

Spot Safety Project Evaluation

Order # 41000011900

Spot Safety Project # 02-04-209

**Spot Safety Project Evaluation of the 7 Left Turn Lane Extensions
NC 11 (South Memorial Drive) from Davenport Farm Road to Mall Drive
Pitt County, City of Greenville**

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

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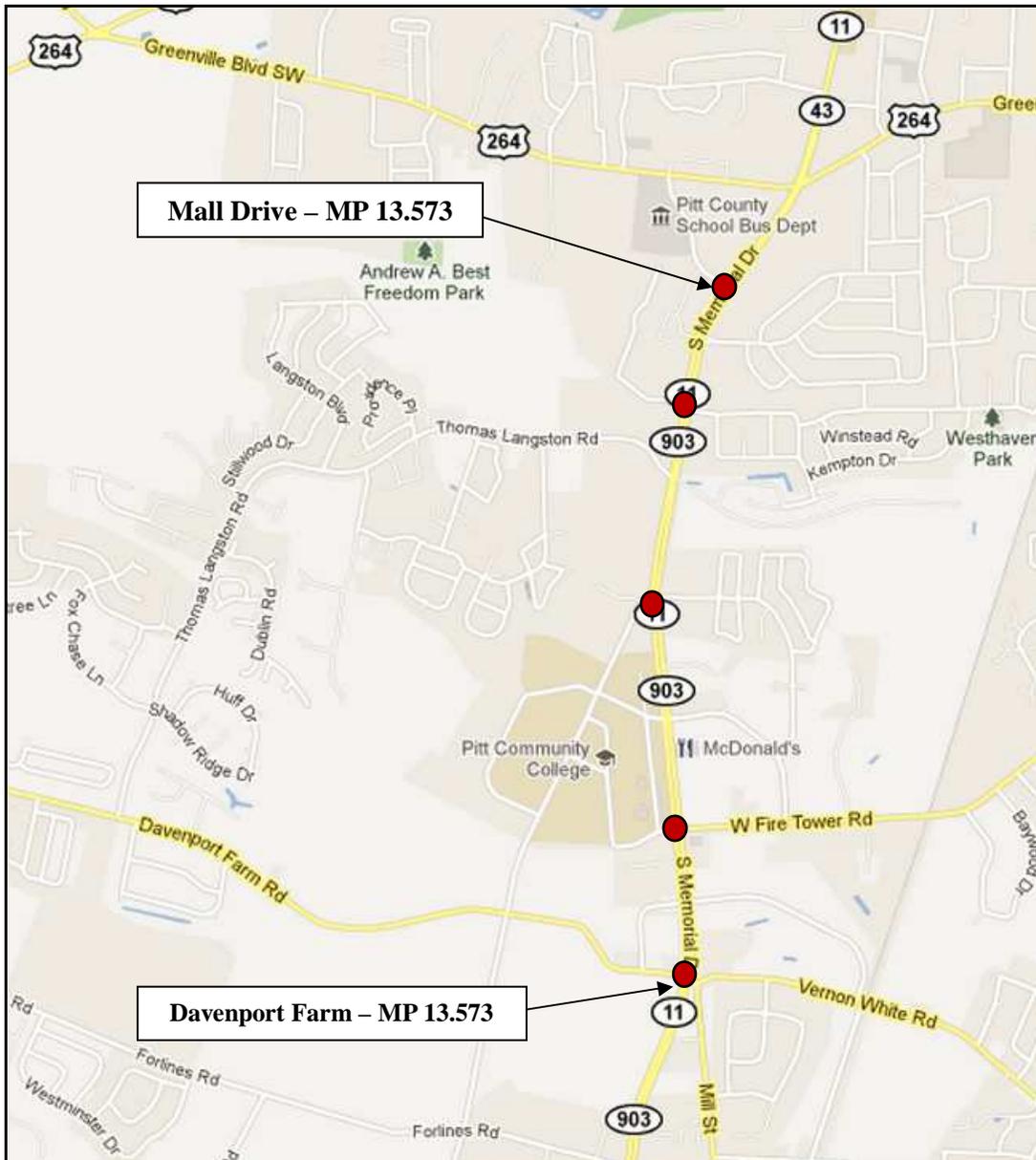
Date

Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 02-04-209 located along the segment of NC 11 / NC 903 (South Memorial Drive) from SR 1128 (Davenport Farm Road) north to Mall Drive in Pitt County, City of Greenville. The NC 11 Milepost range is from 11.800 (SR 1128) to 13.573 (Mall Drive).



