Hazard Elimination Project Evaluation

Project Log # 200608069

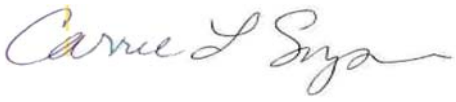
Hazard Elimination Project W-4412

Evaluation of the Intersection Realignment at the Intersection of NC 102 and NC 903
Pitt County

Documents Prepared By:

Safety Evaluation Group
Traffic Safety Systems Management Section
Transportation Mobility and Safety Division
North Carolina Department of Transportation

Principal Investigator



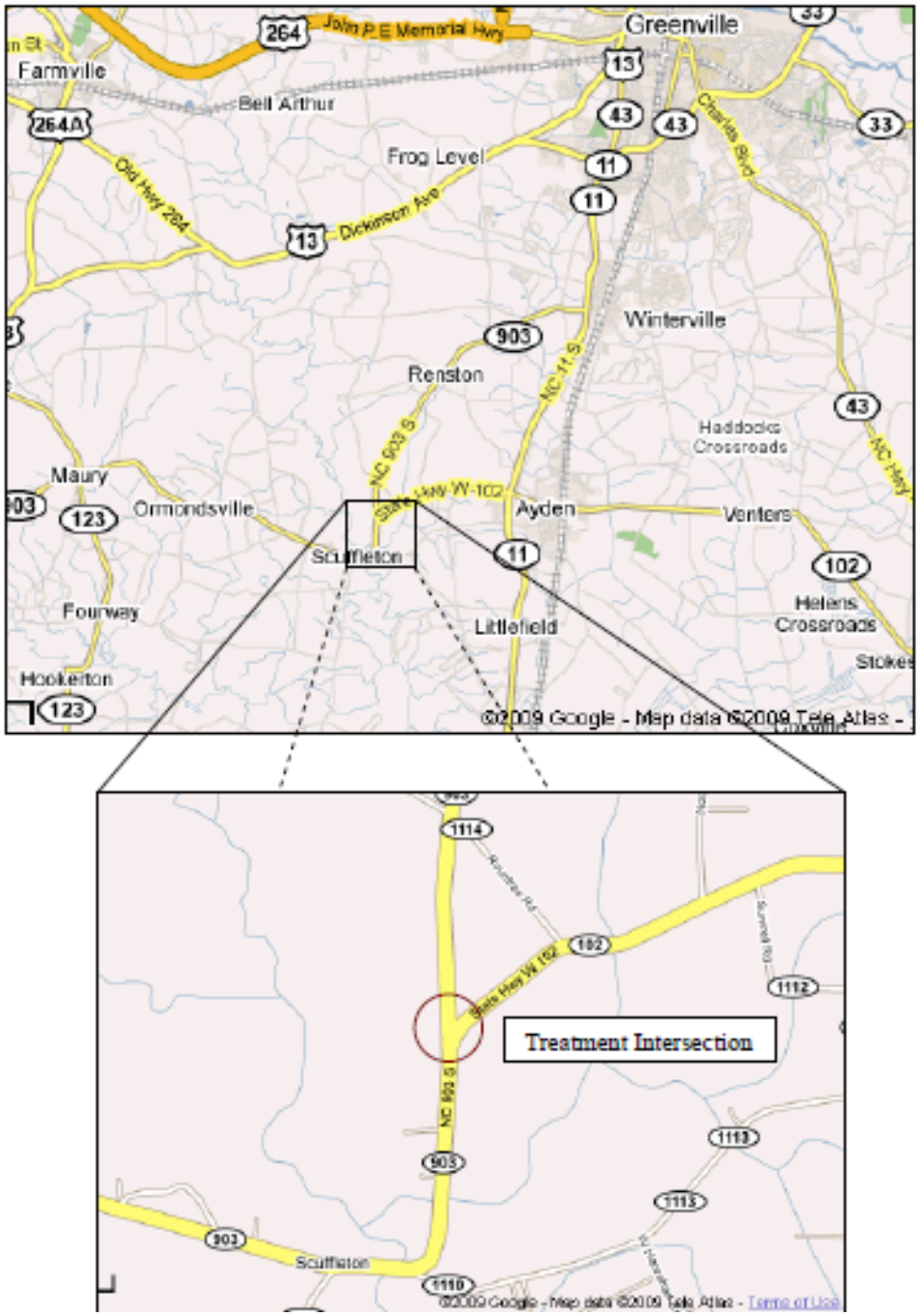
Carrie L. Simpson, PE

Traffic Safety Project Engineer

2/2/2009
Date

Hazard Elimination Project Evaluation Documentation

SUBJECT LOCATION
Intersection of NC 102 and NC 903 in Pitt County
See Location Map below.



Location Map

PROJECT INFORMATION

The safety countermeasure chosen for the subject location was to realign NC 102 at NC 903 so that it tees into NC 903, thereby making NC 903 the through movement.

Prior to realignment, NC 102-NC 903 was teed into NC 903 at a skewed angle (approximately 14 degrees). Traffic was controlled by a stop sign for NC 903 southbound. The speed limit on all legs is 55 mph.

The initial crash analysis for this location was completed from November 1, 1996 through October 31, 1999. Three crash patterns were identified. Of the 14 Total Crashes, there were 6 Left Turn Crashes (43%), 5 Rear End Crashes (36%), and 3 Ran-Off-Road Crashes (21%).

After Period Aerial Photograph

According to the Project Report, poor intersection alignment lead to motorists ignoring traffic controls. Left Turn Crashes occurred when motorists northbound on NC 903 did not yield to oncoming traffic from westbound NC 102. Rear End Crashes occurred due to southbound motorists on NC 903 stopping at the skewed intersection. Ran-Off-Road Crashes resulted from eastbound motorists flowing right onto NC 102 while southbound vehicles were heading towards them. The realignment was intended to reduce all of these crash types by making NC 903 the through movement and leaving eastbound NC 102 as a completely free-flowing right turn.

The project was let for construction in September 2001. The final completion date for the improvement at the subject intersection was on January 31, 2002 with a total cost of $275,000.

