Spot Safety Project Evaluation

Project Log # 200712086

Spot Safety Project # 06-01-210

Spot Safety Project Evaluation of the Traffic Signal Installation
At the Intersection of US 74 and NC 710
Robeson County

Documents Prepared By:

Safety Evaluation Group
Traffic Safety Systems Management Section
Traffic Engineering and Safety Systems Branch
North Carolina Department of Transportation

Principal Investigator

_____ _____
Jason B. Schronce Date

Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 06-01-210 – The Intersection of US 74 and NC 710 in Robeson County, near the Town of Pembroke.

Project Information and Background from the Project File Folder

The spot safety project improvement countermeasure chosen for the subject location was the installation of a 2-phase, actuated traffic signal. In the before period, US 74 and NC 710 were both two-lane facilities at the subject intersection with US 74 providing right turn lanes on both approaches. With the installation of the signal, left turn lanes were also added to US 74 and right turn slips were configured on NC 710. The speed limits are 55 mph on all approaches at this rural intersection. The subject location is a crossroads style intersection, which was controlled by dual posted stop signs on NC 710 in the before period.

In August of 1996, Spot Safety Project 06-95-212 was completed at this location. Under that project actuated "Vehicle Entering" signs were installed on US 74 along with actuated "Stop Ahead" signs and thermoplastic rumble strips on NC 710. These countermeasures were in operation during the complete analysis of the new traffic signal.

The original statement of problem was the inability of vehicles entering US 74 safely resulting in a pattern of angle collisions. The intersection met signal warrants 1A, 1B, 2, and 3B. The initial crash analysis was completed from September 1, 1998 to September 1, 2001 with fifteen (15) reported crashes, twelve (12) of which were deemed correctable. The final completion date for the improvement at the subject intersection was on September 2, 2002 with a total cost of $50,000.00.

Naive Before and After Analysis

After reviewing the spot safety 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 included August and September of 2002. The before period consisted of reported crashes from July 1, 1997 through July 31, 2002 (5 years and 1 month); and the after period consisted of reported crashes from October 1, 2002 through October 31, 2007 (5 years and 1 month). The ending date for this analysis was determined by the date of available crash data at the time of completion.

The treatment data consisted of all crashes within 150 feet of the subject intersection. *Please see attached location map and photos for further details.*

The following data table depicts the Naive Before and After Analysis for the treatment location. Please note that Frontal Impact and "Avoidance" Ran-off Roadway Crashes were the target crashes for the applied countermeasure. The Frontal Impact Crash types considered are as follows: Left

turn, same roadway; Left turn, different roadways; Right turn, same roadway; Right turn, different roadways; Head on; and Angle.

Treatment Information			
	Before	**After**	**Percent Reduction (-) Percent Increase (+)**
Total crashes	26	33	26.92 %
Total Severity Index	5.27	4.81	- 8.73 %
Target Crashes	23	16	- 30.43 %
Target Crash Severity Index	5.50	6.55	19.09 %
Volume	13,420	17,650	31.52 %
Injury Crash Summary - Total			
Fatal injury Crashes	0	0	N/A
Class A injury Crashes	0	0	N/A
Class B injury Crashes	2	3	50.00 %
Class C Injury Crashes	13	14	7.69 %
Total Injury Crashes	15	17	13.33 %

The naive before and after analysis at the treatment location resulted in a 27 percent increase in Total Crashes, a 30 percent decrease in Target Crashes, and a 9 percent decrease in the Total Severity Index. The before period ADT year was 2000 and the after period ADT year was 2005.

Results and Discussion

The naive before and after analysis involving the comparison of treatment actual before data versus treatment actual after data resulted in a 27 percent increase in Total Crashes and an 30 percent decrease in Target Crashes. The summary results above demonstrate that Frontal Impact Target Crashes appear to have decreased at the treatment location from the before to the after period with the potential of a new developing overall crash pattern.

Referencing the *Collision Diagrams*, a large portion of crashes at the intersection in the before period (18 of 26) were the result of a vehicle improperly attempting to cross US 74 resulting in angle collisions or the avoidance of one. After the signal installation, this pattern remains from vehicles running the red indication signal from both roadways but has reduced slightly to eleven (11). Left-turn; same roadway collisions have basically stayed consistent through the analysis with four (4) in the before and five (5) in the after period. Overall, target crashes have reduced at this location but the effectiveness appears to have remained at status quo.

