Hazard Elimination Project Evaluation

Order # 41000018543

Hazard Elimination Project W-4829

Evaluation of the Centerline Rumble Strip Installation
US-220 (now US-220 Alternate)
Town Limits of Ellerbe to Montgomery County Line
Richmond County

Documents Prepared By:

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8-20-2012
Date

Hazard Elimination Project Evaluation Documentation

Subject Location

Evaluation of Hazard Elimination Project Number W-4829 located along US-220 (now US-220 Alternate) from the north town limits of Ellerbe (Milepost 11.06) to the Montgomery County Line (Milepost 18.849) in Richmond County. Total study segment length of 7.789 miles.

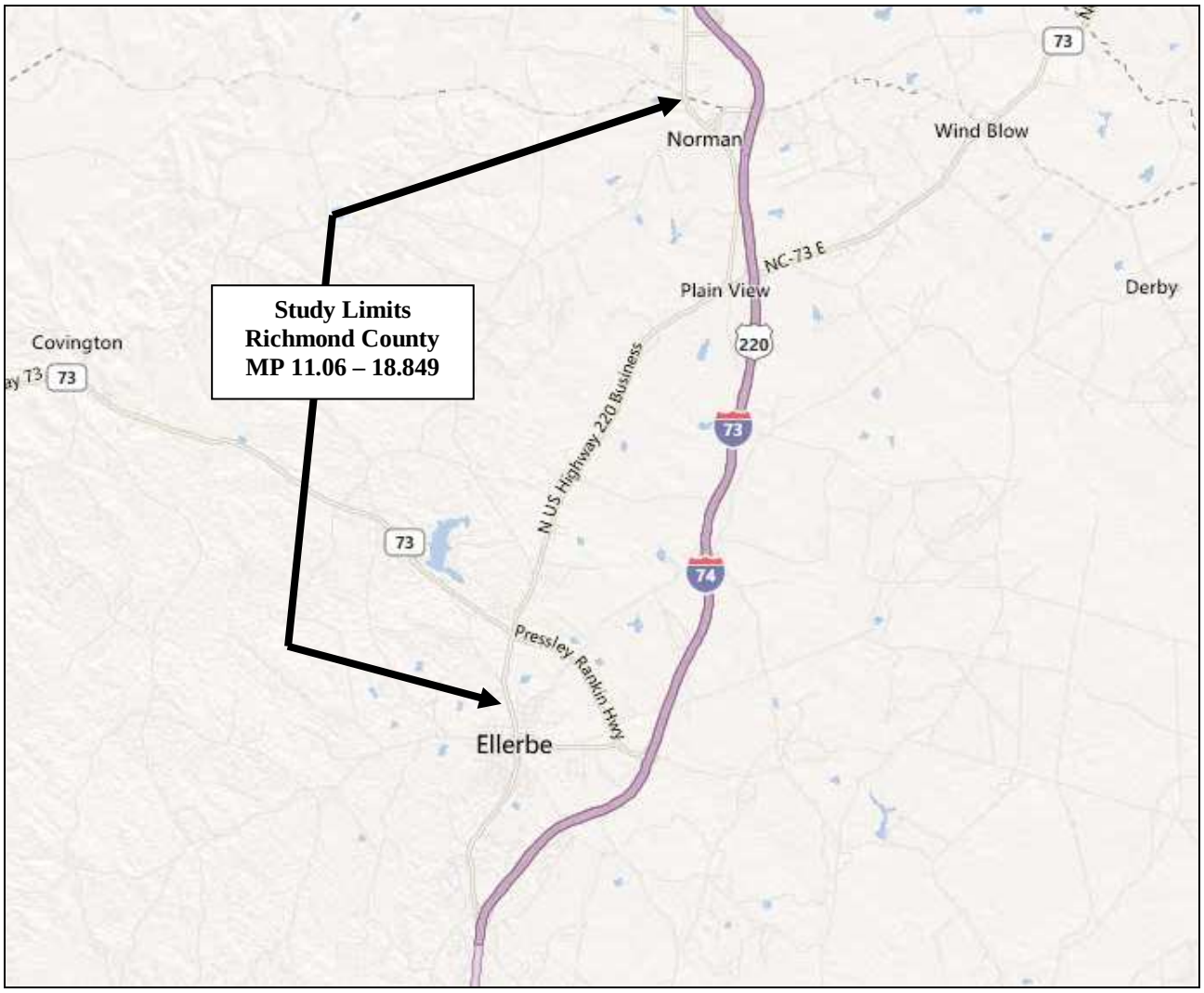


Photo Provided by BING Maps

Project Information and Background from the Project File Folder

The hazard elimination project improvements chosen for the subject location were the installation of milled rumble strips along the shoulders and centerline of this two-lane roadway. However, due to variable pavement widths it was determined to drop the milled rumble strips along the shoulder and only do the centerline countermeasure.

At the time of project completion US-220 in Richmond County was a two-lane facility with 2-foot paved shoulders. At the beginning of 2008, US-220 was rerouted as the newly opened freeway section (also known as I-73/74) became accessible for motorists. The two-lane subject roadway was therefore relabeled as US-220 Alternate.

The original statement of problem mentioned that collisions due to vehicles crossing the centerline into on-coming traffic were the predominant crash pattern along this section. The drift-off road and drift across centerline type crashes result in severe injury collisions. In total, there had been three (3) fatal collisions during the project development phase.

The initial crash analysis was completed from July 1, 2000 to June 30, 2003 with 73 reported crashes, 21 were reported as Ran-Off Roadway and 3 were crossing centerline crashes. The improvement was completed on August 31, 2006 with a total cost of $175,000. The projected B/C Ratio was 17.90.

Naive Before and After Analysis

After reviewing the project file folder along with all the crashes along the subject segment, the crash data omitted from this analysis to consider for an adequate construction period were the months of June through August 2006.

