

Hazard Elimination Project Evaluation

Order # 41000018376

Hazard Elimination Project # W-5014

**Hazard Elimination Project Evaluation of the Friction Course Overlay,
Rumblestrips, Pavement Markers & Left Turn Lane Installation
NC 18 (South of I-40)
Burke County**

Documents Prepared By:

Safety Evaluation Group
Traffic Safety Systems Management Section
Transportation Mobility and Safety Division
North Carolina Department of Transportation

Principal Investigator



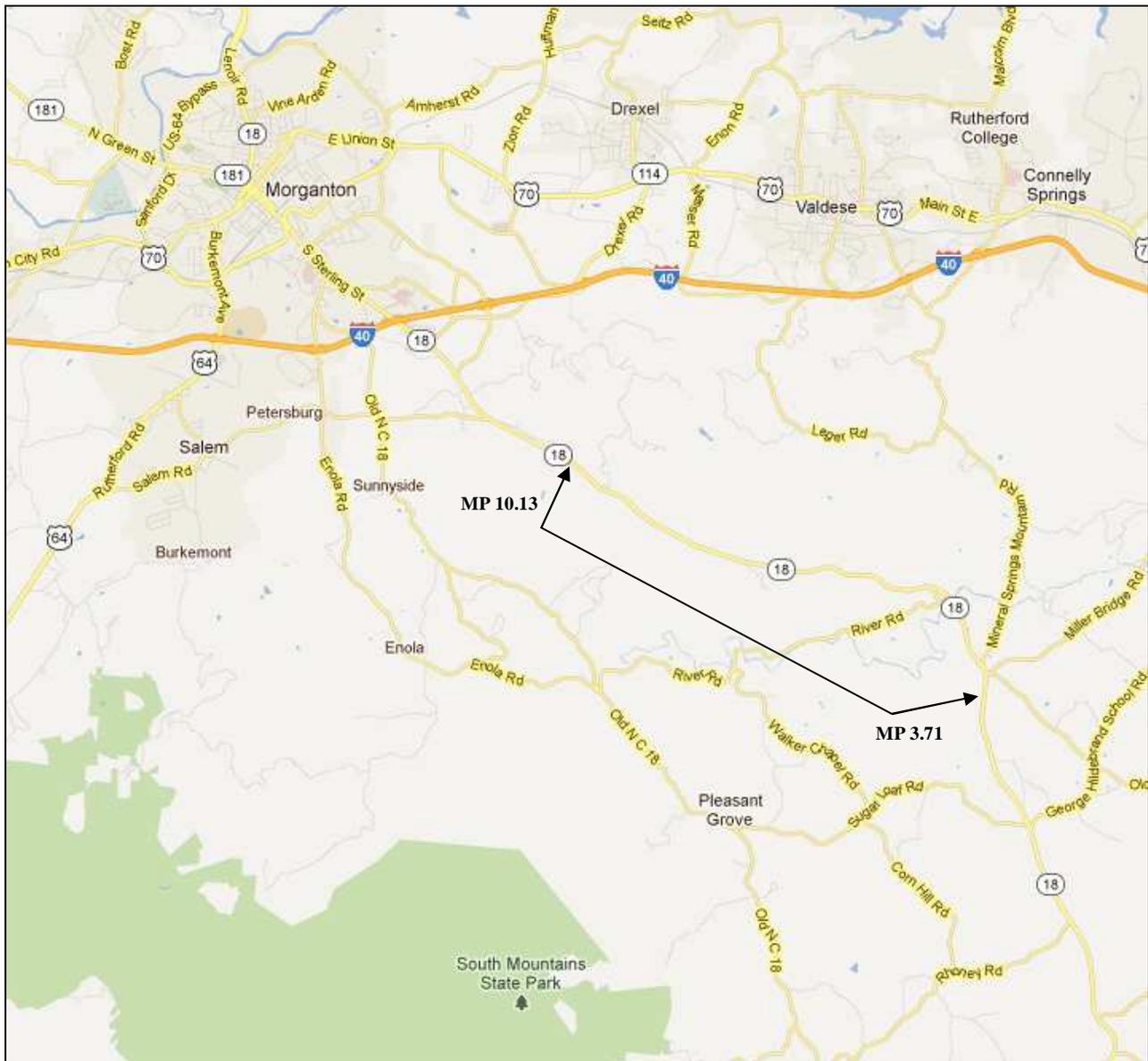
Jason B. Schronce
Traffic Safety Project Engineer

