

# Spot Safety Project Evaluation

Project Log # 200812181

Spot Safety Project # 10-01-204

**Spot Safety Project Evaluation of the Traffic Signal and  
Additional Ramp Left Turn Lane Installation at the Intersection of  
SR 3624 (Rea Rd) and I-485 Westbound Ramp Terminal (Exit 59)  
City of Charlotte, Mecklenburg 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

2-4-2009

Date

Traffic Safety Project Engineer

# ***Spot Safety Project Evaluation Documentation***

## **Subject Location**

Evaluation of Spot Safety Project Number 10-01-204 located at the Intersection of SR 3624 (Rea Road) and the I-485 Westbound Ramp Terminal (Exit 59) in Mecklenburg County.

## **Project Information and Background from the Project File Folder**

The spot safety project improvement countermeasures chosen for the subject location were the installation of an interconnected multi-phase traffic signal (Sig ID 10-1859), along with pavement remarking to form a double left turn from the exit ramp. In the before period, the I-485 Westbound Off-Ramp provided one exclusive right and left turn lanes with sufficient width available for lane additions. SR 3624 (Rea Road) is a four lane highway divided by a small concrete island and a speed limit of 45 mph. The subject location is a three-leg intersection, which was controlled by stop signs on the I-485 Ramp Terminal. The ramp access orientation was not altered during these improvements.

The original statement of problem was that insufficient gaps have developed for vehicles attempting to enter Rea Road and have led to a pattern of frontal impact collisions at the ramp terminal. The intersection met volume warrants 1A, 1B, 1C, 2 and 3B.

The initial crash analysis was completed from May 1, 1997 to May 1, 2000 with seventeen (17) reported crashes, eleven (11) of which were deemed correctable. The final completion date for the improvement at the subject intersection was on September 1, 2003 with a total cost of \$100,000.00.

## **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 1998. 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 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	52	27	- 48.1 %
Total Severity Index	5.59	6.00	7.3 %
Target Crashes	21	6	- 71.4 %
Target Crash Severity Index	8.13	5.93	- 27.1 %
Volume	17,800	27,700	55.6 %
<u>Injury Crash Summary</u>			
Fatal injury Crashes	0	0	N/A
Class A injury Crashes	1	1	0.0 %
Class B injury Crashes	5	1	- 80.0 %
Class C Injury Crashes	17	7	-58.8 %
Total Injury Crashes	23	9	- 60.9 %

The naive before and after analysis at the treatment location resulted in a 48 percent decrease in Total Crashes, a 71 percent decrease in Target Crashes, but a 7 percent increase 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 48 percent decrease in Total Crashes and a 71 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*, the before period presented two distinct crash patterns at this location. First, vehicles exiting the ramp were colliding with northbound Rea Road traffic due to lack of gaps and impatience. Also, low speed rear-end collisions were occurring in the right turn only ramp lane. After the signal installation, the left-turn same roadway pattern was significantly reduced from seventeen (17) to five (5) which were the result of vehicles running the red light.

