Spot Safety Project Evaluation

Project Log # 200611043

Spot Safety Project # 13-01-206

Spot Safety Project Evaluation of the Traffic Signal Revision at the Intersection of US 19/23/74 and NC 151/SR 1220
Buncombe County

Documents Prepared By:

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

Principal Investigator

_____ 7/26/07
Brad Robinson Date

Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 13-01-206 – The Intersection of US 19/23/74 (Smokey Park Hwy) and NC 151 (Pisgah Hwy)/ SR 1220 (Dogwood Rd) in Buncombe County.

Project Information and Background from the Project File Folder

US 19/23 is a 5-lane roadway with a left turn lane, thru lane, and a thru-right turn lane at the treatment intersection. NC 151 has a left turn lane, thru lane, and a right turn lane at the treatment intersection, while SR 1220 only has a single approach lane to the intersection. The speed limit for all approaches is 45 mph.

The original problem statement was that there was a heavy crash pattern for westbound left turn traffic. From 11/1/97 through 10/31/00 there were 14 crashes that were considered preventable. The improvement chosen for the subject location was to revise the signal phasing for left-turning westbound traffic on US 19/23 from protected-permitted to protected only. The final completion date for the improvement at the subject location was on April 15, 2002 at a cost of $20,000.

Naive Before and After Analysis

After reviewing the spot safety project file folder along with all the crashes along the subject road, the crash data omitted from this analysis to consider for an adequate construction period was from March 1, 2002 through May 31, 2002. The before period consisted of reported crashes from December 1, 1997 through February 28, 2002 (4 years, 3 months) and the after period consisted of reported crashes from June 1, 2002 through August 31, 2006 (4 years, 3 months). The ending date for this analysis was determined by the available crash data at the time the crash analysis was completed.

The treatment data consisted of all crashes within 150 feet of the subject intersection. The following data table depicts the Naive Before and After Analysis for the above information. Please note that Left Turn-Same Roadway crashes involving vehicles turning from westbound US 19/23 onto NC 151 were the target crashes for the applied countermeasure.

Treatment Information			
	Before	**After**	**Percent Reduction (-) Percent Increase (+)**
Total Crashes	57	58	1.7
Total Severity Index	6.35	8.62	26.3
Target Crashes	13	1	-92.3
Target Crash Severity Index	4.98	8.4	40.7
Volume	23300	25700	9.3
Crash Severity Summary			
Fatal	0	0	N/A
Class A	1	3	66.7
Class B	5	4	-25.0
Class C	26	25	-4.0
Property Damage Only	25	26	3.8

The naive before and after analysis at the treatment location resulted in a 2 percent increase in Total Crashes, a 92 percent decrease in Target Crashes, and a 9 percent increase in Average Daily Traffic (ADT). The before period ADT year was 2000 and the after period ADT year was 2004.

Results and Discussion

The naïve before and after analysis involving the comparison of treatment actual before data versus treatment actual after data resulted in a 2 percent increase in Total Crashes and a 92 percent decrease in Target Crashes. The summary results above demonstrate that although the treatment location appears to have had an increase in the number of Total Crashes, Target Crashes were almost eliminated after the signal revision.

The high increase in the Target Crash Severity Index (41 percent) is misleading due to their being only a single target crash in the after period. The target crash involved a left-turning vehicle which ran a red light, resulting in a Class B Injury Crash.

Referencing the *Collision Diagrams*, it appears that other crash patterns have increased at the intersection from the before to the after period, most notably Left Turn-Same Roadway crashes involving Eastbound vehicles turning left (from 2 to 6) and Rear-End Crashes involving Eastbound vehicles approaching the intersection (from 4 to 12). The Rear-End Crash pattern might have increased due to possibly longer red phasing for eastbound traffic due to the signal revision. The increase might also be due to increased traffic on the western leg (15%).

After conducting a field investigation, it was observed that the side streets (NC 151 and SR 1220) both had protected left turn phases. It was not known when the phases were added, although it appears that it was around the same time as this project. Left Turn-Same Roadway Crashes on NC 151/SR 1220 were reduced from six in the before period to none in the after period.

The calculated benefit to cost ratio for this project is –72.8 considering total crashes. The benefit to cost ratio considering only target crashes is 9.9. 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.

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 road.