4-18-2012
Date

Hazard Elimination Project Evaluation Documentation

Subject Location

Evaluation of Hazard Elimination Project Number W-5014 located along the segment of NC 18 from 0.3 mile south of SR 1001 (Mineral Springs Road) to 0.3 north of SR 1929 (Port Street) in Burke County, south of the City of Morganton. The milepost range on NC 18 is 3.71 to 10.13; total length of 6.42 miles.



Project Information and Background from the Project File Folder

The hazard elimination improvement countermeasures chosen for the subject location were the installation of centerline and shoulders rumble strips, a friction pavement overlay, snow-plowable raised pavement makers, and a left turn lane at the SR 1001 (Mineral Springs Road) intersection. NC 18 is a two-lane, two-way roadway with a 55-mph speed limit. This segment has significant horizontal curves, multiple residential driveways, and ten (10) roadway intersections. The section has an average 28-foot pavement width with 2-foot paved shoulders.

The original statement of problem was this roadway section was experiencing run-off roadway crashes with many severe injuries.

The initial crash analysis was completed from January 1, 2002 to December 31, 2006 with eighty-three (83) reported crashes, fifty-three (53) of which were deemed correctable. The final completion date for these improvements was on November 20, 2008 with a total cost of \$1,305,000.

Naive Before and After Analysis

After reviewing the spot safety 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 the months of September through October 2008. The before period consisted of reported crashes from July 1, 2005 through August 31, 2008 (3 years and 2 months); and the after period consisted of reported crashes from December 1, 2008 through January 31, 2012 (3 years and 2 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 NC 18 within the segment mileposts 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 countermeasures. The Lane Departure Crash types considered are as follows: Ran-Off Roadway (Right, Straight, Left); Sideswipe (Opposite Direction), Fixed Object, and Head-On.

<u>Treatment Information</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	43	31	- 27.9 %
Total Severity Index	16.61	9.71	- 41.5 %
Lane Departure Target Crashes	26	9	- 65.4 %
LD Target Crash Severity Index	21.91	22.78	4.0 %
Volume (2007, 2010)	4,200	4,700	11.9 %

<u>Additional Information</u>	Before	After	Percent Reduction (-)/ Percent Increase (+)
Injuries			
Fatal Injury Crashes	4	1	- 75.0 %
Class-A Injury Crashes	3	1	- 66.7 %
Class-B Injury Crashes	8	7	- 12.5 %
Class-C Injury Crashes	11	9	- 18.2 %
Property Damage Only Crashes	17	13	- 23.5 %
Contributing Factors			
Total Night Crashes	11	14	27.3 %
Total Animal Crashes	3	6	100.0 %
Total Wet Road Crashes	4	7	75.0 %
Total Alcohol Related Crashes	4	0	- 100.0 %
Lane Departure Crashes (From Crash Reports)			
Head-On	4	2	- 50.0 %
Ran Off Roadway	19	7	- 63.2 %
Sideswipe, Opposite Direction	3	0	- 100.0 %

The naive before and after analysis at the treatment location resulted in a 30 percent decrease in Total Crashes, a 65 percent decrease in Target Crashes, and a 41.5 percent decrease in the Total Severity Index. The before period ADT year was 2007 and the after period ADT year was 2010.

Results and Discussion

Referencing the *charts above*, the before period segment presented a strong pattern of six (6) severe (Fatal + A-Injury) collisions from lane departure crashes. There was one (1) additional fatal crash in the before period resulting from a left turn collision involving a tractor-trailer. With the roadway improvements, severe injury crashes reduced to two (2) including one fatal. The after period fatal was a ran-off roadway crash that occurred at night with speeding appearing to be the contributing factor. Overall, this roadway appears to have benefited with the reduction of both the frequency and severity of segment collisions.