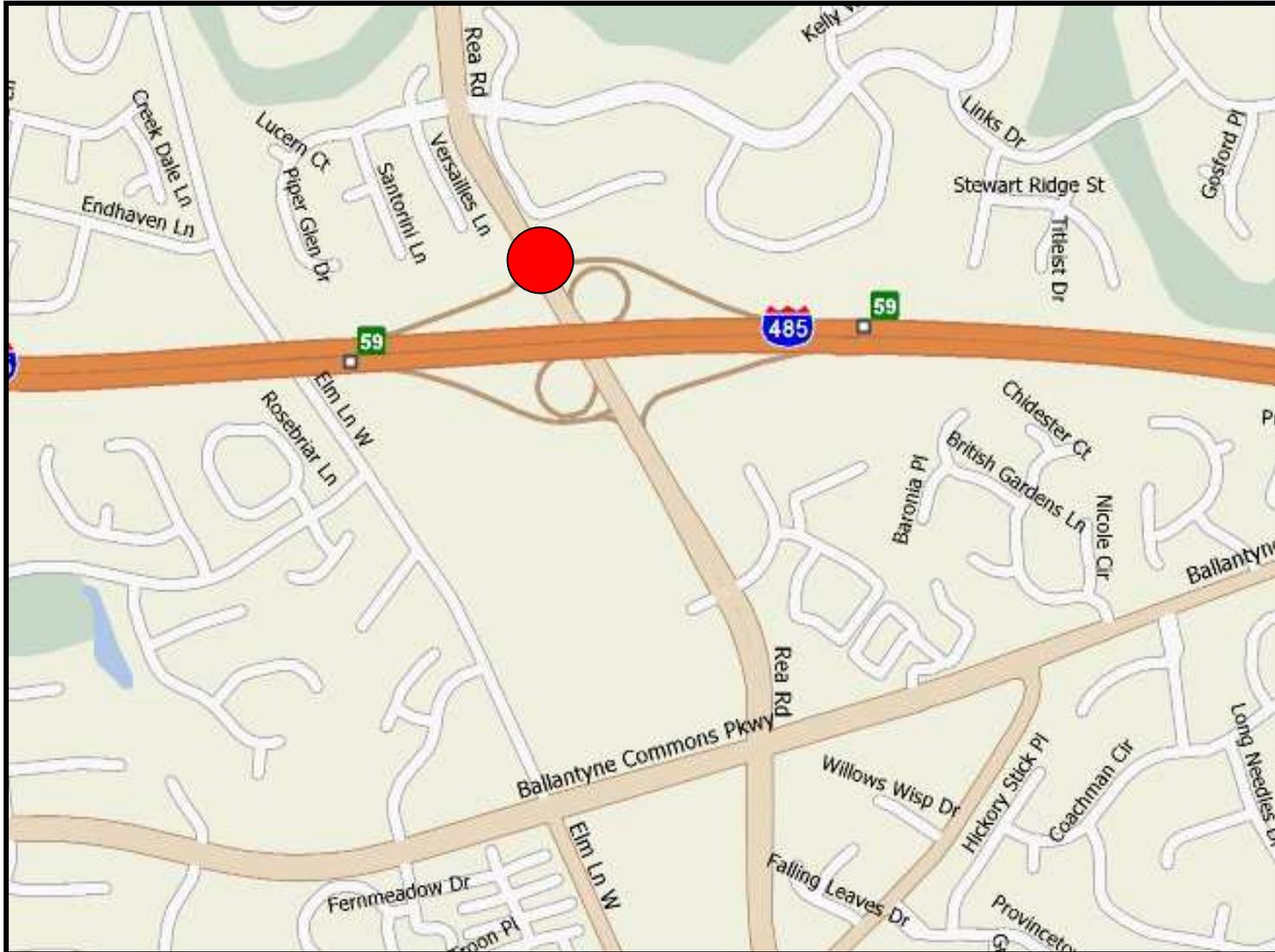
The rear-end crash pattern on the ramp was also positively impacted by the after period changes by the creation of gaps in Rea Road traffic flow. This pattern reduced from sixteen (16) crashes in the before period to seven (7) in the after period.

The calculated benefit to cost ratio for this project is **3.28 considering total crashes**. The benefit to cost ratio **considering only target crashes is 7.10**. 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.

