

Hazard Elimination Project Evaluation

Order # 41000011351

Hazard Elimination Project W-4830

**Evaluation of the Rumble Strip and Rumble Stripe Installation on US 74
From Milepost 8.4 to the Robeson County Line
Scotland 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

3/11/2011

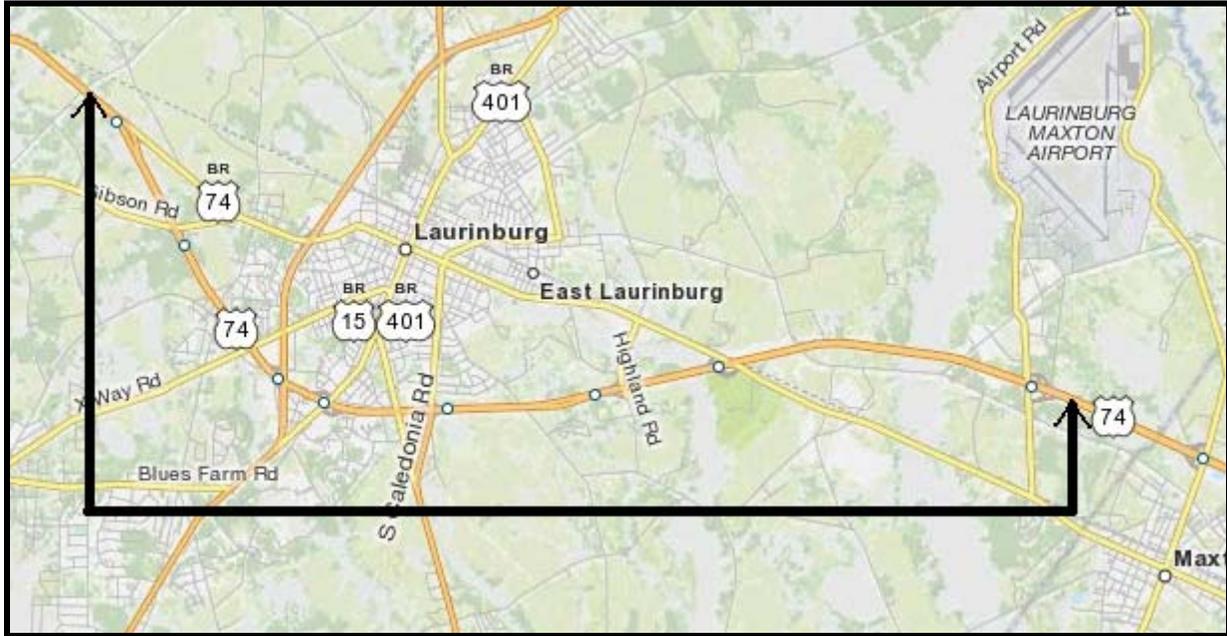
Date

Traffic Safety Project Engineer

Hazard Elimination Project Evaluation Documentation

Subject Location

US 74 from milepost 8.4 to the Robeson County Line (MP 18.48), a distance of approximately 10 miles.



Project Information and Background from the Project File Folder

The hazard elimination project improvements chosen for the subject location were the installation of rumble strips along the outside shoulders and rumble strips along the median shoulders.

US 74 is a four-lane divided highway at the subject location. The posted speed limit is 60 mph. The intended purpose of the improvement was to alleviate the frequency of run-off-road (drift-off) crashes.

The initial crash analysis was completed from August 1, 2000 to July 31, 2003 with 72 total reported crashes, 51 of which were deemed correctable Ran Off Road crashes. The improvement was completed on August 31, 2006 with a total cost of \$155,000. The projected B/C Ratio was 5.58.

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 were from June 1, 2006 through September 30, 2006. The before period consisted of reported crashes from March 1, 2002 through May 31, 2006 (4.25 years); and the after period consisted of reported crashes from October 1, 2006 through December 31, 2010 (4.25 years). The ending date for this analysis was

determined by the date of available crash data at the time of analysis. The before period ADT year was 2004 and the after period ADT year was 2008.

The treatment data consisted of all mainline crashes on US 74 from milepost 8.4 to the Robeson County Line. The analysis was completed with a 0' y-line. Target crashes are lane departure crash types.

<u>Treatment Information</u>	Before	After	Percent Reduction (-)/ Percent Increase (+)
Total Crashes – Both Directions	137	125	-8.8
Total Severity Index	6.04	4.21	-30.3
Lane Departure Crashes – Both Directions	116	87	-25.0
Lane Departure Severity Index	4.54	3.47	-23.6
Volume	15,400	15,800	2.6

The following tables divide the crash data by direction of travel.

