

# Spot Safety Project Evaluation

Order # 41000010517

Spot Safety Project # 03-06-215

**Spot Safety Project Evaluation of the Signal Modifications  
US 74/76 at NC 87 (Maco Road) / SR 1419 (Northwest Road)  
Brunswick 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

3-14-2011

Date

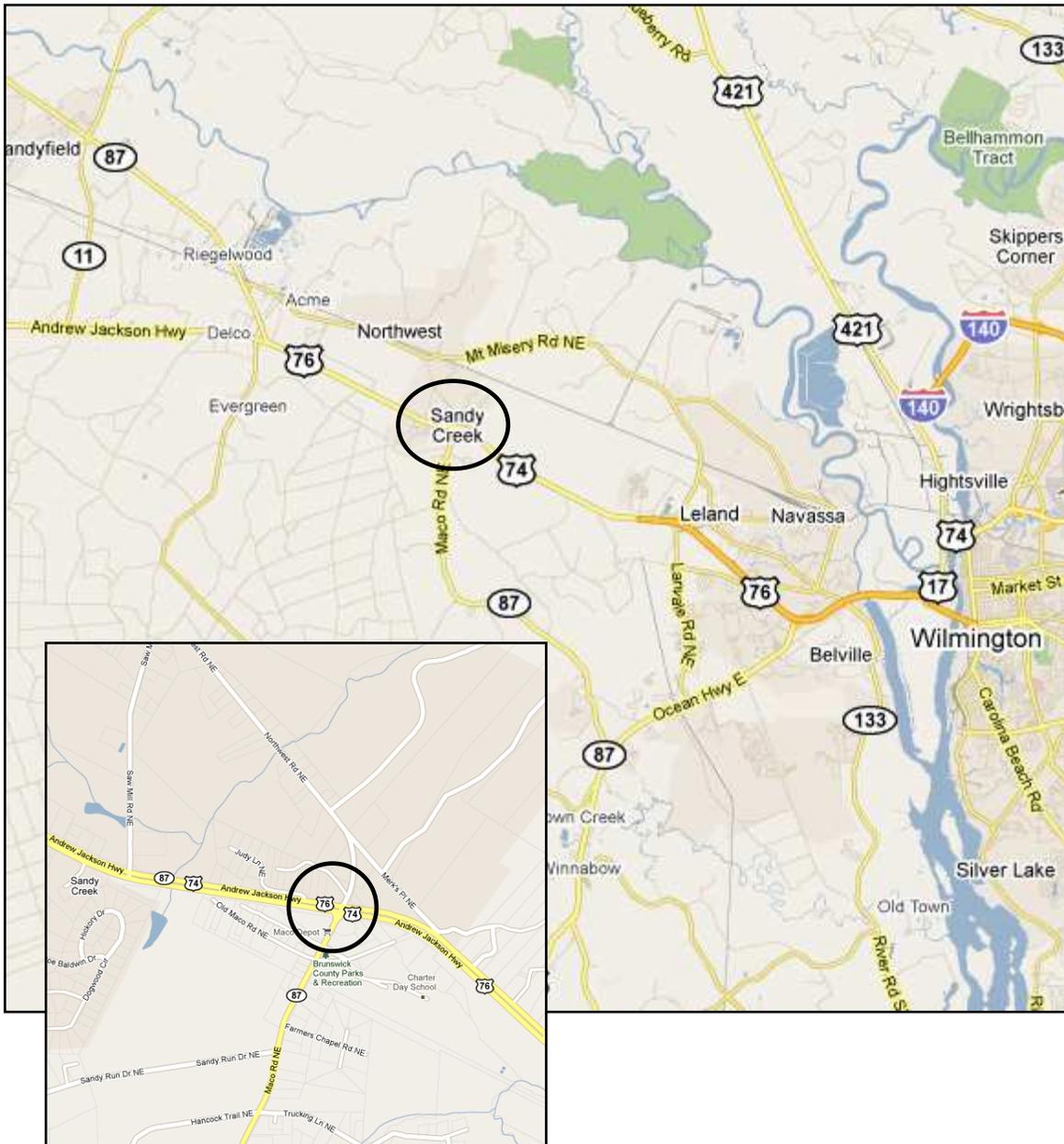
Traffic Safety Project Engineer

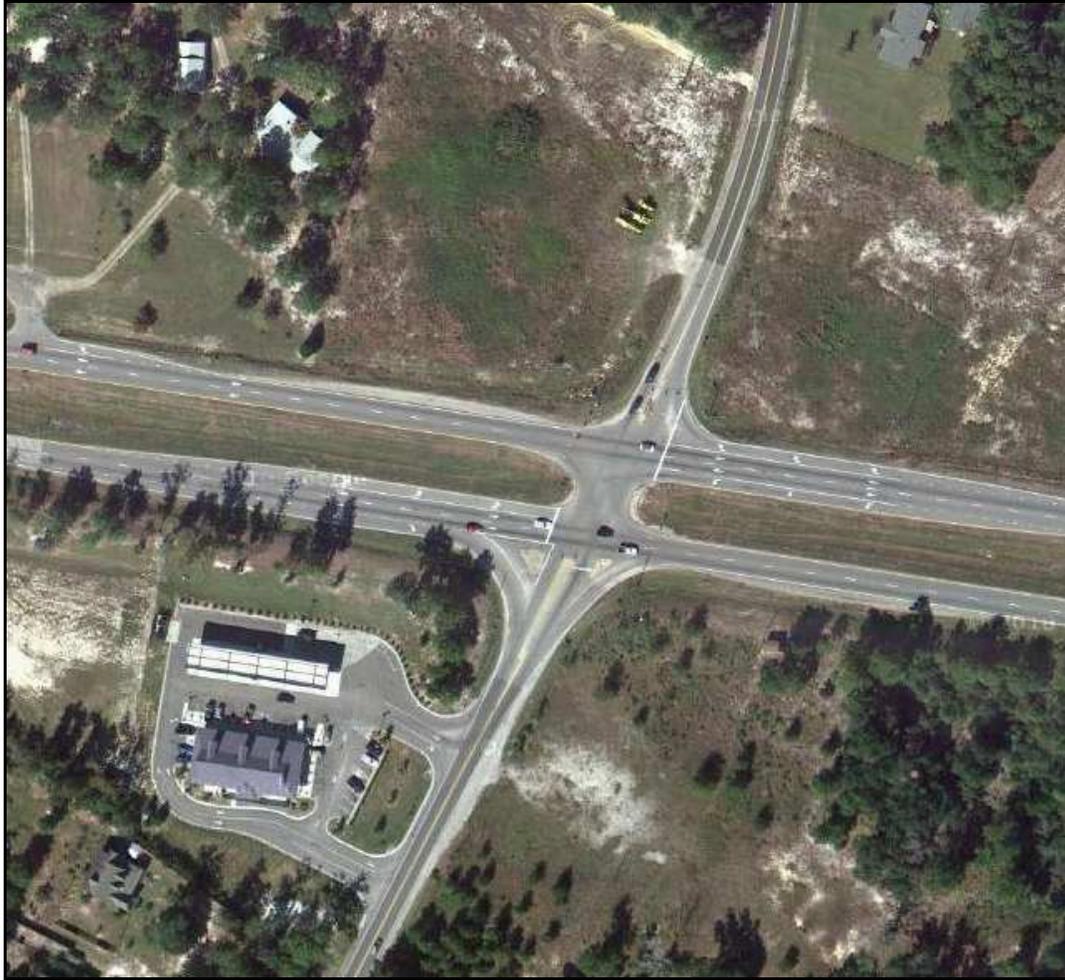
# Spot Safety Project Evaluation Documentation

## Subject Location

Evaluation of Spot Safety Project Number 03-06-215 located at the Intersection of US 74/76 (Andrew Jackson Highway) at NC 87 (Maco Road) / SR 1419 (Northwest Road) in Brunswick County, west of the City of Wilmington.

The Sig ID is 03-0170 for this modified and upgraded existing traffic signal.





