

# Spot Safety Project Evaluation

Work Order #41000006601

Spot Safety Project # 07-03-208

**Evaluation of the Rumblestrip Installation on US 421  
From the Randolph County Line to SR 1005 (Alamance Church Rd)  
Guilford 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

6/17/2010

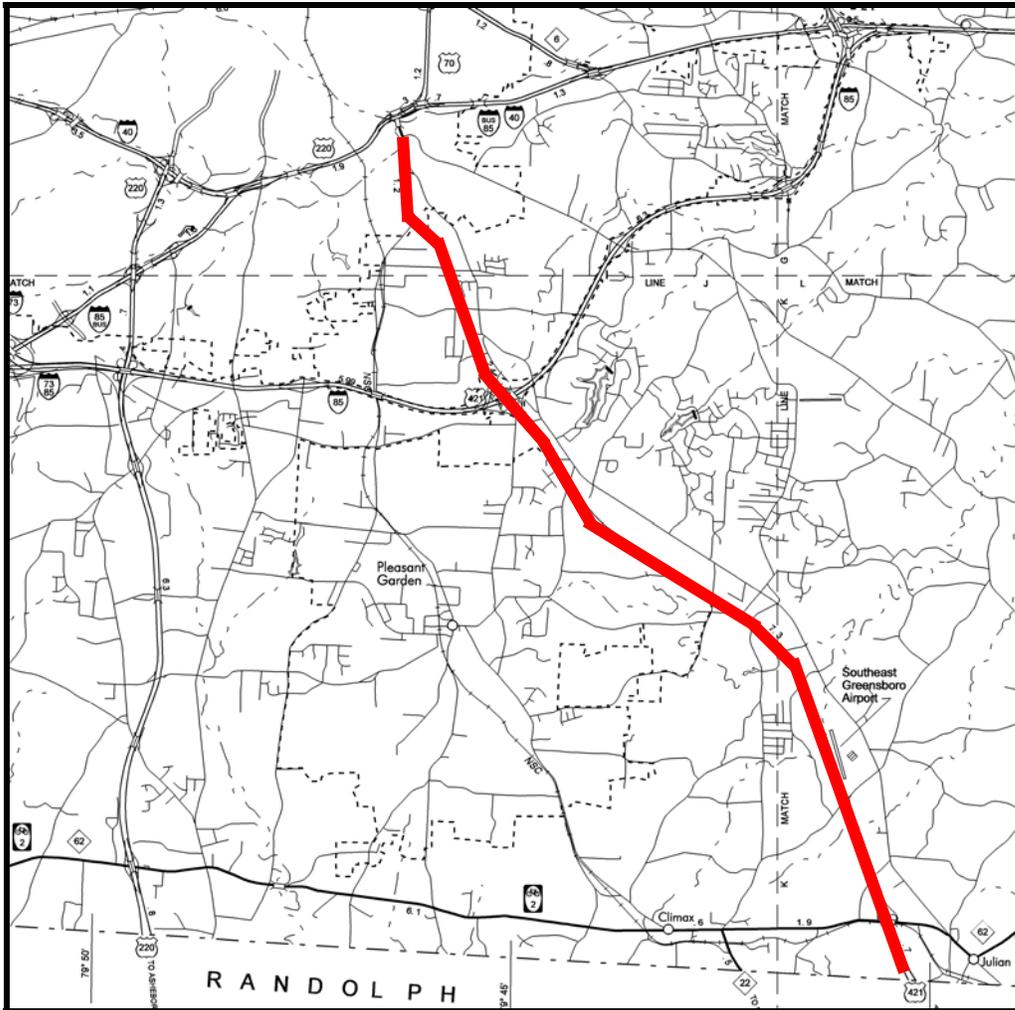
Date

Traffic Safety Project Engineer

# *Spot Safety Project Evaluation Documentation*

## **Subject Location**

Evaluation of Spot Safety Project Number 07-03-208 – US 421 from SR 1005 (Alamance Church Rd) to the Randolph County Line in Guilford County.



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

The safety countermeasure chosen for the subject location was the installation of milled rumble-strips on both the inside and outside shoulders of an approximately 10.79 mile strip of US 421.

US 421 is a four lane divided highway with a speed limit of 55 mph.

The initial crash analysis for this location was completed from March 1, 2000 through February 28, 2003 with a total of 178 reported crashes, 48 of which were Ran Off Road Crashes and considered

correctable by the chosen countermeasure. The project was completed on March 10, 2005 with a total cost of \$126,000.00

### **Naïve Before and After Analysis**

After reviewing the hazard elimination 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 February 1, 2005 through March 31, 2005. The before period consisted of reported crashes from February 1, 2000 through January 31, 2005 (5 Years) and the after period consisted of reported crashes from April 1, 2005 through March 31, 2010 (5 Years). The ending date for this analysis was determined by the available after period crash data.

The treatment data consisted of all crashes on US 421 from the Randolph County Line to 150' south of SR 1005 (Alamance Church Rd), with the exception of all crashes within 150' of intersections. A 0 foot y-line was used.

The following table depicts the Naïve Before and After Analysis for the Total Crashes and Target Crashes at the treatment location. Please note that Ran Off Road crash types were the target crashes for the applied countermeasure. Ran Off Road crash types considered are as follows: Ran Off Road – Left, Ran Off Road – Right, Ran Off Road – Straight, Fixed Object, Head-on, Sideswipe – Same Direction, Sideswipe – Opposite Direction, and Overturn / Rollover.

