

Spot Safety Project Evaluation

Order # 41000016665

Spot Safety Project # 13-06-205

**Spot Safety Project Evaluation of the Guardrail Installation in Order to Close the Gap
Between the Cable Rail and Metal Guardrail on I-26 at Exit 9 (US 19)
Madison 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

12/23/2011

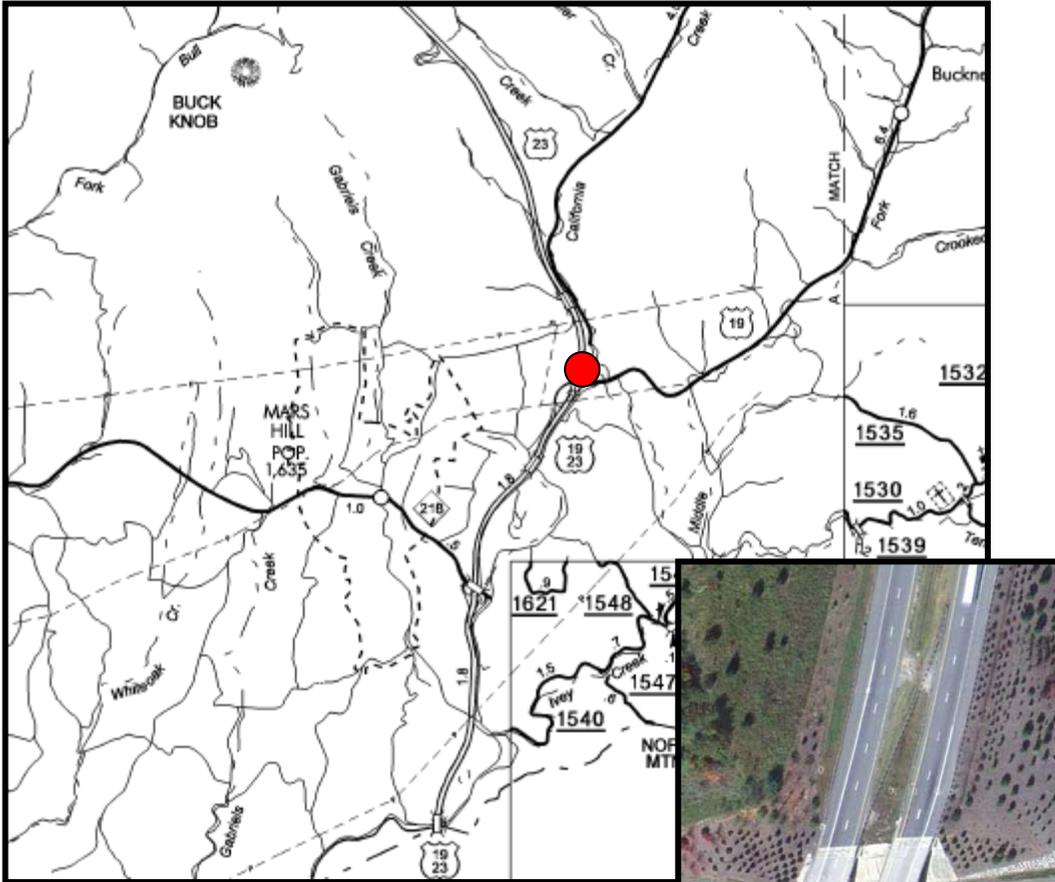
Date

Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 13-06-205 – I-26 on the eastbound (southbound) approach of I-26 to the bridge over US 19 (Exit 9) near Mars Hill in Madison County.



Project Information and Background from the Project File Folder

The spot safety project improvement countermeasure chosen for the subject location was to close the guardrail gap between the cable rail and the metal guardrail.

I-26 is a four-lane divided interstate with a 60 mph speed limit and four foot paved median shoulders with rumble strips. Prior to the project there was a gap between where the cable guardrail ended and the bridge approach guardrail began in addition to a gap between the two bridge approach guardrails.

The project was implemented after two fatal crashes occurred at the subject location. In each crash a vehicle left the roadway to the left, hit the median cable, and then was led into the gap between the two sections of bridge approach guardrail. Both crashes resulted in the vehicle continuing over the bridge and onto the roadway (US 19) below.

The final completion date for the improvements was on June 1, 2007 with a total cost of \$22,000.00.

