

# Spot Safety Project Evaluation

Project Log # 200901026

Spot Safety Project # 08-00-221

**Spot Safety Project Evaluation of the Signal Installation  
NC 211 (Raeford Rd) and SR 2075 / SR 2077  
Moore County, City of Southern Pines**

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

5-27-2009

Date

Traffic Safety Project Engineer

# *Spot Safety Project Evaluation Documentation*

## **Subject Location**

Evaluation of Spot Safety Project Number 08-00-211 located at the Intersections of NC 211 and SR 2075 (Indiana Avenue Extension) and SR 2077 (Carolina Avenue) in Moore County.

The Sig ID is 08-0470 for this new installed signal system.



## Project Information and Background from the Project File Folder

The spot safety project improvement countermeasure chosen for the subject location was the installation of dual coordinated traffic signals. NC 211 (Raeford Road) is a three-lane roadway segment with dedicated left turn lanes at both intersections and a speed limit of 45 mph. SR 2075 (Indiana Ave Extension) and SR 2077 (Carolina Avenue) are both two-lane facilities at the subject location with speed limits of 45 mph and 35 mph respectfully. The subject location is comprised of two offset three-leg intersections approximately 0.2 mile apart with the before period stop condition on SR 2075 and SR 2077. The tractor-trailer truck entrance for Kolcraft Industries makes up the fourth leg of the SR 2075 intersection. Two gas stations and Crestline Fire Department are also located within the study limits of this evaluation.

The original statement of problem was the occurrence of left turn type collisions as vehicles attempted to enter NC 211 from the side streets. The intended purpose of the new traffic signals is to alleviate the current accident patterns. This location met signal warrants 1, 2, 8, 9, and 11.

The initial crash analysis was completed from April 30, 1997 to April 30, 2000 with seven (7) reported crashes, five (5) of which were deemed correctable. The final completion date for the improvement at the subject intersection was on March 10, 2003 with a total cost of \$75,000.00.

## 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 the months of February through March 2003. The before period consisted of reported crashes from May 1, 1997 through January 31, 2003 (5 years and 9 months); and the after period consisted of reported crashes from April 1, 2003 through December 31, 2008 (5 years and 9 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 the segment on NC 211 from MP 0.211 to 0.468 and 150 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 Frontal Impact Crashes were the target crashes for the applied countermeasure. 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; and Angle.

<b>Treatment Information</b>	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-) Percent Increase (+)</b>
Total crashes	16	17	6.3 %
Total Severity Index	8.05	5.35	- 33.5 %
Target Crashes	10	0	- 100.0 %
Target Crash Severity Index	10.80	0.00	- 100.0 %
Volume	13,900	15,200	9.4 %

<u>Injury Crash Summary</u>	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-) Percent Increase (+)</b>
Fatal injury Crashes	0	0	N/A
Class A injury Crashes	1	0	- 100.0 %
Class B injury Crashes	0	2	100.0+ %
Class C Injury Crashes	5	8	60.0 %
Total Injury Crashes	6	10	66.7 %

The naive before and after analysis at the treatment location resulted in a 6 percent increase in Total Crashes, complete elimination of Target Crashes, and a 33.5 percent decrease in the Total Severity Index. The before period ADT year was 2000 and the after period ADT year was 2006.

## **Results and Discussion**

The naive before and after analysis involving the comparison of treatment actual before data versus treatment actual after data resulted in a 6 percent increase in Total Crashes and a complete elimination of Target Crashes. The summary results above demonstrate that both Target Crashes and the overall severity index appear to have decreased at the treatment location from the before to the after period.

Referencing the *Collision Diagrams*, the before period indicates defined frontal impact crash patterns at both intersections involving left turning vehicles from the side street approaches. After the signal installations, these patterns disappear. However, the segment location does experience a slight increase in overall collisions. This increase is in the form of rear-end collisions which more than tripled from three (3) in the before period to eleven (11) after the signal was installed. Due to the elimination of severe injury collisions in the after period, this evaluation still indicates a positive benefit-cost ratio.

