

Spot Safety Project Evaluation

Order # 41000006163

Spot Safety Project # 09-03-204

**Spot Safety Project Evaluation of the Signal Installation
SR 2643 (Union Cross Rd) at I-40 Westbound Ramp Terminal
Forsyth County, City of Kernersville**

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

6-15-2010

Date

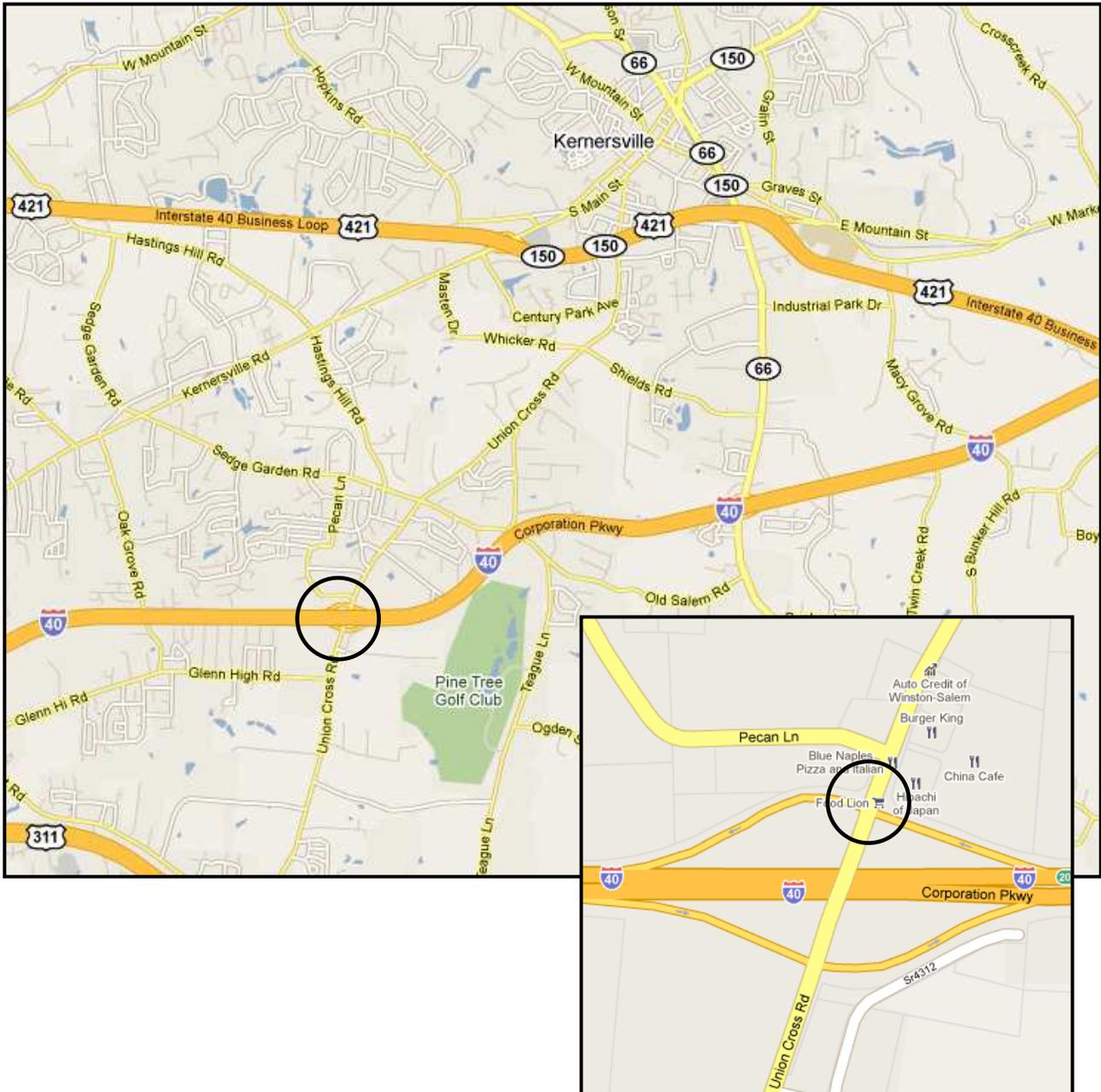
Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 09-03-204 located at the Intersection of SR 2643 (Union Cross Road) and the Interstate 40 Westbound Ramp Terminal (Exit 201) in Forsyth County, in the City of Kernersville.

The Sig ID is 09-1111 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. SR 2643 (Union Cross Road) is a two-lane facility that widens at the subject intersection for a northbound left turn lane and a southbound right turn slip lane; with a speed limit of 45 mph on both approaches. The before period I-40 Westbound Off-Ramp was a single lane approach that provided a right turn slip lane at the intersection under yield condition. The subject off-ramp was widened to two lanes in July 2005 with State forces by utilizing several pots of money. The subject location is a three-leg approach intersection, which was controlled by dual posted stop signs on the Interstate 40 Westbound Off-Ramp (Exit 201).

