

Spot Safety Project Evaluation

Order # 41000009674

Spot Safety Project # 07-01-215

**Spot Safety Project Evaluation of the Installation of a Channelized Island
At the Intersection of NC 86 and SR 1545 (Saw Mill Road) / SR 1352 (Carr Store Road)
North of Hillsborough, In Orange County**

Documents Prepared By:

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

Principal Investigator



Chad J. Neilson

11/18/2010

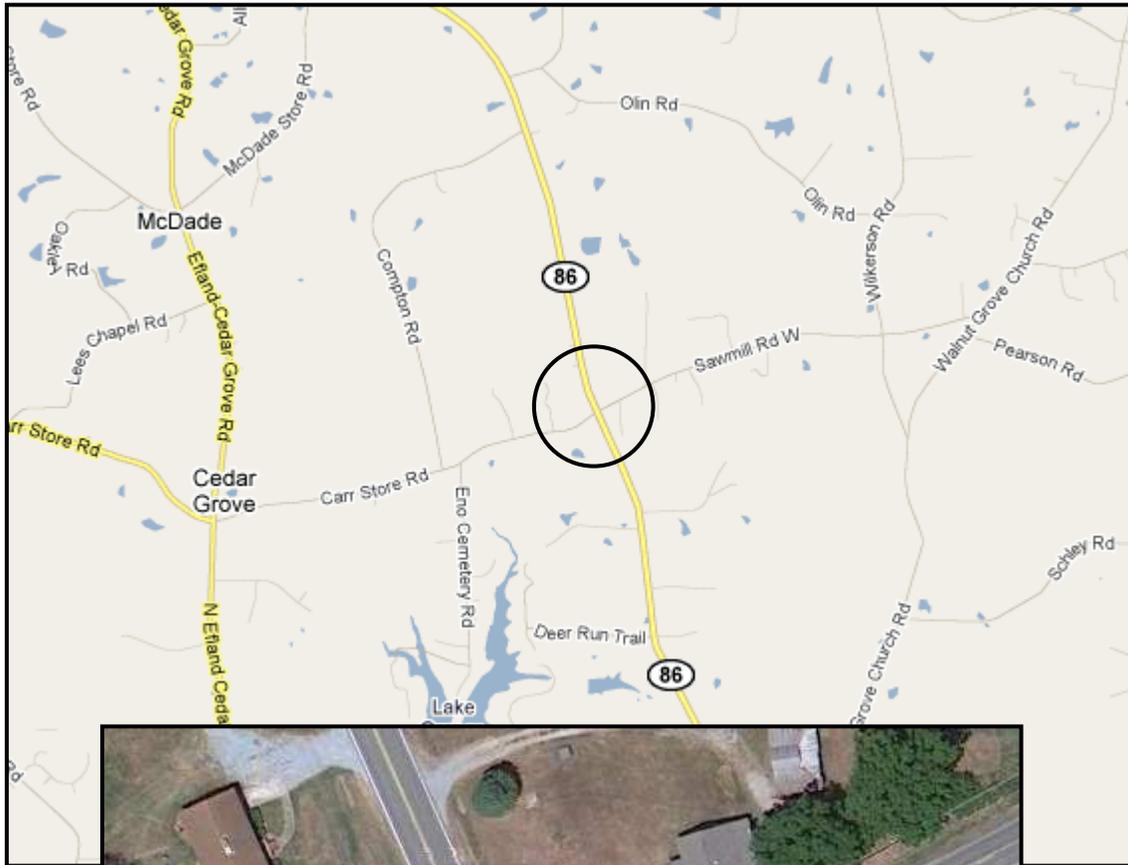
Date

Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 07-01-215 located at the intersection of NC 86 and SR 1545 (Saw Mill Road) / SR 1352 (Carr Store Road) north of Hillsborough, Orange County.



Project Information and Background from the Project File Folder

The spot safety project improvement countermeasure chosen for the subject location was the installation of a channelized island on the southeast shoulder of NC 86. NC 86 is a two-lane facility at the subject intersection with speed limit of 55 mph for both approaches. SR 1545 (Saw Mill Road) / SR 1352 (Carr Store Road) are a two-lane facilities with a speed limits of 55 mph for both approaches. The subject location is a stop sign controlled four-leg intersection with SR 1545 (Saw Mill Road) / SR 1352 (Carr Store Road) encountering the stop sign condition.

