

<p><i>Title</i></p> <p>Traffic Study Spout Springs Road Intersection Improvements Hall County, GA</p>	
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<p><i>Summary</i></p> <p>Hall County is planning to make cost effective improvements along Spout Springs between Hog Mountain Road and the Braselton City Limits. The improvements will consist of shoulder improvements and turn lanes at intersections. This report contains recommendations for turn lanes and minor safety improvements. A signal warrant study was also conducted at Elizabeth Lane intersection.</p> <p>Recommended improvements include (with Spout Springs assumed NB/SB):</p> <ol style="list-style-type: none"> 1. Adding NB through Lane at Hog Mountain Road. 2. Widening Spout Springs to provide NB left at Oak Ridge Drive. 3. Add SB left at Ivy Springs Drive. 4. Add NB left, SB right and EB right at Capitola Farm Road. 5. Add NB right and WB right and extend SB left at Elizabeth Lane. 6. Install Traffic Signal at Elizabeth Lane. 7. Widen Spout Springs between Elizabeth Lane to 3 lane section south to Flowery Branch High School SB left turn lane. 8. Extend Looper Lake Drive to intersection Spout Springs Road and terminate the north and south Piney Grove Church intersections with Spout Springs Road. 9. Add SB left at Spout Springs Elementary School main driveway. 10. Add SB left at Spout Springs Elementary School bus driveway. 11. Widen Spout Springs Road to a 3 lane section from elementary school to Union Circle. 12. Add SB left turn lane at Union Circle. 	

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INTRODUCTION

Wilburn Engineering has conducted this traffic study to identify intersection improvements for the Spout Springs corridor extending from Hog Mountain Road south to the Braselton City Limits (approximately 5 miles).

This study documents the development of traffic projections, capacity analysis and recommended improvements.

Project Location

Spout Springs Road runs generally in a north-south orientation between I-985 and SR 347 (Friendship / Thompson Mill Road). The project lies in southeast Hall County as illustrated in Figure 1 on the following page.

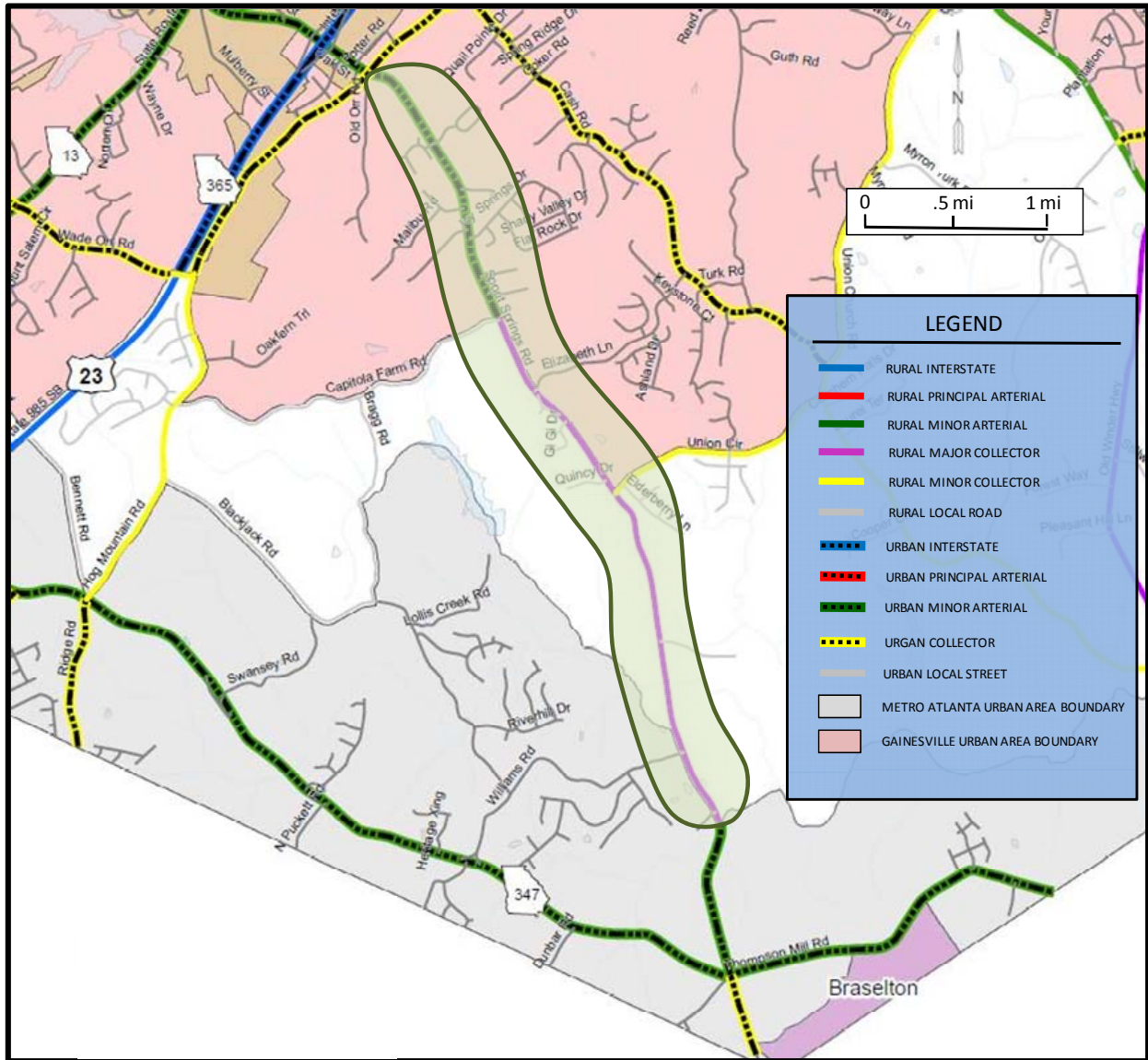
Figure 1: PROJECT LOCATION MAP



Study Area

Figure 2 shows the study area in detail. The intersections included in the study are indicated in Figure 2. The study also addressed Spout Springs Elementary School and the Flowery Branch High School located near Elizabeth Lane.

Figure 2: STUDY AREA MAP



EXISTING CONDITIONS

This section will summarize inventory data describing the current conditions such as roadway infrastructure, traffic volumes and traffic control in effect.

Roadway Infrastructure

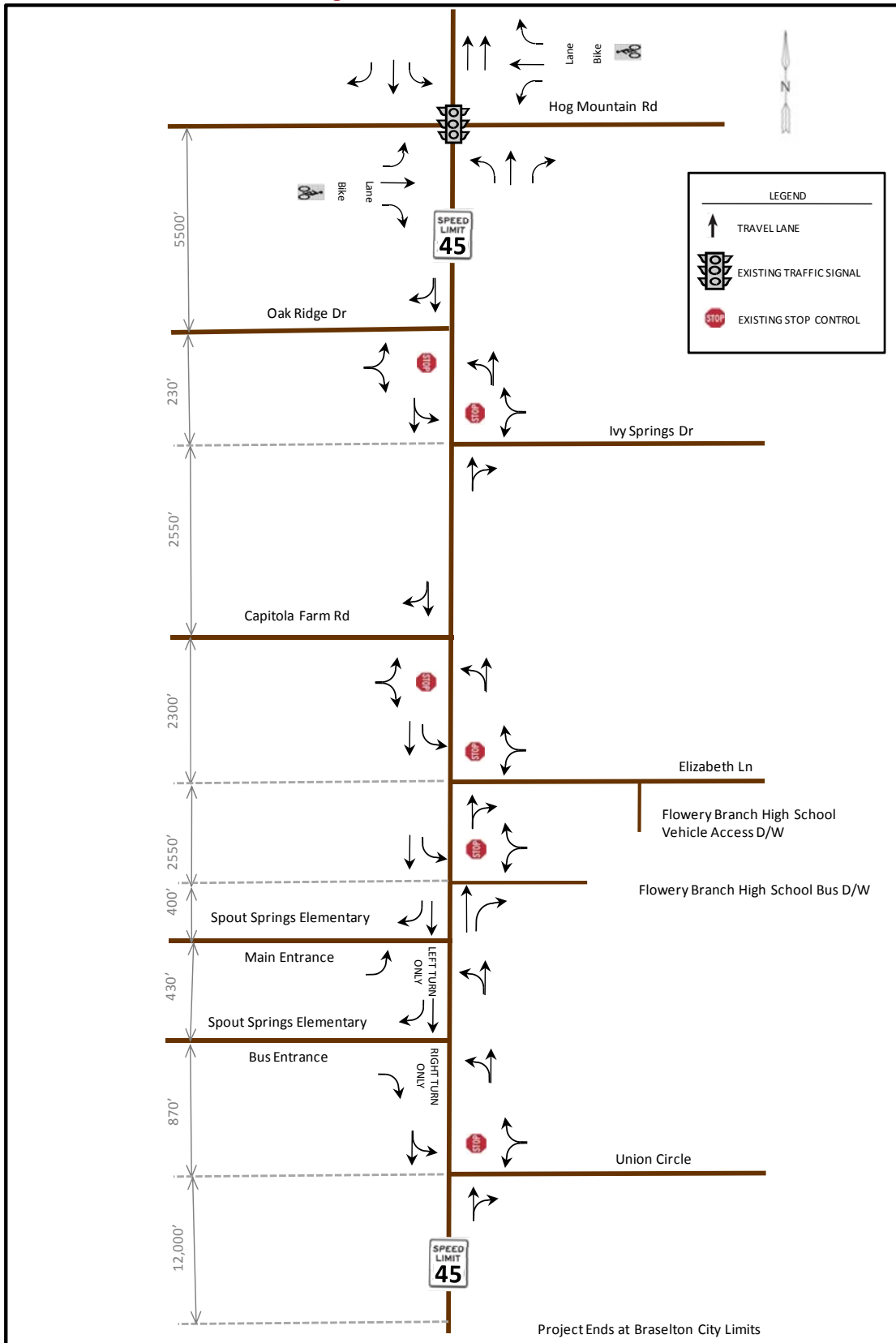
Spout Springs Road is a two-lane roadway with widening at select intersections to accommodate left and right turning lanes. The Georgia Department of Transportation (GDOT) classifies the section of Spout Springs Road from Hog Mountain Road to Capitola Farm Road as an Urban Minor Arterial. The section from Capitola Farm Road to the Braselton City Limit is classified a Rural Major Collector.

Spout Springs Road connects SR 13, I-985 just north of the project limits of Hog Mountain Road to SR 347 (Thompson Mill / Friendship Road and eventually I-85 just beyond the southern project limits and provides regional connectivity within the study limits via Hog Mountain Road, Capitola Farm Road, Elizabeth Lane and Union Circle. A photographic inventory of the study intersections is included in Appendix A.

The posted speed limit along the entire route within the study area is 45 MPH.

Figure 3 illustrates the existing roadway infrastructure and traffic control that serves the corridor.