The original statement of problem was the concern for vehicles attempting to enter a high volume roadway who are encountering delay and congestion. The intended purpose of this traffic signal is to enhance the mobility of this location.

The initial crash analysis was completed from September 1, 1999 to August 31, 2002 with six (6) reported crashes, four (4) of which were deemed correctable. The final completion date for the improvement at the subject intersection was on May 24, 2004 when the signal went into operation with a total cost of \$34,000.

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 May 2004 through July 2005. The year long construction period included both the signal installation and the ramp widening improvement. The before period consisted of reported crashes from September 1, 1999 through April 30, 2004 (4 years and 8 months); and the after period consisted of reported crashes from August 1, 2005 through March 31, 2010 (4 years and 8 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 (in the intersection) 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; U-turn; Head on; and Angle. Ran-off Road crashes in attempt to avoid a frontal impact collision are also considered as target crashes.

<u>Treatment Information</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Total crashes	23	25	8.7 %
Total Severity Index	4.22	2.48	- 41.2 %
Target Crashes	11	5	- 54.5 %
Target Crash Severity Index	4.36	3.96	- 9.2 %
Volume (2001, 2007)	15,500	19,600	26.5 %

<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	3	1	- 66.7 %
Class C Injury Crashes	7	4	- 42.9 %
Total Injury Crashes	10	5	- 50.0 %

The naive before and after analysis at the treatment location resulted in a 9 percent increase in Total Crashes, a 55 percent decrease in Target Crashes, and a 41 percent decrease in the Total Severity Index. The before period ADT year was 2001 and the after period ADT year was 2007.

Results and Discussion

Referencing the *Collision Diagrams*, the before period presented two patterns of concentrated collisions at the intersection. Frontal impact crashes were defined by the existence of seven (7) left turning ramp vehicles choosing improper gaps and two (2) southbound vehicles attempting u-turn maneuvers. There was also a pattern of nine (9) rear-end collisions at the off-ramp right turn slip lane. After the signal installation and the off-ramp widening, total crashes at this location increased slightly. There were four (4) left turn after period crashes caused by SR 2643 vehicles running the red light. The ramp also experienced major improvement in the right turn lane with only three (3) rear-end collisions during the after period. However, rear-end collisions on Union Cross Road increased from one (1) to thirteen (13) through the evaluation.

The calculated benefit to cost ratio for this project is **1.84 considering total crashes**. The benefit to cost ratio **considering only target crashes is 1.92**. 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 the Union Cross Road 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



Looking North on SR 2643 (Union Cross Road)



Traveling South on SR 2643 (Union Cross Rd)



Looking East on I-40 Westbound Off-Ramp (Exit 201)

BENEFIT-COST ANALYSIS WORKSHEET - Total Crashes

LOCATION: SR 2643 at I-40 WB Ramps		BY: JBS						
COUNTY: Forsyth		DATE: 6/10/2010						
FILE NO.: SS 09-03-204								
DETAILED COST:	TYPE IMPROVEMENT - New Traffic Signal							
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$34,000	10	0.149	\$5,067			
		\$0	0	0.000	\$0			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$34,000	10	0.149	\$5,067			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$2,200			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$900			
	TOTAL ANNUAL COST=				\$8,167			
	TOTAL COST OF PROJECT=				\$34,000			
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	4.66	0	0.00	10	2.15	13	2.79	\$54,914
AFTER	4.66	0	0.00	5	1.07	20	4.29	\$39,914
						Annual Benefits from Crash Cost Savings		\$15,000
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$6,833		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	1.84		
TOTAL COST OF PROJECT		-	\$34,000	COMPREHENSIVE B/C RATIO		-	1.84	