The original statement of problem was inadequate sight distance for vehicles traveling westbound on SR 1545 (Saw Mill Road) looking south on NC 86. At times there is limited sight distance due to vehicles parked on the southeast shoulder of NC 86.

The initial crash analysis was completed from October 1, 1999 to September 30, 2004 with eight (8) reported crashes, of which five (5) were injury crashes. The final completion date for the improvement at the subject intersection was on December 6, 2006 with a total cost of \$ 25,000.00.

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 were the months of November 2006 through January 2007. The before period consisted of reported crashes from March 1, 2003 through October 31, 2006 (3 years and 8 months); and the after period consisted of reported crashes from February 1, 2007 through September 30, 2010 (3 years and 8 months). 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 **westbound** Frontal Impact Crashes were the target crashes for the applied countermeasure. The Frontal Impact Crash types considered are as follows: Left turn, different roadways; Right turn, different roadways; Head on; and Angle.

<u>Treatment Information</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	5	10	100.00 %
Total Crash Severity Index	5.44	2.48	- 54.41 %
Target Crashes	1	3	200.0 %
Target Crash Severity Index	8.4	3.47	- 58.69 %
Volume (2005, 2009)	6,400	6,200	- 3.13 %

<u>Injury Crash Summary</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Fatal injury Crashes	0	0	N/A
Class A injury Crashes	0	0	N/A
Class B injury Crashes	2	2	0.00 %
Class C Injury Crashes	1	0	- 100.00 %
Total Injury Crashes	3	2	- 33.33 %

The naive before and after analysis at the treatment location resulted in an one hundred (100) percent increase in Total Crashes, two hundred (200) percent increase of Target Crashes, and a fifty – four (54) percent decrease in the Total Severity Index. The before period ADT year was 2005 and the after period ADT year was 2009.

Results and Discussion

Referencing the *Collision Diagrams*, the before period presented one (1) target crash. After the installation of the channelized island, there were three (3) target crashes.

The calculated benefit to cost ratio for this project is (**- 0.61**) **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 and utility costs.

Photos were provided for this location by Google Street View for all four approaches of this 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 PHOTOS



Looking North on NC 86



Looking West on SR 1545 (Saw Mill Rd)



Looking South on NC 86



Looking East on SR 1352 (Carr Store Rd)

BENEFIT-COST ANALYSIS WORKSHEET - TOTAL

LOCATION: NC 86 and SR 1545 / SR 1352		BY: C Neilson						
COUNTY: Orange		DATE: 11/17/2010						
FILE NO.: SS 07-01-215								
DETAILED COST:	TYPE IMPROVEMENT - Channelized Island							
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$25,000	20	0.102	\$2,546			
		\$0	0	0.000	\$0			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$25,000	20	0.102	\$2,546			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$50			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$0			
	TOTAL ANNUAL COST=				\$2,596			
	TOTAL COST OF PROJECT=				\$25,000			
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	3.66	0	0.00	3	0.82	2	0.55	\$18,743
AFTER	3.66	0	0.00	2	0.55	8	2.19	\$20,328
							Annual Benefits from Crash Cost Savings	(\$1,585)
	NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST				=	(\$4,181)		
	BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST				=	-0.61		
	TOTAL COST OF PROJECT	-	\$25,000	COMPREHENSIVE B/C RATIO	-			-0.61

