

Hazard Elimination Project Evaluation

Order # 41000019322

Hazard Elimination Project W-4826

**Evaluation of the Rumble Strip Installation
US-220 (Now US-220 Alternate) – MP 0.00 to 5.50
Montgomery County**

Documents Prepared By:

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Date

Hazard Elimination Project Evaluation Documentation

Subject Location

Evaluation of Hazard Elimination Project Number W-4826 located along former US-220 (now US-220 Alternate) from the Richmond County Line (Milepost 0.00) to the previous end of the US-220 4-lane Bypass Segment (Milepost 5.50) in Montgomery County.

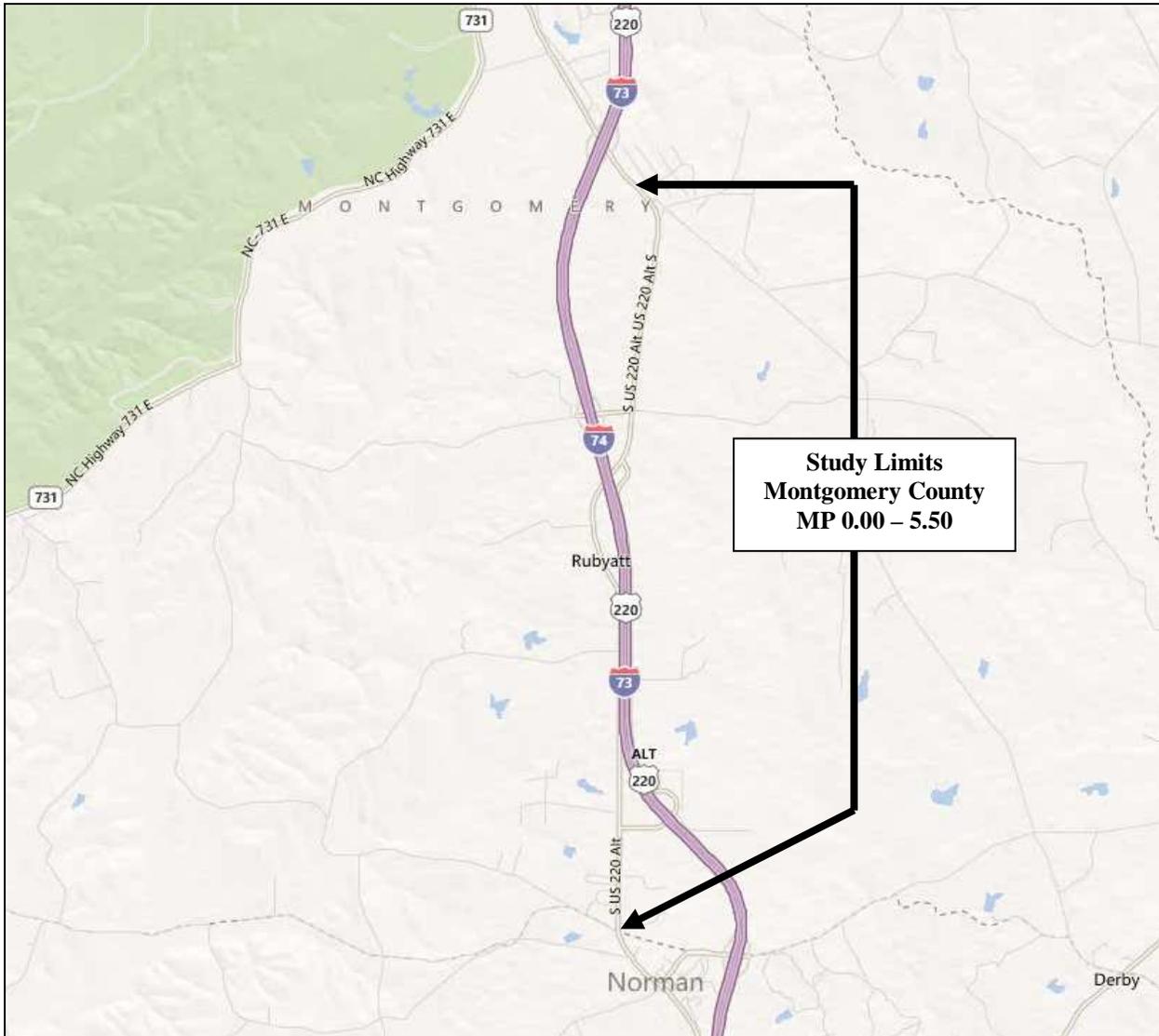


Photo provided by BING Maps

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 a milled rumble stripe with thermoplastic marking along the centerline of this 2-lane roadway.

US-220 in Montgomery County, at the time of this installation, from the Richmond County Line to the end of the four-lane segment was a two-lane facility with two-foot paved shoulders and a speed limit of 55-mph. In early 2008, the four-lane bypass (I-73/74) was extended and opened adjacent to this segment and the subject section of roadway was reposted as US-220 Alternate.

