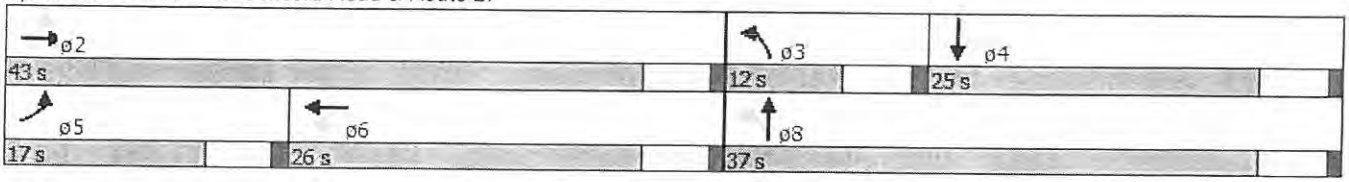
Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 77.2

Natural Cycle: 80
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.93
Intersection Signal Delay: 34.3
Intersection Capacity Utilization 113.1%
Analysis Period (min) 15
90th %ile Actuated Cycle: 80
70th %ile Actuated Cycle: 80
50th %ile Actuated Cycle: 80
30th %ile Actuated Cycle: 78.3
10th %ile Actuated Cycle: 67.5

Intersection LOS: C
ICU Level of Service H

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

Splits and Phases: 1: Concord Road & Route 27



Intersection	
Int Delay, s/veh	3.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	5	1281	553	12	51	20
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	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	0	2	8	0	0	0
Mvmt Flow	5	1348	582	13	54	21

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	595	0	-	0	1947	588
Stage 1	-	-	-	-	588	-
Stage 2	-	-	-	-	1359	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	991	-	-	-	72	513
Stage 1	-	-	-	-	559	-
Stage 2	-	-	-	-	241	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	991	-	-	-	71	513
Mov Cap-2 Maneuver	-	-	-	-	71	-
Stage 1	-	-	-	-	559	-
Stage 2	-	-	-	-	236	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	106.3
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	991	-	-	-	71	513
HCM Lane V/C Ratio	0.005	-	-	-	0.756	0.041
HCM Control Delay (s)	8.7	0	-	-	143.2	12.3
HCM Lane LOS	A	A	-	-	F	B
HCM 95th %tile Q(veh)	0	-	-	-	3.5	0.1

Intersection

Int Delay, s/veh 38.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	1	935	16	139	431	4	25	2	352	2	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	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	40	-	0	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	1	-	-	1	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	0	2	6	7	8	0	9	0	3	0	0	0
Mvmt Flow	1	1005	17	149	463	4	27	2	378	2	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	468	0	0	1023	0	0	1781	1783	1014	1782	1790	466
Stage 1	-	-	-	-	-	-	1016	1016	-	765	765	-
Stage 2	-	-	-	-	-	-	765	767	-	1017	1025	-
Critical Hdwy	4.1	-	-	4.17	-	-	7.19	6.5	6.23	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.19	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.19	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.263	-	-	3.581	4	3.327	3.5	4	3.3
Pot Cap-1 Maneuver	1104	-	-	659	-	-	61	83	~ 288	64	82	601
Stage 1	-	-	-	-	-	-	278	318	-	399	415	-
Stage 2	-	-	-	-	-	-	385	414	-	289	315	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1104	-	-	659	-	-	50	64	~ 288	-	63	601
Mov Cap-2 Maneuver	-	-	-	-	-	-	154	174	-	~ -218	124	-
Stage 1	-	-	-	-	-	-	277	317	-	398	321	-
Stage 2	-	-	-	-	-	-	298	320	-	-	314	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	2.9	187.7	
HCM LOS			F	-

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	155	288	1104	-	-	659	-	-	-
HCM Lane V/C Ratio	0.187	1.314	0.001	-	-	0.227	-	-	-
HCM Control Delay (s)	33.5	199.5	8.3	0	-	12.1	-	-	-
HCM Lane LOS	D	F	A	A	-	B	-	-	-
HCM 95th %tile Q(veh)	0.7	18.8	0	-	-	0.9	-	-	-