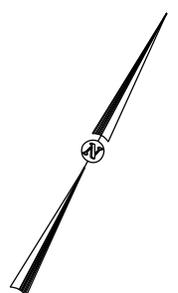
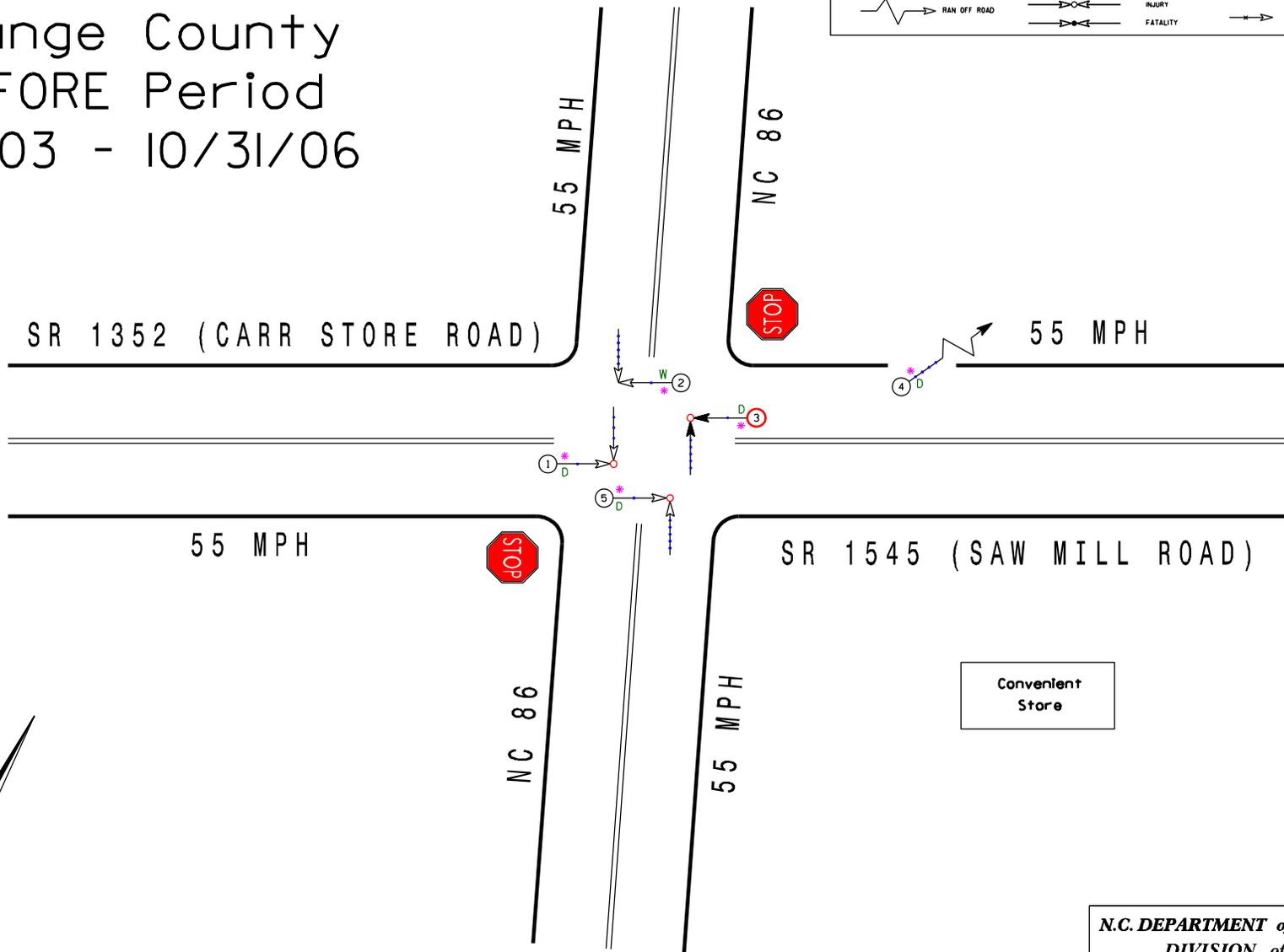
BENEFIT-COST ANALYSIS WORKSHEET - TARGET

LOCATION: NC 86 and SR 1545 / SR 1352		BY: C Neilson						
COUNTY: Orange		DATE: 11/17/2010						
FILE NO.: SS 07-01-215								
DETAILED COST:	TYPE IMPROVEMENT - Channelized Island							
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$25,000	20	0.102	\$2,546			
		\$0	0	0.000	\$0			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$25,000	20	0.102	\$2,546			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$50			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$0			
	TOTAL ANNUAL COST=				\$2,596			
	TOTAL COST OF PROJECT=				\$25,000			
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	3.66	0	0.00	1	0.27	0	0.00	\$5,464
AFTER	3.66	0	0.00	1	0.27	2	0.55	\$7,814
							Annual Benefits from Crash Cost Savings	(\$2,350)
	NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST				=	(\$4,946)		
	BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST				=	-0.91		
	TOTAL COST OF PROJECT	-	\$25,000	COMPREHENSIVE B/C RATIO	-			-0.91

SS# 07-01-215
 Order# 41000009674
 Orange County
 BEFORE Period
 3/1/03 - 10/31/06