Figure 3: EXISTING CONDITIONS

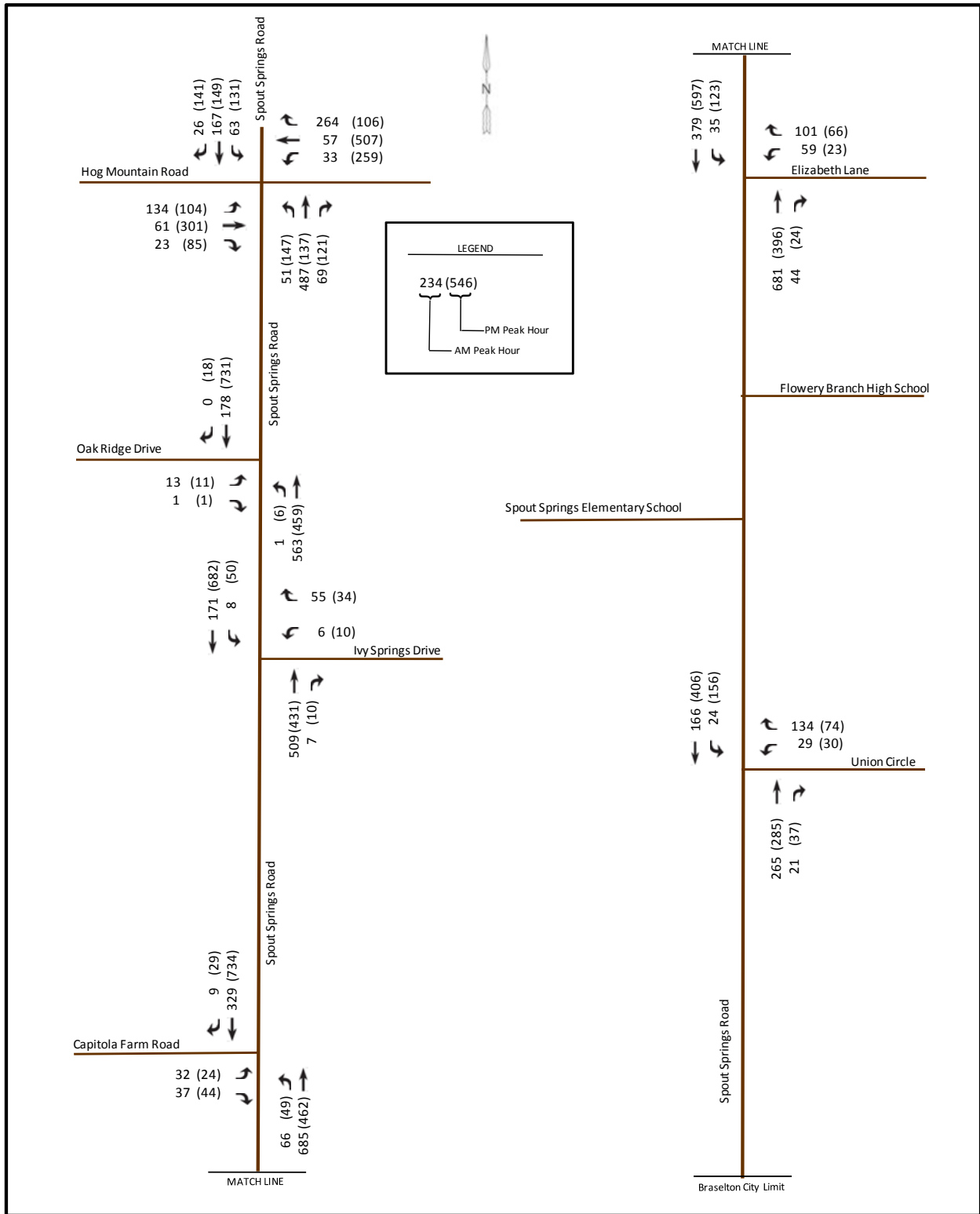


Existing Intersection Turning Movement Volumes

Turning movement counts for the major intersections within the study area were conducted in May and June 2009. Turning movement counts were conducted for the AM and PM Peak Periods. The intersections of Spout Springs Road at Capitola Farm Road and Elizabeth Lane were counted prior to school adjourning for the summer.

The existing turning movement volumes are summarized graphically in Figure 4 on the following page. For each movement, the AM Peak Hour Volume is given first followed by the PM Peak Hour Volume shown in parentheses. The detailed turning movement data is included in Appendix B. The counts collected at Capitola Farm Road and Elizabeth Lane were collected by count data boards that were not calibrated to daylight savings time (DST) and indicate being collected one hour earlier than actually collected. These times were corrected.

Figure 4: EXISTING PEAK HOUR TRAFFIC VOLUMES



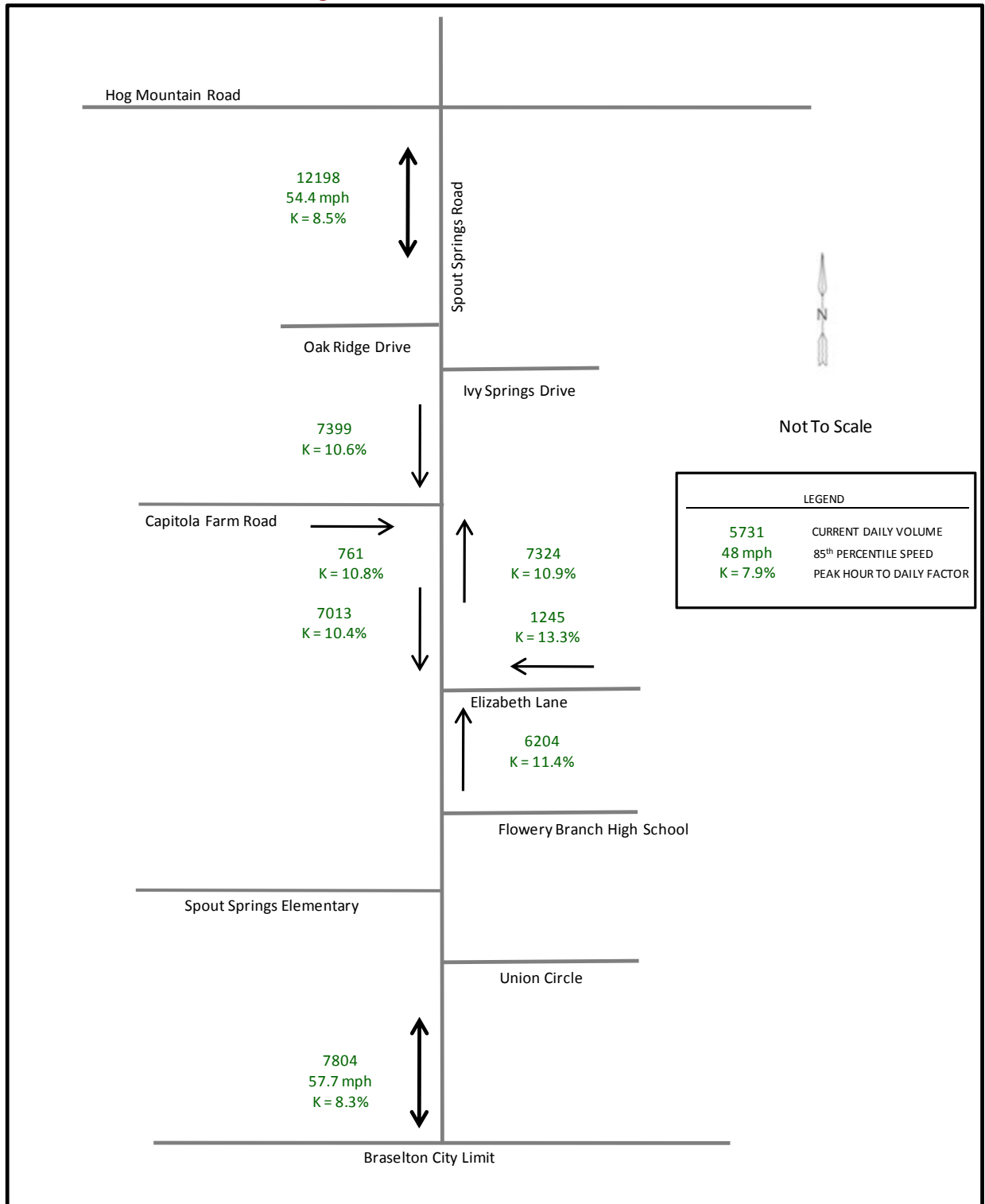
Existing Daily Traffic Volumes

Automatic Traffic Recorders (ATR) were set at four (4) locations in the study area by the Hall County Department of Public Works. The ATR machine counts collected 24-hour volume data. At two (2) of the four (4) locations, speed data was also captured.

The existing daily traffic volumes are illustrated in Figure 5 on the following page. Other existing data is also shown including: 85th percentile speed and calculated k factor (percentage of daily traffic occurring in peak hour). Detailed count data reports from the ATR counts are contained in Appendix C. The ATR machine counters were not calibrated to daylight savings time (DST), therefore summary spreadsheets were prepared to accommodate the time adjustment.

The current daily volumes were observed to be highest in the northern portion of Spout Springs Road (12,198) and gradually decrease to the lowest ADT of 7,804 in the southern section.

Figure 5: EXISTING DAILY TRAFFIC VOLUMES



CRASH HISTORY

Crash data for the study area was obtained from the Hall County Public Works Department. Table 1 summarizes the crash frequency along the corridor for the three year period from 2006 through 2008 and year to date for 2009. The totals given in Table 1 include all crashes between Hog Mountain Road and the Braselton City Limits.

Table 1: YEARLY CRASH FREQUENCY FOR SPOUT SPRINGS RD CORRIDOR

YEAR	TOTAL CRASHES
2006	10
2007	23
2008	12
2009	4

The crash data for the Year 2007 was analyzed in greater detail. A collision diagram was prepared to graphically show the location of each crash.

Figure 6, which is shown on the following four pages, contains a collision diagram for the study area.

A significant number of crashes involved the collision of two vehicles while one was making turning movement from or to Spout Springs Road. One accident occurred at the intersection of the Spout Springs Elementary school main driveway and involved an exiting vehicle having difficulty seeing past the cars queued in the southbound right turn lane entering the school.

Many of the rear end collisions occur with vehicles waiting to turn left at locations where no separate left turn lane exists. It may be desirable to provide either dedicated left turn lanes at selected locations or a two way left turn lane.

