

# Spot Safety Project Evaluation

Order # 41000005545

Spot Safety Project # 07-00-218

**Spot Safety Project Evaluation of the Overhead Sign Installation  
I-40 (I-40 Business) / I-85 (I-85 Business) Westbound Split  
City of Greensboro, Guilford 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

8-13-2010

Date

Traffic Safety Project Engineer

# Spot Safety Project Evaluation Documentation

## Subject Location

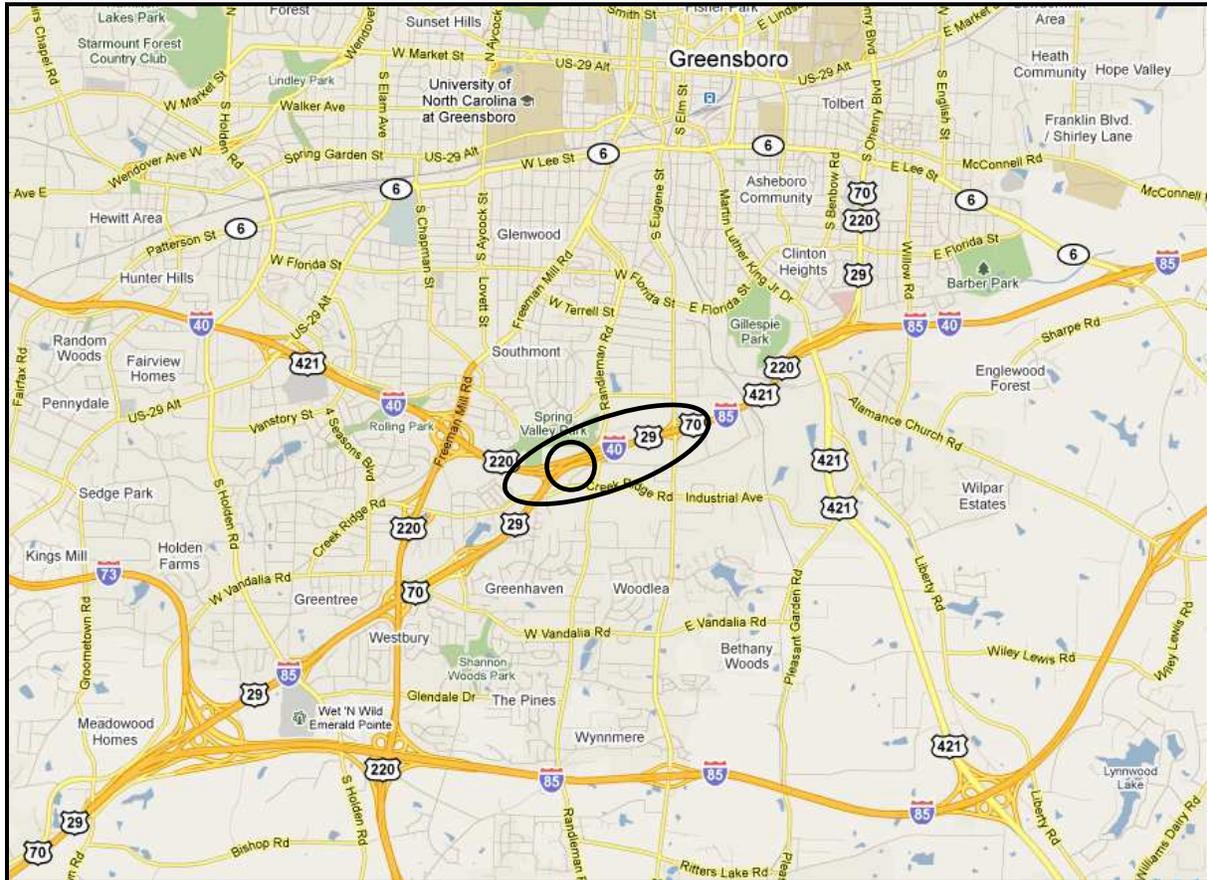
Evaluation of Spot Safety Project Number 07-00-218 located along I-40 (I-40 Business) / I-85 (I-85 Business) Westbound in Guilford County, in the City of Greensboro. The additional roads of US-29, US-70, US-220, and US-421 all coincide with the interstate briefly at this location.