NAÏVE BEFORE AND AFTER ANALYSIS

After reviewing the hazard elimination 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 1, 2001 through March 31, 2002. The before period consisted of reported crashes from February 1, 1995 through July 31, 2001 (6.5 years) and the after period consisted of reported crashes from April 1, 2002 through September 30, 2008 (6.5 years). 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 500 feet of the intersection of NC 102 and NC 903. The extended y-line was used to include the entire length affected by the intersection realignment.

The following tables depict the Naïve Before and After Analysis for the Total Crashes and Target Crashes at the treatment location. Please note that the Target Crashes for the applied countermeasure include three crash types:

Target Crash 1. Left Turn Crashes Involving Northbound Vehicles on NC 903,
Target Crash 2. Rear End Crashes, and
Target Crash 3. Ran Off Road Crashes

Target Crashes 1, 2, and 3 are denoted on the Collision Diagrams by Red, Blue, and Green, respectively.

Table 1a. Total Treatment Information	**Before**	**After**	**Percent Reduction (-)/ Percent Increase (+)**
Total Crashes	26	16	-38.5%
Total Severity Index	8.75	4.24	-51.5%
Target Left Turn Crashes	8	0	-100.0%
Target Left Turn Severity Index	16.95	1.00	-94.1%
Target Rear End Crashes	9	0	-100.0%
Target Rear End Severity Index	3.47	1.00	-71.2%
Target Ran Off Road Crashes	7	10	42.9%
Target Ran Off Road Severity Index	6.29	3.22	-48.8%
Volume	6000	7800	30.0%

Table 1b. Total Crash Information	Before	After	Percent Reduction (-)/ Percent Increase (+)
Fatal Injury Crashes	0	0	N/A
Non-Fatal Injury Crashes	18	7	-61.1%
Total Injury Crashes	18	7	-61.1%
Night Crashes	11	9	-18.2%
Wet Crashes	9	5	-44.4%

The naïve before and after analysis for the treatment location resulted in a 39 percent decrease in Total Crashes, a 100 percent decrease in Target Left Turn Crashes and Target Rear End Crashes, a 43 percent increase in Target Ran Off Road Crashes, and a 30 percent increase in Average Daily Traffic (ADT). The before period ADT year was 1998 and the after period ADT year was 2005.

