

Spot Safety Project Evaluation

Project Log # 200702011

Spot Safety Project # 10-01-212

**Spot Safety Project Evaluation of the Traffic Signal and Left Turn Lane Installation on US 21
at SR 2116 (Alexanderana Road) in Mecklenburg County**

Documents Prepared By:

Safety Evaluation Group
Traffic Safety Systems Management Section
Traffic Engineering and Safety Systems Branch
North Carolina Department of Transportation

Principal Investigator

Brad Robinson, EI

Traffic Safety Project Engineer

10/13/2008

Date

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 10-01-212 – Traffic Signal and Left Turn Lane Installation on US 21 at SR 2116 (Alexanderana Road) in Mecklenburg County.

Project Information and Background from the Project File Folder

The spot safety project improvement countermeasure chosen for the subject location was the installation of a traffic signal with a protected left turn phase for northbound US 21 and left turn lanes for both approaches of US 21. The right turn slip ramps were removed on all approaches.

Both US 21 (Statesville) and SR 2116 (Alexanderana Rd) had a single lane approaches with right turn slip ramps at the intersection in the before period. SR 2116 was controlled by stop signs in the before period and a flasher was present at the intersection. US 21 has a speed limit of 50 mph and SR 2116 has a speed limit of 55 mph. A little over three years after the project was completed it underwent construction again. Currently US 21 has a right turn lane on each approach and the southbound approach has dual left turn lanes and a protected left turn phase. Both approaches of SR 2116 have left turn lanes, protected/permitted phasing, and westbound SR 2116 has a right turn lane.

The original problem statement states that there were insufficient gaps in US 21 traffic to allow safe movement. The signal and left turn lanes were installed to alleviate angle and rear end type collisions.

The original crash analysis yielded 17 total crashes from 8/1/1997 through 8/1/2000. There were 5 angle, 9 rear end, and 1 right turn-different roadway crashes which totaled to 15 correctable crashes. The final completion date for the improvement at the subject location was on August 19, 2002 at a total cost of \$130,000.

Naive Before and After Analysis

After reviewing the spot safety project file folder along with all the crashes along the subject road, the crash data omitted from this analysis to consider for an adequate construction period was from July 1, 2002 through September 30, 2002. The before period consisted of reported crashes from July 1, 1999 through June 30, 2002 (3 years) and the after period consisted of reported crashes from October 1, 2002 through September 30, 2005 (3 years). The ending date for this analysis was determined by the new construction described above in the background section.

The treatment data consisted of all crashes within 150 feet of the subject intersection. The following data table depicts the Naive Before and After Analysis for the above information. Please note that there were two target crash types for the applied countermeasures. The first are Rear End Crashes on US 21 approaching the intersection. The second are frontal impact crash types. Frontal

Impact Crashes are considered as follows: Left Turn, same roadway; Left Turn, different roadway; Right Turn, same roadway; Right Turn, different roadway; Head On, Angle, and Rear End; slow, stop, or turn.

<u>Treatment Information</u>			
	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	29	6	-79.3
Total Severity Index	7.7	3.47	-54.9
Rear-End Crashes (On US 21)	3	0	-100.0
Rear-End Crash Severity Index	3.47	0	-100.0
Frontal Impact Crashes	18	4	-77.8
Frontal Impact Crash Severity Index	9.73	2.85	-70.7
Volume	15,900	17,300	8.8
<u>Crash Severity Summary</u>			
Fatal Crashes	0	0	N/A
Class A Crashes	1	0	-100.0
Class B Crashes	4	0	-100.0
Class C Crashes	12	2	-83.3
PDO Crashes	12	4	-66.7

The naive before and after analysis at the treatment location resulted in a 79 percent decrease in Total Crashes, a 100 percent decrease in Rear End Crashes (on US 21), a 78 percent decrease in Frontal Impact Crashes, and a 9 percent increase in Average Daily Traffic (ADT). The before period ADT year was 2000 and the after period ADT year was 2004.