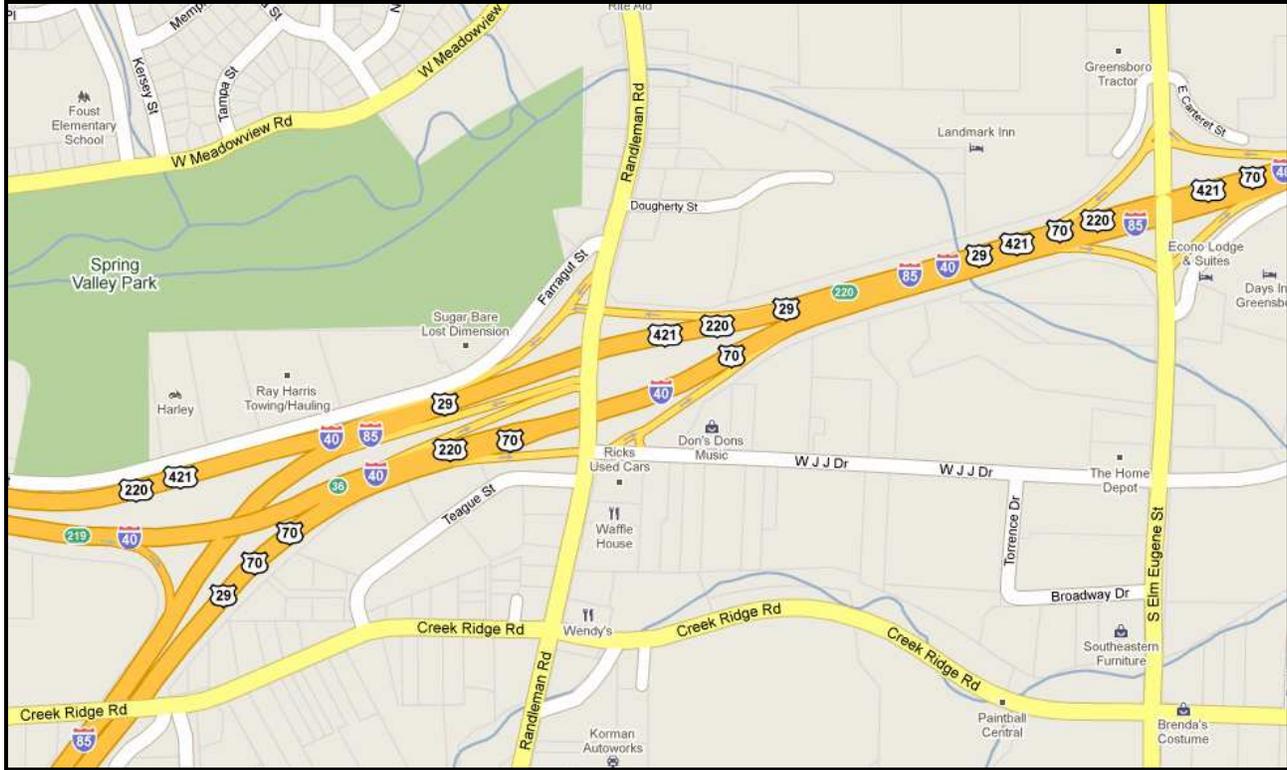
Total Study Limits: I-40 MP Ranges: 14.32 to 15.18 = 0.86 mile

150' West of the I-40 / I-85 Split to 500' East of SR 3300 (Elm Eugene Street) Overpass