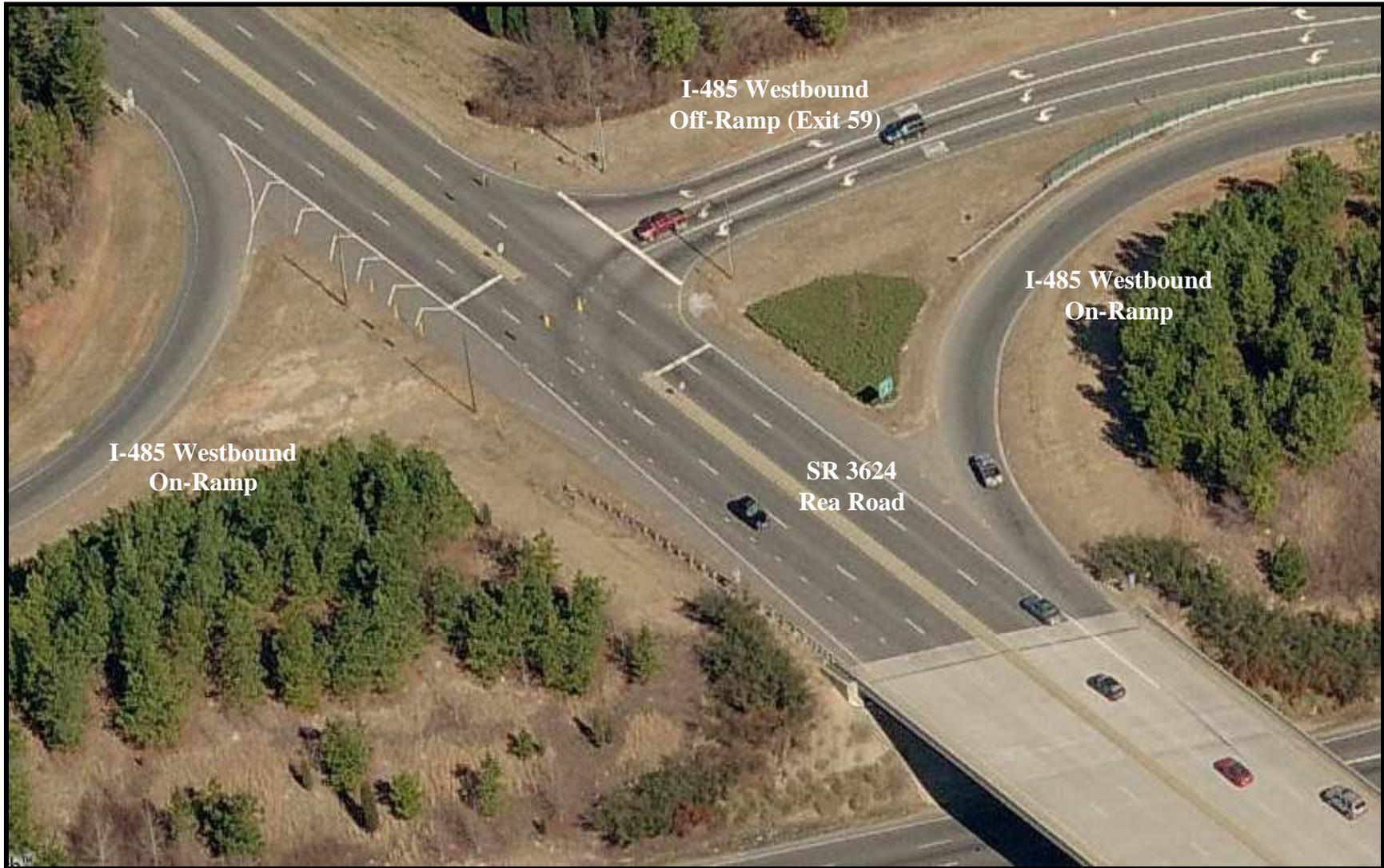
As the Safety Evaluation Group completes additional spot safety reviews for this type of countermeasure, we will be able to provide objective and definite information regarding actual crash reduction factors for this type of intersection.

