Gorrill-Palmer Consulting Engineers, Inc.
Engineering Excellence Since 1998

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March 13, 2014

Mr. Andrew Johnston, PE
SMRT
144 Fore Street
PO Box 618
Portland, ME 04104

Subject: Traffic Assessment for Proposed Police Station
York, Maine

Dear Andrew,

Project Understanding

It is our understanding that The Town of York is now proposing to construct the police station with access only to Ridge Road with the potential for emergency access only to Route 1. The purpose of this review is to estimate the traffic which may be generated by the police station and evaluate the intersection of the access road to the police station and Ridge Road.

Estimated Trip Generation

Traffic Engineers normally utilize the Institute of Transportation Engineers (ITE) publication "Trip Generation" to estimate traffic to and from a proposed land use during the AM and PM peak hours normally used in the traffic analysis. However, this publication does not contain any studies of police stations. We considered counting the existing police station but the building is shared with the senior center and separating out only the Police station traffic would be difficult so we have relied on information supplied by the Department.

The York Police Department has indicated that they project a staff of 63 officers in 2016, three quarter of whom drive to work each day. These 63 officers are broken down into 40 patrol units of which ten may arrive in the morning peak. Assuming these ten officers and 23 remaining staff (63-40) arrive in the AM peak hour yields a total of 33 trip ends (23+10). There are also volunteers and visitors to the station but those trips are not anticipated during the peak hours.

Existing Traffic Volumes

Since the timing of this assessment did not allow for collection of turning movements on Ridge road at the proposed driveway, Gorrill Palmer Consulting Engineers utilized the July 17, 2010, Saturday volumes contained in the "Final Traffic Circulation Study, Town of York, Maine" completed by our firm in 2011. These counts included the intersection of Ridge Road and Railroad Ave which were referenced for this assessment and shown in Figure 2. The peak hour on Saturday occurred from 3:15 to 4:15 PM on Saturday. Weekday counts were not available so these counts were used since they represent peak conditions in July which were used for the above referenced study. These counts have been increased by 1% per year to approximate 2015 conditions when the police station is scheduled to open. The 2015 pre-development volumes are shown in Figure 3.

2015 Post Development Traffic

The 2015 post development traffic was estimated by added the 2015 pre-development traffic volumes to the estimated traffic to be generated by the police station which should be conservative since the peak police station traffic should not coincide with the peak hour of Ridge Road. We have assumed most of the 90% of the traffic entering to be conservative in assessing the need for a left turn lane.

Capacity Analysis

Gorrill-Palmer Consulting Engineers, Inc. completed capacity analyses for the follow intersections:

- Intersection of Access Road and Maine Street which is unsignalized.
- Intersection of Route 16 and Main Street which is signalized

The analysis was completed with the HCS software. Levels of service rankings are similar to the academic ranking system where an 'A' represents little control delay and an 'F' represents significant delay.

The following table summarizes the relationship between delay and level of service for both unsignalized and signalized intersections:

Level of Service Criteria for Unsignalized Intersections

Level of Service	Control Delay per Vehicle (sec)
A	Up to 10.0
B	10.1 to 15.0
C	15.1 to 25.0
D	25.1 to 35.0
E	35.1 to 50.0
F	Greater than 50.0

The results of the capacity analysis shows that the traffic exiting the driveway will operate at a level of service B. A copy of the analysis is included in the Appendix.

Left Lane Analysis

The Figure 8-31 of the MaineDOT Highway Design Guide contains a chart for estimating whether a left turn lane in warranted. A copy of this chart is included in the Appendix which shows a left turn lane is not warranted.

Collision History

Gorrill-Palmer Consulting Engineers, Inc. obtained the crash data from MaineDOT for the period of 2010-2012. Crash information is attached.

In order to evaluate whether a location has a crash problem, MaineDOT uses two criteria to define High Crash Location (HCL). Both criteria must be met in order to be classified as an HCL.

1. A critical rate factor of 1.00 or more for a three-year period. (A Critical Rate Factor {CRF} compares the actual crash rate to the rate for similar intersection in the state. A CRF of less than 1.00 indicates a rate of less than average) **and:**
2. A minimum of eight crashes over the same three-year period.

Based on the crash data supplied by MaineDOT this section of Ridge Road is not a high crash location as there were 2 crashes along Ridge Road in the vicinity of the project.

Site Lines

The Maine Department of Transportation has guidelines for sight distances at driveways within urban compacts. The sight line standards for driveways in an urban compact are as follows:

Maine DOT Standards for Sight Distance

Posted Speed (mph)	Sight Distance
25	200
30	250
35	305
40	360
45	425
50	495
55	570

Gorrill-Palmer Consulting Engineers, Inc. has evaluated the available sight lines at the proposed driveway in accordance with Maine DOT standards.

The Maine DOT standards are as follows:

Driveway observation point: 10 feet off major street travelway
Height of eye at driveway: 3 ½ feet above ground
Height of approaching vehicle: 4 ¼ feet above road surface

We have evaluated the sight lines based on the Ridge Road speed limit of 25 mph. The results of the sight line analysis exiting the site drive is summarized in the following table.

