TRAFFIC IMPACT STUDY
FOR
KROGER STORE #743 ROSEBUD ROAD

LOGANVILLE, GEORGIA

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TABLE OF CONTENTS

Item **Page**

1.0 Introduction 1
2.0 Existing Facilities / Conditions 4
2.1 Roadway Facilities 4
2.1.1 Athens Highway (US 78 / SR 10) 4
2.1.2 Rosebud Road 4
3.0 Study Methodology 5
3.1 Unsignalized Intersections 5
3.2 Signalized Intersections 5
4.0 Existing Traffic Analysis 7
4.1 Existing Traffic Operations 7
5.0 Proposed Development 11
5.1 Trip Generation 11
5.2 Trip Distribution 12
6.0 Future Traffic Analysis 16
6.1 Future "No-Build" Conditions 16
6.1.1 Annual Traffic Growth 16
6.1.2 Recommendations for System Improvements 16
6.1.3 Future "No-Build" Traffic Operations 17
6.2 Future "Build" Conditions 20
6.2.1 Site Access Configuration 20
6.2.2 Recommendations for Site Mitigation Improvements 21
6.2.3 Future "Build" Traffic Operations 22
7.0 Conclusions and Recommendations 26
7.1 System Recommendations and Improvements 26
7.2 Site Access Configuration 26
7.3 Site Mitigation Improvements 27
Appendix

LIST OF TABLES

Item **Page**

Table 1 – Level-of-service Criteria for Unsignalized Intersections 5
Table 2 – Level-of-service Criteria for Signalized Intersections 6
Table 3 – Existing Intersection Operations 7
Table 4 – Existing Intersection 95th Percentile Queues 8
Table 5 – Trip Generation 11
Table 6 – Future "No-Build" Intersection Operations 18
Table 7 – Future "No-Build" Intersection 95th Percentile Queues 18
Table 8 – Future "Build" Intersection Operations 22
Table 9 – Future "Build" Intersection 95th Percentile Queues 23

LIST OF FIGURES

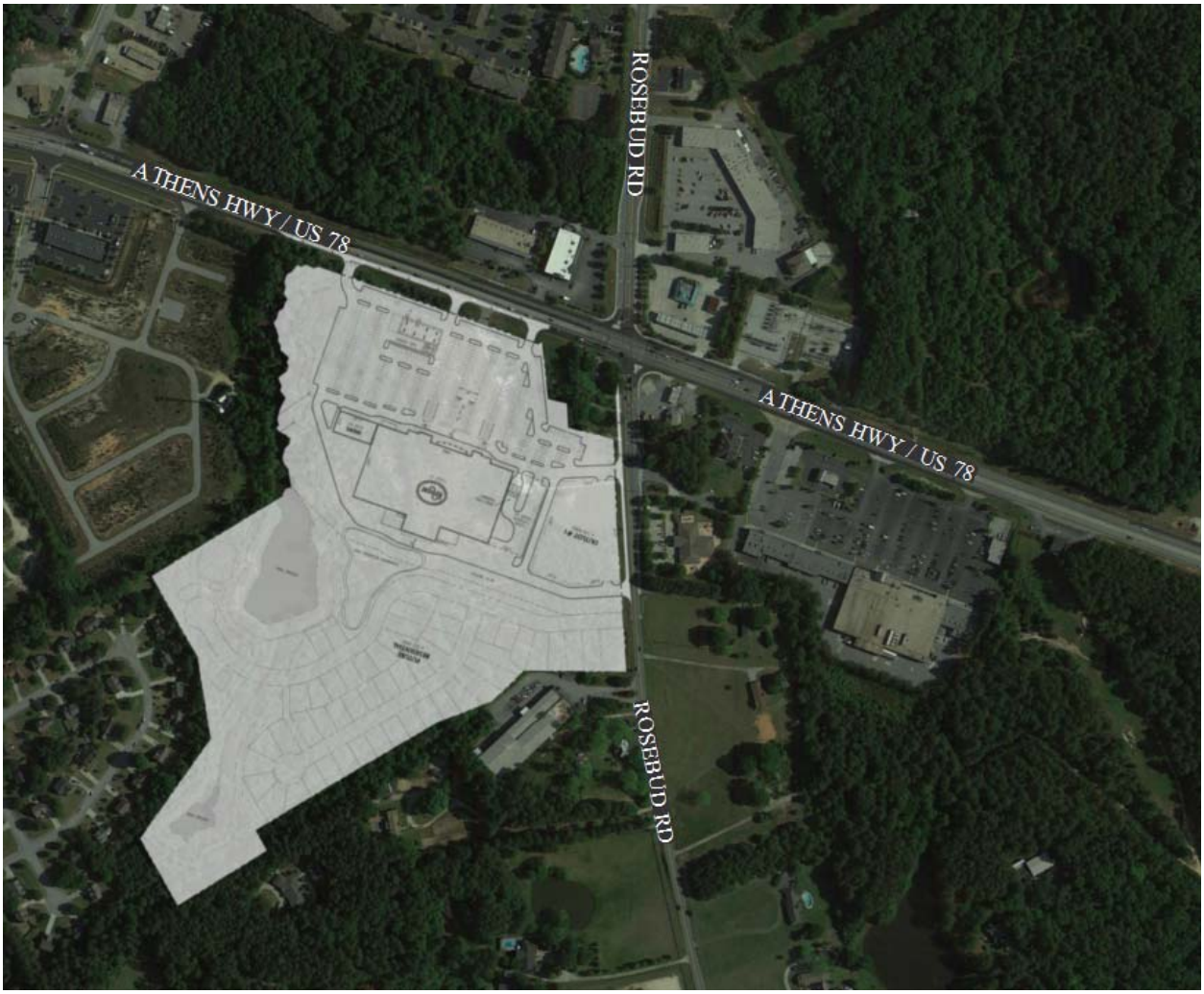
Item **Page**

Figure 1 – Location Map 3
Figure 2 – Existing Weekday Peak Hour Volumes 9
Figure 3 – Existing Traffic Control and Lane Geometry 10
Figure 4 – Population Density 12
Figure 5– Site Plan 13
Figure 6 – Outer Leg Trip Distribution and Site Generated Peak Hour Volumes 14
Figure 7– Site Peak Hour Pass-by Volumes 15
Figure 8 – Retaining Wall Location 17
Figure 9 – Future (No-Build) Peak Hour Volumes 19
Figure 10 – Future (Build) Peak Hour Volumes 24
Figure 11 – Future Traffic Control and Lane Geometry 25

1.0 INTRODUCTION

The purpose of this study is to determine the traffic impact that will result from the proposed Kroger retail development located in the southwest corner of the intersection of Athens Highway (US 78 / SR 10) at Rosebud Road in Loganville, Georgia. Currently the Kroger store is in the southeast corner and will be relocated to the southwest corner of the intersection of Athens Highway (US 78 / SR 10) at Rosebud Road. The traffic analysis evaluates the current operations compared to the future conditions with the traffic generated by the development. The proposed development will consist of:

- Supermarket – 113,531 sf
- Shops – 9,100 sf
- Outlot – 1.86 acres (8,250 sf estimated)
- Gasoline/Service Station – 14 fueling positions



The development proposes access at the following locations:

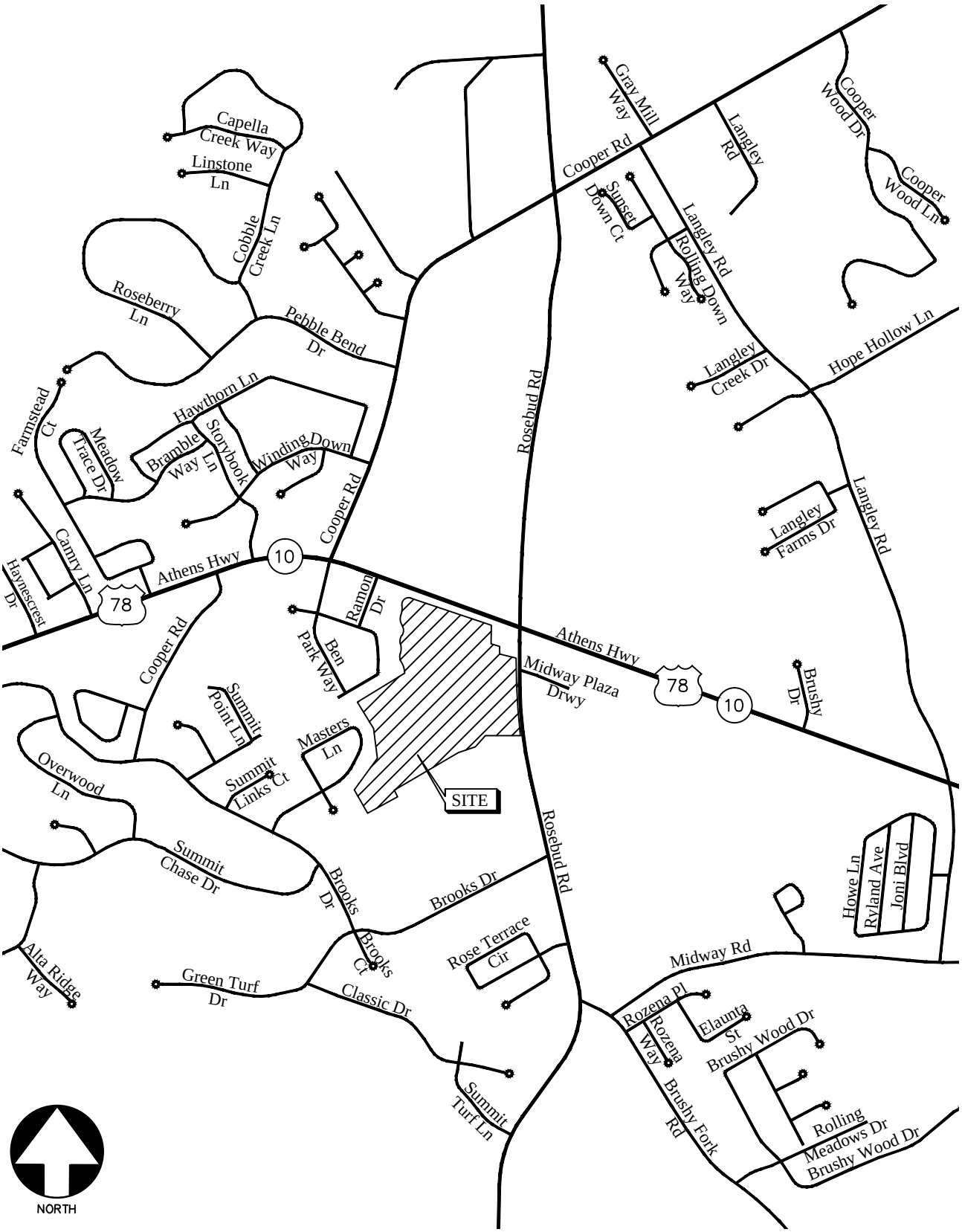
- Site Driveway 1: Full-access driveway on Athens Highway (US 78 / SR 10)
- Site Driveway 2: Right-in / Right-out driveway on Athens Highway (US 78 / SR 10)

- Site Driveway 3: Full-access driveway on Rosebud Road, aligning across from the Midway Plaza driveway
- Site Driveway 4: Full-access driveway on Rosebud Road

The AM and PM peak hours have been analyzed in this study. In addition to the site access points, this study includes the evaluation of traffic operations at the intersections of:

- Athens Highway (US 78 / SR 10) at Rosebud Road
- Rosebud Road at Midway Plaza driveway

Recommendations to improve traffic operations have been identified as appropriate and are discussed in detail in the following sections of the report. The location of the development and the surrounding roadway network is shown in Figure 1.



LOCATION MAP

FIGURE 1

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2.0 EXISTING FACILITIES / CONDITIONS

2.1 Roadway Facilities

The following is a brief description of each of the roadway facilities located in proximity to the site:

2.1.1 Athens Highway (US 78 / SR 10)

Athens Highway (US 78 / SR 10) is an east-west, four-lane roadway with a two-way left-turn lane in the middle and a posted speed limit of 55 mph in the vicinity of the site. GDOT traffic counts (Station ID 1350058 & 1350061) indicate that the daily traffic volume on Athens Highway (US 78 / SR 10) is 39,600 vehicles per day west of Brooks Drive and 33,200 vehicles per day east of Krisam Creek Drive.

2.1.2 Rosebud Road

Rosebud Road is a north-south, two-lane, undivided roadway with a posted speed limit of 45 mph in the vicinity of the site. GDOT traffic counts (Station ID 1350518 & 1350516) indicate that the daily traffic volume on Rosebud Road is 12,900 vehicles per day south of Graymont Drive and 9,910 vehicles per day north of Temple Johnson Road.

3.0 STUDY METHODOLOGY

In this study, the methodology used for evaluating traffic operations at each of the subject intersections is based on the criteria set forth in the Transportation Research Board's Highway Capacity Manual, 2000 edition (HCM 2000). Synchro software, which utilizes the HCM 2000 methodology, was used for the analysis. The following is a description of the methodology employed for the analysis of unsignalized and signalized intersections.

3.1 Unsignalized Intersections

For unsignalized intersections at which the side street or minor street is controlled by a stop sign, the criteria for evaluating traffic operations are the level-of-service (LOS) for the turning movements at the intersection and the level-of-service for the overall intersection. Level-of-service is based on the average controlled delay incurred at the intersection. Controlled delay for unsignalized intersections includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. Several factors affect the controlled delay for unsignalized intersections, such as the availability and distribution of gaps in the conflicting traffic stream, critical gaps, and follow-up time for a vehicle in the queue.

Level-of-service is assigned a letter designation from "A" through "F". Level-of-service "A" indicates excellent operations with little delay to motorists, while level-of-service "F" exists when there are insufficient gaps of acceptable size to allow vehicles on the side street to cross safely, resulting in extremely long total delays and long queues. The level-of-service criteria for two-way stop-controlled and all-way stop-controlled (unsignalized) intersections are given in Table 1.

TABLE 1 – LEVEL-OF-SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS

Level-of-service	Average Delay (sec)
A	≤ 10
B	> 10 and ≤ 15
C	> 15 and ≤ 25
D	> 25 and ≤ 35
E	> 35 and ≤ 50
F	> 50

Source: 2000 Highway Capacity Manual

3.2 Signalized Intersections

For signalized intersections, it is necessary to evaluate both capacity and level-of-service in order to evaluate the overall operation of the intersection. The capacity analysis of an intersection is performed by comparing the volume of traffic using the various lane groups at the intersection to the capacity of those lane groups. This results in a volume/capacity (v/c) ratio for each lane group. A v/c ratio greater than 1.0 indicates that the volume of traffic has exceeded the capacity available, resulting in a temporary excess of demand. Although the capacity of the entire intersection is not defined, a composite v/c ratio for the sum of the critical lane groups within the intersection is computed. This composite v/c ratio is an indication of the overall intersection sufficiency.

Level-of-service for a signalized intersection is defined in terms of average controlled delay per vehicle, which is composed of initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. The level-of-service criteria for signalized intersections, based on average controlled delay, are shown in Table 2. Level-of-service "A" indicates operations with very low controlled delay, while level-of-service "F" describes operations with extremely high average controlled delay. Level-of-service "E" is typically considered to be the limit of acceptable delay, and level-of-service "F" is considered unacceptable by most drivers.

Table 2 – Level-of-service Criteria for Signalized Intersections

Level-of-service	Average Control Delay (sec)
A	≤ 10
B	> 10 and ≤ 20
C	> 20 and ≤ 35
D	> 35 and ≤ 55
E	> 55 and ≤ 80
F	> 80

Source: 2000 Highway Capacity Manual

4.0 Existing Traffic Analysis

Existing traffic counts and intersection geometric data were obtained at the study intersections of:

- Athens Highway (US 78 / SR 10) at Rosebud Road
- Rosebud Road at Midway Plaza driveway

Turning movement counts were collected on Wednesday, July 1, 2015. All turning movement counts were recorded during the AM and PM peak hours between 7:00am to 9:00am and 4:00pm to 6:00pm, respectively. The four consecutive 15-minute interval volumes that summed to produce the highest volume at the intersections were then determined. These volumes make up the peak hour traffic volumes for the intersections counted and are shown in Figure 2.

4.1 Existing Traffic Operations

Existing traffic operations were analyzed at the study intersections in accordance with the HCM methodology. A queue length analysis was also performed. The results of the analyses are shown in Tables 3 and 4. The existing traffic control and lane geometry for the intersections are shown in Figure 3.

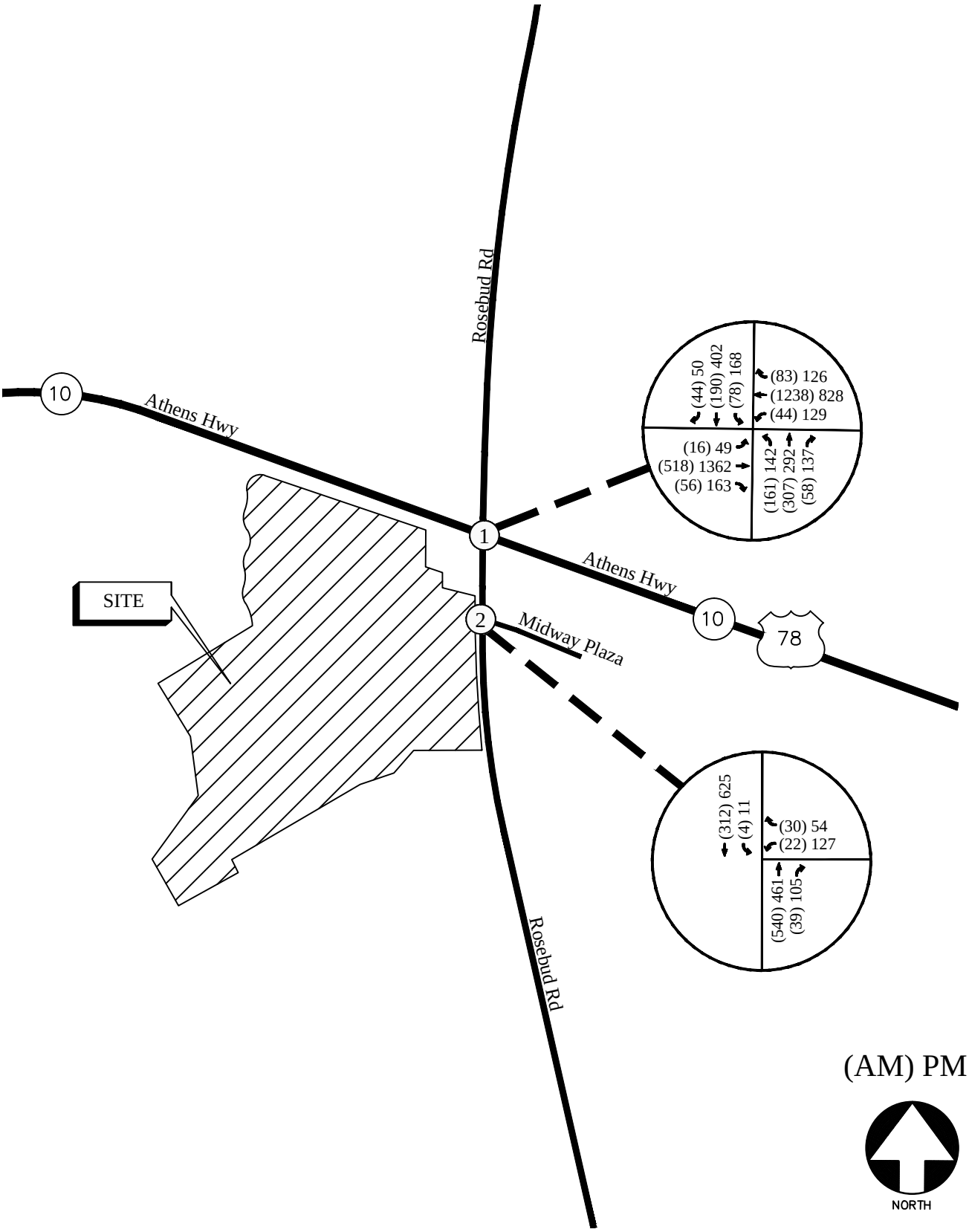
Table 3 – Existing Intersection Operations

	Intersection	Traffic Control	AM Peak Hour		PM Peak Hour	
			LOS (Delay)	v/c ratio	LOS (Delay)	v/c ratio
1	**US 78 @ Rosebud Rd**	Signalized	**C (30.5)**	**0.70**	**E (68.6)**	**1.10**
	-Eastbound Approach		B (17.8)	-	E (71.3)	-
	-Westbound Approach		C (22.3)	-	C (30.1)	-
	-Northbound Approach		D (49.4)	-	F (81.2)	-
	-Southbound Approach		D (53.3)	-	F (111.0)	-
2	**Rosebud Rd @ Midway Plaza Drwy**	Stop Controlled on Westbound Approach				
	-Westbound Approach		C (18.5)	-	F (116.8)	-
	-Southbound Left		A (0.3)	-	A (0.6)	-

* v/c ratio is not calculated for unsignalized intersections

Table 4 – Existing Intersection 95th Percentile Queues				
	Intersection	Available Storage	AM Peak: feet	PM Peak: feet
1	**US 78 @ Rosebud Rd**			
	-Eastbound Left	75’	16	35
	-Eastbound Through/ Right	-	201	882
	-Westbound Left	500’	34	195
	-Westbound Through	-	522	304
	-Westbound Right	325’	0	33
	-Northbound Left	300’	155	216
	-Northbound Through	-	344	379
	-Northbound Right	450’	0	64
	-Southbound Left	270’	80	237
	-Southbound Through	-	231	565
	-Southbound Right	375’	0	0
2	**Rosebud Rd @ Midway Plaza Drwy**			
	-Westbound Left/Right	-	21	254
	-Southbound Left/Through	-	1	2

The results of existing conditions analysis indicate that both the study intersections have an acceptable level-of-service (“D” or better) in the morning peak period. In the evening peak period, the intersection of Athens Highway (US 78 / SR 10) at Rosebud Road is operating at an overall level-of-service “E” which is below the local level-of-service standard (“D” or better). The westbound approach to the intersection of Rosebud Road at Midway Plaza driveway is operating at level-of-service “F” which is below the local level-of-service standard (“D” or better). These areas are addressed in the Future Traffic Operations section.



E□ISTING □ EEKDAY PEAK□HOUR VO□UMES

FIGURE 2

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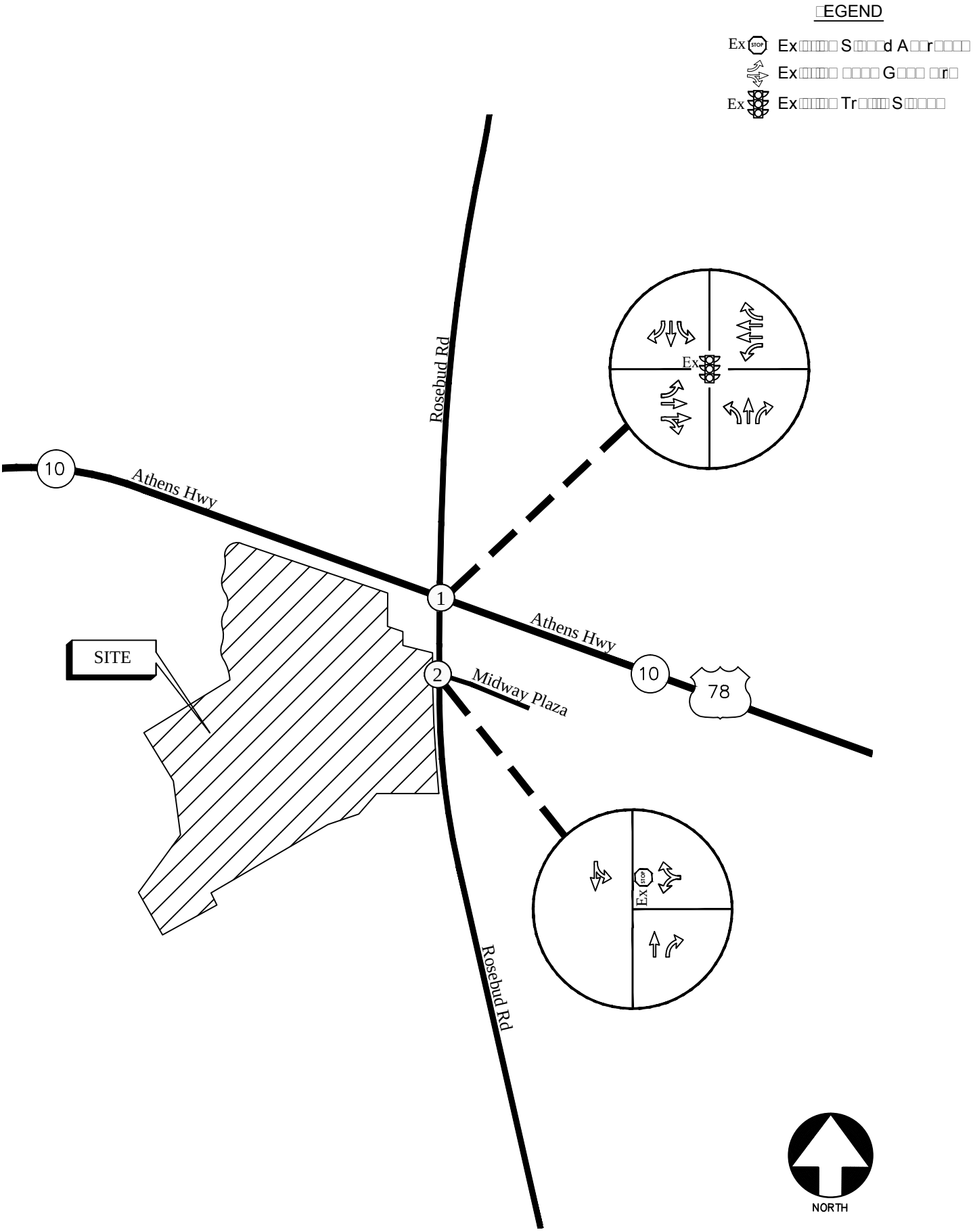

EXISTING TRAFFIC CONTROL AND LANE GEOMETRY FIGURE 3

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5.0 PROPOSED DEVELOPMENT

The proposed Kroger site will be located in the southwest corner of the intersection of Athens Highway (US 78 / SR 10) at Rosebud Road in Loganville, Georgia. Currently the Kroger store is in the Midway Plaza shopping center (southeast corner) and will be relocated to the southwest corner of the intersection of Athens Highway (US 78 / SR 10) at Rosebud Road. The development will consist of:

- Supermarket – 113,531 sf
- Shops – 9,100 sf
- Outlot – 1.86 acres 8,250 sf (estimated)
- Gasoline/Service Station – 14 fueling positions

The development proposes access at the following locations:

- Site Driveway 1: Full-access driveway on Athens Highway (US 78 / SR 10)
- Site Driveway 2: Right-in / Right-out driveway on Athens Highway (US 78 / SR 10)
- Site Driveway 3: Full-access driveway on Rosebud Road, aligning across the Midway Plaza driveway
- Site Driveway 4: Full-access driveway on Rosebud Road

A site plan is shown in Figure 4.

5.1 Trip Generation

Trip generation estimates for the project were based on the rates and equations published in the 9th edition of the Institute of Transportation Engineers (ITE) Trip Generation report. This reference contains traffic volume count data collected at similar facilities nationwide. The trip generation was based on the following ITE Land Uses: 820 – Shopping Center, 850 – Supermarket and 944 – Gasoline/Service Station. Due to the nature of the development, pass-by reductions have been applied per ITE standards. It should be noted that ITE Land Use 850 states "Supermarkets may also contain the following products and services: ATMs, automobile supplies, bakeries, books and magazines, dry cleaning, floral arrangements, greeting cards, limited-service banks, photo centers, pharmacies and video rental areas." The calculated total trip generation for the proposed development is shown in Table 5.

TABLE 5 – TRIP GENERATION

Land Use	Size	AM Peak Hour			PM Peak Hour			24 Hour
		Enter	Exit	Total	Enter	Exit	Total	Two-way
ITE 850 – Supermarket	113,531 sf	239	147	386	436	420	856	8,992
ITE 820 – Shopping Center	17,350 sf	33	21	54	89	96	185	2,175
ITE 944 – Gasoline/Service Station	14 pumps	80	78	158	97	97	194	2,360
Total Trips (without Reductions)		**352**	**246**	**598**	**622**	**613**	**1,235**	**13,527**
Supermarket Passby Trips (0%) 36%		*0*	*0*	*0*	*-157*	*-151*	*-308*	*-3,080*
Shopping Center Passby Trips (0%) 34%		*0*	*0*	*0*	*-30*	*-33*	*-63*	*-630*
Gasoline/Service Station Passby Trips (58%) 42%		*-46*	*-45*	*-91*	*-41*	*-41*	*-82*	*-820*
Total Pass-by Trips		-46	-45	-91	-228	-225	-453	-4,530
New External Trips (with Reductions)		**306**	**201**	**507**	**394**	**388**	**782**	**8,997**

*pass-by trips (AM) PM; 24 Hour pass-by trips estimated by considering PM pass-by as 10% of daily volumes.

5.2 Trip Distribution

The trip distribution describes how traffic arrives and departs from the site. An overall trip distribution was developed for the site based on a review of the existing travel patterns in the area and the locations of major roadways and highways that will serve the development. The site-generated peak hour traffic volumes, shown in Table 5, were assigned to the study area intersections based on this distribution. The outer-leg distribution and AM and PM peak hour new traffic generated by the site are shown in Figure 6. Pass-by volumes have also been distributed based on existing travel patterns and are shown in Figure 7.

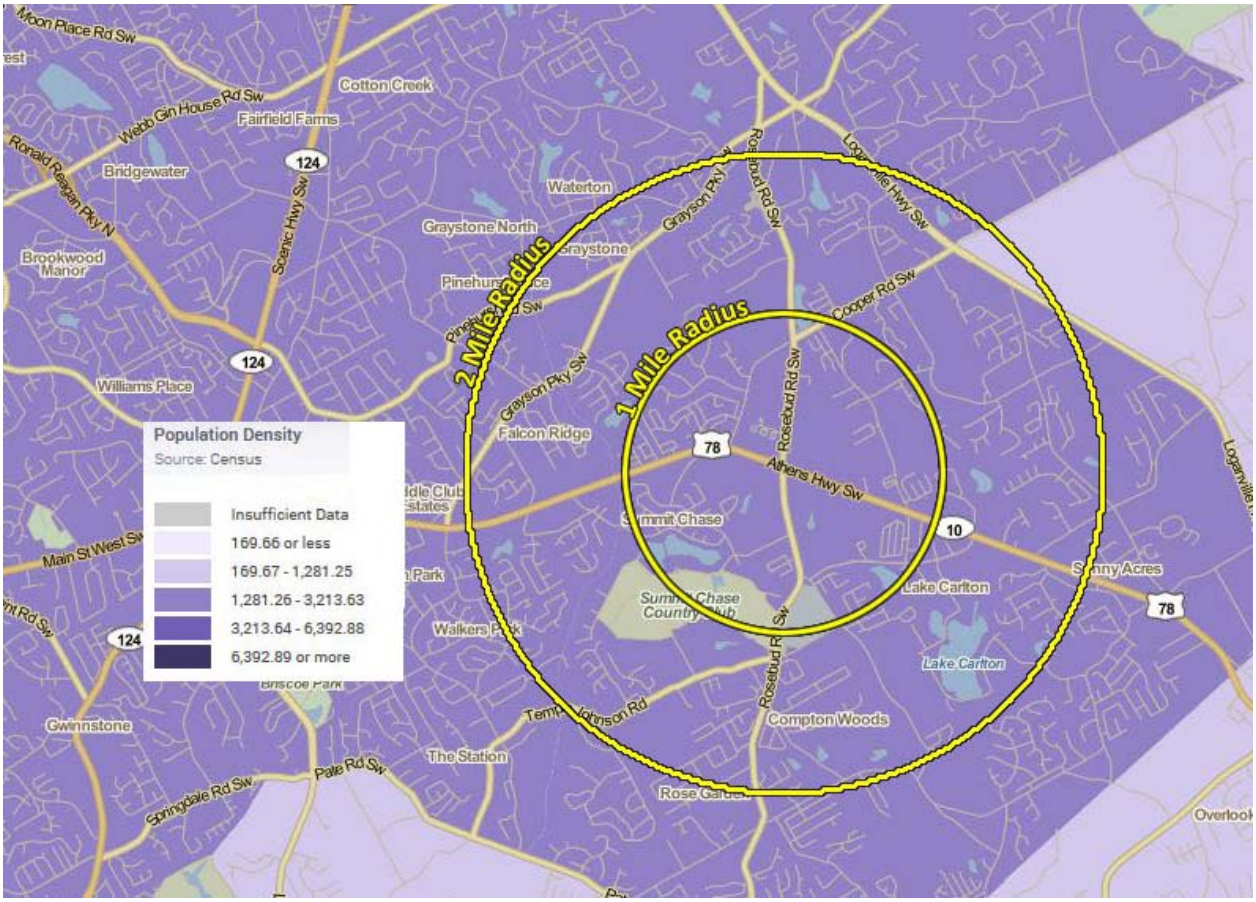
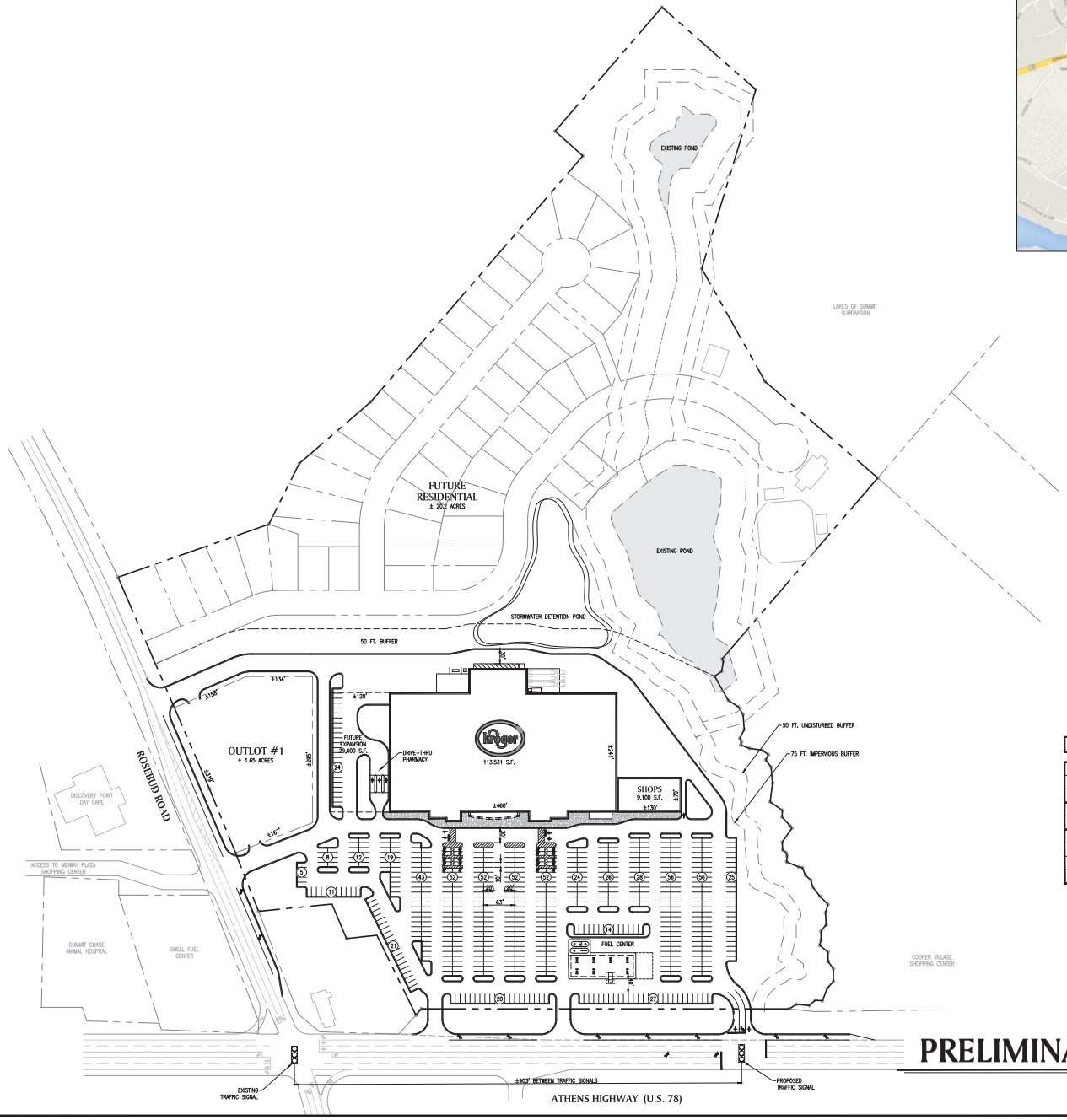