Figure 6: COLLISION DIAGRAM, 2007 CRASH DATA, Page 1 of 4

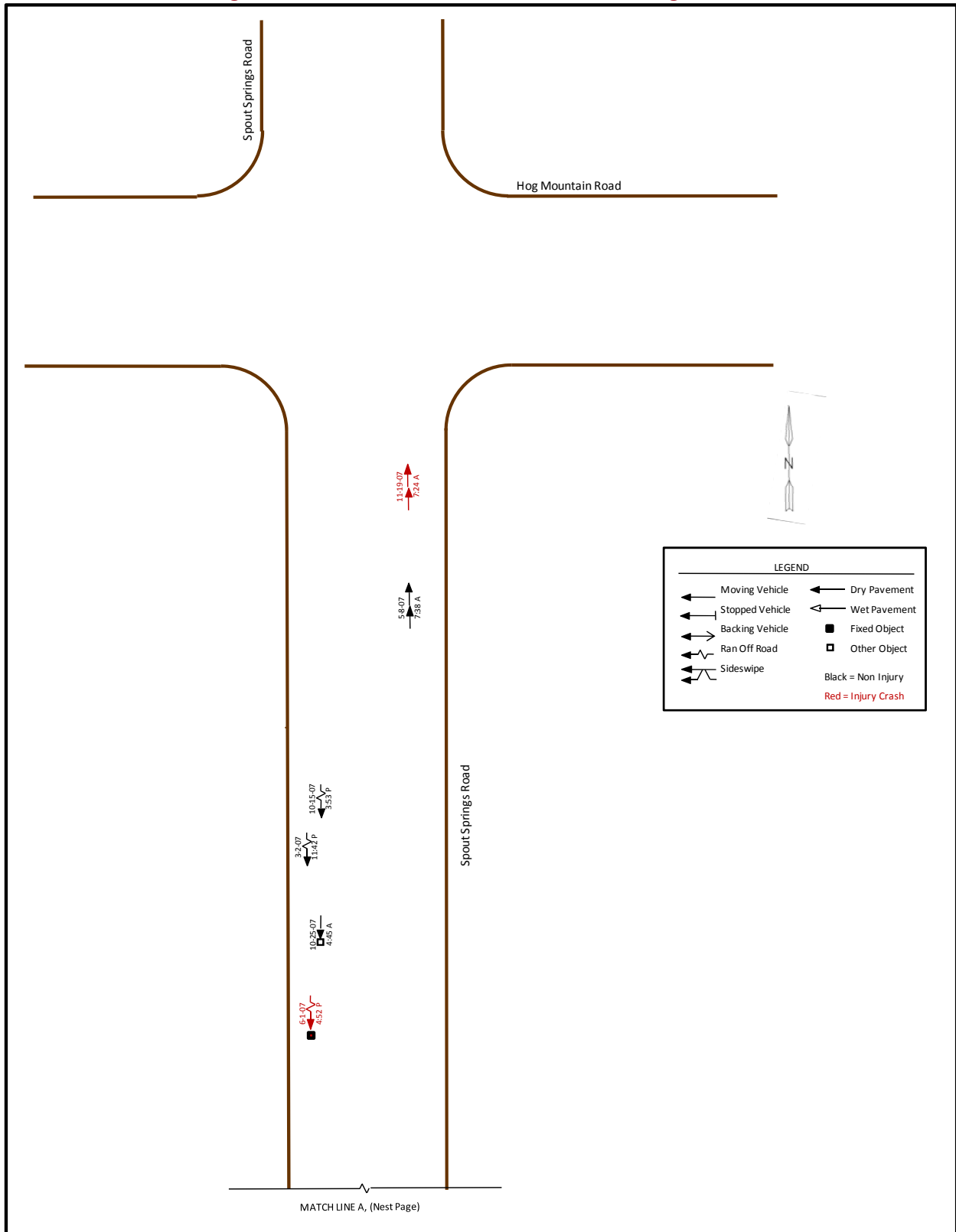


Figure 6: COLLISION DIAGRAM, 2007 CRASH DATA, Page 2 of 4

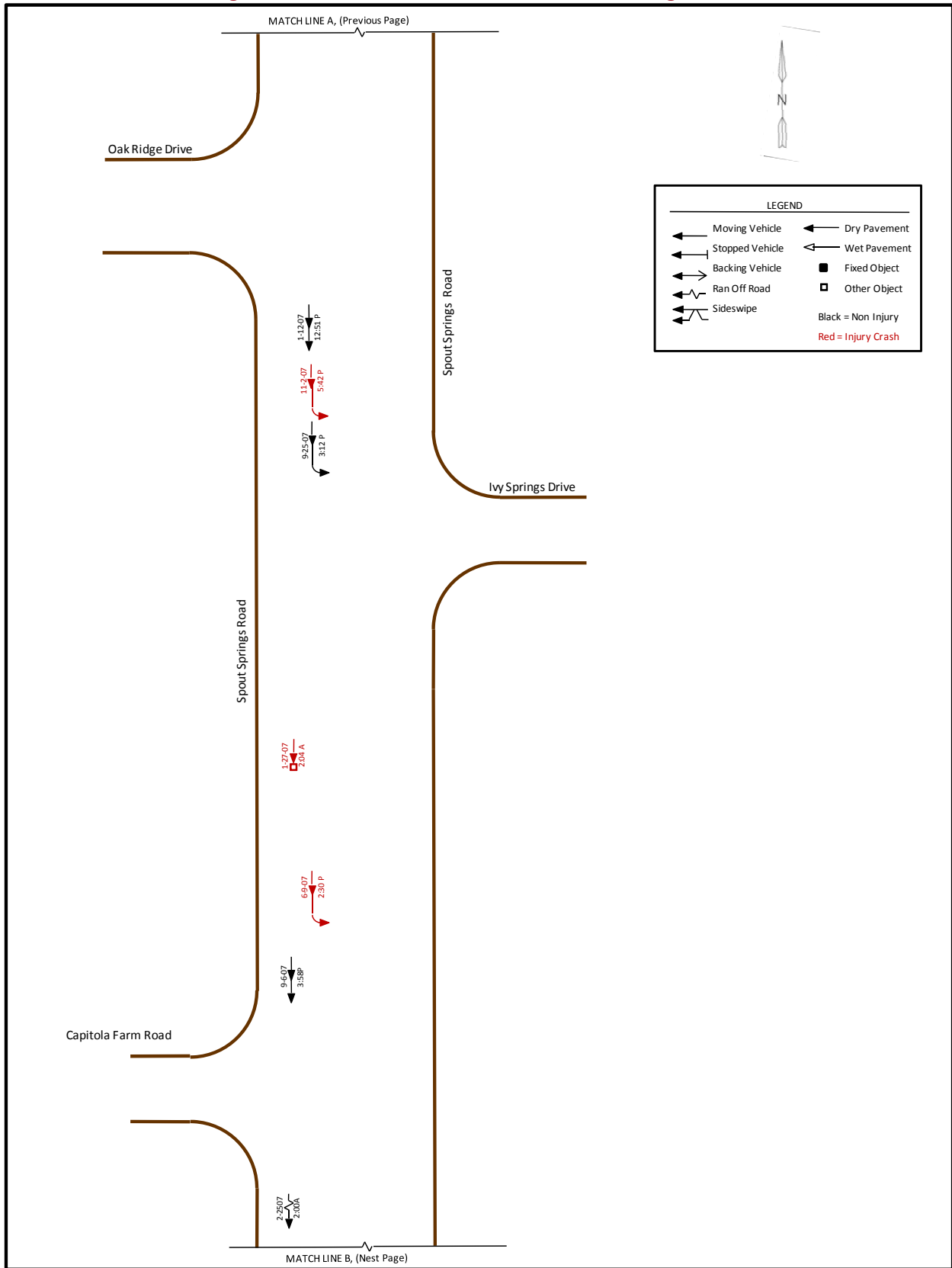


Figure 6: COLLISION DIAGRAM, 2007 CRASH DATA, Page 3 of 4

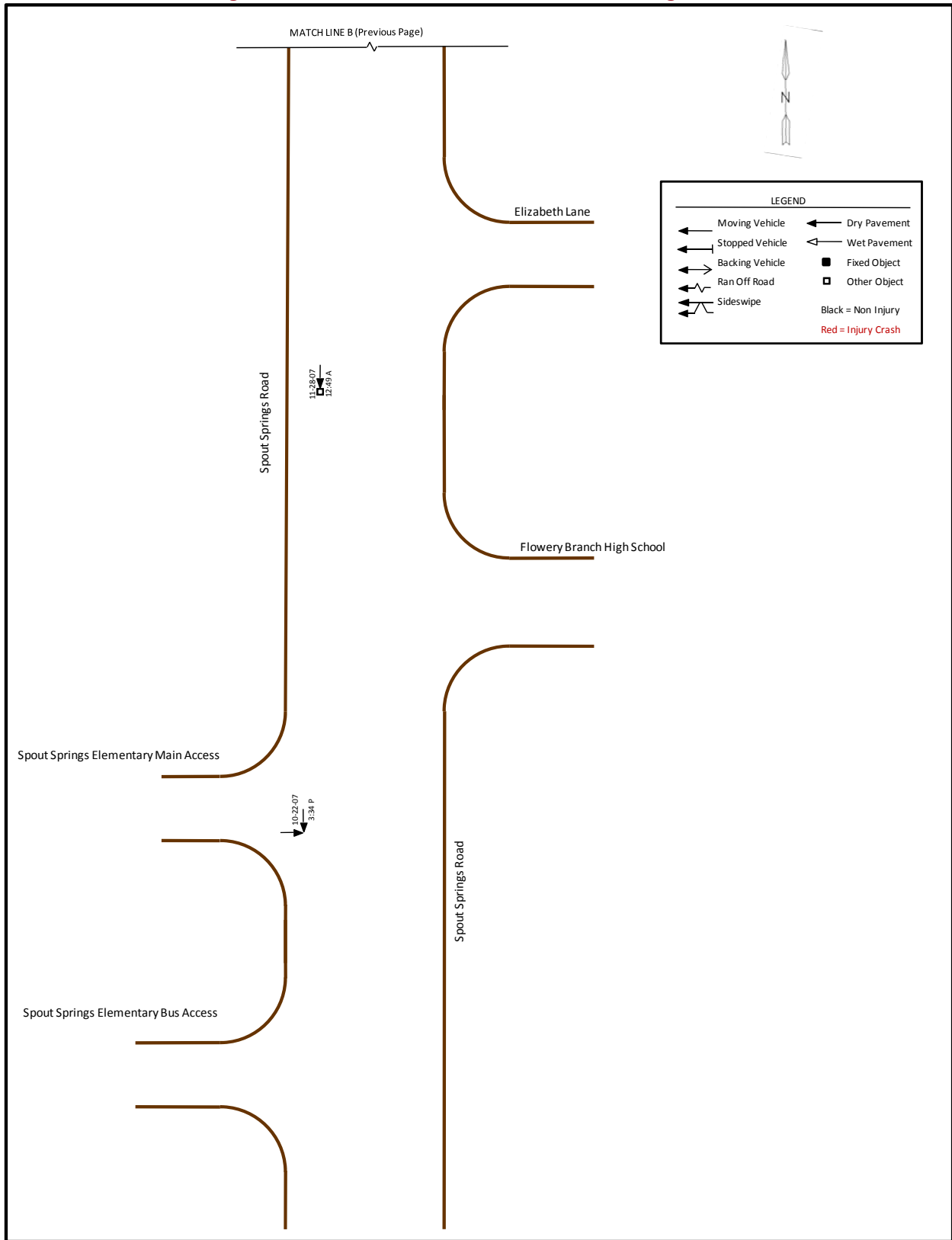
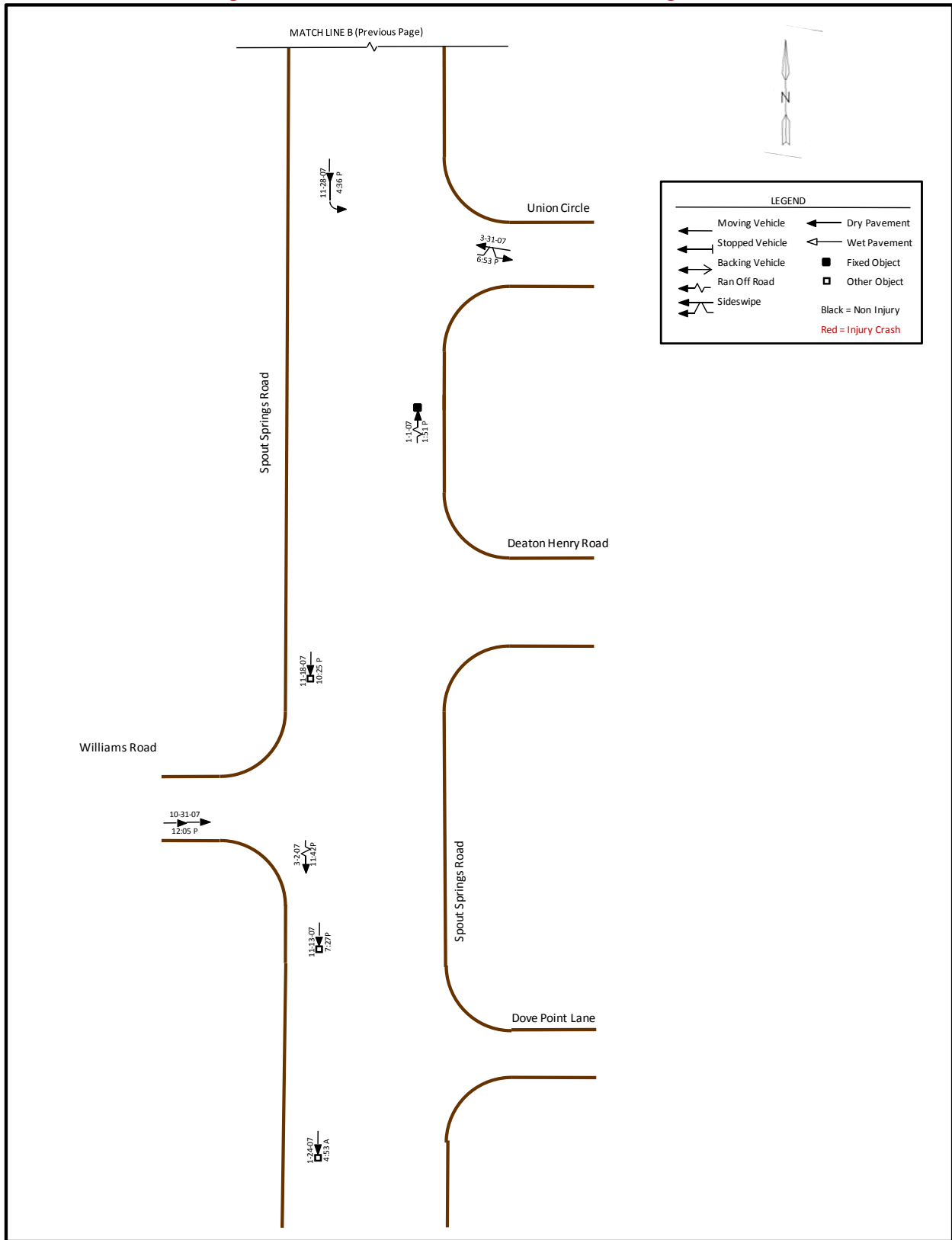


Figure 6: COLLISION DIAGRAM, 2007 CRASH DATA, Page 4 of 4



SIGHT DISTANCE EVALUATION

Sight distance was evaluated at the study intersections to report the current intersection sight distance conditions. The sight distance for a two lane road is the distance traveled at the posted speed limit during 7.5 seconds. At a posted speed limit of 45 mph desirable sight distance is 500 feet. Sight distance measurements are graphically illustrated in Figure 7.

