

Spot Safety Project Evaluation

Order # 41000016120

Spot Safety Project # 13-04-202

**Spot Safety Project Evaluation of the
Traffic Signal and Ramp Turn Lane Installation
SR 1761 (Old NC-10) at I-40 WB Ramp Terminal (Exit 116)
Burke County, Town of Icard**

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

1-23-2012

Date

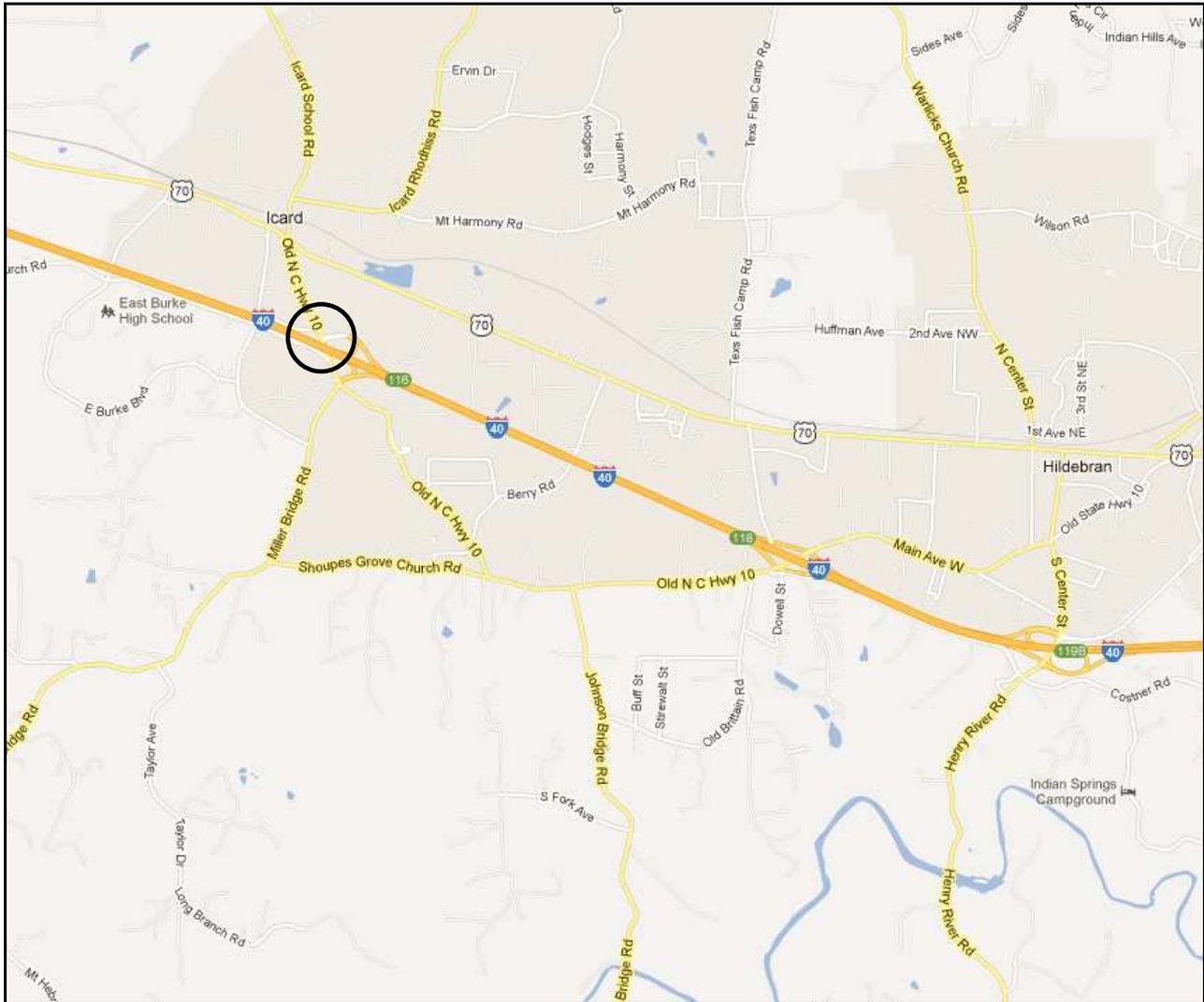
Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 13-04-202 located at the Intersection of SR 1761 (Old NC-10) and the I-40 Westbound Ramp Terminal (Exit 116) in Burke County, Town of Icard.