Figure 4 – Population Density



VICINITY MAP

LOGANVILLE, GA NOT TO SCALE

SITE ANALYSIS	
KROGER	113,531 S.F.
RETAIL SHOPS	9,100 S.F.
TOTAL BUILDING AREA	122,631 S.F.
PARKING SHOWN	626 SPACES
PARKING RATIO	5.10 / MSF
SHOPPING CENTER LAND AREA	± 16.9 ACRES
OUTLOT #1	± 1.65 ACRES
RESIDENTIAL LAND AREA	± 20.2 ACRES
TOTAL LAND AREA	± 38.8 ACRES

PRELIMINARY SITE PLAN

0 50 100 200 400
SCALE: 1 = 100

Land Planning
Engineering - Development
Transportation
Landscape Architecture

PAULSON MITCHELL INCORPORATED

[redacted]

PROJECT:

PROPOSED DEVELOPMENT

SOUTHWEST CORNER OF
ROSEBUD ROAD @ ATHENS HWY.
GWINNETT COUNTY
LOGANVILLE, GA 30052

FOR:

BLANCHARD & CALHOUN COMMERCIAL

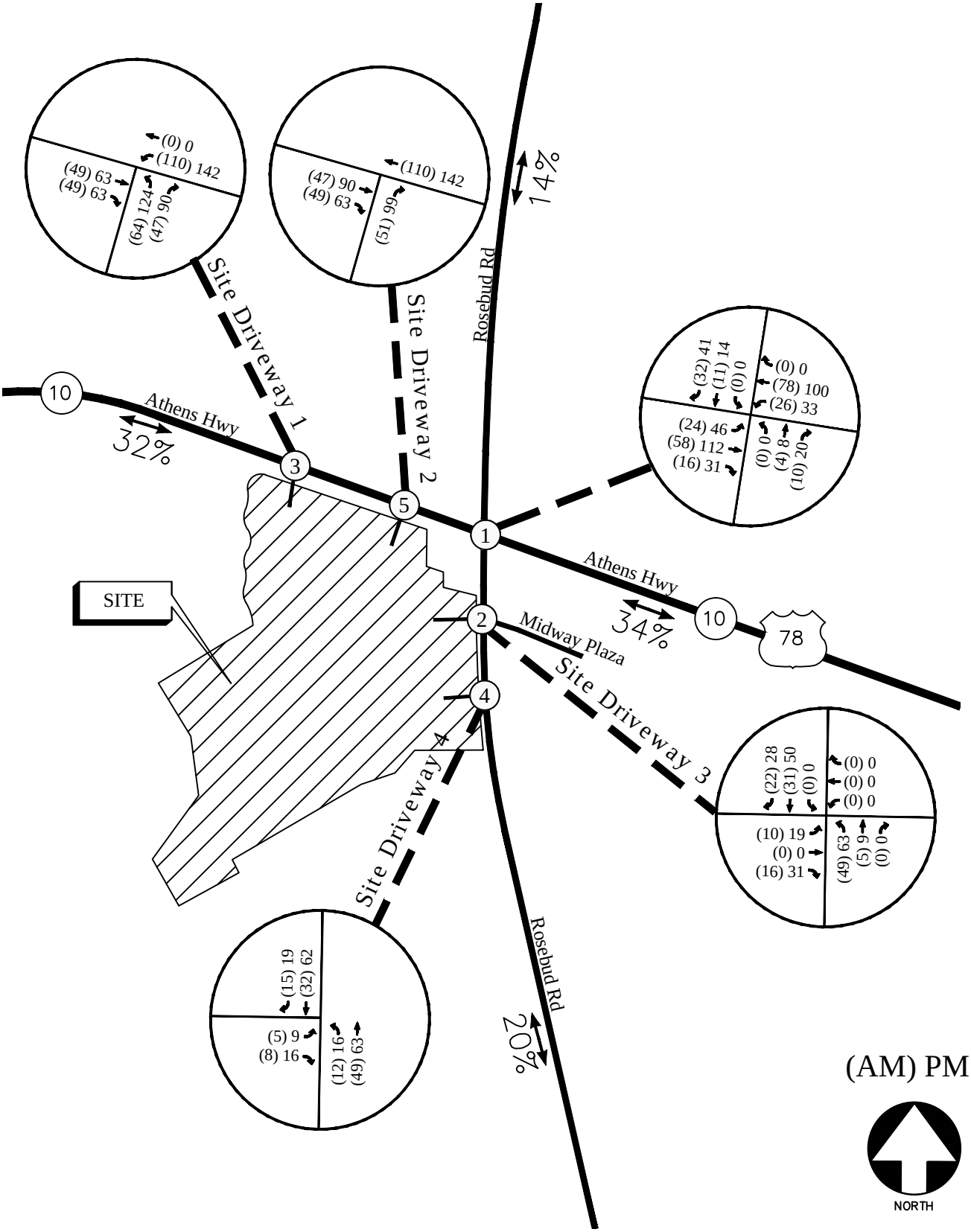
2743 PERIMETER PARKWAY
BLDG. 100, SUITE 370
AUGUSTA, GA 30909
PH. (706) 854-6714

REVISIONS

2014179ps2.dwg 09.24.14

PRELIMINARY SITE PLAN

SHEET **PS-2**



TRIP DISTRI□UTION AND SITE□GENERATED □ EEKDAY PEAK HOUR VO□UMES

FIGURE □

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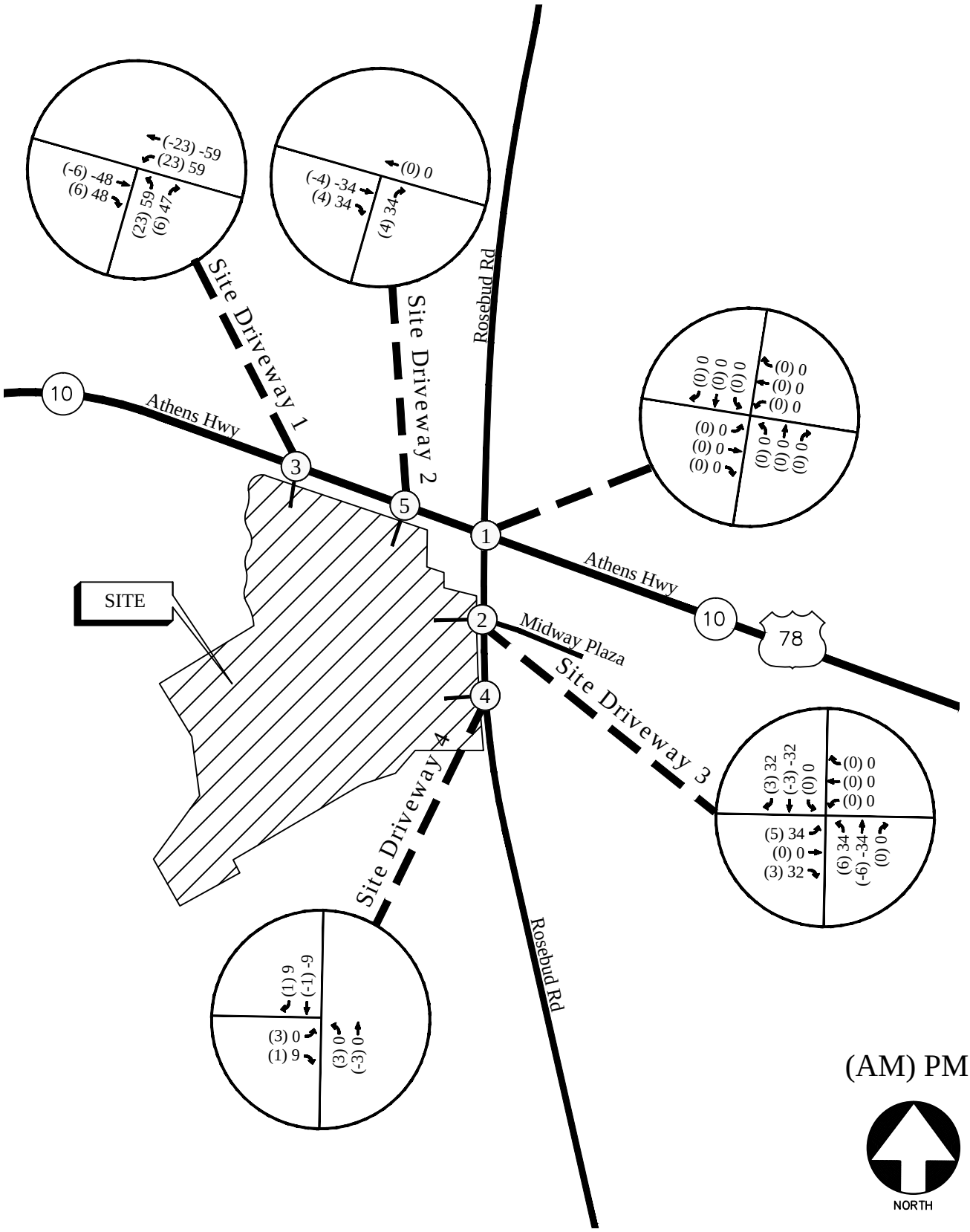

SITE PEAK HOUR PASS□Y VO□UMES

FIGURE □

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6.0 FUTURE TRAFFIC ANALYSIS

The future traffic operations are analyzed for the "Build" and "No-Build" conditions. This provides a basis of reference for determining both the contribution of the site to overall traffic conditions and the additional improvements needed to provide sufficient site access and capacity for passing traffic. Note that survey and construction drawings would be needed to verify the feasibility and extent of additional right-of-way required for any recommended improvements.

Improvements that are identified as "System Improvements" address deficiencies that are found within the existing road network prior to any impacts from the proposed development's added traffic. Improvements that are identified as "Site Mitigation Improvements" address further impacts that are a result of the proposed development's added traffic.

6.1 Future "No-Build" Conditions

The "No-Build" (or background) conditions provide an assessment of how traffic will operate in the study horizon year without the study site being developed as proposed, with projected increases in through traffic volumes due to normal annual growth. The Future "No-Build" volumes consist of the existing traffic volumes (Figure 2) plus increases for annual growth of through traffic. The resulting Future "No-Build" volumes on the roadway are shown in Figure 9.

6.1.1 Annual Traffic Growth

In order to evaluate future traffic operations in this area, a projection of normal traffic growth was applied to the existing volumes. The Georgia Department of Transportation recorded average daily traffic volumes at several locations in the vicinity of the site. A linear regression of four nearby count stations (two on Rosebud Road and two on US 78) showed an average of 0.9% growth between 2007 and 2014. Therefore, a growth of 1% was used in the analysis. For a build year of 2017, this growth factor was applied (approximately 2.01% total growth) to the existing traffic volumes between collector and arterial roadways in order to estimate the future year traffic volumes prior to the addition of site-generated traffic. The resulting Future "No-Build" volumes on the roadway are shown in Figure 9.

6.1.2 Recommendations for System Improvements

A summary of the system improvements, which address deficiencies that are found within the existing road network for the "No-Build" conditions, is provided below with more detailed information on each intersection in the following narratives.

Summary of Recommended System Improvements

- It is recommended that a future project be considered to construct an eastbound right turn lane on Athens Highway (US 78 / SR 10) at Rosebud Road.

Athens Highway (US 78 / SR 10) @ Rosebud Road

In the PM peak hours, currently the intersection of Athens Highway (US 78 / SR 10) @ Rosebud Road is operating at an overall level-of-service "E" which is below the local level-of-service standard ("D" or

better). After accounting for growth of background traffic, the intersection will continue to operate at level-of-service "E", which is below the local level-of-service standard ("D" or better) in the evening peak hour. In order to bring the level-of-service to the accepted threshold "D", it is recommended that a future project to construct a right turn lane on the eastbound approach be considered.

Figure 8 – Retaining Wall Location

It should be noted that this improvement is likely to require additional right-of-way to remove a 3 foot retaining wall in the southwest corner. It is understood that the corner property is up for redevelopment as the owner is seeking an inter-parcel connection to the proposed Kroger site. This redevelopment can facilitate the right-of-way needed for the right turn lane. As an alternative plan, the city can propose to accommodate the right turn lane by decreasing lane widths across US 78 (Athens Highway) as well as some of the striped area in front of the retaining wall. A concept of these changes is included in the Appendix.

Rosebud Road @ Midway Plaza Driveway

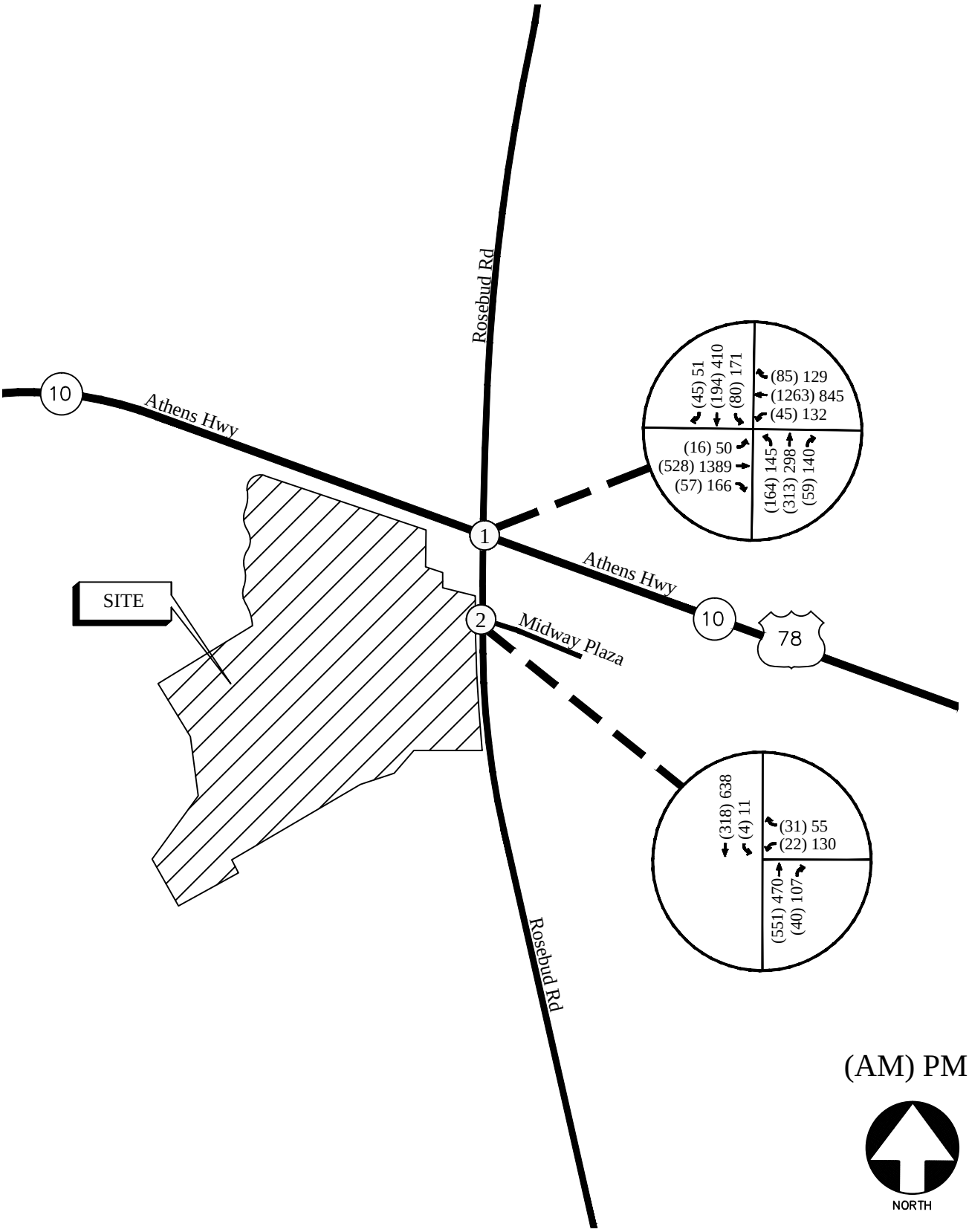
Currently in the evening peak hour, the intersection of Rosebud Road at Midway Plaza driveway is operating at level-of-service "F" for the side street, which is below the local level-of-service standard ("D" or better). After accounting for background traffic growth, the westbound approach will continue to operate at level-of-service "F". A preliminary examination of the peak hour traffic indicates that volumes may meet MUTCD thresholds for construction of a traffic signal; however, the spacing between this intersection and the adjacent signal at US 78 is insufficient. Adequate level-of-service is expected during the off-peak times. No other reasonable improvements can be identified at this intersection.

6.1.3 Future "No-Build" Traffic Operations

The future "No-Build" traffic operations were analyzed using the volumes in Figure 9 and the results are shown in Tables 6 and 7 below.

Table 6 – Future "No-Build" Intersection Operations					
	Intersection	No-Build Condition: LOS (Delay)			
		NO IMPROVEMENTS		SYSTEM IMPROVEMENTS	
		AM Peak	PM Peak	AM Peak	PM Peak
1	**US 78 @ Rosebud Rd**	**C (31.3)**	**E (75.5)**	**C (31.1)**	**D (55.0)**
	-Eastbound Approach	B (17.8)	F (95.1)	B (17.1)	D (48.6)
	-Westbound Approach	C (22.5)	C (32.5)	C (22.5)	D (37.4)
	-Northbound Approach	D (51.3)	E (66.9)	D (51.3)	E (68.1)
	-Southbound Approach	D (55.1)	F (103.9)	D (55.1)	F (86.3)
2	**Rosebud Rd @ Midway Plaza Drwy**				
	-Westbound Approach	C (18.9)	F (143.9)	C (18.9)	F (147.1)
	-Southbound Left	A (0.3)	A (0.6)	A (0.3)	A (0.6)

Table 7 – Future "No-Build" Intersection 95th Percentile Queues						
	Intersection	Available Storage	No-Build Condition: LOS (Delay)			
			NO IMPROVEMENTS		SYSTEM IMPROVEMENTS	
			AM Peak	PM Peak	AM Peak	PM Peak
1	**US 78 @ Rosebud Rd**					
	-Eastbound Left	75'	16	37	16	38
	-Eastbound Through	-	202	936	183	770
	-Eastbound Right	250'	-	-	0	63
	-Westbound Left	500'	34	203	34	214
	-Westbound Through	-	529	322	529	328
	-Westbound Right	325'	0	35	0	36
	-Northbound Left	300'	160	210	160	222
	-Northbound Through	-	356	365	356	336
	-Northbound Right	450'	0	65	0	64
	-Southbound Left	270'	83	229	83	207
	-Southbound Through	-	240	567	240	542
	-Southbound Right	375'	0	0	0	0
2	**Rosebud Rd @ Midway Plaza Drwy**					
	-Westbound Left/Right	-	22	285	22	288
	-Southbound Left/Through	-	1	2	1	2



FUTURE NO UI D EEKDAY PEAK HOUR VO UMES FIGURE

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6.2 Future "Build" Conditions

The "Build" or development conditions include the estimated background traffic from the "No-Build" conditions plus the added traffic from the proposed development. In order to evaluate future traffic operations in this area, the additional traffic volumes from the site (Figure 6) and pass-by volumes (Figure 7) were added to base traffic volumes (Figure 9) to calculate the future traffic volumes after the construction of the development in 2017. These total future traffic volumes (Figure 10) were used to evaluate the "Build" condition, which includes the projected site traffic.

6.2.1 Site Access Configuration

The following access configuration was utilized when modeling the proposed site driveway intersections:

- Site Driveway 1: Full-access driveway on Athens Highway (US 78 / SR 10)
    - This driveway will consist of one entering and three exiting lanes. The northbound approach will have dual left turn lanes and a right turn lane for exiting traffic.
    - Entering left turn movements will be made from the two-way left turn lane on Athens Highway (US 78 / SR 10) which will be restriped to provide a dedicated turn bay for traffic entering the site based on GDOT standards.
    - A deceleration lane will be constructed for entering traffic based on GDOT standards.
    - A preliminary signal warrant analysis indicates that the site's volumes will meet MUTCD thresholds for a traffic signal. A signal warrant analysis was prepared as a separate document and is attached to this document. The intersection will be signalized as part of the development's construction with protected + permissive phasing for westbound left turn movements.
- Site Driveway 2: Right-in / right-out driveway on Athens Highway (US 78 / SR 10)
    - This driveway will consist of one entering and one exiting lanes. The northbound approach will have one right turn lane for exiting traffic.
    - The intersection will be unsignalized with YIELD sign on the northbound approach.
    - A deceleration lane will be constructed for entering traffic based on GDOT standards.
- Site Driveway 3: Northern full-access driveway on Rosebud Road, aligning across from the Midway Plaza driveway.
    - This driveway will consist of one entering and two exiting lanes. The eastbound approach will have a shared left / through and a right turn lane for exiting traffic.
    - The intersection will continue to be unsignalized with an added STOP sign on the eastbound approach.
    - A dedicated left turn bay will be constructed for entering traffic based on local standards.
    - A deceleration lane will be constructed for entering traffic based on local standards.
        - Detailed drawings will be reviewed and approved by Gwinnett County after the zoning process is completed.
- Site Driveway 4: Southern full-access driveway on Rosebud Road
    - This driveway will consist of one entering and one exiting lanes. The eastbound approach will have a shared left /right turn lane for exiting traffic.
    - The intersection will be unsignalized with a STOP sign on the eastbound approach.

- A deceleration lane will be constructed for entering traffic based on local standards.

6.2.2 Recommendations for Site Mitigation Improvements

Improvements that are identified as mitigation improvements address deficiencies that are caused by site traffic and can be identified as related to the proposed development. A summary of the system improvements is provided below, with more detailed information on each intersection in the following narratives.

Summary of Recommended Site Mitigation Improvements

- Recommended system improvements (previous sections) are also applicable as mitigation improvements.

Athens Highway (US 78 / SR 10) @ Rosebud Road

After addition of site-generated traffic, the intersection of Athens Highway (US 78 / SR 10) at Rosebud Road will operate at level-of-service "F" in the PM peak hour without any improvement to the intersection. A system improvement was recommended for the No-Build conditions to construct a right turn lane on the eastbound approach. This is likely to require additional right-of-way to remove a 3 foot retaining wall in the southwest corner (Figure 4).

Other than implementation of a roadway widening project, no feasible improvements can be identified to maintain the level-of-service "D" standard at this intersection. In addition to the recommended system improvements, the following factors may be considered when assessing impacts the intersection:

- Gwinnett County has identified widening of this section of US 78 (from SR 84 to SR 81) to six lanes as a "medium" priority project (Reference GW-078E). Funding for this project has not been identified, so schedule for the improvement is not known at this time.
- Construction of the proposed Kroger signal will allow some of the site's traffic exit onto US 78 without adding to the existing congestion on Rosebud Rd.
- In the PM peak hour, the impact of the development with the recommended improvements changes the overall average delay from 55.0 seconds to 67.8 seconds (less than 13 seconds added average delay).
- The turn bays at the intersection are anticipated to have enough storage to accommodate the 95th percentile queue lengths.

Rosebud Road @ Kroger Driveway / Site Driveway 3

The results of future conditions analysis for Rosebud Road at Midway Plaza / Site Driveway 3 intersection for the PM peak hour indicates the side streets will continue to operate at level-of-service "F" after addition of site traffic. Delays are due to both the limited gaps in traffic along Rosebud Road and the volume of exiting traffic from the Midway Plaza shopping center. If the new development replacing the relocated Kroger does not generate as much volume for the Midway Plaza shopping center, the delay and queuing for this intersection may be less than the projected values. No improvements are identified at this intersection.

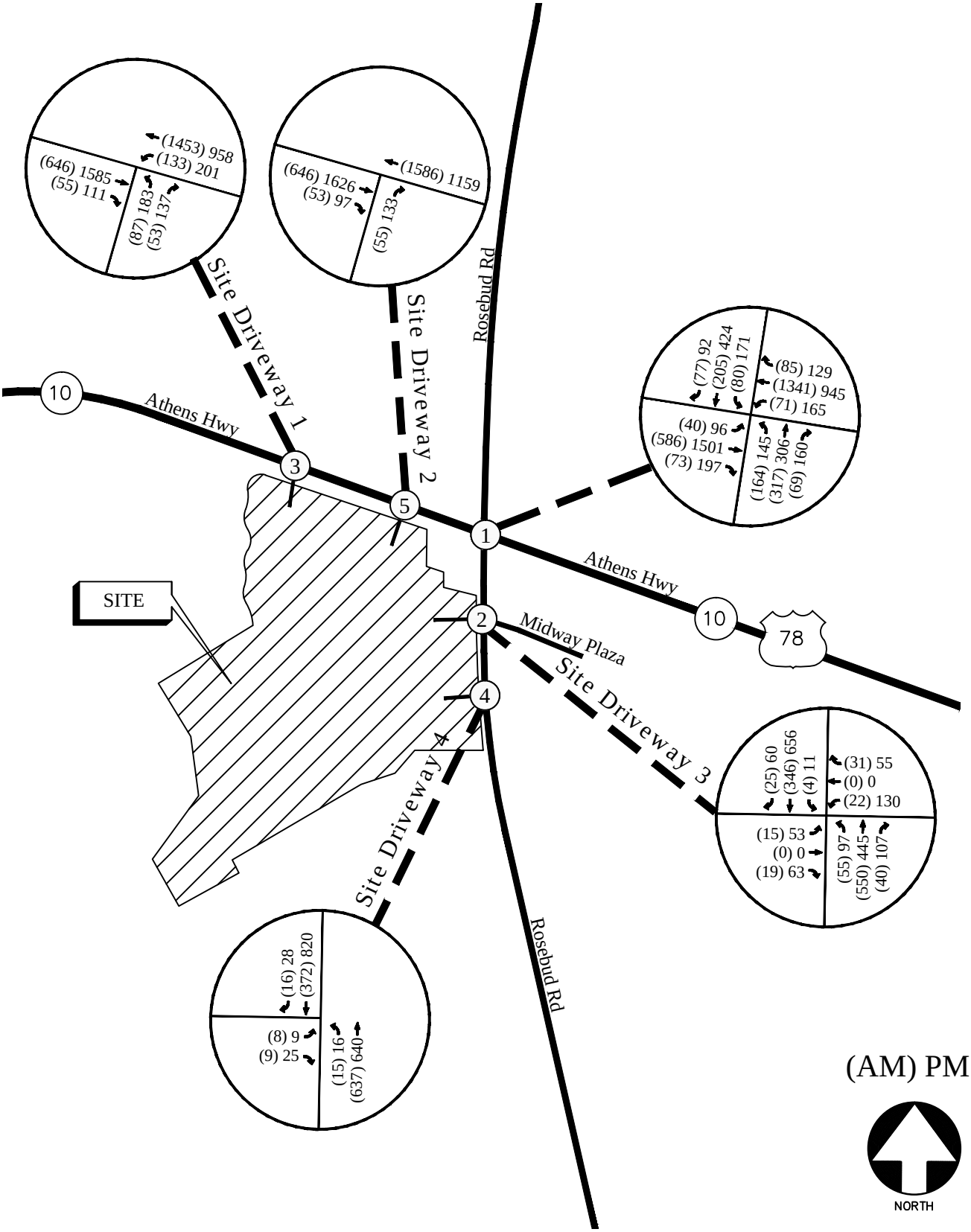
6.2.3 Future "Build" Traffic Operations

The "Build" conditions are evaluated to determine effectiveness of the recommended system and site mitigation improvements. Recommendations on traffic control and lane geometry are shown graphically in Figure 11. The results of the "Build" operations analyses with the assumed site access configuration, system improvements, and site mitigation improvements are shown in Tables 8 and 9.

TABLE 8 – FUTURE "BUILD" INTERSECTION OPERATIONS

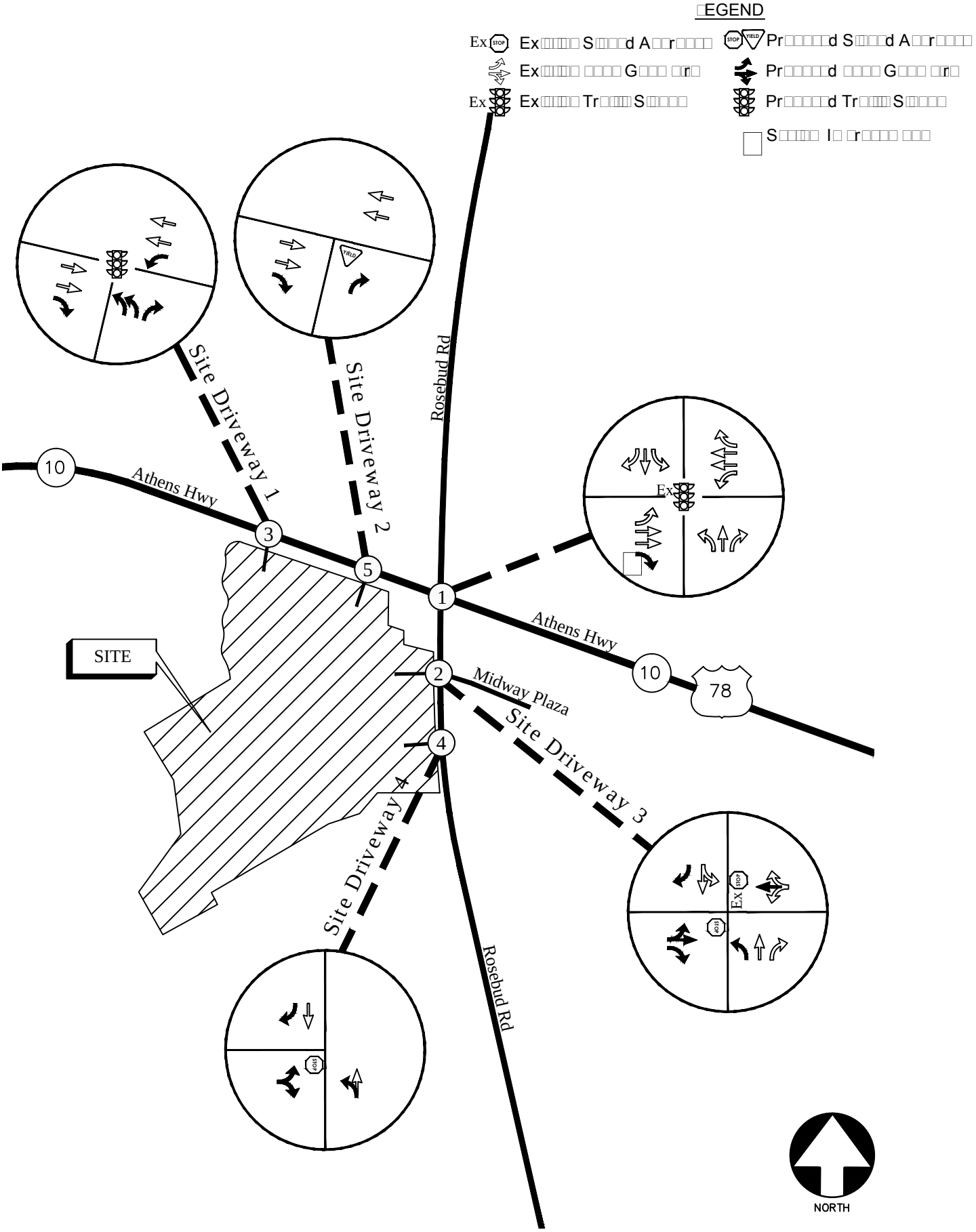
	Intersection	Build Condition: LOS (Delay)			
		NO IMPROVEMENTS		SYSTEM AND SITE IMPROVEMENTS	
		AM Peak	PM Peak	AM Peak	PM Peak
1	**US 78 @ Rosebud Rd**	**C (31.5)**	**F (87.8)**	**C (31.2)**	**E (67.8)**
	-Eastbound Approach	B (15.4)	E (77.7)	B (14.1)	D (50.6)
	-Westbound Approach	C (25.9)	D (53.1)	C (25.9)	D (48.2)
	-Northbound Approach	D (53.6)	B (80.2)	D (53.6)	E (65.2)
	-Southbound Approach	D (47.2)	F (177.2)	D (47.2)	F (146.0)
2	**Rosebud Rd @ Kroger Drwy / Site Drwy 3**				
	-Eastbound Approach	C (20.5)	F (106.1)	C (20.5)	F (108.9)
	-Westbound Approach	D (29.2)	F (969.9)	D (29.2)	F (987.7)
	-Northbound Left	A (8.3)	B (10.3)	A (8.3)	B (10.3)
	-Southbound Left	A (0.3)	A (0.6)	A (0.3)	A (0.6)
3	**US 78 @ Site Drwy 1**	**A (6.3)**	**B (18.3)**	**A (6.4)**	**B (19.3)**
	-Eastbound Approach	A (7.4)	B (16.1)	A (7.4)	B (16.1)
	-Westbound Approach	A (1.7)	B (12.3)	A (1.8)	B (15.1)
	-Northbound Approach	D (53.1)	D (51.1)	D (53.1)	D (51.1)
4	**Rosebud Rd @ Site Drwy 4**				
	-Eastbound Approach	C (17.0)	D (30.4)	C (17.0)	D (30.7)
	-Northbound Through/Left	A (0.4)	A (0.7)	A (0.4)	A (0.7)
5	**US 78 @ Site Drwy 2 (RIRO)**				
	-Northbound Approach	A (9.9)	B (11.2)	A (9.9)	B (11.2)

Table 9 – Future "Build" Intersection 95th Percentile Queues						
	Intersection	Available Storage	Build Condition: LOS (Delay)			
			NO IMPROVEMENTS		SYSTEM AND SITE IMPROVEMENTS	
			AM Peak	PM Peak	AM Peak	PM Peak
1	**US 78 @ Rosebud Rd**					
	-Eastbound Left	75'	18	15	17	52
	-Eastbound Through	-	244	1,011	188	852
	-Eastbound Right	250'	-	-	0	45
	-Westbound Left	500'	48	287	48	276
	-Westbound Through	-	582	373	582	398
	-Westbound Right	325'	8	35	8	38
	-Northbound Left	300'	160	211	160	187
	-Northbound Through	-	385	406	385	394
	-Northbound Right	450'	2	88	2	87
	-Southbound Left	270'	83	265	83	241
	-Southbound Through	-	244	645	244	632
	-Southbound Right	375'	1	23	1	23
2	**Rosebud Rd @ Kroger Drwy / Site Drwy 3**					
	-Eastbound Left/Through	-	10	112	10	114
	-Eastbound Right	-	2	13	2	13
	-Westbound Left/Through/Right	-	36	601	36	604
	-Northbound Left	150'	4	11	4	12
	-Southbound Left/Through	-	1	2	1	2
3	**US 78 @ Site Drwy 1**					
	-Eastbound Through	-	141	576	141	576
	-Eastbound Right	250'	14	32	14	32
	-Westbound Left	310'	11	212	12	219
	-Westbound Through	-	60	106	64	68
	-Northbound Left	-	63	111	63	111
	-Northbound Right	-	41	60	41	60
4	**Rosebud Rd @ Site Drwy 4**					
	-Eastbound Left/Right	-	5	19	5	19
	-Northbound Left	150'	1	2	1	2
5	**US 78 @ Site Drwy 2 (RIRO)**					
	-Northbound Right	-	6	19	6	19



FUTURE □ EEKDAY PEAK HOUR VO□UMES FIGURE 1□

A&R Engineering Inc.



FUTURE TRAFFIC CONTROL AND LANE GEOMETRY FIGURE 11

A&R Engineering Inc.