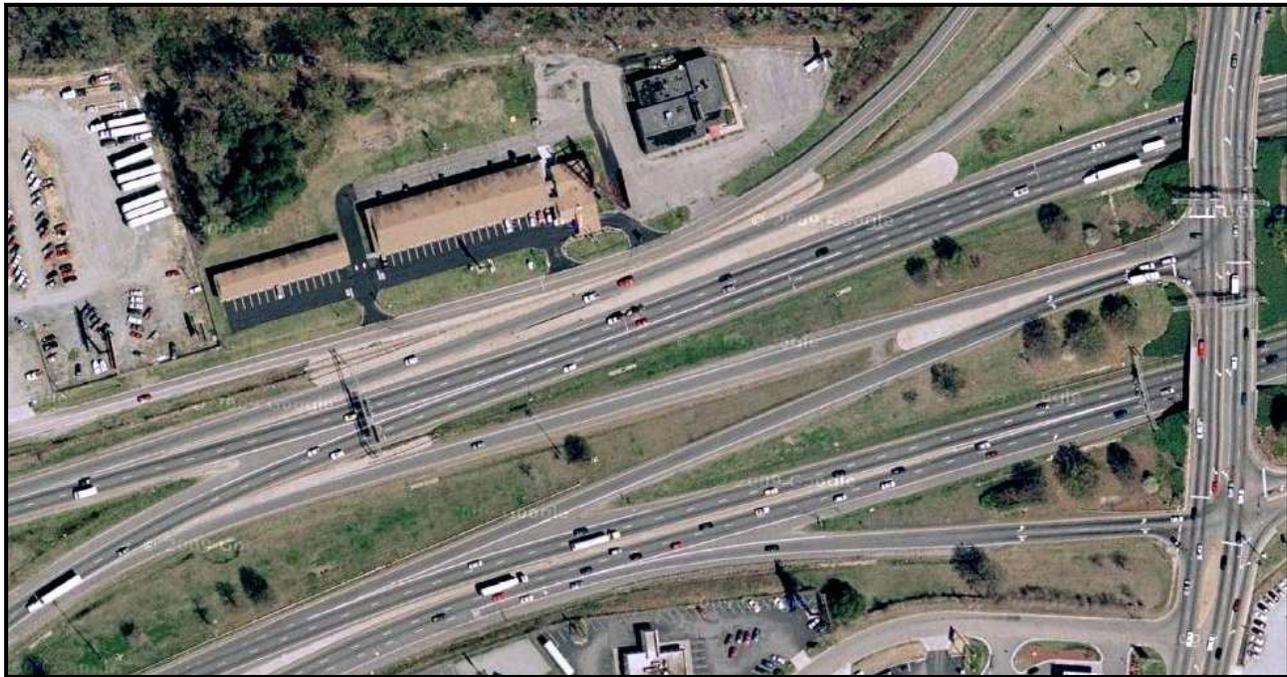
Merge Area Study Limits: I-40 Milepost Range: 14.32 to 14.53 = 0.21 mile

150' West of the I-40 / I-85 Split to the SR 1007 (Randleman Road) Overpass





Map Showing Close-up of Study Area (Westbound Direction Only)



Aerial Map of Merge Area (Randleman Rd Overpass to 150' pass I-40/85 Split)



### **Aerial Map of Total Study Area**

Existing Overhead Sign 1 (A): Located approximately 100 feet west of I-40/85 Split  
Existing Overhead Sign 2 (B): Located approximately 800 feet east of Randleman Road Overpass  
Existing Overhead Sign 3 (C): Located approximately 1000 feet west of Elm Eugene Street Overpass

New Overhead Sign (D) – Not Shown on Aerial: Located approximately 50 feet east of Elm Eugene Street Overpass

## 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 additional overhead guide sign before the I-40/85 split. The interstate at this location in the westbound direction consists of a three-lane segment that widens in the merge area to four lanes in order to provide two lanes for both I-40 and I-85 after the split. The speed limit on this section of highway is 55 mph. There is also a concrete barrier median between Elm Eugene Street and Randleman Road with a grass median in the Merge Study Area leading up to the interstate split.

The original statement of problem proposed that inadequate advanced signing of the split between I-40 and I-85 was leading to a pattern of sideswipe collisions for motorists making last minute evasive maneuver decisions. The intended purpose was to give drivers additional warning and time to accurately choose their appropriate lane of travel.

The initial crash analysis was completed from August 1, 1997 to July 31, 2000 with 161 reported crashes, twenty-three (23) of which were deemed correctable. The final completion date for the improvement at the subject intersection was on January 30, 2004 with a total cost of \$90,000.

