ENGINEERING REPORT

College Street:
Interstate 85 to Donahue Drive
Traffic Signal System Feasibility Study

Auburn, Alabama

Prepared for:

The City of Auburn

Prepared by:

SKIPPER CONSULTING INC.

3644 Vann Road
Suite 100
Birmingham, Alabama 35235

August, 2006

College Street:
Interstate 85 to Donahue Drive

AUBURN, ALABAMA

TRAFFIC SIGNAL SYSTEM FEASIBILITY STUDY

Prepared for:

The City of Auburn
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INTRODUCTION

This report documents a study performed to determine the feasibility of establishing a coordinated signal system on South College Street between Interstate 85 and Donahue Drive in the City of Auburn, Alabama. The study corridor is approximately 2.2 miles in length and contains six existing traffic signals. The existing signalized intersections are as follows:

- South College Street at Interstate 85 Northbound Ramps;
- South College Street at Interstate 85 Southbound Ramps;
- South College Street at Veteran’s Boulevard;
- South College Street at Longleaf Drive;
- South College Street at East University Drive/Shug Jordan Parkway; and
- South College Street at Donahue Drive.

The location of the study corridor and the six study intersections as related to the area roadway network is shown in Figure 1.

Factors which are considered in determining the feasibility of coordination of the traffic signals on South College Street are as follows:

- the distance between signalized intersections;
- the hourly traffic flow variations and directionality;
- the historical growth in traffic;
- the percentage of heavy vehicles in the traffic stream;
- the number of intervening driveways and side streets between signalized intersections;
- the ratio of through vehicular traffic volumes to turning vehicular traffic volumes;
- the magnitude of mid-block generated traffic;
- the compatibility of the natural cycle lengths of each traffic signal;

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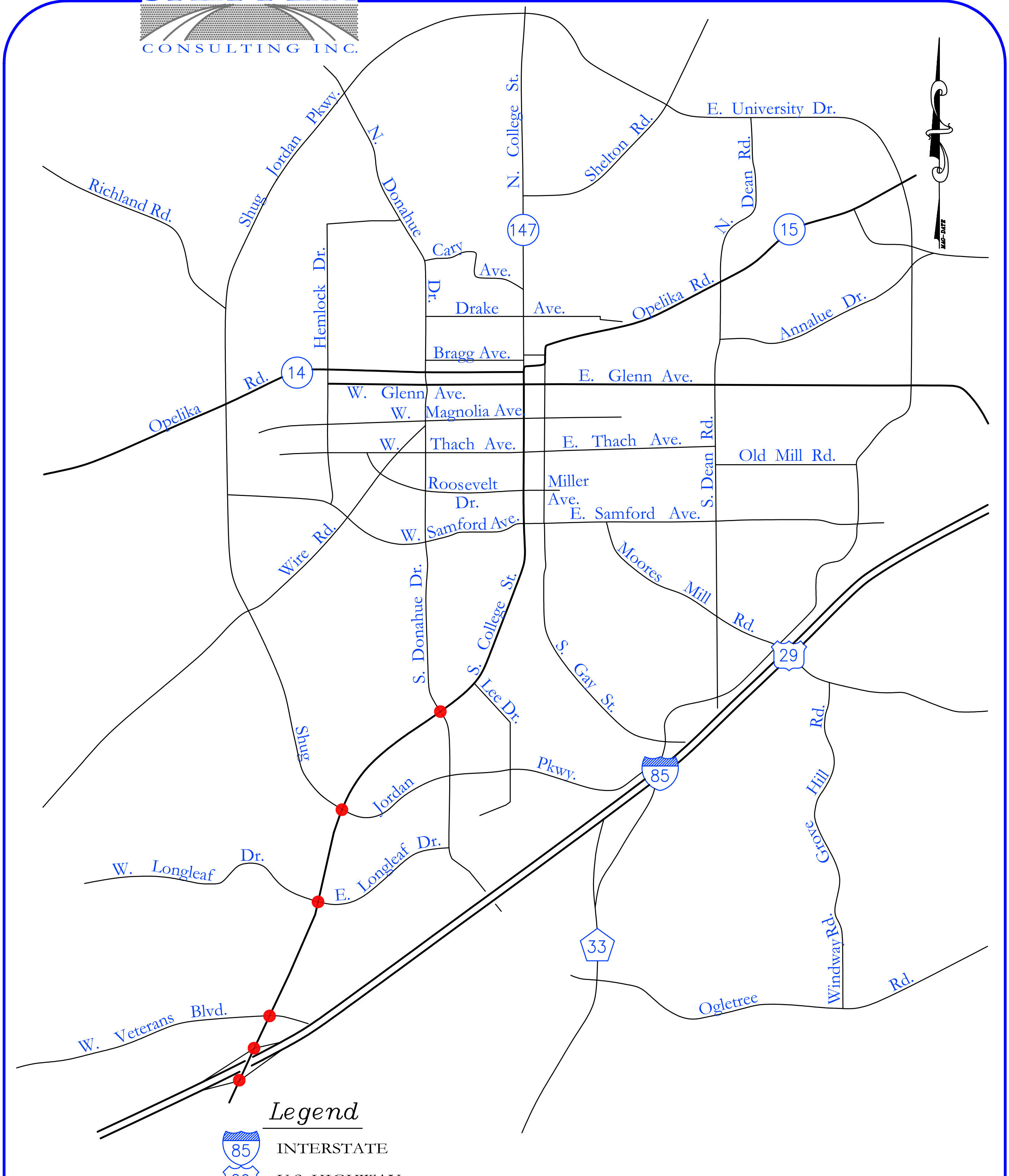

FIGURE 1

STUDY LIMITS

COLLEGE ST. SIGNAL SYSTEM FEASIBILITY STUDY

AUBURN, ALABAMA

NOV. 2005 1103.007

- the change in individual intersection delays with and without traffic signal coordination;
- the change in arterial travel speeds and level of service with and without traffic signal coordination;
- the prospective green bands which could be expected if the signals were coordinated;
- the overall "Coordinatability Factor" as generated by the Synchro 6 software;
- the compatibility of the existing traffic signal equipment for time base and interconnected coordination;
- the locations of possible future traffic signals; and
- possible options for future traffic signal interconnection.

Sources of information used in this report included the City of Auburn, the Alabama Department of Transportation, the Transportation Research Board, traffic counts conducted by Traffic Data, LLC, and office files and field reconnaissance efforts of Skipper Consulting, Inc.