Figure 7: SIGHT DISTANCE, Page 1 of 4

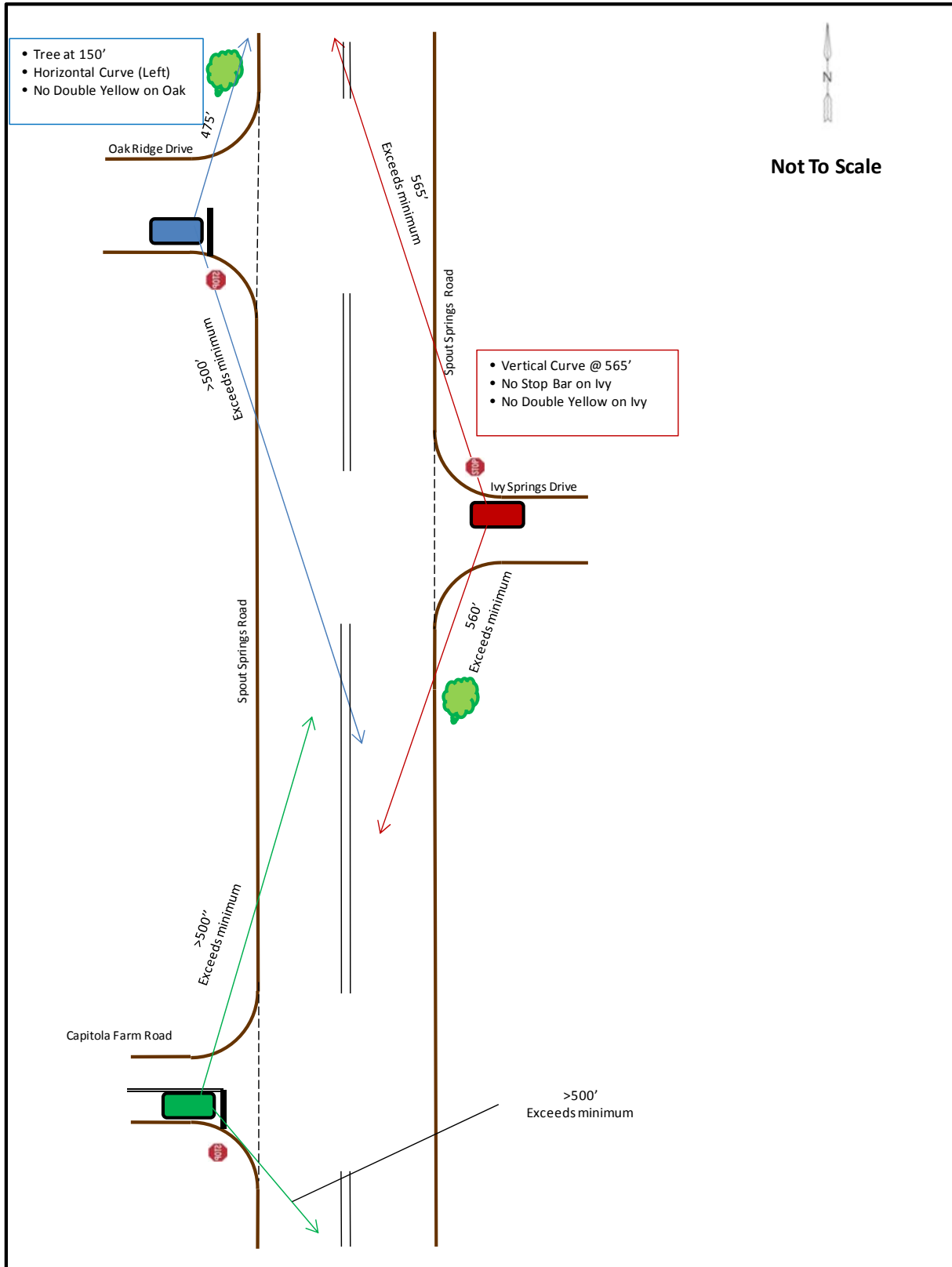


Figure 7: SIGHT DISTANCE, Page 2 of 4

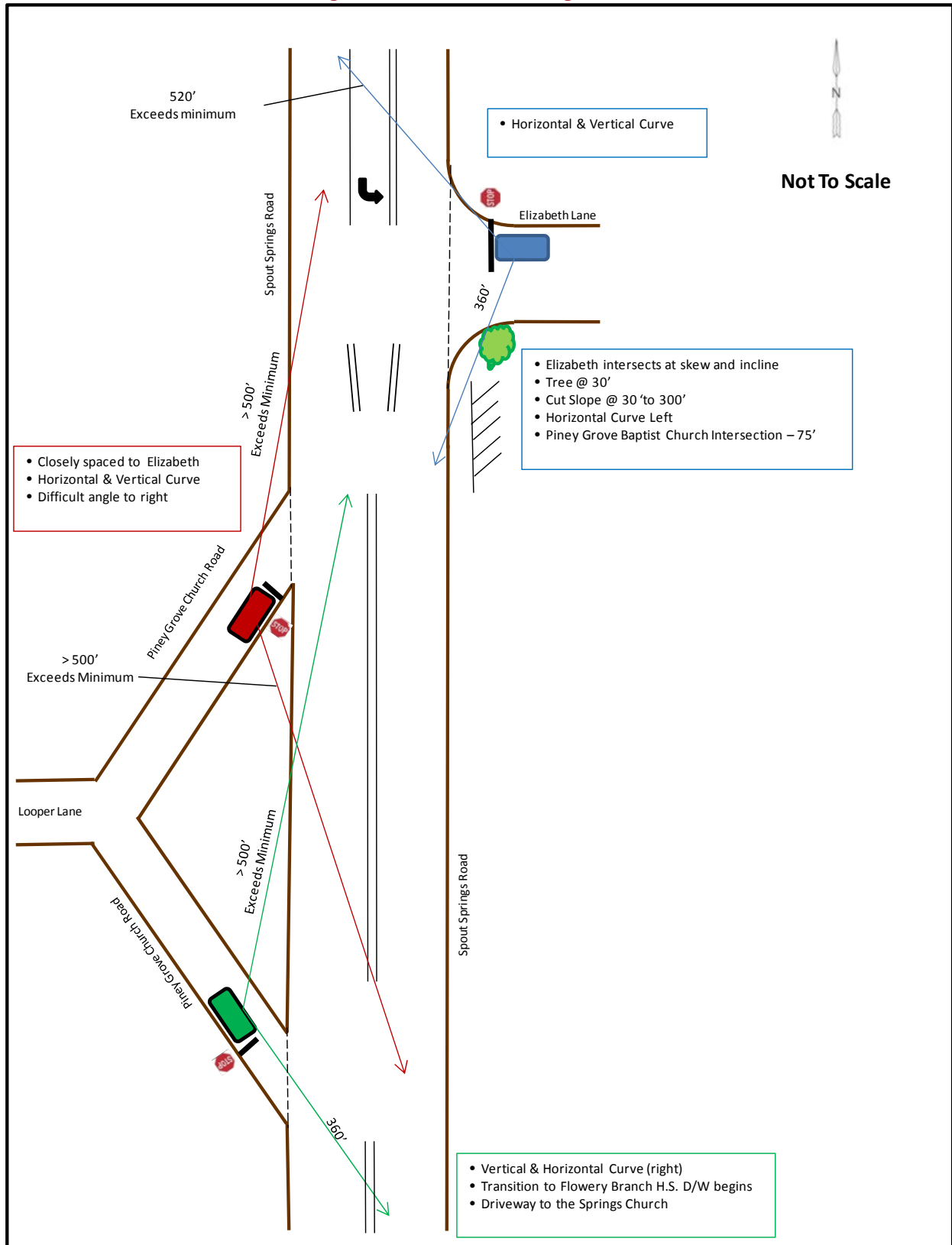


Figure 7: SIGHT DISTANCE, Page 3 of 4

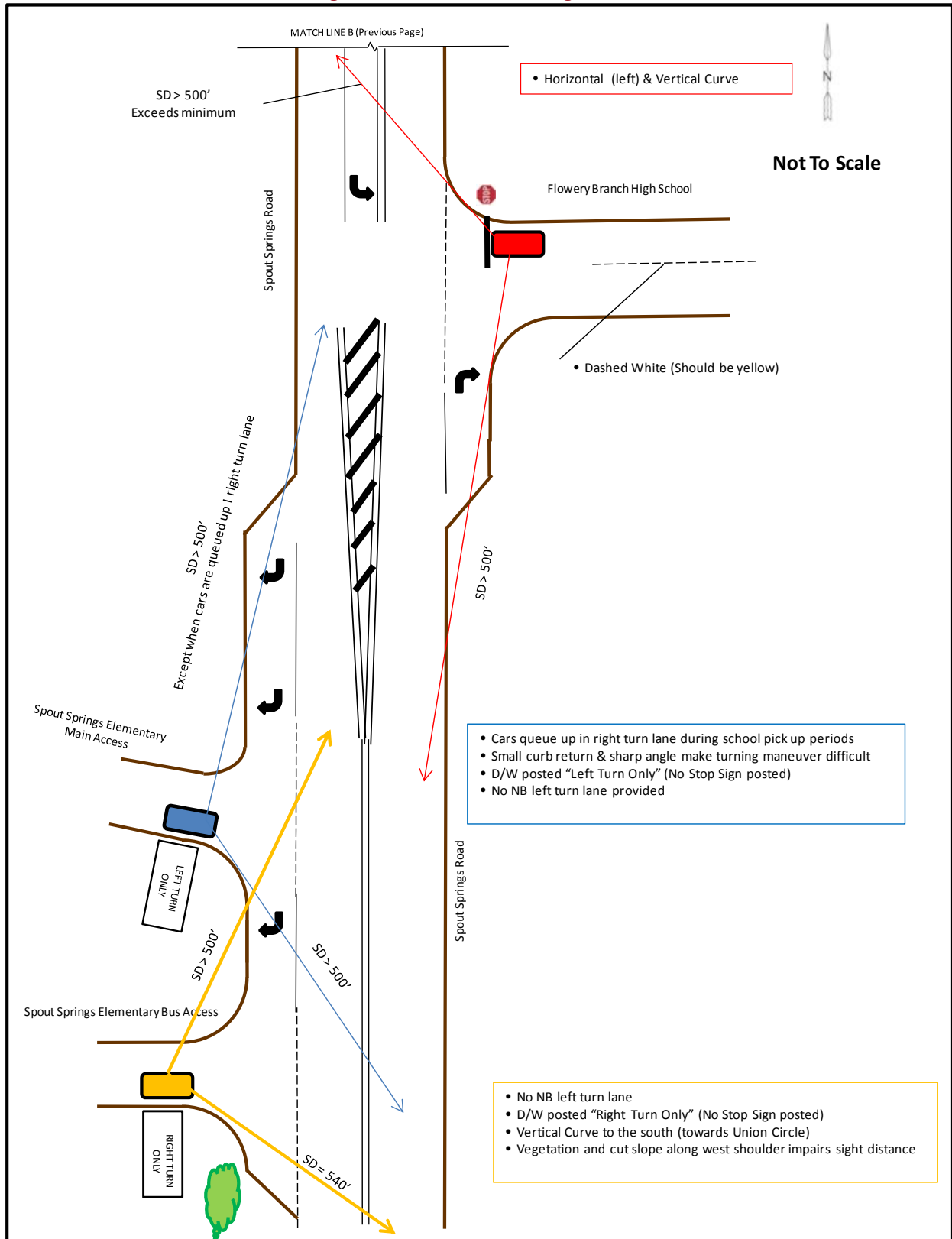
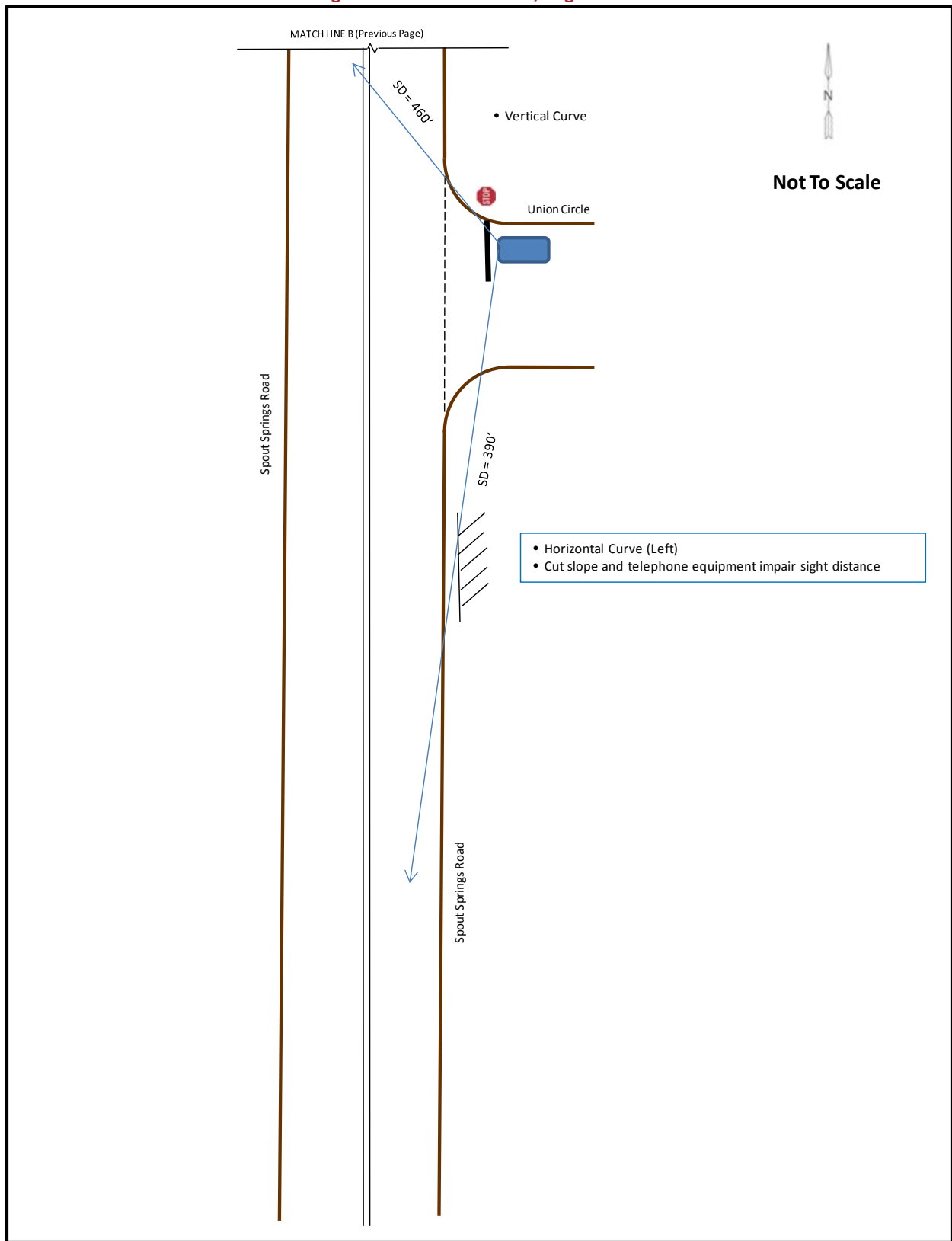


Figure 7: SIGHT DISTANCE, Page 4 of 4



TRAFFIC PROJECTION METHODOLOGY

The methodology used to estimate future traffic volumes began with an examination of historic trends and then considered forecasts obtained from the Gainesville Hall Metropolitan Planning Organization (GHMPO). Forecast were from the regional travel demand model maintained by the GDOT. The following sections describe the analysis of historic data and GHMPO forecasts.

Historic Traffic Data

GDOT maintains several annual traffic count stations in the vicinity of the project. These count stations were evaluated to determine an average overall growth rate in the area. The location of these stations is shown in Figure 8 on the following page. The raw data is available for review in Appendix D.

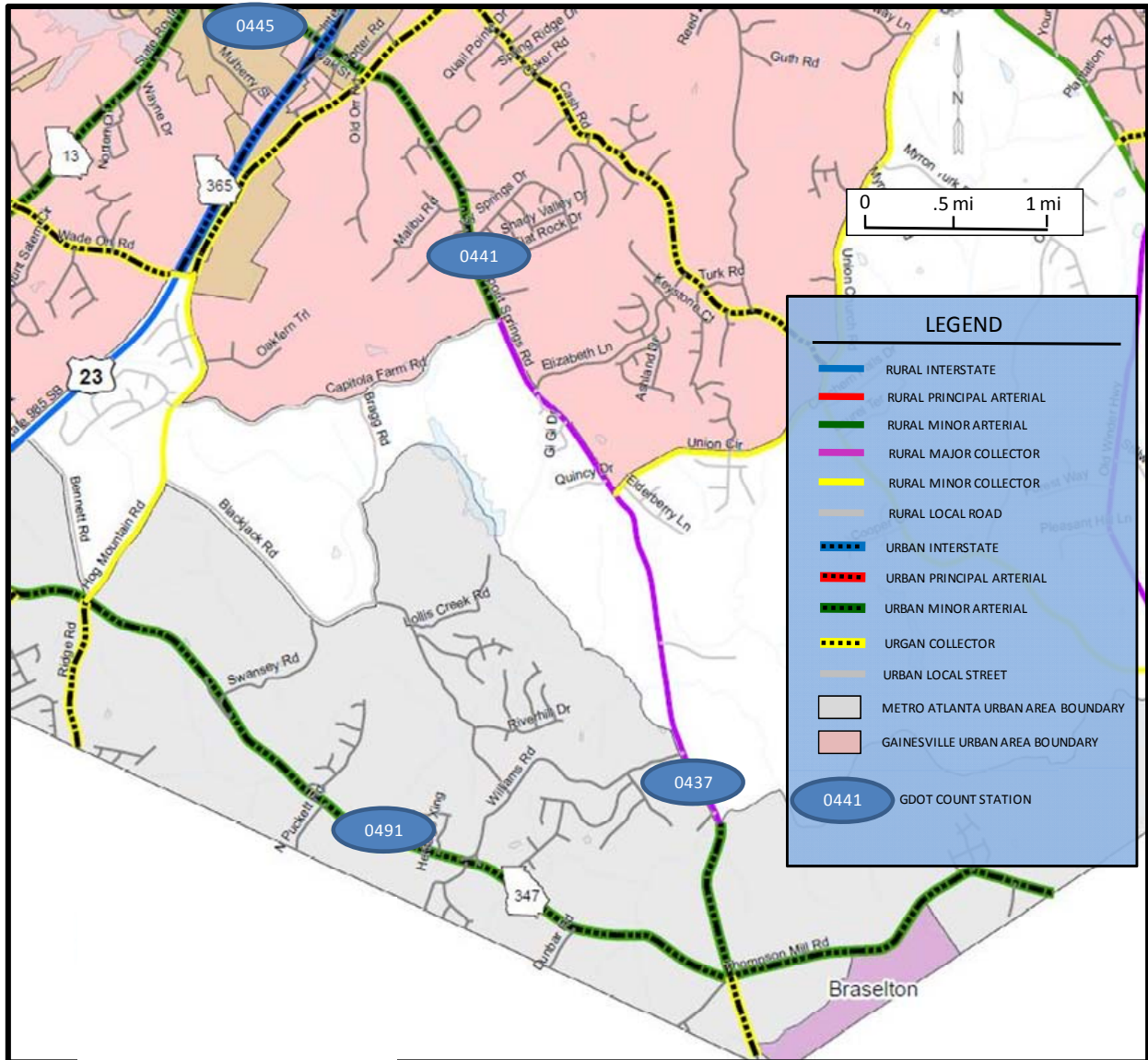
