

# Spot Safety Project Evaluation

Work Order #41000005481

Spot Safety Project # 05-03-210

**Spot Safety Project Evaluation of the Traffic Signal Installation and the Construction of Left Turn Lanes at the Intersection of US 401 and SR 1103 (Flat Rock Church/Clifton Pond) Franklin 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

4/9/2010

Date

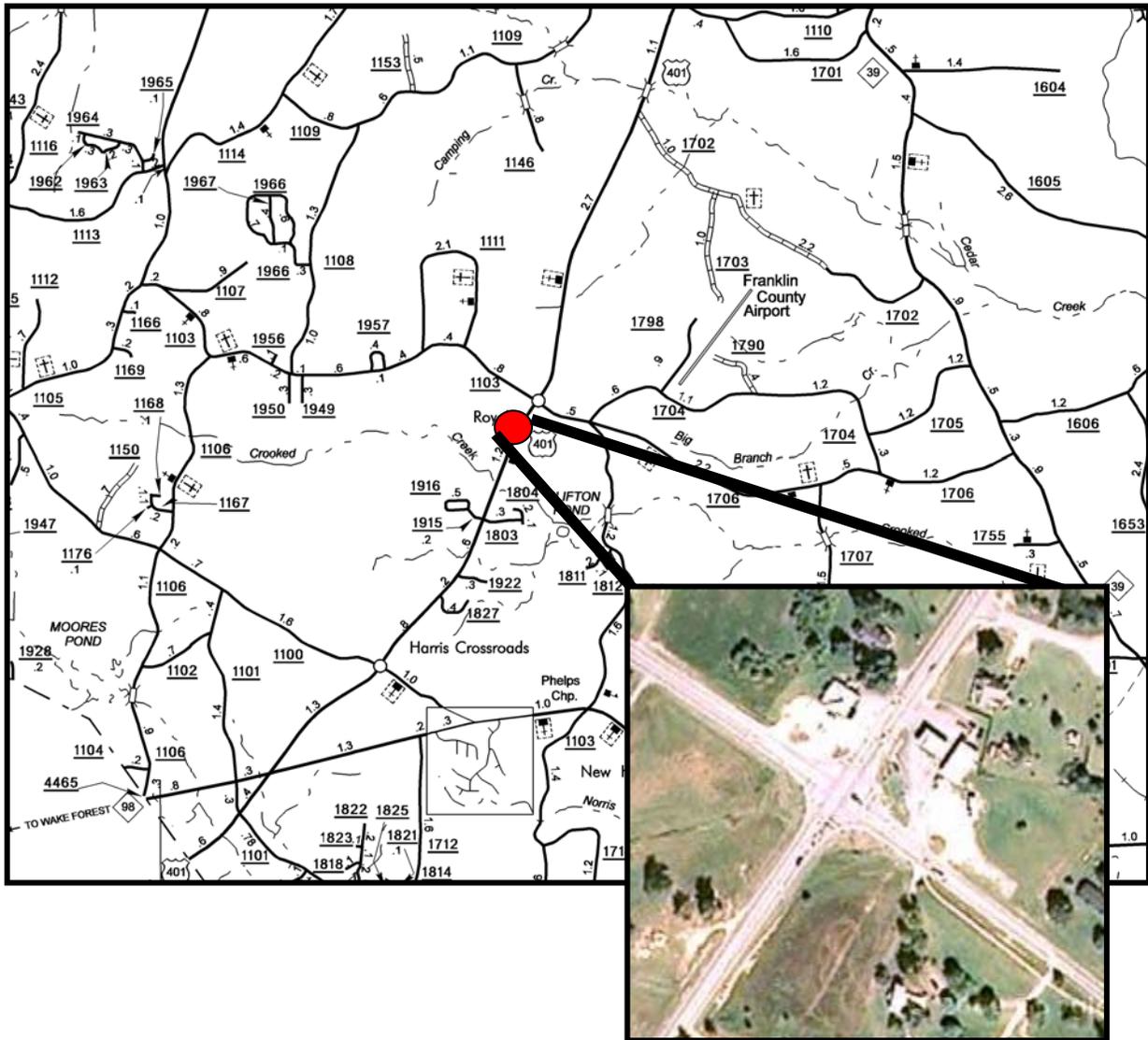
Traffic Safety Project Engineer

# Spot Safety Project Evaluation Documentation

## Subject Location

Evaluation of Spot Safety Project Number 05-03-210 – The Intersection of NC 401 and SR 1103 (Flat Rock Church/Clifton Pond) in Franklin County.

