

TRAFFIC IMPACT AND ACCESS STUDY

**56 DERRY ROAD
Hudson, New Hampshire**

July 1, 2021

Prepared for Keach-Nordstrom Associates, Inc.

TRAFFIC-IMPACT AND ACCESS STUDY

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TEPP LLC

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SUMMARY

PROJECT DESCRIPTION

Keach-Nordstrom Associates, Inc. (KNA) has retained TEPP LLC to prepare this traffic impact and access study (TIAS) for a proposed commercial redevelopment in the Town of Hudson, New Hampshire.

The proposed redevelopment will:

- be at 56 Derry Road
- provide one drive-through coffee shop
- have one driveway to the west side of Derry Road, with a one-lane entrance and a two-lane exit

STUDY SCOPE

The TIAS study area includes the following unsignalized intersections:

- Derry Road/Ledge Road
- Derry Road/driveway

This TIAS analyzes the following conditions as applicable:

- 2021 existing
- 2022 and 2032 no-build, with background-traffic growth
- 2022 and 2032 build, with background-traffic growth and the proposed redevelopment

This TIAS analyzes traffic operations for the following hours as applicable:

- weekday AM street-peak hour
- weekday PM street-peak hour

TRIP GENERATION

Total trips appear on the site driveway but not all are added to Derry Road near the site. 2022 total vehicle-trips are:

- weekday daily, 629 (total of in and out)
- weekday AM-street-peak hour, 106 (53 in and 53 out)
- weekday PM-street-peak hour, 40 (20 in and 20 out)

2032 total vehicle-trips are:

- weekday daily, 694 (total of in and out)
- weekday AM-street-peak hour, 117 (58 in and 539 out)
- weekday PM-street-peak hour, 44 (22 in and 22 out)

Primary trips are added to Derry Road near the site. 2022 primary vehicle-trips are:

- weekday daily, 69 (total of in and out)
- weekday AM-street-peak hour, 12 (6 in and 6 out)
- weekday PM-street-peak hour, 4 (2 in and 2 out)

2032 primary vehicle-trips are:

- weekday daily, 78 (total of in and out)
- weekday AM-street-peak hour, 13 (6 in and 7 out)
- weekday PM-street-peak hour, 6 (3 in and 3 out)

CAPACITY ANALYSIS

Capacity analysis shows, for the Derry Road/Ledge Road intersection

- low delays for left turns from Derry Road
- moderate delays or delayed operations for movements from Ledge Road
- insignificant project impacts

Capacity analysis shows, for the Derry Road/driveway intersection:

- low delays for left turns from Derry Road
- moderate delays or delayed operations for movements from the driveway

Delayed operations on minor-street approaches to high-volume arterials are typical and acceptable.

TRAFFIC IMPACTS

Analysis indicates no significant area impact due to the proposed redevelopment.

INTRODUCTION

PROJECT DESCRIPTION

KNA has retained TEPP LLC to prepare this TIAS for a proposed commercial redevelopment in the Town of Hudson, New Hampshire.

The proposed redevelopment will:

- be at 56 Derry Road
- provide one drive-through coffee shop
- have one driveway to the west side of Derry Road, with a one-lane entrance and a two-lane exit

Figure 1 shows site location. The project plan is in Appendix A.

STUDY APPROACH

This TIAS assesses traffic impacts and access for the proposed redevelopment.

The TIAS study area includes the following unsignalized intersections:

- Derry Road/Ledge Road
- Derry Road/driveway

This TIAS analyzes the following conditions as applicable:

- 2021 existing
- 2022 and 2032 no-build, with background-traffic growth
- 2022 and 2032 build, with background-traffic growth and the proposed redevelopment

This TIAS analyzes traffic operations for the following hours as applicable:

- weekday AM street-peak hour
- weekday PM street-peak hour

Differences in traffic operations between the no-build and build conditions approximate traffic impacts of the proposed redevelopment.



Figure 1. Site location.

EXISTING CONDITIONS

INTRODUCTION

Existing conditions include:

- physical conditions of the transportation network, roads, and intersections
- traffic volumes
- other relevant information

PHYSICAL CONDITIONS

INTRODUCTION

Figure 1 shows the transportation network.

The TIAS study area includes the following existing unsignalized intersection: Derry Road/Ledge Road.

Description of the TIAS study area follows.

DERRY ROAD

Derry Road:

- is oriented approximately north-south
- functions as an arterial street
- is also known as New Hampshire Routes (NH) 3A and 102
- to the south, connects with the Town Center and New Hampshire Route 111 (NH 111), an arterial highway that leads to the City of Nashua and Towns of Windham and Salem
- to the north, connects with NH 102, an arterial highway that leads to the Towns of Londonderry and Derry, and NH 3A, an arterial highway that leads to the Town of Litchfield and the City of Manchester
- has a horizontal alignment includes minor to moderate horizontal curvature, but is essentially tangent at the proposed driveway location
- has a near-level vertical alignment

- has a three-lane cross-section with one travel lane per direction, a center-two-way-left-turn lane (TWLTL), and paved shoulders
- has asphaltic-cement concrete (ACC) pavement in overall good condition
- has curb and sidewalk along both sides
- includes utility poles along the west side, some with luminaires
- has a posted speed limit of 30 miles per hour (mph)
- has nearby commercial and residential development
- is under the jurisdiction of the Town

DERRY ROAD/LEDGE ROAD INTERSECTION

The intersection:

- is three legged
- has Derry Road as the major north-south street
- has Ledge Road as the minor east leg
- on Derry Road, has one travel lane per direction and one center TWLTL
- on the Ledge Road approach, has one lane
- has a STOP sign on the Ledge Road approach
- is illuminated
- has commercial and residential development nearby

TRAFFIC VOLUMES

TRAFFIC COUNTS

TEPP LLC obtained an automatic traffic counter (ATR) count:

- on Derry Road along the site frontage
- from Wednesday, June 2, to Thursday, June 3, 2021

The ATR data are in Appendix B.

ADJUSTMENTS

The June 2021 traffic counts were adjusted to reflect peak-month and non-pandemic conditions.

The increase to peak month was 2.0 percent, based on based on NHDOT 2019 monthly volumes for Group 4 (Urban Highways) averages in Appendix C,

The increase to pre-pandemic was 5.6 percent. NHDOT continuous count station 82229031, on Daniel Webster Highway north of Hilton Drive, in the Town of Merrimack showed May 2021 two-way average-daily traffic (ADT) of 15,404 vehicles. The station showed May 2019 pre-pandemic two-way ADT of 16,260 vehicles, which is 5.6 percent greater.

The combined increase was 7.7 percent.

RESULTS

Table 1 and Figure 2 show 2021 existing traffic volumes.

Table 1. 2021 existing traffic volumes.			
Location and Time Period	Vehicles ^a	K-factor ^b	Percent Direction
Derry Road near Site Frontage			
Weekday Daily	28,667	---	---
Weekday AM-Street-Peak Hour	2,157	7.5	58 Southbound
Weekday PM-Street-Peak Hour	2,290	8.0	54 Northbound

^a Two-way-total volumes.

^b K = hour volume as a percent of daily volume.

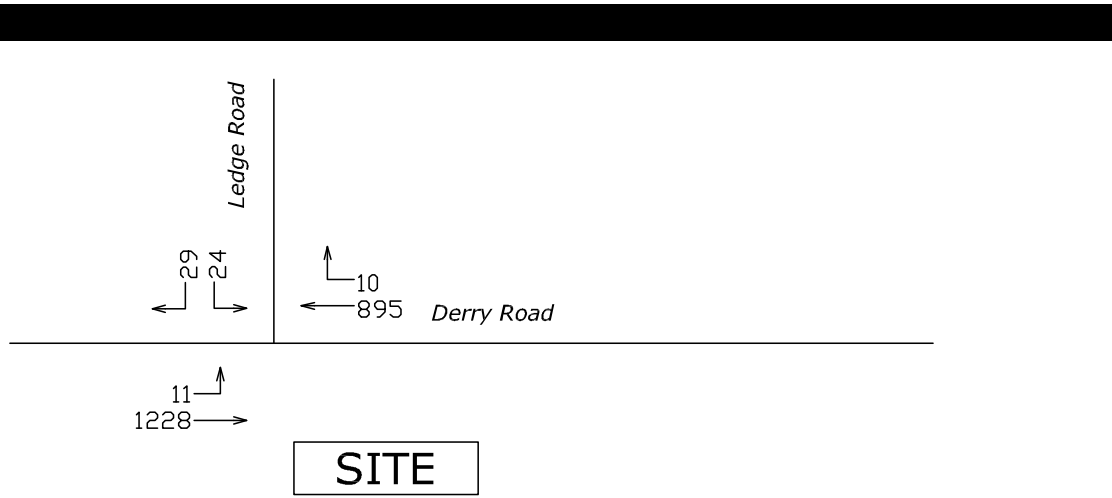
Derry Road near the site frontage showed about:

- 28,667 weekday-daily vehicles
- 2,157 vehicles during the weekday AM street-peak hour, predominantly southbound
- 2,290 vehicles during the weekday PM street-peak hour, predominantly northbound

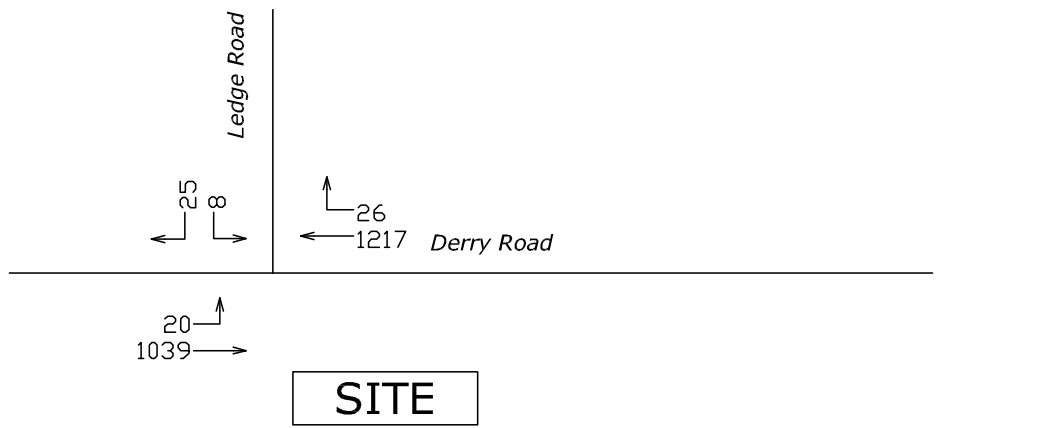
VEHICLE SPEEDS

The ATR collected vehicle speeds:

- on Derry Road along the site frontage
- from Wednesday, June 2, to Thursday, June 3, 2021



Weekday AM-Street-Peak Hour



Not to Scale

Weekday PM-Street-Peak Hour

Figure 2. 2021 existing traffic volumes.

The data are in Appendix D and are summarized in Table 2.

Table 2 indicates that on Derry Road:

Location and Direction	Speeds (mph)		
	Speed Limit	Mean ^a	85 th Percentile ^a
Derry Road along Site Frontage			
Northbound	30	35.3	39.0
Southbound	30	33.6	37.2

^a From ATR conducted from Wednesday, June 2, to Thursday, June 3, 2021.

- the posted speed limit was 30 mph
- the northbound the mean speed was 35.3 mph and the 85th percentile speed was 39.0 mph
- for southbound the mean speed was 33.6 mph and the 85th percentile speed was 37.2 mph

SIGHT DISTANCES

The American Association of State Highway and Transportation Officials (AASHTO) has established authoritative policy for sight distances at unsignalized intersections¹ in terms of:

- stopping sight distance (SSD)
- optional intersection sight distance (ISD)

SSD:²

- provides for safety
- enables a driver, on the major road, to perceive and react accordingly to a vehicle entering the major road from a minor road
- is conservative because it encompasses a wide range of brake-reaction times and deceleration rates

¹ AASHTO, *A Policy on Geometric Design of Highways and Streets*, 6th Edition (Washington, DC, 2011), pages 9-28 to 9-29.

² AASHTO, pages 3-2 to 3-6.

Optional ISD:³

- is ordinarily greater than SSD and may enhance traffic operations
- is not required for safety

Table 3 shows relevant available sight distances that are at least 400 ft, per NHDOT practice, and are adequate.

Table 3. Sight distances.

Intersection, Movements, and View	Available Sight Distance (ft) ^a	Speeds (miles per hour)		
		Limit	SSD Provides For	ISD Provides For
Portland Street/Proposed Road for Proposed Road Movements				
Portland Street to/from South	400	30	45+	36+
Portland Street to/from North	400	30	45+	36+

^a With appropriate roadside and vegetation maintenance.

³ AASHTO, pages 9-22 to 9-55.

FUTURE CONDITIONS

INTRODUCTION

Future conditions include:

- planned road improvements independent of the proposed redevelopment
- future no-build traffic volumes, with background-traffic growth and without the proposed redevelopment
- future build traffic volumes, with background-traffic growth and with the proposed redevelopment

PLANNED ROAD IMPROVEMENTS

TEPP LLC identified no significant planned road improvement in the study area independent of the project.

