Traffic Impact Analysis

Saint Catherine's School

City of Richmond

March 11, 2016

Prepared for:

Saint Catherine's School

Prepared by:

GREEN LIGHT SOLUTIONS

GLS Project #16101

Traffic Impact Analysis

Saint Catherine's School

City of Richmond

March 11, 2016

Prepared for:

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6001 Grove Avenue
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3/11/16

GLS Project #16101

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1. INTRODUCTION

1.1. Purpose and Study Objectives

This report summarizes the findings of the traffic impact analysis conducted for Saint Catherine's School located in the City of Richmond, Virginia. The purpose of this study is to determine the impact to the surrounding roadway network caused by proposed improvements to the existing school.

1.2. Executive Summary

The subject property is located between Grove Avenue and Cary Street to the north and south; Maple Avenue and Saint Catherine's Lane to the east and west, respectively. As part of a proposed capital improvement program for the existing school facility, rezoning of the existing site is required. Where the capital improvement program will not increase student and employee capacity from existing levels, improvements will increase the total number of available parking spaces on the school site. The proposed parking infrastructure will divert existing traffic patterns in and around the existing school site such that a traffic impact analysis is required by the City of Richmond to determine what if any impacts will be expected as a result of the improvements.

The scope of the study was developed based on discussions with the City of Richmond. As part of the scoping discussions, a formal document was provided to the City for review and has been included in the technical appendix of this report. Refer to the scoping documentation in Appendix A.

The proposed parking infrastructure will be constructed along/near the southern property frontage of the existing site and will be provided access via Maple Avenue approximately 200 feet north of the Cary Street intersection. The proposed facility will provide approximately 200 vehicle parking spaces when completed.

It is anticipated that the additional parking spaces to be provided by the capital improvement program will allow for the diversion of existing parking patterns from public parking spaces along Grove Avenue to the new facility to be constructed along Maple Avenue. Once completed, the new facility will add approximately 152 new parking spaces to the existing school site. Under existing conditions, it has been observed that approximately 76 public parking spaces are being utilized along Grove Avenue between Three Chopt Road and Libbie Avenue on a typical weekday during school hours. With the increase in parking spaces to be provided on site, it is anticipated that the existing Grove Avenue parking maneuvers will now divert to the onsite facility allowing for public parking along Grove Avenue and creating new travel patterns during the AM peak hour.

Based on the scoping agreement provided in Appendix A, it was determined that the study area should include the following intersections:

1. Saint Catherine's Lane / Grove Avenue
2. Somerset Avenue / Grove Avenue
3. Maple Avenue / Grove Avenue
4. Maple Avenue / Linden Lane
5. Maple Avenue / Cary Street

Based on analysis of the study area for this site, improvements to the surrounding roadway infrastructure will be needed to accommodate existing operational deficiencies and improve overall safety conditions for existing pedestrian points of access to the existing site.

Analysis of existing (2016), background (2019) and total future (2019) traffic conditions indicates that the following improvements should be considered:

- Installation of a traffic signal at the intersection of Maple Avenue and Grove Avenue (based on existing traffic conditions).
- Installation of a High Intensity Activated Cross Walk (HAWK) signal equally spaced between Saint Catherine's Lane and Somerset Avenue.
- Construction of a pedestrian safety island on the southeast and southwest corners of the Maple Avenue and Linden Lane intersection.

Based on discussions and information provided by the City, existing traffic conditions at the intersection of Maple Avenue and Grove Avenue warrant installation of a traffic signal. Additionally, analysis of existing (2016) and background (2019) AM peak hour traffic conditions indicates that side street levels of service are at failing levels under stopped controlled operation. With the increase in side street traffic conditions and ongoing school travel patterns utilizing the existing Linden Lane connection between Maple Avenue and Libbie Avenue, this improvement is expected to improve side street operations of existing and future traffic operations at the subject intersection. Additionally, the improved operations is expected to divert existing school travel patterns away from Linden Lane and Somerset Avenue by allowing signalized side street movements on Grove Avenue.

Analysis indicates that under existing conditions the warrant for installation of a HAWK signal is justified along the Grove Avenue corridor. Under existing conditions a cross walk guard is stationed at the Somerset Avenue and Grove Avenue intersection allowing for the safe traverse of the Grove Avenue corridor during the most heavily travelled times of the day. However, with the interaction between both the Saint Catherine's and Saint Christopher's schools throughout a typical weekday, it is recommended to install a permanent signalized cross walk operation that will stop mainline traffic and provide better operational control by coordinating movements with up and down stream traffic signals.

2. BACKGROUND INFORMATION

The subject property is located between Grove Avenue and Cary Street to the north and south; Maple Avenue and Saint Catherine's Lane to the east and west, respectively. Refer to Figure 1 for a site location map. Refer to Figure 2 for the Conceptual Plan detailing existing and future infrastructure improvements.

2.1. Existing Land Uses and Zoning

The existing land uses in the generalized study area are a mix of residential uses along property frontages of the existing site. Saint Bridget's School is located north of Grove Avenue to the northeast of the site. Commercial uses along the Grove Avenue Corridor are located to the east of the site.

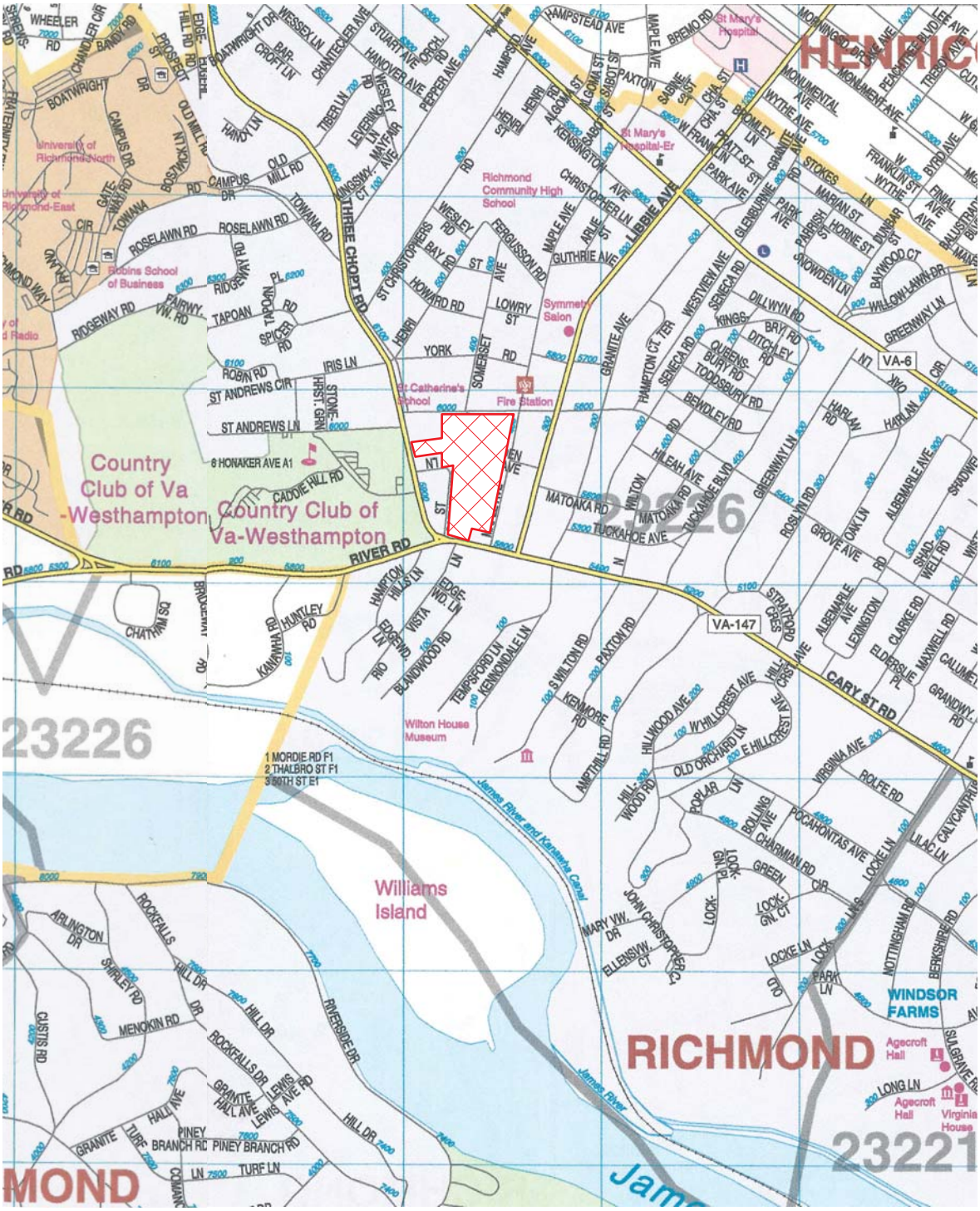
2.2. Existing Network Roadways

Direct access to the site is provided at ten points of full/partial access along Saint Catherine's Lane (three points of access), Grove Avenue (four points of access), and Maple Avenue (three points of access). It is proposed to provide two points of access once the parking infrastructure is constructed. The two points of access will replace one point of existing access. Therefore, under future buildout traffic conditions there will be eleven points of access to the surrounding roadway infrastructure.

Regional access to the site is provided by Grove Avenue, Three Chopt Road, and Cary Street. These facilities either provide direct access to the site or provide indirect access by way of the surrounding roadway infrastructure. The following facilities constitute the study area for this project:

Grove Avenue is a four lane undivided minor arterial that provides an east/west corridor west of the City of Richmond. Grove Avenue has a 25mph posted speed limit within the study area for this project and allows on street parking along the frontage of the site. According to the most recent average daily traffic count data (2014), Grove Avenue carries approximately 9,400 vehicles per day (vpd) between Three Chopt Road (west) and Libbie Avenue (east). This facility provides direct access to the site and carries significant pedestrian activity between Saint Catherine's (south of Grove) and Saint Christopher's (north of Grove on Somerset).

Cary Street is a two lane undivided minor arterial that provides a regional east/west parallel roadway to Grove Avenue. Cary Street has a 35mph posted speed limit within the study area for this project and provides an eastbound auxiliary lane (left turn lane during peak travel times) in proximity to the Maple Avenue intersection. According to the most recent average daily traffic count data (2014), Cary Street carries approximately 20,000vpd between Three Chopt Road (west) and Libbie Avenue (east).



LEGEND

Generalized Site Location

GREEN LIGHT SOLUTIONS, INC.	Saint Catherine's School	FIGURE 1
	Site Location	GLS Project #16101
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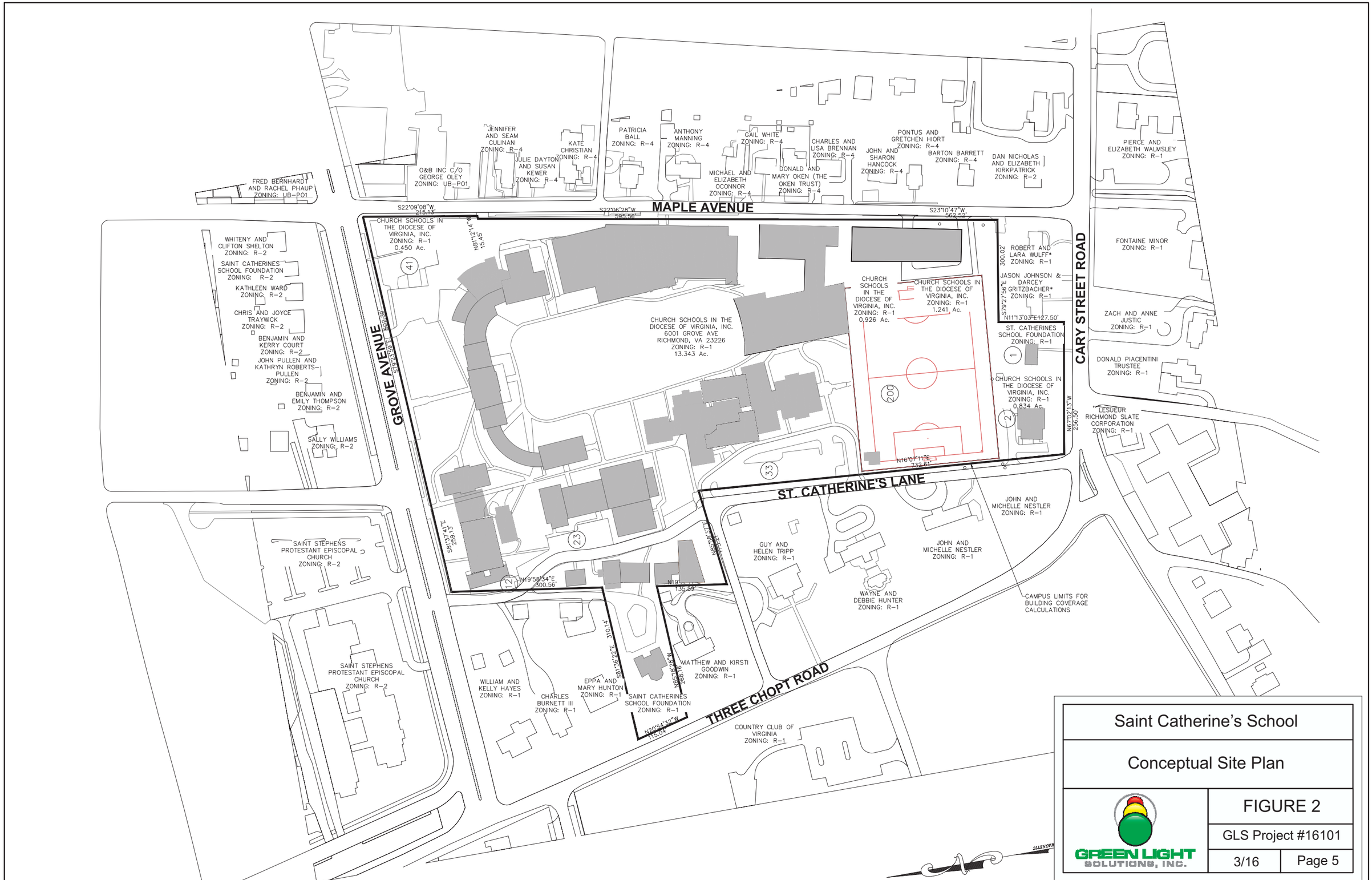

Saint Catherine's School

Conceptual Site Plan

GREEN LIGHT SOLUTIONS, INC.

FIGURE 2

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Maple Avenue is a two lane undivided minor arterial that provides a primary local parallel facility to Libbie Avenue. Maple Avenue has a 25mph posted speed limit within the study area for this project. Maple Avenue provides direct access to the school and residential units along its frontage. The existing cross section provides a 22 foot pavement width with curb and gutter along the majority of the corridor between Cary Street and Grove Avenue. Parking spaces are provided for the residential units along the northbound frontage of the roadway. Parking is restricted from Grove Avenue along the southbound frontage of the roadway up to approximately 250 feet north of the Cary Street intersection. A pedestrian facility (sidewalk) is provided along the southbound frontage of the roadway for approximately 740 feet south of the Grove Avenue intersection.

Saint Catherine's Lane is a two lane undivided urban local road that provides a north/south and east/west public facility between Cary Street and Three Chopt Road. The facility provides access to a north/south private facility between its turn west to Three Chopt Road and Grove Street to the north. Access to the site is provided along both the public section of the roadway and the private section of the roadway.

Linden Lane is a two lane undivided urban local road that provides a connection between Maple Avenue and Libbie Avenue. This connection provides access to several residential units along its corridor. The school provides a point of egress and forms the eastbound approach at the intersection of Maple Avenue and Linden Lane. This point of egress prohibits through movements onto Linden Lane via existing signage. However, due to traffic conditions at the intersection of Maple Avenue and Grove Avenue, traffic exiting the school utilizes this facility to access the Libbie Avenue corridor.

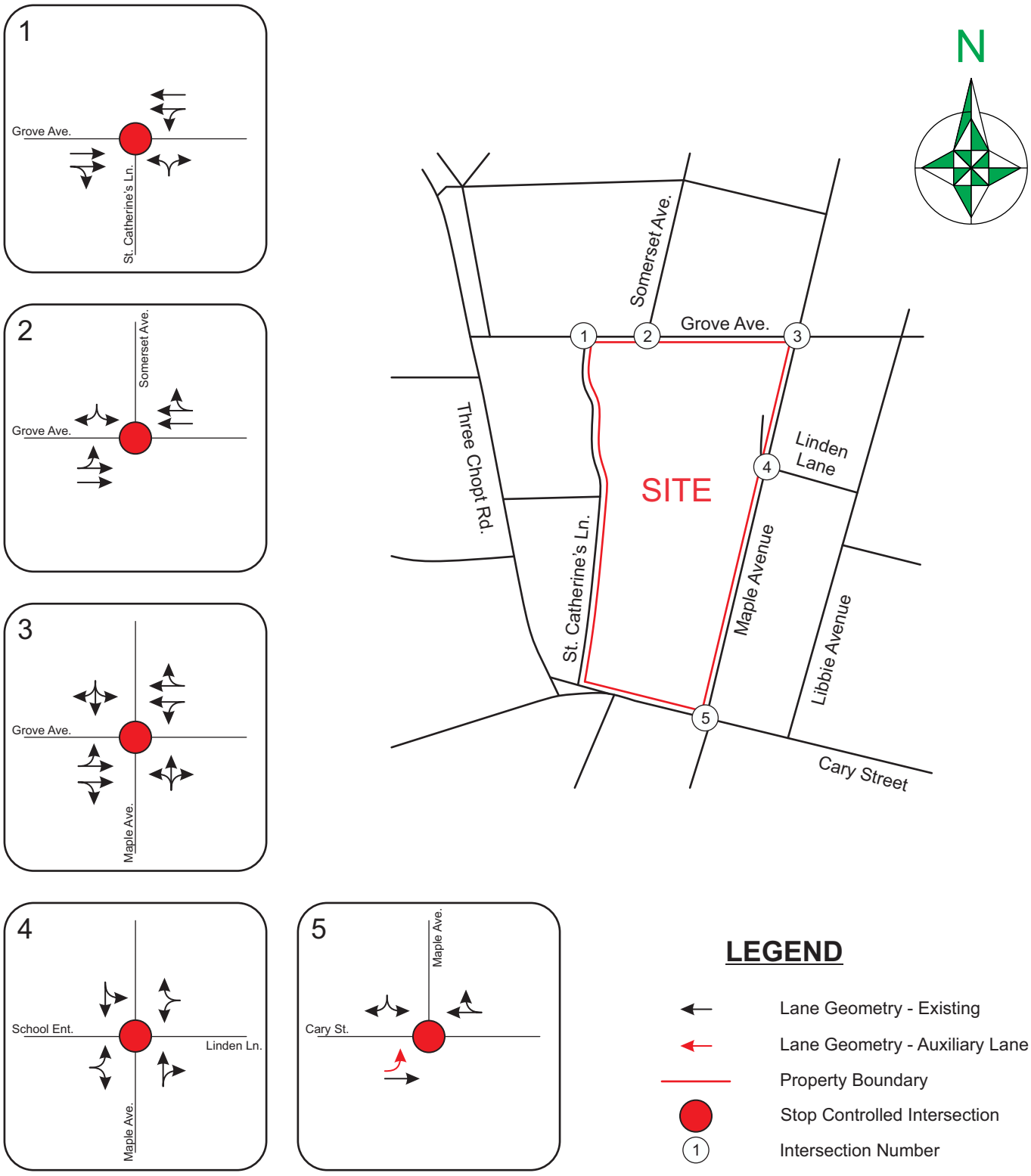
Existing lane configurations (number of traffic lanes on the intersection approaches), storage lane lengths, and other intersection and roadway information within the study area was collected through field reconnaissance and are shown on Figure 3.

2.3. Other Modes of Transportation

Pedestrian Facilities – Currently sidewalks are provided along Grove Avenue in the east and westbound directions with pedestrian crossings at Somerset Avenue and Maple Avenue. Sidewalks are also provided along Maple Avenue on the southbound direction for approximately 740 feet.

Bicycle Facilities – Currently none of the study area corridors have designated bicycle facilities. The City has identified Grove Avenue as a priority in making a safer route for bicyclists that utilize this corridor.