The calculated benefit to cost ratio for this project is **4.32 considering total crashes**. The benefit to cost ratio **considering only target crashes is 5.91**. 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 for all approaches to the treatment location. 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 TAKEN 4/15/2009**



Traveling Southeast on NC 211 (Raeford Road) – Approaching SR 2075



Traveling Southeast on NC 211 – Between Signals



Traveling Southeast on NC 211 – At SR 2077 Intersection



Traveling Northwest on NC 211 (Raeford Rd) – Approaching SR 2077



Traveling Northwest on NC 211– At SR 2077 Signal



Traveling Northwest on NC 211 – Between Signals, Approaching SR 2075



Traveling North on SR 2077 (Carolina Ave)



Traveling North on SR 2077 (Carolina Ave)



Traveling South on SR 2075 (Indiana Avenue Extension)



Traveling South on SR 2075 (Indiana Avenue Extension)  
Kolcraft Industries located across NC 211

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

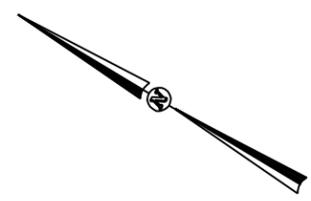
LOCATION: NC 211 at SR 2075		BY: JBS						
COUNTY: Moore		DATE: 5/26/2009						
FILE NO.: SS 08-00-221		NOTES: Total Crashes						
DETAILED COST:	TYPE IMPROVEMENT - 2 New Signals							
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$75,000	10	0.149	\$11,177			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$75,000	10	0.149	\$11,177			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$4,000			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$1,800			
	TOTAL ANNUAL COST=				\$16,977			
	TOTAL COST OF PROJECT=				\$75,000			
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	5.75	1	0.17	5	0.87	10	1.74	\$109,391
AFTER	5.75	0	0.00	10	1.74	7	1.22	\$36,052
						Annual Benefits from Crash Cost Savings		\$73,339
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$56,362		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	4.32		
TOTAL COST OF PROJECT		-	\$75,000	COMPREHENSIVE B/C RATIO		-	4.32	

