

# Spot Safety Project Evaluation

Order # 41000006698

Spot Safety Project # 05-02-211

**Spot Safety Project Evaluation of a Signal Installation with Turn Lanes  
SR 1301 (Purfoy Road) and SR 2765 / SR 3736 (Old Honeycutt Road)  
City of Fuquay Varina, Wake 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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Chad J. Neilson

6-29-2010

Date

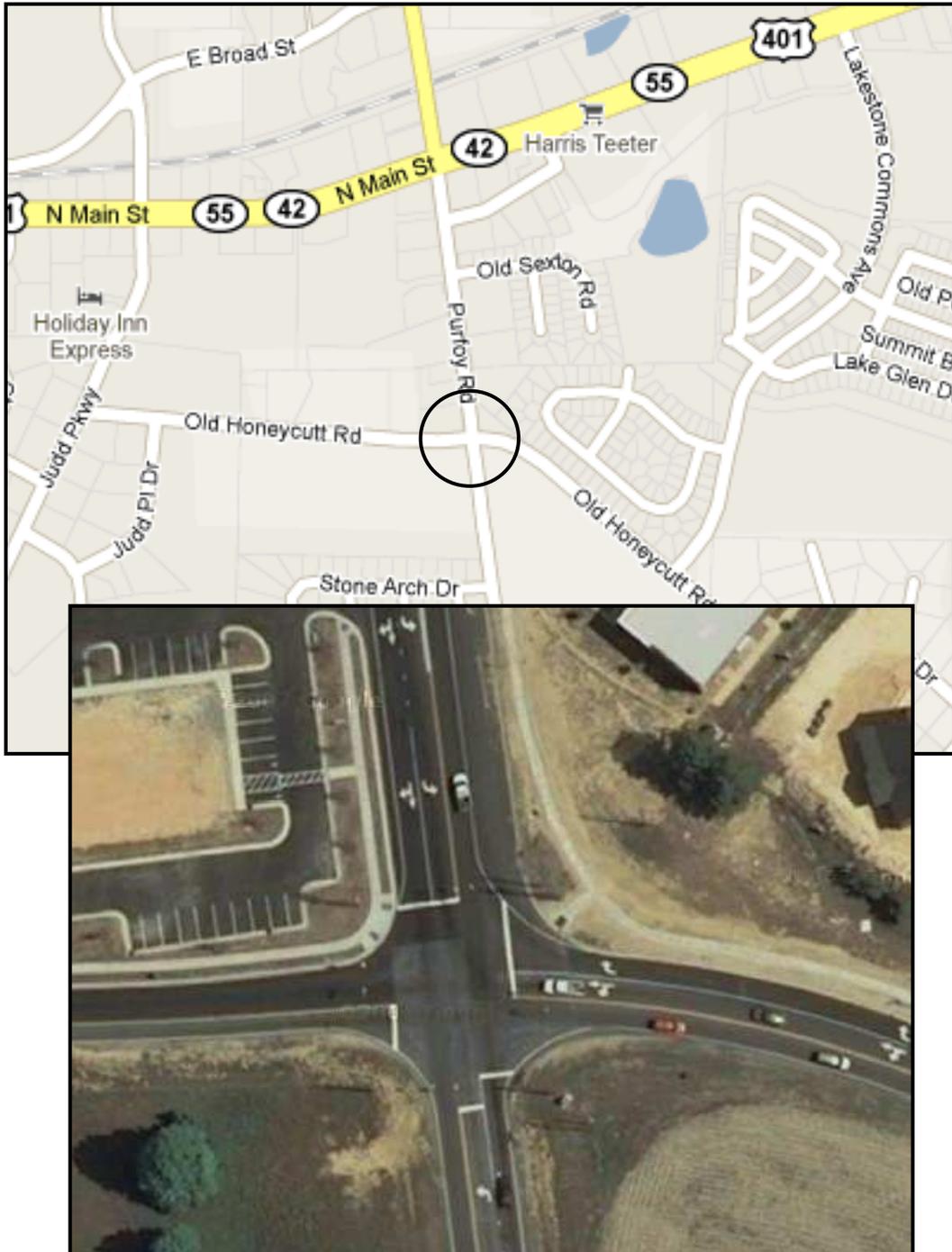
Traffic Safety Project Engineer

## *Spot Safety Project Evaluation Documentation*

### **Subject Location**

Evaluation of Spot Safety Project Number 05-02-211 located at the Intersection of SR 1301 (Purfoy Road) and SR 2765 / SR 3736 (Old Honeycutt Road) in Wake County, in the city of Fuquay Varina.

The Signal ID for the newly installed signal is 05-2191.



## **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 traffic signal. This spot safety project also included left-turn lanes along SR 1301 (Purfoy Road) and a westbound right-turn lane on SR 2765 (Old Honeycutt Road). SR 1301 (Purfoy Road) is a three-lane facility with a center two-way-left-turn-lane and a speed limit of 45 mph. SR 2765 / SR 3736 (Old Honeycutt Road) is a two-lane facility at the subject location with a speed limits of 45 mph. The subject location was controlled by stop signs on SR 2765 / SR 3736 (Old Honeycutt Road) during the before period.

The original statement of problem was the concern for crashes due to increased traffic volumes to the point of motorist's inability to maneuver safely through the intersection. The intended purpose of the new traffic signal is to alleviate the number of crashes and create gaps in traffic for vehicles wishing to enter from SR 2765 / SR 3736 (Old Honeycutt Road) to SR 1301 (Purfoy Road). The intended purpose of the northbound and southbound left-turn lanes and the westbound right-turn lane is to create a storage lane for queuing vehicles in order to reduce rear-end, turn crashes.

The initial crash analysis was completed from December 1, 1998 to November 30, 2001 with thirteen (13) reported crashes, eight (8) of which were deemed correctable. The final completion date for the improvement at the subject intersection was on November 17, 2005 with a total cost of \$230,000.00. This project was funded by \$150,000.00 coming from Spot Safety Funds and the remaining \$80,000.00 from the Secondary Road Fund.