Sight Line Evaluation

Direction	Speed (mph)	Recommended Sight Line (ft)	Actual Sight Line (ft)
Exiting onto Ridge Road Looking:			
Left	25	200	Over 200
Right	25	200	Over 200

As shown, the sight lines for the driveways meet Maine DOT requirements. Gorrill-Palmer Consulting Engineers, Inc. recommends that all plantings and grading to be located within the sight triangle not exceed 3 feet in height and be maintained at or below that height. Signage should not interfere with sight lines. In addition, we recommend that during construction, when heavy equipment is entering and exiting into the site, that appropriate measures, such as signage and flag persons, be utilized in accordance with the Manual on Uniform Traffic Control Devices.

Recommendations

Based on this traffic assessment, it is our opinion that the proposed access to the police station from Ridge road can be accommodated and operate safely.

Sincerely,

Gorrill-Palmer Consulting Engineers, Inc.

Thomas L. Gorrill, P.E., PTOE
President

TLG/tlg/JN2471.02/Johnston 3-13-14

Location Map

Figure No. 1

YORK POLICE STATION, YORK, MAINE

Design:	RED	Scale:	NONE
Draft:	LAN	Date:	MAR 2014
Checked:	TLG	File Name:	2471_02_TRAF.dwg

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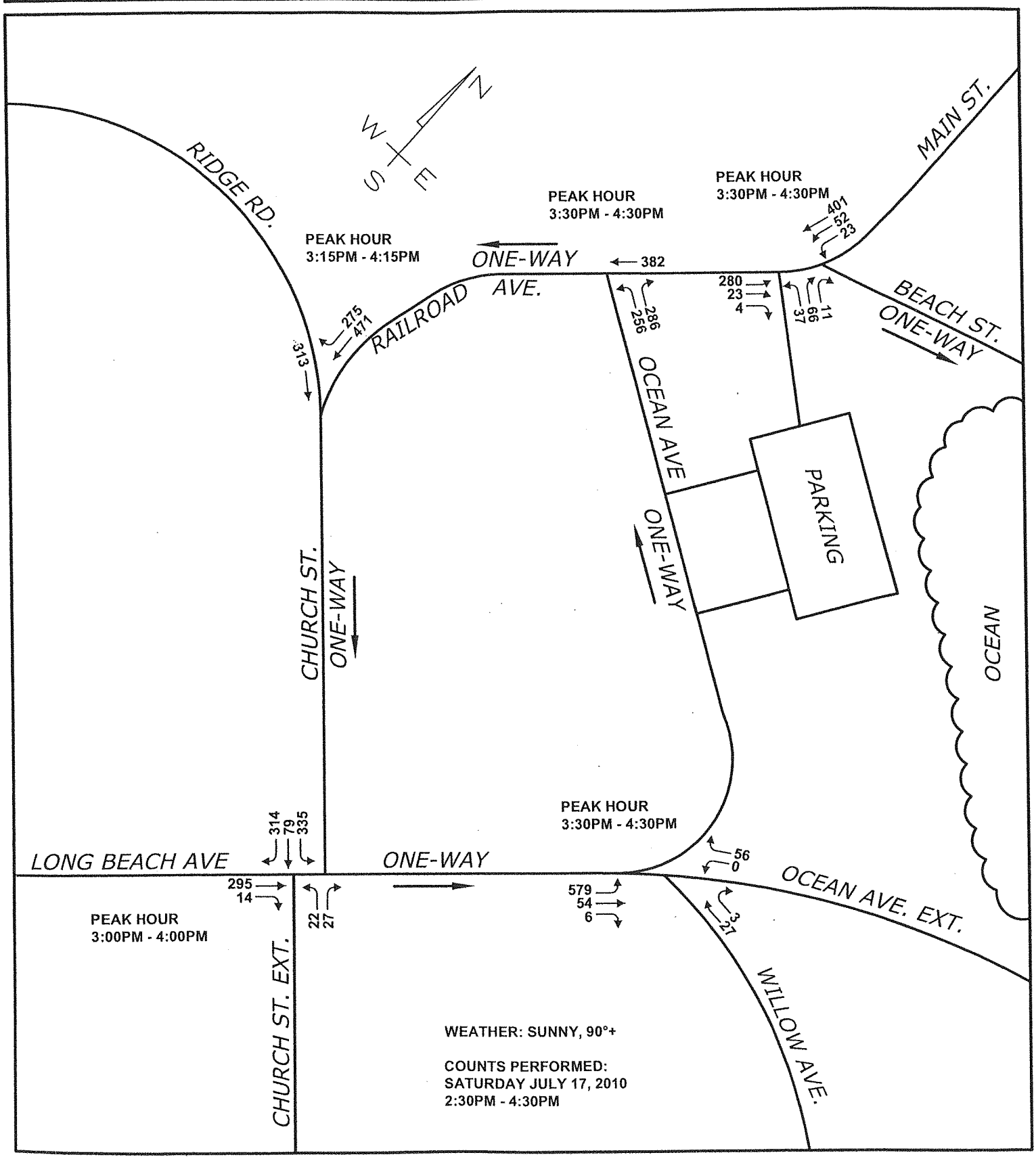
Raw Traffic Volumes - Saturday