Transit Facilities – The Greater Richmond Transit Company (GRTC) operates one route (#16 – Grove) along Grove Avenue with a stops near the school facility.



GREEN LIGHT SOLUTIONS, INC.	Saint Catherine's School	FIGURE 3
	Existing Lane Configurations	GLS Project #16101
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2.4. Geographic Scope and Limits of the Study Area

Based on the scoping agreement provided in Appendix A, it was determined that the study area should include the following intersections/interchanges:

1. Saint Catherine's Lane / Grove Avenue
2. Somerset Avenue / Grove Avenue
3. Maple Avenue / Grove Avenue
4. Maple Avenue / Linden Lane
5. Maple Avenue / Cary Street

2.5. Scenario Scope

Based on the pre-scope of work meeting, the following scenarios were identified to be studied with this report:

- Existing 2016 Peak Hour Traffic Conditions
- Background 2019 Peak Hour Traffic Conditions
- Total Future 2019 Peak Hour Traffic Conditions

2.6. Traffic Analysis Procedure

The study intersections were analyzed for each scenario using the 2010 Highway Capacity Manual (HCM) methodologies using the computer software package Synchro 9 with SimTraffic. The analysis uses capacity, Level of Service, control delay, and queuing as the criteria for the performance of the intersections.

Capacity as defined by the HCM, is a measure of the maximum number of vehicles in an hour that can travel through an intersection or section of roadway under typical conditions. Level of Service (LOS) is a marker of the driving conditions and perception of drivers while traveling during the given time period. LOS ranges from LOS "A" which represents free flow conditions, to LOS "F" which represents breakdown conditions. Table 1 shows the LOS for intersections as defined by the HCM.

TABLE 1
HCM Level of Service Criteria

Unsignalized Intersections		Signalized Intersections	
Level of Service	Average Control Delay (sec/veh)	Level of Service	Average Control Delay (sec/veh)
A	≤ 10	A	≤ 10
B	> 10-15	B	> 10-20
C	> 15-25	C	> 20-35
D	> 25-35	D	> 35-55
E	> 35-50	E	> 55-80
F	≥ 50	F	≥ 80

Control delay is a measure of the total amount of delay experienced by an individual vehicle and includes delay related to deceleration, queue delay, stopped delay, and acceleration. Table 1 shows the amount of control delay (in seconds per vehicle) that corresponds to the LOS for signalized and unsignalized intersections.

The reported queues, or linear distance of delayed vehicles, in this study are 95th percentile queues as reported by SimTraffic after 10 runs of 60 minutes each with a 15 minute seeding time. A 15 minute seeding time was used to ensure vehicles could travel entirely through the network. The queues are reported to ensure that the storage lengths of lanes at intersection are of adequate length and that queued vehicles will not interfere with free flow vehicles or adjacent intersections.

2.7. Traffic Analysis Software Inputs

Signal timing data for existing intersections was obtained from VDOT and field reconnaissance. All traffic scenarios were analyzed using existing peak hour factors. All scenarios were analyzed with a 2% heavy vehicle percentage.

3. EXISTING 2016 TRAFFIC CONDITIONS

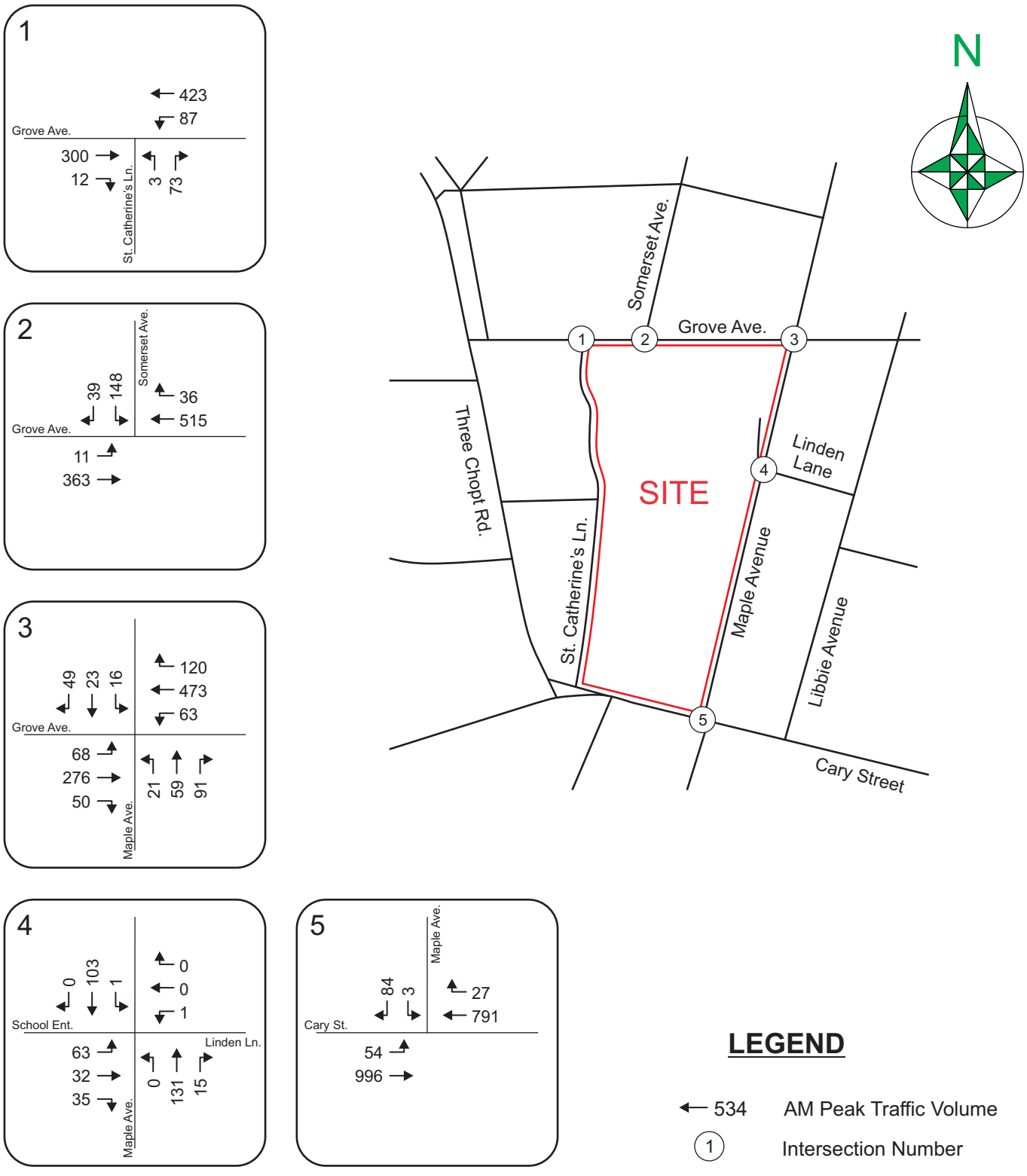
3.1. Existing Peak Hour Traffic Counts

In accordance with the scoping agreement, existing peak hour turning movement traffic counts were conducted by GLS for the AM Peak hour on a typical weekday (Tuesday, Wednesday, Thursday) between 2/3/16 to 2/23/16. Refer to Appendix B for the raw traffic count data used to determine existing 2016 peak hour traffic conditions. Refer to Figure 4 for the existing 2016 AM peak hour traffic conditions used to establish the base traffic conditions for this analysis.

3.2. Analysis of Existing 2016 AM Peak Hour Traffic Conditions

The analysis of existing peak hour traffic conditions was based on the analysis procedures described previously, the existing lane geometries (Figure 3), traffic control (Figure 3), and existing peak hour traffic conditions (Figure 4).

The analysis worksheets are included in Appendix C and the results of the analysis are summarized in Table 2.



GREEN LIGHT SOLUTIONS, INC.	Saint Catherine's School	FIGURE 4
	Existing (2016) AM Peak Hour Traffic Conditions	GLS Project #16101
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TABLE 2
Analysis Summary
Existing 2016 Peak Hour Traffic Conditions

	Intersection	Control	Lane Group	Available Storage[1]	AM Peak Hour Lane LOS	Lane Delay (sec/veh)[2]	Lane Delay (sec/veh)[3]	Lane Queue (ft)[4]
1.	Saint Catherine's Lane (N/S) and Grove Avenue (E/W)	Stop	WBLT	-	A	3.9	6.3/2.6	113
			NBLR	-	B	11.4	17.9/7.3	90
2.	Somerset Avenue (N/S) and Grove Avenue (E/W)	Cross Walk Guard (signal)[5]	EBLTT	-	C	28.7	47.2/24.1	218
			WBTTR	-	C	31.9	30.3/22.4	363
			SBLR	-	D	40.8	40.2/36.5	353
		Overall Intersection			C	32.7	29.9	
3.	Maple Avenue (N/S) and Grove Avenue (E/W)		EBLT	-	A	4.2	11.3/2.4	88
			WBLT	-	A	2.4	6.1/2.1	114
		Stop	NBLTR	-	F	280.6	127.2/99.6/115.6	517
		Stop	SBLTR	-	F	Error	57.1/51.1/25.5	134
4.	Maple Avenue (N/S) and Linden Lane / School Entrance (E/W)	Stop	EBLTR	-	B	10.4	32.7/25.4/24.0	214
		Stop	WBLR	-	A	8.5	4.7/0.0	20
		Stop	NBTR	-	A	9.7	46.1/30.8	320
		Stop	SBLT	-	A	9.4	6.6/6.5	52
5.	Maple Avenue (N/S) and Cary Street (E/W)		EBL	-	A	9.9	8.9/1.8	93
		Stop	SBLR	-	D	27.2	55.8/19.7	122

NOTES
(1) Indicates continuous lane.
(2) Indicates Synchro Lane Delay.
(3) Indicates SimTraffic Lane Delay.
(4) Queues are average 95th percentile queues as reported by SimTraffic.
(5) Analyzed as signalized control / Unsignalized intersection.

As shown in Table 2, all study area intersection are operating at acceptable overall intersection levels of service for the AM peak hour. However, the following movements/approaches are experiencing operational issues:

- Shared northbound left/through/right at the intersection of Maple Avenue and Grove Avenue
- Shared southbound left/through/right at the intersection of Maple Avenue and Grove Avenue

4. BACKGROUND 2019 TRAFFIC CONDITIONS

In order to analyze future traffic conditions background traffic conditions were forecasted based on the existing traffic counts and historic traffic growth.

4.1. Background Traffic Growth

In order to account for development outside of the study area, background traffic growth rates were estimated for each of the roadways in the study area based on historic traffic counts as discussed in the Scoping meeting. Data indicates that a traffic growth of 0.5% annual growth is expected within the study area for this project. Based on discussions with local jurisdiction, a 0.5% annual growth rate was applied to all existing traffic counts for all projected horizon analysis years analyzed in this study.

4.2. Background 2019 Peak Hour Traffic Conditions

Existing 2016 peak hour traffic conditions shown in Figure 4 have been projected to 2019 based on the agreed upon 0.5% annual growth rate. Refer to Figure 5 for the background 2019 peak hour traffic conditions.

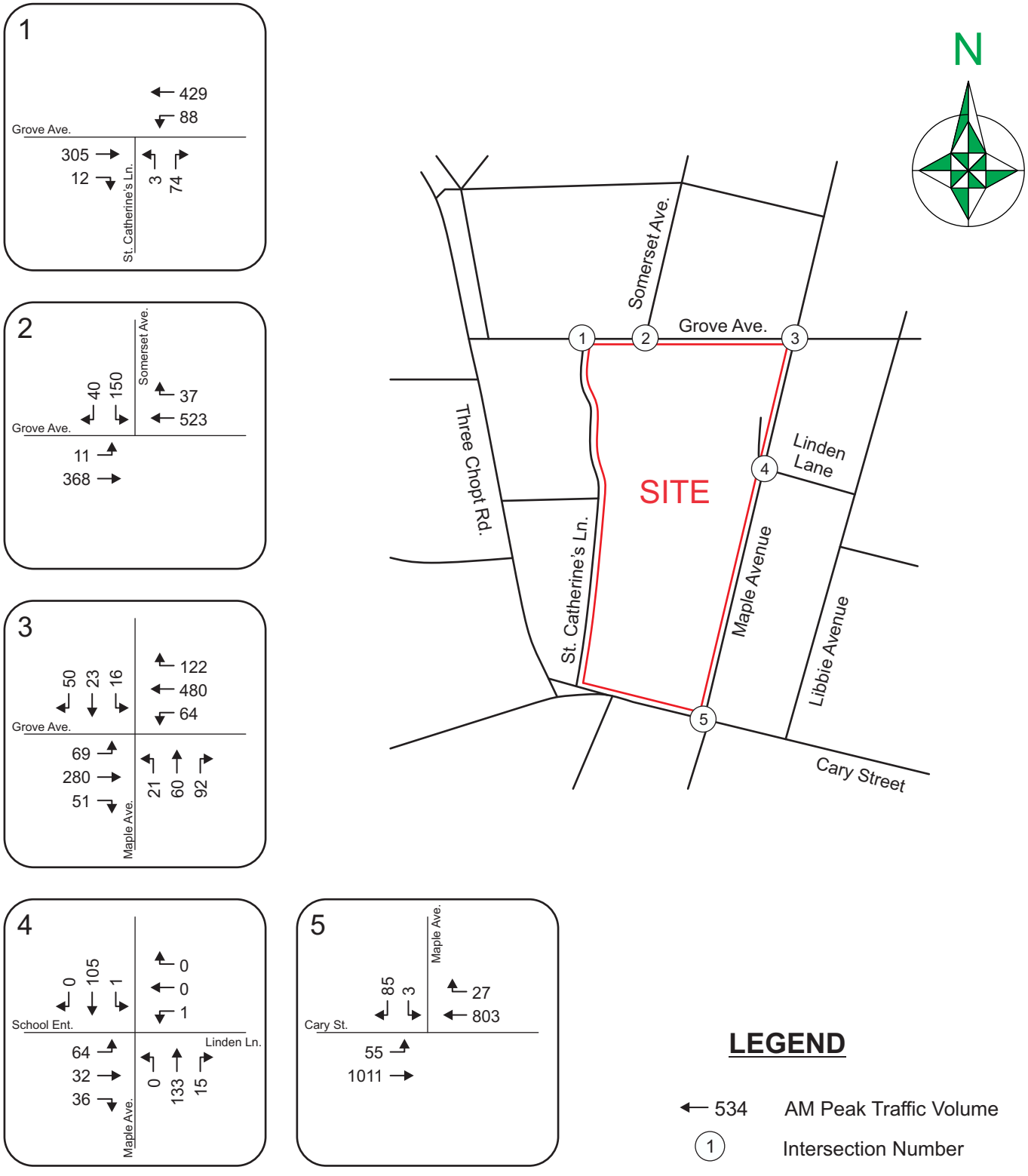
4.3. Analysis of Total Background 2019 Peak Hour Traffic Conditions

The analysis of background peak hour traffic conditions was based on the analysis procedures described previously, the existing lane geometries (Figure 3), traffic control (Figure 3), and background peak hour traffic conditions (Figure 5).

The analysis worksheets are included in Appendix D and the results of the analysis are summarized in Table 3.

As shown in Table 3, all study area intersections are operating at acceptable overall intersection levels of service for both the AM peak hour except for the following movements/approaches that are experiencing operational issues:

- Shared northbound left/through/right at the intersection of Maple Avenue and Grove Avenue
- Shared southbound left/through/right at the intersection of Maple Avenue and Grove Avenue



GREEN LIGHT SOLUTIONS, INC.	Saint Catherine's School	FIGURE 5
	Background (2019) AM Peak Hour Traffic Conditions	GLS Project #16101
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TABLE 3
Analysis Summary
Background 2019 Peak Hour Traffic Conditions

	Intersection	Control	Lane Group	Available Storage[1]	AM Peak Hour Lane LOS	Lane Delay (sec/veh)[2]	Lane Delay (sec/veh)[3]	Lane Queue (ft)[4]
1.	Saint Catherine's Lane (N/S) and Grove Avenue (E/W)	Stop	WBLT	-	A	3.9	6.5/2.6	114
			NBLR	-	B	11.5	23.0/7.5	104
2.	Somerset Avenue (N/S) and Grove Avenue (E/W)	Cross Walk Guard (signal)[5]	EBLTT	-	C	28.8	46.2/24.0	222
			WBTTR	-	C	32.1	31.0/23.3	371
			SBLR	-	D	41.0	39.6/36.6	367
		Overall Intersection			C	32.9	30.1	
3.	Maple Avenue (N/S) and Grove Avenue (E/W)		EBLT	-	A	4.3	10.6/2.4	87
			WBLT	-	A	2.4	6.1/2.0	112
		Stop	NBLTR	-	F	316.0	139.9/100.7/129.1	539
		Stop	SBLTR	-	F	Error	47.3/47.7/27.3	486
4.	Maple Avenue (N/S) and Linden Lane / School Entrance (E/W)	Stop	EBLTR	-	B	10.5	29.3/26.9/24.3	214
		Stop	WBLR	-	A	8.5	4.6/0.0	22
		Stop	NBTR	-	A	9.8	42.4/39.8	300
		Stop	SBLT	-	A	9.4	7.1/6.4	49
5.	Maple Avenue (N/S) and Cary Street (E/W)		EBL	-	B	10.0	8.8	136
		Stop	SBLR	-	D	28.3	80.9/24.8	165

NOTES
(1) Indicates continuous lane.
(2) Indicates Synchro Lane Delay.
(3) Indicates SimTraffic Lane Delay.
(4) Queues are average 95th percentile queues as reported by SimTraffic.
(5) Analyzed as signalized control / Unsignalized intersection.

5. SITE TRAFFIC CONDITIONS

As part of the proposed capital improvement program for the existing school facility, parking infrastructure is planned to be constructed in the southern portion of the school property with access via Maple Avenue. The parking facility will provide a minimum of 200 parking spaces. Once completed the existing school site will have an additional 152 minimum new parking spaces on site.

It is anticipated that the users of the new parking spaces will be faculty/employees that currently park in public parking spaces along Grove Avenue between Three Chopt Road and Libbie Avenue. Based on field observations, there are approximately 76 vehicles parked during the AM peak hour on Grove Avenue. For this study it is assumed that these vehicles will be diverted from Grove Avenue to the new parking facility to be located on Maple Avenue.

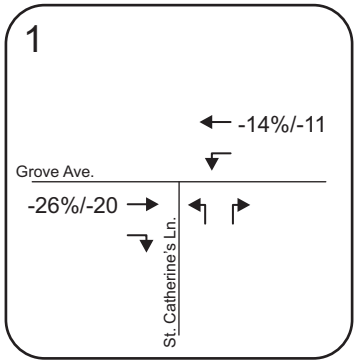
Existing Grove Avenue parking trips have been reassigned based on prevailing flow of traffic conditions along Grove Avenue. With the change in location of the parking spaces, 80% of the diverted trips have been reassigned to Cary Street since this facility is located closer to the entrance of the parking facility on Maple Avenue. Splits have been assumed to be 50% from the east and west on both Grove Avenue and Cary Street. Refer to Figure 6 for the diverted AM peak hour site trips.