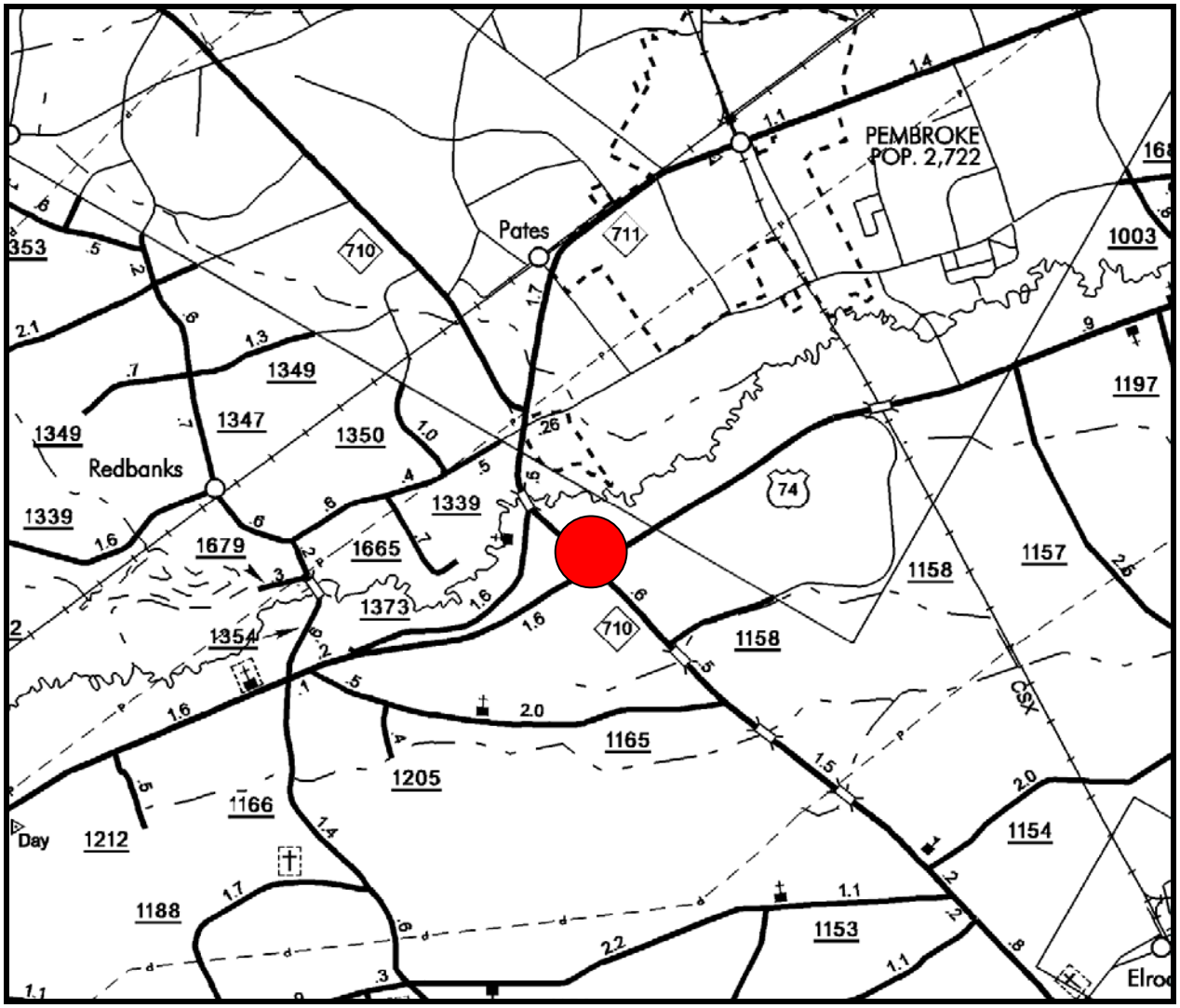
There was a definitive increase in Rear-End Crashes at the intersection (from 3 to 11) in the after period. The Rear-End pattern is seen spread evenly throughout every approach and accounts for the negative overall Total Crash benefit-cost ratio as explained below.

The calculated benefit to cost ratio for this project is -1.06 considering total crashes. The benefit to cost ratio considering only target crashes is 1.06. 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 and utility costs.

Please see the attached *Treatment Site Photos*. Photos are provided for all approaches to the treatment intersection. Notice in picture 3 the remaining countermeasures from Spot Safety Project 06-95-212 including thermoplastic rumble strips and "Stop Ahead" written in the roadway on the NC 710 approaches. Also, from the US 74 photos we can observe developing pot holes and channel rutting due to extended use by tractor-trailers.