BACKGROUND INFORMATION

Roadway Characteristics

Within the boundary of the study area, South College Street is generally a five lane urban cross-section roadway. The posted speed limit on South College Street is 55 miles per hour from south of Interstate 85 to north of Longleaf Drive. The speed limit decreases to 50 miles per hour from north of Longleaf Drive to north of East University Drive. The speed limit further decreases to 45 miles per hour from south of Donahue Drive to south of Samford Avenue.

For the purposes of this study, South College Street is considered a north-south roadway regardless of actual compass orientation.

Intersection Turning Movement Traffic Counts

Intersection turning movement traffic counts were performed at the six study intersections by Traffic Data, LLC on behalf of Skipper Consulting, Inc. The counts were conducted on Wednesday, August 24, 2005, Tuesday, September 6, 2005, and Tuesday, September 13, 2005. The counts were performed in fifteen (15) minute intervals during the periods of 7:00 to 9:00 a.m. and 4:00 to 6:00 p.m. The traffic count data is included in Appendix A. The a.m. and p.m. peak hour intersection turning movement traffic counts are depicted in Figures 2 and 3, respectively. All traffic counts were conducted such that Auburn University was in session but not during the week with a home football game.

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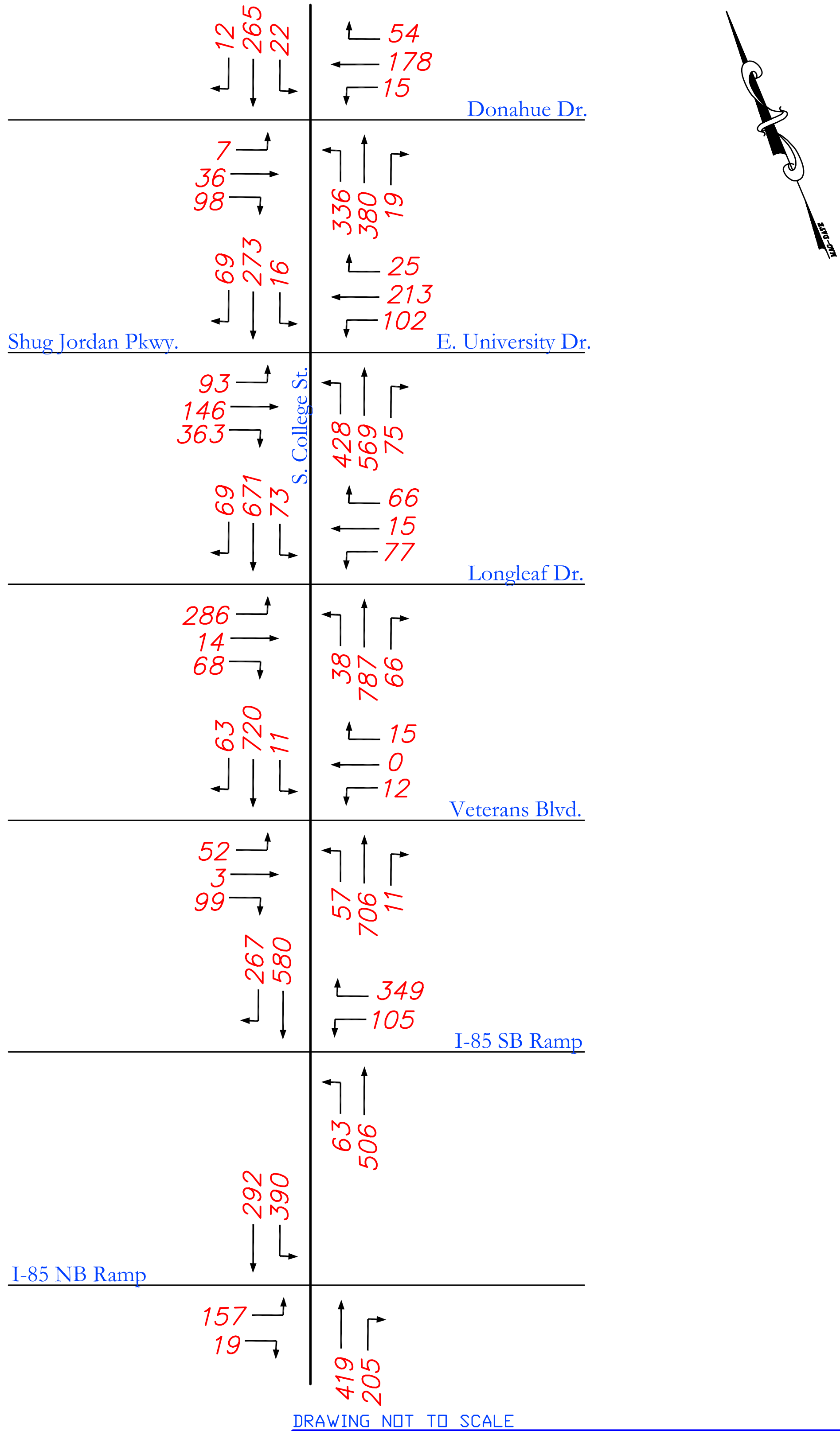

DRAWING NOT TO SCALE

Legend

00 ⟶ TRAFFIC VOLUMES (VEHICLES)

