

Hazard Elimination Project Evaluation

Project Log # 200608076

Hazard Elimination Project W-2940

**Evaluation of the Installation of Left Turn Lanes at Eight Median Crossovers on
US 1 / US 15 / US 501 from 0.48 miles north of US 15-501 to 0.17 miles north of NC 78
Lee Co.**

Documents Prepared By:

Safety Evaluation Group
Traffic Safety Systems Management Section
Transportation Safety and Mobility Division
North Carolina Department of Transportation

Principal Investigator



Carrie L. Simpson, PE

Traffic Safety Project Engineer

1/26/2009

Date

Hazard Elimination Project Evaluation Documentation

Subject Location

Evaluation of Hazard Elimination Project W-2940 – Eight crossovers on US 1 / US 15 / US 501 from 0.48 miles north of US 15-501 to 0.17 miles north of NC 78 in Lee Co.

Location 1: Crossover at Sanford Motel,
MP 5.4
NB and SB Left Turn Lanes Added

Location 2: SR 1302 (Arthur Maddox Rd),
MP 5.67
SB Left Turn Lane Added

Location 3: SR 1300 (Chris Cole Rd), MP 5.98
SB Left Turn Lane Added

Location 4: Crossover at Private Driveways,
MP 6.25
NB Left Turn Lane Added

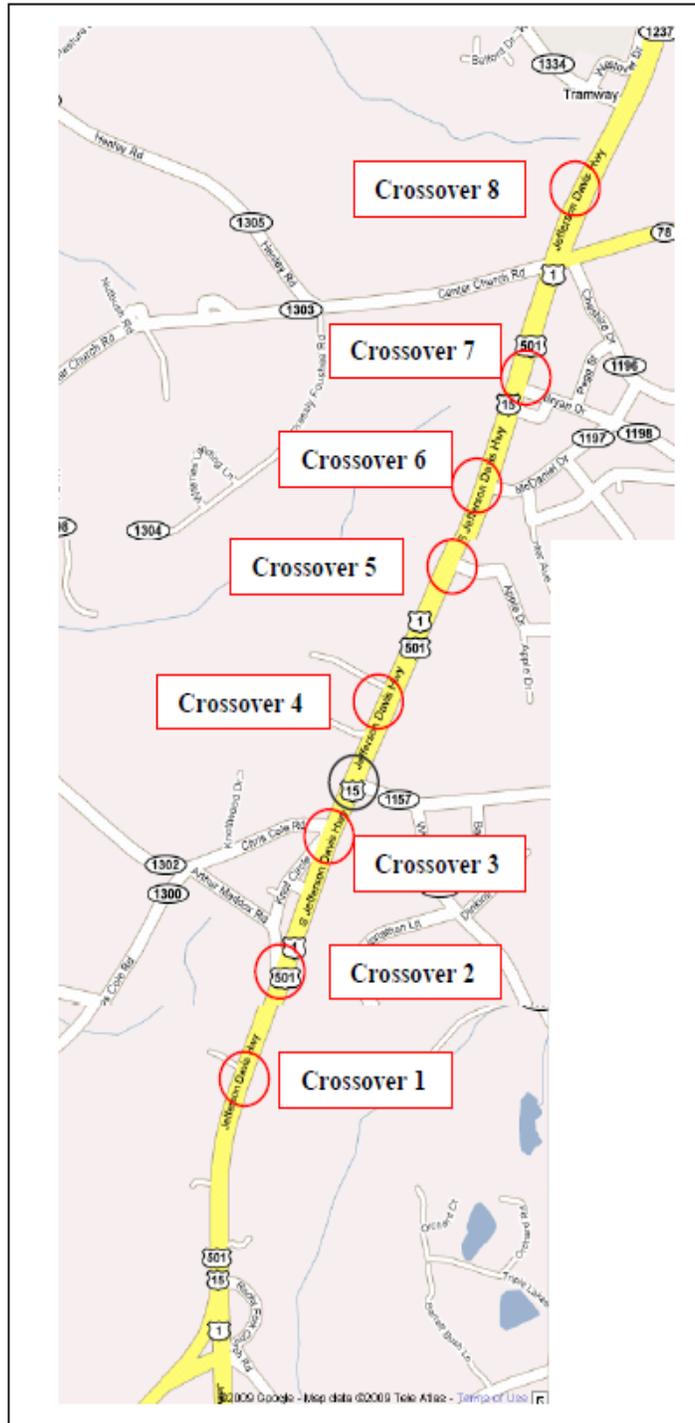
Location 5: Crossover at Grace Chapel Church
& Landscaping Center, MP 6.58
NB Left Turn Lane Added

