

TRAFFIC IMPACT ASSESSMENT

PROPOSED RIVERWOODS DURHAM - CCRC

Durham, New Hampshire

July 2017

Prepared for

The RiverWoods Group



**Stephen G. Pernaw
& Company, Inc.**

**TRAFFIC IMPACT ASSESSMENT
PROPOSED RIVERWOODS DURHAM – CCRC
DURHAM, NEW HAMPSHIRE
JULY 11, 2017**

INTRODUCTION

This study has been prepared for The RiverWoods Group to assess the traffic impacts associated with the proposed continuing care retirement community located on the south side of Stone Quarry Drive in Durham, New Hampshire. The New Hampshire Department of Transportation (NHDOT) and the Town of Durham has required this traffic impact assessment in conjunction with the NHDOT driveway permit system and the Town’s site plan review process.

The scope of this study was established at a Scope Meeting conducted on April 6, 2017 with NHDOT representatives. The town was invited to the meeting, but did not attend. The study area was limited to the NH108/Stone Quarry Drive intersection. The analysis periods included the weekday morning (AM) and evening (PM) commuter peak periods, and both Opening Year (2020) and Horizon Year (2030) analyses were requested. This report is intended to summarize the new traffic count data, the future traffic projections, the technical analyses, and our findings relative to traffic operations, capacity, and safety.



PROPOSAL

The development proposal calls for the construction of a 222-unit, four-story, multi-wing building with a total floor area of approximately 351,800 sf. This type of development provides for multiple levels of care to its residents, including 150 independent living apartments (a combination of 1 bedroom and 2 bedroom units), 24 assisted living apartments, 24 memory care units and 24 skilled nursing units. There will be a common area in the middle of the independent living apartments.

Vehicular access to the facility is proposed via two full-access site driveways, that will intersect the south side of Stone Quarry Drive approximately 280-feet and 700-feet east of NH108. There will be surface parking and enclosed underground parking provided.

Figure 1 shows the location of the subject site with respect to the area highway system and the traffic count locations. Appendix A contains a preliminary site plan prepared by Altus Engineering, Inc.



-  = AUTOMATIC TRAFFIC RECORDER LOCATION (NHDOT)
-  = INTERSECTION TURNING MOVEMENT COUNT LOCATION



1765A

Figure 1

Site Location

Traffic Impact Assessment, Proposed Continuing Care Community, Durham, New Hampshire

EXISTING CONDITIONS

ROADWAYS

NH Route 108 (Dover Road) functions as an arterial highway that carries through traffic in a general north-south direction between the Massachusetts State Line to the south and terminates at Central Ave in Dover to the north. NH108 crosses under U. S. Route 4 (US4), approximately 700-feet south of the NH108/Stone Quarry Drive intersection. In the immediate study area, NH108 is a two-lane highway with one through lane in each direction. The pavement is delineated with a four-inch double-yellow centerline and four-inch white edge lines. The roadway widens on the south side of Stone Quarry Drive and it provides auxiliary turn lanes at the US4 interchange. Paved shoulders of variable width are present along both sides of the highway.

The horizontal alignment of the highway is relatively straight and the vertical alignment follows a -5% downgrade in the vicinity of Stone Quarry Drive. The posted speed limit on this section of NH108 is 35 miles per hour in both directions. This section of highway is under the jurisdiction of the Town of Durham.

Stone Quarry Drive – This roadway is a two-lane town-maintained roadway and it has no outlet. It currently provides access to the Town of Durham Public Works Department. A small law office has driveway access on Stone Quarry Drive (and US4).

INTERSECTIONS

The **NH Route 108/Stone Quarry Drive** intersection currently functions as a standard three-leg T-intersection with stop sign control on the minor approach. Stone Quarry Drive provides access to one law office and the Town of Durham Public Works Department facility. The existing lane configuration is as follows:

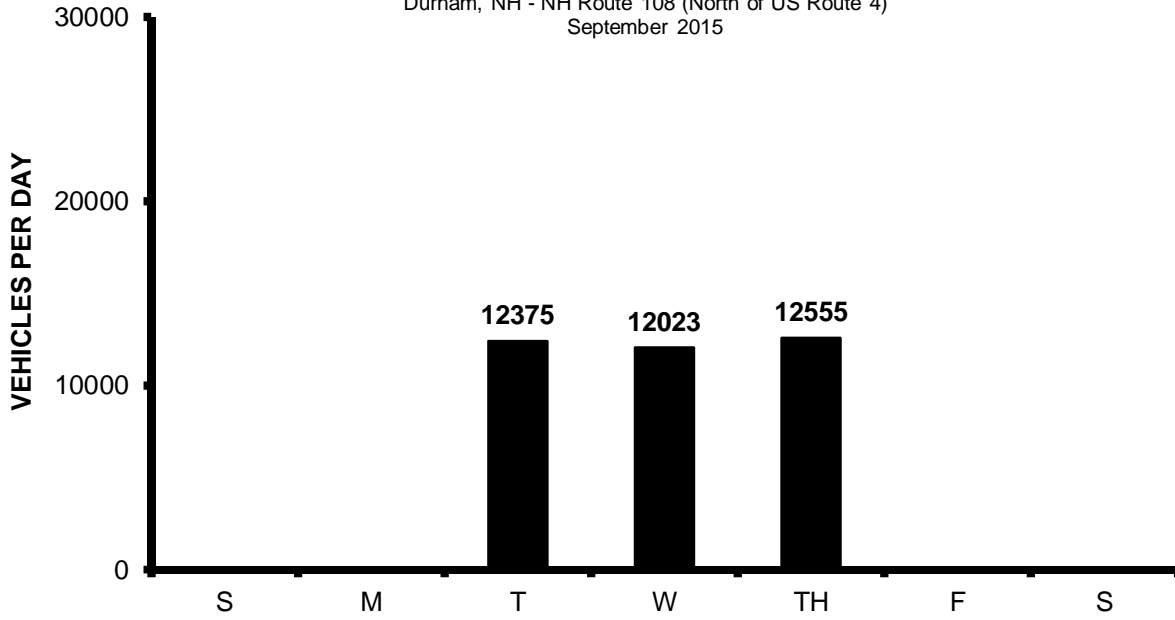
- NH108 Northbound Approach: One shared through-right lane
- NH108 Southbound Approach: One shared through-left lane
- Stone Quarry Drive Westbound Approach: One flared approach (Left and right vehicles can queue side-by-side with no formal lane lines)

TRAFFIC VOLUMES

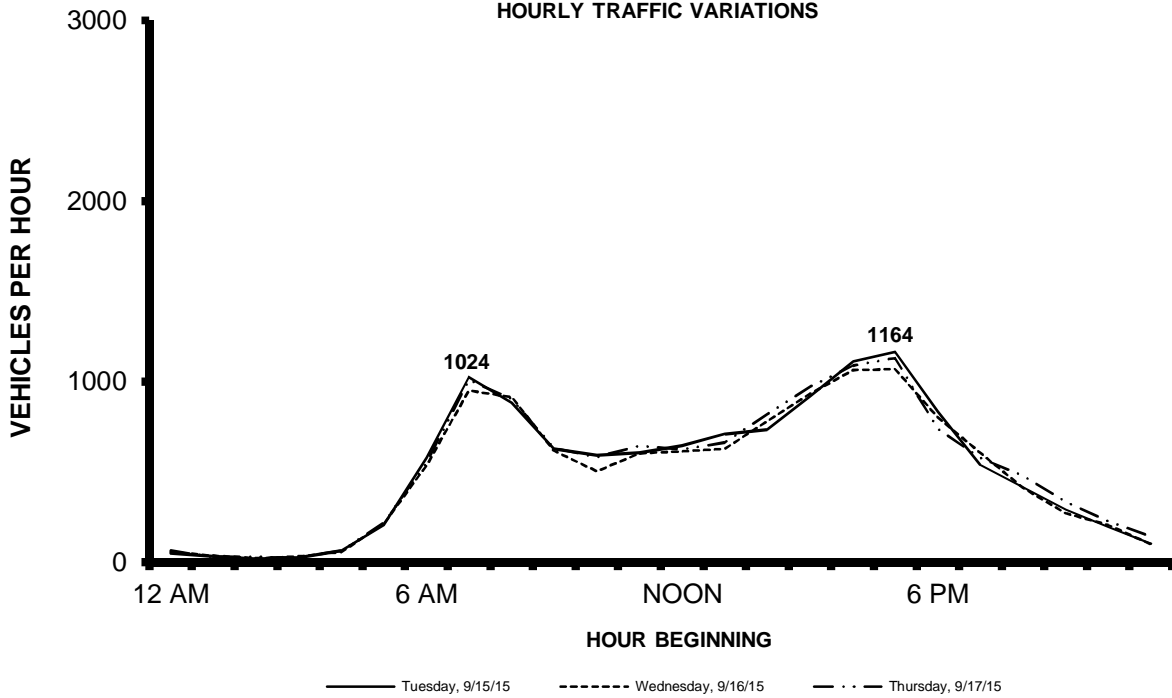
The New Hampshire Department of Transportation conducted a short-term automatic traffic recorder count on NH108 north of US4 in 2015. The count data revealed that this section of NH108 carried an Annual Average Daily Traffic (AADT) volume of 11,000 vehicles per day (vpd) in 2015.

This count station is located adjacent to the study area intersection and it demonstrates that traffic demand on NH108 consistently reached peak levels during the typical AM and PM commuter periods on weekdays. The daily and hourly variations in traffic demand at this count station is illustrated graphically on Page 4. Appendix B contains the detail sheets pertaining to this count.

DAILY TRAFFIC VARIATIONS
 Durham, NH - NH Route 108 (North of US Route 4)
 September 2015



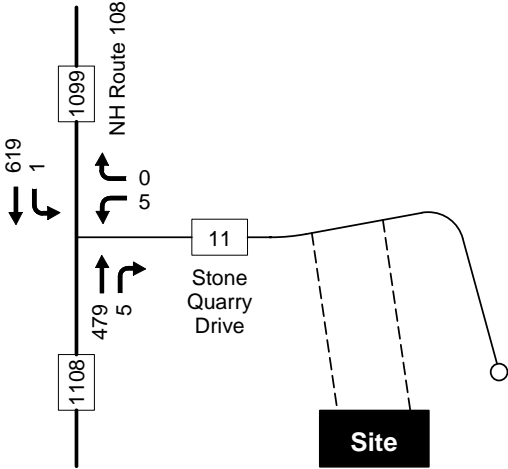
HOURLY TRAFFIC VARIATIONS



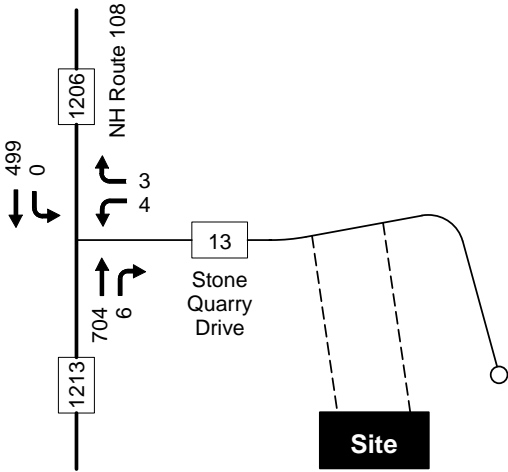
To establish the current traffic demand on Stone Quarry Drive, Pernaw & Company, Inc. conducted manual turning movement and vehicle classification counts at the NH108/Stone Quarry Drive intersection on Tuesday, April 11, 2017 from 7:00 to 9:00 AM and from 3:00 to 6:00 PM. Several facts and conclusions are evident from this count data:

- Peak traffic periods at the NH108/Stone Quarry Drive intersection were found to occur from 7:30 to 8:30 AM in the morning and from 4:45 to 5:45 PM in the afternoon. The traffic flow on NH108 (north of Stone Quarry Drive) totaled 1,099 vehicles (AM) and 1,206 vehicles (PM) during the peak hour periods. The predominant traffic flow was southbound (56%) during the AM peak hour and northbound (59%) during the PM peak hour.
- Stone Quarry Drive accommodated 11 (AM) and 13 (PM) vehicles during the peak hour periods.
- Analysis of the full count data revealed that the majority of the vehicles on Stone Quarry Drive (80%) traveled to/from points south on NH108.
- Truck traffic on NH108 accounted for approximately 4% (AM) and 2% (PM) of the total traffic flow during the peak hour periods.

The peak hour traffic count data for the study area roadways and intersection are summarized on Figure 2. Appendix C contains the detail sheets from the manual turning movement counts.



AM PEAK HOUR
Tuesday, April 11, 2017
7:30 to 8:30 AM



PM PEAK HOUR
Tuesday, April 11, 2017
4:45 to 5:45 PM

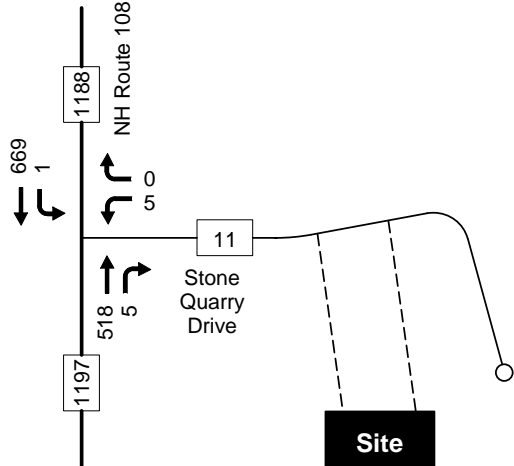


Figure 2

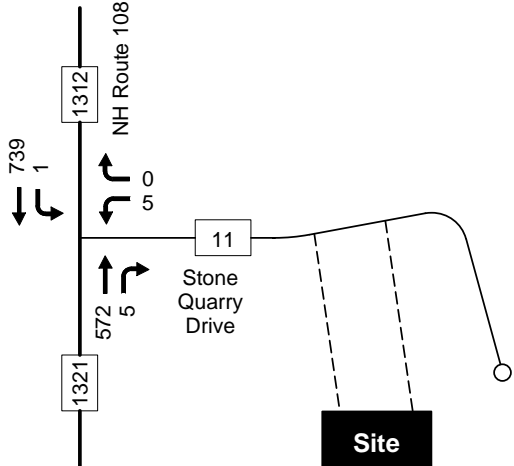
NO-BUILD TRAFFIC VOLUMES

In order to identify the net impact that site traffic will have in the study area, future traffic projections with and without the proposed continuing care retirement community are necessary. The future traffic projections without the proposed facility are referred to as the 2020 No-Build and 2030 No-Build traffic projections and these are summarized on Figure 3. These projections are based on the existing traffic volumes (April 2017 count data), a 1.0 percent annual background traffic growth rate (compounded annually) to account for normal growth in the area, and peak-month seasonal adjustment factors of 1.05 (AM) and 1.02 (PM).

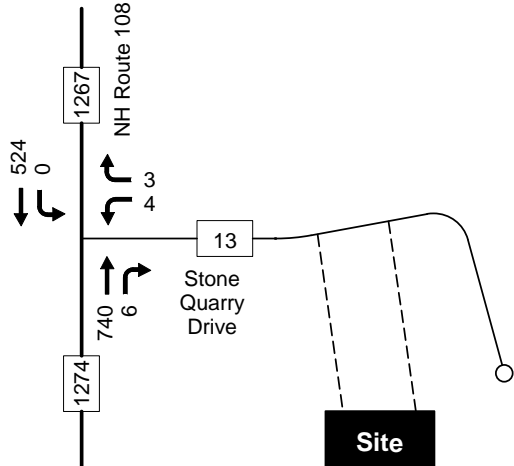
The No-Build traffic projections therefore reflect worst-case, peak-month, peak-hour conditions. Calculations pertaining to the derivation of the background traffic growth rate and the seasonal adjustment factors are contained in Appendix D.



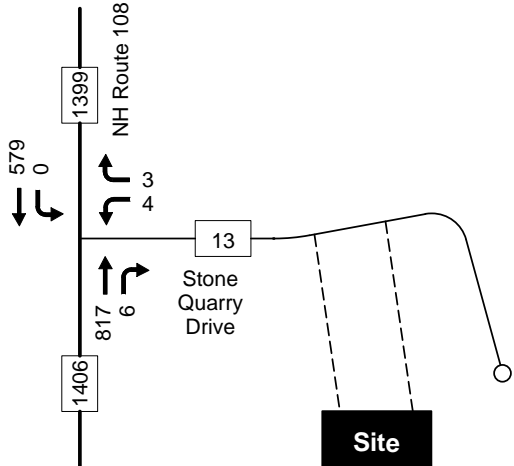
2020 AM NO-BUILD PEAK HOUR



2030 AM NO-BUILD PEAK HOUR



2020 PM NO-BUILD PEAK HOUR



2030 PM NO-BUILD PEAK HOUR



Figure 3

No-Build Traffic Volumes
Traffic Impact Assessment, Proposed Continuing Care Retirement Community, Durham, New Hampshire

SITE GENERATED TRAFFIC

To estimate the quantity of vehicle trips that will be produced by the proposed continuing care retirement community, Pernaw & Co., Inc. utilized the trip-generation rates and equations published by the Institute of Transportation Engineers (ITE)¹. The ITE land use category that correlates best with the proposed development is ITE Land Use Code 255 – Continuing Care Retirement Community.