Notes

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

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	2	848	248	28	51	11
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	50	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	0	2	7	0	0	0
Mvmt Flow	2	912	267	30	55	12

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	297	0	-	0	1198	148
Stage 1	-	-	-	-	282	-
Stage 2	-	-	-	-	916	-
Critical Hdwy	4.1	-	-	-	6.6	6.9
Critical Hdwy Stg 1	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1276	-	-	-	194	878
Stage 1	-	-	-	-	747	-
Stage 2	-	-	-	-	393	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1276	-	-	-	193	878
Mov Cap-2 Maneuver	-	-	-	-	193	-
Stage 1	-	-	-	-	747	-
Stage 2	-	-	-	-	392	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	27.7
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1276	-	-	-	224
HCM Lane V/C Ratio	0.002	-	-	-	0.298
HCM Control Delay (s)	7.8	0	-	-	27.7
HCM Lane LOS	A	A	-	-	D
HCM 95th %tile Q(veh)	0	-	-	-	1.2

Intersection

Int Delay, s/veh 0.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	0	0	1	0	27	0	667	4	63	448	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	0	0	0	0	0	0	0	3	0	0	3	0
Mvmt Flow	0	0	0	1	0	29	0	717	4	68	482	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1351	1339	482	1336	1336	719	482	0	0	722	0	0
Stage 1	617	617	-	719	719	-	-	-	-	-	-	-
Stage 2	734	722	-	617	617	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
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	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	129	154	588	132	155	432	1091	-	-	889	-	-
Stage 1	481	484	-	423	436	-	-	-	-	-	-	-
Stage 2	415	434	-	481	484	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	111	138	588	121	139	432	1091	-	-	889	-	-
Mov Cap-2 Maneuver	111	138	-	121	139	-	-	-	-	-	-	-
Stage 1	481	434	-	423	436	-	-	-	-	-	-	-
Stage 2	387	434	-	431	434	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	14.8	0	1.2
HCM LOS	A	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1091	-	-	-	396	889	-	-
HCM Lane V/C Ratio	-	-	-	-	0.076	0.076	-	-
HCM Control Delay (s)	0	-	-	0	14.8	9.4	0	-
HCM Lane LOS	A	-	-	A	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	-	0.2	0.2	-	-

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	15	15	4	690	496	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	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	16	16	4	726	522	4

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1259	524	526	0	-	0
Stage 1	524	-	-	-	-	-
Stage 2	735	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	188	553	1041	-	-	-
Stage 1	594	-	-	-	-	-
Stage 2	474	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	187	553	1041	-	-	-
Mov Cap-2 Maneuver	187	-	-	-	-	-
Stage 1	594	-	-	-	-	-
Stage 2	471	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	19.5	0	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1041	-	279	-	-
HCM Lane V/C Ratio	0.004	-	0.113	-	-
HCM Control Delay (s)	8.5	0	19.5	-	-
HCM Lane LOS	A	A	C	-	-
HCM 95th %tile Q(veh)	0	-	0.4	-	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	107	365	290	74	800	0	261	383	32	1	256	239
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	14	16	10	14	14	10	14	14	16	16	16
Storage Length (ft)	350		50	0		0	400		0	0		0
Storage Lanes	1		1	1		0	1		0	0		0
Taper Length (ft)	100			25			100			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850					0.988			0.935	
Flt Protected	0.950			0.950			0.950					
Satd. Flow (prot)	1652	1968	1812	1652	2007	0	1668	2002	0	0	2003	0
Flt Permitted	0.086			0.540			0.160				0.999	
Satd. Flow (perm)	150	1968	1812	939	2007	0	281	2002	0	0	2001	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			185					5			42	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		550			240			1000			325	
Travel Time (s)		12.5			5.5			22.7			7.4	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles (%)	2%	3%	1%	2%	1%	0%	1%	0%	0%	0%	1%	0%
Adj. Flow (vph)	109	372	296	76	816	0	266	391	33	1	261	244
Shared Lane Traffic (%)												
Lane Group Flow (vph)	109	372	296	76	816	0	266	424	0	0	506	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		10			10			10			10	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.09	0.92	0.85	1.09	0.92	0.92	1.09	0.92	0.92	0.85	0.85	0.85
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2		1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100	20	20	100		20	100		20	100	
Trailing Detector (ft)	0	0	0	0	0		0	0		0	0	
Detector 1 Position(ft)	0	0	0	0	0		0	0		0	0	
Detector 1 Size(ft)	20	6	20	20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA	Free	Perm	NA		pm+pt	NA		Perm	NA	
Protected Phases	5	2			6		3	8			4	

