

Spot Safety Project Evaluation

Project Log # 200812048

Spot Safety Project # 13-02-205

**Spot Safety Project Evaluation of the Side Road Realignment,
Left Turn Lane Construction, and Signal Installation at the
Intersection of NC 181 and SR 1248/1440 (Frank Whisnant / Spainhour)
Burke 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

8/31/2009

Date

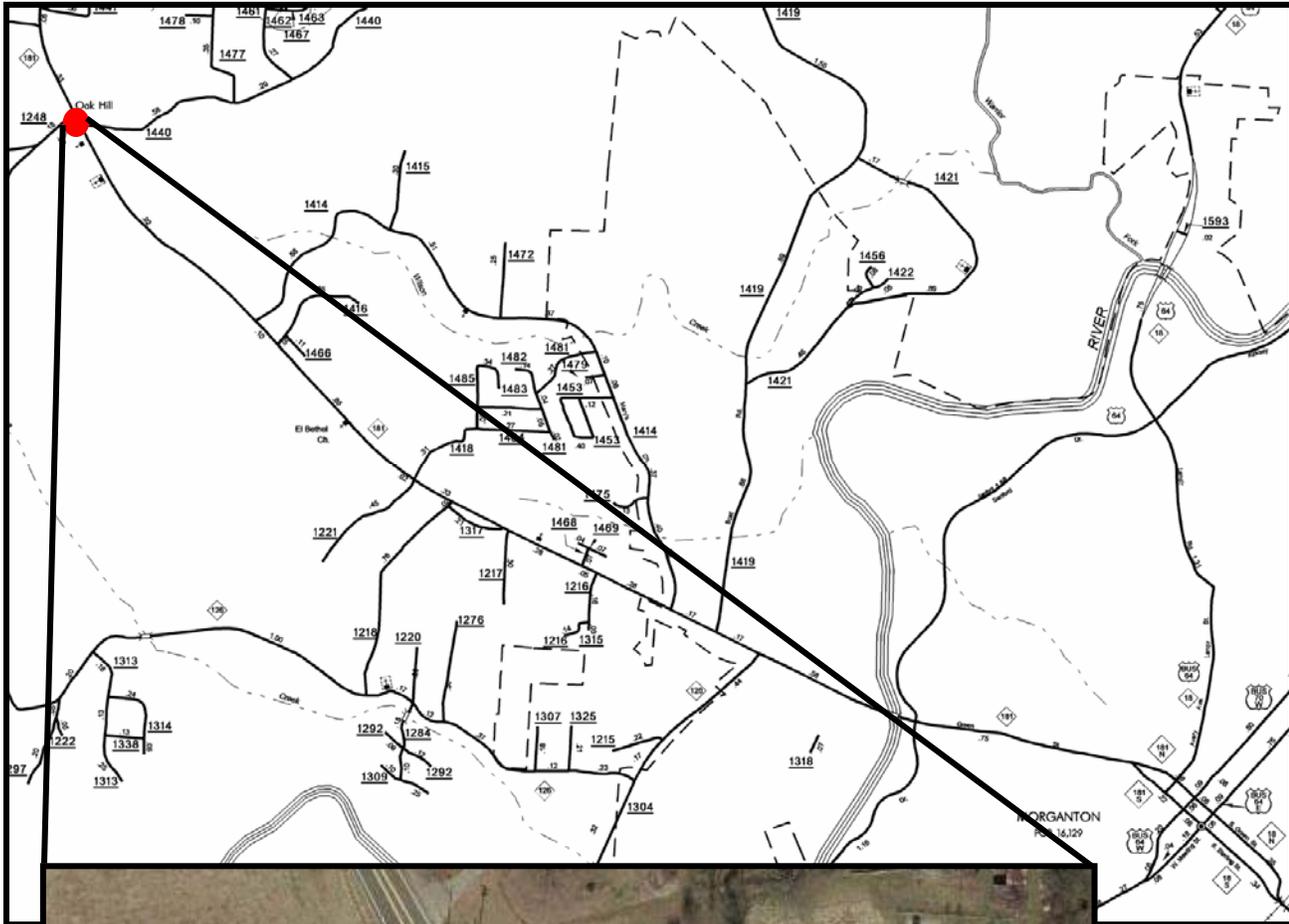
Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 13-02-205 – The Intersection of NC 181 and SR 1248/1440 (Frank Whisnant / Spainhour) in Burke County.

