

# Spot Safety Project Evaluation

Order # 41000004081

Spot Safety Project # 10-01-210

**Spot Safety Project Evaluation of the  
Traffic Signal and Left Turn Lane Installation  
US 601 (Concord Hwy) at SR 1367 (Unionville-Indian Trail Rd)  
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**



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Jason B. Schronce

4-8-2010

Date

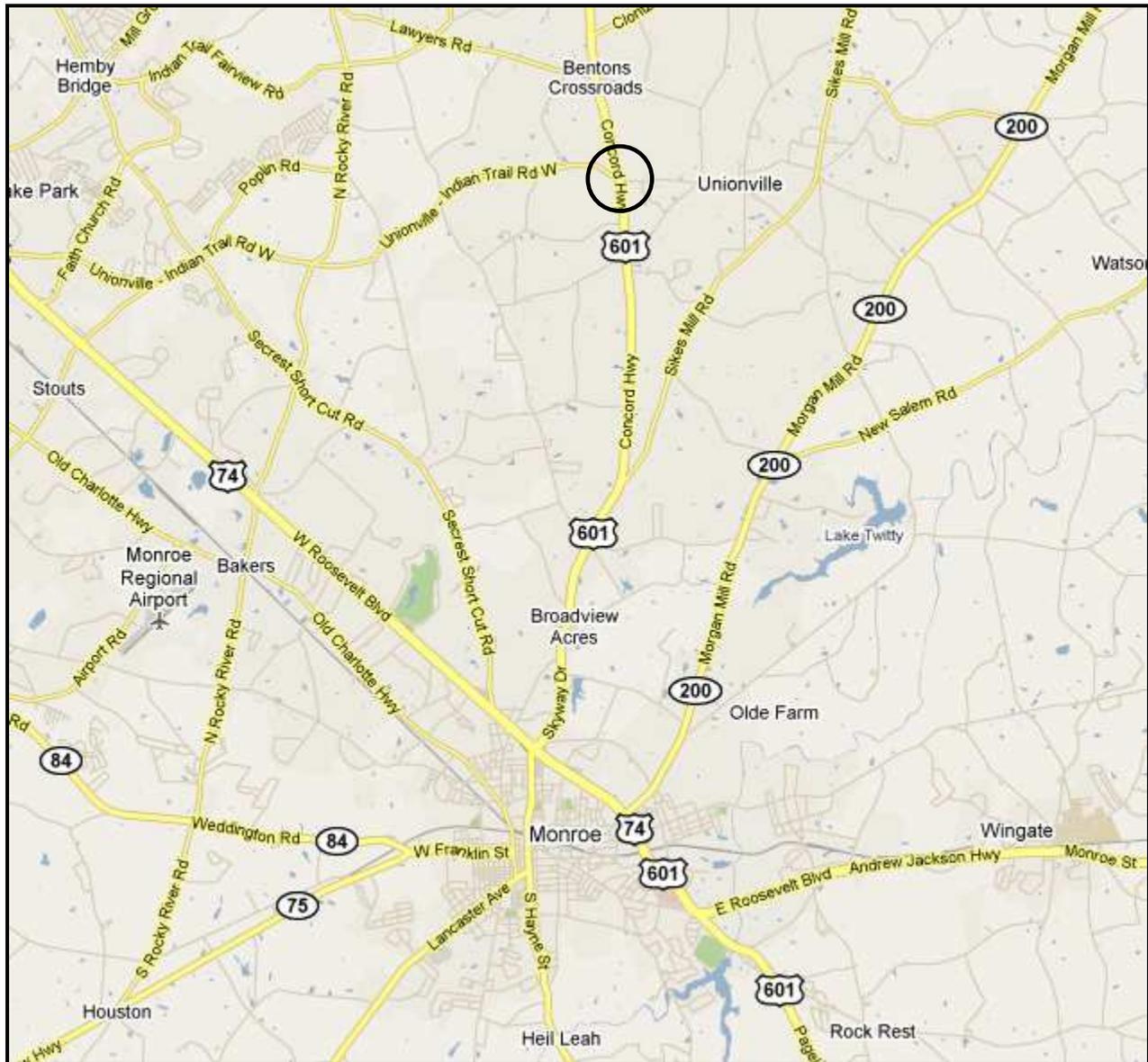
Traffic Safety Project Engineer

# Spot Safety Project Evaluation Documentation

## Subject Location

Evaluation of Spot Safety Project Number 10-01-210 located at the Intersection of US 601 (Concord Highway) and SR 1367 (Unionville-Indian Trail Road) in Union County, north of the City of Monroe.

