

# Spot Safety Project Evaluation

Order # 41000011924

Spot Safety Project # 04-05-215

## Spot Safety Project Evaluation of the Reverse Crossover Installation US 70 at SR 1719 (Beston Road) Wayne County

Documents Prepared By:

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

**Principal Investigator**



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Jason B. Schronce

6-17-2011

Date

Traffic Safety Project Engineer





Aerial Photograph – Google Maps

### **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 reverse crossover at the intersection. By design, the reverse crossover allows left turns from the side streets but prevents mainline left turns. US 70 is a four-lane divided highway that presented left and right turn lanes in the before period. SR 1719 (Beston Road) is a two-lane roadway which operates under stop sign control with an additional overhead flasher at the US 70 intersection. The speed limits are 55-mph on three approaches and 45-mph on the southbound SR 1719 intersection approach.

The original statement of problem was the existence of multiple far-side angle crashes as motorists on SR 1719 attempt to cross over US 70. The intended purpose of this countermeasure was to reduce the number and severity of angle crashes at this location.

The initial crash analysis was completed from April 1, 2000 to March 31, 2005 with thirty-three (33) reported angle collisions. The final completion date for the improvement observed from the crash reports was during the 1<sup>st</sup> Quarter of 2007 with a total cost of \$426,000; of which only \$250,000 was provided with Spot Safety Funds.

## 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 January through March 2007. The before period consisted of reported crashes from February 1, 2003 through December 31, 2006 (3 years and 11 months); and the after period consisted of reported crashes from April 1, 2007 through February 28, 2011 (3 years and 11 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 Crossover Related Crashes were the target crashes for the applied countermeasure. The Crossover Crash types considered are as follows: Left turn, same roadway (side-street) and Angle which are both prevented / illegal traffic movements in the after period.

<u>Treatment Information</u>	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-) Percent Increase (+)</b>
Total Crashes	36	10	- 72.2 %
Total Severity Index	11.43	3.22	- 71.8 %
Target Crashes	31	0	- 100.0 %
Target Crash Severity Index	12.87	0.00	- 100.0 %
Volume (2005, 2009)	20,450	17,800	- 13.0 %

<u>Injury Crash Summary</u>	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-) Percent Increase (+)</b>
Fatal injury Crashes	1	0	- 100.0 %
Class A injury Crashes	2	0	- 100.0 %
Class B injury Crashes	7	0	- 100.0 %
Class C Injury Crashes	13	3	- 76.9 %
<b>Total Injury Crashes</b>	<b>23</b>	<b>3</b>	<b>- 87.0 %</b>

The naive before and after analysis at the treatment location resulted in a 72 percent decrease in Total Crashes, complete elimination of Target Crashes, and a 72 percent decrease in the Total Severity Index. The before period ADT year was 2005 and the after period ADT year was 2009.

## U-Turn Location Analysis

Due to the intersection experiencing changes that limit the movement of vehicles from US 70 directly onto SR 1719, we conducted analysis of the two closest locations for motorists to legally conduct their u-turn movements.

The U-Turn East location is a paved median opening positioned approximately 0.72 mile east of the subject intersection near Darrel Road (small residential street).



<b><u>U-Turn East – Median X-over</u></b>	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-) Percent Increase (+)</b>
Total Crashes	2	0	- 100.0 %
Total Severity Index	4.70	0.00	- 100.0 %
Target Crashes	0	0	N/A
Target Crash Severity Index	0.00	0.00	N/A

The U-Turn West location is a paved median opening positioned approximately 0.38 mile west of the subject intersection at the intersection of US 70 and SR 2200 (Walnut Creek Drive) / Creekside Drive; both residential communities.