The signal number for this location is 13-0819.



Project Information and Background from the Project File Folder

The spot safety project included three countermeasures at the subject location: SR 1248 (Frank Whisnant) was realigned in order to create a true crossroad intersection; Left Turn Lanes were constructed on each approach of NC 18; A fully actuated traffic signal was installed.

The subject location was a four way off-set intersection controlled by stop signs on SR 1248/1440 in the before period. All approaches were two lane roads with no turn lanes at the subject intersection. The speed limits are 45 mph for NC 181 and 35 mph for SR 1248/1440. Oak Hill Elementary School is located near the intersection.

The original statement of problem was there were preventable crash patterns, in addition to excessive delay and congestion due to school-related traffic.

The initial crash analysis was conducted from April 1, 1998 to March 31, 2001 with a total of 29 reported crashes, 22 of which were considered correctable by the chosen countermeasure. The final completion date for the improvements at the subject intersection was on September 1, 2003 with a total cost of \$150,000.00.

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 August 1, 2003 to October 31, 2003. The before period consisted of reported crashes from April 1, 1998 through July 31, 2003 (5 years and 4 months) and the after period consisted of reported crashes from November 1, 2003 through February 28, 2009 (5 years and 4 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 both Rear-End Crashes and Frontal Impact crash types in the intersection were the Target Crashes for the applied countermeasure. Frontal Impact 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.

Treatment Information			
	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	43	9	-79.1
Total Severity Index	7.24	10.24	41.4
Rear-End Target Crashes	26	1	-96.2
Rear-End Target Crash Severity Index	6.12	1	-83.7
Frontal Impact Target Crashes	13	3	-76.9
Frontal Impact Severity Index	4.98	26.27	427.5
Volume	12,300	12,500	1.6
Crash Severity Summary			
Fatal Crashes	0	0	N/A
Class A Crashes	1	1	0.0
Class B Crashes	5	0	-100.0
Class C Crashes	21	1	-95.2
PDO Crashes	16	7	-56.3

The naive before and after analysis at the treatment location resulted in a 79 percent decrease in Total Crashes, a 96 percent decrease in Rear-End Target Crashes, a 77 percent decrease in Frontal Impact Target Crashes, and a 2 percent increase in Average Daily Traffic (ADT). The before period ADT year was 2000 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 79 percent decrease in Total Crashes, a 96 percent decrease in Rear-End Target Crashes, and a 77 percent decrease in Frontal Impact Target Crashes. The Total Severity Index increased by 41 percent, the Rear-End Target Crash Severity Index decreased by 84 percent, and the Frontal Impact Target Crash Severity Index increased by 428 percent. The summary results above demonstrate that both Total Crashes and Target Crashes appear to have decreased at the treatment location from the before to the after period.

The calculated benefit to cost ratio for this project is 4.85 considering total crashes. The benefit to cost ratio considering only target crashes is also -0.75. 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.

Referencing the *Collision Diagram* and the above tables, it appears that the countermeasure where very effective in reducing crashes at the intersection. Rear-End Crashes approaching the intersection were almost eliminated from the before to the after period (from 26 to 1). Frontal Impact Crashes were also significantly reduced, from 13 in the before period to 3 in the after.

The large increase in the Frontal Impact Severity Index (as well as the negative target crash benefit to cost ratio) was the result of a Left Turn-Different Roadway Crash that occurred in the after period that resulted in an “A” injury. This injury contributed greatly to the high Severity Index because there were only two other Frontal Impact Crashes in the after period, neither of which resulted in an injury.

A field investigation was not conducted due to the current economic conditions, therefore no site photos are available for the subject 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.

