

# Spot Safety Project Evaluation

Order # 41000006937

Spot Safety Project # 12-03-211

**Spot Safety Project Evaluation of the Traffic Signal Installation  
US 21 / NC 115 (Charlotte Hwy) at SR 2383 (Shinnville Road)  
Iredell County, City of Mooresville**

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

11-29-2010

Date

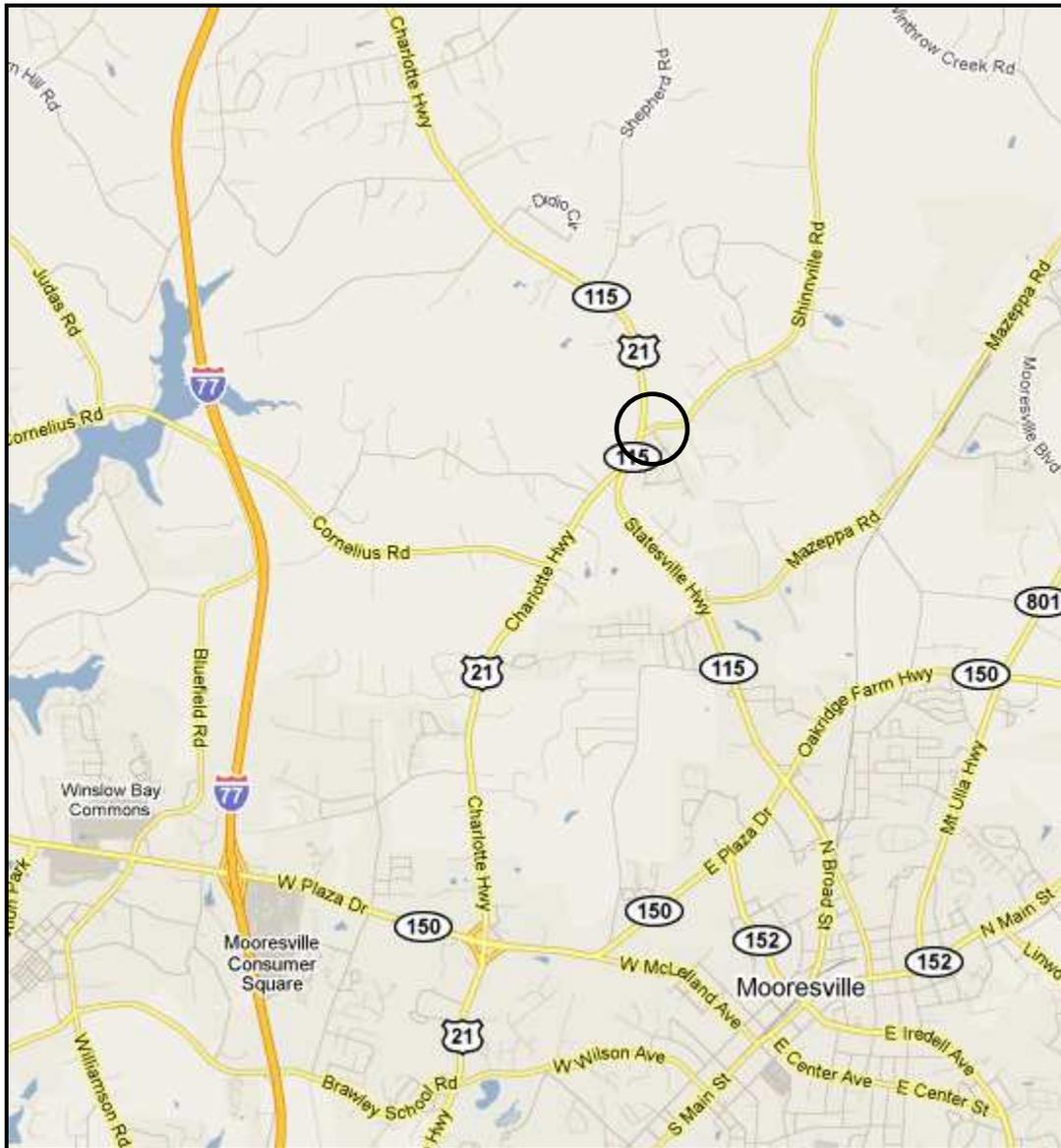
Traffic Safety Project Engineer

# Spot Safety Project Evaluation Documentation

## Subject Location

Evaluation of Spot Safety Project Number 12-03-211 located at the Intersection of US 21 / NC 115 (Charlotte Highway) and SR 2383 (Shinnville Road) in Iredell County, City of Mooresville.