The original statement of problem mentioned that vehicles were running off the road and crossing the centerline resulting in fatalities, serious injuries, and property damage. Casual factors for vehicles leaving the roadway include driver fatigue and/or inattention. Rumble strips provide both noise and vibration as a warning to motorists that they are leaving the travel lane.

The initial crash analysis was completed from July 1, 2000 to June 30, 2003 with 27 reported crashes, with 22 crashes considered correctable Ran-Off Road or Head-on collisions. The correctable collisions resulted in six (6) Fatal/A-injury left-of-center crashes. The improvement was completed on August 31, 2006 with a total cost of \$160,000. The projected B/C Ratio was 101.99.

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. The time periods were split into the following categories:

Before Period:	November 1, 2000 to May 31, 2006	(5.58 Years)
Construction Period (Rumble):	June – August 2006	
After 1 Period (Rumble Install):	September 1, 2006 to December 31, 2007	(1.33 Years)
After 2 Period (US-220 Alt):	January 1, 2008 to March 31, 2012	(4.25 Years)

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 Lane Departure Crashes were the target crashes for the applied countermeasure. The Lane Departure Crash types considered are as follows: Fixed Object; Head-On; Jackknife; Overturn/Rollover; Parked Motor Vehicle; Ran-Off Roadway (Right, Left, Straight); and Sideswipe (Same and Opposite Direction). All target crashes were independently checked and verified.

<u>Treatment Information</u>	Before 5.58 Yrs	After 1 1.33 Yrs	After 2 4.25 Yrs
Total Crashes	80	9	11
Total Crashes Per Year	14.33 CPY	6.77 CPY	2.59 CPY
Total Severity Index	13.44	10.24	11.25
Lane Departure Target Crashes	45	2	5
LD Target Crashes Per Year	8.06 CPY	1.50 CPY	1.18 CPY
Lane Departure Target Severity Index	17.60	4.70	19.12

US-220 Montgomery: MP 0.00 – 5.50	Before 5.58 Yrs	After 1 1.33 Yrs	After 2 4.25 Yrs
Volume (2003, 2007, 2010)	8,500	8,400	1,000
Total Crash Rate (100 Million Vehicle Miles)	83.97	40.00	128.87
Injury Crashes			
Fatal Injury Crashes	5	0	1
Class-A Injury Crashes	5	1	0
Class-B Injury Crashes	11	1	1
Class-C Injury Crashes	21	0	4
Property Damage Only Crashes	38	7	5
Severe Injury Crashes per Year (K/A)	1.79 CPY	0.75 CPY	0.24 CPY
Total Injury Crashes per Year (K/A/B/C)	7.53 CPY	1.50 CPY	1.41 CPY
Contributing Factors			
Night Crashes	29	4	4
Wet Road Crashes	22	1	1
Alcohol Related	5	1	1

Results and Discussion

Reviewing the tables above, the overall segment experienced a steady reduction in crashes per year from 14.33 crashes per year in the before period to 6.77 in the After-1 Period and down to 2.59 crashes per year in the current After-2 Period. Lane Departure Crashes also experienced the step-down reduction in crashes per year from 8.06 (Before) to 1.50 (After-1) and 1.18 (After -2).

