

Hazard Elimination Project Evaluation

Order # 41000019030

Hazard Elimination Project # W-5007

Hazard Elimination Project Evaluation of the Friction Course Overlay 5 Selected Segments of US-264 Bypass Wilson County

Documents Prepared By:

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Date

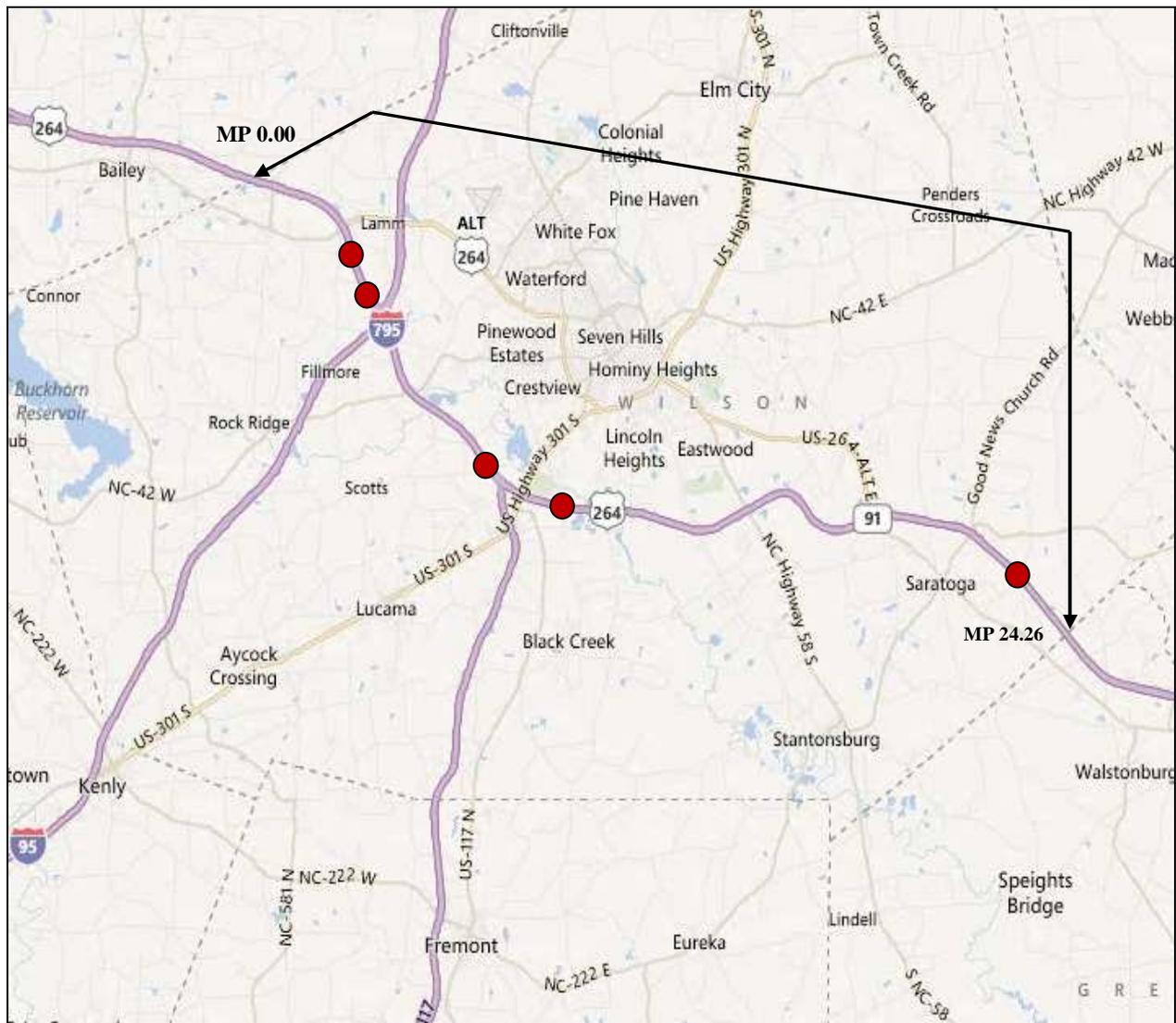
Hazard Elimination Project Evaluation Documentation

Subject Location

Evaluation of Hazard Elimination Project Number W-5007 located along five (5) sections of US 264 in Wilson County, bypassing the City of Wilson.

The selected target areas of Open Graded Asphalt Friction Course were:

1. East of Shepherd Branch Creek (Milepost 3.2 to 3.8) 0.6 mile
2. West of I-95 (Milepost 4.2 to 4.6) 0.4 mile
3. East of SR 1163 (Milepost 7.9 to 9.0) 1.1 mile
4. East of US 301 (Milepost 9.7 to 10.5) 0.8 mile
5. Near SR 1526 (Milepost 22.3 to 22.9) 0.6 mile



Project Information and Background from the Project File Folder

The hazard elimination improvement countermeasure chosen for the subject roadway was to resurface the selected target areas with an open-graded friction course pavement overlay. US 264 is a four-lane divided freeway with 12-foot lanes, variable width paved and soil shoulders, and a speed limit of 70-mph.

