

Hazard Elimination Project Evaluation

Order #41000022132

Hazard Elimination Project W-5012

**Evaluation of the Traffic Signal Installation and Left Turn Lane Construction
At the Intersection of NC 218 and NC 200
Union 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

1/4/2013

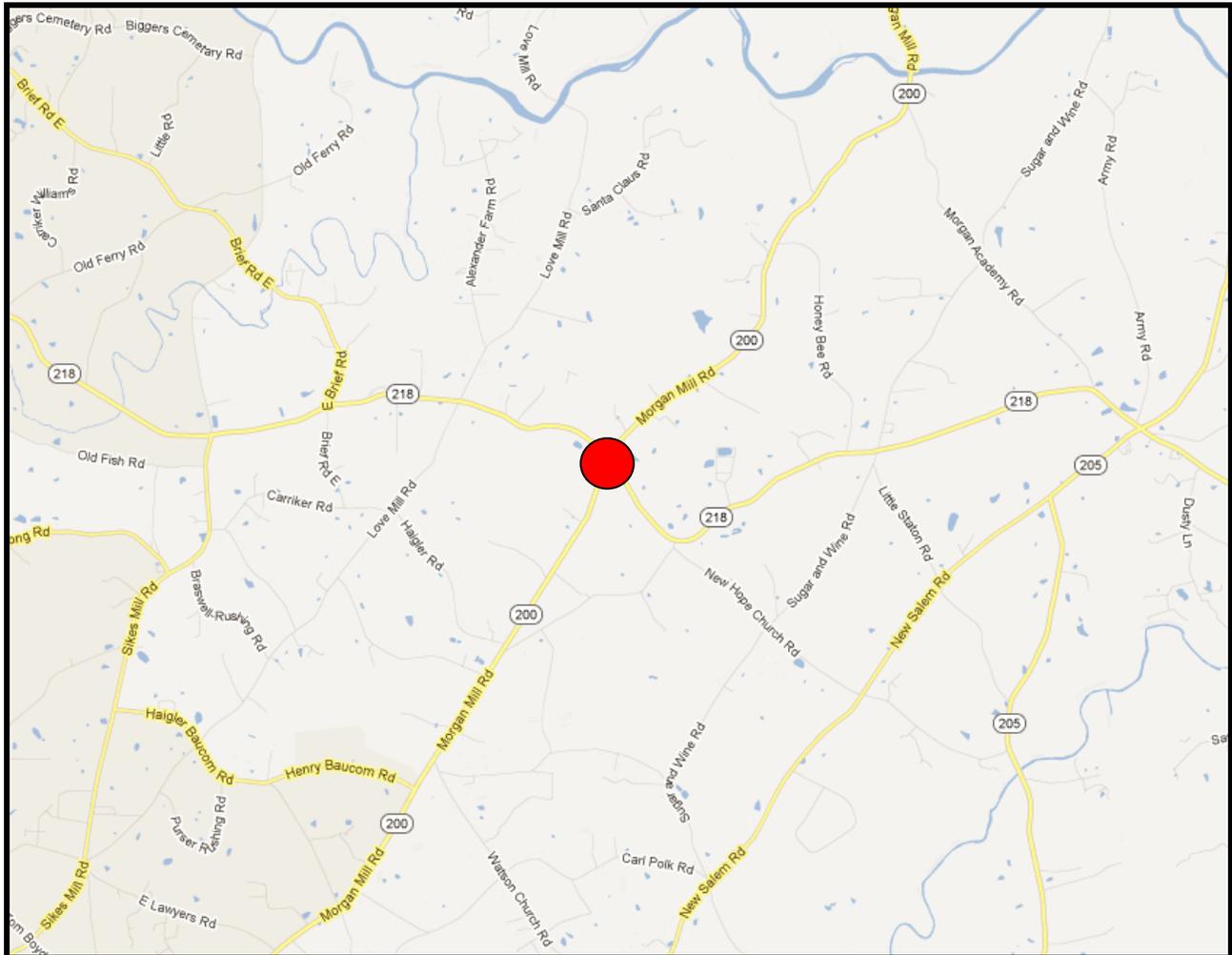
Date

Traffic Safety Project Engineer

Hazard Elimination Project Evaluation Documentation

Subject Location

The intersection of NC 200 and NC 218 in Union County. The signal number for this location is 10-1135.



Project Information and Background from the Project File Folder

The hazard elimination project improvement countermeasures chosen for the subject intersection were to construct left turn lanes on all four approaches and to replace the existing flasher with a new traffic signal.

NC 200 and NC 218 are both two-lane roadways with speed limits of 55 mph. In the before period the intersection was controlled by stop signs on NC 218 in addition to an overhead flasher.

