

Spot Safety Project Evaluation

Project Log # 200907212

Spot Safety Project # 01-02-213

**Spot Safety Project Evaluation of the Traffic Signal Upgrade for Long Vehicle Detection at
the Intersection of US 17 and US 158 / SR 1416
Pasquotank 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, PE

8/26/2009

Date

Traffic Safety Project Engineer

Project Information and Background from the Project File Folder

The spot safety project improvement countermeasure chosen for the subject location was to upgrade the signal for long vehicle detection on both approaches of US 17.

The subject location is a four-leg intersection controlled by a signal in both the before and after periods. US 17 is a four-lane divided highway with left and right turn lanes at the intersection. US 158 has a left, a thru, and a right turn lane at the intersection. SR 1416 has a thru-right and a left turn lane.

The original statement of problem was that the lack of long vehicle detection on both approaches of US 17 was resulting in longer vehicles being caught in the dilemma zone with little opportunity to react.

The initial crash analysis was conducted from November 1, 1998 to October 31, 2001 with a total of 14 reported crashes, only one of which was considered correctable by the chosen countermeasure. The final completion date for the improvements at the subject intersection was on October 20, 2004 with a total cost of \$15,000.00.

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 September 1, 2004 to November 30, 2004. The before period consisted of reported crashes from March 1, 2000 through August 31, 2004 (4 years and 6 months) and the after period consisted of reported crashes from December 1, 2004 through May 31, 2009 (4 years and 6 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 Frontal Impact crash types involving trucks on US 17 (Vehicle styles 10-16 on crash reports) were the Target Crashes for the applied countermeasure. These crash types considered are as follows: Left Turn, same roadway; Left Turn, different roadway; Right Turn, same roadway; Right Turn, different roadway; Head On and Angle. The target crashes are clearly identified in the before and after period collision diagrams.

<u>Treatment Information</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	24	30	25.0
Total Severity Index	8.47	5.93	-30.0
Target Crashes	1	1	0.0
Target Crash Severity Index	76.80	8.40	-89.1
Volume	18,400	24,400	32.6

Crash Severity Summary			
Fatal Crashes	1	0	-100.0
Class A Crashes	0	0	N/A
Class B Crashes	3	5	66.7
Class C Crashes	11	15	36.4
PDO Crashes	9	10	11.1

The naive before and after analysis at the treatment location resulted in a 25 percent increase in Total Crashes, no change in Target Crashes, and a 33 percent increase in Average Daily Traffic (ADT). The before period ADT year was 2002 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 25 percent increase in Total Crashes and no change in Target Crashes. The Total Severity Index decreased by 30 percent and the Target Severity Index decreased by 89 percent. The summary results above demonstrate that while Total Crashes appear to have increased, Target Crashes have remained constant at the treatment location from the before to the after period.

The calculated benefit to cost ratio for this project is 48.13 considering total crashes. The benefit to cost ratio considering only target crashes is also 58.04. 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.

In the before period the single Target Crash (crash #7) resulted in a fatality. It was a Left Turn-Same Roadway Crash involving a southbound truck running a red signal and hitting a vehicle turning left onto US 158.

The single after period Target Crash (crash #29) was a Left Turn-Different Roadway Crash involving a truck traveling south on US 17 running the signal and hitting a left turning vehicle from US 158.

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: US 17 at US 158/SR 1416
 COUNTY: Pasquotank
 FILE NO.: SS 01-02-213

BY: BDR
 DATE: 8/18/2009

DETAILED COST: TYPE IMPROVEMENT - Shoulder Guardrail

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$0	0	0.000	\$0
	\$15,000	10	0.149	\$2,235
Right-of-Way	\$0	0	0.000	\$0
TOTALS	\$15,000	10	0.149	\$2,235

ESTIMATED INCREASE IN ANNUAL MAINT. COST =	\$100
ESTIMATED INCREASE IN ANNUAL UTILITY COST =	\$0
TOTAL ANNUAL COST=	\$2,335
TOTAL COST OF PROJECT=	\$15,000

COMPREHENSIVE COST REDUCTION:

TIME PERIOD	YEARS	ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES						ANNUAL COSTS
		K & A CRASHES	K & A CRASHES PER YR	B & C CRASHES	B & C CRASHES PER YR	PDO CRASHES	PDO CRASHES PER YR	
BEFORE	4.50	1	0.22	14	3.11	9	2.00	\$210,622
AFTER	4.50	0	0.00	20	4.44	10	2.22	\$98,222