**Location Map**  
**City of Charlotte, Mecklenburg County**  
**Evaluation of Spot Safety Project # 10-01-204**



**Treatment Location: SR 3624 (Rea Road) at I-485 Westbound Ramp Terminal**

**SS# 10-01-204 Aerial Map  
Mecklenburg County**



I-485 Westbound  
Off-Ramp (Exit 59)

I-485 Westbound  
On-Ramp

I-485 Westbound  
On-Ramp

SR 3624  
Rea Road

**TREATMENT SITE PHOTOS TAKEN 1-15-2009**



Traveling North on SR 3624 (Rea Road)



Traveling North on Rea Road



Traveling South on SR 3624 (Rea Road)



Traveling South on Rea Road



Traveling West on I-485 Exit 59 Westbound



Traveling West on I-485 Westbound Off-Ramp

**BENEFIT-COST ANALYSIS WORKSHEET**

LOCATION: Rea at I-485 WB Ramp  
 COUNTY: Mecklenburg  
 FILE NO.: SS 10-01-204

BY: JBS  
 DATE: 2/3/2009  
 NOTES: Total Crashes

DETAILED COST: TYPE IMPROVEMENT - New Signal

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$100,000	10	0.149	\$14,903
	\$0	0	0.000	\$0
Right-of-Way	\$0	0	0.000	\$0
<b>TOTALS</b>	<b>\$100,000</b>	<b>10</b>	<b>0.149</b>	<b>\$14,903</b>

ESTIMATED INCREASE IN ANNUAL MAINT. COST = \$2,200  
 ESTIMATED INCREASE IN ANNUAL UTILITY COST = \$900  
 TOTAL ANNUAL COST= \$18,003  
 TOTAL COST OF PROJECT= \$100,000

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	22	4.40	29	5.80	\$201,820
AFTER	5.00	1	0.20	8	1.60	18	3.60	\$142,840

Annual Benefits from Crash Cost Savings \$58,980

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = \$40,977

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 3.28

TOTAL COST OF PROJECT - \$100,000 COMPREHENSIVE B/C RATIO - 3.28

**BENEFIT-COST ANALYSIS WORKSHEET**

LOCATION: Rea Rd at I-485 WB Ramp  
 COUNTY: Mecklenburg  
 FILE NO.: SS 10-01-204

BY: JBS  
 DATE: 2/3/2009  
 NOTES: Target Crashes - Frontal Impact

DETAILED COST: TYPE IMPROVEMENT - New Signal

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$100,000	10	0.149	\$14,903
	\$0	0	0.000	\$0
Right-of-Way	\$0	0	0.000	\$0
<b>TOTALS</b>	<b>\$100,000</b>	<b>10</b>	<b>0.149</b>	<b>\$14,903</b>

ESTIMATED INCREASE IN ANNUAL MAINT. COST = \$2,200  
 ESTIMATED INCREASE IN ANNUAL UTILITY COST = \$900  
 TOTAL ANNUAL COST= \$18,003  
 TOTAL COST OF PROJECT= \$100,000

COMPREHENSIVE COST REDUCTION:

ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES

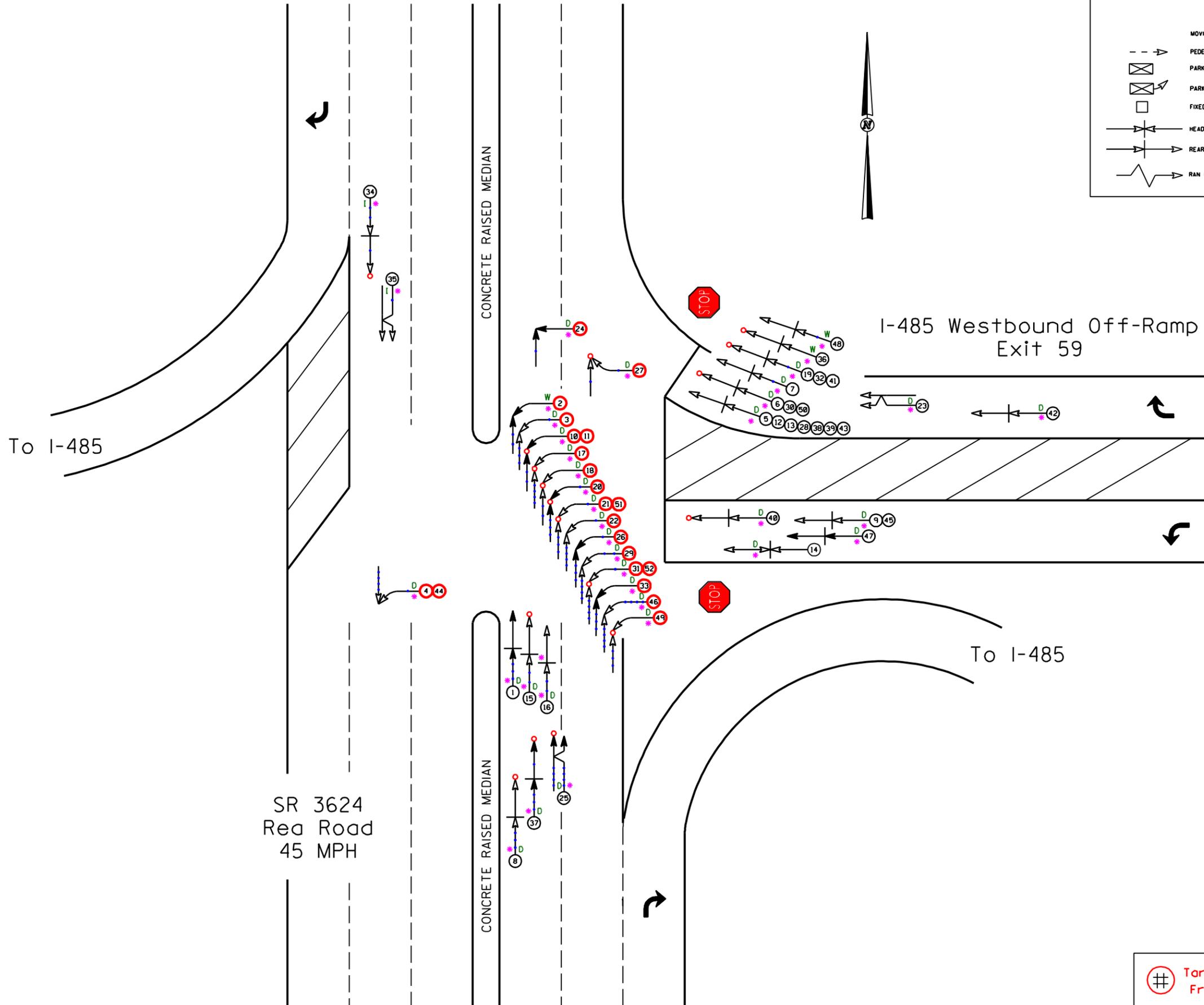
TIME PERIOD	YEARS	K & A CRASHES	K & A CRASHES PER YR	B & C CRASHES	B & C CRASHES PER YR	PDO CRASHES	PDO CRASHES PER YR	ANNUAL COSTS
BEFORE	5.00	1	0.20	10	2.00	10	2.00	\$143,800
AFTER	5.00	0	0.00	4	0.80	2	0.40	\$15,960