Table 2 summarizes the average annual daily traffic (AADT) reported by GDOT for each of the years 2002 through 2007. The average annual growth rate for the period between 2002 and 2007 is given for each station. The overall growth rate for all stations in the project vicinity is an average of 13.9% per year. Growth rates were calculated using simple (non-compounding) formulas.

Table 2: HISTORIC TRAFFIC GROWTH

Station	Local Road Name	Location	2002	2003	2004	2005	2006	2007	Overall Growth Rate
0437	Spout Springs Rd	South of Williams Rd	4,070	5,164	5,252	4,610	4,660	6,950	14.2%
0441	Spout Springs Rd	South of Ivy Springs Dr	5,057	9,086	9,253	8,350	11,910	12,250	28.4%
0445	Spout Springs Rd	North of I-985	7,305	8,177	4,599	7,930	7,380	8,380	2.9%
0491	SR 347 (Friendship Rd)	South of N. Puckett Rd	5,328	6,289	6,403	6,540	7,330	8,010	10.1%

The historic volume data indicates increasing traffic volumes at rates ranging between 2.9 and 28.4 % per year.

Figure 8: GDOT COUNT STATIONS



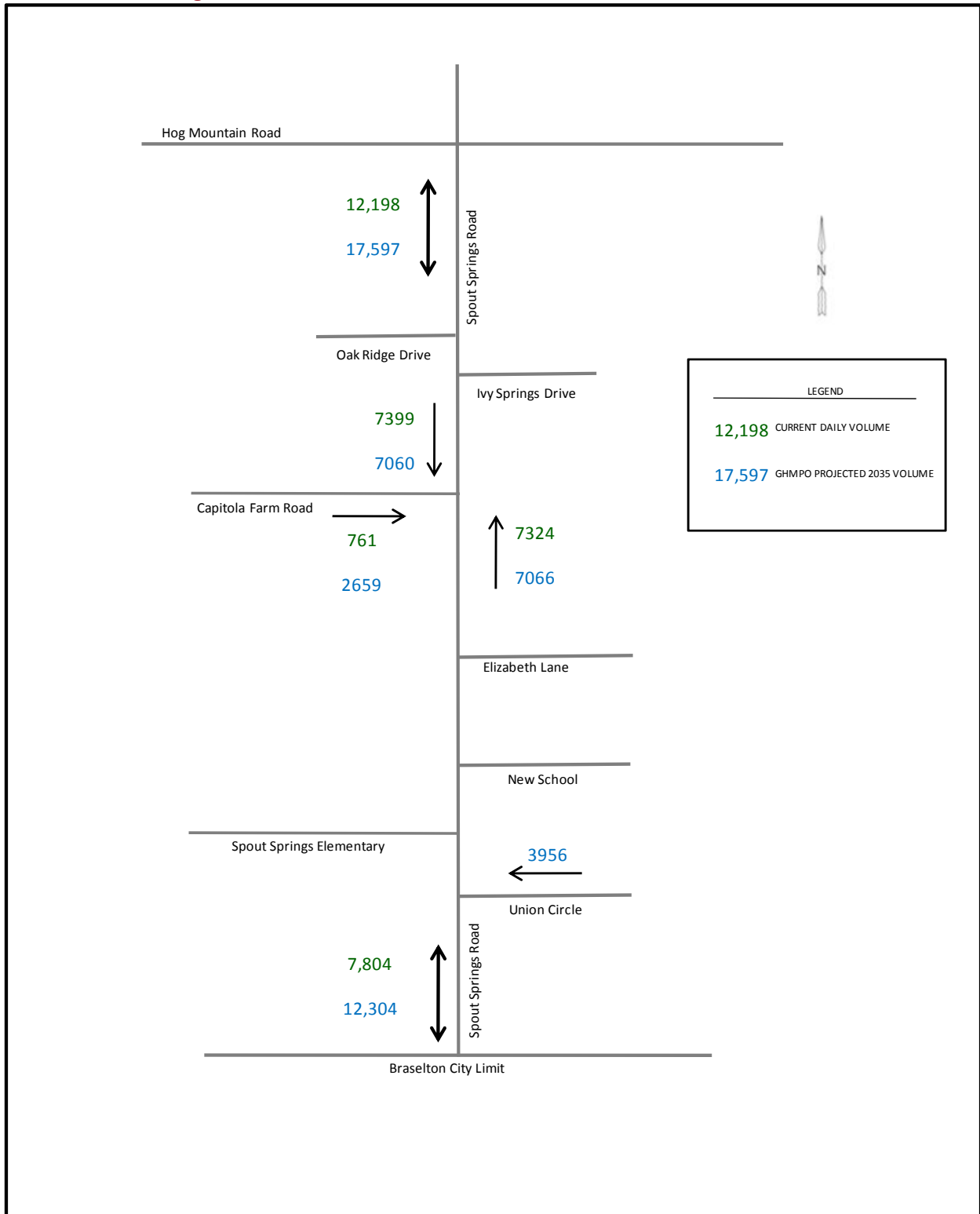
Gainesville Hall County Metropolitan Planning Organization Model (GHMPO)

Figure 9 on the following page shows the GHMPO Assignments and compares them to the existing traffic volumes. The GHMPO assignments are to the Year 2035 and assume that all planned improvements are constructed. Appendix E contains the network model data panels for the study area.

