

Spot Safety Project Evaluation

Project Log # 200702008

Spot Safety Project # 10-01-208

Spot Safety Project Evaluation of the Traffic Signal and Left Turn Lane Installation at US 21 and SR 2147 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

Samuel D. Coleman, EI

08/6/2007
Date

Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 10-01-208 – Traffic Signal and Left Turn Lane Installation at US 21 and SR 2147 in Mecklenburg County.

Project Information and Background from the Project File Folder

US 21 is a two lane roadway with left turn lanes and a speed limit of 45 mph. SR 2147 is a two lane roadway with left turn lanes and a speed limit of 35 mph.

The original problem statement shows there were insufficient gaps in US 21 traffic to allow safe movement. The original crash analysis yielded 21 total crashes from 7/1/1997 through 7/1/2000. There were 11 angle, 3 rear end, and 1 sideswipe crash which totaled to 15 correctable crashes. The improvements chosen for the subject location was to install a traffic signal and left turn lanes. The final completion date for the improvement at the subject location was on June 30, 2002 at a total cost of \$110,000 (\$70,000 from Spot Safety funds and \$40,000 provided by Gandy Development).

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 December 2001 through July 2002. The before period consisted of reported crashes from February 1, 1998 through November 30, 2001 (3 years, 10 months) and the after period consisted of reported crashes from August 1, 2002 through May 31, 2006 (3 years, 10 months). The ending date for this analysis was determined by the available crash data at the time the crash analysis was completed.

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 Frontal Impact (Target I) and Rear End (Target II) crash types influenced by the implemented countermeasures were the target crashes for the treatment location. These crash types considered are as follows: Left Turn, same roadway; Left Turn, different roadway; Right Turn, same roadway; Right Turn, different roadway; Head On, Angle, and (Target II) Rear End; slow, stop, or turn. The target crashes are clearly identified in the before and after period collision diagrams.

<u>Treatment Information</u>			
	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	33	10	-69.7
Total Severity Index	3.5	3.2	-7.1
Frontal Impact Crashes (Target I)	23	7	-69.6
Frontal Severity Index	4.2	4.2	-1.1
Rear End Crashes (Target II)	9	2	-77.8
Rear End Severity Index	1.8	1.0	-45.1
Volume	16000	18600	16.3
<u>Treatment Injury Crashes</u>			
	Before	After	Percent Reduction (-) Percent Increase (+)
Fatal	0	0	N/A
Class A	0	0	N/A
Class B	5	2	-60.0
Class C	6	1	-83.3
Property Damage Only	22	7	-68.2
<u>Frontal Injury Crashes (Target I)</u>			
	Before	After	Percent Reduction (-) Percent Increase (+)
Fatal	0	0	N/A
Class A	0	0	N/A
Class B	5	2	-60.0
Class C	5	1	-80.0
Property Damage Only	13	4	-69.2
<u>Rear End Injury Crashes (Target II)</u>			
	Before	After	Percent Reduction (-) Percent Increase (+)
Fatal	0	0	N/A
Class A	0	0	N/A
Class B	0	0	N/A
Class C	1	0	-100.0
Property Damage Only	8	2	-75.0

Table 1.

The naive before and after analysis at the treatment location resulted in a 70 percent decrease in Total Crashes, a 69 percent decrease in Frontal Impact Crashes, a 78 percent decrease in Rear End Crashes, and a 16 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 naïve before and after analysis involving the comparison of treatment actual before data versus treatment actual after data resulted in a 70 percent decrease in Total Crashes, a 69 percent decrease in Frontal Impact Crashes, and a 78 percent decrease in Rear End Crashes. The summary results above demonstrate that the treatment location appears to have had a decrease in the number of Total Crashes, a decrease in the number of Frontal Impact Crashes, and a decrease in the number of Rear End Crashes from the before to the after period.

The reductions from the before to the after period in Table 1 shows a successful project. Driving through the intersection from all four approaches during the field investigation did not reveal any sight distance or timing issues. The protected left turn arrows provided plenty of time to maneuver when making a left turn (no protected left turn phase on the west leg [SR 2147] of the intersection).

The calculated benefit to cost ratio for this project is 2.75 considering total crashes. The benefit to cost ratio considering only target I and II crashes is 2.19 and 0.56 respectively. 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 road.

