

Hazard Elimination Project Evaluation

Project Log # 200705258

Hazard Elimination Project W-3430

**Evaluation of the Horizontal Alignment Improvements on
SR 1100 (Grabtown Rd) from .4 to .2 Miles West of US 13 Bypass
Bertie 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

Brad Robinson

3/7/2008
Date

Traffic Safety Project Engineer

Hazard Elimination Project Evaluation Documentation

Subject Location

Evaluation of Hazard Elimination Project W-3430 – SR 1100 (Grabtown Rd) from 0.4 to 0.2 miles west of US 13 Bypass in Bertie County.

Project Information and Background from the Project File Folder

The safety countermeasure chosen for the subject location was the purchasing of right-of-way in order to straighten a sharp curve.

At the subject location SR 1100 (Grabtown Rd) is a two lane roadway with a speed limit of 45 mph. In the before period the curve was signed as a reverse curve with a 25 mph advisory speed limit. The project used new right of way in order to straighten the eastern curve.

The initial crash analysis was conducted from March 1, 1992 through February 28, 1995 and included 17 crashes. The crashes included 12 Ran-Off-Roadway, 1 Angle, 1 Rear-End, 1 Head-On, and 2 Sideswipe Crashes. The benefit-cost ratio was calculated to be 18.4.

The final completion date for the improvement at the subject intersection was on November 28, 1997 with a total cost of \$315,000.

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 September 1, 1997 through February 28, 1998. The before period consisted of reported crashes from January 1, 1990 through August 31, 1997 (7 years, 8 months) and the after period consisted of reported crashes from March 1, 1998 through October 31, 2005 (7 years, 8 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 on SR 1100 from 0.4 to 0.2 miles west of US 13 Bypass (MP 6.74-6.94). Please see attached *Location Map* and *Aerial Photo* for further details. Also see the attached *Collision Diagrams* for more detailed visual depiction of the crash data.

The following data tables depict the Naive Before and After Analysis for the treatment location. Please note that Ran-Off-Road crash types were the target crashes for the applied countermeasure. These crash types considered are as follows: Ran Off Road-Left, Ran Off Road-Right, Ran Off Road-Straight, Overturn/Rollover, Fixed Object, Head-On; Sideswipe, Opposite Direction.

<u>Treatment Information</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	17	2	-88.2
Total Severity Index	21.45	42.6	98.6
Target Crashes	15	1	-93.3
Target Crashes Severity Index	24.17	76.8	217.7
Volume	1,100	1,300	18.2

<u>Injury Summary</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Total Injury Crashes	10	2	-80.0
Fatal Crashes	1	0	-100.0
Class A Crashes	3	1	-66.7
Class B Crashes	4	0	-100.0
Class C Crashes	2	1	-50.0
Property Damage Only (PDO) Crashes	7	0	-100.0

The naive before and after analysis at the subject intersection resulted in an 88 percent decrease in Total Crashes, a 93 percent decrease in Target Crashes, and an 18 percent increase in Average Daily Traffic (ADT). In addition, Total Injury Crashes decreased by 80 percent, although the Total Severity Index increased by 99 percent. The before period ADT year was 1993 and the after period ADT year was 2001.

Results and Discussion

The naive before and after analysis involving the comparison of treatment actual before data versus treatment actual after data resulted in an 88 percent decrease in Total Crashes and a 93 percent decrease in Target Crashes. The Total Severity Index increased by 99 percent and the Target Crash Severity Index increased by 217 percent. The summary results above demonstrate that the treatment location appears to have had a decrease in the number of both Total and Target Crashes from the before to the after period, although the severity has significantly increased.

The large increase in the severity indexes is misleading. There were only two total crashes in the after period, one resulting in an “A” injury crash and one resulting in a “C” injury crash. The “A” injury crash was the sole Target Crash in the after period.

The calculated benefit to cost ratio for this project is 6.96 considering total crashes. The benefit to cost ratio considering only target crashes is 7.01. 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.