Before Period:	January 1, 2001 to May 31, 2006	(5 Years, 5 Months)
After 1 Period:	September 1, 2006 to December 31, 2007	(1 Year, 4 Months)
After 2 Period:	January 1, 2008 to January 31, 2012	(4 Years, 1 Month)

The After-1 period consisted of the centerline rumble strip installation and the After-2 period consisted of the opening and renaming of US-220 to the four-lane bypass. The ending date for this analysis was determined by the date of available crash data at the time of analysis. The treatment data consisted of all crashes along US-220 (now US-220 Alternate) with a zero (0) foot y-line. *Please see attached location map for further details.*

The following data table depicts the Naive Before and After Analysis for the treatment location. Please note that Centerline Lane Departure Crashes were the target crashes for the applied countermeasure. The Centerline Lane Departure Crash types considered are as follows: Head-On and Sideswipe-Opposite Direction. Each Centerline Lane Departure Target Crash was independently verified during the analysis.

Treatment Information	**Before 5.42 Yrs**	**After 1 1.33 Yrs**	**After 2 4.08 Yrs**
Total Crashes	147	30	18
Total Crashes Per Year	27.1 CPY	22.6 CPY	4.4 CPY
Total Severity Index	8.66	5.01	14.87
Cross Centerline Target Crashes	18	3	2
Cross Centerline Crashes Per Year	3.3 CPY	2.3 CPY	0.5 CPY
Centerline Target Severity Index	20.31	5.93	1.00

US-220 Richmond (MP 11.06-18.849)	**Before 5.42 Yrs**	**After 1 1.33 Yrs**	**After 2 4.08 Yrs**
Volume (2003, 2007, 2010)	9,300	8,600	1,300
Total Crash Rate (100 Million Vehicle Miles)	102.65	91.96	119.15
Injury Crashes			
Fatal Injury Crashes	5	1	2
Class-A Injury Crashes	4	0	1
Class-B Injury Crashes	17	3	2
Class-C Injury Crashes	43	3	1
Property Damage Only Crashes	78	23	12
Severe Injury Crashes per Year (K,A only)	1.66 CPY	0.75 CPY	0.74 CPY
Total Injury Crashes per Year (K,A,B,C)	12.73 CPY	5.38 CPY	1.47 CPY
Contributing Factors			
Night Crashes	26	14	6
Wet Road Crashes	31	3	2
Alcohol Related	8	1	0

Results and Discussion

Reviewing the tables above, the overall segment reduced crashes by 4.5 crashes per year with a one (1) crash per year reduction in Cross-Centerline Lane Departure collisions from the Before to the After-1 period. Along with that severe injury crashes per year (Fatal and A-injury) reduced from 1.66 in the Before period to 0.75 crashes per year in the After-1 period.