The project was constructed due to the intersection having experienced a high number of angle crashes caused by traffic on NC 218 failing to properly yield to vehicles on NC 200. The final completion date for the improvements at the subject intersection was on July 31, 2009 with a total cost of \$950,000.

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, 2009 to August 31, 2009. The before period consisted of reported crashes from March 1, 2006 through March 31, 2009 (3 years and 1 month) and the after period consisted of reported crashes from September 1, 2009 through September 30, 2012 (3 years and 1 month). 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 Crashes were the Target Crashes for the applied countermeasure. These crash types are considered as follows: Left Turn, same roadway; Left Turn, different 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	30	5	-83.3
Total Severity Index	4.21	6.92	64.4
Target Crashes	27	3	-88.9
Target Severity Index	4.56	5.93	30.0
Volume	5,900	6,700	13.6
<u>Target Crash Severity Summary</u>			
Fatal Crashes	0	0	N/A
Class A Crashes	0	0	N/A
Class B Crashes	7	0	-100.0
Class C Crashes	6	2	-66.7
PDO Crashes	14	1	-92.9

The naive before and after analysis at the treatment location resulted in an 83 percent decrease in total crashes, an 89 percent decrease in target crashes, and a 14 percent increase in average daily traffic (ADT). The before period ADT year was 2007 and the after period ADT year was 2010.

Results and Discussion

Frontal impact crashes decreased at the intersection by 89 percent from the before to the after period. In the before period the majority of target crashes were angle crashes, 17 involving vehicles entering the intersection from westbound NC 218 and seven involving vehicles entering from eastbound NC 218. In the after period all three target crashes were angle crashes, one involving a vehicle on northbound NC 200 running the red signal. Due to conflicting statements the fault could not be determined for the other two.

The calculated benefit to cost ratio for this project is 0.55 considering total crashes. The benefit to cost ratio considering only target crashes is 0.61. 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*. 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 - TOTAL

LOCATION: NC 218 at NC 200		BY: bdr						
COUNTY: Union		DATE: 11/14/2012						
FILE NO.: W-5012								
DETAILED COST:	TYPE IMPROVEMENT -	Signal and 4 Left Turn Lanes						
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$0	0	0.000	\$0			
		\$950,000	10	0.149	\$141,578			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$950,000	10	0.149	\$141,578			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$3,600			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$900			
	TOTAL ANNUAL COST=				\$146,078			
	TOTAL COST OF PROJECT=				\$950,000			
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	3.08	0	0.00	13	4.22	17	5.52	\$108,149
AFTER	3.08	0	0.00	4	1.30	1	0.32	\$27,370
							Annual Benefits from Crash Cost Savings	\$80,779
	NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST				=	(\$65,299)		
	BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST				=	0.55		
	TOTAL COST OF PROJECT	-	\$950,000	COMPREHENSIVE B/C RATIO	-	0.55		

BENEFIT-COST ANALYSIS WORKSHEET - TARGET

LOCATION: NC 218 at NC 200		BY: bdr						
COUNTY: Union		DATE: 11/14/2012						
FILE NO.: W-5012								
DETAILED COST:	TYPE IMPROVEMENT -	Signal and 4 Left Turn Lanes						
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$0	0	0.000	\$0			
		\$950,000	10	0.149	\$141,578			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$950,000	10	0.149	\$141,578			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$3,600			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$900			
	TOTAL ANNUAL COST=				\$146,078			
	TOTAL COST OF PROJECT=				\$950,000			
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	3.08	0	0.00	13	4.22	14	4.55	\$103,961
AFTER	3.08	0	0.00	2	0.65	1	0.32	\$14,383
							Annual Benefits from Crash Cost Savings	\$89,578
	NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST				=	(\$56,500)		
	BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST				=	0.61		
	TOTAL COST OF PROJECT	-	\$950,000	COMPREHENSIVE B/C RATIO	-	0.61		