During the after period, this segment of roadway experienced multiple name changes as growth in the area lead to additional roadway construction. The following is a timetable of events for the study segment:

- February 2004 – I-85 Bypass opened south of Greensboro;  
I-85 study segment was renamed I-85 Business.
- February 2008 – Greensboro Loop (also known as I-73) opened and I-40 diverted;  
I-40 study segment was renamed I-40 Business.
- September 2008 – I-40 designation was moved back and I-40 Business was removed.

## 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 February 2004. The before period consisted of reported crashes from December 1, 1997 through November 30, 2003 (6 years); and the after period consisted of reported crashes from March 1, 2004 through February 28, 2010 (6 years). 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 along the segment with a 0 foot y-line and excluding any ramp crashes. *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 Total Segment.

<b>Treatment Info – Total Segment</b>	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-) Percent Increase (+)</b>
Total Crashes	152	132	- 13.2 %
Total Crash Severity Index	4.08	4.10	0.5 %
Volume (2000, 2007)	149,000	127,000	- 14.8 %

<b><u>Injury Crash Summary</u></b>	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-) Percent Increase (+)</b>
Fatal injury Crashes	1	0	- 100.0 %
Class A injury Crashes	0	1	100.0 %
Class B injury Crashes	9	7	- 22.2 %
Class C Injury Crashes	44	38	- 13.6 %
Total Injury Crashes	54	46	- 14.8 %

The naive before and after analysis at the treatment location resulted in a 13 percent decrease in Total Crashes but a 0.5 percent increase in the Total Severity Index. The before period ADT year was 2000 and the after period ADT year was 2007.

The following data table depicts the Naive Before and After Analysis for the Merge Area only. Please note that Sideswipe (Merge) Crashes were the target crashes for the applied countermeasure. The Merge Crash types considered are as follows: Sideswipe, Same Direction and Ran-off Roadway (avoidance).

<b><u>Treatment Info – Merge Area</u></b>	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-) Percent Increase (+)</b>
Total Crashes	56	29	- 48.2 %
Total Crash Severity Index	2.85	3.04	6.7 %
Target Crashes – Sideswipe / Avoidance	37	16	- 56.8%
Target Crash Severity Index	2.60	2.85	9.6 %

The naive before and after analysis at the merge area location resulted in a 48 percent decrease in Total Crashes, a 57 percent decrease in Target Crashes, but a 7 percent increase in the Total Severity Index.

## **Results and Discussion**

For this evaluation, the Safety Evaluation Group is only providing *Collision Diagrams* for the merge area portion of this analysis. Referencing those *Collision Diagrams*, the before period presented a strong pattern of thirty-seven (37) sideswipe or merge avoidance collisions in this 0.21 mile section. Of those thirty-seven collisions, eighteen (18) occurred right at the I-40/85 split or the last possible decision point. During the after period, sideswipes were reduced to sixteen (16) with only five (5) at the split point. Rear-end collisions in the merge area also reduced through the evaluation from thirteen (13) to seven (7) in the after period.

Overall, it would appear that motorists are making smarter decisions and choosing the appropriate lane of travel in this section. Other additional factors include the construction of I-85 Bypass and I-73 to the west of Greensboro which helped to reduced the ADT at this location by 15 percent.

The calculated benefit to cost ratio for this project is **2.62 considering total crashes on the whole segment**. The benefit to cost ratio **considering only target crashes from the merge area is 1.90**. 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 the westbound approaches to the I-40/85 split. 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 West on I-40/85  
New Overhead Sign (approaching Elm Eugene Overpass)



Traveling West on I-40/85 at Split

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

LOCATION: I-40/85 WB at Split		BY: JBS						
COUNTY: Guilford		DATE: 8/12/2010						
FILE NO.: SS 07-00-218								
DETAILED COST:	TYPE IMPROVEMENT -	New Overhead Sign						
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$90,000	10	0.149	\$13,413			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$90,000	10	0.149	\$13,413			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$50			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$0			
	TOTAL ANNUAL COST=				\$13,463			
	TOTAL COST OF PROJECT=				\$90,000			
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	6.00	1	0.17	53	8.83	98	16.33	\$351,900
AFTER	6.00	1	0.17	45	7.50	86	14.33	\$316,633
						Annual Benefits from Crash Cost Savings		\$35,267
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$21,804		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	2.62		
TOTAL COST OF PROJECT		-	\$90,000	COMPREHENSIVE B/C RATIO		-	2.62	

