

# Spot Safety Project Evaluation

Order # 41000010745

Spot Safety Project 13-03-206

## Evaluation of the Rumble Strip Installation on I-26 from I-40 to the Henderson County Line Buncombe County

Documents Prepared By:

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

Principal Investigator



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2/7/2011

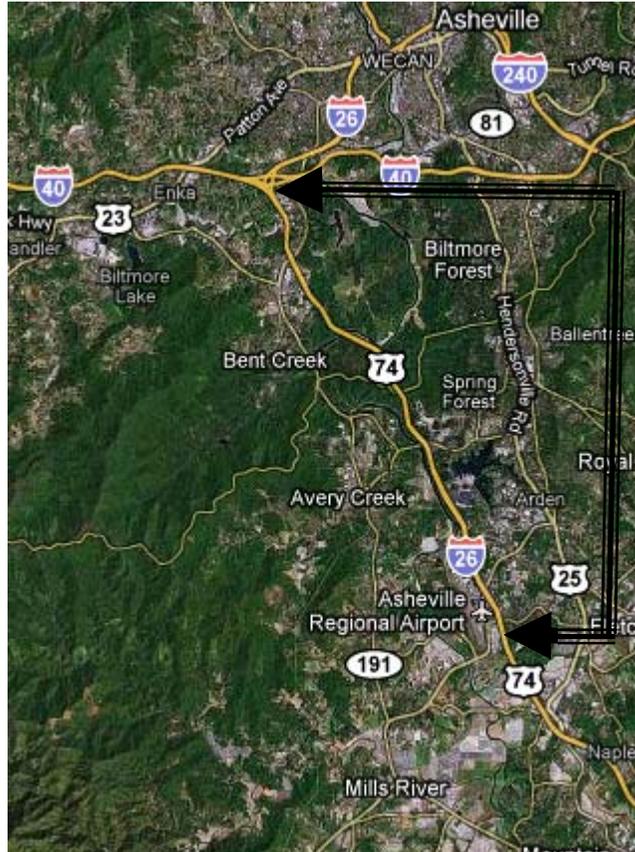
Date

Traffic Safety Project Engineer

# *Spot Safety Project Evaluation Documentation*

## **Subject Location**

Evaluation of Spot Safety Project Number 13-03-206 – I-26 from I-40 to the Henderson County Line (approximately 10 miles) in Buncombe County.



## **Project Information and Background from the Project File Folder**

The safety countermeasure chosen for the subject location was to install rumble strips on the median and outside shoulders for both directions of travel.

I-26 is a four-lane divided highway with 10' outside shoulders and 4' median shoulders. The speed limit is 60 mph.

The original statement of problem was that there were a large number of Ran Off Road type crashes, resulting in fatal and severe injuries.

The initial crash analysis was conducted from October 1, 1999 to September 30, 2002 with a total of 588 reported crashes. The final completion date for the improvements at the subject intersection was on May 8, 2006 with a total cost of \$113,000.00.

## 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 April 1, 2006 through May 30, 2006. The before period consisted of reported crashes from October 1, 2001 through March 31, 2006 (4 years and 6 months) and the after period consisted of reported crashes from June 1, 2006 through November 30, 2010 (4 years and 6 months). 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 I-26 from south of I-40 to the Henderson County Line. The analysis was completed with a 0' y-line. Target crashes are lane departure crash types. Lane Departure crash types are considered as follows: Ran Off Road – Left, Ran Off Road – Right, Fixed Object, Head-on, Jackknife, Parked Motor Vehicle, Sideswipe – Same Direction, Sideswipe – Opposite Direction, and Overturn / Rollover.

<b><u>Treatment Information (4.5 Miles)</u></b>	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-)/ Percent Increase (+)</b>
Total Crashes – Both Directions	773	849	9.8
Total Severity Index	4.82	3.83	-20.5
Lane Departure Crashes – Both Directions	362	339	-6.4
Lane Departure Severity Index	5.3	4.77	-10.0
Volume	66,000	70,000	6.1

The following tables divide the crash data by direction of travel

<b><u>Eastbound Treatment Information</u></b>	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-)/ Percent Increase (+)</b>
Total Crashes	305	372	22.0
Total Severity Index	6.11	3.86	-36.8
Lane Departure Crashes	159	167	5.0

<b><u>Eastbound Target Crash Details</u></b>			
<b>Segment Crashes – Injuries</b>			
Fatal Injury Crashes	3	0	-100.0
Non-Fatal Injury Crashes	55	50	-9.1
Property Damage Only Crashes	101	117	15.8
<b>Crashes - Contributing Factors</b>			
Night Crashes	48	49	2.1
Wet Road Crashes	27	26	-3.7
Alcohol Related	14	9	-35.7
<b>Lane Departure Crash Types</b>			
Fixed Object	70	78	11.4
Head On	0	0	N/A
Jackknife	3	0	-100.0
Overturn / Rollover	4	6	50.0
Parked Motor Vehicle	4	2	-50.0
Ran Off Road (Right & Left)	17	14	-17.6
Sideswipe, Same Direction	61	67	9.8
Sideswipe, Opposite Direction	0	0	N/A