The calculated benefit to cost ratio for this project is **5.22 considering total crashes**. The benefit to cost ratio **considering only target crashes is 4.32**. 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.

A photo is provided from Google Street View to show the standard roadway segment of NC 18. 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.

Treatment Site Photograph (Google Maps)



NC 18 around Milepost 5.5

BENEFIT-COST ANALYSIS WORKSHEET - Total Crashes

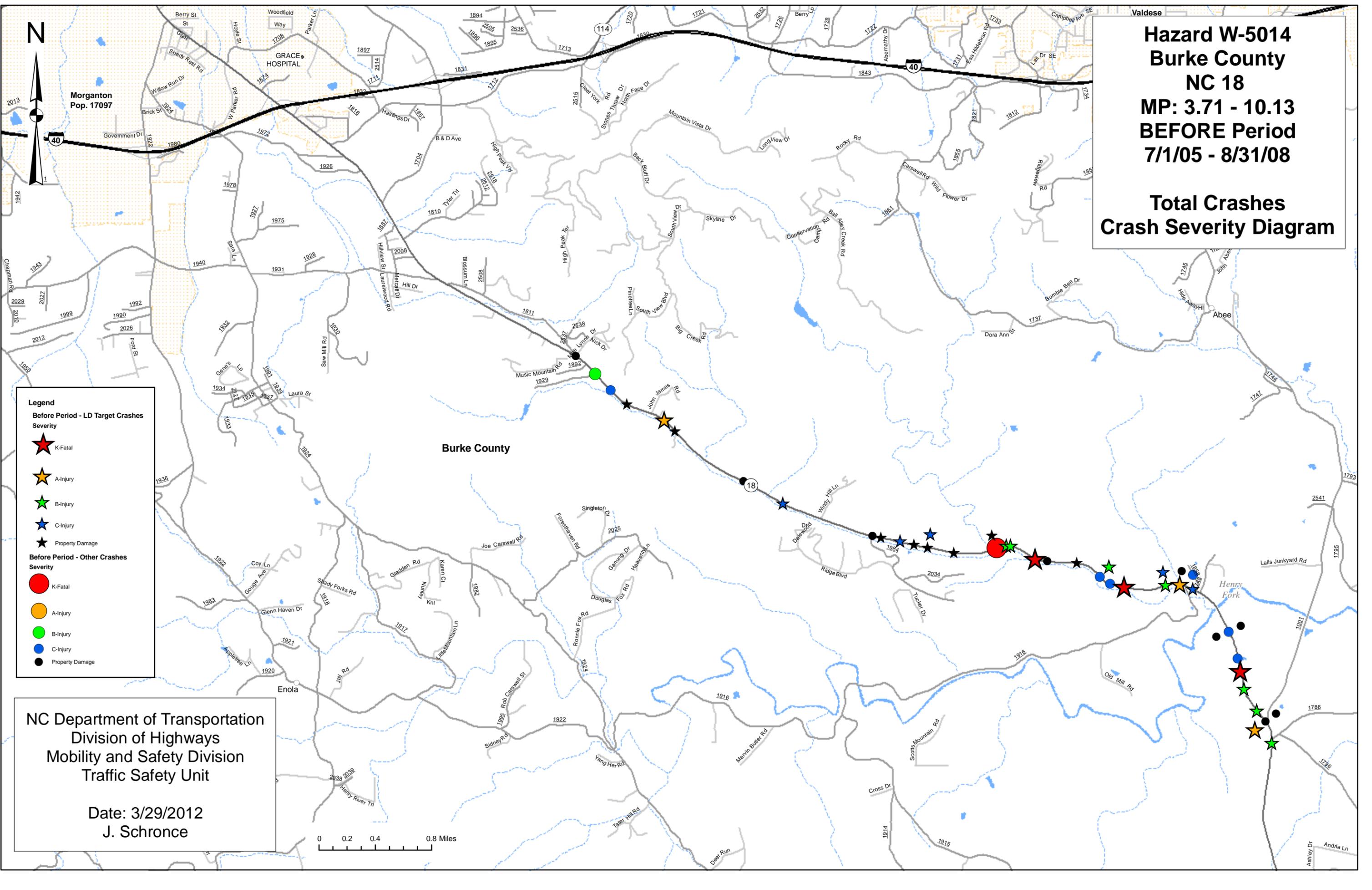
LOCATION: NC 18		BY: JBS							
COUNTY: Burke		DATE: 3/29/2012							
FILE NO.: W-5014									
DETAILED COST:	TYPE IMPROVEMENT - Left Turn Lane, Friction Course, Rumble Strips								
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST				
	Construction	\$1,305,000	10	0.149	\$194,483				
	Right-of-Way	\$0	0	0.000	\$0				
	TOTALS	\$1,305,000	10	0.149	\$194,483				
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$400				
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$0				
	TOTAL ANNUAL COST=				\$194,883				
	TOTAL COST OF PROJECT=				\$1,305,000				
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	3.17	7	2.21	19	5.99	17	5.36	\$1,534,101	
AFTER	3.17	2	0.63	16	5.05	13	4.10	\$516,057	
								Annual Benefits from Crash Cost Savings	\$1,018,044
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$823,161			
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	5.22			
TOTAL COST OF PROJECT		-	\$1,305,000	COMPREHENSIVE B/C RATIO		-	5.22		