7.0 CONCLUSIONS AND RECOMMENDATIONS

Traffic impacts were evaluated for the added traffic from the proposed Kroger retail development that will be located in the southwest corner of the intersection of Athens Highway (US 78 / SR 10) at Rosebud Road in Loganville, Georgia. Currently the Kroger store is in the southeast corner and will be relocated to the southwest corner of the intersection of Athens Highway (US 78 / SR 10) at Rosebud Road. The development will consist of:

- Supermarket – 113,531 sf
- Shopping Center – 17,350 sf
- Gasoline/Service Station – 14 fueling positions

The development proposes one full-access and one right-in / right-out driveways on Athens Highway (US 78 / SR 10) and one full access driveway on Rosebud Road. Existing and future operations after completion of the project were analyzed at the intersections of:

- Athens Highway (US 78 / SR 10) at Rosebud Road
- Rosebud Road at Midway Plaza Driveway

The analysis included the evaluation of Future operations for "No-Build" and "Build" conditions, both of which account for increases in annual growth of through traffic. The results of the analysis are listed below:

7.1 System Recommendations and Improvements

Improvements that are identified as "System Improvements" address deficiencies that are found within the existing road network prior to any impacts from the proposed development's added traffic.

- It is recommended that a future project be considered to construct an eastbound right turn lane on Athens Highway (US 78 / SR 10) at Rosebud Road. It should be noted that this improvement is likely to require additional right-of-way to remove a 3 foot retaining wall in the southwest corner. It should be noted that this improvement is likely to require additional right-of-way to remove a 3 foot retaining wall in the southwest corner. It is understood that the corner property is up for redevelopment as the owner is seeking an inter-parcel connection to the proposed Kroger site. This redevelopment can facilitate the right-of-way needed for the right turn lane. As an alternative plan, the city can propose to accommodate the right turn lane by decreasing lane widths across US 78 (Athens Highway) as well as some of the striped area in front of the retaining wall.

7.2 Site Access Configuration

The following access configuration was utilized when modeling the proposed site driveway intersections:

- Site Driveway 1: Full-access driveway on Athens Highway (US 78 / SR 10)
    - This driveway will consist of one entering and three exiting lanes. The northbound approach will have dual left turn lanes and a right turn lane for exiting traffic.

- Entering left turn movements will be made from the two-way left turn lane on Athens Highway (US 78 / SR 10) which will be restriped to provide a dedicated turn bay for traffic entering the site based on GDOT standards.
- A deceleration lane will be constructed for entering traffic based on GDOT standards.
- A preliminary signal warrant analysis indicates that the site's volumes will meet MUTCD thresholds for a traffic signal. A signal warrant analysis was prepared as a separate document and is attached to this document. The intersection will be signalized as part of the development's construction with protected + permissive phasing for westbound left turn movements.

- Site Driveway 2: Right-in / right-out driveway on Athens Highway (US 78 / SR 10)
  - This driveway will consist of one entering and one exiting lanes. The northbound approach will have one right turn lane for exiting traffic.
  - The intersection will be unsignalized with YIELD sign on the northbound approach.
  - A deceleration lane will be constructed for entering traffic based on GDOT standards.
- Site Driveway 3: Northern full-access driveway on Rosebud Road, aligning across from the Midway Plaza driveway.
  - This driveway will consist of one entering and two exiting lanes. The eastbound approach will have a shared left / through and a right turn lane for exiting traffic.
  - The intersection will continue to be unsignalized with an added STOP sign on the eastbound approach.
  - A dedicated left turn bay will be constructed for entering traffic based on local standards.
  - A deceleration lane will be constructed for entering traffic based on local standards.
    - Detailed drawings will be reviewed and approved by Gwinnett County after the zoning process is completed.
- Site Driveway 4: Southern full-access driveway on Rosebud Road
  - This driveway will consist of one entering and one exiting lanes. The eastbound approach will have a shared left /right turn lane for exiting traffic.
  - The intersection will be unsignalized with a STOP sign on the eastbound approach.
  - A deceleration lane will be constructed for entering traffic based on local standards.

7.3 Site Mitigation Improvements

Improvements that are identified as "Site Mitigation Improvements" address further impacts that are a result of the proposed development's added traffic. Other than implementation of a roadway widening project, no feasible improvements can be identified to maintain the level-of-service "D" standard for the US 78 at Rosebud Road intersection. In addition to the identified system improvements, the following factors may be considered when assessing impacts the intersection:

- Gwinnett County has identified widening of this section of US 78 (from SR 84 to SR 81) to six lanes as a "medium" priority project (Reference GW-078E). Funding for this project has not been identified, so schedule for the improvement is not known at this time.
- Construction of the proposed Kroger signal will allow some of the site's traffic exit onto US 78 without adding to the existing congestion on Rosebud Rd.

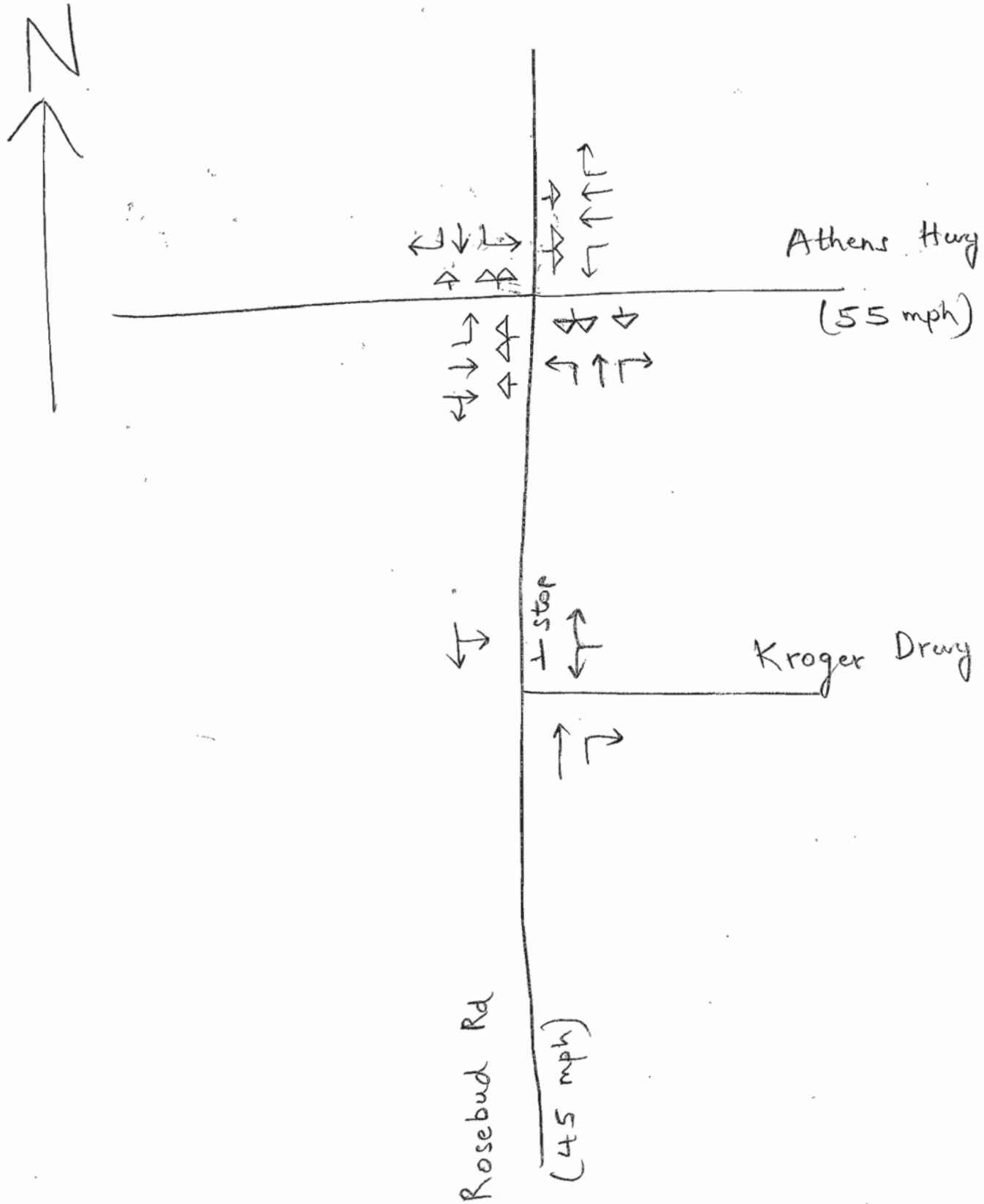
- In the PM peak hour, the impact of the development with the recommended improvements changes the overall average delay from 55.0 seconds to 67.8 seconds (less than 13 seconds added average delay).
- The turn bays at the intersection are anticipated to have enough storage to accommodate the 95th percentile queue lengths.

Appendix

Existing Intersection Traffic Counts .....
Concept Drawing.....
Linear Regression of Daily Traffic.....
Existing Intersection Analysis.....
AASHTO Left Turn Lane Analysis.....
GDOT Left Turn Lane Analysis.....
NCHRP 457 Right Turn Lane Analysis.....
GDOT Right Turn Lane Analysis.....
Future “No-Build” Intersection Analysis .....
Future “No-Build” Intersection Analysis (With Improvements) .....
Future “Build” Intersection Analysis.....
Future “Build” Intersection Analysis (With Improvements) .....
Traffic Volume Worksheets .....

EXISTING INTERSECTION TRAFFIC COUNTS

3712



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TMC Data
Rosebud Rd @
Athens Hwy
7-9am I 4-6pm

File Name : 37120001
Site Code : 37120001
Start Date : 7/1/2015
Page No : 1

Groups Printed- Cars, Buses, Trucks

	Rosebud Rd Northbound					Rosebud Rd Southbound					Athens Hwy Eastbound					Athens Hwy Westbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
07:00 AM	39	83	19	0	141	25	46	10	0	81	0	73	13	0	86	17	288	23	0	328	636
07:15 AM	50	82	15	0	147	10	49	10	0	69	4	128	13	0	145	15	321	27	0	363	724
07:30 AM	44	84	13	0	141	19	46	7	0	72	3	130	14	0	147	7	323	18	0	348	708
07:45 AM	38	73	16	0	127	26	54	18	0	98	5	139	14	0	158	13	295	16	0	324	707
Total	171	322	63	0	556	80	195	45	0	320	12	470	54	0	536	52	1227	84	0	1363	2775
08:00 AM	29	68	14	0	111	23	41	9	0	73	4	121	15	0	140	9	299	22	0	330	654
08:15 AM	40	70	26	0	136	13	40	12	0	65	6	108	15	0	129	17	307	23	0	347	677
08:30 AM	41	62	13	0	116	23	54	8	0	85	14	154	15	0	183	13	302	21	0	336	720
08:45 AM	42	62	19	0	123	30	44	8	0	82	3	137	13	0	153	10	303	20	0	333	691
Total	152	262	72	0	486	89	179	37	0	305	27	520	58	0	605	49	1211	86	0	1346	2742
*** BREAK ***																					
04:00 PM	31	63	24	0	118	39	80	11	0	130	9	297	29	0	335	28	181	40	0	249	832
04:15 PM	37	52	25	0	114	39	96	10	0	145	15	360	30	0	405	20	162	20	0	202	866
04:30 PM	31	61	25	0	117	33	94	8	0	135	10	366	32	0	408	24	205	38	0	267	927
04:45 PM	30	61	41	0	132	43	105	11	0	159	16	323	37	0	376	29	193	28	0	250	917
Total	129	237	115	0	481	154	375	40	0	569	50	1346	128	0	1524	101	741	126	0	968	3542
05:00 PM	38	62	36	0	136	45	98	11	0	154	10	338	44	0	392	36	211	33	0	280	962
05:15 PM	35	76	31	0	142	30	79	14	0	123	17	389	47	0	453	33	221	34	0	288	1006
05:30 PM	39	93	29	0	161	50	120	14	0	184	6	312	35	0	353	31	203	31	0	265	963
05:45 PM	30	64	24	0	118	48	94	7	0	149	5	332	37	0	374	21	174	28	0	223	864
Total	142	295	120	0	557	173	391	46	0	610	38	1371	163	0	1572	121	809	126	0	1056	3795
Grand Total	594	1116	370	0	2080	496	1140	168	0	1804	127	3707	403	0	4237	323	3988	422	0	4733	12854
Apprch %	28.6	53.7	17.8	0		27.5	63.2	9.3	0		3	87.5	9.5	0		6.8	84.3	8.9	0		
Total %	4.6	8.7	2.9	0	16.2	3.9	8.9	1.3	0	14	1	28.8	3.1	0	33	2.5	31	3.3	0	36.8	

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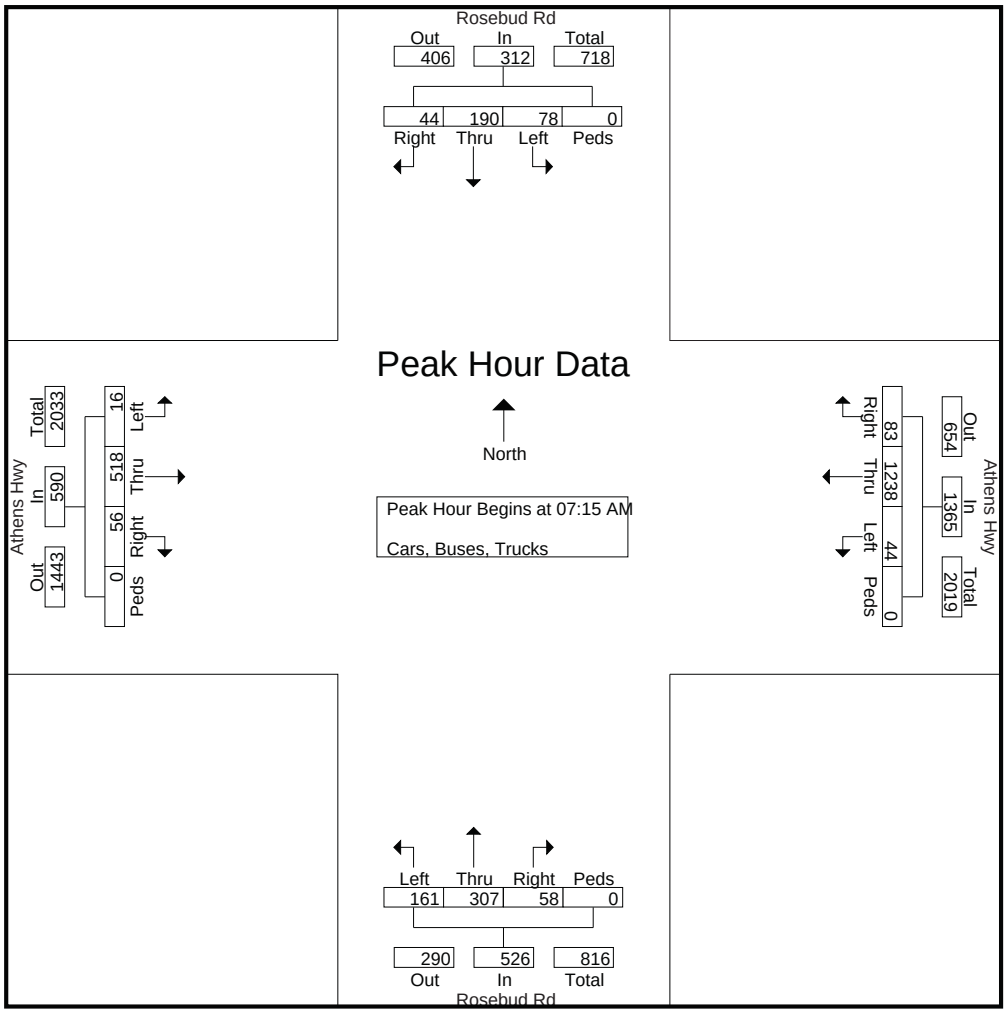
TMC Data
Rosebud Rd @
Athens Hwy
7-9am I 4-6pm

File Name : 37120001
Site Code : 37120001
Start Date : 7/1/2015
Page No : 2

	Rosebud Rd Northbound					Rosebud Rd Southbound					Athens Hwy Eastbound					Athens Hwy Westbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:15 AM																					
07:15 AM	**50**	82	15	0	**147**	10	49	10	0	69	4	128	13	0	145	**15**	321	**27**	0	**363**	**724**
07:30 AM	44	**84**	13	0	141	19	46	7	0	72	3	130	14	0	147	7	**323**	18	0	348	708
07:45 AM	38	73	**16**	0	127	**26**	**54**	**18**	0	**98**	**5**	**139**	14	0	**158**	13	295	16	0	324	707
08:00 AM	29	68	14	0	111	23	41	9	0	73	4	121	**15**	0	140	9	299	22	0	330	654
Total Volume	161	307	58	0	526	78	190	44	0	312	16	518	56	0	590	44	1238	83	0	1365	2793
% App. Total	30.6	58.4	11	0		25	60.9	14.1	0		2.7	87.8	9.5	0		3.2	90.7	6.1	0		
PHF	.805	.914	.906	.000	.895	.750	.880	.611	.000	.796	.800	.932	.933	.000	.934	.733	.958	.769	.000	.940	.964



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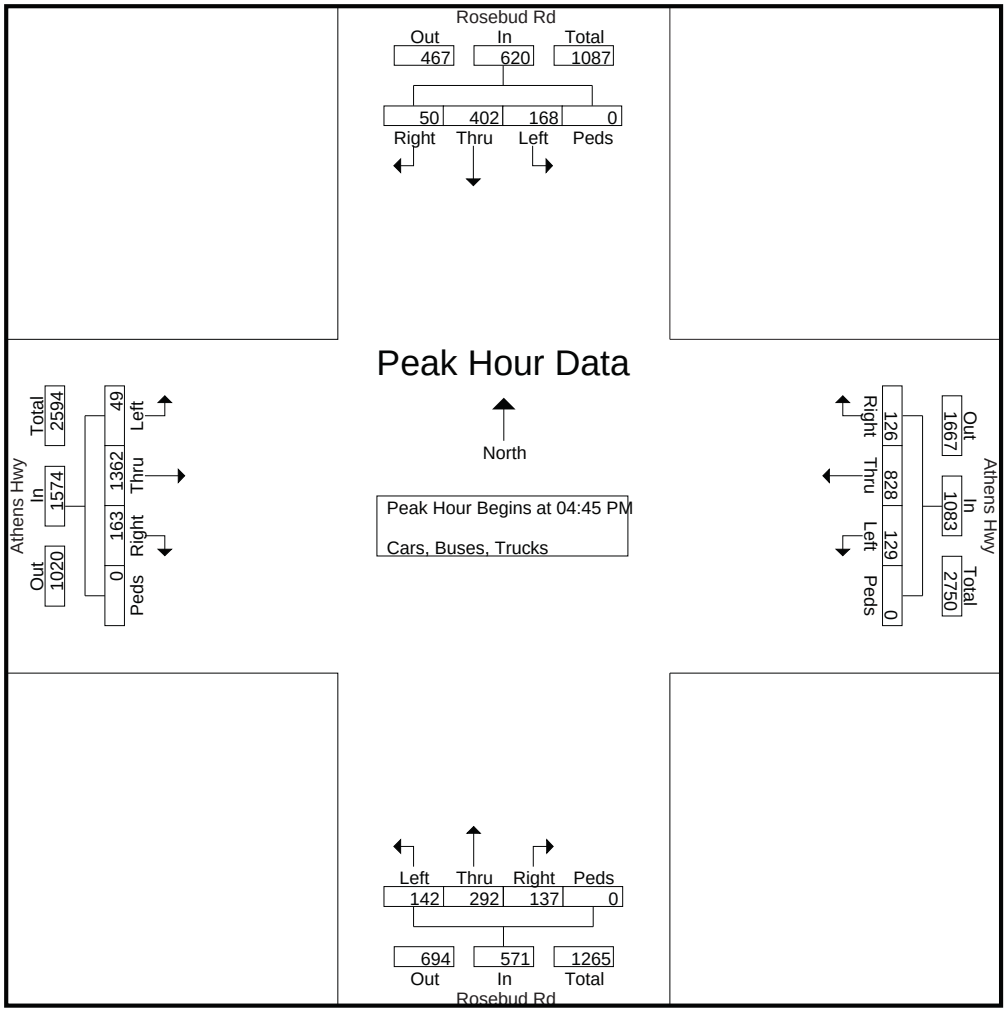
Rosebud Rd @
Athens Hwy
7-9am I 4-6pm

File Name : 37120001
Site Code : 37120001
Start Date : 7/1/2015
Page No : 3

	Rosebud Rd Northbound					Rosebud Rd Southbound					Athens Hwy Eastbound					Athens Hwy Westbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:45 PM																					
04:45 PM	30	61	**41**	0	132	43	105	11	0	159	16	323	37	0	376	29	193	28	0	250	917
05:00 PM	38	62	36	0	136	45	98	11	0	154	10	338	44	0	392	**36**	211	33	0	280	962
05:15 PM	35	76	31	0	142	30	79	**14**	0	123	**17**	**389**	**47**	0	**453**	33	**221**	**34**	0	**288**	**1006**
05:30 PM	**39**	**93**	29	0	**161**	**50**	**120**	14	0	**184**	6	312	35	0	353	31	203	31	0	265	963
Total Volume	142	292	137	0	571	168	402	50	0	620	49	1362	163	0	1574	129	828	126	0	1083	3848
% App. Total	24.9	51.1	24	0		27.1	64.8	8.1	0		3.1	86.5	10.4	0		11.9	76.5	11.6	0		
PHF	.910	.785	.835	.000	.887	.840	.838	.893	.000	.842	.721	.875	.867	.000	.869	.896	.937	.926	.000	.940	.956



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7-9am I 4-6pm

File Name : 37120002
Site Code : 37120002
Start Date : 7/1/2015
Page No : 1

Groups Printed- Cars, Buses, Trucks

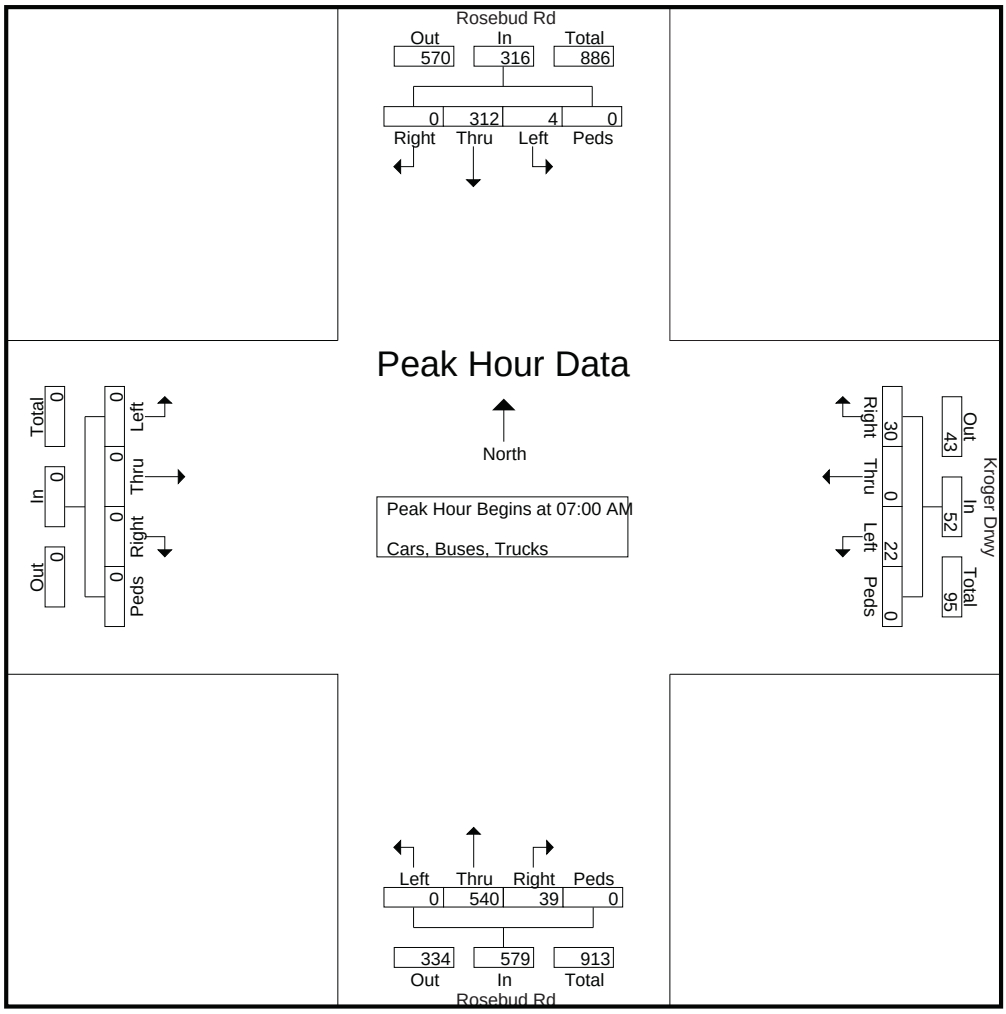
	Rosebud Rd Northbound					Rosebud Rd Southbound					Eastbound					Kroger Drwy Westbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
07:00 AM	0	155	8	0	163	1	84	0	0	85	0	0	0	0	0	4	0	9	0	13	261
07:15 AM	0	140	10	0	150	0	80	0	0	80	0	0	0	0	0	4	0	8	0	12	242
07:30 AM	0	120	8	0	128	2	65	0	0	67	0	0	0	0	0	4	0	7	0	11	206
07:45 AM	0	125	13	0	138	1	83	0	0	84	0	0	0	0	0	10	0	6	0	16	238
Total	0	540	39	0	579	4	312	0	0	316	0	0	0	0	0	22	0	30	0	52	947
08:00 AM	0	105	9	0	114	3	56	0	0	59	0	0	0	0	0	9	0	8	0	17	190
08:15 AM	0	118	10	0	128	0	68	0	0	68	0	0	0	0	0	10	0	5	0	15	211
08:30 AM	0	115	5	0	120	5	64	0	0	69	0	0	0	0	0	6	0	7	0	13	202
08:45 AM	0	123	9	0	132	3	64	0	0	67	0	0	0	0	0	6	0	6	0	12	211
Total	0	461	33	0	494	11	252	0	0	263	0	0	0	0	0	31	0	26	0	57	814
*** BREAK ***																					
04:00 PM	0	96	14	0	110	1	116	0	0	117	0	0	0	0	0	29	0	13	0	42	269
04:15 PM	0	108	12	0	120	2	150	0	0	152	0	0	0	0	0	18	0	6	0	24	296
04:30 PM	0	109	17	0	126	5	129	0	0	134	0	0	0	0	0	20	0	8	0	28	288
04:45 PM	0	97	25	0	122	1	147	0	0	148	0	0	0	0	0	21	0	8	0	29	299
Total	0	410	68	0	478	9	542	0	0	551	0	0	0	0	0	88	0	35	0	123	1152
05:00 PM	0	117	42	0	159	0	160	0	0	160	0	0	0	0	0	25	0	9	0	34	353
05:15 PM	0	113	17	0	130	5	134	0	0	139	0	0	0	0	0	38	0	12	0	50	319
05:30 PM	0	117	19	0	136	3	166	0	0	169	0	0	0	0	0	41	0	14	0	55	360
05:45 PM	0	114	27	0	141	3	165	0	0	168	0	0	0	0	0	23	0	19	0	42	351
Total	0	461	105	0	566	11	625	0	0	636	0	0	0	0	0	127	0	54	0	181	1383
Grand Total	0	1872	245	0	2117	35	1731	0	0	1766	0	0	0	0	0	268	0	145	0	413	4296
Apprch %	0	88.4	11.6	0		2	98	0	0		0	0	0	0		64.9	0	35.1	0		
Total %	0	43.6	5.7	0	49.3	0.8	40.3	0	0	41.1	0	0	0	0	0	6.2	0	3.4	0	9.6	

Reliable Traffic Data Services, LLC
Tel: (770) 578-8158 | Fax: (770) 578-8159
info@reliabletraffic.org | www.reliabletraffic.org

TMC Data
Rosebud Rd @
Kroger Drwy
7-9am I 4-6pm

File Name : 37120002
Site Code : 37120002
Start Date : 7/1/2015
Page No : 2

	Rosebud Rd Northbound					Rosebud Rd Southbound					Eastbound					Kroger Drwy Westbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	0	**155**	8	0	**163**	1	**84**	0	0	**85**	0	0	0	0	0	4	0	**9**	0	13	**261**
07:15 AM	0	140	10	0	150	0	80	0	0	80	0	0	0	0	0	4	0	8	0	12	242
07:30 AM	0	120	8	0	128	**2**	65	0	0	67	0	0	0	0	0	4	0	7	0	11	206
07:45 AM	0	125	**13**	0	138	1	83	0	0	84	0	0	0	0	0	**10**	0	6	0	**16**	238
Total Volume	0	540	39	0	579	4	312	0	0	316	0	0	0	0	0	22	0	30	0	52	947
% App. Total	0	93.3	6.7	0		1.3	98.7	0	0		0	0	0	0		42.3	0	57.7	0		
PHF	.000	.871	.750	.000	.888	.500	.929	.000	.000	.929	.000	.000	.000	.000	.000	.550	.000	.833	.000	.813	.907



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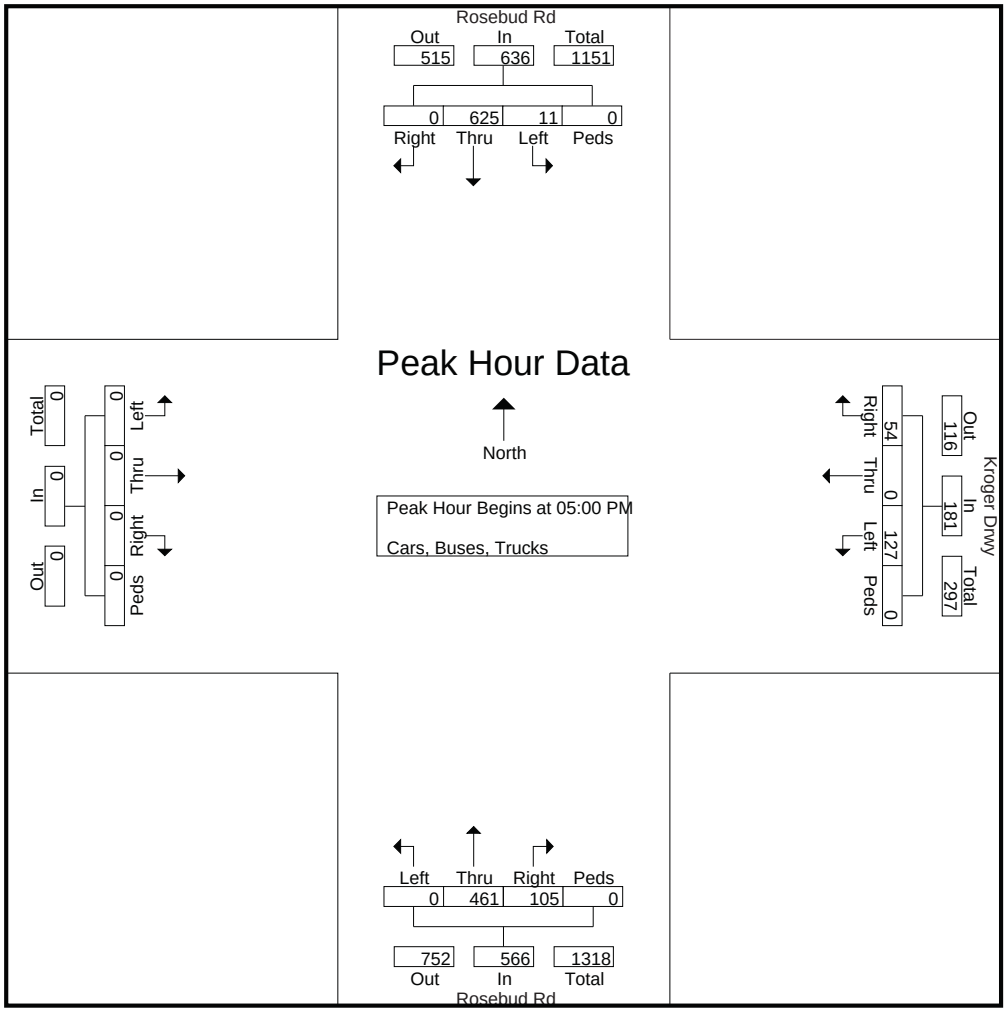
TMC Data
Rosebud Rd @
Kroger Drwy
7-9am I 4-6pm

File Name : 37120002
Site Code : 37120002
Start Date : 7/1/2015
Page No : 3

	Rosebud Rd Northbound					Rosebud Rd Southbound					Eastbound					Kroger Drwy Westbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	0	**117**	**42**	0	**159**	0	160	0	0	160	0	0	0	0	0	25	0	9	0	34	353
05:15 PM	0	113	17	0	130	**5**	134	0	0	139	0	0	0	0	0	38	0	12	0	50	319
05:30 PM	0	117	19	0	136	3	**166**	0	0	**169**	0	0	0	0	0	**41**	0	14	0	**55**	**360**
05:45 PM	0	114	27	0	141	3	165	0	0	168	0	0	0	0	0	23	0	**19**	0	42	351
Total Volume	0	461	105	0	566	11	625	0	0	636	0	0	0	0	0	127	0	54	0	181	1383
% App. Total	0	81.4	18.6	0		1.7	98.3	0	0		0	0	0	0		70.2	0	29.8	0		
PHF	.000	.985	.625	.000	.890	.550	.941	.000	.000	.941	.000	.000	.000	.000	.000	.774	.000	.711	.000	.823	.960



ADT Data

Reliable Traffic Data Services, LLC
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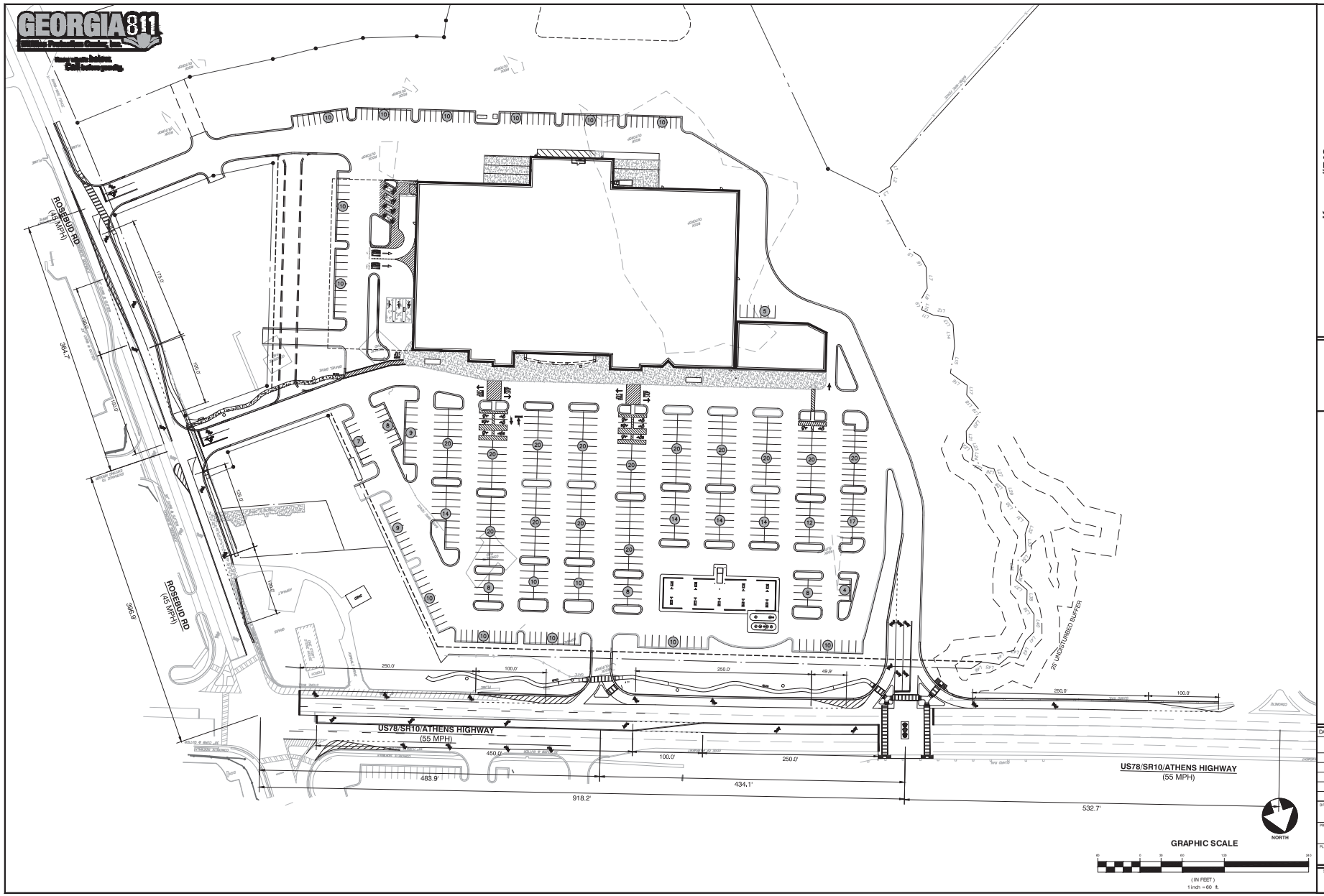
Site Code: 37120101
Athens Hwy West of
Rosebud Rd

