

# Spot Safety Project Evaluation

Order # 41000004645

Spot Safety Project # 08-94-202

## Spot Safety Project Evaluation of the Signal Installation and Lane Upgrades SR 1004 (Trinity Road) at SR 1577 (Archdale Road) Randolph 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

3-19-2010

Date

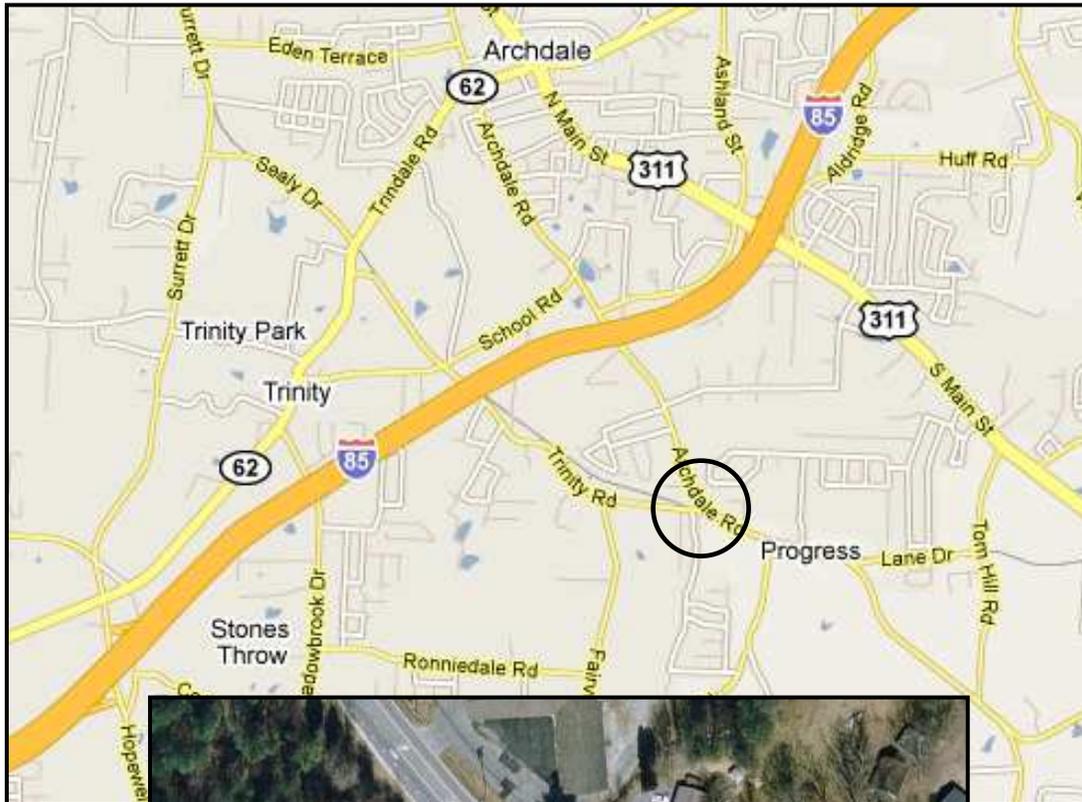
Traffic Safety Project Engineer

# *Spot Safety Project Evaluation Documentation*

## **Subject Location**

Evaluation of Spot Safety Project Number 08-94-202 located at the Intersection of SR 1004 (Trinity Road) and SR 1577 (Archdale Road) in Randolph County, City of Archdale.

The Sig ID is 08-0378 for this newly installed traffic signal.



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

The spot safety project improvement countermeasure chosen for the subject location was the installation of an intersection traffic signal, widening SR 1004 to add an eastbound left turn lane, and widening southbound SR 1577 for a right turn lane. SR 1004 and SR 1577 (Archdale Road) were both two-lane facilities at the subject intersection in the before period with a northbound left turn lane and speed limits of 45 mph on all approaches. The subject location is a three-leg skewed intersection, which was controlled by a stop sign on SR 1004 in the before period.

Additionally, a Carolina and Northwestern Railroad at-grade crossing exists approximately 300 feet to the west of the intersection on SR 1004 (Trinity Road). Also, SR 1577 (Archdale Road) was converted to a three-lane cross section approximately the same time as these intersection improvements which lay outside our Spot Safety study limits.

The original statement of problem was the occurrence of left turn and rear-end type collisions at the intersection. The intended purpose of the intersection improvements was to alleviate crashes. The project was originally proposed in 1994 as a candidate W-project due to the cost of adding railroad gates. Since, a TIP project provided these gates at the crossing; the project was redesigned as the existing Spot Safety Project (SS# 08-94-202) under evaluation.