Treatment Site Photos from Google Street View



Looking northwest on NC 218



Looking southeast on NC 218



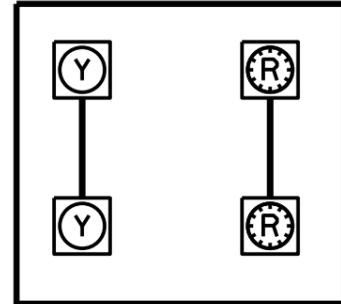
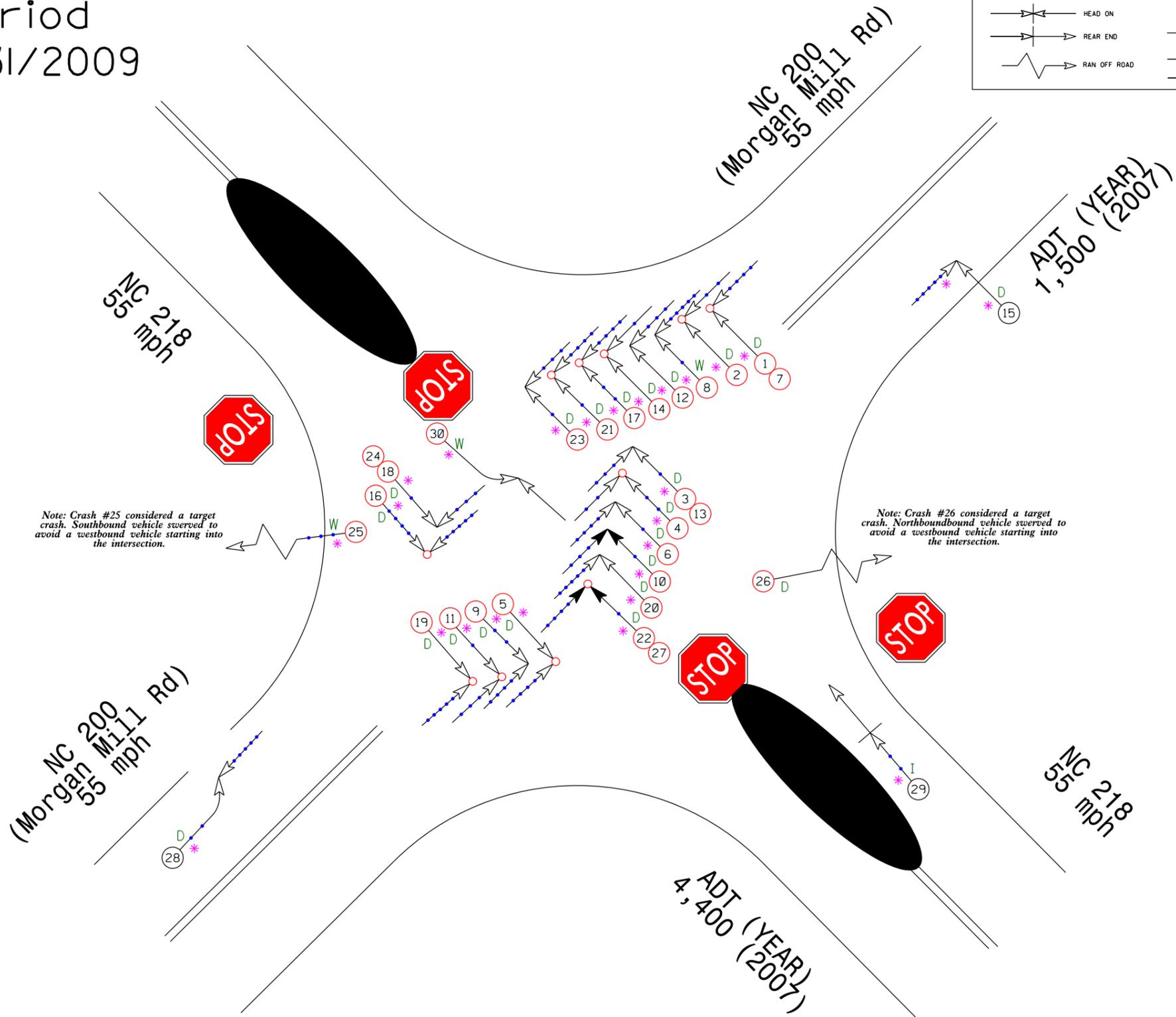
Looking northeast on NC 200



Looking southwest on NC 200 (This picture shows intersection prior to project)

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 Union County
 BEFORE Period
 3/1/2006-3/31/2009