Referencing the *Collision Diagrams*, it is apparent that the horizontal alignment improvements significantly reduced crashes at the subject location. In the before period there were 12 Ran-Off-

Road crashes, resulting in one fatal crash, two “A” injury crashes, and four “B” injury crashes. In the after period there was a single Ran-Off-Road crash (a decrease of 92%) which resulted in an “A” injury crash. The driver of the single after period Ran-Off-Road crash was both exceeding the speed limit (estimated to have an original traveling speed of 65 mph) and intoxicated. The vehicle ran off the roadway and hit a parked vehicle.

There were three other crashes at the subject location in the before period considered Ran-Off-Road crash types. Two were Head-On crashes (resulting in one “A” and one “C” injury crash) and one was a Sideswipe-Opposite Direction crash (resulting in a “C” injury crash). As stated above, there were no other Target Crashes at the subject location in the after period.

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: SR 1100 from .2 to .4 miles west of US 1. BY: Brad Robinson
 COUNTY: Bertie DATE: 3/4/2008
 FILE NO.: W-3430

DETAILED COST: TYPE IMPROVEMENT - Horizontal alignment improvements

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$0	0	0.000	\$0
Right-of-Way	\$315,000	20	0.102	\$32,083
	\$0	0	0.000	\$0
TOTALS	\$315,000	20	0.102	\$32,083

ESTIMATED INCREASE IN ANNUAL MAINT. COST = \$0
 ESTIMATED INCREASE IN ANNUAL UTILITY COST = \$0
 TOTAL ANNUAL COST= \$32,083
 TOTAL COST OF PROJECT= \$315,000

COMPREHENSIVE COST REDUCTION:

ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES

TIME PERIOD	YEARS	ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES				PDO		ANNUAL COSTS
		K & A CRASHES	K & A CRASHES PER YR	B & C CRASHES	B & C CRASHES PER YR	CRASHES	CRASHES PER YR	
BEFORE	7.67	4	0.52	6	0.78	7	0.91	\$295,007
AFTER	7.67	1	0.13	1	0.13	0	0.00	\$71,578

Annual Benefits from Crash Cost Savings \$223,429

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = \$191,345

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 6.96

TOTAL COST OF PROJECT - \$315,000 COMPREHENSIVE B/C RATIO - 6.96

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: SR 1100 from .2 to .4 miles west of US 1. BY: Brad Robinson
 COUNTY: Bertie DATE: 3/4/2008
 FILE NO.: W-3430 Target Crashes

DETAILED COST: TYPE IMPROVEMENT - Horizontal alignment improvements

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$0	0	0.000	\$0
	\$315,000	20	0.102	\$32,083
Right-of-Way	\$0	0	0.000	\$0

TOTALS \$315,000 20 0.102 \$32,083

ESTIMATED INCREASE IN ANNUAL MAINT. COST = \$0
 ESTIMATED INCREASE IN ANNUAL UTILITY COST = \$0
 TOTAL ANNUAL COST= \$32,083
 TOTAL COST OF PROJECT= \$315,000

COMPREHENSIVE COST REDUCTION:

ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES

TIME PERIOD	YEARS	ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES				PDO		ANNUAL COSTS
		K & A CRASHES	K & A CRASHES PER YR	B & C CRASHES	B & C CRASHES PER YR	CRASHES	CRASHES PER YR	
BEFORE	7.67	4	0.52	6	0.78	5	0.65	\$293,937
AFTER	7.67	1	0.13	0	0.00	0	0.00	\$69,100