BACKGROUND-TRAFFIC GROWTH

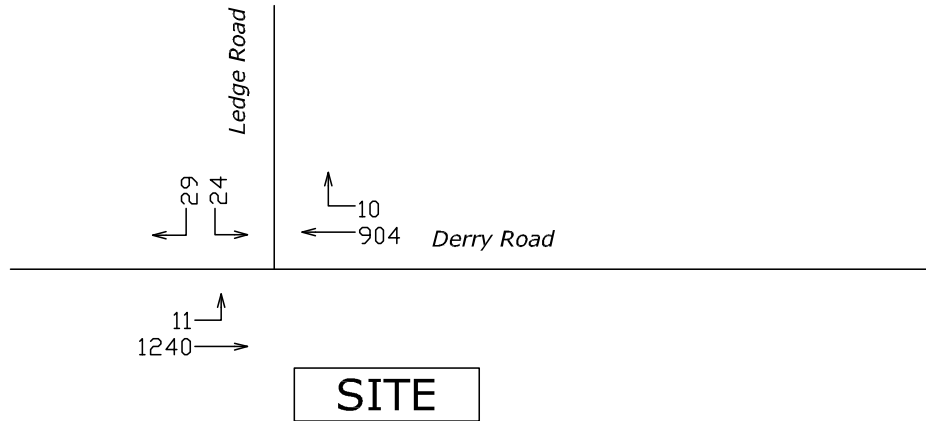
Background-traffic growth:

- is independent of the proposed redevelopment
- is related to land development in the immediate area, population and economic development in the region, and changes in travel patterns in the region
- typically considers two factors: a general traffic-growth rate and specific planned land developments in the immediate area

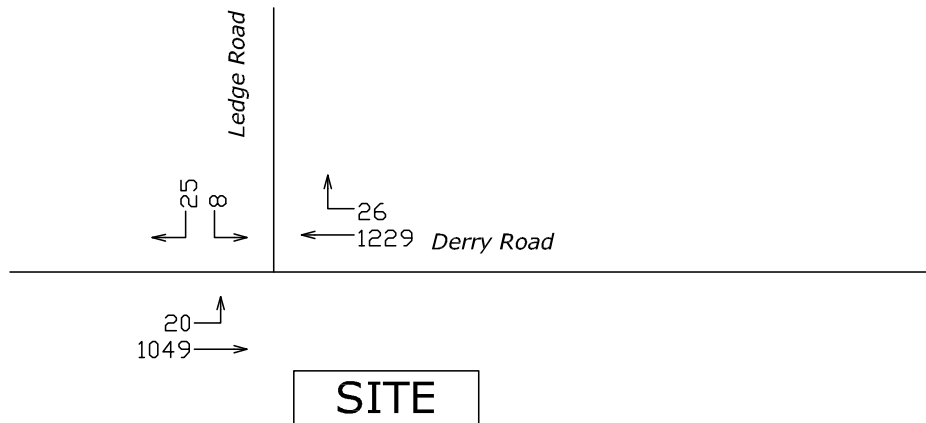
This TIAS uses a 1.0-percent annual growth rate. This yields about 11.6-percent growth between 2021 and 2032.

NO-BUILD TRAFFIC VOLUMES

The background-traffic growth described above was applied to 2021 existing traffic volumes. Figures 3 and 4 show 2022 and 2032 no-build traffic volumes.



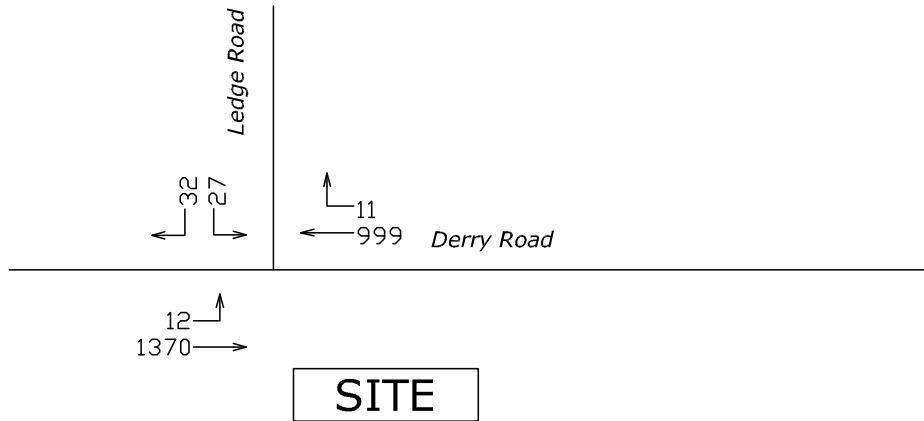
Weekday AM-Street-Peak Hour



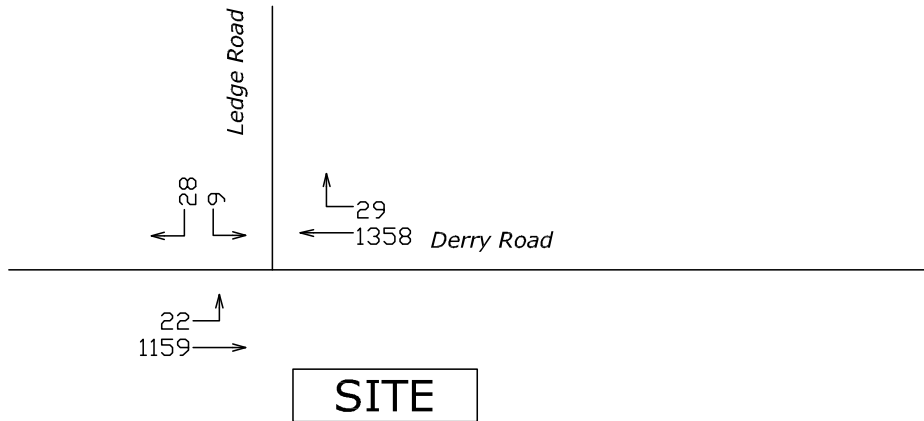
Not to Scale

Weekday PM-Street-Peak Hour

Figure 3. 2022 no-build traffic volumes.



Weekday AM-Street-Peak Hour



Not to Scale

Weekday PM-Street-Peak Hour

Figure 4. 2032 no-build traffic volumes.

TRIP GENERATION

BASIC TRIP GENERATION

The Institute of Transportation Engineers (ITE) compiles and publishes trip-generation information for a variety of land uses in *Trip Generation Manual*.⁴ This guide for estimating site traffic includes coffee/donut shop with drive-through window and no indoor seating, land use 938, based on floor area.⁵ However, this information is based on sites with floor areas of 90 square feet (sf) and is not applicable to the proposed land use, with a floor area of about 900 sf.

Stephen G. Pernaw & Company, Inc. has published appropriate and applicable trip-generation information specific to this land use, which estimates trip generation based on traffic volumes passing the site.⁶ Basic trip generation is based on this information.

TRIP TYPES

Total trips appear on site driveways but not all are added to roads near the site. Accordingly, ITE compiles information on three trip types, based on empirical data for many land uses, in the authoritative Hooper, *Trip Generation Handbook*.⁷ These three trip types are:

- primary trips that are added to the area and are primarily for visiting the site
- diverted trips that not added to the general area; these trips are from existing traffic on roads near the site
- pass-by trips that are not added to the general area; these trips are from existing traffic passing the site⁸

RESULTS

Table 4 shows calculated weekday vehicle-trip generation for the site.

⁴ ITE, *Trip Generation Manual*, 10th edition (Washington DC, September 2017).

⁵ ITE, *Trip Generation Manual*, V Volume 2, Data, Services (Land Uses 900-999), pages 250 and 251, pages 249 to 254.

⁶ Stephen G. Pernaw & Company, Inc., *Traffic Impact Assessment, Proposed Drive-Thru Coffee Shop, Northwood, New Hampshire* (Concord, New Hampshire, October 2019), page 10 and Appendix E.

⁷ Kevin G. Hooper, P.E., Principal Editor, *Trip Generation Handbook*, 3rd edition (Washington DC: Institute of Transportation Engineers, September 2017).

⁸ Definitions of primary trips, diverted trips, and pass-by trips are in Hooper, page 93. Relevant data on primary trips, diverted trips and pass-by trips are in Hooper, 3rd edition, page 216.

Table 4. Calculated weekday vehicle-trip generation

	Daily ^a	AM-Street-Peak Hour		PM-Street-Peak Hour			
		Total ^b	In	Out	Total ^c	In	Out
2022 Vehicle-Trips							
Primary	69	12	6	6	4	2	2
<u>Pass-By^d</u>	<u>560</u>	<u>94</u>	<u>47</u>	<u>47</u>	<u>36</u>	<u>18</u>	<u>18</u>
Total	629	106	53	53	40	20	20
2032 Vehicle-Trips							
Primary	78	13	6	7	6	3	3
<u>Pass-By^d</u>	<u>616</u>	<u>104</u>	<u>52</u>	<u>52</u>	<u>38</u>	<u>19</u>	<u>19</u>
Total	694	117	58	59	44	22	22

^a Estimated total weekday daily trips are 5.93 times weekday AM-street-peak hour trips, based on ITE, *Trip Generation Manual*, Volume 2, Data, Services (Land Uses 900-999), pages 250 and 251.

^b Total weekday AM-street-peak hour trips are 0.0488 times 2021 no-build weekday AM-street-peak hour volume on Derry Road along the site frontage. Stephen G. Pernaw & Company, Inc., Appendix E.

^c Total weekday PM-street-peak hour trips are 0.0172 times 2021 no-build weekday PM-street-peak hour volume on Derry Road along the site frontage. Stephen G. Pernaw & Company, Inc., Appendix E.

^d Pass-by trip percentage is 89. Based on Hooper, *Trip Generation Handbook*, 3rd edition, page 216, coffee/donut shop with drive-through window and no indoor seating, land use 938.

Total trips appear on the site driveway but not all are added to Derry Road near the site. 2022 total vehicle-trips are:

- weekday daily, 629 (total of in and out)
- weekday AM-street-peak hour, 106 (53 in and 53 out)
- weekday PM-street-peak hour, 40 (20 in and 20 out)

2032 total vehicle-trips are:

- weekday daily, 694 (total of in and out)
- weekday AM-street-peak hour, 117 (58 in and 539 out)
- weekday PM-street-peak hour, 44 (22 in and 22 out)

Primary trips are added to Derry Road near the site. 2022 primary vehicle-trips are:

- weekday daily, 69 (total of in and out)
- weekday AM-street-peak hour, 12 (6 in and 6 out)

- weekday PM-street-peak hour, 4 (2 in and 2 out)

2032 primary vehicle-trips are:

- weekday daily, 78 (total of in and out)
- weekday AM-street-peak hour, 13 (6 in and 7 out)
- weekday PM-street-peak hour, 6 (3 in and 3 out)

TRIP DISTRIBUTION AND NETWORK ASSIGNMENT

Trip distribution and network assignment of vehicle-trips to and from the site may consider such factors as existing site distribution, travel patterns, population, regional land development, and site access. Trip distribution and network assignment for this TIAS considered the 2021 existing volumes.

Table 5 shows trip distribution and network assignment for primary trips. Pass-by trips were assigned reflecting peak-hour directional distributions on Derry Road: 58-percent southbound for the weekday AM-street-peak hour and 54-percent northbound for the weekday PM-street-peak hour. Figures 5 and 6 show site traffic volumes.

Table 5. Trip distribution and network assignment.	
Road and Direction (To/From)	Approximate Percent
Derry Road to/from South	45
<u>Derry Road to/from South</u>	<u>55</u>
Total	100

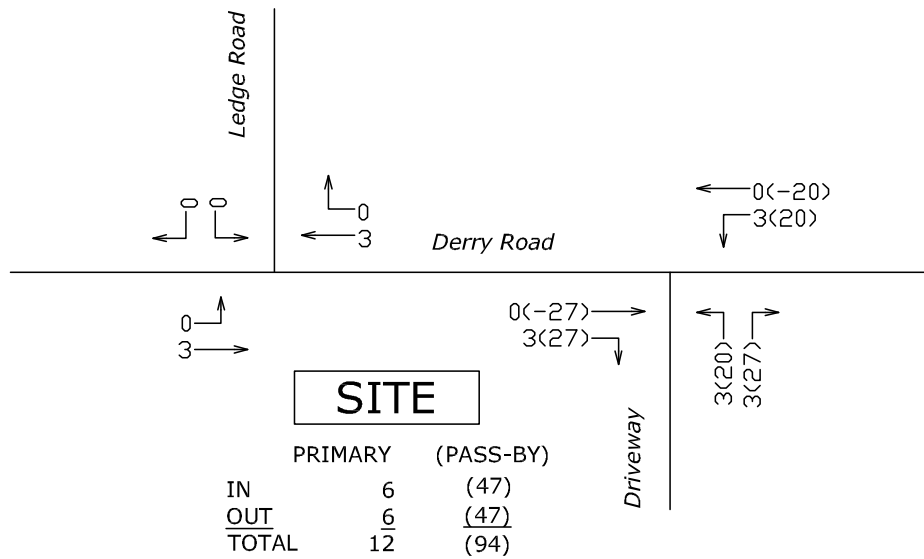
BUILD TRAFFIC VOLUMES

Site traffic volumes were superimposed on the no-build traffic volumes to estimate build traffic volumes. Figures 7 and 8 show the resulting 2022 and 2032 build traffic volumes.

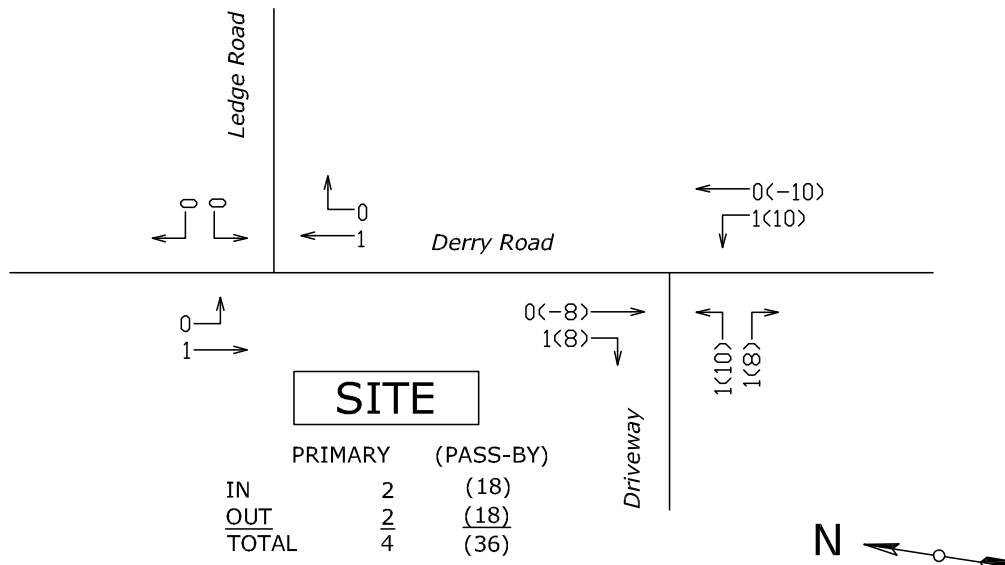
TRAFFIC-VOLUME CHANGES

Table 6 presents calculated traffic-volume changes due to the proposed redevelopment for the:

