Hazard Elimination Project Evaluation

Order # 41000021455

Hazard Elimination Project W-4821

Evaluation of the Rumble Strip Installation on US 29
From US 29 Business in Rockingham County to 0.6 Miles South of the
Virginia State Line in Caswell County

Documents Prepared By:

Safety Evaluation Group
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Brad Robinson, PE

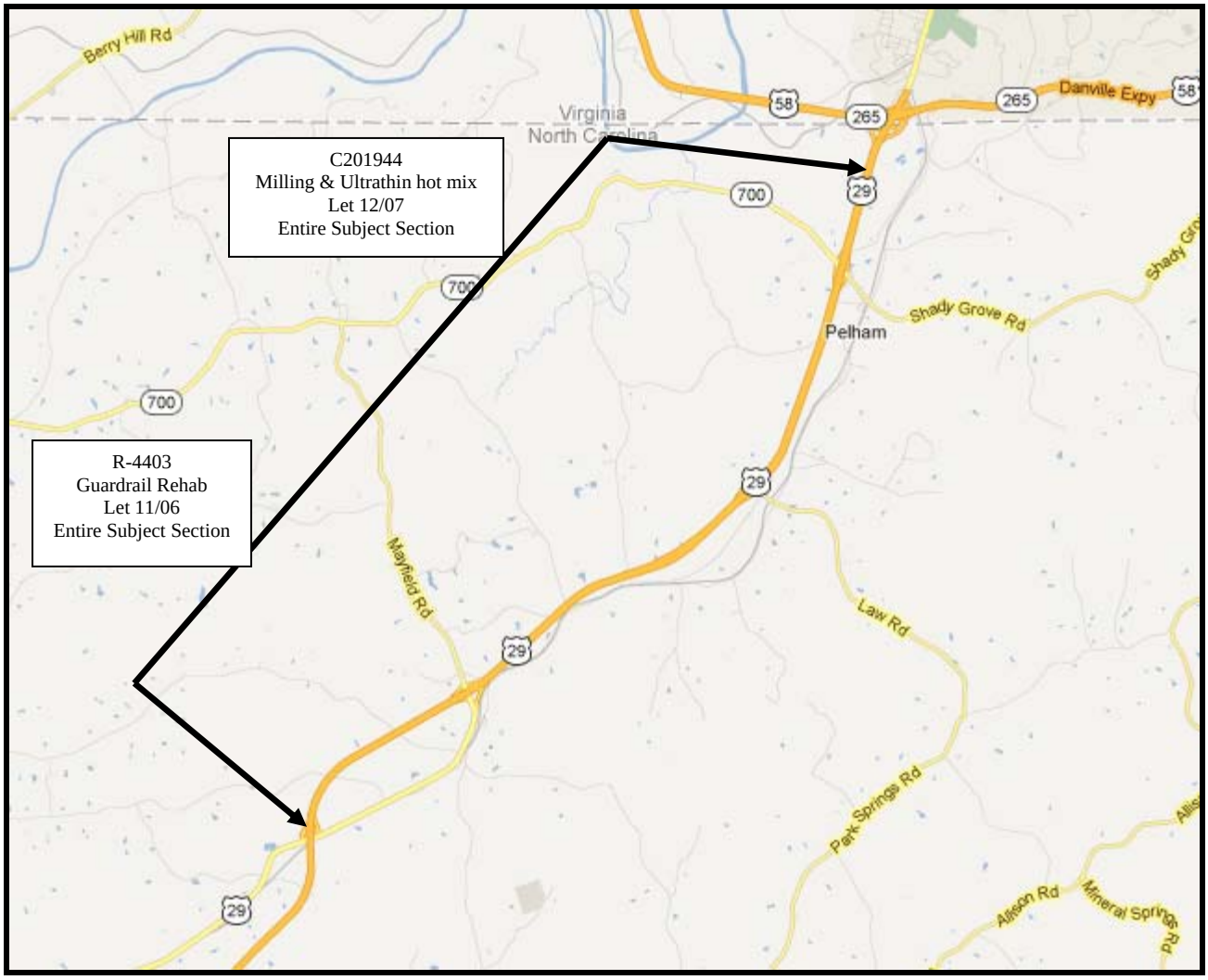
1/9/2013
Date

Traffic Safety Project Engineer

Hazard Elimination Project Evaluation Documentation

Subject Location

US 29 from US 29 Business in Rockingham County to approximately 0.6 miles south of the Virginia state line in Caswell County, a distance of approximately 9.4 miles. Two TIP projects were completed on this section of roadway during the analysis period for this evaluation. They are noted in the location map for your reference but are not accounted for in this evaluation.



Project Information and Background from the Project File Folder

The hazard elimination project improvement chosen for the subject location was the installation of shoulder rumble strips along the entire section.

US 29 is four lane divided facility with full access control. There are 10' paved outside shoulders and 4' paved median shoulders in each direction. The speed limit is 65 mph. The intended purpose of the improvement was to alleviate the frequency of run-off-road crashes.