RESULTS AND DISCUSSION

Using naïve before and after analysis methodologies, it appears the intersection realignment at this location has been effective at reducing the number and severity of Total Crashes. Total Crashes decreased by 39 percent, and the Total Severity Index decreased by 52 percent.

Target Left Turn Crashes and Target Rear End Crashes decreased by 100 percent. The Severity Indexes associated with Target Left Turn Crashes and Target Rear End Crashes decreased by 94 and 71 percent, respectively. The intersection realignment was effective at eliminating the left turn crash pattern by assigning NC 903 as the through movement and eliminating the need for northbound NC 903 to make a left turn. Also, the treatment eliminated the rear end crash pattern by removing the stop condition for vehicles on southbound NC 903.

Target Ran Off Road Crashes increased by 43 percent, while the Severity Index of Target Ran Off Road Crashes decreased by 49 percent. In the after period, there were 10 Ran Off Road Crashes, 7 of which involved westbound vehicles on NC 102 running through the stop sign at the new T-intersection. For westbound traffic, there is currently a Turn sign combined with a 10-mph Advisory Speed plaque and a Stop Ahead Sign in advance of the intersection. Further increasing visibility and awareness of the intersection may reduce the number of westbound vehicles that disregard the stop sign and run off the road.

Please see the *Collision Diagrams* and *Location Photos* for more information.

The calculated benefit to cost ratio for this project is **4.46** considering Total Crashes. The benefit to cost ratio considering only Target Crashes is **4.72**. 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 costs.

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

Location Photos (Taken on December 30, 2008)

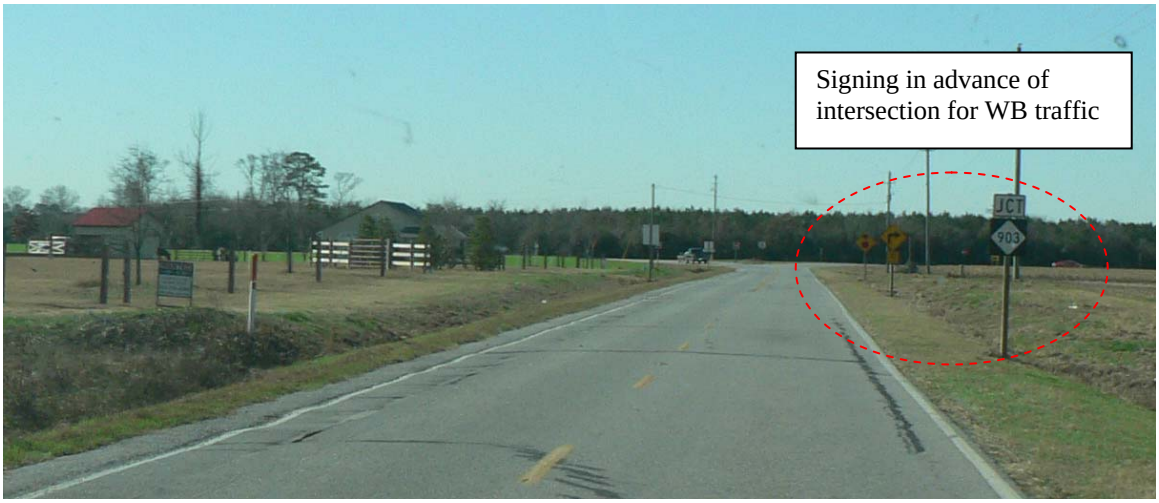
Driving Southbound on NC 903

Driving Northbound on NC 903

Location Photos (Taken on December 30, 2008)