The original statement of problem mentioned that while all design criteria were met for such a high-speed facility, certain segments of the roadway tend to retain water, especially in transitions of horizontal curvature. The predominant crash pattern was wet run-off road crashes at each of these locations. The sections were highlighted in the 2005 Highway Safety Improvement Program under HSIP Project # 97S00014/15.

The initial crash analysis was completed from October 1, 2001 to September 30, 2006 with 189 reported crashes, 168 crashes of which were deemed correctable. The final completion date for these improvements was on October 15, 2007 with a total cost of \$950,000.

Naive Before and After Analysis

After reviewing the spot safety 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 August through October 2007. The before period consisted of reported crashes from April 1, 2003 through July 31, 2007 (4 years and 4 months); and the after period consisted of reported crashes from November 1, 2007 through February 29, 2012 (4 years and 4 months). 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 on US 264 within Wilson County with a zero (0) foot y-line, which excludes ramp collisions. The targeted OGAFRC resurfaced segments are highlighted individually below. *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 & Lane Departure Wet Crashes were the target crashes for the applied countermeasure. The Lane Departure Crash types considered are as follows: Ran-Off Roadway (Right, Straight, Left); Sideswipe (Same/Opposite Direction), Fixed Object, and Head-On. All Lane Departure crashes were individually verified by the crash report.

<u>Treatment Information</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	713	545	- 23.6%
Total Severity Index	4.13	2.93	- 29.1 %
Lane Departure Target Crashes	551	363	- 34.1 %
LD Target Crash Severity Index	4.27	3.15	- 26.3 %
Lane Departure WET Target Crashes	366	181	- 50.5 %
LD Wet Target Crash Severity Index	3.26	2.14	- 34.4 %

<u>Additional Info – Total Crashes</u>	Before	After	Percent Reduction (-)/ Percent Increase (+)
Volume (2005, 2009)	16,000	17,900	11.9 %
Total Crash Rate (100 Million Vehicle Miles)	116.04	79.33	- 31.6 %
Injuries			
Fatal Injury Crashes	10	2	- 80.0 %
Class-A Injury Crashes	3	2	- 33.3 %
Class-B Injury Crashes	58	39	- 32.8 %
Class-C Injury Crashes	110	62	- 43.6 %
Property Damage Only Crashes	532	440	- 17.3 %
Contributing Factors			
Total Night Crashes	259	247	- 4.6 %
Total Animal Crashes	105	125	19.0 %
Total Wet Road Crashes	330	172	- 47.9 %
Total Alcohol Related Crashes	20	26	30.0 %

The naive before and after analysis at the treatment location resulted in a 24 percent decrease in Total Crashes, a 34 percent decrease in Target Crashes, and a 29 percent decrease in the Total Severity Index. The before period ADT year was 2005 and the after period ADT year was 2009.

<u>OGAFC Section 1: MP 3.2-3.8</u>	Before	After	Percent Reduction (-)/ Percent Increase (+)
Total Crashes	48	12	- 75.0 %
Total Severity Index	3.81	3.47	- 8.9 %
Lane Departure			
Lane Departure Target Crashes	47	12	- 74.5 %
LD Target Crash Severity Index	3.71	3.47	- 6.5 %
Lane Departure WET			
Lane Departure WET Target Crashes	43	4	- 90.7 %
LD Wet Target Crash Severity Index	3.62	1.00	- 72.4 %

<u>OGAFC Section 2: MP 4.2-4.6</u>	Before	After	Percent Reduction (-)/ Percent Increase (+)
Total Crashes	39	25	- 35.9 %
Total Severity Index	4.08	3.07	- 24.8 %
Lane Departure			
Lane Departure Target Crashes	36	15	- 58.3 %
LD Target Crash Severity Index	4.34	3.47	- 20.0 %
Lane Departure WET			
Lane Departure WET Target Crashes	29	13	- 55.2 %
LD Wet Target Crash Severity Index	5.14	3.28	- 36.2 %

<u>OGAFC Section 3: MP 7.9-9.0</u>	Before	After	Percent Reduction (-)/ Percent Increase (+)
Total Crashes	54	18	- 66.7 %
Total Severity Index	2.37	1.41	- 40.5 %
Lane Departure Target Crashes	47	13	- 72.3 %
LD Target Crash Severity Index	2.57	1.00	- 61.1 %
Lane Departure WET Target Crashes	40	4	- 90.0 %
LD Wet Target Crash Severity Index	2.30	1.00	- 56.5 %

<u>OGAFC Section 4: MP 9.7-10.5</u>	Before	After	Percent Reduction (-)/ Percent Increase (+)
Total Crashes	49	15	- 69.4 %
Total Severity Index	2.36	1.99	- 15.7 %
Lane Departure Target Crashes	47	12	- 74.5 %
LD Target Crash Severity Index	2.26	2.23	- 1.3 %
Lane Departure WET Target Crashes	45	4	- 91.1 %
LD Wet Target Crash Severity Index	2.32	1.00	- 56.9 %