- weekday AM-street-peak hour
- weekday PM-street-peak hour



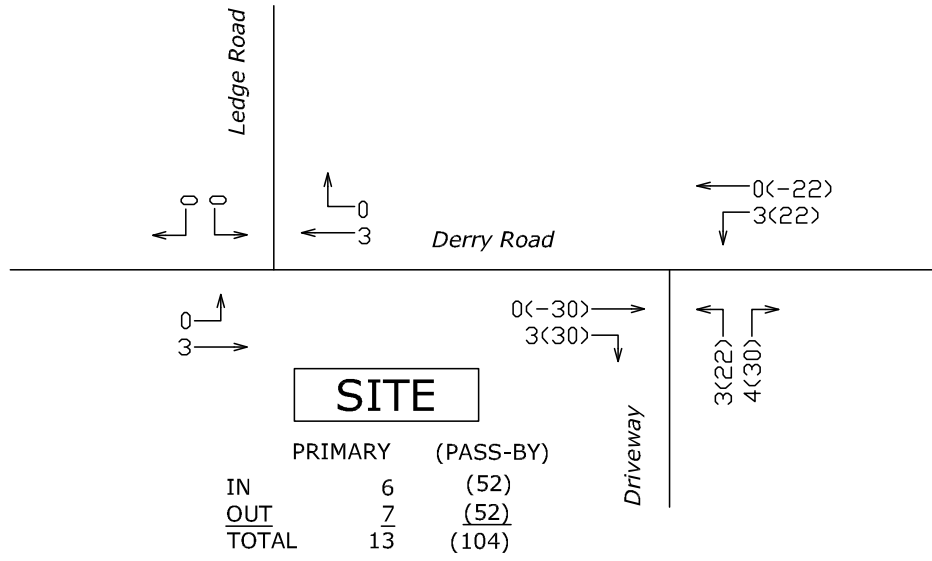
Weekday AM-Street-Peak Hour



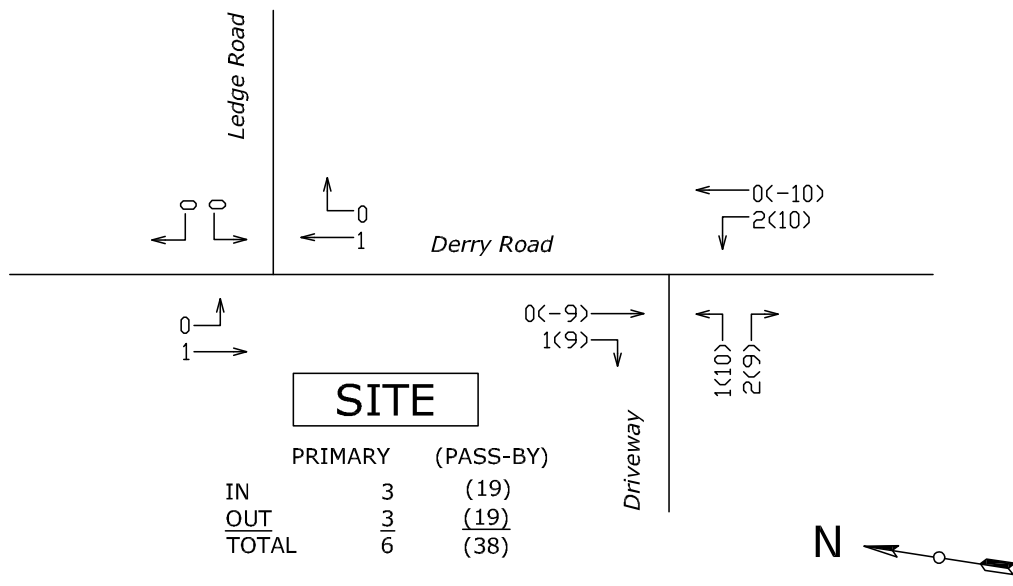
Not to Scale

Weekday PM-Street-Peak Hour

Figure 5. 2022 site traffic volumes.



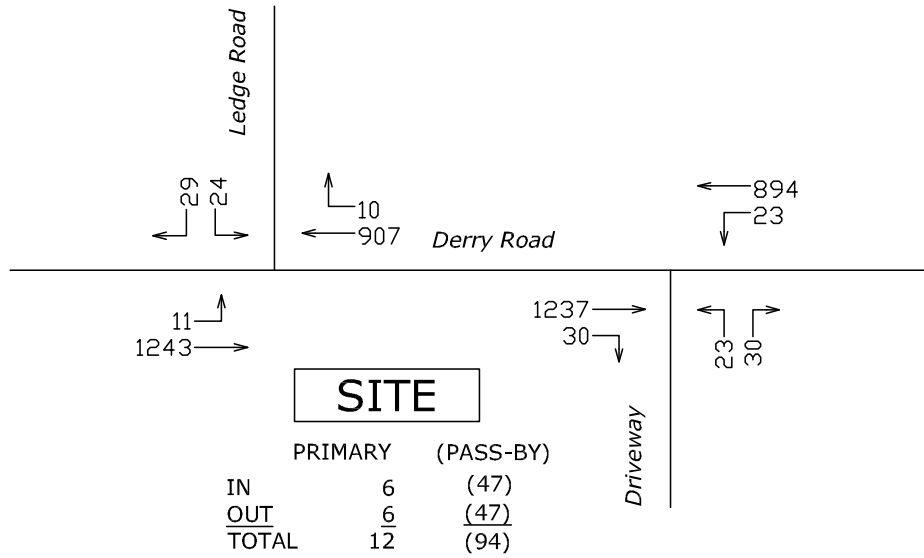
Weekday AM-Street-Peak Hour



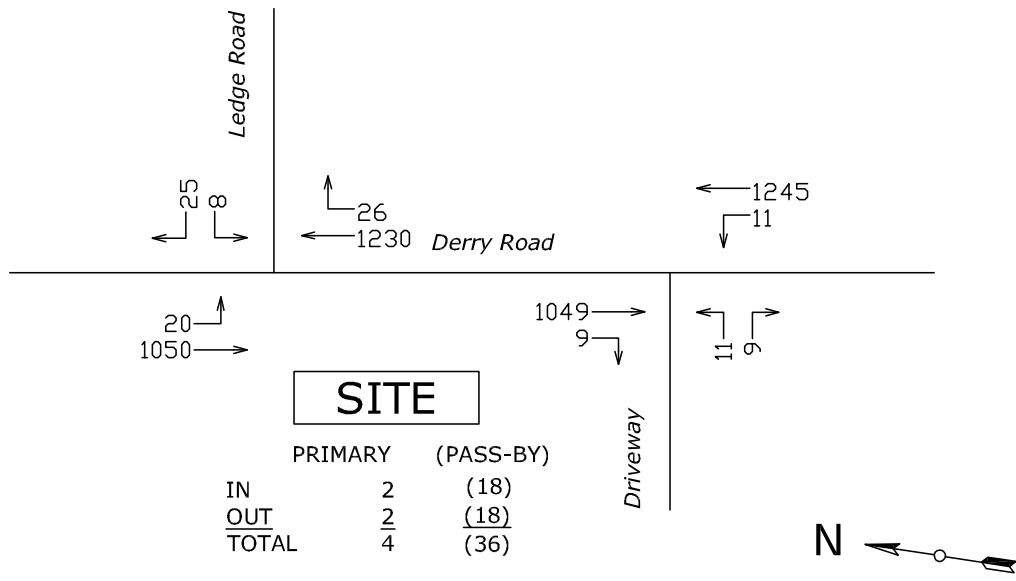
Not to Scale

Weekday PM-Street-Peak Hour

Figure 6. 2032 site traffic volumes.



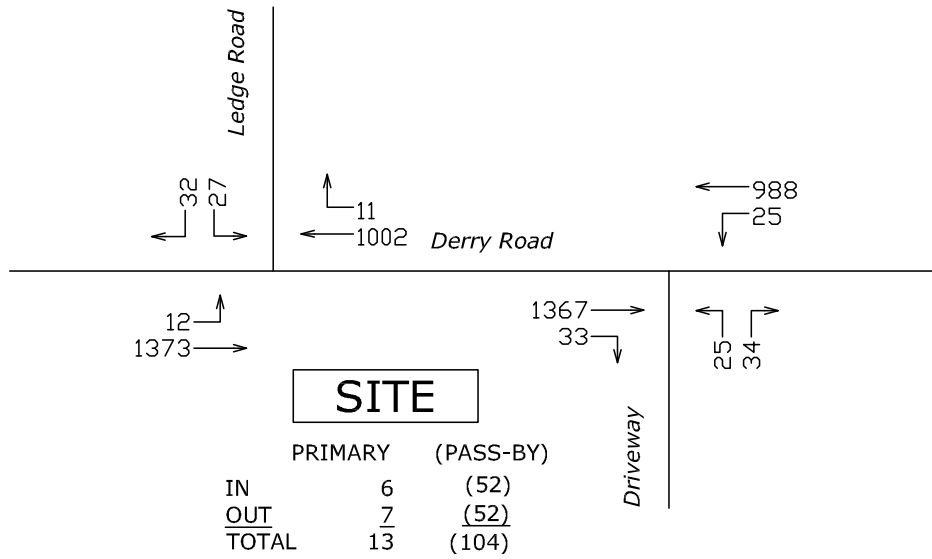
Weekday AM-Street-Peak Hour



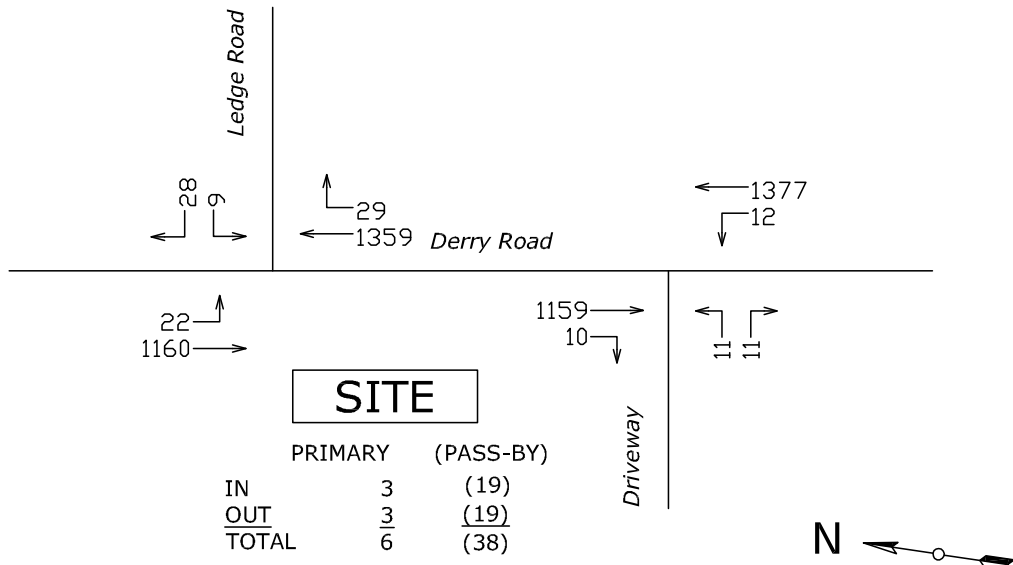
Not to Scale

Weekday PM-Street-Peak Hour

Figure 7. 2022 build traffic volumes.



Weekday AM-Street-Peak Hour



Not to Scale

Weekday PM-Street-Peak Hour

Figure 8. 2032 build traffic volumes.

Table 6. Traffic-volume changes.

Location and Time Period	2022 Traffic Volumes (vph) ^a			2032 Traffic Volumes (vph)		
	No-Build	Build	Change	No-Build	Build	Change
Derry Road North of Driveway						
Weekday AM-Street-Peak Hour	2,178	2,184	6	2,407	2,413	6
Weekday PM-Street-Peak Hour	2,312	2,314	2	2,555	2,557	2
Derry Road South of Driveway						
Weekday AM-Street-Peak Hour	2,178	2,184	6	2,407	2,414	7
Weekday PM-Street-Peak Hour	2,312	2,314	2	2,555	2,559	4

^a Two-way total volumes.

Table 6 shows peak-hour-traffic-volume increases:

- of 2 to 7 vehicle-trips
- constituting averages about one vehicle-trip per 8 to 30 minutes
- that are further split by northbound and southbound direction on Derry Road

CAPACITY ANALYSIS

INTRODUCTION

This TIAS has quantified existing, future-no-build and future-build traffic volumes. Capacity analysis models the quality of traffic operations. Comparing build conditions to the no-build conditions indicates impacts of the proposed redevelopment on quality of traffic operations.

METHODS

Capacity analysis calculates LOS for transportation facilities. LOS indicates the quality of traffic operations based on delay and other measures. The six LOS are designated A to F. LOS A represents the best or highest operating conditions. LOS F is the lowest, but does not necessarily connote failure.

LOS is a function of traffic volumes and traffic control. Because these volumes can vary, LOS of a transportation facility can differ by time of day, day of the week, or month. For example, a transportation facility with a low LOS during peak hours may have a high LOS during other hours. The operational analysis methods of the Transportation Research Board (TRB)⁹ models LOS for intersections based on calculated delay per vehicle, as shown in Table 7. Synchro analysis software was used.

Method inputs include:

- intersection geometry
- traffic control, such as YIELD sign, two-way STOP sign, all-way STOP sign, roundabout, or signal (including phasing, timing, and progression)
- traffic volumes
- vehicle composition, such as passenger cars and trucks

The methods are all approximate. In particular, the method for two-way STOP-sign control can be conservative, with observed delays and queuing shorter than those modeled.

⁹ TRB, *Highway Capacity Manual 2000* (Washington DC 2000) and *Highway Capacity Manual 2010* (Washington DC, 2010).

Table 7. Level-of-service criteria for intersections.

Level of Service	Control Delay (seconds/vehicle)	
	Unsignalized Intersections ^a	Signalized Intersections
A	≤10.0	≤10.0
B	>10.0 and ≤15.0	>10.0 and ≤20.0
C	>15.0 and ≤25.0	>20.0 and ≤35.0
D	>25.0 and ≤35.0	>35.0 and ≤55.0
E	>35.0 and ≤50.0	>55.0 and ≤80.0
F	>50	>80

From Transportation Research Board, *Highway Capacity Manual 2010* (Washington D.C., 2010).

^a For YIELD sign, two-way STOP sign or all-way STOP sign, control delay defines LOS. For roundabout approaches and overall intersection, control delay defines LOS. For roundabout lanes with volume/capacity ratio ≤1.0, control delay defines LOS. For roundabout lanes with volume/capacity ratio > 1.0, LOS is F regardless of control delay.

RESULTS

Table 8 shows computed LOS, delays, and queues at study-area intersections for the:

- weekday AM-street-peak hour
- weekday PM-street-peak hour

The analysis is under the following conditions, as applicable:

- 2021 existing
- 2022 and 2032 no build
- 2022 and 2032 build

Capacity-analysis worksheets that give detail and explanation are in Appendix E.

Table 8 shows, for the Derry Road/Ledge Road intersection

- low delays for left turns from Derry Road
- moderate delays or delayed operations for movements from Ledge Road
- insignificant project impacts

Table 8 shows, for the Derry Road/driveway intersection:

- low delays for left turns from Derry Road
- moderate delays or delayed operations for movements from the driveway

Delayed operations on minor-street approaches to high-volume arterials are typical and acceptable.