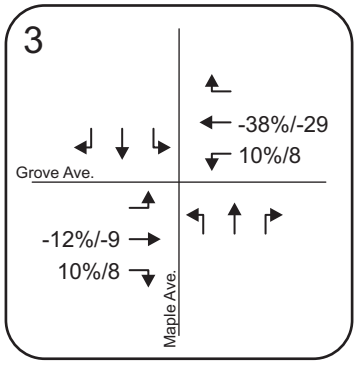
6. TOTAL FUTURE 2019 TRAFFIC CONDITIONS

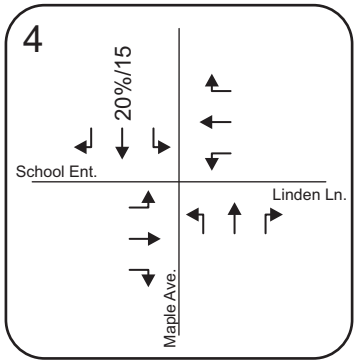
6.1. Grove Avenue Pedestrian Crossing Analysis

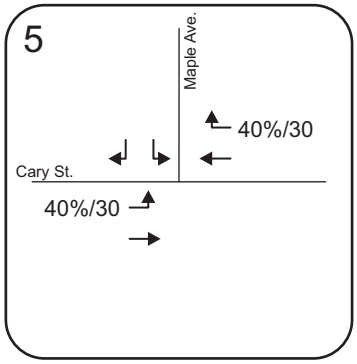
Based on field observations, it has been determined that approximately 127 pedestrians cross Grove Avenue during the AM peak hour on a typical weekday with school in session. Under existing conditions, 97 percent of pedestrian crossings take place at the marked crossing located at the Somerset Avenue and Grove Avenue intersection. Additionally, 81 percent of the crossing take place during the 7:30 AM to 8:00 AM time period. Under existing conditions, this crossing is manned by a crossing guard allowing for protected movements across Grove Avenue from 7:30 AM to 8:00 AM. Based on conversations with the City and school officials, this crossing is utilized throughout the day by students from both Saint Catherine's and Saint Christopher's.

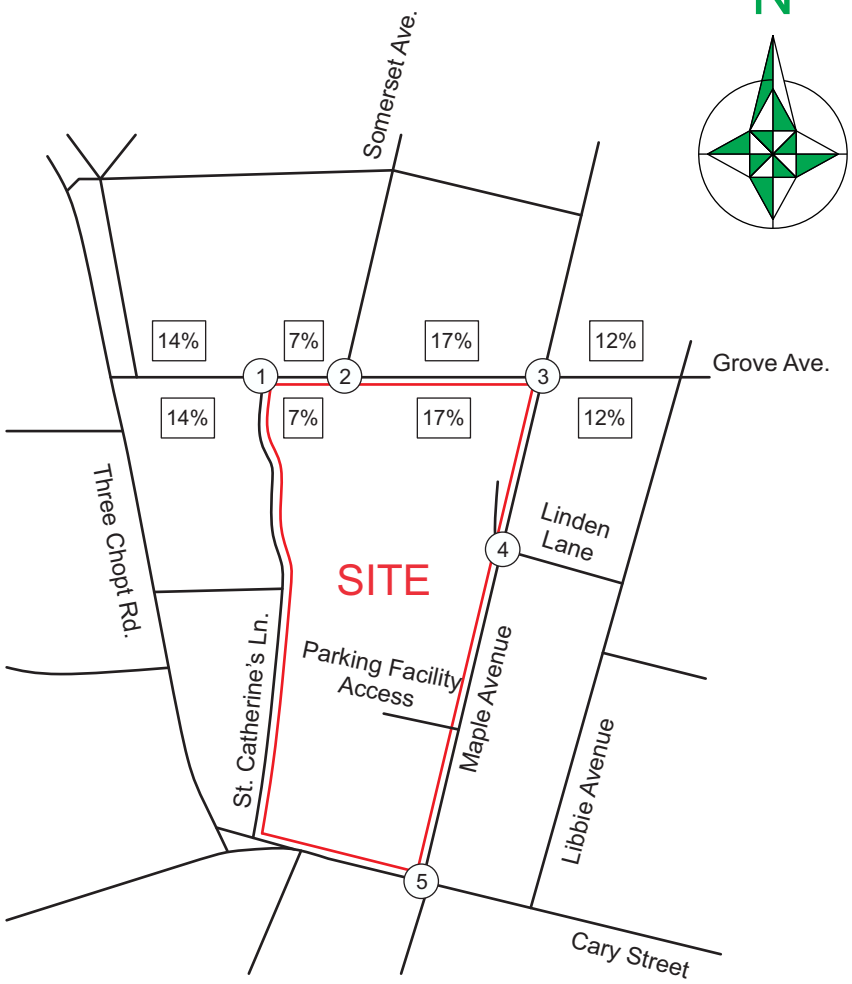
With the significant peak hour pedestrian traffic, the daily pedestrian activity between the schools, and the moderately traveled four lane cross section of Grove Avenue, a warrant analysis has been conducted to determine if a signalized controlled crossing would be warranted under existing conditions. Analysis indicates that a High Intensity Actuated Cross Walk (HAWK) Signal is warranted under existing conditions and will continue to be warranted under future traffic conditions. Refer to Appendix E for the warrant analysis results.











NOTE: 76 total parked vehicles between Three Chopt Road and Libbie Avenue.

LEGEND

- ← 55%/55 — Diversion Percentage/AM Peak Site Trips
- (1) — Intersection Number
- Generalized Site Location
- 7% — Percentage of Diverted Trips

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Saint Catherine's School		FIGURE 6
Diverted AM Peak Hour Site Trips		GLS Project #16101
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6.2. Diverted Background Traffic Conditions

With the installation of a HAWK signal on the Grove Avenue Corridor and the installation of a traffic signal at the intersection of Maple Avenue and Grove Avenue, traffic is expected to divert from its existing routing to better utilize the future improvements. Three movements in particular are expected to divert to the future traffic signal at Maple Avenue and Grove Avenue.

With the warrant for a HAWK signal being met, the installation will be located between Somerset Avenue and Saint Catherine's Lane. This will end the ability of southbound left turn movements at the intersection of Somerset Avenue and Grove Avenue to maneuver onto Grove Avenue under protected movements (cross guard). Therefore, it is the assumption of this report that a significant number (80%) of these movements will potentially reroute the southbound left turn movements from Somerset Avenue to Maple Avenue so that they can utilize the protected movements at the proposed signal operation.

Additionally, with the installation of a traffic signal at the intersection of Maple Avenue and Grove Avenue it is anticipated that existing traffic exiting the school at the intersection of Maple Avenue and Linden Lane will be incentivized to continue north on Maple Avenue and utilize the signalized control to complete their daily trip to and from the school. For this study is has been assumed that 100% of the eastbound through movements and northbound right turn movements at the intersection of Maple Avenue and Linden Lane will reroute to the Maple Avenue and Grove Avenue intersection.

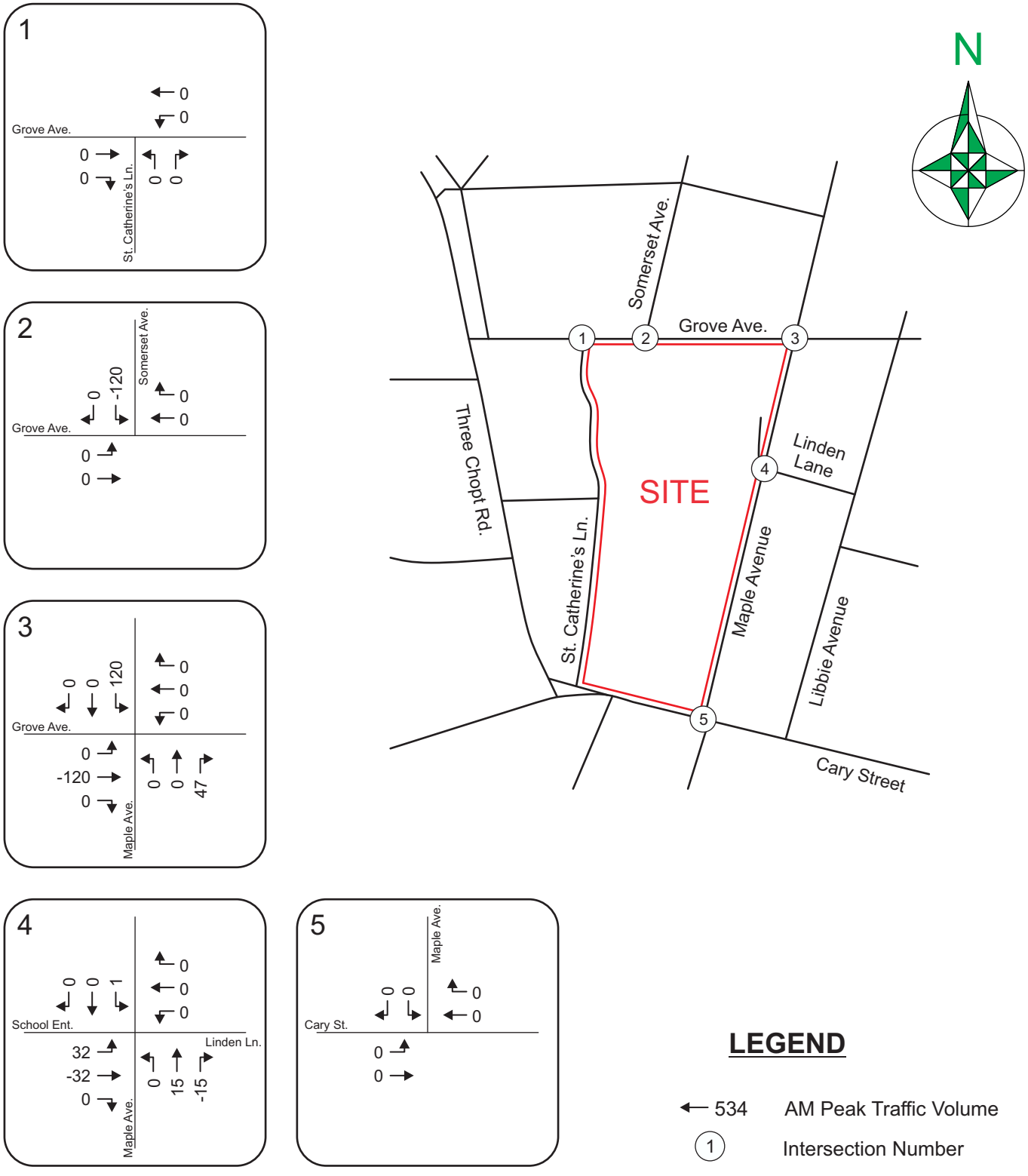
For this analysis, traffic diversions have been assumed to take place and create a 'worst' case traffic operation for the proposed signalized operation at Maple Avenue and Grove Avenue. By routing traffic to this intersection the total future traffic conditions analysis should determine if the intersection under signalized operation is expected to have the capacity to handle the increased traffic volumes. Refer to Figure 7 for the diverted background AM peak hour traffic conditions.

Background 2019 AM peak hour traffic conditions shown in Figure 5 have been combined with diverted AM peak hour site trips in Figure 6 and the diverted background AM peak hour traffic conditions in Figure 7. Refer to Figure 8 for the total future 2019 AM peak hour traffic conditions.

6.3. Analysis of Total Future 2019 AM Peak Hour Traffic Conditions

The analysis of total future 2019 AM peak hour traffic conditions was based on the analysis procedures described previously, the existing lane geometries (Figure 3) and total future 2019 AM peak hour traffic conditions (Figure 7).

The analysis worksheets are included in Appendix F and the results of the analysis are summarized in Table 4.



GREEN LIGHT SOLUTIONS, INC.	Saint Catherine's School	FIGURE 7
	Diverted Background AM Peak Hour Traffic Conditions	GLS Project #16101
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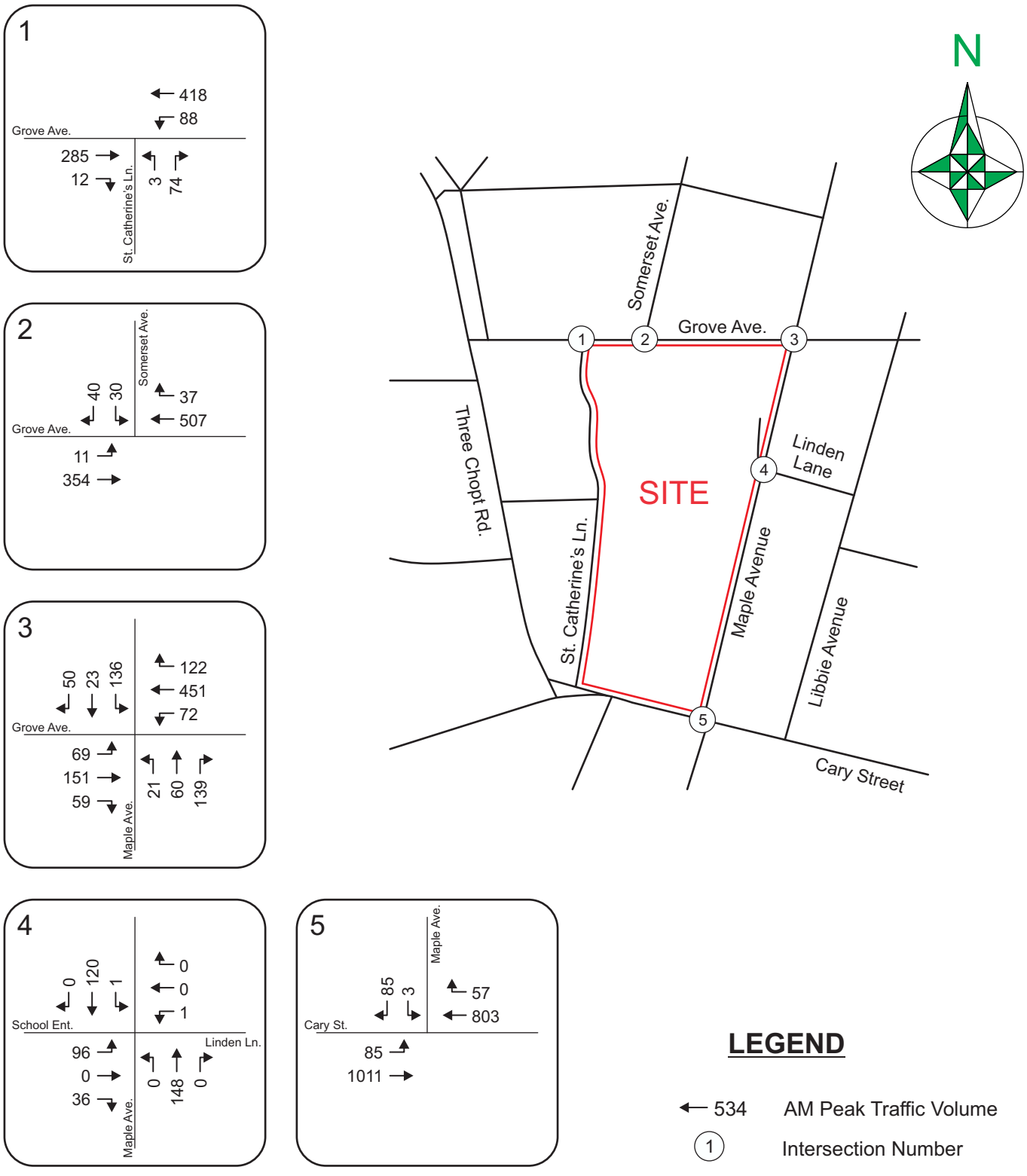

GREEN LIGHT SOLUTIONS, INC.	Saint Catherine's School	FIGURE 8
	Total Future (2019) AM Peak Hour Traffic Conditions	GLS Project #16101
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TABLE 4
Analysis Summary
Total Future 2019 Peak Hour Traffic Conditions

	Intersection	Control	Lane Group	Available Storage[1]	AM Peak Hour Lane LOS	Lane Delay (sec/veh)[2]	Lane Delay (sec/veh)[3]	Lane Queue (ft)[4]
1.	Saint Catherine's Lane (N/S) and Grove Avenue (E/W)	Stop	WBLT	-	A	3.9	4.0/0.8	72
			NBLR	-	B	11.6	13.5/4.6	70
2.	Somerset Avenue (N/S) and Grove Avenue (E/W)	Stop	EBLTT	-	A	0.8	7.6/0.4	48
			SBLR	-	B	13.9	16.8/8.8	82
3.	Maple Avenue (N/S) and Grove Avenue (E/W)	Signal	EBLT	-	C	25.3	55.6/16.0	186
			WBLT	-	D	44.7	45.9/36.3	375
			NBLTR	-	D	54.6	57.2/32.6/40.1	364
			SBLTR	-	E	56.7	49.2/51.4/39.2	277
			Overall Intersection		D	44.1	33.7	
4.	Maple Avenue (N/S) and Linden Lane / School Entrance (E/W)	Stop	EBLR	-	B	10.8	8.1/6.4	111
		Stop	WBLR	-	A	8.6	4.8/0.0	19
		Stop	NBTR	-	A	10.0	8.5/0.0	83
		Stop	SBLT	-	A	9.8	7.3/7.1	64
5.	Maple Avenue (N/S) and Cary Street (E/W)	Stop	EBLT	-	B	10.4	12.0	132
			SBLR	-	D	30.6	64.4/22.7	254

NOTES
(1) Indicates continuous lane.
(2) Indicates Synchro Lane Delay.
(3) Indicates SimTraffic Lane Delay.
(4) Queues are average 95th percentile queues as reported by SimTraffic.
(5) Analyzed as signalized control / Unsignalized intersection.

As shown in Table 4, all study area intersections are operating at acceptable overall intersection levels of service for the AM peak hour with the exception of Maple Avenue and Grove Avenue:

- Shared southbound left/through/right at the intersection of Maple Avenue and Grove Avenue

7. CONCLUSIONS AND RECOMMENDATIONS

Analysis indicates that the impacts expected as a result of the proposed capital improvements program will have a minimal impact to the overall study area. Based on analysis provided by the City it has been determined that a traffic signal is warranted under existing traffic conditions and to improve side street operations under future conditions at the intersection of Maple Avenue and Grove Avenue. Analysis presented in this report indicates that side street movements at this intersection are and will continue to operate at unacceptable levels of service under stopped control intersection operation. With the proposed improvement identified by the City, signalized operation will improve the overall operations to acceptable levels of service. Additionally, this improvement is expected to incentivize existing 'cut-through' traffic to utilize the Maple Avenue and Grove Avenue intersection. Currently, this traffic is utilizing the Linden Lane corridor.

Additionally, it is recommended to improve existing site lines at the intersection of Maple Avenue and Linden Lane to provide a safer pedestrian crossing at this intersection. It is recommended to construct pedestrian safety island on the southeast quadrant of this intersection. The island should reduce the overall cross section of the Maple Avenue approach from 22 feet to 21 feet by utilizing a chicane configuration on the eastern curb line south of the northbound stop bar. It is proposed that island dimensions should provide approximately 6 feet of depth from the edge of pavement without disturbance of the existing stone curb and hedge line.

Further, it is recommended to install a High Intensity Actuated Cross Walk (HAWK) Signal on Grove Avenue. Based on a warrants analysis, it has been determined that AM Peak hour traffic conditions meet thresholds for installation of a signalized cross walk. The recommended cross walk should be installed between Saint Catherine's Lane and Somerset Avenue equal distance between the two intersections. Additionally, the signalize operation should be coordinated with the existing/future traffic signals on Grove Avenue to maximize operations during the AM peak hour.

TECHNICAL APPENDIX

APPENDIX A

SCOPING DOCUMENTATION

PRE-SCOPE OF WORK MEETING FORM

Information on the Project
Traffic Impact Analysis Base Assumptions

The applicant is responsible for entering the relevant information and submitting the form to VDOT and the locality no less than three (3) business days prior to the meeting. If a form is not received by this deadline, the scope of work meeting may be postponed.

Contact Information			
Consultant Name: Tele: E-mail:	Green Light Solutions, Inc. / Erich Strohhacker, PE, PTOE (804) 356-4282 estrohhacker@glstraffic.com		
Developer/Owner Name: Tele: E-mail:	Saint Catherine's School / Peter Pastore (804) 288-2804 ext. 3040 ppastore@st.catherines.org		
Project Information			
Project Name:	Saint Catherine's School Improvements	Locality/County:	City of Richmond
Project Location: (Attach regional and site specific location map)	The project will be located at the existing Saint Catherine's School located on the Southwest quadrant of the Grove Avenue and Maple Avenue intersection. The overall site is bounded by Grove Avenue (north), Maple Avenue (east), Saint Catherine's Lane (west), and Cary Street (south).		
Submission Type	Comp Plan ☐	Rezoning ☒	Site Plan ☐	Subd Plat ☐
Project Description: (Including details on the land use, acreage, phasing, access location, etc. Attach additional sheet if necessary)	The project is to provide additional facilities to the existing day to day operation of the school. The improvements will not increase school enrollment or number of faculty/employees that will enter/exit the site on a daily basis. However, the site will increase the number of existing parking spaces available on site from 160 to 312. Refer to the attachment for a generalized plan detailing the layout of the existing/future facilities.		
Proposed Use(s): (Check all that apply; attach additional pages as necessary)	Residential ☐	Commercial ☐	Mixed Use ☐	Other ☒
	Residential Uses(s) Number of Units: N/A ITE LU Code(s): **Commercial Use(s)** ITE LU Code(s): _____ _____ _____ Square Ft or Other Variable:		**Other Use(s)** ITE LU Code(s): _____ _____ _____ Independent Variable(s): _____ _____ _____	

It is important for the applicant to provide sufficient information to county and VDOT staff so that questions regarding geographic scope, alternate methodology, or other issues can be answered at the scoping meeting.