BENEFIT-COST ANALYSIS WORKSHEET - Target Crashes

LOCATION: NC 18		BY: JBS							
COUNTY: Burke		DATE: 3/29/2012							
FILE NO.: W-5014		Lane Departure Crashes							
DETAILED COST:	TYPE IMPROVEMENT - Left Turn Lane, Friction Course, Rumble Strips								
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST				
	Construction	\$1,305,000	10	0.149	\$194,483				
	Right-of-Way	\$0	0	0.000	\$0				
	TOTALS	\$1,305,000	10	0.149	\$194,483				
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$400				
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$0				
	TOTAL ANNUAL COST=				\$194,883				
	TOTAL COST OF PROJECT=				\$1,305,000				
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	3.17	6	1.89	12	3.79	8	2.52	\$1,278,991	
AFTER	3.17	2	0.63	6	1.89	1	0.32	\$436,688	
								Annual Benefits from Crash Cost Savings	\$842,303
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$647,419			
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	4.32			
TOTAL COST OF PROJECT		-	\$1,305,000	COMPREHENSIVE B/C RATIO		-	4.32		

**Hazard W-5014
Burke County
NC 18
MP: 3.71 - 10.13
BEFORE Period
7/1/05 - 8/31/08**

**Total Crashes
Crash Severity Diagram**



Legend

Before Period - LD Target Crashes Severity

- ★ K-Fatal
- ★ A-Injury
- ★ B-Injury
- ★ C-Injury
- ★ Property Damage

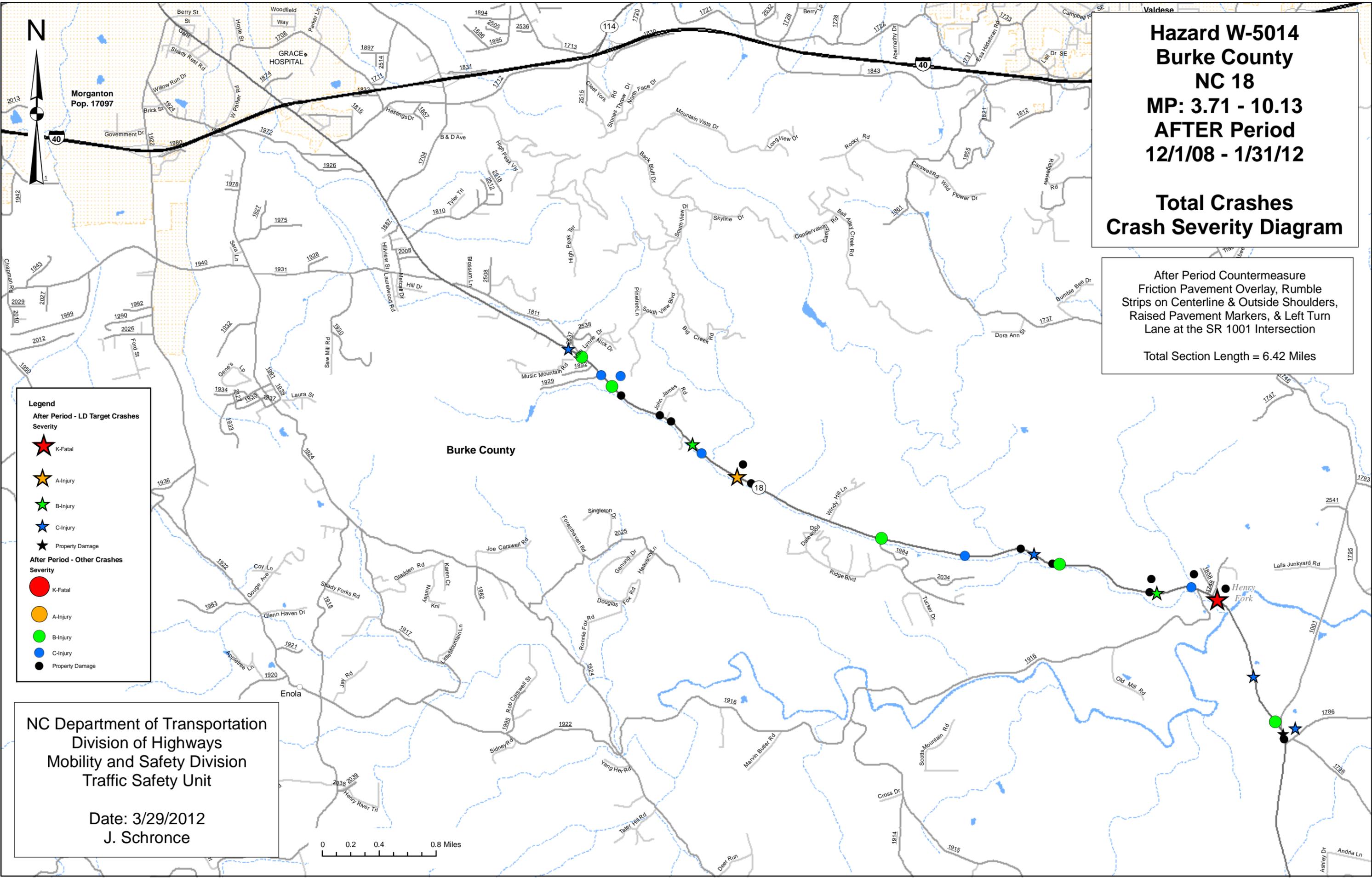
Before Period - Other Crashes Severity

- K-Fatal
- A-Injury
- B-Injury
- C-Injury
- Property Damage

NC Department of Transportation
Division of Highways
Mobility and Safety Division
Traffic Safety Unit

Date: 3/29/2012
J. Schronce





Hazard W-5014
Burke County
NC 18
MP: 3.71 - 10.13
AFTER Period
12/1/08 - 1/31/12

Total Crashes
Crash Severity Diagram

After Period Countermeasure
 Friction Pavement Overlay, Rumble
 Strips on Centerline & Outside Shoulders,
 Raised Pavement Markers, & Left Turn
 Lane at the SR 1001 Intersection

Total Section Length = 6.42 Miles

Legend

After Period - LD Target Crashes
Severity

- ★ K-Fatal
- ★ A-Injury
- ★ B-Injury
- ★ C-Injury
- ★ Property Damage

After Period - Other Crashes
Severity

- K-Fatal
- A-Injury
- B-Injury
- C-Injury
- Property Damage

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