The Sig ID is 10-1561 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 with left turn lanes on the US 601 approaches. Also, a right turn slip lane was installed for westbound SR 1367. US 601 (Concord Hwy) and SR 1367 are both two-lane facilities near the subject location with speed limits of 55 and 45 mph respectively. The actual before period intersection presented and overhead constant flasher and right turn slip lanes on US 601. The subject location is a four-leg crossroads intersection, which was controlled by a stop condition on the SR 1367 (Unionville-Indian Trail Rd) approaches.

The original statement of problem was the existing pattern of angle collisions at this intersection. The high volume and high speed roadway provided insufficient gaps for side street motorists to enter or cross the intersection safely. The intended purpose of this countermeasure was to eliminate crashes at this location.

The initial crash analysis was completed from November 1, 1997 to November 1, 2000 with fifteen (15) reported crashes, twelve (12) of which were deemed correctable including one fatality crash. The final completion date for the improvements, as discovered from examining crash reports, were during the second half of 2002 with a total cost of \$140,000.

## 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 July through December 2002. The before period consisted of reported crashes from August 1, 1995 through June 30, 2002 (6 years and 11 months); and the after period consisted of reported crashes from January 1, 2003 through November 30, 2009 (6 years and 11 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; Angle; and Ran-off Roadway (avoidance of angle collisions).

<b><u>Treatment Information</u></b>	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-) Percent Increase (+)</b>
Total crashes	39	20	- 48.7 %
Total Severity Index	10.82	7.75	- 28.4 %
Target Crashes	34	10	- 70.6 %
Target Crash Severity Index	11.82	13.02	10.2 %
Volume	10,600	11,200	5.7 %

<b><u>Injury Crash Summary</u></b>	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-) Percent Increase (+)</b>
Fatal injury Crashes	1	1	0.0 %
Class A injury Crashes	2	0	- 100.0 %
Class B injury Crashes	6	4	- 33.3 %
Class C Injury Crashes	15	4	- 73.3 %
Total Injury Crashes	24	9	- 62.5 %

The naive before and after analysis at the treatment location resulted in a 49 percent decrease in Total Crashes, a 71 percent decrease in Target Crashes, and a 28 percent decrease in the Total Severity Index. The before period ADT year was 1999 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 49 percent decrease in Total Crashes and a 71 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 intersection crash pattern consisted of a significant percentage of frontal impact collisions including 27 Angle Crashes. These collisions appeared to occur from motorists improperly accessing the intersection after coming to a complete stop at the stop signs. The three (3) before period severe injury crashes, 1-K and 2-As, were also angle collisions.

After the signal installation, frontal impact collisions reduced to ten (10) crashes with all of them occurring from vehicles running the red light. There was one fatality angle collision in the after period which was determined that the roadway did not add any contributing factors to the collision. Of the ten (10) red light run crashes, seven (7) occurred with the at-fault driver traveling northbound on US 601 and two (2) transpired with the at-fault driver traveling southbound on US 601.

