

Spot Safety Project Evaluation

Project Log # 200611051

Spot Safety Project # 12-01-224

**Evaluation of the Drainage Upgrades on I-85 From MP 9.28 to MP 10.28
Gaston County**

Documents Prepared By:

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

Principal Investigator

Brad Robinson, EI

8/7/2007
Date

Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 12-01-224 – I 85 from Milepost 9.28 to MP 10.28 in Gaston County.

Project Information and Background from the Project File Folder

The spot safety project improvement countermeasure chosen for the subject location was to make drainage upgrades on this portion of I-85. The project included some milling, resurfacing and the installation of additional drainage boxes. I-85 is a six lane divided roadway with a concrete median wall in the treatment section. The speed limit was 55 mph in the before period and 60 mph in the after period. The treatment section is located in a reverse curve.

The initial statement of problem was that due to the alignment of I-85 in the section water would sheet across the roadway in the reverse curve during moderate to heavy rainstorms. Drivers would lose control of their vehicles on the sheeting water.

The initial crash analysis for this strip was completed from April 1, 1997 to March 31, 2001 and included 94 crashes, 61 of which were wet crashes and considered correctable.

The final completion date for the improvements at the subject location was on February 27, 2002 with a total cost of \$150,000.

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 was from January 1, 2002 through April 30, 2002. The before period consisted of reported crashes from August 1, 1997 through December 31, 2001 (4 Years, 5 Months) and the after period consisted of reported crashes from May 1, 2002 through September 30, 2006 (4 Years, 5 Months). The ending date for this analysis was determined by the available crash data at the time the analysis was conducted.

The treatment data consisted of all crashes on a one-mile strip of I-85 from MP 9.28 to MP 10.28. A 0 feet Y-line was used in the analysis and only mainline crashes were included. Please see attached *Location Map* for further detail.

The following data table depicts the Naive Before and After Analysis for the treatment location. Please note that crashes that occurred during wet conditions were the target crashes for the applied countermeasure.

<u>Treatment Information</u>			
	Before Period	After Period	Percent Reduction (-)/ Percent Increase (+)
Total Crashes	155	119	-23.2
Total Severity Index	5.53	4.76	-13.9
Target Crashes	104	56	-46.2
Target Severity Index	5.82	5	-14.1
Volume	74,000	91,000	23.0
<u>Target Crash Injury Summary</u>			
Fatal Injuries	0	1	N/A
Class A Injuries	3	0	-100.0
Class B Injuries	7	2	-71.4
Class C Injuries	30	18	-40.0
Total Injuries	64	35	-45.3

The naive before and after analysis at the treatment location resulted in a 23 percent decrease in Total Crashes, a 46 percent decrease in Target Crashes, and a 23 percent increase in Average Daily Traffic (ADT). The before period ADT year was 1999 and the after period ADT year was 2004.

Results and Discussion

The naive before and after analysis involving the comparison of treatment actual before data versus treatment actual after data resulted in a 23 percent decrease in Total Crashes, a 46 percent decrease in Target Crashes, and a 23 percent increase in ADT. The Total Severity Index and the Target Severity Index both decreased by 14 percent. The summary results above demonstrate that the treatment location appears to have had a decrease in both the number of Total Crashes and Target Crashes from the before to the after period.

From the above table it appears that the drainage upgrades were effective in reducing wet road crashes along this section of I-85. Injury crashes of all types decreased for wet road crashes except for fatal crashes. The single fatal crash in the after period appears to have occurred due to a medical condition and not wet road conditions. The driver of the vehicle that ran off the road claimed he had been blacking out recently. He ran off the roadway and hit an occupied parked vehicle.

Yearly rainfall data for this area could not be found. In order to account for the possibility that the decrease in Target Crashes was a result of less rainfall in the after period, this one-mile strip of I-85 was compared to another one-mile strip of I-85 a couple miles to the east (MP 12.6 to MP 13.6). The Odds Ratio method was used for this comparison. The Odds Ratio is used as another means of calculating the treatment effect. The number of crashes in the before and after period from the comparison are used to calculate the percent reduction in crashes for the Treatment Intersection.

Odds Ratio: Treatment versus Comparison (Wet Crashes)

	Before	After	Percent Reduction (-)/ Percent Increase (+)
Treatment Wet Crashes	155	119	---
Comparison Wet Crashes	7	11	- 65.7 %

Using the Odds Ratio, it appears that the treatment had an even greater effect than when using the naïve before and after analysis (a 66% decrease compared to 46%). The assumptions made by this comparison is that the two sections experienced similar rainfall patterns, traffic volumes, and vehicle and driver mix in both the before and the after periods.

The calculated benefit to cost ratio for this project is 19.7 considering total crashes. The benefit to cost ratio considering only target crashes is 21.01. 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 road.

