

# Spot Safety Project Evaluation

Order # 41000015456

Spot Safety Project # 12-02-202

## Spot Safety Project Evaluation of the Guardrail Installation Segments along NC 115 (Wilkesboro Highway) Iredell County

Documents Prepared By:

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

**Principal Investigator**



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Jason B. Schronce

2-23-2012

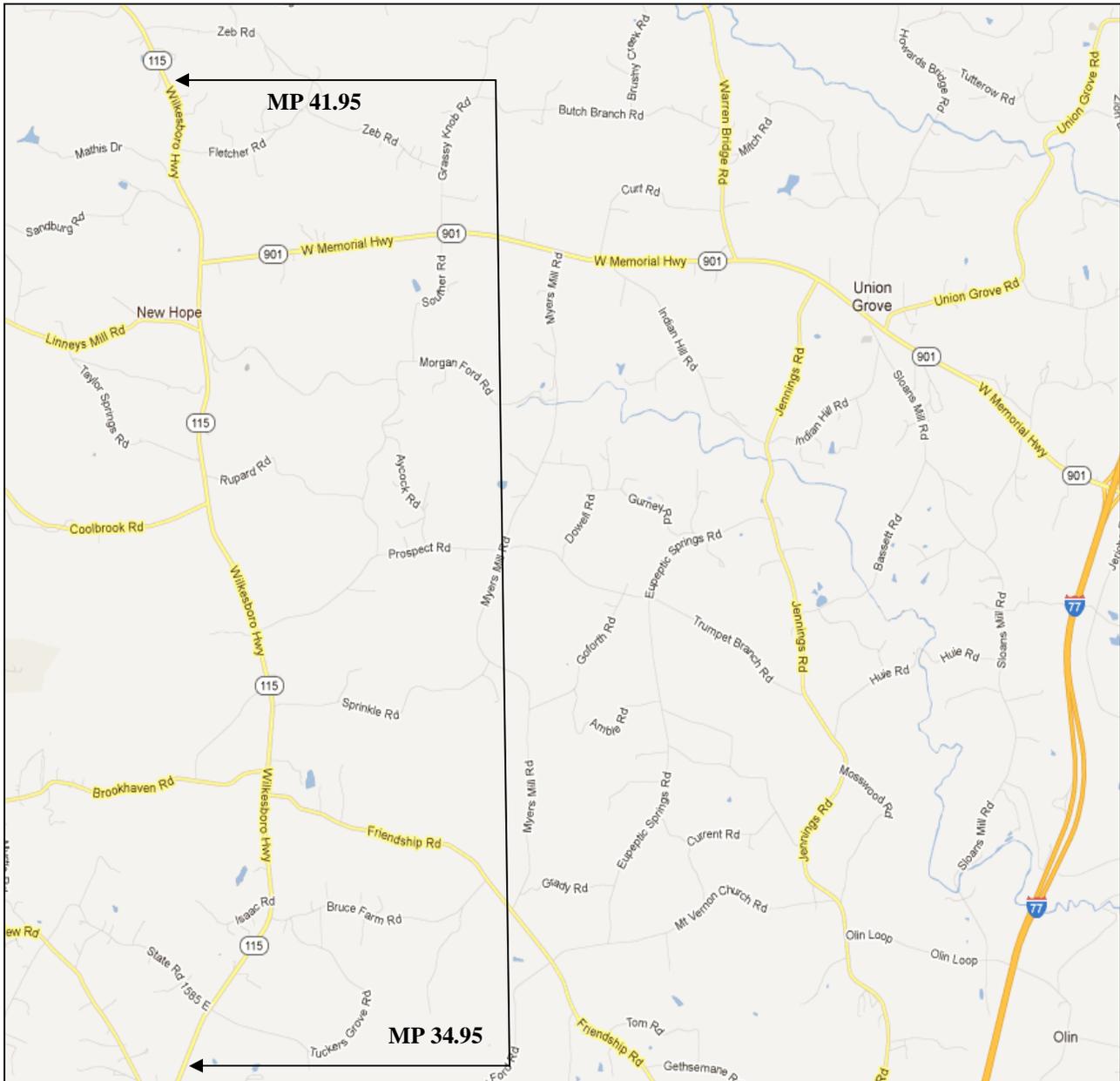
Date

Traffic Safety Project Engineer

# Spot Safety Project Evaluation Documentation

## Subject Location

Evaluation of Spot Safety Project Number 12-02-202 located along the segment of NC 115 from 0.2 mile south of SR 1871 (Tuckers Grove Road) to 0.4 mile south of SR 1800 (Zeb Road) in Iredell County, north of Statesville. The segment consists of NC 115 mileposts 34.95 through 41.95; a total segment length of 7 miles.



## **Project Information and Background from the Project File Folder**

The spot safety project improvement countermeasure chosen for the subject roadway segment was the installation 4,000 feet of w-beam guardrail along certain portions. NC 115 is a rural two-lane facility with varying three to five foot shoulders and a 55-mph speed limit. The roadway consists of deep ravines immediately adjacent to the edge of pavement. This segment also consists of many intersections and private residential driveways.

The original statement of problem concluded that vehicles that run off the roadway in this region do not have adequate recovery area. The addition of guardrail will provide positive protection for lane departure crashes and is preventive countermeasure.

The project background information did not explicitly list the locations of the guardrail installations. However, from our field investigation on October 31, 2011 the following sections appeared to have the highest concentration of installed guardrail:

A. Bruce Farm Road to Friendship Road (milepost 35.94 – 36.79)	0.85 mile
B. Sprinkle Road to Prospect Road (milepost 37.37 – 37.95)	0.58 mile
C. Linneys Mill Road to 0.1 mile south of US-901 (40.13 – 40.50)	0.37 mile
D. Fletcher Road to Zeb Road (milepost 41.46 – 41.95)	0.49 mile

