

Spot Safety Project Evaluation

Order # 41000006127

Spot Safety Project # 09-03-201

**Spot Safety Project Evaluation of the
Traffic Signal Installation and SR 2205 Left Turn Lanes
NC 109 at SR 2205 (Old US 64)
Davidson County**

Documents Prepared By:

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

Principal Investigator



Jason B. Schronce

5-11-2010

Date

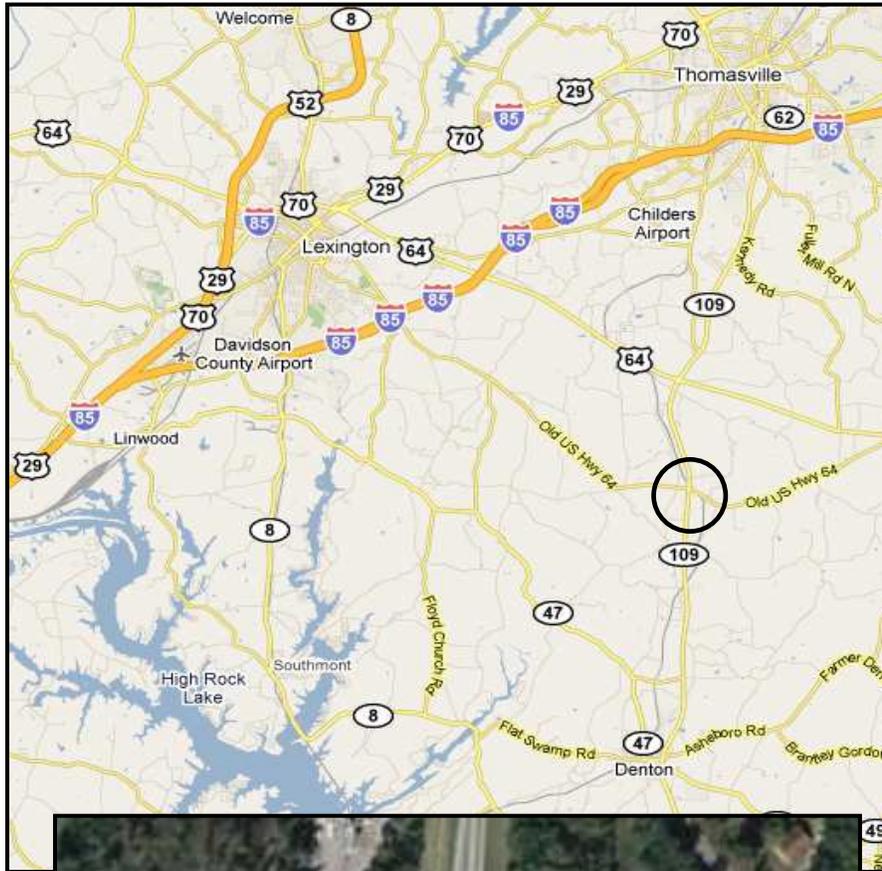
Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 09-03-201 located at the Intersection of NC 109 and SR 2205 (Old US 64) in Davidson County, north of the City of Denton.

The Sig ID is 09-0934 for this newly installed traffic signal.



Project Information and Background from the Project File Folder

The spot safety project improvement countermeasure chosen for the subject location was the installation of an intersection traffic signal. Also, the SR 2205 concrete median islands were removed and left turn lanes installed. NC 109 and SR 2205 (Old US 64) are both two-lane facilities at the subject intersection with speed limits of 55 mph on all approaches. NC 109 also presents right turn lanes on both approaches. The subject location is a four-leg crossroads intersection, which was controlled by dual posted stop signs on SR 2205 with an overhead flasher assembly.

The original statement of problem was that side street motorists were misjudging the speed of approaching vehicles and improperly entering the 55-mph roadway of NC 109, resulting in angle collisions. This location was also on the 1996 HSIP Listing. The intended purpose of the countermeasure was to alleviate the current crash patterns.

The initial crash analysis was completed from May 1, 1999 to April 30, 2002 with fifteen (15) reported crashes, eleven (11) of which were deemed correctable. The final completion derived from the police crash reports for the improvement at the subject intersection was during January 2004 with a total cost of \$35,000.

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 were the months of December 2003 through January 2004. The before period consisted of reported crashes from October 1, 1997 through November 30, 2003 (6 years and 2 months); and the after period consisted of reported crashes from February 1, 2004 through March 31, 2010 (6 years and 2 months). The ending date for this analysis was determined by the date of available crash data at the time of analysis.

The treatment data consisted of all crashes within 150 feet of the subject intersection. *Please see attached location map, aerial map, and photos for further details.*

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. The Frontal Impact Crash types considered are as follows: Left turn, same roadway; Left turn, different roadways; Right turn, same roadway; Right turn, different roadways; Head on; and Angle.