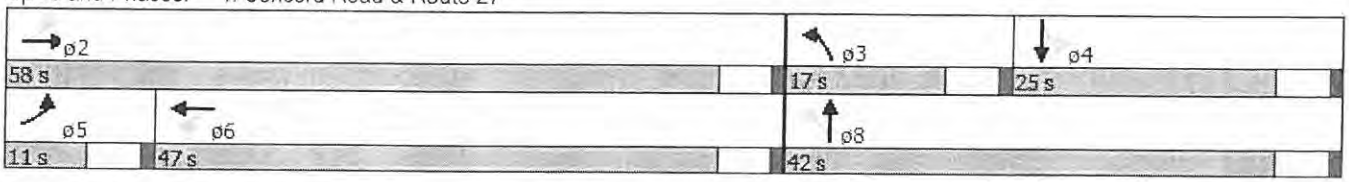
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	2		Free	6			8			4		
Detector Phase	5	2		6	6		3	8		4	4	
Switch Phase												
Minimum Initial (s)	6.0	10.0		10.0	10.0		6.0	8.0		8.0	8.0	
Minimum Split (s)	11.0	15.0		15.0	15.0		11.0	13.0		13.0	13.0	
Total Split (s)	11.0	58.0		47.0	47.0		17.0	42.0		25.0	25.0	
Total Split (%)	11.0%	58.0%		47.0%	47.0%		17.0%	42.0%		25.0%	25.0%	
Maximum Green (s)	6.0	53.0		42.0	42.0		12.0	37.0		20.0	20.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0			0.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0		5.0	5.0			5.0	
Lead/Lag	Lead			Lag	Lag		Lead			Lag	Lag	
Lead-Lag Optimize?	Yes			Yes	Yes		Yes			Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	Min		Min	Min		None	None		None	None	
Act Effct Green (s)	52.6	52.6	99.6	41.6	41.6		37.0	37.0			20.0	
Actuated g/C Ratio	0.53	0.53	1.00	0.42	0.42		0.37	0.37			0.20	
v/c Ratio	0.64	0.36	0.16	0.19	0.97		0.98	0.57			1.17	
Control Delay	32.4	14.9	0.2	20.0	55.0		78.0	28.4			130.9	
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Total Delay	32.4	14.9	0.2	20.0	55.0		78.0	28.4			130.9	
LOS	C	B	A	C	E		E	C			F	
Approach Delay		11.8			52.1			47.5			130.9	
Approach LOS		B			D			D			F	
90th %ile Green (s)	6.0	53.0		42.0	42.0		12.0	37.0		20.0	20.0	
90th %ile Term Code	Max	Hold		Max	Max		Max	Hold		Max	Max	
70th %ile Green (s)	6.0	53.0		42.0	42.0		12.0	37.0		20.0	20.0	
70th %ile Term Code	Max	Hold		Max	Max		Max	Hold		Max	Max	
50th %ile Green (s)	6.0	53.0		42.0	42.0		12.0	37.0		20.0	20.0	
50th %ile Term Code	Max	Hold		Max	Max		Max	Hold		Max	Max	
30th %ile Green (s)	6.0	53.0		42.0	42.0		12.0	37.0		20.0	20.0	
30th %ile Term Code	Max	Hold		Max	Max		Max	Hold		Max	Max	
10th %ile Green (s)	6.0	51.2		40.2	40.2		12.0	37.0		20.0	20.0	
10th %ile Term Code	Max	Hold		Gap	Gap		Max	Hold		Max	Max	
Queue Length 50th (ft)	33	131	0	30	497		125	210			~364	
Queue Length 95th (ft)	#93	194	0	62	#756		#286	308			#567	
Internal Link Dist (ft)		470			160			920			245	
Turn Bay Length (ft)	350		50				400					
Base Capacity (vph)	169	1047	1812	395	845		271	746			434	
Starvation Cap Reductn	0	0	0	0	0		0	0			0	
Spillback Cap Reductn	0	0	0	0	0		0	0			0	
Storage Cap Reductn	0	0	0	0	0		0	0			0	
Reduced v/c Ratio	0.64	0.36	0.16	0.19	0.97		0.98	0.57			1.17	