### **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 October 2005 and November 2005. The before period consisted of reported crashes from May 1, 2001 through September 30, 2005 (4 years and 5 months); and the after period consisted of reported crashes from December 1, 2005 through April 30, 2010 (4 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 Frontal Impact Crashes were the target crashes for the signal installation and the Rear-end (turn lane) crashes were the target crashes for the turn lane installations. 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; Head on; Angle; and Ran-off roadway (to avoid Angle crash). The Rear-end (turn lane) crash types are considered as follows: Rear-end, turn; and Sideswipe, same roadway. The sideswipe crash type is only classified as a target crash where a turn lane was installed in the after period.

<u>Treatment Information</u>	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-) Percent Increase (+)</b>
Total Crashes	34	21	- 38.24 %
Total Severity Index	6.06	4.17	- 31.19 %
Target Crashes (Frontal Impact)	16	7	- 56.25 %
Target Crash Severity Index (Frontal)	8.98	7.34	- 18.26 %
Target Crashes (Rear-end, turn)	10	0	- 100.00 %
Target Crash Severity Index (Rear-end)	3.22	0.00	- 100.00 %
Target Crashes (Total)	26	7	- 73.08 %
Target Crash Severity Index (Total)	6.76	7.34	8.58 %
Volume	16,200	17,400	7.41 %

<u>Injury Crash Summary</u>	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-) Percent Increase (+)</b>
Fatal Injury Crashes	1	0	- 100.00 %
Class A Injury Crashes	0	0	0.00 %
Class B Injury Crashes	1	5	500.00 %
Class C Injury Crashes	12	4	- 66.67 %
Total Injury Crashes	14	9	- 35.71 %

The naive before and after analysis at the treatment location resulted in a thirty-eight (38) percent decrease in Total Crashes, an seventy-three (73) percent decrease in Target Crashes, and a thirty-one (31) percent decrease in the Total Severity Index. The before period ADT year was 2003 and the after period ADT year was 2008.

