

Spot Safety Project Evaluation

Order # 41000003027

Spot Safety Project # 03-00-401

**Spot Safety Project Evaluation of the Guardrail Installation and Pavement Wedging on
SR 1500 (Midway) at Bridge # 104
Brunswick County**

Documents Prepared By:

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

Principal Investigator



Brad Robinson, PE

12/03/2009

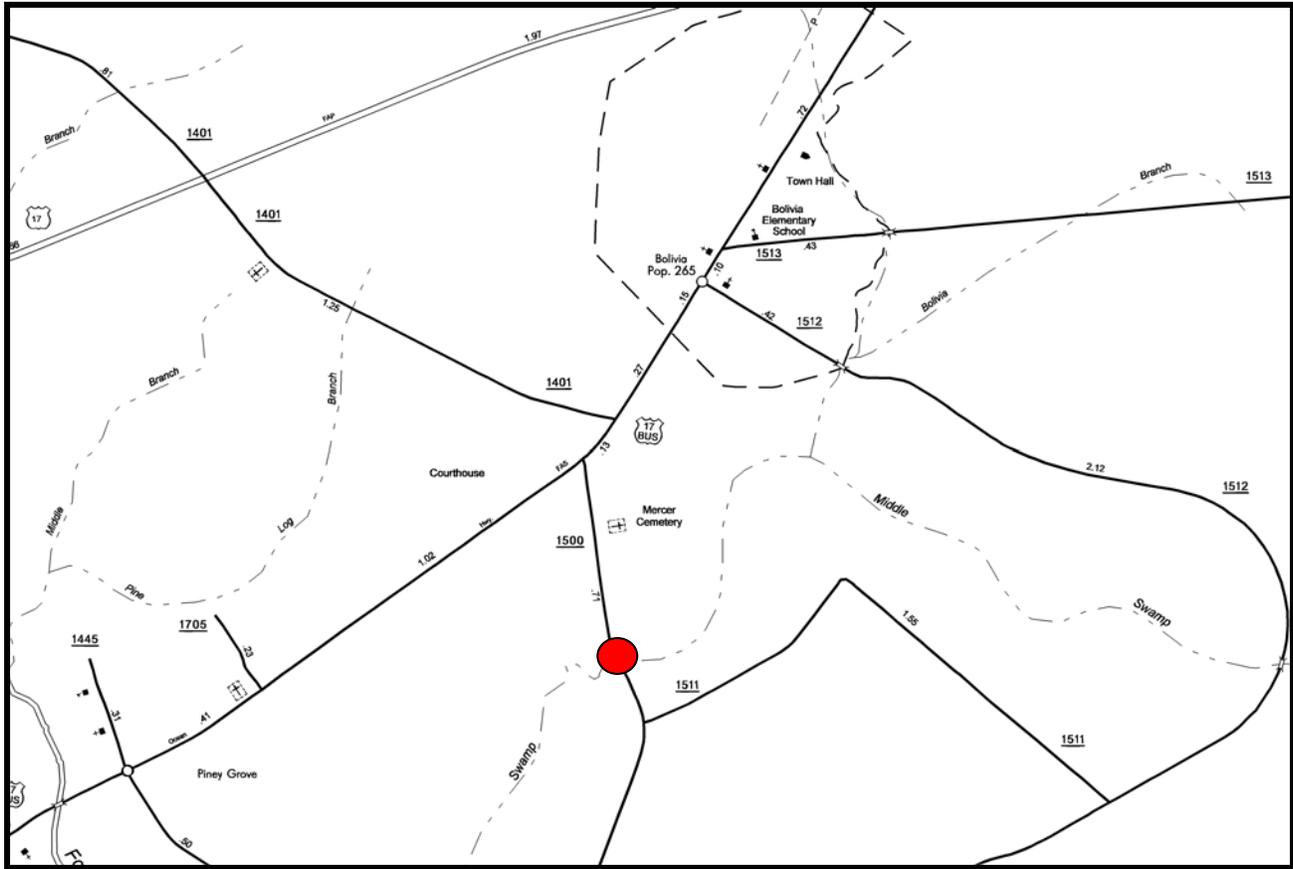
Date

Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 03-00-401 – SR 1500 (Midway) at Bridge #104 over Middle Swamp, south of US 17B in Brunswick County.



Project Information and Background from the Project File Folder

The spot safety project improvement countermeasures chosen for the subject location were guardrail installation and the resurfacing of pavement to correct a dip in the road.

The subject location is a two-lane bridge with concrete bridge rails. The speed limit for SR 1500 is 55 mph. The bridge is located just south of a curve on SR 1500.

The original statement of problem was that southbound motorists exiting the curve encountered a dip in the pavement which was causing vehicles to run off the road and strike the bridge rail end.

The initial crash analysis was conducted from June 1, 1997 to May 31, 2003 with a total of eleven reported crashes, eight of which were considered correctable by the chosen countermeasure. The final completion date for the improvements at the subject intersection was on February 6, 2004 with a total cost of \$60,000.00.

