Hazard Elimination Project Evaluation

Project Log # 200705257

Hazard Elimination Project W-3304

Evaluation of the Traffic Signal Installation at the Intersection of US 70 and NC 801/SR 1958 (Barber Junction) and the Widening of US 70 from NC 801 Eastward to Provide a Three Lane Section
Rowan 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

_____ 3/6/2008
Brad Robinson Date

Traffic Safety Project Engineer

Hazard Elimination Project Evaluation Documentation

Subject Location

Evaluation of Hazard Elimination Project W-3304 – US 70 (Statesville) at NC 801/SR 1958 (Barber Junction) in Rowan County.

Project Information and Background from the Project File Folder

The safety countermeasures chosen for the subject location was the installation of a traffic signal and the widening of US 70 east of the intersection to provide a three lane section.

Prior to the project US 70 had one through lane and one left turn lane on each approach. NC 801 and SR 1958 both had single lane approaches with median islands and dual stop signs at the intersection. As part of the project the left turn lane on the eastern leg of US 70 continued into a center turn lane for approximately 400 feet east of the intersection. Also as part of the project the median islands on NC 801 and SR 1958 were removed and right turn slip ramps with "yield" signs were installed. The speed limit for SR 1958 was 45 mph, with the other three approaches having a 55 mph speed limit.

According to the provided project background, the widening of the roadway and the signal were proposed to accommodate the expansion of an industrial plant and the anticipated increase in traffic on US 70 as a result.

Currently this section of US 70 is undergoing construction to a four lane divided roadway. Photos are provided for all approaches to the intersection, although they do not show the intersection as it was during the study periods. It appears the US 70 approaches in the photos are actually a new roadway, with the original alignment north of the US 70 shown and undergoing construction.

The final completion date for the improvement at the subject intersection was on June 30, 1996 with a total cost of $195,000.

Naive 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 May 1, 1996 through August 31, 1996. The before period consisted of reported crashes from January 1, 1990 through April 30, 1996 (6 years, 4 months) and the after period consisted of reported crashes from September 1, 1996 through December 31, 2002 (6 years, 4 months). The beginning date for this analysis was determined by the available crash data at the time the crash analysis was completed.

The treatment data includes all crashes within 400 feet east of the intersection on US 70, and within 150 feet of the subject intersection for the three other approaches.

The following data tables depict the Naive Before and After Analysis for the treatment location. Please note that both eastbound Rear-End Crashes on the eastern leg of US 70 and Frontal Impact crash types in the intersection were the target crashes for the applied countermeasures. Frontal Impact crash types are considered as follows: Left Turn, same roadway; Left Turn, different roadway; Right Turn, same roadway; Right Turn, different roadway; Head On, and Angle.

Treatment Information	**Before**	**After**	**Percent Reduction (-) Percent Increase (+)**
Total Crashes	34	23	-32.4
Total Severity Index	8.51	9.84	15.6
Target Crashes	23	8	-65.2
Target Crashes Severity Index	10.17	21.8	114.4
Volume	11,900	13,500	13.4

Injury Summary	**Before**	**After**	**Percent Reduction (-) Percent Increase (+)**
Total Injury Crashes	16	9	-43.8
Fatal Crashes	0	0	N/A
Class A Crashes	2	2	0.0
Class B Crashes	2	2	0.0
Class C Crashes	12	5	-58.3
Property Damage Only (PDO) Crashes	18	14	-22.2

The naive before and after analysis at the subject intersection resulted in a 32 percent decrease in Total Crashes, a 65 percent decrease in Target Crashes, and a 13 percent increase in Average Daily Traffic (ADT). The before period ADT year was 1996 and the after period ADT year was 1999.

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 32 percent decrease in Total Crashes and a 65 percent decrease in Target Crashes. The Total Severity Index increased by 16 percent and the Target Crash Severity Index increased by 114 percent. The summary results above demonstrate that the treatment location appears to have had a decrease in both the number and severity of Total and Target Crashes from the before to the after period, although the crash severities increased.

The calculated benefit to cost ratio for this project is 0.90 considering total crashes. The benefit to cost ratio considering only target crashes is 0.91. 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.