Results and Discussion

The naive before and after analysis involving the comparison of treatment actual before data versus treatment actual after data resulted in a 79 percent decrease in Total Crashes, a 100 percent decrease in Rear End Crashes, and a 78 percent decrease in Frontal Impact Crashes,. The summary results above demonstrate that the treatment location appears to have had a decrease in the number of Total Crashes as well as both type of Target Crashes from the before to the after period.

The calculated benefit to cost ratio for this project is 11.97 considering total crashes. The benefit to cost ratio considering only target crashes is 10.97. 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.

Referencing the *Collision Diagrams* and the above table it is apparent that the countermeasures reduced crashes at the intersection. In the before period there were three apparent patterns of

Frontal Impact Crashes: Angle Crashes between westbound SR 2116 traffic and southbound US 21 traffic, Angle Crashes between eastbound SR 2116 and northbound US 21, and Left Turn-Same Roadway Crashes involving southbound US 21 traffic turning left. These patterns were eliminated in the after period.

In the before period there was also a small Rear-End Crash pattern involving southbound US 21 traffic at the intersection. In the after period there were no crashes of this type.

There was a fifth pattern of crashes that was reduced from the before to the after period that were not considered target crashes. There was a rear-end crash pattern involving westbound SR 2116 vehicles attempting to turn right on the slip ramp to US 21. This slip ramp was removed during the construction period, and the rear-end pattern was reduced from six in the before period to two in the after.

As mentioned in the *Project Background* section the intersection underwent new construction in late 2005. After viewing crash reports in the time period after, it appears that the intersection also underwent construction in early 2008. There were a total of 8 crashes at the intersection in the period from November 1, 2005 to July 31, 2008. At least 3 of these crashes appear to have occurred during construction periods.

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 road.

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: **US 21 at SR 2116**
 COUNTY: **Mecklenburg**
 FILE NO.: **SS 10-01-212 Target Crashes**

BY: **BDR**
 DATE: **9/22/2008**

DETAILED COST: TYPE IMPROVEMENT - **Signal and Turn Lanes**

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$0	0	0.000	\$0
	\$130,000	10	0.149	\$19,374
Right-of-Way	\$0	0	0.000	\$0
TOTALS	\$130,000	10	0.149	\$19,374

ESTIMATED INCREASE IN ANNUAL MAINT. COST = **\$2,800**
 ESTIMATED INCREASE IN ANNUAL UTILITY COST = **\$900**
 TOTAL ANNUAL COST= **\$23,074**
 TOTAL COST OF PROJECT= **\$130,000**

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	3.00	1	0.33	12	4.00	8	2.67	\$263,600
AFTER	3.00	0	0.00	1	0.33	3	1.00	\$10,433