<u>Eastbound Treatment Information</u>	Before	After	Percent Reduction (-)/ Percent Increase (+)
Total Crashes	56	57	1.8
Total Severity Index	4.34	4.25	-2.1
Lane Departure Crashes	48	40	-16.7

<u>Eastbound Target Crash Details</u>	Before	After	Percent Reduction (-)/ Percent Increase (+)
Segment Crashes – Injuries			
Fatal Injury Crashes	1	0	-100.0
Non-Fatal Injury Crashes	13	16	23.1
Property Damage Only Crashes	34	24	-29.4
Crashes - Contributing Factors			
Night Crashes	11	14	27.3
Wet Road Crashes	17	15	-11.8
Alcohol Related	2	1	-50.0
Lane Departure Crash Types			
Fixed Object	36	28	-22.2
Overturn / Rollover	1	2	100.0
Ran Off Road (Right & Left)	2	3	50.0
Sideswipe, Same Direction	9	7	-22.2

<u>Westbound Treatment Information</u>	Before	After	Percent Reduction (-)/ Percent Increase (+)
Total Crashes	81	68	-16.0
Total Severity Index	7.21	4.18	-42.0
Lane Departure Crashes	68	47	-30.9

<u>Westbound Target Crash Details</u>	Before	After	Percent Reduction (-)/ Percent Increase (+)
Segment Crashes – Injuries			
Fatal Injury Crashes	1	0	-100.0
Non-Fatal Injury Crashes	22	13	-40.9
Property Damage Only Crashes	45	34	-24.4
Crashes - Contributing Factors			
Night Crashes	20	16	-20.0
Wet Road Crashes	19	6	-68.4
Alcohol Related	2	4	100.0
Lane Departure Crash Types			
Fixed Object	42	36	-14.3
Overturn / Rollover	5	0	-100.0
Ran Off Road (Right & Left)	12	8	-33.3
Sideswipe, Same Direction	9	3	-66.7

Results and Discussion

Using naïve before and after analysis, Total Crashes have decreased by 9 percent and Target Crashes have decreased by 25 percent in the subject area. Looking at the crashes by direction, the eastbound lanes experienced a 2 percent increase in total crashes but a 17 percent decrease in lane Departure Crashes while the westbound lanes experienced a 16 percent decrease in total crashes and a 31 percent decrease in lane departure crashes.

The calculated benefit to cost ratio for the project is **25.70** considering Total Crashes. The benefit to cost ratio considering only Target Crashes is **14.98**. 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 when applicable.

As the Safety Evaluation Group completes additional 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 treatment.

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: US 74 from MP 8.4 to Robeson County Line BY: bdr
 COUNTY: Scotland DATE: 2/25/2011
 FILE NO.: W-4830

DETAILED COST: TYPE IMPROVEMENT - Rumble Strips/Stripes

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$0	0	0.000	\$0
Right-of-Way	\$155,000	10	0.149	\$23,100
	\$0	0	0.000	\$0
TOTALS	\$155,000	10	0.149	\$23,100

ESTIMATED INCREASE IN ANNUAL MAINT. COST =	\$0
ESTIMATED INCREASE IN ANNUAL UTILITY COST =	\$0
TOTAL ANNUAL COST=	\$23,100
TOTAL COST OF PROJECT=	\$155,000

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	4.25	5	1.18	42	9.88	90	21.18	\$1,029,882
AFTER	4.25	1	0.24	44	10.35	80	18.82	\$436,235

Annual Benefits from Crash Cost Savings \$593,647

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = \$570,547

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 25.70

TOTAL COST OF PROJECT - \$155,000 COMPREHENSIVE B/C RATIO - 25.70

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: US 74 from MP 8.4 to Robeson County Line BY: bdr
 COUNTY: Scotland DATE: 2/25/2011
 FILE NO.: W-4830 Target Crashes Only

DETAILED COST: TYPE IMPROVEMENT - Rumble Strips/Stripes

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$0	0	0.000	\$0
Right-of-Way	\$155,000	10	0.149	\$23,100
	\$0	0	0.000	\$0
TOTALS	\$155,000	10	0.149	\$23,100

ESTIMATED INCREASE IN ANNUAL MAINT. COST = \$0
 ESTIMATED INCREASE IN ANNUAL UTILITY COST = \$0
 TOTAL ANNUAL COST= \$23,100
 TOTAL COST OF PROJECT= \$155,000

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	4.25	2	0.47	35	8.24	79	18.59	\$541,106
AFTER	4.25	0	0.00	29	6.82	58	13.65	\$195,153