The GHMPO model is a regional macroscopic model and is not calibrated in a manner that allows it to project, with precision, the different volume levels along the corridor.

The traffic growth rates calculated using the GHMPO 2035 Forecasts in comparison to current volumes are 1.7% per year on the north section, -0.16% per year in the middle section, and 2.2% per year on the south section.

Figure 9: GHMPO MODEL AND EXISTING DAILY VOLUME COMPARISONS



Future Generated Traffic, New Flowery Branch High School

The new Flowery Branch High School is located southeast of Elizabeth Lane near Spout Springs Elementary School and will generate new trips along the corridor. The new high school is proposed to have a capacity of 1,800 students with an initial 1,500 students and will operate from 8:45 AM to 3:45 PM. Two access points are proposed; one on Spout Springs Road and one on Elizabeth Lane. During the hours when school is commencing and ending it is anticipated that bus traffic will utilize the Spout Springs Road access while student and administration traffic will utilize the Elizabeth Lane access.

New trips anticipated to be generated by the high school were estimated as shown in Table 3.

Table 3: EXPECTED TRIP GENERATION, ADJACENT STREET PEAK HOUR

ITE CATEGORY	ITE CODE	SIZE	UNIT	Daily			AM Peak Hour			PM Peak Hour		
				Total	In	Out	Total	In	Out	Total	In	Out
High School	530	1500	Students	2566	1283	1283	630	428	202	195	92	103
NEW TRIPS				2565	1283	1283	630	428	202	195	92	103

The new trips shown in Table 3 represent the time at which the adjacent street (Spout Springs Road) has its highest traffic volumes (AM and PM), which between 7 and 8 PM and 5 and 6 PM, respectively. However, the time at which the school generates its highest traffic volume is different from the adjacent street’s PM Peak Hour. This is because the school will be dismissed before the street’s PM peak hour. Table 4 shows the trips anticipated to be generated by the high school during the school’s peak hour of traffic generation.

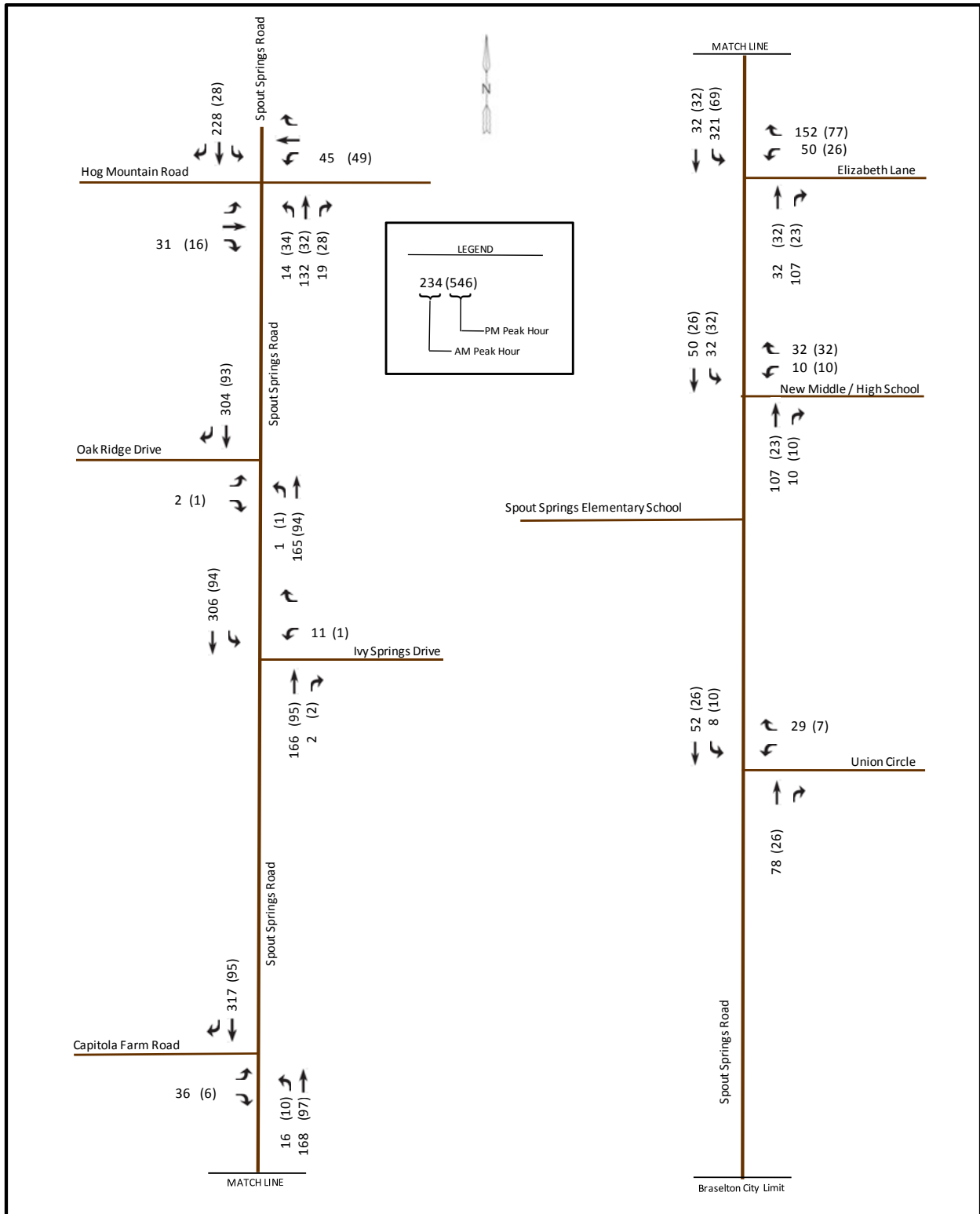
Table 4: EXPECTED TRIP GENERATION, PEAK HOUR GENERATOR

ITE CATEGORY	ITE CODE	SIZE	UNIT	PM Peak Hour		
				Total	In	Out
High School	530	1500	Students	435	144	291
NEW TRIPS				435	144	291

Figure 10 shows the anticipated distribution of the generated trips. The trips were distributed based on school board assessment of the schools service area with 75% to and from the north and 25% to and from the south.

Superimposing the trips generated by the new high school (Figure 10) onto the existing volumes (Figure 4) forms the Construction Year traffic volumes. Figure 11 illustrates these volumes.

Figure 10: PEAK HOUR TRIPS GENERATED FROM NEW FLOWERY BRANCH HIGH SCHOOL



Traffic Projections

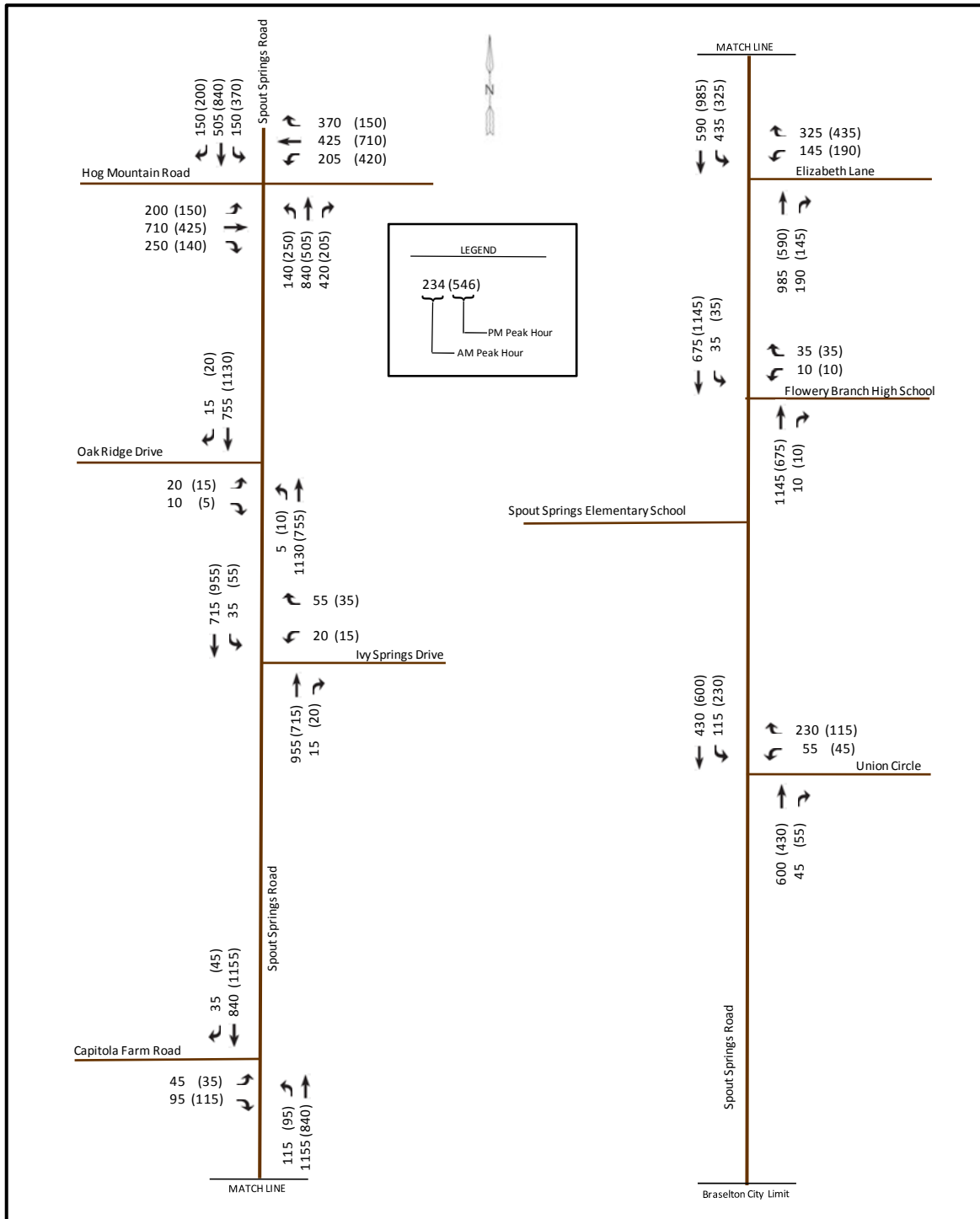
The following summarizes the traffic projection methodology used in this study. The projects identified are anticipated to be constructed by the end of this year (2009) or early 2010. Therefore the Construction Year will be 2010. The Design Year will be 2030. Based on the traffic growth information provided herein, the following conclusions are drawn:

1. The GDOT historical data shows an overall traffic growth rate of 13.9% per year.
2. The GHMPO Model indicates a growth rate of about 2% per year between now and the Year 2035.
3. Since a project to widen Spout Springs Road is anticipated within the next 20 year horizon, the lower of the two growth rates was selected for projecting the Design Year traffic volumes.
4. The Construction Year Volumes were developed by adding the generated volumes estimated for the new high school (Figure 10) to the existing traffic volumes (Figure 4).
5. The Design Year Volumes were projected by applying a factor of 1.4 to the Existing Volumes (Figure 4). The high school has a capacity of 1800 students (300 more than the opening day of 1500). The trips generated by 1800 students was calculated and superimposed onto the projected traffic to develop the Design Year Volumes.
6. The Construction and Design Year Volumes were balanced and rounded to nearest 5.
7. ADT volumes were estimated by dividing the Construction and Design Volumes by a factor of 10 percent.

