

Spot Safety Project Evaluation

Project Log # 200811210

Spot Safety Project # 06-01-205

**Spot Safety Project Evaluation of the Traffic Signal Installation
NC 41 (Elizabethtown Rd) and SR 2033 / SR 2126
Robeson County, City of Lumberton**

Documents Prepared By:

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

Principal Investigator



Jason B. Schronce

5-27-2009

Date

Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 06-01-205 located at the Intersection of NC 41 (Elizabethtown Road) and SR 2033 (Hornets Rd) / SR 2126 (Harrill Rd) in Robeson County.

The Sig ID is 06-0663 for this new installed traffic signal.



Project Information and Background from the Project File Folder

The spot safety project improvement countermeasure chosen for the subject location was the installation of an actuated traffic signal. In the before period, NC 41 and SR 2033 / SR 2126 were all two-lane facilities at the subject intersection with only a southbound SR 2033 dedicated left turn lane and speed limits of 45 mph on all approaches. The subject location is a four-leg crossroads intersection, which was controlled by stop signs on the secondary road approaches. Prior to the signal installation, NC 41 was also widened to a three-lane segment at this location.

The original statement of problem was the high occurrence of angle type collisions at this intersection. The intended purpose of the new traffic signal was to alleviate these angle collisions and the signal met warrants 1B, 2, and 3B.

The initial crash analysis was completed from March 31, 1998 to March 31, 2001 with twelve (12) reported crashes, eight (8) of which were deemed correctable. The final completion date for the improvement at the subject intersection was on April 22, 2003 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 was the months of December 2002 through May 2003. The before period consisted of reported crashes from April 1, 1997 through November 30, 2002 (5 years and 8 months); and the after period consisted of reported crashes from June 1, 2003 through January 31, 2009 (5 years and 8 months). The ending date for this analysis was determined by the date of available crash data at the time of analysis.

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

The following data table depicts the Naive Before and After Analysis for the treatment location. Please note that Intersection Frontal Impact 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; Angle; and Ran-off Roadway due to avoidance of an Angle Collision.

<u>Treatment Information</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Total crashes	42	34	- 19.0 %
Total Severity Index	6.50	4.92	- 24.3 %
Target Crashes	28	17	- 39.3 %
Target Crash Severity Index	6.61	5.35	- 19.1 %
Volume	18,300	19,400	6.0 %

<u>Injury Crash Summary</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Fatal injury Crashes	0	0	N/A
Class A injury Crashes	1	0	- 100.0 %
Class B injury Crashes	7	4	- 42.9 %
Class C Injury Crashes	14	14	0.0 %
Total Injury Crashes	22	18	- 18.2 %

The naive before and after analysis at the treatment location resulted in a 19 percent decrease in Total Crashes, a 39 percent decrease in Target Crashes, and a 24 percent decrease in the Total Severity Index. The before period ADT year was 2000 and the after period ADT year was 2006.

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 19 percent decrease in Total Crashes and a 39 percent decrease in Target Crashes. The summary results above demonstrate that both Total Crashes and Target Crashes appear to have decreased at the treatment location from the before to the after period.

Referencing the *Collision Diagrams*, the before period consisted of an angle crash pattern (21 crashes) from side street vehicles improperly attempting to cross NC 41; including three ran-off road collisions by NC 41 motorists attempting to avoid the angle collision. After the signal installation, the angle crash pattern reduced but the intersection still experienced ten (10) red light run collisions. Of these ten red light run crashes, eight (8) occurred with the NC 41 as the at-fault driver; five (5) traveling westbound and three (3) traveling eastbound. The intersection is also experiencing a small pattern (5 crashes) of left turn same-roadway type collisions involving vehicles between SR 2033 and SR 2126 in the northbound direction.

In the before period, a turning rear-end crash pattern (6 collisions) was also occurring at this location from vehicles waiting to turn left off of NC 41. The upgrade to a three-lane segment corrected this pattern in the after period; however, a westbound NC 41 rear-end slow-stop pattern has developed consisting of seven (7) collisions.

The calculated benefit to cost ratio for this project is **9.52 considering total crashes**. The benefit to cost ratio **considering only target crashes is 9.25**. 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 four approaches to the treatment intersection. 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.