Annual Benefits from Crash Cost Savings \$112,400

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = \$110,065

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 48.13

TOTAL COST OF PROJECT - \$15,000 COMPREHENSIVE B/C RATIO - 48.13

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: US 17 at US 158/SR 1416
 COUNTY: Pasquotank
 FILE NO.: SS 01-02-213 Target Crashes Only

BY: BDR
 DATE: 8/18/2009

DETAILED COST: TYPE IMPROVEMENT - Shoulder Guardrail

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$0	0	0.000	\$0
	\$15,000	10	0.149	\$2,235
Right-of-Way	\$0	0	0.000	\$0

TOTALS \$15,000 10 0.149 \$2,235

ESTIMATED INCREASE IN ANNUAL MAINT. COST = \$100
 ESTIMATED INCREASE IN ANNUAL UTILITY COST = \$0
 TOTAL ANNUAL COST= \$2,335
 TOTAL COST OF PROJECT= \$15,000

COMPREHENSIVE COST REDUCTION:

ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES

TIME PERIOD	YEARS	ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES				PDO		ANNUAL COSTS
		K & A CRASHES	K & A CRASHES PER YR	B & C CRASHES	B & C CRASHES PER YR	CRASHES	CRASHES PER YR	
BEFORE	4.50	1	0.22	0	0.00	0	0.00	\$140,000
AFTER	4.50	0	0.00	1	0.22	0	0.00	\$4,444

Annual Benefits from Crash Cost Savings \$135,556

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = \$133,220

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 58.04

TOTAL COST OF PROJECT - \$15,000 COMPREHENSIVE B/C RATIO - 58.04

Site Photos from Google Street-View



Looking North on US 17



Looking South on US 17



Looking East on US 158

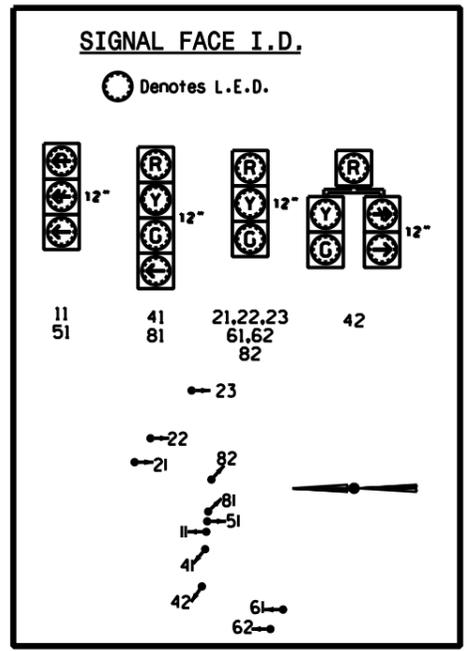
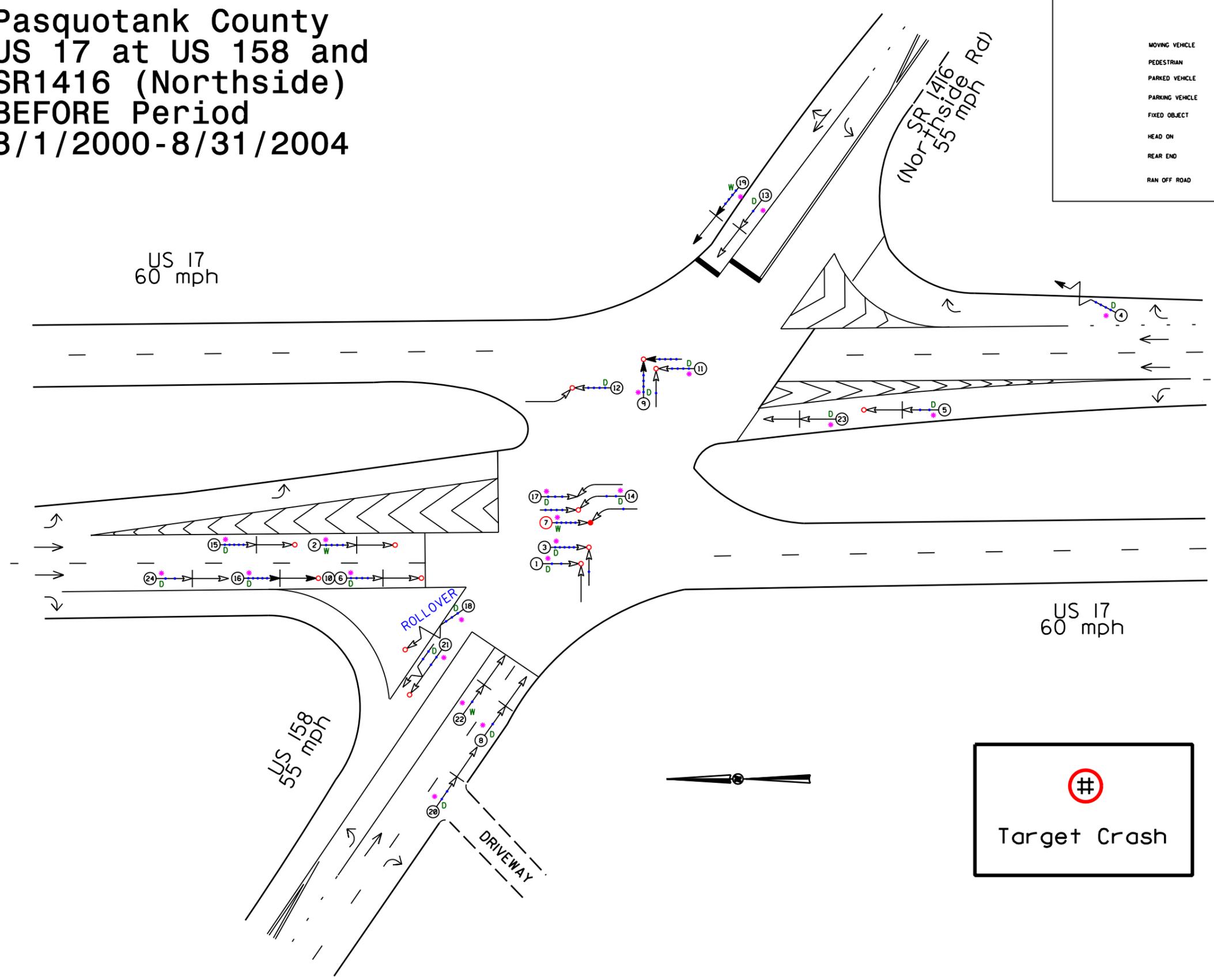