For calculation purposes, the total number of units was used as the independent variable.

The following table shows that the proposed continuing care retirement community will generate approximately 50 (AM) and 88 (PM) trips during the peak hour periods. This type of use generates “primary” trips which constitute new trips to the area. Appendix E contains the trip generation computations for this project, along with a diagram that summarizes the distribution of the primary trips at the study area intersection.

¹ Institute of Transportation Engineers, *Trip Generation*, ninth edition (Washington, D.C., 2012)
1765A

Table 1

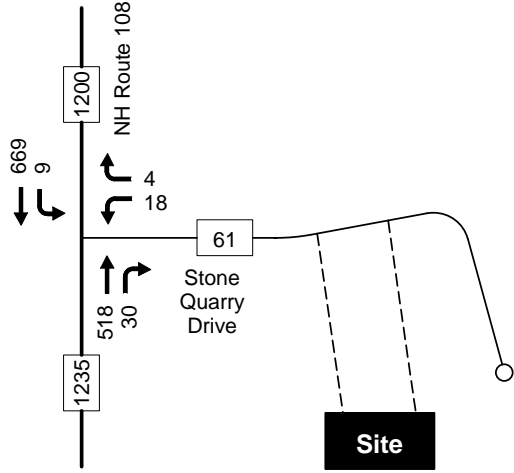
Trip Generation Summary - 222 CCRC Units ¹

		<u>Trip Rate Method</u>	<u>Trip Equation Method</u>
Weekday Total			
	Entering	278 veh	346 veh
	Exiting	<u>278 veh</u>	<u>346 veh</u>
	Total	556 trips	692 trips
Weekday AM Peak Hour			
	Entering	21 veh	33 veh
	Exiting	<u>12 veh</u>	<u>17 veh</u>
	Total	33 trips	50 trips
Weekday PM Peak Hour			
	Entering	18 veh	35 veh
	Exiting	<u>26 veh</u>	<u>53 veh</u>
	Total	44 trips	88 trips
<hr/>			
Saturday Total			
	Entering	232 veh	343 veh
	Exiting	<u>232 veh</u>	<u>343 veh</u>
	Total	464 trips	686 trips
Saturday Peak Hour			
	Entering	27 veh	46 veh
	Exiting	<u>24 veh</u>	<u>43 veh</u>
	Total	51 trips	89 trips
<hr/>			
Sunday Total			
	Entering	222 veh	315 veh
	Exiting	<u>222 veh</u>	<u>315 veh</u>
	Total	444 trips	630 trips
Sunday Peak Hour			
	Entering	25 veh	38 veh
	Exiting	<u>24 veh</u>	<u>35 veh</u>
	Total	49 trips	73 trips

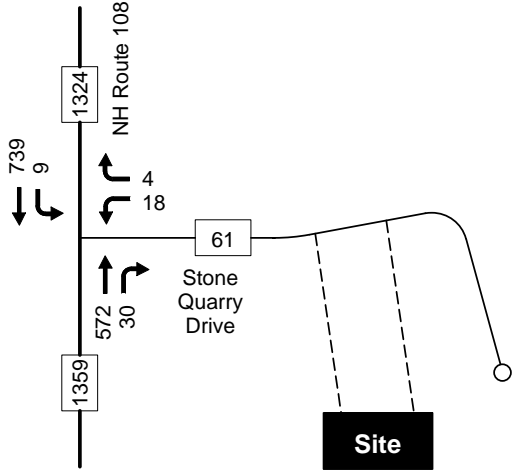
¹ITE Land Use Code 255 - Continuing Care Retirement Community (222 Occupied Units)

BUILD TRAFFIC VOLUMES

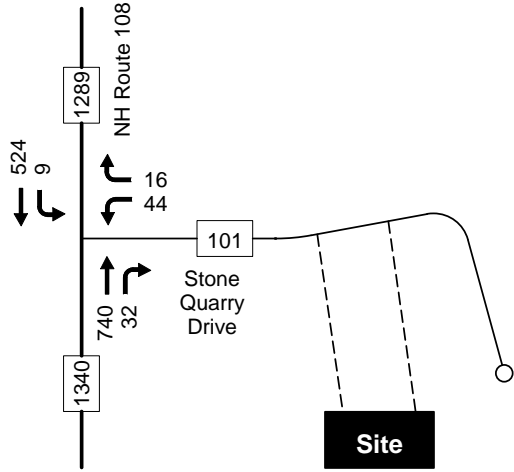
The future traffic projections with the proposed continuing care retirement community in full operation are referred to as the “Build” traffic projections and these are summarized schematically on Figure 4. These projections are based on the No-Build projections (Figure 3), the site generated traffic levels depicted in Table 1, and the expectation that the majority of the new trips (75%) will travel to/from points south on NH108. This percentage was based on analysis of census commuting pattern data and the actual travel patterns observed at the NH108/Stone Quarry Drive intersection.



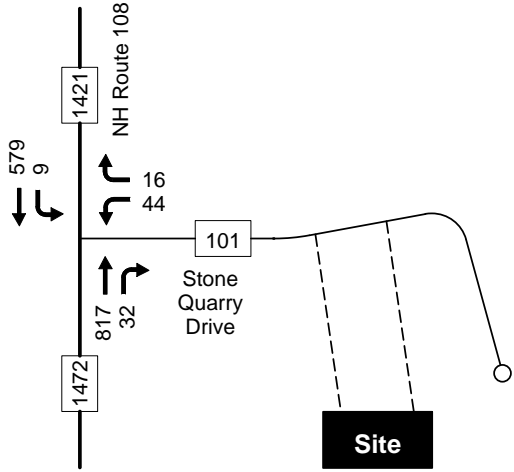
2020 AM BUILD PEAK HOUR



2030 AM BUILD PEAK HOUR



2020 PM BUILD PEAK HOUR



2030 PM BUILD PEAK HOUR



Figure 4

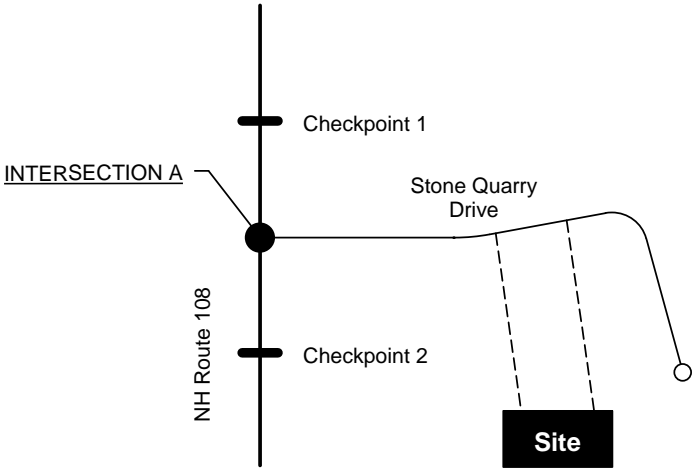
Build Traffic Volumes
Traffic Impact Assessment, Proposed Continuing Care Retirement Community, Durham, New Hampshire

IMPACT SUMMARY

TRAFFIC VOLUME INCREASES

The net impact that the proposed continuing care retirement community will have on traffic levels on NH108 can be estimated by comparing the No-Build traffic projections with the Build traffic projections. This comparison is summarized on Figure 5 and it demonstrates that the greatest impact to roadway volumes will occur during the worst-case PM peak hour period on the short section of NH108 between Stone Quarry Drive and the US4 interchange. Traffic volumes are projected to increase by approximately +5% (PM) which corresponds to net increases of approximately +66 vehicles south of the site. The impacts north of the site will be slightly less. Impacts beyond the immediate study area will dissipate further as drivers turn at various intersections along the NH108 corridor, including the nearby US4 interchange.

By way of comparison, the short-term NHDOT count on NH108 (see Appendix B) revealed that random traffic flow from one day to the next accounted for changes as much as 9%; which is greater than is anticipated from this proposed development project.



I. AM Peak Hour

Location	2020 No-Build	2020 Build	Change	% Change
Intersection A	1198	1248	+50 veh	4%
Checkpoint 1	1188	1200	+12 veh	1%
Checkpoint 2	1197	1235	+38 veh	3%

II. PM Peak Hour

Location	2020 No-Build	2020 Build	Change	% Change
Intersection A	1277	1365	+88 veh	7%
Checkpoint 1	1267	1289	+22 veh	2%
Checkpoint 2	1274	1340	+66 veh	5%

Figure 5

TRAFFIC OPERATIONS AND SAFETY

INTERSECTION CAPACITY - UNSIGNALIZED INTERSECTIONS

The short-range (2020) and long-range (2030) traffic projections form the basis for assessing traffic operations at the Stone Quarry Drive intersection on NH108. This intersection was analyzed according to the methodologies of the *Highway Capacity Manual* as replicated by the latest edition of the *Synchro Traffic Signal Coordination Software (Version 9)*, which also performs unsignalized intersection capacity analyses.

Capacity and Level of Service (LOS) calculations pertaining to unsignalized intersections address the quality of service for those vehicles turning into and out of intersecting side streets. The availability of adequate gaps in the traffic stream on the major street (NH108) actually controls the potential capacity for vehicle movements from the minor approach (Stone Quarry Drive). Levels of Service are simply letter grades (A-F) that categorize the vehicle delays associated with specific turning maneuvers. Table 2 describes the criteria used in this analysis.

Table 2	Level-of-Service Criteria for Unsignalized Intersections
Level of Service	Control Delay (seconds/vehicle)
A	≤ 10.0
B	> 10.0 and ≤ 15.0
C	> 15.0 and ≤ 25.0
D	> 25.0 and ≤ 35.0
E	> 35.0 and ≤ 50.0
F	> 50.0

Source: Transportation Research Board, Highway Capacity Manual 2010.

The results of this analysis for the **NH108/Stone Quarry Drive** intersection are summarized on Table 3. The analysis confirms that the westbound departures from Stone Quarry Drive currently involve long delays during the peak hour periods as evidenced by the LOS C (PM) and LOS D (AM) results. By 2030 the Stone Quarry Drive approach will operate at LOS E during the peak hour periods with the proposed CCRC fully occupied. This approach will operate below capacity during all hours of the day through 2030, and beyond.

It should also be noted that the Stone Quarry Drive approach to NH108 is flared and the wider pavement area enables a right-turning vehicle to queue beside a left-turning vehicle. This condition is not reflected in the capacity analysis, but it does tend to reduce delays for drivers heading north on NH108.

The southbound left-turn arrival movement at this intersection is also expected to operate well below capacity during all hours of the day through 2030 and beyond and at LOS A with the subject site in full operation.

Appendix F contains the computations pertaining to the unsignalized intersection capacity analyses.

Table 3

**STOP-Controlled Intersection Capacity Analysis
NH Route 108 / Stone Quarry Drive**

	Weekday AM Peak Hour				Weekday PM Peak Hour			
	<u>Delay</u> ¹	<u>V/C</u> ²	<u>LOS</u> ³	<u>Queue</u> ⁴	<u>Delay</u> ¹	<u>V/C</u> ²	<u>LOS</u> ³	<u>Queue</u> ⁴
Stone Quarry Drive - WB Combined Departures								
2017 Existing	26	0.03	D	<1	20	0.03	C	<1
2020 No-Build	30	0.04	D	<1	21	0.03	C	<1
2020 Build	31	0.15	D	1	33	0.35	D	2
2030 No-Build	35	0.05	E	<1	25	0.04	C	<1
2030 Build	38	0.18	E	1	43	0.42	E	2
NH Route 108 - SB Left-Turns Arrivals								
2017 Existing	9	0.00	A	<1	0	0.00	A	<1
2020 No-Build	9	0.00	A	<1	0	0.00	A	<1
2020 Build	9	0.01	A	<1	9	0.01	A	<1
2030 No-Build	9	0.00	A	<1	0	0.00	A	<1
2030 Build	9	0.01	A	<1	10	0.01	A	<1

¹ HCM Control Delay (seconds per vehicle), ² HCM Volume to Capacity Ratio, ³ HCM Level of Service, ⁴ HCM 95th Percentile Queue (vehicles)

AUXILIARY TURN LANE ANALYSES

Left-Turn Treatment - The type of treatment needed to accommodate left-turning vehicles from any street or highway to an intersecting side street (or driveway) can range from no treatment, where turning volumes are low; to the provision of a bypass lane for through traffic to travel around left-turning vehicles; to the addition of a formal center turn lane used exclusively by left-turning vehicles for deceleration and storage while waiting to complete their maneuvers.

Analysis of the “horizon year” 2030 Build traffic volumes using NCHRP 457 guidelines indicates that left-turn treatment will not be warranted on NH108 for left-turn arrivals at Stone Quarry Drive. The existing shared through-left lane will continue to function adequately with the proposed facility in full operation. The results are summarized on Table 4 and the computations are included in Appendix G.

Table 4	Left-Turn Lane Warrants Analysis - 2030 NH Route 108 / Stone Quarry Drive	
	2030 AM Build Volumes	2030 PM Build Volumes
Peak Hour Inputs		
Left-Turn Volume (SB)	9	9
Advancing Volume (SB)	748	588
Opposing Volume (NB)	602	849
Percent Lefts	1.2%	1.5%
Speed (mph)	35	35
Limiting Advancing Volume (veh/h)	872	605
Conclusion		
Left-Turn Treatment Warranted	NO	NO

Right-Turn Treatment - The type of treatment needed to accommodate right-turning vehicles from any street or highway to any intersecting side street (or driveway) can range from a radius only, where turning volumes are low; to the provision of a short 10:1 right-turn taper; to the addition of an exclusive right-turn lane, where turning volumes and through traffic volumes are significant.

Analysis of the 2030 Build traffic volume projections using NCHRP 457 guidelines confirmed that right-turn treatment may eventually be warranted at the subject intersection for northbound vehicles turning right on to Stone Quarry Drive by 2030, but not in the opening year (2020). This finding is a borderline situation as the guideline is only exceeded by 2 vehicles during the 2030 PM peak hour period. The results are summarized on Table 5 and the computations are included in Appendix G.

Table 5 **Right-Turn Lane Warrants Analysis - 2020 & 2030**
NH Route 108 / Stone Quarry Drive

	2030 AM Build Volumes	2020 PM Build Volumes	2030 PM Build Volumes
Peak Hour Inputs			
Right-Turn Volume (NB)	30	32	32
Total Approach Volume (NB)	602	772	849
Speed (mph)	35	35	35
Limiting Right-Turn Volume (veh/h)	105	42	30
Conclusion			
Add Right-Turn Bay	NO	NO	YES

Minor-Road Approach Analysis – The type of treatment needed to accommodate exiting vehicles from the minor-road approach at a stop-controlled intersection can range from a single lane (shared left-right lane) in low-volume conditions, to two exit lanes (exclusive left-turn lane and exclusive right-turn lane) where turning volumes and through traffic volumes are significant, to multiple exit lanes in extreme cases.

Analysis of the “horizon year” 2030 Build traffic volume projections using NCHRP 457 guidelines confirmed that one exit lane on the Stone Quarry Drive approach to NH108 is sufficient for the projected traffic volumes. The results of these analyses are summarized on Table 6 and the computations are included in Appendix G.

Table 6 **Minor-Road Approach Geometry - 2030**
NH Route 108 / Stone Quarry Drive

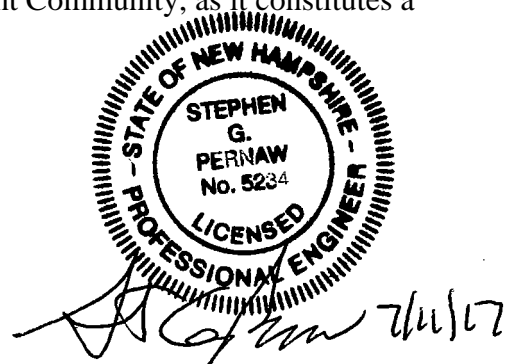
	2030 AM Build Volumes	2030 PM Build Volumes
Peak Hour Inputs		
Major-Road Volume (NB-SB)	1350	1437
% Right-Turns on Minor (WB)	18	27
Minor-Road Approach Volume	22	60
Limiting Minor-Road Volume (veh/h)	98	94
Conclusion		
Consider TWO Approach Lanes	NO	NO

STUDY FINDINGS AND RECOMMENDATIONS

Based upon the existing conditions data collected on NH Route 108 at the Stone Quarry Drive intersection, the anticipated traffic volume increases associated with the proposed continuing care retirement community, and the analysis of future traffic conditions at this study area intersection, Pernaw & Company, Inc. finds that:

1. The peak period traffic counts conducted by Pernaw & Company, Inc. at the NH108/Stone Quarry Drive intersection in April 2017 revealed that the busiest traffic hours at this intersection occurred from 7:30 to 8:30 AM and from 4:45 to 5:45 PM on a typical weekday. During these periods, 1,099 vehicles (AM) and 1,206 vehicles (PM) were observed traveling in both directions on NH108 (north of Stone Quarry Drive).
2. The trip generation analysis revealed that, on an average weekday basis, the proposed continuing care retirement community will generate approximately 50 (AM) and 88 (PM) trips during the peak hour periods. This type of use generates “new” trips to the area. The trip distribution analysis indicates that the majority (75%) will travel to/from points south on NH108.
3. Analysis of the 2020 opening year traffic projections revealed that site traffic will increase the two-way traffic flow on NH108 by approximately +2% north of the site and +5% south of the site during the worst-case PM peak hour period. By way of comparison, the short-term NHDOT count on NH108 revealed that random traffic flow from one day to the next accounted for changes as much as 9%. In terms of magnitude, the net increase in the two-way volume on NH108 will range from +12 to +66 vehicles depending upon location and peak hour.
4. Analysis of the traffic operations at the subject intersection confirmed that the departures from Stone Quarry Drive on to NH108 will continue to operate well below capacity through 2030, however long delays (LOS E) will be encountered during the peak hour periods. Vehicle queuing on Stone Quarry Drive will remain minimal. Southbound left-turn arrivals from NH108 will continue to operate well below capacity through the horizon year and at LOS A with the proposed CCRC fully occupied.
5. The auxiliary turn lane warrants analyses indicate that the ideal lane configuration for the NH108/Stone Quarry Drive intersection includes an exclusive northbound right-turn lane on NH108 by 2030. This finding is a borderline situation where the guideline is exceeded by only 2 vehicles during the 2030 PM peak hour period. The 2030 auxiliary turn lane warrants analyses also indicates that a single lane on Stone Quarry Drive is sufficient for departures and the existing shared through-left lane on NH108 southbound is sufficient for the anticipated volumes.

