

Spot Safety Project Evaluation

Order # 41000003595

Spot Safety Project # 04-01-212

Spot Safety Project Evaluation of the Lane Modification and Traffic Signal Revision at the Intersection of US 70 and US 301 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, PE

1/26/2010

Date

Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 04-01-212 – The Intersection of US 70 and US 301-NC 39/96.

The signal number for this location is 04-0213.



Project Information and Background from the Project File Folder

The spot safety project improvement countermeasures chosen for the subject location were to revise the existing eight phase signal to six phases with split side streets for US 70 and to revise the US 70 westbound lanes from one left turn lane and two through lanes to one through lane, one through-left lane, and one left turn lane.

The subject location is a four-leg intersection controlled by a signal in both the before and after periods. Both US 70 eastbound and US 301 southbound have one left turn lane, one through lane, and one through-right lane. US 301 northbound has two right turn lanes, two through lanes, and one left turn lane. The speed limit is 45 mph for all approaches.

The original statement of problem was that traffic patterns had shifted since the opening of US 70 Bypass in Selma. The US 70 westbound left turns would routinely back out of the protected left turn lane for hundreds of feet. The increased left turn phase time detracted from all other phases.

The initial crash analysis was conducted from November 1, 1997 to October 31, 2000 with a total of 16 reported crashes. The final completion date for the improvements at the subject intersection was on January 9, 2004 with a total cost of \$50,000.00.

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 December 1, 2003 to February 29, 2004. The before period consisted of reported crashes from April 1, 1998 through November 30, 2003 (5 years and 8 months) and the after period consisted of reported crashes from March 1, 2004 through October 31, 2009 (5 years and 8 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.

Treatment Information			
	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	33	75	127.3
Total Severity Index	2.35	3.98	69.4
Volume	34,500	37,000	7.2
Crash Severity Summary			
Fatal Crashes	0	0	N/A
Class A Crashes	0	1	N/A
Class B Crashes	1	5	400.0
Class C Crashes	5	15	200.0
PDO Crashes	27	54	100.0

The naive before and after analysis at the treatment location resulted in a 127 percent increase in Total Crashes and a 7 percent increase in Average Daily Traffic (ADT). The before period ADT year was 2001 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 127 percent increase in Total Crashes. The Total Severity Index increased by 7 percent.

The calculated benefit to cost ratio for this project is -24.22 considering total crashes. 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.

There was a pattern of crashes that developed in the after period that appears to have been a direct result of the project. Thirteen Sideswipe-Same Direction Crashes involving vehicles making left turns from US 70 westbound occurred either during the turning movement or immediately afterwards. In all but three of the crashes the driver turning from the inside lane (the exclusive left) were faulted.

Rear-End Crashes on US 301 approaching the intersection increased significantly from the before to the after periods. On the northbound US 301 approach Rear-End Crashes increased from 6 to 16, and on southbound US 301 approach they increased from 3 to 8.

Frontal Impact Crashes in the intersection also increased at the subject location. There were a total of 10 in the before period and 21 in the after period. The increase can be attributed to several small patterns that developed.

As shown in the *Project Background* section, the project appears to have been constructed more to improve traffic flow at the intersection than for any safety benefits. The naive before and after analysis does not take into account any operational improvements to the intersection.

In the signal files a plan dated September 2008 was found showing changes in the yellow and red clearance times. It is not known if this is how the signal is currently operating.

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 70 at US 301
 COUNTY: Johnston
 FILE NO.: SS 04-01-212

BY: BDR
 DATE: 1/21/2010

DETAILED COST: TYPE IMPROVEMENT - Signal and lane revision

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$0	0	0.000	\$0
	\$50,000	10	0.149	\$7,451
Right-of-Way	\$0	0	0.000	\$0
TOTALS	\$50,000	10	0.149	\$7,451

ESTIMATED INCREASE IN ANNUAL MAINT. COST =	\$0
ESTIMATED INCREASE IN ANNUAL UTILITY COST =	\$0
TOTAL ANNUAL COST=	\$7,451
TOTAL COST OF PROJECT=	\$50,000

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	5.67	0	0.00	6	1.06	27	4.76	\$41,164
AFTER	5.67	1	0.18	20	3.53	54	9.52	\$221,658

Annual Benefits from Crash Cost Savings (\$180,494)

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = (\$187,945)