The initial crash analysis was completed from August 1, 1989 to July 31, 1998 with nineteen (19) reported crashes, eight (8) of which were deemed correctable. The final completion date for the improvement at the subject intersection was on February 3, 2004 with a total cost of \$180,000. However, of the total cost amount, \$140,000 was provided with Spot Safety Funding and the remaining \$40,000 from Small Urban 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 was the months of January through February 2004. The before period consisted of reported crashes from March 1, 1998 through December 31, 2003 (5 years and 10 months); and the after period consisted of reported crashes from March 1, 2004 through December 31, 2009 (5 years and 10 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 and aerial maps 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 new Signal Installation and Eastbound SR 1004 Rear-end Collisions for the additional Eastbound Left Turn Lane Installation. 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.

<u>Treatment Information</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Total crashes	12	11	- 8.3 %
Total Severity Index	2.85	3.02	6.0 %
Frontal Impact Target Crashes – Signal	1	1	0.0 %
Signal Target Crash Severity Index	8.40	8.40	0.0 %
Rear-End Target Crashes – EB SR 1004	10	5	- 50.0 %
Rear-End Target Crash Severity Index	2.48	2.48	0.0 %
Volume	14,400	11,100	- 22.9 %

<u>Injury Crash Summary</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Fatal injury Crashes	0	0	N/A
Class A injury Crashes	0	0	N/A
Class B injury Crashes	0	0	N/A
Class C Injury Crashes	3	3	0.0 %
Total Injury Crashes	3	3	0.0 %

The naive before and after analysis at the treatment location resulted in an 8 percent decrease in Total Crashes, a 50 percent decrease in Combined Target Crashes, but a 6 percent increase in the Total Severity Index. The before period ADT year was 2001 and the after period ADT year was 2007.

## 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 8 percent decrease in Total Crashes and a 50 percent decrease in Combined Target Crashes. The summary results above demonstrate that both Total Crashes and Target Crashes appear to have decreased at the treatment location from the before to the after period.

Referencing the *Collision Diagrams*, the before period eastbound rear-end crash pattern at the intersection consisted of ten (10) collisions and was the only defined crash pattern during this time. After the left turn lane installation, this pattern was reduced by half to five (5) crashes. All of these collisions were low-speed impacts at 10 mph or less and occurred in the thru-right lane where vehicles have the opportunity to turn right on red. From past evaluation experience, the rear-end crash pattern could be contributed to the skew angle in which motorists are looking left for gap clearance with the assumption that the driver in front as already made the right turn on red.

Frontal impact collisions at the intersection remained consistent at one (1) collision through the study and signal installation, both resulting in a C-class injury. The after period shows five (5) other collisions that do not present any defined repeated crash patterns. Also noteworthy, the ADT dropped by more than 20 percent through the analysis period.

The calculated benefit to cost ratio for this project is **0.02 considering total crashes**. The benefit to cost ratio **considering only target crashes is 0.19**. 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 intersection.

**TREATMENT SITE PHOTO**  
**Additional Close-up Aerial Photography**



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

LOCATION: SR 1004 at SR 1577		BY: JBS						
COUNTY: Randolph		DATE: 3/17/2010						
FILE NO.: SS 08-94-202		NOTES: Total Crashes						
DETAILED COST:	TYPE IMPROVEMENT - Signal & Turn Lanes							
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$180,000	10	0.149	\$26,825			
	Right-of-Way	\$0	0	0.000	\$0			
		\$0	0	0.000	\$0			
	TOTALS	\$180,000	10	0.149	\$26,825			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$3,000			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$900			
	TOTAL ANNUAL COST=				\$30,725			
	TOTAL COST OF PROJECT=				\$180,000			
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	5.84	0	0.00	3	0.51	9	1.54	\$15,257
AFTER	5.84	0	0.00	3	0.51	8	1.37	\$14,589
						Annual Benefits from Crash Cost Savings		\$668
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	(\$30,057)		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	0.02		
TOTAL COST OF PROJECT		-	\$180,000	COMPREHENSIVE B/C RATIO		-	0.02	