Location 6: SR 1197 (McDaniel Rd), MP 6.73
NB and SB Left Turn Lanes Added

Location 7: SR 1198 (Brian Rd), MP 6.93
NB and SB Left Turn Lanes Added

Location 8: Tramway Crossing (Food Lion)
Crossover, MP 7.35
NB and SB Left Turn Lanes Added

An additional crossover was included in the Hazard Elimination Project (SR 1157 (Hickory House Rd), MP 6.08), but was not evaluated in this report because the crossover was altered after the countermeasure was installed. The traffic control was converted to a signal in November 2002, and was evaluated in June 2008 as Project Log # 200712096 (SS #08-01-212).



Project Information and Background from the Project File Folder

The safety countermeasure chosen for the subject location was to construct left turn lanes at existing median openings on US 1/ US 15/ US 501. The Project Report states that the lack of left turn lane storage in the median created the potential for Rear End crashes.

US 1/ US 15/ US 501 is a four-lane divided facility with no control access. The area is characterized by a mix of light commercial and rural type development. The speed limit along US 1/ US 15/ US 501 is 55 mph for Crossovers 1-2 and 45 mph for Crossovers 3-8.

The initial crash analysis was completed for a 3 year time period from January 1, 1989 through December 31, 1991. According to the initial analysis, there were 60 Total Crashes, including 18 Rear-End crashes and 4 Left Turn-Same Roadway Crashes. Development of the exclusive left turn storage lane was intended to reduce the pattern of Rear End crashes by segregating vehicles with through destinations from those desiring to turn left. The left turn lanes were also intended to reduce the Left Turn-Same Roadway Crashes by allowing motorists time to await adequate gaps in oncoming traffic.

The project was completed on May 30, 1999 at a cost of \$630,000.

Naive Before and After Analysis

After reviewing the project file folder along with all the crashes at the subject location, the crash data omitted from this analysis to consider for an adequate construction period was from September 1, 1998 through July 31, 1999. The before period consisted of reported crashes from January 1, 1990 through August 31, 1998 (8.67 Years) and the after period consisted of reported crashes from August 1, 1999 through March 31, 2008 (8.67 Years).

The treatment data for all locations consisted of all crashes on US 1/ US 15/ US 501 within 150 feet of each crossover. A 0' Y-line was used on all cross streets.

Target Crashes for the applied countermeasure occurred on US 1/ US 15/ US 501 in advance of each median crossover in the direction of the installed left turn lane and involved a left-turning / u-turning vehicle. They include the following crash types:

- Rear End Crashes,
- Sideswipe Crashes, and
- Left Turn-Same Roadway Crashes.

Please see the attached Collision Diagrams. Note that the crash numbers for Target Rear End Crashes, Target Sideswipe Crashes, and Target Left Turn-Same Roadway Crashes are circled on the diagrams in Red, Blue, and Green, respectively.

The following tables depict the Naïve Before and After Analysis for the Total Crashes and Target Crashes at Crossovers 1-8.

<u>Total Treatment Information</u>	Before	After	Percent Reduction (-)/ Percent Increase (+)
Total Crashes	65	147	126.2%
Total Severity Index	6.89	4.55	-34.0%
Target Crashes	16	9	-43.8%
Target Severity Index	4.70	2.64	-43.8%
Target Rear End Crashes	8	2	-75.0%
Target Sideswipe Crashes	5	0	-100.0%
Target Left Turn-Same Road Crashes	3	7	133.3%
Volume	16,800	24,700	47.0%

<u>Total Crash Information</u>	Before	After	Percent Reduction (-)/ Percent Increase (+)
Fatal Injury Crashes	0	1	N/A
Non-Fatal Injury Crashes	24	51	112.5%
Total Injury Crashes	24	52	116.7%
Night Crashes	20	34	70.0%
Wet Crashes	26	16	-38.5%

As shown in the previous tables, Locations 1-8 overall experienced a 126 percent increase in Total Crashes, a 44 percent decrease in Target Crashes, and a 47 percent increase in Average Daily Traffic (ADT). The before period ADT year was 1994 and the after period ADT year was 2003.