TREATMENT BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: US 21 at SR 2147
 COUNTY: Mecklenburg
 FILE NO.: SS 10-01-208

BY: SDC
 DATE: 2/22/2007

DETAILED COST: TYPE IMPROVEMENT - Signal and Left Turn Lane

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$110,000	10	0.149	\$16,393
	\$0	0	0.000	\$0
Right-of-Way	\$0	0	0.000	\$0
TOTALS	\$110,000	10	0.149	\$16,393

ESTIMATED INCREASE IN ANNUAL MAINT. COST = \$2,000
 ESTIMATED INCREASE IN ANNUAL UTILITY COST = \$900
 TOTAL ANNUAL COST= \$19,293
 TOTAL COST OF PROJECT= \$110,000

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	3.82	0	0.00	11	2.88	22	5.76	\$74,293
AFTER	3.82	0	0.00	3	0.79	7	1.83	\$21,283

Annual Benefits from Crash Cost Savings \$53,010

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = \$33,717

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 2.75

TOTAL COST OF PROJECT - \$110,000 COMPREHENSIVE B/C RATIO - 2.75

TARGET I BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: US 21 at SR 2147
 COUNTY: Mecklenburg
 FILE NO.: SS 10-01-208

BY: SDC
 DATE: 2/22/2007

DETAILED COST: TYPE IMPROVEMENT - Signal and Left Turn Lane

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$110,000	10	0.149	\$16,393
	\$0	0	0.000	\$0
Right-of-Way	\$0	0	0.000	\$0
TOTALS	\$110,000	10	0.149	\$16,393

ESTIMATED INCREASE IN ANNUAL MAINT. COST =	\$2,000
ESTIMATED INCREASE IN ANNUAL UTILITY COST =	\$900
TOTAL ANNUAL COST=	\$19,293
TOTAL COST OF PROJECT=	\$110,000

COMPREHENSIVE COST REDUCTION:

TIME PERIOD	YEARS	ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES						ANNUAL COSTS
		K & A CRASHES	K & A CRASHES PER YR	B & C CRASHES	B & C CRASHES PER YR	PDO CRASHES	PDO CRASHES PER YR	
BEFORE	3.82	0	0.00	10	2.62	13	3.40	\$60,393
AFTER	3.82	0	0.00	3	0.79	4	1.05	\$18,220

Annual Benefits from Crash Cost Savings \$42,173

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST	=	\$22,880
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST	=	2.19

TOTAL COST OF PROJECT - \$110,000 COMPREHENSIVE B/C RATIO - 2.19

TARGET II BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: US 21 at SR 2147
 COUNTY: Mecklenburg
 FILE NO.: SS 10-01-208

BY: SDC
 DATE: 2/22/2007

DETAILED COST: TYPE IMPROVEMENT - Signal and Left Turn Lane

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$110,000	10	0.149	\$16,393
	\$0	0	0.000	\$0
Right-of-Way	\$0	0	0.000	\$0
TOTALS	\$110,000	10	0.149	\$16,393

ESTIMATED INCREASE IN ANNUAL MAINT. COST =	\$2,000
ESTIMATED INCREASE IN ANNUAL UTILITY COST =	\$900
TOTAL ANNUAL COST=	\$19,293
TOTAL COST OF PROJECT=	\$110,000

COMPREHENSIVE COST REDUCTION:

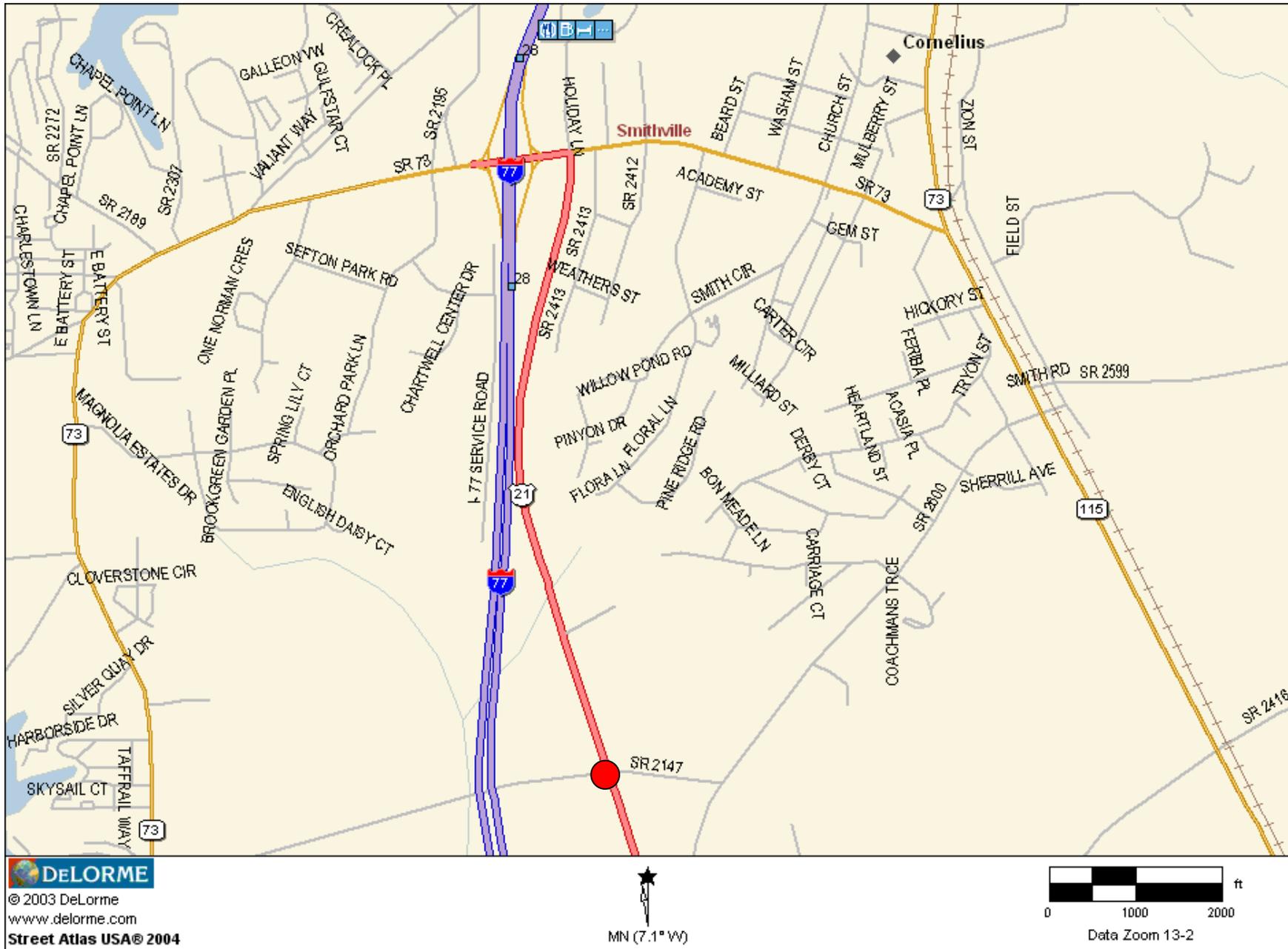
ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES