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

Location Map
Robeson County
Evaluation of Spot Safety Project # 06-01-210



Treatment Location: US 74 at NC 710

TREATMENT SITE PHOTOS TAKEN 4/8/2008

Traveling East on US 74

Traveling West on US 74

Traveling North on NC 710

Traveling North on NC 710

Traveling South on NC 710

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: US-74 at NC-710 | BY: JBS
COUNTY: Robeson | DATE: 4/15/2008
FILE NO.: SS 06-01-210 | NOTES: Total Crashes

DETAILED COST: TYPE IMPROVEMENT - New Signal

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	$50,000	10	0.149	$7,451
	$0	0	0.000	$0
Right-of-Way	$0	0	0.000	$0
TOTALS	$50,000	10	0.149	$7,451

ESTIMATED INCREASE IN ANNUAL MAINT. COST = $2,000
ESTIMATED INCREASE IN ANNUAL UTILITY COST = $900

TOTAL ANNUAL COST= $10,351
TOTAL COST OF PROJECT= $50,000

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	5.08	0	0.00	15	2.95	11	2.17	$61,594
AFTER	5.08	0	0.00	17	3.35	16	3.15	$72,520

Annual Benefits from Crash Cost Savings ($10,925)

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = ($21,277)

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = -1.06

TOTAL COST OF PROJECT - $50,000 **COMPREHENSIVE B/C RATIO - -1.06**

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: US-74 at NC-710 | BY: JBS
COUNTY: Robeson | DATE: 4/15/2008
FILE NO.: SS 06-01-210 | NOTES: Target Crashes - Frontal Impact & Avoidance

DETAILED COST: TYPE IMPROVEMENT - New Signal

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	$50,000	10	0.149	$7,451
	$0	0	0.000	$0
Right-of-Way	$0	0	0.000	$0
TOTALS	$50,000	10	0.149	$7,451

ESTIMATED INCREASE IN ANNUAL MAINT. COST = $2,000
ESTIMATED INCREASE IN ANNUAL UTILITY COST = $900

TOTAL ANNUAL COST= $10,351
TOTAL COST OF PROJECT= $50,000

COMPREHENSIVE COST REDUCTION:

ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES

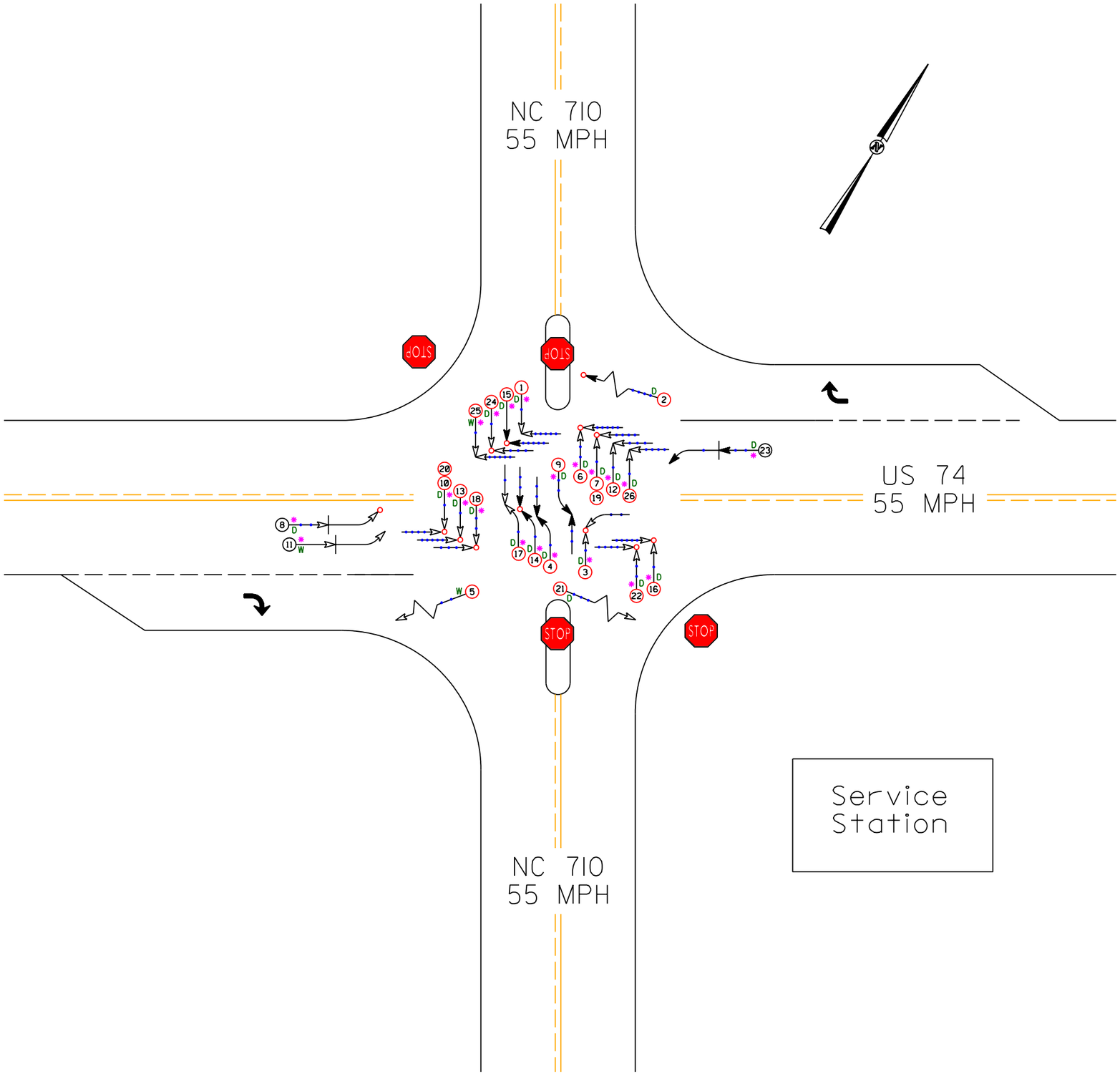
TIME PERIOD	YEARS	K & A CRASHES	K & A CRASHES PER YR	B & C CRASHES	B & C CRASHES PER YR	PDO CRASHES	PDO CRASHES PER YR	ANNUAL COSTS
BEFORE	5.08	0	0.00	14	2.76	9	1.77	$56,516
AFTER	5.08	0	0.00	12	2.36	4	0.79	$45,591