FIGURE 2

EXISTING TURNING TRAFFIC COUNTS-AM PEAK HOUR

COLLEGE ST. SIGNAL SYSTEM FEASIBILITY STUDY

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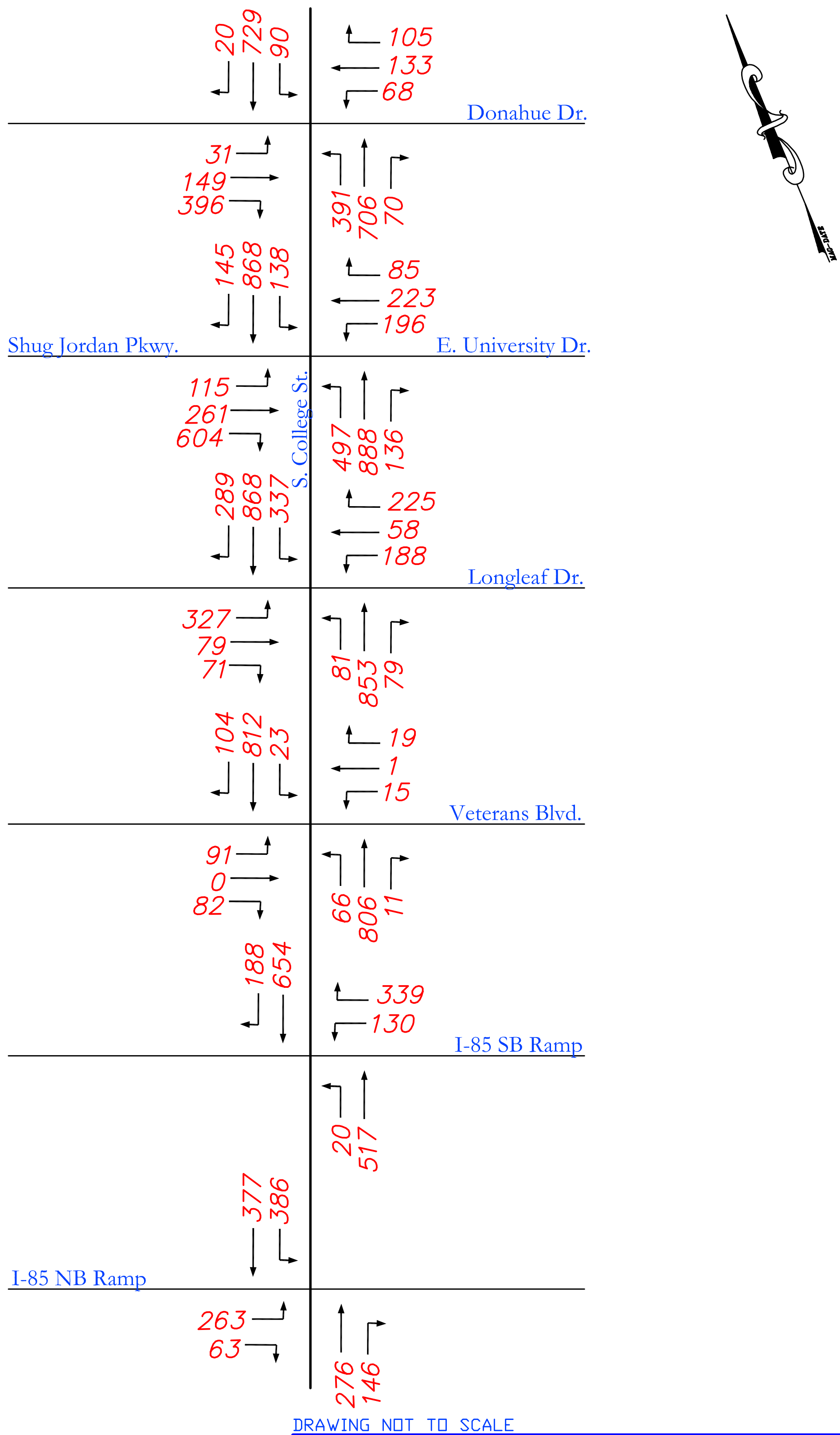

Legend

00 → TRAFFIC VOLUMES (VEHICLES)

FIGURE 3

EXISTING TURNING TRAFFIC COUNTS-PM PEAK HOUR

COLLEGE ST. SIGNAL SYSTEM FEASIBILITY STUDY

AUBURN, ALABAMA

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Machine Traffic Count

A machine traffic count was conducted on College Street in the vicinity of the unsignalized driveway for the Wal-Mart Supercenter. The count was conducted in fifteen minute increments for 72 continuous hours on Saturday-Monday, August 20-22, 2005. The data from this traffic count is included in Appendix B. All traffic counts were conducted such that Auburn University was in session but not during the week with a home football game.

ANALYSIS

Distance Between Intersections

The distance between signalized intersections is a major factor to consider in the feasibility of coordination of traffic signals. In general, the following "rules-of-thumb" apply:

- traffic signals spaced farther apart than one-half mile (2,640 feet) should rarely be coordinated;
- traffic signals spaced closer than one-quarter mile (1,320 feet) should generally be coordinated; and
- traffic signals spaced closer than 600 feet are discouraged and generally must be coordinated.

Table 1 shows the distance between each study intersection from centerline of the intersections. The distances were recorded by Skipper Consulting, Inc. using a calibrated vehicle-mounted Distance Measuring Instrument (DMI).

Based on the distance between signalized intersections, it appears that coordination of signals on South College Street would be feasible in the following two locations:

- between the Interstate 85 Northbound Ramps and Veteran's Boulevard; and
- between Longleaf Drive and East University Drive.

Table 1
Distances between Intersections

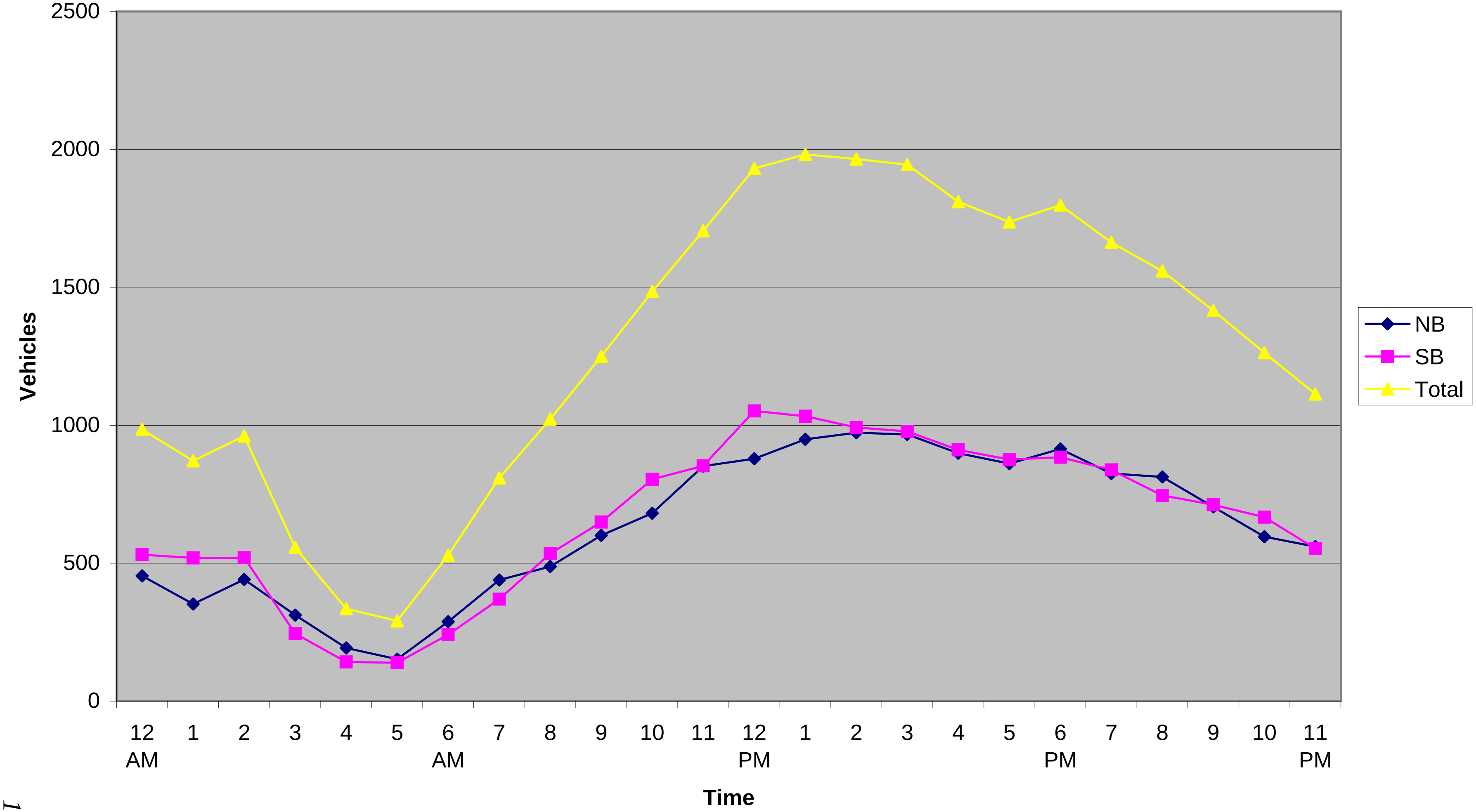
Intersection	*Cumulative Distance*	*Distance Between Intersections*
Interstate 85 Northbound Ramps	0 feet	
		995 feet
Interstate 85 Southbound Ramps	995 feet	
		1,046 feet
Veteran's Boulevard	2,041 feet	
		3,975 feet
Longleaf Drive	6,016 feet	
		1,785 feet
East University Drive	7,801 feet	
		3,808 feet
Donahue Drive	11,609 feet	