The signal number for this location is 05-1473.



## Project Information and Background from the Project File Folder

The spot safety project improvement countermeasure chosen for the subject location was to install a traffic signal and to construct left turn lanes on US 401. Based on the signal plan and the diagrams on the crash reports, left turn lanes were also constructed on SR 1103 at the same time.

The subject location is a four-leg intersection which was controlled by stop signs on SR 1103 and “Vehicle Entering When Flashing” signs and flashers in the before period. In the before period all approaches included a through-left lane and a right turn slip ramp. The speed limit is 55 mph on US 401 and 45 mph on SR 1103.

The original statement of problem was that vehicles on SR 1103 could not safely enter the intersection and vehicles on US 401 could not safely make left turns due to insufficient gaps in traffic.

The initial crash analysis was conducted from July 1, 1999 to June 30, 2002 with a total of 20 reported crashes, 15 of which were considered correctable by the chosen countermeasure. The final completion date for the improvements at the subject intersection was on June 14, 2004 with a total cost of \$222,520.00.

### 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 May 1, 2004 to July 30, 2004. The before period consisted of reported crashes from November 1, 1998 through April 30, 2004 (5 years and 6 months) and the after period consisted of reported crashes from August 1, 2004 through January 31, 2010 (5 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 that occurred in the intersection 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, same roadway; Right Turn, different roadway; Head On and Angle. The target crashes are clearly identified in the before and after period collision diagrams.

<b><u>Treatment Information</u></b>	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-) Percent Increase (+)</b>
Total Crashes	34	8	-76.5
Total Severity Index	11.82	3.77	-68.1
Target Crashes	26	3	-88.5
Target Severity Index	14.3	5.93	-58.5
Volume	9,900	11,900	20.2
<b><u>Target Crash Severity Summary</u></b>			
Fatal Crashes	1	0	-100.0
Class A Crashes	2	0	-100.0
Class B Crashes	7	1	-85.7
Class C Crashes	9	1	-88.9
PDO Crashes	7	1	-85.7

The naive before and after analysis at the treatment location resulted in a 77 percent decrease in Total Crashes, an 89 percent decrease in Target Crashes, and a 20 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 77 percent decrease in Total Crashes and an 89 percent decrease in Target Crashes. The Total Severity Index decreased by 68 percent and the Target Severity Index decreased by 59 percent. The summary results above demonstrate that both Total and Target Crashes appear to have decreased from the before to the after period.

The calculated benefit to cost ratio for this project is 10.93 considering total crashes. The benefit to cost ratio considering only target crashes is also 10.71. 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.

It appears that the countermeasures were effective in reducing Frontal Impact Crashes at the intersection. None of the prominent crash patterns in the before period were present in the after period. The three after period Target Crashes included two Left Turn-Same Roadway Crashes involving southbound US 401 vehicles turning left and one Angle Crash involving a northbound US 401 vehicle running the signal.

There was a fatal angle crash in the before period which resulted from a westbound SR 1103 vehicle running the stop sign and colliding with a northbound US 401 vehicle.

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 401 and SR 1103  
 COUNTY: Franklin  
 FILE NO.: SS 05-03-210

BY: bdr  
 DATE: 4/5/2010

DETAILED COST: TYPE IMPROVEMENT - Signal and Left Turn Lanes

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$0	0	0.000	\$0
	\$222,520	10	0.149	\$33,162
Right-of-Way	\$0	0	0.000	\$0
<b>TOTALS</b>	<b>\$222,520</b>	<b>10</b>	<b>0.149</b>	<b>\$33,162</b>

ESTIMATED INCREASE IN ANNUAL MAINT. COST = \$3,200  
 ESTIMATED INCREASE IN ANNUAL UTILITY COST = \$900  
 TOTAL ANNUAL COST= \$37,262  
 TOTAL COST OF PROJECT= \$222,520

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	5.50	3	0.55	19	3.45	12	2.18	\$421,891
AFTER	5.50	0	0.00	3	0.55	5	0.91	\$14,727

Annual Benefits from Crash Cost Savings \$407,164

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = \$369,902

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 10.93

TOTAL COST OF PROJECT - \$222,520 COMPREHENSIVE B/C RATIO - 10.93

**BENEFIT-COST ANALYSIS WORKSHEET**

LOCATION: US 401 and SR 1103  
 COUNTY: Franklin  
 FILE NO.: SS 05-03-210 Target Crashes Only