## **Results and Discussion**

Referencing the *Collision Diagrams*, the before period shows an angle crash pattern consisting of eleven (11) target crashes, including one fatality crash for vehicles attempting to cross SR 1301 (Purfoy Road). Also, there is a southbound rear-end collision pattern for vehicles waiting to make a left turn onto SR 2765 (Old Honeycutt Rd) that accounts for four (4) target crashes. Lastly, there is a rear-end, turn crash pattern for the westbound right-turn movement in the before period that accounts for four (4) target crashes. After the signal installation, the angle crash pattern was reduced to four (4) crashes and both the southbound rear-end, turn and westbound rear-end, turn crash patterns were eliminated.

The calculated benefit to cost ratio for this project is **4.51 considering total crashes**. The benefit to cost ratio **considering only target crashes is 4.66**. 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.

**BENEFIT-COST ANALYSIS WORKSHEET TOTAL CRASHES**

LOCATION: SR 1301 (Purfoy Rd) @ SR 2765/SR 3736		BY: C Neilson						
COUNTY: Wake		DATE: 6/18/2010						
FILE NO.: SS 05-02-211								
DETAILED COST:	TYPE IMPROVEMENT - Signal Install							
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$230,000	10	0.149	\$34,277			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$230,000	10	0.149	\$34,277			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$2,200			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$900			
	TOTAL ANNUAL COST=				\$37,377			
	TOTAL COST OF PROJECT=				\$230,000			
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	4.42	1	0.23	13	2.94	20	4.52	\$220,814
AFTER	4.42	0	0.00	9	2.04	12	2.71	\$52,398
						Annual Benefits from Crash Cost Savings		\$168,416
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$131,040		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	4.51		
TOTAL COST OF PROJECT		-	\$230,000	COMPREHENSIVE B/C RATIO		-	4.51	

**BENEFIT-COST ANALYSIS WORKSHEET TARGET CRASHES**

LOCATION: SR 1301 (Purfoy Rd) @ SR 2765/SR 3736		BY: C Neilson						
COUNTY: Wake		DATE: 6/18/2010						
FILE NO.: SS 05-02-211								
DETAILED COST:	TYPE IMPROVEMENT - Signal Install							
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$230,000	10	0.149	\$34,277			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$230,000	10	0.149	\$34,277			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$2,200			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$900			
	TOTAL ANNUAL COST=				\$37,377			
	TOTAL COST OF PROJECT=				\$230,000			
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	4.42	1	0.23	10	2.26	15	3.39	\$202,376
AFTER	4.42	0	0.00	6	1.36	1	0.23	\$28,122
						Annual Benefits from Crash Cost Savings		\$174,253
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$136,877		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	4.66		
TOTAL COST OF PROJECT		-	\$230,000	COMPREHENSIVE B/C RATIO		-	4.66	

## TREATMENT SITE PHOTOS



Looking South on SR 1301(Purfoy Road)



Looking East on SR 3736 (Old Honeycutt Road)



Looking North on SR 1301 (Purfoy Road)