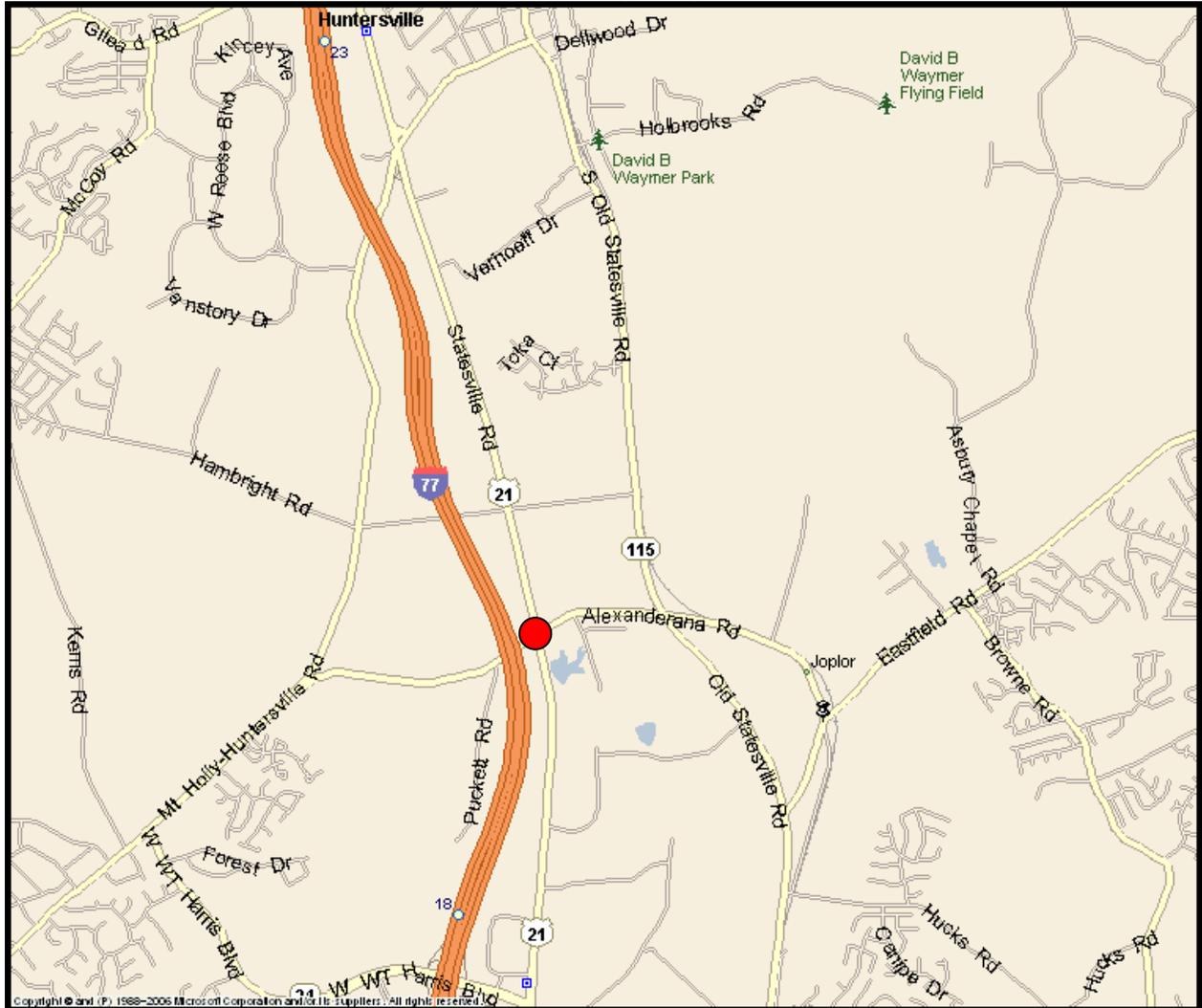
Annual Benefits from Crash Cost Savings **\$253,167**

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = **\$230,093**

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = **10.97**

TOTAL COST OF PROJECT - \$130,000 COMPREHENSIVE B/C RATIO - 10.97

Location Map
Mecklenburg County
Evaluation of Spot Safety Project #10-01-212



Treatment Location: US 21 (Statesville) and SR 2116 (Alexanderana Rd)

Treatment Site Photos Taken September 18, 2008

Note: Current intersection configuration is different than from the time periods analyzed



Traveling Northbound on US 21



Traveling Southbound on US 21



Traveling Eastbound on SR 2116 (Alexanderana Rd)



Traveling Westbound on SR 2116 (Alexanderana Rd)

Mecklenburg County
 Treatment Site - TotalCrashes
 Before Period
 July 1, 1999 - June 30, 2002