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		TO AND LIP		50 MPH TO 59		ICY OR SNOWY
	REAR END		INJURY		60 MPH TO 69		SPEED UNKNOWN
	RAN OFF ROAD		FATALITY		FATALITY		ONLY



Frontal Impact
Target Crashes

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

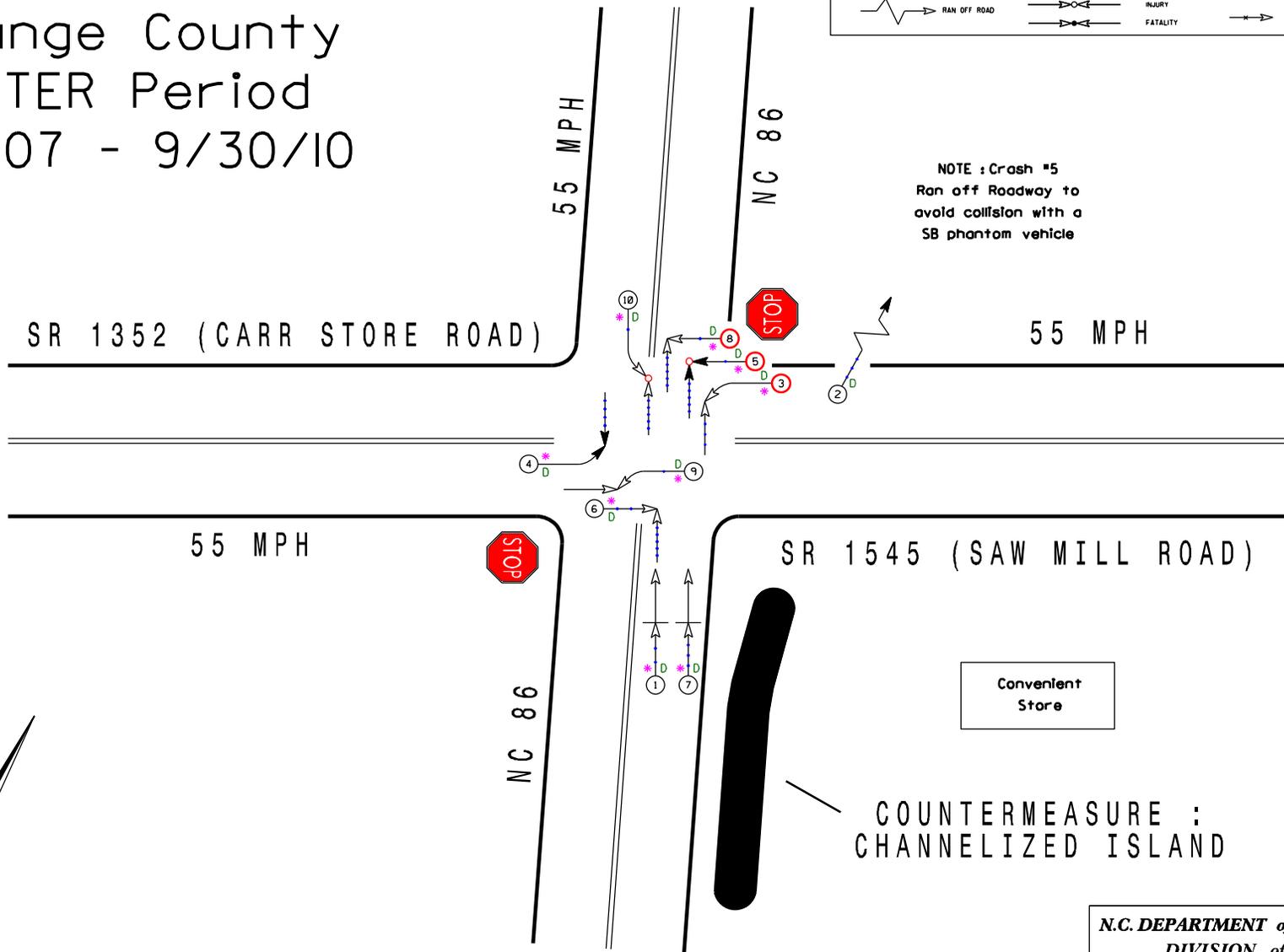
TRAFFIC SAFETY UNIT

Date: 11-17-2010 Prepared By: C Neilson

SS# 07-01-215
 Order# 41000009674
 Orange County
 AFTER Period
 2/1/07 - 9/30/10

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		TO AND LIP		50 MPH TO 59		ICY OR SNOWY
	REAR END		INJURY		60 MPH TO 69		SPEED UNKNOWN
	RAN OFF ROAD		FATALITY		SPEED UNKNOWN		ONLY

