

Hazard Elimination Project Evaluation

Order # 41000019046

Hazard Elimination Project W-4847

**Evaluation of the Rumble Strip Installation on US 74
From I-40 to the Jackson County Line in Haywood County**

Documents Prepared By:

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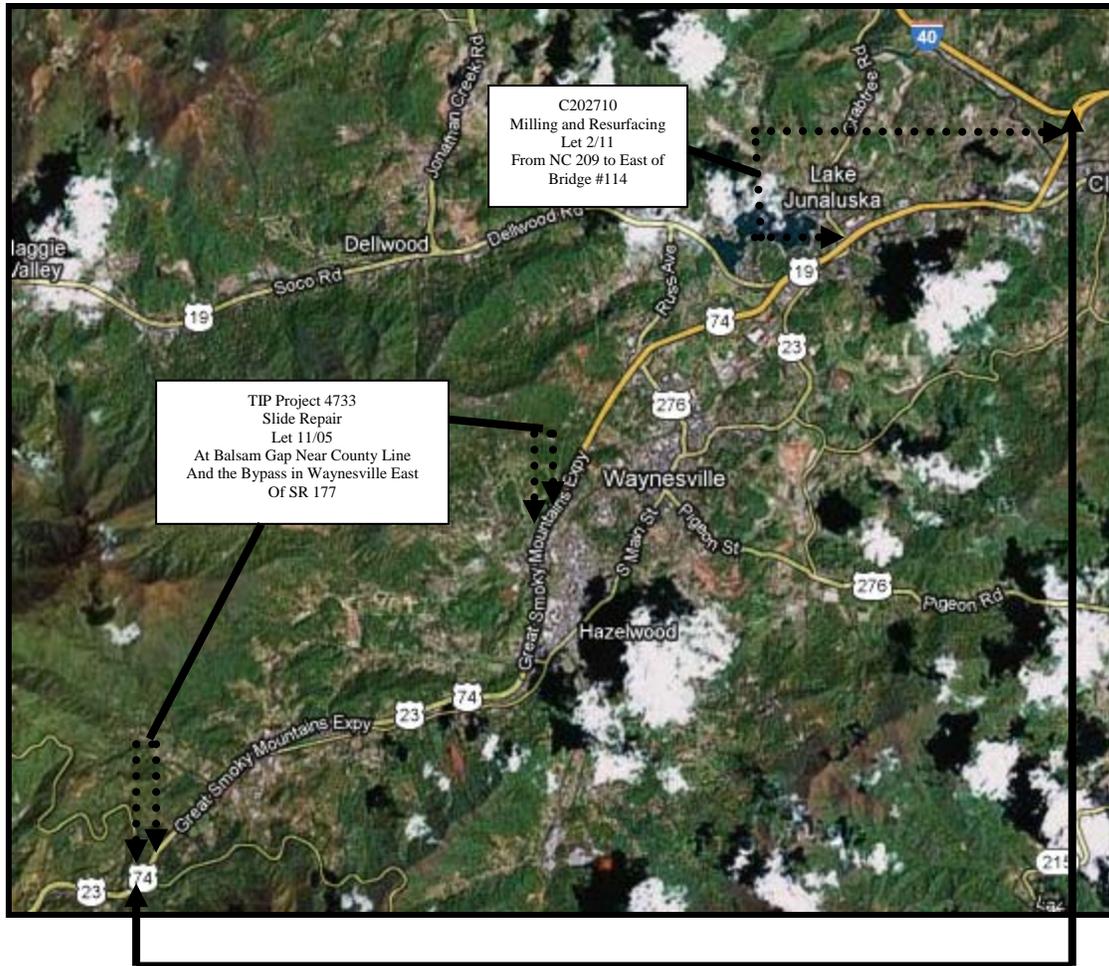
Date

Traffic Safety Project Engineer

Hazard Elimination Project Evaluation Documentation

Subject Location

US 74 from I-40 to the Jackson County line in Haywood County, a distance of approximately 13 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 rumble strips along both the inside and outside shoulders of US 74.

US 74 is mostly a four-lane fully or partially-controlled primary route with 2-10' paved median and outside shoulders. Median protection exists along the entire section and varies between W-beam guardrail, concrete barrier wall, and raised concrete island. The posted speed limit ranges from 55 mph to 60 mph. The intended purpose of the improvement was to alleviate the frequency of run-off-road crashes.

