

Spot Safety Project Evaluation

Work Order #41000015142

Spot Safety Project # 03-06-200

**Spot Safety Project Evaluation of the Installation of a Traffic Signal at the
Intersection of US 421 (Carolina Beach Rd) and Medical Center Dr/Bell St
New Hanover County**

Documents Prepared By:

Safety Evaluation Group
Traffic Safety Systems Management Section
Transportation Mobility and Safety Division
North Carolina Department of Transportation

Principal Investigator



Brad Robinson, PE

10/12/2011

Date

Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 03-06-200 – The intersection of US 421 (Carolina Beach Rd) and Medical Center Dr./Bell St. in New Hanover County.

The signal number for this location is 03-0996.



Project Information and Background from the Project File Folder

The spot safety project improvement countermeasure chosen for the subject location was to install a traffic signal with protected-permitted left turn phasing on US 421.

The subject intersection is a four leg intersection which was controlled by stop signs on Medical Center Dr and Bell St in the before period. US 421 is a five-lane roadway with exclusive left turn lanes at the intersection. Medical Center Dr. and Bell St. both have thru-right and exclusive left turn lanes at the intersection.

The final completion date for the improvements at the subject intersection was on September 28, 2007 with a total cost of \$153,000.00.

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 from September 1, 2007 to September 30, 2007. The before period consisted of reported crashes from November 1, 2003 through August 31, 2007 (3 years and 10 months) and the after period consisted of reported crashes from October 1, 2007 through July 31, 2011 (3 years and 10 months). The ending date for this analysis was limited by the available crash data at the time the analysis was conducted.

The treatment data consisted of all reported crashes within 150 feet of the subject intersection. 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. These crash types are considered as follows: Left Turn, same roadway; Left Turn, different roadway; Right Turn, different roadway; Head On and Angle. 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	15	-54.5
Total Severity Index	4.59	5.93	29.2
Target Crashes	23	5	-78.3
Target Severity Index	4.54	6.92	52.4
Volume	28,500	28,500	0.0
<u>Target Crash Severity Summary</u>			
Fatal Crashes	0	0	N/A
Class A Crashes	0	0	N/A
Class B Crashes	4	3	-25.0
Class C Crashes	7	1	-85.7
PDO Crashes	12	1	-91.7

The naive before and after analysis at the treatment location resulted in a 55 percent decrease in total crashes, a 78 percent decrease in target crashes, and no change in average daily traffic (ADT). The before period ADT year was 2005 and the after period ADT year was 2009.

Results and Discussion

It appears that the signal installation was effective at reducing target crashes in the intersection. In the before period there were several small patterns of frontal impact crash types, with the largest being a pattern of angle crashes between northbound US 421 vehicles and eastbound Bell St vehicles. This pattern was reduced from five in the before period to zero in the after. The after period target crashes included two angle crashes between southbound US 421 vehicles and eastbound Bell St vehicles and three left turn, same roadway crashes, all three involving a different left turn movement.

The calculated benefit to cost ratio for this project is 1.96 considering total crashes. The benefit to cost ratio considering only target crashes is 4.29. 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*. 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.

BENEFIT-COST ANALYSIS WORKSHEET - TOTAL

LOCATION: US 421 and Medical Center Dr		BY: bdr							
COUNTY: New Hanover		DATE: 10/12/2011							
FILE NO.: SS 03-06-200									
DETAILED COST:	TYPE IMPROVEMENT - Signal								
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST				
	Construction	\$0	0	0.000	\$0				
		\$153,000	10	0.149	\$22,802				
	Right-of-Way	\$0	0	0.000	\$0				
	TOTALS	\$153,000	10	0.149	\$22,802				
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$2,000				
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$900				
	TOTAL ANNUAL COST=				\$25,702				
	TOTAL COST OF PROJECT=				\$153,000				
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	3.83	0	0.00	16	4.18	17	4.44	\$102,637	
AFTER	3.83	0	0.00	10	2.61	5	1.31	\$57,833	
						Annual Benefits from Crash Cost Savings		\$44,804	
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$19,103			
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	1.74			
TOTAL COST OF PROJECT		-	\$153,000	COMPREHENSIVE B/C RATIO		-	1.74		

BENEFIT-COST ANALYSIS WORKSHEET - TARGET

LOCATION: SR 1406 at SR 1413		BY: bdr							
COUNTY: Onslow		DATE: 10/12/2011							
FILE NO.: SS 03-06-203									
DETAILED COST:	TYPE IMPROVEMENT - Signal								
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST				
	Construction	\$0	0	0.000	\$0				
		\$57,000	10	0.149	\$8,495				
	Right-of-Way	\$0	0	0.000	\$0				
	TOTALS	\$57,000	10	0.149	\$8,495				
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$2,000				
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$900				
	TOTAL ANNUAL COST=				\$11,395				
	TOTAL COST OF PROJECT=				\$57,000				
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	3.83	0	0.00	11	2.87	12	3.13	\$70,914	
AFTER	3.83	0	0.00	4	1.04	1	0.26	\$22,010	
						Annual Benefits from Crash Cost Savings		\$48,903	
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$37,509			
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	4.29			
TOTAL COST OF PROJECT		-	\$153,000	COMPREHENSIVE B/C RATIO		-	4.29		

Treatment Site Photos Taken September 29, 2011



Traveling northbound on US 421 (Carolina Beach RD)



Traveling southbound on US 421 (Carolina Beach RD)



Traveling westbound on Medical Center Dr



Traveling eastbound on Belle St

SS# 03-06-200
 Order# 4100015142
 New Hanover County
 BEFORE Period
 11/1/2003-8/31/2007

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

Bell St
25 mph

US 421
(Carolina Beach Rd)
40 mph

ADT (YEAR)
33,000 (2005)

US 421
(Carolina Beach Rd)
40 mph

ADT (YEAR)
24,000 (2005)

Medical Center Dr
35 mph



Target Crashes

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

TRAFFIC SAFETY UNIT

Date: September 2011

Prepared By: bdr

SS# 03-06-200
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 New Hanover County
 AFTER Period
 10/1/2007-7/31/2011

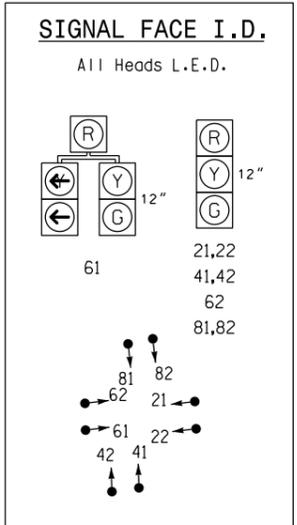
Bell St
 25 mph

US 421
 (Carolina Beach Rd) ADT (YEAR)
 40 mph 29,000 (2009)

US 421
 (Carolina Beach Rd) ADT (YEAR)
 40 mph 28,000 (2009)

Medical Center Dr
 35 mph

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



Target Crashes

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

TRAFFIC SAFETY UNIT

Date: September 2011 Prepared By: bdr