<u>U-Turn West</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	7	4	- 42.9 %
Total Severity Index	13.94	8.40	- 39.7 %
Target Crashes	0	2	100.0 %
Target Crash Severity Index	0.00	8.40	100.0 %

The U-turn West location overall experienced a decrease in crashes at the SR 2200 (Walnut Creek Drive / Creekside Drive) intersection including the reduction of severe injury crashes from the one (1) A-injury collision in the before period. However, there were two (2) u-turn related crashes in the after period including one rear-end approaching the intersection and one “angle” crash as a motorist attempted a u-turn in the intersection. The two u-turn Crash IDs are: 102481592 and 102806711.

## Results and Discussion

Referencing the *Collision Diagrams*, the before period presented a strong pattern of thirty-one (31) target crashes including two (2) left turn same road for SR 1719 and twenty-nine (29) angle collisions. Of these angle crashes; twenty-six (26) occurred after the side-street motorist successfully accessed the median of US-70 and then was struck on the “far-side” of the intersection. These angle collisions included one fatality and two A-injury crashes.

The after period countermeasure removed this traffic maneuver and therefore successfully eliminated this crash pattern. The reverse crossover design still allows left turns from SR 1719 onto US 70 as evident by the small after period crash pattern of five (5) left turn different roadway collisions in the eastbound lanes of US 70.

The calculated benefit to cost ratio for this project is **13.23 considering total crashes**. The benefit to cost ratio **considering only target crashes is 13.54**. 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 a field visit conducted on May 25<sup>th</sup>, 2011 for all four 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**



**Eastbound US-70 at SR 1719 Intersection**



**Westbound US-70 at SR 1719 Intersection**



**Northbound SR 1719 at US-70 Intersection**



**Southbound SR 1719 at US-70 Intersection**

**BENEFIT-COST ANALYSIS WORKSHEET - Total Crashes**

LOCATION: US 70 at SR 1719		BY: JBS						
COUNTY: Wayne		DATE: 6/6/2011						
FILE NO.: SS 04-05-215								
DETAILED COST:	TYPE IMPROVEMENT -	New Crossover						
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$426,000	20	0.102	\$43,389			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$426,000	20	0.102	\$43,389			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$100			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$0			
	TOTAL ANNUAL COST=				\$43,489			
	TOTAL COST OF PROJECT=				\$426,000			
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	3.92	3	0.77	20	5.10	13	3.32	\$598,444
AFTER	3.92	0	0.00	3	0.77	7	1.79	\$22,985
						Annual Benefits from Crash Cost Savings		\$575,459
	NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST				=	\$531,970		
	BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST				=	13.23		
	TOTAL COST OF PROJECT	-	\$426,000		COMPREHENSIVE B/C RATIO	-		13.23