The calculated benefit to cost ratio for this project is **7.35 considering total crashes**. The benefit to cost ratio **considering only target crashes is 7.47**. 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



Looking South on US 601 (Concord Hwy) approaching Intersection



Traveling North on US 601 with Left Turn Lanes



Traveling West on SR 1367 (Unionville-Indian Trail Road)  
Notice Right Turn Slip Lane



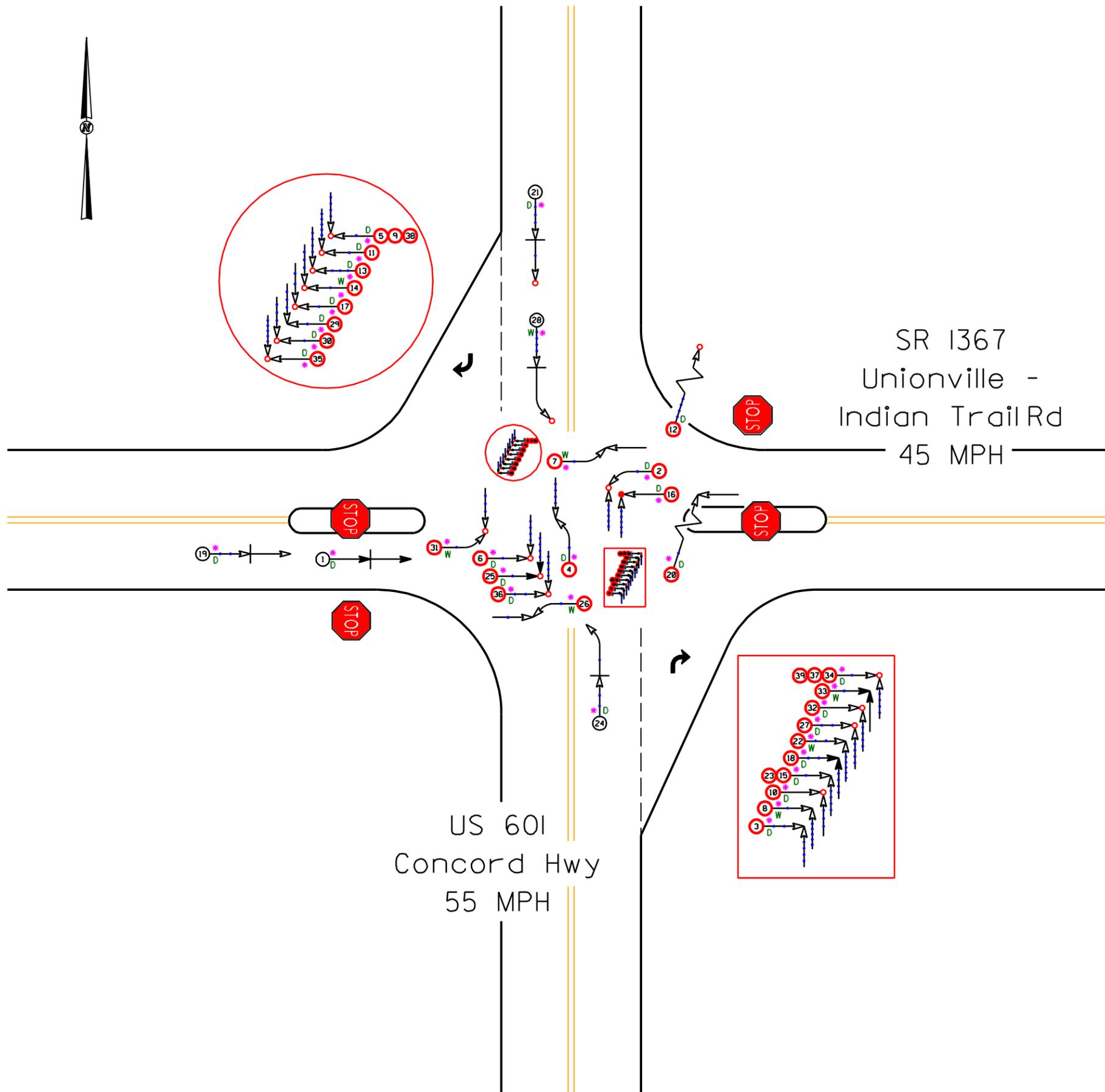
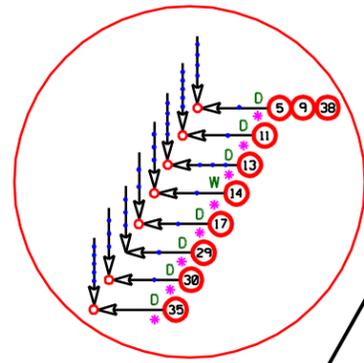
Looking East on SR 1367 (Unionville-Indian Trail Road)