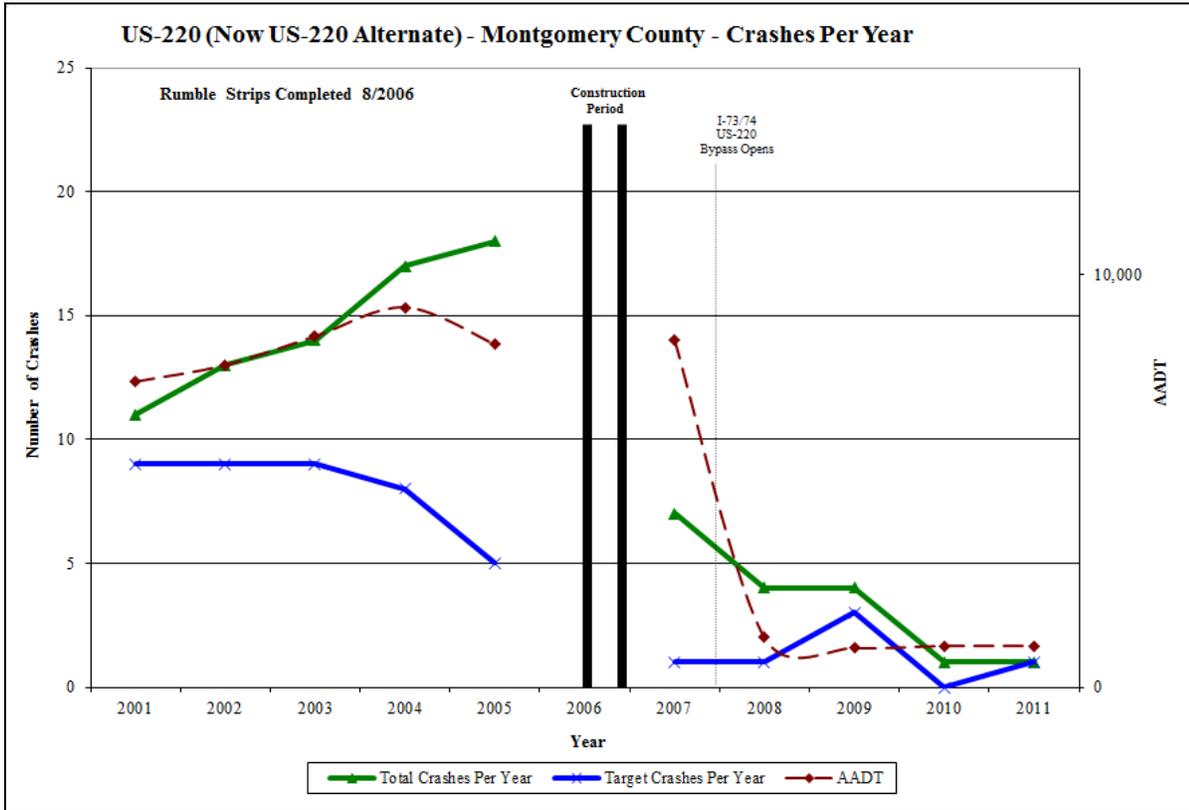
From further evaluation, the rumble stripes along the outside shoulder and centerline greatly reduced the number of severe injury crashes (consisting of Fataals & A-Injuries) from 1.79 before period crashes per year to 0.75 after-1 period crashes per year. Total injury collisions saw an even greater reduction in crashes per year from 7.53 (Before) to 1.50 (After-1).

With the opening the I-73/I-74/US-220 four-lane roadway and relabeling of the subject section to US-220 Alternate, the study location experienced an ADT decrease of 88 percent. However, as seen in the table above, the After-2 period crashes per year stayed consistent with After-1 period which caused a 200 percent increase in the Total Crash Rate due to the lower roadway volume.

There was one (1) severe injury crash in each of the after periods. The after-1 period A-injury collision occurred when a pedestrian standing in the roadway was struck. The after-2 period fatality was caused by a distracted driver leaving the roadway to the right, overturning on an embankment, and killing a backseat passenger.

The calculated benefit to cost ratio for this project (Before Period to After-1 Period) is **31.94 considering total crashes**. The benefit to cost ratio **considering only target crashes is 40.55**. 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 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, along with the AADT. Crashes per year appear reduced dramatically with the opening of the I-73/I-74/US-220 four-lane section in 2008. 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.

BENEFIT-COST ANALYSIS WORKSHEET - Total Crashes

LOCATION: US-220 (MP 0.0-5.5)		BY: JBS							
COUNTY: Montgomery		DATE: 8/10/2012							
FILE NO.: W-4826									
DETAILED COST:	TYPE IMPROVEMENT - Shoulder & Centerline Rumble								
ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST					
Construction	\$160,000	10	0.149	\$23,845					
Right-of-Way	\$0	0	0.000	\$0					
TOTALS	\$160,000	10	0.149	\$23,845					
ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$0					
ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$0					
TOTAL ANNUAL COST=				\$23,845					
TOTAL COST OF PROJECT=				\$160,000					
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	5.58	10	1.79	32	5.73	38	6.81	\$1,273,011	
AFTER	1.33	1	0.75	1	0.75	7	5.26	\$511,353	
Annual Benefits from Crash Cost Savings								\$761,657	
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$737,813			
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	31.94			
TOTAL COST OF PROJECT		-	\$160,000	COMPREHENSIVE B/C RATIO		-	31.94		

BENEFIT-COST ANALYSIS WORKSHEET - Target Crashes

LOCATION: US-220 (MP 0.0-5.5)		BY: JBS							
COUNTY: Montgomery		DATE: 8/10/2012							
FILE NO.: W-4826		Lane Departure Target Crashes							
DETAILED COST:	TYPE IMPROVEMENT - Shoulder & Centerline Rumble								
ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST					
Construction	\$160,000	10	0.149	\$23,845					
Right-of-Way	\$0	0	0.000	\$0					
TOTALS	\$160,000	10	0.149	\$23,845					
ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$0					
ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$0					
TOTAL ANNUAL COST=				\$23,845					
TOTAL COST OF PROJECT=				\$160,000					
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	5.58	8	1.43	19	3.41	18	3.23	\$985,197	
AFTER	1.33	0	0.00	1	0.75	1	0.75	\$18,271	
Annual Benefits from Crash Cost Savings								\$966,926	
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$943,082			
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	40.55			
TOTAL COST OF PROJECT		-	\$160,000	COMPREHENSIVE B/C RATIO		-	40.55		