Driving Northbound on NC 903

Driving Northbound on NC 903 Approaching NC 102



Driving Westbound on NC 102 Approaching NC 903

Location Photos (Taken on December 30, 2008)

Driving Westbound on NC 102 Approaching NC 903

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: NC 903 at NC 102 - TOTAL CRASHES BY: CLS
COUNTY: Pitt DATE: 1/12/2009
FILE NO.: W-4412

DETAILED COST: TYPE IMPROVEMENT - Intersection Realignment

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	$275,000	20	0.102	$28,009
	$0	0	0.000	$0
Right-of-Way	$0	0	0.000	$0
TOTALS	$275,000	20	0.102	$28,009

ESTIMATED INCREASE IN ANNUAL MAINT. COST = $500
ESTIMATED INCREASE IN ANNUAL UTILITY COST = $0

TOTAL ANNUAL COST= $28,509
TOTAL COST OF PROJECT= $275,000

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	6.50	1	0.15	17	2.62	8	1.23	$154,400
AFTER	6.50	0	0.00	7	1.08	9	1.38	$27,354

Annual Benefits from Crash Cost Savings $127,046

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = $98,537

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 4.46

TOTAL COST OF PROJECT - $275,000 COMPREHENSIVE B/C RATIO - 4.46

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: NC 903 at NC 102 - TARGET CRASHES BY: CLS
COUNTY: Pitt DATE: 1/12/2009
FILE NO.: W-4412

DETAILED COST: TYPE IMPROVEMENT - Intersection Realignment

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TOTAL ANNUAL COST= $28,509
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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	6.50	1	0.15	15	2.31	8	1.23	$148,246
AFTER	6.50	0	0.00	3	0.46	7	1.08	$13,754