See the next page for a Crash Breakdown by Crossover, and additional Crash Type information for Crossover 8.

Crash Breakdown by Crossover

Median Crossovers Summary	Before	After	Percent Reduction (-)/ Percent Increase (+)
Location 1			
Total Crashes	3	2	-33.3%
Target Crashes	2	1	-50.0%
Location 2			
Total Crashes	11	7	-36.4%
Target Crashes	2	0	-100.0%
Location 3			
Total Crashes	7	12	71.4%
Target Crashes	0	0	N/A
Location 4			
Total Crashes	0	2	N/A
Target Crashes	0	1	N/A
Location 5			
Total Crashes	2	8	300.0%
Target Crashes	0	0	N/A
Location 6			
Total Crashes	31	14	-54.8%
Target Crashes	7	1	-85.7%
Location 7			
Total Crashes	4	9	125.0%
Target Crashes	2	3	50.0%
Location 8			
Total Crashes	7	93	1228.6%
Target Crashes	3	3	0.0%

Location 8

Location 8: Crash Type Information	Before	After	Percent Reduction (-)/ Percent Increase (+)
Angle Crashes	4	48	1100.0%
Left Turn-Same Road Crashes	0	21	N/A
Left Turn-Different Road Crashes	0	15	N/A
Right Turn-Different Road Crashes	0	4	N/A
Rear End Crashes	1	3	200.0%
Sideswipe Crashes	2	1	-50.0%
Backing Up Crashes	0	1	N/A

Results and Discussion

The naïve before and after analysis involving the comparison of treatment actual before data versus treatment actual after data resulted in a 126 percent increase in Total Crashes (from 65 to 147 crashes) and a 44 percent decrease in Target Crashes (from 16 to 9 crashes). Further investigation shows there was a 34 percent decrease in the Severity Index for Total Crashes and a 44 percent decrease in the Severity Index for Target Crashes.

The calculated benefit to cost ratio for this project is -0.30 considering total crashes. The benefit to cost ratio considering only target crashes is 0.21. The benefits are calculated using the change in annual crash costs from the before to the after period. Operational and other benefits related to the project are not considered in this analysis. The costs of the project include the actual construction costs as well as the increase in annual maintenance costs.

The treatment appears to have had the greatest positive effect on Crossover 6 (US 1 / 15 / 501 at SR 1197–McDaniel Rd), where the number of Target Crashes decreased by 86 percent (from 7 to 1 crashes). This crossover also had a substantial pattern of Ran-Off-Road Crashes under Wet Conditions that disappeared in the after period.

The number of Total Crashes at Crossover 8 increased by over 1000 percent from the before to after period (from 7 to 93 crashes). The two largest after period crash patterns include:

- Angle & Left Turn-Different Roadway Crashes involving southbound US 1 / 15 / 501 vehicles and vehicles leaving Tramway Crossing driveway (48 crashes), and
- Left Turn-Same Roadway Crashes involving vehicles from Tramway Crossing and Exxon Gas Station driveways (18 crashes).

Vehicles are having difficulty making safe gap choices when crossing US 1 / 15 / 501 from Tramway Crossing and Exxon driveways. From the before to the after period, the width of US 1 / 15 / 501 at Crossover 8 has widened significantly. There are now five additional lanes at the crossover, including southbound left and right turn lanes with a southbound left turn lane for the downstream NC 78 intersection AND northbound left and right turn lanes.

Please see the *Collision Diagrams, Location Photos, and Aerial Photos* provided for Locations 1-8.

As the Safety Evaluation Group completes additional reviews for this type of countermeasure, we will be able to provide more objective and definite information regarding actual crash reduction factors.