**BENEFIT-COST ANALYSIS WORKSHEET - Total Crashes**

LOCATION: US 601 at SR 1367		BY: JBS						
COUNTY: Union		DATE: 4/8/2010						
FILE NO.: SS 10-01-210		NOTES: Total Crashes						
DETAILED COST:	TYPE IMPROVEMENT - Traffic Signal with 2 Left Turn Lanes							
ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST				
Construction	\$140,000	10	0.149	\$20,864				
Right-of-Way	\$0	0	0.000	\$0				
TOTALS	\$140,000	10	0.149	\$20,864				
ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$2,800				
ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$900				
TOTAL ANNUAL COST=				\$24,564				
TOTAL COST OF PROJECT=				\$140,000				
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	6.92	3	0.43	21	3.03	15	2.17	\$279,841
AFTER	6.92	1	0.14	8	1.16	11	1.59	\$99,263
Annual Benefits from Crash Cost Savings								\$180,578
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$156,014		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	7.35		
TOTAL COST OF PROJECT		-	\$140,000	COMPREHENSIVE B/C RATIO		-	7.35	

**BENEFIT-COST ANALYSIS WORKSHEET - Target Crashes**

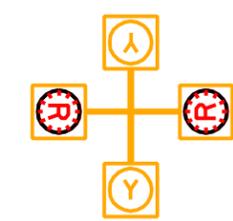
LOCATION: US 601 at SR 1367		BY: JBS						
COUNTY: Union		DATE: 4/8/2010						
FILE NO.: SS 10-01-210		NOTES: Target Crashes - Frontal Impact						
DETAILED COST:	TYPE IMPROVEMENT - Traffic Signal with 2 Left Turn Lanes							
ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST				
Construction	\$140,000	10	0.149	\$20,864				
Right-of-Way	\$0	0	0.000	\$0				
TOTALS	\$140,000	10	0.149	\$20,864				
ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$2,800				
ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$900				
TOTAL ANNUAL COST=				\$24,564				
TOTAL COST OF PROJECT=				\$140,000				
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	6.92	3	0.43	19	2.75	12	1.73	\$272,948
AFTER	6.92	1	0.14	6	0.87	3	0.43	\$89,552
Annual Benefits from Crash Cost Savings								\$183,396
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$158,832		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	7.47		
TOTAL COST OF PROJECT		-	\$140,000	COMPREHENSIVE B/C RATIO		-	7.47	