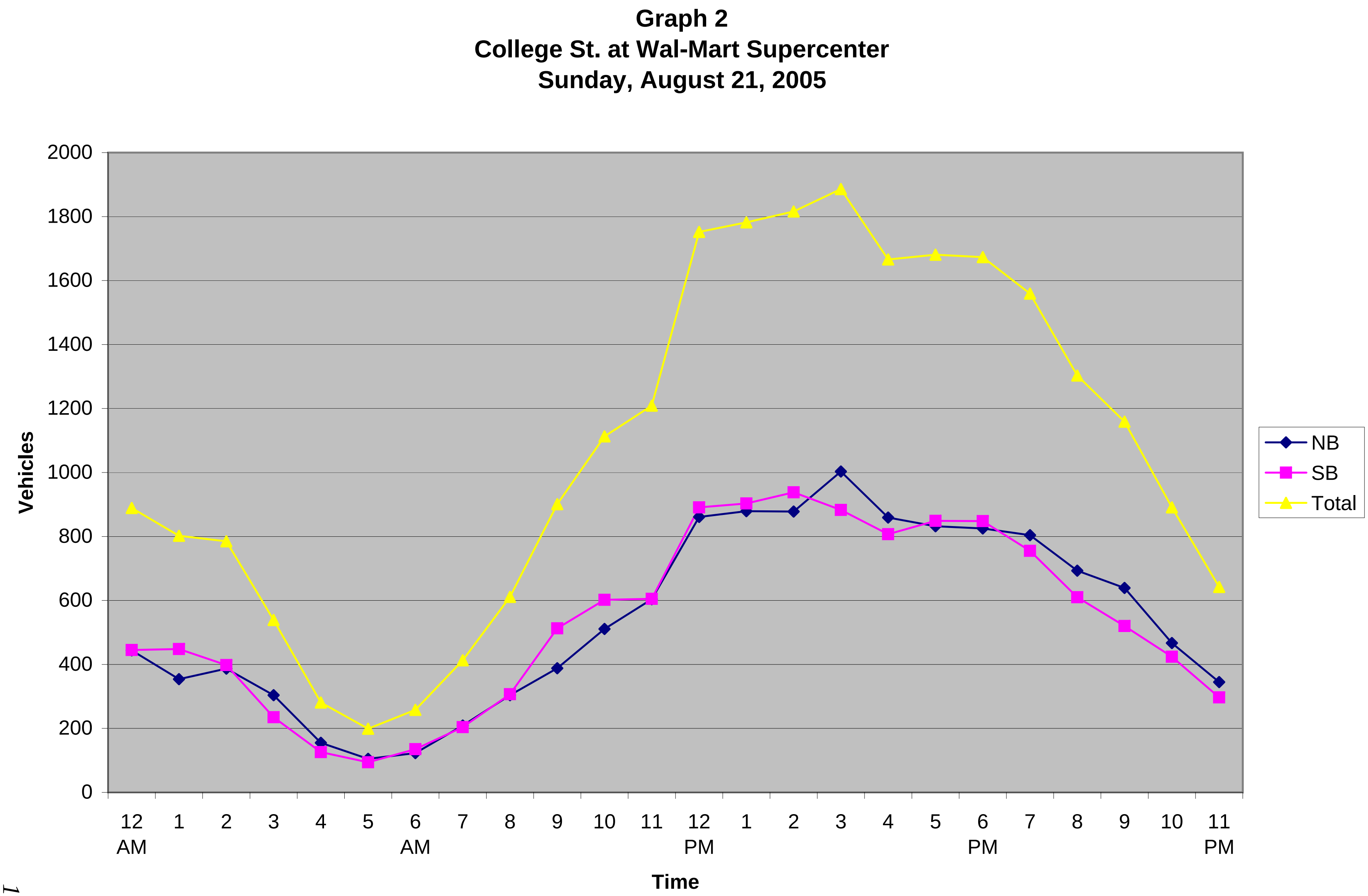
Hourly Traffic Flow Variations and Directionality

The machine traffic count data included in Appendix B was graphed to determine the variation in hourly traffic flow and the directionality of the traffic flow by hour. The graphs are presented as Graphs 1, 2, and 3, which depict hourly traffic volumes by direction for Saturday, August 20, 2005, Sunday, August 21, 2005, and Monday, August 22, 2005. All traffic counts were conducted such that Auburn University was in session but not during the week with a home football game.

While there are no general guidelines as related to hourly flow variation and directionality of traffic flow characteristics as related to the feasibility of providing coordination, there are general factors which can be examined to determine the nature of coordination should it be implemented. The following items summarize conclusions which can be drawn from the information shown in Graphs 1-3.