SR 2116 (Alexanderana Rd)
 55 MPH

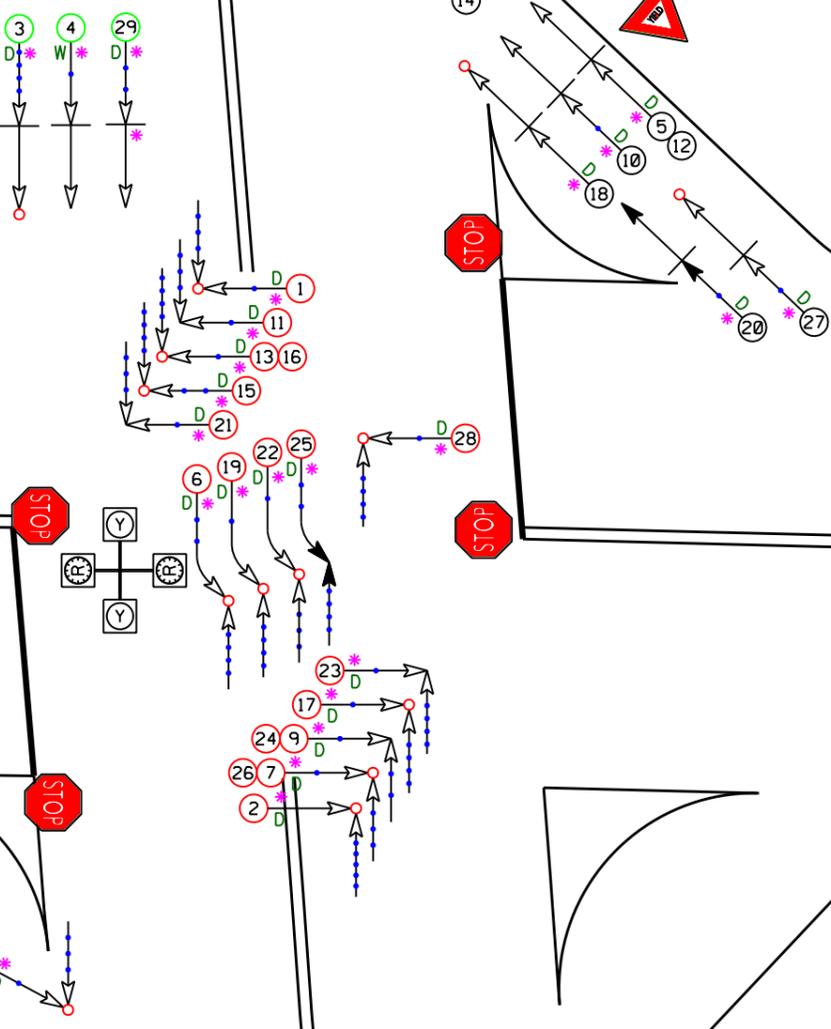
US 21 (Statesville Rd)
 50 MPH

LEGEND

	MOVING VEHICLE		ANGLE		9 MPH OR LESS	P	PEDESTRIAN
	PEDESTRIAN/BICYCLE		TURNING		10 MPH TO 19	B	BICYCLE
	PARKEED VEHICLE		BACKING		20 MPH TO 29	T	TRAIN
	PARKING VEHICLE		SIDE-SWIPE		30 MPH TO 39	A	ANIMAL
	MOVABLE OBJECT		OUT OF CONTROL		40 MPH TO 49	*	DRIVER AT FAULT
	HEAD ON		HAZARD		50 MPH TO 59	D	DRY
	REAR END		FATALITY		60 MPH TO 69	W	WET
	RAN OFF ROAD		DAYLIGHT CRASH		TO AND UP	I	ICY OR SNOWY