Annual Benefits from Crash Cost Savings $10,925

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = $574

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 1.06

TOTAL COST OF PROJECT - $50,000 COMPREHENSIVE B/C RATIO - 1.06



LEGEND

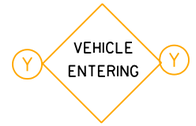
MOVING VEHICLE
PEDESTRIAN
PARKED VEHICLE
PARKING VEHICLE
FIXED OBJECT
HEAD ON
REAR END
RAN OFF ROAD

ANGLE
TURNING
BACKING
SIDESWIPE
OUT OF CONTROL
INJURY
FATALITY

9 MPH OR LESS
10 MPH TO 19
20 MPH TO 29
30 MPH TO 39
40 MPH TO 49
50 MPH TO 59
60 MPH TO 69
70 AND UP
SPEED UNKNOWN

P PEDESTRIAN
T TRAIN
* DRIVER AT FAULT
D DRY
W WET
I ICY OR SNOWY
O OILY

SS# 06-01-210
Robeson County
BEFORE Period
7/1/97 - 7/31/02
US 74 at NC 710



US 74 Sign
w/ Actuated
Flasher

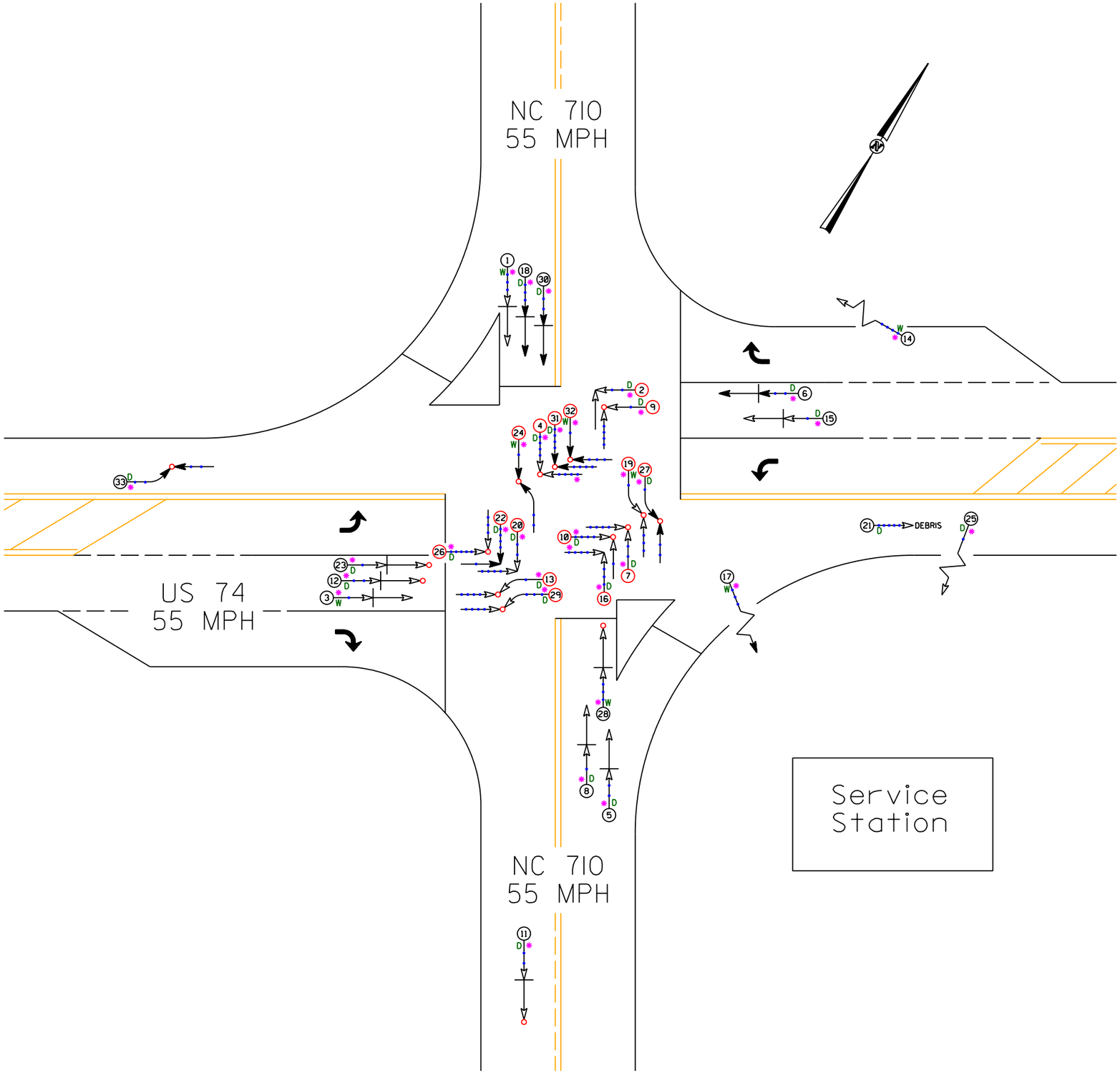
NC 710 Sign
w/ Actuated
Flasher

Target Crashes
Frontal Impact
& Avoidance

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

COLLISION DIAGRAM	
DIVISION: 6	AREA:
STUDY PERIOD: 7/1/1997 TO 7/31/2002	
DISTANCE: Y-LINE = 150FT	
ANALYSIS PREPARED BY: JBS	
ANALYSIS CHECKED BY: BR	
DIAGRAM PREPARED BY: JBS	
DIAGRAM REVIEWED BY: ST	
SCALE: NOT TO SCALE	
DATE: 4-14-2008	
LOG NUMBER: SS# 06-01-210	