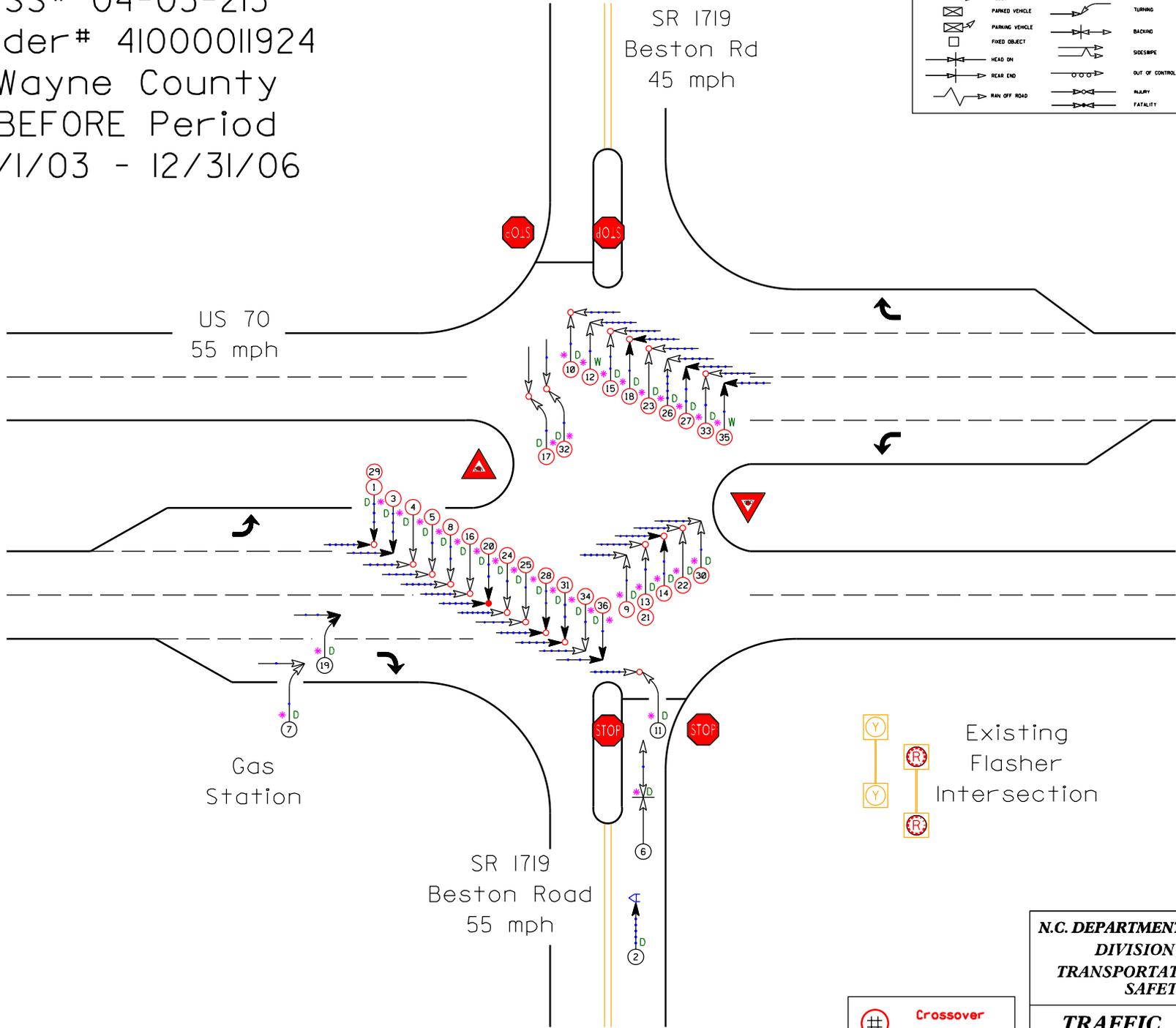
**BENEFIT-COST ANALYSIS WORKSHEET - Target Crashes**

LOCATION: US 70 at SR 1719		BY: JBS						
COUNTY: Wayne		DATE: 6/6/2011						
FILE NO.: SS 04-05-215		Restricted Movement Crashes						
DETAILED COST:	TYPE IMPROVEMENT -	New Crossover						
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$426,000	20	0.102	\$43,389			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$426,000	20	0.102	\$43,389			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$100			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$0			
	TOTAL ANNUAL COST=				\$43,489			
	TOTAL COST OF PROJECT=				\$426,000			
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	3.92	3	0.77	19	4.85	9	2.30	\$588,954
AFTER	3.92	0	0.00	0	0.00	0	0.00	\$0
						Annual Benefits from Crash Cost Savings		\$588,954
	NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST				=	\$545,465		
	BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST				=	13.54		
	TOTAL COST OF PROJECT	-	\$426,000		COMPREHENSIVE B/C RATIO	-		13.54

SS# 04-05-215  
 Order# 41000011924  
 Wayne County  
 BEFORE Period  
 2/1/03 - 12/31/06

**LEGEND**

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



Existing  
 Flasher  
 Intersection

Crossover  
 Target Crashes

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

**TRAFFIC SAFETY UNIT**

Date: 4-11-2011      Prepared By: J. Schronce