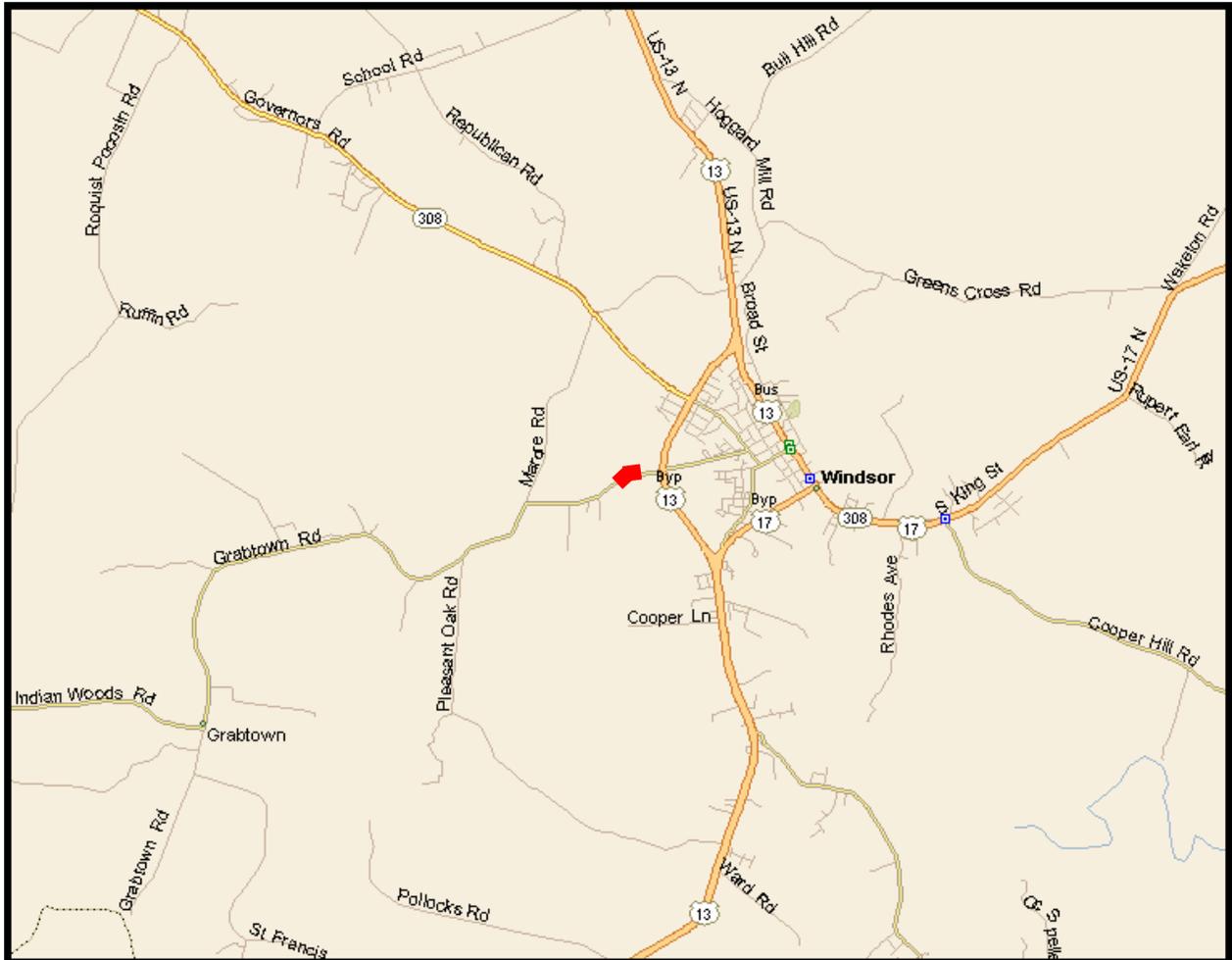
Annual Benefits from Crash Cost Savings \$224,837

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = \$192,754

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 7.01

TOTAL COST OF PROJECT - \$315,000 COMPREHENSIVE B/C RATIO - 7.01

**Location Map
Bertie County
Evaluation of W-3430**



Treatment Location: SR 1100 (Grabtown Rd) from .2 to .4 miles west of US 13 Bypass

2002 Aerial Photo



Treatment Site Photos Taken February 7, 2008



Driving Westbound on SR 1100 (Grabtown)



Driving Westbound on SR 1100 (Grabtown)



Driving Westbound on SR 1100 (Grabtown)



Driving Westbound on SR 1100 (Grabtown)