Start	01-Jul-15	Eastbound		Hour Totals		Westbound		Hour Totals		Combined Totals	
Time	Wed	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
12:00		56	215			28	272				
12:15		41	236			18	275				
12:30		34	225			20	261				
12:45		36	292	167	968	17	254	83	1062	250	2030
01:00		37	231			20	244				
01:15		32	260			22	239				
01:30		29	252			19	258				
01:45		24	277	122	1020	24	270	85	1011	207	2031
02:00		26	262			21	265				
02:15		21	234			19	226				
02:30		18	314			16	257				
02:45		16	258	81	1068	19	231	75	979	156	2047
03:00		18	337			21	220				
03:15		14	361			22	238				
03:30		15	311			10	211				
03:45		12	287	59	1296	24	219	77	888	136	2184
04:00		14	364			34	220				
04:15		18	369			43	203				
04:30		24	399			45	230				
04:45		25	334	81	1466	60	221	182	874	263	2340
05:00		26	389			110	258				
05:15		27	407			145	254				
05:30		37	370			197	231				
05:45		56	373	146	1539	245	254	697	997	843	2536
06:00		53	344			310	226				
06:15		86	349			287	253				
06:30		89	338			342	243				
06:45		90	328	318	1359	317	200	1256	922	1574	2281
07:00		104	295			334	204				
07:15		141	295			399	159				
07:30		147	242			344	153				
07:45		170	274	562	1106	382	124	1459	640	2021	1746
08:00		133	236			322	167				
08:15		134	211			345	170				
08:30		147	210			324	119				
08:45		157	230	571	887	310	130	1301	586	1872	1473
09:00		150	184			269	132				
09:15		158	166			254	131				
09:30		186	164			308	92				
09:45		166	141	660	655	253	84	1084	439	1744	1094
10:00		200	115			250	82				
10:15		180	104			252	66				
10:30		196	110			254	57				
10:45		171	78	747	407	251	56	1007	261	1754	668
11:00		197	74			225	40				
11:15		222	80			259	33				
11:30		245	54			272	39				
11:45		247	55	911	263	220	31	976	143	1887	406
Total		4425	12034			8282	8802			12707	20836
Percent		26.9%	73.1%			48.5%	51.5%			37.9%	62.1%
Grand Total		4425	12034			8282	8802			12707	20836
Percent		26.9%	73.1%			48.5%	51.5%			37.9%	62.1%

ADT ADT 33,543 AADT 33,543

CONCEPT DRAWING



Kroger #743
Signal Design Concept
Rosebud Rd, Logamville, GA

PREPARED FOR
The Kroger Company
2175 Parklake Drive, Suite 150
Atlanta, Georgia 30345

OVERALL PROPOSED CONCEPT

A&R Engineering Inc.
2160 Kingston Court, Suite O
Marietta, Georgia 30067
Tel: (770) 690-9255 Fax: (770) 690-9210
www.arengi.com

DATE	10/23/2015
REVISIONS	
NO.	DATE

DRAWN BY:	CHECKED BY:
TAB	CAO

PROJECT NO: 15-075

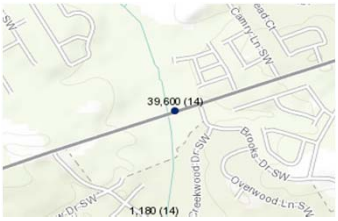
PLAN SET: Concept

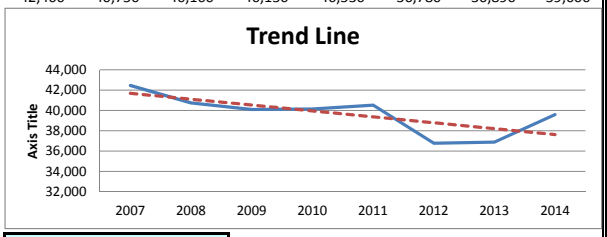
SHEET T1

LINEAR REGRESSION OF DAILY TRAFFIC

Location	Growth Rate	R Squared	Station ID	Route	2007	2008	2009	2010	2011	2012	2013	2014
Athens Hwy (WEST)	-1.5%	0.54	1350058	001000	42,460	40,750	40,100	40,150	40,530	36,780	36,890	39,600
Athens Hwy (EAST)	3.6%	0.33	1350061	001000	31,740	23,160	22,790	33,010	32,060	32,610	33,190	33,200
Rosebud Rd (SOUTH)	1.3%	0.31	1350516	194700	9,260	8,720	10,190	10,210	10,200	10,140	9,910	9,910
Rosebud Rd (NORTH)	1.9%	0.36	1350518	194700	11,020	10,370	10,080	10,820	10,810	10,750	10,800	12,900
Weighted Average	**0.9%**	0.16	Sum of Count Stations =		94,480	83,000	83,160	94,190	93,600	90,280	90,790	95,610

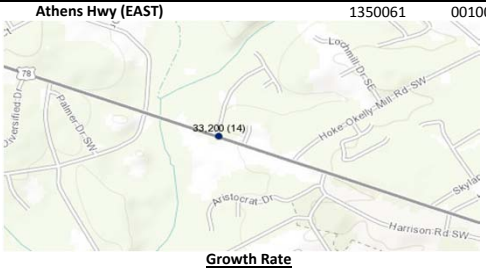
Location	Traffic Counter	RCLINK	2007	2008	2009	2010	2011	2012	2013	2014
Athens Hwy (WEST)	1350058	001000	42,460	40,750	40,100	40,150	40,530	36,780	36,890	39,600

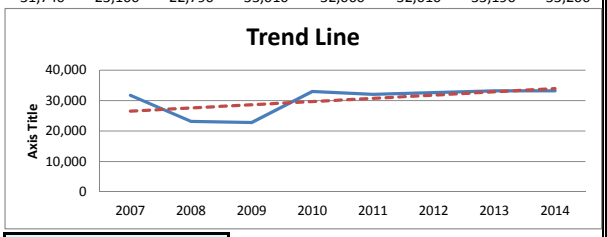




Growth Rate	-1.5%				**Intercept**	1,210,056		**Slope**	-582.14	
Trend Line	41,695	41,113	40,531	39,949	39,366	38,784	38,202	37,620		

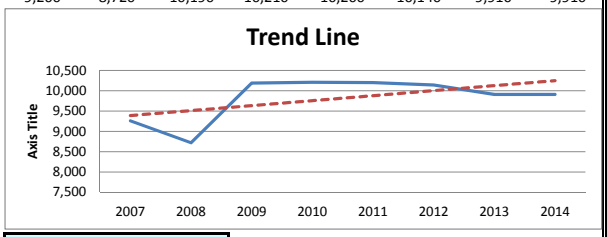
Location	Traffic Counter	RCLINK	2007	2008	2009	2010	2011	2012	2013	2014
Athens Hwy (EAST)	1350061	001000	31,740	23,160	22,790	33,010	32,060	32,610	33,190	33,200





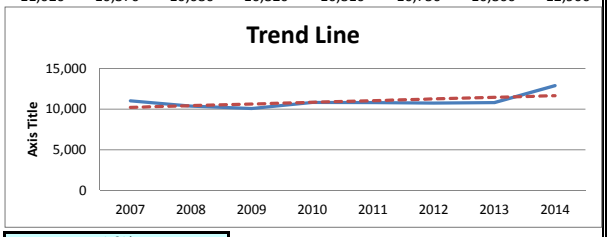
Growth Rate	3.6%				**Intercept**	-2,097,080		**Slope**	1,058.10	
Trend Line	26,517	27,575	28,633	29,691	30,749	31,807	32,865	33,923		

Location	Traffic Counter	RCLINK	2007	2008	2009	2010	2011	2012	2013	2014
Rosebud Rd (SOUTH)	1350516	194700	9,260	8,720	10,190	10,210	10,200	10,140	9,910	9,910



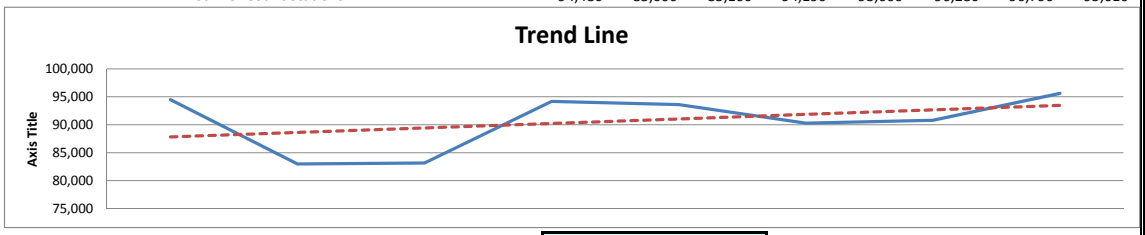
Growth Rate	1.3%				**Intercept**	-237,665		**Slope**	123.10	
Trend Line	9,387	9,510	9,633	9,756	9,879	10,002	10,125	10,248		

Location	Traffic Counter	RCLINK	2007	2008	2009	2010	2011	2012	2013	2014
Rosebud Rd (NORTH)	1350518	194700	11,020	10,370	10,080	10,820	10,810	10,750	10,800	12,900



Growth Rate	1.9%				**Intercept**	-403,363		**Slope**	206.07	
Trend Line	10,223	10,429	10,635	10,841	11,047	11,253	11,459	11,665		

Weighted Average	2005	2006	2007	2008	2009	2010	2011	2012
Sum of Count Stations	94,480	83,000	83,160	94,190	93,600	90,280	90,790	95,610



Growth Rate	0.9%				**Intercept**	-1,526,443		**Slope**	805.12	
Trend Line	87,821	88,626	89,431	90,236	91,041	91,846	92,652	93,457		

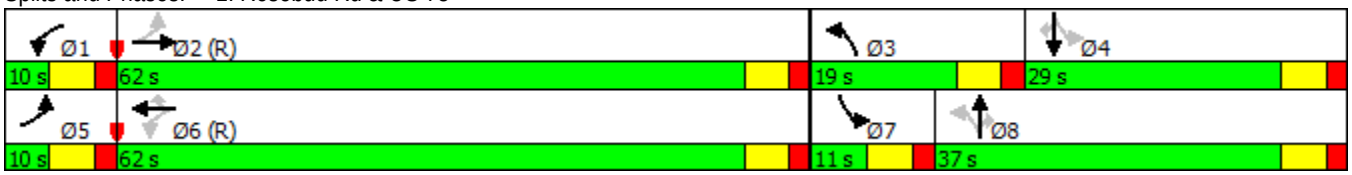
EXISTING INTERSECTION ANALYSIS

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	16	518	44	1238	83	161	307	58	78	190	44
Future Volume (vph)	16	518	44	1238	83	161	307	58	78	190	44
Lane Group Flow (vph)	20	617	60	1290	108	199	337	64	104	216	72
Turn Type	pm+pt	NA	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	5	2	1	6		3	8		7	4	
Permitted Phases	2		6		6	8		8	4		4
Detector Phase	5	2	1	6	6	3	8	8	7	4	4
Switch Phase											
Minimum Initial (s)	4.0	15.0	4.0	15.0	15.0	4.0	6.0	6.0	4.0	6.0	6.0
Minimum Split (s)	10.0	24.0	10.0	24.0	24.0	10.0	31.0	31.0	10.0	24.0	24.0
Total Split (s)	10.0	62.0	10.0	62.0	62.0	19.0	37.0	37.0	11.0	29.0	29.0
Total Split (%)	8.3%	51.7%	8.3%	51.7%	51.7%	15.8%	30.8%	30.8%	9.2%	24.2%	24.2%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	C-Min	None	C-Min	C-Min	None	None	None	None	None	None
v/c Ratio	0.11	0.34	0.14	0.66	0.11	0.68	0.83	0.14	0.63	0.75	0.18
Control Delay	13.3	18.1	12.6	22.4	0.2	44.1	61.7	0.7	50.0	64.0	1.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	13.3	18.1	12.6	22.4	0.2	44.1	61.7	0.7	50.0	64.0	1.0
Queue Length 50th (ft)	6	144	19	327	0	118	248	0	58	161	0
Queue Length 95th (ft)	16	201	34	522	0	155	344	0	80	231	0
Internal Link Dist (ft)		1303		804			330			645	
Turn Bay Length (ft)	75		500		325	300		450	270		375
Base Capacity (vph)	175	1828	420	1968	965	295	481	509	166	357	457
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.11	0.34	0.14	0.66	0.11	0.67	0.70	0.13	0.63	0.61	0.16

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 1: Rosebud Rd & US 78



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	16	518	56	44	1238	83	161	307	58	78	190	44
Future Volume (vph)	16	518	56	44	1238	83	161	307	58	78	190	44
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3488		1770	3539	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.12	1.00		0.36	1.00	1.00	0.27	1.00	1.00	0.32	1.00	1.00
Satd. Flow (perm)	225	3488		674	3539	1583	512	1863	1583	595	1863	1583
Peak-hour factor, PHF	0.80	0.93	0.93	0.73	0.96	0.77	0.81	0.91	0.91	0.75	0.88	0.61
Adj. Flow (vph)	20	557	60	60	1290	108	199	337	64	104	216	72
RTOR Reduction (vph)	0	6	0	0	0	51	0	0	50	0	0	61
Lane Group Flow (vph)	20	611	0	60	1290	57	199	337	14	104	216	11
Turn Type	pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6		6	8		8	4		4
Actuated Green, G (s)	63.1	61.5		66.3	63.1	63.1	37.3	26.3	26.3	23.7	18.7	18.7
Effective Green, g (s)	63.1	61.5		66.3	63.1	63.1	37.3	26.3	26.3	23.7	18.7	18.7
Actuated g/C Ratio	0.53	0.51		0.55	0.53	0.53	0.31	0.22	0.22	0.20	0.16	0.16
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0		3.0	5.0	5.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	138	1787		401	1860	832	291	408	346	166	290	246
v/s Ratio Prot	0.00	0.18		c0.00	c0.36		c0.07	c0.18		0.03	0.12	
v/s Ratio Perm	0.07			0.08		0.04	0.14		0.01	0.10		0.01
v/c Ratio	0.14	0.34		0.15	0.69	0.07	0.68	0.83	0.04	0.63	0.74	0.05
Uniform Delay, d1	16.8	17.3		12.8	21.2	14.0	33.1	44.7	36.9	42.6	48.4	43.1
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.5	0.5		0.2	2.2	0.2	6.5	12.8	0.0	7.2	9.9	0.1
Delay (s)	17.3	17.8		12.9	23.4	14.2	39.6	57.5	37.0	49.8	58.3	43.1
Level of Service	B	B		B	C	B	D	E	D	D	E	D
Approach Delay (s)		17.8			22.3			49.4			53.3	
Approach LOS		B			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	30.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	72.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	22	30	540	39	4	312
Future Volume (Veh/h)	22	30	540	39	4	312
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.55	0.83	0.87	0.75	0.50	0.93
Hourly flow rate (vph)	40	36	621	52	8	335
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						410
pX, platoon unblocked	0.89					
vC, conflicting volume	972	621			673	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	905	621			673	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	85	93			99	
cM capacity (veh/h)	270	487			918	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1
Volume Total	76	621	52	343
Volume Left	40	0	0	8
Volume Right	36	0	52	0
cSH	342	1700	1700	918
Volume to Capacity	0.22	0.37	0.03	0.01
Queue Length 95th (ft)	21	0	0	1
Control Delay (s)	18.5	0.0	0.0	0.3
Lane LOS	C			A
Approach Delay (s)	18.5	0.0		0.3
Approach LOS	C			

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	38.4%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	49	1362	129	828	126	142	292	137	168	402	50
Future Volume (vph)	49	1362	129	828	126	142	292	137	168	402	50
Lane Group Flow (vph)	68	1735	143	881	135	156	370	165	200	479	56
Turn Type	pm+pt	NA	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	5	2	1	6		3	8		7	4	
Permitted Phases	2		6		6	8		8	4		4
Detector Phase	5	2	1	6	6	3	8	8	7	4	4
Switch Phase											
Minimum Initial (s)	4.0	15.0	4.0	15.0	15.0	4.0	6.0	6.0	4.0	6.0	6.0
Minimum Split (s)	10.0	24.0	10.0	24.0	24.0	10.0	31.0	31.0	10.0	24.0	24.0
Total Split (s)	11.0	62.0	12.0	63.0	63.0	12.0	31.0	31.0	15.0	34.0	34.0
Total Split (%)	9.2%	51.7%	10.0%	52.5%	52.5%	10.0%	25.8%	25.8%	12.5%	28.3%	28.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	C-Min	None	C-Min	C-Min	None	None	None	None	None	None
v/c Ratio	0.24	1.06	0.95	0.50	0.16	1.04	0.95	0.38	1.03	1.10	0.12
Control Delay	14.1	72.7	87.1	22.3	3.3	120.0	82.8	12.9	107.1	117.4	0.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.1	72.7	87.1	22.3	3.3	120.0	82.8	12.9	107.1	117.4	0.5
Queue Length 50th (ft)	23	~777	61	244	0	~93	285	18	~121	~422	0
Queue Length 95th (ft)	35	#882	#195	304	33	#216	#379	64	#237	#565	0
Internal Link Dist (ft)		1303		804			330			645	
Turn Bay Length (ft)	75		500		325	300		450	270		375
Base Capacity (vph)	286	1632	150	1746	849	150	388	437	194	434	473
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.24	1.06	0.95	0.50	0.16	1.04	0.95	0.38	1.03	1.10	0.12

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Rosebud Rd & US 78

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	49	1362	163	129	828	126	142	292	137	168	402	50
Future Volume (vph)	49	1362	163	129	828	126	142	292	137	168	402	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3482		1770	3539	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.24	1.00		0.07	1.00	1.00	0.16	1.00	1.00	0.14	1.00	1.00
Satd. Flow (perm)	456	3482		128	3539	1583	298	1863	1583	266	1863	1583
Peak-hour factor, PHF	0.72	0.88	0.87	0.90	0.94	0.93	0.91	0.79	0.83	0.84	0.84	0.89
Adj. Flow (vph)	68	1548	187	143	881	135	156	370	165	200	479	56
RTOR Reduction (vph)	0	7	0	0	0	70	0	0	108	0	0	43
Lane Group Flow (vph)	68	1728	0	143	881	65	156	370	57	200	479	13
Turn Type	pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6		6	8		8	4		4
Actuated Green, G (s)	60.0	56.0		64.0	58.0	58.0	31.0	25.0	25.0	37.0	28.0	28.0
Effective Green, g (s)	60.0	56.0		64.0	58.0	58.0	31.0	25.0	25.0	37.0	28.0	28.0
Actuated g/C Ratio	0.50	0.47		0.53	0.48	0.48	0.26	0.21	0.21	0.31	0.23	0.23
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0		3.0	5.0	5.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	271	1624		150	1710	765	150	388	329	194	434	369
v/s Ratio Prot	0.01	c0.50		c0.05	0.25		0.05	0.20		c0.08	c0.26	
v/s Ratio Perm	0.12			0.46		0.04	0.22		0.04	0.24		0.01
v/c Ratio	0.25	1.06		0.95	0.52	0.09	1.04	0.95	0.17	1.03	1.10	0.04
Uniform Delay, d1	16.5	32.0		30.4	21.3	16.7	42.7	46.9	39.0	36.7	46.0	35.6
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.5	41.5		59.1	1.1	0.2	84.5	33.6	0.3	72.9	74.4	0.0
Delay (s)	16.9	73.5		89.5	22.4	16.9	127.1	80.5	39.3	109.7	120.4	35.6
Level of Service	B	E		F	C	B	F	F	D	F	F	D
Approach Delay (s)		71.3			30.1			81.2			111.0	
Approach LOS		E			C			F			F	

Intersection Summary			
HCM 2000 Control Delay	68.6	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.10		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	99.0%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	127	54	461	105	11	625
Future Volume (Veh/h)	127	54	461	105	11	625
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.77	0.71	0.98	0.62	0.55	0.94
Hourly flow rate (vph)	165	76	470	169	20	665
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						410
pX, platoon unblocked	0.74					
vC, conflicting volume	1175	470			639	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1061	470			639	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	8	87			98	
cM capacity (veh/h)	180	594			945	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1
Volume Total	241	470	169	685
Volume Left	165	0	0	20
Volume Right	76	0	169	0
cSH	230	1700	1700	945
Volume to Capacity	1.05	0.28	0.10	0.02
Queue Length 95th (ft)	255	0	0	2
Control Delay (s)	117.6	0.0	0.0	0.6
Lane LOS	F			A
Approach Delay (s)	117.6	0.0		0.6
Approach LOS	F			

Intersection Summary			
Average Delay	18.3		
Intersection Capacity Utilization	58.7%	ICU Level of Service	B
Analysis Period (min)	15		

AASHTO Left Turn Lane Analysis

LEFT TURN LANE ANALYSIS
per AASHTO standards

The following left turn lane analyses were used to determine the need for dedicated turn bays at the proposed site driveway locations that are not located on State Routes.

7.4 Methdology

M.D. Harmelink utilized a probabilistic model to establish left turn lane warrants for two-lane and four-lane highways at unsignalized T-intersections. These warrants are the basis for AASHTO guidelines for justifying a left-turn lane at an unsignalized intersection. The warrants developed are in the form of sets of different volume combinations, specifically, the advancing volume, the percentage of left-turns in the advancing volume, and the opposing volume. These warrants are based on maximum allowable probabilities that one or more through vehicles are present in the queue formed by the left-turning vehicles that is waiting for a suitable gap. The warrants, as summarized by AASHTO, were developed for the approach speeds of 40, 50 and 60 mph and left turn volumes that are 5%, 10%, 20%, and 30% of the advancing stream.

AASHTO Thresholds (Exhibit 9-75, pg 685), 50 MPH				
Opposing Volumes	Advancing Volumes (by left turn %)			
	5%	10.0%	20.0%	30.0%
100	615	445	335	295
200	550	400	300	270
400	430	320	240	210
600	350	260	195	170
800	280	210	165	135

An interpolation of the thresholds is needed for other volumes and percentages that are not in the AASHTO table for left turn percentages that are not represented in the table.

7.5 Results

A graphic of the peak hour turning movements for the site, as they relate to the AASHTO criteria are provided in the following figures.

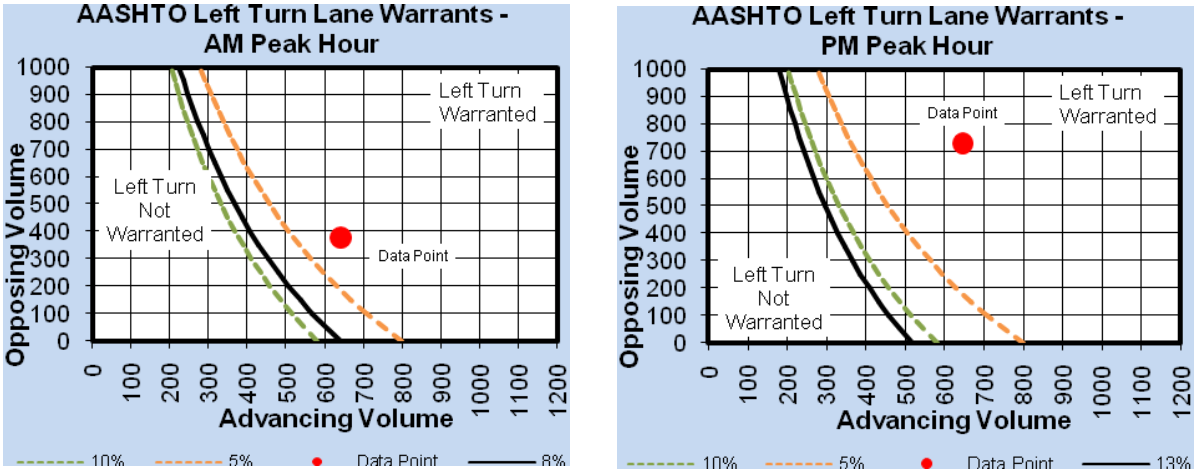


Figure 1 – AASHTO Left Turn Lane Guidelines: Site Driveway 3

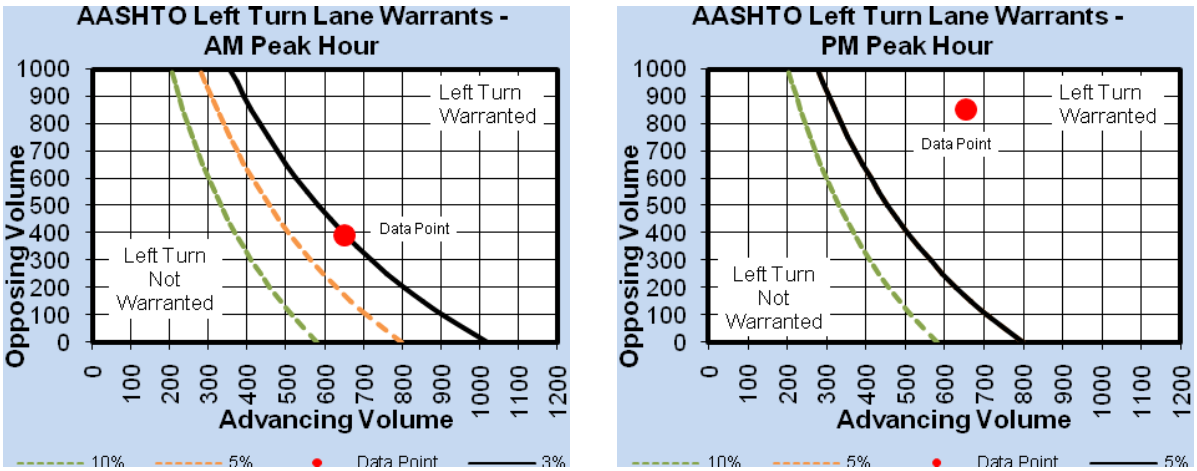


Figure 2 – AASHTO Left Turn Lane Guidelines: Site Driveway 4

7.6 Findings

The results of the analysis show that based on the 2% probability criterion of AASHTO guidelines dedicated left turn lanes are warranted on Rosebud Road at both the site driveways.

GDOT Left Turn Lane Analysis

LEFT TURN LANE ANALYSIS
per GDOT standards

The following left turn lane analyses were used to determine the need for dedicated turn bays at the proposed site driveway locations that are located on State Routes.

GDOT standards require the installation of a left lane at no cost to the department when traffic entering the development meets or exceeds the values shown in the following table.

GDOT Requirements For Left Turn Lanes					
Site Driveway	Left Turn Traffic (% Total Entering)	Left Turn Volume (veh/day)	Roadway Speed / # Lanes	GDOT Threshold (veh/day)	Requirement
US 78 @ Site Drwy 1	36%	1,619	55 mph / 4-Lane	175	310' storage 100' taper

7.7

7.8 Findings

Based on the number of projected daily left turns the full-access site driveway on Athens Highway (US 78 / SR 10) will meet the GDOT requirements for construction of a left turn lane.

NCHRP 457 Right Turn Lane Analysis

RIGHT TURN LANE ANALYSIS
per NCHRP 457 guidelines

The following right turn lane analyses were used to determine the need for dedicated turn bays at the proposed site driveway locations that are not located on State Routes.

7.9 Methdology

Guidelines for determining when to provide a right-turn bay on the major road of a two-way stop-controlled intersection are provided in Hasan, T. and Stokes, R.W. "Guidelines for Right-Turn Treatments at Unsignalized Intersections and Driveways on Rural Highways" (Transportation Research Record 1579). These guidelines were based on an evaluation of the operating and collisions costs associated with the right turn maneuver relative to the cost of construction. The operating costs included those of road-user fuel and delay. Separate guidelines were developed for two-lane and four-lane roadways, which are found in the NCHRP Report 457 "Evaluating Intersection Improvements: An Engineering Study Guide".

7.10 Results

An evaluation of site traffic in relation to these guidelines is shown graphically in the following figures.

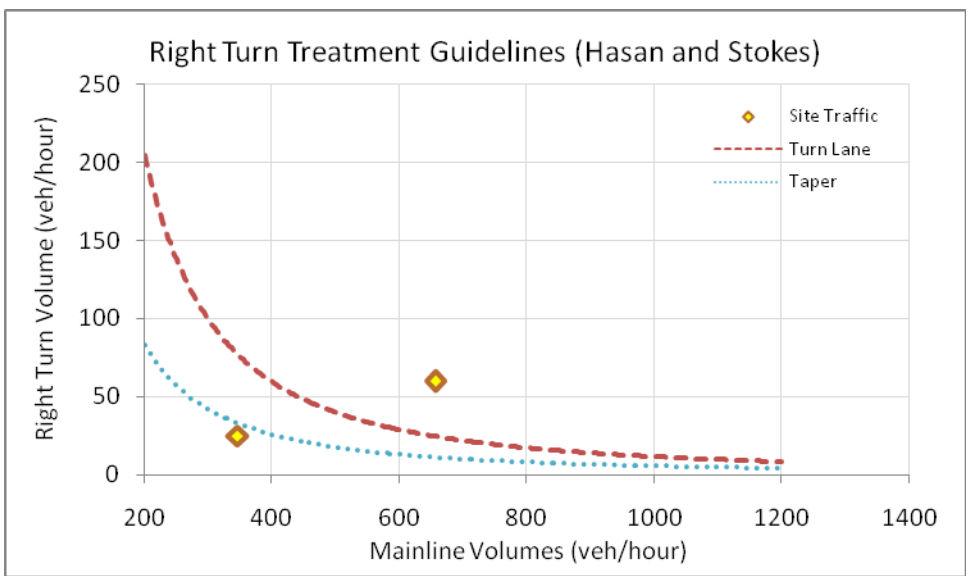


Figure 1 – NCHRP 457 Right Turn Lane Guidelines: Site Driveway 3

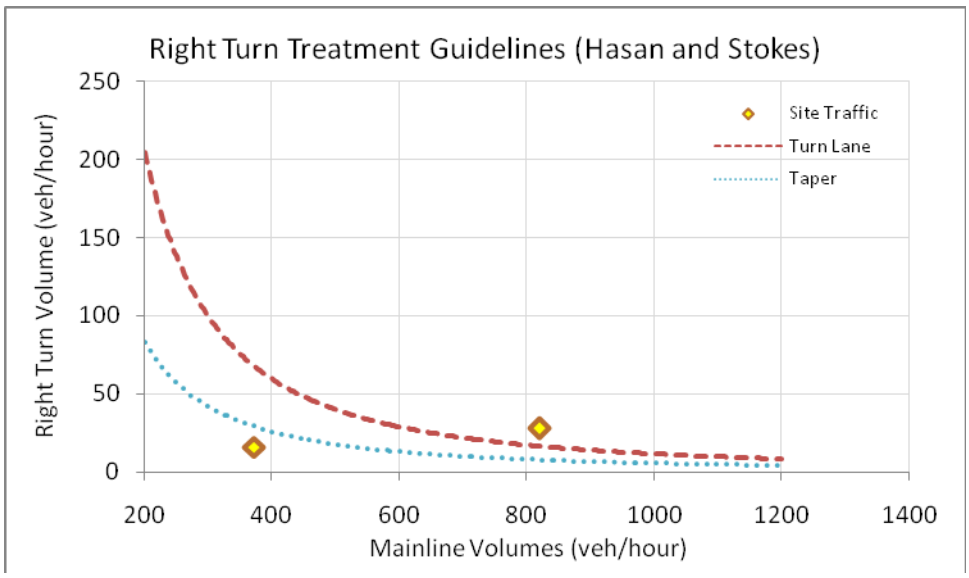


Figure 2 – NCHRP 457 Right Turn Lane Guidelines: Site Driveway 4

7.11 Findings

The analysis shows that a deceleration lane is warranted on the mainline at both the site driveways on Rosebud Road based on NCHRP Report 457 guidelines.

GDOT Right Turn Lane Analysis

RIGHT TURN LANE ANALYSIS
per GDOT standards

The following left turn lane analyses were used to determine the need for dedicated turn bays at the proposed site driveway locations that are not located on State Routes.
GDOT standards require the installation of a deceleration lane at no cost to the department when traffic entering the development meets or exceeds the values shown in the following table.

Table 1 – GDOT Requirements For Deceleration Lanes					
Site Driveway	Right Turn Traffic (% Total Entering)	Right Turn Volume (veh/day)	Roadway Speed / # Lanes	GDOT Threshold (veh/day)	Requirement
US 78 @ Site Drwy 1	16%	720	55 mph / 4-Lane	50	250' storage 100' taper
US 78 @ Site Drwy 2	16%	720	55 mph / 2-Lane	50	250' storage 50' taper

7.12 Findings

Based on the number of projected daily right turns both the site driveways on Athens Highway (US 78 / SR 10) will meet the GDOT requirements for construction of a deceleration lane.