<u>Treatment Information</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Total crashes	35	21	- 40.0 %
Total Severity Index	10.19	8.84	- 13.2 %
Target Crashes	20	11	- 45.0 %
Target Crash Severity Index	13.76	6.38	- 53.6 %
Volume (2000, 2007)	10,600	11,400	7.5 %

<u>Injury Crash Summary</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Fatal injury Crashes	0	0	N/A
Class A injury Crashes	2	1	- 50.0 %
Class B injury Crashes	8	5	- 37.5 %
Class C Injury Crashes	15	7	- 53.3 %
Total Injury Crashes	25	13	- 48.0 %

The naive before and after analysis at the treatment location resulted in a 40 percent decrease in Total Crashes, a 45 percent decrease in Target Crashes, and a 13 percent decrease in the Total Severity Index. The before period ADT year was 2000 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 40 percent decrease in Total Crashes and a 45 percent decrease in Target Crashes. The summary results above demonstrate that both Total and Target Crashes appear to have decreased at the treatment location from the before to the after period.

Referencing the *Collision Diagrams*, the before period presented a strong pattern of twenty (20) angle or left turn collisions from a SR 2205 motorists who pulled out into oncoming traffic after obeying the stop condition. This resulted in two (2) A-injury collisions. The signal providing right-of-way assignments should prevent this crash type; however there were eight (8) red-light run crashes in the after period. All of these occurred when the NC 109 vehicle disobeyed the traffic signal red indication.

The after period also experienced an increase in left turn-same roadway collisions from zero (0) to three (3) crashes. The intersection did have a small pattern of NC 109 rear-end collisions, nine (9) crashes, in the before period as vehicles stopped to make the left turn onto SR 2205. After the signal, this pattern was reduced to six (6) rear-end collisions in the signal queue.

The calculated benefit to cost ratio for this project is **14.09 considering total crashes**. The benefit to cost ratio **considering only target crashes is 22.20**. 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*. Photos are provided from Google Street View for all four approaches to the treatment intersection. 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.

TREATMENT SITE PHOTOS



Traveling South on NC 109



Traveling South on NC 109 at intersection



Traveling North on NC 109



Traveling North on NC 109 at intersection



Traveling West on SR 2205 (Old US 64)



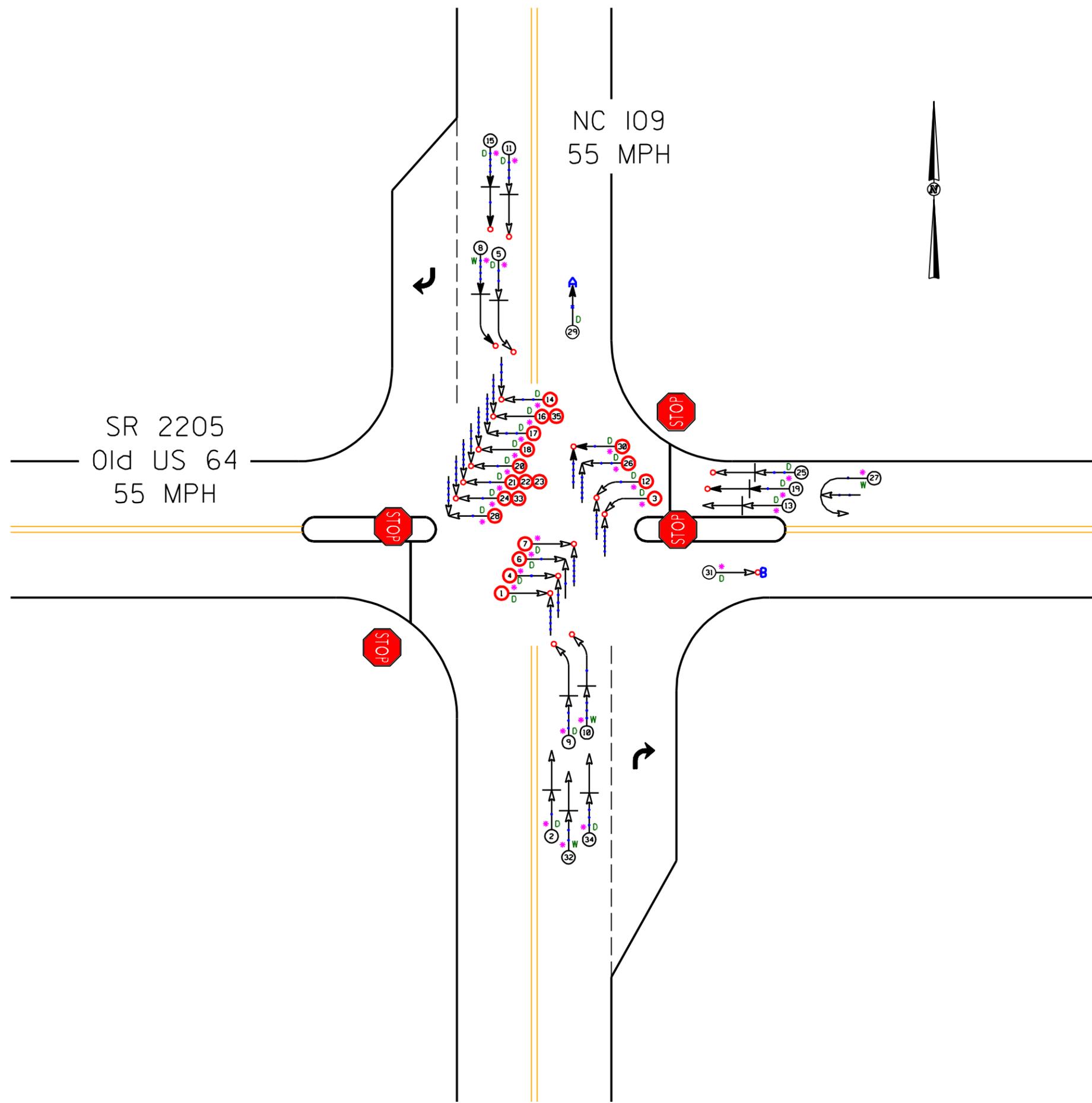
Traveling East on SR 2205 (Old US 64)