The initial crash analysis was completed from August 1, 2000 to August 1, 2003 with 177 total reported crashes, 34 of which were deemed correctable ran off road crashes. The projected B/C ratio was 35.70. The improvement was completed on January 8, 2009 with a total cost of $100,000.

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 were from December 1, 2008 through January 31, 2009. The before period consisted of reported crashes from June 1, 2005 through November 30, 2008 (3.5 years); and the after period consisted of reported crashes from February 1, 2009 through July 31, 2012 (3.5 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 2007 and the after period ADT year was 2010.

The treatment data consisted of all mainline crashes on US 29 from US 29B in Rockingham County to 0.6 miles south of the Virginia state line in Caswell County. The analysis was completed with a 0' y-line.

The following data tables depict the Naïve Before and After Analysis for the treatment location. Please note that lane departure crashes were the target crashes for the applied countermeasure. The lane departure crash types on fully controlled access facilities are considered as follows: Angle, Fixed Object, Head-On, Overturn/Rollover, Parked Motor Vehicle, Ran-Off Roadway (Right, Left, and Straight), and Sideswipe (Same and Opposite Direction).

Treatment Information	**Before**	**After**	**Percent Reduction (-)/ Percent Increase (+)**
Total Crashes – Both Directions	100	81	-19.0
Total Severity Index	2.48	3.97	60.1
Lane Departure Crashes – Both Directions	51	31	-39.2
Lane Departure Severity Index	2.74	5.35	95.3
Volume (2006, 2010)	14,800	14,600	-1.4
Total Crash Rate (100 Million Vehicle Miles)	55.61	45.73	-17.8

US 29 Target Crashes Both Directions	Before	After	Percent Reduction (-)/ Percent Increase (+)
Injury Crashes			
Fatal Injury Crashes	0	0	N/A
Class-A Injury Crashes	0	1	N/A
Class-B Injury Crashes	6	2	-66.7
Class-C Injury Crashes	6	6	0.0
Property Damage Only Crashes	39	22	-43.6
Contributing Factors			
Night Crashes	18	19	5.6
Wet Road Crashes	12	6	-50.0
Alcohol Related	10	3	-70.0
Lane Departure Crash Types			
Fixed Object	42	20	-52.4
Head On	0	0	N/A
Jackknife	0	0	N/A
Overturn / Rollover	3	5	66.7
Parked Motor Vehicle	0	1	N/A
Ran Off Road	1	1	0.0
Sideswipe, Opposite Direction	0	0	N/A
Sideswipe, Same Direction	5	4	-20.0

US 29 Northbound Only	Before	After	Percent Reduction (-)/ Percent Increase (+)
NB Total Crashes	56	44	-21.4
NB Total Severity Index	2.45	5.62	129.4
NB Lane Departure Crashes	34	17	-50.0
NB Lane Departure Severity Index	2.52	7.64	203.2

US 29 Southbound Only	Before	After	Percent Reduction (-)/ Percent Increase (+)
SB Total Crashes	44	37	-15.9
SB Total Severity Index	2.51	2	-20.3
SB Lane Departure Crashes	17	14	-17.6
SB Lane Departure Severity Index	3.18	2.59	-18.6

Results and Discussion

Using naïve before and after analysis, Total Crashes have decreased by 19 percent and Target Crashes have decreased by 39 percent in the subject area. Looking at the crashes by direction,