TREATMENT SITE PHOTOS



Looking East on NC 41 (Elizabethtown Rd) – Side of Food Lion



Traveling West on NC 41 – Side of Church & Tractor Sales



Looking North on SR 2126 (Harrill Road)



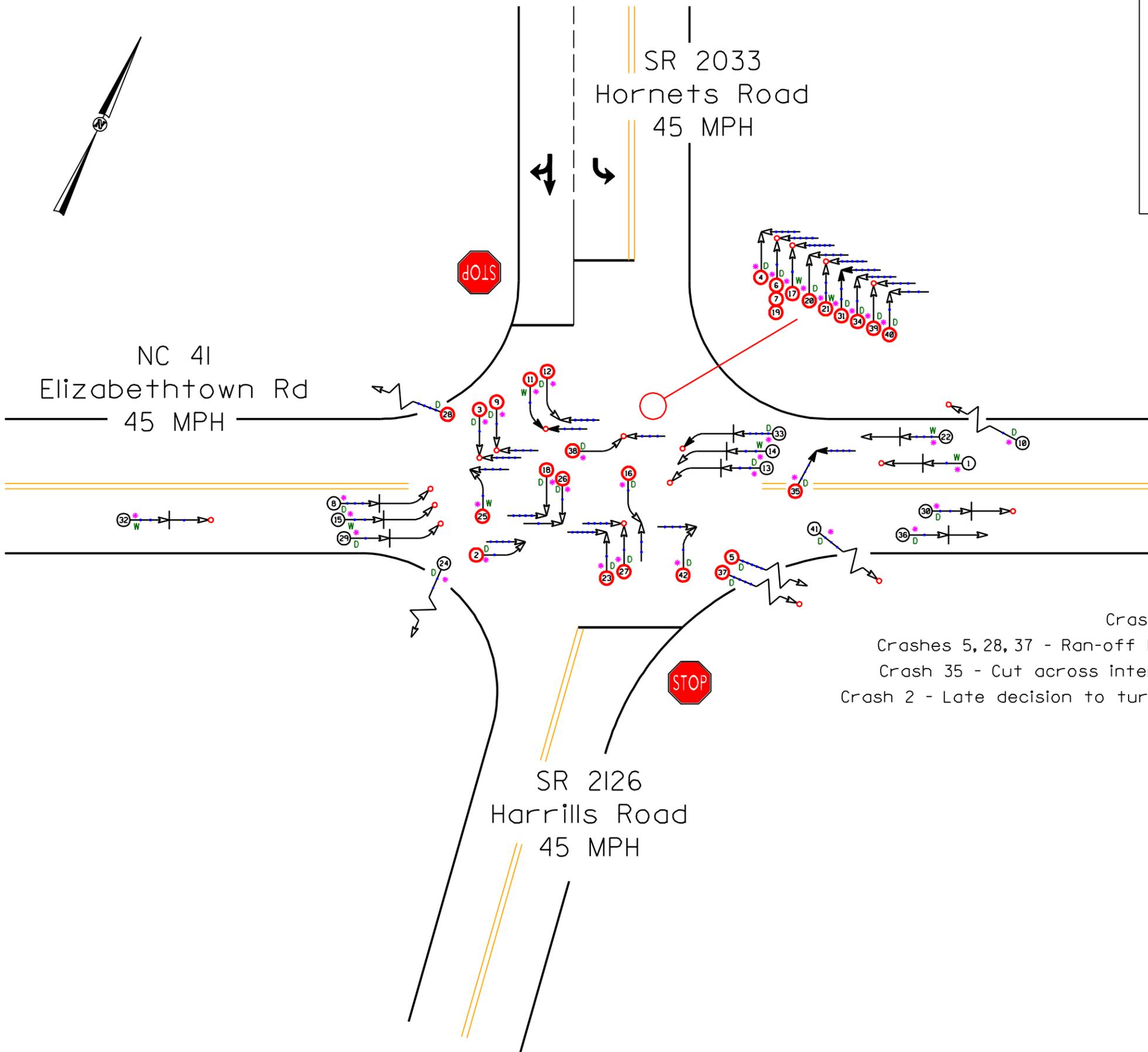
Looking South on SR 2033 (Hornets Road)