BENEFIT-COST ANALYSIS WORKSHEET - Total Crashes

LOCATION: NC 109 at SR 2205		BY: JBS						
COUNTY: Davidson		DATE: 5/10/2010						
FILE NO.: SS 09-03-201		NOTES: Total Crashes						
DETAILED COST:	TYPE IMPROVEMENT - New Signal							
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$35,000	10	0.149	\$5,216			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$35,000	10	0.149	\$5,216			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$2,000			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$900			
	TOTAL ANNUAL COST=				\$8,116			
	TOTAL COST OF PROJECT=				\$35,000			
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	6.17	2	0.32	23	3.73	10	1.62	\$235,494
AFTER	6.17	1	0.16	12	1.94	8	1.30	\$121,102
						Annual Benefits from Crash Cost Savings		\$114,392
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$106,276		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	14.09		
TOTAL COST OF PROJECT		-	\$35,000	COMPREHENSIVE B/C RATIO		-	14.09	

BENEFIT-COST ANALYSIS WORKSHEET - Target Crashes

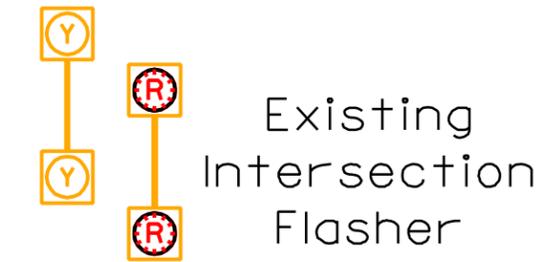
LOCATION: NC 109 at SR 2205		BY: JBS						
COUNTY: Davidson		DATE: 5/10/2010						
FILE NO.: SS 09-03-201		NOTES: Target Crashes - Frontal Impact						
DETAILED COST:	TYPE IMPROVEMENT - New Signal							
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$35,000	10	0.149	\$5,216			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$35,000	10	0.149	\$5,216			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$2,000			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$900			
	TOTAL ANNUAL COST=				\$8,116			
	TOTAL COST OF PROJECT=				\$35,000			
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	6.17	2	0.32	14	2.27	4	0.65	\$205,446
AFTER	6.17	0	0.00	8	1.30	3	0.49	\$25,235
						Annual Benefits from Crash Cost Savings		\$180,211
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$172,095		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	22.20		
TOTAL COST OF PROJECT		-	\$35,000	COMPREHENSIVE B/C RATIO		-	22.20	