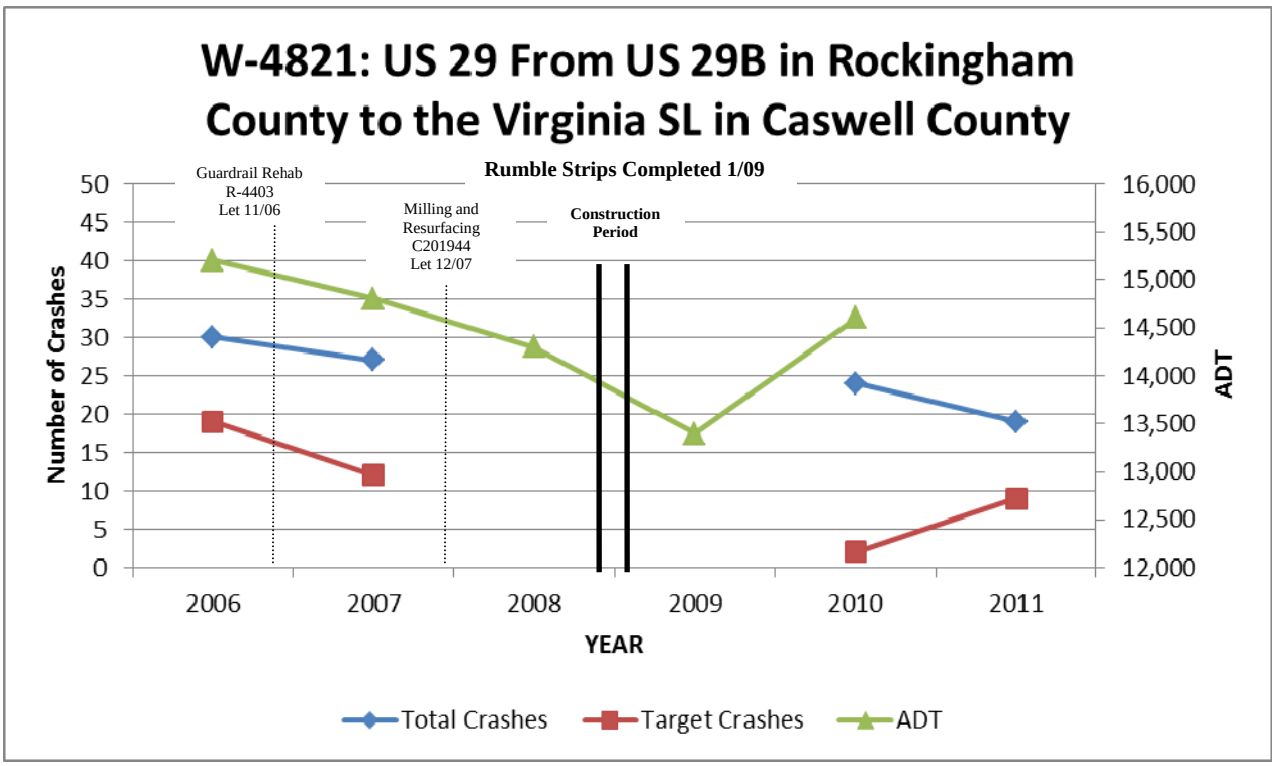
Target Crashes in the northbound lanes decreased by 50 percent and Target Crashes in the southbound lanes decreased by 18 percent from the before to the after period.

The calculated benefit to cost ratio for the project is **-20.02** considering Total Crashes. The benefit to cost ratio considering only Target Crashes is **-9.14**. 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.

The total severity index increased by 60 percent and the target crash severity index increased by 95 percent from the before to the after period. The increases in the severity indexes, in addition to the negative BC ratios, are due to two Class A injury crashes that occurred in the after period. One of the Class A crashes was also a target crash and involved a vehicle running off the roadway to the right and then overcorrecting, resulting in the vehicle overturning.

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.

The following chart depicts the crash trends along this segment of US 29. The number of Total and Target Crashes per year are plotted in the before and after periods, along with the ADT. The dates of known projects that may have influenced crashes are noted.



BENEFIT-COST ANALYSIS WORKSHEET - TOTAL

LOCATION: US 29 From US 29B to Virginia SL
COUNTY: Rockingham, Caswell
FILE NO.: W-4821

BY: bdr
DATE: 9/19/2012

DETAILED COST: TYPE IMPROVEMENT - Rumble Strips

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	$0	0	0.000	$0
	$100,000	10	0.149	$14,903
Right-of-Way	$0	0	0.000	$0
TOTALS	$100,000	10	0.149	$14,903

ESTIMATED INCREASE IN ANNUAL MAINT. COST = $0
ESTIMATED INCREASE IN ANNUAL UTILITY COST = $0

TOTAL ANNUAL COST= $14,903
TOTAL COST OF PROJECT= $100,000

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	3.50	0	0.00	20	5.71	80	22.86	$212,571
AFTER	3.50	2	0.57	12	3.43	67	19.14	$510,886

Annual Benefits from Crash Cost Savings ($298,314)

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = ($313,217)

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = -20.02

TOTAL COST OF PROJECT - $100,000 COMPREHENSIVE B/C RATIO - -20.02

BENEFIT-COST ANALYSIS WORKSHEET - TARGET

LOCATION: US 29 From US 29B to Virginia SL
COUNTY: Rockingham, Caswell
FILE NO.: W-4821

BY: bdr
DATE: 9/19/2012

DETAILED COST: TYPE IMPROVEMENT - Rumble Strips

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	$0	0	0.000	$0
	$100,000	10	0.149	$14,903
Right-of-Way	$0	0	0.000	$0
TOTALS	$100,000	10	0.149	$14,903

ESTIMATED INCREASE IN ANNUAL MAINT. COST = $0
ESTIMATED INCREASE IN ANNUAL UTILITY COST = $0

TOTAL ANNUAL COST= $14,903
TOTAL COST OF PROJECT= $100,000

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	3.50	0	0.00	12	3.43	39	11.14	$116,486
AFTER	3.50	1	0.29	8	2.29	22	6.29	$252,743

Annual Benefits from Crash Cost Savings ($136,257)

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = ($151,160)

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = -9.14

TOTAL COST OF PROJECT - $100,000 COMPREHENSIVE B/C RATIO - -9.14