From further evaluation, the ADT of this roadway segment dropped by 85 percent with the opening of the US-220 four-lane bypass in early 2008. This fact alone is the primary reason for the reduction of crashes per year from the mid-20s to 4.4 crashes per year in the After-2 period. Also, we observe that injury crashes per year have decreased steadily from 12.7 in the Before period to 5.4 in the After-1 period and now down to 1.5 in the current road state.

However, there have been four (4) severe injury crashes in the combined after periods including three (3) Fatals. Each crash is listed and explained below:

ID-102087069 (After-1 Fatal): Vehicle was passing a Tractor-Trailer legally, failed to get back over in time and clipped a vehicle head-on. The at-fault driver lost control of the vehicle and then struck a motorcycle, killing the motorcycle driver.

ID-102406838 (After-2 Fatal): Angle Crash at the newly converted four-leg intersection of NC-73 (TIP R-3303); vehicle ran stop-sign.

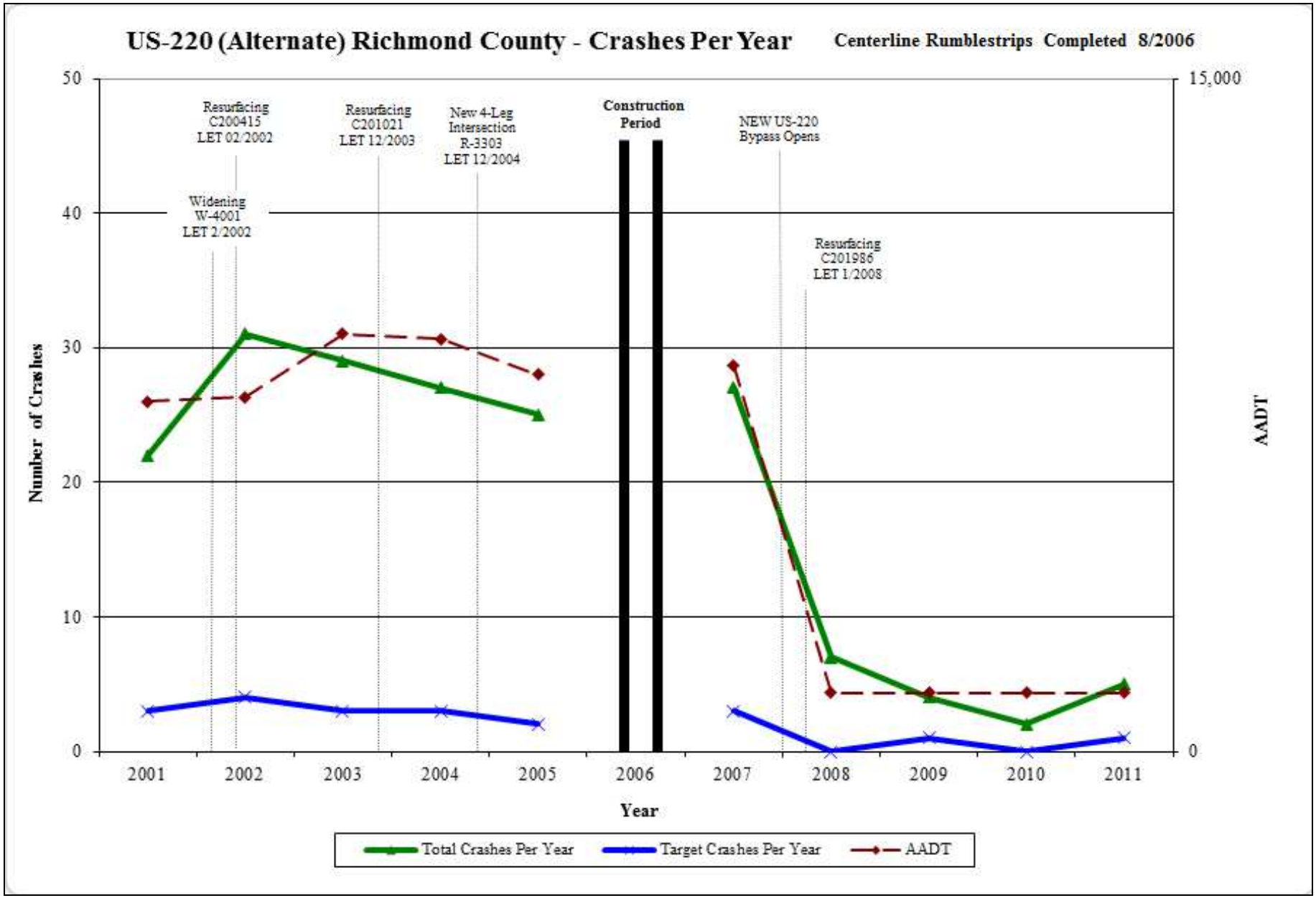
ID-103224527 (After-2 Fatal): Angle Crash at the newly converted four-leg intersection of NC-73 (TIP R-3303); vehicle ran stop-sign.