The Sig ID is 12-1708 for this newly installed traffic signal.





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

The spot safety project improvement countermeasure chosen for the subject location was the installation of an intersection traffic signal. US 21 / NC 115 (Charlotte Highway) and SR 2383 (Shinnville Rd) are both two-lane facilities at the subject intersection with speed limits of 45 mph on all approaches. The intersection also has turn lanes on the westbound SR 2383 and southbound US 21 approach which were installed, by crash data, during the first quarter of calendar year 2003. The subject location is a three-leg intersection, which was controlled by a stop sign on SR 2383.

The original statement of problem consisted of excessive delay and congestion issues for SR 2383. The intended purpose of this improvement was to eliminate the delay problem and the existing small pattern of left turn collisions from SR 2383 onto US 21.

The initial crash analysis was completed from March 1, 2000 to February 28, 2003 with eleven (11) reported crashes, six (6) of which were deemed correctable left turn crashes. The final completion date for the improvement at the subject intersection was on April 11, 2005 with a total cost of \$53,000.

## 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 March through April 2005. The before period consisted of reported crashes from April 1, 2003 through February 28, 2005 (1 year and 11 months); and the after period consisted of reported crashes from May 1, 2005 through September 30, 2010 (5 years and 5 months). The before period was limited by the installation of the US 21 left turn lane and 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 within 150 feet of the subject intersection. *Please see attached location map, aerial map, and photos for further details.*

The following data table depicts the Naive Before and After Analysis for the treatment location. Please note that Frontal Impact Crashes were the target crashes for the applied countermeasure. The Frontal Impact Crash types considered are as follows: Left turn, same roadway; Left turn, different roadways; Right turn, same roadway; Right turn, different roadways; Head on; and Angle.

<b><u>Treatment Information</u></b>	<b>Before 1.92 Yrs</b>	<b>After 5.42 Yrs</b>	<b>Percent Reduction (-) Percent Increase (+)</b>
Total Crashes	5	10	N/A
<b>Total Crashes per Year</b>	<b>2.6</b>	<b>1.8</b>	<b>- 30.8 %</b>
Total Severity Index	3.96	3.96	0.0 %
Target Crashes – Frontal Impact	3	1	N/A
<b>Target Crashes per Year</b>	<b>1.6</b>	<b>0.2</b>	<b>- 87.5 %</b>
Target Crash Severity Index	3.47	1.00	- 71.2 %
Volume (2004, 2008)	17,300	17,900	3.5 %

<b><u>Injury Crash Summary</u></b>	<b>Before 1.92 Yrs</b>	<b>After 5.42 Yrs</b>	<b>Percent Reduction (-) Percent Increase (+)</b>
Fatal injury Crashes	0	0	N/A
Class A injury Crashes	0	0	
Class B injury Crashes	0	1	
Class C Injury Crashes	2	3	
Total Injury Crashes	2	4	
<b>Injury Crashes per Year</b>	<b>1.0</b>	<b>0.7</b>	<b>- 30.0 %</b>

The naive before and after analysis at the treatment location resulted in a 31 percent decrease in Total Crashes per year, an 87.5 percent decrease in Target Crashes per year, but a zero percent change in the Total Severity Index. The before period ADT year was 2004 and the after period ADT year was 2008.

## Results and Discussion

Referencing the *Collision Diagrams*, the before period experienced a small crash pattern of three (3) left turn collisions from vehicles on SR 2383 choosing insufficient gaps while accessing US 21. There were also two (2) rear-end collisions at this intersection during the period. After the signal installation, frontal impact crashes were reduced to just one (1); when a southbound US 21 vehicle ran the red light. The post-signal installation intersection did experience nine (9) additional rear-end collisions on US 21 approaches resulting in a total of 1.8 crashes per year. This value represents a thirty-one (31) percent reduction from the before period 2.6 total crashes per year.

