

Spot Safety Project Evaluation

Project Log # 200811079

Spot Safety Project # 05-01-215

**Spot Safety Project Evaluation of the Ramp Merge Lane Addition
At the Intersection of SR 1497 (Cary Towne Center Blvd) and
I-40 Eastbound Ramp Terminal (Exit 291)
Wake 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

2-9-2009

Date

Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 05-01-215 located at the Intersection of SR 1497 (Cary Towne Center Blvd) and the I-40 Eastbound Off-ramp Terminal (Exit 291) in Wake County.

Project Information and Background from the Project File Folder

The spot safety project improvement countermeasure chosen for the subject location was the installation of a full width merge lane on SR 1497 to give Exit 291 Eastbound vehicles a continuous right turn lane. The subject intersection has four legs with the stop / yield condition on the I-40 East Off-ramp. Eastbound SR 1497 (Cary Towne Center Blvd) has a single lane approach and a speed limit of 45 mph. Westbound SR 1497 has a three lane approach including a left turn lane for the On-ramp and two through lanes. The I-40 Ramps are single lane approaches with right turn slips onto SR 1497 and the I-40 On-ramp.

The original statement of problem was that a lack of storage in the right turn / merge slip lane from the I-40 Eastbound Off-ramp has produced a rear-end crash problem. Motorists have to turn their heads to view on-coming traffic therefore causing low-speed collisions at the yield sign.

The initial crash analysis was completed from July 1, 1997 to June 30, 2000 with twenty-eight (28) reported crashes, all of which were deemed correctable. The final completion date for the improvement at the subject intersection was on October 15, 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 through October 2003. The before period consisted of reported crashes from August 1, 1998 through July 31, 2003 (5 years); and the after period consisted of reported crashes from November 1, 2003 through October 31, 2008 (5 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 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 I-40 Exit 291 Ramp Rear-End crashes were the target crashes for the applied countermeasure. Westbound SR 1497 Sideswipe crashes were also considered targets in the after period since this traffic movement was created by the installed countermeasure.

<u>Treatment Information</u>			
	Before	After	Percent Reduction (-) Percent Increase (+)
Total crashes	64	19	- 70.3 %
Total Severity Index	4.96	3.73	- 24.8 %
Target Crashes	52	5	- 90.4 %
Target Crash Severity Index	3.85	6.92	79.7 %
Volume	16,600	14,800	- 10.8 %
<u>Injury Crash Summary</u>			
Fatal injury Crashes	0	0	- 100.0 %
Class A injury Crashes	1	0	- 100.0 %
Class B injury Crashes	3	0	- 100.0 %
Class C Injury Crashes	21	7	- 66.7 %
Total Injury Crashes	25	7	- 72.0 %

The naive before and after analysis at the treatment location resulted in a 70 percent decrease in Total Crashes, a 90 percent decrease in Target Crashes, and a 25 percent decrease in the Total Severity Index. The before period ADT year was 2001 and the after period ADT year was 2006.