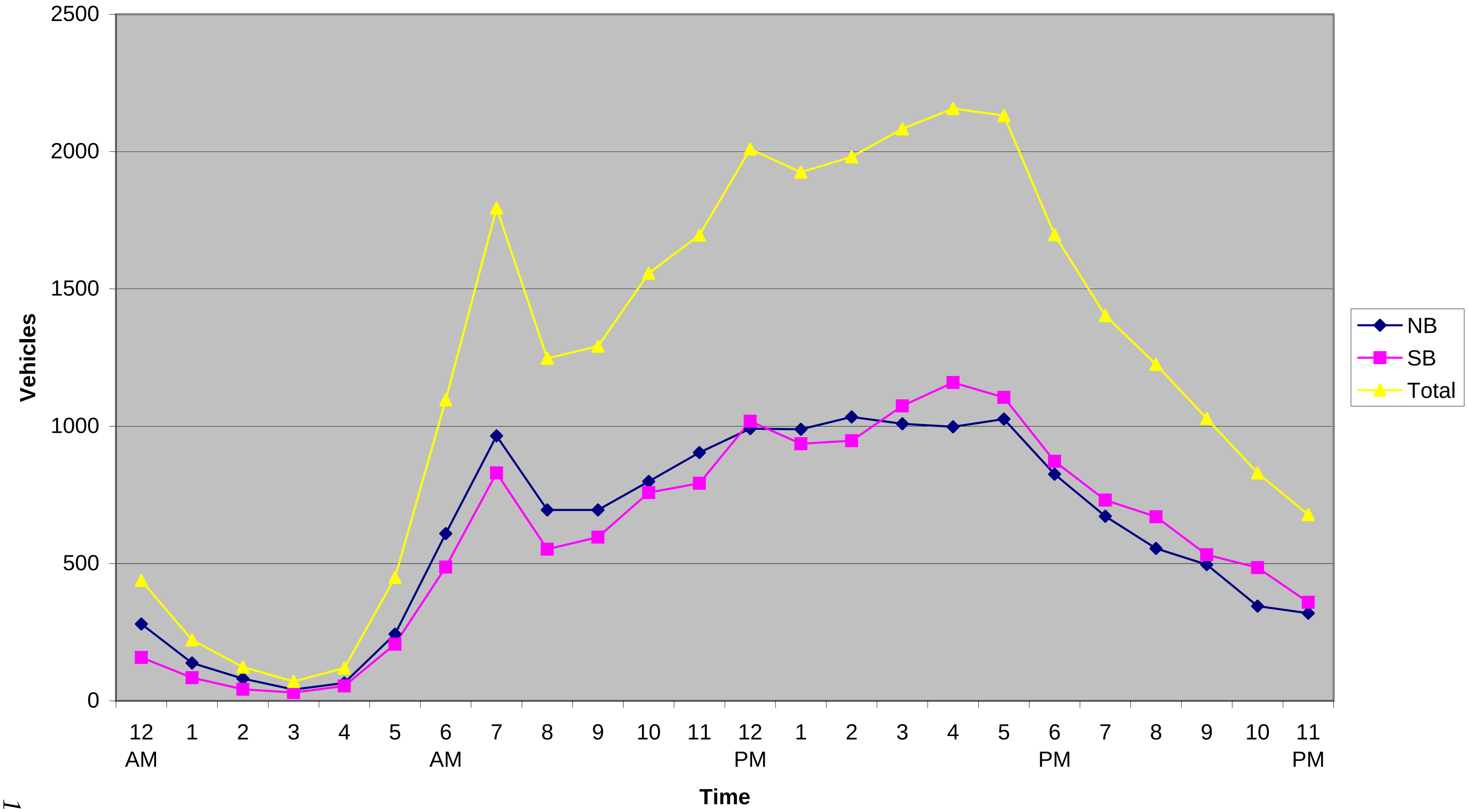
Graph 1
College St. at Wal-Mart Supercenter
Saturday August 20, 2005





Graph 2
College St. at Wal-Mart Supercenter
Sunday, August 21, 2005
Vehicles
2000
1800
1600
1400
1200
1000
800
600
400
200
0
12 AM
1
2
3
4
5
6 AM
7
8
9
10
11
12 PM
1
2
3
4
5
6 PM
7
8
9
10
11 PM
Time
NB
SB
Total

Graph 3
College St. at Wal-Mart Supercenter
Monday, August 22, 2005



Saturday. Traffic rises steadily on Saturday beginning at 6:00 a.m. and peaks from 12:00 noon to 3:00 p.m. Traffic then decreases slowly until 6:00 p.m., and then decreases more rapidly until 4:00 a.m. There is only a very short time, perhaps from 3:00 a.m. to 6:00 a.m., where traffic flow is low enough to indicate "free" operation of traffic signals which would otherwise be coordinated. There is no significant directionality in traffic flow on Saturday.

Sunday. The shape of the traffic curve for Sunday is similar to that for Saturday. Sunday exhibits a sharp rise in traffic at 12:00 noon, and a more pronounced rate of decrease in traffic from 6:00 p.m. until 4:00 a.m.

Monday. Traffic rises sharply on Monday (and by inference, on all weekdays), beginning at 5:00 a.m., with a sharp spike in traffic at 7:00 a.m. Directionality northbound is approximately 10% higher than southbound during the a.m. peak period. There is a lull in traffic around 8:00 to 9:00 a.m., and then traffic rises steadily, peaking from 12:00 noon to 5:00 p.m. There is a favored southbound directionality of approximately 10% during the p.m. peak period Traffic then decreases steadily from 6:00 p.m. to 2:00 a.m. There is a period of time, perhaps from midnight to 5:00 a.m., where traffic flow is low enough to indicate "free" operation of traffic signals which would otherwise be coordinated.

Historical Growth in Traffic

Historical traffic counts as available from the Alabama Department of Transportation for South College Street in the study area were collected and analyzed for the years 1994 to 2004. Three count stations are included in the study area:

- South College Street south of Donahue Drive;
- South College Street south of East University Drive; and
- South College Street north of Interstate 85.

The data from these three count stations was analyzed to determine the historical rate of growth of traffic on South College Street. This information is included in Table 2. As shown in Table 2, South College Street has experienced a significant increase in traffic at all three count stations during the period 1994 to 2004. The historical growth rate in traffic has been between 8 and 13 percent per year. Traffic growth on an average highway in an urbanized area in the State of Alabama is generally 2 to 4 percent.