Annual Benefits from Crash Cost Savings $134,492

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = $105,983

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 4.72

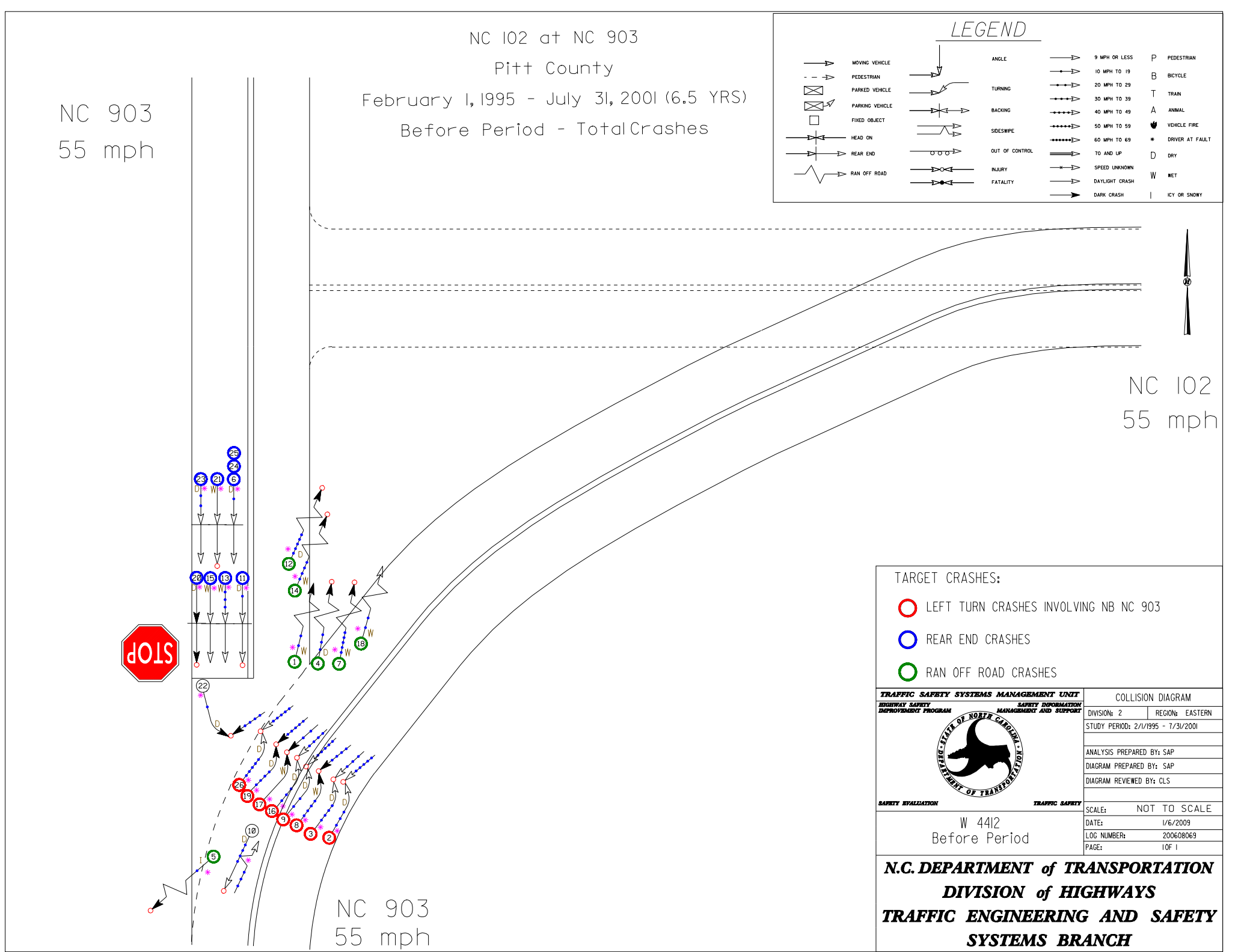
TOTAL COST OF PROJECT - $275,000 COMPREHENSIVE B/C RATIO - 4.72

NC 102 at NC 903

Pitt County

February 1, 1995 - July 31, 2001 (6.5 YRS)

Before Period - Total Crashes



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
VEHICLE FIRE
* DRIVER AT FAULT
D DRY
W WET
I ICY OR SNOWY

TARGET CRASHES:

- LEFT TURN CRASHES INVOLVING NB NC 903
- REAR END CRASHES
- RAN OFF ROAD CRASHES

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

HIGHWAY SAFETY IMPROVEMENT PROGRAM | SAFETY INFORMATION MANAGEMENT AND SUPPORT

SAFETY EVALUATION | TRAFFIC SAFETY

W 4412
Before Period

COLLISION DIAGRAM	
DIVISION: 2	REGION: EASTERN
STUDY PERIOD: 2/1/1995 - 7/31/2001	
ANALYSIS PREPARED BY: SAP	
DIAGRAM PREPARED BY: SAP	
DIAGRAM REVIEWED BY: CLS	
SCALE:	NOT TO SCALE
DATE:	1/6/2009
LOG NUMBER:	200608069
PAGE:	1 OF 1