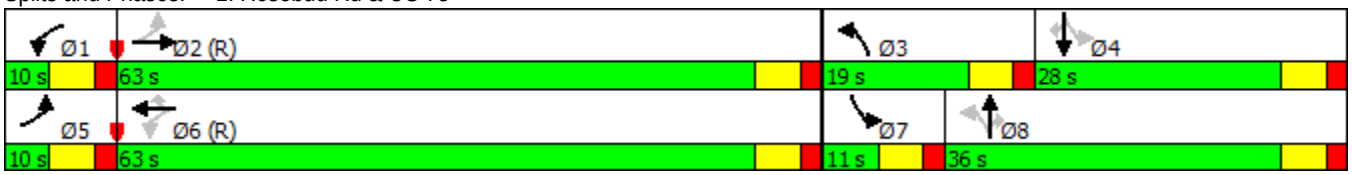
FUTURE "NO-BUILD" INTERSECTION ANALYSIS

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	16	528	45	1263	85	164	313	59	80	194	45
Future Volume (vph)	16	528	45	1263	85	164	313	59	80	194	45
Lane Group Flow (vph)	20	629	62	1316	110	202	344	65	107	220	74
Turn Type	pm+pt	NA	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	5	2	1	6		3	8		7	4	
Permitted Phases	2		6		6	8		8	4		4
Detector Phase	5	2	1	6	6	3	8	8	7	4	4
Switch Phase											
Minimum Initial (s)	4.0	15.0	4.0	15.0	15.0	4.0	6.0	6.0	4.0	6.0	6.0
Minimum Split (s)	10.0	24.0	10.0	24.0	24.0	10.0	31.0	31.0	10.0	24.0	24.0
Total Split (s)	10.0	63.0	10.0	63.0	63.0	19.0	36.0	36.0	11.0	28.0	28.0
Total Split (%)	8.3%	52.5%	8.3%	52.5%	52.5%	15.8%	30.0%	30.0%	9.2%	23.3%	23.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	C-Min	None	C-Min	C-Min	None	None	None	None	None	None
v/c Ratio	0.12	0.34	0.15	0.67	0.11	0.71	0.85	0.14	0.67	0.76	0.18
Control Delay	13.2	18.0	12.5	22.6	0.2	45.8	63.8	0.7	54.4	65.5	1.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	13.2	18.0	12.5	22.6	0.2	45.8	63.8	0.7	54.4	65.5	1.0
Queue Length 50th (ft)	6	148	20	339	0	120	254	0	60	164	0
Queue Length 95th (ft)	16	202	34	529	0	160	356	0	83	240	0
Internal Link Dist (ft)		1303		804			330			645	
Turn Bay Length (ft)	75		500		325	300		450	270		375
Base Capacity (vph)	168	1829	414	1969	965	291	465	497	160	341	446
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.12	0.34	0.15	0.67	0.11	0.69	0.74	0.13	0.67	0.65	0.17

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 1: Rosebud Rd & US 78



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	16	528	57	45	1263	85	164	313	59	80	194	45
Future Volume (vph)	16	528	57	45	1263	85	164	313	59	80	194	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3488		1770	3539	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.11	1.00		0.36	1.00	1.00	0.26	1.00	1.00	0.30	1.00	1.00
Satd. Flow (perm)	213	3488		663	3539	1583	493	1863	1583	557	1863	1583
Peak-hour factor, PHF	0.80	0.93	0.93	0.73	0.96	0.77	0.81	0.91	0.91	0.75	0.88	0.61
Adj. Flow (vph)	20	568	61	62	1316	110	202	344	65	107	220	74
RTOR Reduction (vph)	0	6	0	0	0	52	0	0	51	0	0	63
Lane Group Flow (vph)	20	623	0	62	1316	58	202	344	14	107	220	11
Turn Type	pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6		6	8		8	4		4
Actuated Green, G (s)	63.2	61.6		66.4	63.2	63.2	37.2	26.2	26.2	23.6	18.6	18.6
Effective Green, g (s)	63.2	61.6		66.4	63.2	63.2	37.2	26.2	26.2	23.6	18.6	18.6
Actuated g/C Ratio	0.53	0.51		0.55	0.53	0.53	0.31	0.22	0.22	0.20	0.16	0.16
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0		3.0	5.0	5.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	132	1790		396	1863	833	286	406	345	160	288	245
v/s Ratio Prot	0.00	0.18		c0.00	c0.37		c0.07	c0.18		0.03	0.12	
v/s Ratio Perm	0.08			0.08		0.04	0.14		0.01	0.10		0.01
v/c Ratio	0.15	0.35		0.16	0.71	0.07	0.71	0.85	0.04	0.67	0.76	0.05
Uniform Delay, d1	17.0	17.3		12.8	21.4	14.0	33.3	45.0	37.0	43.1	48.6	43.2
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.5	0.5		0.2	2.3	0.2	7.7	15.0	0.0	10.1	11.4	0.1
Delay (s)	17.6	17.8		12.9	23.7	14.1	41.0	60.0	37.0	53.2	60.0	43.2
Level of Service	B	B		B	C	B	D	E	D	D	E	D
Approach Delay (s)		17.8			22.5			51.3			55.1	
Approach LOS		B			C			D			E	

Intersection Summary			
HCM 2000 Control Delay	31.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	73.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	22	31	551	40	4	318
Future Volume (Veh/h)	22	31	551	40	4	318
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.55	0.83	0.87	0.75	0.50	0.93
Hourly flow rate (vph)	40	37	633	53	8	342
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						410
pX, platoon unblocked	0.88					
vC, conflicting volume	991	633			686	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	924	633			686	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	85	92			99	
cM capacity (veh/h)	262	480			908	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1
Volume Total	77	633	53	350
Volume Left	40	0	0	8
Volume Right	37	0	53	0
cSH	335	1700	1700	908
Volume to Capacity	0.23	0.37	0.03	0.01
Queue Length 95th (ft)	22	0	0	1
Control Delay (s)	18.9	0.0	0.0	0.3
Lane LOS	C			A
Approach Delay (s)	18.9	0.0		0.3
Approach LOS	C			

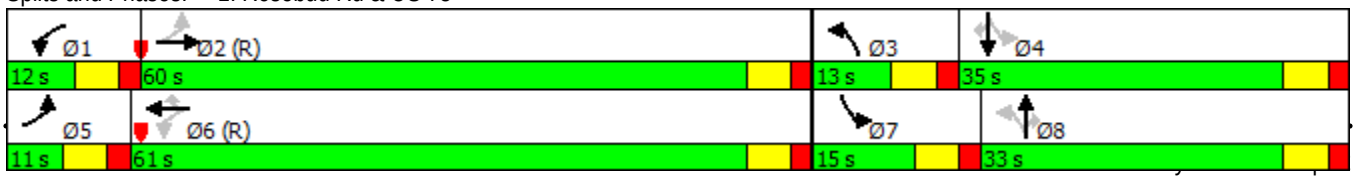
Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	39.0%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	50	1389	132	845	129	145	298	140	171	410	51
Future Volume (vph)	50	1389	132	845	129	145	298	140	171	410	51
Lane Group Flow (vph)	69	1769	147	899	139	159	377	169	204	488	57
Turn Type	pm+pt	NA	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	5	2	1	6		3	8		7	4	
Permitted Phases	2		6		6	8		8	4		4
Detector Phase	5	2	1	6	6	3	8	8	7	4	4
Switch Phase											
Minimum Initial (s)	4.0	15.0	4.0	15.0	15.0	4.0	6.0	6.0	4.0	6.0	6.0
Minimum Split (s)	10.0	24.0	10.0	24.0	24.0	10.0	31.0	31.0	10.0	24.0	24.0
Total Split (s)	11.0	60.0	12.0	61.0	61.0	13.0	33.0	33.0	15.0	35.0	35.0
Total Split (%)	9.2%	50.0%	10.0%	50.8%	50.8%	10.8%	27.5%	27.5%	12.5%	29.2%	29.2%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	C-Min	None	C-Min	C-Min	None	None	None	None	None	None
v/c Ratio	0.26	1.12	0.98	0.53	0.17	0.96	0.90	0.37	1.01	1.08	0.12
Control Delay	15.4	96.2	94.6	24.0	3.6	95.0	70.7	12.6	99.5	110.3	0.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	15.4	96.2	94.6	24.0	3.6	95.0	70.7	12.6	99.5	110.3	0.5
Queue Length 50th (ft)	24	~832	65	260	0	87	286	20	~117	~424	0
Queue Length 95th (ft)	37	#936	#203	322	35	#210	#365	65	#229	#567	0
Internal Link Dist (ft)		1303		804			330			645	
Turn Bay Length (ft)	75		500		325	300		450	270		375
Base Capacity (vph)	266	1575	150	1687	827	165	419	461	202	450	485
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.26	1.12	0.98	0.53	0.17	0.96	0.90	0.37	1.01	1.08	0.12

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 140
Control Type: Actuated-Coordinated
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Rosebud Rd & US 78



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	50	1389	166	132	845	129	145	298	140	171	410	51
Future Volume (vph)	50	1389	166	132	845	129	145	298	140	171	410	51
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3482		1770	3539	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.23	1.00		0.07	1.00	1.00	0.15	1.00	1.00	0.16	1.00	1.00
Satd. Flow (perm)	428	3482		133	3539	1583	276	1863	1583	289	1863	1583
Peak-hour factor, PHF	0.72	0.88	0.87	0.90	0.94	0.93	0.91	0.79	0.83	0.84	0.84	0.89
Adj. Flow (vph)	69	1578	191	147	899	139	159	377	169	204	488	57
RTOR Reduction (vph)	0	8	0	0	0	74	0	0	105	0	0	43
Lane Group Flow (vph)	69	1761	0	147	899	65	159	377	64	204	488	14
Turn Type	pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6		6	8		8	4		4
Actuated Green, G (s)	58.0	54.0		62.0	56.0	56.0	34.0	27.0	27.0	38.0	29.0	29.0
Effective Green, g (s)	58.0	54.0		62.0	56.0	56.0	34.0	27.0	27.0	38.0	29.0	29.0
Actuated g/C Ratio	0.48	0.45		0.52	0.47	0.47	0.28	0.22	0.22	0.32	0.24	0.24
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0		3.0	5.0	5.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	251	1566		150	1651	738	165	419	356	202	450	382
v/s Ratio Prot	0.01	c0.51		c0.05	0.25		0.06	0.20		c0.08	c0.26	
v/s Ratio Perm	0.12			0.46		0.04	0.22		0.04	0.24		0.01
v/c Ratio	0.27	1.12		0.98	0.54	0.09	0.96	0.90	0.18	1.01	1.08	0.04
Uniform Delay, d1	17.7	33.0		30.3	22.9	17.8	39.4	45.2	37.5	36.5	45.5	34.8
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.6	65.1		66.6	1.3	0.2	58.9	21.5	0.2	65.9	67.1	0.0
Delay (s)	18.3	98.1		96.9	24.2	18.0	98.3	66.7	37.8	102.4	112.6	34.8
Level of Service	B	F		F	C	B	F	E	D	F	F	C
Approach Delay (s)		95.1			32.5			66.9			103.9	
Approach LOS		F			C			E			F	

Intersection Summary			
HCM 2000 Control Delay	75.5	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.12		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	100.6%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	130	55	470	107	11	638
Future Volume (Veh/h)	130	55	470	107	11	638
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.77	0.71	0.98	0.62	0.55	0.94
Hourly flow rate (vph)	169	77	480	173	20	679
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						410
pX, platoon unblocked	0.73					
vC, conflicting volume	1199	480			653	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1088	480			653	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	1	87			98	
cM capacity (veh/h)	171	586			934	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1
Volume Total	246	480	173	699
Volume Left	169	0	0	20
Volume Right	77	0	173	0
cSH	219	1700	1700	934
Volume to Capacity	1.12	0.28	0.10	0.02
Queue Length 95th (ft)	285	0	0	2
Control Delay (s)	143.9	0.0	0.0	0.6
Lane LOS	F			A
Approach Delay (s)	143.9	0.0		0.6
Approach LOS	F			

Intersection Summary			
Average Delay	22.4		
Intersection Capacity Utilization	59.6%	ICU Level of Service	B
Analysis Period (min)	15		

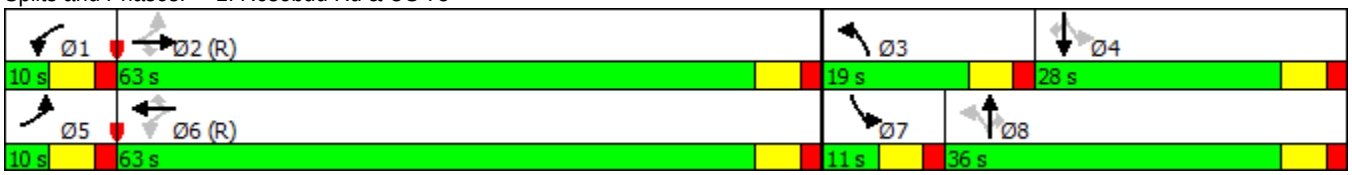
FUTURE "NO-BUILD" INTERSECTION ANALYSIS (WITH IMPROVEMENTS)

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	16	528	57	45	1263	85	164	313	59	80	194	45
Future Volume (vph)	16	528	57	45	1263	85	164	313	59	80	194	45
Lane Group Flow (vph)	20	568	61	62	1316	110	202	344	65	107	220	74
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2		2	6		6	8		8	4		4
Detector Phase	5	2	2	1	6	6	3	8	8	7	4	4
Switch Phase												
Minimum Initial (s)	4.0	15.0	15.0	4.0	15.0	15.0	4.0	6.0	6.0	4.0	6.0	6.0
Minimum Split (s)	10.0	24.0	24.0	10.0	24.0	24.0	10.0	31.0	31.0	10.0	24.0	24.0
Total Split (s)	10.0	63.0	63.0	10.0	63.0	63.0	19.0	36.0	36.0	11.0	28.0	28.0
Total Split (%)	8.3%	52.5%	52.5%	8.3%	52.5%	52.5%	15.8%	30.0%	30.0%	9.2%	23.3%	23.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	C-Min	C-Min	None	C-Min	C-Min	None	None	None	None	None	None
v/c Ratio	0.12	0.31	0.07	0.14	0.67	0.11	0.71	0.85	0.14	0.67	0.76	0.18
Control Delay	13.2	18.0	0.1	12.4	22.6	0.2	45.8	63.8	0.7	54.4	65.5	1.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	13.2	18.0	0.1	12.4	22.6	0.2	45.8	63.8	0.7	54.4	65.5	1.0
Queue Length 50th (ft)	6	134	0	20	339	0	120	254	0	60	164	0
Queue Length 95th (ft)	16	183	0	34	529	0	160	356	0	83	240	0
Internal Link Dist (ft)		1303			804			330			645	
Turn Bay Length (ft)	75		250	500		325	300		450	270		375
Base Capacity (vph)	168	1851	919	446	1969	965	291	465	497	160	341	446
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.12	0.31	0.07	0.14	0.67	0.11	0.69	0.74	0.13	0.67	0.65	0.17

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 1: Rosebud Rd & US 78



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	16	528	57	45	1263	85	164	313	59	80	194	45
Future Volume (vph)	16	528	57	45	1263	85	164	313	59	80	194	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.11	1.00	1.00	0.39	1.00	1.00	0.26	1.00	1.00	0.30	1.00	1.00
Satd. Flow (perm)	213	3539	1583	724	3539	1583	493	1863	1583	557	1863	1583
Peak-hour factor, PHF	0.80	0.93	0.93	0.73	0.96	0.77	0.81	0.91	0.91	0.75	0.88	0.61
Adj. Flow (vph)	20	568	61	62	1316	110	202	344	65	107	220	74
RTOR Reduction (vph)	0	0	30	0	0	52	0	0	51	0	0	63
Lane Group Flow (vph)	20	568	31	62	1316	58	202	344	14	107	220	11
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2		2	6		6	8		8	4		4
Actuated Green, G (s)	63.2	61.6	61.6	66.4	63.2	63.2	37.2	26.2	26.2	23.6	18.6	18.6
Effective Green, g (s)	63.2	61.6	61.6	66.4	63.2	63.2	37.2	26.2	26.2	23.6	18.6	18.6
Actuated g/C Ratio	0.53	0.51	0.51	0.55	0.53	0.53	0.31	0.22	0.22	0.20	0.16	0.16
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	132	1816	812	428	1863	833	286	406	345	160	288	245
v/s Ratio Prot	0.00	0.16		c0.00	c0.37		c0.07	c0.18		0.03	0.12	
v/s Ratio Perm	0.08		0.02	0.08		0.04	0.14		0.01	0.10		0.01
v/c Ratio	0.15	0.31	0.04	0.14	0.71	0.07	0.71	0.85	0.04	0.67	0.76	0.05
Uniform Delay, d1	17.0	16.9	14.5	12.6	21.4	14.0	33.3	45.0	37.0	43.1	48.6	43.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.5	0.5	0.1	0.2	2.3	0.2	7.7	15.0	0.0	10.1	11.4	0.1
Delay (s)	17.6	17.4	14.6	12.8	23.7	14.1	41.0	60.0	37.0	53.2	60.0	43.2
Level of Service	B	B	B	B	C	B	D	E	D	D	E	D
Approach Delay (s)		17.1			22.5			51.3			55.1	
Approach LOS		B			C			D			E	

Intersection Summary			
HCM 2000 Control Delay	31.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	73.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	22	31	551	40	4	318
Future Volume (Veh/h)	22	31	551	40	4	318
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.55	0.83	0.87	0.75	0.50	0.93
Hourly flow rate (vph)	40	37	633	53	8	342
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						410
pX, platoon unblocked	0.88					
vC, conflicting volume	991	633			686	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	924	633			686	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	85	92			99	
cM capacity (veh/h)	262	480			908	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1
Volume Total	77	633	53	350
Volume Left	40	0	0	8
Volume Right	37	0	53	0
cSH	335	1700	1700	908
Volume to Capacity	0.23	0.37	0.03	0.01
Queue Length 95th (ft)	22	0	0	1
Control Delay (s)	18.9	0.0	0.0	0.3
Lane LOS	C			A
Approach Delay (s)	18.9	0.0		0.3
Approach LOS	C			

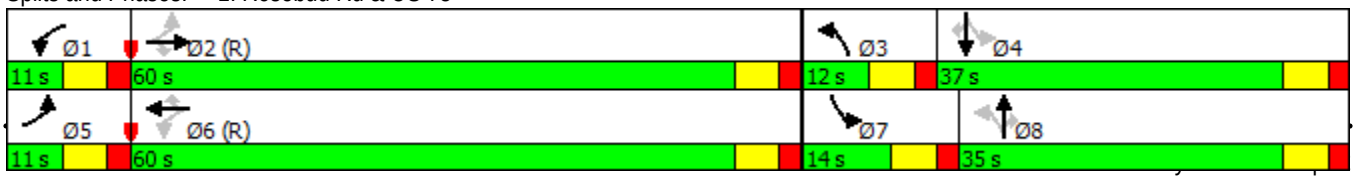
Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	39.0%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	50	1389	166	132	845	129	145	298	140	171	410	51
Future Volume (vph)	50	1389	166	132	845	129	145	298	140	171	410	51
Lane Group Flow (vph)	69	1578	191	147	899	139	159	377	169	204	488	57
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2		2	6		6	8		8	4		4
Detector Phase	5	2	2	1	6	6	3	8	8	7	4	4
Switch Phase												
Minimum Initial (s)	4.0	15.0	15.0	4.0	15.0	15.0	4.0	6.0	6.0	4.0	6.0	6.0
Minimum Split (s)	10.0	24.0	24.0	10.0	24.0	24.0	10.0	31.0	31.0	10.0	24.0	24.0
Total Split (s)	11.0	60.0	60.0	11.0	60.0	60.0	12.0	35.0	35.0	14.0	37.0	37.0
Total Split (%)	9.2%	50.0%	50.0%	9.2%	50.0%	50.0%	10.0%	29.2%	29.2%	11.7%	30.8%	30.8%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	C-Min	C-Min	None	C-Min	C-Min	None	None	None	None	None	None
v/c Ratio	0.27	0.99	0.24	1.09	0.54	0.17	1.06	0.84	0.35	0.98	1.01	0.11
Control Delay	16.0	53.7	7.1	126.6	24.8	3.7	123.5	60.8	11.9	91.3	89.2	0.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.0	53.7	7.1	126.6	24.8	3.7	123.5	60.8	11.9	91.3	89.2	0.5
Queue Length 50th (ft)	24	624	23	~78	264	0	~93	279	20	114	~388	0
Queue Length 95th (ft)	38	#770	63	#214	328	36	#222	336	64	#207	#542	0
Internal Link Dist (ft)		1303			804			330			645	
Turn Bay Length (ft)	75		250	500		325	300		450	270		375
Base Capacity (vph)	260	1592	788	135	1657	815	150	450	485	208	481	509
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.27	0.99	0.24	1.09	0.54	0.17	1.06	0.84	0.35	0.98	1.01	0.11

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 110
Control Type: Actuated-Coordinated
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Rosebud Rd & US 78



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	50	1389	166	132	845	129	145	298	140	171	410	51
Future Volume (vph)	50	1389	166	132	845	129	145	298	140	171	410	51
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.22	1.00	1.00	0.07	1.00	1.00	0.14	1.00	1.00	0.19	1.00	1.00
Satd. Flow (perm)	413	3539	1583	135	3539	1583	257	1863	1583	352	1863	1583
Peak-hour factor, PHF	0.72	0.88	0.87	0.90	0.94	0.93	0.91	0.79	0.83	0.84	0.84	0.89
Adj. Flow (vph)	69	1578	191	147	899	139	159	377	169	204	488	57
RTOR Reduction (vph)	0	0	76	0	0	75	0	0	103	0	0	42
Lane Group Flow (vph)	69	1578	115	147	899	64	159	377	66	204	488	15
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2		2	6		6	8		8	4		4
Actuated Green, G (s)	58.0	54.0	54.0	60.0	55.0	55.0	35.0	29.0	29.0	39.0	31.0	31.0
Effective Green, g (s)	58.0	54.0	54.0	60.0	55.0	55.0	35.0	29.0	29.0	39.0	31.0	31.0
Actuated g/C Ratio	0.48	0.45	0.45	0.50	0.46	0.46	0.29	0.24	0.24	0.32	0.26	0.26
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	244	1592	712	135	1622	725	150	450	382	208	481	408
v/s Ratio Prot	0.01	0.45		c0.05	0.25		0.05	0.20		c0.07	c0.26	
v/s Ratio Perm	0.13		0.07	c0.50		0.04	0.26		0.04	0.25		0.01
v/c Ratio	0.28	0.99	0.16	1.09	0.55	0.09	1.06	0.84	0.17	0.98	1.01	0.04
Uniform Delay, d1	17.9	32.8	19.6	27.9	23.6	18.3	40.3	43.3	36.0	37.3	44.5	33.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.6	20.6	0.5	103.3	1.4	0.2	90.4	12.8	0.2	56.6	44.7	0.0
Delay (s)	18.5	53.3	20.1	131.2	25.0	18.6	130.6	56.1	36.2	94.0	89.2	33.4
Level of Service	B	D	C	F	C	B	F	E	D	F	F	C
Approach Delay (s)		48.6			37.4			68.1			86.3	
Approach LOS		D			D			E			F	

Intersection Summary			
HCM 2000 Control Delay	55.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.09		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	95.3%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	130	55	470	107	11	638
Future Volume (Veh/h)	130	55	470	107	11	638
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.77	0.71	0.98	0.62	0.55	0.94
Hourly flow rate (vph)	169	77	480	173	20	679
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						410
pX, platoon unblocked	0.72					
vC, conflicting volume	1199	480			653	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1079	480			653	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	87			98	
cM capacity (veh/h)	169	586			934	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1
Volume Total	246	480	173	699
Volume Left	169	0	0	20
Volume Right	77	0	173	0
cSH	218	1700	1700	934
Volume to Capacity	1.13	0.28	0.10	0.02
Queue Length 95th (ft)	288	0	0	2
Control Delay (s)	147.1	0.0	0.0	0.6
Lane LOS	F			A
Approach Delay (s)	147.1	0.0		0.6
Approach LOS	F			

Intersection Summary			
Average Delay	22.9		
Intersection Capacity Utilization	59.6%	ICU Level of Service	B
Analysis Period (min)	15		

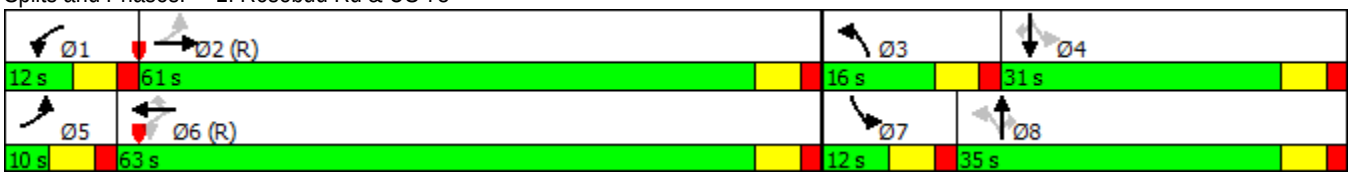
FUTURE "BUILD" INTERSECTION ANALYSIS

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	40	586	71	1341	85	164	317	69	80	205	77
Future Volume (vph)	40	586	71	1341	85	164	317	69	80	205	77
Lane Group Flow (vph)	50	708	97	1397	110	202	348	76	107	233	126
Turn Type	pm+pt	NA	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	5	2	1	6		3	8		7	4	
Permitted Phases	2		6		6	8		8	4		4
Detector Phase	5	2	1	6	6	3	8	8	7	4	4
Switch Phase											
Minimum Initial (s)	4.0	15.0	4.0	15.0	15.0	4.0	6.0	6.0	4.0	6.0	6.0
Minimum Split (s)	10.0	24.0	10.0	24.0	24.0	10.0	31.0	31.0	10.0	24.0	24.0
Total Split (s)	10.0	61.0	12.0	63.0	63.0	16.0	35.0	35.0	12.0	31.0	31.0
Total Split (%)	8.3%	50.8%	10.0%	52.5%	52.5%	13.3%	29.2%	29.2%	10.0%	25.8%	25.8%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	C-Min	None	C-Min	C-Min	None	None	None	None	None	None
v/c Ratio	0.37	0.42	0.26	0.76	0.12	0.73	0.86	0.17	0.63	0.68	0.31
Control Delay	21.4	15.0	13.7	28.0	1.9	48.7	66.1	0.9	48.4	56.0	7.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.4	15.0	13.7	28.0	1.9	48.7	66.1	0.9	48.4	56.0	7.7
Queue Length 50th (ft)	9	183	33	471	0	118	256	0	59	167	0
Queue Length 95th (ft)	18	244	48	582	8	160	#385	2	83	244	1
Internal Link Dist (ft)		376		804			330			645	
Turn Bay Length (ft)	75		500		325	300		450	270		375
Base Capacity (vph)	136	1688	372	1828	883	275	450	485	169	388	437
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.37	0.42	0.26	0.76	0.12	0.73	0.77	0.16	0.63	0.60	0.29

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 18 (15%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Rosebud Rd & US 78



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	40	586	73	71	1341	85	164	317	69	80	205	77
Future Volume (vph)	40	586	73	71	1341	85	164	317	69	80	205	77
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3481		1770	3539	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.09	1.00		0.30	1.00	1.00	0.32	1.00	1.00	0.24	1.00	1.00
Satd. Flow (perm)	160	3481		560	3539	1583	590	1863	1583	443	1863	1583
Peak-hour factor, PHF	0.80	0.93	0.93	0.73	0.96	0.77	0.81	0.91	0.91	0.75	0.88	0.61
Adj. Flow (vph)	50	630	78	97	1397	110	202	348	76	107	233	126
RTOR Reduction (vph)	0	8	0	0	0	54	0	0	60	0	0	103
Lane Group Flow (vph)	50	700	0	97	1397	56	202	348	16	107	233	23
Turn Type	pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6		6	8		8	4		4
Actuated Green, G (s)	61.2	58.0		66.8	60.8	60.8	36.0	26.0	26.0	28.0	22.0	22.0
Effective Green, g (s)	61.2	58.0		66.8	60.8	60.8	36.0	26.0	26.0	28.0	22.0	22.0
Actuated g/C Ratio	0.51	0.48		0.56	0.51	0.51	0.30	0.22	0.22	0.23	0.18	0.18
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0		3.0	5.0	5.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	124	1682		372	1793	802	275	403	342	169	341	290
v/s Ratio Prot	0.01	0.20		c0.01	c0.39		c0.06	c0.19		0.03	0.13	
v/s Ratio Perm	0.19			0.13		0.04	0.16		0.01	0.12		0.01
v/c Ratio	0.40	0.42		0.26	0.78	0.07	0.73	0.86	0.05	0.63	0.68	0.08
Uniform Delay, d1	19.8	20.1		13.3	24.1	15.1	34.8	45.3	37.2	38.3	45.7	40.6
Progression Factor	1.13	0.70		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.1	0.7		0.4	3.4	0.2	9.7	17.1	0.1	7.5	5.6	0.1
Delay (s)	24.5	14.8		13.7	27.6	15.3	44.6	62.4	37.3	45.8	51.3	40.7
Level of Service	C	B		B	C	B	D	E	D	D	D	D
Approach Delay (s)		15.4			25.9			53.6			47.2	
Approach LOS		B			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	31.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	81.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	15	0	19	22	0	31	55	550	40	4	346	25
Future Volume (Veh/h)	15	0	19	22	0	31	55	550	40	4	346	25
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.55	0.92	0.83	0.92	0.87	0.75	0.50	0.93	0.92
Hourly flow rate (vph)	16	0	21	40	0	37	60	632	53	8	372	27
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											410	
pX, platoon unblocked	0.87	0.87	0.87	0.87	0.87		0.87					
vC, conflicting volume	1177	1193	372	1161	1167	632	399			685		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1129	1147	204	1111	1117	632	235			685		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	88	100	97	73	100	92	95			99		
cM capacity (veh/h)	139	163	728	150	170	480	1160			908		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	16	21	77	60	632	53	380	27
Volume Left	16	0	40	60	0	0	8	0
Volume Right	0	21	37	0	0	53	0	27
cSH	139	728	225	1160	1700	1700	908	1700
Volume to Capacity	0.12	0.03	0.34	0.05	0.37	0.03	0.01	0.02
Queue Length 95th (ft)	10	2	36	4	0	0	1	0
Control Delay (s)	34.3	10.1	29.2	8.3	0.0	0.0	0.3	0.0
Lane LOS	D	B	D	A			A	
Approach Delay (s)	20.5		29.2	0.7			0.3	
Approach LOS	C		D					

Intersection Summary			
Average Delay	2.9		
Intersection Capacity Utilization	62.2%	ICU Level of Service	B
Analysis Period (min)	15		

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	646	55	133	1453	87	53
Future Volume (vph)	646	55	133	1453	87	53
Lane Group Flow (vph)	743	60	145	1597	95	58
Turn Type	NA	Perm	pm+pt	NA	Prot	Prot
Protected Phases	2		1	6	8	8
Permitted Phases		2	6			
Detector Phase	2	2	1	6	8	8
Switch Phase						
Minimum Initial (s)	15.0	15.0	4.0	15.0	6.0	6.0
Minimum Split (s)	24.0	24.0	10.0	24.0	34.0	34.0
Total Split (s)	69.0	69.0	17.0	86.0	34.0	34.0
Total Split (%)	57.5%	57.5%	14.2%	71.7%	28.3%	28.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?						
Recall Mode	C-Min	C-Min	None	C-Min	None	None
v/c Ratio	0.30	0.05	0.24	0.55	0.38	0.34
Control Delay	7.8	1.8	1.7	1.8	56.9	18.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.8	1.8	1.7	1.8	56.9	18.7
Queue Length 50th (ft)	109	0	11	74	36	0
Queue Length 95th (ft)	141	14	m11	60	63	41
Internal Link Dist (ft)	671			366	203	
Turn Bay Length (ft)		250	310			
Base Capacity (vph)	2449	1114	609	2925	801	413
Starvation Cap Reductn	0	0	0	61	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.30	0.05	0.24	0.56	0.12	0.14

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 21 (18%), Referenced to phase 2:EBT and 6:WBTL, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: Main Site Drwy & US 78

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	646	55	133	1453	87	53
Future Volume (vph)	646	55	133	1453	87	53
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	0.95	1.00	1.00	0.95	0.97	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	1770	3539	3433	1583
Flt Permitted	1.00	1.00	0.33	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	609	3539	3433	1583
Peak-hour factor, PHF	0.87	0.92	0.92	0.91	0.92	0.92
Adj. Flow (vph)	743	60	145	1597	95	58
RTOR Reduction (vph)	0	18	0	0	0	54
Lane Group Flow (vph)	743	42	145	1597	95	4
Turn Type	NA	Perm	pm+pt	NA	Prot	Prot
Protected Phases	2		1	6	8	8
Permitted Phases		2	6			
Actuated Green, G (s)	83.1	83.1	99.2	99.2	8.8	8.8
Effective Green, g (s)	83.1	83.1	99.2	99.2	8.8	8.8
Actuated g/C Ratio	0.69	0.69	0.83	0.83	0.07	0.07
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	5.0	5.0	3.0	5.0	3.0	3.0
Lane Grp Cap (vph)	2450	1096	601	2925	251	116
v/s Ratio Prot	0.21		0.02	c0.45	c0.03	0.00
v/s Ratio Perm		0.03	0.18			
v/c Ratio	0.30	0.04	0.24	0.55	0.38	0.04
Uniform Delay, d1	7.2	5.8	2.5	3.3	53.0	51.7
Progression Factor	1.00	1.00	0.47	0.37	1.00	1.00
Incremental Delay, d2	0.3	0.1	0.1	0.5	1.0	0.1
Delay (s)	7.5	5.9	1.3	1.7	54.0	51.8
Level of Service	A	A	A	A	D	D
Approach Delay (s)	7.4			1.7	53.1	
Approach LOS	A			A	D	

Intersection Summary			
HCM 2000 Control Delay	6.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	55.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	8	9	15	637	372	16
Future Volume (Veh/h)	8	9	15	637	372	16
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.87	0.93	0.92
Hourly flow rate (vph)	9	10	16	732	400	17
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)					780	
pX, platoon unblocked	0.90	0.90	0.90			
vC, conflicting volume	1164	400	417			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1127	277	296			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	96	99	99			
cM capacity (veh/h)	201	685	1138			

Direction, Lane #	EB 1	NB 1	SB 1	SB 2
Volume Total	19	748	400	17
Volume Left	9	16	0	0
Volume Right	10	0	0	17
cSH	320	1138	1700	1700
Volume to Capacity	0.06	0.01	0.24	0.01
Queue Length 95th (ft)	5	1	0	0
Control Delay (s)	17.0	0.4	0.0	0.0
Lane LOS	C	A		
Approach Delay (s)	17.0	0.4	0.0	
Approach LOS	C			

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	55.6%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	646	53	0	1586	0	55
Future Volume (Veh/h)	646	53	0	1586	0	55
Sign Control	Free			Free	Yield	
Grade	0%			0%	0%	
Peak Hour Factor	0.87	0.92	0.92	0.91	0.92	0.92
Hourly flow rate (vph)	743	58	0	1743	0	60
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			TWLTL		
Median storage veh)	2			2		
Upstream signal (ft)	446			456		
pX, platoon unblocked			0.92		0.71	0.92
vC, conflicting volume			743		1614	372
vC1, stage 1 conf vol					743	
vC2, stage 2 conf vol					872	
vCu, unblocked vol			553		557	150
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	93
cM capacity (veh/h)			934		464	802

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	NB 1
Volume Total	372	372	58	872	872	60
Volume Left	0	0	0	0	0	0
Volume Right	0	0	58	0	0	60
cSH	1700	1700	1700	1700	1700	802
Volume to Capacity	0.22	0.22	0.03	0.51	0.51	0.07
Queue Length 95th (ft)	0	0	0	0	0	6
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	9.9
Lane LOS						A
Approach Delay (s)	0.0			0.0		9.9
Approach LOS						A

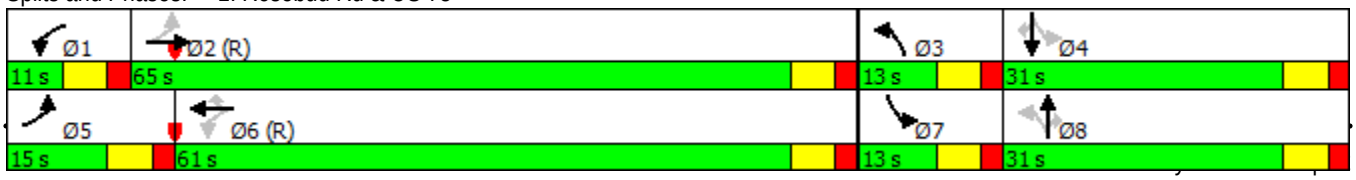
Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	47.2%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	96	1501	165	945	129	145	306	160	171	424	92
Future Volume (vph)	96	1501	165	945	129	145	306	160	171	424	92
Lane Group Flow (vph)	133	1932	183	1005	139	159	387	193	204	505	103
Turn Type	pm+pt	NA	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	5	2	1	6		3	8		7	4	
Permitted Phases	2		6		6	8		8	4		4
Detector Phase	5	2	1	6	6	3	8	8	7	4	4
Switch Phase											
Minimum Initial (s)	4.0	15.0	4.0	15.0	15.0	4.0	6.0	6.0	4.0	6.0	6.0
Minimum Split (s)	10.0	24.0	10.0	24.0	24.0	10.0	31.0	31.0	10.0	24.0	24.0
Total Split (s)	15.0	65.0	11.0	61.0	61.0	13.0	31.0	31.0	13.0	31.0	31.0
Total Split (%)	12.5%	54.2%	9.2%	50.8%	50.8%	10.8%	25.8%	25.8%	10.8%	25.8%	25.8%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	C-Min	None	C-Min	C-Min	None	None	None	None	None	None
v/c Ratio	0.48	1.13	1.36	0.61	0.17	0.96	1.00	0.44	1.24	1.30	0.24
Control Delay	9.3	84.3	222.8	26.3	3.6	97.4	92.9	17.0	179.8	192.1	4.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	9.3	84.3	222.8	26.3	3.6	97.4	92.9	17.0	179.8	192.1	4.1
Queue Length 50th (ft)	14	~910	~136	302	0	92	302	37	~144	~501	0
Queue Length 95th (ft)	15	#1011	#287	373	35	#211	#406	88	#265	#645	23
Internal Link Dist (ft)		376		804			330			645	
Turn Bay Length (ft)	75		500		325	300		450	270		375
Base Capacity (vph)	286	1717	135	1637	806	165	388	437	165	388	437
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.47	1.13	1.36	0.61	0.17	0.96	1.00	0.44	1.24	1.30	0.24

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 2 (2%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Rosebud Rd & US 78