### **Project Information and Background from the Project File Folder**

The spot safety project improvement countermeasure chosen for the subject location was the addition of 22 foot long vehicle detection system on both directions US 74/76 with the existing traffic signal. US 74/76 (Andrew Jackson Highway) is a four-lane divided facility with heavy volumes of truck traffic and a speed limit of 55-mph. NC 87 (Maco Road) and SR 1419 (Northwest Road) are both two-lane roadways with speed limits of 55-mph and 45-mph respectfully. The location is a four-leg crossroads intersection that has been signalized since 1999. The existing signal was also upgraded in June 2006 with a new controller and modified (more visible) signal heads.

The original statement of problem stated that this location had a growing issue of crashes, some of which involved tractor-trailer trucks. It was determined with the high percentage of truck volume utilizing US 74/76 that a long vehicle detection system should aid in reducing crashes.

The initial crash analysis was completed from June 1, 2001 to June 1, 2006 with fifteen (15) reported crashes. The final completion date for the improvement at the subject intersection was on June 19, 2007 with a total cost of \$31,000.

Upon verifying this site with the Regional Field Personnel, the Safety Evaluation Group learned that a project had been developed and funding pursued to modify the existing turn lanes and install offset left turns for both directions of US 74/76. As of our knowledge, this project has not been installed and is not accounted for in this evaluation.

### 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 July 2006 through June 2007 (full year to account for both signal modifications). The before period consisted of reported crashes from February 1, 2003 through June 30, 2006 (3 years and 5 months); and the after period consisted of reported crashes from July 1, 2007 through November 30, 2010 (3 years and 5 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 US 74/76 Truck Related Crashes were the target crashes for the applied countermeasure. The Truck Related Crash types considered are as follows: Angle; Left Turn, Different Roadway; Rear-End; and Lost Load where the at-fault vehicle (truck) was traveling on US 74/76 (Andrew Jackson Highway).

<b><u>Treatment Information</u></b>	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-) Percent Increase (+)</b>
Total Crashes	21	20	- 4.8 %
Total Severity Index	9.54	12.28	28.7%
Target Crashes	5	1	- 80.0 %
Target Crash Severity Index	19.12	8.40	- 56.1 %
Volume (2004, 2009)	21,000	23,100	10.0 %

<b><u>Injury Crash Summary</u></b>	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-) Percent Increase (+)</b>
Fatal injury Crashes	0	1	100.0 %
Class A injury Crashes	1	1	0.0 %
Class B injury Crashes	6	5	- 16.7 %
Class C Injury Crashes	7	5	- 28.6 %
<b>Total Injury Crashes</b>	<b>14</b>	<b>12</b>	<b>- 14.3 %</b>

The naive before and after analysis at the treatment location resulted in a 5 percent decrease in Total Crashes, an 80 percent decrease in Target Crashes, and a 56 percent decrease in the Target Crash 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 five (5) crashes involving trucks traveling on US 74/76. These collisions included two (2) eastbound rear-ends, two (2) eastbound trucks running the red light, and one (1) westbound truck that lost its load as it stopped at the signal. After the long vehicle detection modification was added, truck crashes reduced to one (1) eastbound red light run collision. This addition has seemed to be beneficial to the signal and has reduced the target crash severity by 56 percent.

Overall, the intersection has remained consistent with around twenty crashes in both the before and after periods. From examining the collision diagrams, we see however that the crash pattern types have changed through the evaluation. The before period experienced five (5) angle, four (4) left turn same roadway, and five (5) left turn different roadway collisions in the US 74/76 eastbound section of the intersection. In the after period (which also included the signal modifications in June 2006), the patterns changed to two (2) angle, eleven (11) left turn same roadway, and two (2) left turn different roadway crashes. The spike in left turn same roadway type collisions has led to the development of the US 74/76 offset left project as previously mentioned.

The intersection did present one (1) after period fatal collision. This crash involved a tractor-trailer traveling north on NC 87 that partially blocked the intersection while making a left turn. From the crash report, a motorist traveling east struck the trailer portion of the truck resulting in an angle fatality. This crash was not considered a target crash since the truck was not traveling on US 74/76 initially. The fatal investigation yielded no improvement recommendations.