Total Peak Hour Trip Projection:	Less than 100 ☐	100 – 499 ☐	500 – 999 ☐	1,000 or more ☐

Traffic Impact Analysis Assumptions				
Study Period	Existing Year: 2016	Build-out Year: 2019	Design Year:	
Study Area Boundaries (Attach map)	North: Grove Avenue	South: Cary Street		
	East: Maple Avenue	West: Saint Catherine's Lane		
External Factors That Could Affect Project (Planned road improvements, other nearby developments)	The City has identified the intersection of Grove Avenue and Maple Avenue for a traffic signal installation based on existing traffic conditions. Currently there is no funding for this improvement. Plans for two adjacent developments have been proposed for Saint Bridget's and Westhampton.			
Consistency With Comprehensive Plan (Land use, transportation plan)	Plans are consistent with the existing uses on site.			
Available Traffic Data (Historical, forecasts)	Data to be obtained by conducting turning movement traffic counts at all existing study area intersections.			
Trip Distribution (Attach sketch)	Road Name: N/A	Road Name: N/A		
	Road Name: N/A	Road Name: N/A		
Annual Vehicle Trip Growth Rate:	0.5%	Peak Period for Study (check all that apply)	☒ AM ☐ PM ☐ SAT	
		Peak Hour of the Generator	N/A	
Study Intersections and/or Road Segments (Attach additional sheets as necessary)	1.Grove Ave. / St. Catherine's Ln.	6.		
	2.Grove Ave. / Somerset Ave.	7.		
	3.Grove Ave. / Maple Ave.	8.		
	4.Maple Ave. / Linden Ln.	9.		
	5.Cary St. / Maple Ave.	10.		
Trip Adjustment Factors	Internal allowance: ☐ Yes ☒ No Reduction: _____% trips	Pass-by allowance: ☐ Yes ☒ No Reduction: _____% trips		
Software Methodology	☒ Synchro ☐ HCS (v.2000/+) ☐ aaSIDRA ☐ CORSIM ☐ Other _____			
Traffic Signal Proposed or Affected (Analysis software to be used,	There are no existing traffic signals to be analyzed as part of this study.			

It is important for the applicant to provide sufficient information to county and VDOT staff so that questions regarding geographic scope, alternate methodology, or other issues can be answered at the scoping meeting.

progression speed, cycle length)	
Improvement(s) Assumed or to be Considered	There are no roadway improvements that will be assumed to be in place by others as part of this study. The installation of a traffic signal at the intersection of Grove Ave. / Maple Ave. will be evaluated as part of this study.
Background Traffic Studies Considered	To be determined
Plan Submission	☒ Master Development Plan (MDP) ☐ Generalized Development Plan (GDP) ☐ Preliminary/Sketch Plan ☐ Other Plan type (Final Site, Subd. Plan)
Additional Issues to be Addressed	☒ Queuing analysis ☐ Actuation/Coordination ☐ Weaving analysis ☐ Merge analysis ☒ Bike/Ped Accommodations ☒ Intersection(s) ☐ TDM Measures ☐ Other _____

NOTES on ASSUMPTIONS: The annual growth rate has been determined based on historic (VDOT) average daily traffic volumes conducted on Grove Avenue and Cary Street. Data indicates that in the last five years volumes have been stagnant or in decline. For this analysis all background traffic conditions will be projected based on a 0.5% annual growth rate.

A physical roadway inventory of Maple Avenue will be conducted as part of the study. Evaluations of existing pedestrian crossings will be conducted at Grove Ave. / Somerset Ave. and Maple Ave. / Linden Ln. Further, special consideration will be given to existing cut-through traffic on Linden Lane as to magnitude of the conditions and possible mitigation measures to minimize the existing cut-through volumes.

Analysis of traffic conditions will be based on a comparative analysis of existing traffic conditions and future traffic conditions with the proposed parking plan in place. Future traffic conditions will be based on reassignment of existing faculty parking from existing locations to the future parking area to be constructed on site. Additionally, existing traffic will be reassigned to accommodate student parking at parking spaces currently being utilized by faculty that will be made available with faculty reassignment.

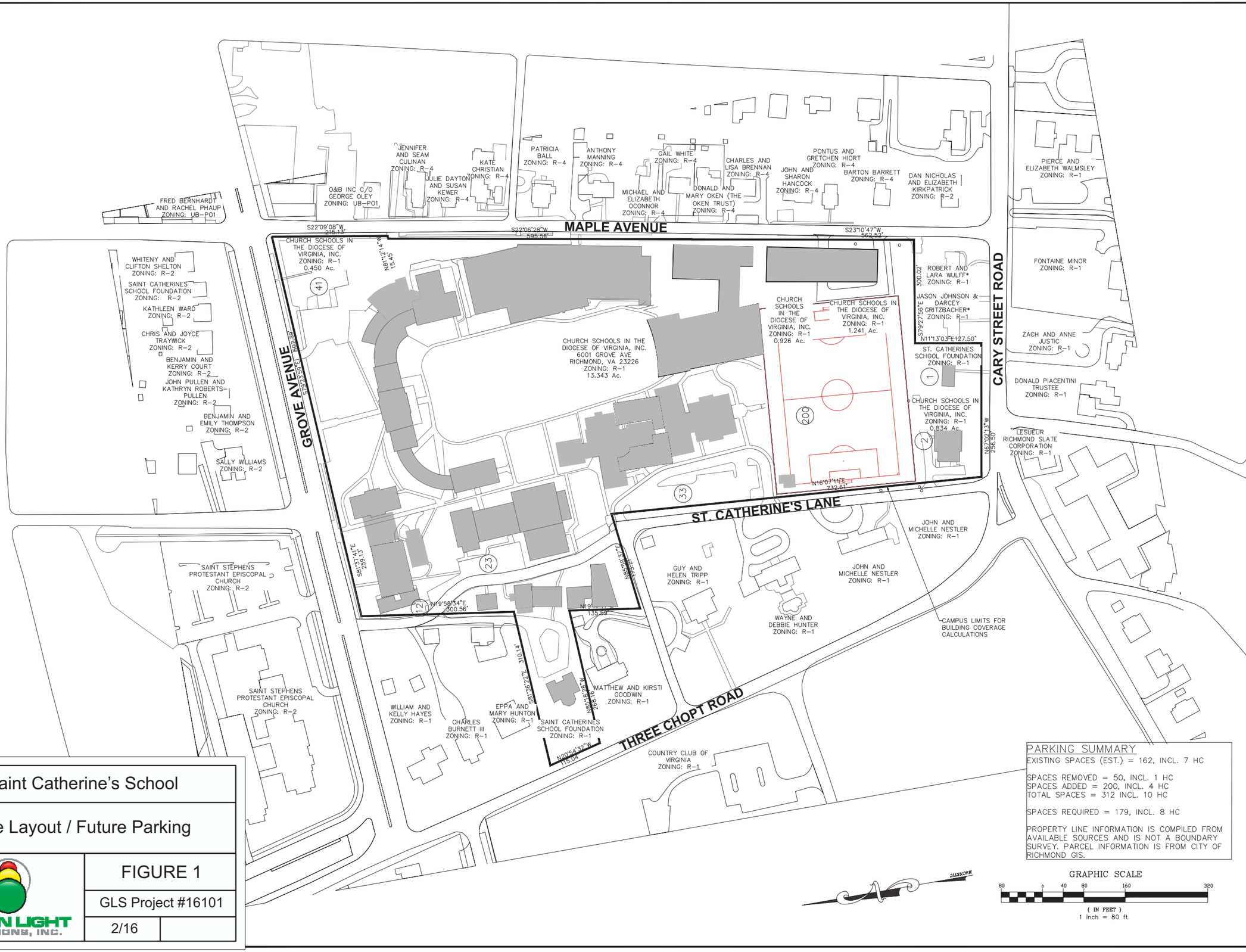
Analysis will evaluate the operational impact of the proposed traffic signal at the intersection of Grove Ave. / Maple Ave. Due to the limitation of funding sources for the installation of the traffic signal, the analysis will

determine if existing traffic control is adequate for future traffic conditions. Additionally, it will be determined if a traffic signal will provide any relief to AM peak hour traffic conditions.

SIGNED: _____ DATE: _____
Applicant or Consultant

PRINT NAME: _____
Applicant or Consultant

It is important for the applicant to provide sufficient information to county and VDOT staff so that questions regarding geographic scope, alternate methodology, or other issues can be answered at the scoping meeting.



Saint Catherine's School

Site Layout / Future Parking

FIGURE 1

GLS Project #16101

2/16

GREEN LIGHT SOLUTIONS, INC.

Draper Aden Associates
Engineering • Surveying • Environmental Services
Blacksburg, VA
Charlottesville, VA
Hampton Roads, VA
Coats, NC
Richmond, VA
8100 Three Chopt Road
Richmond, VA 23228
804-264-2228 Fax: 804-264-8773
www.daa.com

PROPOSED CONDITIONS ZONING PLAN

SAINT CATHERINE'S SCHOOL

CITY OF RICHMOND, VIRGINIA

REVISIONS

DESIGNED BY: SWM
DRAWN BY: SWM
CHECKED BY: GHT
SCALE: 1"=80'
DATE: 12/23/2015
PROJECT NUMBER: R00615R-37

EX. B

APPENDIX B

TRAFFIC COUNTS

Green Light Solutions, Inc.

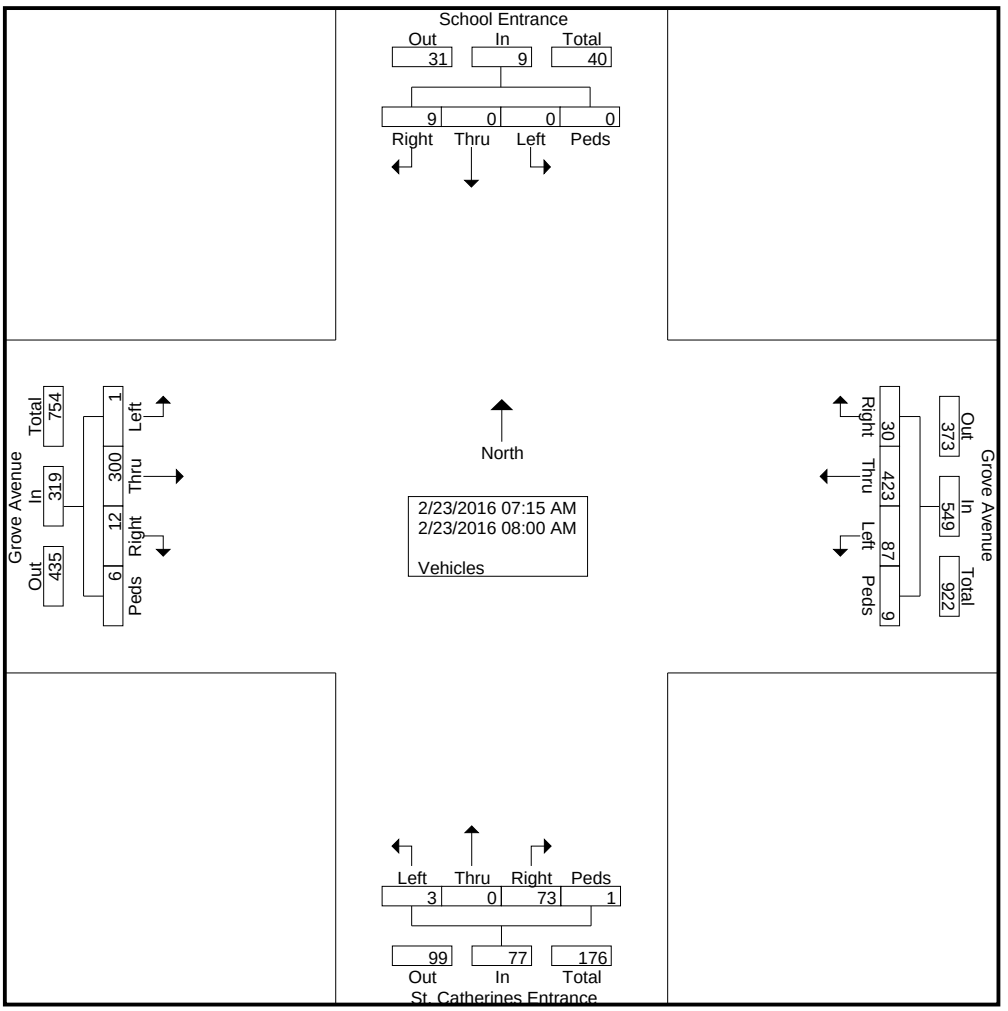
(804) 356-4282
estrohhacker@glstraffic.com

Project: Saint Catherine's School
Counter: Erich Strohhacker
Weather: Clear

File Name : GSSCam
Site Code : 00005555
Start Date : 2/23/2016
Page No : 1

Groups Printed- Vehicles

	School Entrance From North					Grove Avenue From East					St. Catherines Entrance From South					Grove Avenue From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:15 AM	0	0	0	0	0	2	74	9	1	86	4	0	0	0	4	0	48	1	1	50	140
07:30 AM	2	0	0	0	2	2	115	23	2	142	11	0	0	0	11	4	95	0	0	99	254
07:45 AM	4	0	0	0	4	15	122	44	2	183	43	0	3	1	47	7	104	0	2	113	347
Total	6	0	0	0	6	19	311	76	5	411	58	0	3	1	62	11	247	1	3	262	741
08:00 AM	3	0	0	0	3	11	112	11	4	138	15	0	0	0	15	1	53	0	3	57	213
Grand Total	9	0	0	0	9	30	423	87	9	549	73	0	3	1	77	12	300	1	6	319	954
Apprch %	100	0	0	0		5.5	77	15.8	1.6		94.8	0	3.9	1.3		3.8	94	0.3	1.9		
Total %	0.9	0	0	0	0.9	3.1	44.3	9.1	0.9	57.5	7.7	0	0.3	0.1	8.1	1.3	31.4	0.1	0.6	33.4	



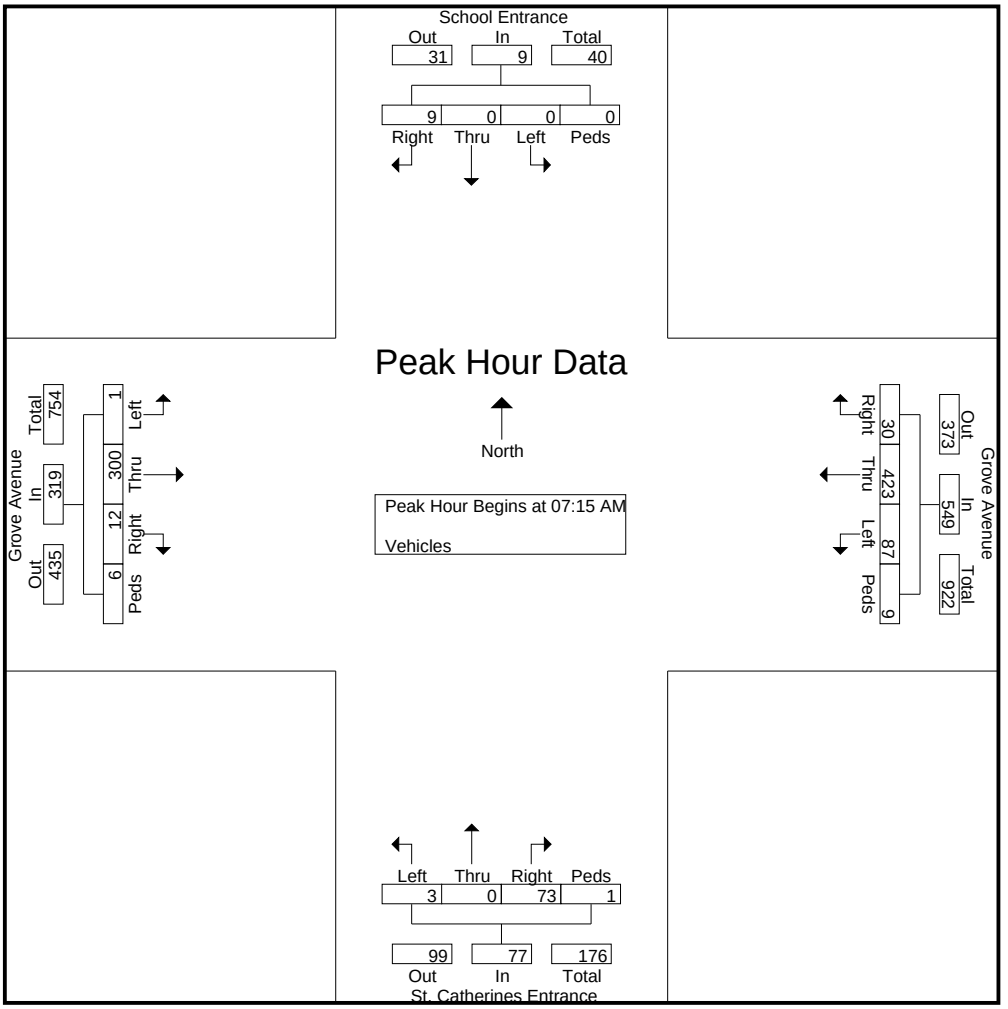
Green Light Solutions, Inc.

(804) 356-4282
estrohhacker@glstraffic.com

Project: Saint Catherine's School
Counter: Erich Strohhacker
Weather: Clear

File Name : GSSCam
Site Code : 00005555
Start Date : 2/23/2016
Page No : 2

	School Entrance From North					Grove Avenue From East					St. Catherines Entrance From South					Grove Avenue From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:15 AM to 08:00 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:15 AM																					
07:15 AM	0	0	0	0	0	2	74	9	1	86	4	0	0	0	4	0	48	**1**	1	50	140
07:30 AM	2	0	0	0	2	2	115	23	2	142	11	0	0	0	11	4	95	0	0	99	254
07:45 AM	**4**	0	0	0	**4**	**15**	**122**	**44**	2	**183**	**43**	0	**3**	**1**	**47**	**7**	**104**	0	2	**113**	**347**
08:00 AM	3	0	0	0	3	11	112	11	**4**	138	15	0	0	0	15	1	53	0	**3**	57	213
Total Volume	9	0	0	0	9	30	423	87	9	549	73	0	3	1	77	12	300	1	6	319	954
% App. Total	100	0	0	0		5.5	77	15.8	1.6		94.8	0	3.9	1.3		3.8	94	0.3	1.9		
PHF	.563	.000	.000	.000	.563	.500	.867	.494	.563	.750	.424	.000	.250	.250	.410	.429	.721	.250	.500	.706	.687



Green Light Solutions, Inc.