The NHDOT Driveway Permit that was issued to the Town of Durham in 1996 should be updated to reflect the proposed Continuing Care Retirement Community, as it constitutes a “change of use” of Stone Quarry Drive.



APPENDIX

Appendix A	Site Plan
Appendix B	Automatic Traffic Recorder Counts
Appendix C	Intersection Turning Movement Counts
Appendix D	Seasonal Adjustment Factors / Historical Growth Rates
Appendix E	Trip Generation Calculations / Site Generated Traffic Volumes
Appendix F	Capacity and Level of Service Calculations – Unsignalized
Appendix G	Auxiliary Turn Lane Warrants Analysis

Appendix A

Site Plan



THIS DRAWING HAS NOT BEEN RELEASED FOR CONSTRUCTION

DESIGN LEVEL

ISSUE DATE: APRIL 19, 2017

REVISIONS:

BY DATE

0 INITIAL SUBMISSION 04/19/17

DRAWN BY: RHE

APPROVED BY: JAC

DRAWING FILE: 4836 WORKING.DWG

SCALE: 1" = 50'

DINER:

ROCKINGHAM PROPERTIES 1, LTD

P.O. BOX 433

BEAUMONT, NH 03216

APPLICANT:

THE RIVERWOODS GROUP

7 RIVERWOODS DRIVE

KEETER, NH 03825

PROJECT:

RIVERWOODS DURHAM

STONE QUARRY DRIVE

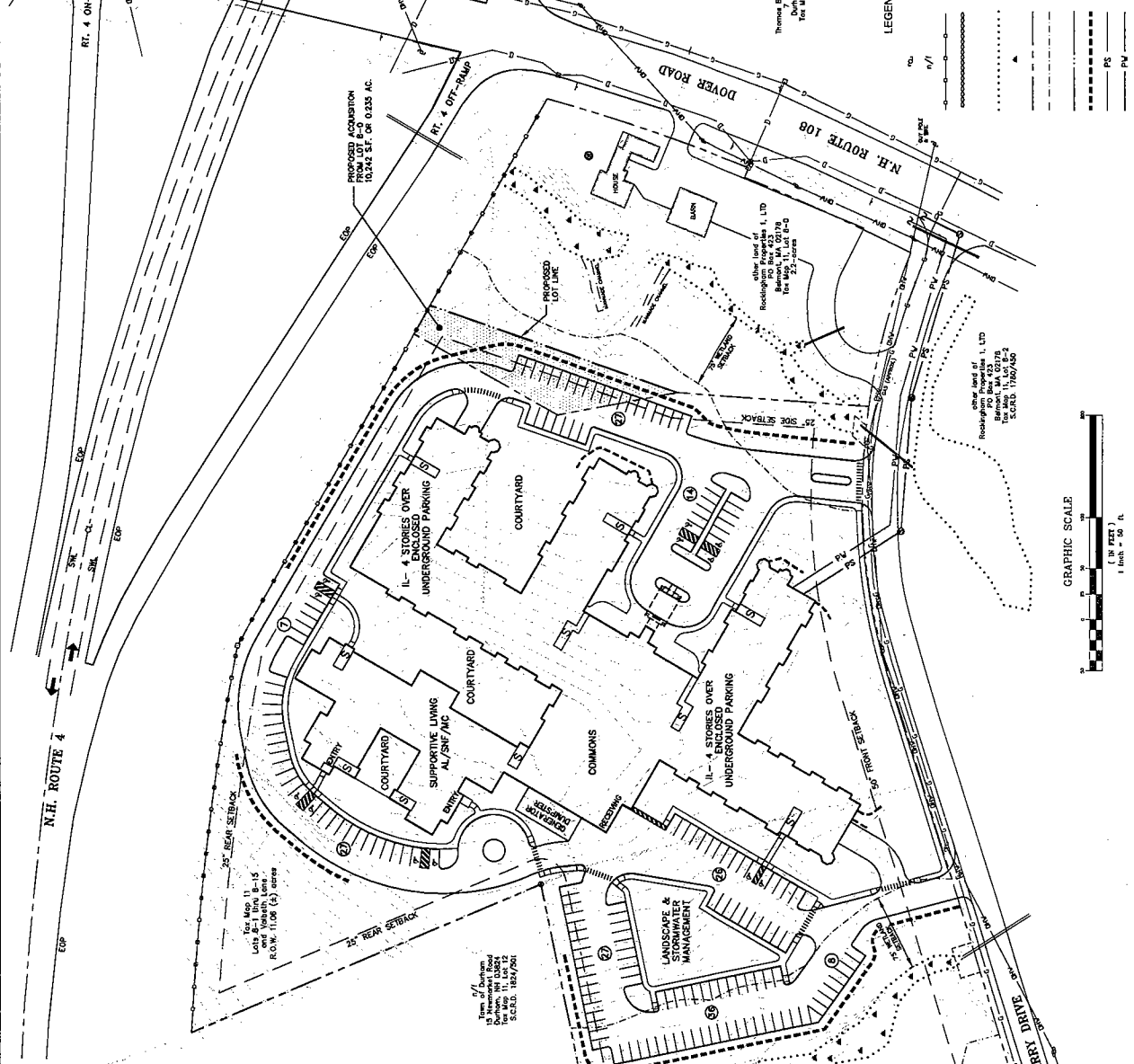
DURHAM, NH

TITLE:

CONCEPTUAL SITE PLAN

SHEET NUMBER:

C-1



ZONING SUMMARY:

PROPERTY REFERENCE: MAP 11, LOTS 8-1 THRU 8-15 AND PORTION OF LOT 8-0

TOTAL SITE AREA: 482,246 SF. OR 11.30 AC.

ZONING: OFFICE AND RESEARCH DISTRICT-ROUTE 108 (OR) WETLANDS CONSERVATION OVERLAY DISTRICT (WCO)

OWNER: ROCKINGHAM PROPERTIES 1, LTD
 600 W. 11th St
 BEAUMONT, NH 03216

SETBACKS:

FRONT YARD	50' MIN.	BROWDED
REAR YARD	25' MIN.	50'
REAR YARD	25' MIN.	50'
WETLANDS BUFFER	75' MIN.	12'
MAX. IMPERVIOUS	50% MAX.	43%

BUILDING HEIGHT: 50/75' MAX. 55'

OVERALL BUILDING FOOTPRINT: 85,141 SF.

FLOOR AREA:

GROUND FLOOR	68,558 SF.
FIRST FLOOR	64,828 SF.
SECOND FLOOR	64,828 SF.
THIRD FLOOR	67,096 SF.
FOURTH FLOOR	67,096 SF.
TOTAL	332,416 SF.

PARKING:

ENCLOSED	107 SPACES
UNENCLOSED	773 SPACES
TOTAL	880 SPACES

(INCL. 14 ADA SPACES)

* CONDITIONAL USE PERMIT REQUIRED

REFERENCE PLANS:

- "TESTING CONDITIONS PLAN, PREPARED FOR THE RIVERWOODS GROUP", PREPARED BY ATLANTIC SURVEY COMPANY, DATED APRIL 2017.
- "PLAN STONE QUARRY OFFICE PARK, DURHAM NH", PREPARED BY AMERICAN ENGINEERING CONSULTANTS, CORP., DATED SEPT. 04, 2002.
- "SUBDIVISION OF LAND, PREPARED FOR ROCKINGHAM PROPERTIES 1, LTD.", PREPARED BY ATLANTIC SURVEY COMPANY, DATED DECEMBER 2001.

1/1 Term of Division
 Durham, NH 03824
 S.C.D. 182/761

other land of
 Rockingham Properties 1, Ltd
 P.O. Box 433
 Beaufort, NH 03216
 For Map 11, Lot 8-2
 S.C.D. 118/7456

other land of
 Rockingham Properties 1, Ltd
 P.O. Box 433
 Beaufort, NH 03216
 For Map 11, Lot 8-2
 S.C.D. 118/7456

LEGEND:

UTILITY POLE

NOW OR FORMERLY

HIGHWAY FENCE

STONE WALL

Z CONTIGUOUS LINE

EAST, JURISD. WETLANDS

WETLAND SYMBOL

EXISTING PROPERTY LINE

75' WETLAND PROTECTION OVERLAY DISTRICT

PROP. LOT LINE ADJUSTMENT

PROP. RETAINING WALL

PROP. SCORE LINE

PROP. WATER LINE

GRAPHIC SCALE
 1" = 50' 0"

PROPOSED ACQUISITION
 10,742 SF. OF 0.233 AC.

PROPOSED LOT LINES

HOUSE

BARN

other land of
 Rockingham Properties 1, Ltd
 P.O. Box 433
 Beaufort, NH 03216
 For Map 11, Lot 8-2
 S.C.D. 118/7456

other land of
 Rockingham Properties 1, Ltd
 P.O. Box 433
 Beaufort, NH 03216
 For Map 11, Lot 8-2
 S.C.D. 118/7456

Appendix B

Automatic Traffic Recorder Counts



Excel Version

Weekly Volume Report			
Location ID:	22133022	Type:	SPOT
Located On:	Dover Rd		
Direction:	2-WAY		
Community:	DURHAM	Period:	Mon 9/14/2015 - Sun 9/20/2015
AADT:	11000		

Start Time	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Avg	Graph
12:00 AM		51	57	65				58	
1:00 AM		33	35	29				32	
2:00 AM		19	22	29				23	
3:00 AM		27	31	26				28	
4:00 AM		66	59	65				63	
5:00 AM		206	213	217				212	
6:00 AM		577	534	551				554	
7:00 AM		1024	950	1010				995	
8:00 AM		881	915	905				900	
9:00 AM		629	617	632				626	
10:00 AM		594	504	581				560	
11:00 AM		606	603	647				619	
12:00 PM		647	612	623				627	
1:00 PM		709	629	664				667	
2:00 PM		734	781	818				778	
3:00 PM		919	932	973				941	
4:00 PM		1111	1064	1088				1,088	
5:00 PM		1164	1069	1130				1,121	
6:00 PM		833	802	738				791	
7:00 PM		539	608	577				575	
8:00 PM		416	412	480				436	
9:00 PM		292	270	335				299	
10:00 PM		196	206	229				210	
11:00 PM		102	98	143				114	
Total	0	12,375	12,023	12,555	0	0	0		
24hr Total			12375	12023	12555				12,318
AM Pk Hr		7:00	7:00	7:00					
AM Peak		1024	950	1010				995	
PM Pk Hr		5:00	5:00	5:00					
PM Peak		1164	1069	1130				1,121	
% Pk Hr			9.41%	8.89%	9.00%				9.00%

List View

All DIRs

Record 1 of 1 Goto Record go

Location ID	22133022	MPO ID	
Type	SPOT	HPMS ID	
On NHS	No	On HPMS	No
LRS ID	S0000108__	LRS Loc Pt	
SF Group	04	Route Type	
AF Group	04	Route	NH 108
GF Group	E		
Class Dist Grp	Default		
WIM Group	Default		
QC Group	Default		
Funct'l Class	Minor Arterial	Milepost	
Located On	Dover Rd		
Loc On Alias	NH 108 (DOVER RD) NORTH OF US 4 (SB-NB) (21133023-21133024)		
	PR	MP	PT

More Detail

STATION DATA

Directions: 2-WAY NB SB

AADT

	Year	AADT	DHV-30	K %	D %	PA	BC	Src
	2016	11,220 ³				10,232 (91%)	988 (9%)	Grown from 2015
	2015	11,000						
	2012	11,000						
	2006	11,000						
	2004	11,000 ²						

|<< < > >>| 1-5 of 18

Travel Demand Model

Model Year	Model AADT	AM PHV	AM PPV	MD PHV	MD PPV	PM PHV	PM PPV	NT PHV	NT PPV
------------	------------	--------	--------	--------	--------	--------	--------	--------	--------

VOLUME COUNT

	Date	Int	Total
	Thu 9/17/2015	60	12,555
	Wed 9/16/2015	60	12,023
	Tue 9/15/2015	60	12,375
	Thu 10/18/2012	60	12,946
	Wed 10/17/2012	60	12,258
	Tue 10/16/2012	60	12,259
	Thu 9/14/2006	60	12,813
	Wed 9/13/2006	60	12,523
	Tue 9/12/2006	60	12,718

VOLUME TREND

Year	Annual Growth
2016	2%
2015	0%
2012	0%
2006	0%
2004	0%
2001	0%
1999	0%
1997	2%

Appendix C

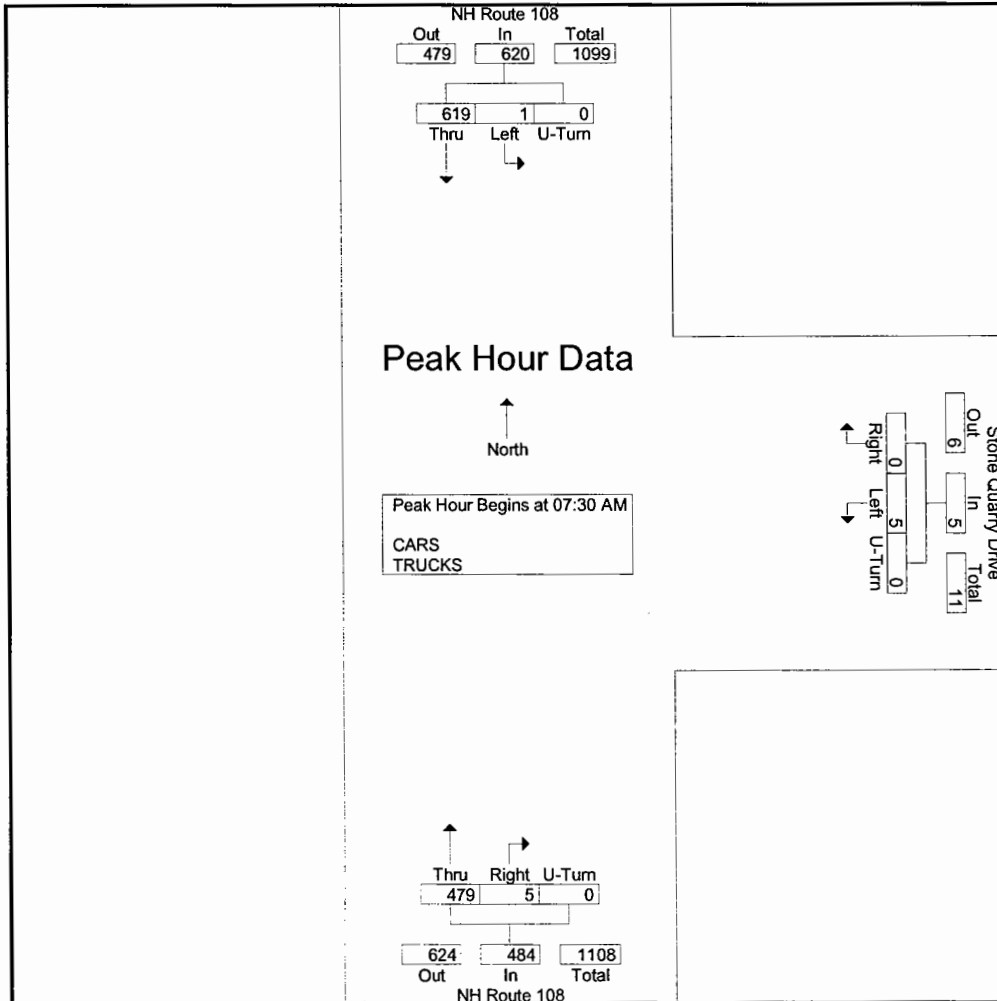
Intersection Turning Movement Counts

Stephen G. Pernaw & Company, Inc.
P.O. Box 1721
Concord, New Hampshire 03302

Weather: Clear
Collected By: MV
Job Number: 1765A
Town/State: Durham, New Hampshire