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	96	1501	197	165	945	129	145	306	160	171	424	92
Future Volume (vph)	96	1501	197	165	945	129	145	306	160	171	424	92
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3477		1770	3539	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.17	1.00		0.07	1.00	1.00	0.16	1.00	1.00	0.16	1.00	1.00
Satd. Flow (perm)	312	3477		134	3539	1583	298	1863	1583	298	1863	1583
Peak-hour factor, PHF	0.72	0.88	0.87	0.90	0.94	0.93	0.91	0.79	0.83	0.84	0.84	0.89
Adj. Flow (vph)	133	1706	226	183	1005	139	159	387	193	204	505	103
RTOR Reduction (vph)	0	9	0	0	0	75	0	0	108	0	0	82
Lane Group Flow (vph)	133	1923	0	183	1005	64	159	387	85	204	505	21
Turn Type	pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6		6	8		8	4		4
Actuated Green, G (s)	67.5	59.0		60.5	55.5	55.5	32.0	25.0	25.0	32.0	25.0	25.0
Effective Green, g (s)	67.5	59.0		60.5	55.5	55.5	32.0	25.0	25.0	32.0	25.0	25.0
Actuated g/C Ratio	0.56	0.49		0.50	0.46	0.46	0.27	0.21	0.21	0.27	0.21	0.21
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0		3.0	5.0	5.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	278	1709		135	1636	732	165	388	329	165	388	329
v/s Ratio Prot	0.03	c0.55		c0.06	0.28		0.06	0.21		c0.07	c0.27	
v/s Ratio Perm	0.23			c0.62		0.04	0.20		0.05	0.26		0.01
v/c Ratio	0.48	1.13		1.36	0.61	0.09	0.96	1.00	0.26	1.24	1.30	0.07
Uniform Delay, d1	15.7	30.5		28.0	24.2	18.1	40.7	47.5	39.8	41.2	47.5	38.1
Progression Factor	0.40	0.63		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.1	63.3		200.6	1.7	0.2	58.9	44.7	0.4	147.5	153.4	0.1
Delay (s)	7.4	82.5		228.6	25.9	18.3	99.6	92.2	40.2	188.7	200.9	38.2
Level of Service	A	F		F	C	B	F	F	D	F	F	D
Approach Delay (s)		77.7			53.1			80.2			177.2	
Approach LOS		E			D			F			F	

Intersection Summary			
HCM 2000 Control Delay	87.8	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.29		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	107.3%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	53	0	63	130	0	55	97	445	107	11	656	60
Future Volume (Veh/h)	53	0	63	130	0	55	97	445	107	11	656	60
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.77	0.92	0.71	0.92	0.98	0.62	0.55	0.94	0.92
Hourly flow rate (vph)	58	0	68	169	0	77	105	454	173	20	698	65
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											410	
pX, platoon unblocked	0.75	0.75	0.75	0.75	0.75		0.75					
vC, conflicting volume	1479	1575	698	1470	1467	454	763			627		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1472	1600	430	1460	1456	454	517			627		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	4	100	85	0	100	87	87			98		
cM capacity (veh/h)	61	67	468	61	83	606	786			955		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	58	68	246	105	454	173	718	65
Volume Left	58	0	169	105	0	0	20	0
Volume Right	0	68	77	0	0	173	0	65
cSH	61	468	84	786	1700	1700	955	1700
Volume to Capacity	0.96	0.15	2.91	0.13	0.27	0.10	0.02	0.04
Queue Length 95th (ft)	112	13	601	11	0	0	2	0
Control Delay (s)	214.1	14.0	969.9	10.3	0.0	0.0	0.6	0.0
Lane LOS	F	B	F	B			A	
Approach Delay (s)	106.1		969.9	1.5			0.5	
Approach LOS	F		F					

Intersection Summary			
Average Delay	134.3		
Intersection Capacity Utilization	85.8%	ICU Level of Service	E
Analysis Period (min)	15		

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	1585	111	201	958	183	137
Future Volume (vph)	1585	111	201	958	183	137
Lane Group Flow (vph)	1686	121	218	988	199	149
Turn Type	NA	Perm	pm+pt	NA	Prot	Perm
Protected Phases	2		1	6	8	
Permitted Phases		2	6			8
Detector Phase	2	2	1	6	8	8
Switch Phase						
Minimum Initial (s)	15.0	15.0	4.0	15.0	6.0	6.0
Minimum Split (s)	24.0	24.0	10.0	24.0	34.0	34.0
Total Split (s)	68.0	68.0	18.0	86.0	34.0	34.0
Total Split (%)	56.7%	56.7%	15.0%	71.7%	28.3%	28.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?						
Recall Mode	C-Min	C-Min	None	C-Min	None	None
v/c Ratio	0.74	0.11	0.81	0.35	0.55	0.50
Control Delay	17.4	3.1	48.7	3.3	56.6	13.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	17.4	3.1	48.7	3.3	56.6	13.6
Queue Length 50th (ft)	428	7	121	71	76	0
Queue Length 95th (ft)	576	32	m#212	m106	111	60
Internal Link Dist (ft)	671			366	203	
Turn Bay Length (ft)		250	310			
Base Capacity (vph)	2283	1054	270	2814	801	483
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.74	0.11	0.81	0.35	0.25	0.31

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 104 (87%), Referenced to phase 2:EBT and 6:WBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: Main Site Drwy & US 78

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	1585	111	201	958	183	137
Future Volume (vph)	1585	111	201	958	183	137
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	0.95	1.00	1.00	0.95	0.97	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	1770	3539	3433	1583
Flt Permitted	1.00	1.00	0.07	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	134	3539	3433	1583
Peak-hour factor, PHF	0.94	0.92	0.92	0.97	0.92	0.92
Adj. Flow (vph)	1686	121	218	988	199	149
RTOR Reduction (vph)	0	33	0	0	0	133
Lane Group Flow (vph)	1686	88	218	988	199	16
Turn Type	NA	Perm	pm+pt	NA	Prot	Perm
Protected Phases	2		1	6	8	
Permitted Phases		2	6			8
Actuated Green, G (s)	77.4	77.4	95.4	95.4	12.6	12.6
Effective Green, g (s)	77.4	77.4	95.4	95.4	12.6	12.6
Actuated g/C Ratio	0.65	0.65	0.80	0.80	0.10	0.10
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	5.0	5.0	3.0	5.0	3.0	3.0
Lane Grp Cap (vph)	2282	1021	270	2813	360	166
v/s Ratio Prot	0.48		c0.08	0.28	c0.06	
v/s Ratio Perm		0.06	c0.56			0.01
v/c Ratio	0.74	0.09	0.81	0.35	0.55	0.09
Uniform Delay, d1	14.4	8.0	30.9	3.5	51.0	48.5
Progression Factor	1.00	1.00	1.32	0.82	1.00	1.00
Incremental Delay, d2	2.2	0.2	12.9	0.3	1.8	0.2
Delay (s)	16.6	8.2	53.9	3.1	52.9	48.8
Level of Service	B	A	D	A	D	D
Approach Delay (s)	16.1			12.3	51.1	
Approach LOS	B			B	D	

Intersection Summary			
HCM 2000 Control Delay	18.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	75.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	9	25	16	640	820	28
Future Volume (Veh/h)	9	25	16	640	820	28
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.87	0.93	0.92
Hourly flow rate (vph)	10	27	17	736	882	30
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)					780	
pX, platoon unblocked	0.79	0.79	0.79			
vC, conflicting volume	1652	882	912			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1694	713	751			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	87	92	97			
cM capacity (veh/h)	78	339	674			

Direction, Lane #	EB 1	NB 1	SB 1	SB 2
Volume Total	37	753	882	30
Volume Left	10	17	0	0
Volume Right	27	0	0	30
cSH	178	674	1700	1700
Volume to Capacity	0.21	0.03	0.52	0.02
Queue Length 95th (ft)	19	2	0	0
Control Delay (s)	30.4	0.7	0.0	0.0
Lane LOS	D	A		
Approach Delay (s)	30.4	0.7	0.0	
Approach LOS	D			

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	56.5%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	1626	97	0	1159	0	133
Future Volume (Veh/h)	1626	97	0	1159	0	133
Sign Control	Free			Free	Yield	
Grade	0%			0%	0%	
Peak Hour Factor	0.94	0.92	0.92	0.97	0.92	0.92
Hourly flow rate (vph)	1730	105	0	1195	0	145
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			TWLTL		
Median storage veh)	2			2		
Upstream signal (ft)	446			456		
pX, platoon unblocked			0.67		0.77	0.67
vC, conflicting volume			1730		2328	865
vC1, stage 1 conf vol					1730	
vC2, stage 2 conf vol					598	
vCu, unblocked vol			1101		902	0
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	80
cM capacity (veh/h)			421		183	725

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	NB 1
Volume Total	865	865	105	598	598	145
Volume Left	0	0	0	0	0	0
Volume Right	0	0	105	0	0	145
cSH	1700	1700	1700	1700	1700	725
Volume to Capacity	0.51	0.51	0.06	0.35	0.35	0.20
Queue Length 95th (ft)	0	0	0	0	0	19
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	11.2
Lane LOS						B
Approach Delay (s)	0.0			0.0		11.2
Approach LOS						B

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	59.8%	ICU Level of Service	B
Analysis Period (min)	15		

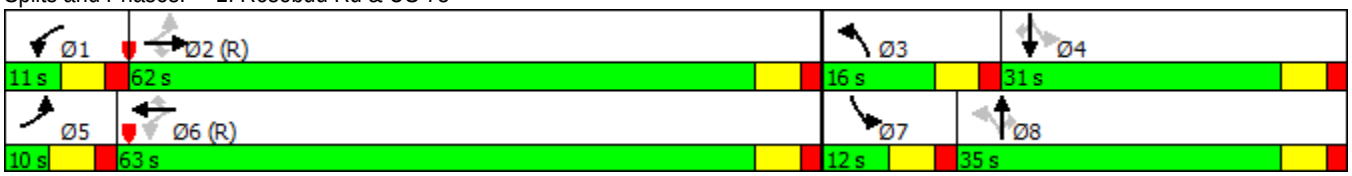
FUTURE "BUILD" INTERSECTION ANALYSIS (WITH IMPROVEMENTS)

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	40	586	73	71	1341	85	164	317	69	80	205	77
Future Volume (vph)	40	586	73	71	1341	85	164	317	69	80	205	77
Lane Group Flow (vph)	50	630	78	97	1397	110	202	348	76	107	233	126
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2		2	6		6	8		8	4		4
Detector Phase	5	2	2	1	6	6	3	8	8	7	4	4
Switch Phase												
Minimum Initial (s)	4.0	15.0	15.0	4.0	15.0	15.0	4.0	6.0	6.0	4.0	6.0	6.0
Minimum Split (s)	10.0	24.0	24.0	10.0	24.0	24.0	10.0	31.0	31.0	10.0	24.0	24.0
Total Split (s)	10.0	62.0	62.0	11.0	63.0	63.0	16.0	35.0	35.0	12.0	31.0	31.0
Total Split (%)	8.3%	51.7%	51.7%	9.2%	52.5%	52.5%	13.3%	29.2%	29.2%	10.0%	25.8%	25.8%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	C-Min	C-Min	None	C-Min	C-Min	None	None	None	None	None	None
v/c Ratio	0.37	0.36	0.09	0.24	0.76	0.12	0.73	0.86	0.17	0.63	0.68	0.31
Control Delay	21.4	14.0	0.3	13.6	28.0	1.9	48.7	66.1	0.9	48.4	56.0	7.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.4	14.0	0.3	13.6	28.0	1.9	48.7	66.1	0.9	48.4	56.0	7.7
Queue Length 50th (ft)	9	158	0	33	471	0	118	256	0	59	167	0
Queue Length 95th (ft)	17	188	0	48	582	8	160	#385	2	83	244	1
Internal Link Dist (ft)		376			804			330			645	
Turn Bay Length (ft)	75		250	500		325	300		450	270		375
Base Capacity (vph)	136	1739	847	403	1828	883	275	450	485	169	388	437
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.37	0.36	0.09	0.24	0.76	0.12	0.73	0.77	0.16	0.63	0.60	0.29

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 18 (15%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Rosebud Rd & US 78



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	40	586	73	71	1341	85	164	317	69	80	205	77
Future Volume (vph)	40	586	73	71	1341	85	164	317	69	80	205	77
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.08	1.00	1.00	0.35	1.00	1.00	0.32	1.00	1.00	0.24	1.00	1.00
Satd. Flow (perm)	157	3539	1583	648	3539	1583	590	1863	1583	443	1863	1583
Peak-hour factor, PHF	0.80	0.93	0.93	0.73	0.96	0.77	0.81	0.91	0.91	0.75	0.88	0.61
Adj. Flow (vph)	50	630	78	97	1397	110	202	348	76	107	233	126
RTOR Reduction (vph)	0	0	40	0	0	54	0	0	60	0	0	103
Lane Group Flow (vph)	50	630	38	97	1397	56	202	348	16	107	233	23
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2		2	6		6	8		8	4		4
Actuated Green, G (s)	62.2	59.0	59.0	65.8	60.8	60.8	36.0	26.0	26.0	28.0	22.0	22.0
Effective Green, g (s)	62.2	59.0	59.0	65.8	60.8	60.8	36.0	26.0	26.0	28.0	22.0	22.0
Actuated g/C Ratio	0.52	0.49	0.49	0.55	0.51	0.51	0.30	0.22	0.22	0.23	0.18	0.18
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	124	1740	778	402	1793	802	275	403	342	169	341	290
v/s Ratio Prot	c0.01	0.18		0.01	c0.39		c0.06	c0.19		0.03	0.13	
v/s Ratio Perm	0.20		0.02	0.12		0.04	0.16		0.01	0.12		0.01
v/c Ratio	0.40	0.36	0.05	0.24	0.78	0.07	0.73	0.86	0.05	0.63	0.68	0.08
Uniform Delay, d1	19.6	18.9	15.9	13.4	24.1	15.1	34.8	45.3	37.2	38.3	45.7	40.6
Progression Factor	1.14	0.69	0.77	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.1	0.6	0.1	0.3	3.4	0.2	9.7	17.1	0.1	7.5	5.6	0.1
Delay (s)	24.5	13.5	12.4	13.7	27.6	15.3	44.6	62.4	37.3	45.8	51.3	40.7
Level of Service	C	B	B	B	C	B	D	E	D	D	D	D
Approach Delay (s)		14.1			25.9			53.6			47.2	
Approach LOS		B			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	31.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	81.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	15	0	19	22	0	31	55	550	40	4	346	25
Future Volume (Veh/h)	15	0	19	22	0	31	55	550	40	4	346	25
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.55	0.92	0.83	0.92	0.87	0.75	0.50	0.93	0.92
Hourly flow rate (vph)	16	0	21	40	0	37	60	632	53	8	372	27
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											410	
pX, platoon unblocked	0.87	0.87	0.87	0.87	0.87		0.87					
vC, conflicting volume	1177	1193	372	1161	1167	632	399			685		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1129	1147	204	1111	1117	632	235			685		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	88	100	97	73	100	92	95			99		
cM capacity (veh/h)	139	163	728	150	170	480	1160			908		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	16	21	77	60	632	53	380	27
Volume Left	16	0	40	60	0	0	8	0
Volume Right	0	21	37	0	0	53	0	27
cSH	139	728	225	1160	1700	1700	908	1700
Volume to Capacity	0.12	0.03	0.34	0.05	0.37	0.03	0.01	0.02
Queue Length 95th (ft)	10	2	36	4	0	0	1	0
Control Delay (s)	34.3	10.1	29.2	8.3	0.0	0.0	0.3	0.0
Lane LOS	D	B	D	A			A	
Approach Delay (s)	20.5		29.2	0.7			0.3	
Approach LOS	C		D					

Intersection Summary			
Average Delay	2.9		
Intersection Capacity Utilization	62.2%	ICU Level of Service	B
Analysis Period (min)	15		

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	646	55	133	1453	87	53
Future Volume (vph)	646	55	133	1453	87	53
Lane Group Flow (vph)	743	60	145	1597	95	58
Turn Type	NA	Perm	pm+pt	NA	Prot	Prot
Protected Phases	2		1	6	8	8
Permitted Phases		2	6			
Detector Phase	2	2	1	6	8	8
Switch Phase						
Minimum Initial (s)	15.0	15.0	4.0	15.0	6.0	6.0
Minimum Split (s)	24.0	24.0	10.0	24.0	34.0	34.0
Total Split (s)	69.0	69.0	17.0	86.0	34.0	34.0
Total Split (%)	57.5%	57.5%	14.2%	71.7%	28.3%	28.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?						
Recall Mode	C-Min	C-Min	None	C-Min	None	None
v/c Ratio	0.30	0.05	0.24	0.55	0.38	0.34
Control Delay	7.8	1.8	1.7	1.9	56.9	18.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.8	1.8	1.7	1.9	56.9	18.7
Queue Length 50th (ft)	109	0	11	78	36	0
Queue Length 95th (ft)	141	14	m12	64	63	41
Internal Link Dist (ft)	671			366	224	
Turn Bay Length (ft)		250	310			
Base Capacity (vph)	2449	1114	609	2925	801	413
Starvation Cap Reductn	0	0	0	61	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.30	0.05	0.24	0.56	0.12	0.14

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 21 (18%), Referenced to phase 2:EBT and 6:WBTL, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: Site Drwy 1 & US 78

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	646	55	133	1453	87	53
Future Volume (vph)	646	55	133	1453	87	53
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	0.95	1.00	1.00	0.95	0.97	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	1770	3539	3433	1583
Flt Permitted	1.00	1.00	0.33	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	609	3539	3433	1583
Peak-hour factor, PHF	0.87	0.92	0.92	0.91	0.92	0.92
Adj. Flow (vph)	743	60	145	1597	95	58
RTOR Reduction (vph)	0	18	0	0	0	54
Lane Group Flow (vph)	743	42	145	1597	95	4
Turn Type	NA	Perm	pm+pt	NA	Prot	Prot
Protected Phases	2		1	6	8	8
Permitted Phases		2	6			
Actuated Green, G (s)	83.1	83.1	99.2	99.2	8.8	8.8
Effective Green, g (s)	83.1	83.1	99.2	99.2	8.8	8.8
Actuated g/C Ratio	0.69	0.69	0.83	0.83	0.07	0.07
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	5.0	5.0	3.0	5.0	3.0	3.0
Lane Grp Cap (vph)	2450	1096	601	2925	251	116
v/s Ratio Prot	0.21		0.02	c0.45	c0.03	0.00
v/s Ratio Perm		0.03	0.18			
v/c Ratio	0.30	0.04	0.24	0.55	0.38	0.04
Uniform Delay, d1	7.2	5.8	2.5	3.3	53.0	51.7
Progression Factor	1.00	1.00	0.50	0.40	1.00	1.00
Incremental Delay, d2	0.3	0.1	0.1	0.5	1.0	0.1
Delay (s)	7.5	5.9	1.4	1.8	54.0	51.8
Level of Service	A	A	A	A	D	D
Approach Delay (s)	7.4			1.8	53.1	
Approach LOS	A			A	D	

Intersection Summary			
HCM 2000 Control Delay	6.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	55.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	8	9	15	637	372	16
Future Volume (Veh/h)	8	9	15	637	372	16
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.87	0.93	0.92
Hourly flow rate (vph)	9	10	16	732	400	17
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)					780	
pX, platoon unblocked	0.90	0.90	0.90			
vC, conflicting volume	1164	400	417			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1127	277	296			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	96	99	99			
cM capacity (veh/h)	201	685	1138			

Direction, Lane #	EB 1	NB 1	SB 1	SB 2
Volume Total	19	748	400	17
Volume Left	9	16	0	0
Volume Right	10	0	0	17
cSH	320	1138	1700	1700
Volume to Capacity	0.06	0.01	0.24	0.01
Queue Length 95th (ft)	5	1	0	0
Control Delay (s)	17.0	0.4	0.0	0.0
Lane LOS	C	A		
Approach Delay (s)	17.0	0.4	0.0	
Approach LOS	C			

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	55.6%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	646	53	0	1586	0	55
Future Volume (Veh/h)	646	53	0	1586	0	55
Sign Control	Free			Free	Yield	
Grade	0%			0%	0%	
Peak Hour Factor	0.87	0.92	0.92	0.91	0.92	0.92
Hourly flow rate (vph)	743	58	0	1743	0	60
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			TWLTL		
Median storage veh)	2			2		
Upstream signal (ft)	446			456		
pX, platoon unblocked			0.92		0.71	0.92
vC, conflicting volume			743		1614	372
vC1, stage 1 conf vol					743	
vC2, stage 2 conf vol					872	
vCu, unblocked vol			553		557	150
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	93
cM capacity (veh/h)			934		464	802

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	NB 1
Volume Total	372	372	58	872	872	60
Volume Left	0	0	0	0	0	0
Volume Right	0	0	58	0	0	60
cSH	1700	1700	1700	1700	1700	802
Volume to Capacity	0.22	0.22	0.03	0.51	0.51	0.07
Queue Length 95th (ft)	0	0	0	0	0	6
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	9.9
Lane LOS						A
Approach Delay (s)	0.0			0.0		9.9
Approach LOS						A

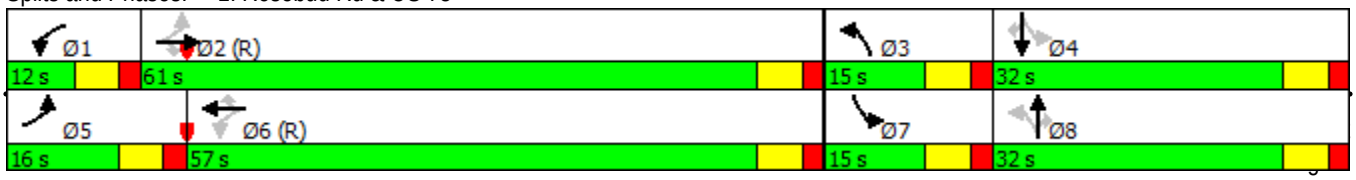
Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	47.2%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	96	1501	197	165	945	129	145	306	160	171	424	92
Future Volume (vph)	96	1501	197	165	945	129	145	306	160	171	424	92
Lane Group Flow (vph)	133	1706	226	183	1005	139	159	387	193	204	505	103
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2		2	6		6	8		8	4		4
Detector Phase	5	2	2	1	6	6	3	8	8	7	4	4
Switch Phase												
Minimum Initial (s)	4.0	15.0	15.0	4.0	15.0	15.0	4.0	6.0	6.0	4.0	6.0	6.0
Minimum Split (s)	10.0	24.0	24.0	10.0	24.0	24.0	10.0	31.0	31.0	10.0	24.0	24.0
Total Split (s)	16.0	61.0	61.0	12.0	57.0	57.0	15.0	32.0	32.0	15.0	32.0	32.0
Total Split (%)	13.3%	50.8%	50.8%	10.0%	47.5%	47.5%	12.5%	26.7%	26.7%	12.5%	26.7%	26.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	C-Min	C-Min	None	C-Min	C-Min	None	None	None	None	None	None
v/c Ratio	0.50	1.05	0.28	1.22	0.66	0.18	0.82	0.96	0.43	1.05	1.25	0.23
Control Delay	19.4	59.3	4.9	171.1	29.7	4.0	62.4	82.9	16.5	112.3	172.5	4.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	19.4	59.3	4.9	171.1	29.7	4.0	62.4	82.9	16.5	112.3	172.5	4.0
Queue Length 50th (ft)	31	~761	12	~125	322	0	89	298	36	~120	~489	0
Queue Length 95th (ft)	52	#852	m45	#276	398	38	#187	#394	87	#241	#632	23
Internal Link Dist (ft)		376			804			330			645	
Turn Bay Length (ft)	75		250	500		325	300		450	270		375
Base Capacity (vph)	278	1622	808	150	1530	763	194	403	449	194	403	449
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.48	1.05	0.28	1.22	0.66	0.18	0.82	0.96	0.43	1.05	1.25	0.23

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 14 (12%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 130
Control Type: Actuated-Coordinated
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 1: Rosebud Rd & US 78



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	96	1501	197	165	945	129	145	306	160	171	424	92
Future Volume (vph)	96	1501	197	165	945	129	145	306	160	171	424	92
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.15	1.00	1.00	0.08	1.00	1.00	0.15	1.00	1.00	0.15	1.00	1.00
Satd. Flow (perm)	286	3539	1583	144	3539	1583	287	1863	1583	287	1863	1583
Peak-hour factor, PHF	0.72	0.88	0.87	0.90	0.94	0.93	0.91	0.79	0.83	0.84	0.84	0.89
Adj. Flow (vph)	133	1706	226	183	1005	139	159	387	193	204	505	103
RTOR Reduction (vph)	0	0	83	0	0	79	0	0	107	0	0	81
Lane Group Flow (vph)	133	1706	143	183	1005	60	159	387	86	204	505	22
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2		2	6		6	8		8	4		4
Actuated Green, G (s)	64.1	55.0	55.0	57.9	51.9	51.9	35.0	26.0	26.0	35.0	26.0	26.0
Effective Green, g (s)	64.1	55.0	55.0	57.9	51.9	51.9	35.0	26.0	26.0	35.0	26.0	26.0
Actuated g/C Ratio	0.53	0.46	0.46	0.48	0.43	0.43	0.29	0.22	0.22	0.29	0.22	0.22
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	265	1622	725	150	1530	684	194	403	342	194	403	342
v/s Ratio Prot	0.04	c0.48		c0.06	0.28		0.06	0.21		c0.08	c0.27	
v/s Ratio Perm	0.23		0.09	c0.53		0.04	0.18		0.05	0.23		0.01
v/c Ratio	0.50	1.05	0.20	1.22	0.66	0.09	0.82	0.96	0.25	1.05	1.25	0.07
Uniform Delay, d1	17.7	32.5	19.4	29.2	27.0	20.1	35.3	46.5	39.0	38.1	47.0	37.3
Progression Factor	1.08	0.70	0.61	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.2	35.4	0.5	144.6	2.2	0.3	22.9	34.5	0.4	78.9	132.9	0.1
Delay (s)	20.4	58.1	12.3	173.8	29.2	20.3	58.2	81.0	39.3	117.0	179.9	37.4
Level of Service	C	E	B	F	C	C	E	F	D	F	F	D
Approach Delay (s)		50.6			48.2			65.2			146.0	
Approach LOS		D			D			E			F	

Intersection Summary			
HCM 2000 Control Delay	67.8	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.18		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	101.0%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	53	0	63	130	0	55	97	445	107	11	656	60
Future Volume (Veh/h)	53	0	63	130	0	55	97	445	107	11	656	60
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.77	0.92	0.71	0.92	0.98	0.62	0.55	0.94	0.92
Hourly flow rate (vph)	58	0	68	169	0	77	105	454	173	20	698	65
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											410	
pX, platoon unblocked	0.74	0.74	0.74	0.74	0.74		0.74					
vC, conflicting volume	1479	1575	698	1470	1467	454	763			627		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1472	1602	414	1459	1455	454	502			627		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	3	100	86	0	100	87	87			98		
cM capacity (veh/h)	60	66	471	60	81	606	785			955		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	58	68	246	105	454	173	718	65
Volume Left	58	0	169	105	0	0	20	0
Volume Right	0	68	77	0	0	173	0	65
cSH	60	471	83	785	1700	1700	955	1700
Volume to Capacity	0.97	0.14	2.95	0.13	0.27	0.10	0.02	0.04
Queue Length 95th (ft)	114	13	604	12	0	0	2	0
Control Delay (s)	220.3	13.9	987.7	10.3	0.0	0.0	0.6	0.0
Lane LOS	F	B	F	B			A	
Approach Delay (s)	108.9		987.7	1.5			0.5	
Approach LOS	F		F					

Intersection Summary			
Average Delay	136.8		
Intersection Capacity Utilization	85.8%	ICU Level of Service	E
Analysis Period (min)	15		

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	1585	111	201	958	183	137
Future Volume (vph)	1585	111	201	958	183	137
Lane Group Flow (vph)	1686	121	218	988	199	149
Turn Type	NA	Perm	pm+pt	NA	Prot	Perm
Protected Phases	2		1	6	8	
Permitted Phases		2	6			8
Detector Phase	2	2	1	6	8	8
Switch Phase						
Minimum Initial (s)	15.0	15.0	4.0	15.0	6.0	6.0
Minimum Split (s)	24.0	24.0	10.0	24.0	34.0	34.0
Total Split (s)	68.0	68.0	18.0	86.0	34.0	34.0
Total Split (%)	56.7%	56.7%	15.0%	71.7%	28.3%	28.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?						
Recall Mode	C-Min	C-Min	None	C-Min	None	None
v/c Ratio	0.74	0.11	0.81	0.35	0.55	0.50
Control Delay	17.4	3.1	60.3	2.8	56.6	13.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	17.4	3.1	60.3	2.8	56.6	13.6
Queue Length 50th (ft)	428	7	122	52	76	0
Queue Length 95th (ft)	576	32	m#219	68	111	60
Internal Link Dist (ft)	671			366	224	
Turn Bay Length (ft)		250	310			
Base Capacity (vph)	2283	1054	270	2814	801	483
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.74	0.11	0.81	0.35	0.25	0.31

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 20 (17%), Referenced to phase 2:EBT and 6:WBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: Site Drwy 1 & US 78

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	1585	111	201	958	183	137
Future Volume (vph)	1585	111	201	958	183	137
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	0.95	1.00	1.00	0.95	0.97	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	1770	3539	3433	1583
Flt Permitted	1.00	1.00	0.07	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	134	3539	3433	1583
Peak-hour factor, PHF	0.94	0.92	0.92	0.97	0.92	0.92
Adj. Flow (vph)	1686	121	218	988	199	149
RTOR Reduction (vph)	0	33	0	0	0	133
Lane Group Flow (vph)	1686	88	218	988	199	16
Turn Type	NA	Perm	pm+pt	NA	Prot	Perm
Protected Phases	2		1	6	8	
Permitted Phases		2	6			8
Actuated Green, G (s)	77.4	77.4	95.4	95.4	12.6	12.6
Effective Green, g (s)	77.4	77.4	95.4	95.4	12.6	12.6
Actuated g/C Ratio	0.65	0.65	0.80	0.80	0.10	0.10
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	5.0	5.0	3.0	5.0	3.0	3.0
Lane Grp Cap (vph)	2282	1021	270	2813	360	166
v/s Ratio Prot	0.48		c0.08	0.28	c0.06	
v/s Ratio Perm		0.06	c0.56			0.01
v/c Ratio	0.74	0.09	0.81	0.35	0.55	0.09
Uniform Delay, d1	14.4	8.0	30.9	3.5	51.0	48.5
Progression Factor	1.00	1.00	1.90	0.67	1.00	1.00
Incremental Delay, d2	2.2	0.2	12.7	0.3	1.8	0.2
Delay (s)	16.6	8.2	71.4	2.6	52.9	48.8
Level of Service	B	A	E	A	D	D
Approach Delay (s)	16.1			15.1	51.1	
Approach LOS	B			B	D	

Intersection Summary			
HCM 2000 Control Delay	19.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	75.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	9	25	16	640	820	28
Future Volume (Veh/h)	9	25	16	640	820	28
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.87	0.93	0.92
Hourly flow rate (vph)	10	27	17	736	882	30
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)					780	
pX, platoon unblocked	0.78	0.78	0.78			
vC, conflicting volume	1652	882	912			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1696	703	742			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	87	92	97			
cM capacity (veh/h)	77	339	671			

Direction, Lane #	EB 1	NB 1	SB 1	SB 2
Volume Total	37	753	882	30
Volume Left	10	17	0	0
Volume Right	27	0	0	30
cSH	177	671	1700	1700
Volume to Capacity	0.21	0.03	0.52	0.02
Queue Length 95th (ft)	19	2	0	0
Control Delay (s)	30.7	0.7	0.0	0.0
Lane LOS	D	A		
Approach Delay (s)	30.7	0.7	0.0	
Approach LOS	D			

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	56.5%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	1626	97	0	1159	0	133
Future Volume (Veh/h)	1626	97	0	1159	0	133
Sign Control	Free			Free	Yield	
Grade	0%			0%	0%	
Peak Hour Factor	0.94	0.92	0.92	0.97	0.92	0.92
Hourly flow rate (vph)	1730	105	0	1195	0	145
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			TWLTL		
Median storage veh)	2			2		
Upstream signal (ft)	446			456		
pX, platoon unblocked			0.67		0.78	0.67
vC, conflicting volume			1730		2328	865
vC1, stage 1 conf vol					1730	
vC2, stage 2 conf vol					598	
vCu, unblocked vol			1101		849	0
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	80
cM capacity (veh/h)			421		183	725

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	NB 1
Volume Total	865	865	105	598	598	145
Volume Left	0	0	0	0	0	0
Volume Right	0	0	105	0	0	145
cSH	1700	1700	1700	1700	1700	725
Volume to Capacity	0.51	0.51	0.06	0.35	0.35	0.20
Queue Length 95th (ft)	0	0	0	0	0	19
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	11.2
Lane LOS						B
Approach Delay (s)	0.0			0.0		11.2
Approach LOS						B

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	59.8%	ICU Level of Service	B
Analysis Period (min)	15		

TRAFFIC VOLUME WORKSHEETS

15-075 Kroger #743 - Rosebud Rd and Athens Hwy - Loganville, GA

Traffic Volumes
Future Conditions

A&R Engineering
November 2015

1. US 78 @ Rosebud Rd

A.M. Peak Hour

	Northbound				Southbound				Eastbound				Westbound			
Condition	L	T	R	Tot	L	T	R	Tot	L	T	R	Tot	L	T	R	Tot
Existing:	161	307	58	526	78	190	44	312	16	518	56	590	44	1238	83	1365
Growth Factor (%):	1	1	1		1	1	1		1	1	1		1	1	1	
Base Condition:	164	313	59	536	80	194	45	319	16	528	57	601	45	1263	85	1393
Total New Trips	0	4	10	14	0	11	32	43	24	58	16	98	26	78	0	104
Pass-by Trips	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Future Traffic Volumes:	164	317	69	550	80	205	77	362	40	586	73	699	71	1341	85	1497

P.M. Peak Hour

	Northbound				Southbound				Eastbound				Westbound			
Condition	L	T	R	Tot	L	T	R	Tot	L	T	R	Tot	L	T	R	Tot
Existing:	142	292	137	571	168	402	50	620	49	1362	163	1574	129	828	126	1083
Growth Factor (%):	1	1	1		1	1	1		1	1	1		1	1	1	
Base Condition:	145	298	140	583	171	410	51	632	50	1389	166	1605	132	845	129	1106
Total New Trips	0	8	20	28	0	14	41	55	46	112	31	189	33	100	0	133
Pass-by Trips	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Future Traffic Volumes:	145	306	160	611	171	424	92	687	96	1501	197	1794	165	945	129	1239

15-075 Kroger #743 - Rosebud Rd and Athens Hwy - Loganville, GA

Traffic Volumes
Future Conditions

A&R Engineering
November 2015

2. Rosebud Rd @ Site Drwy 3

A.M. Peak Hour

	Northbound				Southbound				Eastbound				Westbound			
Condition	L	T	R	Tot	L	T	R	Tot	L	T	R	Tot	L	T	R	Tot
Existing:	0	540	39	579	4	312	0	316	0	0	0	0	22	0	30	52
Growth Factor (%):	1	1	1		1	1	1		1	1	1		1	1	1	
Base Condition:	0	551	40	591	4	318	0	322	0	0	0	0	22	0	31	53
Total New Trips	49	5	0	54	0	31	22	53	10	0	16	26	0	0	0	0
Pass-by Trips	6	-6	0	0	0	-3	3	0	5	0	3	8	0	0	0	0
Future Traffic Volumes:	55	550	40	645	4	346	25	375	15	0	19	34	22	0	31	53

P.M. Peak Hour

	Northbound				Southbound				Eastbound				Westbound			
Condition	L	T	R	Tot	L	T	R	Tot	L	T	R	Tot	L	T	R	Tot
Existing:	0	461	105	566	11	625	0	636	0	0	0	0	127	0	54	181
Growth Factor (%):	1	1	1		1	1	1		1	1	1		1	1	1	
Base Condition:	0	470	107	577	11	638	0	649	0	0	0	0	130	0	55	185
Total New Trips	63	9	0	72	0	50	28	78	19	0	31	50	0	0	0	0
Pass-by Trips	34	-34	0	0	0	-32	32	0	34	0	32	66	0	0	0	0
Future Traffic Volumes:	97	445	107	649	11	656	60	727	53	0	63	116	130	0	55	185

15-075 Kroger #743 - Rosebud Rd and Athens Hwy - Loganville, GA

Traffic Volumes
Future Conditions

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3. US 78 @ Site Drwy 1

A.M. Peak Hour

	Northbound				Southbound				Eastbound				Westbound			
Condition	L	T	R	Tot	L	T	R	Tot	L	T	R	Tot	L	T	R	Tot
Existing:	0	0	0	0	0	0	0	0	0	591	0	591	0	1447	0	1447
Growth Factor (%):	1	1	1		1	1	1		1	1	1		1	1	1	
Base Condition:	0	0	0	0	0	0	0	0	0	603	0	603	0	1476	0	1476
Total New Trips	64	0	47	111	0	0	0	0	0	49	49	98	110	0	0	110
Pass-by Trips	23	0	6	29	0	0	0	0	0	-6	6	0	23	-23	0	0
Future Traffic Volumes:	87	0	53	140	0	0	0	0	0	646	55	701	133	1453	0	1586