ID-102637730 (After-2 A-Injury): Motorcycle excessively speeding (100+ mph) ran off the roadway at the northern NC-73 (3-leg) intersection and was ejected.

The calculated benefit to cost ratio for this project is **26.50 considering total crashes from the Before period to the After-1 period**. The benefit to cost ratio **considering only target crashes is 17.64 for the same period**. 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.

The following chart depicts the number of Total and Target Crashes per year plotted in the before and after period combined, along with the AADT. Crashes per year appear to have decreased dramatically with the opening of the US-220 four-lane bypass as expected. Due to the number of other projects that likely influenced crashes during the study period, the increase change in crash values cannot be attributed solely to the rumble strip installations.

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.


US-220 (Alternate) Richmond County - Crashes Per Year
Centerline Rumblestrips Completed 8/2006
Resurfacing C200415 LET 02/2002
Widening W-4001 LET 2/2002
Resurfacing C201021 LET 12/2003
New 4-Leg Intersection R-3303 LET 12/2004
Construction Period
NEW US-220 Bypass Opens
Resurfacing C201986 LET 1/2008
Number of Crashes
AADT
Year
Total Crashes Per Year
Target Crashes Per Year
AADT

BENEFIT-COST ANALYSIS WORKSHEET - Total Crashes

LOCATION: US-220 (11.06-18.849) BY: JBS
COUNTY: Richmond DATE: 7/31/2012
FILE NO.: W-4829

DETAILED COST: TYPE IMPROVEMENT - Centerline Rumble

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	$175,000	10	0.149	$26,080
	$0	0	0.000	$0
Right-of-Way	$0	0	0.000	$0
TOTALS	$175,000	10	0.149	$26,080

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

TOTAL ANNUAL COST= $26,080
TOTAL COST OF PROJECT= $175,000

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	5.42	9	1.66	60	11.07	78	14.39	$1,329,410
AFTER	1.33	1	0.75	6	4.51	23	17.29	$638,271

Annual Benefits from Crash Cost Savings $691,139

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = $665,059

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 26.50

TOTAL COST OF PROJECT - $175,000 COMPREHENSIVE B/C RATIO - 26.50

BENEFIT-COST ANALYSIS WORKSHEET - Target Crashes

LOCATION: US-220 (11.06-18.849) BY: JBS
COUNTY: Richmond DATE: 7/31/2012
FILE NO.: W-4829 Target - Centerline Lane Departure

DETAILED COST: TYPE IMPROVEMENT - Centerline Rumble

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	$175,000	10	0.149	$26,080
	$0	0	0.000	$0
Right-of-Way	$0	0	0.000	$0
TOTALS	$175,000	10	0.149	$26,080

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

TOTAL ANNUAL COST= $26,080
TOTAL COST OF PROJECT= $175,000

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	5.42	4	0.74	6	1.11	8	1.48	$493,432
AFTER	1.33	0	0.00	2	1.50	1	0.75	$33,308

Annual Benefits from Crash Cost Savings $460,123

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = $434,043

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 17.64

TOTAL COST OF PROJECT - $175,000 COMPREHENSIVE B/C RATIO - 17.64