While there are no general rules about the rate of traffic growth as related to the feasibility of establishing a coordinated signal system, this analysis indicates that traffic can be expected to grow on South College Street at an accelerated rate if the trends continue. And the greater the traffic volumes, the greater will be the need for coordination of traffic signals.

Table 2
Historical Traffic Count Analysis

Year	***Average Annual Daily Traffic Volumes - South College Street***					
	south of Donahue Dr.		***south of E. Univ. Dr.***		***north of I-85***	
1994	12,560	--	13,960	--	12,020	--
1995	14,090	12.2%	15,720	12.6%	14,070	17.1%
1996	14,110	0.1%	17,110	8.8%	15,190	8.0%
1997	14,910	5.7%	18,150	6.1%	16,560	9.0%
1998	15,070	1.1%	18,910	4.2%	16,580	0.1%
1999	19,560	29.8%	20,810	10.0%	18,450	11.3%
2000	18,710	-4.3%	21,180	1.8%	18,780	1.8%
2001	18,410	-1.6%	20,900	-1.3%	18,300	-2.6%
2002	21,420	16.3%	23,190	11.0%	20,440	11.7%
2003	22,550	5.3%	24,420	5.3%	21,620	5.8%
2004	22,550	0.0%	32,290	32.2%	22,070	2.1%
Overall Growth	***+8.0%***		***+13.1%***		***+8.4%***	

Percentage of Heavy Vehicles

The historical traffic count data collected from the Alabama Department of Transportation also included information on the percentage of heavy vehicles on South College Street in the study area. The three count stations had identical data. The truck percentage on a daily basis is 3 percent, and the truck percentage on a design hour basis is 2 percent. 50 percent of the trucks are classified as "Heavy". Therefore, during the peak hour, it can be anticipated that approximately 20 trucks will use South College Street. It should be noted that a truck percentage of 2 percent during the design hour is low when compared to typical State highways in urbanized areas, which may have 4 to 5 percent trucks.

Again, there are no general rules which relate the percentage of heavy vehicles to the feasibility of coordination of traffic signals. However, the more trucks on the roadway, the more difficult it is to coordinate traffic signals because of the difference in acceleration characteristics between passenger vehicles and trucks. Given that the heavy vehicle percentage is low on South College Street makes it a better candidate for implementation of a coordinated traffic signal system.

Number of Intervening Driveways and Side Streets

The 2000 *Highway Capacity Manual*, as published by the Transportation Research Board, shows that the ability to maintain travel speed on multi-lane highways is affected by access point density (see page 21-7). It is also true that as the number of access points increases between traffic signals, the less effective traffic signal coordination will be. There are five ranges established in the 2000 *Highway Capacity Manual*, for the density of access points per mile: 0, 10, 20, 30, and >40. The number of driveways and side streets intersecting South College Street between the Interstate 85 Northbound Ramps and Donahue Drive were counted and then the access density per mile was determined. The results are summarized in Table 3.

As shown in Table 3, the access point densities for each segment/direction of travel on South College Street in the study area all fall within the lowest two categories, except for the segment of South College Street from Longleaf Drive to Veteran's Boulevard, which falls in the third category. Therefore, the density of access points could be considered relatively low, thus making South College Street a better candidate for traffic signal coordination.

Table 3
Access Point Density

Segment	*Direction of Traffic Flow*	*Number of Accesses*	*Length*	*Access Density*
I-85 NB Ramps to I-85 SB Ramps	Northbound	0	.19 miles	0 per mile
	Southbound	0		0 per mile
I-85 SB Ramps to Veterans Blvd.	Northbound	3	.21 miles	14 per mile
	Southbound	2		10 per mile
Veterans Blvd. to Longleaf Dr.	Northbound	9	.75 miles	12 per mile
	Southbound	16		21 per mile
Longleaf Dr. to East University Dr.	Northbound	5	.34 miles	15 per mile
	Southbound	4		12 per mile
East University Dr. to Donahue Dr.	Northbound	8	.72 miles	11 per mile
	Southbound	3		4 per mile

<u>Ratio of Through to Turning Traffic Volumes</u>

The quality of progression on a roadway is impacted by the number of vehicles which make left and right turns at the traffic signals as opposed to continuing on straight through the intersection. This is true because coordinated signal systems are generally set up to optimize the green band for main street through vehicles and ignore progression for turning traffic. Table 4 presents an analysis which shows the ratio of turning traffic (left and right turns) to the through traffic at each intersection for the a.m. and p.m. peak hours of traffic flow. As shown in Table 4, there are several intersections where the ratio of turning vehicles to through vehicles is significant (as highlighted in yellow), including:

- South College Street at Interstate 85 Northbound Ramps (a.m. and p.m. peak hours);
- South College Street at Longleaf Drive (p.m. peak hour);
- South College Street at East University Drive (a.m. and p.m. peak hours); and
- South College Street at Donahue Drive (a.m. and p.m. peak hours).

This indicates that providing good coordination through these signals at these times of the day may be problematic.

Table 4
Ratio of Through to Turning Traffic

Intersection	Direction of Traffic Flow	AM Peak Hour		PM Peak Hour	
		Through %	Turning %	Through %	Turning %
I-85 NB Ramps	Northbound	68%	32%	66%	34%
	Southbound	43%	57%	49%	51%
I-85 SB Ramps	Northbound	89%	11%	97%	3%
	Southbound	68%	32%	78%	22%
Veteran's Blvd.	Northbound	92%	8%	92%	8%
	Southbound	91%	9%	87%	13%
Longleaf Dr.	Northbound	89%	11%	84%	16%
	Southbound	83%	17%	58%	42%
East University Dr.	Northbound	53%	47%	58%	42%
	Southbound	77%	23%	76%	24%
Donahue Dr.	Northbound	51%	49%	59%	41%
	Southbound	89%	11%	87%	13%

Mid-Block Generated Traffic

Similar to the impact of turning traffic at the signalized intersections, traffic which is generated by the side streets and driveways on South College Street will also have a negative impact on the ability to coordinate traffic flow. While it was not possible to perform traffic counts at all side streets and driveways in the corridor limits within the confines of this study effort, an assessment of the order of magnitude of mid-block generated traffic can be determined by the difference in traffic volumes (frequently known as the "delta") between the signalized intersections. Table 5 shows the difference in traffic volumes between each study intersection for each direction of traffic flow for the a.m. and p.m. peak periods. Links where the difference indicated significant mid-block activity are highlighted in yellow. As shown in Table 5, the only link where there is not a significant contribution of mid-block generated traffic is between the two Interstate 85 ramps.