Figure No. 2



TRAFFIC CIRCULATION STUDY, YORK, MAINE

Design:	RED	Scale:	NONE
Draft:	DB	Date:	JULY 2010
Checked:	JJB	File Name:	2423 TRAF.dwg

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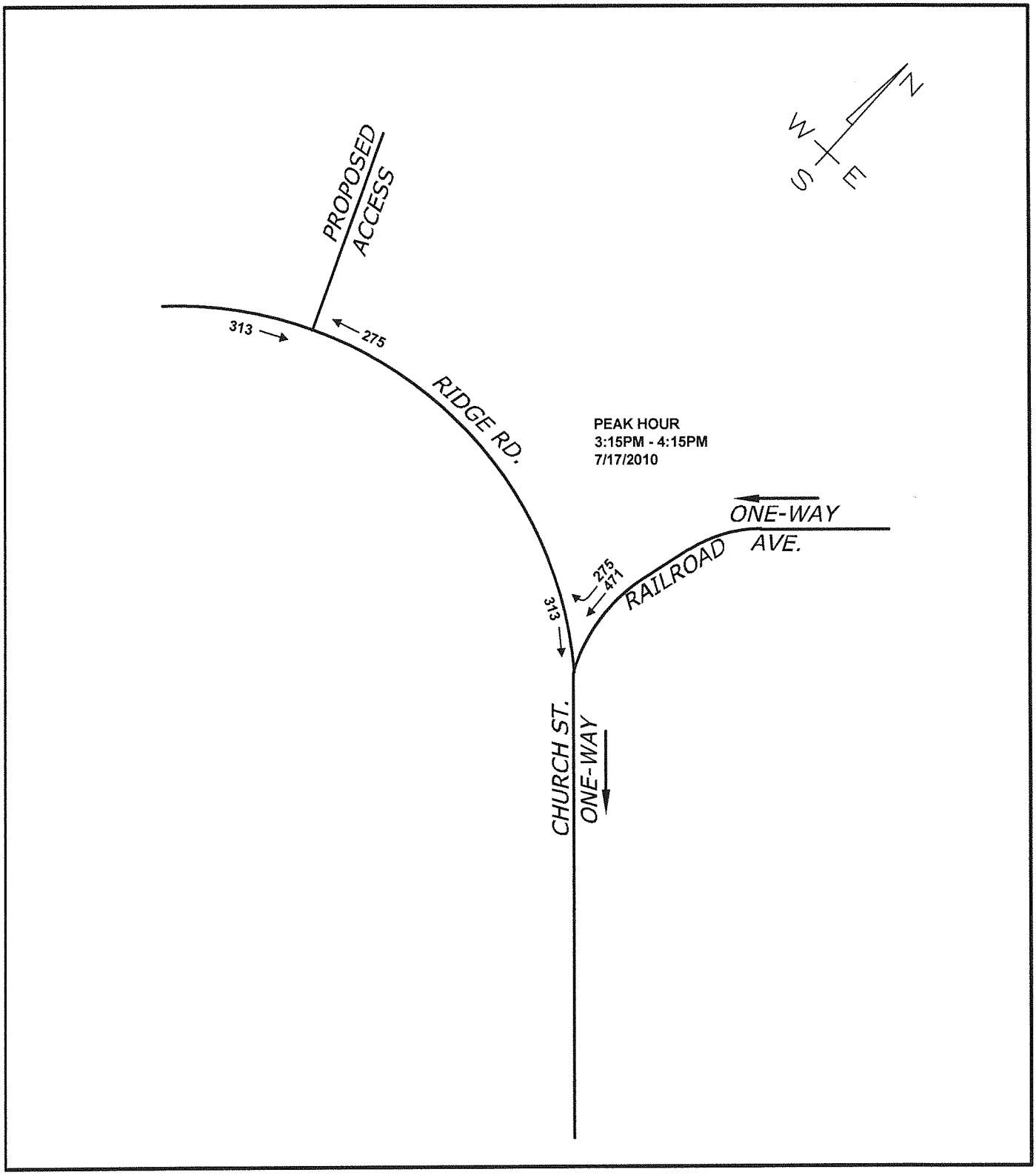
Raw Data Volumes - 2010