Results and Discussion

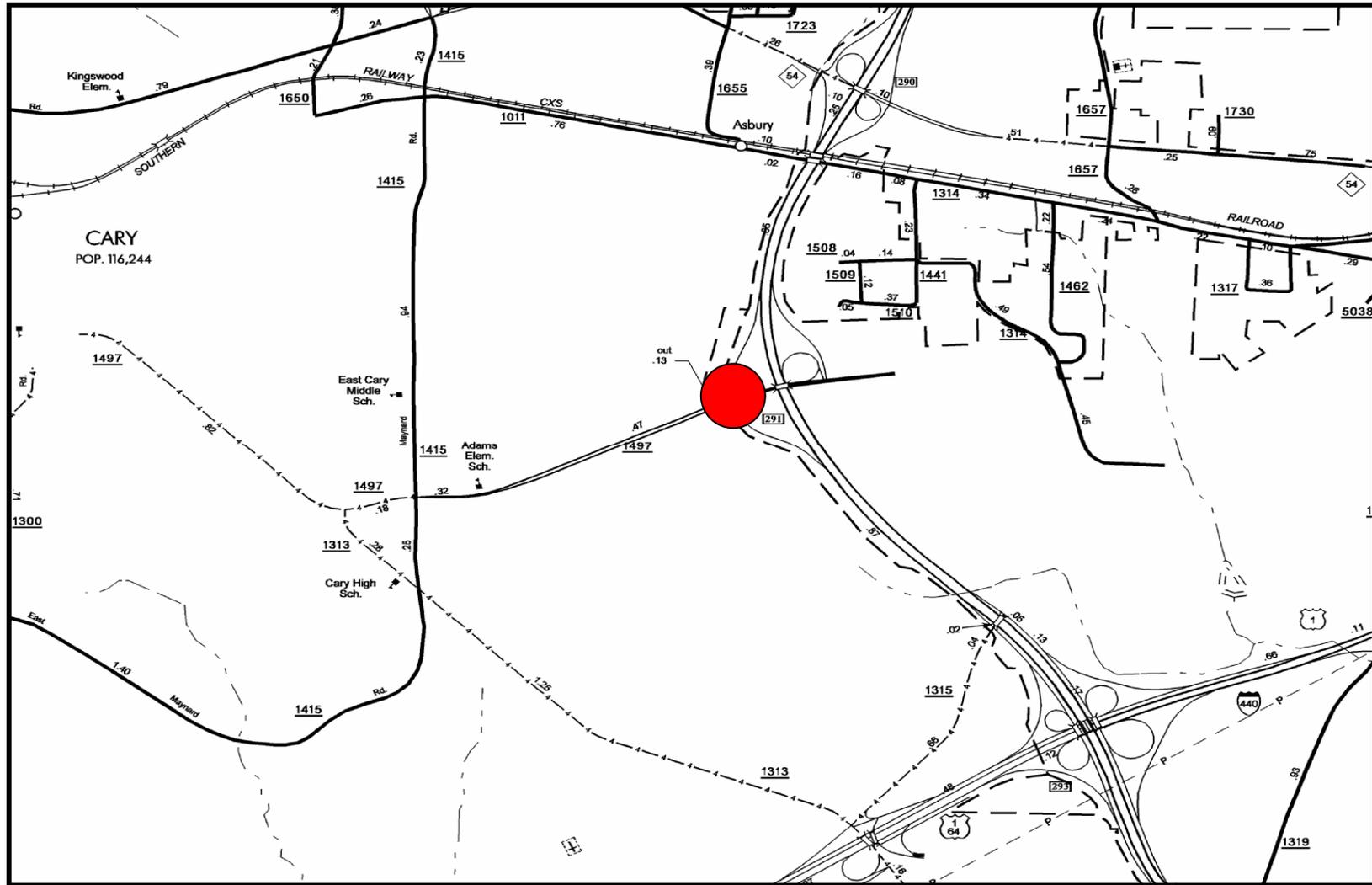
The naive before and after analysis involving the comparison of treatment actual before data versus treatment actual after data resulted in a 70 percent decrease in Total Crashes and a 90 percent decrease in Target Crashes. The summary results above demonstrate that both Total Crashes and Target Crashes appear to have decreased at the treatment location from the before to the after period.

Referencing the *Collision Diagrams*, a large portion of crashes at the intersection in the before period (52 of 64) were the result of a vehicle failing to stop on the ramp accessing SR 1497 at the yield sign. After the merge lane extension, this pattern was significantly reduced to just five (5). A small pattern of rear-end crashes accessing the on-ramp has developed in the after period. This is possibly due to a volume increase of left turning motorists from residential development across the interstate. Overall, this location has seen a 10 percent reduction in volume over the analysis.

The calculated benefit to cost ratio for this project is **8.01 considering total crashes**. The benefit to cost ratio **considering only target crashes is 3.59**. 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 for all 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.

