Spot Safety Project Evaluation

Work Order #41000003672

Spot Safety Project # 04-01-235

Spot Safety Project Evaluation of the Traffic Signal Installation and Left Turn Lane Construction at the Intersection of SR 1003 (Buffalo) and SR 1929 (Oak) Johnston County

Documents Prepared By:

Safety Evaluation Group
Traffic Safety Systems Management Section
Transportation Mobility and Safety Division
North Carolina Department of Transportation

Principal Investigator

Brad Robinson

Brad Robinson, PE

2/8/2010
Date

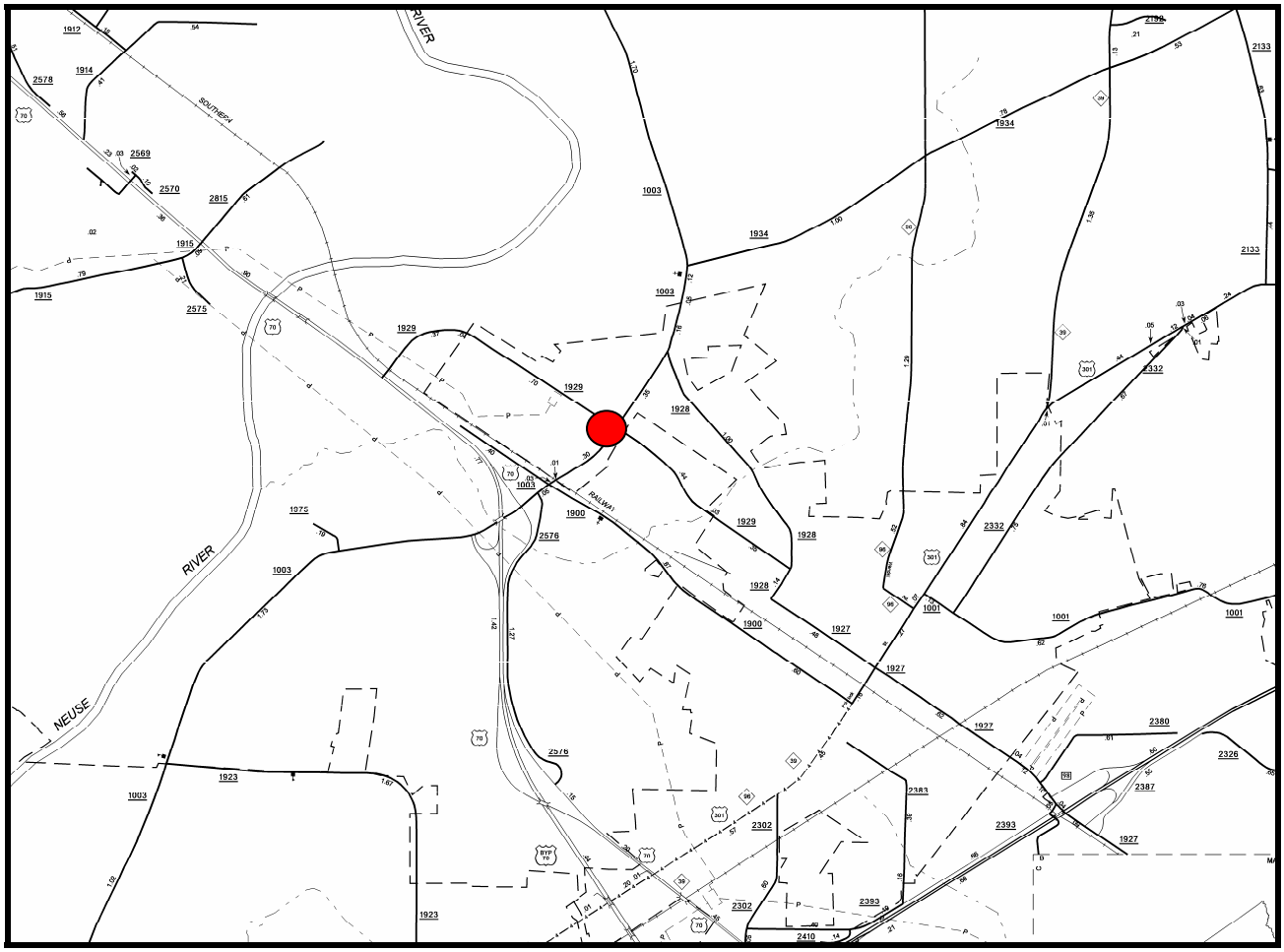
Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 04-01-235 – The Intersection of SR 1003 (Buffalo) and SR 1929 (Oak) in Johnston County.