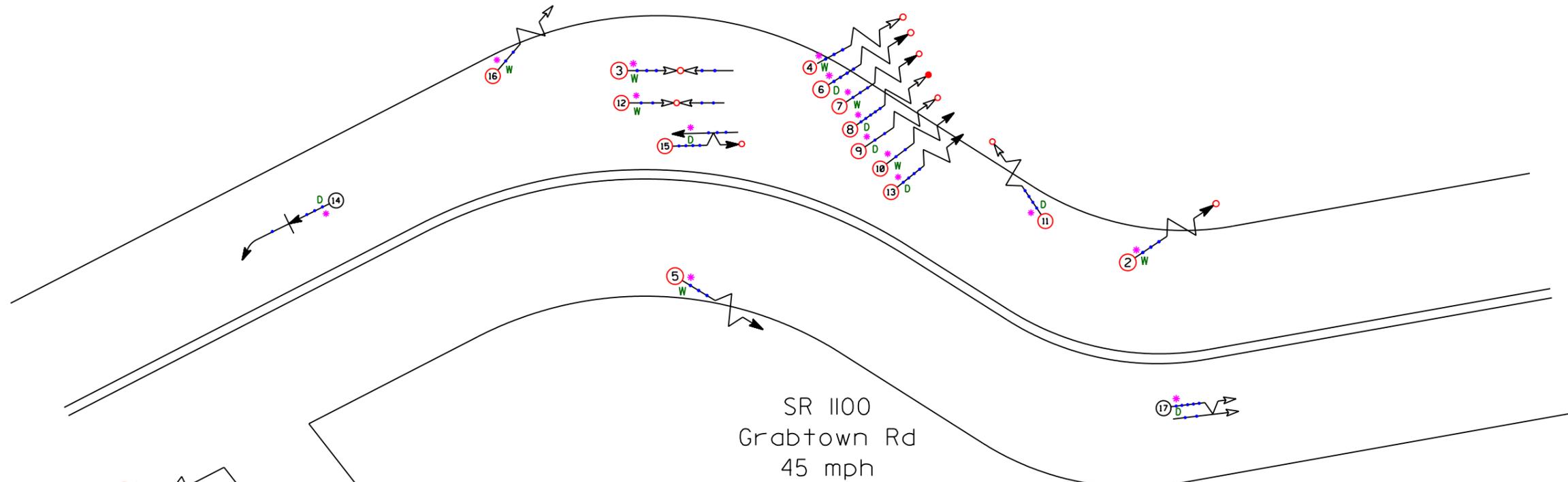
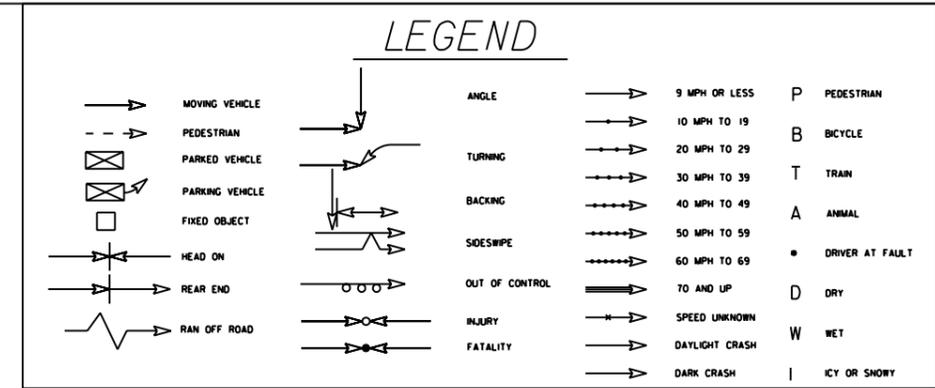


Driving Eastbound on SR 1100 (Grabtown)



Driving Eastbound on SR 1100 (Grabtown)

Bertie County
 SR 1100 From .4 miles to .2 miles
 West of US 13 Bypass
 Before Period From 1/1/90-8/31/97