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 from January 1, 2004 to March 31, 2004. The before period consisted of reported crashes from July 1, 1998 through December 31, 2003 (5 years and 6 months) and the after period consisted of reported crashes from April 1, 2004 through September 30, 2009 (5 years and 6 months). The ending date for this analysis was limited by the available crash data at the time the analysis was conducted.

The treatment data consisted of all reported crashes on SR 1500 from 500 feet north of the bridge to 200 feet south of the bridge. The following data table depicts the Naive Before and After Analysis for the treatment location. Please note that Ran-off Roadway Collisions were the target crashes for the applied countermeasure. The Target Crash types considered are as follows: Ran-off Road, Right; Ran-off Road, Left; Ran-off Road, Straight; and Head-on crashes. The target crashes are clearly identified in the before and after period collision diagrams.

<u>Treatment Information</u>			
	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	12	11	-8.3
Total Severity Index	11.02	3.02	-72.6
Target Crashes	11	9	-18.2
Target Crash Severity Index	11.93	3.47	-70.9
Volume	2700	3900	44.4
<u>Crash Severity Summary</u>			
Fatal Crashes	1	0	-100.0
Class A Crashes	0	0	N/A
Class B Crashes	3	3	0.0
Class C Crashes	3	0	-100.0
PDO Crashes	4	6	50.0

The naive before and after analysis at the treatment location resulted in an 8 percent decrease in Total Crashes, an 18 percent decrease in Target Crashes, and a 44 percent increase in Average Daily Traffic (ADT). The before period ADT year was 2001 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 an 8 percent decrease in Total Crashes and an 18 percent decrease in Target Crashes. The Total Severity Index decreased by 73 percent and the Target Severity Index decreased by 71 percent. 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.

The calculated benefit to cost ratio for this project is 12.83 considering total crashes. The benefit to cost ratio considering only target crashes is also 12.91. 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.

Typically, one would expect guardrail installation projects to result in an increased number of Ran Off Road Crashes and a decrease in the severity of Ran Off Road crashes. The increase in Ran Off Road Crashes is expected due to the placement of a fixed object (guardrail) near the travel way. The decrease in the severity of Ran Off Road Crashes is expected due to the guardrail being more forgiving than the object it is protecting. The resurfacing of the roadway in order to correct the dip was an attempt to prevent vehicles from running off the roadway in the first place. The combination of these countermeasures has resulted in both a decrease in Ran Off Road Crashes and a large decrease in the severity of the Ran Off Road crashes.

There was a fatal crash at the subject location in the before period. The driver came out of the southbound curve towards the bridge, ran off the roadway to the right, and struck the concrete bridge face. Alcohol was involved in the crash and the driver was not wearing a seat belt. The recommendations given during the fatal investigation were used in this project.

According the file folder, this bridge is part of a TIP bridge Project (B-4441) which was scheduled for 2008.

Please see the attached *Treatment Site Photos*. Photos were obtained from Google Street-view. 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.

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: SR 1500 at Bridge #104
 COUNTY: Brunswick
 FILE NO.: SS 03-00-401

BY: BDR
 DATE: 11/30/2009

DETAILED COST: TYPE IMPROVEMENT - Resurface, guardrail

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$0	0	0.000	\$0
	\$60,000	10	0.149	\$8,942
Right-of-Way	\$0	0	0.000	\$0
TOTALS	\$60,000	10	0.149	\$8,942

ESTIMATED INCREASE IN ANNUAL MAINT. COST = \$655
 ESTIMATED INCREASE IN ANNUAL UTILITY COST = \$0
 TOTAL ANNUAL COST= \$9,597
 TOTAL COST OF PROJECT= \$60,000

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	5.50	1	0.18	6	1.09	5	0.91	\$140,182
AFTER	5.50	0	0.00	3	0.55	8	1.45	\$17,018

Annual Benefits from Crash Cost Savings \$123,164

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = \$113,567

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 12.83

TOTAL COST OF PROJECT - \$60,000 COMPREHENSIVE B/C RATIO - 12.83

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: SR 1500 at Bridge #104
 COUNTY: Brunswick
 FILE NO.: SS 03-00-401 Target Crashes Only

BY: BDR
 DATE: 11/30/2009

DETAILED COST: TYPE IMPROVEMENT - Resurface, guardrail

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$0	0	0.000	\$0
Right-of-Way	\$60,000	10	0.149	\$8,942
	\$0	0	0.000	\$0
TOTALS	\$60,000	10	0.149	\$8,942

ESTIMATED INCREASE IN ANNUAL MAINT. COST =	\$655
ESTIMATED INCREASE IN ANNUAL UTILITY COST =	\$0
TOTAL ANNUAL COST=	\$9,597
TOTAL COST OF PROJECT=	\$60,000

COMPREHENSIVE COST REDUCTION:

TIME PERIOD	YEARS	ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES						ANNUAL COSTS
		K & A CRASHES	K & A CRASHES PER YR	B & C CRASHES	B & C CRASHES PER YR	PDO CRASHES	PDO CRASHES PER YR	
BEFORE	5.50	1	0.18	6	1.09	4	0.73	\$139,418
AFTER	5.50	0	0.00	3	0.55	6	1.09	\$15,491