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: **US 1-15-501 Crossovers - TARGET Crashes** BY: **CLS**
 COUNTY: **Lee** DATE: **1/23/2009**
 FILE NO.: **W-2940**

DETAILED COST: TYPE IMPROVEMENT - **Left Turn Lanes**

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$630,000	20	0.102	\$64,167
	\$0	0	0.000	\$0
Right-of-Way	\$0	0	0.000	\$0
TOTALS	\$630,000	20	0.102	\$64,167

ESTIMATED INCREASE IN ANNUAL MAINT. COST = **\$4,800**
 ESTIMATED INCREASE IN ANNUAL UTILITY COST = **\$0**
 TOTAL ANNUAL COST= **\$68,967**
 TOTAL COST OF PROJECT= **\$630,000**

COMPREHENSIVE COST REDUCTION:

ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES

TIME PERIOD	YEARS	K & A CRASHES	K & A CRASHES PER YR	B & C CRASHES	B & C CRASHES PER YR	PDO CRASHES	PDO CRASHES PER YR	ANNUAL COSTS
BEFORE	8.67	0	0.00	8	0.92	8	0.92	\$22,330
AFTER	8.67	0	0.00	2	0.23	7	0.81	\$8,005

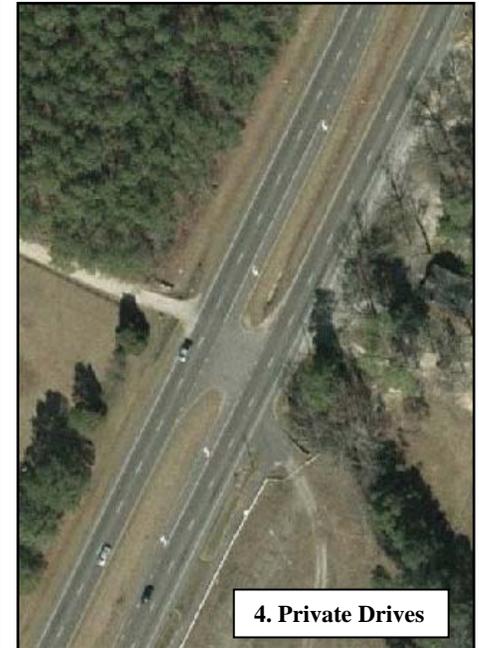
Annual Benefits from Crash Cost Savings **\$14,325**

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = **(\$54,642)**

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = **0.21**

TOTAL COST OF PROJECT - **\$630,000** COMPREHENSIVE B/C RATIO - **0.21**

W-2490 Aerial Photographs – 8 Crossovers on US 1 / US 15 / US 501 South of Sanford, Lee Co.



Location Photos (Taken on January 8, 2009)



Crossover 1 - NB



Crossover 1 - SB



Crossover 2 - SB

SR 1302



Crossover 3 - SB

SR 1300

Location Photos (Taken on January 8, 2009)



Location Photos (Taken on January 8, 2009)



Crossover 7 - NB

SR 1198



Crossover 7 - SB

SR 1198



Crossover 8 - NB

Tramway Crossing
Food Lion



Crossover 8 - NB

Tramway Crossing
Food Lion

Location Photos (Taken on January 8, 2009)



**Crossover 8 – Looking North
from Tramway Crossing**



**Crossover 8 – Looking North
from Median Xing**



**Crossover 8 – Looking West
from Exxon**



**Crossover 8 – Looking West
from Exxon**

Location Photos (Taken on January 8, 2009)



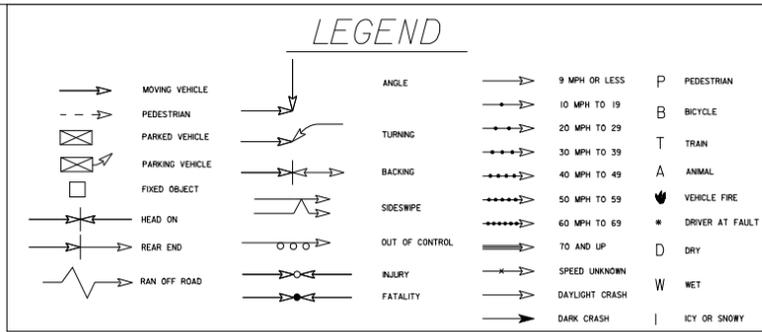
TARGET CRASHES:

- REAR END CRASHES*
- SIDESWIPE CRASHES*
- LEFT TURN-SAME ROADWAY CRASHES*

* CRASHES OCCURRING ON US 1/15/501 IN ADVANCE OF EACH MEDIAN CROSSOVER IN THE DIRECTION OF THE INSTALLED TURN LANE & INVOLVING A LEFT-TURNING / U-TURNING VEHICLE

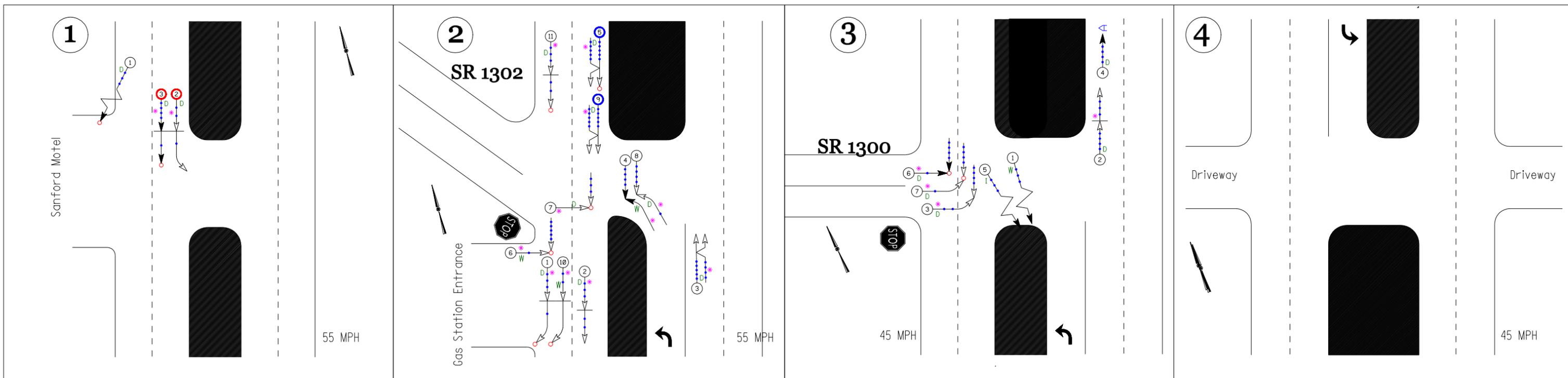
Treatment Crossover Locations 1-4

On US 1/15/501 South of Sanford, Lee Co.



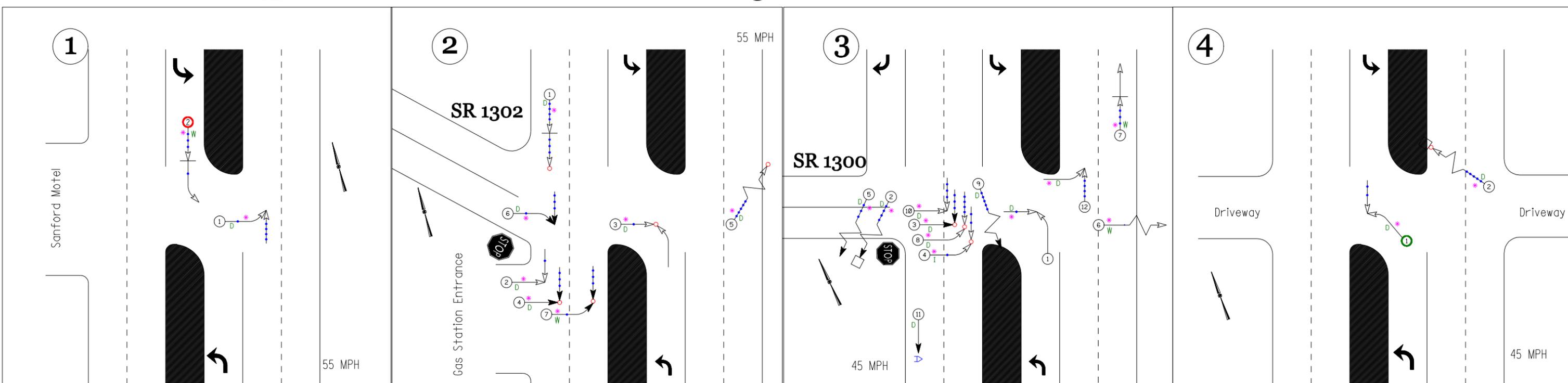
BEFORE PERIOD - TOTAL CRASHES

January 1, 1990 - August 31, 1998 (8.67 Yrs)