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 April 1, 2007 to June 30, 2007. The before period consisted of reported crashes from December 1, 2002 through March 31, 2007 (4 years, 4 months) and the after period consisted of reported crashes from July 1, 2007 through October 31, 2011 (4 years, 4 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 southbound I-26 from the US 19 bridge to a point 0.1 mile north. The following data table depicts the Naive Before and After Analysis for the treatment location. Please note that Ran Off Road crash types involving vehicles leaving the roadway to the left were the target crashes for the guardrail installation. The target crashes are clearly identified in the before and after period crash severity diagrams.

<u>Treatment Information</u>			
	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	4	2	-50.0
Total Severity Index	40.75	4.70	-88.5
Target Crashes	2	1	-50.0
Target Crash Severity Index	76.80	8.40	-89.1
Volume	8,800	10,000	13.6

Target Crash Severity Summary			
Fatal Crashes	2	0	-100.0
Class A Crashes	0	0	N/A
Class B Crashes	0	0	N/A
Class C Crashes	0	1	N/A
PDO Crashes	0	0	N/A

The naive before and after analysis at the treatment location resulted in a 50 percent decrease in total crashes, a 50 percent decrease in target crashes, and a 14 percent increase in Average Daily Traffic (ADT). The target severity index decreased by 89 percent. The before period ADT year was 2005 and the after period ADT year was 2009.

Results and Discussion

Both of the before period target crashes involved vehicles entering the gap and falling between the bridges and onto the roadway below. Both also resulted in fatalities. The single after period crash involved a vehicle striking the median cable, coming back onto the roadway and then running off the road to the right.

The calculated benefit to cost ratio for this project is 88.75 considering total crashes. The benefit to cost ratio considering only target crashes is 87.35. 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.

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 roadway.

BENEFIT-COST ANALYSIS WORKSHEET - TOTAL

LOCATION: I-26 at US 19		BY: bdr						
COUNTY: Madison		DATE: 12/23/2011						
FILE NO.: SS 13-06-205								
DETAILED COST:	TYPE IMPROVEMENT -	guardrail-closing a gap						
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$0	0	0.000	\$0			
		\$22,000	10	0.149	\$3,279			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$22,000	10	0.149	\$3,279			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$0			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$0			
	TOTAL ANNUAL COST=				\$3,279			
	TOTAL COST OF PROJECT=				\$22,000			
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	4.33	2	0.46	1	0.23	1	0.23	\$296,605
AFTER	4.33	0	0.00	1	0.23	1	0.23	\$5,612
							Annual Benefits from Crash Cost Savings	\$290,993
	NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST							\$287,714
	BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST							88.75
	TOTAL COST OF PROJECT -	\$22,000		COMPREHENSIVE B/C RATIO -				88.75

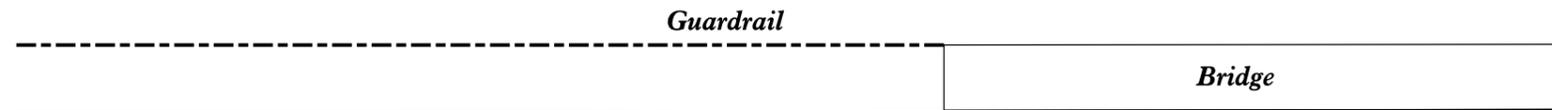
BENEFIT-COST ANALYSIS WORKSHEET - TARGET

LOCATION: I-26 at US 19		BY: bdr						
COUNTY: Madison		DATE: 12/23/2011						
FILE NO.: SS 13-06-205								
DETAILED COST:	TYPE IMPROVEMENT -	guardrail-closing a gap						
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$0	0	0.000	\$0			
		\$22,000	10	0.149	\$3,279			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$22,000	10	0.149	\$3,279			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$0			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$0			
	TOTAL ANNUAL COST=				\$3,279			
	TOTAL COST OF PROJECT=				\$22,000			
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	4.33	2	0.46	0	0.00	0	0.00	\$290,993
AFTER	4.33	0	0.00	1	0.23	0	0.00	\$4,619
							Annual Benefits from Crash Cost Savings	\$286,374
	NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST							\$283,095
	BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST							87.35
	TOTAL COST OF PROJECT -	\$22,000		COMPREHENSIVE B/C RATIO -				87.35