The signal number for this location is 04-1265.



Project Information and Background from the Project File Folder

The spot safety project improvement countermeasures chosen for the subject location were to install a signal and to construct left turn lanes on all approaches to the intersection.

The subject location is a four-leg intersection which was under dual stop sign control on SR 1929 (Oak ST) in the before period. Prior to the project all approaches were single lane. The speed limit for all approaches is 45 mph.

The original statement of problem was that the intersection is in the heart of the Selma oil facility with fuel tankers passing through the intersection at all times of day. With the danger this posed, combined with the crash history, a signal was said to be needed.

The initial crash analysis was conducted from March 1, 1998 to February 28, 2001 with a total of 23 reported crashes, 13 of which were considered correctable by the chosen countermeasure. The final completion date for the improvements at the subject intersection was on May 18, 2004 with a total cost of $135,000.00.

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 from April 1, 2004 to June 30, 2004. The before period consisted of reported crashes from December 1, 1998 through March 31, 2004 (5 years and 4 months) and the after period consisted of reported crashes from July 1, 2004 through October 31, 2009 (5 years and 4 months). The ending date for this analysis was limited by the available crash data at the time the analysis was conducted.

The treatment data consisted of all reported crashes within 150 feet of the subject intersection. The following data table depicts the Naive Before and After Analysis for the treatment location. Please note that there were two Target Crash Types for the applied countermeasure. The first are Frontal Impact Crashes. These crash types are considered as follows: Left Turn, same roadway; Left Turn, different roadway; Right Turn, same roadway; Right Turn, different roadway; Head On and Angle. The second type of Target Crashes were Rear-End Crashes approaching the intersection. The target crashes are clearly identified in the before and after period collision diagrams.

Treatment Information			
	Before	**After**	**Percent Reduction (-) Percent Increase (+)**
Total Crashes	13	9	-30.8
Total Severity Index	3.85	11.89	208.8
Frontal Impact Crashes	8	4	-50.0
Frontal Impact Severity Index	3.77	23.65	527.3
Rear-End Target Crashes	4	2	-50.0
Rear-End Severity Index	2.85	1	-64.9
Volume	14,300	10,190	-28.7
Target Crash Severity Summary			
Fatal Crashes	0	0	N/A
Class A Crashes	0	1	N/A
Class B Crashes	2	1	-50.0
Class C Crashes	2	1	-50.0
PDO Crashes	8	3	-62.5

The naive before and after analysis at the treatment location resulted in a 31 percent decrease in Total Crashes, a 50 percent decrease in Frontal Impact Crashes, a 50 percent decrease in Target Crashes, and a 29 percent decrease in Average Daily Traffic (ADT). 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 31 percent decrease in Total Crashes and a 50 percent decrease in both Frontal Impact Crashes and Rear-End Target Crashes. The Total Severity Index increased by 209 percent, the Frontal Impact Severity Index increased by 527 percent, and the Rear-End Severity Index decreased by 65 percent. The summary results above demonstrate that both Total Crashes and Target Crashes appear to have decreased at the subject location from the before to the after period.

The calculated benefit to cost ratio for this project is -4.47 considering total crashes. The benefit to cost ratio considering only target crashes is also -4.41. 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.

The countermeasures appear to have been effective at reducing Target Crashes at the intersection. There are not any noticeable patterns of crashes in the after period. The reason for the large increase in the Total Severity Index, the Frontal Impact Severity Index, and the negative benefit to cost ratios is the single 'A' injury crash in the after period (crash #1). This crash was an Angle Crash and resulted from a northwest bound vehicle on SR 1929 running the signal.