Figure No. 2



YORK POLICE STATION, YORK, MAINE

Design:	RED	Scale:	NONE
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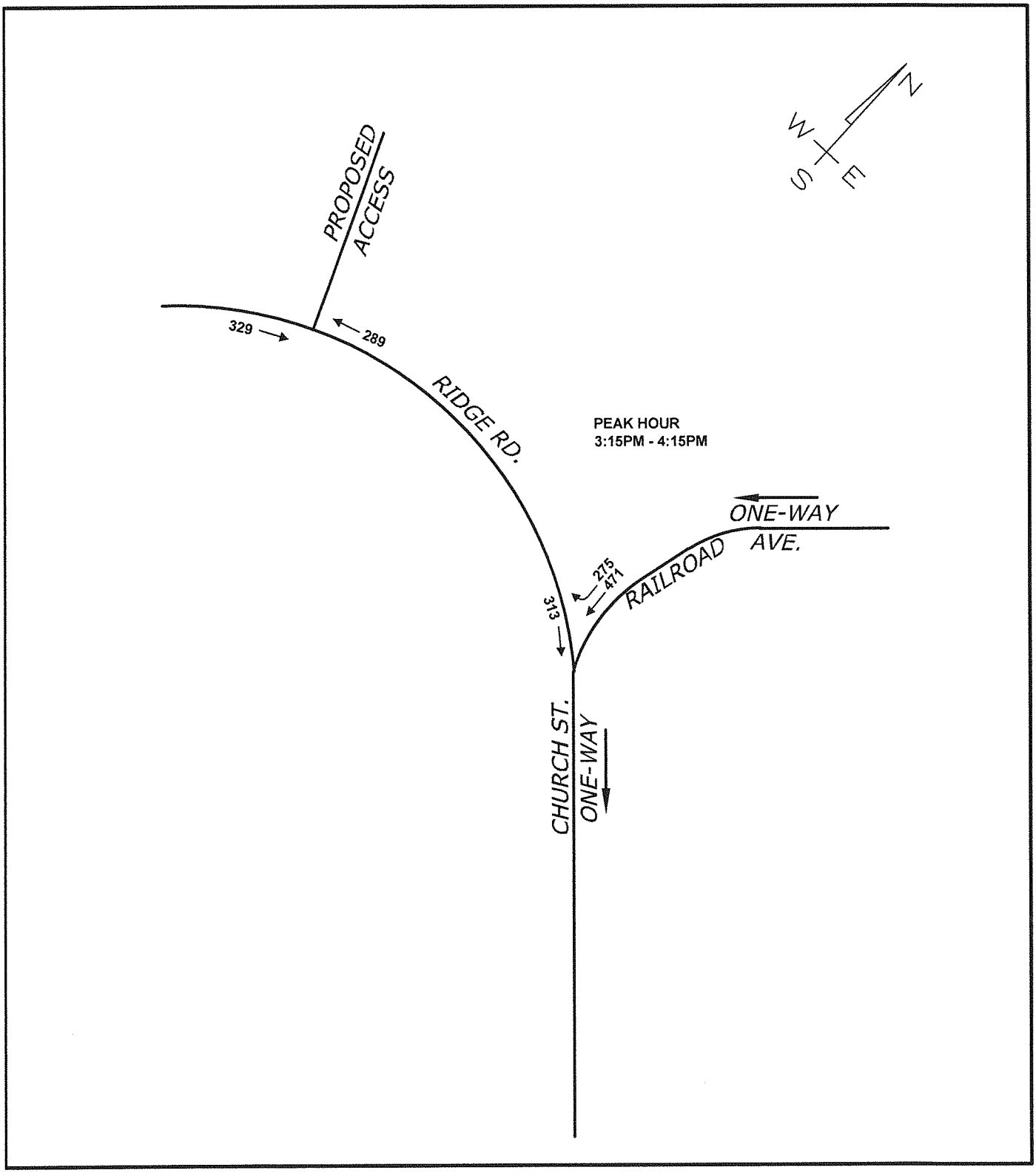
2015 Predevelopment Volumes