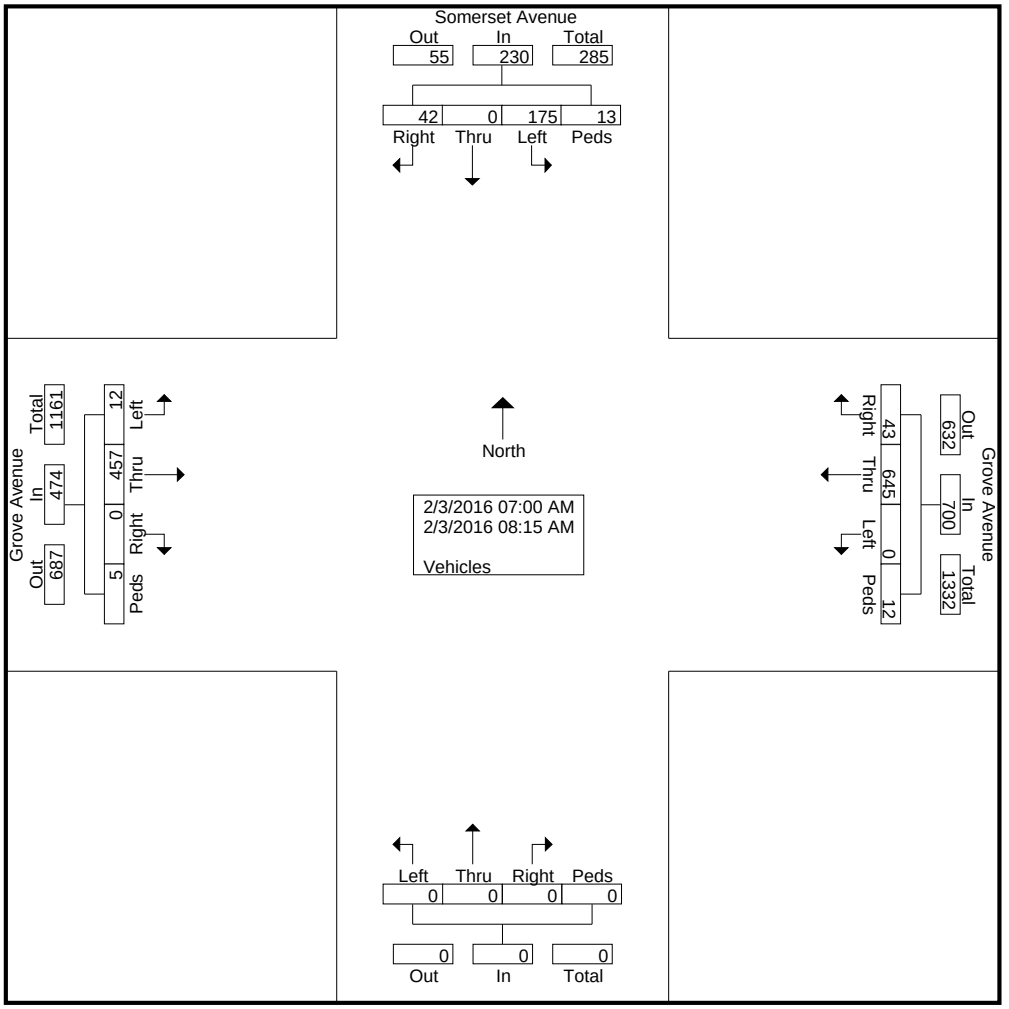
(804) 356-4282
estrohhacker@glstraffic.com

Project: Saint Catherine's School
Counter: Erich Strohhacker
Weather: Clear

File Name : GSSSam
Site Code : 00001111
Start Date : 2/3/2016
Page No : 1

Groups Printed- Vehicles

	Somerset Avenue From North					Grove Avenue From East					From South					Grove Avenue From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	3	0	7	0	10	4	46	0	3	53	0	0	0	0	0	0	37	1	0	38	101
07:15 AM	0	0	20	1	21	3	84	0	2	89	0	0	0	0	0	0	57	0	1	58	168
07:30 AM	13	0	50	1	64	14	161	0	0	175	0	0	0	0	0	0	121	3	0	124	363
07:45 AM	17	0	72	0	89	14	180	0	2	196	0	0	0	0	0	0	124	5	3	132	417
Total	33	0	149	2	184	35	471	0	7	513	0	0	0	0	0	0	339	9	4	352	1049
08:00 AM	8	0	14	5	27	3	80	0	2	85	0	0	0	0	0	0	62	3	1	66	178
08:15 AM	1	0	12	6	19	5	94	0	3	102	0	0	0	0	0	0	56	0	0	56	177
Grand Total	42	0	175	13	230	43	645	0	12	700	0	0	0	0	0	0	457	12	5	474	1404
Apprch %	18.3	0	76.1	5.7		6.1	92.1	0	1.7		0	0	0	0		0	96.4	2.5	1.1		
Total %	3	0	12.5	0.9	16.4	3.1	45.9	0	0.9	49.9	0	0	0	0	0	0	32.5	0.9	0.4	33.8	



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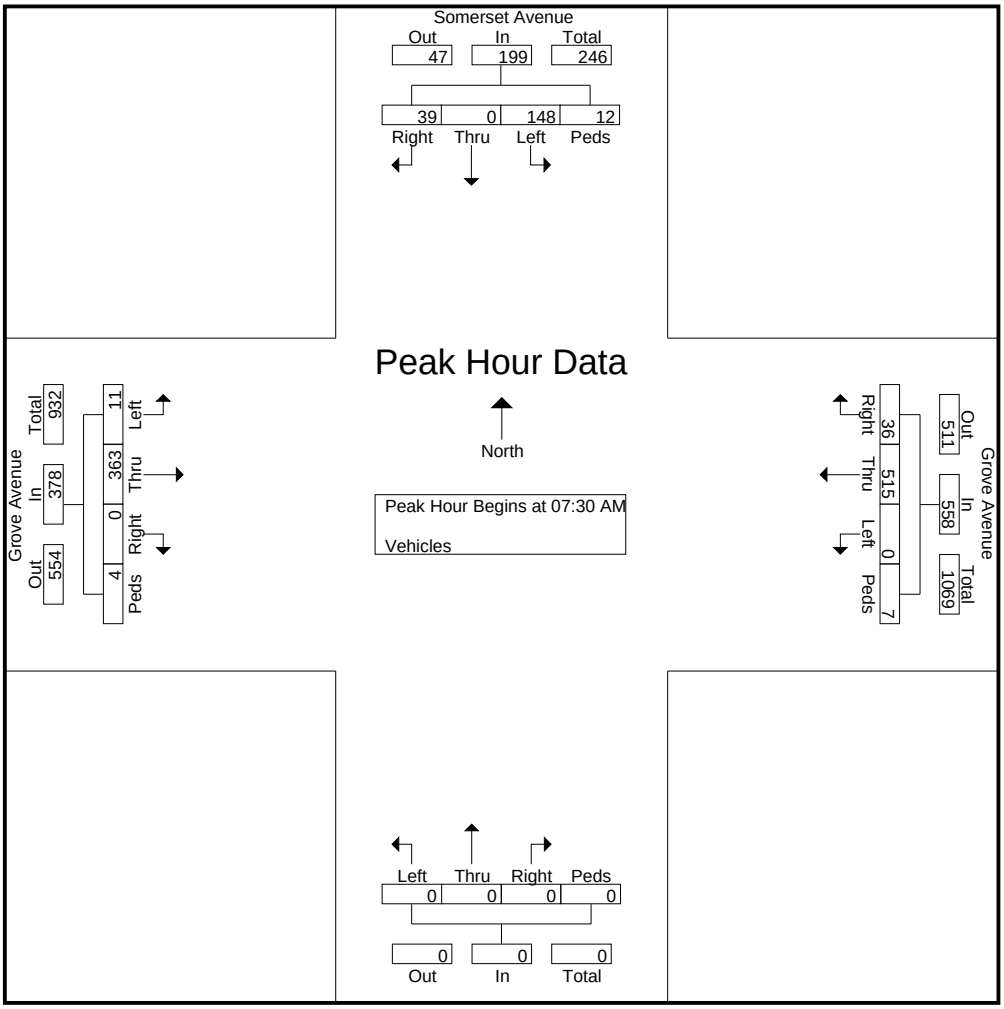
Project: Saint Catherine's School
Counter: Erich Strohhacker
Weather: Clear

File Name : GSSSam
Site Code : 00001111
Start Date : 2/3/2016
Page No : 2

	Somerset Avenue From North					Grove Avenue From East					From South					Grove Avenue From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:15 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	13	0	50	1	64	**14**	161	0	0	175	0	0	0	0	0	0	121	3	0	124	363
07:45 AM	**17**	0	**72**	0	**89**	14	**180**	0	2	**196**	0	0	0	0	0	0	**124**	**5**	**3**	**132**	**417**
08:00 AM	8	0	14	5	27	3	80	0	2	85	0	0	0	0	0	0	62	3	1	66	178
08:15 AM	1	0	12	**6**	19	5	94	0	**3**	102	0	0	0	0	0	0	56	0	0	56	177
Total Volume	39	0	148	12	199	36	515	0	7	558	0	0	0	0	0	0	363	11	4	378	1135
% App. Total	19.6	0	74.4	6		6.5	92.3	0	1.3		0	0	0	0		0	96	2.9	1.1		
PHF	.574	.000	.514	.500	.559	.643	.715	.000	.583	.712	.000	.000	.000	.000	.000	.000	.732	.550	.333	.716	.680



Green Light Solutions, Inc.

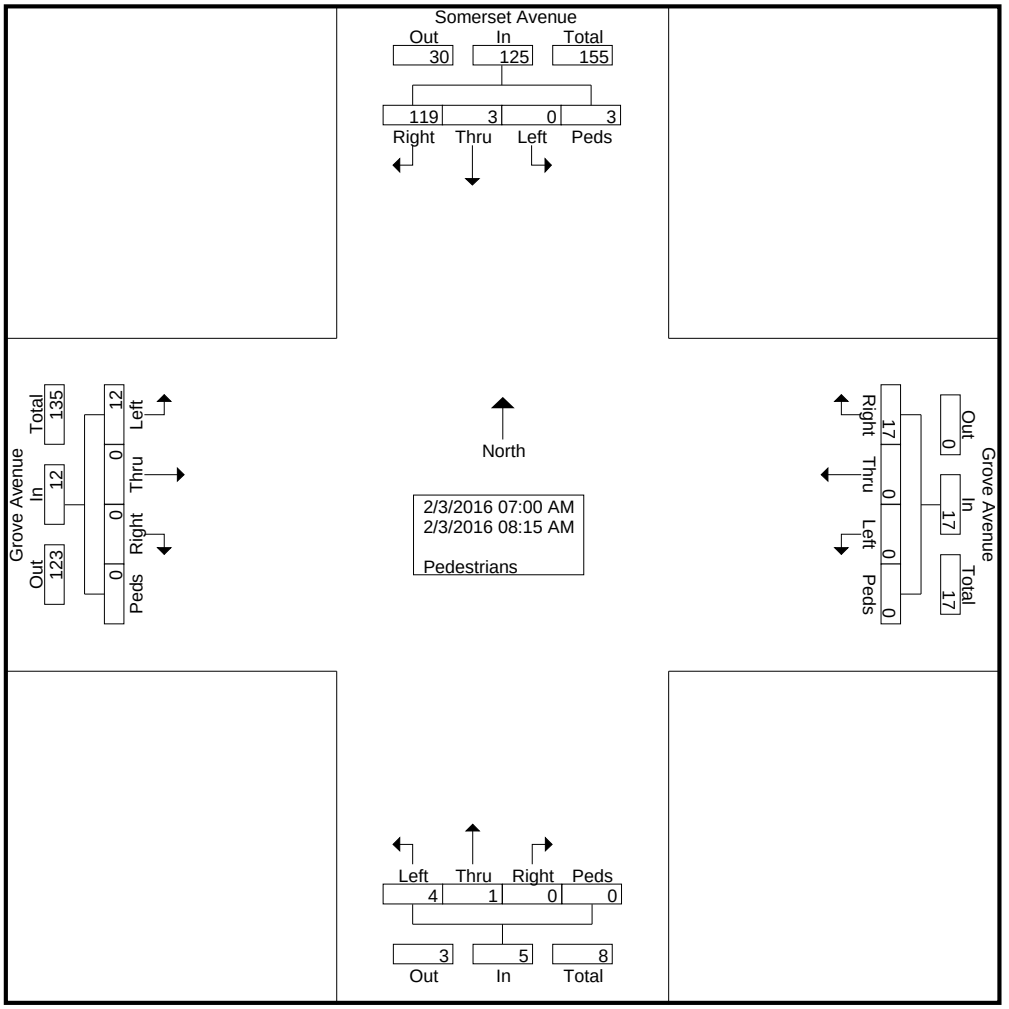
(804) 356-4282
estrohhacker@glstraffic.com

Project: Saint Catherine's School
Counter: Erich Strohhacker
Weather: Clear

File Name : GSSSam
Site Code : 00001111
Start Date : 2/3/2016
Page No : 1

Groups Printed- Pedestrians

	Somerset Avenue From North					Grove Avenue From East					From South					Grove Avenue From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	1	1	0	0	2	1	0	0	0	1	0	0	0	0	0	0	0	2	0	2	5
07:15 AM	9	2	0	0	11	0	0	0	0	0	0	1	1	0	2	0	0	0	0	0	13
07:30 AM	48	0	0	3	51	9	0	0	0	9	0	0	2	0	2	0	0	0	0	0	62
07:45 AM	55	0	0	0	55	3	0	0	0	3	0	0	1	0	1	0	0	0	0	0	59
Total	113	3	0	3	119	13	0	0	0	13	0	1	4	0	5	0	0	2	0	2	139
08:00 AM	6	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	16
08:15 AM	0	0	0	0	0	4	0	0	0	4	0	0	0	0	0	0	0	0	0	0	4
Grand Total	119	3	0	3	125	17	0	0	0	17	0	1	4	0	5	0	0	12	0	12	159
Apprch %	95.2	2.4	0	2.4		100	0	0	0		0	20	80	0		0	0	100	0		
Total %	74.8	1.9	0	1.9	78.6	10.7	0	0	0	10.7	0	0.6	2.5	0	3.1	0	0	7.5	0	7.5	



Green Light Solutions, Inc.

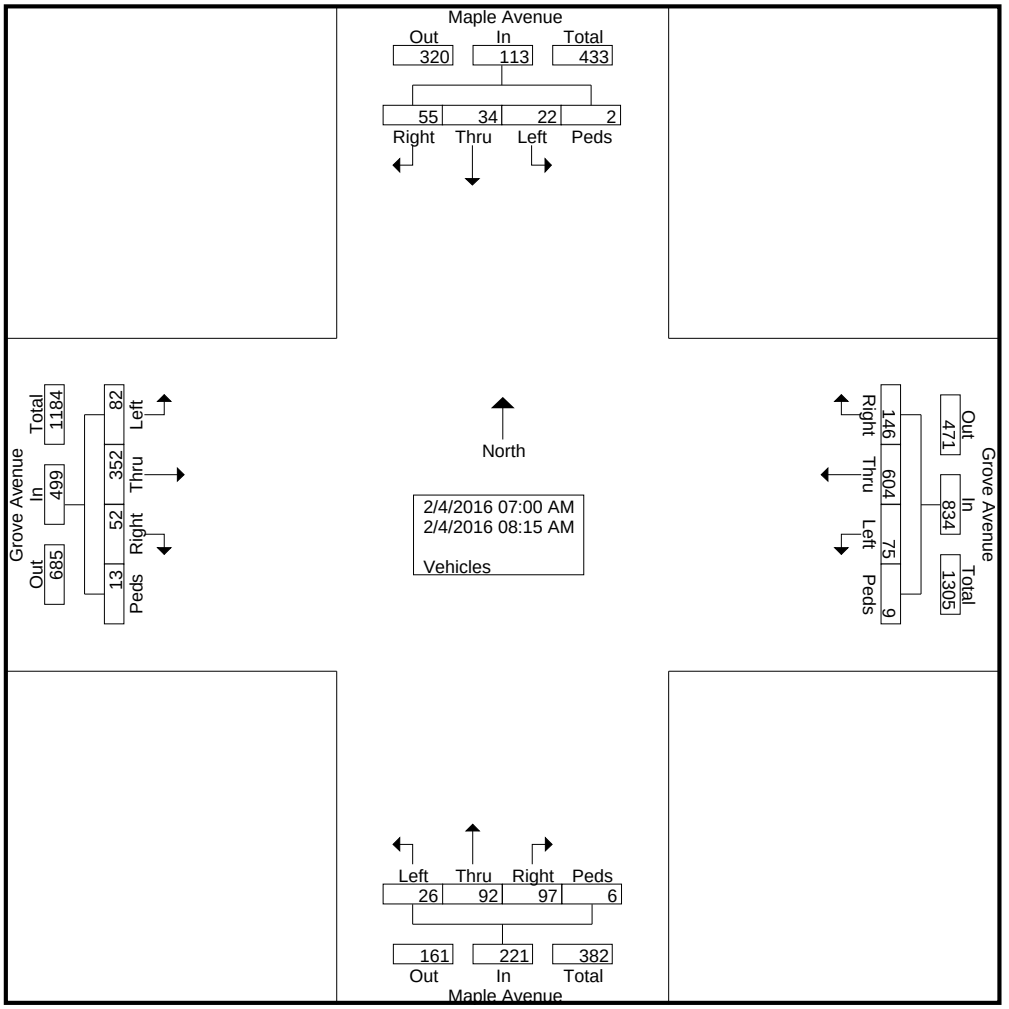
(804) 356-4282
estrohhacker@glstraffic.com

Project: Saint Catherine's School
Counter: Erich Strohhacker
Weather: Clear

File Name : GSMAam
Site Code : 00002222
Start Date : 2/4/2016
Page No : 1

Groups Printed- Vehicles

	Maple Avenue From North					Grove Avenue From East					Maple Avenue From South					Grove Avenue From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	5	6	2	0	13	10	38	8	2	58	4	18	4	1	27	1	29	4	0	34	132
07:15 AM	6	5	4	1	16	16	83	11	3	113	10	16	6	1	33	7	38	6	1	52	214
07:30 AM	13	7	4	1	25	54	145	23	1	223	25	17	8	0	50	16	66	27	0	109	407
07:45 AM	18	9	2	0	29	32	156	25	0	213	48	15	2	1	66	22	112	30	2	166	474
Total	42	27	12	2	83	112	422	67	6	607	87	66	20	3	176	46	245	67	3	361	1227
08:00 AM	12	2	6	0	20	18	89	4	2	113	8	11	5	3	27	5	60	5	2	72	232
08:15 AM	1	5	4	0	10	16	93	4	1	114	2	15	1	0	18	1	47	10	8	66	208
Grand Total	55	34	22	2	113	146	604	75	9	834	97	92	26	6	221	52	352	82	13	499	1667
Apprch %	48.7	30.1	19.5	1.8		17.5	72.4	9	1.1		43.9	41.6	11.8	2.7		10.4	70.5	16.4	2.6		
Total %	3.3	2	1.3	0.1	6.8	8.8	36.2	4.5	0.5	50	5.8	5.5	1.6	0.4	13.3	3.1	21.1	4.9	0.8	29.9	



Green Light Solutions, Inc.