P.M. Peak Hour

	Northbound				Southbound				Eastbound				Westbound			
Condition	L	T	R	Tot	L	T	R	Tot	L	T	R	Tot	L	T	R	Tot
Existing:	0	0	0	0	0	0	0	0	0	1539	0	1539	0	997	0	997
Growth Factor (%):	1	1	1		1	1	1		1	1	1		1	1	1	
Base Condition:	0	0	0	0	0	0	0	0	0	1570	0	1570	0	1017	0	1017
Total New Trips	124	0	90	214	0	0	0	0	0	63	63	126	142	0	0	142
Pass-by Trips	59	0	47	106	0	0	0	0	0	-48	48	0	59	-59	0	0
Future Traffic Volumes:	183	0	137	320	0	0	0	0	0	1585	111	1696	201	958	0	1159

15-075 Kroger #743 - Rosebud Rd and Athens Hwy - Loganville, GA

Traffic Volumes
Future Conditions

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4. Rosebud Rd @ Site Drwy 4

A.M. Peak Hour

	Northbound				Southbound				Eastbound				Westbound			
Condition	L	T	R	Tot	L	T	R	Tot	L	T	R	Tot	L	T	R	Tot
Existing:	0	579	0	579	0	334	0	334	0	0	0	0	0	0	0	0
Growth Factor (%):	1	1	1		1	1	1		1	1	1		1	1	1	
Base Condition:	0	591	0	591	0	341	0	341	0	0	0	0	0	0	0	0
Total New Trips	12	49	0	61	0	32	15	47	5	0	8	13	0	0	0	0
Pass-by Trips	3	-3	0	0	0	-1	1	0	3	0	1	4	0	0	0	0
Future Traffic Volumes:	15	637	0	652	0	372	16	388	8	0	9	17	0	0	0	0

P.M. Peak Hour

	Northbound				Southbound				Eastbound				Westbound			
Condition	L	T	R	Tot	L	T	R	Tot	L	T	R	Tot	L	T	R	Tot
Existing:	0	566	0	566	0	752	0	752	0	0	0	0	0	0	0	0
Growth Factor (%):	1	1	1		1	1	1		1	1	1		1	1	1	
Base Condition:	0	577	0	577	0	767	0	767	0	0	0	0	0	0	0	0
Total New Trips	16	63	0	79	0	62	19	81	9	0	16	25	0	0	0	0
Pass-by Trips	0	0	0	0	0	-9	9	0	0	0	9	9	0	0	0	0
Future Traffic Volumes:	16	640	0	656	0	820	28	848	9	0	25	34	0	0	0	0

15-075 Kroger #743 - Rosebud Rd and Athens Hwy - Loganville, GA

Traffic Volumes
Future Conditions

A&R Engineering
November 2015

5. US 78 @ Site Drwy 2 (RIRO)

A.M. Peak Hour

	Northbound				Southbound				Eastbound				Westbound			
Condition	L	T	R	Tot	L	T	R	Tot	L	T	R	Tot	L	T	R	Tot
Existing:	0	0	0	0	0	0	0	0	0	591	0	591	0	1447	0	1447
Growth Factor (%):	1	1	1		1	1	1		1	1	1		1	1	1	
Base Condition:	0	0	0	0	0	0	0	0	0	603	0	603	0	1476	0	1476
Total New Trips	0	0	51	51	0	0	0	0	0	47	49	96	0	110	0	110
Pass-by Trips	0	0	4	4	0	0	0	0	0	-4	4	0	0	0	0	0
Future Traffic Volumes:	0	0	55	55	0	0	0	0	0	646	53	699	0	1586	0	1586

P.M. Peak Hour

	Northbound				Southbound				Eastbound				Westbound			
Condition	L	T	R	Tot	L	T	R	Tot	L	T	R	Tot	L	T	R	Tot
Existing:	0	0	0	0	0	0	0	0	0	1539	0	1539	0	997	0	997
Growth Factor (%):	1	1	1		1	1	1		1	1	1		1	1	1	
Base Condition:	0	0	0	0	0	0	0	0	0	1570	0	1570	0	1017	0	1017
Total New Trips	0	0	99	99	0	0	0	0	0	90	63	153	0	142	0	142
Pass-by Trips	0	0	34	34	0	0	0	0	0	-34	34	0	0	0	0	0
Future Traffic Volumes:	0	0	133	133	0	0	0	0	0	1626	97	1723	0	1159	0	1159

SIGNAL WARRANT ANALYSIS
FOR
US 78 (ATHENS HIGHWAY) AT KROGER SITE DRIVEWAY
LOGANVILLE, GEORGIA

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A&R Engineering Project #: 15-075

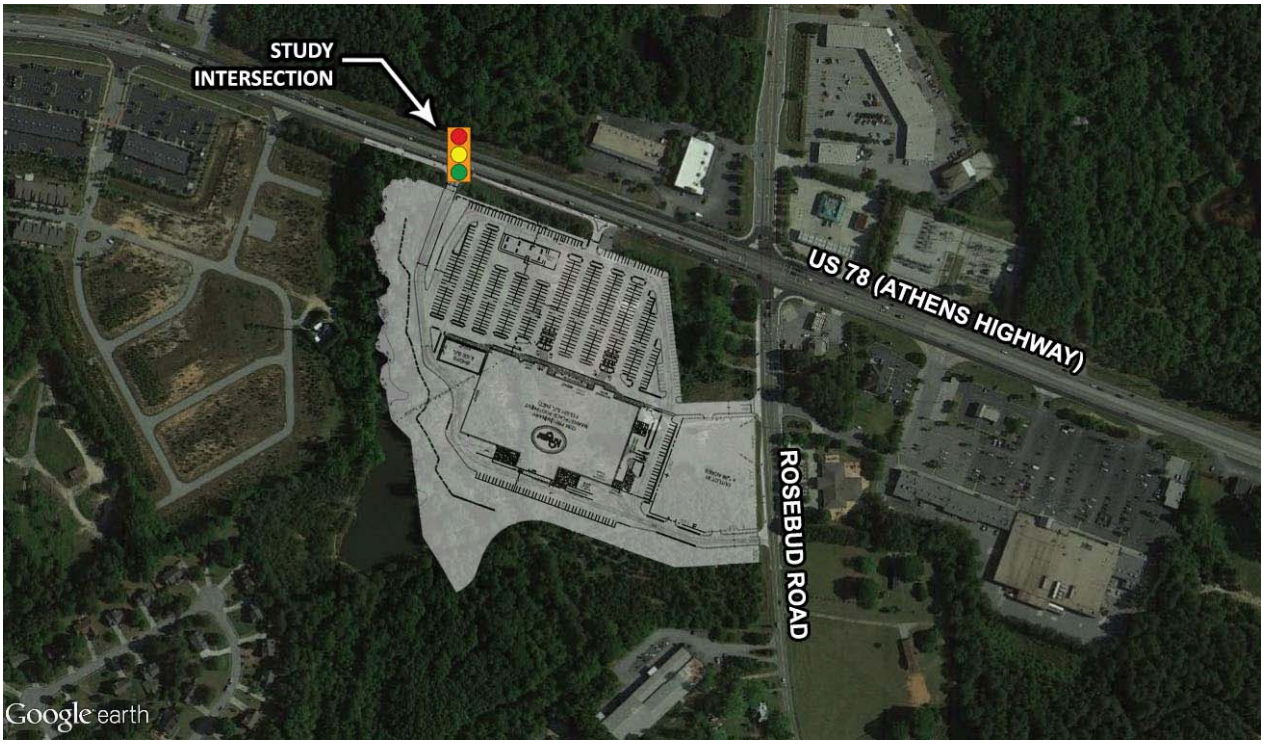
TRAFFIC ENGINEERING STUDY

US 78 (Athens Highway) at Kroger Site Driveway

Loganville, Georgia

LOCATION:

The study intersection is the proposed intersection of US 78 (Athens Highway) at the Kroger Site Driveway in Loganville, Georgia. The study intersection is located 920 feet west of the existing signalized intersection of US 78 (Athens Highway) at Rosebud Road. The Kroger shopping center development is proposed to be located in the southwest corner of the intersection of US 78 (Athens Highway) at Rosebud Road. A location map is included in the Appendix.



COUNTY:

The study intersection is in Gwinnett County, Georgia.

REQUESTED BY:

The Kroger Co. has requested this traffic engineering study.

REASON FOR INVESTIGATION:

The purpose of this study is to determine if the future traffic volumes at the intersection of US 78 (Athens Highway) at the Kroger Site Driveway will satisfy the MUTCD warrants for installation of a traffic signal.

DESCRIPTION OF THE INTERSECTION:

US 78 (Athens Highway) is an east-west, five-lane roadway with a 15-foot two-way left turn lane and a posted speed limit of 55 mph in the vicinity of the study intersection. The Kroger Site Driveway will serve as the northbound approach to the intersection.

EXISTING TRAFFIC CONTROL:

As this is a proposed intersection, no traffic control yet exists at the study intersection.

VEHICULAR VOLUMES:

An existing 24-hour tube count was collected on US 78 (Athens Highway) on Wednesday, July 1, 2015, west of Rosebud Road. The counts revealed that US 78 (Athens Highway) had a bi-directional volume of 33,543 vehicles during the period collected. The eastbound approach had 16,459 vehicles and the westbound approach had 17,084 vehicles during the same period. For the purpose of this study, the volumes collected between the hours of 7:00 a.m. to 7:00 p.m. were used in the analysis. Detailed traffic counts are included in the Appendix.

Table 1 – Existing Traffic Volumes
US 78 (Athens Highway) West of Rosebud Road

Time	Eastbound US 78 (Athens Highway)	Westbound US 78 (Athens Highway)
7:00 A.M. – 8:00 A.M.	562	1,459
8:00 A.M. – 9:00 A.M.	571	1,301
9:00 A.M. – 10:00 A.M.	660	1,084
10:00 A.M. – 11:00 A.M.	747	1,007
11:00 A.M. – 12:00 Noon	911	976
12:00 Noon – 1:00 P.M.	968	1,062
1:00 P.M. – 2:00 P.M.	1,020	1,011
2:00 P.M. – 3:00 P.M.	1,068	979
3:00 P.M. – 4:00 P.M.	1,296	888
4:00 P.M. – 5:00 P.M.	1,466	874
5:00 P.M. – 6:00 P.M.	1,539	997
6:00 P.M. – 7:00 P.M.	1,359	922

VEHICLE SPEEDS:

The posted speed limit on US 78 (Athens Highway) is 55 mph, and there is no posted speed limit on the Kroger Site Driveway.

PEDESTRIAN ACTIVITY:

No pedestrian activity was observed near the study intersection.

PARKING:

No parking is allowed on US 78 (Athens Highway) in the vicinity of the study intersection.

DELAY:

A traffic operations analysis was prepared, assuming a stop-controlled driveway, an eastbound right turn lane, a northbound dedicated left turn lane, and a westbound dedicated left turn lane. This analysis revealed that the site driveway approach to the study intersection would see heavy delays during the PM peak hour without the installation of a traffic signal. If a traffic signal is installed, the intersection will have an overall delay of 6.4 seconds/vehicle in the AM peak hour and 19.3 seconds/vehicle in the PM peak hour. Further detail is provided in the “Capacity Analysis” section of the report.

SIGHT DISTANCE:

US 78 (Athens Highway) is a five-lane roadway with a 15-foot two-way left turn lane and a posted speed limit of 55 mph. AASHTO requires 650 feet of sight distance for left turns from the minor road (Case B1: two lanes crossed) and 530 feet of sight distance for right turns (Case B2: one lane crossed).

ADJACENT SIGNALIZED INTERSECTIONS:

There are presently two signalized intersections on US 78 (Athens Highway) within one mile of the study intersection. The intersection of US 78 (Athens Highway) at Cooper Road/Cooper Springs Road is located 1,000 feet west of the study intersection. Moreover, the intersection of US 78 (Athens Highway) at Rosebud Road is located 920 feet east of the study intersection. A graphic showing the locations of the adjacent signalized intersections on US 78 (Athens Highway) is included in the Appendix.

SITE INFORMATION:

The proposed Kroger shopping center development will be located to the southwest corner of the intersection US 78 (Athens Highway) at Rosebud Road. The development will consist of:

- 113,531 square foot supermarket
- 17,350 square feet of retail
- Gasoline/service station with 14 fueling positions

The development proposes one full-access driveway as well as one right-in/right-out driveway on US 78 (Athens Highway) and two full-access driveways on Rosebud Road. A site plan is included in the Appendix.

Trip generation estimates were based on the rates and equations published in the 9th edition of the Institute of Transportation Engineers (ITE) Trip Generation report. This reference contains traffic volume count data collected at similar facilities nationwide. The trip generation was based on the following ITE Land Uses: *820 – Shopping Center, 850 – Supermarket*, and *944 – Gasoline/Service Station*. The calculated trip generation for the site is shown in Table 2.

TABLE 2 – TRIP GENERATION

Land Use	Size	AM Peak Hour			PM Peak Hour			24-Hour
		Enter	Exit	Total	Enter	Exit	Total	Two-way
ITE 820 – Shopping Center	17,350 sf	33	21	54	89	96	185	2,175
ITE 850 – Supermarket	113,531 sf	239	147	386	436	420	853	8,992
ITE 944 – Gasoline/Service Station	14 pumps	80	78	158	97	97	194	2,360
Total Trips to Site		**352**	**246**	**598**	**622**	**613**	**1,235**	**13,527**
Pass-by Trips (0%) 34%		*0*	*0*	*0*	*-30*	*-33*	*-63*	*-630*
Pass-by Trips (0%) 36%		*0*	*0*	*0*	*-157*	*-151*	*-308*	*-3,080*
Pass-by Trips (58%) 42%		*-46*	*-45*	*-91*	*-41*	*-41*	*-82*	*-820*
Total New (non-pass-by) External Trips		**306**	**201**	**507**	**394**	**388**	**782**	**8,997**

WARRANT ANALYSIS:

The posted speed limit on US 78 (Athens Highway) is 55 mph. A signal warrant analysis was performed for the study intersection per MUTCD (2009 Edition) using a main street approach speed limit of 55 mph with the intersection geometry of a multi-lane major street approach and a multi-lane minor street approach.

24-hour traffic volumes that have been calculated using the ITE Trip Generation Manual were distributed hourly to the existing counts at the proposed study intersection. The hourly site traffic is shown in Table 3. The distribution of site traffic was such that:

- 14% of the new trips will travel to/from the north on Rosebud Road
- 20% will travel to/from the south on Rosebud Road
- 34% will travel to/from the east on US 78 (Athens Highway)
- 32% will travel to/from the west on US 78 (Athens Highway)

Because the site has multiple access points, not all of the generated traffic will enter and exit from the study intersection. Table 4 shows the site-generated traffic from the development at the study intersection.

Table 3 – Hourly Distribution of Site Traffic

TIME	Supermarket Traffic (8,992 vpd)		Retail Traffic (2,175 vpd)		Gas Station Traffic (2,360 vpd)		TOTAL TRIPS		
	Enter %	Exit %	Enter %	Exit %	Enter %	Exit %	Enter	Exit	Total
7:00 A.M. – 8:00 A.M.	2.0	0.9	2.0	0.9	4.4	4.3	164	100	264
8:00 A.M. – 9:00 A.M.	4.8	3.4	3.1	1.2	4.5	4.9	303	224	527
9:00 A.M. – 10:00 A.M.	4.2	2.9	5.5	2.0	5.2	4.9	311	210	521
10:00 A.M. – 11:00 A.M.	4.3	3.1	7.0	4.3	4.9	5.2	327	247	574
11:00 A.M. – 12:00 Noon	6.5	5.4	8.4	6.2	5.8	7.4	451	398	849
12:00 Noon – 1:00 P.M.	7.0	6.9	9.4	8.3	5.3	7.1	480	483	963
1:00 P.M. – 2:00 P.M.	6.0	5.5	8.2	8.6	4.1	4.8	407	398	805
2:00 P.M. – 3:00 P.M.	7.6	8.3	7.7	8.9	5.4	5.2	490	531	1,021
3:00 P.M. – 4:00 P.M.	8.5	8.9	7.8	8.8	6.6	7.3	545	582	1,127
4:00 P.M. – 5:00 P.M.	11.6	11.2	8.0	8.9	6.2	6.3	683	675	1,358
5:00 P.M. – 6:00 P.M.	10.9	12.3	8.4	9.2	6.8	6.7	662	733	1,395
6:00 P.M. – 7:00 P.M.	7.7	11.0	8.0	7.5	5.7	6.0	500	647	1,147
TOTAL	**89.2**	**89.9**	**83.5**	**74.8**	**65**	**70.0**	**5,323**	**5,228**	**10,551**

Table 4 – New Site-Generated Traffic Volumes
US 78 (Athens Highway) at Kroger Site Driveway

Time	Northbound Kroger Site Drwy			Southbound			Eastbound US 78			Westbound US 78		
Entering Traffic %	-	-	-	-	-	-	-	16	16	36	-	-
Exiting Traffic %	32	-	23.2	-	-	-	-	-	-	-	-	-
Time / Movement	L	T	R	L	T	R	L	T	R	L	T	R
7:00 A.M. – 8:00 A.M.	32	0	23	0	0	0	0	26	26	59	0	0
8:00 A.M. – 9:00 A.M.	72	0	52	0	0	0	0	48	48	109	0	0
9:00 A.M. – 10:00 A.M.	67	0	49	0	0	0	0	50	50	112	0	0
10:00 A.M. – 11:00 A.M.	79	0	57	0	0	0	0	52	52	118	0	0
11:00 A.M. – 12:00 Noon	127	0	92	0	0	0	0	72	72	162	0	0
12:00 Noon – 1:00 P.M.	155	0	112	0	0	0	0	77	77	173	0	0
1:00 P.M. – 2:00 P.M.	127	0	92	0	0	0	0	65	65	147	0	0
2:00 P.M. – 3:00 P.M.	170	0	123	0	0	0	0	78	78	176	0	0
3:00 P.M. – 4:00 P.M.	186	0	135	0	0	0	0	87	87	196	0	0
4:00 P.M. – 5:00 P.M.	216	0	157	0	0	0	0	109	109	246	0	0
5:00 P.M. – 6:00 P.M.	235	0	170	0	0	0	0	106	106	238	0	0
6:00 P.M. – 7:00 P.M.	207	0	150	0	0	0	0	80	80	180	0	0

The new site-generated traffic volumes from proposed development (shown in Table 4) were added to the existing traffic volumes (shown in Table 1) to calculate the future traffic volumes, which are shown below in Table 5.

Table 5 – Future Traffic Volumes
US 78 (Athens Highway) at Kroger Site Driveway

Time	Northbound Kroger Site Drwy			Southbound			Eastbound US 78			Westbound US 78		
	L	T	R	L	T	R	L	T	R	L	T	R
7:00 A.M. – 8:00 A.M.	32	0	23	0	0	0	0	588	26	59	1,459	0
8:00 A.M. – 9:00 A.M.	72	0	52	0	0	0	0	619	48	109	1,301	0
9:00 A.M. – 10:00 A.M.	67	0	49	0	0	0	0	710	50	112	1,084	0
10:00 A.M. – 11:00 A.M.	79	0	57	0	0	0	0	799	52	118	1,007	0
11:00 A.M. – 12:00 Noon	127	0	92	0	0	0	0	983	72	162	976	0
12:00 Noon – 1:00 P.M.	155	0	112	0	0	0	0	1,045	77	173	1,062	0
1:00 P.M. – 2:00 P.M.	127	0	92	0	0	0	0	1,085	65	147	1,011	0
2:00 P.M. – 3:00 P.M.	170	0	123	0	0	0	0	1,146	78	176	979	0
3:00 P.M. – 4:00 P.M.	186	0	135	0	0	0	0	1,383	87	196	888	0
4:00 P.M. – 5:00 P.M.	216	0	157	0	0	0	0	1,575	109	246	874	0
5:00 P.M. – 6:00 P.M.	235	0	170	0	0	0	0	1,645	106	238	997	0
6:00 P.M. – 7:00 P.M.	207	0	150	0	0	0	0	1,439	80	180	922	0

The future traffic volumes shown in Table 5 were used in the signal warrant analysis. The results of the signal warrant analysis indicate that signal warrants 1, 2, and 3 will be satisfied for the 100% threshold of the following warrants. A detailed copy of the signal warrant analysis is included in the Appendix.

- Warrant 1 – Eight-hour vehicular volume – SATISFIED
- Warrant 2 – Four-hour vehicular volume – SATISFIED
- Warrant 3 – Peak hour vehicular volume – SATISFIED

CAPACITY ANALYSIS:

A capacity analysis was performed for signalized and unsignalized conditions at the intersection of US 78 (Athens Highway) at the Kroger Site Driveway. The methodology used for evaluating traffic operations at the intersection is based on the criteria set forth in the Transportation Research Board's Highway Capacity Manual (HCM 2000). Synchro software, which emulates the HCM methodology, was used for conducting the analysis. The intersection operations analysis for an unsignalized condition is shown in Table 6, and Table 7 shows operations for a signalized condition.

Table 6
Future Intersection Operations – No Signal

Intersection	A.M. Peak Hour		P.M. Peak Hour	
	LOS	Delay (sec)	LOS	Delay (sec)
Athens Highway @ Kroger Site Drwy				
-Westbound Left	A	8.4	A	9.1
-Northbound Approach	D	25.7	F	119.9

Table 7 Future Intersection Operations – Signal				
Intersection	A.M. Peak Hour		P.M. Peak Hour	
	LOS	Delay (sec)	LOS	Delay (sec)
Athens Highway @ Kroger Site Drwy	**A**	**6.4**	**B**	**19.3**
-Eastbound Approach	A	7.4	B	16.1
-Westbound Approach	A	1.8	B	15.1
-Northbound Approach	D	53.1	D	51.1

As shown in Table 7, after the installation of a traffic signal, the study intersection will operate at an overall level-of-service "B" in the PM peak hour and level-of-service "A" in the AM peak hour. A left turn phase analysis was completed to determine if any left turn movements will meet the criteria for a protected + permissive left turn phase using the product rule for the future AM and PM peak hours. The results of the analysis revealed that the intersection warrants a separate protected + permissive phase for the westbound left turn movement. Results of the left turn phase analysis are included in the Appendix. In addition to the signal installation, the following improvements are recommended:

- The signal should be interconnected with the adjacent controller at the intersection of US 78 (Athens Highway) at Rosebud Road.
- Based on the product of the westbound left turns and opposing eastbound through volumes, a protected + permissive left turn phase is recommended for traffic turning left from US 78 (Athens Highway) into the proposed Kroger shopping center development.
- It is recommended that a westbound left turn lane and eastbound right turn lane be constructed per GDOT standards on US 78 (Athens Highway) at the study intersection.

ROUNDABOUT FEASIBILITY:

Based on the traffic volumes on US 78 (Athens Highway) and the Kroger Site Driveway approach, the GDOT roundabout analysis tool is not required since the future volumes on US 78 (Athens Highway) will have more than the GDOT threshold of 90% of the total traffic at the study intersection. The results of the future traffic volumes revealed that US 78 (Athens Highway) will carry 91% of the total traffic at the study intersection between 7:00 a.m. and 7:00 p.m.

CONCLUSIONS AND RECOMMENDATIONS:

The results of the signal warrant analysis indicate that the future traffic volumes at the intersection of US 78 (Athens Highway) at Kroger Site Driveway are projected to meet the MUTCD warrants 1, 2, and 3 after construction of the proposed Kroger shopping center development. Therefore, a traffic signal installation is recommended at this intersection based on the projected traffic volumes. Further recommendations include:

- The signal should be interconnected with the adjacent controller at the intersection of US 78 (Athens Highway) at Rosebud Road.
- Based on the product of the westbound left turns and opposing eastbound through volumes, a protected + permissive left turn phase is recommended for traffic turning left from US 78 (Athens Highway) into the proposed Kroger shopping center development.
- It is recommended that a westbound left turn lane and eastbound right turn lane be constructed per GDOT standards on US 78 (Athens Highway) at the study intersection.

PREPARED BY: _____ DATE: _____

A&R Engineering, Inc.

RECOMMENDED BY: _____ DATE: _____

District Traffic Engineer

RECOMMENDED BY: _____ DATE: _____

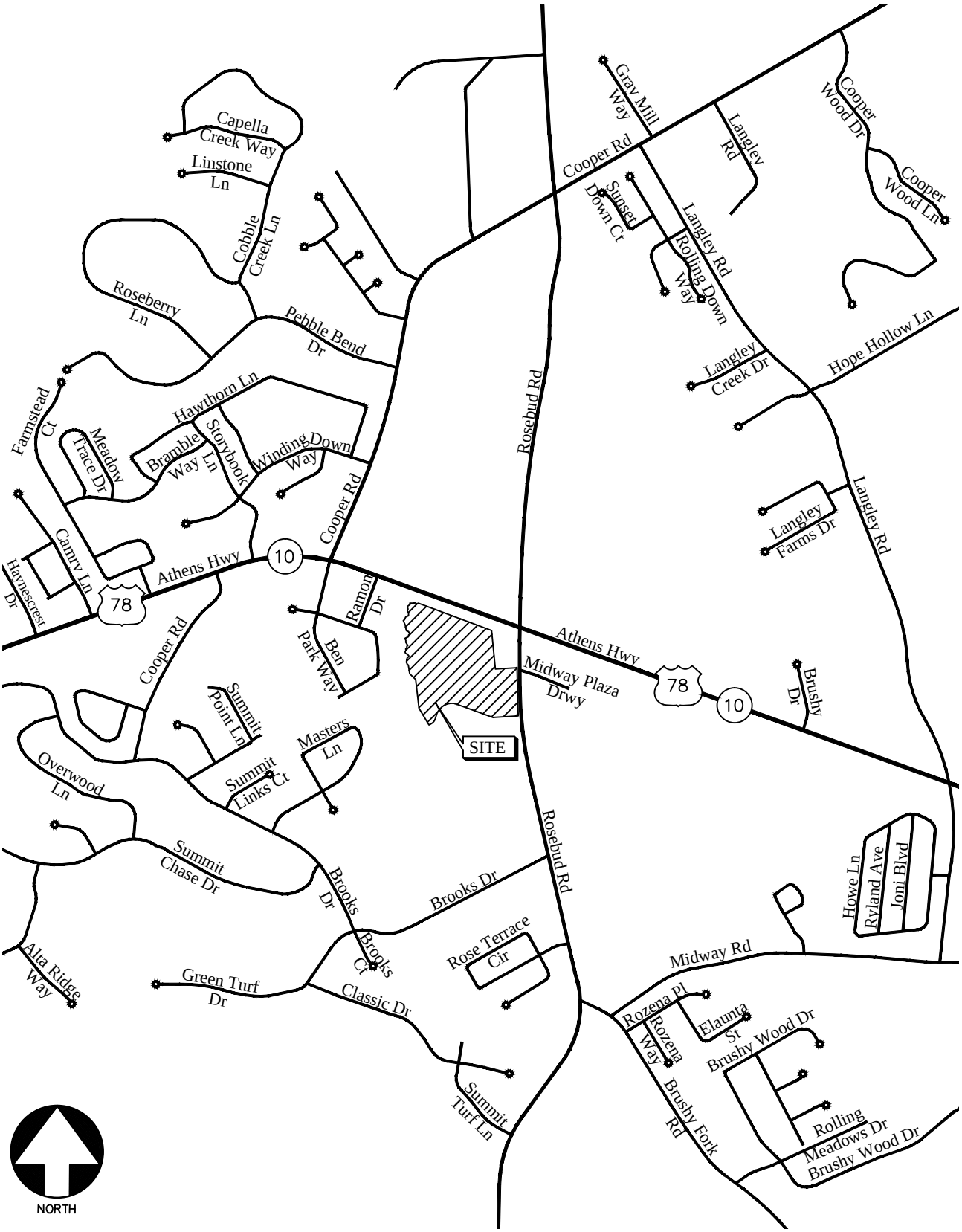
State Traffic Engineer

RECOMMENDED BY: _____ DATE: _____

Director of Operations

APPENDIX

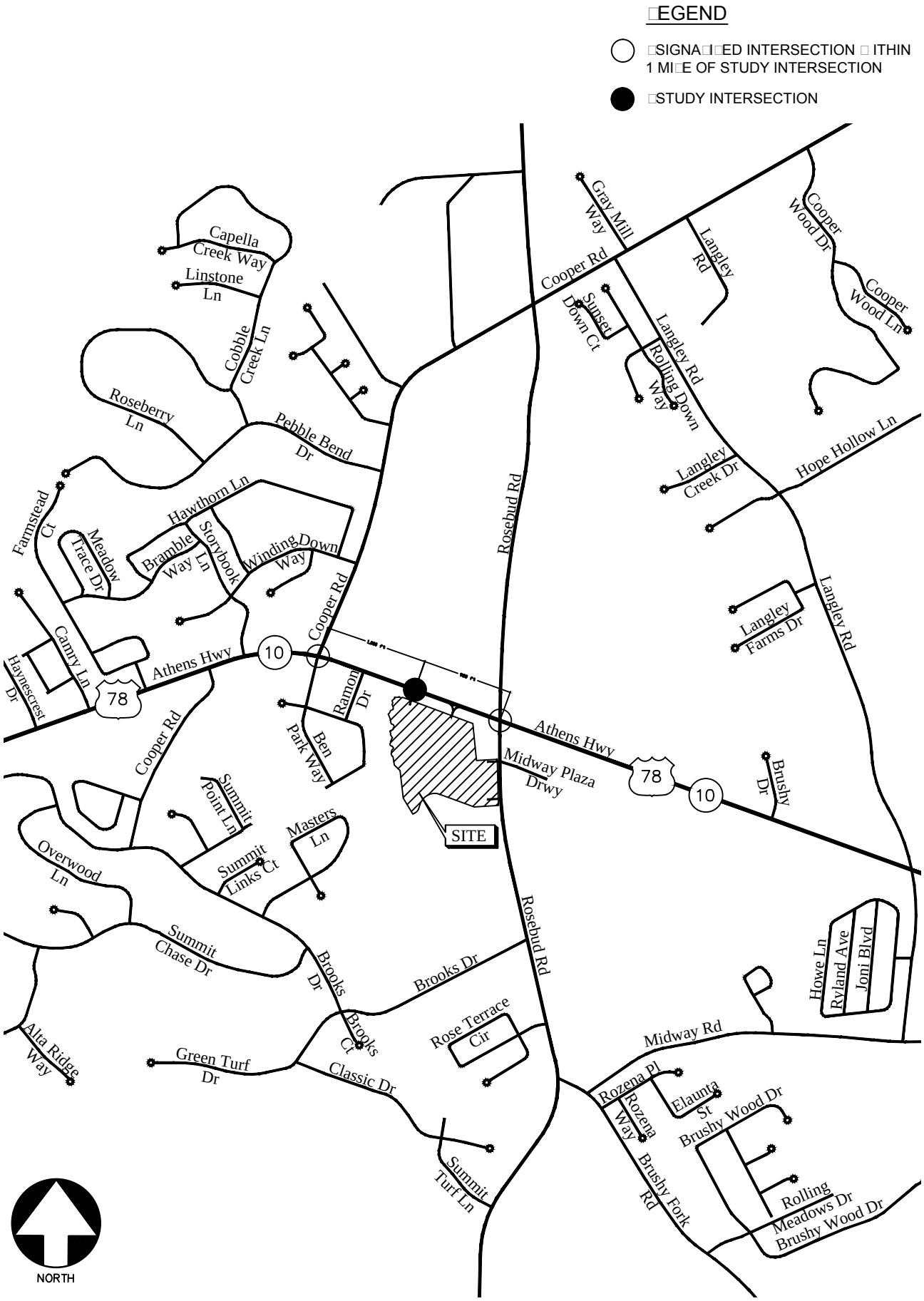
LOCATION MAP



LOCATION MAP

A&R Engineering Inc.

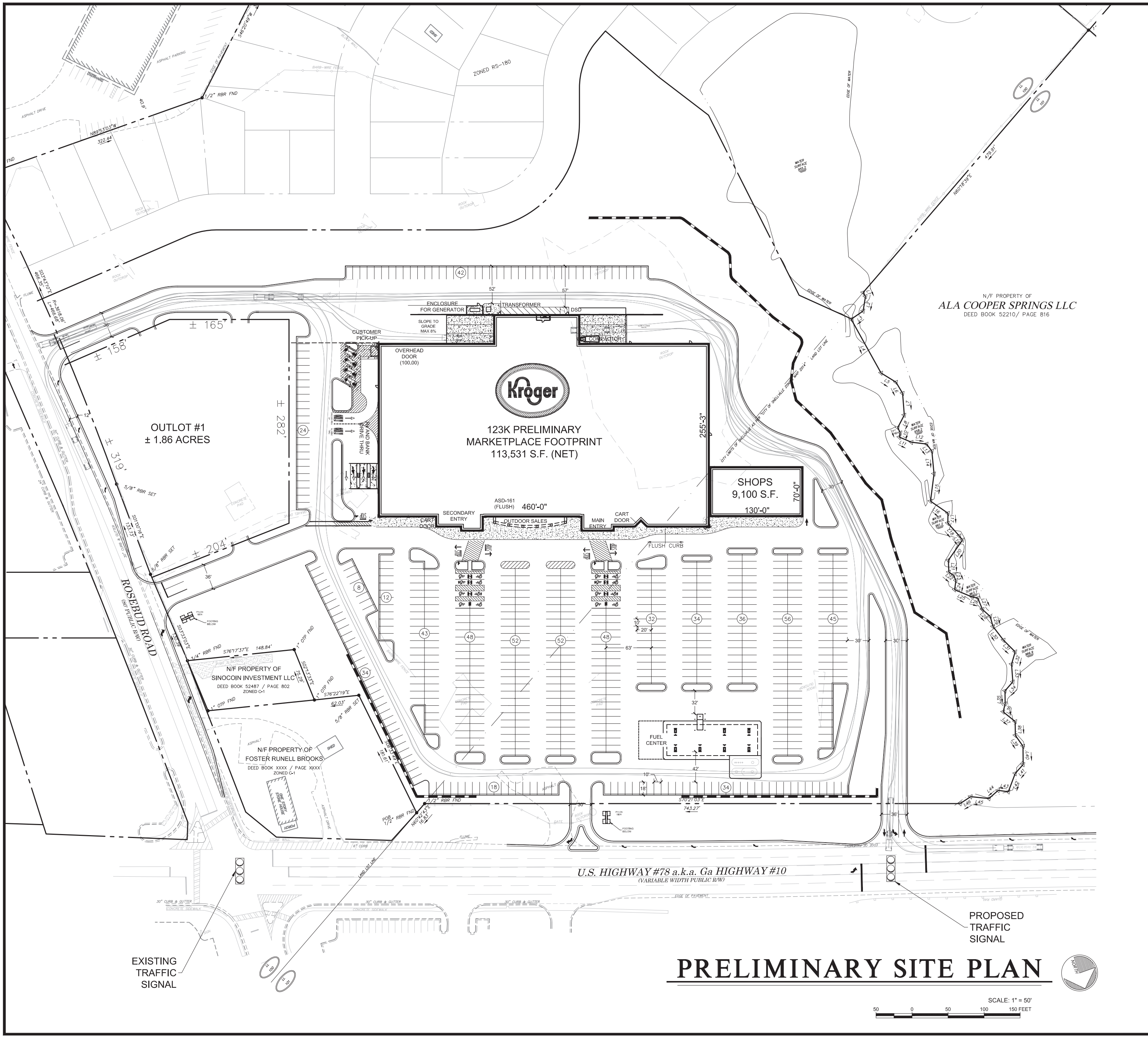
ADJACENT SIGNALIZED INTERSECTIONS



ADJACENT SIGNALIZED INTERSECTIONS

A&R Engineering Inc.