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

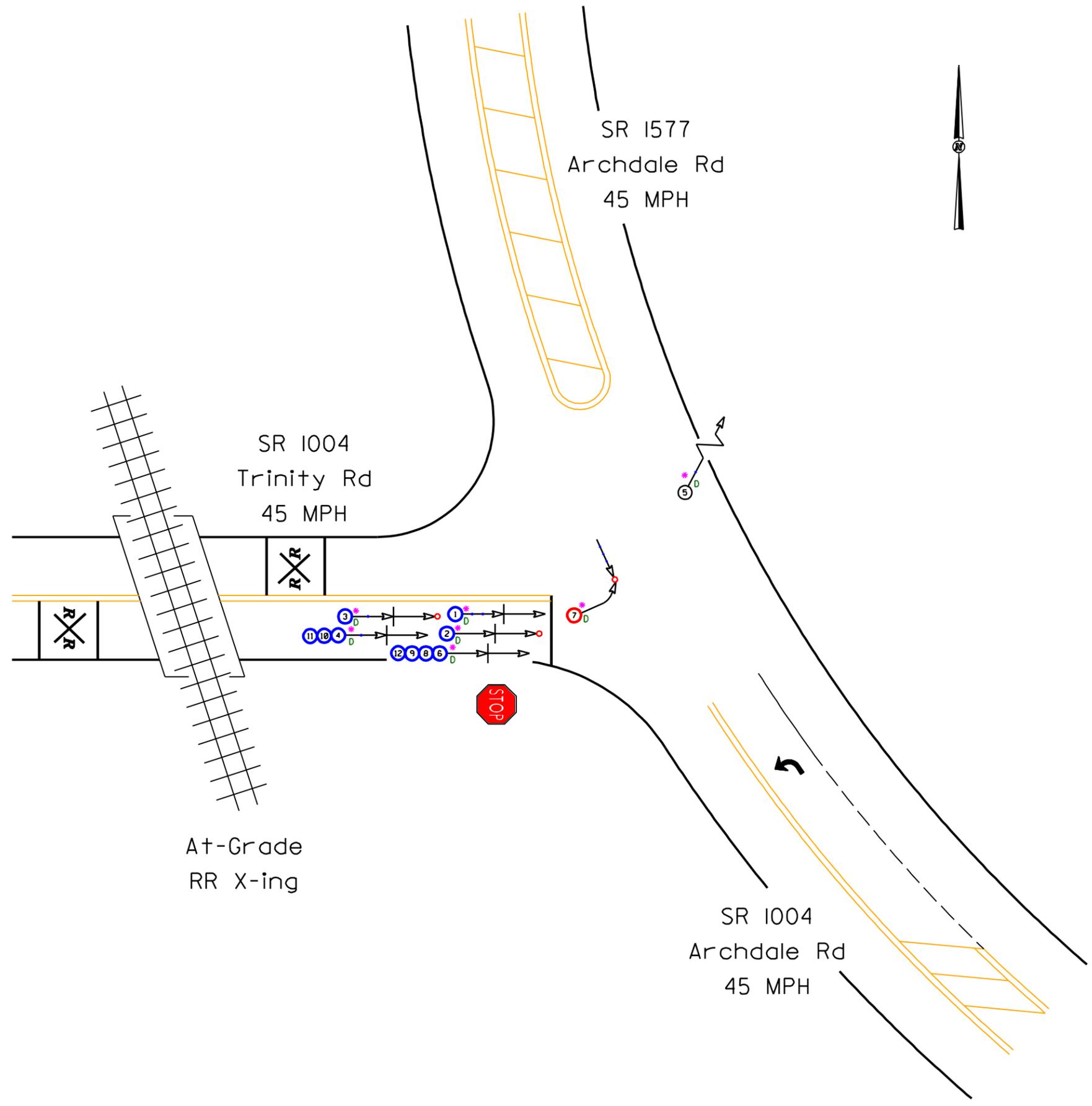
LOCATION: SR 1004 at SR 1577		BY: JBS						
COUNTY: Randolph		DATE: 3/17/2010						
FILE NO.: SS 08-94-202		NOTES: Target Crashes - Frontal & EB Rear-End						
DETAILED COST:	TYPE IMPROVEMENT - Signal & Turn Lanes							
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$180,000	10	0.149	\$26,825			
	Right-of-Way	\$0	0	0.000	\$0			
		\$0	0	0.000	\$0			
	TOTALS	\$180,000	10	0.149	\$26,825			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$3,000			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$900			
	TOTAL ANNUAL COST=				\$30,725			
	TOTAL COST OF PROJECT=				\$180,000			
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	5.84	0	0.00	3	0.51	8	1.37	\$14,589
AFTER	5.84	0	0.00	2	0.34	4	0.68	\$8,836
						Annual Benefits from Crash Cost Savings		\$5,753
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	(\$24,972)		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	0.19		
TOTAL COST OF PROJECT		-	\$180,000	COMPREHENSIVE B/C RATIO		-	0.19	

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# 08-94-202  
 Randolph County  
 City of Archdale  
 BEFORE Period  
 3/1/98 - 12/31/03