The large increase in the Target Crash Severity Index can be misleading. Crashes do not appear to have become more severe at the intersection. There were only eight Target Crashes in the after period, with two resulting in "A" injuries.

The installation of a traffic signal appears to have resulted in significant decrease in the Frontal Impact Crash patterns at the intersection. In the before period there were 18 Frontal Impact Crashes. In the after period there were only six such crashes, a decrease of 67 percent.

The widening of US 70 east of the intersection and the construction of the short three lane section appears to have decreased the small Rear-End Crash pattern involving eastbound traffic on US 70. In the before period there were four eastbound Rear-End Crashes east of the intersection, plus one Ran-Off-Road Crash which should be considered a Rear-End Crash. In the after period there was only two crashes of this type, a decrease of 60 percent.

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.

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: US 70 at NC 801/SR 1958 BY: Brad Robinson
COUNTY: Jackson DATE: 2/19/2008
FILE NO.: W-3304 Total Crashes

DETAILED COST: TYPE IMPROVEMENT - Widen US 70 to provide 3 lane and install Signal

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	$195,000	15	0.117	$22,782
	$0	0	0.000	$0
Right-of-Way	$0	0	0.000	$0
TOTALS	$195,000	15	0.117	$22,782

ESTIMATED INCREASE IN ANNUAL MAINT. COST = $2,400
ESTIMATED INCREASE IN ANNUAL UTILITY COST = $900

TOTAL ANNUAL COST= $26,082
TOTAL COST OF PROJECT= $195,000

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	6.33	2	0.32	14	2.21	18	2.84	$221,137
AFTER	6.33	2	0.32	7	1.11	14	2.21	$197,536

Annual Benefits from Crash Cost Savings $23,602

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = ($2,480)

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 0.90

TOTAL COST OF PROJECT - $195,000 COMPREHENSIVE B/C RATIO - 0.90

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: US 70 at NC 801/SR 1958 BY: Brad Robinson
COUNTY: Jackson DATE: 2/19/2008
FILE NO.: W-3304 Target Crashes

DETAILED COST: TYPE IMPROVEMENT - Widen US 70 to provide 3 lane and install Signal

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	$195,000	15	0.117	$22,782
	$0	0	0.000	$0
Right-of-Way	$0	0	0.000	$0
TOTALS	$195,000	15	0.117	$22,782

ESTIMATED INCREASE IN ANNUAL MAINT. COST = $2,400
ESTIMATED INCREASE IN ANNUAL UTILITY COST = $900

TOTAL ANNUAL COST= $26,082
TOTAL COST OF PROJECT= $195,000

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	6.33	2	0.32	8	1.26	13	2.05	$199,889
AFTER	6.33	2	0.32	2	0.32	4	0.63	$176,051