BENEFIT-COST ANALYSIS WORKSHEET - Total Crashes

LOCATION: NC 41 at SR 2033		BY: JBS						
COUNTY: Robeson		DATE: 5/26/2009						
FILE NO.: SS 06-01-205		NOTES: Total Crashes						
DETAILED COST:	TYPE IMPROVEMENT -	New Traffic Signal						
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$50,000	10	0.149	\$7,451			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$50,000	10	0.149	\$7,451			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$2,200			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$900			
	TOTAL ANNUAL COST=				\$10,551			
	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	5.67	1	0.18	21	3.70	20	3.53	\$168,607
AFTER	5.67	0	0.00	18	3.17	16	2.82	\$68,148
						Annual Benefits from Crash Cost Savings		\$100,459
	NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$89,907	
	BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	9.52	
	TOTAL COST OF PROJECT	-	\$50,000	COMPREHENSIVE B/C RATIO	-		9.52	

BENEFIT-COST ANALYSIS WORKSHEET - Target Crashes

LOCATION: NC 41 at SR 2033		BY: JBS						
COUNTY: Robeson		DATE: 5/26/2009						
FILE NO.: SS 06-01-205		NOTES: Target Crashes - Frontal Impact						
DETAILED COST:	TYPE IMPROVEMENT -	New Traffic Signal						
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$50,000	10	0.149	\$7,451			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$50,000	10	0.149	\$7,451			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$2,200			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$900			
	TOTAL ANNUAL COST=				\$10,551			
	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	5.67	1	0.18	11	1.94	16	2.82	\$134,109
AFTER	5.67	0	0.00	10	1.76	7	1.23	\$36,561
						Annual Benefits from Crash Cost Savings		\$97,549
	NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$86,997	
	BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	9.25	
	TOTAL COST OF PROJECT	-	\$50,000	COMPREHENSIVE B/C RATIO	-		9.25	



LEGEND

	MOVING VEHICLE		ANGLE		9 MPH OR LESS		PEDESTRIAN
	PEDESTRIAN		TURNING		10 MPH TO 19		TRAIN
	PARKED VEHICLE		BACKING		20 MPH TO 29		DRIVER AT FAULT
	PARKING VEHICLE		SIDESWIPE		30 MPH TO 39		DRY
	FIXED OBJECT		OUT OF CONTROL		40 MPH TO 49		WET
	HEAD ON		INJURY		50 MPH TO 59		ICY OR SNOWY
	REAR END		FATALITY		60 MPH TO 69		OILY
	RAN OFF ROAD		SPEED UNKNOWN		70 AND UP		

SS# 06-01-205
 Robeson County
 City of Lumberton
 BEFORE Period
 4/1/97 - 11/30/02

Crash Notes:
 Crashes 5, 28, 37 - Ran-off Road to avoid an Angle Collision
 Crash 35 - Cut across intersection to access Church PVA
 Crash 2 - Late decision to turn left after already turning right

Frontal Impact
Target Crashes

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT	
COLLISION DIAGRAM	
DIVISION: 6	AREA:
STUDY PERIOD: 4/1/1997 - 11/30/2002	
DISTANCE: Y-LINE : 150FT	
ANALYSIS PREPARED BY: JBS	
ANALYSIS CHECKED BY: N/A	
DIAGRAM PREPARED BY: JBS	
DIAGRAM REVIEWED BY: ST	
SCALE: NOT TO SCALE	
DATE: 5-21-2009	
LOG NUMBER: SS* 06-01-205 BEFORE	