**Location Map
Wake County
Evaluation of Spot Safety Project # 05-01-215**



Treatment Location: SR 1497 (Cary Towne Center Blvd) at I-40 EB Ramp Terminal (Exit 291)

**SS# 05-01-215 Aerial Map
Wake County**



**I-40 EB Merge Lane
Addition**

I-40 EB On-Ramp

**SR 1497
Cary Towne Center
Blvd**

TREATMENT SITE PHOTOS TAKEN 1-27-2009



Traveling South on I-40 EB Ramp (Exit 291)



I-40 EB Off-Ramp Merge Lane onto SR 1497



End of Merge Lane onto Cary Towne Center Blvd



Traveling West on SR 1497 (Cary Towne Center Blvd) approaching Ramp



Traveling East on SR 1497



Traveling East on Cary Towne Center Blvd

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: Cary Towne Center Blvd at I-40 EB
 COUNTY: Wake
 FILE NO.: SS 05-01-215

BY: JBS
 DATE: 2/5/2009
 NOTES: Total Crashes

DETAILED COST: TYPE IMPROVEMENT - Add Merge Lane

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$150,000	10	0.149	\$22,354
	\$0	0	0.000	\$0
Right-of-Way	\$0	0	0.000	\$0
TOTALS	\$150,000	10	0.149	\$22,354

ESTIMATED INCREASE IN ANNUAL MAINT. COST = \$400
 ESTIMATED INCREASE IN ANNUAL UTILITY COST = \$0
 TOTAL ANNUAL COST= \$22,754
 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	5.00	1	0.20	24	4.80	39	7.80	\$216,820
AFTER	5.00	0	0.00	7	1.40	12	2.40	\$34,560

Annual Benefits from Crash Cost Savings \$182,260

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = \$159,506

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 8.01

TOTAL COST OF PROJECT - \$150,000 COMPREHENSIVE B/C RATIO - 8.01

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: SR 1497 at I-40 EB Ramps
 COUNTY: Wake
 FILE NO.: SS 05-01-215

BY: JBS
 DATE: 2/5/2009
 NOTES: Target Crashes - Ramp Rear Ends

DETAILED COST: TYPE IMPROVEMENT - Add Merge Lane off Ramp

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$150,000	10	0.149	\$22,354
Right-of-Way	\$0	0	0.000	\$0
TOTALS	\$150,000	10	0.149	\$22,354

ESTIMATED INCREASE IN ANNUAL MAINT. COST = \$400
 ESTIMATED INCREASE IN ANNUAL UTILITY COST = \$0
 TOTAL ANNUAL COST= \$22,754
 TOTAL COST OF PROJECT= \$150,000

COMPREHENSIVE COST REDUCTION:

ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES

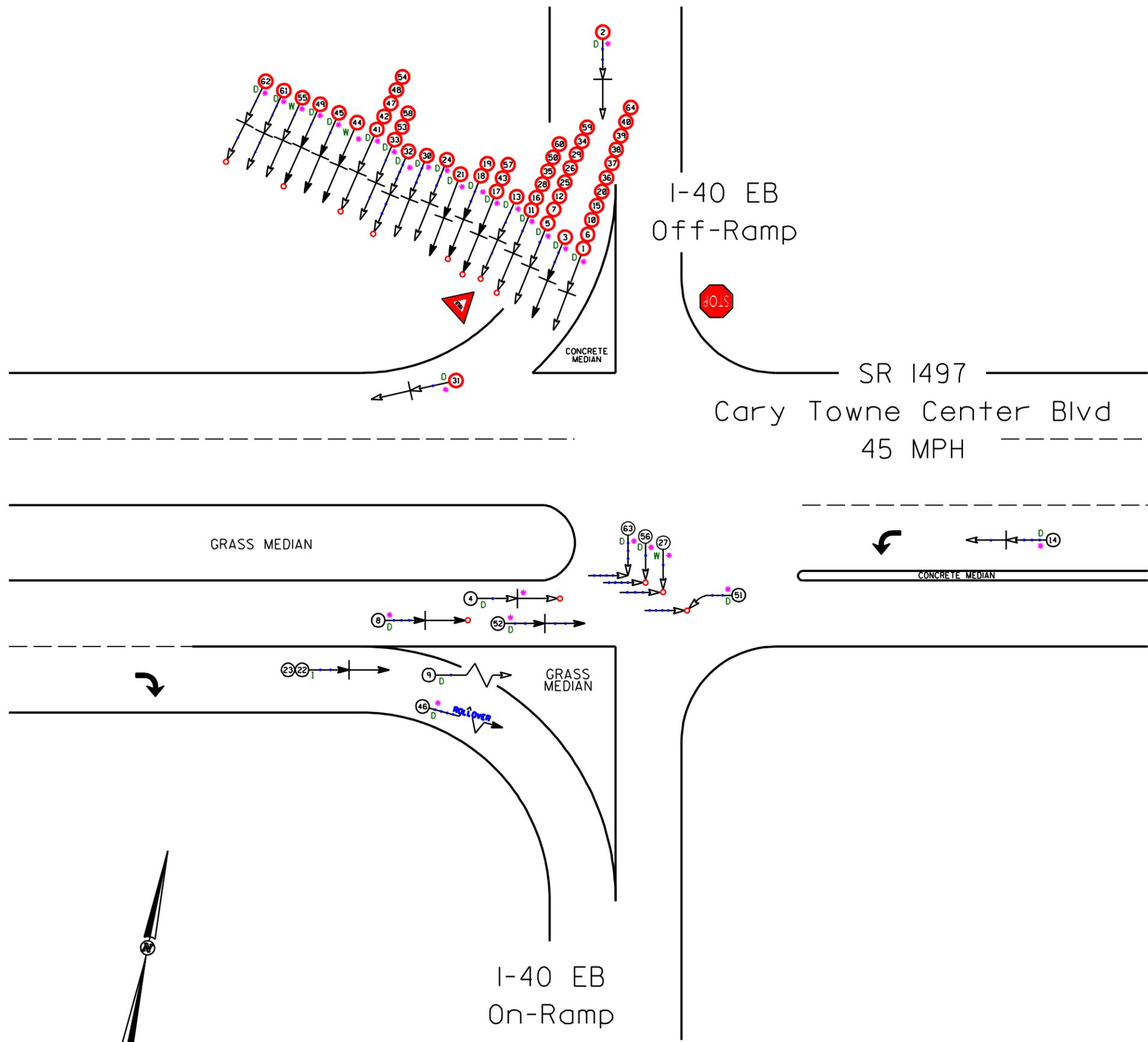
TIME PERIOD	YEARS	K & A CRASHES	K & A CRASHES PER YR	B & C CRASHES	B & C CRASHES PER YR	PDO CRASHES	PDO CRASHES PER YR	ANNUAL COSTS
BEFORE	5.00	0	0.00	20	4.00	32	6.40	\$96,960
AFTER	5.00	0	0.00	4	0.80	1	0.20	\$15,180