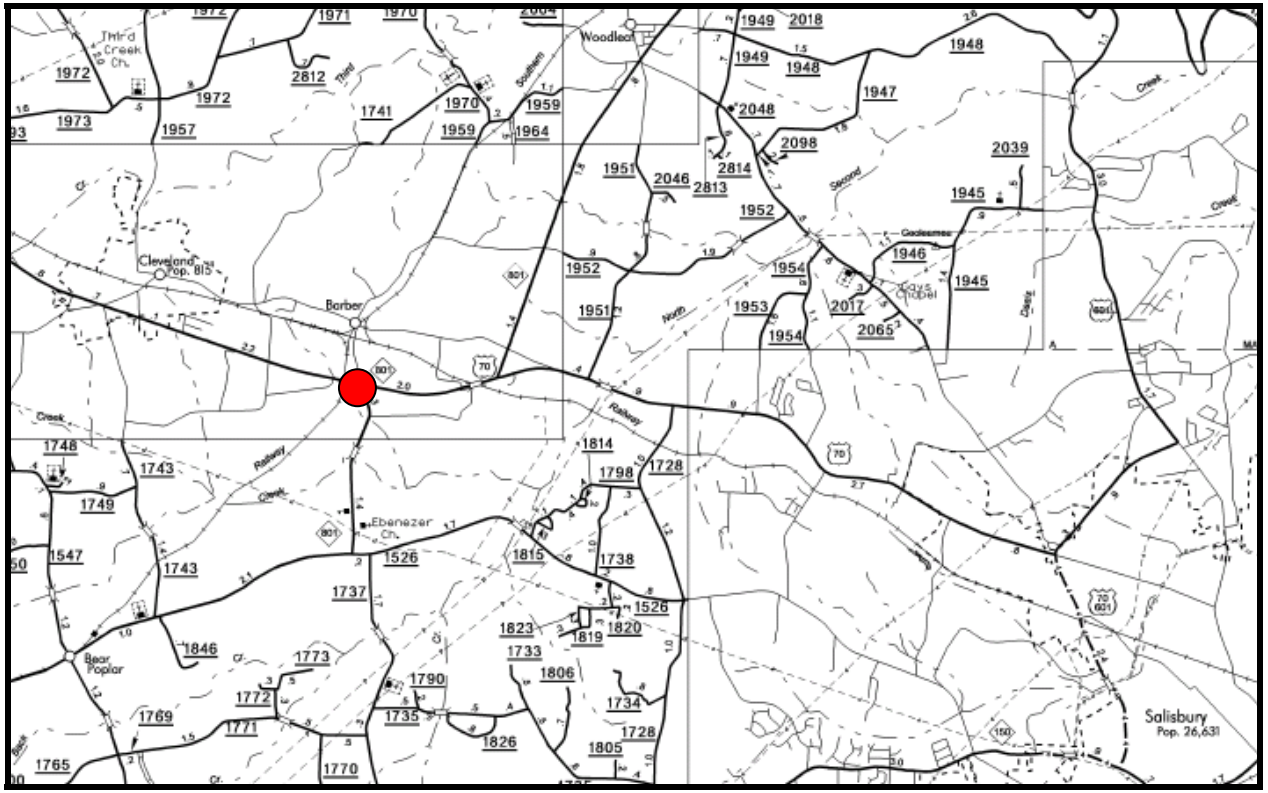
Annual Benefits from Crash Cost Savings $23,839

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = ($2,243)

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 0.91

TOTAL COST OF PROJECT - $195,000 COMPREHENSIVE B/C RATIO - 0.91

Location Map
Rowan County
Evaluation of W-3304



Treatment Location: US 70 at NC 801/SR 1958 (Barber Junction)

2006 Aerial Photo

Treatment Site Photos Taken February 4, 2008

US 70 currently undergoing new construction to a 4-lane divided road. Photos do not show intersection as existed in study period
US 70 Shown in Photos is new roadway and does not show 3-lane section constructed in project

Driving West on US 70/NC 801

Driving West on US 70/NC 801

Driving East on US 70

Driving East on US 70

Driving North on NC 801

Driving North on NC 801

Driving South on SR 1958 (Barber Junction)

Driving South on SR 1958 (Barber Junction)

Rowan County
US 70 and NC 801/SR 1958 Barber Junction)
Before Period From 1/1/90-4/30/96