Figure No. 3



YORK POLICE STATION, YORK, MAINE

Design:	RED	Scale:	NONE
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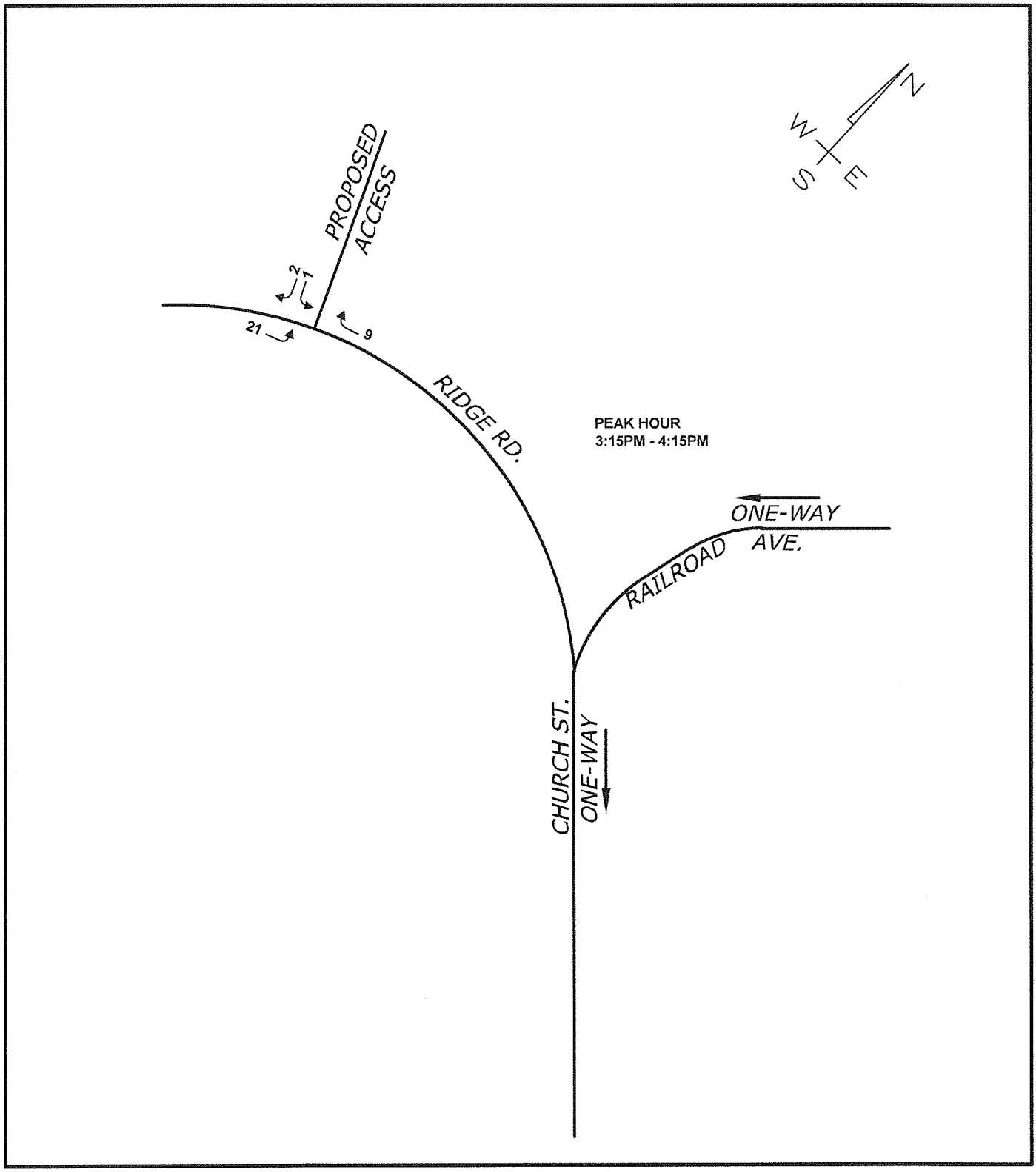
2015 Development Trips -AM Peak Hour

Figure No. 4



YORK POLICE STATION, YORK, MAINE

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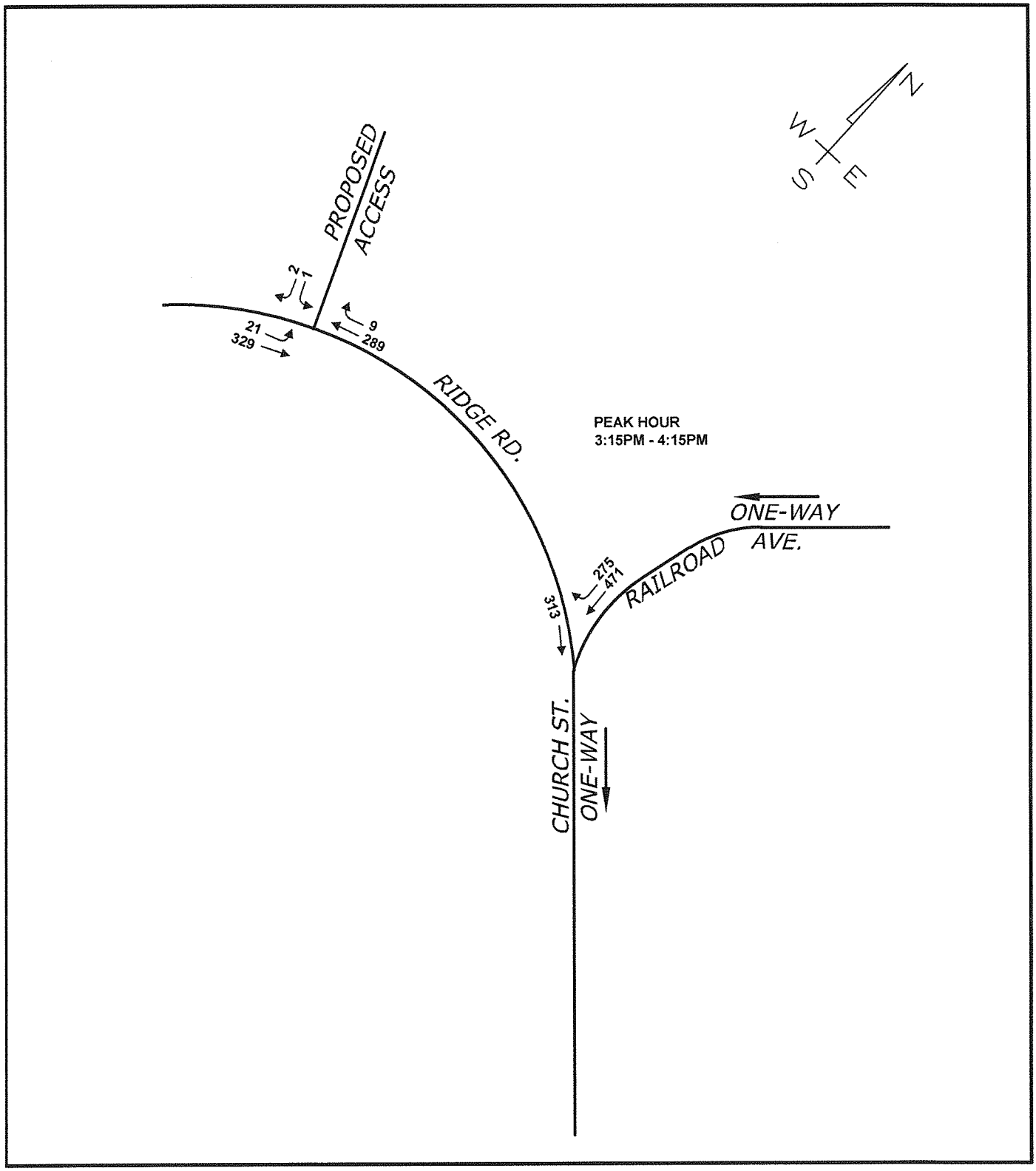
2015 Postdevelopment Volumes