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: US 19/23 at NC 151 BY: Brad Robinson
COUNTY: Buncombe DATE: 7/24/2007
FILE NO.: SS 13-01-206

DETAILED COST: TYPE IMPROVEMENT - Signal Upgrade

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 = $150

TOTAL ANNUAL COST= $3,131
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	4.25	1	0.24	31	7.29	25	5.88	$271,882
AFTER	4.25	3	0.71	29	6.82	26	6.12	$499,624

Annual Benefits from Crash Cost Savings ($227,741)

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = ($230,872)

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = -72.75

TOTAL COST OF PROJECT - $20,000 COMPREHENSIVE B/C RATIO - -72.75

BENEFIT-COST ANALYSIS WORKSHEET TARGET

LOCATION: US 19/23 at NC 151 BY: Brad Robinson
COUNTY: Buncombe DATE: 7/24/2007
FILE NO.: SS 13-01-206

DETAILED COST: TYPE IMPROVEMENT - Signal Upgrade

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 = $150

TOTAL ANNUAL COST= $3,131
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	4.25	0	0.00	7	1.65	6	1.41	$35,153
AFTER	4.25	0	0.00	1	0.24	0	0.00	$4,235

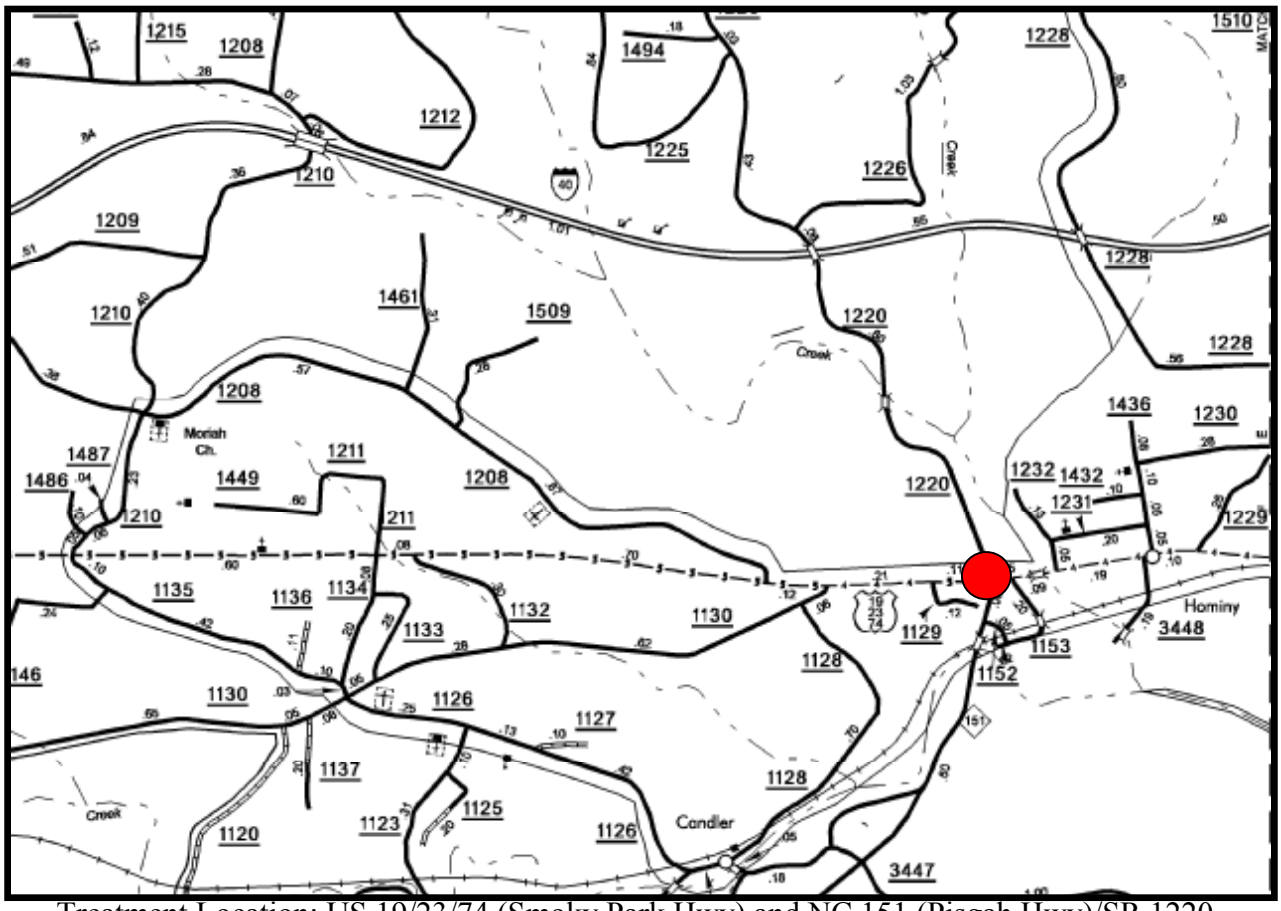
Annual Benefits from Crash Cost Savings $30,918