The initial crash analysis was completed from December 1, 1998 to November 30, 2001 with fourteen (14) reported crashes, five (5) of which were deemed correctable including one fatality and two A-injury crashes. The final completion date for the improvement at the subject roadway segment was on December 5, 2007 with a total cost of \$165,000.

### **Naive Before and After Analysis**

After reviewing the spot safety project file folder along with all the crashes along the subject strip, the crash data omitted from this analysis to consider for an adequate construction period were the months of November through December 2007. The before period consisted of reported crashes from November 1, 2003 through October 31, 2007 (4 years); and the after period consisted of reported crashes from January 1, 2008 through December 31, 2011 (4 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 the 7-mile segment with a 0 feet y-line. *Please see attached location map and photos 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: Ran-Off Road (right, left, straight); fixed object, sideswipe (opposite direction), and Head on. For this evaluation, Lane Departure Target Crashes were examined and chosen directly from the crash reports.

<u>Treatment Information</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Total Segment Crashes	42	57	35.7 %
Total Severity Index	4.92	4.96	0.8 %
Lane Departure Target Crashes	21	20	- 4.8 %
Target Crash Severity Index	7.08	9.32	31.6 %
Volume (2005, 2009)	2,400	2,400	0.0 %

<u>Injury Crash Summary</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Fatal injury Crashes	0	2	200.0 %
Class A injury Crashes	1	0	- 100.0 %
Class B injury Crashes	6	3	- 50.0%
Class C Injury Crashes	6	7	16.7 %
Total Injury Crashes	13	12	- 7.7 %

The naive before and after analysis at the treatment location resulted in a 36 percent increase in Total Crashes, a 5 percent decrease in Target Crashes, but a 0.8 percent increase in the Total Severity Index. The before period ADT year was 2005 and the after period ADT year was 2009.

<u>Guardrail Sections</u>	Before Total	After Total		Before LD	After LD
A: MP 35.94 – 36.79	7	8		4	1
B: MP 37.37 – 37.95	5	4		0	0
C: MP 40.13 – 40.50	1	8		1	3
D: MP 41.46 – 41.95	3	0		2	0

From reviewing the crash reports, only three (3) after period crashes explicitly show a vehicle striking a guardrail.