PEAK HOUR TRAFFIC PROJECTIONS, DESIGN YEAR

Figure 12 illustrates the Design Year Peak Hour projections. Truck percentages are expected to remain constant from the current time throughout the design period.

Figure 12: PEAK HOUR VOLUMES, DESIGN YEAR

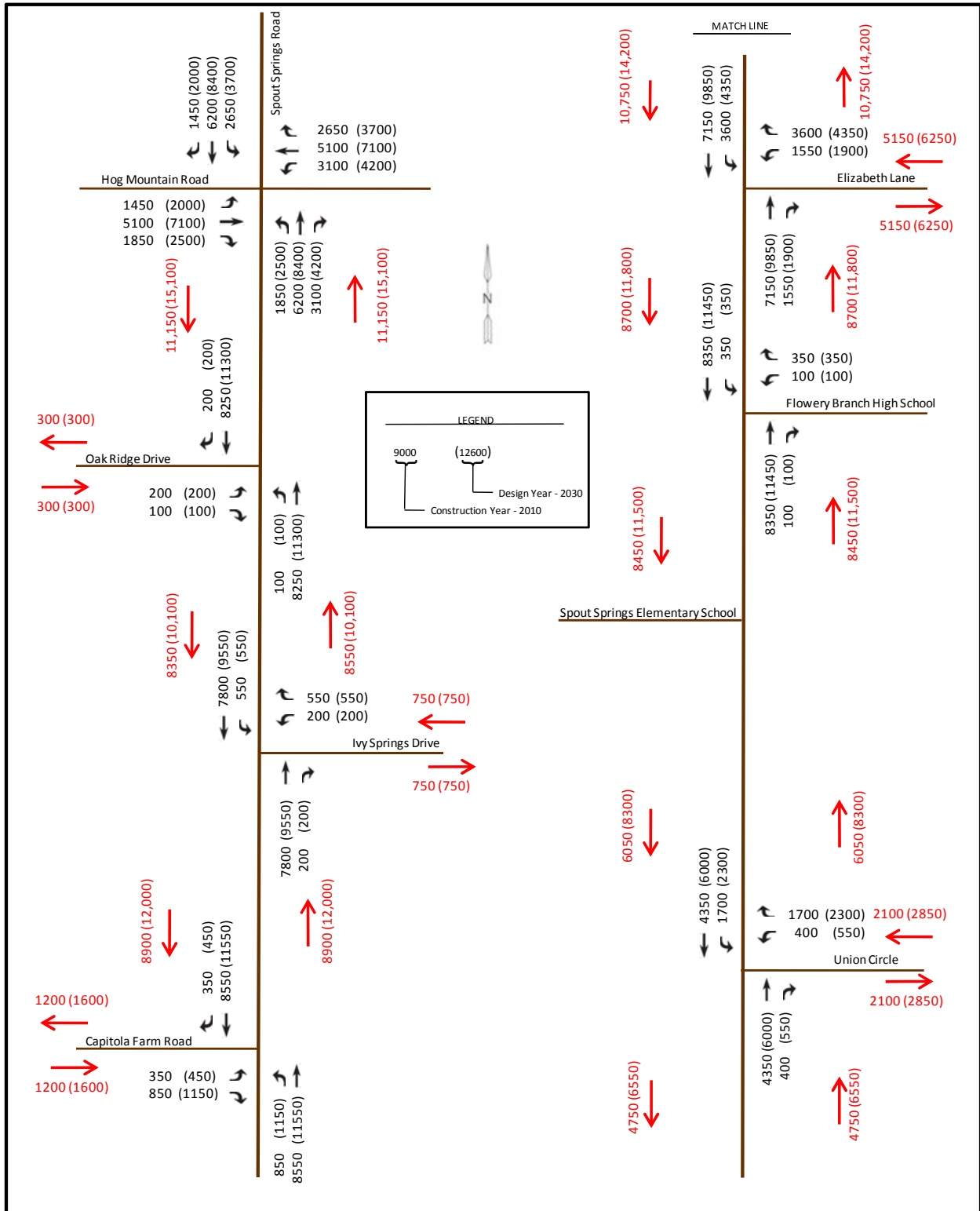


DAILY TRAFFIC PROJECTIONS

The projected daily traffic volumes are illustrated in Figure 13 on the following page. The daily volumes are shown for each turning movement. The Construction Year Volumes are shown first followed by the Design Year Volume in parentheses. The total directional volume is also provided for each section. Minor adjustments were made to achieve volume balancing. The ADT for each section can be derived by adding together the volumes for the two directions in that section.

The highest ADT anticipated occurs on the section near Hog Mountain Road which is projected to carry 30,200 vpd in the 2030 Design Year. The lowest ADT anticipated occurs on the section just south of Union Circle and is projected to carry 13,100 vpd in the 2030 Design Year.

Figure 13: DAILY VOLUMES, CONSTRUCTION AND DESIGN YEARS



CAPACITY ANALYSIS

Capacity analysis was used to evaluate both existing and projected traffic volumes. The *Synchro* program was used to conduct the capacity analysis. This program replicates the procedures outlined in the *Highway Capacity Manual 2000* (HCM) published by the Transportation Research Board.

The following reports from the *Synchro* analysis are contained in the appendices:

- Appendix F: Existing Volumes
- Appendix G: Construction Year Volumes
- Appendix H: Construction Year Volumes (with improvements)
- Appendix I: Design Year Volumes (with improvements)

Capacity analysis is shown for signalized intersections first followed by unsignalized intersections. Capacity analysis results for unsignalized intersections provide LOS given for minor movements that are required to yield to free flow movements. No overall intersection LOS is given for the unsignalized intersections. LOS for each scenario is shown followed by the estimated delay per vehicle in seconds.

Table 5 summarizes the results of the capacity analysis for the intersections studied under existing conditions. Table 6 summarizes the results of the capacity analysis for Construction Year (2010) volumes (with Flowery Branch High School open). Table 7 summarizes the results of the capacity analysis for Construction Year (2010) volumes (with Flowery Branch High School open) with recommended improvements.

Table 8 summarizes the results of the capacity analysis for the Design Year (2035) volumes with the recommended improvements.

Table 5: EXISTING LEVELS OF SERVICE, SIGNALIZED INTERSECTIONS

Intersection	AM Peak Hour	PM Peak Hour
Hog Mountain Road	C (20.8)	C (26.0)

Table 5: EXISTING LEVELS OF SERVICE, UNSIGNALIZED INTERSECTIONS

Intersection	Movement	Control	AM Peak Hour	PM Peak Hour
Oak Ridge Drive	EBL	Stop	B (12.8)	C (15.6)
	EBR	Stop	B (12.8)	C (15.6)
	NRL	Free	A (0.0)	A (0.2)
	NBT	Free	A (0.0)	A (0.4)
	SBT	Free	A (0.0)	A (0.0)
	SBR	Free	A (0.0)	A (0.0)
Ivy Springs Drive	WBL	Stop	C (15.9)	C (16.9)
	WBR	Stop	C (15.9)	C (16.9)
	NRT	Free	A (0.0)	A (0.0)
	NBR	Free	A (0.0)	A (0.0)
	SBL	Free	A (0.2)	A (1.1)
	SBT	Free	A (1.0)	A (1.7)
Capitola Farm Road	EBL	Stop	D (26.8)	D (30.0)
	EBR	Stop	D (26.8)	C (30.0)
	NBL	Free	A (1.2)	A (1.2)
	NBT	Free	A (2.0)	A (2.2)
	SBT	Free	A (0.0)	A (0.0)
	SBR	Free	A (0.0)	A (0.0)
Elizabeth Lane	WBL	Stop	E (40.3)	C (15.9)
	WBR	Stop	E (40.2)	C (15.9)
	NBT	Stop	A (0.0)	A (0.0)
	NBR	Free	A (0.0)	A (0.0)
	SBL	Free	B (10.4)	A (8.9)
	SBT	Free	A (0.0)	A (0.0)
Flowery Branch High School	WBL	Stop	N/A	N/A
	WBR	Stop	N/A	N/A
	NBT	Stop	N/A	N/A
	NBR	Free	N/A	N/A
	SBL	Free	N/A	N/A
	SBT	Free	N/A	N/A
Union Circle	WBL	Stop	B (14.3)	C (17.9)
	WBR	Stop	B (14.3)	C (17.9)
	NBT	Stop	A (0.0)	A (0.0)
	NBR	Free	A (0.0)	A (0.0)
	SBL	Free	A (0.3)	A (1.6)
	SBT	Free	A (1.7)	A (3.5)

Table 6: CONSTRUCTION YEAR (2010) LEVELS OF SERVICE, SIGNALIZED INTERSECTIONS

Intersection	AM Peak Hour	PM Peak Hour
Hog Mountain Road	E (55.0)	E (66.8)

Table 6: CONSTRUCTION YEAR (2010) LEVELS OF SERVICE, UNSIGNALIZED INTERSECTIONS

Intersection	Movement	Control	AM Peak Hour	PM Peak Hour
Oak Ridge Drive	EBL	Stop	C (18.3)	C (18.5)
	EBR	Stop	C (18.3)	C (18.5)
	NRL	Free	A (0.5)	A (0.5)
	NBT	Free	A (0.7)	A (0.8)
	SBT	Free	A (0.0)	A (0.0)
	SBR	Free	A (0.0)	A (0.0)
Ivy Springs Drive	WBL	Stop	F (176.4)	D (25.3)
	WBR	Stop	F (176.4)	D (25.3)
	NRT	Free	A (0.0)	A (0.0)
	NBR	Free	A (0.0)	A (0.0)
	SBL	Free	A (2.2)	A (1.5)
	SBT	Free	A (3.3)	A (2.1)
Capitola Farm Road	EBL	Stop	F (171.9)	F (85.0)
	EBR	Stop	F (171.9)	F (85.0)
	NBL	Free	A (3.5)	A (2.9)
	NBT	Free	A (4.1)	A (3.9)
	SBT	Free	A (0.0)	A (0.0)
	SBR	Free	A (0.0)	A (0.0)
Elizabeth Lane	WBL	Stop	F (*)	F (836.2)
	WBR	Stop	F (*)	F (836.2)
	NBT	Stop	A (0.0)	A (0.0)
	NBR	Free	A (0.0)	A (0.0)
	SBL	Free	F (60.4)	B (10.8)
	SBT	Free	A (0.0)	A (0.0)
Flowery Branch High School	WBL	Stop	C (23.5)	C (18.5)
	WBR	Stop	C (23.5)	C (18.5)
	NBT	Stop	A (0.0)	A (0.0)
	NBR	Free	A (0.0)	A (0.0)
	SBL	Free	B (10.1)	A (8.6)
	SBT	Free	A (0.0)	A (0.0)
Union Circle	WBL	Stop	E (49.9)	C (19.9)
	WBR	Stop	E (49.9)	C (19.9)
	NBT	Stop	A (0.0)	A (0.0)
	NBR	Free	A (0.0)	A (0.0)
	SBL	Free	A (1.8)	A (1.9)
	SBT	Free	A (4.0)	A (3.8)