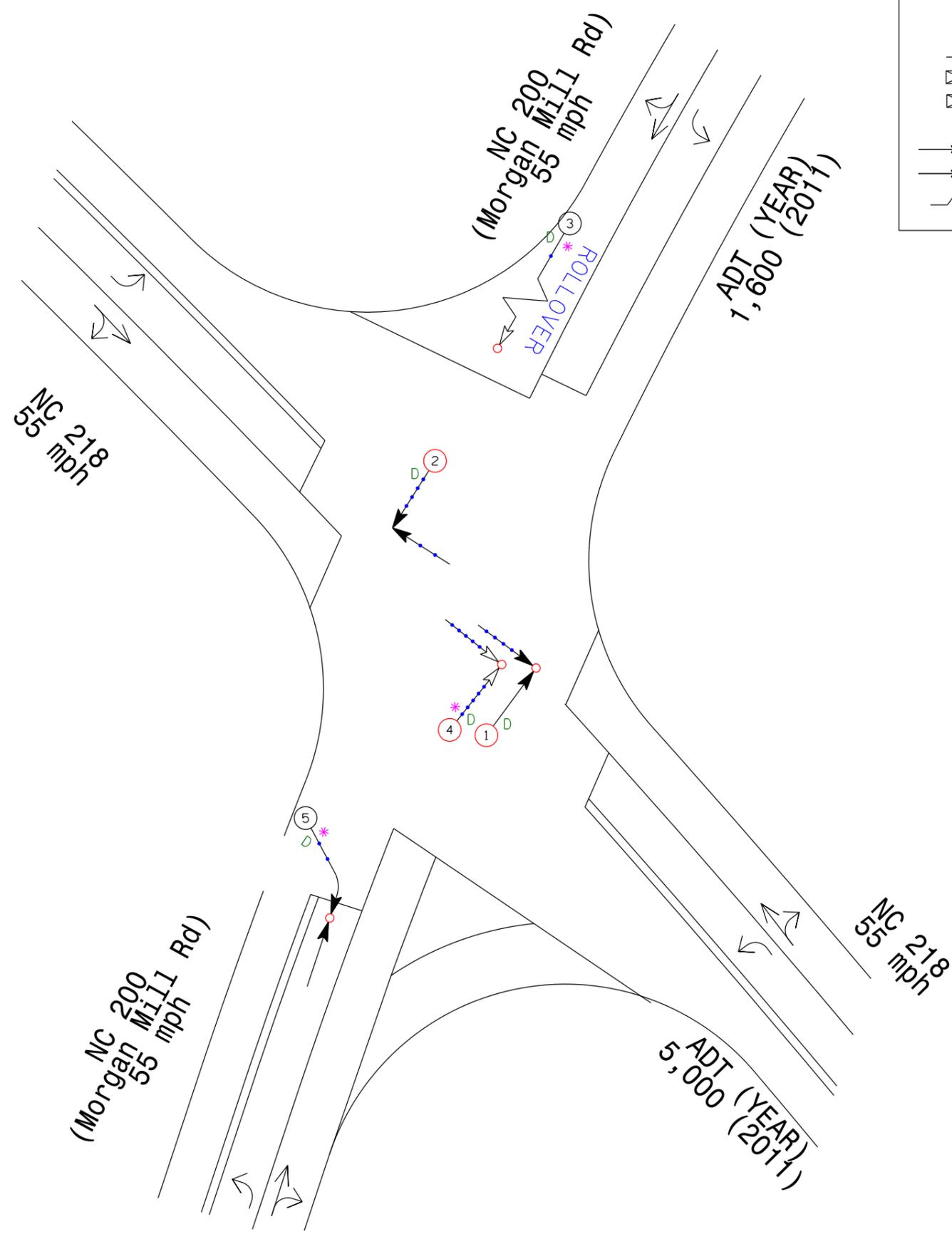
LEGEND			
	MOVING VEHICLE		ANGLE
	PEDESTRIAN		TURNING
	PARKED VEHICLE		BACKING
	PARKING VEHICLE		SIDESWIPE
	FIXED OBJECT		OUT OF CONTROL
	HEAD ON		INJURY
	REAR END		FATALITY
	RAN OFF ROAD		9 MPH OR LESS
			10 MPH TO 19
			20 MPH TO 29
			30 MPH TO 39
			40 MPH TO 49
			50 MPH TO 59
			60 MPH TO 69
	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



Target Crashes

N.C. DEPARTMENT of TRANSPORTATION
 DIVISION of HIGHWAYS
 TRANSPORTATION MOBILITY and SAFETY DIVISION
TRAFFIC SAFETY UNIT
 Date: November 2012 Prepared By: bdr

W-5012
 Order# 4100022132
 Union County
 AFTER Period
 9/1/2009-9/30/2012

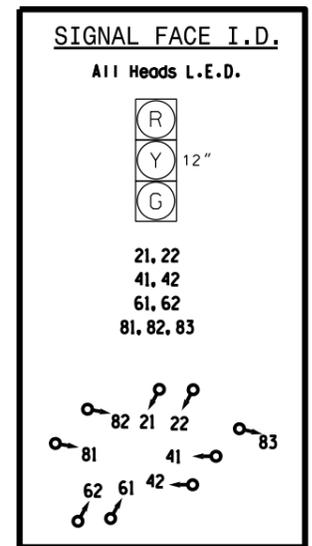


LEGEND

	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		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 ONLY
	RAN OFF ROAD				70 AND UP		



Target Crashes



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TRAFFIC SAFETY UNIT

Date: November 2012

Prepared By: bdr