## Results and Discussion

Referencing the *GIS Collision Diagrams*, the before period only highlights one (1) A-injury lane departure crash where a motorcyclist ran-off the roadway and flipped in a ditch. After the guardrail installations along certain segments of NC 115 the number of lane departure collisions nearly stayed the same and included two (2) fatal collisions.

Fatal Crash 1 (102840483) – Vehicle attempted to pass and stuck on-coming vehicle head-on, dry roadway conditions, guardrail present on both sides of roadway.

Fatal Crash 2 (102953853) – Vehicle ran-off road right, stuck curb and overcorrected resulting in head-on collision, dry roadway conditions.

The table results above show a total crash increase of 36 percent. Other noteworthy contributors include an increase in “Night Crashes” from 19 in the before period to 26 collisions in the after period. Also, animal collisions increased from 12 to 20 through the evaluation periods. Crashes under “Wet Conditions” additionally increased from 3 collisions in the before period to 13 crashes in the after period.

The calculated benefit to cost ratio for this project is **(-6.26) considering total crashes**. The benefit to cost ratio **considering only target crashes is (-5.16)**. 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.

Please see the attached *Treatment Site Photos*. Photos are provided from our Field Visit on October 31<sup>st</sup>, 2011 for multiple locations along the NC 115 route segment. 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 intersection.

#### **Treatment Site Photos (Field Visit 10-31-2012)**



**Typical Roadway Segment – Guardrail Installation**



**BENEFIT-COST ANALYSIS WORKSHEET - Total Crashes**

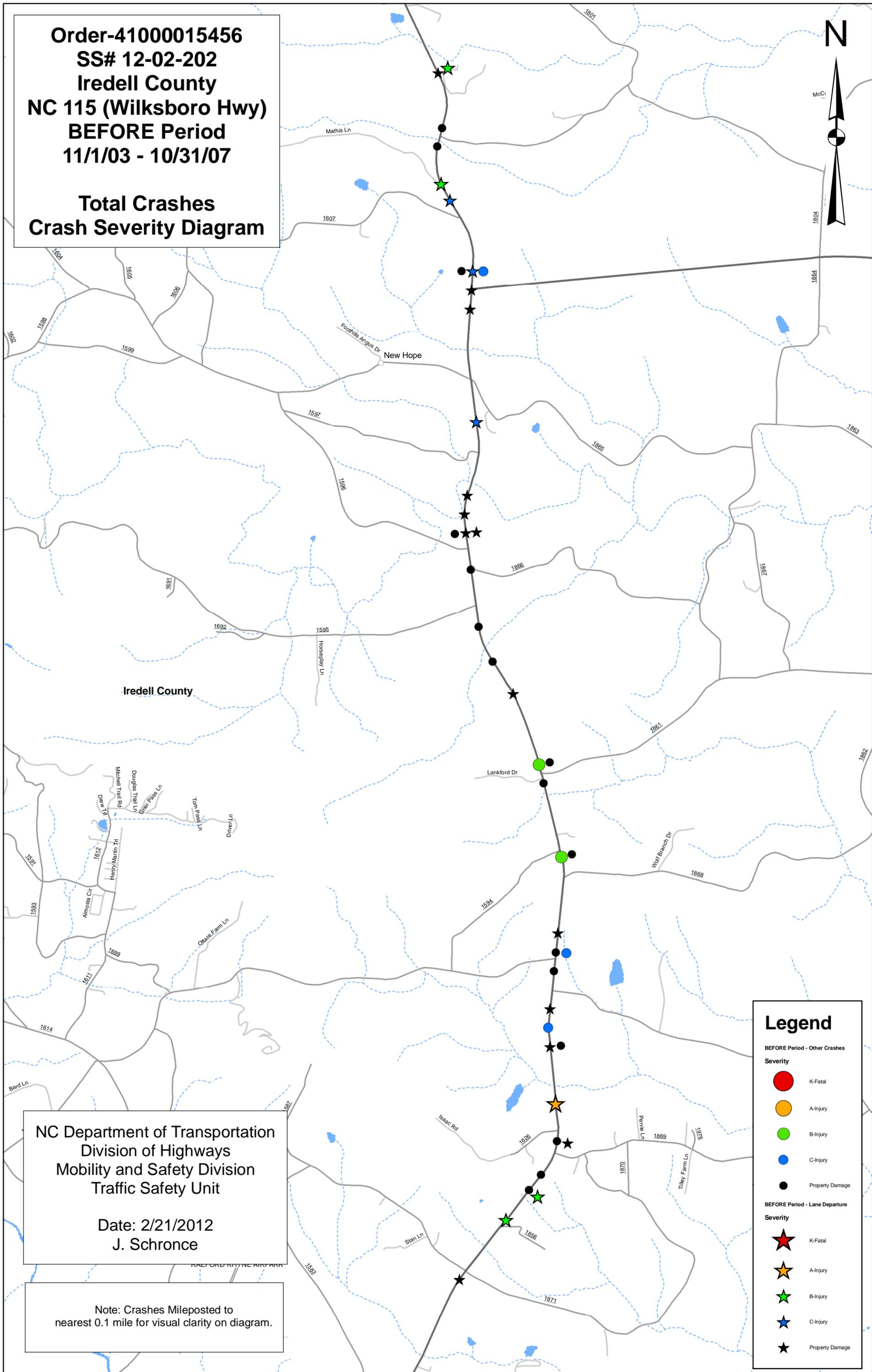
LOCATION: NC 115		BY: JBS						
COUNTY: Iredell		DATE: 2/21/2012						
FILE NO.: SS 12-02-202								
DETAILED COST:	TYPE IMPROVEMENT - <b>Shoulder Guardrail</b>							
ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST				
Construction	\$165,000	10	0.149	\$24,590				
Right-of-Way	\$0	0	0.000	\$0				
TOTALS	\$165,000	10	0.149	\$24,590				
ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$1,700				
ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$0				
TOTAL ANNUAL COST=				\$26,290				
TOTAL COST OF PROJECT=				\$165,000				
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	4.00	1	0.25	12	3.00	29	7.25	\$248,675
AFTER	4.00	2	0.50	10	2.50	45	11.25	\$413,375
Annual Benefits from Crash Cost Savings								(\$164,700)
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST						=	(\$190,990)	
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST						=	-6.26	
TOTAL COST OF PROJECT		-	\$165,000	COMPREHENSIVE B/C RATIO		-		-6.26