NOTE : Crash #5
 Ran off Roadway to
 avoid collision with a
 SB phantom vehicle



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

TRAFFIC SAFETY UNIT

Date: 11-17-2010
 Prepared By: C Neilson



North Carolina Department of Transportation
Traffic Engineering Accident Analysis System
Intersection Analysis Report

Summary Statistics

High Level Crash Summary

Crash Type	Number of Crashes	Percent of Total
Total Crashes	5	100.00
Fatal Crashes	0	0.00
Non-Fatal Injury Crashes	3	60.00
Total Injury Crashes	3	60.00
Property Damage Only Crashes	2	40.00
Night Crashes	2	40.00
Wet Crashes	1	20.00
Alcohol/Drugs Involvement Crashes	0	0.00

Crash Severity Summary

Crash Type	Number of Crashes	Percent of Total
Total Crashes	5	100.00
Fatal Crashes	0	0.00
Class A Crashes	0	0.00
Class B Crashes	2	40.00
Class C Crashes	1	20.00
Property Damage Only Crashes	2	40.00

Vehicle Exposure Statistics

Annual ADT = 99999

Total Vehicle Exposure = 134.1 (MEV)

Crash Rate	Crashes Per 100 Million Vehicles Entered
Total Crash Rate	3.73
Fatal Crash Rate	0.00
Non Fatal Crash Rate	2.24
Night Crash Rate	1.49
Wet Crash Rate	0.75
EPDO Rate	20.28

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Traffic Engineering Accident Analysis System
Intersection Analysis Report**

Miscellaneous Statistics

Severity Index =	5.44
EPDO Crash Index =	27.20
Estimated Property Damage Total = \$	28700.00

Accident Type Summary

Accident Type	Number of Crashes	Percent of Total
ANGLE	4	80.00
FIXED OBJECT	1	20.00

Injury Summary

Injury Type	Number of Injuries	Percent of Total
Fatal Injuries	0	0.00
Class A Injuries	0	0.00
Class B Injuries	3	37.50
Class C Injuries	5	62.50
Total Non-Fatal Injuries	8	100.00
Total Injuries	8	100.00

**North Carolina Department of Transportation
Traffic Engineering Accident Analysis System
Intersection Analysis Report**

Monthly Summary

Month	Number of Crashes	Percent of Total
Jan	0	0.00
Feb	0	0.00
Mar	0	0.00
Apr	0	0.00
May	1	20.00
Jun	1	20.00
Jul	2	40.00
Aug	0	0.00
Sep	1	20.00
Oct	0	0.00
Nov	0	0.00
Dec	0	0.00

Daily Summary

Day	Number of Crashes	Percent of Total
Mon	0	0.00
Tue	0	0.00
Wed	0	0.00
Thu	2	40.00
Fri	0	0.00
Sat	2	40.00
Sun	1	20.00

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Intersection Analysis Report**

Hourly Summary

Hour	Number of Crashes	Percent of Total
0000-0059	0	0.00
0100-0159	0	0.00
0200-0259	0	0.00
0300-0359	0	0.00
0400-0459	0	0.00
0500-0559	0	0.00
0600-0659	0	0.00
0700-0759	0	0.00
0800-0859	0	0.00
0900-0959	0	0.00
1000-1059	0	0.00
1100-1159	0	0.00
1200-1259	1	20.00
1300-1359	0	0.00
1400-1459	0	0.00
1500-1559	0	0.00
1600-1659	0	0.00
1700-1759	0	0.00
1800-1859	2	40.00
1900-1959	0	0.00
2000-2059	0	0.00
2100-2159	0	0.00
2200-2259	1	20.00
2300-2359	1	20.00

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Traffic Engineering Accident Analysis System
Intersection Analysis Report**

Light and Road Conditions Summary

Condition	Dry	Wet	Other	Total
Day	2	1	0	3
Dark	2	0	0	2
Other	0	0	0	0
Total	4	1	0	5

Object Struck Summary

Object Type	Times Struck	Percent of Total
DITCH	3	75.00
PARKED MOTOR VEHICLE	1	25.00