The calculated benefit to cost ratio for this project is **0.74 considering total crashes**. The benefit to cost ratio **considering only target crashes is 1.30**. 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 Google Street View for all three approaches to the treatment intersection. 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



Traveling South on US 21 / NC 115 (Charlotte Highway)



Traveling North on US 21 / NC 115



Looking West on SR 2383 (Shinnville Road)

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

LOCATION: US 21 / NC 115 at SR 2383		BY: JBS						
COUNTY: Iredell		DATE: 11/22/2010						
FILE NO.: SS 12-03-211								
DETAILED COST:	TYPE IMPROVEMENT - <b>New Traffic Signal</b>							
ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST				
Construction	\$53,500	10	0.149	\$7,973				
Right-of-Way	\$0	0	0.000	\$0				
TOTALS	\$53,500	10	0.149	\$7,973				
ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$2,000				
ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$900				
TOTAL ANNUAL COST=				\$10,873				
TOTAL COST OF PROJECT=				\$53,500				
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	1.92	0	0.00	2	1.04	3	1.56	\$27,552
AFTER	5.42	0	0.00	4	0.74	6	1.11	\$19,520
Annual Benefits from Crash Cost Savings								\$8,032
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	(\$2,841)		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	0.74		
TOTAL COST OF PROJECT		-	\$53,500	COMPREHENSIVE B/C RATIO		-	0.74	

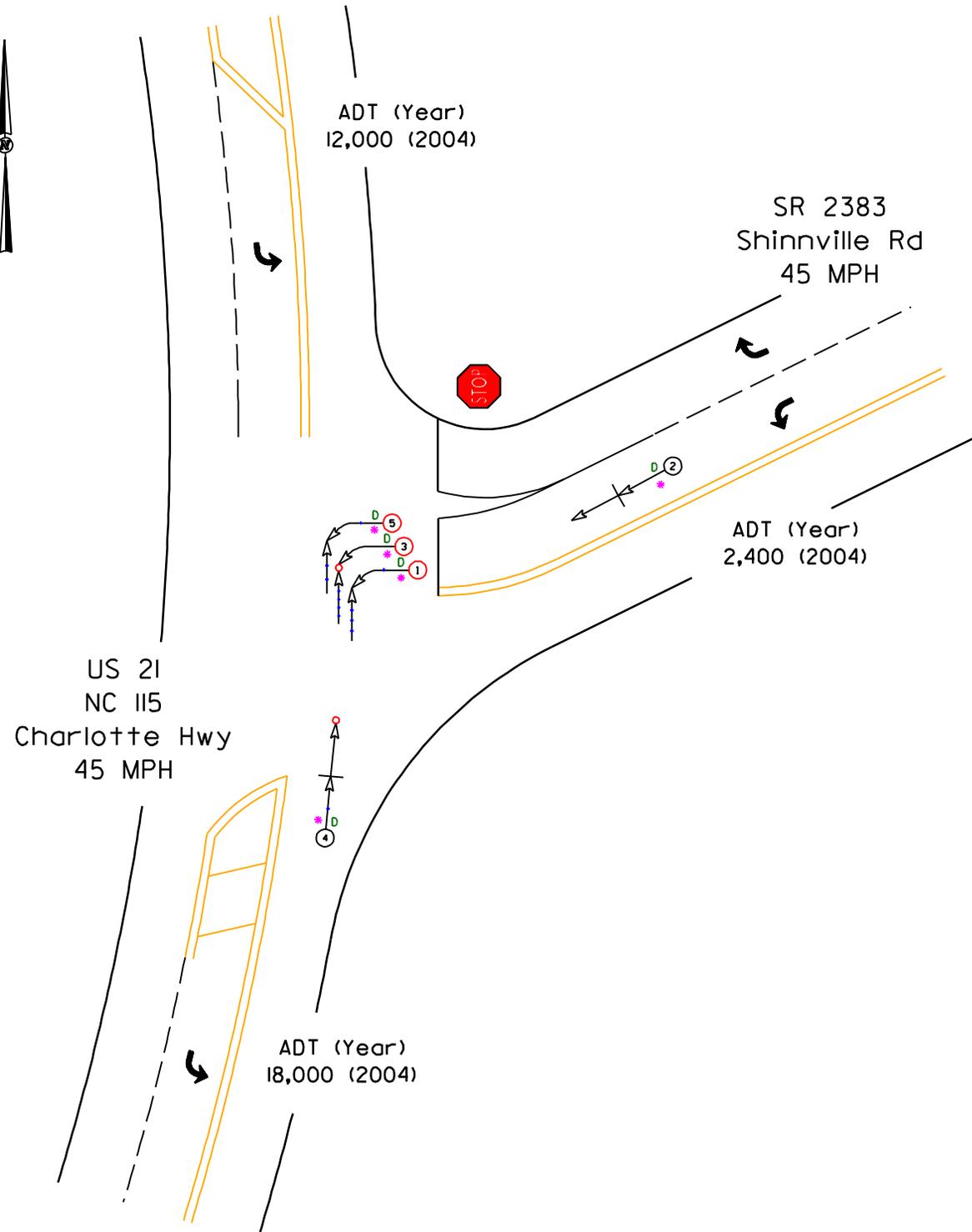
**BENEFIT-COST ANALYSIS WORKSHEET - Target Crashes**