Annual Benefits from Crash Cost Savings \$123,927

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = \$114,331

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 12.91

TOTAL COST OF PROJECT - \$60,000 COMPREHENSIVE B/C RATIO - 12.91

Treatment Site Photos from Google Street-View



Looking north on SR 1500 (Midway)



Looking north on SR 1500 (Midway)



Looking south on SR 150 (Midway)



Looking south on SR 150 (Midway)

Brunswick County
 SR 1500 (Midway) at
 Bridge #401
 BEFORE Period
 7/1/1998-12/31/2003

LEGEND

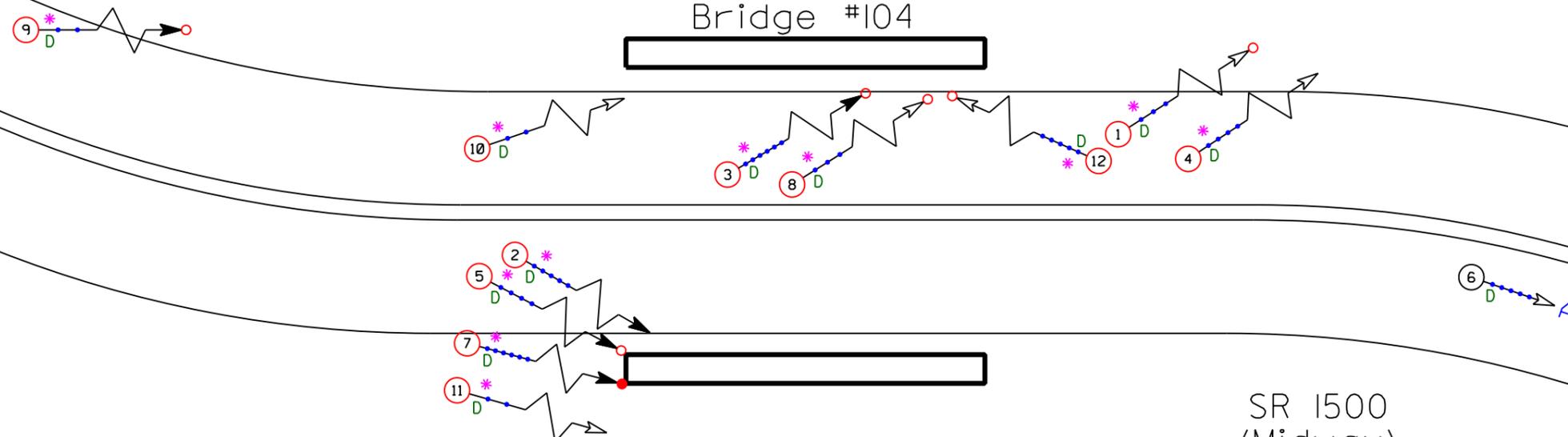
MOVING VEHICLE	ANGLE	9 MPH OR LESS	P PEDESTRIAN
PEDESTRIAN	TURNING	10 MPH TO 19	T TRAIN
PARKED VEHICLE	BACKING	20 MPH TO 29	* DRIVER AT FAULT
PARKING VEHICLE	SIDESWIPE	30 MPH TO 39	D DRY
FIXED OBJECT	OUT OF CONTROL	40 MPH TO 49	W WET
HEAD ON	INJURY	50 MPH TO 59	I ICY OR SNOWY
REAR END	FATALITY	60 MPH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



SR 1500
 (Midway)

Bridge #104

SR 1500
 (Midway)



 Target Crash

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

	COLLISION DIAGRAM	
	DIVISION: 3	AREA:
STUDY PERIOD: 7/1/98-12/31/03		
DISTANCE: Y-LINE : OF1		
ANALYSIS PREPARED BY: BOR		
ANALYSIS CHECKED BY:		
DIAGRAM PREPARED BY: BOR		
DIAGRAM REVIEWED BY:		
SCALE: NOT TO SCALE		
DATE: November 2009		
ORDER NUMBER: 4000003027		

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

**Brunswick County
SR 1500 (Midway) at
Bridge #401
AFTER Period
4/1/2004-9/30/2009**

LEGEND

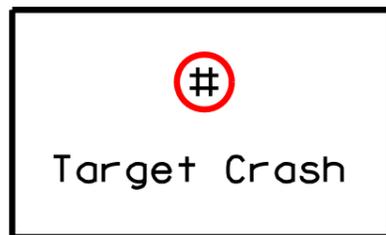
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RAN OFF ROAD	FATALITY	60 MPH TO 69	O OILY
		70 AND UP	
		SPEED UNKNOWN	

SR 1500
(Midway)

Bridge #104

SR 1500
(Midway)

ROLLOVER



TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

	COLLISION DIAGRAM	
	DIVISION: 3	AREA:
STUDY PERIOD: 4/1/04-9/30/09		
DISTANCE: Y-LINE : OF 1		
ANALYSIS PREPARED BY: BDR		
ANALYSIS CHECKED BY:		
DIAGRAM PREPARED BY: BDR		
DIAGRAM REVIEWED BY:		
SCALE: NOT TO SCALE		
DATE: November 2009		
ORDER NUMBER: 4000003027		

**N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
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