File Name : 1765A_INT_A_AM
Site Code : 1765A
Start Date : 4/11/2017
Page No : 2

Start Time	NH Route 108 From North				Stone Quarry Drive From East				NH Route 108 From South				Int. Total
	U-Turn	Thru	Left	App. Total	U-Turn	Right	Left	App. Total	U-Turn	Right	Thru	App. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:30 AM													
07:30 AM	0	158	0	158	0	0	3	3	0	0	140	140	301
07:45 AM	0	164	0	164	0	0	0	0	0	4	146	150	314
08:00 AM	0	151	0	151	0	0	0	0	0	1	86	87	238
08:15 AM	0	146	1	147	0	0	2	2	0	0	107	107	256
Total Volume	0	619	1	620	0	0	5	5	0	5	479	484	1109
% App. Total	0	99.8	0.2		0	0	100		0	1	99		
PHF	.000	.944	.250	.945	.000	.000	.417	.417	.000	.313	.820	.807	.883

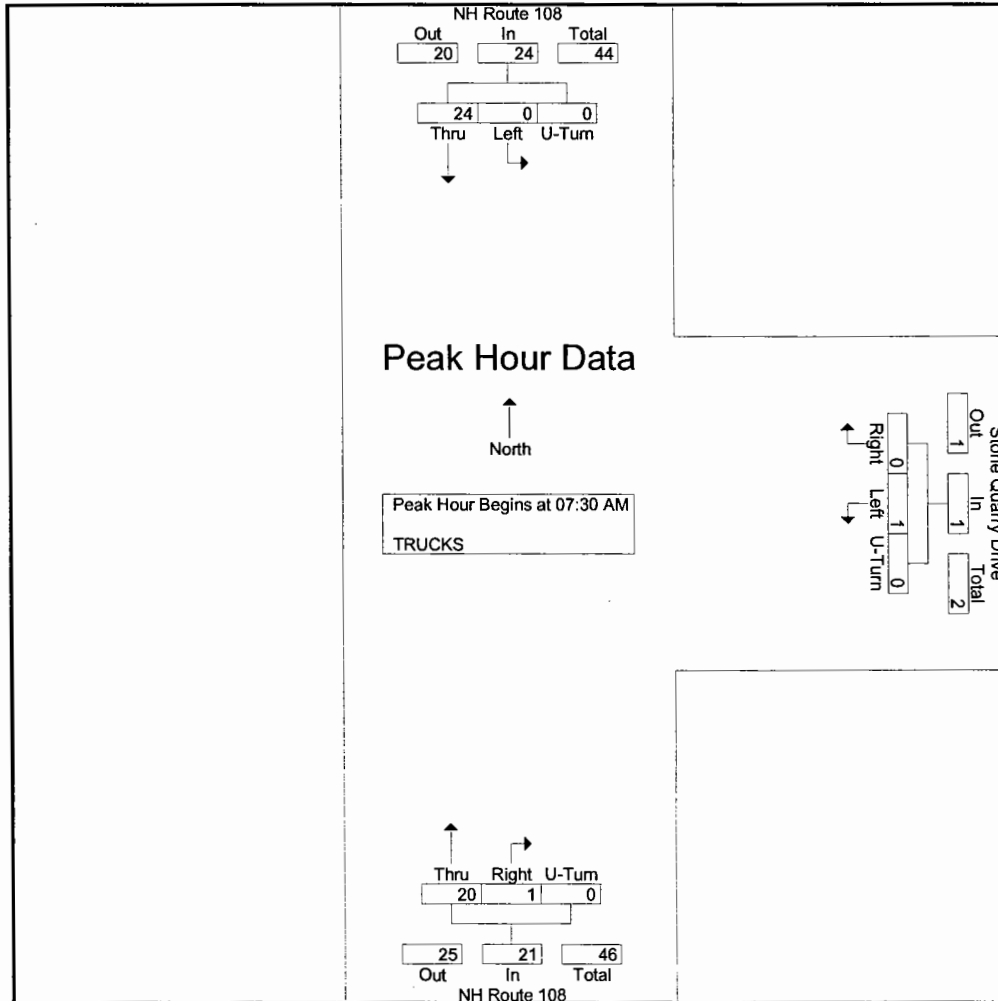


Stephen G. Pernaw & Company, Inc.
P.O. Box 1721
Concord, New Hampshire 03302

Weather: Clear
Collected By: MV
Job Number: 1765A
Town/State: Durham, New Hampshire

File Name : 1765A_INT_A_AM
Site Code : 1765A
Start Date : 4/11/2017
Page No : 2

Start Time	NH Route 108 From North				Stone Quarry Drive From East				NH Route 108 From South				Int. Total
	U-Turn	Thru	Left	App. Total	U-Turn	Right	Left	App. Total	U-Turn	Right	Thru	App. Total	
Peak Hour Analysis From 07:30 AM to 08:15 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:30 AM													
07:30 AM	0	7	0	7	0	0	0	0	0	0	7	7	14
07:45 AM	0	5	0	5	0	0	0	0	0	1	7	8	13
08:00 AM	0	8	0	8	0	0	0	0	0	0	1	1	9
08:15 AM	0	4	0	4	0	0	1	1	0	0	5	5	10
Total Volume	0	24	0	24	0	0	1	1	0	1	20	21	46
% App. Total	0	100	0		0	0	100		0	4.8	95.2		
PHF	.000	.750	.000	.750	.000	.000	.250	.250	.000	.250	.714	.656	.821



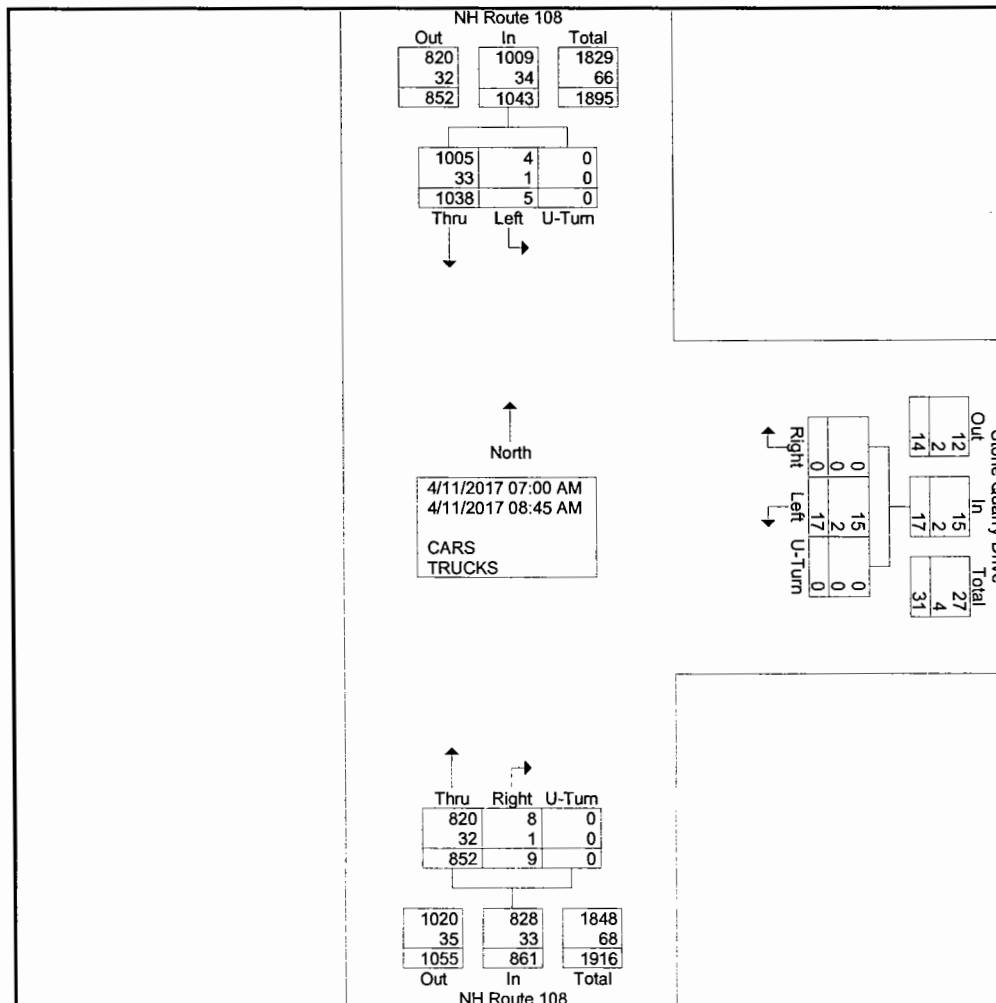
Stephen G. Pernaw & Company, Inc.
P.O. Box 1721
Concord, New Hampshire 03302

Weather: Clear
Collected By: MV
Job Number: 1765A
Town/State: Durham, New Hampshire

File Name : 1765A_INT_A_AM
Site Code : 1765A
Start Date : 4/11/2017
Page No : 1

Groups Printed- CARS - TRUCKS

Start Time	NH Route 108 From North				Stone Quarry Drive From East				NH Route 108 From South				Int. Total
	U-Turn	Thru	Left	App. Total	U-Turn	Right	Left	App. Total	U-Turn	Right	Thru	App. Total	
07:00 AM	0	87	0	87	0	0	0	0	0	2	96	98	185
07:15 AM	0	104	1	105	0	0	6	6	0	0	119	119	230
07:30 AM	0	158	0	158	0	0	3	3	0	0	140	140	301
07:45 AM	0	164	0	164	0	0	0	0	0	4	146	150	314
Total	0	513	1	514	0	0	9	9	0	6	501	507	1030
08:00 AM	0	151	0	151	0	0	0	0	0	1	86	87	238
08:15 AM	0	146	1	147	0	0	2	2	0	0	107	107	256
08:30 AM	0	120	1	121	0	0	2	2	0	1	79	80	203
08:45 AM	0	108	2	110	0	0	4	4	0	1	79	80	194
Total	0	525	4	529	0	0	8	8	0	3	351	354	891
Grand Total	0	1038	5	1043	0	0	17	17	0	9	852	861	1921
Apprch %	0	99.5	0.5		0	0	100		0	1	99		
Total %	0	54	0.3	54.3	0	0	0.9	0.9	0	0.5	44.4	44.8	
CARS	0	1005	4	1009	0	0	15	15	0	8	820	828	1852
% CARS	0	96.8	80	96.7	0	0	88.2	88.2	0	88.9	96.2	96.2	96.4
TRUCKS	0	33	1	34	0	0	2	2	0	1	32	33	69
% TRUCKS	0	3.2	20	3.3	0	0	11.8	11.8	0	11.1	3.8	3.8	3.6



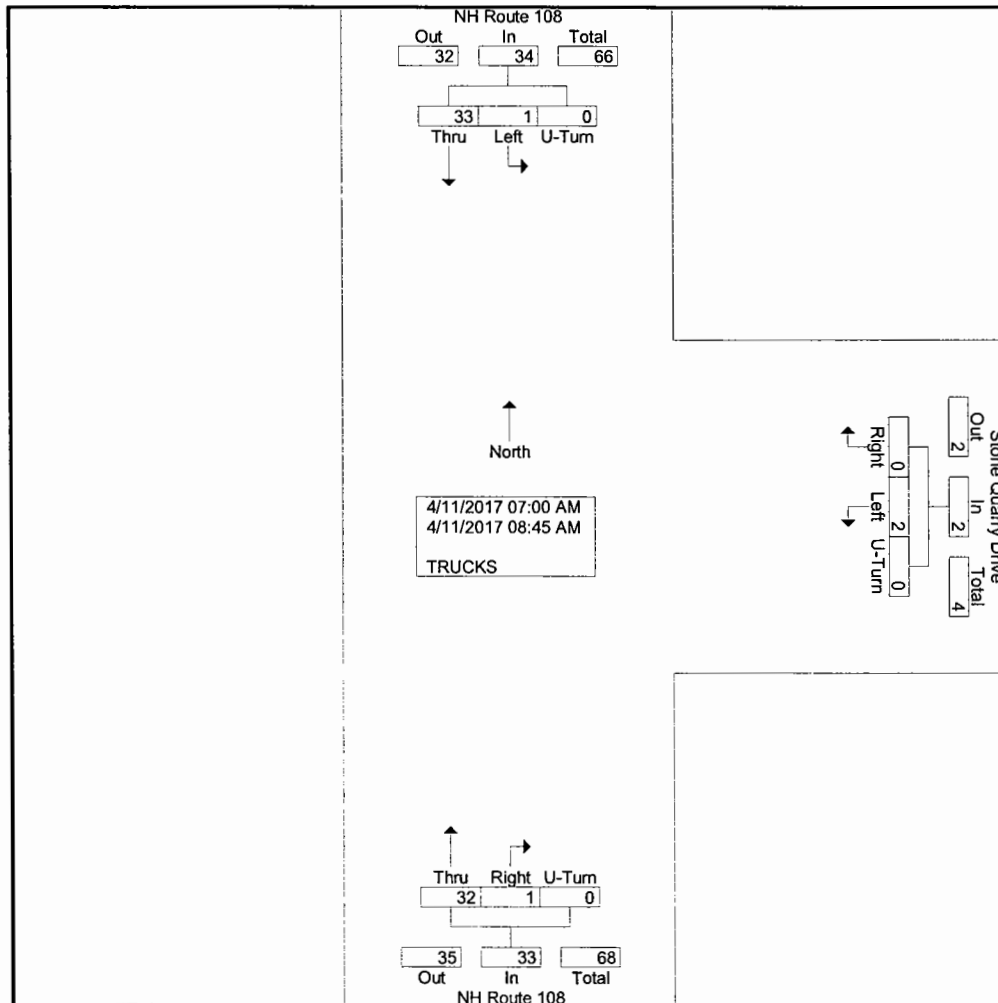
Stephen G. Pernaw & Company, Inc.
P.O. Box 1721
Concord, New Hampshire 03302

Weather: Clear
Collected By: MV
Job Number: 1765A
Town/State: Durham, New Hampshire

File Name : 1765A_INT_A_AM
Site Code : 1765A
Start Date : 4/11/2017
Page No : 1

Groups Printed- TRUCKS

Start Time	NH Route 108 From North				Stone Quarry Drive From East				NH Route 108 From South				Int. Total
	U-Turn	Thru	Left	App. Total	U-Turn	Right	Left	App. Total	U-Turn	Right	Thru	App. Total	
07:00 AM	0	2	0	2	0	0	0	0	0	0	3	3	5
07:15 AM	0	1	0	1	0	0	1	1	0	0	3	3	5
07:30 AM	0	7	0	7	0	0	0	0	0	0	7	7	14
07:45 AM	0	5	0	5	0	0	0	0	0	1	7	8	13
Total	0	15	0	15	0	0	1	1	0	1	20	21	37
08:00 AM	0	8	0	8	0	0	0	0	0	0	1	1	9
08:15 AM	0	4	0	4	0	0	1	1	0	0	5	5	10
08:30 AM	0	5	0	5	0	0	0	0	0	0	4	4	9
08:45 AM	0	1	1	2	0	0	0	0	0	0	2	2	4
Total	0	18	1	19	0	0	1	1	0	0	12	12	32
Grand Total	0	33	1	34	0	0	2	2	0	1	32	33	69
Apprch %	0	97.1	2.9		0	0	100		0	3	97		
Total %	0	47.8	1.4	49.3	0	0	2.9	2.9	0	1.4	46.4	47.8	

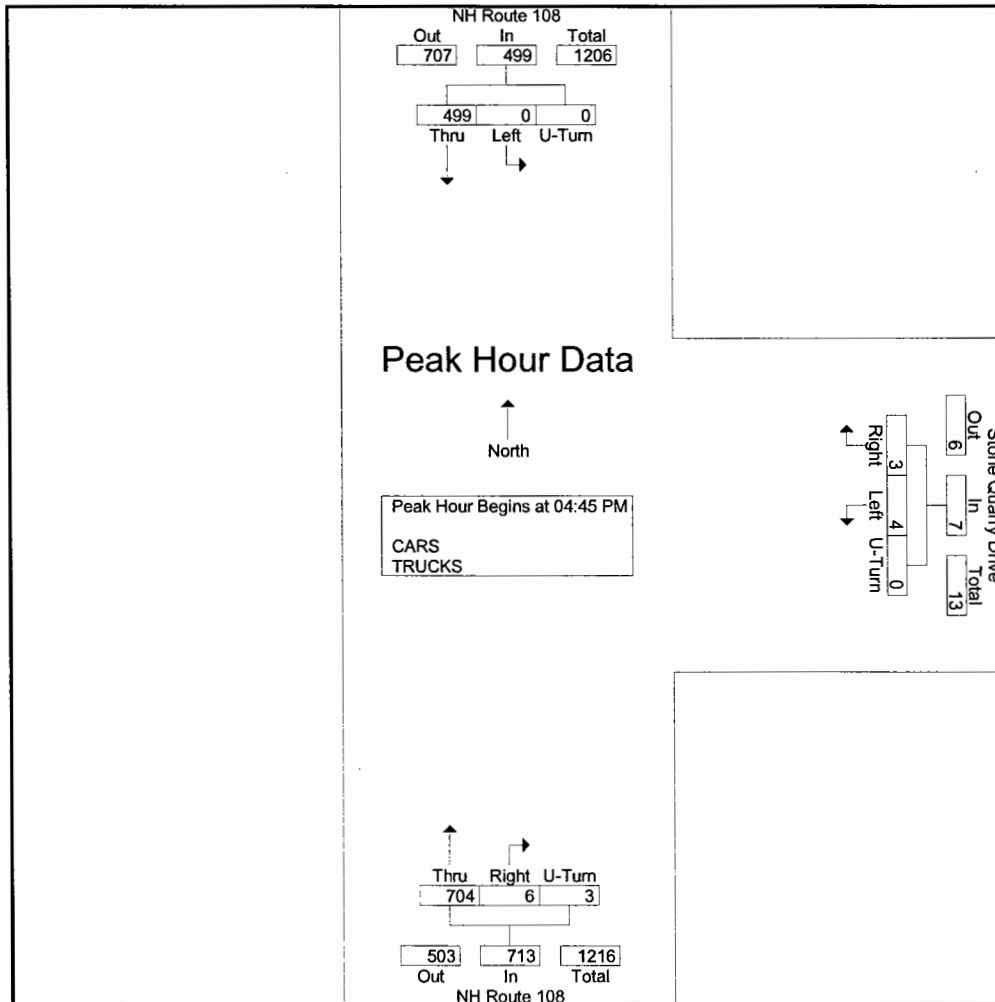


Stephen G. Pernaw & Company, Inc.
P.O. Box 1721
Concord, New Hampshire 03302

Weather: Clear
Collected By: MV
Job Number: 1765A
Town/State: Durham, New Hampshire