Figure No. 5



YORK POLICE STATION, YORK, MAINE

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HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: TLG
Agency/Co.: Gorrill Palmer
Date Performed: 3/13/2014
Analysis Time Period: Saturday Peak hour
Intersection: Ridge Road and Police Station
Jurisdiction:
Units: U. S. Customary
Analysis Year: 2015
Project ID: 2015 post-development
East/West Street: Ridge Rd
North/South Street: Police station DW
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	21	329			289	9
Peak-Hour Factor, PHF	0.90	0.90			0.90	0.90
Hourly Flow Rate, HFR	23	365			321	10
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes	0	1			1	0
Configuration		LT				TR
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				1	0	2
Peak Hour Factor, PHF				0.90	0.90	0.90
Hourly Flow Rate, HFR				1	0	2
Percent Heavy Vehicles				2	2	2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/		No	/
Lanes				0	1	0
Configuration					LTR	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT						LTR	
v (vph)	23						3	
C(m) (vph)	1228						552	
v/c	0.02						0.01	
95% queue length	0.06						0.02	
Control Delay	8.0						11.6	
LOS	A						B	
Approach Delay							11.6	
Approach LOS							B	

HCS+: Unsignalized Intersections Release 5.6

Phone: Fax:
E-Mail:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: TLG
Agency/Co.: Gorrill Palmer
Date Performed: 3/13/2014
Analysis Time Period: Saturday Peak hour
Intersection: Ridge Road and Police Station
Jurisdiction:
Units: U. S. Customary
Analysis Year: 2015
Project ID: 2015 post-development
East/West Street: Ridge Rd
North/South Street: Police station DW
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1 L	2 T	3 R	4 L	5 T	6 R
Volume	21	329			289	9
Peak-Hour Factor, PHF	0.90	0.90			0.90	0.90
Peak-15 Minute Volume	6	91			80	2
Hourly Flow Rate, HFR	23	365			321	10
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	0	1			1	0
Configuration	LT					TR
Upstream Signal?		No			No	

Minor Street Movements	7 L	8 T	9 R	10 L	11 T	12 R
Volume				1	0	2
Peak Hour Factor, PHF				0.90	0.90	0.90
Peak-15 Minute Volume				0	0	1
Hourly Flow Rate, HFR				1	0	2
Percent Heavy Vehicles				2	2	2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage				/		No /
RT Channelized?						
Lanes				0	1	0
Configuration					LTR	

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:	365	
Shared ln volume, major rt vehicles:	0	
Sat flow rate, major th vehicles:	1700	
Sat flow rate, major rt vehicles:	1700	
Number of major street through lanes:	1	

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)	4.1					7.1	6.5	6.2
t(c,hv)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)	2					2	2	2
t(c,g)			0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade			0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)	0.00					0.70	0.00	0.00
t(c,T): 1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c) 1-stage	4.1					6.4	6.5	6.2
2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)	2.20					3.50	4.00	3.30
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)	2					2	2	2
t(f)	2.2					3.5	4.0	3.3

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)	
Arrival Type	
Effective Green, g (sec)	
Cycle Length, C (sec)	
Rp (from Exhibit 16-11)	
Proportion vehicles arriving on green P	
g(q1)	
g(q2)	
g(q)	