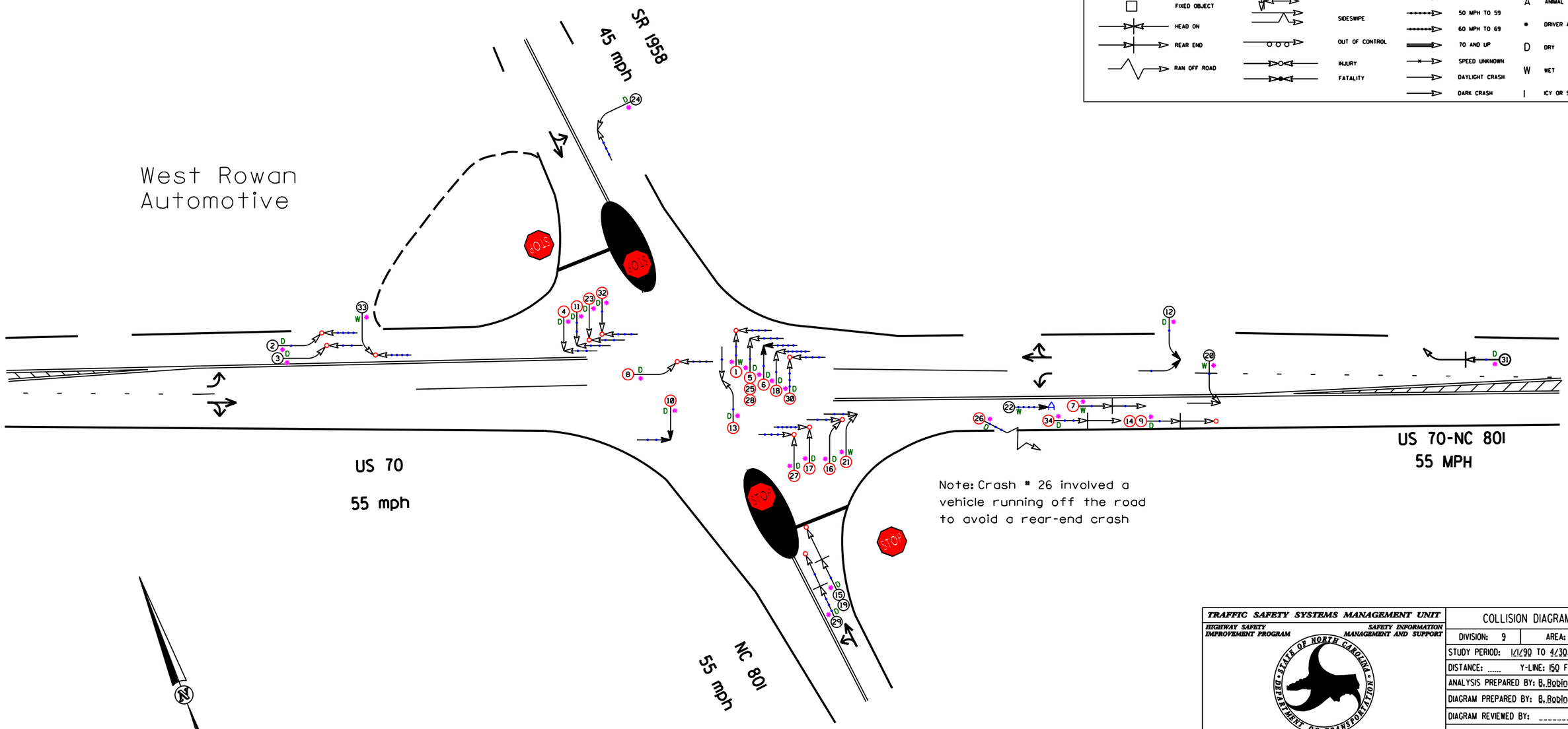
LEGEND

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
I ICY OR SNOWY



Note: Crash # 26 involved a vehicle running off the road to avoid a rear-end crash

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

BEFORE

COLLISION DIAGRAM

DIVISION: 9	AREA: ..
STUDY PERIOD: 1/1/90 TO 4/30/96	
DISTANCE:	Y-LINE: 150 FT
ANALYSIS PREPARED BY: B.Robinson	
DIAGRAM PREPARED BY: B.Robinson	
DIAGRAM REVIEWED BY: _____	
SCALE:	NOT TO SCALE
DATE:	February 2008
LOG NUMBER:	200705257

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

Rowan County
US 70 and NC 801/SR 1958 Barber Junction)
After Period From 9/1/96-12/31/02