File Name : 1765A_INT_A_PM_399192_04-11-2017
Site Code : 1765A
Start Date : 4/11/2017
Page No : 2

Start Time	NH Route 108 From North				Stone Quarry Drive From East				NH Route 108 From South				Int. Total
	U-Turn	Thru	Left	App. Total	U-Turn	Right	Left	App. Total	U-Turn	Right	Thru	App. Total	
Peak Hour Analysis From 03:00 PM to 05:30 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 04:45 PM													
04:45 PM	0	108	0	108	0	2	1	3	0	1	177	178	289
05:00 PM	0	138	0	138	0	0	1	1	1	1	174	176	315
05:15 PM	0	117	0	117	0	1	0	1	1	3	176	180	298
05:30 PM	0	136	0	136	0	0	2	2	1	1	177	179	317
Total Volume	0	499	0	499	0	3	4	7	3	6	704	713	1219
% App. Total	0	100	0		0	42.9	57.1		0.4	0.8	98.7		
PHF	.000	.904	.000	.904	.000	.375	.500	.583	.750	.500	.994	.990	.961

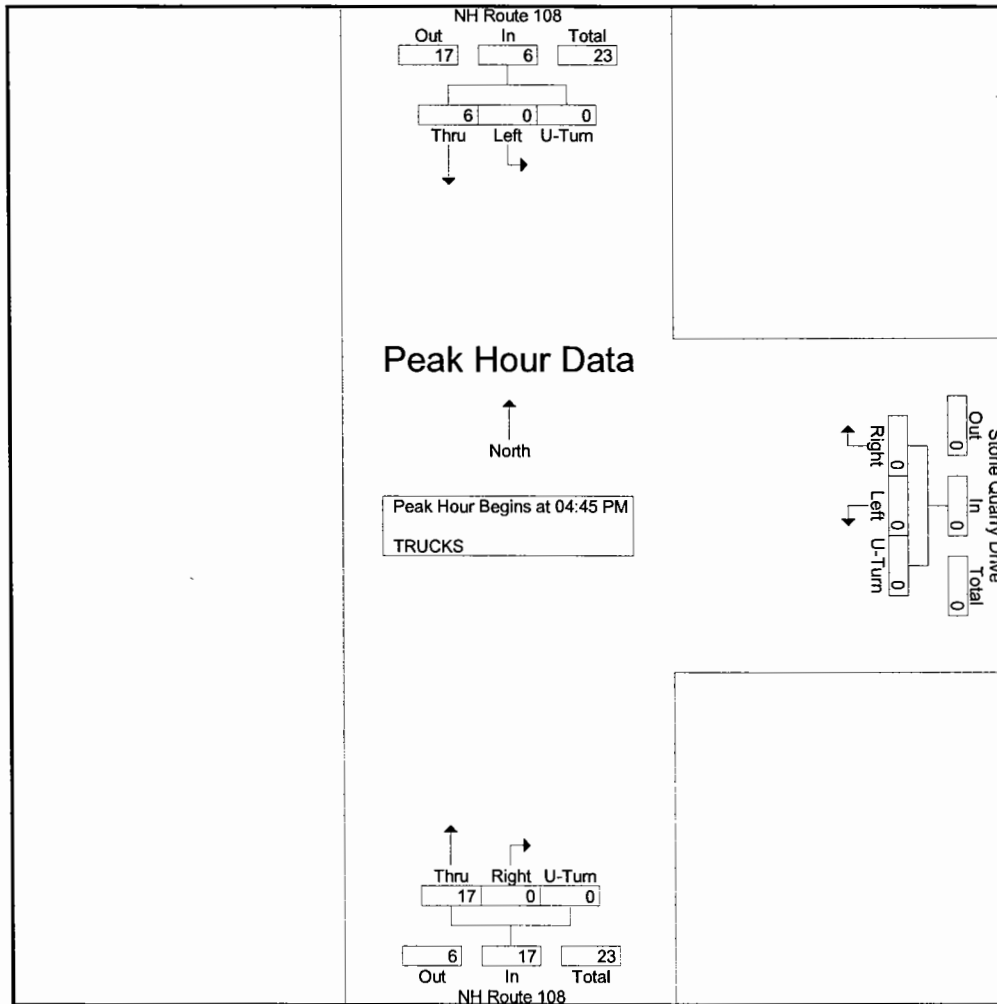


Stephen G. Pernaw & Company, Inc.
P.O. Box 1721
Concord, New Hampshire 03302

Weather: Clear
Collected By: MV
Job Number: 1765A
Town/State: Durham, New Hampshire

File Name : 1765A_INT_A_PM_399192_04-11-2017
Site Code : 1765A
Start Date : 4/11/2017
Page No : 2

Start Time	NH Route 108 From North				Stone Quarry Drive From East				NH Route 108 From South				Int. Total
	U-Turn	Thru	Left	App. Total	U-Turn	Right	Left	App. Total	U-Turn	Right	Thru	App. Total	
Peak Hour Analysis From 04:45 PM to 05:30 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 04:45 PM													
04:45 PM	0	1	0	1	0	0	0	0	0	0	1	1	2
05:00 PM	0	3	0	3	0	0	0	0	0	0	5	5	8
05:15 PM	0	1	0	1	0	0	0	0	0	0	7	7	8
05:30 PM	0	1	0	1	0	0	0	0	0	0	4	4	5
Total Volume	0	6	0	6	0	0	0	0	0	0	17	17	23
% App. Total	0	100	0		0	0	0		0	0	100		
PHF	.000	.500	.000	.500	.000	.000	.000	.000	.000	.000	.607	.607	.719



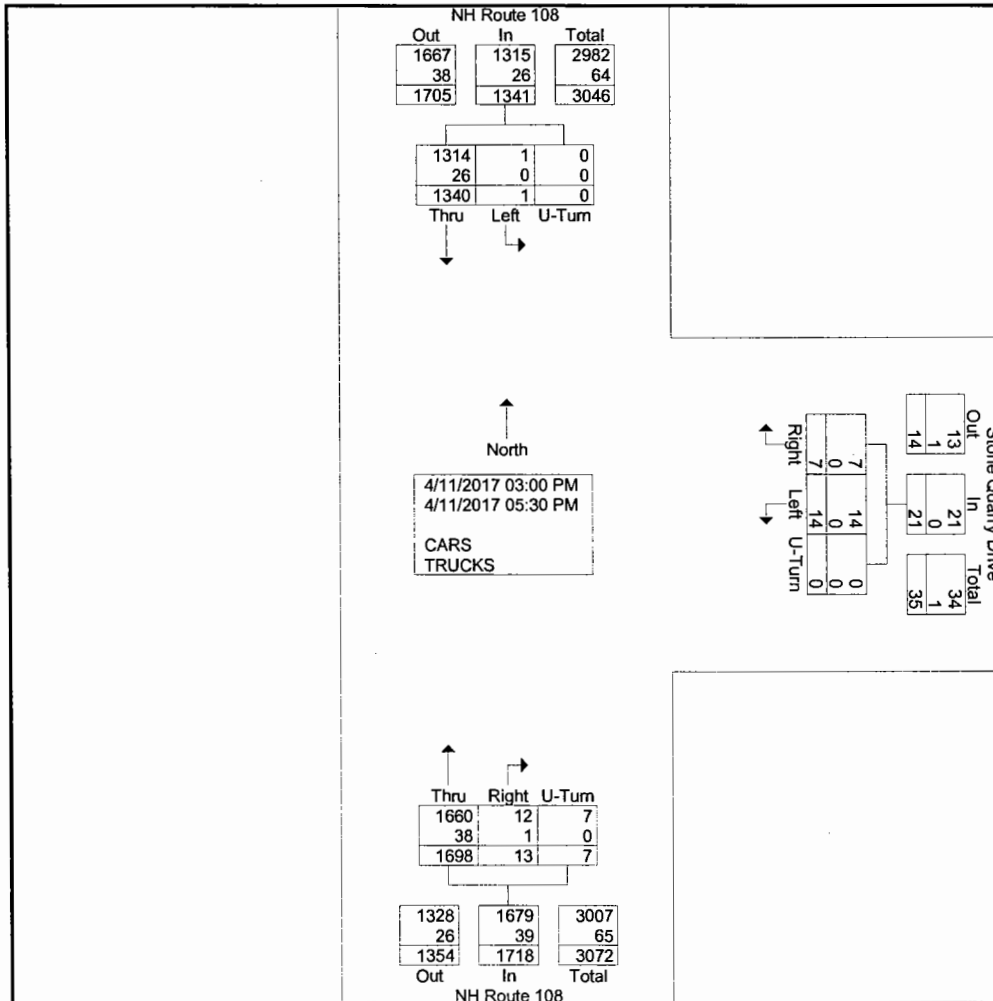
Stephen G. Pernaw & Company, Inc.
P.O. Box 1721
Concord, New Hampshire 03302

Weather: Clear
Collected By: MV
Job Number: 1765A
Town/State: Durham, New Hampshire

File Name : 1765A_INT_A_PM_399192_04-11-2017
Site Code : 1765A
Start Date : 4/11/2017
Page No : 1

Groups Printed- CARS - TRUCKS

Start Time	NH Route 108 From North				Stone Quarry Drive From East				NH Route 108 From South				Int. Total
	U-Turn	Thru	Left	App. Total	U-Turn	Right	Left	App. Total	U-Turn	Right	Thru	App. Total	
03:00 PM	0	120	1	121	0	0	1	1	2	4	103	109	231
03:15 PM	0	122	0	122	0	0	0	0	0	0	127	127	249
03:30 PM	0	111	0	111	0	3	8	11	0	1	141	142	264
03:45 PM	0	135	0	135	0	0	1	1	1	1	147	149	285
Total	0	488	1	489	0	3	10	13	3	6	518	527	1029
04:00 PM	0	111	0	111	0	0	0	0	0	0	138	138	249
04:15 PM	0	108	0	108	0	0	0	0	1	1	166	168	276
04:30 PM	0	134	0	134	0	1	0	1	0	0	172	172	307
04:45 PM	0	108	0	108	0	2	1	3	0	1	177	178	289
Total	0	461	0	461	0	3	1	4	1	2	653	656	1121
05:00 PM	0	138	0	138	0	0	1	1	1	1	174	176	315
05:15 PM	0	117	0	117	0	1	0	1	1	3	176	180	298
05:30 PM	0	136	0	136	0	0	2	2	1	1	177	179	317
Grand Total	0	1340	1	1341	0	7	14	21	7	13	1698	1718	3080
Apprch %	0	99.9	0.1		0	33.3	66.7		0.4	0.8	98.8		
Total %	0	43.5	0	43.5	0	0.2	0.5	0.7	0.2	0.4	55.1	55.8	
CARS	0	1314	1	1315	0	7	14	21	7	12	1660	1679	3015
% CARS	0	98.1	100	98.1	0	100	100	100	100	92.3	97.8	97.7	97.9
TRUCKS	0	26	0	26	0	0	0	0	0	1	38	39	65
% TRUCKS	0	1.9	0	1.9	0	0	0	0	0	7.7	2.2	2.3	2.1



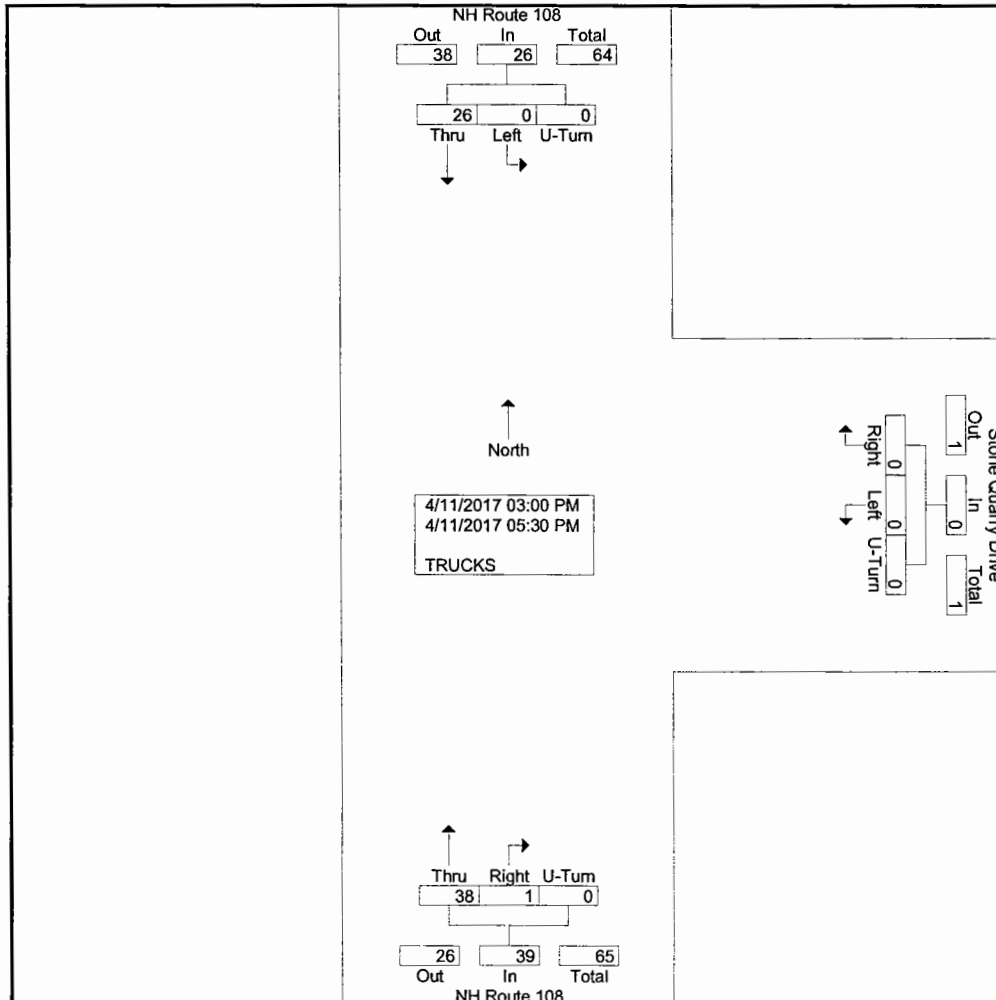
Stephen G. Pernaw & Company, Inc.
P.O. Box 1721
Concord, New Hampshire 03302

Weather: Clear
Collected By: MV
Job Number: 1765A
Town/State: Durham, New Hampshire

File Name : 1765A_INT_A_PM_399192_04-11-2017
Site Code : 1765A
Start Date : 4/11/2017
Page No : 1

Groups Printed- TRUCKS

Start Time	NH Route 108 From North				Stone Quarry Drive From East				NH Route 108 From South				Int. Total
	U-Turn	Thru	Left	App. Total	U-Turn	Right	Left	App. Total	U-Turn	Right	Thru	App. Total	
03:00 PM	0	2	0	2	0	0	0	0	0	1	4	5	7
03:15 PM	0	6	0	6	0	0	0	0	0	0	2	2	8
03:30 PM	0	2	0	2	0	0	0	0	0	0	2	2	4
03:45 PM	0	3	0	3	0	0	0	0	0	0	6	6	9
Total	0	13	0	13	0	0	0	0	0	1	14	15	28
04:00 PM	0	0	0	0	0	0	0	0	0	0	3	3	3
04:15 PM	0	4	0	4	0	0	0	0	0	0	3	3	7
04:30 PM	0	3	0	3	0	0	0	0	0	0	1	1	4
04:45 PM	0	1	0	1	0	0	0	0	0	0	1	1	2
Total	0	8	0	8	0	0	0	0	0	0	8	8	16
05:00 PM	0	3	0	3	0	0	0	0	0	0	5	5	8
05:15 PM	0	1	0	1	0	0	0	0	0	0	7	7	8
05:30 PM	0	1	0	1	0	0	0	0	0	0	4	4	5
Grand Total	0	26	0	26	0	0	0	0	0	1	38	39	65
Apprch %	0	100	0		0	0	0		0	2.6	97.4		
Total %	0	40	0		0	0	0		0	1.5	58.5		