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: NC 181 at SR 1248/1440
 COUNTY: Burke
 FILE NO.: SS 13-02-205

BY: BDR
 DATE: 7/20/2009

DETAILED COST: TYPE IMPROVEMENT - **Realignment, left turn lanes, signal**

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$0	0	0.000	\$0
Right-of-Way	\$150,000	15	0.117	\$17,524
	\$0	0	0.000	\$0
TOTALS	\$150,000	15	0.117	\$17,524

ESTIMATED INCREASE IN ANNUAL MAINT. COST = \$2,400
 ESTIMATED INCREASE IN ANNUAL UTILITY COST = \$900
 TOTAL ANNUAL COST= \$20,824
 TOTAL COST OF PROJECT= \$150,000

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	5.33	1	0.19	26	4.88	16	3.00	\$228,368
AFTER	5.33	1	0.19	1	0.19	7	1.31	\$127,467

Annual Benefits from Crash Cost Savings \$100,901

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = \$80,076
 BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 4.85

TOTAL COST OF PROJECT - \$150,000 COMPREHENSIVE B/C RATIO - 4.85

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: NC 181 at SR 1248/1440
 COUNTY: Burke
 FILE NO.: SS 13-02-205 Target Crashes Only

BY: BDR
 DATE: 7/20/2009

DETAILED COST: TYPE IMPROVEMENT - Realignment, left turn lanes, signal

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$0	0	0.000	\$0
Right-of-Way	\$150,000	15	0.117	\$17,524
	\$0	0	0.000	\$0
TOTALS	\$150,000	15	0.117	\$17,524

ESTIMATED INCREASE IN ANNUAL MAINT. COST = \$2,400
 ESTIMATED INCREASE IN ANNUAL UTILITY COST = \$900
 TOTAL ANNUAL COST= \$20,824
 TOTAL COST OF PROJECT= \$150,000

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	5.33	0	0.00	25	4.69	14	2.63	\$104,841
AFTER	5.33	1	0.19	0	0.00	3	0.56	\$120,563

Annual Benefits from Crash Cost Savings (\$15,722)

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = (\$36,547)

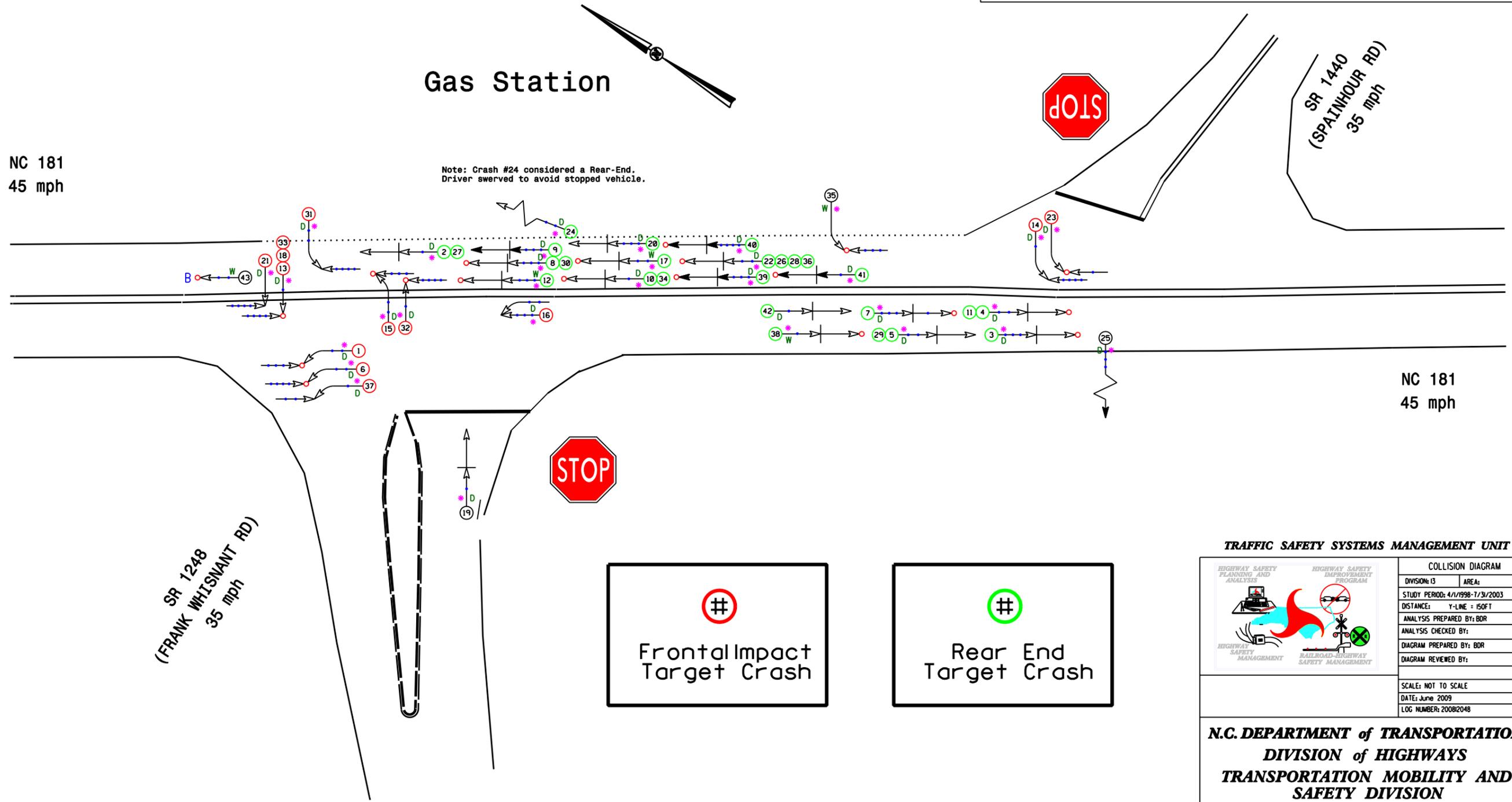
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = -0.75