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

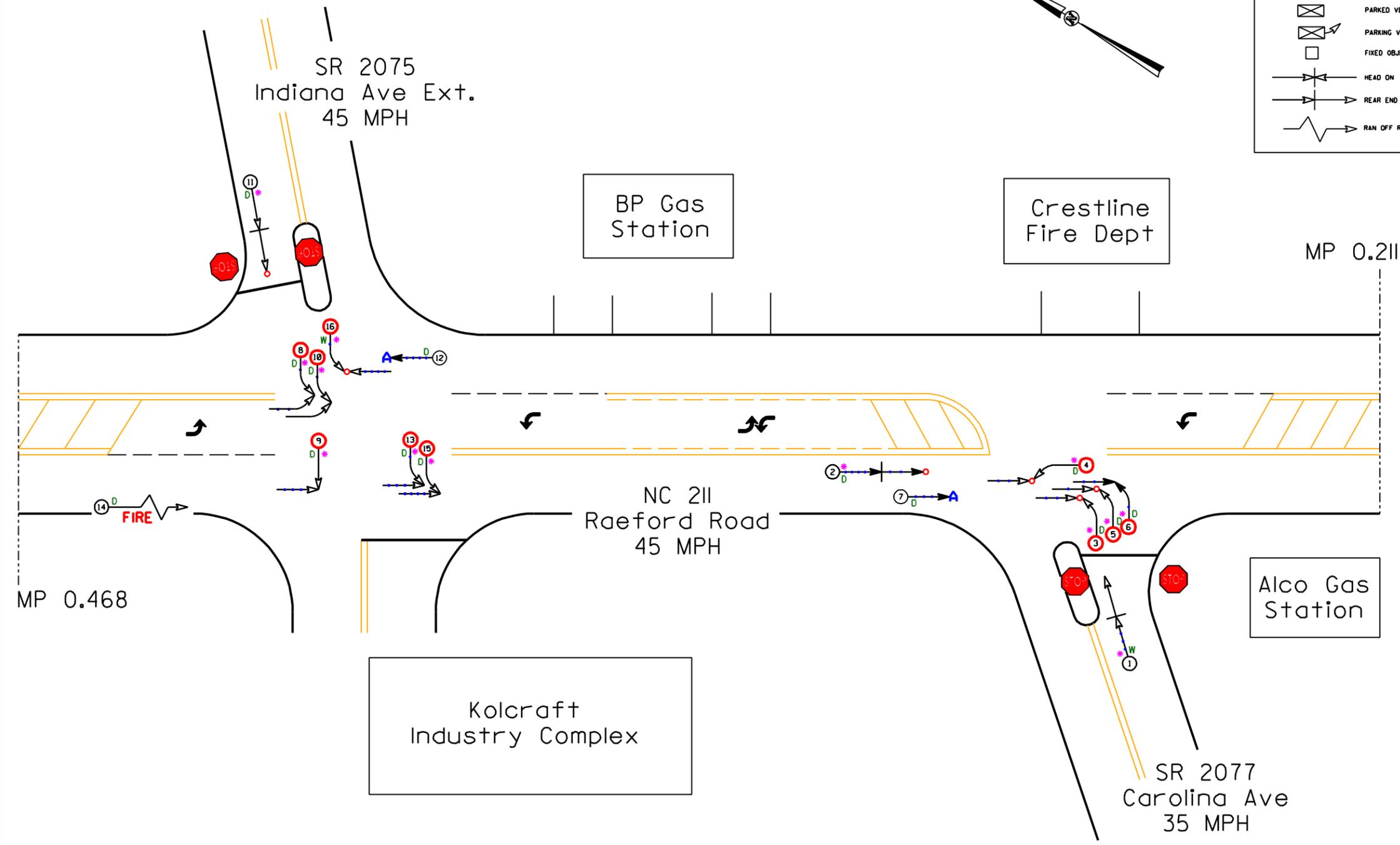
LOCATION: NC 211 at SR 2075		BY: JBS						
COUNTY: Moore		DATE: 5/26/2009						
FILE NO.: SS 08-00-221		NOTES: Target Crashes - Frontal Impact						
DETAILED COST:	TYPE IMPROVEMENT - 2 New Signals							
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$75,000	10	0.149	\$11,177			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$75,000	10	0.149	\$11,177			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$4,000			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$1,800			
	TOTAL ANNUAL COST=				\$16,977			
	TOTAL COST OF PROJECT=				\$75,000			
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	5.75	1	0.17	3	0.52	6	1.04	\$100,417
AFTER	5.75	0	0.00	0	0.00	0	0.00	\$0
						Annual Benefits from Crash Cost Savings		\$100,417
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$83,440		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	5.91		
TOTAL COST OF PROJECT		-	\$75,000	COMPREHENSIVE B/C RATIO		-	5.91	

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		OILY
	RAN OFF ROAD		SPEED UNKNOWN		70 AND UP		



SS# 08-00-221  
 Moore County  
 BEFORE Period  
 5/1/97 - 1/31/03



Frontal Impact  
 Target Crashes

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

	COLLISION DIAGRAM	
	DIVISION: 8	AREA:
	STUDY PERIOD: 5/1/1997 - 1/31/2003	
	DISTANCE: Y-LINE = 150 FT	
ANALYSIS PREPARED BY: JBS		
ANALYSIS CHECKED BY: BR		
DIAGRAM PREPARED BY: JBS		
DIAGRAM REVIEWED BY: ST		
SCALE: NOT TO SCALE		
DATE: 5-26-2009		
LOG NUMBER: SS* 08-00-221 BEFORE		