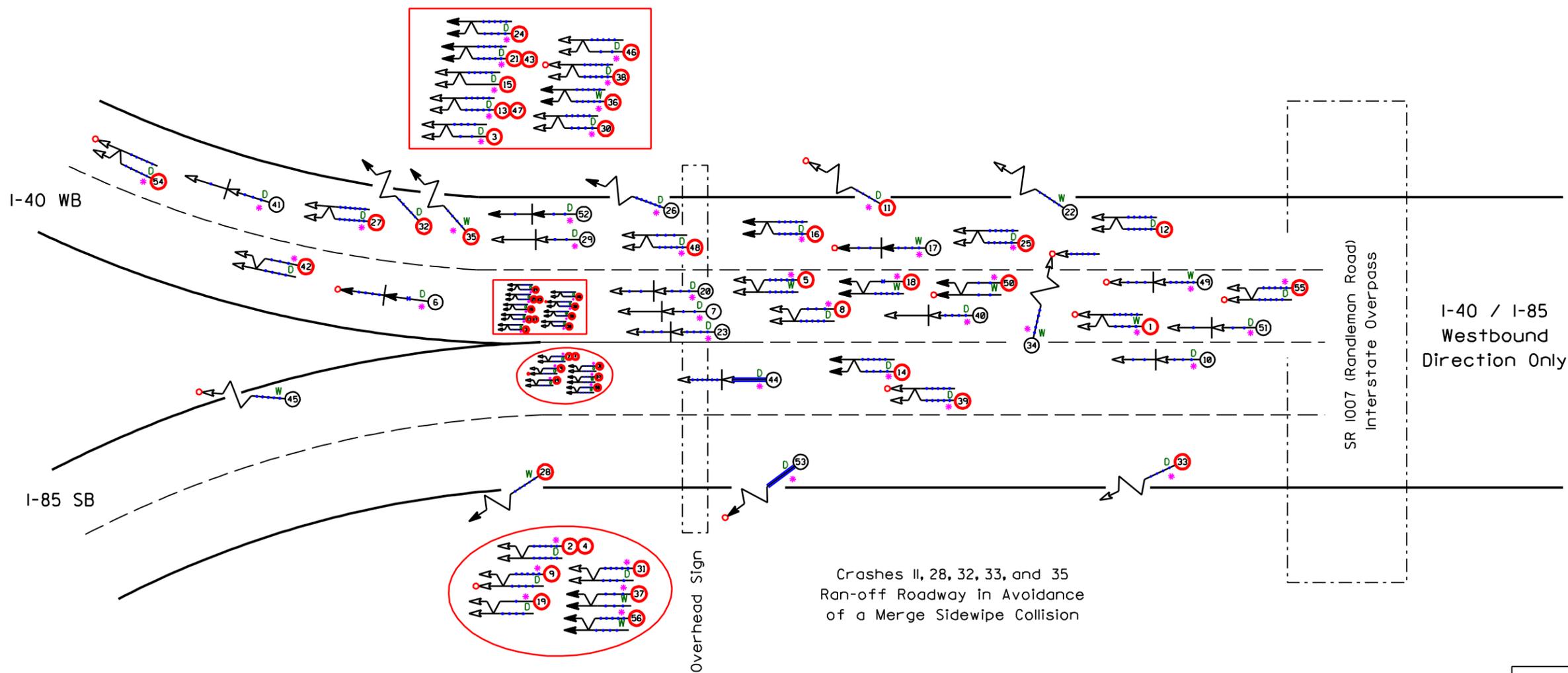
**BENEFIT-COST ANALYSIS WORKSHEET - Merge Area Target Crashes**