Frontal Impact Target Crashes

Rear-End Target Crashes



TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT <small>HIGHWAY SAFETY IMPROVEMENT PROGRAM</small>		COLLISION DIAGRAM DIVISION: 10 AREA: .. STUDY PERIOD: 7/1/1999 TO 6/30/2002 DISTANCE: Y-LINE: 150 FT ANALYSIS PREPARED BY: B. BOBROWSON DIAGRAM PREPARED BY: B. BOBROWSON DIAGRAM REVIEWED BY:	
		SCALE: NOT TO SCALE DATE: APRIL 2008 LOG NUMBER: 20070208	
		N.C. DEPARTMENT of TRANSPORTATION DIVISION of HIGHWAYS TRAFFIC ENGINEERING AND SAFETY SYSTEMS BRANCH	

Mecklenburg County
 Treatment Site - Total Crashes
 Before Period
 October 1, 2002 - September 30, 2005

SR 2116 (Alexanderana Rd)
 55 MPH

42
 41

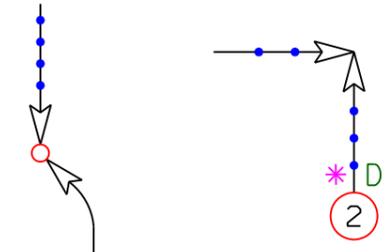
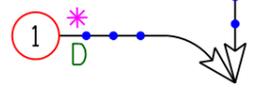
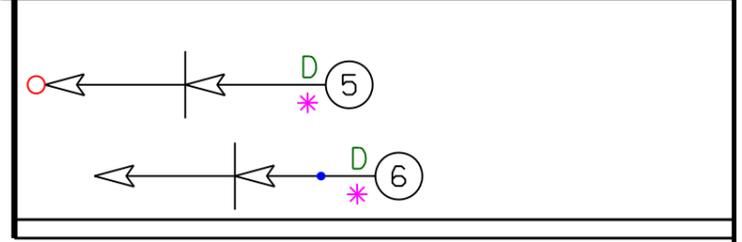
61
 62

LEGEND

	MOVING VEHICLE		ANGLE		9 MPH OR LESS	P	PEDESTRIAN
	PEDESTRIAN/BICYCLE		TURNING		10 MPH TO 19	B	BICYCLE
	PAKED VEHICLE		BACKING		20 MPH TO 29	T	TRAIN
	PARKING VEHICLE		SHOESLIP		30 MPH TO 39	A	ANIMAL
	MOVABLE OBJECT		OUT OF CONTROL		40 MPH TO 49	*	DRIVER AT FAULT
	HEAD ON		MAJRT		50 MPH TO 59	D	DRY
	REAR END		FATALITY		60 MPH TO 69	W	WET
	RAN OFF ROAD				70 AND UP	I	ICY OR SNOWY

Frontal Impact
Target Crashes

Rear-End
Target Crashes



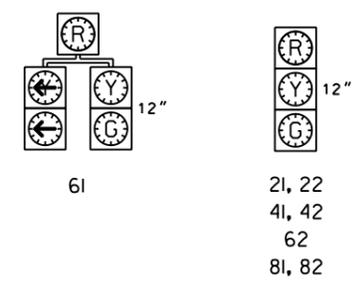
81
 82

22
 21

3

SIGNAL FACE I.D.

Denotes L.E.D.



US 21 (Statesville Rd)
 50 MPH

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT		COLLISION DIAGRAM	
HIGHWAY SAFETY IMPROVEMENT PROGRAM	SAFETY INFORMATION MANAGEMENT AND SUPPORT	DIVISION: 10	AREA: ..
		STUDY PERIOD: 10/1/2002 TO 9/30/2005	Y-LINE: 150 FT
		ANALYSIS PREPARED BY: B. BOBINSOHN	DIAGRAM PREPARED BY: B. BOBINSOHN
SAFETY EVALUATION		DATE: APRIL 2008	LOG NUMBER: 2007020H
AFTER TRAFFIC SIGNAL AND TURN LANE INSTALLATION		SCALE: NOT TO SCALE	
N.C. DEPARTMENT of TRANSPORTATION DIVISION of HIGHWAYS TRAFFIC ENGINEERING AND SAFETY SYSTEMS BRANCH			