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = -24.22

TOTAL COST OF PROJECT - \$50,000 COMPREHENSIVE B/C RATIO - -24.22

Site Photos from Google Street-View



Looking Northwest on US 70



Looking Southeast on US 70



Looking Northeast on US 301

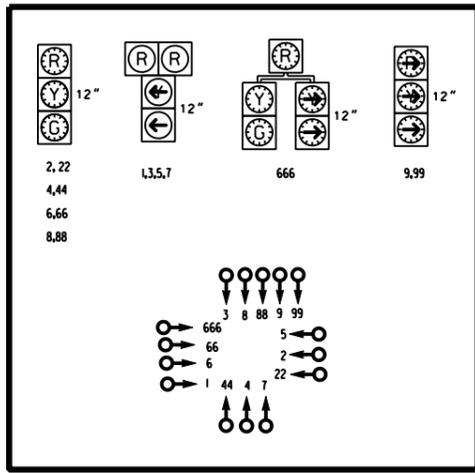
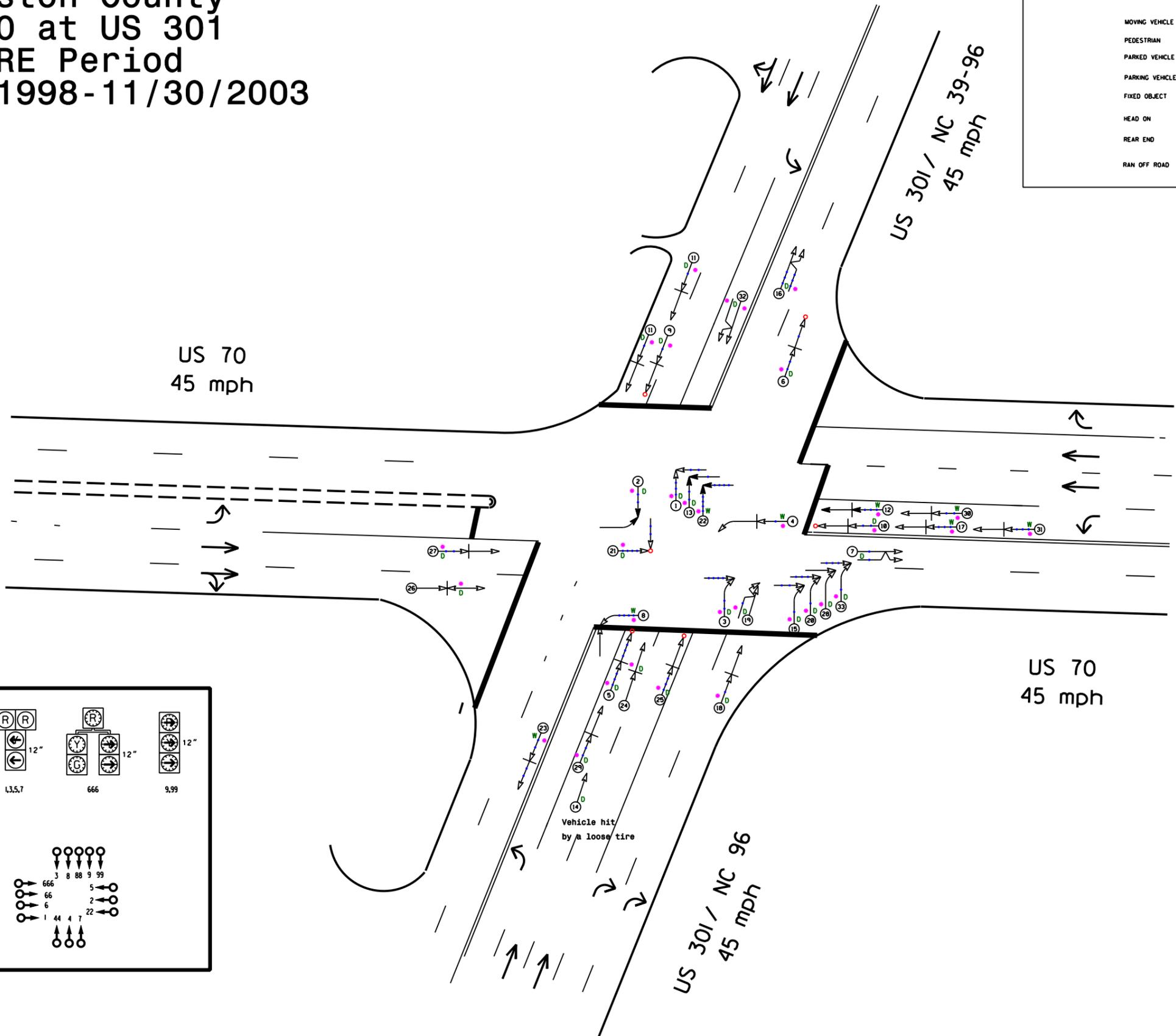