Looking East Toward SR 1416 From Intersection

Pasquotank County
 US 17 at US 158 and
 SR1416 (Northside)
 BEFORE Period
 3/1/2000-8/31/2004

LEGEND

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



Target Crash

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

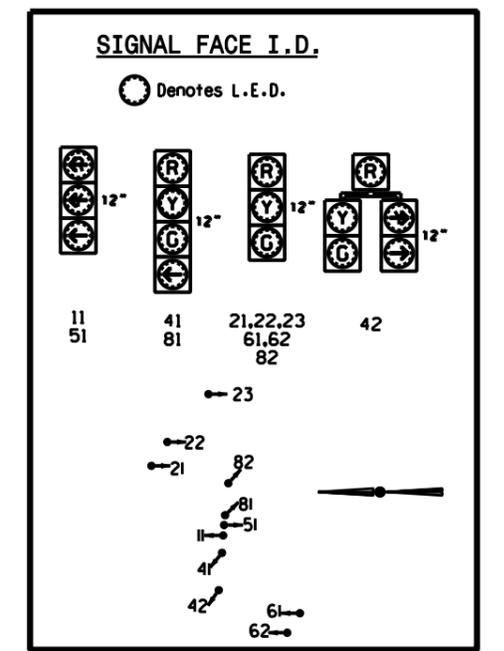
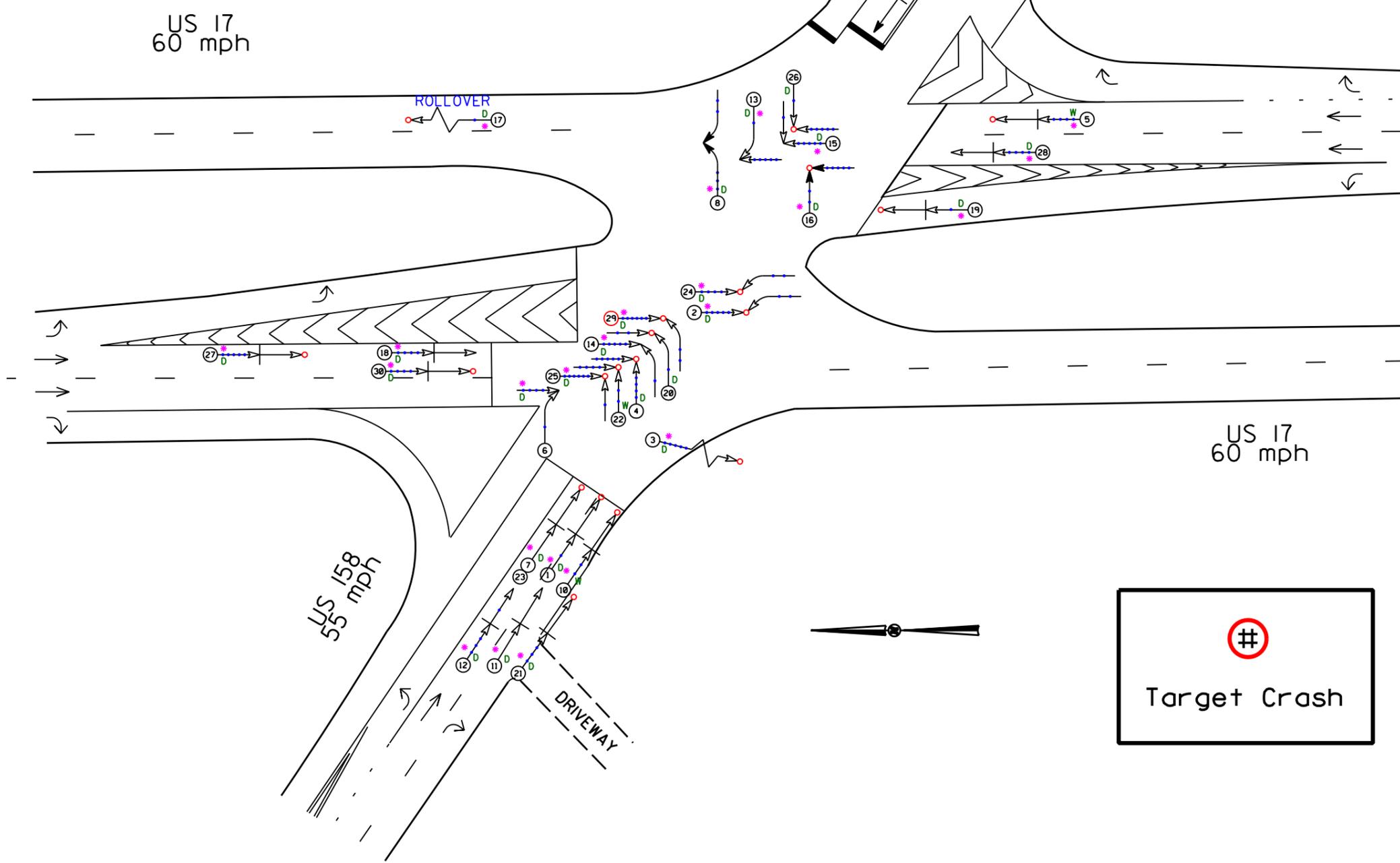
	COLLISION DIAGRAM	
	DIVISION: 1	AREA:
	STUDY PERIOD: 3/1/00-8/31/04	
	DISTANCE: Y-LINE + 150 FT	
	ANALYSIS PREPARED BY: BDR	
	ANALYSIS CHECKED BY:	
	DIAGRAM PREPARED BY: BDR	
	DIAGRAM REVIEWED BY:	
	SCALE: NOT TO SCALE	
	DATE: August 2009	
	LOG NUMBER: 20090722	

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

Pasquotank County
 US 17 at US 158 and
 SR1416 (Northside)
 AFTER Period
 12/1/2004-5/31/2009

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	ONLY
		70 AND UP		
		SPEED UNKNOWN		



TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

	COLLISION DIAGRAM	
	DIVISION: 1	AREA:
STUDY PERIOD: 12/1/04-5/31/09		
DISTANCE: Y-LINE = 150 FT		
ANALYSIS PREPARED BY: BDR		
ANALYSIS CHECKED BY:		
DIAGRAM PREPARED BY: BDR		
DIAGRAM REVIEWED BY:		
SCALE: NOT TO SCALE		
DATE: August 2009		
LOG NUMBER: 20090722		

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