Vehicle Type Summary

Vehicle Type	Number Involved	Percent of Total
PASSENGER CAR	7	70.00
PICKUP	1	10.00
SPORT UTILITY	1	10.00
VAN	1	10.00

North Carolina Department of Transportation
Traffic Engineering Accident Analysis System
Intersection Analysis Report

Yearly Totals Summary

Accident Totals

Year	Total Accidents	Fatal Accidents	Injury Accidents	Property Damage Only Accidents
2003	2	0	1	1
2004	3	0	2	1
2005	0	0	0	0
2006	0	0	0	0
Total	5	0	3	2

Injury Totals

Year	Fatal Injuries	Class A, B, or C Injuries
2003	0	3
2004	0	5
2005	0	0
2006	0	0
Total	0	8

Miscellaneous Totals

Year	Property Damage	EPDO Index
2003	\$ 6700	9.40
2004	\$ 22000	17.80
2005	\$ 0	0.00
2006	\$ 0	0.00
Total	\$ 28700	27.20

Type of Accident Totals

Year	Left Turn	Right Turn	Rear End	Run Off Road &			
				Fixed Object	Angle	Side Swipe	Other
2003	0	0	0	0	2	0	0
2004	0	0	0	1	2	0	0
2005	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0
Total	0	0	0	1	4	0	0

**North Carolina Department of Transportation
Traffic Engineering Accident Analysis System
Intersection Analysis Report**

Acc No	Crash ID	Date	Accident Type	Total Damage	Injuries				Condition			Road		Trfc Ctl	
					F	A	B	C	R	L	W	Ch	Ci	Dv	Op
9	102890468	06/13/2010 08:50	LEFT TURN, DIFFERENT ROADWAYS	\$ 2500	0	0	0	0	1	1	1	1	0	1	1
Unit	1 : 1	Alchl/Drugs: 0	Speed: 45 MPH	Dir: W	Veh Mnvr / Ped Actn: 8				Obj Strk:						
Unit	2 : 1	Alchl/Drugs: 0	Speed: 45 MPH	Dir: E	Veh Mnvr / Ped Actn: 4				Obj Strk:						
10	102910114	07/10/2010 10:28	ANGLE	\$ 4500	0	0	4	0	1	1	1	1	0	13	1
Unit	1 : 1	Alchl/Drugs: 0	Speed: 55 MPH	Dir: N	Veh Mnvr / Ped Actn: 4				Obj Strk:						
Unit	2 : 1	Alchl/Drugs: 0	Speed: 20 MPH	Dir: S	Veh Mnvr / Ped Actn: 8				Obj Strk:						

Legend for Report Details:

- Acc No - Accident Number
- Injuries: F - Fatal, A - Class A, B - Class B, C - Class C
- Condition: R - Road Surface, L - Ambient Light, W - Weather
- Rd Ch - Road Character
- Rd Ci - Roadway Contributing Circumstances
- Trfc Ctl - Traffic Control: Dv - Device, Op - Operating
- Alchl/Drugs - Alcohol Drugs Suspected
- Veh Mnvr/Ped Actn - Vehicle Maneuver/Pedestrian Action
- Obj Strk - Object Struck

**North Carolina Department of Transportation
Traffic Engineering Accident Analysis System
Intersection Analysis Report**

Summary Statistics

High Level Crash Summary

Crash Type	Number of Crashes	Percent of Total
Total Crashes	10	100.00
Fatal Crashes	0	0.00
Non-Fatal Injury Crashes	2	20.00
Total Injury Crashes	2	20.00
Property Damage Only Crashes	8	80.00
Night Crashes	3	30.00
Wet Crashes	0	0.00
Alcohol/Drugs Involvement Crashes	0	0.00

Crash Severity Summary

Crash Type	Number of Crashes	Percent of Total
Total Crashes	10	100.00
Fatal Crashes	0	0.00
Class A Crashes	0	0.00
Class B Crashes	2	20.00
Class C Crashes	0	0.00
Property Damage Only Crashes	8	80.00

Vehicle Exposure Statistics

Annual ADT = 99999

Total Vehicle Exposure = 133.8 (MEV)

Crash Rate	Crashes Per 100 Million Vehicles Entered
Total Crash Rate	7.47
Fatal Crash Rate	0.00
Non Fatal Crash Rate	1.49
Night Crash Rate	2.24
Wet Crash Rate	0.00
EPDO Rate	18.54

