

Spot Safety Project Evaluation

Project Log # 200704325

Spot Safety Project # 12-01-203

**Spot Safety Project Evaluation of the Traffic Signal Phasing Changes
At the Intersection of SR 1401 (16th Street NE) and
SR 1402 / 1404 (29th Avenue Drive NE)
Catawba County, City of Hickory**

Documents Prepared By:

Safety Evaluation Group
Traffic Safety Systems Management Section
Traffic Engineering and Safety Systems Branch
North Carolina Department of Transportation

Principal Investigator

Jason B. Schronce

9-26-2007
Date

Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 12-01-203 – The Intersection of SR 1401 (16th Street NE) and SR 1402 / 1404 (29th Avenue Drive NE) in Catawba County.

Project Information and Background from the Project File Folder

The spot safety project improvement countermeasure chosen for the subject location was the addition of protected-permitted phases on the northbound, westbound, and eastbound approaches to the intersection. The signal heads were also upgraded to LEDs during this revision. In the study period, SR 1401 (16th St. NE) and SR 1402 / 1404 (29th Ave. Dr. NE) were both two-lane facilities at the subject intersection which widen to include left turn lanes on all four approaches. Speed limits of 45 mph exist for both roadways. The subject location has businesses in 3 quadrants including a 3-story office complex, State Employees Credit Union, and a grocery store strip mall adding to the traffic influx.

The original statement of problem was the excessive delay on the three approaches requiring new phasing. The goal was to relieve delay during peak hour traffic flows. The intersection was identified as a potential location on the 2000 Highway Safety Improvement Program but did not meet all warrants.

The initial crash analysis was completed from January 1, 1997 to December 31, 1999 with twenty-one (21) reported crashes, eight (8) of which were Left Turn Same Roadway Crashes. The final completion date for the improvement at the subject intersection was on April 29, 2002 with a total cost of \$20,000.00.

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 March 1, 2002 to June 30, 2002. The before period consisted of reported crashes from August 1, 1997 through February 28, 2002 (4 years and 7 months) and the after period consisted of reported crashes from July 1, 2002 through January 31, 2007 (4 years and 7 months). The ending date for this analysis was determined by the available crash data at the time of analysis.

The treatment data consisted of all crashes within 150 feet of the subject intersection. All commercial driveways and entrances were outside the 150-foot y-line. *Please see attached location 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.

Treatment Information			
	Before	After	Percent Reduction (-) Percent Increase (+)
Total crashes	37	46	24.32 %
Total Severity Index	6.45	2.93	- 54.57 %
Target Crashes	26	21	- 19.23 %
Target Crash Severity Index	7.62	3.11	- 59.19 %
Volume	19,550	24,000	22.76 %
Injury Crash Summary			
Fatal injury Crashes	0	0	N/A
Class A injury Crashes	1	0	- 100.00 %
Class B injury Crashes	6	3	- 50.00 %
Class C Injury Crashes	11	9	- 18.18 %
Total Injury Crashes	18	12	- 33.33 %

The naive before and after analysis at the treatment location resulted in a 24 percent increase in Total Crashes, a 19 percent decrease in Target Crashes, and a 59 percent decrease in the Target Severity Index. The before period ADT year was 1999 and the after period ADT year was 2004.

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 24 percent increase in Total Crashes and a 19 percent decrease in Target Crashes. The summary results above demonstrate that Target Crashes and overall Crash Severity appear to have decreased at the treatment location from the before to the after period.

Referencing the *Collision Diagram*, a large portion of Target Crashes at the intersection in the before period (18 of 26) were the result of vehicles improperly turning left on permissive green signal phasing. After the additional phases were installed, this pattern was reduced on SR 1402 / 1404 (29th Ave. Dr. NE) from twelve (12) crashes to four (4). However, Left Turn Same Roadway crashes on SR 1401 (16th St. NE) remained constant at three (3) in both the northbound and southbound directions.

There was also a significant increase in Rear-End Crashes on the SR 1402 / 1404 approaches of the intersection (from 6 to 19). Examining the volume increase over the study period, we see approximately a 30 percent increase on both the eastbound and westbound approaches in average daily traffic. It can be assumed that driver impatience has increased due to the longer signal cycle created by the addition of the protected left turn phasing.

The calculated benefit to cost ratio for this project is 35.37 considering total crashes. The benefit to cost ratio considering only target crashes is 40.88. 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. The main factor in having high benefit-cost values is reduction in crash severity.

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.