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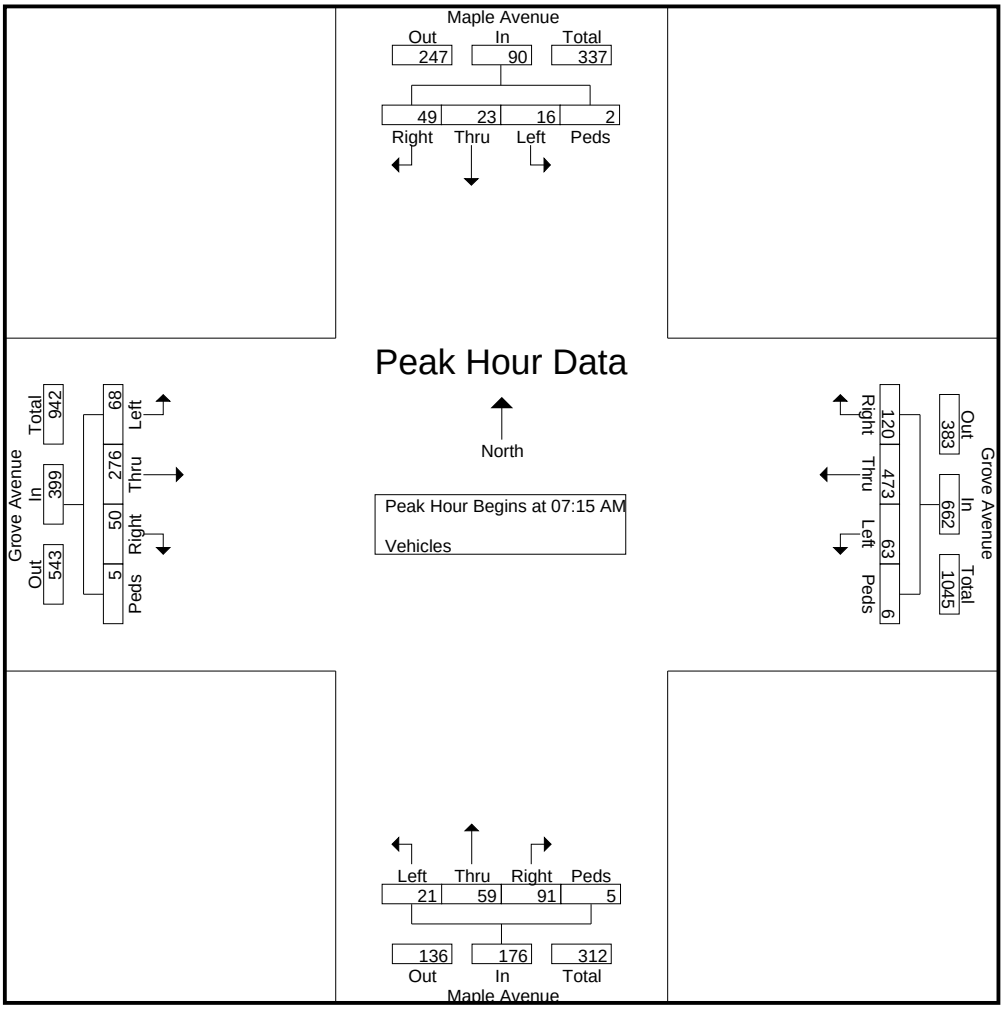
Project: Saint Catherine's School
Counter: Erich Strohhacker
Weather: Clear

File Name : GSMAam
Site Code : 00002222
Start Date : 2/4/2016
Page No : 2

	Maple Avenue From North					Grove Avenue From East					Maple Avenue From South					Grove Avenue From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:15 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:15 AM																					
07:15 AM	6	5	4	**1**	16	16	83	11	**3**	113	10	16	6	1	33	7	38	6	1	52	214
07:30 AM	13	7	4	1	25	**54**	145	23	1	**223**	25	**17**	**8**	0	50	16	66	27	0	109	407
07:45 AM	**18**	**9**	2	0	**29**	32	**156**	**25**	0	213	**48**	15	2	1	**66**	**22**	**112**	**30**	**2**	**166**	**474**
08:00 AM	12	2	**6**	0	20	18	89	4	2	113	8	11	5	**3**	27	5	60	5	2	72	232
Total Volume	49	23	16	2	90	120	473	63	6	662	91	59	21	5	176	50	276	68	5	399	1327
% App. Total	54.4	25.6	17.8	2.2		18.1	71.5	9.5	0.9		51.7	33.5	11.9	2.8		12.5	69.2	17	1.3		
PHF	.681	.639	.667	.500	.776	.556	.758	.630	.500	.742	.474	.868	.656	.417	.667	.568	.616	.567	.625	.601	.700



Green Light Solutions, Inc.

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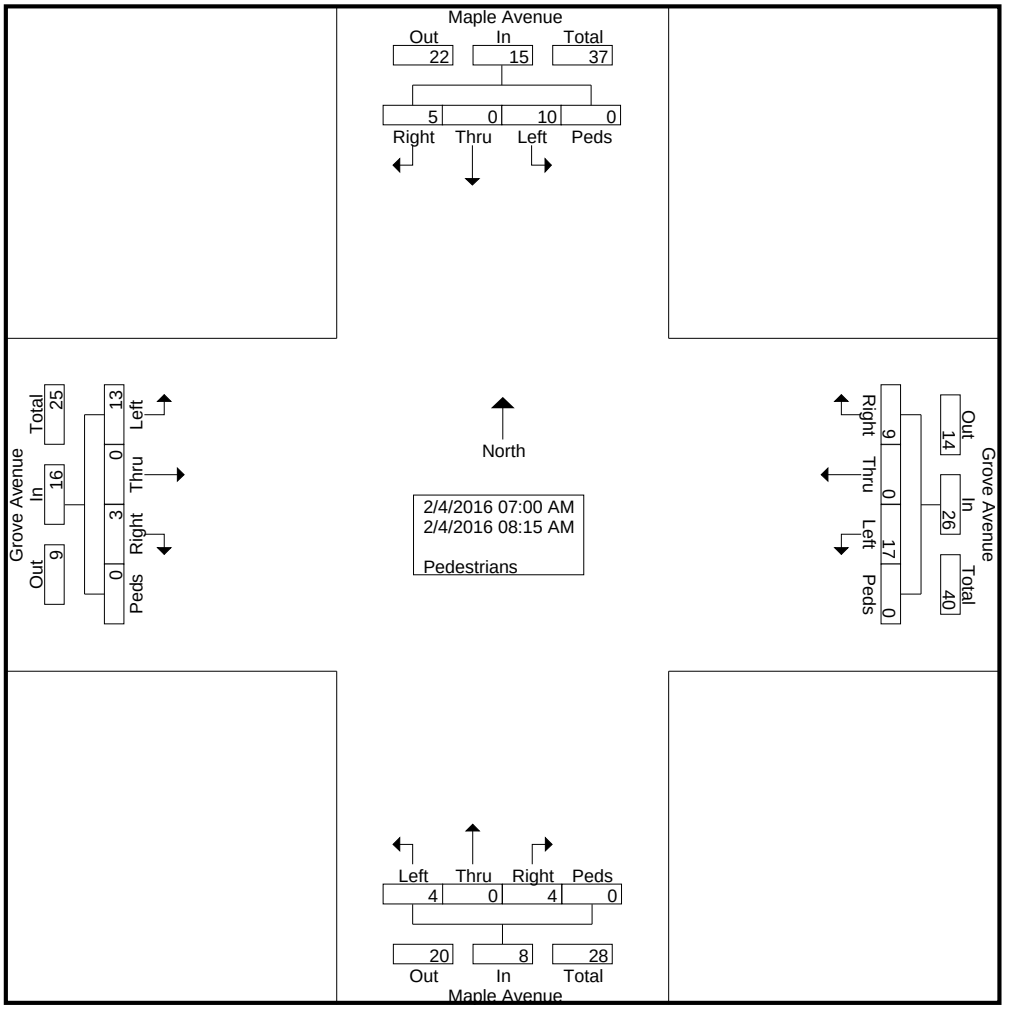
Project: Saint Catherine's School
Counter: Erich Strohhacker
Weather: Clear

File Name : GSMAam
Site Code : 00002222
Start Date : 2/4/2016
Page No : 1

Groups Printed- Pedestrians

	Maple Avenue From North					Grove Avenue From East					Maple Avenue From South					Grove Avenue From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	0	0	4	0	4	0	0	7	0	7	1	0	2	0	3	0	0	3	0	3	17
07:15 AM	0	0	1	0	1	1	0	3	0	4	0	0	0	0	0	0	0	0	0	0	5
07:30 AM	4	0	3	0	7	2	0	0	0	2	0	0	1	0	1	1	0	1	0	2	12
07:45 AM	1	0	0	0	1	4	0	2	0	6	0	0	0	0	0	0	0	3	0	3	10
Total	5	0	8	0	13	7	0	12	0	19	1	0	3	0	4	1	0	7	0	8	44
08:00 AM	0	0	2	0	2	0	0	3	0	3	2	0	1	0	3	2	0	5	0	7	15
08:15 AM	0	0	0	0	0	2	0	2	0	4	1	0	0	0	1	0	0	1	0	1	6
Grand Total	5	0	10	0	15	9	0	17	0	26	4	0	4	0	8	3	0	13	0	16	65
Apprch %	33.3	0	66.7	0		34.6	0	65.4	0		50	0	50	0		18.8	0	81.2	0		
Total %	7.7	0	15.4	0	23.1	13.8	0	26.2	0	40	6.2	0	6.2	0	12.3	4.6	0	20	0	24.6	



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Project: Saint Catherine's School
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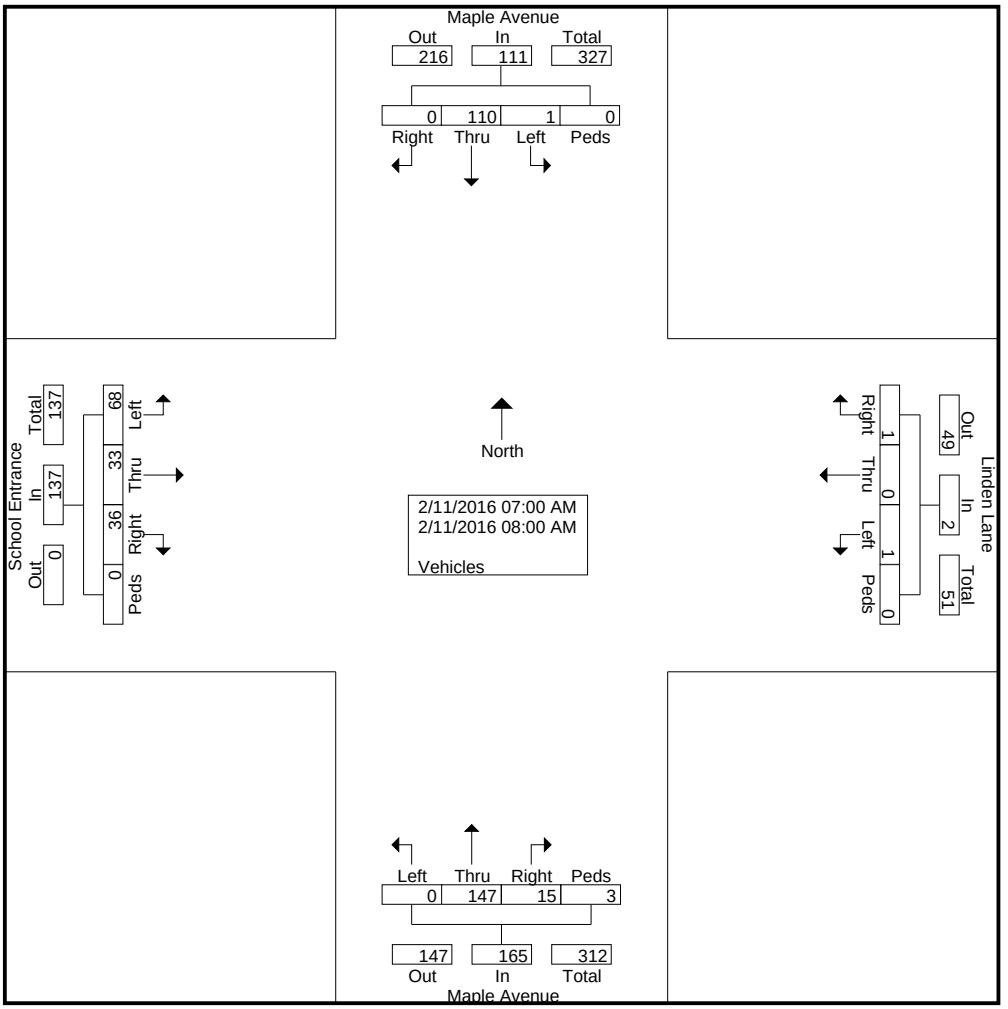
Weather: Clear

File Name : MALRam
Site Code : 00004444
Start Date : 2/11/2016
Page No : 1

Groups Printed- Vehicles

	Maple Avenue From North					Linden Lane From East					Maple Avenue From South					School Entrance From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	0	8	0	0	8	0	0	0	0	0	1	28	0	0	29	1	3	3	0	7	44
07:15 AM	0	17	0	0	17	0	0	0	0	0	1	22	0	0	23	3	1	3	0	7	47
07:30 AM	0	37	0	0	37	0	0	1	0	1	5	35	0	0	40	18	13	36	0	67	145
07:45 AM	0	41	1	0	42	0	0	0	0	0	8	46	0	0	54	13	15	21	0	49	145
Total	0	103	1	0	104	0	0	1	0	1	15	131	0	0	146	35	32	63	0	130	381
08:00 AM	0	7	0	0	7	1	0	0	0	1	0	16	0	3	19	1	1	5	0	7	34
Grand Total	0	110	1	0	111	1	0	1	0	2	15	147	0	3	165	36	33	68	0	137	415
Apprch %	0	99.1	0.9	0		50	0	50	0		9.1	89.1	0	1.8		26.3	24.1	49.6	0		
Total %	0	26.5	0.2	0	26.7	0.2	0	0.2	0	0.5	3.6	35.4	0	0.7	39.8	8.7	8	16.4	0	33	



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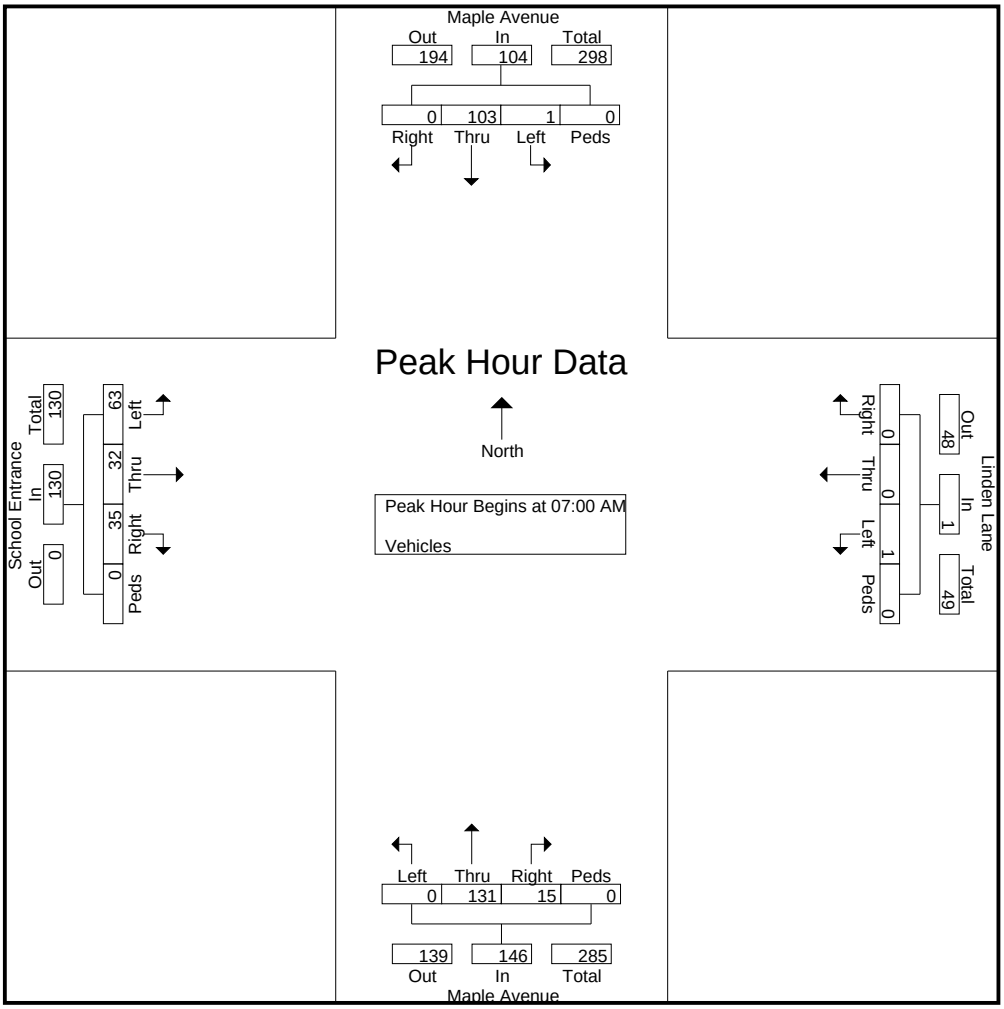
Project: Saint Catherine's School
Counter: Erich Strohhacker
Weather: Clear

File Name : MALRam
Site Code : 00004444
Start Date : 2/11/2016
Page No : 2

	Maple Avenue From North					Linden Lane From East					Maple Avenue From South					School Entrance From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:00 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	0	8	0	0	8	0	0	0	0	0	1	28	0	0	29	1	3	3	0	7	44
07:15 AM	0	17	0	0	17	0	0	0	0	0	1	22	0	0	23	3	1	3	0	7	47
07:30 AM	0	37	0	0	37	0	0	**1**	0	**1**	5	35	0	0	40	**18**	13	**36**	0	**67**	**145**
07:45 AM	0	**41**	**1**	0	**42**	0	0	0	0	0	**8**	**46**	0	0	**54**	13	**15**	21	0	49	145
Total Volume	0	103	1	0	104	0	0	1	0	1	15	131	0	0	146	35	32	63	0	130	381
% App. Total	0	99	1	0		0	0	100	0		10.3	89.7	0	0		26.9	24.6	48.5	0		
PHF	.000	.628	.250	.000	.619	.000	.000	.250	.000	.250	.469	.712	.000	.000	.676	.486	.533	.438	.000	.485	.657



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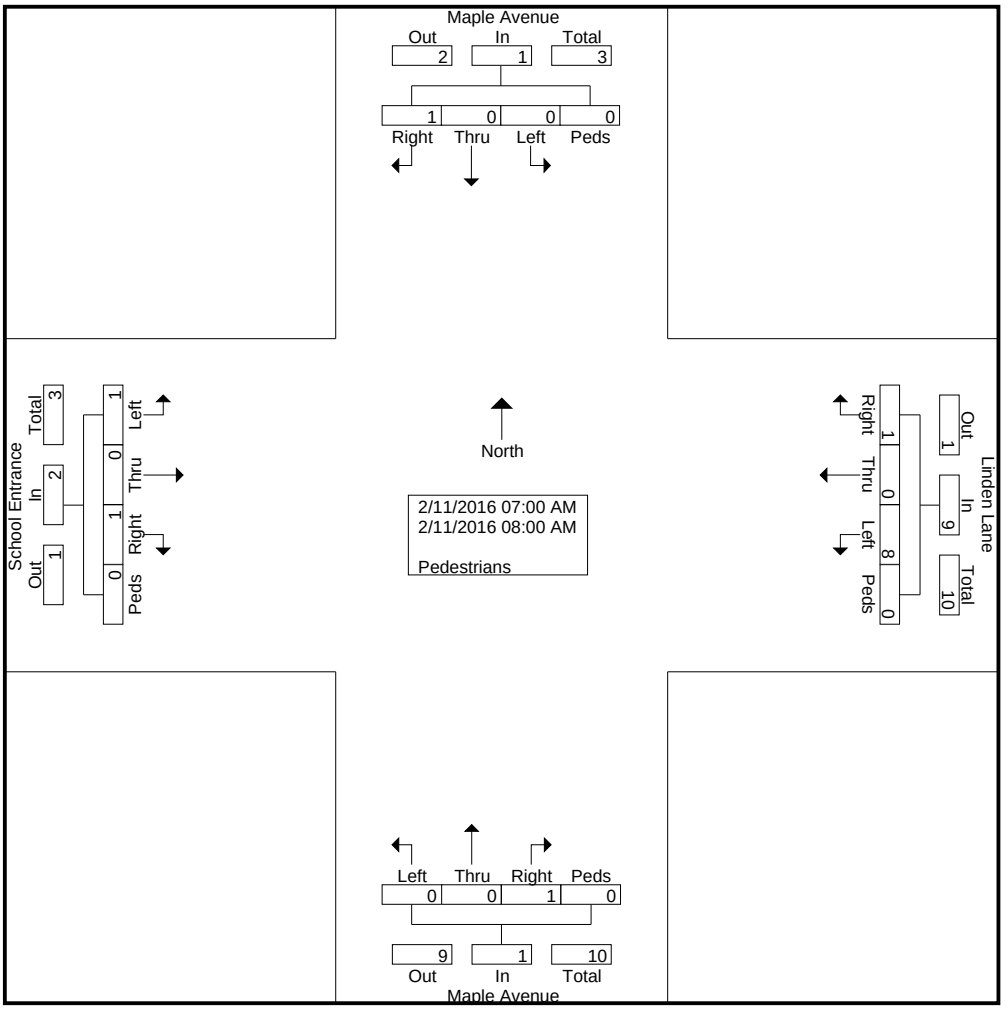
Weather: Clear