LOCATION: I-40/85 WB at Split		BY: JBS						
COUNTY: Guilford		DATE: 8/12/2010						
FILE NO.: SS 07-00-218								
DETAILED COST:	TYPE IMPROVEMENT -	New Overhead Sign						
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$90,000	10	0.149	\$13,413			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$90,000	10	0.149	\$13,413			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$50			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$0			
	TOTAL ANNUAL COST=				\$13,463			
	TOTAL COST OF PROJECT=				\$90,000			
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	6.00	0	0.00	8	1.33	29	4.83	\$47,450
AFTER	6.00	0	0.00	4	0.67	12	2.00	\$21,933
						Annual Benefits from Crash Cost Savings		\$25,517
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$12,054		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	1.90		
TOTAL COST OF PROJECT		-	\$90,000	COMPREHENSIVE B/C RATIO		-	1.90	



SS# 07-00-218  
 Order# 41000005545  
 Guilford County  
 BEFORE Period  
 12/1/97 - 11/30/03

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		



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

**TRAFFIC SAFETY UNIT**

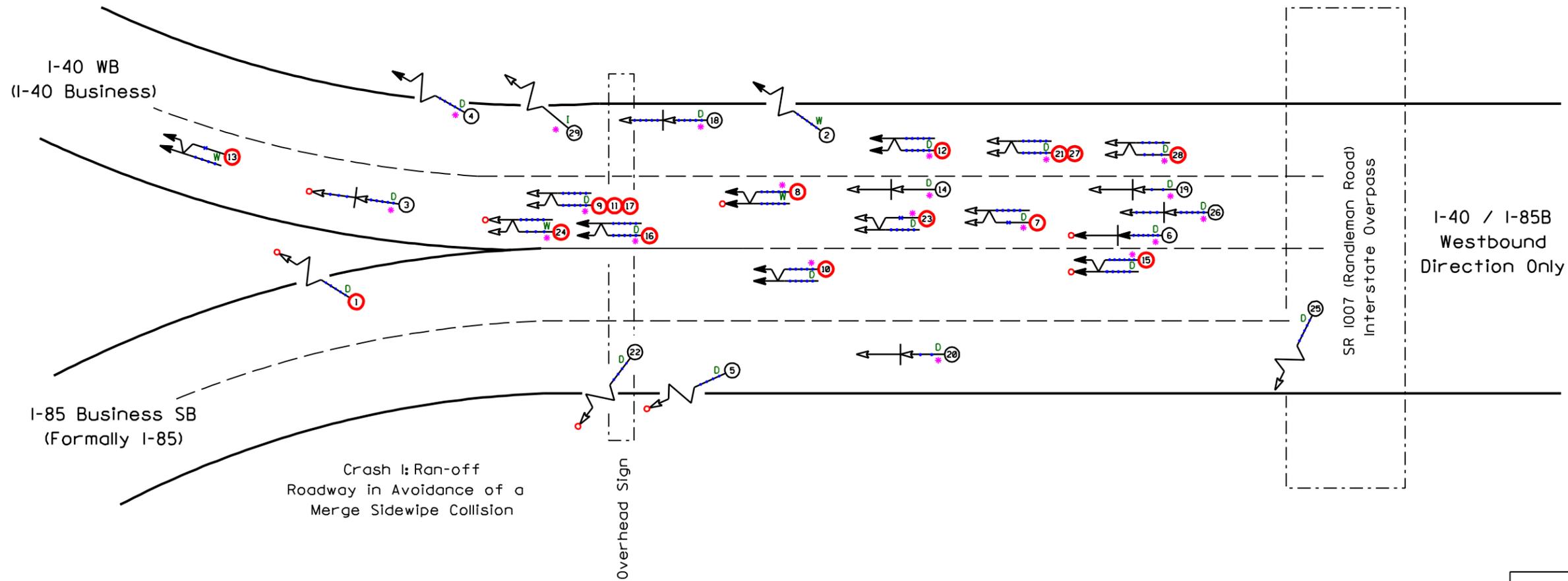
Date: 8-10-2010      Prepared By: J. Schronce

Sideswipe / Avoid Target Crashes



SS# 07-00-218  
 Order# 41000005545  
 Guilford County  
 AFTER Period  
 3/1/04 - 2/28/10

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



Sideswipe / Avoid Target Crashes

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

**TRAFFIC SAFETY UNIT**

Date: 8-11-2010      Prepared By: J. Schronce