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = $27,787

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 9.88

TOTAL COST OF PROJECT - $20,000 COMPREHENSIVE B/C RATIO - 9.88

Location Map
Buncombe County
Evaluation of Spot Safety Project #13-01-206



Treatment Location: US 19/23/74 (Smoky Park Hwy) and NC 151 (Pisgah Hwy)/SR 1220 (Dogwood Rd)

Treatment Site Photos Taken July 17, 2007

Driving West on US 19/23

Driving West on US 19/23

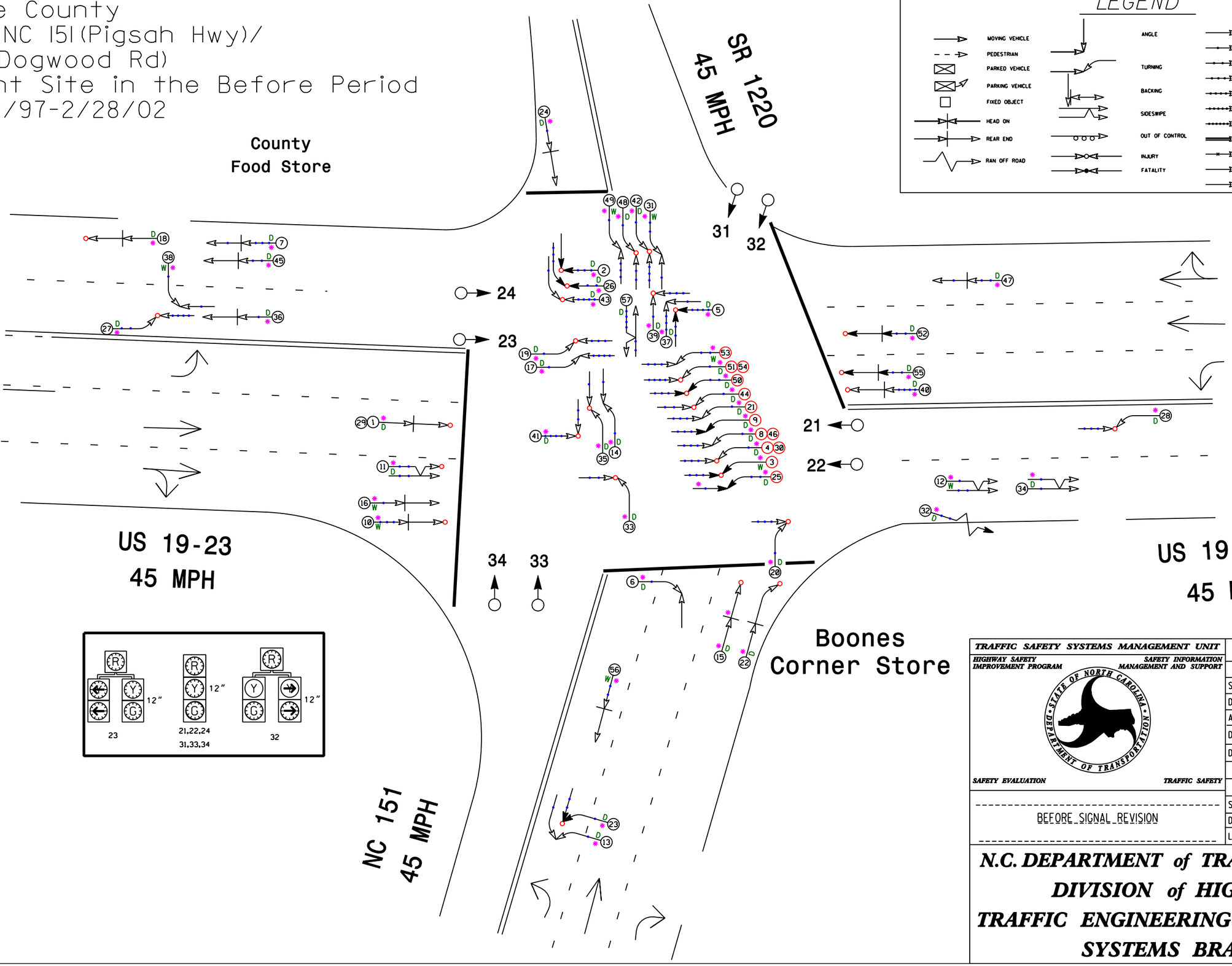
Driving East on US 19/23

Driving East on US 19/23

Driving North on NC 151

Driving South on SR 1220

Buncombe County
US 19/23 NC 151(Pigsah Hwy)/
SR 1220 (Dogwood Rd)
Treatment Site in the Before Period
From 12/1/97-2/28/02



TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT
HIGHWAY SAFETY IMPROVEMENT PROGRAM
SAFETY INFORMATION MANAGEMENT AND SUPPORT
SAFETY EVALUATION
TRAFFIC SAFETY

BEFORE SIGNAL REVISION

COLLISION DIAGRAM

DIVISION: 13	AREA: ..
STUDY PERIOD: 12/1/97 TO 2/28/02	
DISTANCE:	Y-LINE: 150 FT
ANALYSIS PREPARED BY: B.Robinson	
DIAGRAM PREPARED BY: B.Robinson	
DIAGRAM REVIEWED BY: ----------	
SCALE:	NOT TO SCALE
DATE:	November 2006
LOG NUMBER:	20061104 3

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

Buncombe County