Table 8. Capacity-analysis summary.

Intersection, Control, Hour and Movement	2021 Existing				2022 No Build				2032 No Build				2022 Build				2032 No Build			
	LOS ^a	Delay ^b	V/C ^c	Queue ^d	LOS	Delay	V/C	Queue	LOS	Delay	V/C	Queue	LOS	Delay	V/C	Queue	LOS	Delay	V/C	Queue
Derry Road/Ledge Road Intersection, Unsignalized, Weekday AM-Street-Peak Hour																				
Derry Road SB L	B	10.7	0.019	0.1	B	10.9	0.020	0.1	B	11.6	0.024	0.1	B	11.0	0.020	0.1	B	11.6	0.024	0.1
Ledge Road WB LR	D	33.3	0.370	1.6	D	31.8	0.307	1.2	E	41.2	0.402	1.8	E	35.2	0.333	1.4	E	41.6	0.405	1.8
Derry Road/Ledge Road Intersection, Unsignalized, Weekday PM-Street-Peak Hour																				
Derry Road SB L	B	11.7	0.037	0.1	B	12.6	0.045	0.1	B	13.7	0.056	0.2	B	12.6	0.045	0.1	B	13.7	0.056	0.2
Ledge Road WB LR	D	29.6	0.250	1.0	D	33.4	0.225	0.8	E	42.9	0.305	1.2	D	33.6	0.226	0.8	E	43.3	0.307	1.2
Derry Road/Driveway Intersection, Unsignalized, Weekday AM-Street-Peak Hour																				
Derry Road NB L	---	---	---	---	---	---	---	---	---	---	---	---	B	12.9	0.053	0.2	B	14.1	0.2	0.066
Driveway EB L	---	---	---	---	---	---	---	---	---	---	---	---	E	37.5	0.188	0.7	E	46.9	0.246	0.9
Driveway EB R	---	---	---	---	---	---	---	---	---	---	---	---	D	30.5	0.192	0.7	E	39.3	0.266	1.0
Derry Road/Driveway Intersection, Unsignalized, Weekday PM-Street-Peak Hour																				
Derry Road NB L	---	---	---	---	---	---	---	---	---	---	---	---	B	11.2	0.021	0.1	B	11.9	0.025	0.1
Driveway EB L	---	---	---	---	---	---	---	---	---	---	---	---	E	36.1	0.095	0.3	E	42.5	0.113	0.4
Driveway EB R	---	---	---	---	---	---	---	---	---	---	---	---	C	21.0	0.043	0.1	C	24.3	0.061	0.2

^a LOS = level of service.
^b Delay = average delay in seconds per vehicle.
^c V/C = volume/capacity ratio.
^d 95th percentile queue in vehicles.
 EB = eastbound, WB = westbound, SB = southbound, NB = northbound, L = left, T = through, R = right.

CONCLUSION

PROJECT DESCRIPTION

The proposed redevelopment will:

- be at 56 Derry Road
- provide one drive-through coffee shop
- have one driveway to the west side of Derry Road, with a one-lane entrance and a two-lane exit

TRIP GENERATION

Total trips appear on the site driveway but not all are added to Derry Road near the site. 2022 total vehicle-trips are:

- weekday daily, 629 (total of in and out)
- weekday AM-street-peak hour, 106 (53 in and 53 out)
- weekday PM-street-peak hour, 40 (20 in and 20 out)

2032 total vehicle-trips are:

- weekday daily, 694 (total of in and out)
- weekday AM-street-peak hour, 117 (58 in and 539 out)
- weekday PM-street-peak hour, 44 (22 in and 22 out)

Primary trips are added to Derry Road near the site. 2022 primary vehicle-trips are:

- weekday daily, 69 (total of in and out)
- weekday AM-street-peak hour, 12 (6 in and 6 out)
- weekday PM-street-peak hour, 4 (2 in and 2 out)

2032 primary vehicle-trips are:

- weekday daily, 78 (total of in and out)
- weekday AM-street-peak hour, 13 (6 in and 7 out)

- weekday PM-street-peak hour, 6 (3 in and 3 out)

CAPACITY ANALYSIS

Capacity analysis shows, for the Derry Road/Ledge Road intersection

- low delays for left turns from Derry Road
- moderate delays or delayed operations for movements from Ledge Road
- insignificant project impacts

Capacity analysis shows, for the Derry Road/driveway intersection:

- low delays for left turns from Derry Road
- moderate delays or delayed operations for movements from the driveway

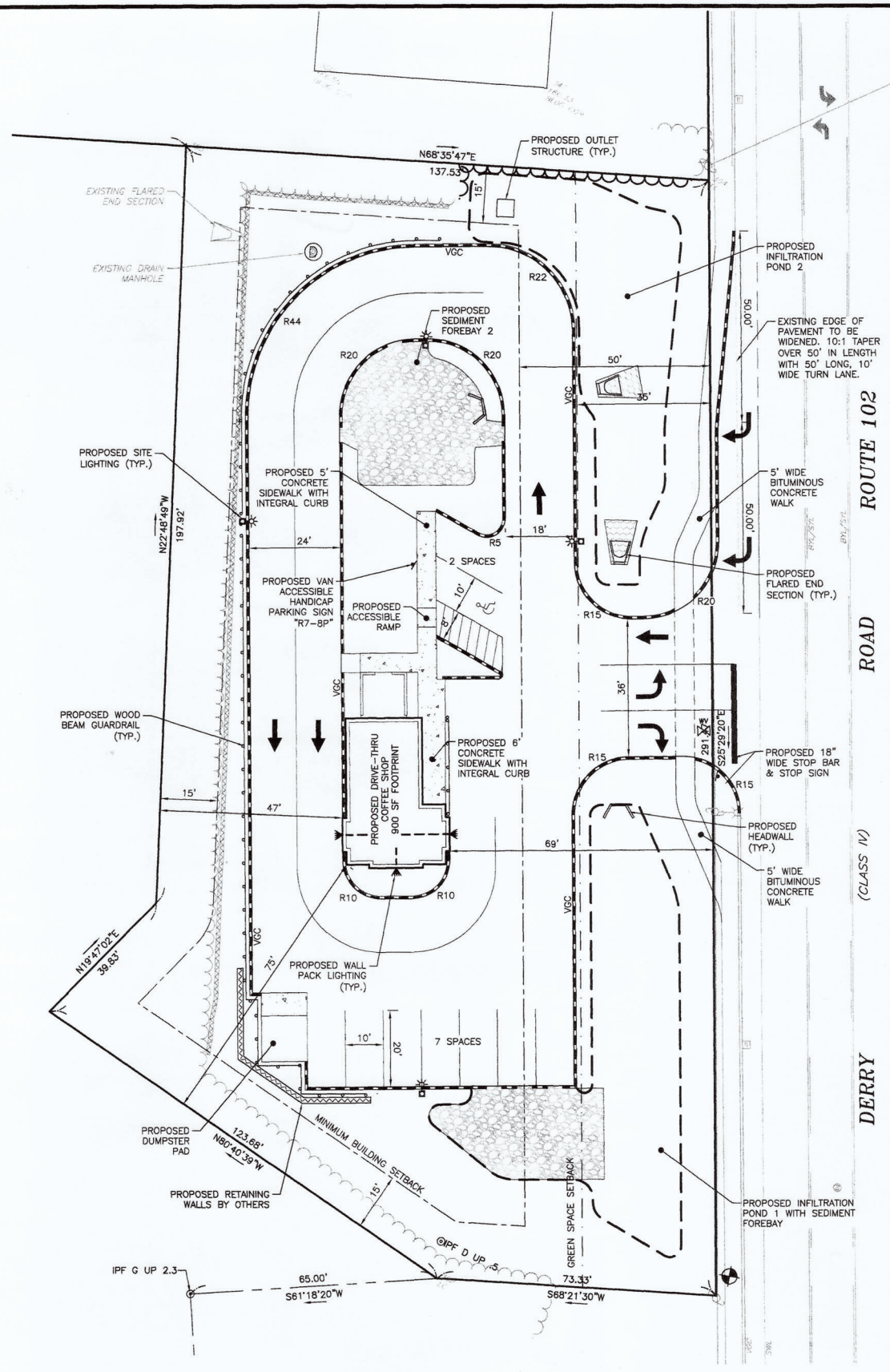
Delayed operations on minor-street approaches to high-volume arterials are typical and acceptable.

TRAFFIC IMPACTS

Analysis indicates no significant area impact due to the proposed redevelopment.

APPENDIX

Appendix A: Project Plan



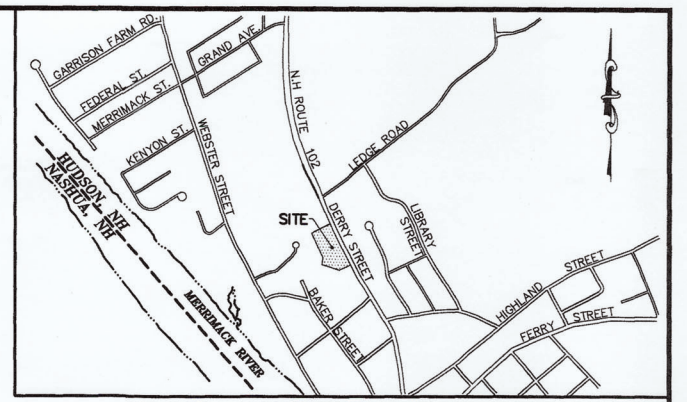
REFERENCE PLANS:

1. "EXISTING CONDITIONS PLAN, AROMA JOE'S, MAP 173 LOT 29, 56 DERRY STREET, HUDSON, NEW HAMPSHIRE, DATED MAY 7, 2021," PREPARED BY KEACH-NORDSTROM ASSOCIATES, INC.

NOTES:

- THE PURPOSE OF THIS PLAN IS TO DEPICT THE PROPOSED SITE LAYOUT ON MAP 173 LOT 29 IN THE TOWN OF HUDSON, NEW HAMPSHIRE AS SHOWN HEREON.
- OWNER OF RECORD:
STEVE S. & HSIANG HWA W. PAN
13 KING HENRY DRIVE
LONDONDERRY, N.H. 03053
BK. 6281 PG. 776
- AREA OF SUBJECT PARCEL = 40,793 SF, OR 0.935 ACRES
- TOPOGRAPHIC AND BOUNDARY INFORMATION SHOWN HEREON ARE BASED ON AN ACTUAL FIELD SURVEY MADE BY THIS OFFICE IN APRIL OF 2021.
- HORIZONTAL DATUM IS NAD83. VERTICAL DATUM IS NGVD29 FROM GPS SURVEY METHODS POST PROCESSED THROUGH NOAA-OPUS.
- THE SUBJECT PARCEL IS LOCATED WITHIN THE BUSINESS (B) ZONING DISTRICT. DIMENSIONAL REQUIREMENTS ARE AS FOLLOWS FOR LOTS SERVICED WITH MUNICIPAL SEWER AND WATER:

MINIMUM LOT AREA	30,000 SF	40,793 SF
MINIMUM LOT FRONTAGE	150 FT	291.47 FT
MINIMUM BUILDING SETBACKS:		
FRONT	50 FT	69 FT
SIDE	15 FT	75 FT
REAR	15 FT	47 FT
- PARCEL WILL BE SERVICED BY MUNICIPAL WATER & SEWER.
- EXAMINATION OF THE FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA) FLOOD INSURANCE RATE MAP (FIRM) FOR THE TOWN OF MERRIMACK N.H., HILLSBOROUGH COUNTY, MAP NUMBER 33011C0514E, PANEL 501 OF 701, EFFECTIVE DATE: APRIL 18, 2011 INDICATES THAT NO PORTION OF THE SUBJECT PARCEL IS LOCATED WITHIN A DESIGNATED FLOOD HAZARD AREA.
- THE LOCATION OF ANY UNDERGROUND UTILITY INFORMATION SHOWN HEREON IS APPROXIMATE. KEACH-NORDSTROM ASSOCIATES, INC. MAKES NO CLAIM TO THE ACCURACY OR COMPLETENESS OF THE UTILITIES SHOWN. PRIOR TO ANY EXCAVATION ON SITE THE CONTRACTOR OR OWNER SHALL CONTACT DIG-SAFE AT 811.
- EASEMENTS, RIGHTS AND RESTRICTIONS SHOWN OR IDENTIFIED HEREON ARE THOSE FOUND DURING RESEARCH AT THE HILLSBOROUGH COUNTY REGISTRY OF DEEDS. OTHER EASEMENTS, RIGHTS AND RESTRICTIONS MAY EXIST WHICH A TITLE EXAMINATION OF THE SUBJECT PREMISES MAY DETERMINE.
- OPEN SPACE REQUIRED = 40%
- OPEN SPACE PROPOSED = 58.6%
- PARKING CALCULATIONS:**
PARKING REQUIRED = 1 SPACE / 100 SF X 900 SF = 9 SPACES
TOTAL PARKING PROVIDED = 9 SPACES
- SITE LIGHTING SHALL BE AS SHOWN ON THE PLAN, DIRECTED ONTO SITE, AND SHALL CONFORM WITH ALL APPLICABLE TOWN OF HUDSON ZONING REGULATIONS.
- CONSTRUCTION ACTIVITIES SHALL BE LIMITED TO THE HOURS OF 7:00 AM & 7:00 PM, MONDAY THROUGH SATURDAY. NO EXTERIOR CONSTRUCTION ACTIVITIES SHALL OCCUR ON SUNDAY.
- HOURS OF OPERATION: 6:00 AM TO 6:00 PM, MONDAY THROUGH SATURDAY.
- APPROVAL OF THIS PLAN SHALL BE SUBJECT TO FINAL ENGINEERING REVIEW.
- SITE IMPROVEMENTS DEPICTED ON THE PLAN SHALL CONFORM WITH TITLE III OF THE AMERICANS WITH DISABILITIES ACT WITH REGARD TO DIMENSION AND GRADE.
- IT SHALL BE UNLAWFUL TO MODIFY, CHANGE, OR ALTER ANY STRUCTURE OR USE SHOWN ON THIS SITE PLAN IN ANYWAY WHATSOEVER, OR CONVERT OR ALTER ANY STRUCTURE OR USE SHOWN ON THIS SITE PLAN, OR CHANGE THE ABOVE USE INDICATED ON THE PLAN WITHOUT RECEIVING APPROVAL FROM THE TOWN OF HUDSON PLANNING BOARD.
- PRIOR TO THE ISSUANCE OF A FINAL CERTIFICATE OF OCCUPANCY, AN L.L.S. CERTIFIED "AS-BUILT" SITE PLAN SHALL BE PROVIDED TO THE TOWN OF HUDSON COMMUNITY DEVELOPMENT DEPARTMENT CONFIRMING THAT THE SITE CONFORMS WITH THE PLANNING BOARD APPROVED SITE PLAN.
- IDENTIFICATION SIGNAGE SHALL NOT BE ERRECTED UNTIL APPROVED BY THE BUILDING INSPECTOR AND ZONING ADMINISTRATOR.
- PLOWED SNOW FROM THE FACILITIES, DRIVEWAY, PARKING LOTS AND SIDEWALK SHALL BE STORED IN THE DESIGNATED AREAS SHOWN IN THIS PLAN SET. NO SNOW MAY BE PLOWED OR STORED ON THE ADJACENT PARCELS. WHEN THE SNOW STORAGE AREAS ARE AT CAPACITY, SUBSEQUENT SNOW SHALL BE HAULED OFF-SITE AND DISPOSED OF IN AN ENVIRONMENTALLY SOUND FASHION AND IN ACCORDANCE WITH ALL LOCAL, STATE AND FEDERAL REGULATIONS.
- ONSITE DRAINAGE SYSTEM SHALL BE CONSTRUCTED AND MAINTAINED IN COMPLIANCE WITH NHDES REQUIREMENTS FOR SUCH SYSTEMS.
- THE APPLICANT'S ENGINEER AND/OR CONTRACTOR SHALL CONTACT THE TOWN OF HUDSON TO SCHEDULE A PRE-CONSTRUCTION MEETING, WHICH WILL BE HELD WITH STAFF PRIOR TO STARTING CONSTRUCTION.
- ALL STIPULATIONS OF APPROVAL SHALL BE INCORPORATED INTO THE DEVELOPMENT AGREEMENT, WHICH SHALL BE RECORDED AT THE HILLSBOROUGH COUNTY REGISTRY OF DEEDS, TOGETHER WITH THE SITE PLAN-OF-RECORD AND ALL AGREED UPON EASEMENT DEEDS, WHICH SHALL BE FAVORABLY REVIEWED BY TOWN COUNSEL PRIOR TO PLANNING BOARD ENDORSEMENT OF PLAN.
- ALL IMPROVEMENTS SHOWN ON THE SITE PLAN-OF-RECORD, INCLUDING NOTES 1-29, SHALL BE COMPLETED IN THEIR ENTIRETY AND AT THE EXPENSE OF THE APPLICANT OR HIS ASSIGNS.
- THE TOWN OF HUDSON SHALL RESERVE THE RIGHT TO REQUIRE ADDITIONAL EROSION CONTROL MEASURES DURING CONSTRUCTION.
- AFTER ISSUANCE OF THE FOUNDATION PERMIT FOR THE PROPOSED BUILDING, AND PRIOR TO THE ISSUANCE OF THE FRAMING PERMIT THEREOF, THE APPLICANT SHALL SUBMIT TO THE HUDSON COMMUNITY DEVELOPMENT DEPARTMENT A FOUNDATION "AS-BUILT" PLAN ON A TRANSPARENCY AND TO THE SAME SCALE AS THE APPROVED SITE PLAN. THE FOUNDATION "AS-BUILT" PLAN SHALL INCLUDE ALL STRUCTURAL DIMENSIONS AND LOT LINE SETBACK MEASUREMENTS TO THE FOUNDATION AND BE STAMPED BY A LICENSED LAND SURVEYOR. ANY DISCREPANCY BETWEEN THE APPROVED SITE PLAN AND FOUNDATION "AS-BUILT" PLANS SHALL BE DOCUMENTED BY THE APPLICANT AND BE PART OF THE FOUNDATION "AS-BUILT" SUBMISSION.
- THE PROPOSED PROJECT HAS BEEN DESIGNED TO MEET 2018 M54 REQUIREMENTS.
- ALL SIGNS ARE SUBJECT TO APPROVAL BY THE HUDSON PLANNING BOARD PRIOR TO INSTALLATION.



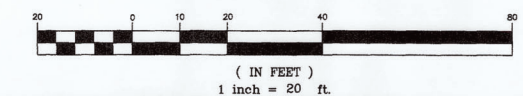
VICINITY PLAN
SCALE: 1" = 1000'

LEGEND

- GB-F GRANITE BOUND FOUND
- JP-F IRON PIN FOUND
- IP-S IRON PIN SET WITH CAP
- U UTILITY POLE
- S STREET LIGHT
- W/CAP GAS VALVE
- WATER VALVE
- SEWER MANHOLE
- DRAINAGE MANHOLE
- CATCH BASIN
- ABUTTER LINE
- PROPERTY LINE
- OHU OVERHEAD UTILITIES
- DRAINAGE LINE
- TREELINE
- EOP RETAINING WALL
- VGC EDGE OF PAVEMENT
- SETBACK
- GREEN SPACE BUFFER
- PROPOSED SIGN
- PROPOSED LIGHT
- PROPOSED GAS VALVE
- PROPOSED WATER VALVE
- PROPOSED WOOD GUARDRAIL
- PROPOSED TREELINE
- PROPOSED EDGE OF PAVEMENT
- PROPOSED RETAINING WALL
- PROPOSED VERTICAL GRANITE CURB
- PROPOSED OUTLET STRUCTURE

LOAM & SEED ALL DISTURBED AREAS (TYP.)

GRAPHIC SCALE



NON RESIDENTIAL SITE PLAN
AROMA JOE'S
MAP 173 LOT 29
56 DERRY STREET
HUDSON, NEW HAMPSHIRE
HILLSBOROUGH COUNTY

OWNER OF RECORD:
STEVE S. & HSIANG HWA W. PAN
13 KING HENRY DRIVE
LONDONDERRY, N.H. 03053
BK. 6281 PG. 776

APPLICANT:
SCOTT ZIEFELDER
169 CANAAN BACK ROAD
BARRINGTON, NH 03825

KMA KEACH-NORDSTROM ASSOCIATES, INC.
Civil Engineering Land Surveying Landscape Architecture
10 Commerce Park North, Suite 3B, Bedford, NH 03110 Phone (603) 627-2881

PURSUANT TO THE SITE REVIEW REGULATIONS OF THE HUDSON PLANNING BOARD, THE SITE PLAN APPROVAL GRANTED HEREIN EXPIRES TWO YEARS FROM DATE OF APPROVAL

APPROVED BY THE HUDSON, NH PLANNING BOARD
DATE OF MEETING: _____

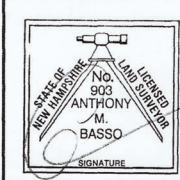
SIGNATURE DATE: _____

SIGNATURE DATE: _____

SITE PLANS ARE VALID FOR TWO YEARS FROM THE DATE OF PLANNING BOARD MEETING FINAL APPROVAL. FINAL APPROVAL COMMENCES AT THE PLANNING BOARD MEETING DATE AT WHICH THE PLAN RECEIVES FINAL APPROVAL.

OWNER OF MAP 173 LOT 29

SIGNATURE: *Steve S. Pan*
DATE: 6-16-2021



SURVEYOR'S CERTIFICATION:

I HEREBY CERTIFY THAT THIS PLAN WAS PREPARED BY ME OR THOSE UNDER MY DIRECT SUPERVISION. FURTHER, THAT THIS PLAN IS BASED ON AN ACTUAL FIELD SURVEY MADE BY THIS OFFICE DURING APRIL OF 2021. SAID SURVEY HAS A RELATIVE ERROR OF CLOSURE OF ONE PART IN TEN THOUSAND (1:10,000) OR BETTER.

LICENSED LAND SURVEYOR
DATE: 6/21/21

REVISIONS			
No.	DATE	DESCRIPTION	BY

DATE: JUNE 22, 2021 SCALE: 1"=20'
PROJECT NO: 21-0311-1 SHEET 2 OF 12

Appendix B: Traffic Counts

Accurate Counts

978-664-2565

N/S Street : Derry Road
 E/W Street : Ledge Road
 City/State : Hudson, NH
 Weather : Clear

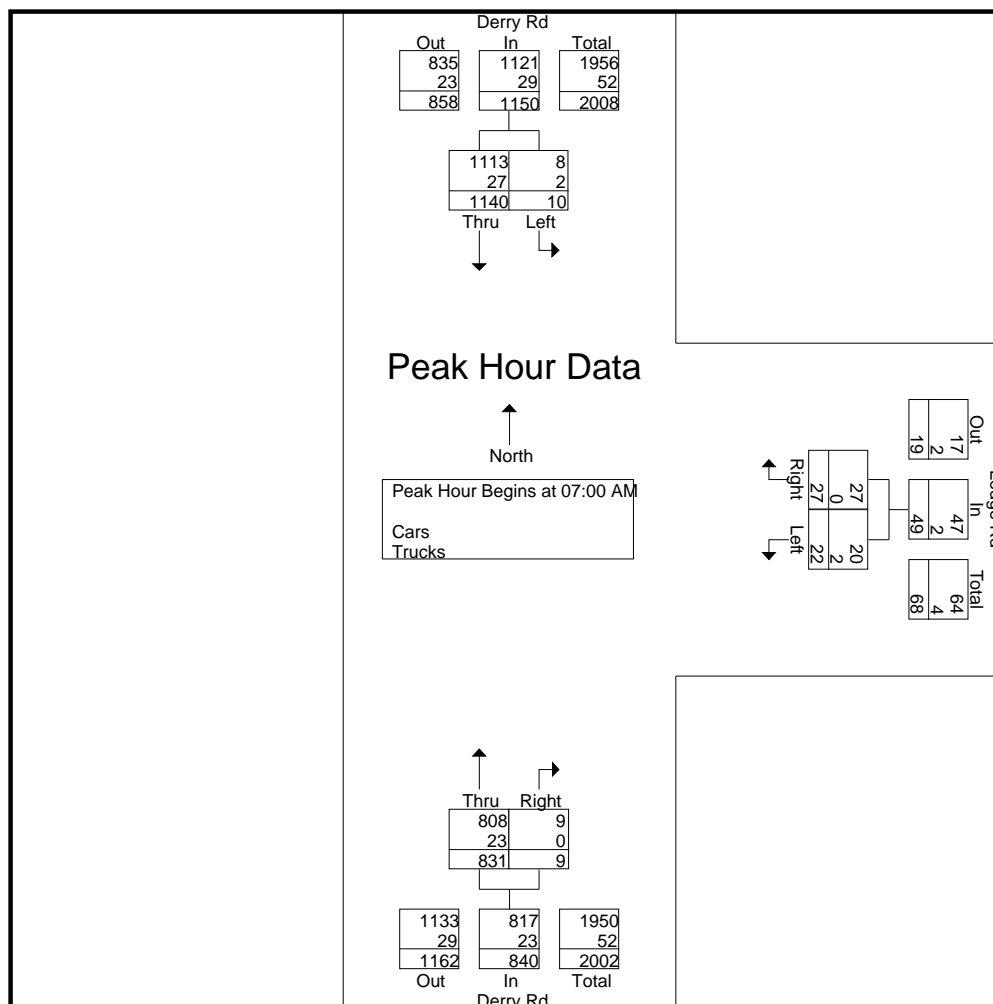
File Name : 15530001
 Site Code : 15530001
 Start Date : 6/2/2021
 Page No : 1

Groups Printed- Cars - Trucks

Start Time	Derry Rd From North		Ledge Rd From East		Derry Rd From South		Int. Total
	Left	Thru	Left	Right	Thru	Right	
07:00 AM	3	246	7	10	211	3	480
07:15 AM	3	297	7	5	225	0	537
07:30 AM	1	319	5	4	191	3	523
07:45 AM	3	278	3	8	204	3	499
Total	10	1140	22	27	831	9	2039
08:00 AM	2	251	3	3	162	4	425
08:15 AM	2	250	2	4	153	3	414
08:30 AM	2	288	7	2	175	2	476
08:45 AM	2	240	3	5	212	6	468
Total	8	1029	15	14	702	15	1783
Grand Total	18	2169	37	41	1533	24	3822
Apprch %	0.8	99.2	47.4	52.6	98.5	1.5	
Total %	0.5	56.8	1	1.1	40.1	0.6	
Cars	16	2092	34	40	1492	23	3697
% Cars	88.9	96.4	91.9	97.6	97.3	95.8	96.7
Trucks	2	77	3	1	41	1	125
% Trucks	11.1	3.6	8.1	2.4	2.7	4.2	3.3

Start Time	Derry Rd From North			Ledge Rd From East			Derry Rd From South			Int. Total
	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:00 AM										
07:00 AM	3	246	249	7	10	17	211	3	214	480
07:15 AM	3	297	300	7	5	12	225	0	225	537
07:30 AM	1	319	320	5	4	9	191	3	194	523
07:45 AM	3	278	281	3	8	11	204	3	207	499
Total Volume	10	1140	1150	22	27	49	831	9	840	2039
% App. Total	0.9	99.1		44.9	55.1		98.9	1.1		
PHF	.833	.893	.898	.786	.675	.721	.923	.750	.933	.949
Cars	8	1113	1121	20	27	47	808	9	817	1985
% Cars	80.0	97.6	97.5	90.9	100	95.9	97.2	100	97.3	97.4
Trucks	2	27	29	2	0	2	23	0	23	54
% Trucks	20.0	2.4	2.5	9.1	0	4.1	2.8	0	2.7	2.6

N/S Street : Derry Road
E/W Street : Ledge Road
City/State : Hudson, NH
Weather : Clear



Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:15 AM			07:00 AM			07:00 AM		
+0 mins.	3	297	300	7	10	17	211	3	214
+15 mins.	1	319	320	7	5	12	225	0	225
+30 mins.	3	278	281	5	4	9	191	3	194
+45 mins.	2	251	253	3	8	11	204	3	207
Total Volume	9	1145	1154	22	27	49	831	9	840
% App. Total	0.8	99.2		44.9	55.1		98.9	1.1	
PHF	.750	.897	.902	.786	.675	.721	.923	.750	.933
Cars	8	1120	1128	20	27	47	808	9	817
% Cars	88.9	97.8	97.7	90.9	100	95.9	97.2	100	97.3
Trucks	1	25	26	2	0	2	23	0	23
% Trucks	11.1	2.2	2.3	9.1	0	4.1	2.8	0	2.7