**North Carolina Department of Transportation
Traffic Engineering Accident Analysis System
Intersection Analysis Report**

Miscellaneous Statistics

Severity Index =	2.48
EPDO Crash Index =	24.80
Estimated Property Damage Total = \$	69500.00

Accident Type Summary

Accident Type	Number of Crashes	Percent of Total
ANGLE	4	40.00
FIXED OBJECT	1	10.00
LEFT TURN, DIFFERENT ROADWAYS	3	30.00
REAR END, SLOW OR STOP	2	20.00

Injury Summary

Injury Type	Number of Injuries	Percent of Total
Fatal Injuries	0	0.00
Class A Injuries	0	0.00
Class B Injuries	6	100.00
Class C Injuries	0	0.00
Total Non-Fatal Injuries	6	100.00
Total Injuries	6	100.00

**North Carolina Department of Transportation
Traffic Engineering Accident Analysis System
Intersection Analysis Report**

Monthly Summary

Month	Number of Crashes	Percent of Total
Jan	0	0.00
Feb	0	0.00
Mar	1	10.00
Apr	1	10.00
May	1	10.00
Jun	1	10.00
Jul	1	10.00
Aug	0	0.00
Sep	1	10.00
Oct	3	30.00
Nov	0	0.00
Dec	1	10.00

Daily Summary

Day	Number of Crashes	Percent of Total
Mon	1	10.00
Tue	1	10.00
Wed	1	10.00
Thu	1	10.00
Fri	1	10.00
Sat	4	40.00
Sun	1	10.00

**North Carolina Department of Transportation
Traffic Engineering Accident Analysis System
Intersection Analysis Report**

Hourly Summary

Hour	Number of Crashes	Percent of Total
0000-0059	0	0.00
0100-0159	0	0.00
0200-0259	0	0.00
0300-0359	0	0.00
0400-0459	0	0.00
0500-0559	0	0.00
0600-0659	0	0.00
0700-0759	0	0.00
0800-0859	1	10.00
0900-0959	0	0.00
1000-1059	1	10.00
1100-1159	0	0.00
1200-1259	0	0.00
1300-1359	0	0.00
1400-1459	2	20.00
1500-1559	0	0.00
1600-1659	3	30.00
1700-1759	0	0.00
1800-1859	0	0.00
1900-1959	3	30.00
2000-2059	0	0.00
2100-2159	0	0.00
2200-2259	0	0.00
2300-2359	0	0.00

**North Carolina Department of Transportation
Traffic Engineering Accident Analysis System
Intersection Analysis Report**

Light and Road Conditions Summary

Condition	Dry	Wet	Other	Total
Day	7	0	0	7
Dark	3	0	0	3
Other	0	0	0	0
Total	10	0	0	10

Object Struck Summary

Object Type	Times Struck	Percent of Total
TREE	1	50.00
UTILITY POLE	1	50.00

Vehicle Type Summary

Vehicle Type	Number Involved	Percent of Total
LIGHT TRUCK (MINI-VAN, PANEL)	1	5.26
PASSENGER CAR	12	63.16
PICKUP	5	26.32
SPORT UTILITY	1	5.26

North Carolina Department of Transportation
Traffic Engineering Accident Analysis System
Intersection Analysis Report

Yearly Totals Summary

Accident Totals

Year	Total Accidents	Fatal Accidents	Injury Accidents	Property Damage Only Accidents
2007	4	0	0	4
2008	4	0	1	3
2009	0	0	0	0
2010	2	0	1	1
Total	10	0	2	8

Injury Totals

Year	Fatal Injuries	Class A, B, or C Injuries
2007	0	0
2008	0	2
2009	0	0
2010	0	4
Total	0	6

Miscellaneous Totals

Year	Property Damage	EPDO Index
2007	\$ 21000	4.00
2008	\$ 41500	11.40
2009	\$ 0	0.00
2010	\$ 7000	9.40
Total	\$ 69500	24.80

Type of Accident Totals

Year	Left Turn	Right Turn	Rear End	Run Off Road &			
				Fixed Object	Angle	Side Swipe	Other
2007	2	0	1	1	0	0	0
2008	0	0	1	0	3	0	0
2009	0	0	0	0	0	0	0
2010	1	0	0	0	1	0	0
Total	3	0	2	1	4	0	0