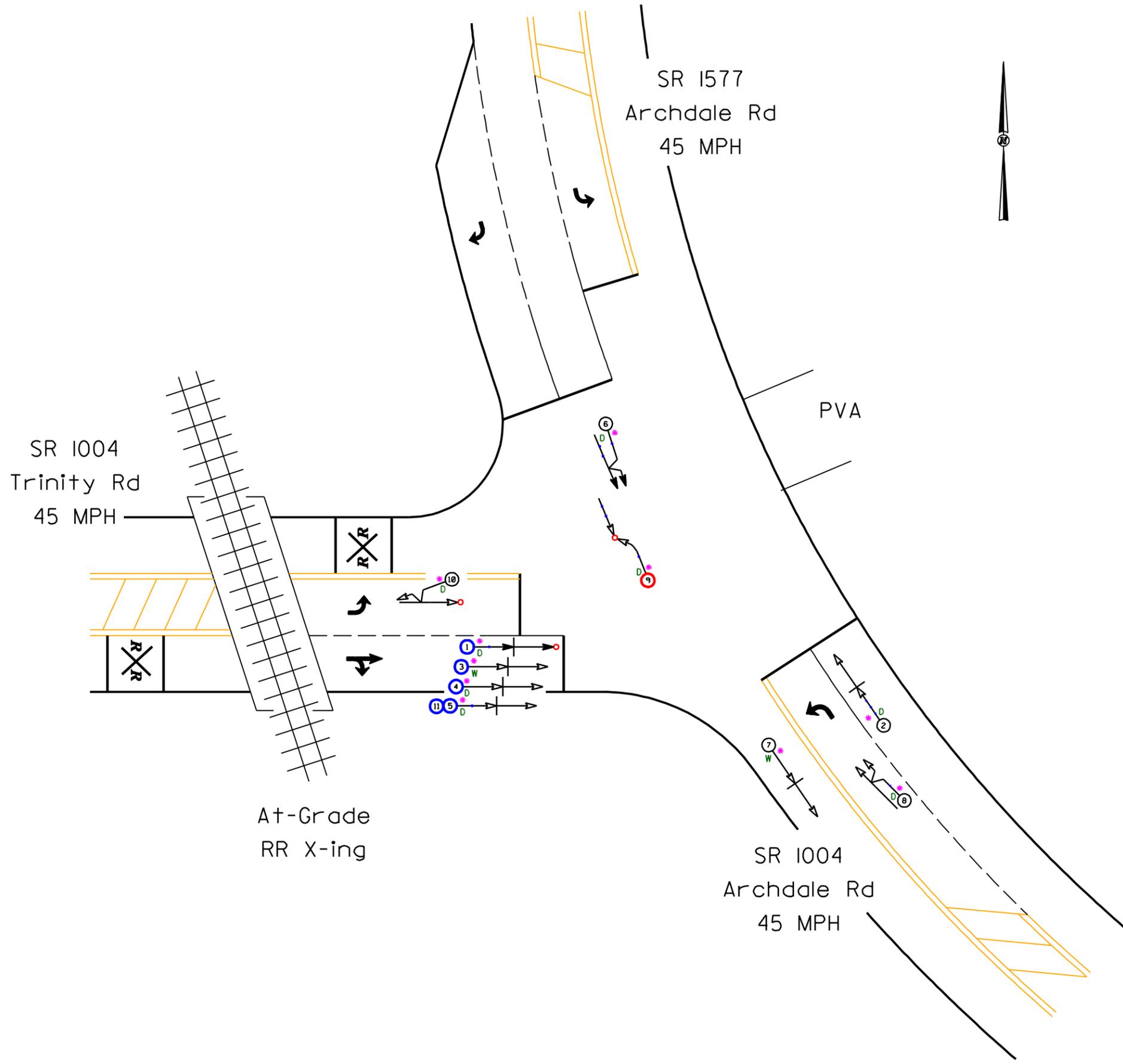
Signal Target  
Frontal Impact

Left Turn Target  
EB SR 1004 Rear-Ends

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

	COLLISION DIAGRAM	
	DIVISION: B	AREA:
	STUDY PERIOD: 3/1/1998 - 12/31/2003	
	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: 3-15-2010		
LOG NUMBER: SS* 08-94-202 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		SPEED UNKNOWN
	RAN OFF ROAD				70 AND UP		OILY

SS# 08-94-202  
 Randolph County  
 City of Archdale  
 AFTER Period  
 3/1/04 - 12/31/09

New Intersection  
 Traffic Signal  
 SIG ID 08-0378

Signal Target  
 Frontal Impact  
 Left Turn Target  
 EB SR 1004 Rear-Ends

**TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT**

	COLLISION DIAGRAM	
	DIVISION: B	AREA: A
	STUDY PERIOD: 3/1/2004 - 12/31/2009	
	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: 3-15-2010		
LOG NUMBER: SS# 08-94-202 AFTER		

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