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p		0.000		0.000

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5 Single-Stage Process								
Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
V c,x	331					737	737	326
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process				
	7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s						1500		1500
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows		326
Potential Capacity		715
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		715
Probability of Queue free St.	1.00	1.00
Step 2: LT from Major St.	4	1
Conflicting Flows		331
Potential Capacity		1228
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		1228
Probability of Queue free St.	1.00	0.98
Maj L-Shared Prob Q free St.		0.98
Step 3: TH from Minor St.	8	11
Conflicting Flows		737
Potential Capacity		346
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.98	0.98
Movement Capacity		338
Probability of Queue free St.	1.00	1.00
Step 4: LT from Minor St.	7	10
Conflicting Flows		737
Potential Capacity		386
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	0.98	
Maj. L, Min T Adj. Imp Factor.	0.98	
Cap. Adj. factor due to Impeding mvmnt	0.98	0.98
Movement Capacity		379

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		

Part 2 - Second Stage			
Conflicting Flows			
Potential Capacity			
Pedestrian Impedance Factor			
Cap. Adj. factor due to Impeding mvmnt			
Movement Capacity			
Part 3 - Single Stage			
Conflicting Flows			737
Potential Capacity			346
Pedestrian Impedance Factor		1.00	1.00
Cap. Adj. factor due to Impeding mvmnt		0.98	0.98
Movement Capacity			338
Result for 2 stage process:			
a			
y			
C t			338
Probability of Queue free St.		1.00	1.00
Step 4: LT from Minor St.		7	10
Part 1 - First Stage			
Conflicting Flows			
Potential Capacity			
Pedestrian Impedance Factor			
Cap. Adj. factor due to Impeding mvmnt			
Movement Capacity			
Part 2 - Second Stage			
Conflicting Flows			
Potential Capacity			
Pedestrian Impedance Factor			
Cap. Adj. factor due to Impeding mvmnt			
Movement Capacity			
Part 3 - Single Stage			
Conflicting Flows			737
Potential Capacity			386
Pedestrian Impedance Factor		1.00	1.00
Maj. L, Min T Impedance factor		0.98	
Maj. L, Min T Adj. Imp Factor.		0.98	
Cap. Adj. factor due to Impeding mvmnt		0.98	0.98
Movement Capacity			379
Results for Two-stage process:			
a			
y			
C t			379

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)				1	0	2
Movement Capacity (vph)				379	338	715
Shared Lane Capacity (vph)					552	

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

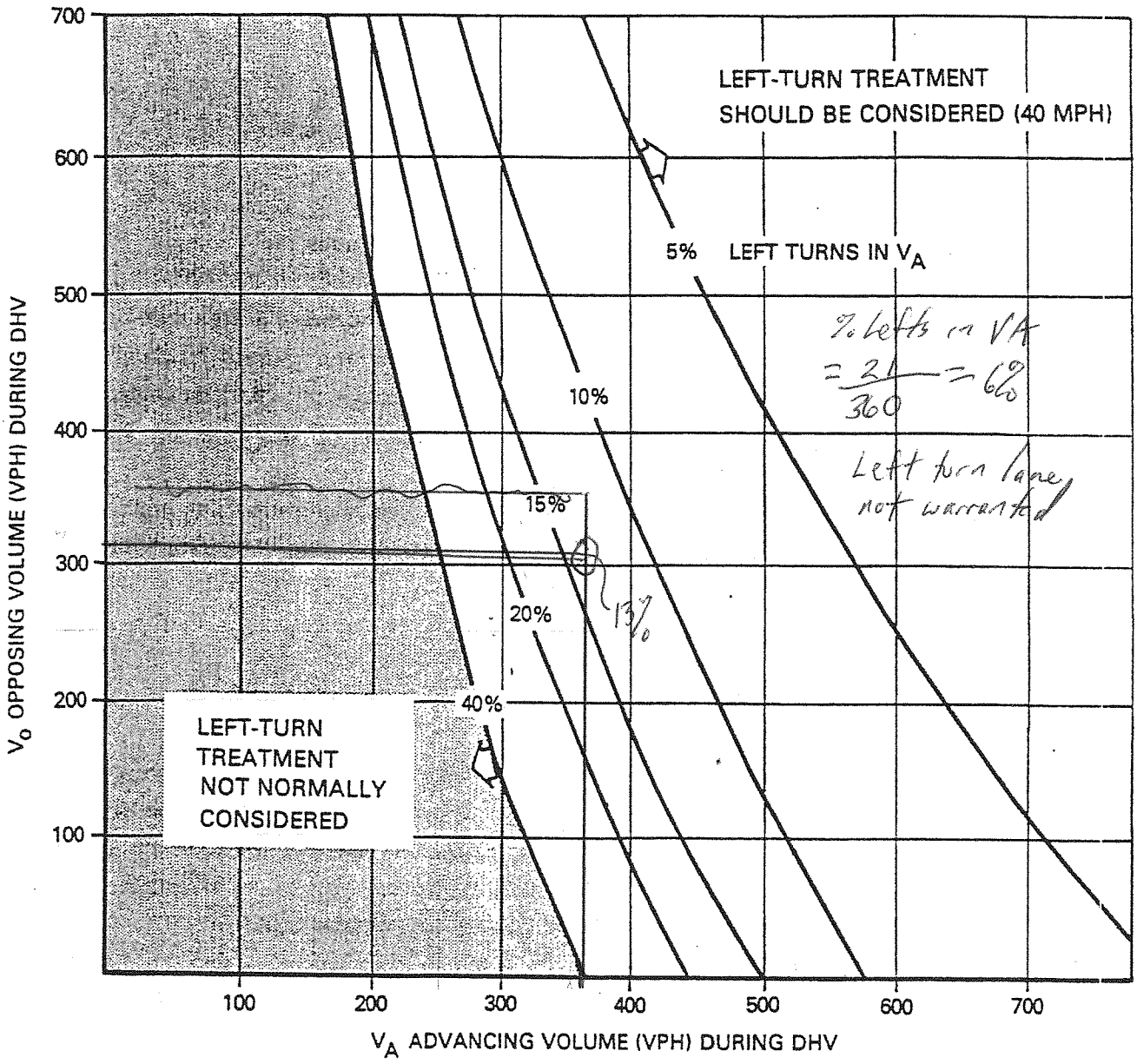
Movement	7 L	8 T	9 R	10 L	11 T	12 R
C sep				379	338	715
Volume				1	0	2
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh					552	
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config	LT						LTR	
v (vph)	23						3	
C(m) (vph)	1228						552	
v/c	0.02						0.01	
95% queue length	0.06						0.02	
Control Delay	8.0						11.6	
LOS	A						B	
Approach Delay							11.6	
Approach LOS							B	