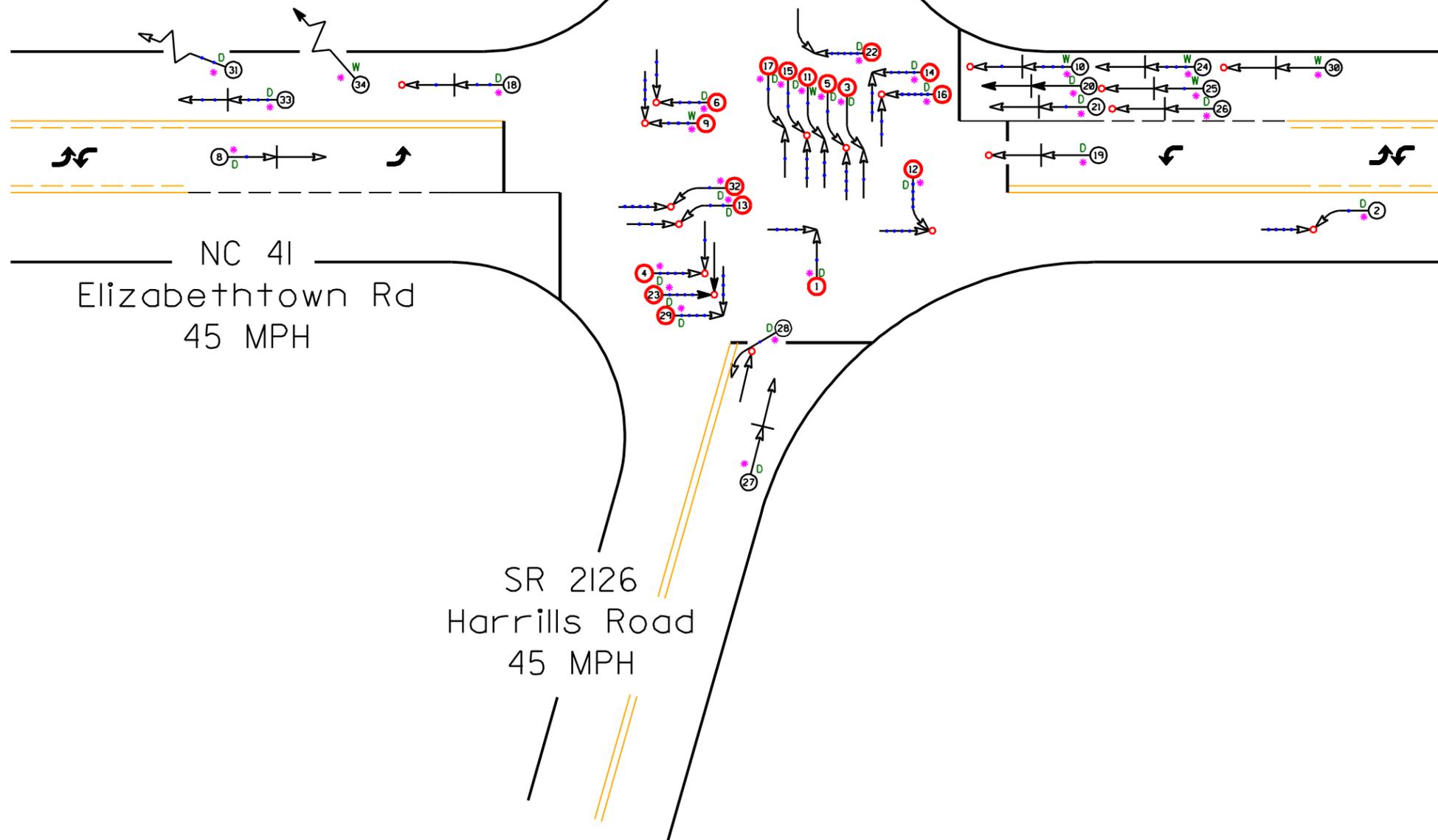
N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRANSPORTATION MOBILITY and
SAFETY DIVISION



SR 2033
Hornets Road
45 MPH

NC 41
Elizabethtown Rd
45 MPH

SR 2126
Harrills Road
45 MPH



LEGEND

	MOVING VEHICLE		ANGLE		9 MPH OR LESS		PEDESTRIAN
	PEDESTRIAN		TURNING		10 MPH TO 19		TRAIN
	PARKED VEHICLE		BACKING		20 MPH TO 29		DRIVER AT FAULT
	PARKING VEHICLE		SIDESWIPE		30 MPH TO 39		DRY
	FIXED OBJECT		OUT OF CONTROL		40 MPH TO 49		WET
	HEAD ON		INJURY		50 MPH TO 59		ICY OR SNOWY
	REAR END		FATALITY		60 MPH TO 69		OILY
	RAN OFF ROAD		70 AND UP		SPEED UNKNOWN		

SS# 06-01-205
Robeson County
City of Lumberton
AFTER Period
6/1/03 - 1/31/09



New Signalized
Intersection
Sig ID 06-0663



TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

	COLLISION DIAGRAM	
	DIVISION: 6	AREA:
	STUDY PERIOD: 6/1/2003 - 1/31/2009	
	DISTANCE: Y-LINE = 150FT	
	ANALYSIS PREPARED BY: JBS	
	ANALYSIS CHECKED BY: N/A	
	DIAGRAM PREPARED BY: JBS	
	DIAGRAM REVIEWED BY: ST	
	SCALE: NOT TO SCALE	
	DATE: 5-21-2009	
	LOG NUMBER: SS* 06-01-205 AFTER	

N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRANSPORTATION MOBILITY and
SAFETY DIVISION