US 19/23 NC 151(Pigsah Hwy)/
SR 1220 (Dogwood Rd)
Treatment Site in the After Period
From 6/1/02-8/31/06

LEGEND

MOVING VEHICLE
PEDESTRIAN
PARKED VEHICLE
PARKING VEHICLE
FIXED OBJECT
HEAD ON
REAR END
RAN OFF ROAD

ANGLE
TURNING
BACKING
SIDESWIPE
OUT OF CONTROL
INJURY
FATALITY

9 MPH OR LESS
10 MPH TO 19
20 MPH TO 29
30 MPH TO 39
40 MPH TO 49
50 MPH TO 59
60 MPH TO 69
70 AND UP
SPEED UNKNOWN
DAYLIGHT CRASH
DARK CRASH

P PEDESTRIAN
B BICYCLE
T TRAIN
A ANIMAL
• DRIVER AT FAULT
D DRY
W WET
| ICY OR SNOWY

County
Food Store

SR 1220
45 MPH

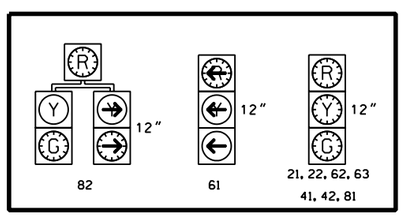
US 19-23
45 MPH

US 19-23
45 MPH

NC 151
45 MPH

Boones
Corner Store

63
62
61
81
82
21
22
42
41



TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

HIGHWAY SAFETY IMPROVEMENT PROGRAM — *SAFETY INFORMATION MANAGEMENT AND SUPPORT*

STATE OF NORTH CAROLINA • DEPARTMENT OF TRANSPORTATION

SAFETY EVALUATION — *TRAFFIC SAFETY*

AFTER SIGNAL REVISION

COLLISION DIAGRAM

DIVISION: 13	AREA: ..
STUDY PERIOD: 6/1/02 TO 8/31/06	
DISTANCE:	Y-LINE: 150 FT
ANALYSIS PREPARED BY: B. Robinson	
DIAGRAM PREPARED BY: B. Robinson	
DIAGRAM REVIEWED BY: ----------	
SCALE:	NOT TO SCALE
DATE:	November 2006
LOG NUMBER:	20061104.3

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