Please see the attached *Treatment Site Photos*. Photos were obtained from Google Street-view. 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

LOCATION: SR 1003 at SR 1929 BY: bdr
COUNTY: Johnston DATE: 2/5/2010
FILE NO.: SS 04-01-235

DETAILED COST: TYPE IMPROVEMENT - Signal and left turn lanes

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	$0	0	0.000	$0
	$135,000	10	0.149	$20,119
Right-of-Way	$0	0	0.000	$0
TOTALS	$135,000	10	0.149	$20,119

ESTIMATED INCREASE IN ANNUAL MAINT. COST = $3,200
ESTIMATED INCREASE IN ANNUAL UTILITY COST = $900

TOTAL ANNUAL COST= $24,219
TOTAL COST OF PROJECT= $135,000

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	5.33	0	0.00	5	0.94	8	1.50	$25,066
AFTER	5.33	1	0.19	3	0.56	5	0.94	$133,396

Annual Benefits from Crash Cost Savings ($108,330)

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = ($132,549)

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = -4.47

TOTAL COST OF PROJECT - $135,000 COMPREHENSIVE B/C RATIO - -4.47

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: SR 1003 at SR 1929 BY: bdr
COUNTY: Johnston DATE: 2/5/2010
FILE NO.: SS 04-01-235 Target Crashes Only

DETAILED COST: TYPE IMPROVEMENT - Signal and left turn lanes

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	$0	0	0.000	$0
	$135,000	10	0.149	$20,119
Right-of-Way	$0	0	0.000	$0
TOTALS	$135,000	10	0.149	$20,119

ESTIMATED INCREASE IN ANNUAL MAINT. COST = $3,200
ESTIMATED INCREASE IN ANNUAL UTILITY COST = $900

TOTAL ANNUAL COST= $24,219
TOTAL COST OF PROJECT= $135,000

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	5.33	0	0.00	4	0.75	8	1.50	$21,313
AFTER	5.33	1	0.19	2	0.38	3	0.56	$128,068

Annual Benefits from Crash Cost Savings ($106,754)

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = ($130,973)

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = -4.41

TOTAL COST OF PROJECT - $135,000 COMPREHENSIVE B/C RATIO - -4.41

Treatment Site Photos from Google Street-View

Looking northwest on SR 1929 (Oak)

Looking Southeast on SR 1929 (Oak)

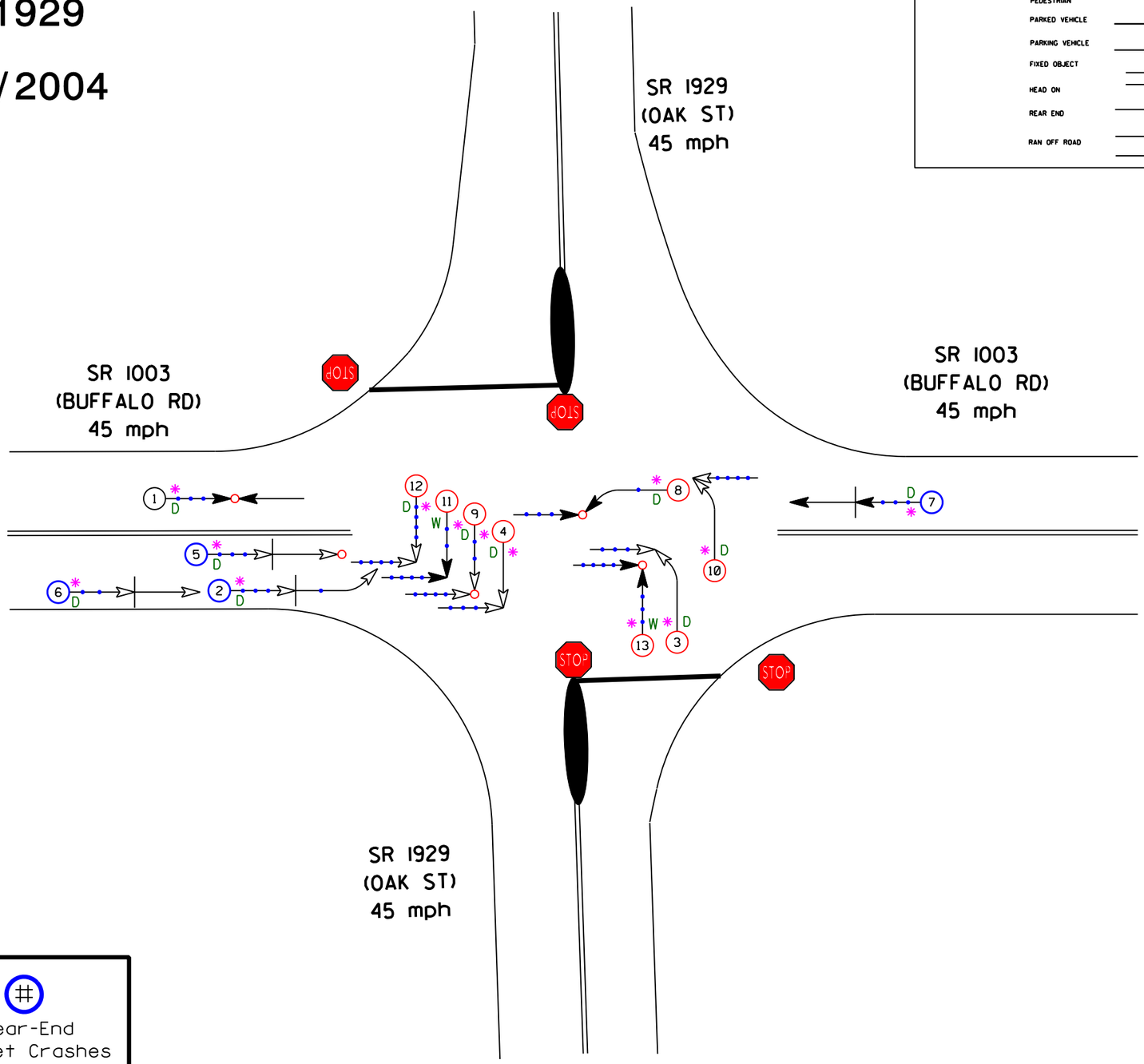
Looking northeast on SR 1003 (Buffalo Rd)