Annual Benefits from Crash Cost Savings \$345,953

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = \$322,853

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 14.98

TOTAL COST OF PROJECT - \$155,000 COMPREHENSIVE B/C RATIO - 14.98

Treatment Site Photos from Google Street-View



On US 74 eastbound approaching US 501

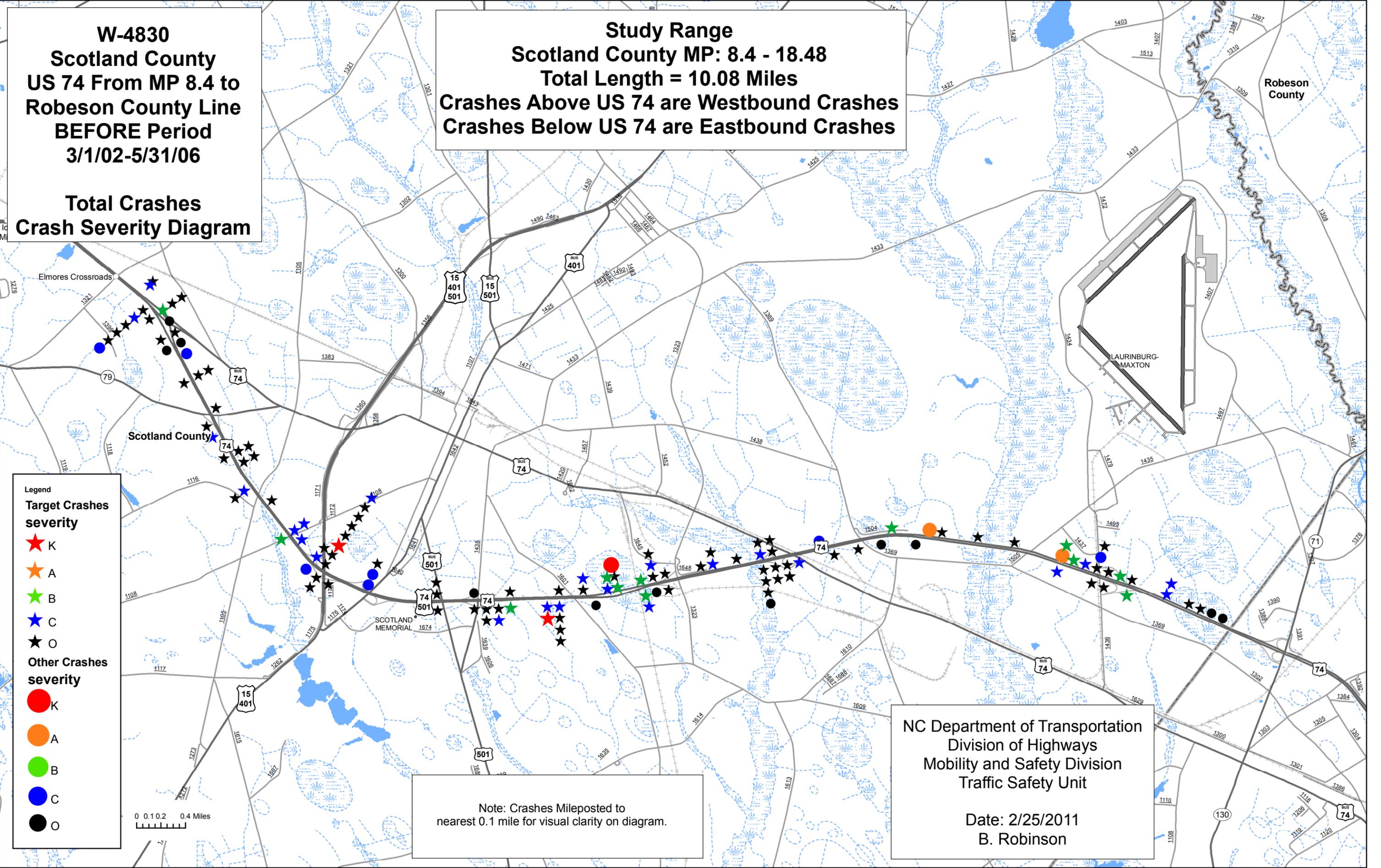


On US 74 eastbound

W-4830
Scotland County
US 74 From MP 8.4 to
Robeson County Line
BEFORE Period
3/1/02-5/31/06

Total Crashes
Crash Severity Diagram

Study Range
Scotland County MP: 8.4 - 18.48
Total Length = 10.08 Miles
Crashes Above US 74 are Westbound Crashes
Crashes Below US 74 are Eastbound Crashes



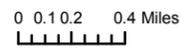
Legend

Target Crashes severity

- ★ K
- ★ A
- ★ B
- ★ C
- ★ O

Other Crashes severity

- K
- A
- B
- C
- O



Note: Crashes Mileposted to nearest 0.1 mile for visual clarity on diagram.

NC Department of Transportation
 Division of Highways
 Mobility and Safety Division
 Traffic Safety Unit

Date: 2/25/2011
 B. Robinson

W-4830
Scotland County
US 74 From MP 8.4 to
Robeson County line
AFTER Period
10/1/06-12/31/10

Total Crashes
Crash Severity Diagram

Study Range
Scotland County MP: 8.4 - 18.48
Total Length = 10.08 Miles
Crashes Above US 74 are Westbound Crashes
Crashes Below US 74 are Eastbound Crashes

After Period Countermeasure
 Rumble Strips and Stripes

Legend

Target Crashes severity

- ★ K
- ★ A
- ★ B
- ★ C
- ★ O

Other Crashes severity

- K
- A
- B
- C
- O

0 0.1 0.2 0.4 Miles

Note: Crashes Mileposted to nearest 0.1 mile for visual clarity on diagram.

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