Appendix D

Seasonal Adjustment Factors / Historical Growth Rates



STEPHEN G. PERNAW & COMPANY, INC.
PROJECT: Proposed Continuing Care Retirement Community, Exeter, New Hampshire
NUMBER: 1765A
STATION: 02133021

SEASONAL ADJUSTMENT FACTOR - SUMMARY

CASE: Peak Hour Data (April to Peak Month)

LOCATION : US 4 - East of NH 108 - Durham, New Hampshire

	<u>AM</u>	<u>PM</u>
2015 Monthly Data	1.03	1.00
2014 Monthly Data	1.07	1.03
2013 Monthly Data	1.05	1.03
Average	1.05	1.02
Use	1.05	1.02



Year 2015 Monthly Data								
Peak Hour Data								
Station = 133021 Durham, US 4 E of NH 108						Group: 04		
Data					Factors			
Month	AM	Mid	PM	Sat Mid	AM	Mid	PM	Sat Mid
Jan	1002	1019	1310	1367	1.09	1.05	1.06	0.98
Feb	981	984	1300	1295	1.12	1.09	1.06	1.04
Mar	1128	931	1327	1250	0.97	1.15	1.04	1.08
Apr	1148	1071	1481	1498	0.96	1.00	0.93	0.90
May	1118	1086	1424	1365	0.98	0.99	0.97	0.99
Jun	1124	1057	1391	1245	0.98	1.01	1.00	1.08
Jul	1072	1111	1365	1168	1.02	0.97	1.01	1.15
Aug	1105	1141	1397	1360	0.99	0.94	0.99	0.99
Sep	1183	1189	1469	1394	0.93	0.90	0.94	0.97
Oct	1155	1138	1432	1387	0.95	0.94	0.97	0.97
Nov	1127	1087	1395	1380	0.97	0.99	0.99	0.98
Dec	1023	1053	1320	1438	1.07	1.02	1.05	0.94
Average	1097	1072	1384	1346				
<p><i>FACTOR = 1.03 1.00</i></p>								
Average Daily Data								
Data					Factors			
Month	AveSun	AveWD	AveSat	AveDay	AveSun	AveWD	AveSat	AveDay
Jan	11819	15621	15928	15139	1.17	1.06	1.02	1.07
Feb	11090	15501	15350	14850	1.25	1.07	1.06	1.09
Mar	13275	15293	14987	14928	1.04	1.09	1.08	1.08
Apr	14502	17043	17697	16792	0.96	0.97	0.92	0.96
May	14745	17149	16645	16680	0.94	0.97	0.97	0.97
Jun	13138	16826	15480	16155	1.05	0.99	1.05	1.00
Jul	14287	17278	14529	16538	0.97	0.96	1.11	0.98
Aug	15285	17489	16451	16966	0.91	0.95	0.98	0.95
Sep	15778	17841	17220	17483	0.88	0.93	0.94	0.92
Oct	15189	17139	16938	16822	0.91	0.97	0.96	0.96
Nov	14599	16437	16655	16160	0.95	1.01	0.97	1.00
Dec	12547	15740	16506	15427	1.10	1.06	0.98	1.05
Average	13855	16613	16199	16162				
<p>Notes: 1. A box around the data indicates a calculated value. Do not use as data. 2. Yearly average days may not match the published report 3. Factors are based on Average Month</p>								



Year 2014 Monthly Data									
Peak Hour Data									
Station =	133021 Durham, US 4 E of NH 108						Group:	04	
	Data				Factors				
Month	AM	Mid	PM	Sat Mid	AM	Mid	PM	Sat Mid	
Jan	1013	883	1237	1086	1.14	1.17	1.14	1.24	
Feb	1042	897	1208	1303	1.11	1.15	1.16	1.03	
Mar	1137	905	1347	1350	1.02	1.14	1.04	1.00	
Apr	1187	1074	1484	1387	0.97	0.96	0.95	0.97	
May	1188	1088	1472	1379	0.97	0.95	0.96	0.97	
Jun	1247	1020	1400	1243	0.93	1.02	1.00	1.08	
Jul	1164	1114	1451	1266	0.99	0.93	0.97	1.06	
Aug	1111	1141	1436	1440	1.04	0.91	0.98	0.93	
Sep	1266	1125	1522	1598	0.91	0.92	0.92	0.84	
Oct	1215	1107	1504	1387	0.95	0.94	0.93	0.97	
Nov	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	
Dec	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	
Average	1157	1035	1406	1344					

FACTOR = 1.07 1.03



Year 2013 Monthly Data									
Peak Hour Data									
Station =	133021 Durham, US 4 E of NH 108						Group:	04	
Data					Factors				
Month	AM	Mid	PM	Sat Mid	AM	Mid	PM	Sat Mid	
Jan	1018	887	1264	1156	1.11	1.18	1.12	1.15	
Feb	1095	946	1337	983	1.03	1.10	1.06	1.36	
Mar	1071	930	1350	1329	1.05	1.12	1.05	1.00	
Apr	1173	1027	1486	1408	0.96	1.02	0.95	0.95	
May	1197	1093	1493	1442	0.94	0.96	0.95	0.92	
Jun	1214	1073	1418	1294	0.93	0.97	1.00	1.03	
Jul	1107	1119	1420	1283	1.02	0.93	1.00	1.04	
Aug	1108	1175	1505	1426	1.02	0.89	0.94	0.94	
Sep	1227	1111	1496	1494	0.92	0.94	0.95	0.89	
Oct	1221	1105	1527	1501	0.92	0.95	0.93	0.89	
Nov	1099	1052	1430	1354	1.02	0.99	0.99	0.98	
Dec	975	1024	1297	1333	1.15	1.02	1.09	1.00	
Average	1125	1045	1419	1334					

Factor = 1.05 1.03



STEPHEN G. PERNAW & COMPANY

PROJECT: Proposed Continuing Care Retirement Community, Durham, New Hampshire

NUMBER: 1765A

HISTORICAL GROWTH CALCULATIONS SUMMARY

CASE : AADT

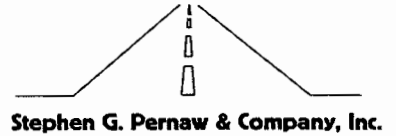
LOCATION :

US 4 - East of NH 108 - Durham, NH
NH 108 - North of US 4 - Durham, NH
NH 108 - South of US 4 - Durham, NH

= -0.6 % per year
= 0.4 % per year
= 1.1 % per year

Average = 0.3 % per year

Use = 1 % per year



STEPHEN G. PERNAW & COMPANY, INC.
 PROJECT: Proposed Continuing Care Retirement Community, Durham, New Hampshire
 NUMBER: 1765A
 COUNT STATION: 02133021

HISTORICAL GROWTH CALCULATIONS

LOCATION : US 4 - East of NH 108 - Durham, NH
 CASE : AADT

ARITHMETIC PROJECTIONS

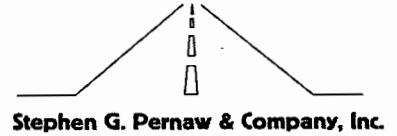
YEAR	AADT	Regression Output:		PROJECTIONS	
2008	16535	Constant	220343.14	2017	15738
2009	16830	Std Err of Y Est	250.4525	2018	15636
2010	16682	R Squared	0.534524	2019	15535
2011	16000	No. of Observations	8	2020	15433
2012	16152	Degrees of Freedom	6	2021	15332
2013	15989			2022	15231
2014	15969	X Coefficient	-101.44048	2023	15129
2015	16208	Std Err of Coef.	38.64566	2024	15028
				2025	14926
				2026	14825
				2027	14723

RATE = -101 VPD/YEAR

GEOMETRIC PROJECTIONS

YEAR	AADT	Ln AADT	Regression Output:		PROJECTIONS	
2008	16535	9.71323	Constant	22.15592	2017	15747
2009	16830	9.73092	Std Err of Y Est	0.0153032	2018	15650
2010	16682	9.72209	R Squared	0.5341113	2019	15553
2011	16000	9.68034	No. of Observations	8	2020	15457
2012	16152	9.68980	Degrees of Freedom	6	2021	15362
2013	15989	9.67966			2022	15267
2014	15969	9.67840	X Coefficient	-0.0061931	2023	15173
2015	16208	9.69326	Std Err of Coef.	0.0023613	2024	15079
					2025	14986
					2026	14893
					2027	14801

RATE = -0.6 % / YEAR



STEPHEN G. PERNAW & COMPANY, INC.

PROJECT: Proposed Continuing Care Retirement Community, Durham, New Hampshire
 NUMBER: 1765A
 COUNT STATION: 22133022

HISTORICAL GROWTH CALCULATIONS

LOCATION : NH 108 - North of US 4 - Durham, NH
 CASE : AADT

ARITHMETIC PROJECTIONS

YEAR	AADT	Regression Output:		PROJECTIONS	
2012	11000	Constant	-74148.46154	2017	11186
2015	11000	Std Err of Y Est	129.4366492	2018	11228
2016	11220	R Squared	0.480769231	2019	11271
		No. of Observations	3	2020	11313
		Degrees of Freedom	1	2021	11355
		X Coefficient	42.30769231	2022	11398
		Std Err of Coef.	43.96744358	2023	11440
				2024	11482
				2025	11525
				2026	11567
				2027	11609

RATE = 42 VPD/YEAR

GEOMETRIC PROJECTIONS

YEAR	AADT	Ln AADT	Regression Output:		PROJECTIONS	
2012	11000	9.30565	Constant	1.64127	2017	11186
2015	11000	9.30565	Std Err of Y Est	0.011650844	2018	11229
2016	11220	9.32545	R Squared	0.480769231	2019	11271
			No. of Observations	3	2020	11314
			Degrees of Freedom	1	2021	11358
			X Coefficient	0.003808198	2022	11401
			Std Err of Coef.	0.003957595	2023	11444
					2024	11488
					2025	11532
					2026	11576
					2027	11620

RATE = 0.4 % / YEAR



STEPHEN G. PERNAW & COMPANY, INC.

PROJECT: Proposed Continuing Care Retirement Community, Durham, New Hampshire
 NUMBER: 1765A
 COUNT STATION: 82133057

HISTORICAL GROWTH CALCULATIONS

LOCATION : NH 108 - South of US 4 - Durham, NH
 CASE : AADT

ARITHMETIC PROJECTIONS

YEAR	AADT	Regression Output:		PROJECTIONS	
2010	16000	Constant	-354026.31579	2017	17526
2012	17000	Std Err of Y Est	486.6642634	2018	17711
2015	17000	R Squared	0.644736842	2019	17895
		No. of Observations	3	2020	18079
		Degrees of Freedom	1	2021	18263
		X Coefficient	184.2105263	2022	18447
		Std Err of Coef.	136.7408532	2023	18632
				2024	18816
				2025	19000
				2026	19184
				2027	19368

RATE = 184 VPD/YEAR

GEOMETRIC PROJECTIONS

YEAR	AADT	Ln AADT	Regression Output:		PROJECTIONS	
2010	16000	9.68034	Constant	-12.75236	2017	17551
2012	17000	9.74097	Std Err of Y Est	0.029503837	2018	17748
2015	17000	9.74097	R Squared	0.644736842	2019	17948
			No. of Observations	3	2020	18149
			Degrees of Freedom	1	2021	18353
			X Coefficient	0.011167693	2022	18559
			Std Err of Coef.	0.008289863	2023	18768
					2024	18978
					2025	19191
					2026	19407
					2027	19625

RATE = 1.1 % / YEAR

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION
BUREAU OF TRAFFIC

18-Feb-16

Bureau of Planning, Traffic Section, Traffic Reports

STAT.	TYPE	LOCATION	FC	2008	2009	2010	2011	2012	2013	2014	2015
Town: DURHAM											
133021	02	US 4 EAST OF NH 108 (EB-WB) (01133019-01133020)	02	16535	16830	16682	16000	16152	15989	15969	16208
133022	22	NH 108 (DOVER RD) NORTH OF US 4 (SB-NB) (21133023-21133024)	16	*	*	*	*	11000	*	*	11000
133047	82	MILL RD SOUTH OF MAIN ST	17	*	*	7600	*	*	*	8100	*
133049	82	MAIN ST EAST OF NH 155A	16	*	*	*	*	*	*	11000	*
133051	82	MAIN ST WEST OF NH 108	16	*	13000	*	*	14000	*	*	14000
133052	62	NH 108 (NEWMARKET RD) NORTH OF LONGMARSH RD (SB-NB) (61133025-61133026)	17	*	*	9900	*	11000	*	*	10000
133053	62	US 4 AT LEE TL (EB-WB) (61133027-61133028)	14	*	*	*	*	13000	*	*	11000
133054	82	NH 108 (NEWMARKET RD) OVER OYSTER RIVER (SB-NB) (81133083-81133084)	17	*	*	*	*	12000	*	*	13000
133055	82	MAIN ST EAST OF NORTH DR (EB-WB) (81133089-81133090)	16	*	*	9500	*	*	9900	*	*
133056	82	MADBURY RD SOUTH OF US 4	16	*	4800	*	*	5300	*	*	5500
133057	82	NH 108 (DOVER RD) SOUTH OF US 4 (SB-NB) (81133029-81133030)	16	*	*	16000	*	17000	*	*	17000
133058	82	US 4 WEST OF NH 108 (EB-WB) (81133031-81133032)	14	*	*	9500	*	*	10000	*	*
133059	82	MILL RD AT B&M RR BRIDGE (EB-WB) (81133033-81133034)	08	*	*	*	*	2300	*	*	2000
133060	82	GARRISON AVE WEST OF MADBURY RD	17	*	*	*	*	*	*	3400	*
133061	82	MADBURY RD SOUTH OF GARRISON AVE (SB-NB) (81133035-81133036)	16	6900	*	*	6300	*	*	*	6000

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION
BUREAU OF TRAFFIC

18-Feb-16

Bureau of Planning, Traffic Section, Traffic Reports

STAT.	TYPE	LOCATION	FC	2008	2009	2010	2011	2012	2013	2014	2015
Town: DURHAM											
133062	82	NH 155A (MAST RD) SOUTH OF COLLEGE BROOK (SB-NB) (81133037-81133038)	17	*	*	*	*	3400	*	*	4600
133063	82	NH 155A WEST OF MAST RD	16	7900	*	7600	*	*	*	*	8700
133064	82	MADBURY RD NORTH OF US 4 (SB-NB) (81133039-81133040)	16	*	*	5800	*	*	5400	*	*
133065	82	MAIN ST WEST OF GARRISON AVE	16	*	9400	*	*	8600	*	*	9300
133067	82	BAGDAD RD AT US 4 OVERPASS (EB-WB) (81133041-81133042)	19	*	*	*	*	1800	*	*	1800
133068	82	BENNETT RD AT B&M RR OVERPASS (EB-WB) (81133043-81133044)	09	*	*	*	*	590	*	*	580
133069	82	BAGDAD RD EAST OF DENNISON RD (EB-WB) (81133074-81133075)	19	780	*	*	690	*	*	790	*
133070	82	MILL POND RD WEST OF NH 108	19	*	*	*	*	2200	*	*	2200
133072	82	WISWALL RD OVER LAMPREY RIVER (EB- WB) (81133076-81133077)	09	*	*	*	*	310	*	*	280
133073	82	BAY RD SOUTH OF ADAMS POINT RD (SB-NB) (81133078-81133079)	09	*	*	*	*	270	*	*	320
133081	82	PETTEE BROOK LN EAST OF ROSEMARY LN	16	*	*	*	*	*	*	8000	*
133082	82	US 4 WEST OF MADBURY RD	14	*	*	12000	*	*	11000	*	*
133085	81	MADBURY RD NORTH OF MAIN ST	16	11000	*	*	11000	*	*	*	10000
133087	82	MAIN ST EAST OF PETTEE BROOK LN	16	*	*	*	*	*	*	8200	*
133088	81	MAIN ST WEST OF MADBURY RD	16	11000	*	*	11000	*	*	*	11000
133091	82	US 4 EAST OF NH 108 (EB-WB) (81133092- 81133093) (CLASS ONLY)	02	*	*	*	*	17000	*	*	15000

Appendix E

Trip Generation Calculations / Site Generated Traffic Volumes

Trip Generation Summary

Alternative: Alternative 1

Phase:

Project: 1765A

Open Date: 4/25/2017

Analysis Date: 4/25/2017

ITE	Land Use	Weekday Average Daily Trips			Weekday AM Peak Hour of Adjacent Street Traffic			Weekday PM Peak Hour of Adjacent Street Traffic		
		* Enter	Exit	Total	* Enter	Exit	Total	* Enter	Exit	Total
255	CCRETIREMENT 1	278	277	555	21	12	33	18	26	44
	222 Occupied Units									
	<i>RATE</i>									
255	CCRETIREMENT 2	346	345	691	33	17	50	35	53	88
	222 Occupied Units									
	<i>EQUATION</i>									
<hr/>										
	Unadjusted Volume	624	622	1246	54	29	83	53	79	132
	Internal Capture Trips	0	0	0	0	0	0	0	0	0
	Pass-By Trips	0	0	0	0	0	0	0	0	0
	Volume Added to Adjacent Streets	624	622	1246	54	29	83	53	79	132

Total Weekday Average Daily Trips Internal Capture = 0 Percent

Total Weekday AM Peak Hour of Adjacent Street Traffic Internal Capture = 0 Percent

Total Weekday PM Peak Hour of Adjacent Street Traffic Internal Capture = 0 Percent

* - Custom rate used for selected time period.