Accurate Counts
978-664-2565

File Name : 15530001
Site Code : 15530001
Start Date : 6/2/2021
Page No : 10

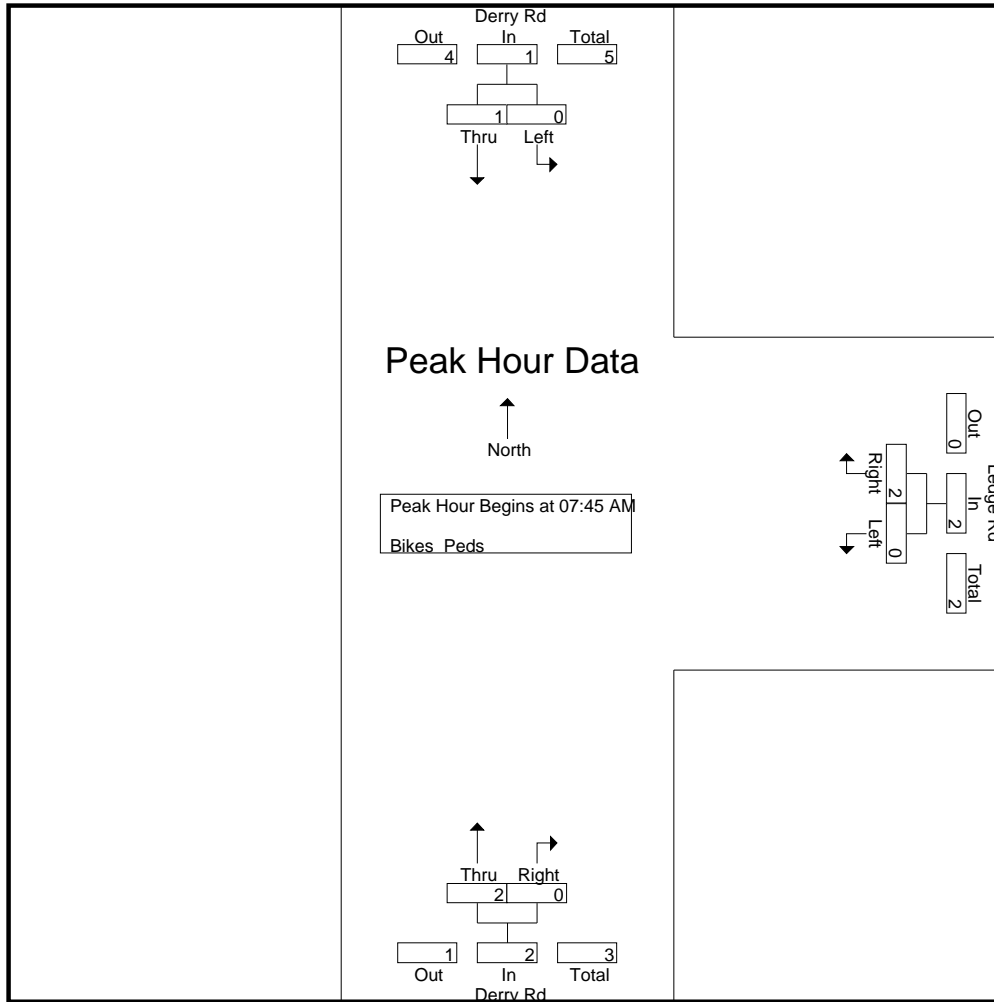
N/S Street : Derry Road
E/W Street : Ledge Road
City/State : Hudson, NH
Weather : Clear

Groups Printed- Bikes Peds

Start Time	Derry Rd From North			Ledge Rd From East			Derry Rd From South			Exclu. Total	Inclu. Total	Int. Total
	Left	Thru	Peds	Left	Right	Peds	Thru	Right	Peds			
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	2	0	0	0	2	2
Total	0	0	0	0	0	0	2	0	0	0	2	2
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	1	0	0	2	1	0	0	0	1	3	4
08:45 AM	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	1	0	0	2	1	0	0	0	1	3	4
Grand Total	0	1	0	0	2	1	2	0	0	1	5	6
Apprch %	0	100		0	100		100	0				
Total %	0	20		0	40		40	0		16.7	83.3	

Start Time	Derry Rd From North			Ledge Rd From East			Derry Rd From South			Int. Total
	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:45 AM										
07:45 AM	0	0	0	0	0	0	2	0	2	2
08:00 AM	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	1	1	0	2	2	0	0	0	3
Total Volume	0	1	1	0	2	2	2	0	2	5
% App. Total	0	100		0	100		100	0		
PHF	.000	.250	.250	.000	.250	.250	.250	.000	.250	.417

N/S Street : Derry Road
E/W Street : Ledge Road
City/State : Hudson, NH
Weather : Clear



Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:45 AM			07:45 AM			07:00 AM		
+0 mins.	0	0	0	0	0	0	0	0	0
+15 mins.	0	0	0	0	0	0	0	0	0
+30 mins.	0	0	0	0	0	0	0	0	0
+45 mins.	0	1	1	0	2	2	2	0	2
Total Volume	0	1	1	0	2	2	2	0	2
% App. Total	0	100		0	100		100	0	
PHF	.000	.250	.250	.000	.250	.250	.250	.000	.250

Accurate Counts

978-664-2565

N/S Street : Derry Road
 E/W Street : Ledge Road
 City/State : Hudson, NH
 Weather : Clear

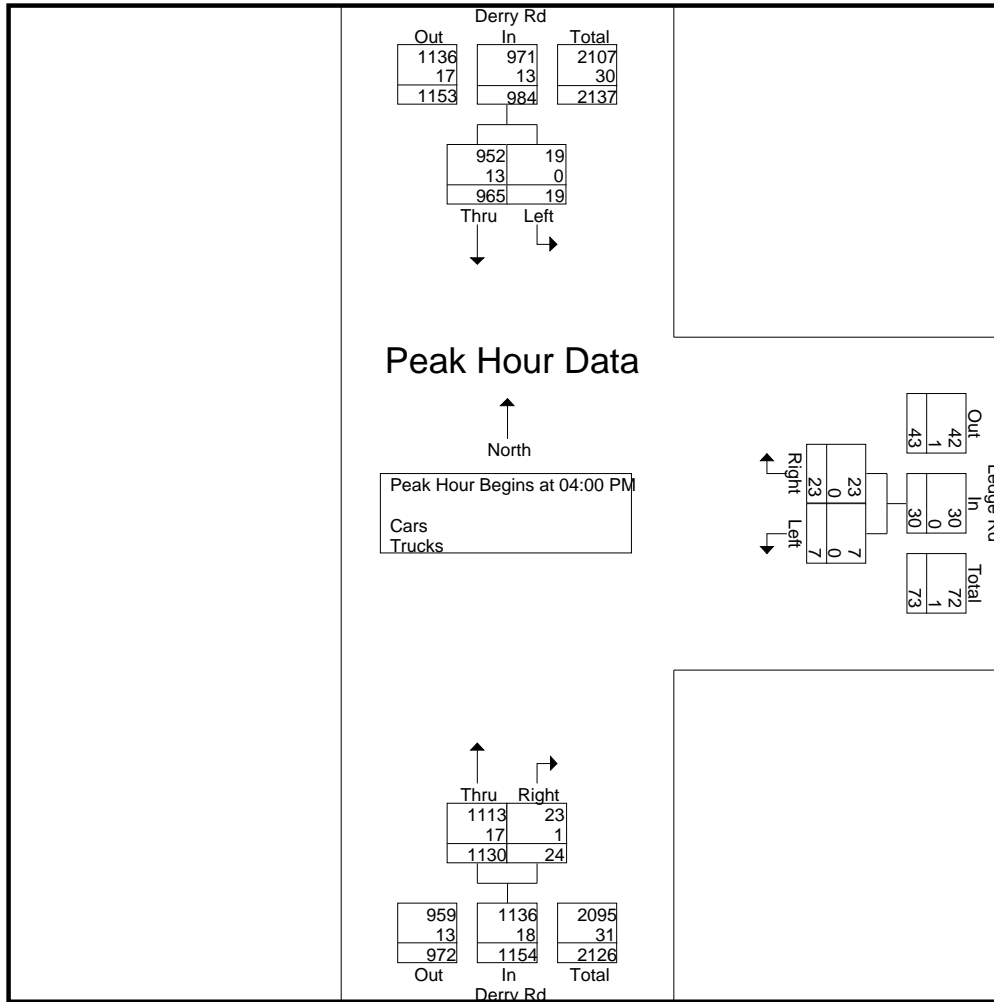
File Name : 15530001
 Site Code : 15530001
 Start Date : 6/2/2021
 Page No : 1

Groups Printed- Cars - Trucks

Start Time	Derry Rd From North		Ledge Rd From East		Derry Rd From South		Int. Total
	Left	Thru	Left	Right	Thru	Right	
04:00 PM	2	251	2	6	284	8	553
04:15 PM	2	239	1	6	277	6	531
04:30 PM	6	227	1	3	287	5	529
04:45 PM	9	248	3	8	282	5	555
Total	19	965	7	23	1130	24	2168
05:00 PM	3	237	1	6	258	6	511
05:15 PM	6	269	4	5	282	6	572
05:30 PM	8	220	2	8	261	6	505
05:45 PM	3	244	1	5	277	4	534
Total	20	970	8	24	1078	22	2122
Grand Total	39	1935	15	47	2208	46	4290
Apprch %	2	98	24.2	75.8	98	2	
Total %	0.9	45.1	0.3	1.1	51.5	1.1	
Cars	39	1913	15	47	2188	45	4247
% Cars	100	98.9	100	100	99.1	97.8	99
Trucks	0	22	0	0	20	1	43
% Trucks	0	1.1	0	0	0.9	2.2	1

Start Time	Derry Rd From North			Ledge Rd From East			Derry Rd From South			Int. Total
	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:00 PM										
04:00 PM	2	251	253	2	6	8	284	8	292	553
04:15 PM	2	239	241	1	6	7	277	6	283	531
04:30 PM	6	227	233	1	3	4	287	5	292	529
04:45 PM	9	248	257	3	8	11	282	5	287	555
Total Volume	19	965	984	7	23	30	1130	24	1154	2168
% App. Total	1.9	98.1		23.3	76.7		97.9	2.1		
PHF	.528	.961	.957	.583	.719	.682	.984	.750	.988	.977
Cars	19	952	971	7	23	30	1113	23	1136	2137
% Cars	100	98.7	98.7	100	100	100	98.5	95.8	98.4	98.6
Trucks	0	13	13	0	0	0	17	1	18	31
% Trucks	0	1.3	1.3	0	0	0	1.5	4.2	1.6	1.4

N/S Street : Derry Road
E/W Street : Ledge Road
City/State : Hudson, NH
Weather : Clear



Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	04:30 PM			04:45 PM			04:00 PM		
+0 mins.	6	227	233	3	8	11	284	8	292
+15 mins.	9	248	257	1	6	7	277	6	283
+30 mins.	3	237	240	4	5	9	287	5	292
+45 mins.	6	269	275	2	8	10	282	5	287
Total Volume	24	981	1005	10	27	37	1130	24	1154
% App. Total	2.4	97.6		27	73		97.9	2.1	
PHF	.667	.912	.914	.625	.844	.841	.984	.750	.988
Cars	24	975	999	10	27	37	1113	23	1136
% Cars	100	99.4	99.4	100	100	100	98.5	95.8	98.4
Trucks	0	6	6	0	0	0	17	1	18
% Trucks	0	0.6	0.6	0	0	0	1.5	4.2	1.6

Accurate Counts
978-664-2565

File Name : 15530001
Site Code : 15530001
Start Date : 6/2/2021
Page No : 10

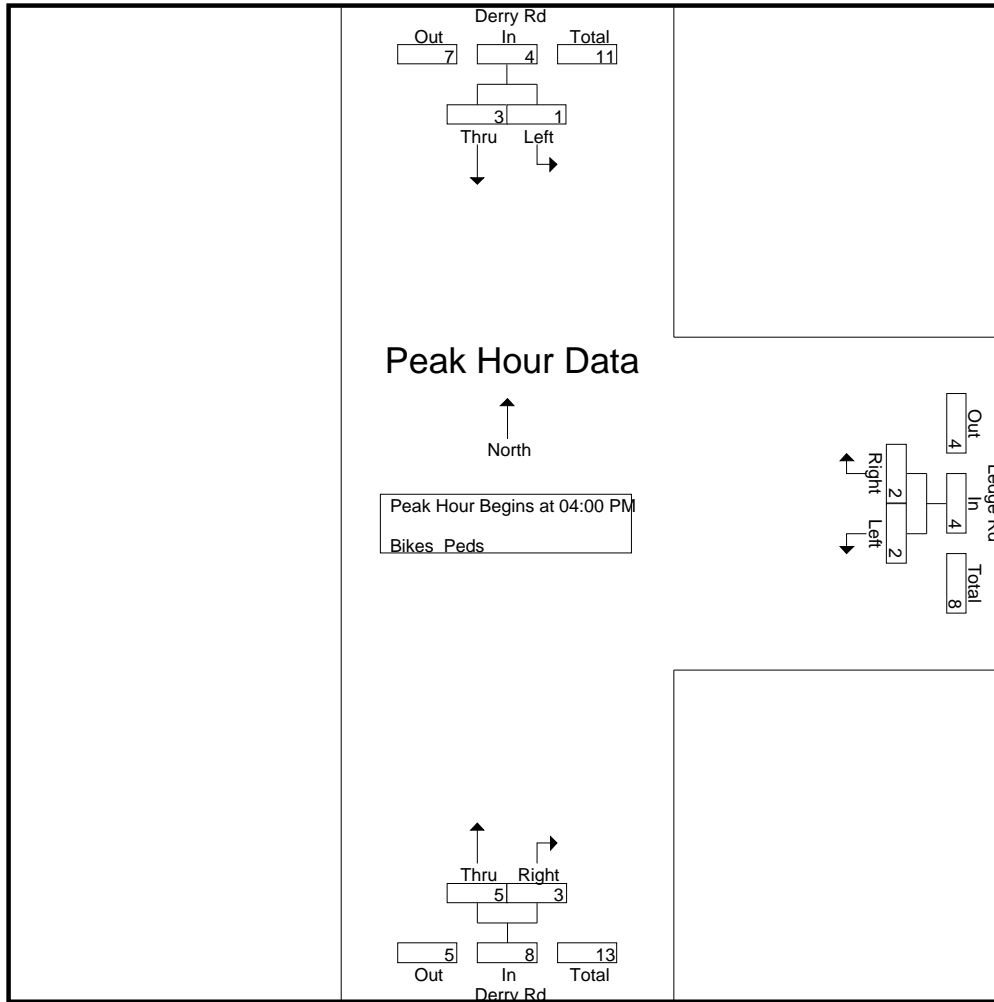
N/S Street : Derry Road
E/W Street : Ledge Road
City/State : Hudson, NH
Weather : Clear