**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# 10-01-210  
 Union County  
 BEFORE Period  
 8/1/95 - 6/30/02



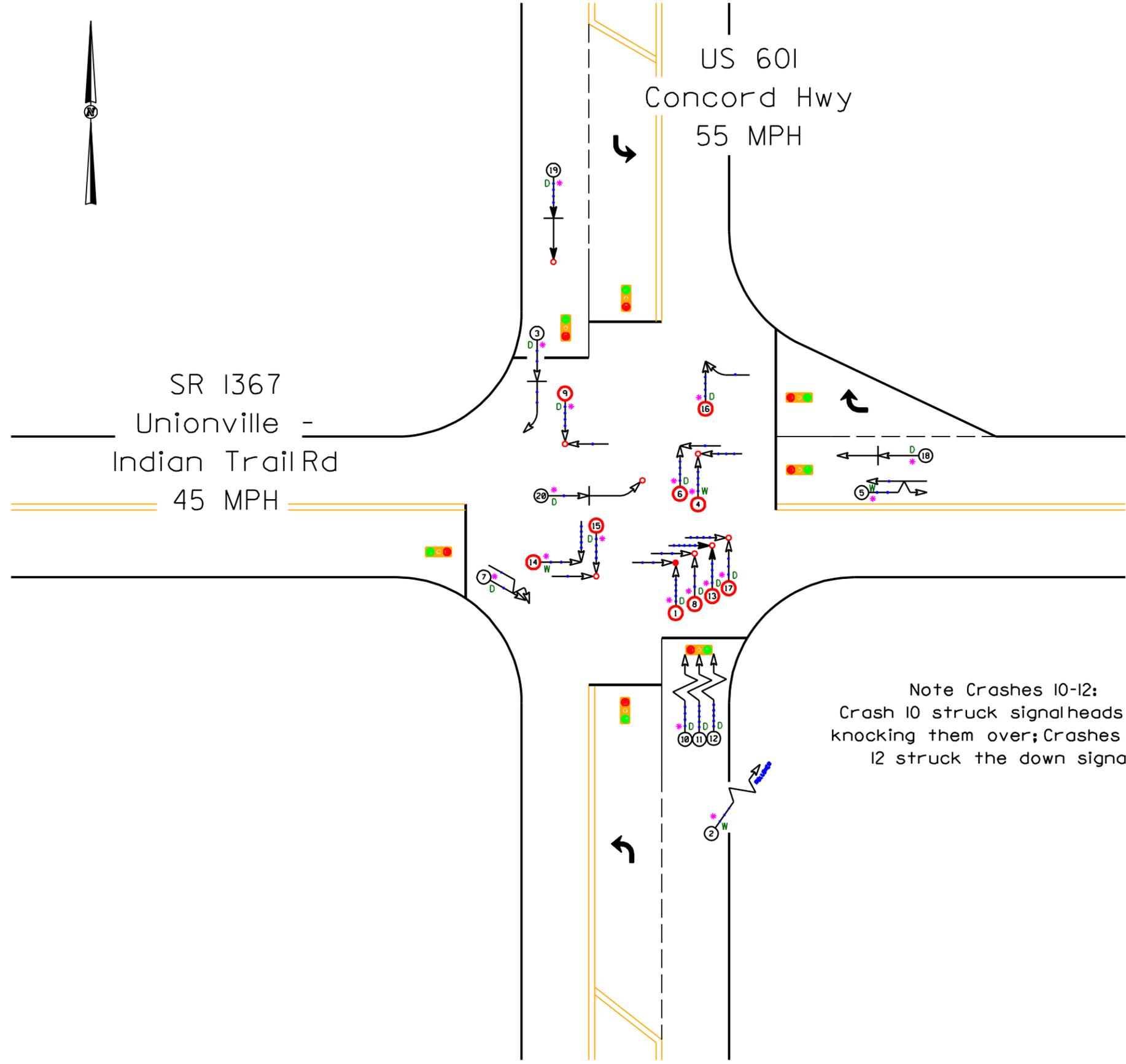
Existing  
 Intersection  
 Flasher

Frontal Impact  
 Target Crashes

**TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT**

	<b>COLLISION DIAGRAM</b>	
	DIVISION: 10	AREA:
STUDY PERIOD: 8/1/1995 - 6/30/2002		
DISTANCE: Y-LINE = 150 FT		
ANALYSIS PREPARED BY: JBS		
ANALYSIS CHECKED BY: BR		
DIAGRAM PREPARED BY: JBS		
DIAGRAM REVIEWED BY: ST		
SCALE: NOT TO SCALE		
DATE: 4-6-2010		
LOG NUMBER: SS* 10-01-210 BEFORE		

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



Note Crashes 10-12:  
Crash 10 struck signalheads and knocking them over; Crashes 11 and 12 struck the down signal.

### LEGEND

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

SS# 10-01-210  
Union County  
AFTER Period  
1/1/03 - 11/30/09



New Intersection  
Traffic Signal  
Sig ID 10-1561

Frontal Impact  
Target Crashes

**TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT**

	<b>COLLISION DIAGRAM</b>	
	DIVISION: 10	AREA: 1
STUDY PERIOD: 1/1/2003 - 11/30/2009		
DISTANCE: Y-LINE = 150 FT		
ANALYSIS PREPARED BY: JBS		
ANALYSIS CHECKED BY: BR		
DIAGRAM PREPARED BY: JBS		
DIAGRAM REVIEWED BY: ST		
SCALE: NOT TO SCALE		
DATE: 4-6-2010		
LOG NUMBER: SS* 10-01-210 AFTER		

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