Trip Generation Summary

Alternative: Alternative 1
 Phase:
 Project: 1765A

Open Date: 4/25/2017
 Analysis Date: 4/25/2017

ITE	Land Use	Saturday Average Daily Trips			Saturday Peak Hour of Generator			Sunday			Sunday Peak Hour of Generator		
		* Enter	Exit	Total	* Enter	Exit	Total	* Enter	Exit	Total	* Enter	Exit	Total
255	CCRETIREMENT 1 222 Occupied Units	232	232	464	27	24	51	222	222	444	25	24	49
	<i>RATE</i>												
255	CCRETIREMENT 2 222 Occupied Units	343	343	686	46	43	89	315	314	629	38	35	73
	<i>EQUATION</i>												
	Unadjusted Volume	575	575	1150	73	67	140	537	536	1073	63	59	122
	Internal Capture Trips	0	0	0	0	0	0	0	0	0	0	0	0
	Pass-By Trips	0	0	0	0	0	0	0	0	0	0	0	0
	Volume Added to Adjacent Streets	575	575	1150	73	67	140	537	536	1073	63	59	122

Total Saturday Average Daily Trips Internal Capture = 0 Percent
 Total Saturday Peak Hour of Generator Internal Capture = 0 Percent
 Total Sunday Internal Capture = 0 Percent
 Total Sunday Peak Hour of Generator Internal Capture = 0 Percent

* - Custom rate used for selected time period.

Project Location: Durham, NH
 Project Number: 1765A

TRIP DISTRIBUTION ANALYSIS

I. METHOD A - Journey to Work Data

Durham Workplace	Workers	Percent To/From		Workers To/From		
		<u>N</u>	<u>S</u>	<u>N</u>	<u>S</u>	
Durham town Strafford Co. NH	2700	0.05	0.95	135	2565	
Dover city Strafford Co. NH	905	1.00		905	0	
Lee town Strafford Co. NH	420		1.00	0	420	
Newmarket town Rockingham Co. NH	379		1.00	0	379	
Rochester city Strafford Co. NH	352	1.00		352	0	
Barrington town Strafford Co. NH	303		1.00	0	303	
Portsmouth city Rockingham Co. NH	284		1.00	0	284	
Somersworth city Strafford Co. NH	180	1.00		180	0	
Nottingham town Rockingham Co. NH	132		1.00	0	132	
Madbury town Strafford Co. NH	105	0.05	0.95	5	100	
Rollinsford town Strafford Co. NH	98	1.00		98	0	
Exeter town Rockingham Co. NH	94		1.00	0	94	
York town York Co. ME	86		1.00	0	86	
Strafford town Strafford Co. NH	78		1.00	0	78	
Manchester city Hillsborough Co. NH	70		1.00	0	70	
Berwick town York Co. ME	69	1.00		69	0	
Sanford town York Co. ME	60	1.00		60	0	
Kittery town York Co. ME	53		1.00	0	53	
Farmington town Strafford Co. NH	52	1.00		52	0	
	6420			1856.25	4563.75	6420
				28.91	71.09	
			ROUNDED:	29%	71%	
				<u>N</u>	<u>S</u>	

Source Information: 2000 U.S. Census, by New Hampshire Employment Security

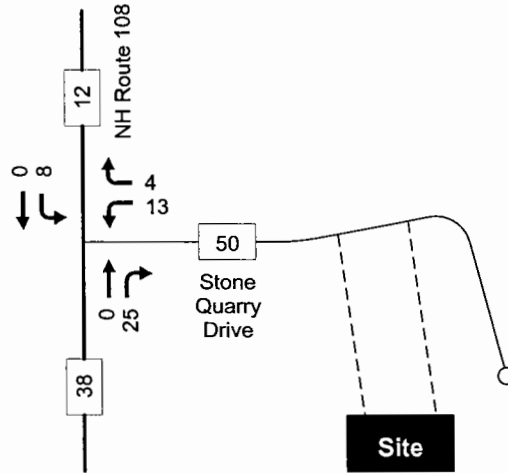
II. METHOD B - TMC Patterns at Stone Quarry Drive

Five Hour Count - To/From North =	13	20%
Five Hour Count - To/From South =	<u>53</u>	80%
	66	

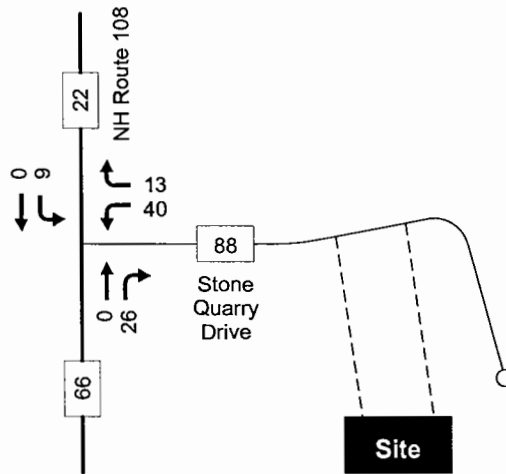
III. Average of Method A and Method B

To/From North =	29 + 20 =	49
To/From South =	71 + 80 =	<u>151</u>
		200

USE
25%
75%



AM PEAK HOUR



PM PEAK HOUR

Appendix F

Capacity and Level of Service Calculations – Unsignalized

HCM 2010 TWSC
 1: NH Route 108 & Stone Quarry Drive

Intersection

Int Delay, s/veh 0.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	Y		↑		↑	↑
Traffic Vol, veh/h	5 ✓	0 ✓	479 ✓	5 ✓	1 ✓	619 ✓
Future Vol, veh/h	5	0	479	5	1	619
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	90	90	81	81	95	95
Heavy Vehicles, %	20	0	4	20	0	4
Mvmt Flow	6	0	591	6	1	652

Major/Minor	Minor1	Minor2	Major1	Major2	Major3	Major4
Conflicting Flow All	1248	594	0	0	598	0
Stage 1	594	-	-	-	-	-
Stage 2	654	-	-	-	-	-
Critical Hdwy	6.6	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.6	-	-	-	-	-
Critical Hdwy Stg 2	5.6	-	-	-	-	-
Follow-up Hdwy	3.68	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	176	509	-	-	989	-
Stage 1	518	-	-	-	-	-
Stage 2	485	-	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	176	509	-	-	989	-
Mov Cap-2 Maneuver	176	-	-	-	-	-
Stage 1	518	-	-	-	-	-
Stage 2	484	-	-	-	-	-

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

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	176	989	-
HCM Lane V/C Ratio	-	-	0.032	0.001	-
HCM Control Delay (s)	-	-	26.1	8.6	0
HCM Lane LOS	-	-	D	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0	-

HCM 2010 TWSC
 1: NH Route 108 & Stone Quarry Drive

Intersection

Int Delay, s/veh 0.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	Y		T			T
Traffic Vol, veh/h	5 ✓	0 ✓	518 ✓	5 ✓	1 ✓	669 ✓
Future Vol, veh/h	5	0	518	5	1	669
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	90	90	81	81	95	95
Heavy Vehicles, %	20	0	4	20	0	4
Mvmt Flow	6	0	640	6	1	704

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1349	643	0	0	646	0
Stage 1	643	-	-	-	-	-
Stage 2	706	-	-	-	-	-
Critical Hdwy	6.6	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.6	-	-	-	-	-
Critical Hdwy Stg 2	5.6	-	-	-	-	-
Follow-up Hdwy	3.68	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	152	477	-	-	949	-
Stage 1	491	-	-	-	-	-
Stage 2	458	-	-	-	-	-
Platoon blocked, %			-	-		
Mov Cap-1 Maneuver	152	477	-	-	949	-
Mov Cap-2 Maneuver	152	-	-	-	-	-
Stage 1	491	-	-	-	-	-
Stage 2	457	-	-	-	-	-

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

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	152	949
HCM Lane V/C Ratio	-	-	0.037	0.001
HCM Control Delay (s)	-	-	29.6	8.8
HCM Lane LOS	-	-	D	A
HCM 95th %tile Q(veh)	-	-	0.1	0

HCM 2010 TWSC
 1: NH Route 108 & Stone Quarry Drive

Intersection

Int Delay, s/veh 0.6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	Y		1			4
Traffic Vol, veh/h	18 ✓	4 ✓	518 ✓	30 ✓	9 ✓	669 ✓
Future Vol, veh/h	18	4	518	30	9	669
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	90	90	81	81	95	95
Heavy Vehicles, %	20	0	4	20	0	4
Mvmt Flow	20	4	640	37	9	704

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1381	658	0	0	677	0
Stage 1	658	-	-	-	-	-
Stage 2	723	-	-	-	-	-
Critical Hdwy	6.6	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.6	-	-	-	-	-
Critical Hdwy Stg 2	5.6	-	-	-	-	-
Follow-up Hdwy	3.68	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	145	468	-	-	924	-
Stage 1	483	-	-	-	-	-
Stage 2	449	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	143	468	-	-	924	-
Mov Cap-2 Maneuver	143	-	-	-	-	-
Stage 1	483	-	-	-	-	-
Stage 2	442	-	-	-	-	-

Approach	WB		NB		SB
HCM Control Delay, s	30.8		0		0.1
HCM LOS	D				

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	164	924	-
HCM Lane V/C Ratio	-	-	0.149	0.01	-
HCM Control Delay (s)	-	-	30.8	8.9	0
HCM Lane LOS	-	-	D	A	A
HCM 95th %tile Q(veh)	-	-	0.5	0	-

HCM 2010 TWSC
 1: NH Route 108 & Stone Quarry Drive

Intersection

Int Delay, s/veh 0.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	Y		T			A
Traffic Vol, veh/h	5 ✓	0 ✓	572 ✓	5 ✓	1 ✓	739 ✓
Future Vol, veh/h	5	0	572	5	1	739
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	90	90	81	81	95	95
Heavy Vehicles, %	20	0	4	20	0	4
Mvmt Flow	6	0	706	6	1	778

Major/Minor	Minor1	Major1	Major2
Conflicting Flow All	1489	709	0
Stage 1	709	-	-
Stage 2	780	-	-
Critical Hdwy	6.6	6.2	4.1
Critical Hdwy Stg 1	5.6	-	-
Critical Hdwy Stg 2	5.6	-	-
Follow-up Hdwy	3.68	3.3	2.2
Pot Cap-1 Maneuver	124	438	897
Stage 1	456	-	-
Stage 2	422	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	124	438	897
Mov Cap-2 Maneuver	124	-	-
Stage 1	456	-	-
Stage 2	421	-	-

Approach	WB	NB	SB
HCM Control Delay, s	35.4	0	0
HCM LOS	E		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	124	897
HCM Lane V/C Ratio	-	-	0.045	0.001
HCM Control Delay (s)	-	-	35.4	9
HCM Lane LOS	-	-	E	A
HCM 95th %tile Q(veh)	-	-	0.1	0

HCM 2010 TWSC
 1: NH Route 108 & Stone Quarry Drive

Intersection

Int Delay, s/veh 0.6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	Y		↑			↑
Traffic Vol, veh/h	18 ✓	4 ✓	572 ✓	30 ✓	9 ✓	739 ✓
Future Vol, veh/h	18	4	572	30	9	739
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	90	90	81	81	95	95
Heavy Vehicles, %	20	0	4	20	0	4
Mvmt Flow	20	4	706	37	9	778

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1522	725	0	0	743	0
Stage 1	725	-	-	-	-	-
Stage 2	797	-	-	-	-	-
Critical Hdwy	6.6	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.6	-	-	-	-	-
Critical Hdwy Stg 2	5.6	-	-	-	-	-
Follow-up Hdwy	3.68	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	118	428	-	-	873	-
Stage 1	448	-	-	-	-	-
Stage 2	414	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	116	428	-	-	873	-
Mov Cap-2 Maneuver	116	-	-	-	-	-
Stage 1	448	-	-	-	-	-
Stage 2	407	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	37.8	0	0.1
HCM LOS	E		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	134	873	-
HCM Lane V/C Ratio	-	-	0.182	0.011	-
HCM Control Delay (s)	-	-	37.8	9.2	0
HCM Lane LOS	-	-	E	A	A
HCM 95th %tile Q(veh)	-	-	0.6	0	-

HCM 2010 TWSC
 1: NH Route 108 & Stone Quarry Drive

Intersection

Int Delay, s/veh 0.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	Y		↑			↓
Traffic Vol, veh/h	4 ✓	3 ✓	704 ✓	6 ✓	0 ✓	499 ✓
Future Vol, veh/h	4	3	704	6	0	499
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	90	90	99	99	90	90
Heavy Vehicles, %	0	0	2	0	0	1
Mvmt Flow	4	3	711	6	0	554

Major/Minor	Minor1	Major1	Major2
Conflicting Flow All	1268	714	0
Stage 1	714	-	-
Stage 2	554	-	-
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	188	435	893
Stage 1	489	-	-
Stage 2	580	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	188	435	893
Mov Cap-2 Maneuver	188	-	-
Stage 1	489	-	-
Stage 2	580	-	-

Approach	WB	NB	SB
HCM Control Delay, s	20	0	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	- 248	893	-
HCM Lane V/C Ratio	-	- 0.031	-	-
HCM Control Delay (s)	-	- 20	0	-
HCM Lane LOS	-	- C	A	-
HCM 95th %tile Q(veh)	-	- 0.1	0	-

HCM 2010 TWSC
 1: NH Route 108 & Stone Quarry Drive

Intersection

Int Delay, s/veh 0.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	Y		1			1
Traffic Vol, veh/h	4 ✓	3 ✓	740 ✓	6 ✓	0	524 ✓
Future Vol, veh/h	4	3	740	6	0	524
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	90	90	99	99	90	90
Heavy Vehicles, %	0	0	2	0	0	1
Mvmt Flow	4	3	747	6	0	582

Major/Minor	Minor1	Minor2	Major1	Major2	Major3	Major4
Conflicting Flow All	1333	751	0	0	754	0
Stage 1	751	-	-	-	-	-
Stage 2	582	-	-	-	-	-
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	172	414	-	-	865	-
Stage 1	470	-	-	-	-	-
Stage 2	563	-	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	172	414	-	-	865	-
Mov Cap-2 Maneuver	172	-	-	-	-	-
Stage 1	470	-	-	-	-	-
Stage 2	563	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	21.3	0	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	229	865	-
HCM Lane V/C Ratio	-	-	0.034	-	-
HCM Control Delay (s)	-	-	21.3	0	-
HCM Lane LOS	-	-	C	A	-
HCM 95th %tile Q(veh)	-	-	0.1	0	-

HCM 2010 TWSC
 1: NH Route 108 & Stone Quarry Drive

Intersection

Int Delay, s/veh 1.6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	Y		T		T	T
Traffic Vol, veh/h	44 ✓	16 ✓	740 ✓	32 ✓	9 ✓	524 ✓
Future Vol, veh/h	44	16	740	32	9	524
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	90	90	99	99	90	90
Heavy Vehicles, %	0	0	2	0	0	1
Mvmt Flow	49	18	747	32	10	582

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1366	764	0	0	780	0
Stage 1	764	-	-	-	-	-
Stage 2	602	-	-	-	-	-
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	164	407	-	-	846	-
Stage 1	463	-	-	-	-	-
Stage 2	551	-	-	-	-	-
Platoon blocked, %			-	-		
Mov Cap-1 Maneuver	161	407	-	-	846	-
Mov Cap-2 Maneuver	161	-	-	-	-	-
Stage 1	463	-	-	-	-	-
Stage 2	542	-	-	-	-	-

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

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	192	846	-
HCM Lane V/C Ratio	-	-	0.347	0.012	-
HCM Control Delay (s)	-	-	33.4	9.3	0
HCM Lane LOS	-	-	D	A	A
HCM 95th %tile Q(veh)	-	-	1.5	0	-

HCM 2010 TWSC
 1: NH Route 108 & Stone Quarry Drive

Intersection

Int Delay, s/veh 0.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	4 ✓	3 ✓	817 ✓	6 ✓	0 ✓	579 ✓
Future Vol, veh/h	4	3	817	6	0	579
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	90	90	99	99	90	90
Heavy Vehicles, %	0	0	2	0	0	1
Mvmt Flow	4	3	825	6	0	643

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1471	828	0	0	831	0
Stage 1	828	-	-	-	-	-
Stage 2	643	-	-	-	-	-
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	141	374	-	-	810	-
Stage 1	432	-	-	-	-	-
Stage 2	527	-	-	-	-	-
Platoon blocked, %			-	-	-	-
Mov Cap-1 Maneuver	141	374	-	-	810	-
Mov Cap-2 Maneuver	141	-	-	-	-	-
Stage 1	432	-	-	-	-	-
Stage 2	527	-	-	-	-	-

Approach	WB		NB		SB
HCM Control Delay, s	24.5		0		0
HCM LOS	C				

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	- 192	810	-
HCM Lane V/C Ratio	-	- 0.041	-	-
HCM Control Delay (s)	-	- 24.5	0	-
HCM Lane LOS	-	- C	A	-
HCM 95th %tile Q(veh)	-	- 0.1	0	-