**BENEFIT-COST ANALYSIS WORKSHEET - Target Crashes**

LOCATION: NC 115		BY: JBS						
COUNTY: Iredell		DATE: 2/21/2012						
FILE NO.: SS 12-02-202		Lane Departure Target Crashes						
DETAILED COST:	TYPE IMPROVEMENT - <b>Shoulder Guardrail</b>							
ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST				
Construction	\$165,000	10	0.149	\$24,590				
Right-of-Way	\$0	0	0.000	\$0				
TOTALS	\$165,000	10	0.149	\$24,590				
ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$1,700				
ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$0				
TOTAL ANNUAL COST=				\$26,290				
TOTAL COST OF PROJECT=				\$165,000				
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	4.00	1	0.25	7	1.75	13	3.25	\$206,475
AFTER	4.00	2	0.50	2	0.50	16	4.00	\$342,200
Annual Benefits from Crash Cost Savings								(\$135,725)
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST						=	(\$162,015)	
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST						=	-5.16	
TOTAL COST OF PROJECT		-	\$165,000	COMPREHENSIVE B/C RATIO		-		-5.16

**Order-41000015456**  
**SS# 12-02-202**  
**Iredell County**  
**NC 115 (Wilksboro Hwy)**  
**BEFORE Period**  
**11/1/03 - 10/31/07**

**Total Crashes**  
**Crash Severity Diagram**



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

Date: 2/21/2012  
 J. Schronce

Note: Crashes Mileposted to nearest 0.1 mile for visual clarity on diagram.

### Legend

**BEFORE Period - Other Crashes**

**Severity**

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

**BEFORE Period - Lane Departure**

**Severity**

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