SITE PLAN



VICINITY MAP

SCALE: NONE

PRELIMINARY SITE PLAN

SITE ANALYSIS

RETAIL BUILDING AREA	113,531 S.F.
SHOPS BUILDING AREA	9,100 S.F.
TOTAL BUILDING AREA	122,631 S.F.
PARKING	618 SPACES
PARKING RATIO	5.03 SPACE/M.S.F.
RETAIL AREA	18.25 ACRES
TOTAL OUTLOT AREA	1.86 ACRES
TOTAL SITE AREA	20.11 ACRES

ROBERTSON LOIA ROOF
ARCHITECTS & ENGINEERS
3460 Preston Ridge Road . Suite 275 . Alpharetta, Georgia 30005
770-674-2600 . Fax 678-319-0745

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KROGER GA-743
LOGANVILLE, GEORGIA
FOR
THE KROGER COMPANY
2175 PARKLAKE DRIVE
PHONE: (770) 496-7486

REVISIONS

SHEET TITLE
PRELIMINARY SITE PLAN

DATE 07-31-15
PROJECT NUMBER 15-155
SHEET NUMBER CPs-1

WARRANT ANALYSIS SHEETS

A&R ENGINEERING, INC.

SIGNAL WARRANT ANALYSIS SUMMARY REPORT - US 78 @ Kroger Drwy

Project Number :	15-075	Report Date :	November 12, 2015
		Counts Date :	July 1, 2015
Major Street :	US 78		
Minor Street :	Kroger Drwy		
Speed on Major Street :	55		
Lanes @ Intersection :	Major Street - 2		
	Minor Street - 2		
Analyst :	ALR		

WARRANT 1, EIGHT-HOUR VEHICULAR VOLUME

WARRANT 1	**SATISFIED**				
	STANDARD 1	**SATISFIED**	CONDITION A	3	HOURS
			CONDITION B	8	HOURS
	STANDARD 2	**NOT SATISFIED**	CONDITION A	5	HOURS
			CONDITION B	8	HOURS

WARRANT 2, FOUR-HOUR VEHICULAR VOLUME

WARRANT 2	**SATISFIED**	8	HOURS

WARRANT 3, PEAK HOUR

WARRANT 3	**SATISFIED**			
	STANDARD A	**SATISFIED**	47	VEHICLE HOURS
	STANDARD B	**SATISFIED**	8	HOURS

WARRANT 4, PEDESTRIAN VOLUME

WARRANT 4	**NOT EVALUATED**			
	STANDARD A	**NOT SATISFIED**	0	HOURS
	STANDARD B	**NOT SATISFIED**	0	HOURS

WARRANT 5, SCHOOL CROSSING

WARRANT 5 **NOT EVALUATED**

WARRANT 6, COORDINATED SIGNAL SYSTEM

WARRANT 6 **NOT EVALUATED**

WARRANT 7, CRASH EXPERIENCE

WARRANT 7 **NOT EVALUATED**

WARRANT 8, ROADWAY NETWORK

WARRANT 8 **NOT EVALUATED**

WARRANT 9, INTERSECTION NEAR A GRADE CROSSING

WARRANT 9 **NOT EVALUATED**

A&R ENGINEERING, INC.

SIGNAL WARRANT ANALYSIS SUMMARY REPORT - US 78 @ Kroger Drwy

Project Number : 15-075
Report Date : November 12, 2015
Counts Date : July 1, 2015
Major Street : US 78
Lanes @ Intersection : Major Street - 2
Minor Street : Kroger Drwy
Minor Street - 2
Speed on Major Street : 55
Analyst : ALR

24-HOUR TRAFFIC VOLUME

TABLE 1

Time	Minor Street Northbound				Minor Street Southbound			
24 Hours	Total Approach Volume	Right Turn	% Right Turn	With 100 % RT Turn Reduction	Total Approach Volume	Right Turn	% Right Turn	With 0% RT Turn Reduction
12:00 AM	0	0	0	0	0	0	0	0
1:00 AM	0	0	0	0	0	0	0	0
2:00 AM	0	0	0	0	0	0	0	0
3:00 AM	0	0	0	0	0	0	0	0
4:00 AM	0	0	0	0	0	0	0	0
5:00 AM	0	0	0	0	0	0	0	0
6:00 AM	0	0	0	0	0	0	0	0
7:00 AM	55	23	42	32	0	0	0	0
8:00 AM	124	52	42	72	0	0	0	0
9:00 AM	116	49	42	67	0	0	0	0
10:00 AM	136	57	42	79	0	0	0	0
11:00 AM	219	92	42	127	0	0	0	0
12:00 PM	267	112	42	155	0	0	0	0
1:00 PM	219	92	42	127	0	0	0	0
2:00 PM	293	123	42	170	0	0	0	0
3:00 PM	321	135	42	186	0	0	0	0
4:00 PM	373	157	42	216	0	0	0	0
5:00 PM	405	170	42	235	0	0	0	0
6:00 PM	357	150	42	207	0	0	0	0
7:00 PM	0	0	0	0	0	0	0	0
8:00 PM	0	0	0	0	0	0	0	0
9:00 PM	0	0	0	0	0	0	0	0
10:00 PM	0	0	0	0	0	0	0	0
11:00 PM	0	0	0	0	0	0	0	0
Total				1673				0

A&R ENGINEERING, INC.

24-HOUR TRAFFIC VOLUME

TABLE 2

Time	Major Street				Major Street			
	Eastbound				Westbound			
24 Hours	Total Approach Volume	Right Turn	% Right Turn	With 0% RT Turn Reduction	Total Approach Volume	Right Turn	% Right Turn	With 0% RT Turn Reduction
12:00 AM	0	0	0	0	0	0	0	0
1:00 AM	0	0	0	0	0	0	0	0
2:00 AM	0	0	0	0	0	0	0	0
3:00 AM	0	0	0	0	0	0	0	0
4:00 AM	0	0	0	0	0	0	0	0
5:00 AM	0	0	0	0	0	0	0	0
6:00 AM	0	0	0	0	0	0	0	0
7:00 AM	614	26	4	614	1518	0	0	1518
8:00 AM	667	48	7	667	1410	0	0	1410
9:00 AM	760	50	7	760	1196	0	0	1196
10:00 AM	851	52	6	851	1125	0	0	1125
11:00 AM	1055	72	7	1055	1138	0	0	1138
12:00 PM	1122	77	7	1122	1235	0	0	1235
1:00 PM	1150	65	6	1150	1158	0	0	1158
2:00 PM	1224	78	6	1224	1155	0	0	1155
3:00 PM	1470	87	6	1470	1084	0	0	1084
4:00 PM	1684	109	6	1684	1120	0	0	1120
5:00 PM	1751	106	6	1751	1235	0	0	1235
6:00 PM	1519	80	5	1519	1102	0	0	1102
7:00 PM	0	0	0	0	0	0	0	0
8:00 PM	0	0	0	0	0	0	0	0
9:00 PM	0	0	0	0	0	0	0	0
10:00 PM	0	0	0	0	0	0	0	0
11:00 PM	0	0	0	0	0	0	0	0
Total				13867				14476

A&R ENGINEERING, INC.

WARRANT ANALYSIS RESULTS - US 78 @ Kroger Drwy

WARRANT 1 - EIGHT-HOUR VEHICULAR VOLUME

WARRANT 1 SATISFIED

STANDARD 1	SATISFIED	CONDITION A	3	HOURS
		CONDITION B	8	HOURS
STANDARD 2	NOT SATISFIED	CONDITION A	5	HOURS
		CONDITION B	8	HOURS

24-HOUR TRAFFIC VOLUME EVALUATION

TABLE 3

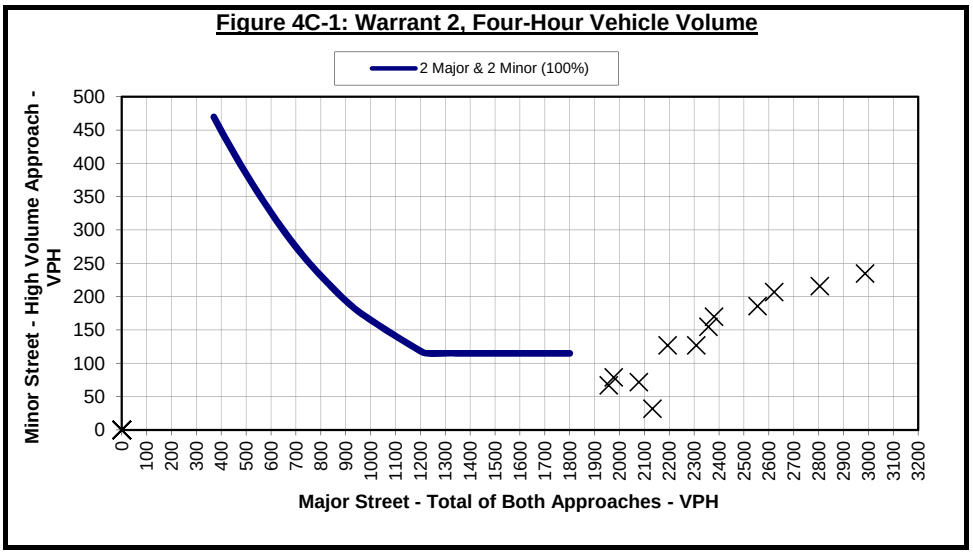
HOUR OF DAY	MAJOR ST TOTAL OF BOTH APPROACHES	MINOR ST HIGH VOLUME APPROACH	WARRANT 1			
			STANDARD 1		STANDARD 2	
			CONDITION A	CONDITION B	CONDITION A	CONDITION B
12:00 AM	0	0	0	0	0	0
1:00 AM	0	0	0	0	0	0
2:00 AM	0	0	0	0	0	0
3:00 AM	0	0	0	0	0	0
4:00 AM	0	0	0	0	0	0
5:00 AM	0	0	0	0	0	0
6:00 AM	0	0	0	0	0	0
7:00 AM	2132	32	MAJOR	MAJOR	MAJOR	MAJOR
8:00 AM	2077	72	MAJOR	MAJOR	MAJOR	MAJOR
9:00 AM	1956	67	MAJOR	MAJOR	MAJOR	MAJOR
10:00 AM	1976	79	MAJOR	MAJOR	MAJOR	MAJOR
11:00 AM	2193	127	MAJOR	BOTH	MAJOR	BOTH
12:00 PM	2357	155	MAJOR	BOTH	MAJOR	BOTH
1:00 PM	2308	127	MAJOR	BOTH	MAJOR	BOTH
2:00 PM	2379	170	MAJOR	BOTH	BOTH	BOTH
3:00 PM	2554	186	MAJOR	BOTH	BOTH	BOTH
4:00 PM	2804	216	BOTH	BOTH	BOTH	BOTH
5:00 PM	2986	235	BOTH	BOTH	BOTH	BOTH
6:00 PM	2621	207	BOTH	BOTH	BOTH	BOTH
7:00 PM	0	0	0	0	0	0
8:00 PM	0	0	0	0	0	0
9:00 PM	0	0	0	0	0	0
10:00 PM	0	0	0	0	0	0
11:00 PM	0	0	0	0	0	0
TOTAL	28343	1673				

CRITERIA**		STANDARD 1 - 100%		STANDARD 2 - 80%	
		CONDITION A	CONDITION B	CONDITION A	CONDITION B
	MAJOR ST	600	900	480	720
	MINOR ST	200	100	160	80
NO. OF HOURS MET		3	8	5	8

A&R ENGINEERING, INC.

WARRANT 2, FOUR-HOUR VEHICULAR VOLUME

WARRANT 2* SATISFIED 8 HOURS

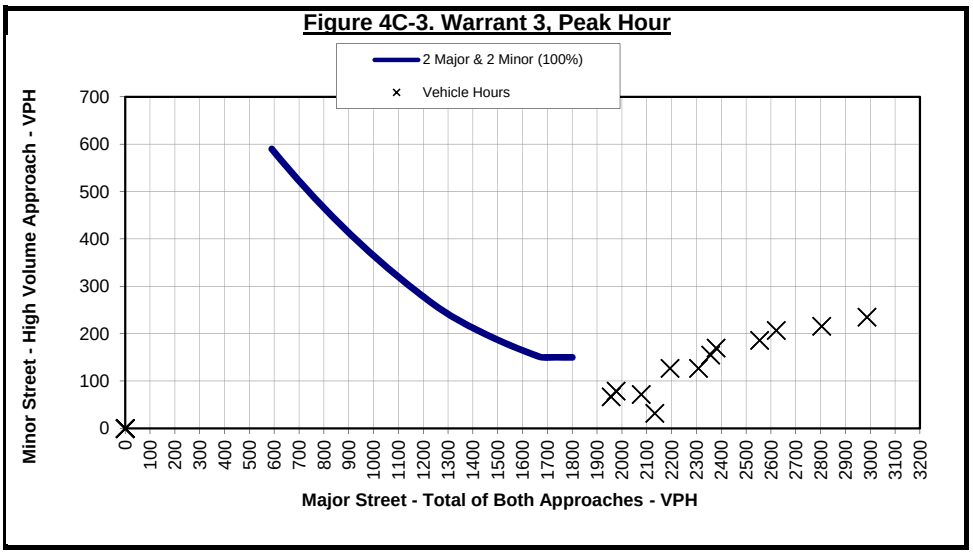


WARRANT 3, PEAK HOUR

STANDARD A SATISFIED 47 VEHICLE HOURS

185	Peak Hour Minor-Street Volume
921	Average Minor-Street Delay (seconds)
2	Number of Approach Lanes (Minor Street)

STANDARD B* SATISFIED 8 HOURS



*Note: Curves for minimum volumes are based on the curves from FIGURES 4C-1 & 4C-2, Page 4C-7 for WARRANT 2, and FIGURES 4C-3 & 4C-4, Page 4C-9 in section C of the MUTCD 2009 edition for WARRANT 3.

A&R ENGINEERING, INC.

WARRANT 4, PEDESTRIAN VOLUME

WARRANT 4	**NOT EVALUATED**			
	STANDARD A	**NOT SATISFIED**	0	HOURS
	STANDARD B	**NOT SATISFIED**	0	HOURS

WARRANT 5, SCHOOL CROSSING

WARRANT 5 **NOT EVALUATED**

WARRANT 6, COORDINATED SIGNAL SYSTEM

WARRANT 6 **NOT EVALUATED**

WARRANT 7, CRASH EXPERIENCE

WARRANT 7 **NOT EVALUATED**

WARRANT 8, ROADWAY NETWORK

WARRANT 8 **NOT EVALUATED**

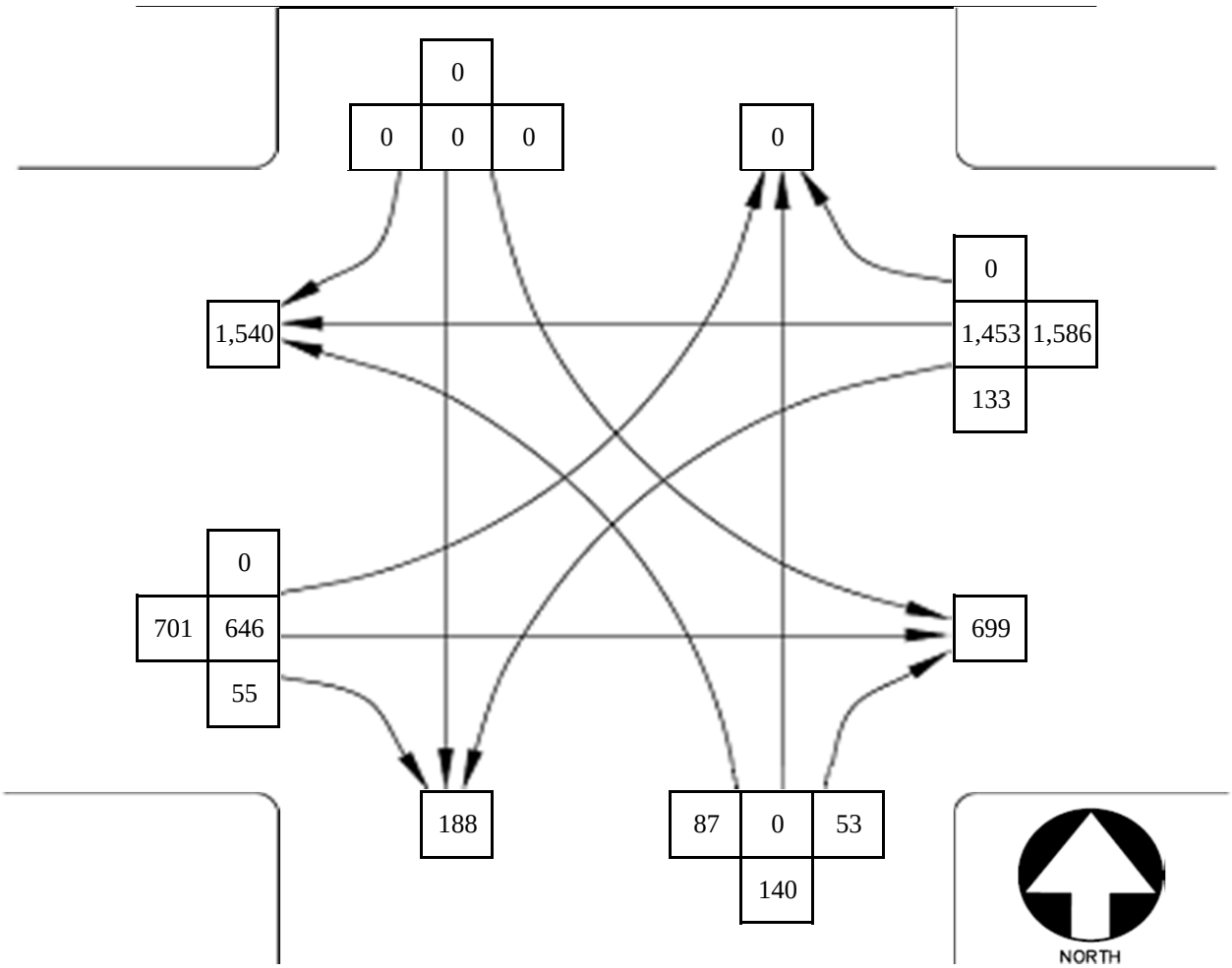
WARRANT 9, INTERSECTION NEAR A GRADE CROSSING

WARRANT 9 **NOT EVALUATED**

LEFT TURN CRITERIA

Future Traffic Count Summary Sheet

Peak Hour Count (AM)



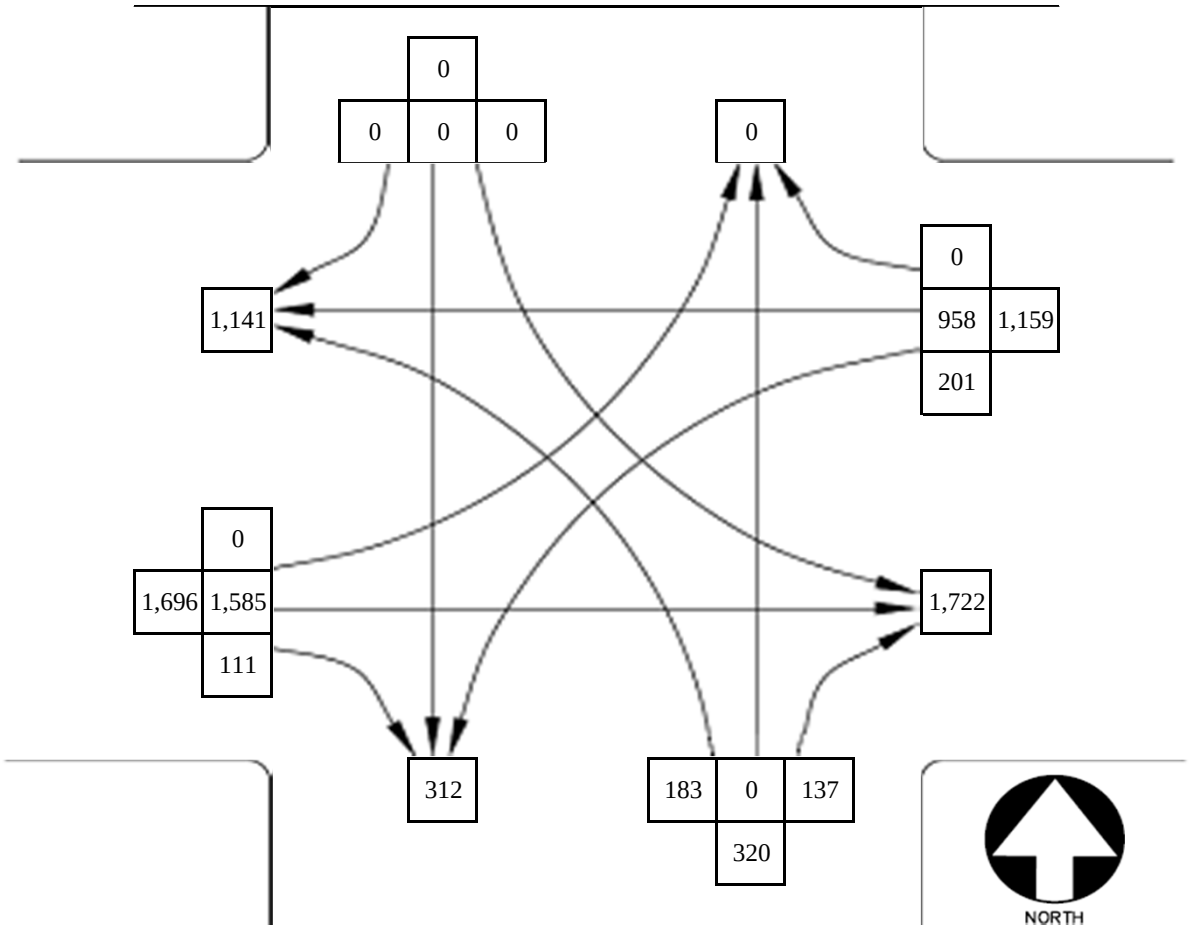
Conflicting Movements	Through Volume (V_o)	Left Turn Volume (V_{lt})	Opposing Lanes (N_o)	Cross-Product ($V_o \times V_{lt} \div N_o$)	Cross-Product Warrant?	Left Turn Volume Warrant?
NBL & SBT	0	87	2	0	NO	FYA lag only
SBL & NBT	0	0	2	0	NO	NO
EBL & WBT	1,453	0	1	0	NO	NO
WBL & EBT	646	133	1	85,918	YES	YES

LEFT TURN CRITERIA - AM PEAK HOUR

A&R Engineering Inc.

Future Traffic Count Summary Sheet

Peak Hour Count (PM)



Conflicting Movements	Through Volume (V_o)	Left Turn Volume (V_{lt})	Opposing Lanes (N_o)	Cross-Product ($V_o \times V_{lt} \div N_o$)	Cross-Product Warrant?	Left Turn Volume Warrant?
NBL & SBT	0	183	2	0	NO	YES
SBL & NBT	0	0	2	0	NO	NO
EBL & WBT	958	0	1	0	NO	NO
WBL & EBT	1,585	201	1	318,585	YES	YES

LEFT TURN CRITERIA - PM PEAK HOUR

A&R Engineering Inc.

TRAFFIC COUNT INFORMATION

ADT Data

Reliable Traffic Data Services, LLC
Tel: (770) 578-8158 Fax: (770) 578-8159
info@reliabletraffic.org | www.reliabletraffic.org

Site Code: 37120101
Athens Hwy West of
Rosebud Rd

Start	01-Jul-15	Eastbound		Hour Totals		Westbound		Hour Totals		Combined Totals	
Time	Wed	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
12:00		56	215			28	272				
12:15		41	236			18	275				
12:30		34	225			20	261				
12:45		36	292	167	968	17	254	83	1062	250	2030
01:00		37	231			20	244				
01:15		32	260			22	239				
01:30		29	252			19	258				
01:45		24	277	122	1020	24	270	85	1011	207	2031
02:00		26	262			21	265				
02:15		21	234			19	226				
02:30		18	314			16	257				
02:45		16	258	81	1068	19	231	75	979	156	2047
03:00		18	337			21	220				
03:15		14	361			22	238				
03:30		15	311			10	211				
03:45		12	287	59	1296	24	219	77	888	136	2184
04:00		14	364			34	220				
04:15		18	369			43	203				
04:30		24	399			45	230				
04:45		25	334	81	1466	60	221	182	874	263	2340
05:00		26	389			110	258				
05:15		27	407			145	254				
05:30		37	370			197	231				
05:45		56	373	146	1539	245	254	697	997	843	2536
06:00		53	344			310	226				
06:15		86	349			287	253				
06:30		89	338			342	243				
06:45		90	328	318	1359	317	200	1256	922	1574	2281
07:00		104	295			334	204				
07:15		141	295			399	159				
07:30		147	242			344	153				
07:45		170	274	562	1106	382	124	1459	640	2021	1746
08:00		133	236			322	167				
08:15		134	211			345	170				
08:30		147	210			324	119				
08:45		157	230	571	887	310	130	1301	586	1872	1473
09:00		150	184			269	132				
09:15		158	166			254	131				
09:30		186	164			308	92				
09:45		166	141	660	655	253	84	1084	439	1744	1094
10:00		200	115			250	82				
10:15		180	104			252	66				
10:30		196	110			254	57				
10:45		171	78	747	407	251	56	1007	261	1754	668
11:00		197	74			225	40				
11:15		222	80			259	33				
11:30		245	54			272	39				
11:45		247	55	911	263	220	31	976	143	1887	406
Total		4425	12034			8282	8802			12707	20836
Percent		26.9%	73.1%			48.5%	51.5%			37.9%	62.1%
Grand Total		4425	12034			8282	8802			12707	20836
Percent		26.9%	73.1%			48.5%	51.5%			37.9%	62.1%

ADT ADT 33,543 AADT 33,543

FUTURE CAPACITY ANALYSIS
NO SIGNAL

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	646	55	133	1453	87	53
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.87	0.92	0.92	0.91	0.92	0.92
Hourly flow rate (vph)	743	60	145	1597	95	58
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			TWLTL		
Median storage veh)	2			2		
Upstream signal (ft)				902		
pX, platoon unblocked					0.68	
vC, conflicting volume			802		1830	371
vC1, stage 1 conf vol					743	
vC2, stage 2 conf vol					1087	
vCu, unblocked vol			802		1272	371
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			82		70	91
cM capacity (veh/h)			817		320	626

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	NB 2
Volume Total	371	371	60	145	798	798	95	58
Volume Left	0	0	0	145	0	0	95	0
Volume Right	0	0	60	0	0	0	0	58
cSH	1700	1700	1700	817	1700	1700	320	626
Volume to Capacity	0.22	0.22	0.04	0.18	0.47	0.47	0.30	0.09
Queue Length 95th (ft)	0	0	0	16	0	0	30	8
Control Delay (s)	0.0	0.0	0.0	10.4	0.0	0.0	20.9	11.3
Lane LOS				B			C	B
Approach Delay (s)	0.0			0.9			17.3	
Approach LOS							C	

Intersection Summary			
Average Delay	1.5		
Intersection Capacity Utilization	51.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1585	111	201	958	183	137
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.94	0.92	0.92	0.97	0.92	0.92
Hourly flow rate (vph)	1686	121	218	988	199	149
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			TWLTL		
Median storage veh)	2			2		
Upstream signal (ft)				902		
pX, platoon unblocked					0.81	
vC, conflicting volume			1807		2617	843
vC1, stage 1 conf vol					1686	
vC2, stage 2 conf vol					931	
vCu, unblocked vol			1807		2527	843
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			35		0	52
cM capacity (veh/h)			337		101	307

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	NB 2
Volume Total	843	843	121	218	494	494	199	149
Volume Left	0	0	0	218	0	0	199	0
Volume Right	0	0	121	0	0	0	0	149
cSH	1700	1700	1700	337	1700	1700	101	307
Volume to Capacity	0.50	0.50	0.07	0.65	0.29	0.29	1.98	0.48
Queue Length 95th (ft)	0	0	0	107	0	0	419	63
Control Delay (s)	0.0	0.0	0.0	33.5	0.0	0.0	543.7	27.3
Lane LOS				D			F	D
Approach Delay (s)	0.0			6.1			322.6	
Approach LOS							F	

Intersection Summary			
Average Delay	35.6		
Intersection Capacity Utilization	75.1%	ICU Level of Service	D
Analysis Period (min)	15		

FUTURE CAPACITY ANALYSIS
WITH SIGNAL

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	646	55	133	1453	87	53
Future Volume (vph)	646	55	133	1453	87	53
Lane Group Flow (vph)	743	60	145	1597	95	58
Turn Type	NA	Perm	pm+pt	NA	Prot	Prot
Protected Phases	2		1	6	8	8
Permitted Phases		2	6			
Detector Phase	2	2	1	6	8	8
Switch Phase						
Minimum Initial (s)	15.0	15.0	4.0	15.0	6.0	6.0
Minimum Split (s)	24.0	24.0	10.0	24.0	34.0	34.0
Total Split (s)	69.0	69.0	17.0	86.0	34.0	34.0
Total Split (%)	57.5%	57.5%	14.2%	71.7%	28.3%	28.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?						
Recall Mode	C-Min	C-Min	None	C-Min	None	None
v/c Ratio	0.30	0.05	0.24	0.55	0.38	0.34
Control Delay	7.8	1.8	1.7	1.9	56.9	18.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.8	1.8	1.7	1.9	56.9	18.7
Queue Length 50th (ft)	109	0	11	78	36	0
Queue Length 95th (ft)	141	14	m12	64	63	41
Internal Link Dist (ft)	671			366	224	
Turn Bay Length (ft)		250	310			
Base Capacity (vph)	2449	1114	609	2925	801	413
Starvation Cap Reductn	0	0	0	61	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.30	0.05	0.24	0.56	0.12	0.14

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 21 (18%), Referenced to phase 2:EBT and 6:WBTL, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: Site Drwy 1 & US 78

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	646	55	133	1453	87	53
Future Volume (vph)	646	55	133	1453	87	53
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	0.95	1.00	1.00	0.95	0.97	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	1770	3539	3433	1583
Flt Permitted	1.00	1.00	0.33	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	609	3539	3433	1583
Peak-hour factor, PHF	0.87	0.92	0.92	0.91	0.92	0.92
Adj. Flow (vph)	743	60	145	1597	95	58
RTOR Reduction (vph)	0	18	0	0	0	54
Lane Group Flow (vph)	743	42	145	1597	95	4
Turn Type	NA	Perm	pm+pt	NA	Prot	Prot
Protected Phases	2		1	6	8	8
Permitted Phases		2	6			
Actuated Green, G (s)	83.1	83.1	99.2	99.2	8.8	8.8
Effective Green, g (s)	83.1	83.1	99.2	99.2	8.8	8.8
Actuated g/C Ratio	0.69	0.69	0.83	0.83	0.07	0.07
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	5.0	5.0	3.0	5.0	3.0	3.0
Lane Grp Cap (vph)	2450	1096	601	2925	251	116
v/s Ratio Prot	0.21		0.02	c0.45	c0.03	0.00
v/s Ratio Perm		0.03	0.18			
v/c Ratio	0.30	0.04	0.24	0.55	0.38	0.04
Uniform Delay, d1	7.2	5.8	2.5	3.3	53.0	51.7
Progression Factor	1.00	1.00	0.50	0.40	1.00	1.00
Incremental Delay, d2	0.3	0.1	0.1	0.5	1.0	0.1
Delay (s)	7.5	5.9	1.4	1.8	54.0	51.8
Level of Service	A	A	A	A	D	D
Approach Delay (s)	7.4			1.8	53.1	
Approach LOS	A			A	D	

Intersection Summary			
HCM 2000 Control Delay	6.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	55.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	1585	111	201	958	183	137
Future Volume (vph)	1585	111	201	958	183	137
Lane Group Flow (vph)	1686	121	218	988	199	149
Turn Type	NA	Perm	pm+pt	NA	Prot	Perm
Protected Phases	2		1	6	8	
Permitted Phases		2	6			8
Detector Phase	2	2	1	6	8	8
Switch Phase						
Minimum Initial (s)	15.0	15.0	4.0	15.0	6.0	6.0
Minimum Split (s)	24.0	24.0	10.0	24.0	34.0	34.0
Total Split (s)	68.0	68.0	18.0	86.0	34.0	34.0
Total Split (%)	56.7%	56.7%	15.0%	71.7%	28.3%	28.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?						
Recall Mode	C-Min	C-Min	None	C-Min	None	None
v/c Ratio	0.74	0.11	0.81	0.35	0.55	0.50
Control Delay	17.4	3.1	60.3	2.8	56.6	13.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	17.4	3.1	60.3	2.8	56.6	13.6
Queue Length 50th (ft)	428	7	122	52	76	0
Queue Length 95th (ft)	576	32	m#219	68	111	60
Internal Link Dist (ft)	671			366	224	
Turn Bay Length (ft)		250	310			
Base Capacity (vph)	2283	1054	270	2814	801	483
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.74	0.11	0.81	0.35	0.25	0.31

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 20 (17%), Referenced to phase 2:EBT and 6:WBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: Site Drwy 1 & US 78

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	1585	111	201	958	183	137
Future Volume (vph)	1585	111	201	958	183	137
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	0.95	1.00	1.00	0.95	0.97	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	1770	3539	3433	1583
Flt Permitted	1.00	1.00	0.07	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	134	3539	3433	1583
Peak-hour factor, PHF	0.94	0.92	0.92	0.97	0.92	0.92
Adj. Flow (vph)	1686	121	218	988	199	149
RTOR Reduction (vph)	0	33	0	0	0	133
Lane Group Flow (vph)	1686	88	218	988	199	16
Turn Type	NA	Perm	pm+pt	NA	Prot	Perm
Protected Phases	2		1	6	8	
Permitted Phases		2	6			8
Actuated Green, G (s)	77.4	77.4	95.4	95.4	12.6	12.6
Effective Green, g (s)	77.4	77.4	95.4	95.4	12.6	12.6
Actuated g/C Ratio	0.65	0.65	0.80	0.80	0.10	0.10
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	5.0	5.0	3.0	5.0	3.0	3.0
Lane Grp Cap (vph)	2282	1021	270	2813	360	166
v/s Ratio Prot	0.48		c0.08	0.28	c0.06	
v/s Ratio Perm		0.06	c0.56			0.01
v/c Ratio	0.74	0.09	0.81	0.35	0.55	0.09
Uniform Delay, d1	14.4	8.0	30.9	3.5	51.0	48.5
Progression Factor	1.00	1.00	1.90	0.67	1.00	1.00
Incremental Delay, d2	2.2	0.2	12.7	0.3	1.8	0.2
Delay (s)	16.6	8.2	71.4	2.6	52.9	48.8
Level of Service	B	A	E	A	D	D
Approach Delay (s)	16.1			15.1	51.1	
Approach LOS	B			B	D	

Intersection Summary			
HCM 2000 Control Delay	19.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	75.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

VOLUME WORKSHEETS

15-075 Kroger #743 - Rosebud Rd and Athens Hwy - Loganville, GA

Traffic Volumes
Future Conditions

A&R Engineering
August 2015

3. US 78 @ Site Drwy 1

A.M. Peak Hour

	Northbound				Southbound				Eastbound				Westbound			
Condition	L	T	R	Tot	L	T	R	Tot	L	T	R	Tot	L	T	R	Tot
Existing:	0	0	0	0	0	0	0	0	0	591	0	591	0	1447	0	1447
Growth Factor (%):	1	1	1		1	1	1		1	1	1		1	1	1	
Base Condition:	0	0	0	0	0	0	0	0	0	603	0	603	0	1476	0	1476
Total New Trips	64	0	47	111	0	0	0	0	0	49	49	98	110	0	0	110
Pass-by Trips	23	0	6	29	0	0	0	0	0	-6	6	0	23	-23	0	0
Future Traffic Volumes:	87	0	53	140	0	0	0	0	0	646	55	701	133	1453	0	1586

P.M. Peak Hour

	Northbound				Southbound				Eastbound				Westbound			
Condition	L	T	R	Tot	L	T	R	Tot	L	T	R	Tot	L	T	R	Tot
Existing:	0	0	0	0	0	0	0	0	0	1539	0	1539	0	997	0	997
Growth Factor (%):	1	1	1		1	1	1		1	1	1		1	1	1	
Base Condition:	0	0	0	0	0	0	0	0	0	1570	0	1570	0	1017	0	1017
Total New Trips	124	0	90	214	0	0	0	0	0	63	63	126	142	0	0	142
Pass-by Trips	59	0	47	106	0	0	0	0	0	-48	48	0	59	-59	0	0
Future Traffic Volumes:	183	0	137	320	0	0	0	0	0	1585	111	1696	201	958	0	1159