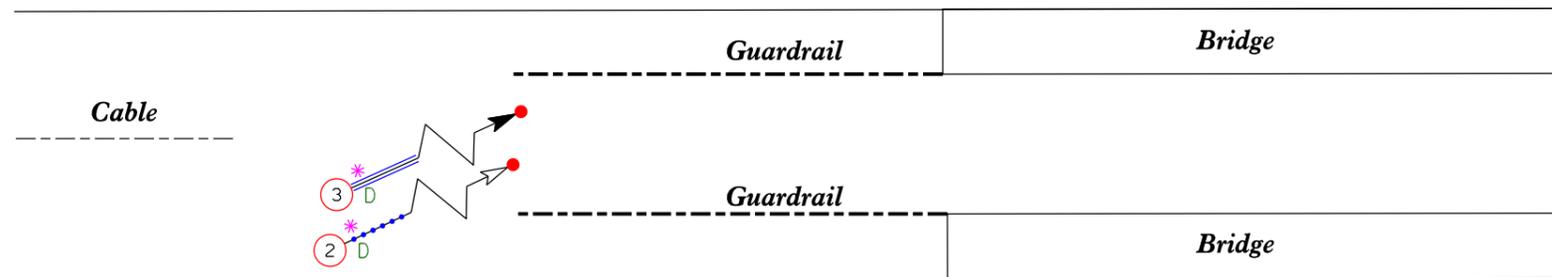
SS# 13-06-205
 Order# 41000016665
 Madison County
 BEFORE Period
 12/1/2002-3/31/2007



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		



I-26
 westbound (north) lanes
 60 mph



I-26
 eastbound (south) lanes
 60 mph



ADT (Year)
 8,800 (2005)

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

TRAFFIC SAFETY UNIT

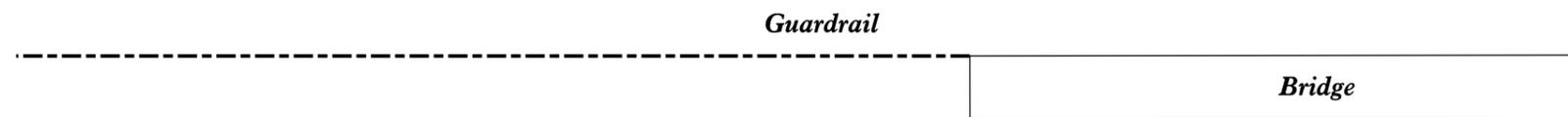
Date: December 2011

Prepared By: bdr

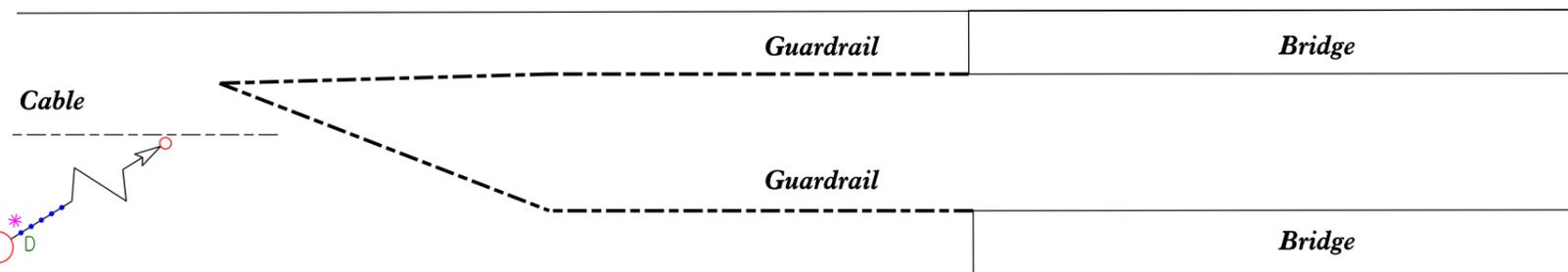
SS# 13-06-205
 Order# 41000016665
 Madison County
 AFTER Period
 7/1/2007-10/31/2011



LEGEND			
	MOVING VEHICLE		ANGLE
	PEDESTRIAN		TURNING
	PARKED VEHICLE		BACKING
	PARKING VEHICLE		SIDESWIPE
	FIXED OBJECT		OUT OF CONTROL
	HEAD ON		INJURY
	REAR END		FATALITY
	RAN OFF ROAD		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



I-26
 westbound (north) lanes
 60 mph



I-26
 eastbound (south) lanes
 60 mph



ADT (Year)
 10,000 (2009)



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

TRAFFIC SAFETY UNIT

Date: December 2011

Prepared By: bdr