BY: bdr  
 DATE: 4/5/2010

DETAILED COST: TYPE IMPROVEMENT - Signal and Left Turn Lanes

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$0	0	0.000	\$0
	\$222,520	10	0.149	\$33,162
Right-of-Way	\$0	0	0.000	\$0
<b>TOTALS</b>	<b>\$222,520</b>	<b>10</b>	<b>0.149</b>	<b>\$33,162</b>

ESTIMATED INCREASE IN ANNUAL MAINT. COST = \$3,200  
 ESTIMATED INCREASE IN ANNUAL UTILITY COST = \$900  
 TOTAL ANNUAL COST= \$37,262  
 TOTAL COST OF PROJECT= \$222,520

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	5.50	3	0.55	16	2.91	7	1.27	\$407,164
AFTER	5.50	0	0.00	2	0.36	1	0.18	\$8,036

Annual Benefits from Crash Cost Savings \$399,127

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = \$361,865

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 10.71

TOTAL COST OF PROJECT - \$222,520 COMPREHENSIVE B/C RATIO - 10.71

## Treatment Site Photos from Google Street-View



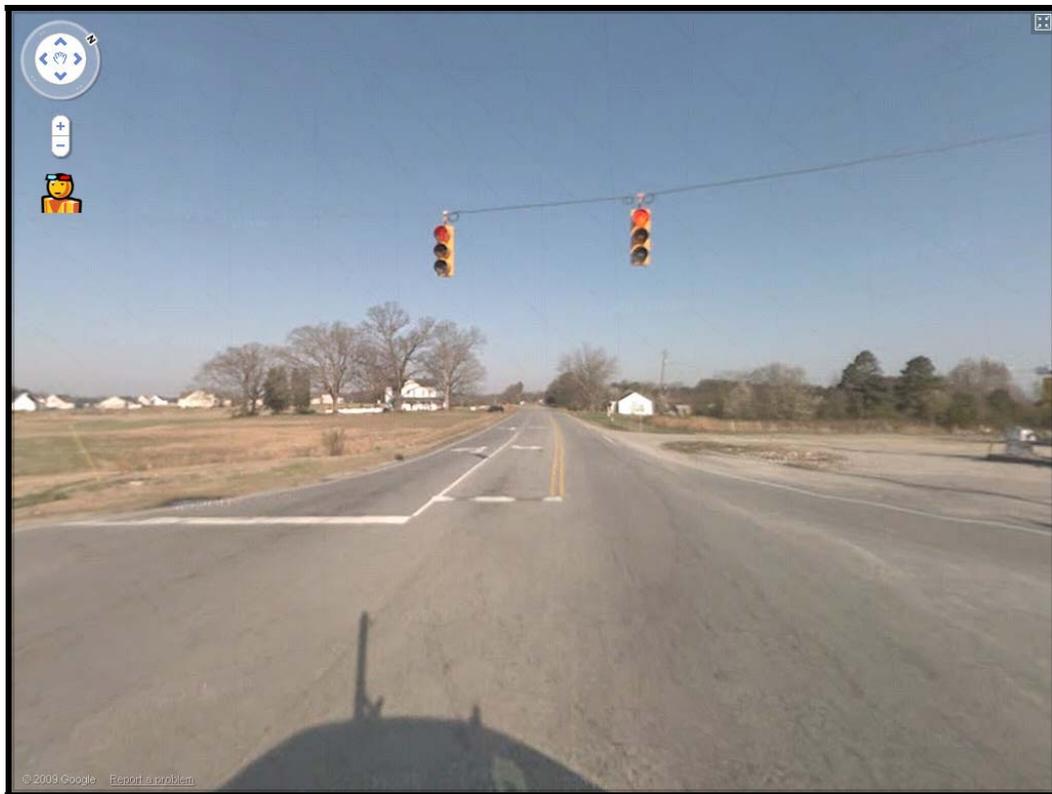
Looking north on US 401



Looking south on US 401



Looking east toward SR 1103 (Clifton Pond Rd) from intersection



Looking west toward SR 1103 (Flat Rock Church Rd) from intersection

Franklin County  
 US 401 and SR 1103  
 (Flat Rock Ch/Clifton Pond)  
 BEFORE Period  
 11/1/1998-4/30/2004