Looking Southwest on US 301

Johnston County
 US 70 at US 301
 BEFORE Period
 4/1/1998-11/30/2003

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	



TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

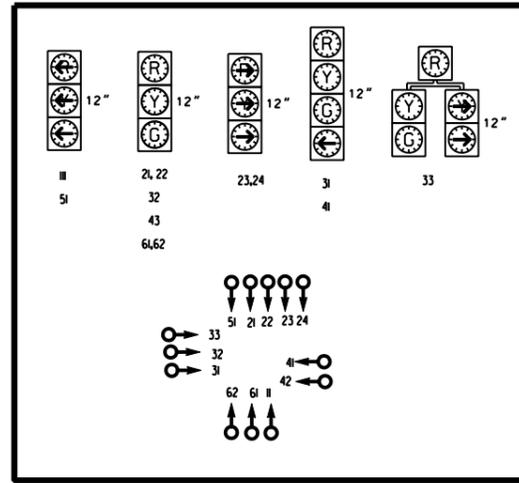
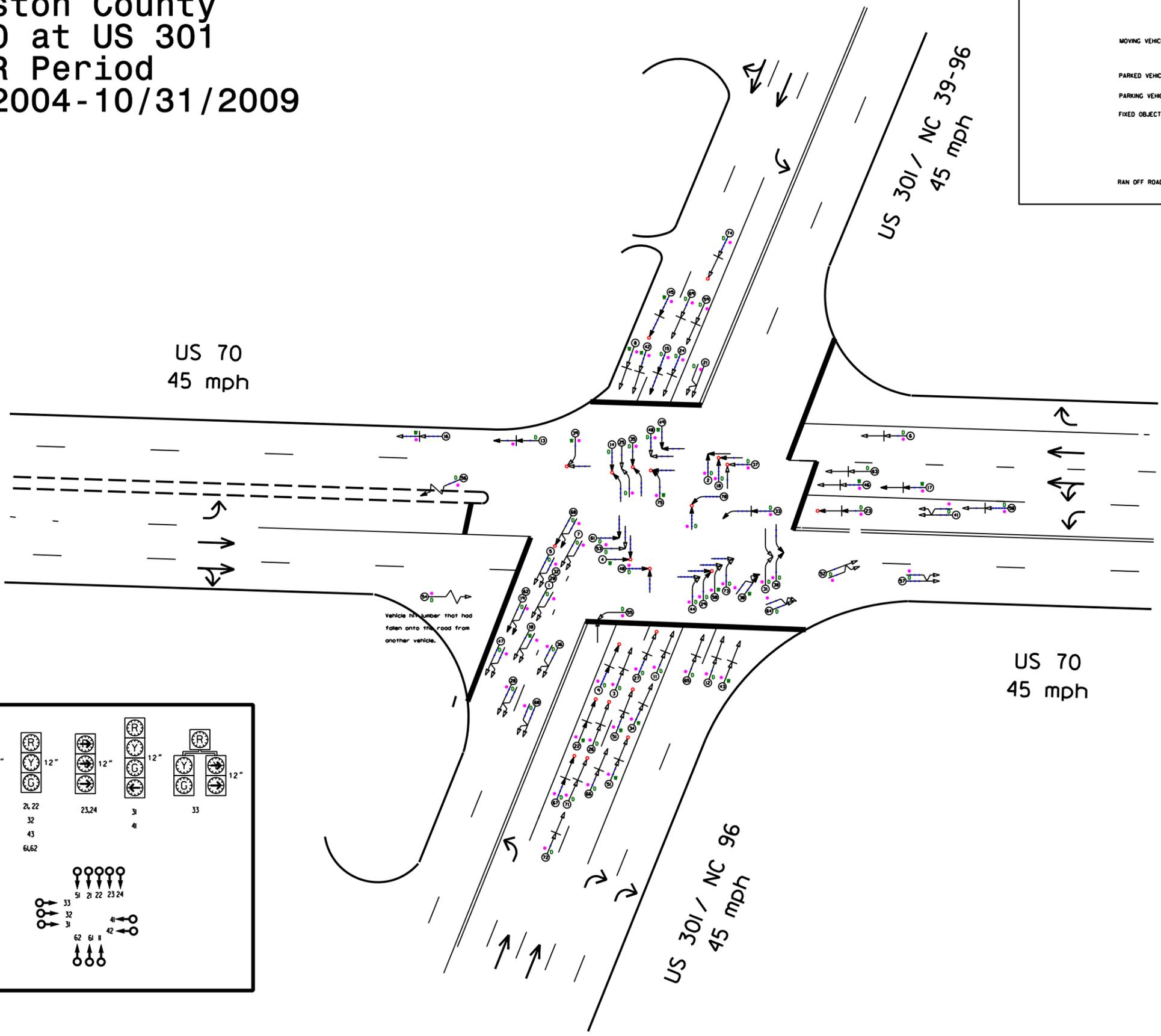
	COLLISION DIAGRAM	
	DIVISION: 4	AREA:
	STUDY PERIOD: 4/1/98-11/30/03	
	DISTANCE: Y-LINE + 150 FT	
	ANALYSIS PREPARED BY: BDR	
ANALYSIS CHECKED BY:		
DIAGRAM PREPARED BY: BDR		
DIAGRAM REVIEWED BY:		
SCALE: NOT TO SCALE		
DATE: January 2004		
LOG NUMBER: 4000003595		

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

Johnston County
 US 70 at US 301
 AFTER Period
 3/1/2004-10/31/2009

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: 4	AREA:
	STUDY PERIOD: 3/1/04-10/31/09	
	DISTANCE: Y-LINE = 150 FT	
	ANALYSIS PREPARED BY: BDR	
ANALYSIS CHECKED BY:		
DIAGRAM PREPARED BY: BDR		
DIAGRAM REVIEWED BY:		
SCALE: NOT TO SCALE		
DATE: January 2010		
LOG NUMBER: 4000003595		

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