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

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B BICYCLE
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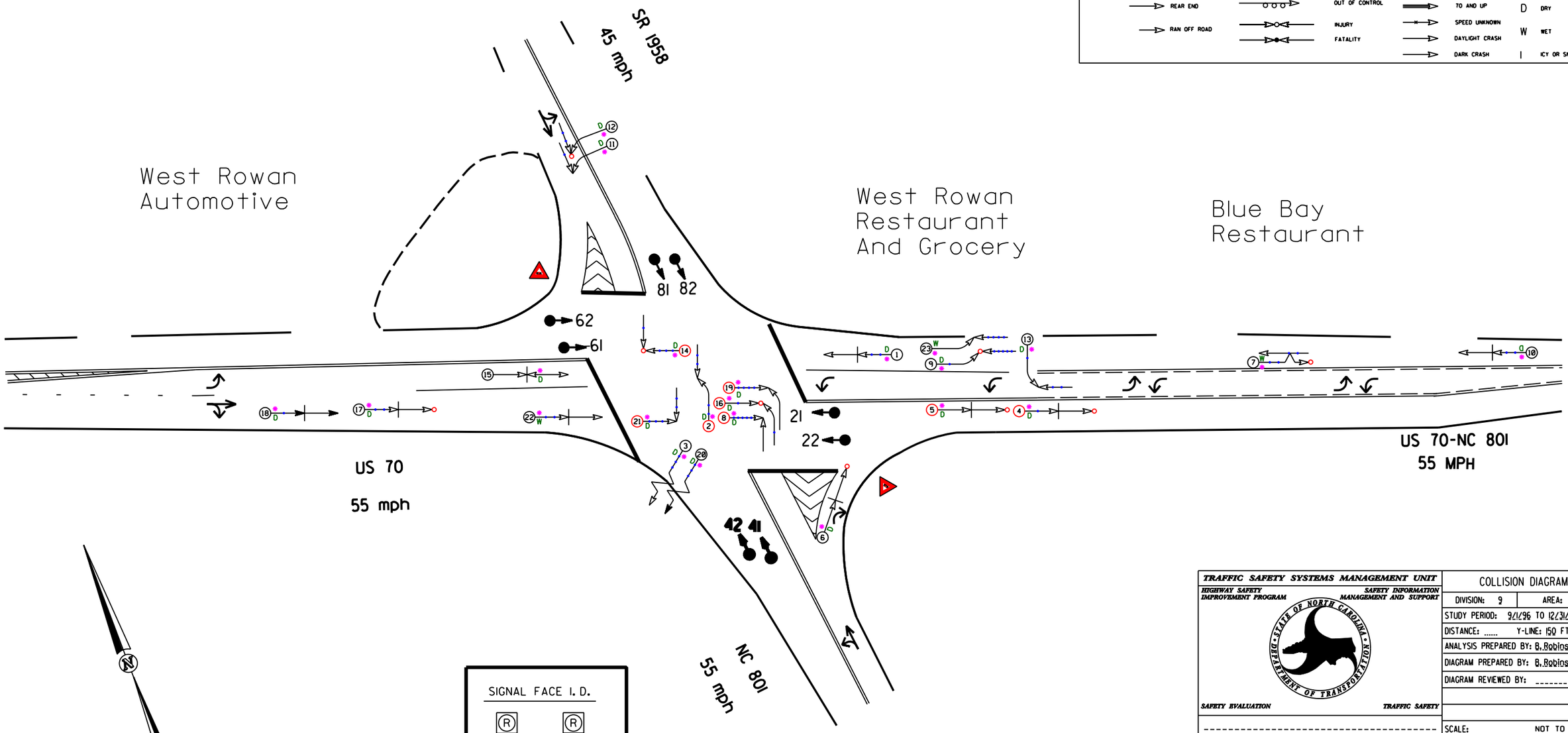

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

HIGHWAY SAFETY IMPROVEMENT PROGRAM | SAFETY INFORMATION MANAGEMENT AND SUPPORT

STATE OF NORTH CAROLINA • DEPARTMENT OF TRANSPORTATION

SAFETY EVALUATION | TRAFFIC SAFETY

AFTER

COLLISION DIAGRAM

DIVISION: 9	AREA: ..
STUDY PERIOD:	9/1/96 TO 12/31/02
DISTANCE:	Y-LINE: 150 FT
ANALYSIS PREPARED BY:	B. Robinson
DIAGRAM PREPARED BY:	B. Robinson
DIAGRAM REVIEWED BY:	----------
SCALE:	NOT TO SCALE
DATE:	February 2008
LOG NUMBER:	200705257

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