Intersection Summary

Area Type: Other
Cycle Length: 100
Actuated Cycle Length: 99.6

Natural Cycle: 100
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 1.17
Intersection Signal Delay: 54.0
Intersection LOS: D
Intersection Capacity Utilization 114.9%
ICU Level of Service H
Analysis Period (min) 15
90th %ile Actuated Cycle: 100
70th %ile Actuated Cycle: 100
50th %ile Actuated Cycle: 100
30th %ile Actuated Cycle: 100
10th %ile Actuated Cycle: 98.2
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Concord Road & Route 27



Intersection	
Int Delay, s/veh	2.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	20	752	1240	51	27	11
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	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	0	3	1	0	0	0
Mvmt Flow	21	792	1305	54	28	12

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1359	0	-	0	2166	1332
Stage 1	-	-	-	-	1332	-
Stage 2	-	-	-	-	834	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	512	-	-	-	52	191
Stage 1	-	-	-	-	249	-
Stage 2	-	-	-	-	430	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	512	-	-	-	48	191
Mov Cap-2 Maneuver	-	-	-	-	48	-
Stage 1	-	-	-	-	249	-
Stage 2	-	-	-	-	399	-

Approach	EB	WB	SB
HCM Control Delay, s	0.3	0	118.7
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	512	-	-	-	48	191
HCM Lane V/C Ratio	0.041	-	-	-	0.592	0.061
HCM Control Delay (s)	12.3	0	-	-	156.8	25.1
HCM Lane LOS	B	A	-	-	F	D
HCM 95th %tile Q(veh)	0.1	-	-	-	2.3	0.2

Intersection

Int Delay, s/veh 4.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	621	21	226	1049	0	45	1	127	10	1	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	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	40	-	0	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	1	-	-	1	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	97	97	97	97	97	97	97	97	97	97	97	97
Heavy Vehicles, %	0	1	0	0	0	0	2	100	0	0	100	0
Mvmt Flow	0	640	22	233	1081	0	46	1	131	10	1	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1081	0	0	662	0	0	2199	2198	651	2199	2209	1081
Stage 1	-	-	-	-	-	-	651	651	-	1547	1547	-
Stage 2	-	-	-	-	-	-	1548	1547	-	652	662	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.12	7.5	6.2	7.1	7.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	6.5	-	6.1	6.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	6.5	-	6.1	6.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.518	4.9	3.3	3.5	4.9	3.3
Pot Cap-1 Maneuver	653	-	-	936	-	-	~ 32	24	472	33	23	267
Stage 1	-	-	-	-	-	-	457	342	-	145	108	-
Stage 2	-	-	-	-	-	-	143	108	-	460	337	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	653	-	-	936	-	-	~ 25	18	472	19	17	267
Mov Cap-2 Maneuver	-	-	-	-	-	-	85	65	-	62	49	-
Stage 1	-	-	-	-	-	-	457	342	-	145	81	-
Stage 2	-	-	-	-	-	-	106	81	-	331	337	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	1.8	36.1	77
HCM LOS			E	F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	84	472	653	-	-	936	-	-	61
HCM Lane V/C Ratio	0.565	0.277	-	-	-	0.249	-	-	0.186
HCM Control Delay (s)	93	15.5	0	-	-	10.1	-	-	77
HCM Lane LOS	F	C	A	-	-	B	-	-	F
HCM 95th %tile Q(veh)	2.5	1.1	0	-	-	1	-	-	0.6