Specific Study Intersections – Turn Lane Extensions

The following intersections experienced the stated improvements to the dedicated left turn lanes. Please note that the Firetower Road approach was also being widened during the time frame of this analysis (as seen in the aerial photograph). Intersections are listed by increasing milepost order from south to north on NC 11 / 903 (South Memorial Drive).

1. Southbound Left Turn Lane – Davenport Farm Road – MP 11.800
2. Northbound Left Turn Lane – Firetower Road – MP 12.180
3. Southbound Left Turn Lane – Firetower Road – MP 12.180
4. Northbound Left Turn Lane – Reedy Branch Road – MP 12.700
5. Northbound Left Turn Lane – Westhaven Road – MP 13.238
6. Southbound Left Turn Lane – Westhaven Road – MP 13.238
7. Northbound Left Turn Lane – Mall Drive – MP 13.573

Aerial Maps of Study Intersections



**NC 11/903 at Davenport Farm Road
MP 11.800**



**NC 11/903 at Firetower Road (Construction Pic)
MP 12.180**



**NC 11/903 at SR 1311 (Reedy Branch Rd)
MP 12.770**



**NC 11/903 at Westhaven Road
MP 13.238**



**NC 11/903 at Mall Drive
MP 13.573**

Project Information and Background from the Project File Folder

The spot safety project improvement countermeasures chosen for the subject segment were the extensions of the seven (7) existing left turn lanes at the five (5) specified intersections above. From measurements, the storage capacity of each extended turn lane is now approximately 500 feet. NC 11 / 903 is a six-lane median divided facility with speed limits varying between 45-mph and 55-mph. The intersection median openings provide left turn lanes along this segment and right turn lanes at most intersections as well. This area is heavily congested with multiple shopping centers, Pitt Community College, and many PVA driveways (restaurants and gas stations).

The original statement of problem was the potential for collisions due to vehicles on NC 11 queuing back into the left-most through lane due to inadequate left turn storage. The intended purpose of the left turn lane is to alleviate the accident potential of rear-end collisions and increase capacity. This project was developed around congestion and delays needs.

The initial crash analysis was completed from June 1, 2001 to May 31, 2004 with 319 reported crashes, one (1) of which was deemed correctable. The final completion date for the improvement at the subject intersection was on September 26, 2007 with a total cost of \$250,000.

Naive Before and After Analysis

After reviewing the spot safety project file folder along with all the crashes along the subject segment, the crash data omitted from this analysis to consider for an adequate construction period were the months of July through September 2007. The before period consisted of reported crashes from December 1, 2003 through June 30, 2007 (3 years and 7 months); and the after period consisted of reported crashes from October 1, 2007 through April 30, 2011 (3 years and 7 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 along the segment from 0.1 mile south of SR 1128 (Davenport Farm Road) to 0.1 mile north of Mall Drive; Milepost Range: 11.700 – 13.673 (Total of 1.973 miles). The study was completed with a zero (0) foot y-line. *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 general Rear-End and Sideswipe-Same Direction crashes were the selected Target Crashes for the countermeasure.

<u>Treatment Information</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Total Segment Crashes	444	358	- 19.4 %
Total Segment Severity Index	4.25	3.53	- 16.9 %
Target Crashes – Segment Rear-Ends	235	208	- 11.5 %
Segment Rear-End Severity Index	4.20	3.31	- 21.2 %
Target Crashes – Sideswipe-Same Dir.	46	39	- 15.2 %
Sideswipe Same-Dir. Severity Index	3.45	1.76	- 49.0 %
Volume (2005, 2009)	40,460	37,300	- 7.8 %

<u>Injury Crash Summary</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Fatal injury Crashes	1	0	- 100.0 %
Class A injury Crashes	4	1	- 75.0 %
Class B injury Crashes	29	15	- 48.3 %
Class C Injury Crashes	115	97	- 15.7 %
Property Damage Only	295	245	- 16.9 %

The naive before and after analysis at the treatment location resulted in a 19 percent decrease in Total Crashes, a 11.5 percent decrease in Rear-End Target Crashes, and a 17 percent decrease in the Total Severity Index. The before period ADT year was 2005 and the after period ADT year was 2009.

To further examine the data, the five intersections with left turn lane improvements were examined with a zero (0) foot y-line for the side streets and a 0.1 mile y-line on the mainline NC 11 / NC 903.