US 401  
 55 mph

SR 1103  
 (FLAT ROCK CHURCH RD)  
 45 mph

SR 1103  
 (CLIFTON POND RD)  
 45 mph

US 401  
 55 mph

**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		ONLY

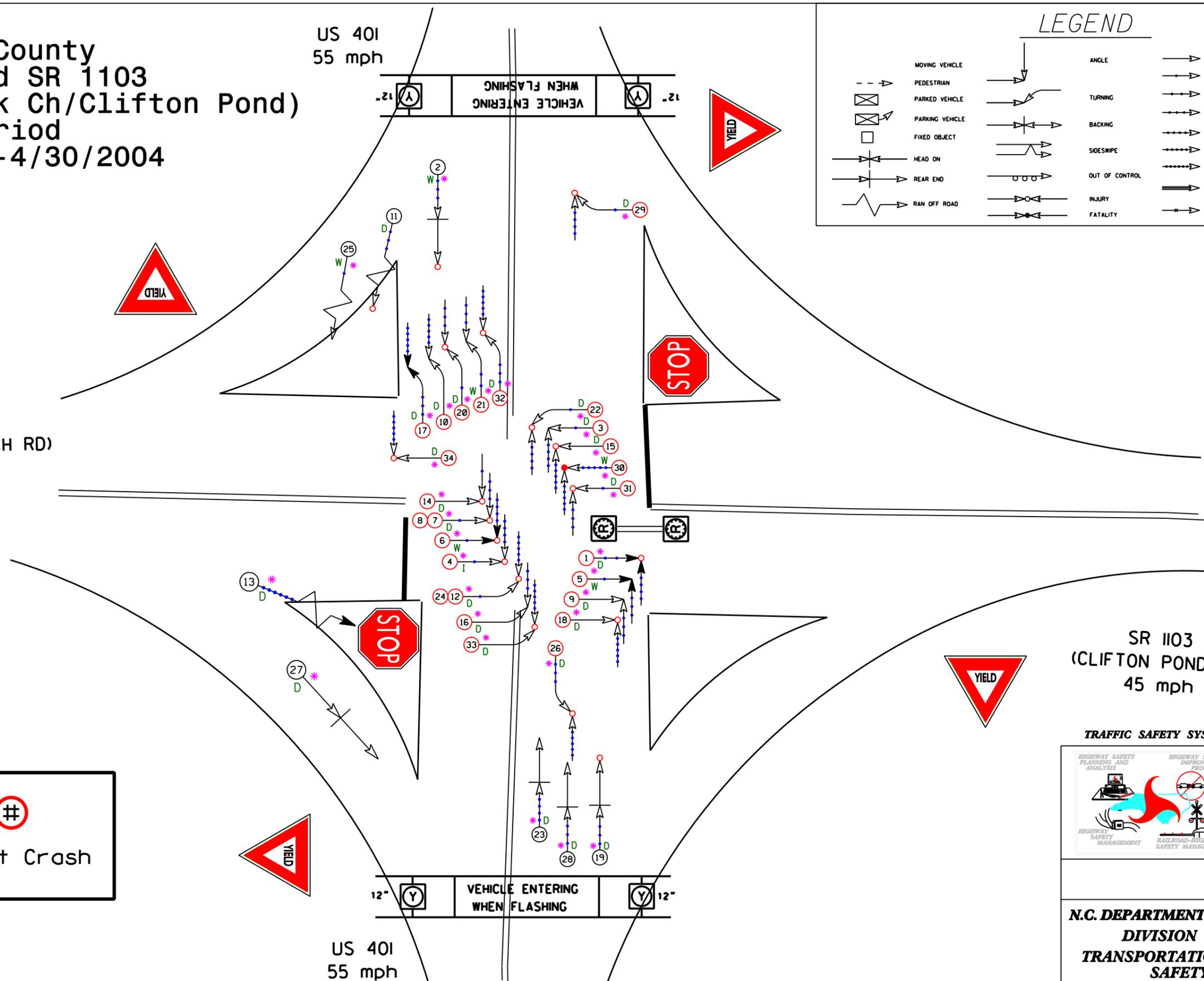


#  
 Target Crash

**TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT**

	COLLISION DIAGRAM	
	DIVISION: 5	AREA:
	STUDY PERIOD: 11/1/98-4/30/04	
	DISTANCE: Y-LINE + 150 FT	
ANALYSIS PREPARED BY: BOR		
ANALYSIS CHECKED BY:		
DIAGRAM PREPARED BY: BOR		
DIAGRAM REVIEWED BY:		
SCALE: NOT TO SCALE		
DATE: Apr 11 2004		
LOG NUMBER: 4000005481		

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



Franklin County  
 US 401 and SR 1103  
 (Flat Rock Ch/Clifton Pond)  
 AFTER Period  
 8/1/2004-1/31/2010