Annual Benefits from Crash Cost Savings \$127,840

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = \$109,837

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 7.10

TOTAL COST OF PROJECT - \$100,000 COMPREHENSIVE B/C RATIO - 7.10



**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		

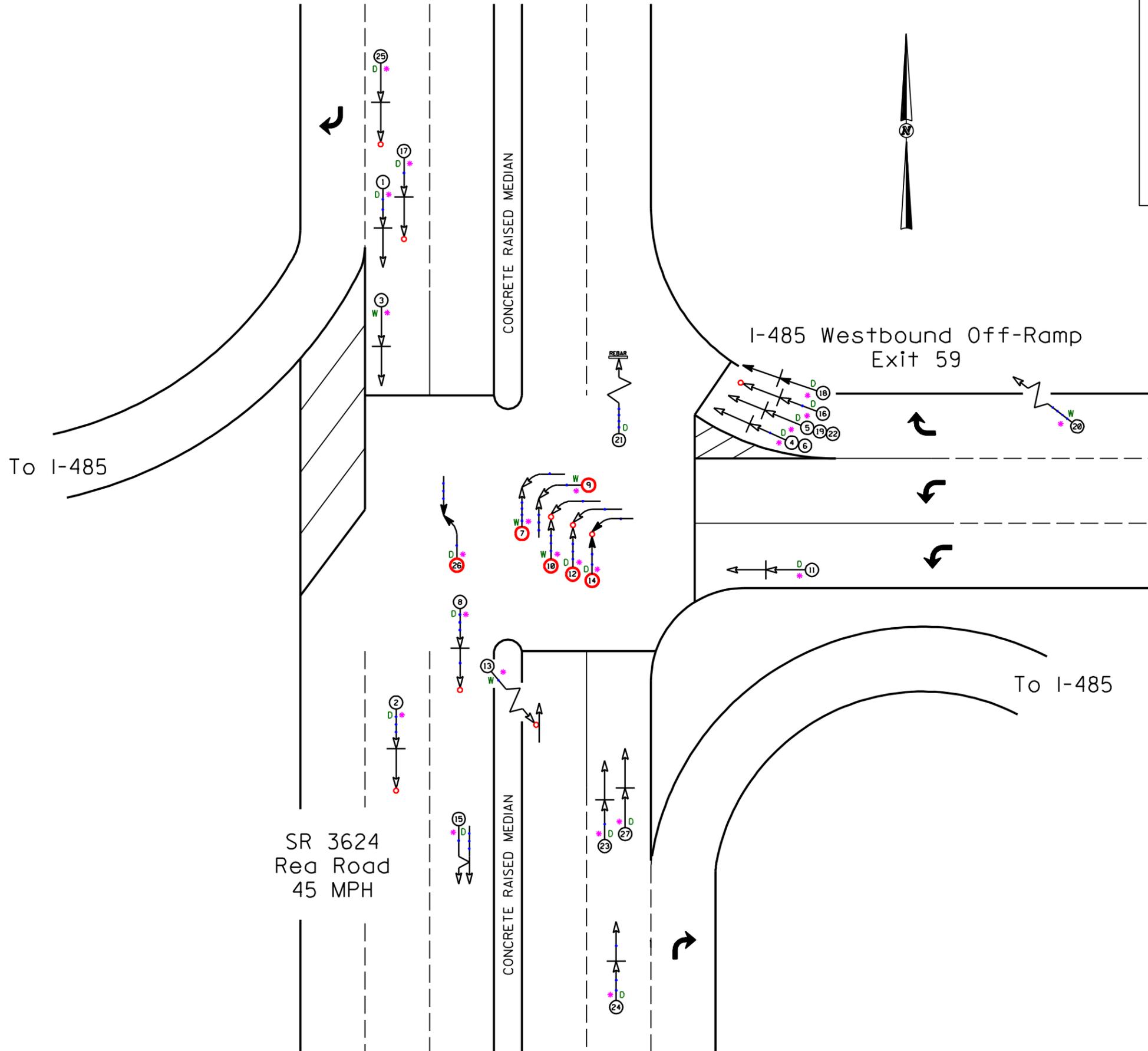
SS# 10-01-204  
 Mecklenburg County  
 City of Charlotte  
 BEFORE Period  
 8/1/98 - 7/31/03

**TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT**

	COLLISION DIAGRAM	
	DIVISION: 10	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: 1-28-2009		
LOG NUMBER: SS* 10-01-204 BEFORE		

Target Crashes  
 Frontal Impact

**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	OILY
RAN OFF ROAD		70 AND UP	
		SPEED UNKNOWN	

SS# 10-01-204  
 Mecklenburg County  
 City of Charlotte  
 AFTER Period  
 11/1/03 - 10/31/08

New Signalized  
 Intersection &  
 Left Turn Lane  
 Ramp Addition

Target Crashes  
 Frontal Impact

**TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT**

COLLISION DIAGRAM	
DIVISION: 10	AREA:
STUDY PERIOD: 11/1/2003 - 10/31/2008	
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: 1-29-2009	
LOG NUMBER: SS* 10-01-204 AFTER	

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