N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRAFFIC ENGINEERING AND SAFETY SYSTEMS BRANCH



LEGEND

MOVING VEHICLE
PEDESTRIAN
PARKED VEHICLE
PARKING VEHICLE
FIXED OBJECT
HEAD ON
REAR END
RAN OFF ROAD

ANGLE
TURNING
BACKING
SIDESWIPE
OUT OF CONTROL
INJURY
FATALITY

9 MPH OR LESS
10 MPH TO 19
20 MPH TO 29
30 MPH TO 39
40 MPH TO 49
50 MPH TO 59
60 MPH TO 69
70 AND UP
SPEED UNKNOWN

P PEDESTRIAN
T TRAIN
* DRIVER AT FAULT
D DRY
W WET
I ICY OR SNOWY
O OILY

SS# 06-01-210
Robeson County
AFTER Period
10/1/02 - 10/31/07
US 74 at NC 710

R
Y
G
New Signalized Intersection

(#) Target Crashes Frontal Impact & Avoidance

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

HIGHWAY SAFETY PLANNING AND ANALYSIS
HIGHWAY SAFETY IMPROVEMENT PROGRAM
HIGHWAY SAFETY MANAGEMENT
RAILROAD-HIGHWAY SAFETY MANAGEMENT

COLLISION DIAGRAM	
DIVISION: 6	AREA:
STUDY PERIOD: 10/1/2002 - 10/31/2007	
DISTANCE: Y-LINE = 150FT	
ANALYSIS PREPARED BY: JBS	
ANALYSIS CHECKED BY: BR	
DIAGRAM PREPARED BY: JBS	
DIAGRAM REVIEWED BY: ST	
SCALE: NOT TO SCALE	
DATE: 4-14-2008	
LOG NUMBER: SS# 06-01-210	

N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRAFFIC ENGINEERING AND SAFETY SYSTEMS BRANCH