<u>Davenport Farm Rd</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	41	13	- 68.3 %
Intersection Rear-End	27	9	- 66.7 %
Intersection Sideswipe	2	1	- 50.0 %

<u>Firetower Road</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	57	17	- 70.2 %
Intersection Rear-End	28	12	- 57.1 %
Intersection Sideswipe	11	3	- 72.7 %

<u>Reedy Branch Road</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	60	55	- 8.3 %
Intersection Rear-End	38	34	- 10.5 %
Intersection Sideswipe	2	3	50.0 %

<u>Westhaven Road</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	58	63	8.6 %
Intersection Rear-End	30	37	23.3 %
Intersection Sideswipe	7	3	- 57.1 %

<u>Mall Drive</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	63	61	- 3.2 %
Intersection Rear-End	39	35	- 10.3 %
Intersection Sideswipe	5	7	40.0 %

Results and Discussion

Referencing the multiple charts above, the total segment experienced noticeable improvement in crash values with a 20 percent reduction in total crashes, a 12 percent reduction in segment rear-end collisions, and a 15 percent reduction in segment sideswipes. The Davenport Farm Road and Firetower Road intersections both saw considerable reductions of total crashes near 70 percent with above 50 percent reductions of both intersection rear-end and sideswipe crashes.

The only intersection that recorded an increase in crash totals was the Westhaven intersection; which experienced a 9 percent increase in total crashes and a 23 percent increase in rear-end collisions. However, with a 57 percent reduction in sideswipes; this location saw an increase in combined target crashes from thirty-seven (37) to forty (40) collisions. This combine target crash figure only indicates an increase of 8 percent.

Due to the sheer quantity of segment crashes, positive results from the analysis, and the improvement completed for congestion and delay purposes, collision diagrams were not provided for this study. However, another table of highlighted data follows:

<u>Segment Rear-End & Sideswipe-Same Dir.</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Severe Injury (K+A)	4	0	- 100.0 %
Minor Injury (B+C)	76	69	- 11.5 %
Property Damage Only	201	178	- 11.4 %

The previous table indicates that severe injury target crashes were eliminated in the after period along with an eleven percent reduction in minor injury and property damage crashes. These values lead this project to a positive benefit-cost ratio as stated below.

The calculated benefit to cost ratio for this project is **37.02 considering total segment crashes**. The benefit to cost ratio **considering only segment rear-end and sideswipe-same direction crashes is 30.27**. 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 countermeasure.

BENEFIT-COST ANALYSIS WORKSHEET - Total Segment Crashes

LOCATION: NC 11/903 (S. Memorial Drive)		BY: JBS						
COUNTY: Pitt		DATE: 8/24/2011						
FILE NO.: SS 02-04-209								
DETAILED COST:	TYPE IMPROVEMENT - Extend 7 Left Turn Lanes at 5 Intersections							
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$250,000	20	0.102	\$25,463			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$250,000	20	0.102	\$25,463			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$0			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$0			
	TOTAL ANNUAL COST=				\$25,463			
	TOTAL COST OF PROJECT=				\$250,000			
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	3.58	5	1.40	144	40.22	295	82.40	\$2,038,687
AFTER	3.58	1	0.28	112	31.28	245	68.44	\$1,095,950
						Annual Benefits from Crash Cost Savings		\$942,737
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$917,274		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	37.02		
TOTAL COST OF PROJECT		-	\$250,000	COMPREHENSIVE B/C RATIO		-	37.02	

BENEFIT-COST ANALYSIS WORKSHEET - Target Segment Crashes

LOCATION: NC 11/903 (S. Memorial Drive)		BY: JBS						
COUNTY: Pitt		DATE: 8/24/2011						
FILE NO.: SS 02-04-209		Segment Rear-End & Sideswipe-Same Direction Crashes						
DETAILED COST:	TYPE IMPROVEMENT - Extend 7 Left Turn Lanes at 5 Intersections							
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$250,000	20	0.102	\$25,463			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$250,000	20	0.102	\$25,463			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$0			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$0			
	TOTAL ANNUAL COST=				\$25,463			
	TOTAL COST OF PROJECT=				\$250,000			
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	3.58	4	1.12	76	21.23	201	56.15	\$1,369,916
AFTER	3.58	0	0.00	69	19.27	178	49.72	\$599,274
						Annual Benefits from Crash Cost Savings		\$770,642
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$745,179		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	30.27		
TOTAL COST OF PROJECT		-	\$250,000	COMPREHENSIVE B/C RATIO		-	30.27	