LOCATION: US 21 / NC 115 at SR 2383		BY: JBS						
COUNTY: Iredell		DATE: 11/22/2010						
FILE NO.: SS 12-03-211								
DETAILED COST:	TYPE IMPROVEMENT - <b>New Traffic Signal</b>							
ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST				
Construction	\$53,500	10	0.149	\$7,973				
Right-of-Way	\$0	0	0.000	\$0				
TOTALS	\$53,500	10	0.149	\$7,973				
ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$2,000				
ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$900				
TOTAL ANNUAL COST=				\$10,873				
TOTAL COST OF PROJECT=				\$53,500				
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	1.92	0	0.00	1	0.52	2	1.04	\$14,896
AFTER	5.42	0	0.00	0	0.00	1	0.18	\$793
Annual Benefits from Crash Cost Savings								\$14,102
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$3,229		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	1.30		
TOTAL COST OF PROJECT		-	\$53,500	COMPREHENSIVE B/C RATIO		-	1.30	

LEGEND

	MOVING VEHICLE		ANGLE		9 MPH OR LESS		P PEDESTRIAN
	PEDESTRIAN		TURNING		10 MPH TO 19		T TRAIN
	PAKED VEHICLE		BACKING		20 MPH TO 29		• DRIVER AT FAULT
	PARKING VEHICLE		SHOULDER		30 MPH TO 39		D DRY
	FIXED OBJECT		OUT OF CONTROL		40 MPH TO 49		W WET
	HEAD ON		INJURY		50 MPH TO 59		I ICY OR SHORT
	REAR END		FATALITY		60 MPH TO 69		10 AND UP
	RAN OFF ROAD		SPEED UNKNOWN		70 AND UP		O ONLY

SS# 12-03-211  
 Order# 41000006937  
 Iredell County  
 BEFORE Period  
 4/1/03 - 2/28/05  
 1.92 Years



Frontal Impact  
 Target Crashes

**N.C. DEPARTMENT of TRANSPORTATION**  
**DIVISION of HIGHWAYS**  
**TRANSPORTATION MOBILITY and SAFETY DIVISION**

**TRAFFIC SAFETY UNIT**

Date: 11-19-2010 Prepared By: J. Schronce

LEGEND

	MOVING VEHICLE		ANGLE		9 MPH OR LESS		P PEDESTRIAN
	PEDESTRIAN		TURNING		10 MPH TO 19		T TRAIN
	PAKED VEHICLE		BACKING		20 MPH TO 29		= DRIVER AT FAULT
	PAKED VEHICLE		SHOULDER		30 MPH TO 39		D DRY
	FIXED OBJECT		OUT OF CONTROL		40 MPH TO 49		W WET
	HEAD ON		INJURY		50 MPH TO 59		10 AND UP
	REAR END		FATALITY		60 MPH TO 69		I ICY OR SNOW
	RAN OFF ROAD		SPEED UNKNOWN		SPEED UNKNOWN		O ONLY

SS# 12-03-211  
 Order# 41000006937  
 Iredell County  
 AFTER Period  
 5/1/05 - 9/30/10  
 5.42 Years



New Signalized  
 Intersection  
 Sig ID 12-1708



Frontal Impact  
 Target Crashes

**N.C. DEPARTMENT of TRANSPORTATION**  
**DIVISION of HIGHWAYS**  
**TRANSPORTATION MOBILITY and**  
**SAFETY DIVISION**

**TRAFFIC SAFETY UNIT**

Date: 11-19-2010

Prepared By: J. Schronce