File Name : MALRam
Site Code : 00004444
Start Date : 2/11/2016
Page No : 1

Groups Printed- Pedestrians

	Maple Avenue From North					Linden Lane From East					Maple Avenue From South					School Entrance From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
*** BREAK ***																					
07:15 AM	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0	1	2
07:30 AM	1	0	0	0	1	0	0	7	0	7	0	0	0	0	0	1	0	0	0	1	9
07:45 AM	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Total	1	0	0	0	1	1	0	8	0	9	0	0	0	0	0	1	0	1	0	2	12
08:00 AM	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1
Grand Total	1	0	0	0	1	1	0	8	0	9	1	0	0	0	1	1	0	1	0	2	13
Apprch %	100	0	0	0		11.1	0	88.9	0		100	0	0	0		50	0	50	0		
Total %	7.7	0	0	0	7.7	7.7	0	61.5	0	69.2	7.7	0	0	0	7.7	7.7	0	7.7	0	15.4	



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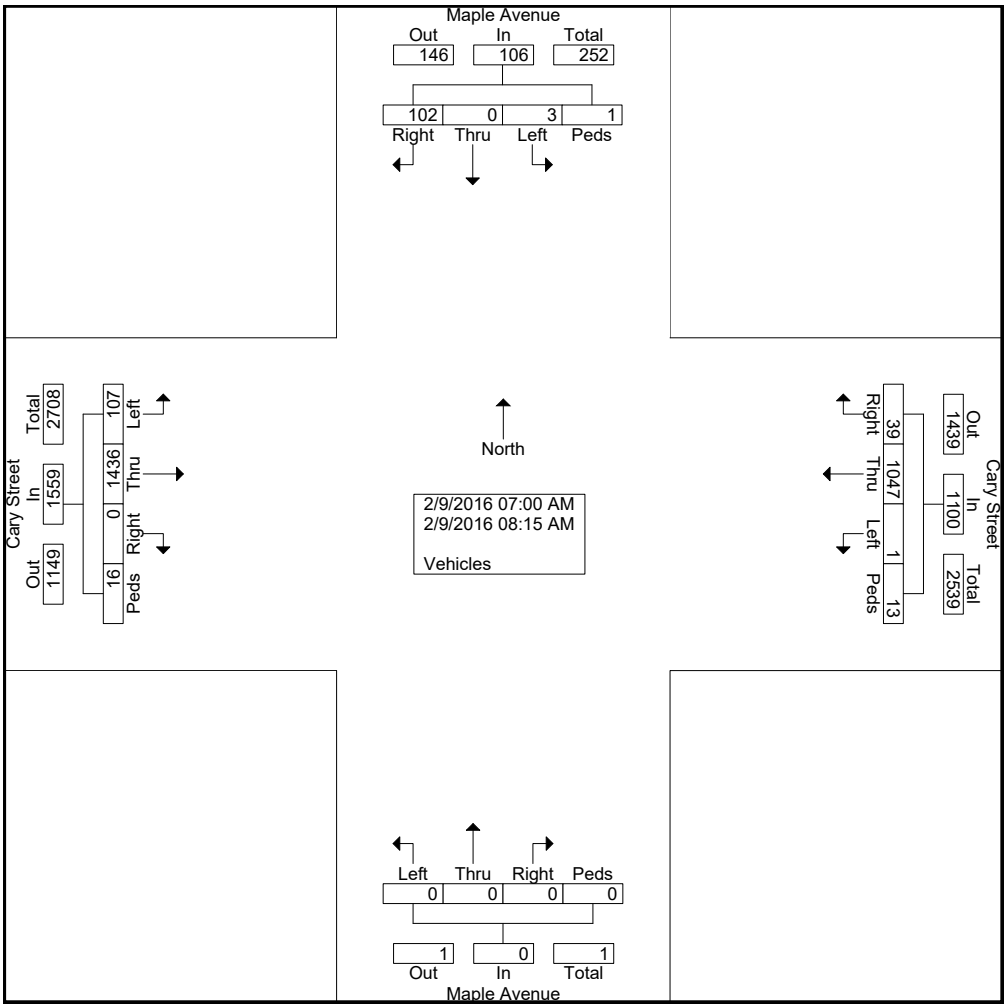
Weather: Clear

File Name : CSMAam
Site Code : 00003333
Start Date : 2/9/2016
Page No : 1

Groups Printed- Vehicles

	Maple Avenue From North					Cary Street From East					Maple Avenue From South					Cary Street From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	5	0	0	0	5	4	89	0	0	93	0	0	0	0	0	0	208	25	1	234	332
07:15 AM	13	0	0	0	13	8	167	0	1	176	0	0	0	0	0	0	232	28	1	261	450
07:30 AM	31	0	1	0	32	16	196	1	1	214	0	0	0	0	0	0	202	21	2	225	471
07:45 AM	37	0	1	1	39	10	199	0	2	211	0	0	0	0	0	0	269	12	4	285	535
Total	86	0	2	1	89	38	651	1	4	694	0	0	0	0	0	0	911	86	8	1005	1788
08:00 AM	10	0	0	0	10	0	211	0	6	217	0	0	0	0	0	0	256	7	4	267	494
08:15 AM	6	0	1	0	7	1	185	0	3	189	0	0	0	0	0	0	269	14	4	287	483
Grand Total	102	0	3	1	106	39	1047	1	13	1100	0	0	0	0	0	0	1436	107	16	1559	2765
Apprch %	96.2	0	2.8	0.9		3.5	95.2	0.1	1.2		0	0	0	0		0	92.1	6.9	1		
Total %	3.7	0	0.1	0	3.8	1.4	37.9	0	0.5	39.8	0	0	0	0	0	0	51.9	3.9	0.6	56.4	



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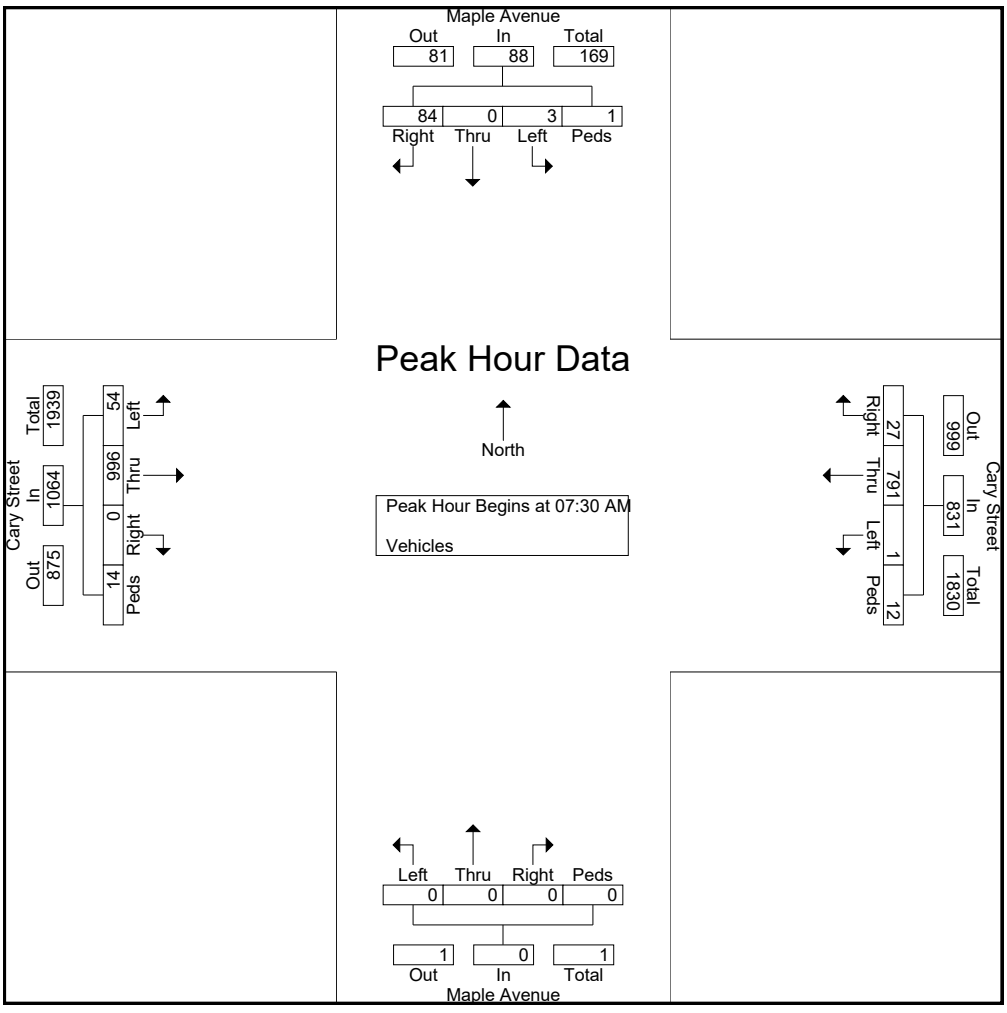
Project: Saint Catherine's School
Counter: Erich Strohhacker
Weather: Clear

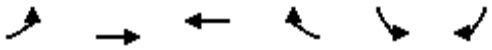
File Name : CSMAam
Site Code : 00003333
Start Date : 2/9/2016
Page No : 2

	Maple Avenue From North					Cary Street From East					Maple Avenue From South					Cary Street From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:15 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	31	0	**1**			**16**	196	**1**										**21**			
07:45 AM	**37**	**0**	**1**	**1**	**39**	10	199	0	2	211	0	0	0	0	0	0	**269**	12	**4**	**285**	**535**
08:00 AM	10	0	0	0	10	0	**211**		**6**	**217**	0	0	0	0	0	0	256	7	4	267	494
08:15 AM	6	0	1	0	7	1	185	0	3	189	0	0	0	0	0	0	269	14	4	**287**	483
Total Volume	84	0	3	1	88	27	791	1	12	831	0	0	0	0	0	0	996	54	14	1064	1983
% App. Total	95.5	0	3.4	1.1		3.2	95.2	0.1	1.4		0	0	0	0		0	93.6	5.1	1.3		
PHF	.568	.000	.750	.250	.564	.422	.937	.250	.500	.957	.000	.000	.000	.000	.000	.000	.926	.643	.875	.927	.927



APPENDIX C

EXISTING PEAK HOUR ANALYSIS



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	11	363	515	36	148	39
Future Volume (vph)	11	363	515	36	148	39
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5	4.5		4.5	
Lane Util. Factor		0.95	0.95		1.00	
Frt		1.00	0.99		0.97	
Flt Protected		1.00	1.00		0.96	
Satd. Flow (prot)		3278	3093		1741	
Flt Permitted		0.92	1.00		0.96	
Satd. Flow (perm)		3007	3093		1741	
Peak-hour factor, PHF	0.72	0.72	0.72	0.72	0.56	0.56
Adj. Flow (vph)	15	504	715	50	264	70
RTOR Reduction (vph)	0	0	2	0	5	0
Lane Group Flow (vph)	0	519	763	0	330	0
Parking (#/hr)		9	27			
Turn Type	Perm	NA	NA		Prot	
Protected Phases		4	8		6	
Permitted Phases	4					
Actuated Green, G (s)		103.5	103.5		87.5	
Effective Green, g (s)		103.5	103.5		87.5	
Actuated g/C Ratio		0.52	0.52		0.44	
Clearance Time (s)		4.5	4.5		4.5	
Lane Grp Cap (vph)		1556	1600		761	
v/s Ratio Prot			c0.25		c0.19	
v/s Ratio Perm		0.17				
v/c Ratio		0.33	0.48		0.43	
Uniform Delay, d1		28.1	30.9		39.0	
Progression Factor		1.00	1.00		1.00	
Incremental Delay, d2		0.6	1.0		1.8	
Delay (s)		28.7	31.9		40.8	
Level of Service		C	C		D	
Approach Delay (s)		28.7	31.9		40.8	
Approach LOS		C	C		D	

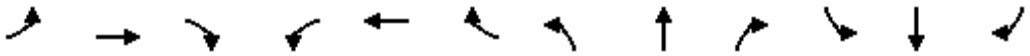
Intersection Summary			
HCM 2000 Control Delay	32.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	200.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	36.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	300	12	87	423	3	73
Future Volume (Veh/h)	300	12	87	423	3	73
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.72	0.72	0.72	0.72	0.41	0.41
Hourly flow rate (vph)	417	17	121	588	7	178
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)				214		
pX, platoon unblocked					0.85	
vC, conflicting volume			434		962	217
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			434		604	217
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			89		98	77
cM capacity (veh/h)			1122		326	787

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	278	156	317	392	185
Volume Left	0	0	121	0	7
Volume Right	0	17	0	0	178
cSH	1700	1700	1122	1700	747
Volume to Capacity	0.16	0.09	0.11	0.23	0.25
Queue Length 95th (ft)	0	0	9	0	24
Control Delay (s)	0.0	0.0	3.9	0.0	11.4
Lane LOS			A		B
Approach Delay (s)	0.0		1.8		11.4
Approach LOS					B

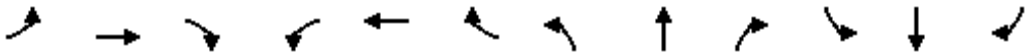
Intersection Summary			
Average Delay	2.5		
Intersection Capacity Utilization	37.6%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	68	276	50	63	473	120	21	59	91	16	23	49
Future Volume (Veh/h)	68	276	50	63	473	120	21	59	91	16	23	49
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.72	0.72	0.72	0.72	0.72	0.72	0.67	0.67	0.67	0.78	0.78	0.78
Hourly flow rate (vph)	94	383	69	88	657	167	31	88	136	21	29	63
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		581										
pX, platoon unblocked				0.95			0.95	0.95	0.95	0.95	0.95	
vC, conflicting volume	824			452			1188	1606	226	1476	1556	412
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	824			314			1089	1530	75	1393	1478	412
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	88			93			68	2	85	0	70	89
cM capacity (veh/h)	802			1179			96	90	921	7	97	589

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	286	260	416	496	255	113
Volume Left	94	0	88	0	31	21
Volume Right	0	69	0	167	136	63
cSH	802	1700	1179	1700	176	33
Volume to Capacity	0.12	0.15	0.07	0.29	1.45	3.46
Queue Length 95th (ft)	10	0	6	0	398	Err
Control Delay (s)	4.2	0.0	2.4	0.0	280.6	Err
Lane LOS	A		A		F	F
Approach Delay (s)	2.2		1.1		280.6	Err
Approach LOS					F	F

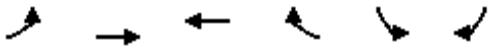
Intersection Summary				
Average Delay	659.2			
Intersection Capacity Utilization	51.8%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	63	32	35	1	0	0	0	131	15	1	103	0
Future Volume (vph)	63	32	35	1	0	0	0	131	15	1	103	0
Peak Hour Factor	0.49	0.49	0.49	0.25	0.25	0.25	0.68	0.68	0.68	0.62	0.62	0.62
Hourly flow rate (vph)	129	65	71	4	0	0	0	193	22	2	166	0

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	265	4	215	168
Volume Left (vph)	129	4	0	2
Volume Right (vph)	71	0	22	0
Hadj (s)	-0.03	0.23	-0.03	0.04
Departure Headway (s)	4.8	5.5	4.8	4.9
Degree Utilization, x	0.35	0.01	0.29	0.23
Capacity (veh/h)	701	583	711	687
Control Delay (s)	10.4	8.5	9.7	9.4
Approach Delay (s)	10.4	8.5	9.7	9.4
Approach LOS	B	A	A	A

Intersection Summary				
Delay	9.9			
Level of Service	A			
Intersection Capacity Utilization	21.0%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	54	996	791	27	3	84
Future Volume (Veh/h)	54	996	791	27	3	84
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.93	0.93	0.96	0.96	0.56	0.56
Hourly flow rate (vph)	58	1071	824	28	5	150
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	852				2025	838
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	852				2025	838
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	93				91	59
cM capacity (veh/h)	787				59	366

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	58	1071	852	155
Volume Left	58	0	0	5
Volume Right	0	0	28	150
cSH	787	1700	1700	313
Volume to Capacity	0.07	0.63	0.50	0.49
Queue Length 95th (ft)	6	0	0	65
Control Delay (s)	9.9	0.0	0.0	27.2
Lane LOS	A			D
Approach Delay (s)	0.5		0.0	27.2
Approach LOS				D

Intersection Summary			
Average Delay	2.2		
Intersection Capacity Utilization	64.5%	ICU Level of Service	C
Analysis Period (min)	15		

1: St. Catherine's Ln. & Grove Ave. Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBR	All
Denied Del/Veh (s)	0.1	0.1	0.0	0.0	0.3	0.2	0.1
Total Del/Veh (s)	2.3	0.4	6.3	2.6	17.9	7.3	3.5

2: Grove Ave. & Somerset Ave. Performance by movement

Movement	EBL	EBT	WBT	WBR	SBL	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.3	0.3	0.1
Total Del/Veh (s)	47.2	24.1	30.3	22.4	40.2	36.5	29.9

3: Maple Ave. & Grove Ave. Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	0.4	0.2	0.3	0.0	0.0	0.0	0.2	0.2	0.2
Total Del/Veh (s)	11.3	2.4	1.8	6.1	2.1	0.9	127.2	99.6	115.6	57.1	51.1	25.5

3: Maple Ave. & Grove Ave. Performance by movement

Movement	All
Denied Del/Veh (s)	0.1
Total Del/Veh (s)	20.0

4: Maple Ave. & School Ent./Linden Ln. Performance by movement

Movement	EBL	EBT	EBR	WBL	NBT	NBR	SBL	SBT	All
Denied Del/Veh (s)	20.6	16.5	19.8	0.1	8.5	11.4	0.0	0.0	10.5
Total Del/Veh (s)	32.7	25.4	24.0	4.7	46.1	30.8	6.6	6.5	27.3

5: Cary St. & Maple Ave. Performance by movement

Movement	EBL	EBT	WBT	WBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	0.4	0.7	0.8	0.8	0.0	0.0	0.0	0.6
Total Del/Veh (s)	8.9	1.8	1.2	0.5	55.8	1.7	19.7	3.1

Total Network Performance

Denied Del/Veh (s)	2.0
Total Del/Veh (s)	28.3

Intersection: 1: St. Catherine's Ln. & Grove Ave.

Movement	EB	EB	WB	WB	NB
Directions Served	T	TR	LT	T	LR
Maximum Queue (ft)	134	68	151	150	124
Average Queue (ft)	24	5	48	14	45
95th Queue (ft)	85	37	113	81	90
Link Distance (ft)	365	365	179	179	578
Upstream Blk Time (%)			0	0	
Queuing Penalty (veh)			0	0	
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 2: Grove Ave. & Somerset Ave.

Movement	EB	EB	WB	WB	SB
Directions Served	LT	T	T	TR	LR
Maximum Queue (ft)	196	195	383	348	395
Average Queue (ft)	150	132	229	201	215
95th Queue (ft)	218	214	363	336	353
Link Distance (ft)	179	179	503	503	528
Upstream Blk Time (%)	8	5			
Queuing Penalty (veh)	23	14			
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 3: Maple Ave. & Grove Ave.

Movement	EB	EB	WB	WB	NB	SB
Directions Served	LT	TR	LT	TR	LTR	LTR
Maximum Queue (ft)	114	92	163	85	448	162
Average Queue (ft)	42	7	44	9	268	64
95th Queue (ft)	88	42	114	47	517	134
Link Distance (ft)	503	503	349	349	440	486
Upstream Blk Time (%)					17	
Queuing Penalty (veh)					53	
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 4: Maple Ave. & School Ent./Linden Ln.

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	TR	LT
Maximum Queue (ft)	212	30	289	61
Average Queue (ft)	92	4	104	34
95th Queue (ft)	214	20	320	52
Link Distance (ft)	220	316	868	440
Upstream Blk Time (%)	14			
Queuing Penalty (veh)	0			
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 5: Cary St. & Maple Ave.