The Sig ID is 13-1211 for this newly installed 2-phase traffic signal.





Aerial View provided from Google Maps

Project Information and Background from the Project File Folder

The spot safety project improvement countermeasures chosen for the subject location were the installation of an intersection traffic signal and ramp widening for left turn lane. SR 1761 (Old NC 10) is a two-lane facility at the subject intersection with a speed limit of 35 mph on both approaches. The I-40 Exit 116 Westbound Ramp Terminal presents a single off-ramp lane and one on-ramp lane divided with a concrete median. The subject location is a three-leg intersection, which was controlled by a stop sign on the ramp terminal.

The original statement of problem was the existence of peak hour congestion and long queues on the exit ramp. The intended purpose of the new left turn lane and traffic signal was to reduce congestion, delay, and the crash potential. The intersection met Signal Warrants 2 and 3.

The initial crash analysis was completed from April 1, 2000 to March 31, 2003 with sixteen (16) reported crashes, five (5) of which were deemed correctable. The final completion date for the improvement at the subject intersection was on March 26, 2007 with a total cost of \$120,000.

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 was the month of March 2007. The before period consisted of reported crashes from September 1, 2002 through February 28, 2007 (4 years and 6 months); and the after period consisted of reported crashes from April 1, 2007 through September 30, 2011 (4 years and 6 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 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.

<u>Treatment Information</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	15	11	- 26.7 %
Total Severity Index	2.97	2.35	- 20.9 %
Target Crashes – Frontal Impact	8	3	- 62.5 %
Target Crash Severity Index	1.93	3.47	79.8 %
Volume (2004, 2009)	7,500	6,700	- 10.7 %

<u>Injury Crash Summary</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Fatal injury Crashes	0	0	N/A
Class A injury Crashes	0	0	N/A
Class B injury Crashes	2	0	- 100.0 %
Class C Injury Crashes	2	2	0.0 %
Total Injury Crashes	4	2	- 50.0 %

The naive before and after analysis at the treatment location resulted in a 27 percent decrease in Total Crashes, an 62.5 percent decrease in Target Crashes, and a 21 percent decrease in the Total Severity Index. The before period ADT year was 2004 and the after period ADT year was 2009.

Results and Discussion

Referencing the *Collision Diagrams*, the before period presented two crash patterns at the westbound I-40 ramp terminal. There were seven (7) left turn crashes from the off-ramp that chose insufficient gaps along with one (1) left turn same roadway SR 1761 collision. Old NC-10 also showed a pattern of four (4) southbound rear-end crashes as vehicles waited to turn left onto the I-

40 westbound on-ramp. After the signal installation, there were two (2) left turn crashes in the intersection from SR 1761 vehicles running the red light. There was also one (1) random u-turn collision in the intersection. The southbound rear-end crash pattern was additionally reduced by half to two (2) after period collisions.

Additionally, each analysis period experienced one (1) bridge strike of the I-40 Westbound Bridge overpass. The bridge begins 70 feet from the Westbound Ramp Terminal and is signed at 13'7".

The calculated benefit to cost ratio for this project is **0.51 considering total crashes**. The benefit to cost ratio **considering only target crashes is 0.23**. 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 December 12th, 2011 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.

Field Observation

The "West I-40" Marker on southbound SR 1761 (Old NC-10) was missing the "West" designation.



Treatment Site Photos (Field Visit 12-12-2011)



Travelling North on SR 1761 (Old NC-10)



Travelling South on SR 1761 (Old NC-10)



Travelling West on the I-40 Westbound Ramp Terminal – Exit 116

BENEFIT-COST ANALYSIS WORKSHEET - Total Crashes

LOCATION: SR 1761 at I-40 WB Exit 116		BY: JBS						
COUNTY: Burke		DATE: 1/3/2012						
FILE NO.: SS 13-04-202								
DETAILED COST:	TYPE IMPROVEMENT -	Signal and Ramp Widening						
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$120,000	10	0.149	\$17,884			
		\$0	0	0.000	\$0			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$120,000	10	0.149	\$17,884			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$2,400			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$900			
	TOTAL ANNUAL COST=				\$21,184			
	TOTAL COST OF PROJECT=				\$120,000			
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	4.50	0	0.00	4	0.89	11	2.44	\$28,289
AFTER	4.50	0	0.00	2	0.44	9	2.00	\$17,489
							Annual Benefits from Crash Cost Savings	\$10,800
	NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST						=	(\$10,384)
	BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST						=	0.51
	TOTAL COST OF PROJECT	-	\$120,000		COMPREHENSIVE B/C RATIO	-		0.51