The calculated benefit to cost ratio for this project is **(-35.58) considering total crashes**. The benefit to cost ratio **considering only target crashes is 40.80**. 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 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



Traveling East on US 74/76 (Andrew Jackson Highway)



Traveling East on US 74/76



Traveling West on US 74/76 (Andrew Jackson Highway)



Traveling West on US 74/76



Traveling North on NC 87 (Maco Road)



Traveling South on SR 1419 (Northwest Road)

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

LOCATION: US 74/76 at NC 87 / SR 1419		BY: JBS						
COUNTY: Brunswick		DATE: 3/10/2011						
FILE NO.: SS 03-06-215								
DETAILED COST:	TYPE IMPROVEMENT - Long Vehicle Detection System							
ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST				
Construction	\$31,000	10	0.149	\$4,620				
Right-of-Way	\$0	0	0.000	\$0				
TOTALS	\$31,000	10	0.149	\$4,620				
ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$100				
ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$0				
TOTAL ANNUAL COST=				\$4,720				
TOTAL COST OF PROJECT=				\$31,000				
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	3.42	1	0.29	13	3.80	7	2.05	\$269,035
AFTER	3.42	2	0.58	10	2.92	8	2.34	\$436,959
Annual Benefits from Crash Cost Savings								(\$167,924)
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	(\$172,644)		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	-35.58		
TOTAL COST OF PROJECT		-	\$31,000	COMPREHENSIVE B/C RATIO		-	-35.58	

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

LOCATION: US 74/76 at NC 87 / SR 1419		BY: JBS						
COUNTY: Brunswick		DATE: 3/10/2011						
FILE NO.: SS 03-06-215		Truck Related Crashes						
DETAILED COST:	TYPE IMPROVEMENT - Long Vehicle Detection System							
ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST				
Construction	\$31,000	10	0.149	\$4,620				
Right-of-Way	\$0	0	0.000	\$0				
TOTALS	\$31,000	10	0.149	\$4,620				
ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$100				
ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$0				
TOTAL ANNUAL COST=				\$4,720				
TOTAL COST OF PROJECT=				\$31,000				
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	3.42	1	0.29	2	0.58	2	0.58	\$198,421
AFTER	3.42	0	0.00	1	0.29	0	0.00	\$5,848
Annual Benefits from Crash Cost Savings								\$192,573
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$187,853		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	40.80		
TOTAL COST OF PROJECT		-	\$31,000	COMPREHENSIVE B/C RATIO		-	40.80	

SS# 03-06-215  
 Order# 41000010517  
 Brunswick County  
 BEFORE Period  
 2/1/03 - 6/30/06

**LEGEND**




SR 1419  
 Northwest Rd  
 45 MPH

US 74-76 / NC 87  
 Andrew Jackson Hwy  
 55 MPH

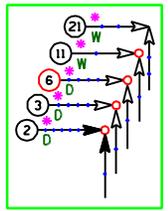
US 74-76  
 Andrew Jackson Hwy  
 55 MPH

NC 87  
 Maco Road  
 55 MPH

Existing  
 Signalized  
 Intersection  
 Sig ID 03-0170

Note Crash 15: Truck lost  
 its load as it came to  
 a stop at the traffic signal