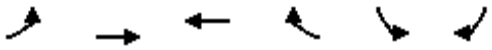
Movement	EB	EB	WB	SB
Directions Served	L	T	TR	LR
Maximum Queue (ft)	152	291	8	172
Average Queue (ft)	29	13	0	63
95th Queue (ft)	93	131	6	122
Link Distance (ft)	388	388	275	868
Upstream Blk Time (%)	0	0		
Queuing Penalty (veh)	0	0		
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 90

APPENDIX D

BACKGROUND PEAK HOUR ANALYSIS



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	11	368	523	37	150	40
Future Volume (vph)	11	368	523	37	150	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5	4.5		4.5	
Lane Util. Factor		0.95	0.95		1.00	
Frt		1.00	0.99		0.97	
Flt Protected		1.00	1.00		0.96	
Satd. Flow (prot)		3278	3093		1741	
Flt Permitted		0.92	1.00		0.96	
Satd. Flow (perm)		3006	3093		1741	
Peak-hour factor, PHF	0.72	0.72	0.72	0.72	0.56	0.56
Adj. Flow (vph)	15	511	726	51	268	71
RTOR Reduction (vph)	0	0	2	0	5	0
Lane Group Flow (vph)	0	526	775	0	335	0
Parking (#/hr)		9	27			
Turn Type	Perm	NA	NA		Prot	
Protected Phases		4	8		6	
Permitted Phases	4					
Actuated Green, G (s)		103.5	103.5		87.5	
Effective Green, g (s)		103.5	103.5		87.5	
Actuated g/C Ratio		0.52	0.52		0.44	
Clearance Time (s)		4.5	4.5		4.5	
Lane Grp Cap (vph)		1555	1600		761	
v/s Ratio Prot			c0.25		c0.19	
v/s Ratio Perm		0.17				
v/c Ratio		0.34	0.48		0.44	
Uniform Delay, d1		28.2	31.1		39.2	
Progression Factor		1.00	1.00		1.00	
Incremental Delay, d2		0.6	1.1		1.8	
Delay (s)		28.8	32.1		41.0	
Level of Service		C	C		D	
Approach Delay (s)		28.8	32.1		41.0	
Approach LOS		C	C		D	

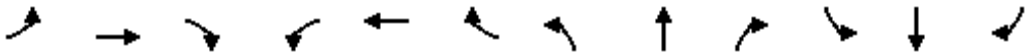
Intersection Summary			
HCM 2000 Control Delay	32.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	200.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	36.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	305	12	88	429	3	74
Future Volume (Veh/h)	305	12	88	429	3	74
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.72	0.72	0.72	0.72	0.41	0.41
Hourly flow rate (vph)	424	17	122	596	7	180
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)				214		
pX, platoon unblocked					0.85	
vC, conflicting volume			441		974	220
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			441		610	220
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			89		98	77
cM capacity (veh/h)			1115		322	783

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	283	158	321	397	187
Volume Left	0	0	122	0	7
Volume Right	0	17	0	0	180
cSH	1700	1700	1115	1700	743
Volume to Capacity	0.17	0.09	0.11	0.23	0.25
Queue Length 95th (ft)	0	0	9	0	25
Control Delay (s)	0.0	0.0	3.9	0.0	11.5
Lane LOS			A		B
Approach Delay (s)	0.0		1.8		11.5
Approach LOS					B

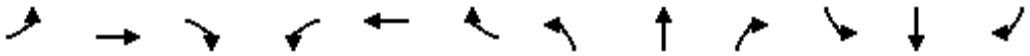
Intersection Summary			
Average Delay	2.5		
Intersection Capacity Utilization	38.0%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	69	280	51	64	480	122	21	60	92	16	23	50
Future Volume (Veh/h)	69	280	51	64	480	122	21	60	92	16	23	50
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.72	0.72	0.72	0.72	0.72	0.72	0.67	0.67	0.67	0.78	0.78	0.78
Hourly flow rate (vph)	96	389	71	89	667	169	31	90	137	21	29	64
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		581										
pX, platoon unblocked				0.95			0.95	0.95	0.95	0.95	0.95	
vC, conflicting volume	836			460			1206	1630	230	1498	1582	418
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	836			316			1105	1553	73	1413	1501	418
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	88			92			66	0	85	0	69	89
cM capacity (veh/h)	794			1174			91	86	922	0	93	584

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	290	266	422	502	258	114
Volume Left	96	0	89	0	31	21
Volume Right	0	71	0	169	137	64
cSH	794	1700	1174	1700	169	0
Volume to Capacity	0.12	0.16	0.08	0.30	1.53	Err
Queue Length 95th (ft)	10	0	6	0	423	Err
Control Delay (s)	4.3	0.0	2.4	0.0	316.0	Err
Lane LOS	A		A		F	F
Approach Delay (s)	2.2		1.1		316.0	Err
Approach LOS					F	F

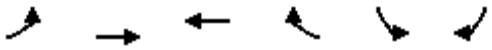
Intersection Summary				
Average Delay	Err			
Intersection Capacity Utilization	52.4%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	64	32	36	1	0	0	0	133	15	1	105	0
Future Volume (vph)	64	32	36	1	0	0	0	133	15	1	105	0
Peak Hour Factor	0.49	0.49	0.49	0.25	0.25	0.25	0.68	0.68	0.68	0.62	0.62	0.62
Hourly flow rate (vph)	131	65	73	4	0	0	0	196	22	2	169	0

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	269	4	218	171
Volume Left (vph)	131	4	0	2
Volume Right (vph)	73	0	22	0
Hadj (s)	-0.03	0.23	-0.03	0.04
Departure Headway (s)	4.8	5.5	4.8	4.9
Degree Utilization, x	0.36	0.01	0.29	0.23
Capacity (veh/h)	699	580	708	684
Control Delay (s)	10.5	8.5	9.8	9.4
Approach Delay (s)	10.5	8.5	9.8	9.4
Approach LOS	B	A	A	A

Intersection Summary				
Delay	10.0			
Level of Service	A			
Intersection Capacity Utilization	21.2%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	55	1011	803	27	3	85
Future Volume (Veh/h)	55	1011	803	27	3	85
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.93	0.93	0.96	0.96	0.56	0.56
Hourly flow rate (vph)	59	1087	836	28	5	152
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	864				2055	850
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	864				2055	850
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	92				91	58
cM capacity (veh/h)	779				56	360

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	59	1087	864	157
Volume Left	59	0	0	5
Volume Right	0	0	28	152
cSH	779	1700	1700	307
Volume to Capacity	0.08	0.64	0.51	0.51
Queue Length 95th (ft)	6	0	0	68
Control Delay (s)	10.0	0.0	0.0	28.3
Lane LOS	B			D
Approach Delay (s)	0.5		0.0	28.3
Approach LOS				D

Intersection Summary			
Average Delay	2.3		
Intersection Capacity Utilization	65.3%	ICU Level of Service	C
Analysis Period (min)	15		

1: St. Catherine's Ln. & Grove Ave. Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBR	All
Denied Del/Veh (s)	0.1	0.1	0.0	0.0	0.2	0.2	0.1
Total Del/Veh (s)	2.9	0.2	6.5	2.6	23.0	7.5	3.7

2: Grove Ave. & Somerset Ave. Performance by movement

Movement	EBL	EBT	WBT	WBR	SBL	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.4	0.4	0.1
Total Del/Veh (s)	46.2	24.0	31.0	23.3	39.6	36.6	30.1

3: Maple Ave. & Grove Ave. Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	0.4	0.2	0.3	0.0	0.0	0.0	0.2	0.2	0.2
Total Del/Veh (s)	10.6	2.4	1.7	6.1	2.0	1.0	139.9	100.7	129.1	47.3	47.7	27.3

3: Maple Ave. & Grove Ave. Performance by movement

Movement	All
Denied Del/Veh (s)	0.1
Total Del/Veh (s)	21.6

4: Maple Ave. & School Ent./Linden Ln. Performance by movement

Movement	EBL	EBT	EBR	WBL	NBT	NBR	SBL	SBT	All
Denied Del/Veh (s)	8.2	9.2	10.6	0.1	3.6	2.1	0.0	0.0	4.8
Total Del/Veh (s)	29.3	26.9	24.3	4.6	42.4	39.8	7.1	6.4	26.4

5: Cary St. & Maple Ave. Performance by movement

Movement	EBL	EBT	WBT	WBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	0.5	0.7	0.8	0.7	0.0	0.0	0.0	0.7
Total Del/Veh (s)	8.8	1.9	1.2	0.5	80.9	1.7	24.8	3.5

Total Network Performance

Denied Del/Veh (s)	1.2
Total Del/Veh (s)	29.4

Intersection: 1: St. Catherine's Ln. & Grove Ave.

Movement	EB	EB	WB	WB	NB
Directions Served	T	TR	LT	T	LR
Maximum Queue (ft)	154	108	151	156	149
Average Queue (ft)	29	8	50	13	49
95th Queue (ft)	103	56	114	78	104
Link Distance (ft)	365	365	179	179	578
Upstream Blk Time (%)			0	0	
Queuing Penalty (veh)			0	0	
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 2: Grove Ave. & Somerset Ave.

Movement	EB	EB	WB	WB	SB
Directions Served	LT	T	T	TR	LR
Maximum Queue (ft)	195	196	390	356	414
Average Queue (ft)	150	138	235	206	221
95th Queue (ft)	222	216	371	341	367
Link Distance (ft)	179	179	503	503	528
Upstream Blk Time (%)	8	5			
Queuing Penalty (veh)	25	15			
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 3: Maple Ave. & Grove Ave.

Movement	EB	EB	WB	WB	NB	SB
Directions Served	LT	TR	LT	TR	LTR	LTR
Maximum Queue (ft)	111	57	172	119	447	167
Average Queue (ft)	44	4	42	10	301	61
95th Queue (ft)	87	29	112	52	539	132
Link Distance (ft)	503	503	349	349	440	486
Upstream Blk Time (%)					19	
Queuing Penalty (veh)					61	
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 4: Maple Ave. & School Ent./Linden Ln.

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	TR	LT
Maximum Queue (ft)	231	30	316	56
Average Queue (ft)	95	4	103	33
95th Queue (ft)	214	22	300	49
Link Distance (ft)	220	316	868	440
Upstream Blk Time (%)	13			
Queuing Penalty (veh)	0			
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 5: Cary St. & Maple Ave.

Movement	EB	EB	WB	SB
Directions Served	L	T	TR	LR
Maximum Queue (ft)	279	253	4	207
Average Queue (ft)	37	12	0	68
95th Queue (ft)	136	125	4	165
Link Distance (ft)	388	388	275	868
Upstream Blk Time (%)	0	0		
Queuing Penalty (veh)	0	0		
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

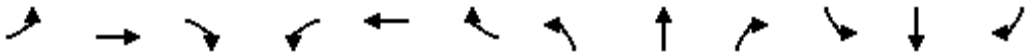
Network wide Queuing Penalty: 101

APPENDIX E

WARRANT ANALYSIS

APPENDIX F

TOTAL FUTURE PEAK HOUR ANALYSIS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	69	151	59	72	451	122	21	60	139	136	23	50
Future Volume (vph)	69	151	59	72	451	122	21	60	139	136	23	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5			4.5			4.5	
Lane Util. Factor		0.95			0.95			1.00			1.00	
Frt		0.97			0.97			0.91			0.97	
Flt Protected		0.99			0.99			1.00			0.97	
Satd. Flow (prot)		2987			3095			1696			1746	
Flt Permitted		0.61			0.76			1.00			0.97	
Satd. Flow (perm)		1830			2374			1696			1746	
Peak-hour factor, PHF	0.72	0.72	0.72	0.72	0.72	0.72	0.67	0.67	0.67	0.78	0.78	0.78
Adj. Flow (vph)	96	210	82	100	626	169	31	90	207	174	29	64
RTOR Reduction (vph)	0	24	0	0	20	0	0	62	0	0	11	0
Lane Group Flow (vph)	0	364	0	0	875	0	0	266	0	0	256	0
Parking (#/hr)		27			18							
Turn Type	pm+pt	NA		pm+pt	NA		Split	NA		Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases	4			8								
Actuated Green, G (s)		38.5			38.5			20.0			18.5	
Effective Green, g (s)		38.5			38.5			20.0			18.5	
Actuated g/C Ratio		0.38			0.38			0.20			0.18	
Clearance Time (s)		4.5			4.5			4.5			4.5	
Lane Grp Cap (vph)		762			950			339			323	
v/s Ratio Prot		c0.02			c0.05			c0.16			c0.15	
v/s Ratio Perm		0.16			c0.31							
v/c Ratio		0.48			0.92			0.79			0.79	
Uniform Delay, d1		23.2			29.3			38.0			38.9	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		2.1			15.4			16.6			17.8	
Delay (s)		25.3			44.7			54.6			56.7	
Level of Service		C			D			D			E	
Approach Delay (s)		25.3			44.7			54.6			56.7	
Approach LOS		C			D			D			E	

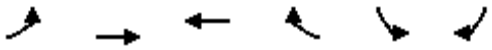
Intersection Summary			
HCM 2000 Control Delay	44.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	66.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	285	12	88	418	3	74
Future Volume (Veh/h)	285	12	88	418	3	74
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.72	0.72	0.72	0.72	0.41	0.41
Hourly flow rate (vph)	396	17	122	581	7	180
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)				795		
pX, platoon unblocked						
vC, conflicting volume			413		939	206
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			413		939	206
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			89		97	77
cM capacity (veh/h)			1142		234	800

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	264	149	316	387	187
Volume Left	0	0	122	0	7
Volume Right	0	17	0	0	180
cSH	1700	1700	1142	1700	734
Volume to Capacity	0.16	0.09	0.11	0.23	0.25
Queue Length 95th (ft)	0	0	9	0	25
Control Delay (s)	0.0	0.0	3.9	0.0	11.6
Lane LOS			A		B
Approach Delay (s)	0.0		1.8		11.6
Approach LOS					B

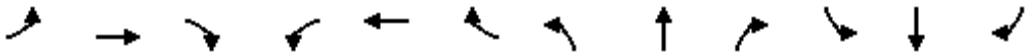
Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	37.1%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	11	354	507	37	30	40
Future Volume (Veh/h)	11	354	507	37	30	40
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.72	0.72	0.72	0.72	0.56	0.56
Hourly flow rate (vph)	15	492	704	51	54	71
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)			581			
pX, platoon unblocked	0.85				0.85	0.85
vC, conflicting volume	755				1006	378
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	346				642	0
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				84	92
cM capacity (veh/h)	1023				339	917

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	179	328	469	286	125
Volume Left	15	0	0	0	54
Volume Right	0	0	0	51	71
cSH	1023	1700	1700	1700	528
Volume to Capacity	0.01	0.19	0.28	0.17	0.24
Queue Length 95th (ft)	1	0	0	0	23
Control Delay (s)	0.8	0.0	0.0	0.0	13.9
Lane LOS	A				B
Approach Delay (s)	0.3		0.0		13.9
Approach LOS					B

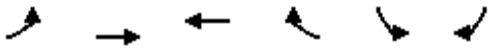
Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	28.5%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	96	0	36	1	0	0	0	148	0	1	120	0
Future Volume (vph)	96	0	36	1	0	0	0	148	0	1	120	0
Peak Hour Factor	0.49	0.49	0.49	0.25	0.25	0.25	0.68	0.68	0.68	0.62	0.62	0.62
Hourly flow rate (vph)	196	0	73	4	0	0	0	218	0	2	194	0

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	269	4	218	196
Volume Left (vph)	196	4	0	2
Volume Right (vph)	73	0	0	0
Hadj (s)	0.02	0.23	0.03	0.04
Departure Headway (s)	5.0	5.6	4.9	4.9
Degree Utilization, x	0.37	0.01	0.30	0.27
Capacity (veh/h)	681	566	692	683
Control Delay (s)	10.8	8.6	10.0	9.8
Approach Delay (s)	10.8	8.6	10.0	9.8
Approach LOS	B	A	A	A

Intersection Summary				
Delay	10.3			
Level of Service	B			
Intersection Capacity Utilization	21.3%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	85	1011	803	57	3	85
Future Volume (Veh/h)	85	1011	803	57	3	85
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.93	0.93	0.96	0.96	0.56	0.56
Hourly flow rate (vph)	91	1087	836	59	5	152
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	895				2134	866
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	895				2134	866
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	88				90	57
cM capacity (veh/h)	758				48	353

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	91	1087	895	157
Volume Left	91	0	0	5
Volume Right	0	0	59	152
cSH	758	1700	1700	293
Volume to Capacity	0.12	0.64	0.53	0.54
Queue Length 95th (ft)	10	0	0	74
Control Delay (s)	10.4	0.0	0.0	30.6
Lane LOS	B			D
Approach Delay (s)	0.8		0.0	30.6
Approach LOS				D

Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	65.9%	ICU Level of Service	C
Analysis Period (min)	15		

1: St. Catherine's Ln. & Grove Ave. Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBR	All
Denied Del/Veh (s)	0.1	0.1	0.0	0.0	0.2	0.2	0.1
Total Del/Veh (s)	0.3	0.2	4.0	0.8	13.5	4.6	1.5

2: Grove Ave. & Somerset Ave. Performance by movement

Movement	EBL	EBT	WBT	WBR	SBL	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.2	0.1	0.0
Total Del/Veh (s)	7.6	0.4	2.9	2.6	16.8	8.8	2.7

3: Maple Ave. & Grove Ave. Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	0.5	0.3	0.4	0.0	0.0	0.0	0.3	0.3	0.3
Total Del/Veh (s)	55.6	16.0	11.4	45.9	36.3	19.5	57.2	32.6	40.1	49.2	51.4	39.2

3: Maple Ave. & Grove Ave. Performance by movement

Movement	All
Denied Del/Veh (s)	0.2
Total Del/Veh (s)	33.7

4: Maple Ave. & School Ent./Linden Ln. Performance by movement

Movement	EBL	EBR	WBL	NBT	SBL	SBT	All
Denied Del/Veh (s)	1.0	1.5	0.1	0.1	0.0	0.0	0.5
Total Del/Veh (s)	8.1	6.4	4.8	8.5	7.3	7.1	7.7

5: Cary St. & Maple Ave. Performance by movement

Movement	EBL	EBT	WBT	WBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	0.5	0.7	0.9	0.8	0.0	0.0	0.0	0.7
Total Del/Veh (s)	12.0	1.9	1.6	0.7	64.4	1.9	22.7	3.6

Total Network Performance

Denied Del/Veh (s)	0.6
Total Del/Veh (s)	21.4

Intersection: 1: St. Catherine's Ln. & Grove Ave.

Movement	EB	WB	WB	NB
Directions Served	TR	LT	T	LR
Maximum Queue (ft)	2	86	14	87
Average Queue (ft)	0	34	0	41
95th Queue (ft)	3	72	9	70
Link Distance (ft)	365	179	179	578
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 2: Grove Ave. & Somerset Ave.

Movement	EB	EB	WB	WB	SB
Directions Served	LT	T	T	TR	LR
Maximum Queue (ft)	90	26	4	16	113
Average Queue (ft)	10	1	0	1	44
95th Queue (ft)	48	16	4	9	82
Link Distance (ft)	179	179	503	503	528
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 3: Maple Ave. & Grove Ave.

Movement	EB	EB	WB	WB	NB	SB
Directions Served	LT	TR	LT	TR	LTR	LTR
Maximum Queue (ft)	212	183	366	342	408	318
Average Queue (ft)	117	91	269	211	197	160
95th Queue (ft)	186	159	375	323	364	277
Link Distance (ft)	503	503	349	349	440	486
Upstream Blk Time (%)			2	0	1	
Queuing Penalty (veh)			0	0	6	
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 4: Maple Ave. & School Ent./Linden Ln.

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	TR	LT
Maximum Queue (ft)	130	30	94	73
Average Queue (ft)	60	4	46	41
95th Queue (ft)	111	19	83	64
Link Distance (ft)	220	316	868	440
Upstream Blk Time (%)	1			
Queuing Penalty (veh)	0			
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 5: Cary St. & Maple Ave.

Movement	EB	EB	WB	SB
Directions Served	L	T	TR	LR
Maximum Queue (ft)	235	327	22	192
Average Queue (ft)	44	15	2	69
95th Queue (ft)	132	138	11	154
Link Distance (ft)	388	388	275	868
Upstream Blk Time (%)	0	0		
Queuing Penalty (veh)	0	0		
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 6