Looking southwest on SR 1003 (Buffalo Rd)

Johnston County
SR 1003 at SR 1929
BEFORE Period
12/1/1998-3/31/2004

LEGEND

MOVING VEHICLE	ANGLE	9 MPH OR LESS	P	PEDESTRIAN
PEDESTRIAN		10 MPH TO 19	T	TRAIN
PARKED VEHICLE	TURNING	20 MPH TO 29	•	DRIVER AT FAULT
PARKING VEHICLE		30 MPH TO 39		
FIXED OBJECT	BACKING	40 MPH TO 49	D	DRY
HEAD ON	SIDESWIPE	50 MPH TO 59	W	WET
REAR END	OUT OF CONTROL	60 MPH TO 69	I	ICY OR SNOWY
RAN OFF ROAD	INJURY	70 AND UP	O	OILY
	FATALITY	SPEED UNKNOWN		



Frontal Impact Target Crashes

Rear-End Target Crashes

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

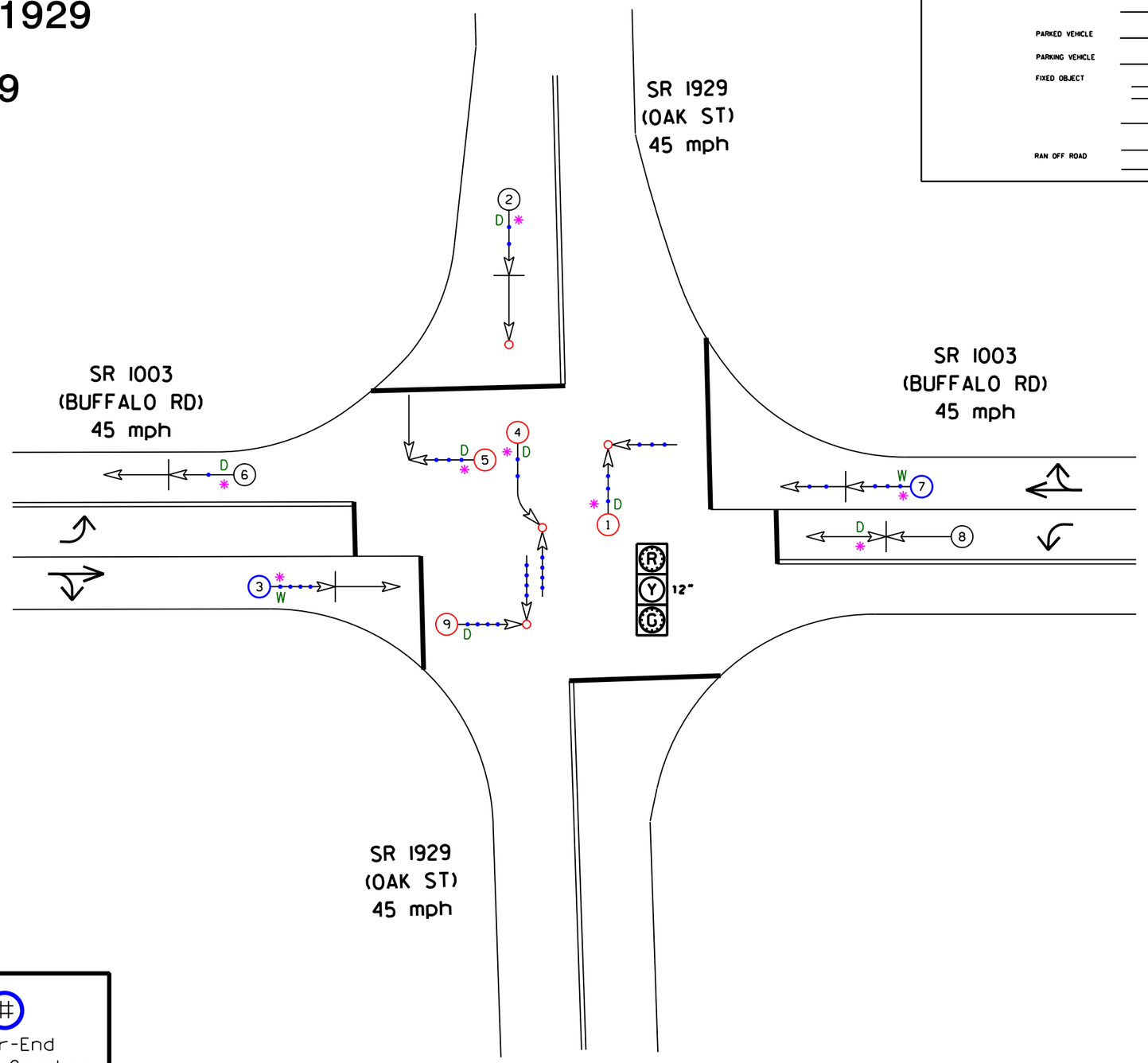
COLLISION DIAGRAM	
DIVISION: 4	AREA:
STUDY PERIOD: 12/1/98-3/31/04	
DISTANCE: Y-LINE = 150FT	
ANALYSIS PREPARED BY: BDR	
ANALYSIS CHECKED BY:	
DIAGRAM PREPARED BY: BDR	
DIAGRAM REVIEWED BY:	
SCALE: NOT TO SCALE	
DATE: December 2009	
ORDER NUMBER: 4100003672	

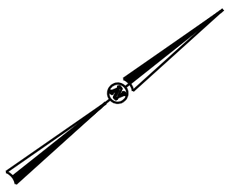