AFTER PERIOD - TOTAL CRASHES

August 1, 1999 - March 31, 2008 (8.67 Yrs)



TARGET CRASHES:
 ○ REAR END CRASHES*
 ○ SIDESWIPE CRASHES*
 ○ LEFT TURN-SAME ROADWAY CRASHES*
 * CRASHES OCCURRING ON US 1/15/501 IN ADVANCE OF EACH MEDIAN CROSSOVER IN THE DIRECTION OF THE INSTALLED TURN LANE & INVOLVING A LEFT-TURNING / U-TURNING VEHICLE

Treatment Crossover Locations 5-8

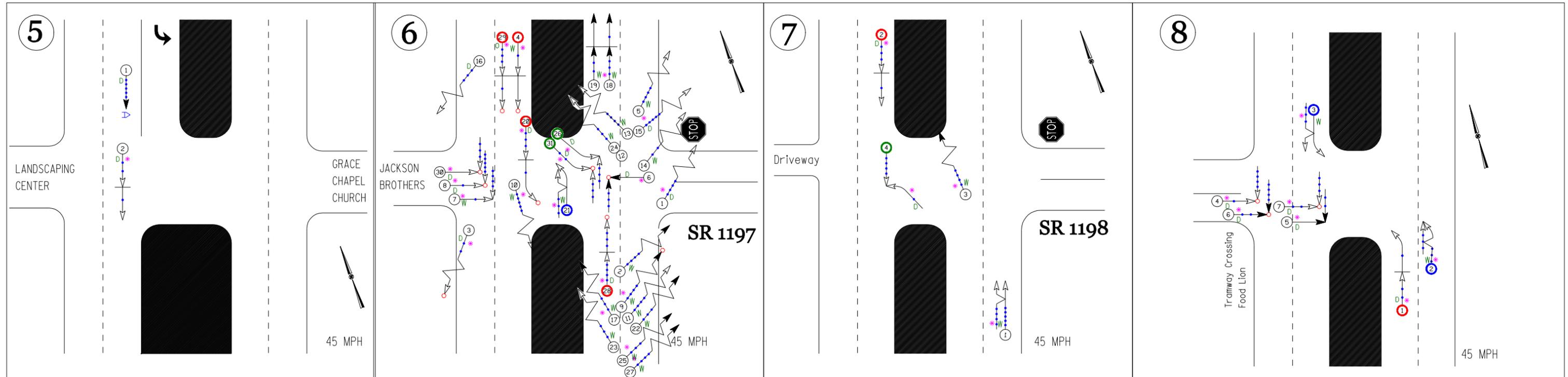
On US 1/15/501 South of Sanford, Lee Co.

LEGEND

	MOVING VEHICLE		ANGLE		9 MPH OR LESS		P PEDESTRIAN
	PEDESTRIAN		TURNING		10 MPH TO 19		B BICYCLE
	PARKED VEHICLE		BACKING		20 MPH TO 29		T TRAM
	PARKING VEHICLE		SIDESWIPE		30 MPH TO 39		A ANIMAL
	FIXED OBJECT		OUT OF CONTROL		40 MPH TO 49		V VEHICLE FIRE
	HEAD ON		INJURY		50 MPH TO 59		* DRIVER AT FAULT
	REAR END		FATALITY		60 MPH TO 69		D DRY
	RAN OFF ROAD		DARK CRASH		70 AND UP		W WET
			DAYLIGHT CRASH		SPEED UNKNOWN		I ICY OR SNOWY

BEFORE PERIOD - TOTAL CRASHES

January 1, 1990 - August 31, 1998 (8.67 Yrs)



AFTER PERIOD - TOTAL CRASHES

August 1, 1999 - March 31, 2008 (8.67 Yrs)