* = Delay outside of calculated range

Table 7: CONSTRUCTION YEAR (2010) LEVELS OF SERVICE WITH IMPROVEMENTS, SIGNALIZED INTERSECTIONS

Intersection	AM Peak Hour	PM Peak Hour
Hog Mountain Road	D (35.1)	E (60.3)
Elizabeth Lane	D (53.5)	B (18.0)

Table 7: CONSTRUCTION YEAR (2010) LEVELS OF SERVICE WITH IMPROVEMENTS, UNSIGNALIZED INTERSECTIONS

Intersection	Movement	Control	AM Peak Hour	PM Peak Hour
Oak Ridge Drive	EBL	Stop	C (18.3)	C (18.5)
	EBR	Stop	C (18.3)	C (18.5)
	NRL	Free	A (9.1)	A (10.3)
	NBT	Free	A (0.0)	A (0.0)
	SBT	Free	A (0.0)	A (0.0)
	SBR	Free	A (0.0)	A (0.0)
Ivy Springs Drive	WBL	Stop	D (30.2)	C (15.2)
	WBR	Stop	D (30.2)	C (15.2)
	NRT	Free	A (0.0)	A (0.0)
	NBR	Free	A (0.0)	A (0.0)
	SBL	Free	B (11.0)	A (8.9)
	SBT	Free	A (0.0)	A (0.0)
Capitola Farm Road	EBL	Stop	F (65.4)	E (36.8)
	EBR	Stop	F (65.4)	E (36.8)
	NBL	Free	A (9.9)	B (10.9)
	NBT	Free	A (0.0)	A (0.0)
	SBT	Free	A (0.0)	A (0.0)
	SBR	Free	A (0.0)	A (0.0)
Flowery Branch High School	WBL	Stop	C (17.7)	B (13.6)
	WBR	Stop	C (17.7)	B (13.6)
	NBT	Stop	A (0.0)	A (0.0)
	NBR	Free	A (0.0)	A (0.0)
	SBL	Free	B (10.1)	A (8.6)
	SBT	Free	A (0.0)	A (0.0)
Union Circle	WBL	Stop	C (23.9)	B (14.1)
	WBR	Stop	C (23.9)	B (14.1)
	NBT	Stop	A (0.0)	A (0.0)
	NBR	Free	A (0.0)	A (0.0)
	SBL	Free	A (9.4)	A (8.6)
	SBT	Free	A (0.0)	A (0.0)

Table 8: DESIGN YEAR (2035) LEVELS OF SERVICE WITH IMPROVEMENTS, SIGNALIZED INTERSECTIONS

Intersection	AM Peak Hour	PM Peak Hour
Hog Mountain Road	F (84.2)	F (150.4)
Elizabeth Lane	F (123.9)	C (34.6)

Table 8: DESIGN YEAR (2035) LEVELS OF SERVICE WITH IMPROVEMENTS, UNSIGNALIZED INTERSECTIONS

Intersection	Movement	Control	AM Peak Hour	PM Peak Hour
Oak Ridge Drive	EBL	Stop	D (27.2)	D (27.8)
	EBR	Stop	D (27.2)	D (27.8)
	NRL	Free	B (10.1)	B (12.3)
	NBT	Free	A (0.0)	A (0.0)
	SBT	Free	A (0.0)	A (0.0)
	SBR	Free	A (0.0)	A (0.0)
Ivy Springs Drive	WBL	Stop	F (52.1)	C (19.0)
	WBR	Stop	F (52.1)	C (19.0)
	NRT	Free	A (0.0)	A (0.0)
	NBR	Free	A (0.0)	A (0.0)
	SBL	Free	B (12.4)	A (9.7)
	SBT	Free	A (0.0)	A (0.0)
Capitola Farm Road	EBL	Stop	F (*)	F (577.7)
	EBR	Stop	F (*)	F (577.7)
	NBL	Free	B (11.7)	B (14.1)
	NBT	Free	A (0.0)	A (0.0)
	SBT	Free	A (0.0)	A (0.0)
	SBR	Free	A (0.0)	A (0.0)
Flowery Branch High School	WBL	Stop	D (26.67)	C (17.1)
	WBR	Stop	D (26.6)	C (17.1)
	NBT	Stop	A (0.0)	A (0.0)
	NBR	Free	A (0.0)	A (0.0)
	SBL	Free	B (11.9)	A (9.3)
	SBT	Free	A (0.0)	A (0.0)
Union Circle	WBL	Stop	F (126.3)	C (23.0)
	WBR	Stop	F (126.3)	C (23.0)
	NBT	Stop	A (0.0)	A (0.0)
	NBR	Free	A (0.0)	A (0.0)
	SBL	Free	B (11.2)	A (9.6)
	SBT	Free	A (0.0)	A (0.0)

TURN BAY REQUIREMENTS

Recommended lengths of full width turn bay lengths are provided in Table 9 not including applicable taper lengths. The recommended lengths are based on the expected Construction Year Daily Volumes. The expected 95th percentile queue length for each movement for the Design Hour Construction Volume was checked accordingly.

Table 9: RECOMMENDED TURN BAY LENGTHS

Spout Springs @	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Oak Ridge Drive							25					
Ivy Springs Drive										75		
Capitola Farm Road			100				250					175
Elizabeth Lane						150			175	400		
Spout Springs Elementary (Main)							175					175
Spout Springs Elementary (Bus)							175					300
Union Circle										175		

Bold = New or Extended Turn Bay Length

TRAFFIC SIGNAL WARRANT STUDY

A Traffic Signal Warrant Analysis was conducted for the Elizabeth Road intersection using the Construction Year (2010) volumes. These volumes include the projected Flowery Branch High School volumes. The analysis resulted in a traffic signal being warranted. Table 10 summarizes the results of the warrant study. The Warrant Analysis Report is included in [Appendix J](#).

The expected volumes presented in Table 11 were compared to the warrant requirements to signal warrant conditions contained in the *Manual on Uniform Traffic Control Devices, 2003*(MUTCD) published by the Federal Highway Administration.

The MUTCD states that satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic signal control, but it also indicates that traffic signal control should not be installed unless one or more warrants are met.

The MUTCD contains provisions for reducing the minimum volumes when the major street speed exceeds 40 mph. Since the speed limit on Spout Springs Road is 45 mph, the warrant analysis was conducted for using the 70% threshold volumes.

The expected conditions will clearly meet the requirements of the 70% volumes which are allowed by the MUTCD. For the reasons stated above, it recommended that traffic signal control be provided for the intersection of Spout Springs Road and Elizabeth Lane.

**Table 10: RESULTS OF WARRANT STUDY, CONSTRUCTION YEAR (2010) TRAFFIC VOLUMES
(Spout Springs @ Elizabeth)**

WARRANT	70% VOLUME REQUIREMENTS		
	MET?	HOURS REQUIRED	HOURS MET
1. Eight-Hour Vehicular Volume	Yes	8	12
2. Four-Hour Vehicular Volume	Yes	4	12
3. Peak Hour	Yes	1	6

Table 11: CONSTRUCTION YEAR (2010) TRAFFIC VOLUMES (Spout Springs @ Elizabeth)

Period, Begin	WB: ELIZABETH LANE		NB: SPOUT SPRINGS		SB: SPOUT SPRINGS	
	Left	Right	Thru	Right	Left	Thru
6:00	6	10	43	3	6	15
6:15	4	8	52	5	12	18
6:30	8	14	75	9	12	20
6:45	10	19	65	8	7	36
7:00	13	25	101	27	55	55
7:15	17	32	146	34	69	100
7:30	20	39	223	45	112	124
7:45	17	31	193	45	120	101
8:00	17	41	148	22	57	73
8:15	19	48	101	19	37	80
8:30	19	49	85	18	38	82
8:45	24	64	93	18	39	59
9:00	12	29	65	9	24	92
9:15	14	31	65	9	24	100
9:30	9	20	77	10	21	66
9:45	6	11	65	8	19	70
10:00	14	35	77	9	16	70
10:15	10	25	82	8	16	64
10:30	8	18	85	8	17	70
10:45	10	20	151	13	14	64
11:00	11	27	116	12	13	57
11:15	8	21	90	9	17	72
11:30	11	25	79	8	16	69
11:45	12	28	84	8	16	65
12:00	9	19	79	9	20	85
12:15	9	21	69	9	19	81
12:30	11	25	89	10	20	81
12:45	6	14	89	10	23	120
13:00	15	34	98	9	19	111
13:15	10	23	81	7	18	93
13:30	6	11	93	8	19	103
13:45	7	14	70	8	12	103
14:00	9	21	69	8	16	93
14:15	12	27	116	11	18	118
14:30	12	28	77	7	18	115
14:45	8	17	111	9	17	102
15:00	11	27	94	10	18	90
15:15	17	46	90	10	20	99
15:30	15	40	85	8	15	109
15:45	15	42	74	7	24	125
16:00	16	37	99	16	29	149
16:15	27	68	87	16	43	137
16:30	33	87	86	16	48	135
16:45	34	92	100	12	41	150
17:00	14	34	90	11	35	163
17:15	11	27	95	14	40	164
17:30	16	37	121	13	32	182
17:45	16	37	90	11	24	159
18:00	14	30	111	9	20	172
18:15	10	22	98	7	14	130
18:30	9	19	114	7	12	112
18:45	12	25	74	5	12	106

SUMMARY OF FINDINGS

The following statements along with Figure 14 summarize the conclusions reached and the recommendations of the study.

1. Spout Springs Road @ Hog Mountain Road (Spout Springs assumed North/South):

- Add second NB thru lane on Spout Springs Road and extend minimum of 400 foot of full width.
- Maintain NB right turn lane.
- Modify traffic signal and islands accordingly.

2. Spout Springs Road @ Oak Ridge and Ivy Springs Drives (offset intersections)

- Widen to accommodate center lane between intersections.
- Provide dedicated 25 foot NBLTL for Oak Ridge Drive.
- Provide dedicated 75 foot SBLTL for Ivy Springs Drive.
- Stripe remaining area between turn lanes as TWLTL.

3. Spout Springs Road @ Capitola Farm Road

- Provide NBLTL 250 foot, with 100 foot taper.
- Provide SBRTL 175 foot, with 100 foot taper.
- Provide channelized EBRTL 100 foot, with 50 foot taper.

4. Spout Springs Road @ Elizabeth Lane

- Realign Elizabeth approximately 50 foot north to line up at 90° angle with Spout Springs Road (improving WB right sight distance).
- Extend SBLTL from 130 foot to 400 foot (striping)
- Provide NBRTL 175 foot, with 100 foot taper.
- Provide WBRTL 150 foot, with 50 foot taper.
- Extend TWLTL from Elizabeth south to match the LTL at Flowery Branch High School (approximately 1500 foot).

5. Spout Springs Road @ Piney Grove Church Roads (South and North)

- Extend Looper Lake Drive to intersect Spout Springs Road near sag in Spout Springs (approximately 150 foot).
- Disconnect Piney Grove Church Roads (North & South) providing access via extended Looper Road.
- This will significantly improve intersection spacing and sight distance.
- TWLTL provides protected area for turning vehicles onto extended Looper Lake Drive.

6. Spout Springs Road @ Spout Springs Elementary School Main D/W

- Provide NBLTL 250 foot, extend TWLTL south to Bus driveway (approximately 125 foot).
- Extend SBRTL from 125 foot to 175 foot.
- Improve curb return radii and widen to accommodate two-way traffic.
- Install Stop Bar and Stop Sign on EB approach.

7. Spout Springs Road @ Spout Springs Elementary School Bus D/W

- Provide NBLTL 250 foot, extend TWLTL south to meet LTL for Union Circle (approximately 350 foot).
- This improvement will provide a NBLTL onto Quincy Drive.

8. Spout Springs Road @ Union Circle

- Provide SBLTL 250 foot.
- Grade embankment along east shoulder south of Union Circle approximately 25 foot off edge of pavement 300 to 450 foot from intersection to improve sight distance.

Figure 14 illustrates the improvements identified along the corridor.

Figure 14: CORRIDOR IMPROVEMENTS