TREATMENT SITE PHOTO TAKEN 8/27/2007



Traveling East on SR 1404 (29th Avenue Drive NE)



Traveling East on SR 1404 (29th Ave. Dr. NE)



Traveling West on SR 1402 (29th Ave. Dr. NE)



Traveling North on SR 1401 (16th Street NE)



Traveling South on SR 1401 (16th St. NE)

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: 16th St. NE at 29th Ave Dr. NE
 COUNTY: Catawba (Hickory)
 FILE NO.: SS 12-01-203

BY: JBS
 DATE: 9/25/2007
 NOTES: Total Crashes

DETAILED COST: TYPE IMPROVEMENT - Added Protected-Permitted Phasing (and LEDs)

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$20,000	10	0.149	\$2,981
	\$0	0	0.000	\$0
Right-of-Way	\$0	0	0.000	\$0
TOTALS	\$20,000	10	0.149	\$2,981

ESTIMATED INCREASE IN ANNUAL MAINT. COST = \$0
 ESTIMATED INCREASE IN ANNUAL UTILITY COST = \$300
 TOTAL ANNUAL COST= \$3,281
 TOTAL COST OF PROJECT= \$20,000

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	4.58	1	0.22	17	3.71	19	4.15	\$192,162
AFTER	4.58	0	0.00	12	2.62	34	7.42	\$76,114

Annual Benefits from Crash Cost Savings \$116,048

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = \$112,767

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 35.37

TOTAL COST OF PROJECT - \$20,000 COMPREHENSIVE B/C RATIO - 35.37

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: 16th St. NE at 29th Ave. Dr. NE
 COUNTY: Catawba (Hickory)
 FILE NO.: SS 12-01-203

BY: JBS
 DATE: 9/25/2007
 NOTES: Target Crashes (Frontal Impact)

DETAILED COST: TYPE IMPROVEMENT - Added Protected-Permitted Phasing

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$20,000	10	0.149	\$2,981
	\$0	0	0.000	\$0
Right-of-Way	\$0	0	0.000	\$0
TOTALS	\$20,000	10	0.149	\$2,981

ESTIMATED INCREASE IN ANNUAL MAINT. COST = \$0
 ESTIMATED INCREASE IN ANNUAL UTILITY COST = \$300
 TOTAL ANNUAL COST= \$3,281
 TOTAL COST OF PROJECT= \$20,000

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	4.58	1	0.22	13	2.84	12	2.62	\$170,480
AFTER	4.58	0	0.00	6	1.31	15	3.28	\$36,354

Annual Benefits from Crash Cost Savings \$134,127

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = \$130,846

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 40.88

TOTAL COST OF PROJECT - \$20,000 COMPREHENSIVE B/C RATIO - 40.88

Family Video

Office Building

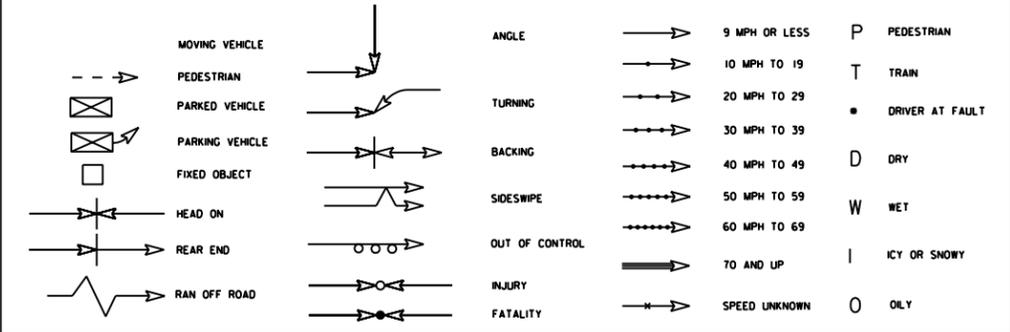
SECU

SR 1401
16th Street NE
45 MPH

SR 1402
29th Ave. Drive NE
45 MPH

SS# 12-01-203
Catawba County
City of Hickory
Before Period
8/1/97 - 2/28/02
SR 1401 at SR 1402

LEGEND



Target Crashes

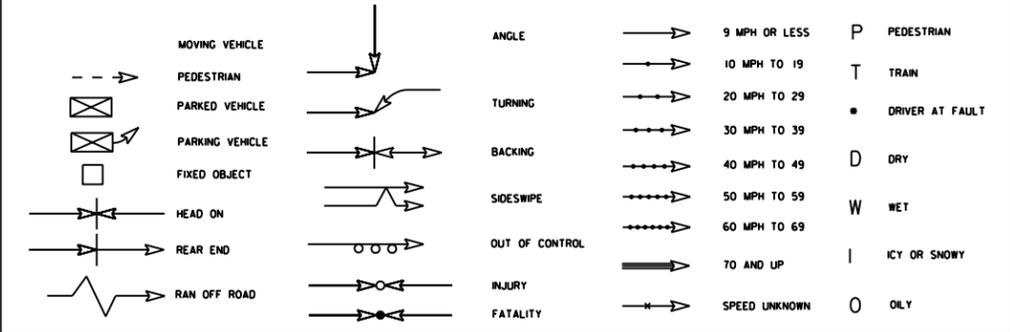


TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

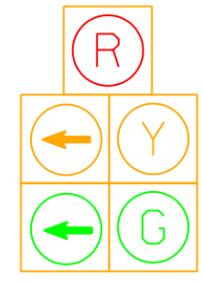
	COLLISION DIAGRAM	
	DIVISION: 12	AREA:
	STUDY PERIOD: 8/1/1997 TO 2/28/2002	
	DISTANCE: Y-LINE = 150FT	
ANALYSIS PREPARED BY: JBS		
ANALYSIS CHECKED BY: BR		
DIAGRAM PREPARED BY: JBS		
DIAGRAM REVIEWED BY: ST		
SCALE: NOT TO SCALE		
DATE: 8-23-2007		
LOG NUMBER: SS* 12-01-203		