<b><u>Treatment Information</u></b>	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-)/ Percent Increase (+)</b>
Total Crashes	200	129	-35.5
Total Severity Index	5.38	3.67	-31.8
Total Target Crashes	118	48	-59.3
Target Severity Index	7.8	6.16	-21.0
Volume	14,000	17,000	21.4

<b><u>Target Crash Information</u></b>	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-)/ Percent Increase (+)</b>
<i>Target Crashes - Injuries</i>			
Fatal Injury Crashes	2	2	0.0
Non-Fatal Injury Crashes	51	13	-74.5
Total Injury Crashes	53	15	-71.7
<i>Target Crashes - Contributing Factors</i>			
Night Crashes	47	17	-63.8
Wet Crashes	38	14	-63.2
<i>Target Crashes - Crash Types</i>			
Ran Off Road	11	4	-63.6

Overturn/Rollover	6	4	-33.3
Fixed Object	69	27	-60.9
Parked Motor Vehicle	2	2	0.0
Sideswipe, Same Direction	22	10	-54.5
Sideswipe-Opposite Direction	5	0	-100.0
Head On	3	1	-66.7
<i>Target Crashes – Crash Severity Summary</i>			
Fatal Crashes	2	2	0.0
Class A Crashes	4	0	-100.0
Class B Crashes	18	6	-66.7
Class C Crashes	29	7	-75.9
Property Damage Only Crashes	65	33	-49.2

The naïve before and after analysis at the treatment location resulted in a 36 percent decrease in Total Crashes, a 59 percent decrease in Target Crashes, and a 21 percent increase in Average Daily Traffic (ADT). The before period ADT year was 2002 and the after period ADT year was 2007.

## Results and Discussion

The naïve before and after analysis involving the comparison of treatment actual before data versus treatment actual after data resulted in a 36 percent decrease in Total Crashes and a 59 percent decrease in Target Crashes. The Total Severity Index decreased by 32 percent and the Target Severity Index decreased by 21 percent. The summary results above demonstrate that the treatment location appears to have had a decrease in both Total and Target Crashes as well as experiencing decreases in both Severity Indexes.

The calculated benefit to cost ratio for this project is 35.09 considering total crashes. The benefit to cost ratio considering only target crashes is 35.55. 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 constructions costs as well as the increase in annual maintenance and utility costs.

It appears that the rumblestrip installation was effective at reducing Run Off Road Crashes along this strip. Target Crashes of all types decreased with the exception of Parked Motor Vehicle Crashes, which remained constant. The overall decrease in Total Crashes along this section (71 crashes) is nearly equal to the decrease in Target Crashes along the section (70 crashes).

Please see the attached Treatment Site Photos for additional visual information. As the Safety Evaluation Group completes additional reviews for this type of countermeasure, we will be able to provide more objective and definite information regarding actual crash reduction factors.

## Treatment Site Photos from Google Street-View



Looking north on US 421, approximately 0.5 miles north of NC 62



Looking south on US 421, approximately 0.5 miles north of NC 62

**BENEFIT-COST ANALYSIS WORKSHEET**

LOCATION: US 421 from SR 1005 to Randolph County L      BY: bdr  
 COUNTY: Guilford      DATE: 6/1/2010  
 FILE NO.: SS 07-03-208

DETAILED COST:      TYPE IMPROVEMENT -      **Shoulder Rumble Strips**

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$0	0	0.000	\$0
Right-of-Way	\$126,000	10	0.149	\$18,778
	\$0	0	0.000	\$0
<b>TOTALS</b>	<b>\$126,000</b>	<b>10</b>	<b>0.149</b>	<b>\$18,778</b>

ESTIMATED INCREASE IN ANNUAL MAINT. COST =      \$0  
 ESTIMATED INCREASE IN ANNUAL UTILITY COST =      \$0  
 TOTAL ANNUAL COST=      \$18,778  
 TOTAL COST OF PROJECT=      \$126,000

COMPREHENSIVE COST REDUCTION:

ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES

TIME PERIOD	YEARS	ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES				PDO		ANNUAL COSTS
		K & A CRASHES	K & A CRASHES PER YR	B & C CRASHES	B & C CRASHES PER YR	CRASHES	CRASHES PER YR	
BEFORE	5.00	6	1.20	57	11.40	137	27.40	\$1,101,820
AFTER	5.00	2	0.40	26	5.20	101	20.20	\$442,860

Annual Benefits from Crash Cost Savings      \$658,960

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST      =      \$640,182  
 BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST      =      35.09

TOTAL COST OF PROJECT      -      \$126,000      COMPREHENSIVE B/C RATIO      -      35.09

**BENEFIT-COST ANALYSIS WORKSHEET**

LOCATION: US 421 from SR 1005 to Randolph County L      BY: bdr  
 COUNTY: Guilford      DATE: 6/1/2010  
 FILE NO.: SS 07-03-208 Target Crashes Only

DETAILED COST:      TYPE IMPROVEMENT -      Shoulder Rumble Strips

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$0	0	0.000	\$0
Right-of-Way	\$126,000	10	0.149	\$18,778
	\$0	0	0.000	\$0
<b>TOTALS</b>	<b>\$126,000</b>	<b>10</b>	<b>0.149</b>	<b>\$18,778</b>

ESTIMATED INCREASE IN ANNUAL MAINT. COST =      \$0  
 ESTIMATED INCREASE IN ANNUAL UTILITY COST =      \$0  
 TOTAL ANNUAL COST=      \$18,778  
 TOTAL COST OF PROJECT=      \$126,000

COMPREHENSIVE COST REDUCTION:

ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES

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	5.00	6	1.20	47	9.40	65	13.00	\$999,900
AFTER	5.00	2	0.40	13	2.60	33	6.60	\$332,380

Annual Benefits from Crash Cost Savings      \$667,520

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST      =      \$648,742  
 BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST      =      35.55

TOTAL COST OF PROJECT      -      \$126,000      COMPREHENSIVE B/C RATIO      -      35.55