US 401  
 55 mph

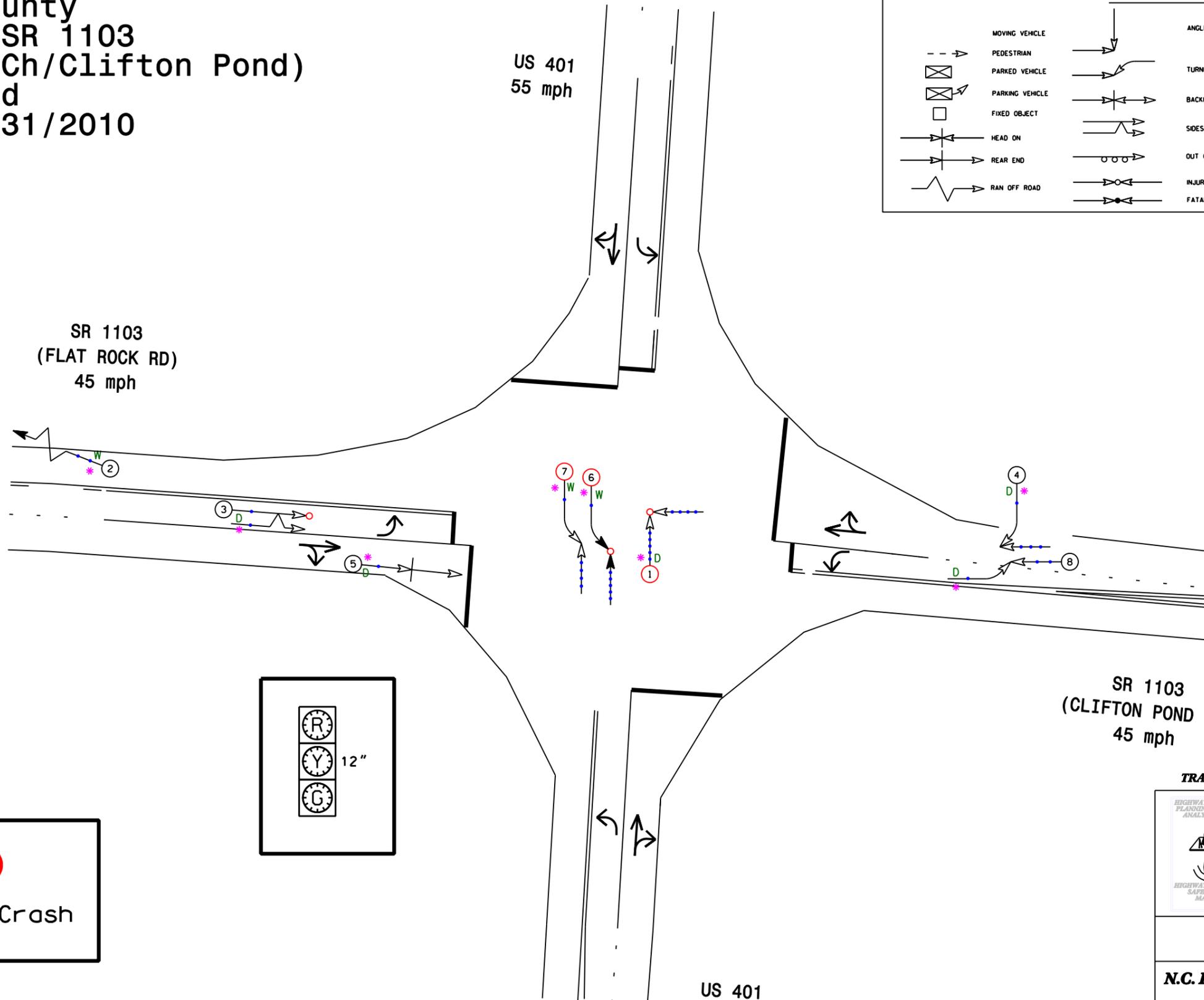
SR 1103  
 (FLAT ROCK RD)  
 45 mph

SR 1103  
 (CLIFTON POND RD)  
 45 mph

US 401  
 55 mph

**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		SPEED UNKNOWN		70 AND UP		



Target Crash

12"

**TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT**

	COLLISION DIAGRAM	
	DIVISION: 5	AREA:
STUDY PERIOD: 8/1/04-1/31/10		
DISTANCE: Y-LINE = 150 FT		
ANALYSIS PREPARED BY: BOR		
ANALYSIS CHECKED BY:		
DIAGRAM PREPARED BY: BOR		
DIAGRAM REVIEWED BY:		
SCALE: NOT TO SCALE		
DATE: Apr 11 2010		
LOG NUMBER: 4000005481		

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