Groups Printed- Bikes Peds

Start Time	Derry Rd From North			Ledge Rd From East			Derry Rd From South			Exclu. Total	Inclu. Total	Int. Total
	Left	Thru	Peds	Left	Right	Peds	Thru	Right	Peds			
04:00 PM	0	0	0	0	0	0	1	0	1	1	1	2
04:15 PM	0	2	1	0	1	0	1	1	0	1	5	6
04:30 PM	1	1	0	0	0	0	3	2	0	0	7	7
04:45 PM	0	0	0	2	1	0	0	0	0	0	3	3
Total	1	3	1	2	2	0	5	3	1	2	16	18
05:00 PM	0	0	0	0	0	0	0	1	0	0	1	1
05:15 PM	0	1	0	0	0	0	0	0	0	0	1	1
05:30 PM	0	1	0	0	0	0	0	0	0	0	1	1
05:45 PM	0	0	0	4	0	2	0	0	0	2	4	6
Total	0	2	0	4	0	2	0	1	0	2	7	9
Grand Total	1	5	1	6	2	2	5	4	1	4	23	27
Apprch %	16.7	83.3		75	25		55.6	44.4				
Total %	4.3	21.7		26.1	8.7		21.7	17.4		14.8	85.2	

Start Time	Derry Rd From North			Ledge Rd From East			Derry Rd From South			Int. Total
	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:00 PM										
04:00 PM	0	0	0	0	0	0	1	0	1	1
04:15 PM	0	2	2	0	1	1	1	1	2	5
04:30 PM	1	1	2	0	0	0	3	2	5	7
04:45 PM	0	0	0	2	1	3	0	0	0	3
Total Volume	1	3	4	2	2	4	5	3	8	16
% App. Total	25	75		50	50		62.5	37.5		
PHF	.250	.375	.500	.250	.500	.333	.417	.375	.400	.571

N/S Street : Derry Road
E/W Street : Ledge Road
City/State : Hudson, NH
Weather : Clear



Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	04:00 PM			04:00 PM			04:00 PM		
+0 mins.	0	0	0	0	0	0	1	0	1
+15 mins.	0	2	2	0	1	1	1	1	2
+30 mins.	1	1	2	0	0	0	3	2	5
+45 mins.	0	0	0	2	1	3	0	0	0
Total Volume	1	3	4	2	2	4	5	3	8
% App. Total	25	75		50	50		62.5	37.5	
PHF	.250	.375	.500	.250	.500	.333	.417	.375	.400

Appendix C: Monthly Traffic Volumes

Year 2019 Monthly Data

Group 4 Averages: Urban Highways

<u>Month</u>	<u>ADT</u>	<u>Adjustment to Average</u>	<u>Adjustment to Peak</u>
January	11,431	1.12	1.23
February	11,848	1.08	1.18
March	12,141	1.06	1.15
April	12,860	1.00	1.09
May	13,551	0.95	1.03
June	13,785	0.93	1.02
July	13,942	0.92	1.01
August	14,016	0.92	1.00
September	13,379	0.96	1.05
October	13,339	0.96	1.05
November	12,265	1.05	1.14
December	11,496	1.12	1.22
Average ADT:	12,838		
Peak ADT:	14,016		

Appendix D: Vehicle Speeds

Accurate Counts
978-664-2565

15530001

Location : Derry Road
Location : South of Ledge Road
City/State: Hudson, NH
Direction: SB,

6/2/2021 Time	0 - 15 MPH	> 15 - 20 MPH	> 20 - 25 MPH	> 25 - 30 MPH	> 30 - 35 MPH	> 35 - 40 MPH	> 40 - 45 MPH	> 45 - 50 MPH	> 50 - 55 MPH	> 55 - 60 MPH	> 60 - 65 MPH	> 65 - 70 MPH	> 70 MPH	Total
12:00 AM	0	0	0	3	16	9	3	1	1	0	0	0	0	33
1:00	0	0	0	2	13	8	4	0	0	0	0	0	0	27
2:00	0	0	0	4	8	6	0	0	0	0	0	0	0	18
3:00	0	0	0	4	17	15	8	1	0	1	0	0	0	46
4:00	0	1	2	8	37	73	31	3	0	0	0	0	0	155
5:00	0	2	1	9	108	237	59	12	0	0	0	0	0	428
6:00	0	0	17	69	257	350	63	3	0	0	0	0	0	759
7:00	0	2	3	154	618	244	25	2	0	0	0	0	0	1048
8:00	0	8	24	255	435	206	26	2	0	0	0	0	0	956
9:00	2	7	8	133	363	227	27	0	0	0	0	0	0	767
10:00	0	8	5	101	400	264	33	1	1	0	0	0	0	813
11:00	0	6	10	104	364	219	33	2	0	0	0	0	0	738
12:00 PM	0	5	15	134	397	255	31	3	0	0	0	0	0	840
1:00	1	9	14	121	427	197	25	4	0	0	0	0	0	798
2:00	0	10	27	182	566	215	12	1	0	0	0	0	0	1013
3:00	1	3	29	222	475	228	20	3	0	0	0	0	0	981
4:00	2	4	11	119	498	253	37	3	0	0	0	0	0	927
5:00	1	4	38	102	438	313	45	2	0	0	0	0	0	943
6:00	0	5	8	77	334	298	59	2	0	0	0	0	0	783
7:00	0	3	2	38	298	221	39	3	1	0	0	0	0	605
8:00	0	2	1	27	206	180	30	2	0	0	0	0	0	448
9:00	0	2	1	21	129	89	21	3	1	0	0	0	0	267
10:00	0	0	0	15	69	54	14	2	0	0	0	0	0	154
11:00	0	2	0	7	26	30	7	0	0	0	0	0	0	72
Total	7	83	216	1911	6499	4191	652	55	4	1	0	0	0	13619

Percentile	15th	50th	85th	95th
Speed	29.7	33.5	37.8	40.3
Mean Speed (Average)	33.7			
10 MPH Pace Speed	30-39			
Number in Pace	10644			
Percent in Pace	78.2%			
Number > 30 MPH	11402			
Percent > 30 MPH	83.7%			

Accurate Counts
978-664-2565

Location : Derry Road
Location : South of Ledge Road
City/State: Hudson, NH
Direction: NB,

15530001

6/2/2021 Time	0 - 15 MPH	> 15 - 20 MPH	> 20 - 25 MPH	> 25 - 30 MPH	> 30 - 35 MPH	> 35 - 40 MPH	> 40 - 45 MPH	> 45 - 50 MPH	> 50 - 55 MPH	> 55 - 60 MPH	> 60 - 65 MPH	> 65 - 70 MPH	> 70 MPH	Total
12:00 AM	0	0	1	1	7	23	7	2	0	0	0	0	0	41
1:00	0	0	0	0	10	10	2	0	0	0	0	0	0	22
2:00	0	0	0	2	4	6	5	2	0	0	0	0	0	19
3:00	0	0	0	0	7	18	7	7	0	0	0	0	1	40
4:00	0	0	2	0	11	29	27	4	0	0	0	0	2	75
5:00	0	0	2	3	38	102	77	17	0	1	0	0	1	241
6:00	0	5	21	61	133	217	94	11	2	0	0	0	0	544
7:00	3	1	17	87	235	404	86	7	1	0	0	0	1	842
8:00	3	1	24	63	221	352	68	1	0	0	0	0	2	735
9:00	1	2	12	34	204	323	70	5	0	0	0	1	2	654
10:00	3	6	8	30	238	274	72	7	0	0	0	0	2	640
11:00	2	6	8	63	275	312	80	6	0	0	0	1	2	755
12:00 PM	2	7	16	39	296	362	72	5	0	0	0	0	0	799
1:00	6	2	17	90	312	317	60	3	1	0	0	0	0	808
2:00	3	2	4	75	349	411	70	5	0	0	0	1	1	921
3:00	4	4	20	86	423	431	94	3	0	0	0	0	0	1065
4:00	6	8	24	204	498	389	32	1	0	0	0	0	1	1163
5:00	0	3	6	105	408	493	86	5	0	0	0	0	0	1106
6:00	3	5	3	45	293	418	104	11	0	0	0	0	1	883
7:00	0	3	3	28	179	348	70	9	2	0	0	0	0	642
8:00	0	1	5	41	189	222	42	7	0	0	0	0	0	507
9:00	1	0	0	13	103	159	50	3	0	0	0	0	0	329
10:00	0	0	2	10	44	81	25	2	0	1	0	0	0	165
11:00	0	0	3	3	23	51	15	4	0	0	0	0	0	99
Total	37	56	198	1083	4500	5752	1315	127	6	2	0	3	16	13095

Percentile	15th	50th	85th	95th
Speed	31	35.3	39	41.5
Mean Speed (Average)	35.4			
10 MPH Pace Speed	30-39			
Number in Pace	10159			
Percent in Pace	77.6%			
Number > 30 MPH	11721			
Percent > 30 MPH	89.5%			

Accurate Counts
978-664-2565

Location : Derry Road
Location : South of Ledge Road
City/State: Hudson, NH
Direction: NB,

15530001

6/3/2021 Time	0 - 15 MPH	> 15 - 20 MPH	> 20 - 25 MPH	> 25 - 30 MPH	> 30 - 35 MPH	> 35 - 40 MPH	> 40 - 45 MPH	> 45 - 50 MPH	> 50 - 55 MPH	> 55 - 60 MPH	> 60 - 65 MPH	> 65 - 70 MPH	> 70 MPH	Total	
12:00 AM	0	1	0	5	9	27	7	0	0	0	1	1	0	51	
1:00	0	0	0	2	7	8	8	1	1	0	0	0	0	27	
2:00	0	0	1	1	4	7	7	3	0	0	0	0	0	23	
3:00	0	0	0	1	5	9	7	0	1	0	0	0	0	23	
4:00	0	0	0	4	11	45	25	6	0	0	0	0	0	91	
5:00	0	0	5	9	52	108	68	21	0	0	0	0	1	264	
6:00	1	2	18	66	104	199	85	11	1	1	0	0	2	490	
7:00	4	2	16	103	315	359	62	6	1	0	0	2	1	871	
8:00	7	2	20	56	261	326	85	7	1	0	0	0	9	774	
9:00	1	1	3	48	218	316	65	9	1	0	0	0	2	664	
10:00	1	4	3	51	199	318	90	7	0	0	0	0	0	673	
11:00	2	5	9	71	232	270	95	1	0	0	0	3	2	690	
12:00 PM	3	3	7	50	310	358	75	8	0	0	0	0	0	814	
1:00	2	4	16	74	373	349	56	3	0	0	0	0	0	877	
2:00	5	7	15	129	431	347	47	2	0	0	1	2	0	986	
3:00	5	2	17	180	447	366	53	1	1	0	0	0	0	1072	
4:00	15	16	39	121	396	460	73	0	0	0	0	0	0	1120	
5:00	0	5	12	68	433	471	104	5	0	0	0	0	0	1098	
6:00	0	0	2	46	317	359	103	13	1	0	0	0	0	841	
7:00	3	0	6	38	195	301	89	6	0	0	0	0	0	638	
8:00	0	0	1	24	160	215	44	2	1	0	0	0	0	447	
9:00	0	3	4	16	99	119	62	1	0	0	0	0	0	304	
10:00	0	0	1	13	38	81	30	7	1	0	0	0	0	171	
11:00	0	0	1	2	22	53	25	1	0	0	0	0	0	104	
Total	49	57	196	1178	4638	5471	1365	121	10	1	2	8	17	13113	
Percentile				15th	50th	85th	95th								
Speed				31	35.3	39	41.5								
Mean Speed (Average)				35.3											
10 MPH Pace Speed				30-39											
Number in Pace				10023											
Percent in Pace				76.4%											
Number > 30 MPH				11633											
Percent > 30 MPH				88.7%											
Grand Total	86	113	394	2261	9138	11223	2680	248	16	3	2	11	33	26208	
Stats				Percentile	15th	50th	85th	95th							
Speed				31	35.3	39	41.5								
Mean Speed (Average)				35.3											
10 MPH Pace Speed				30-39											
Number in Pace				20182											
Percent in Pace				77.0%											
Number > 30 MPH				23354											
Percent > 30 MPH				89.1%											

Appendix E: Capacity-Analysis Worksheets

HCM 6th TWSC
1: Derry Road & Ledge Road

06/30/2021

Intersection						
Int Delay, s/veh	1.1					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	Y		T		T	T
Traffic Vol, veh/h	24	29	895	10	11	1228
Future Vol, veh/h	24	29	895	10	11	1228
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	-	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	72	72	93	93	90	90
Heavy Vehicles, %	9	0	3	0	20	2
Mvmt Flow	33	40	962	11	12	1364

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	2356	968	0	0	973
Stage 1	968	-	-	-	-
Stage 2	1388	-	-	-	-
Critical Hdwy	6.49	6.2	-	-	4.3
Critical Hdwy Stg 1	5.49	-	-	-	-
Critical Hdwy Stg 2	5.49	-	-	-	-
Follow-up Hdwy	3.581	3.3	-	-	2.38
Pot Cap-1 Maneuver	37	311	-	-	642
Stage 1	358	-	-	-	-
Stage 2	223	-	-	-	-
Platoon blocked, %			-	-	-
Mov Cap-1 Maneuver	36	311	-	-	642
Mov Cap-2 Maneuver	139	-	-	-	-
Stage 1	358	-	-	-	-
Stage 2	219	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	33.3	0	0.1
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	199	642
HCM Lane V/C Ratio	-	-	0.37	0.019
HCM Control Delay (s)	-	-	33.3	10.7
HCM Lane LOS	-	-	D	B
HCM 95th %tile Q(veh)	-	-	1.6	0.1

HCM 6th TWSC
1: Derry Road & Ledge Road

06/30/2021

Intersection						
Int Delay, s/veh	0.7					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	8	25	1217	26	20	1039
Future Vol, veh/h	8	25	1217	26	20	1039
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	-	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	68	68	99	99	96	96
Heavy Vehicles, %	0	0	2	4	0	1
Mvmt Flow	12	37	1229	26	21	1082

Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	2366	1242	0	0	1255	0
Stage 1	1242	-	-	-	-	-
Stage 2	1124	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	39	215	-	-	561	-
Stage 1	275	-	-	-	-	-
Stage 2	313	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	38	215	-	-	561	-
Mov Cap-2 Maneuver	148	-	-	-	-	-
Stage 1	275	-	-	-	-	-
Stage 2	301	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	29.6	0	0.2
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	194	561
HCM Lane V/C Ratio	-	-	0.25	0.037
HCM Control Delay (s)	-	-	29.6	11.7
HCM Lane LOS	-	-	D	B
HCM 95th %tile Q(veh)	-	-	1	0.1