HCM 2010 TWSC
 1: NH Route 108 & Stone Quarry Drive

Intersection

Int Delay, s/veh 1.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	Y		T		T	T
Traffic Vol, veh/h	44 ✓	16 ✓	817 ✓	32 ✓	9 ✓	579 ✓
Future Vol, veh/h	44	16	817	32	9	579
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	90	90	99	99	90	90
Heavy Vehicles, %	0	0	2	0	0	1
Mvmt Flow	49	18	825	32	10	643

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1504	841	0	0	858	0
Stage 1	841	-	-	-	-	-
Stage 2	663	-	-	-	-	-
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	135	368	-	-	791	-
Stage 1	426	-	-	-	-	-
Stage 2	516	-	-	-	-	-
Platoon blocked, %			-	-		
Mov Cap-1 Maneuver	132	368	-	-	791	-
Mov Cap-2 Maneuver	132	-	-	-	-	-
Stage 1	426	-	-	-	-	-
Stage 2	506	-	-	-	-	-

Approach	WB		NB		SB
HCM Control Delay, s	43.1		0		0.1
HCM LOS	E				

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	159	791	-
HCM Lane V/C Ratio	-	-	0.419	0.013	-
HCM Control Delay (s)	-	-	43.1	9.6	0
HCM Lane LOS	-	-	E	A	A
HCM 95th %tile Q(veh)	-	-	1.9	0	-

Appendix G

Auxiliary Turn Lane Warrants Analysis

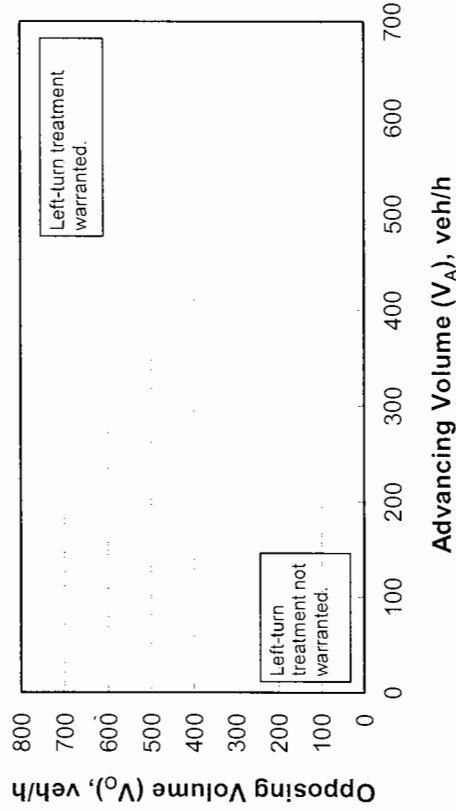
Figure 2 - 5. Guideline for determining the need for a major-road left-turn bay at a two-way stop-controlled intersection.

2-lane roadway (English)

INPUT	Variable	Value
	85 th percentile speed, mph:	35
	Percent of left-turns in advancing volume (V_A), %:	1%
	Advancing volume (V_A), veh/h:	748
	Opposing volume (V_O), veh/h:	602

OUTPUT

Variable	Value
Limiting advancing volume (V_A), veh/h:	872
Guidance for determining the need for a major-road left-turn bay:	
Left-turn treatment NOT warranted.	



CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway, s:	5.0
Average time for left-turn vehicle to clear the advancing lane, s:	1.9

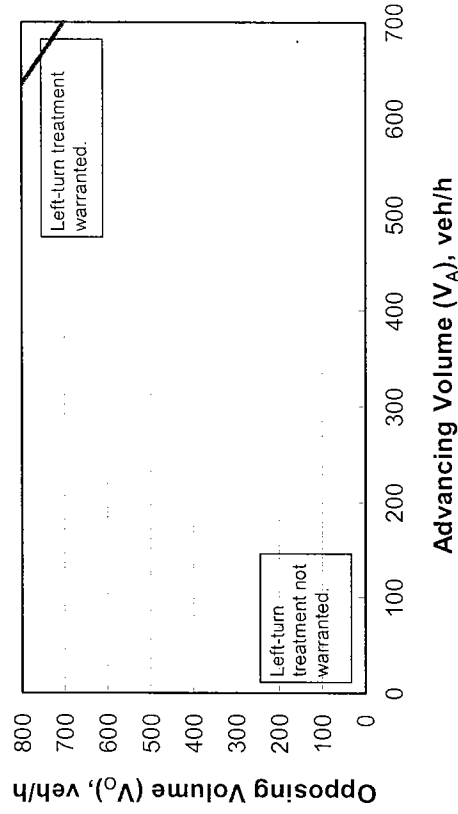
Figure 2 - 5. Guideline for determining the need for a major-road left-turn bay at a two-way stop-controlled intersection.

2-lane roadway (English)

INPUT	Variable	Value
	85 th percentile speed, mph:	35
	Percent of left-turns in advancing volume (V_A), %:	2%
	Advancing volume (V_A), veh/h:	588
	Opposing volume (V_O), veh/h:	849

OUTPUT

Variable	Value
Limiting advancing volume (V_A), veh/h:	605
Guidance for determining the need for a major-road left-turn bay:	
Left-turn treatment NOT warranted.	



CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway, s:	5.0
Average time for left-turn vehicle to clear the advancing lane, s:	1.9

Figure 2 - 6. Guideline for determining the need for a major-road right-turn bay at a two-way stop-controlled intersection.

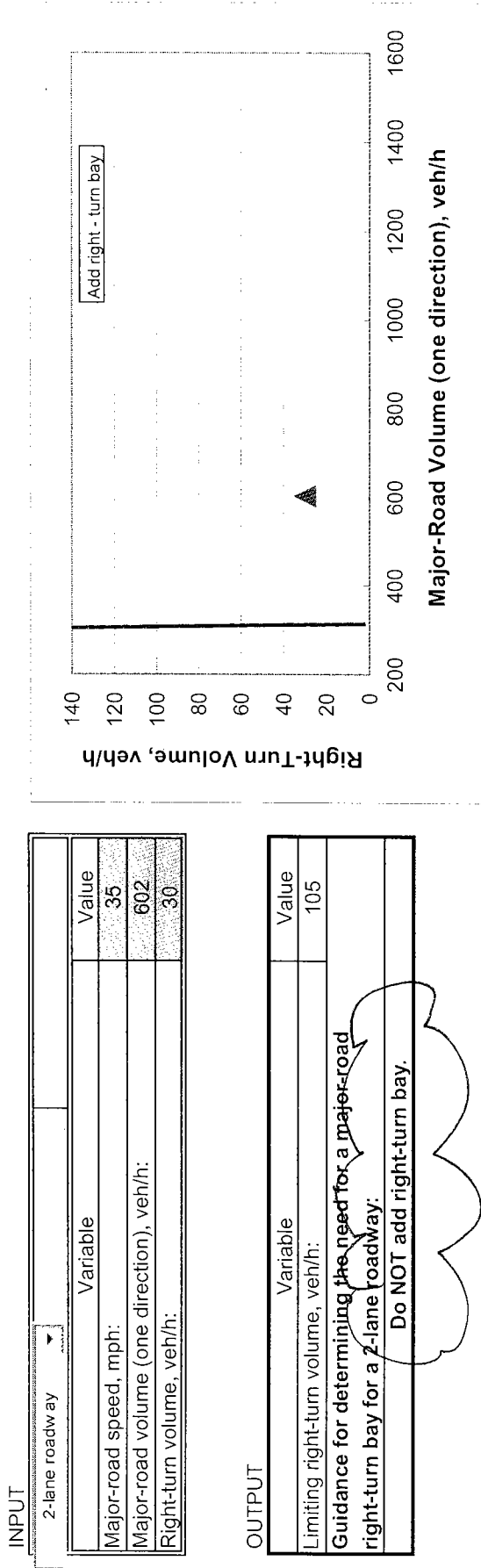


Figure 2 - 6. Guideline for determining the need for a major-road right-turn bay at a two-way stop-controlled intersection.

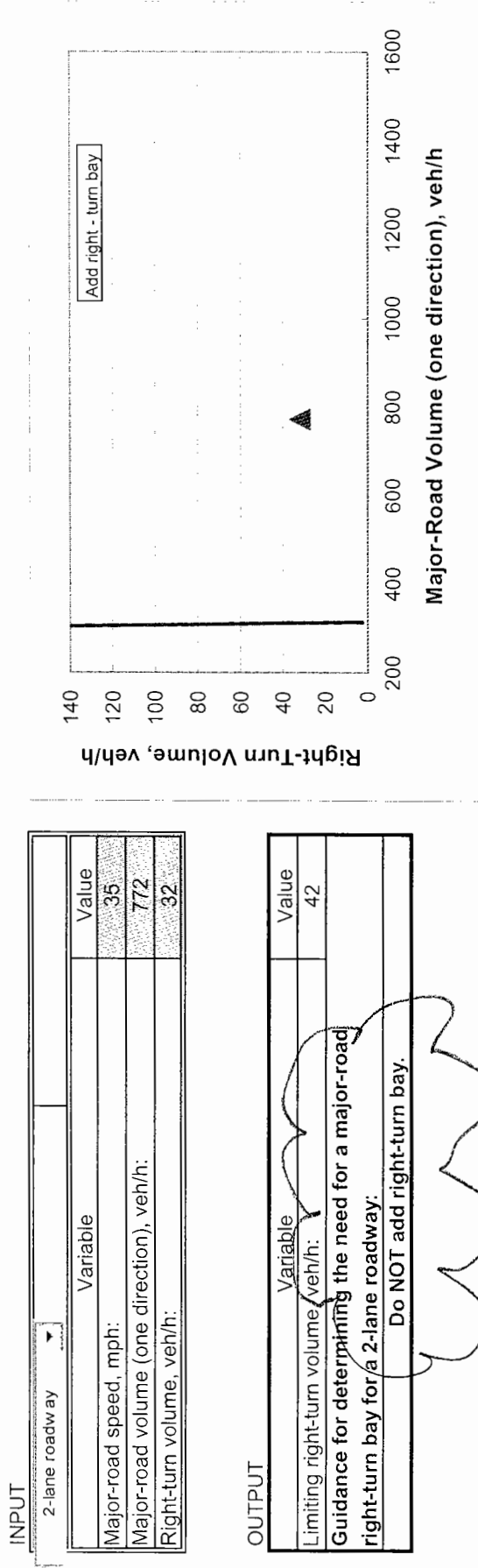


Figure 2 - 6. Guideline for determining the need for a major-road right-turn bay at a two-way stop-controlled intersection.

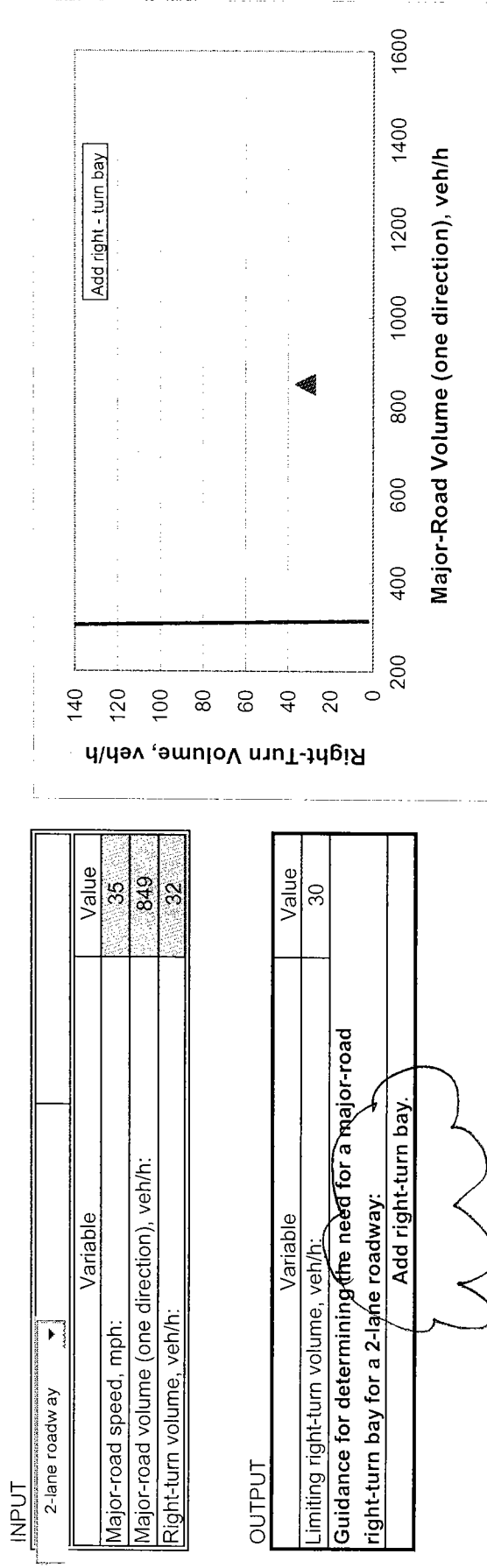


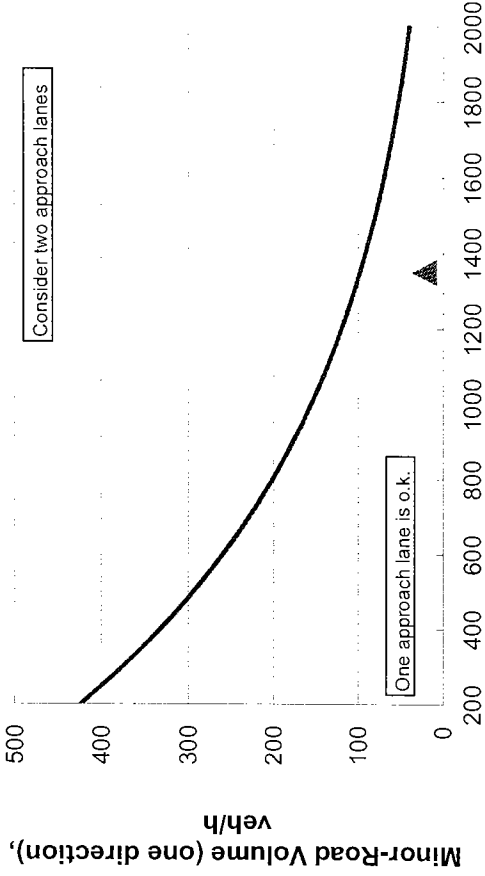
Figure 2 - 4. Guideline for determining minor-road approach geometry at two-way stop-controlled intersections.

INPUT

Variable	Value
Major-road volume (total of both directions), veh/h:	1350
Percentage of right-turns on minor road, %:	18%
Minor-road volume (one direction), veh/h:	22

OUTPUT

Variable	Value
Limiting minor-road volume (one direction), veh/h:	98
Guidance for determining minor-road approach geometry:	
ONE approach lane is o.k.	



CALIBRATION CONSTANTS

Minor Road	Critical gap, s:	Follow-up gap, s:
Right-turn capacity, veh/h:	6.2	3.3
Left-turn and through capacity, veh/h:	6.5	4.0

* according to Table 17 - 5 of the HCM

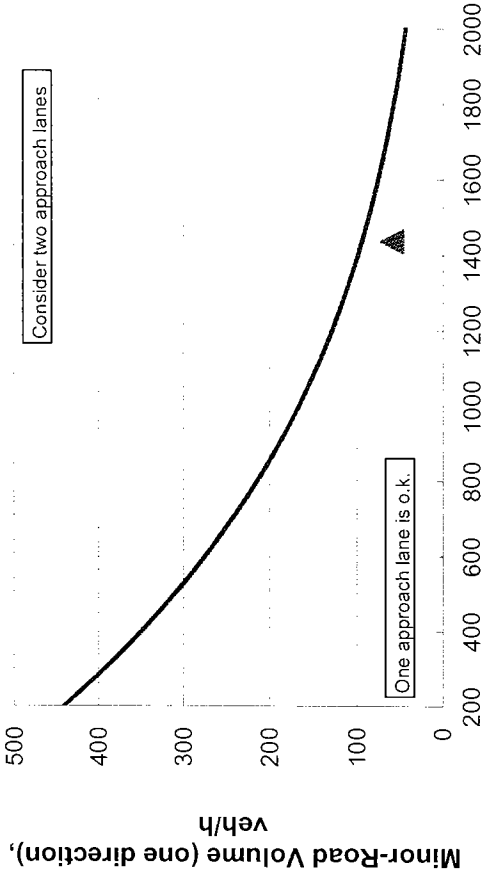
Figure 2 - 4. Guideline for determining minor-road approach geometry at two-way stop-controlled intersections.

INPUT

Variable	Value
Major-road volume (total of both directions), veh/h:	1437
Percentage of right-turns on minor road, %:	27%
Minor-road volume (one direction), veh/h:	60

OUTPUT

Variable	Value
Limiting minor-road volume (one direction), veh/h:	94
Guidance for determining minor-road approach geometry:	
ONE approach lane is o.k.	



CALIBRATION CONSTANTS

Minor Road	Critical gap, s:	Follow-up gap, s:
Right-turn capacity, veh/h:	6.2	3.3
Left-turn and through capacity, veh/h:	6.5	4.0

* according to Table 17 - 5 of the HCM