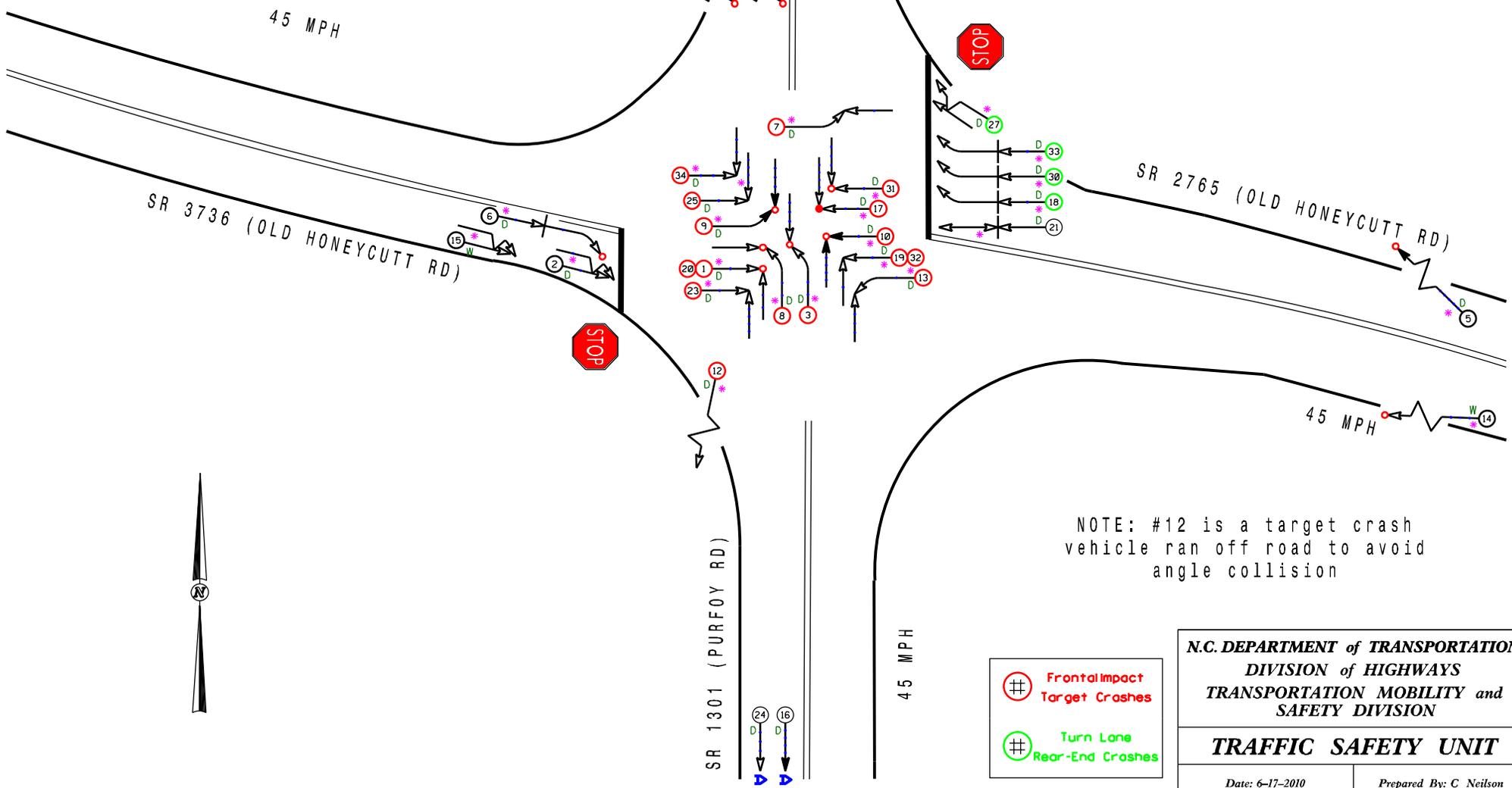


Looking West on SR 2765 (Old Honeycutt Road)

SS# 05-02-211  
 Order# 41000006698  
 Wake County  
 BEFORE Period  
 5/1/01 - 9/30/05