<b>Westbound Treatment Information</b>	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-)/ Percent Increase (+)</b>
Total Crashes	468	477	1.9
Total Severity Index	3.98	3.81	-4.3
Lane Departure Crashes	203	172	-15.3

<b>Westbound Target Crash Details</b>			
<b>Segment Crashes – Injuries</b>			
Fatal Injury Crashes	0	1	N/A
Non-Fatal Injury Crashes	69	57	-17.4
Property Damage Only Crashes	134	114	-14.9
<b>Crashes - Contributing Factors</b>			
Night Crashes	47	42	-10.6
Wet Road Crashes	71	43	-39.4
Alcohol Related	12	7	-41.7
<b>Lane Departure Crash Types</b>			
Fixed Object	113	75	-33.6
Head On	0	0	N/A
Jackknife	0	2	N/A
Overturn / Rollover	4	9	125.0
Parked Motor Vehicle	4	3	-25.0
Ran Off Road (Right & Left)	19	25	31.6
Sideswipe, Same Direction	63	58	-7.9
Sideswipe, Opposite Direction	0	0	N/A

## Results and Discussion

Overall, using naïve before and after analysis, Total Crashes experienced a 10 percent increase and Lane Departure Crashes experienced a 6 percent decrease from the before to the after period. Eastbound Target Crashes increased by 5 percent and westbound Target Crashes decreased by 15 percent.

The Target Crash Severity Index decreased by 10 percent from the before to the after period. There were three fatal Target Crashes in the before period, all involving eastbound vehicles. One of the crashes involved a vehicle in the left lane losing control and running off the road to the left, striking the median barrier, and then skidding back onto the road and being struck by another vehicle. The second fatal crash involved a vehicle pulling a trailer running off the road to the right, jackknifing, and then overturning. The third and final before period fatal Target Crash involved a vehicle running off the roadway to the right, hitting a tree stump and ditch, and then overturning.

In the after period there was one fatal Target Crash. It involved a westbound truck running off the right side of the road, traveling through the guardrail, and overturning.

The calculated benefit to cost ratio is **56.30** considering Total Crashes. The benefit to cost ratio considering only Target Crashes is **18.13**. 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 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 treatment.

**Treatment Site Photos from Google Street-View**



Looking northwest on I-26



Looking southeast on I-26

**BENEFIT-COST ANALYSIS WORKSHEET**

LOCATION: I-26 from I-40 to Henderson County Line  
 COUNTY: Buncombe  
 FILE NO.: SS 13-03-206

BY: bdr  
 DATE: 2/4/2011

DETAILED COST: TYPE IMPROVEMENT - Rumble Strips

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$0	0	0.000	\$0
	\$133,000	10	0.149	\$19,821
Right-of-Way	\$0	0	0.000	\$0
<b>TOTALS</b>	<b>\$133,000</b>	<b>10</b>	<b>0.149</b>	<b>\$19,821</b>

ESTIMATED INCREASE IN ANNUAL MAINT. COST =	\$0
ESTIMATED INCREASE IN ANNUAL UTILITY COST =	\$0
<b>TOTAL ANNUAL COST=</b>	<b>\$19,821</b>
<b>TOTAL COST OF PROJECT=</b>	<b>\$133,000</b>

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	4.50	16	3.56	235	52.22	522	116.00	\$3,783,244
AFTER	4.50	7	1.56	253	56.22	589	130.89	\$2,667,267

Annual Benefits from Crash Cost Savings \$1,115,978

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = \$1,096,157

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 56.30

TOTAL COST OF PROJECT - \$133,000 COMPREHENSIVE B/C RATIO - 56.30

**BENEFIT-COST ANALYSIS WORKSHEET**

LOCATION: I-26 from I-40 to Henderson County Line      BY: bdr  
 COUNTY: Buncombe      DATE: 2/4/2011  
 FILE NO.: SS 13-03-206 Target Crashes Only

DETAILED COST:      TYPE IMPROVEMENT -      Rumble Strips

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$0	0	0.000	\$0
Right-of-Way	\$133,000	10	0.149	\$19,821
	\$0	0	0.000	\$0
<b>TOTALS</b>	<b>\$133,000</b>	<b>10</b>	<b>0.149</b>	<b>\$19,821</b>

ESTIMATED INCREASE IN ANNUAL MAINT. COST =      \$0  
 ESTIMATED INCREASE IN ANNUAL UTILITY COST =      \$0  
 TOTAL ANNUAL COST=      \$19,821  
 TOTAL COST OF PROJECT=      \$133,000

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	4.50	9	2.00	118	26.22	235	52.22	\$2,009,000
AFTER	4.50	7	1.56	101	22.44	231	51.33	\$1,649,622

Annual Benefits from Crash Cost Savings      \$359,378

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST      =      \$339,557

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST      =      18.13

TOTAL COST OF PROJECT      -      \$133,000      COMPREHENSIVE B/C RATIO      -      18.13