Notes

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

Intersection	
Int Delay, s/veh	0.8

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	2	396	851	52	26	23
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	50	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	98	98	98	98	98	98
Heavy Vehicles, %	0	3	1	0	0	0
Mvmt Flow	2	404	868	53	27	23

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	921	0	-	0	1303	461
Stage 1	-	-	-	-	895	-
Stage 2	-	-	-	-	408	-
Critical Hdwy	4.1	-	-	-	6.6	6.9
Critical Hdwy Stg 1	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	750	-	-	-	166	553
Stage 1	-	-	-	-	364	-
Stage 2	-	-	-	-	676	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	750	-	-	-	166	553
Mov Cap-2 Maneuver	-	-	-	-	166	-
Stage 1	-	-	-	-	364	-
Stage 2	-	-	-	-	674	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	23.2
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	750	-	-	-	247
HCM Lane V/C Ratio	0.003	-	-	-	0.202
HCM Control Delay (s)	9.8	0	-	-	23.2
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0	-	-	-	0.7

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	0	0	3	0	48	0	458	32	32	493	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	98	98	98	98	98	98	98	98	98	98	98	98
Heavy Vehicles, %	0	0	0	0	0	3	0	0	0	0	1	0
Mvmt Flow	0	0	0	3	0	49	0	467	33	33	503	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1076	1068	503	1052	1052	484	503	0	0	500	0	0
Stage 1	568	568	-	484	484	-	-	-	-	-	-	-
Stage 2	508	500	-	568	568	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.23	4.1	-	-	4.1	-	-
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	3.5	4	3.3	3.5	4	3.327	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	199	223	573	206	228	581	1072	-	-	1075	-	-
Stage 1	511	510	-	568	555	-	-	-	-	-	-	-
Stage 2	551	546	-	511	510	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	176	213	573	199	218	581	1072	-	-	1075	-	-
Mov Cap-2 Maneuver	176	213	-	199	218	-	-	-	-	-	-	-
Stage 1	511	488	-	568	555	-	-	-	-	-	-	-
Stage 2	505	546	-	489	488	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	12.7	0	0.5
HCM LOS	A	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1072	-	-	-	522	1075	-	-
HCM Lane V/C Ratio	-	-	-	-	0.1	0.03	-	-
HCM Control Delay (s)	0	-	-	0	12.7	8.5	0	-
HCM Lane LOS	A	-	-	A	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	-	0.3	0.1	-	-

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	8	8	15	491	517	15
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	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	8	8	16	517	544	16

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1100	552	560	0	-	0
Stage 1	552	-	-	-	-	-
Stage 2	548	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	235	533	1011	-	-	-
Stage 1	577	-	-	-	-	-
Stage 2	579	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	230	533	1011	-	-	-
Mov Cap-2 Maneuver	230	-	-	-	-	-
Stage 1	577	-	-	-	-	-
Stage 2	566	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	16.8	0.3	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1011	-	321	-	-
HCM Lane V/C Ratio	0.016	-	0.052	-	-
HCM Control Delay (s)	8.6	0	16.8	-	-
HCM Lane LOS	A	A	C	-	-
HCM 95th %tile Q(veh)	0	-	0.2	-	-