**LEGEND**

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



NOTE: #12 is a target crash vehicle ran off road to avoid angle collision

- Frontal Impact Target Crashes
- Turn Lane Rear-End Crashes

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

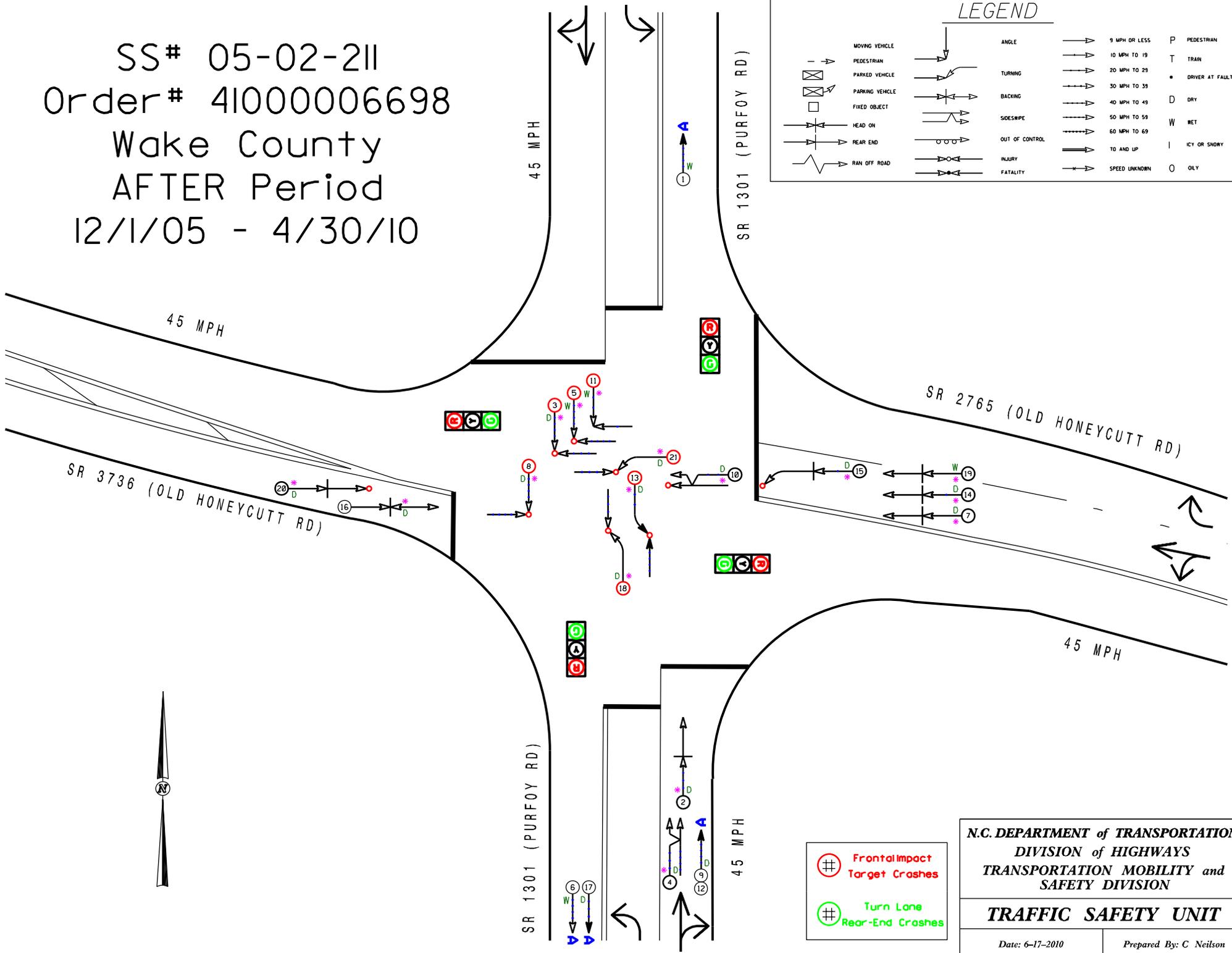
**TRAFFIC SAFETY UNIT**

Date: 6-17-2010      Prepared By: C Neilson

SS# 05-02-211  
 Order# 41000006698  
 Wake County  
 AFTER Period  
 12/1/05 - 4/30/10

**LEGEND**

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



Frontal Impact  
 Target Crashes

Turn Lane  
 Rear-End Crashes

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**TRAFFIC SAFETY UNIT**

Date: 6-17-2010 Prepared By: C Neilson