HCM 6th TWSC
1: Derry Road & Ledge Road

06/30/2021

Intersection						
Int Delay, s/veh	0.8					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	Y		T		T	T
Traffic Vol, veh/h	24	29	904	10	11	1240
Future Vol, veh/h	24	29	904	10	11	1240
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	-	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	9	0	3	0	20	2
Mvmt Flow	27	32	1004	11	12	1378

Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	2412	1010	0	0	1015	0
Stage 1	1010	-	-	-	-	-
Stage 2	1402	-	-	-	-	-
Critical Hdwy	6.49	6.2	-	-	4.3	-
Critical Hdwy Stg 1	5.49	-	-	-	-	-
Critical Hdwy Stg 2	5.49	-	-	-	-	-
Follow-up Hdwy	3.581	3.3	-	-	2.38	-
Pot Cap-1 Maneuver	34	294	-	-	618	-
Stage 1	342	-	-	-	-	-
Stage 2	220	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	33	294	-	-	618	-
Mov Cap-2 Maneuver	135	-	-	-	-	-
Stage 1	342	-	-	-	-	-
Stage 2	216	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	31.8	0	0.1
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	192	618
HCM Lane V/C Ratio	-	-	0.307	0.02
HCM Control Delay (s)	-	-	31.8	10.9
HCM Lane LOS	-	-	D	B
HCM 95th %tile Q(veh)	-	-	1.2	0.1

HCM 6th TWSC
1: Derry Road & Ledge Road

06/30/2021

Intersection						
Int Delay, s/veh	0.6					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	8	25	1229	26	20	1049
Future Vol, veh/h	8	25	1229	26	20	1049
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	-	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	0	0	2	4	0	1
Mvmt Flow	9	28	1366	29	22	1166

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	2591	1381	0	0	1395
Stage 1	1381	-	-	-	-
Stage 2	1210	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1
Critical Hdwy Stg 1	5.4	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2
Pot Cap-1 Maneuver	28	178	-	-	497
Stage 1	236	-	-	-	-
Stage 2	285	-	-	-	-
Platoon blocked, %			-	-	-
Mov Cap-1 Maneuver	27	178	-	-	497
Mov Cap-2 Maneuver	128	-	-	-	-
Stage 1	236	-	-	-	-
Stage 2	272	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	33.4	0	0.2
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	163	497
HCM Lane V/C Ratio	-	-	0.225	0.045
HCM Control Delay (s)	-	-	33.4	12.6
HCM Lane LOS	-	-	D	B
HCM 95th %tile Q(veh)	-	-	0.8	0.1

HCM 6th TWSC
1: Derry Road & Ledge Road

06/30/2021

Intersection						
Int Delay, s/veh	1					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	Y		T		T	T
Traffic Vol, veh/h	27	32	999	11	12	1370
Future Vol, veh/h	27	32	999	11	12	1370
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	-	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	9	0	3	0	20	2
Mvmt Flow	30	36	1110	12	13	1522

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	2664	1116	0	0	1122
Stage 1	1116	-	-	-	-
Stage 2	1548	-	-	-	-
Critical Hdwy	6.49	6.2	-	-	4.3
Critical Hdwy Stg 1	5.49	-	-	-	-
Critical Hdwy Stg 2	5.49	-	-	-	-
Follow-up Hdwy	3.581	3.3	-	-	2.38
Pot Cap-1 Maneuver	~ 24	255	-	-	561
Stage 1	303	-	-	-	-
Stage 2	186	-	-	-	-
Platoon blocked, %			-	-	-
Mov Cap-1 Maneuver	~ 23	255	-	-	561
Mov Cap-2 Maneuver	114	-	-	-	-
Stage 1	303	-	-	-	-
Stage 2	182	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	41.2	0	0.1
HCM LOS	E		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	163	561
HCM Lane V/C Ratio	-	-	0.402	0.024
HCM Control Delay (s)	-	-	41.2	11.6
HCM Lane LOS	-	-	E	B
HCM 95th %tile Q(veh)	-	-	1.8	0.1

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

HCM 6th TWSC
1: Derry Road & Ledge Road

06/30/2021

Intersection						
Int Delay, s/veh	0.7					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	9	28	1358	29	22	1159
Future Vol, veh/h	9	28	1358	29	22	1159
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	-	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	0	0	2	4	0	1
Mvmt Flow	10	31	1509	32	24	1288

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	2861	1525	0	0	1541
Stage 1	1525	-	-	-	-
Stage 2	1336	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1
Critical Hdwy Stg 1	5.4	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2
Pot Cap-1 Maneuver	19	147	-	-	437
Stage 1	200	-	-	-	-
Stage 2	248	-	-	-	-
Platoon blocked, %			-	-	-
Mov Cap-1 Maneuver	18	147	-	-	437
Mov Cap-2 Maneuver	107	-	-	-	-
Stage 1	200	-	-	-	-
Stage 2	234	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	42.9	0	0.3
HCM LOS	E		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	135	437
HCM Lane V/C Ratio	-	-	0.305	0.056
HCM Control Delay (s)	-	-	42.9	13.7
HCM Lane LOS	-	-	E	B
HCM 95th %tile Q(veh)	-	-	1.2	0.2

HCM 6th TWSC
1: Derry Road & Ledge Road

06/30/2021

Intersection						
Int Delay, s/veh	0.9					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	Y		T		T	T
Traffic Vol, veh/h	29	24	907	10	11	1243
Future Vol, veh/h	29	24	907	10	11	1243
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	-	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	9	0	3	0	20	2
Mvmt Flow	32	27	1008	11	12	1381

Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	2419	1014	0	0	1019	0
Stage 1	1014	-	-	-	-	-
Stage 2	1405	-	-	-	-	-
Critical Hdwy	6.49	6.2	-	-	4.3	-
Critical Hdwy Stg 1	5.49	-	-	-	-	-
Critical Hdwy Stg 2	5.49	-	-	-	-	-
Follow-up Hdwy	3.581	3.3	-	-	2.38	-
Pot Cap-1 Maneuver	34	292	-	-	616	-
Stage 1	340	-	-	-	-	-
Stage 2	219	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	33	292	-	-	616	-
Mov Cap-2 Maneuver	134	-	-	-	-	-
Stage 1	340	-	-	-	-	-
Stage 2	215	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	35.2	0	0.1
HCM LOS	E		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	177	616
HCM Lane V/C Ratio	-	-	0.333	0.02
HCM Control Delay (s)	-	-	35.2	11
HCM Lane LOS	-	-	E	B
HCM 95th %tile Q(veh)	-	-	1.4	0.1

HCM 6th TWSC
5: Derry Road & Driveway

06/30/2021

Intersection						
Int Delay, s/veh	0.9					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	23	30	23	894	1237	30
Future Vol, veh/h	23	30	23	894	1237	30
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	0	0	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	3	3	3	3
Mvmt Flow	26	33	26	993	1374	33

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	2436	1391	1407	0	-	0
Stage 1	1391	-	-	-	-	-
Stage 2	1045	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.13	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.227	-	-	-
Pot Cap-1 Maneuver	35	174	482	-	-	-
Stage 1	231	-	-	-	-	-
Stage 2	339	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	33	174	482	-	-	-
Mov Cap-2 Maneuver	136	-	-	-	-	-
Stage 1	219	-	-	-	-	-
Stage 2	339	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	33.5	0.3	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	482	-	136	174	-	-
HCM Lane V/C Ratio	0.053	-	0.188	0.192	-	-
HCM Control Delay (s)	12.9	-	37.5	30.5	-	-
HCM Lane LOS	B	-	E	D	-	-
HCM 95th %tile Q(veh)	0.2	-	0.7	0.7	-	-

HCM 6th TWSC
1: Derry Road & Ledge Road

06/30/2021

Intersection						
Int Delay, s/veh	0.6					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	8	25	1230	26	20	1050
Future Vol, veh/h	8	25	1230	26	20	1050
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	-	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	0	0	2	4	0	1
Mvmt Flow	9	28	1367	29	22	1167

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	2593	1382	0	0	1396
Stage 1	1382	-	-	-	-
Stage 2	1211	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1
Critical Hdwy Stg 1	5.4	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2
Pot Cap-1 Maneuver	28	178	-	-	496
Stage 1	235	-	-	-	-
Stage 2	285	-	-	-	-
Platoon blocked, %			-	-	-
Mov Cap-1 Maneuver	27	178	-	-	496
Mov Cap-2 Maneuver	127	-	-	-	-
Stage 1	235	-	-	-	-
Stage 2	272	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	33.6	0	0.2
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	162	496
HCM Lane V/C Ratio	-	-	0.226	0.045
HCM Control Delay (s)	-	-	33.6	12.6
HCM Lane LOS	-	-	D	B
HCM 95th %tile Q(veh)	-	-	0.8	0.1

HCM 6th TWSC
5: Derry Road & Driveway

06/30/2021

Intersection						
Int Delay, s/veh	0.3					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	11	9	11	1245	1049	9
Future Vol, veh/h	11	9	11	1245	1049	9
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	0	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	12	10	12	1383	1166	10

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	2578	1171	1176	0	-	0
Stage 1	1171	-	-	-	-	-
Stage 2	1407	-	-	-	-	-
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	28	235	594	-	-	-
Stage 1	295	-	-	-	-	-
Stage 2	226	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	27	235	594	-	-	-
Mov Cap-2 Maneuver	128	-	-	-	-	-
Stage 1	289	-	-	-	-	-
Stage 2	226	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	29.3	0.1	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	594	-	128	235	-	-
HCM Lane V/C Ratio	0.021	-	0.095	0.043	-	-
HCM Control Delay (s)	11.2	-	36.1	21	-	-
HCM Lane LOS	B	-	E	C	-	-
HCM 95th %tile Q(veh)	0.1	-	0.3	0.1	-	-

HCM 6th TWSC
1: Derry Road & Ledge Road

06/30/2021

Intersection						
Int Delay, s/veh	1.1					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	Y		T		T	T
Traffic Vol, veh/h	27	32	1002	11	12	1373
Future Vol, veh/h	27	32	1002	11	12	1373
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	-	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	9	0	3	0	20	2
Mvmt Flow	30	36	1113	12	13	1526

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	2671	1119	0	0	1125
Stage 1	1119	-	-	-	-
Stage 2	1552	-	-	-	-
Critical Hdwy	6.49	6.2	-	-	4.3
Critical Hdwy Stg 1	5.49	-	-	-	-
Critical Hdwy Stg 2	5.49	-	-	-	-
Follow-up Hdwy	3.581	3.3	-	-	2.38
Pot Cap-1 Maneuver	~ 23	254	-	-	559
Stage 1	302	-	-	-	-
Stage 2	185	-	-	-	-
Platoon blocked, %			-	-	-
Mov Cap-1 Maneuver	~ 22	254	-	-	559
Mov Cap-2 Maneuver	113	-	-	-	-
Stage 1	302	-	-	-	-
Stage 2	181	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	41.6	0	0.1
HCM LOS	E		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	162	559
HCM Lane V/C Ratio	-	-	0.405	0.024
HCM Control Delay (s)	-	-	41.6	11.6
HCM Lane LOS	-	-	E	B
HCM 95th %tile Q(veh)	-	-	1.8	0.1

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

HCM 6th TWSC
5: Derry Road & Driveway

06/30/2021

Intersection						
Int Delay, s/veh	1.1					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	25	34	25	988	1367	33
Future Vol, veh/h	25	34	25	988	1367	33
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	0	0	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	3	3	3	3
Mvmt Flow	28	38	28	1098	1519	37

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	2692	1538	1556	0	-	0
Stage 1	1538	-	-	-	-	-
Stage 2	1154	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.13	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.227	-	-	-
Pot Cap-1 Maneuver	~ 24	142	422	-	-	-
Stage 1	195	-	-	-	-	-
Stage 2	300	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 22	142	422	-	-	-
Mov Cap-2 Maneuver	113	-	-	-	-	-
Stage 1	182	-	-	-	-	-
Stage 2	300	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	42.5	0.3	0
HCM LOS	E		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	422	-	113	142	-	-
HCM Lane V/C Ratio	0.066	-	0.246	0.266	-	-
HCM Control Delay (s)	14.1	-	46.9	39.3	-	-
HCM Lane LOS	B	-	E	E	-	-
HCM 95th %tile Q(veh)	0.2	-	0.9	1	-	-

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

HCM 6th TWSC
1: Derry Road & Ledge Road

06/30/2021

Intersection						
Int Delay, s/veh	0.8					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↘↙		↗↘		↘↙	↗↘
Traffic Vol, veh/h	9	28	1359	29	22	1160
Future Vol, veh/h	9	28	1359	29	22	1160
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	-	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	0	0	2	4	0	1
Mvmt Flow	10	31	1510	32	24	1289

Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	2863	1526	0	0	1542	0
Stage 1	1526	-	-	-	-	-
Stage 2	1337	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	19	146	-	-	436	-
Stage 1	200	-	-	-	-	-
Stage 2	247	-	-	-	-	-
Platoon blocked, %			-	-	-	-
Mov Cap-1 Maneuver	18	146	-	-	436	-
Mov Cap-2 Maneuver	106	-	-	-	-	-
Stage 1	200	-	-	-	-	-
Stage 2	233	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	43.3	0	0.3
HCM LOS	E		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	134	436
HCM Lane V/C Ratio	-	-	0.307	0.056
HCM Control Delay (s)	-	-	43.3	13.7
HCM Lane LOS	-	-	E	B
HCM 95th %tile Q(veh)	-	-	1.2	0.2

HCM 6th TWSC
5: Derry Road & Driveway

06/30/2021

Intersection						
Int Delay, s/veh	0.3					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	11	11	12	1377	1159	10
Future Vol, veh/h	11	11	12	1377	1159	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	0	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	12	12	13	1530	1288	11

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	2850	1294	1299	0	-	0
Stage 1	1294	-	-	-	-	-
Stage 2	1556	-	-	-	-	-
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	19	199	533	-	-	-
Stage 1	257	-	-	-	-	-
Stage 2	191	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	19	199	533	-	-	-
Mov Cap-2 Maneuver	108	-	-	-	-	-
Stage 1	251	-	-	-	-	-
Stage 2	191	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	33.4	0.1	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	533	-	108	199	-	-
HCM Lane V/C Ratio	0.025	-	0.113	0.061	-	-
HCM Control Delay (s)	11.9	-	42.5	24.3	-	-
HCM Lane LOS	B	-	E	C	-	-
HCM 95th %tile Q(veh)	0.1	-	0.4	0.2	-	-