TOTAL COST OF PROJECT - \$150,000 COMPREHENSIVE B/C RATIO - -0.75

Burke County
 NC 181 and SR 1440 (Spainhour)
 and SR 1248 (Frank Whisnant)
 BEFORE Period
 4/1/1998-7/31/2003

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

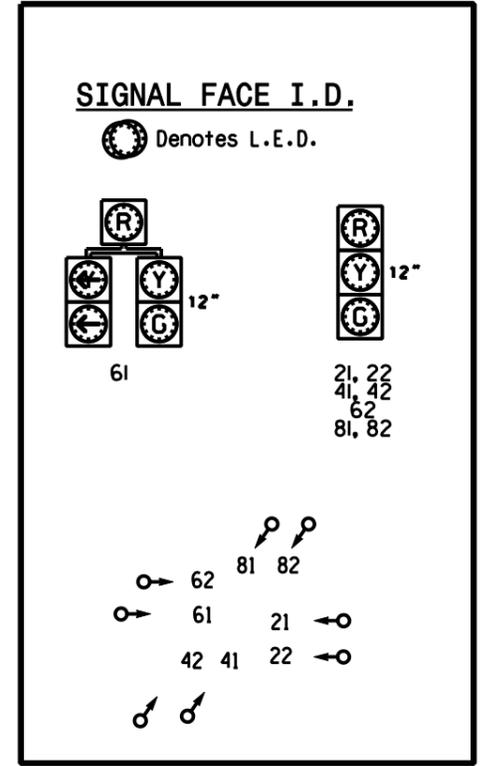
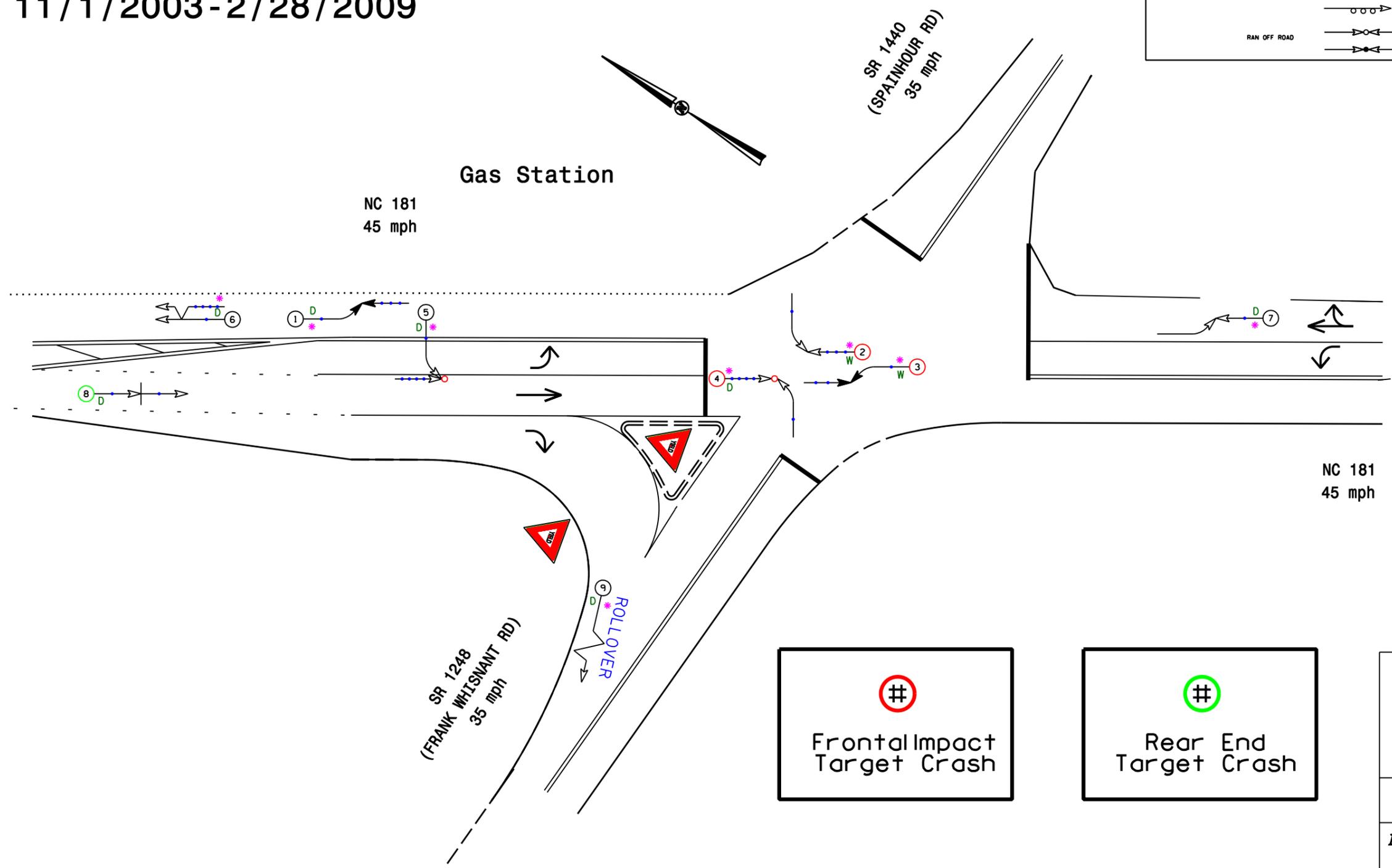
	COLLISION DIAGRAM	
	DIVISION: 13	AREA:
	STUDY PERIOD: 4/1/1998-7/31/2003	
	DISTANCE: Y-LINE + 150 FT	
	ANALYSIS PREPARED BY: BDR	
ANALYSIS CHECKED BY:		
DIAGRAM PREPARED BY: BDR		
DIAGRAM REVIEWED BY:		
SCALE: NOT TO SCALE		
DATE: June 2009		
LOG NUMBER: 20082048		

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

**Burke County
 NC 181 and SR 1440 (Spainhour)
 and SR 1248 (Frank Whisnant)
 AFTER Period
 11/1/2003-2/28/2009**

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
	OUT OF CONTROL	40 MPH TO 49	W WET
	INJURY	50 MPH TO 59	I ICY OR SNOWY
RAN OFF ROAD	FATALITY	60 MPH TO 69	O OILY
		70 AND UP	
		SPEED UNKNOWN	



⊙
**Frontal Impact
 Target Crash**

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**Rear End
 Target Crash**

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

	COLLISION DIAGRAM	
	DIVISION: 13	AREA:
STUDY PERIOD: 11/1/2003-2/28/2009		
DISTANCE: Y-LINE = 150 FT		
ANALYSIS PREPARED BY: BOR		
ANALYSIS CHECKED BY:		
DIAGRAM PREPARED BY: BOR		
DIAGRAM REVIEWED BY:		
SCALE: NOT TO SCALE		
DATE: June 2009		
LOG NUMBER: 20082048		

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