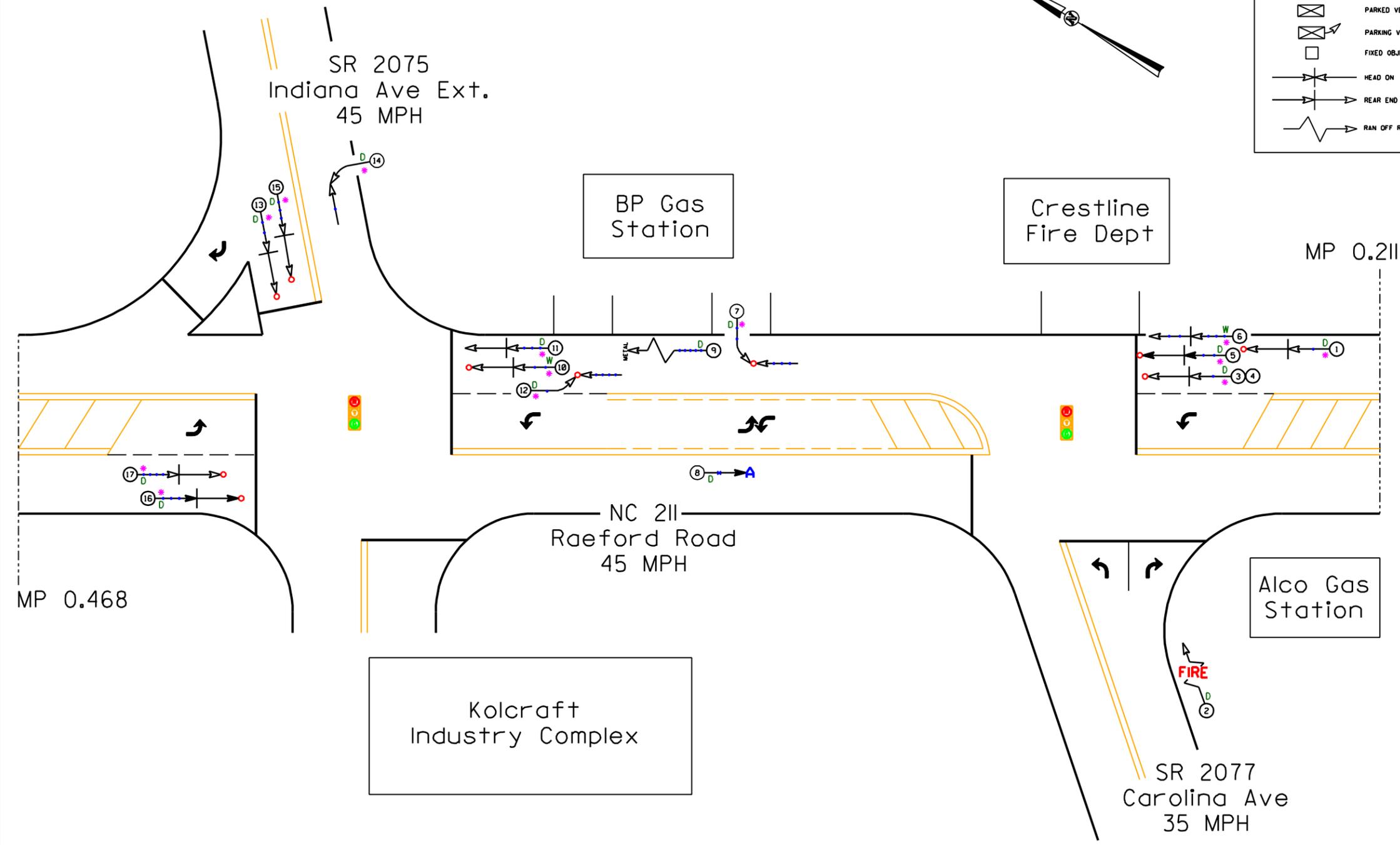
**N.C. DEPARTMENT of TRANSPORTATION**  
**DIVISION of HIGHWAYS**  
**TRANSPORTATION MOBILITY and**  
**SAFETY DIVISION**

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		OILY
	RAN OFF ROAD		70 AND UP		SPEED UNKNOWN		

SS# 08-00-221  
 Moore County  
 AFTER Period  
 4/1/03 - 12/31/08

New Signalized Intersections  
 Sig ID 088-0470



Frontal Impact Target Crashes

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

	COLLISION DIAGRAM	
	DIVISION: B	AREA:
	STUDY PERIOD: 4/1/2003 - 12/31/2008	
	DISTANCE: Y-LINE : 150FT	
ANALYSIS PREPARED BY: JBS		
ANALYSIS CHECKED BY: BR		
DIAGRAM PREPARED BY: JBS		
DIAGRAM REVIEWED BY: ST		
SCALE: NOT TO SCALE		
DATE: 5-26-2009		
LOG NUMBER: SS* 08-00-221AFTER		

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