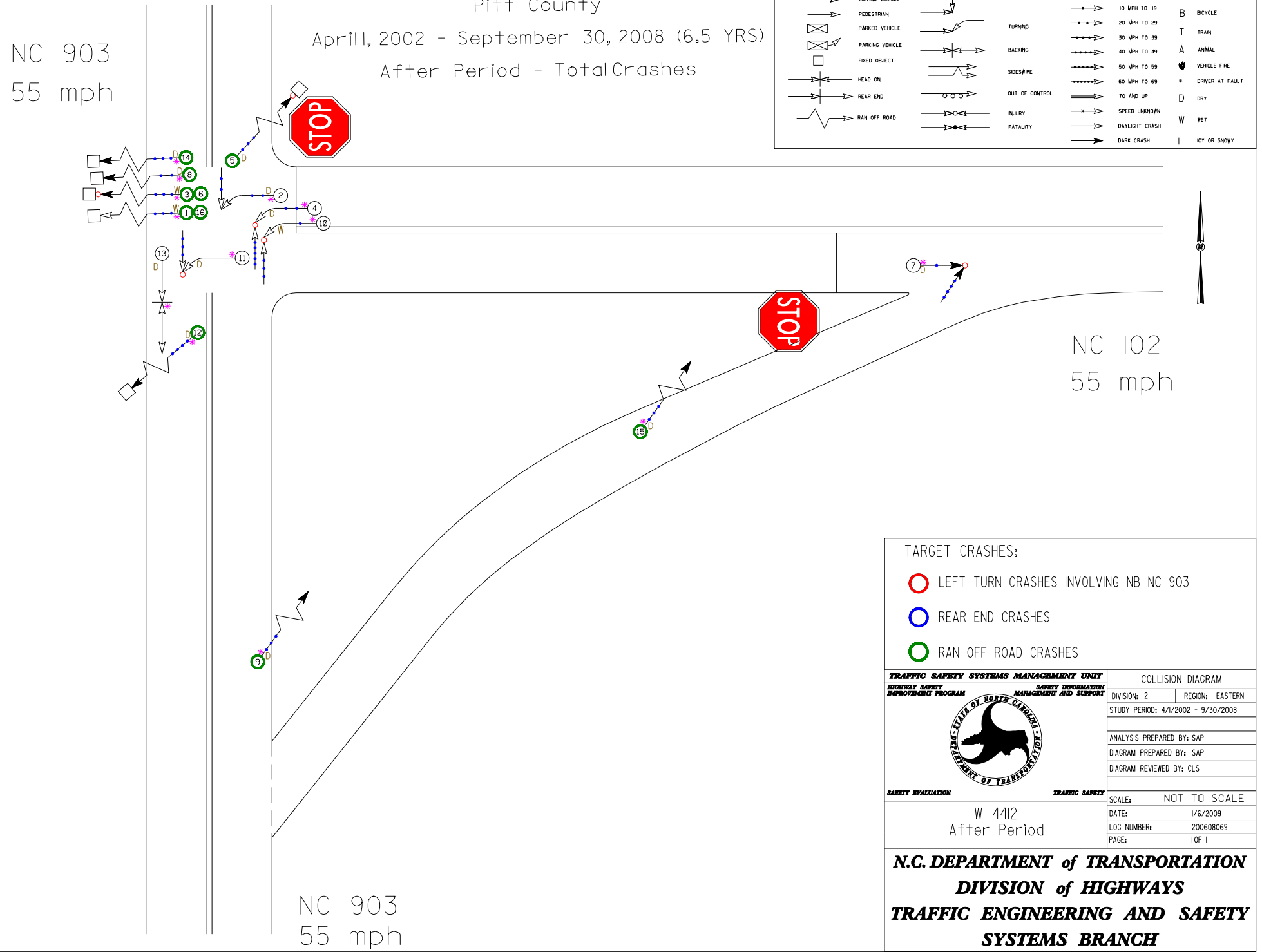
N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRAFFIC ENGINEERING AND SAFETY SYSTEMS BRANCH

NC 102 at NC 903

Pitt County

April1, 2002 - September 30, 2008 (6.5 YRS)

After Period - Total Crashes



LEGEND

- MOVING VEHICLE
- PEDESTRIAN
- PARKED VEHICLE
- PARKING VEHICLE
- FIXED OBJECT
- HEAD ON
- REAR END
- RAN OFF ROAD
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- OUT OF CONTROL
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TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

HIGHWAY SAFETY IMPROVEMENT PROGRAM

SAFETY INFORMATION MANAGEMENT AND SUPPORT

SAFETY EVALUATION

TRAFFIC SAFETY

W 4412
After Period

COLLISION DIAGRAM

DIVISION: 2	REGION: EASTERN
STUDY PERIOD: 4/1/2002 - 9/30/2008	
ANALYSIS PREPARED BY: SAP	
DIAGRAM PREPARED BY: SAP	
DIAGRAM REVIEWED BY: CLS	
SCALE:	NOT TO SCALE
DATE:	1/6/2009
LOG NUMBER:	200608069
PAGE:	1OF 1

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