The initial crash analysis was completed from July 1, 2000 to June 30, 2003 with 156 total reported crashes, 64 of which were deemed correctable ran off road crashes. The improvement was completed on September 1, 2007 with a total cost of \$126,000. The projected B/C ratio was 30.43.

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 July 1, 2007 through September 30, 2007. The before period consisted of reported crashes from February 1, 2003 through June 30, 2007 (4.41 years); and the after period consisted of reported crashes from October 1, 2007 through February 29, 2012 (4.41 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 2005 and the after period ADT year was 2009.

The treatment data consisted of all mainline crashes on US 74 from I-440 to the Jackson County Line. 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 are considered as follows: Fixed Object, Head-On, Overturn/Rollover, Parked Motor Vehicle, Ran-Off Roadway (Right, Left, and Straight), and Sideswipe (Same and Opposite Direction).

<u>Treatment Information</u>	Before	After	Percent Reduction (-)/ Percent Increase (+)
Total Crashes – Both Directions	349	338	-3.2
Total Severity Index	7.47	6.27	-16.1
Lane Departure Crashes – Both Directions	241	224	-7.1
Lane Departure Severity Index	7.67	6.96	-9.3
Volume (2005, 2009)	31,200	30,500	-2.2
Total Crash Rate (100 Million Vehicle Miles)	52.36	51.81	-1.1

<u>US 74 Both Directions</u>	Before	After	Percent Reduction (-)/ Percent Increase (+)
Injury Crashes			
Fatal Injury Crashes	7	5	-28.6
Class-A Injury Crashes	6	5	-16.7
Class-B Injury Crashes	32	27	-15.6
Class-C Injury Crashes	52	51	-1.9
Property Damage Only Crashes	144	136	-5.6
Contributing Factors			
Night Crashes	74	60	-18.9
Wet Road Crashes	67	58	-13.4
Alcohol Related	14	14	0.0
Lane Departure Crash Types			
Angle	7	1	-85.7
Fixed Object	132	128	-3.0
Head On	0	3	N/A
Jackknife	4	0	-100.0
Overturn / Rollover	15	7	-53.3
Parked Motor Vehicle	4	4	0.0
Ran Off Road	28	32	14.3
Sideswipe, Opposite Direction	4	1	-75.0
Sideswipe, Same Direction	47	48	2.1

<u>US 74 Eastbound Only</u>	Before	After	Percent Reduction (-)/ Percent Increase (+)
EB Total Crashes	182	176	-3.3
EB Total Severity Index	7.89	7.10	-10.0
EB Lane Departure Crashes	126	108	-14.3
EB Lane Departure Severity Index	8.4	8.17	-2.7

<u>US 74 Westbound Only</u>	Before	After	Percent Reduction (-)/ Percent Increase (+)
WB Total Crashes	167	162	-3.0
WB Total Severity Index	7.01	5.37	-23.4
WB Lane Departure Crashes	115	116	0.9
WB Lane Departure Severity Index	6.87	5.83	-15.1