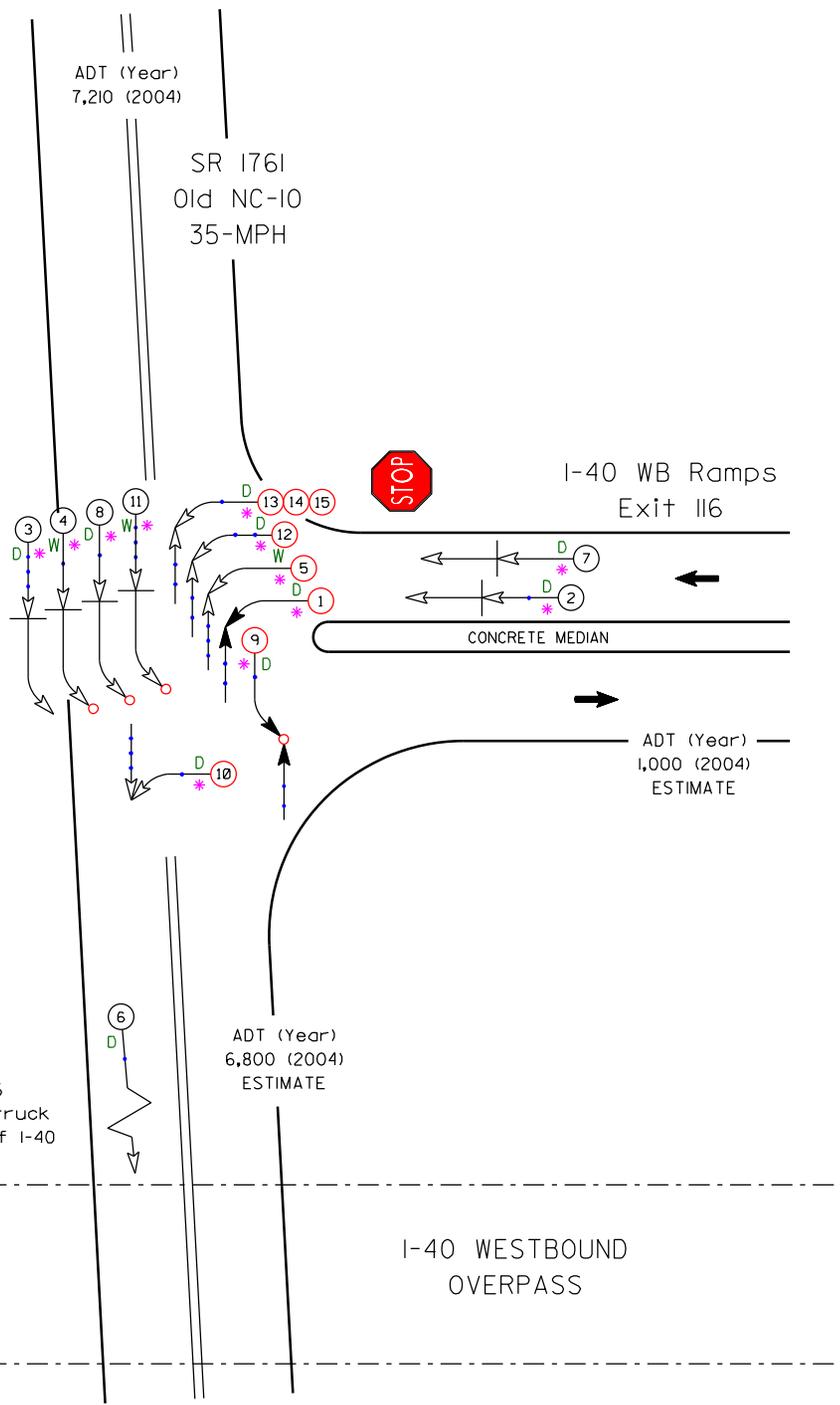
BENEFIT-COST ANALYSIS WORKSHEET - Target Crashes