N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRAFFIC ENGINEERING AND SAFETY
SYSTEMS BRANCH

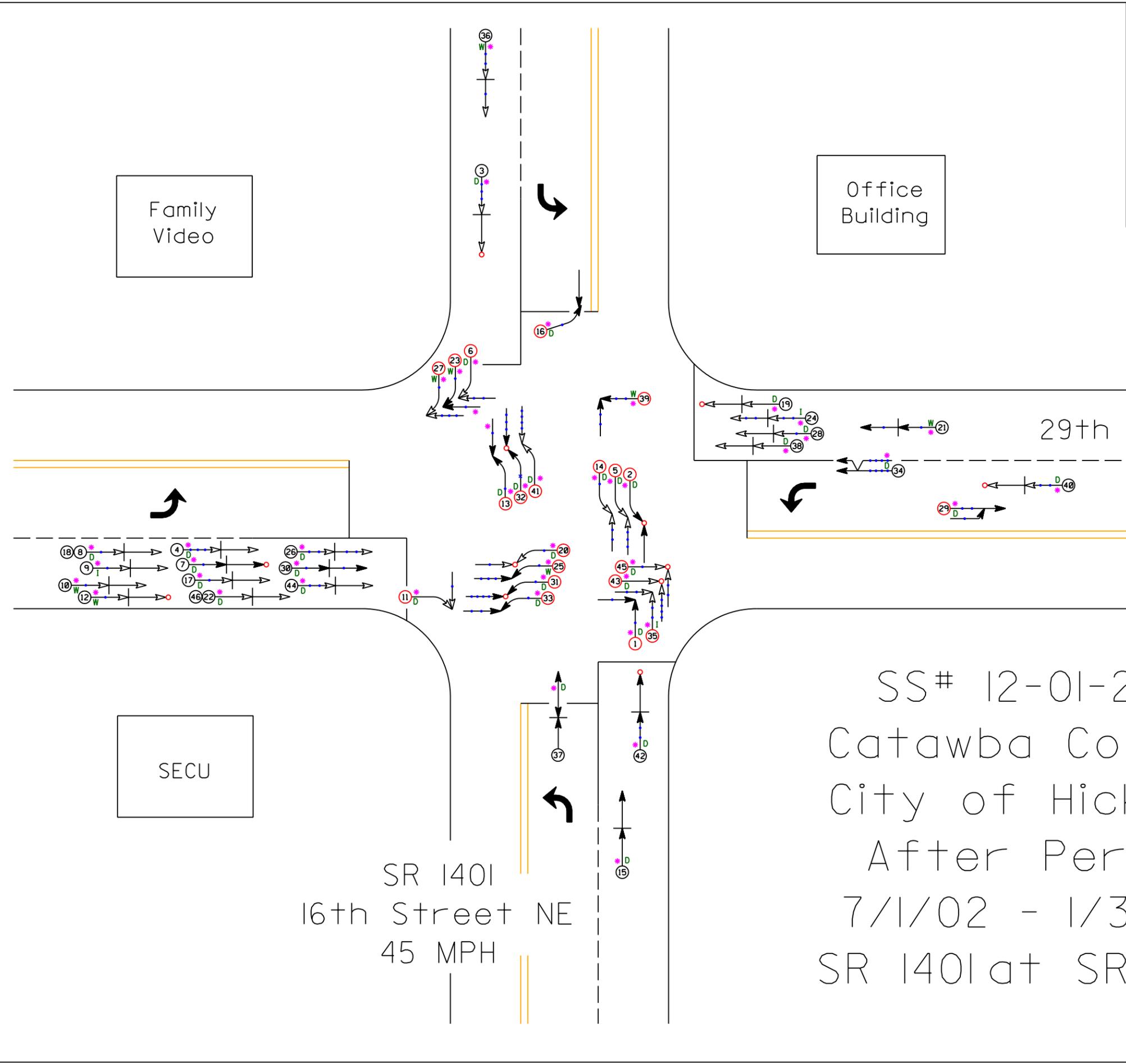
LEGEND



Target Crashes



Protected-Permitted Phasing added to Northbound, Eastbound, & Westbound approaches



SS# 12-01-203
 Catawba County
 City of Hickory
 After Period
 7/1/02 - 1/31/07
 SR 1401 at SR 1402

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

	COLLISION DIAGRAM	
	DIVISION: I2	AREA: 1
	STUDY PERIOD: 7/1/2002 TO 1/31/2007	
	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: 8-23-2007		
LOG NUMBER: SS* 12-01-203		

N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRAFFIC ENGINEERING AND SAFETY SYSTEMS BRANCH