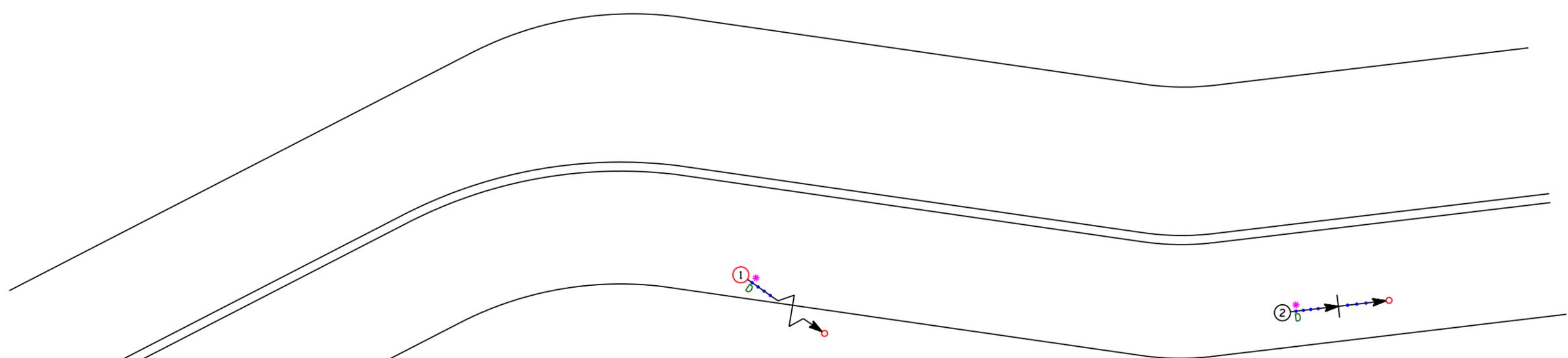

 Target Crashes



TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT		COLLISION DIAGRAM	
<small>HIGHWAY SAFETY IMPROVEMENT PROGRAM</small>		<small>SAFETY INFORMATION MANAGEMENT AND SUPPORT</small>	
		DIVISION: 1 AREA: ..	
<small>SAFETY EVALUATION</small>		<small>TRAFFIC SAFETY</small>	
BEFORE		STUDY PERIOD: 1/1/90 TO 8/31/97	
		DISTANCE: Y-LINE: 0 FT	
		ANALYSIS PREPARED BY: B. Robleso	
		DIAGRAM PREPARED BY: B. Robleso	
		DIAGRAM REVIEWED BY:	
		SCALE: NOT TO SCALE	
		DATE: February 2008	
		LOG NUMBER: 200705258	
N.C. DEPARTMENT of TRANSPORTATION			
DIVISION of HIGHWAYS			
TRAFFIC ENGINEERING AND SAFETY			
SYSTEMS BRANCH			

Bertie County
 SR 1100 From .4 miles to .2 miles
 West of US 13 Bypass
 After Period From 3/1/98-10/31/05

LEGEND							
	MOVING VEHICLE		ANGLE		9 MPH OR LESS	P	PEDESTRIAN
	PEDESTRIAN		TURNING		10 MPH TO 19	B	BICYCLE
	PARKED VEHICLE		BACKING		20 MPH TO 29	T	TRAIN
	PARKING VEHICLE		SIDESWIPE		30 MPH TO 39	A	ANIMAL
	FIXED OBJECT		OUT OF CONTROL		40 MPH TO 49	*	DRIVER AT FAULT
	HEAD ON		INJURY		50 MPH TO 59	D	DRY
	REAR END		FATALITY		60 MPH TO 69	W	WET
	RAN OFF ROAD		FATALITY		70 AND UP	I	ICY OR SNOWY



SR 1100
 Grabtown Rd
 45 mph



Target Crashes

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT <small>HIGHWAY SAFETY IMPROVEMENT PROGRAM SAFETY INFORMATION MANAGEMENT AND SUPPORT</small>		COLLISION DIAGRAM	
		DIVISION: I	AREA: ..
		STUDY PERIOD: 3/1/98 TO 10/31/05	
		DISTANCE: Y-LINE: 0 FT	
		ANALYSIS PREPARED BY: B. Bobiosso	
DIAGRAM PREPARED BY: B. Bobiosso		DIAGRAM REVIEWED BY:	
SAFETY EVALUATION		TRAFFIC SAFETY	
AFTER		SCALE: NOT TO SCALE	DATE: February 2008
		LOG NUMBER: 200705258	
N.C. DEPARTMENT of TRANSPORTATION DIVISION of HIGHWAYS TRAFFIC ENGINEERING AND SAFETY SYSTEMS BRANCH			