LOCATION: SR 1761 at I-40 WB Exit 116		BY: JBS						
COUNTY: Burke		DATE: 1/3/2012						
FILE NO.: SS 13-04-202		Frontal Impact Target Crashes						
DETAILED COST:	TYPE IMPROVEMENT -	Signal and Ramp Widening						
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$120,000	10	0.149	\$17,884			
		\$0	0	0.000	\$0			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$120,000	10	0.149	\$17,884			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$2,400			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$900			
	TOTAL ANNUAL COST=				\$21,184			
	TOTAL COST OF PROJECT=				\$120,000			
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	4.50	0	0.00	1	0.22	7	1.56	\$11,133
AFTER	4.50	0	0.00	1	0.22	2	0.44	\$6,356
							Annual Benefits from Crash Cost Savings	\$4,778
	NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST						=	(\$16,406)
	BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST						=	0.23
	TOTAL COST OF PROJECT	-	\$120,000		COMPREHENSIVE B/C RATIO	-		0.23

LEGEND

	MOVING VEHICLE		ANGLE		9 MPH OR LESS		PEDESTRIAN
	PEDESTRIAN		TURNING		10 MPH TO 19		TRAIN
	PAKED VEHICLE		BACKING		20 MPH TO 29		DRIVER AT FAULT
	FIXED OBJECT		SIDESWIPE		40 MPH TO 49		DRY
	HEAD ON		OUT OF CONTROL		50 MPH TO 59		WET
	REAR END		REAR END		60 MPH TO 69		ICE OR SNOWY
	RAN OFF ROAD		REAR END		TO AND UP		FATALITY
			REAR END		SPEED UNKNOWN		ONLY

SS# 13-04-202
 Order# 41000016120
 Burke County
 BEFORE Period
 9/1/02 - 2/28/07



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

TRAFFIC SAFETY UNIT

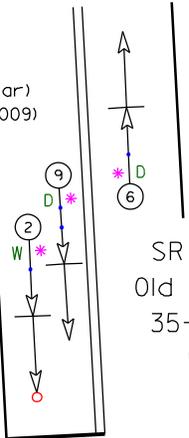
Date: 1-3-2012

Prepared By: J. Schronce

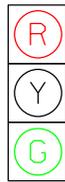
Frontal Impact
 Target Crashes



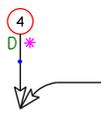
ADT (Year)
6,500 (2009)



SR 1761
Old NC-10
35-MPH

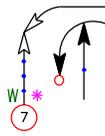


New Signalized
Intersection
Sig ID 13-1211
All Permissive



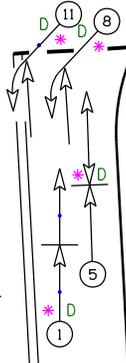
ADT (Year)
1,000 (2009)
ESTIMATE

CONCRETE MEDIAN



I-40 WB Ramps
Exit 116

ADT (Year)
5,900 (2009)
ESTIMATE



NOTE Crash #10
Tractor-Trailer Struck
Overpass Bridge of I-40

I-40 WESTBOUND
OVERPASS

LEGEND							
	MOVING VEHICLE		ANGLE		5 MPH OR LESS		PEDESTRIAN
	PEDESTRIAN		TURNING		10 MPH TO 19		TRAIN
	PARKED VEHICLE		BACKING		20 MPH TO 29		DRIVER AT FAULT
	FIXED OBJECT		SIDEWIPK		30 MPH TO 39		WET
	HEAD ON		OUT OF CONTROL		40 MPH TO 49		ICY OR SNOWY
	REAR END		HARRY		50 MPH TO 59		ONLY
	RAN OFF ROAD		FATALITY		60 MPH TO 69		
					TO AND UP		
					SPEED UNKNOWN		

SS# 13-04-202
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Burke County
AFTER Period
4/1/07 - 9/30/11

Frontal Impact
Target Crashes

N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRANSPORTATION MOBILITY and
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TRAFFIC SAFETY UNIT

Date: 1-3-2012

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