ROLLOVER



Truck Related  
 Target Crashes

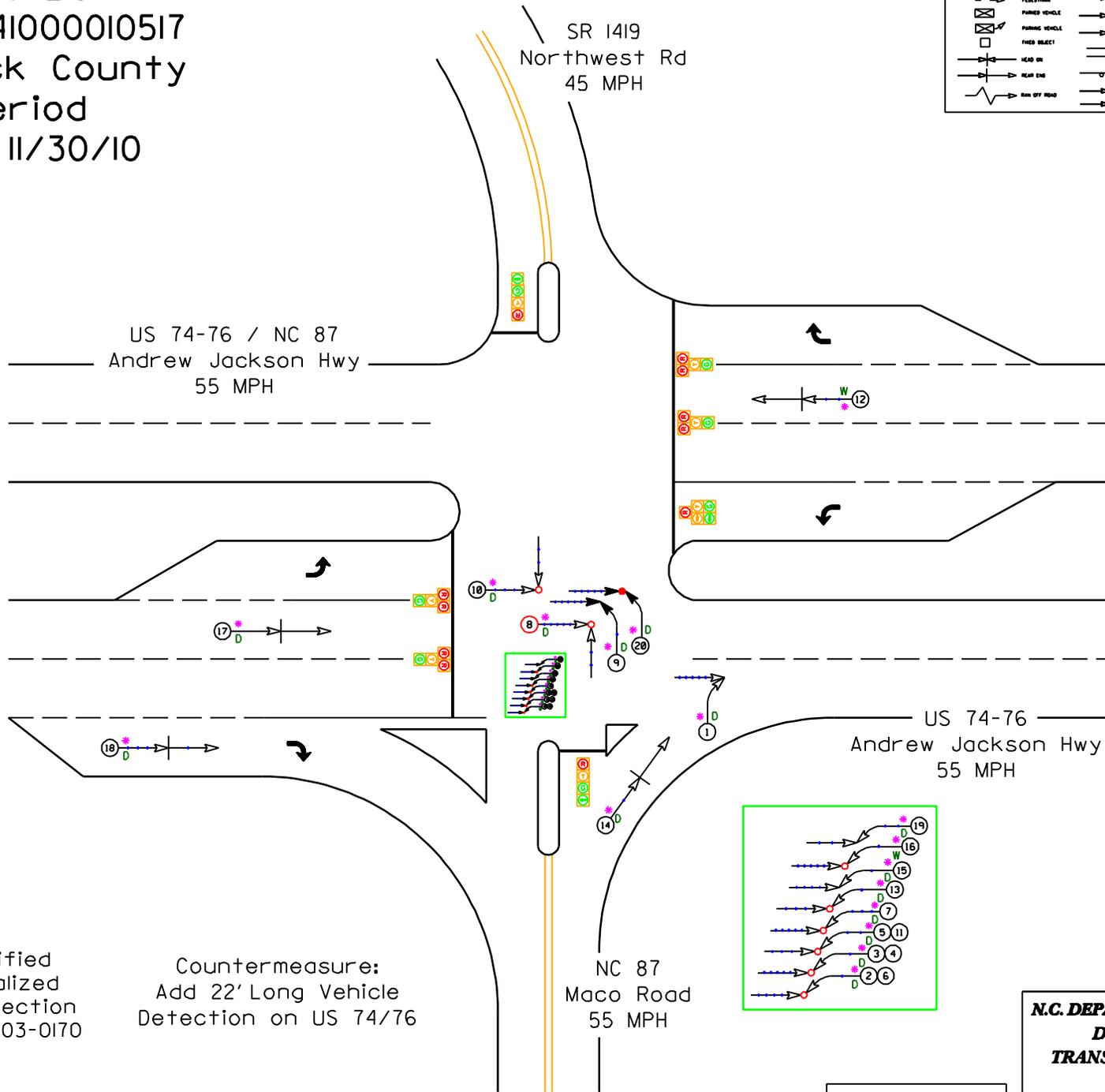
**N.C. DEPARTMENT of TRANSPORTATION**  
**DIVISION of HIGHWAYS**  
**TRANSPORTATION MOBILITY and**  
**SAFETY DIVISION**

**TRAFFIC SAFETY UNIT**

Date: 1-31-2011      Prepared By: J. Schronce

SS# 03-06-215  
 Order# 41000010517  
 Brunswick County  
 AFTER Period  
 7/1/07 - 11/30/10

**LEGEND**

Modified  
 Signalized  
 Intersection  
 Sig ID 03-0170

Countermeasure:  
 Add 22' Long Vehicle  
 Detection on US 74/76

NC 87  
 Maco Road  
 55 MPH

Truck Related  
 Target Crashes

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

**TRAFFIC SAFETY UNIT**

Date: 1-31-2011 Prepared By: J. Schrone