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: I-85 from MP 9.28 to 10.28
 COUNTY: Gaston
 FILE NO.: SS 12-01-224

BY: Brad Robinson
 DATE: 8/2/2007

DETAILED COST: TYPE IMPROVEMENT - Drainage Upgrades

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$150,000	20	0.102	\$15,278
	\$0	0	0.000	\$0
Right-of-Way	\$0	0	0.000	\$0
TOTALS	\$150,000	20	0.102	\$15,278

ESTIMATED INCREASE IN ANNUAL MAINT. COST = \$0
 ESTIMATED INCREASE IN ANNUAL UTILITY COST = \$0
 TOTAL ANNUAL COST= \$15,278
 TOTAL COST OF PROJECT= \$150,000

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	4.42	4	0.90	54	12.22	97	21.95	\$757,986
AFTER	4.42	2	0.45	40	9.05	77	17.42	\$457,081

Annual Benefits from Crash Cost Savings \$300,905

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = \$285,627

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 19.70

TOTAL COST OF PROJECT - \$150,000 COMPREHENSIVE B/C RATIO - 19.70

BENEFIT-COST ANALYSIS WORKSHEET WET CRASHES

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COMPREHENSIVE COST REDUCTION:

ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES

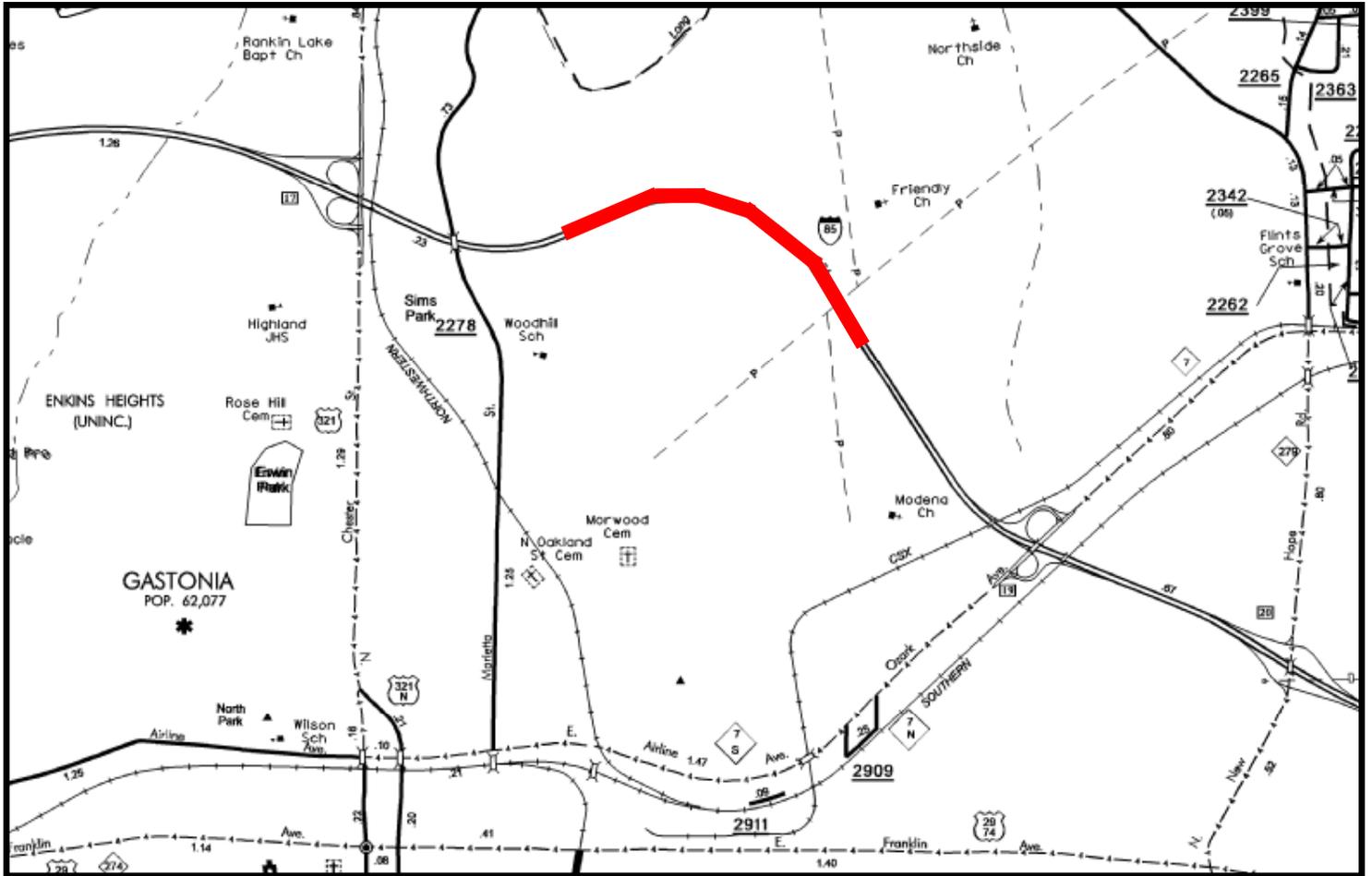
TIME PERIOD	YEARS	ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES				PDO		ANNUAL COSTS
		K & A CRASHES	K & A CRASHES PER YR	B & C CRASHES	B & C CRASHES PER YR	CRASHES	CRASHES PER YR	
BEFORE	4.42	3	0.68	37	8.37	64	14.48	\$546,516
AFTER	4.42	1	0.23	20	4.52	35	7.92	\$225,452

Annual Benefits from Crash Cost Savings \$321,063

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = \$305,786
 BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 21.01

TOTAL COST OF PROJECT - \$150,000 COMPREHENSIVE B/C RATIO - 21.01

Location Map
Gaston County
Evaluation of Spot Safety Project #12-01-224



Treatment Location: I-85 from Milepost 9.28 to Milepost 10.28

Treatment Site Photos Taken July 11, 2007



Driving East



Driving East



Driving West



Driving West