Table 5
Difference Due to Mid-Block Traffic Generation

Northbound			***Southbound***		
Link	***AM***	***PM***	***Link***	***AM***	***PM***
I-85 NB Ramps to I-85 SB Ramps	-7	-2	Donahue Dr. to East University Dr.	-2	-42
I-85 SB Ramps to Veteran's Blvd.	-81	+27	East University Dr. to Longleaf Dr.	+75	+75
Veteran's Blvd. to Longleaf Dr.	+118	+97	Longleaf Dr. to Veteran's Blvd.	-22	-22
Longleaf Dr. to East University Dr.	-67	+116	Veteran's Blvd. to I-85 SB Ramps	+16	+16
East University Dr. to Donahue Drive	+48	+79	I-85 SB Ramps to I-85 NB Ramps	-3	-3

Natural Cycle Compatibility

When traffic signals run in an uncoordinated, or "free", mode, the cycle length varies from phase to phase. However, over the course of a given period of time, typically one hour, the lengths of each cycle can be averaged. This is known as the "natural cycle". If traffic signals are coordinated, and the cycle length is not close to the natural cycle length, then one of two things occurs:

- if the coordinated cycle length is significantly greater than the natural cycle, then the side street and left turn movements experience increased delay; or

- if the coordinated cycle length is significantly less than the natural cycle, then queue failures will occur.

Table 6 shows the natural cycles for each study intersection for the a.m. and p.m. peak hours of traffic flow as calculated using the Synchro 6 software models prepared for this study. As shown in Table 6, during the a.m. peak period, the majority of the traffic signals operate at natural cycles in the 60 to 75 second range, except for the intersection of South College Street at the Interstate 85 northbound ramps, which operates at a natural cycle of 110 seconds. During the p.m. peak hour, there is wide variety and range of natural cycle lengths, from 60 seconds to 140 seconds.

Table 6
Natural Cycle Lengths

Intersection	*Natural Cycle Length*	
	AM Peak	*PM Peak*
I-85 NB Ramps	110 secs.	110 secs.
I-85 SB Ramps	75 secs.	75 secs.
Veteran's Blvd.	60 secs.	60 secs.
Longleaf Dr.	75 secs.	90 secs.
East University Dr.	75 secs.	140 secs.
Donahue Dr.	65 secs.	65 secs.

Intersection Delay

The Synchro 6 model runs were used to determine the average delay in seconds per entering vehicle that is experienced in the a.m. and p.m. peak periods without coordination and subsequently if coordination is implemented. The delays with coordination assume a cycle length of 110 seconds during the a.m. and p.m. peak periods It should be noted that the results of coordination timings are preliminary and do not necessarily represent what would be implemented in the field. Table 7 presents the results of the delay calculations.

Table 7
Intersection Delay Comparison

Intersection	*AM Peak Hour*			*PM Peak Hour*		
	Uncoordinated	*Coordinated*	*Difference*	*Uncoordinated*	*Coordinated*	*Difference*
I-85 NB Ramps	16.4 secs.	21.1 secs.	+4.7 secs.	16.8 secs.	22.6 secs.	+5.8 secs.
I-85 SB Ramps	9.3 secs.	8.7 secs.	-0.6 secs.	8.3 secs.	9.2 secs.	+0.9 secs.
Veteran's Boulevard	7.5 secs.	4.4 secs.	-3.1 secs.	8.6 secs.	7.1 secs.	-1.5 secs.
Longleaf Drive	17.2 secs.	17.9 secs.	+0.7 secs.	35.1 secs.	32.0 secs.	-3.1 secs.
E. University Drive	21.8 secs.	23.5 secs.	+1.7 secs.	58.3 secs.	55.8 secs.	-2.5 secs.
Donahue Drive	10.6 secs.	13.6 secs.	+3.0 secs.	17.8 secs.	19.7 secs.	-1.9 secs

As shown in Table 7, no intersections experience undue delay during the a.m. peak period, and coordination would provide no significant benefit or detriment to intersection delay. However, during the p.m. peak hour, two intersections experience significant delay (Longleaf Drive and East University Drive), and coordination would provide no significant benefit or detriment to intersection delay.

Arterial Speeds and Levels of Service

The Synchro 6 model was used to analyze the impact to travel speeds and arterial levels of service on South College Street with the implementation of a coordinated traffic signal system. The results of the analyses are included in Appendix C and are summarized in Table 8.

As shown in Table 8, coordination of the traffic signals would provide a small benefit to travel speeds and levels of service on South College Street during the a.m. and p.m. peak periods of traffic flow.

Table 8
Arterial Speeds and Levels of Service

Time Period	*Operation*	*Direction of Travel*	*Average Speed*	*Level of Service*
AM Peak Hour	Uncoordinated	Northbound	33.6 mph	C
		Southbound	32.0 mph	C
	Coordinated	Northbound	34.1 mph	B
		Southbound	34.8 mph	B
PM Peak Hour	Uncoordinated	Northbound	29.4 mph	C
		Southbound	25.6 mph	D
	Coordinated	Northbound	30.1 mph	C
		Southbound	27.7 mph	C

Prospective Green Bands and Progression Effectiveness

A preliminary analysis was performed to estimate the potential green bands which could be experienced on South College Street with the implementation of a coordinated traffic signal system. The analyses were performed assuming 110 second cycle lengths for the a.m. and p.m. peak hours of traffic flow. The Synchro 6 software package was used to perform the analysis. Graphical depictions of the green bands are included in Appendix D. Effectiveness analysis of the possible green bands was also performed. In general, the following formula and criteria are used to evaluate the effectiveness of coordination:

Efficiency = ((band A + band B) / 2) / cycle

0.00 – 0.12	poor progression
0.13 – 0.24	fair progression
0.25 – 0.36	good progression
0.37 – 1.00	great progression

Table 9 displays the possible green bands during the a.m. and p.m. peak hours of traffic flow and calculations of the efficiency of progression.

Table 9
Prospective Green Bands and Progression Effectiveness

AM Peak Hour				*PM Peak Hour*			
Northbound Band	***Southbound Band***	***Cycle Length***	***Efficiency***	***Northbound Band***	***Southbound Band***	***Cycle Length***	***Efficiency***
12 secs.	12 secs.	110 secs.	11%	17 secs.	17 secs.	110 secs.	15%

As shown in Table 9, only "poor" progression can be anticipated during the a.m. and p.m. peak periods with the implementation of a traffic signal system the entire length of South College Street through the study area. However, it should be noted that efficiencies could be anticipated to be much higher if signal systems were implemented through only a portion of the traffic signals.