N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRANSPORTATION MOBILITY AND SAFETY DIVISION

Johnston County
SR 1003 at SR 1929
AFTER Period
7/1/04-10/31/09

LEGEND

MOVING VEHICLE	ANGLE	9 MPH OR LESS	P	PEDESTRIAN
PARKED VEHICLE	TURNING	10 MPH TO 19	T	TRAIN
PARKING VEHICLE	BACKING	20 MPH TO 29	*	DRIVER AT FAULT
FIXED OBJECT	SIDESWIPE	30 MPH TO 39	D	DRY
RAN OFF ROAD	OUT OF CONTROL	40 MPH TO 49	W	WET
	INJURY	50 MPH TO 59	I	ICY OR SNOWY
	FATALITY	60 MPH TO 69	O	OILY
		70 AND UP		
		SPEED UNKNOWN		





Frontal Impact Target Crashes

Rear-End Target Crashes

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

COLLISION DIAGRAM	
DIVISION: 4	AREA:
STUDY PERIOD: 7/1/04-10/31/09	
DISTANCE: Y-LINE = 150 FT	
ANALYSIS PREPARED BY: BDR	
ANALYSIS CHECKED BY:	
DIAGRAM PREPARED BY: BDR	
DIAGRAM REVIEWED BY:	
SCALE: NOT TO SCALE	
DATE: December 2009	
ORDER NUMBER: 4100003672	

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