Results and Discussion

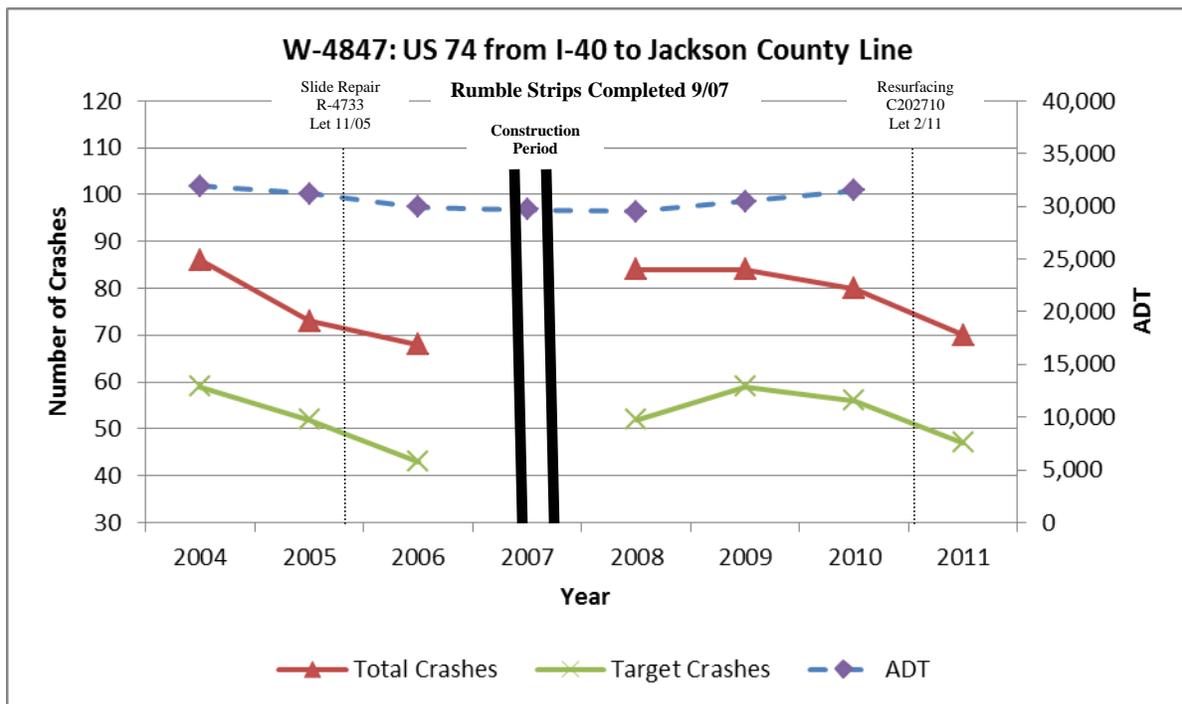
Using naïve before and after analysis, Total Crashes have decreased by 3 percent and Target Crashes have decreased by 7 percent in the subject area. Looking at the crashes by direction, the eastbound lanes experienced a 14 percent decrease in Target Crashes and the westbound lanes experienced a 1 percent increase in Target Crashes. The total severity index decreased by 16 percent and the target crash severity index decreased by 9 percent.

The rumble strip installation appears to have been effective at reducing lane departure crash types at the subject location. In addition to the decrease in overall target crashes, target crashes occurring at night decreased by 19 percent and those occurring during wet conditions decreased by 13 percent.

The calculated benefit to cost ratio for the project is **40.82** considering Total Crashes. The benefit to cost ratio considering only Target Crashes is **24.69**. 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 following chart depicts the crash trends along this segment of US 74. 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.

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

LOCATION: US 74 from I-40 to Jackson County Line		BY: bdr						
COUNTY: Haywood		DATE: 4/23/2012						
FILE NO.: W-4847								
DETAILED COST:	TYPE IMPROVEMENT -	Rumble Strips						
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$0	0	0.000	\$0			
		\$126,000	10	0.149	\$18,778			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$126,000	10	0.149	\$18,778			
	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	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	4.41	17	3.85	131	29.71	201	45.58	\$3,218,662
AFTER	4.41	12	2.72	118	26.76	208	47.17	\$2,452,245
							Annual Benefits from Crash Cost Savings	\$766,417
	NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST							\$747,640
	BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST							40.82
	TOTAL COST OF PROJECT	-	\$126,000		COMPREHENSIVE B/C RATIO	-		40.82

BENEFIT-COST ANALYSIS WORKSHEET - TARGET

LOCATION: US 74 from I-40 to Jackson County Line		BY: bdr						
COUNTY: Haywood		DATE: 4/23/2012						
FILE NO.: W-4847								
DETAILED COST:	TYPE IMPROVEMENT -	Rumble Strips						
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$0	0	0.000	\$0			
		\$126,000	10	0.149	\$18,778			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$126,000	10	0.149	\$18,778			
	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	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	4.41	13	2.95	84	19.05	144	32.65	\$2,378,503
AFTER	4.41	10	2.27	78	17.69	136	30.84	\$1,914,921
							Annual Benefits from Crash Cost Savings	\$463,583
	NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST							\$444,805
	BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST							24.69
	TOTAL COST OF PROJECT	-	\$126,000		COMPREHENSIVE B/C RATIO	-		24.69