Synchro Coordinatability Factor

The Synchro 6 software has a feature called "Coordinatability Analysis" which is an empirical calculation to determine the measure of desirability for implementing traffic signal coordination. This measure combines many of the aspects already addressed in this study as "scores", which when added, provide a number out of 100 which expresses the desirability for coordination. The analysis is performed on a link-by-link basis. The factors which are included in the coordinatability analysis include:

- the travel time between intersections;
- the amount of queue storage space between intersections as related to the anticipated queue;
- the proportion of traffic which occurs in a platoon;
- the main street traffic volume;
- comparison of the natural cycle length of the signal with the natural cycle lengths of the signals on either side.

All these factors are summed together to derive the coordinatability factor.

The results of the coordinatability analyses are included in Appendix E and are summarized in Table 10.

Table 10
Coordinatability Factors

Segment	*Coordinatability Factor*		*Coordination Recommendation*
	AM Peak	*PM Peak*	
I-85 NB to I-85 SB	74	66	Definitely Recommended
I-85 SB to Veteran's Blvd.	85	85	Definitely Recommended
Veteran's Blvd. to Longleaf Dr.	32	32	Probably Not Recommended
Longleaf Dr. to E University Dr.	79	60	Definitely Recommended
E University Dr. to Donahue Dr.	39	50	Probably Not Recommended

Traffic Signal Equipment Compatibility

An inventory of existing traffic signal equipment was performed by the Consultant for all traffic signals in the study area. Of the six traffic signals, five are controlled by Eagle EPAC 300 controllers. One traffic signal (at Longleaf Drive) is controlled by a Naztec 900 controller. All six controllers are capable of time base coordination, and the Eagle controllers are capable of time base coordination that is compatible with the Naztec controller. However, the Eagle controllers are not capable of communication with the Naztec controller in a master controller situation.

However, if a time base signal system is implemented and includes the intersection of Longleaf Drive, it is recommended that the Naztec controller be replaced with an Eagle EPAC 300 controller so that only one software package is needed for upload/download data to all the controllers in this system. If a master controller based signal system is implemented, all controllers will have to be the same manufacture/model. It should be noted that the signal system on College Street from Mitcham Avenue to Samford Avenue is composed of Eagle EPAC 300 controllers as well.

Possible Future Traffic Signals

Currently, the only intersection proposed for signalization in the study limits know to the Consultant is the Wal-Mart driveway adjacent to Murphy Oil. This intersection is located 553 feet south of the Longleaf Drive intersection, and 3,422 feet north of the Veteran's Boulevard intersection. Based on this information and the other findings of this report, the following observations and recommendations can be made:

- installation of a new signal for the Wal-Mart driveway should be strongly discouraged due to proximity of the intersection to the existing traffic signal at Longleaf Drive;
- if a new traffic signal is installed for the Wal-Mart driveway, it should definitely be coordinated with the existing traffic signal at Longleaf Drive; and
- the presence of a new traffic signal at the Wal-Mart driveway would not affect any recommendations made regarding coordinating the signals at Longleaf Drive and Veteran's Boulevard due to the significant distance between the Wal-Mart driveway and the Veteran's Boulevard intersection.

Future Interconnect Options

In their current configuration, the six intersections in the study area cannot be interconnected. If the existing Naztec 900 controller at Longleaf Drive were changed out for an Eagle EPAC 300 controller, then the six signals would be compatible for interconnection.

The methods of interconnect commonly available and available at a reasonable price for this situation include the following options. These options are listed generally in order of ascending cost. Also, it should be noted that upon interconnection, a decision would also be required regarding the use of an on-street master controller or a more advanced centrally-controlled computer system.

Option 1 – Spread Spectrum Radio. Each cabinet could be equipped with a spread spectrum radio and an antenna placed on an adjacent traffic signal pole. It is possible that these six signals could communicate with the existing on-street master located at the Auburn municipal water tank, but a path profile analysis would be needed to make sure. The traffic signal controllers would need to be upgraded with an RS-232 port 3 card.

Option 2 – Hardwire Interconnect. A copper twisted-pair shielded interconnect cable could be run to each traffic signal, either aerially or underground. The traffic signal controllers would need to be upgraded with an FSK modem card.

Option 3 – Fiber Optic Interconnect. A single or multi-mode fiber optic interconnect line could be run to each traffic signal, either aerially or underground. The traffic signal controllers would need to be upgraded with fiber optic modems. This option has significant flexibility because the number of fibers to be installed could include future uses such as cameras, dynamic signs, or municipal functions.

Option 4 – IEEE 802.11g. This is emerging technology with limited traffic signal applications in the region. It is a line-of-sight radio system. The City of Montgomery has experimented with camera control using 802.11g technology, and the Alabama Department of Transportation has also experimented with 802.11g technology for portable cameras for hurricane evacuation. The scheme the City of Montgomery is currently designing involves placing 802.11g repeaters on fire station radio towers.

There are other available interconnect options, including Ethernet, microwave, dial-up, andTCP/IP which would have similarities to the four primary options discussed above.

RECOMMENDATIONS

Based on the information presented in this report, the following recommendations concerning traffic signal coordination on South College Street from the Interstate 85 Northbound Ramps to Donahue Drive are offered for consideration to the City of Auburn:

1. Replace the existing Naztec 900 controller at the intersection of South College Street at Longleaf Drive with a new Eagle EPAC 300 controller with a port 3 suitable for a spread spectrum radio.

2. Implement a time base coordination traffic signal system on South College Street between Longleaf Drive and East University Drive.

3. Implement a time base coordination traffic signal system on South College Street between the Interstate 85 Northbound Ramps and Veteran's Boulevard.

4. Perform a path profile analysis for the spread spectrum radio mounted on the Auburn municipal water tank to the six traffic signal locations included in this study.

5. Upgrade the cabinets at the six intersections and the Eagle EPAC 300 controllers to allow for spread spectrum communication. Set up the existing MARC 360 on-street master at the water tank for these signals if the path profile analysis is favorable. Otherwise, perform additional path profile analyses to determine the appropriate location for a new MARC 360 on-street master.

6. Be ready to implement traffic signal coordination timing on South College Street from the Interstate 85 Northbound Ramps to Donahue Drive within the next five years.

7. Do not install a traffic signal at the existing unsignalized intersection accessing the Wal-Mart adjacent to the Murphy Oil.

8. Evaluate future traffic signal requests in the study area in the light of the impact that they will have on traffic signal progression.