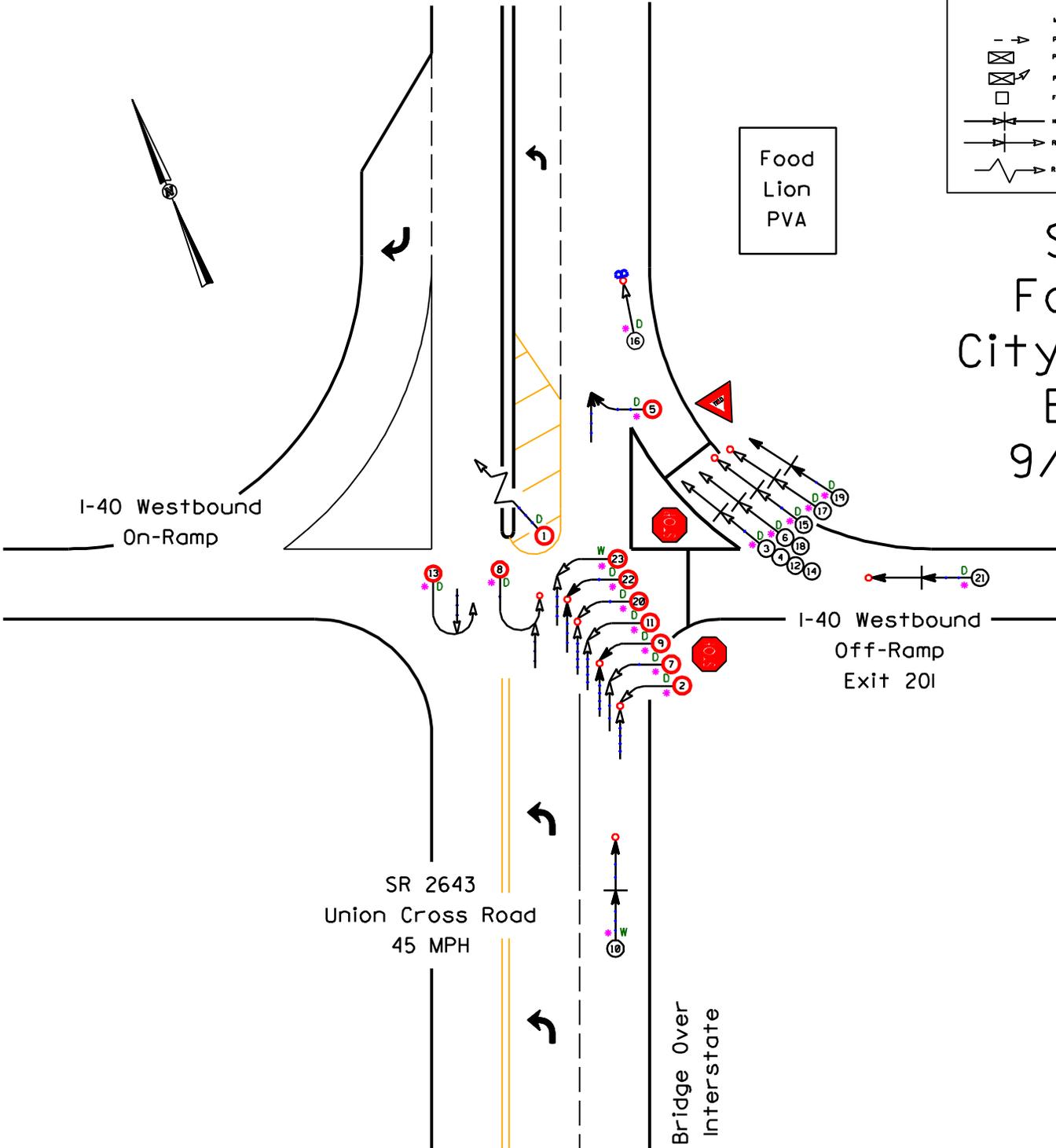
BENEFIT-COST ANALYSIS WORKSHEET - Target Crashes

LOCATION: SR 2643 at I-40 WB Ramps		BY: JBS						
COUNTY: Forsyth		DATE: 6/10/2010						
FILE NO.: SS 09-03-204								
DETAILED COST:	TYPE IMPROVEMENT - New Traffic Signal							
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$34,000	10	0.149	\$5,067			
		\$0	0	0.000	\$0			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$34,000	10	0.149	\$5,067			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$2,200			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$900			
	TOTAL ANNUAL COST=				\$8,167			
	TOTAL COST OF PROJECT=				\$34,000			
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	4.66	0	0.00	5	1.07	6	1.29	\$26,996
AFTER	4.66	0	0.00	2	0.43	3	0.64	\$11,352
						Annual Benefits from Crash Cost Savings		\$15,644
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$7,477		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	1.92		
TOTAL COST OF PROJECT		-	\$34,000	COMPREHENSIVE B/C RATIO		-	1.92	

LEGEND

	MOVING VEHICLE		ANGLE		9 MPH OR LESS		PEDESTRIAN
	PEDESTRIAN		TURNING		10 MPH TO 19		TRAM
	PAKED VEHICLE		BACKING		20 MPH TO 29		DRIVER AT FAULT
	PAKED VEHICLE		SIDESWIPE		30 MPH TO 39		DRY
	FIXED OBJECT		OUT OF CONTROL		40 MPH TO 49		WET
	HEAD ON		HURRY		50 MPH TO 59		ICY OR SNOW
	REAR END		FATALITY		70 AND UP		ONLY
	RAN OFF ROAD				SPEED UNKNOWN		

SS# 09-03-204
 Forsyth County
 City of Kernersville
 BEFORE Period
 9/1/99 - 4/30/04



Frontal Impact
 Target Crashes

Order # 41000006163
 Created: J. Schronce
 Date: 6-10-2010
N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRANSPORTATION MOBILITY and
SAFETY DIVISION

LEGEND

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

SS# 09-03-204
 Forsyth County
 City of Kernersville
 AFTER Period
 8/1/05 - 3/31/10

New Signalized
 Intersection
 Sig ID 09-III

Frontal Impact
 Target Crashes

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 Date: 6-10-2010
N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRANSPORTATION MOBILITY and
SAFETY DIVISION