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	0.98	1.00
v(il), Volume for stream 2 or 5	365	
v(i2), Volume for stream 3 or 6	0	
s(il), Saturation flow rate for stream 2 or 5	1700	
s(i2), Saturation flow rate for stream 3 or 6	1700	
P*(oj)	0.98	
d(M,LT), Delay for stream 1 or 4	8.0	
N, Number of major street through lanes	1	
d(rank,1) Delay for stream 2 or 5	0.2	



Instructions:

1. The family of curves represent the percent of left turns in the advancing volume (V_A). The designer should locate the curve for the actual percentage of left turns. When this is not an even increment of 5, the designer should estimate where the curve lies.

2. A. Read V_A and V_O into the chart and locate the intersection of the two volumes.

3. B. Note the location of the point in #2 relative to the line in #1. If the point is to the right of the line, then a left-turn lane is warranted. If the point is to the left of the line, then a left-turn lane is not warranted based on traffic volumes.

VOLUME WARRANTS FOR LEFT-TURN LANES AT UNSIGNALIZED INTERSECTIONS ON 2-LANE HIGHWAYS (40 mph)

Figure 8-19

Maine Department Of Transportation - Traffic Engineering, Crash Records Section

Crash Summary Report

Report Selections and Input Parameters

REPORT SELECTIONS

☑ Crash Summary I ☐ Section Detail ☑ Crash Summary II ☑ 1320 Public ☐ 1320 Private ☐ 1320 Summary

REPORT DESCRIPTION

Ridge Rd

REPORT PARAMETERS

Year 2010, Start Month 1 through Year 2012 End Month: 12

Route: **3170699**	Start Node: **56124**	Start Offset: **0**	☐ **Exclude First Node**
	End Node: **51636**	End Offset: **0**	☑ **Exclude Last Node**

Maine Department Of Transportation - Traffic Engineering, Crash Records Section

Crash Summary I

Nodes

Node	Route - MP	Node Description	U/R	Total Crashes	Injury Crashes K	A	B	C	PD	Percent Injury	Annual M Ent-Veh	Crash Rate	Critical Rate	CRF
56124	3170699 - 0	Int of CHURCH ST RAILROAD AV RIDGE RD	2	0	0	0	0	0	0	0.0	2.465	0.00	0.36	0.00
												Statewide Crash Rate:	0.11	
Study Years:	3.00	**NODE TOTALS:**		0	0	0	0	0	0	0.0	2.465	0.00	0.36	0.00

Crash Summary I

Sections

Start Node	End Node	Element	Offset Begin - End	Route - MP	Section Length	U/R	Total Crashes	Injury Crashes K	A	B	C	PD	Percent Injury	Annual HMVM	Crash Rate	Critical Rate	CRF
51636	56124	3139832	0 - 0.45	3170699 - 0	0.45	2	2	0	0	0	1	1	50.0	0.00591	112.84	313.94	0.00
Int of RIDGE RD	ROGERS RD			RD INV 31 70699											Statewide Crash Rate: 125.44		
Study Years: 3.00				**Section Totals:**	0.45		2	0	0	0	1	1	50.0	0.00591	112.84	313.94	0.36
				Grand Totals:	0.45		2	0	0	0	1	1	50.0	0.00591	112.84	409.90	0.28

Crash Summary

Section Details

Start Node	End Node	Element	Offset Begin - End	Route - MP	Total Crashes	Injury Crashes K	A	B	C	PD	Crash Report	Crash Date	Crash Mile Point	Injury Degree
51636	56124	3139832	0 - 0.45	3170699 - 0	2	0	0	0	1	1	2011-14334	10/28/2011	0.16	C
											2011-10093	09/09/2011	0.43	PD
				Totals:	2	0	0	0	1	1				