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	

SS# 09-03-201
 Davidson County
 BEFORE Period
 10/1/97 - 11/30/03

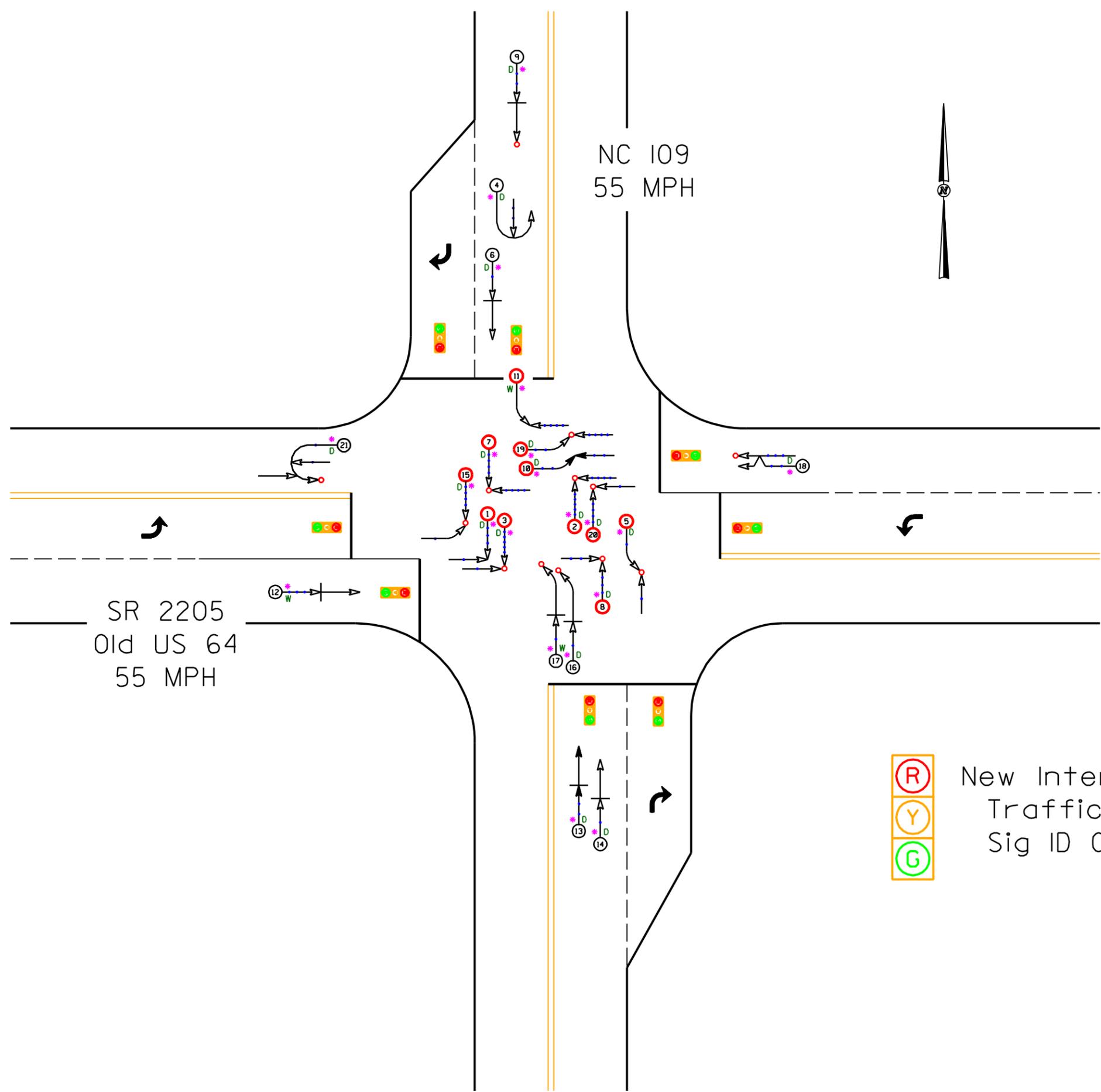


⊕ Frontal Impact
 Target Crashes

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

	COLLISION DIAGRAM	
	DIVISION: 9	AREA:
	STUDY PERIOD: 10/1/1997 - 11/30/2003	
	DISTANCE: Y-LINE : 150FT	
	ANALYSIS PREPARED BY: JBS	
	ANALYSIS CHECKED BY: BR	
	DIAGRAM PREPARED BY: JBS	
	DIAGRAM REVIEWED BY: ST	
	SCALE: NOT TO SCALE	
	DATE: 5-10-2010	
	LOG NUMBER: SS* 09-03-201 BEFORE	

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DIVISION of HIGHWAYS
TRANSPORTATION MOBILITY and SAFETY DIVISION



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		70 AND UP		SPEED UNKNOWN		

SS# 09-03-201
Davidson County
AFTER Period
2/1/04 - 3/31/10

New Intersection
Traffic Signal
Sig ID 09-0934

Frontal Impact
Target Crashes

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

	COLLISION DIAGRAM	
	DIVISION: 9	AREA: 9
STUDY PERIOD: 2/1/2004 - 3/31/2010		
DISTANCE: Y-LINE = 150FT		
ANALYSIS PREPARED BY: JBS		
ANALYSIS CHECKED BY: BR		
DIAGRAM PREPARED BY: JBS		
DIAGRAM REVIEWED BY: ST		
SCALE: NOT TO SCALE		
DATE: 5-10-2010		
LOG NUMBER: SS* 09-03-201AFTER		

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