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	3.82	0	0.00	1	0.26	8	2.09	\$12,880
AFTER	3.82	0	0.00	0	0.00	2	0.52	\$2,042

Annual Benefits from Crash Cost Savings \$10,838

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST	=	(\$8,456)
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST	=	0.56

TOTAL COST OF PROJECT - \$110,000 COMPREHENSIVE B/C RATIO - 0.56



Location Map: US 21 (Statesville Rd) and SR 217 (Westmoreland Rd).

Treatment Site Photos Taken March 23, 2007



Driving north on US 21



Driving east on SR 2147



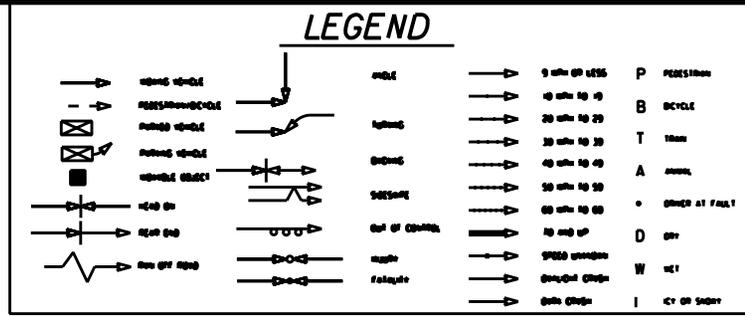
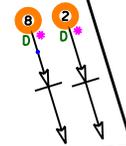
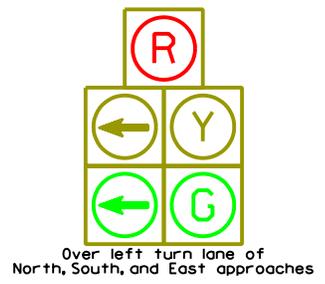
Driving west on SR 2147



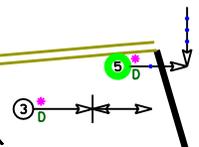
Driving south on US 21



US 21 (Statesville Rd)
45 MPH



SR 2147 (Westmoreland Rd)
45 MPH



Mecklenburg County
Treatment Site - Total Crashes
After Period
August 1, 2002 - May 31, 2006
(3 years, 10 months)



Signalized
Intersection

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT		COLLISION DIAGRAM	
ROADWAY SAFETY IMPROVEMENT PROGRAM	SAFETY ORGANIZATION MANAGEMENT AND SUPPORT	DIVISION	AREA
		STUDY PERIOD: 08/2002 TO 5/31/2006	T-LINE: 150 FT
		ANALYSIS PREPARED BY: S. COLEMAN	DIAGRAM PREPARED BY: S. COLEMAN
SAFETY EVALUATION		TRAFFIC SAFETY	SCALE: NOT TO SCALE
METER, TRAFFIC SIGNAL AND LEFT TURN LANES ON US 21		DATE: MARCH 2007	LOG NUMBER:
N.C. DEPARTMENT of TRANSPORTATION DIVISION of HIGHWAYS TRAFFIC ENGINEERING AND SAFETY SYSTEMS BRANCH			