Annual Benefits from Crash Cost Savings \$81,780

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = \$59,026

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 3.59

TOTAL COST OF PROJECT - \$150,000 COMPREHENSIVE B/C RATIO - 3.59



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	

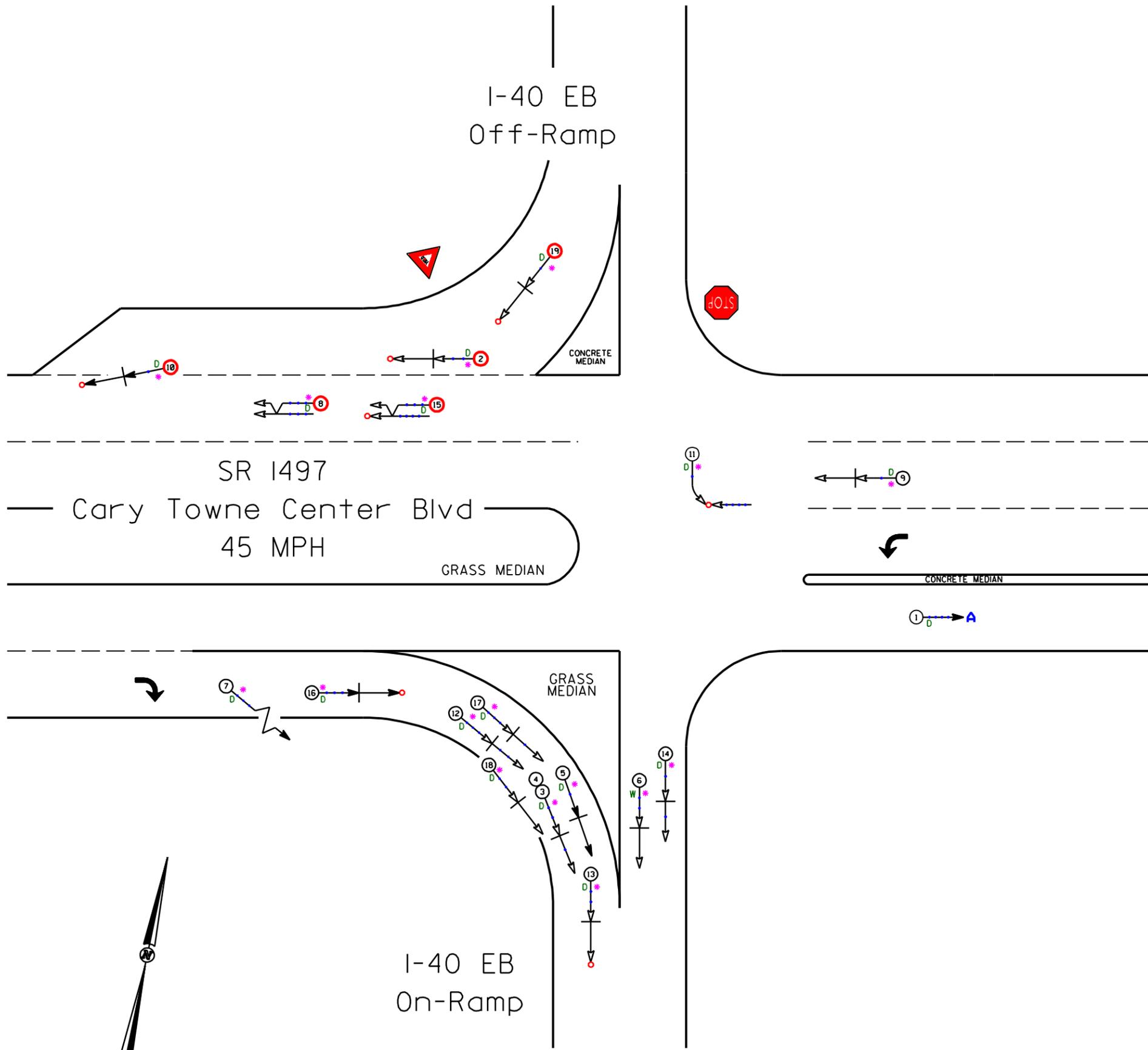
SS# 05-01-215
Wake County
BEFORE Period
8/1/98 - 7/31/03

⊕ Target Crashes

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

	COLLISION DIAGRAM	
	DIVISION: 5	AREA:
	STUDY PERIOD: 8/1/1998 - 1/31/2003	
	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: 2-5-2009		
LOG NUMBER: SS* 05-01-215 BEFORE		

N.C. DEPARTMENT of TRANSPORTATION
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		SPEED UNKNOWN
	RAN OFF ROAD				70 AND UP		OILY

SS# 05-01-215
Wake County
AFTER Period
11/1/03 - 10/31/08

Target Crashes

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

	COLLISION DIAGRAM	
	DIVISION: 5	AREA:
	STUDY PERIOD: 11/1/2003 - 10/31/2008	
	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: 2-5-2009		
LOG NUMBER: SS* 05-01-215 AFTER		

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