<u>OGAFC Section 5: MP 22.3-22.9</u>	Before	After	Percent Reduction (-)/ Percent Increase (+)
Total Crashes	40	15	- 62.5 %
Total Severity Index	5.67	4.95	- 12.7 %
Lane Departure Target Crashes	32	9	- 71.9 %
LD Target Crash Severity Index	6.14	5.11	- 16.8 %
Lane Departure WET Target Crashes	21	4	- 81.0 %
LD Wet Target Crash Severity Index	6.72	4.70	- 30.1 %

<u>All 5 OGAFC Sections Combined</u>	Before	After	Percent Reduction (-)/ Percent Increase (+)
Total Crashes	230	85	- 63.0 %
Total Severity Index	3.53	2.92	- 17.3 %
Lane Departure Target Crashes	209	61	- 70.8 %
LD Target Crash Severity Index	3.61	2.94	- 18.6 %
Lane Departure WET Target Crashes	178	29	- 83.7 %
LD Wet Target Crash Severity Index	3.61	2.53	- 29.9 %

Weather Data Analysis

Due to the nature of the friction course overlay, Weather Data was also examined to compare natural rainfall/winter weather events during the analysis that affect roadway conditions. Historical weather data was obtained from the State Climate Office of North Carolina at the closest collection point within the City of Wilson. The date ranges match the study periods and days of precipitation above 0.01 inches were recorded.

<u>Weather Data Information</u>	Before 4.33 Yrs	After 4.33 Yrs	Percent Reduction (-) Percent Increase (+)
Total Recorded Precipitation (inches)	142.66 in	159.67 in	11.9 %
Total Days of Precipitation / WET Road	518 days	566 days	9.3 %
Average Precip per Event Day	0.28 in	0.28 in	0.0 %
Average Precip Total per Year	32.95 in	36.88 in	11.9 %
Avg Days of WET Conditions per Year	119.6 days	130.7 days	9.3 %

Results and Discussion

Referencing the *charts above*, the entire route of US-264 through Wilson County experienced a 24 percent decrease in total crashes and a 50 percent reduction in Wet Lane Departure crashes throughout the study. However, the Safety Evaluation Group does not know of all countermeasures that may have occurred on this route during this timeframe.

Examining just the five (5) open-grade friction course segments totaling 3.5 miles, the data indicates a 63 percent reduction in total crashes and an 84 percent reduction in Wet Lane Departure collisions. The only segment that did not experience greater than an 80 percent reduction in Wet Lane Departure crashes was Segment-2 which still reduced by 55 percent. There were zero (0) serious injury (fatal / A-injury) wet lane departure crashes in the after period; down from three (3) in the before period.

The exceptional results seen in this evaluation are verified again when analyzing the weather data. The after period additionally experienced more wet weather days by 9 percent with a 12 percent increase in the total recorded precipitation; yet the crash totals still reduced significantly.

The calculated benefit to cost ratio for this project (Total OG AFC 5 Segments) is **4.74 considering total crashes**. The benefit to cost ratio **considering only WET Target Crashes on the 5 OG AFC Segments is 4.77**. 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 countermeasure.

BENEFIT-COST ANALYSIS WORKSHEET - Total OGAF C Segments

LOCATION: 5 Segments of US-264		BY: JBS						
COUNTY: Wilson		DATE: 6/4/2012						
FILE NO.: W-5007								
DETAILED COST:	TYPE IMPROVEMENT - Resurface with Open-Grade Friction Course							
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$950,000	10	0.149	\$141,578			
		\$0	0	0.000	\$0			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$950,000	10	0.149	\$141,578			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$0			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$0			
	TOTAL ANNUAL COST=				\$141,578			
	TOTAL COST OF PROJECT=				\$950,000			
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	4.33	3	0.69	48	11.09	179	41.34	\$835,958
AFTER	4.33	0	0.00	22	5.08	63	14.55	\$164,180
						Annual Benefits from Crash Cost Savings		\$671,778
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$530,200		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	4.74		
TOTAL COST OF PROJECT		-	\$950,000	COMPREHENSIVE B/C RATIO		-	4.74	

BENEFIT-COST ANALYSIS WORKSHEET - WET LD OGAF C Segments

LOCATION: 5 Segments of US-264		BY: JBS						
COUNTY: Wilson		DATE: 6/4/2012						
FILE NO.: W-5007		WET Lane Departure Crashes						
DETAILED COST:	TYPE IMPROVEMENT - Resurface with Open-Grade Friction Course							
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$950,000	10	0.149	\$141,578			
		\$0	0	0.000	\$0			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$950,000	10	0.149	\$141,578			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$0			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$0			
	TOTAL ANNUAL COST=				\$141,578			
	TOTAL COST OF PROJECT=				\$950,000			
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	4.33	3	0.69	32	7.39	143	33.03	\$726,305
AFTER	4.33	0	0.00	6	1.39	23	5.31	\$50,554
						Annual Benefits from Crash Cost Savings		\$675,751
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$534,173		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	4.77		
TOTAL COST OF PROJECT		-	\$950,000	COMPREHENSIVE B/C RATIO		-	4.77	