

Hazard Elimination Project Evaluation

Project Log # 41000010993

Hazard Elimination Project W-4708

**Evaluation of the Intersection Realignment and
NC-87 Dual Left Turn Lane Installation
NC-87 at SR 1501 (Garrett Road) and SR 1557 (Westerly Park Road)
Rockingham County**

Documents Prepared By:

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

Principal Investigator



Jason B. Schronce

3-7-2011

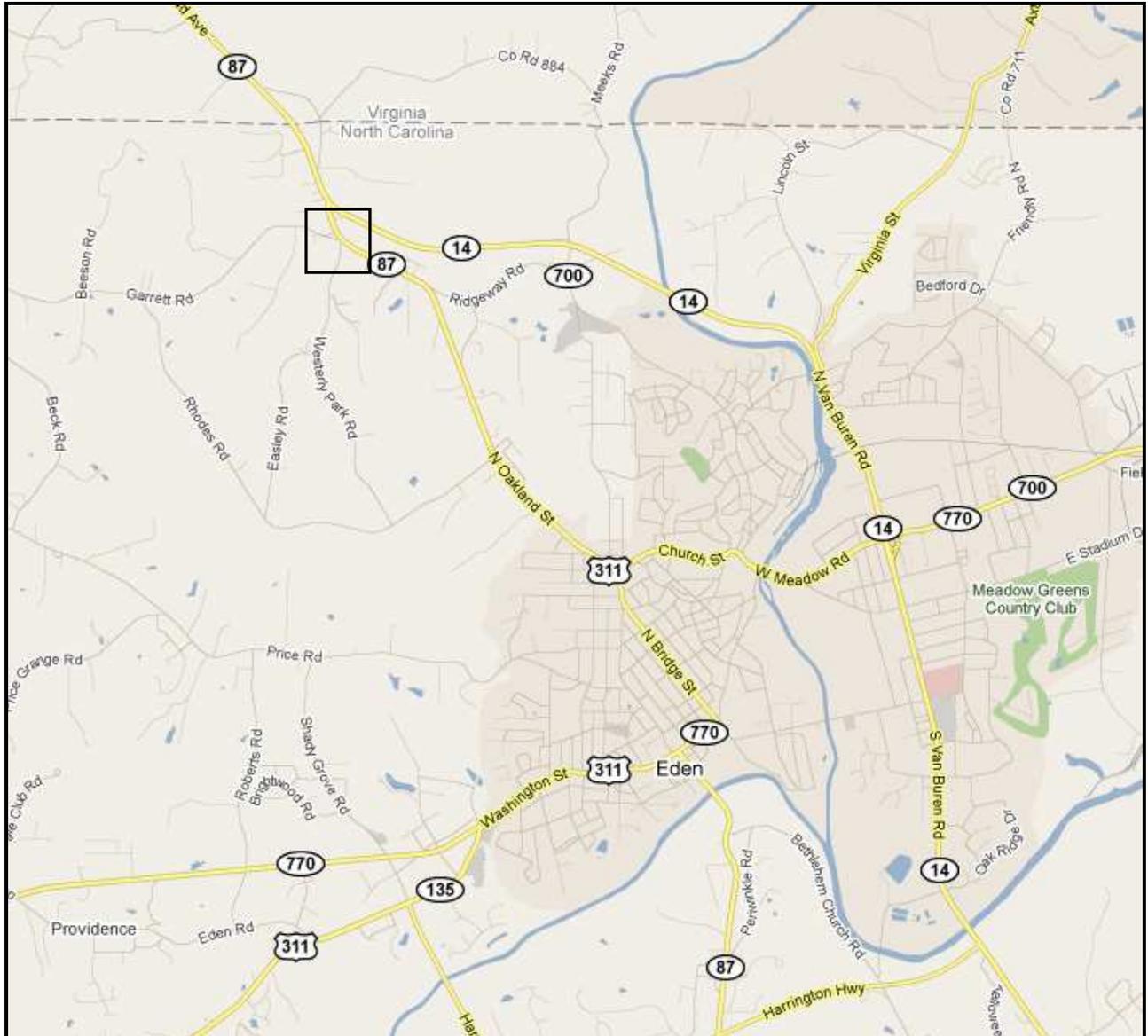
Date

Traffic Safety Project Engineer

Hazard Elimination Project Evaluation Documentation

SUBJECT LOCATION

Subject Intersection is NC-87 (also listed as SR 1605 – Oakland Ave) at SR 1501 (Garrett Road) and SR 1557 (Westerly Park Road), north of Eden near the Virginia Border in Rockingham County. See Location Map below.





**Rockingham County GIS
Before Period (Former Alignment) – “K” Intersection**



**Rockingham County GIS – After Period (2007) – New Alignment
2 Separate Intersections with Independent Left Turn Lanes**

PROJECT INFORMATION

The safety countermeasures chosen for the subject location were to horizontally realign the existing “K” intersection by separating SR 1501 and SR 1557 into two (2) detached 3-leg intersections with NC-87 and; construct two separate left turn lanes on the northbound approach of NC-87 by roadway widening.

The subject intersection exists at the mid-point of a lengthy horizontal curve on NC-87. All three roadways are rural two-lane, two-way facilities with minimal paved shoulders. The speed limit on NC-87 and SR 1501 (Garrett Road) is 45 mph, while SR 1557 (Westerly Park Road) is posted at 35 mph. The surrounding area is mainly residential with multiple driveways present in the vicinity. The realignment of SR 1501 actually placed the new road on the opposite side, to the north, of an existing residence which left the previous alignment as a “Dead End” paved roadway for driveway access (*see aerial photos on previous page*). Dual posted intersection stop signs were also added to SR 1557 in the after period.

According to the Project Report, the “K” shape intersection design was contributing to a pattern of “Left Turn Different Road” and “Rear-End” type crashes at this location. The large intersection design created driver confusion concerning which roadway the motorist was accessing and the significant skew potentially produced sight distance issues. Left turn lanes on NC-87 were also considered following the presence of northbound rear-end collisions while motorists were stopped in the horizontal curve preparing to turn left onto SR 1501 / SR 1557.

The initial crash analysis was completed from December 1, 1998 to November 30, 2001 with four (4) reported crashes, all of which were deemed correctable including one fatality crash. The final completion date for the improvement at the subject location was on November 30, 2006 with a total cost of \$490,000. The projected benefit cost ratio was 15.52:1.

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 were the months of July through December 2006. The before period consisted of reported crashes from July 1, 2002 through June 30, 2006 (4.0 years); and the after period consisted of reported crashes from January 1, 2007 through December 31, 2010 (4.0 years). The ending date for this analysis was determined by the available crash data at the time the crash analysis was completed. The before period ADT year was 2004 and the after period ADT year was 2008.

The treatment data consisted of all crashes within 150 feet of the intersection. The y-line was used and adjusted following the split of the initial intersection by approximately 200 feet 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 targeted crash types for the applied countermeasures were Frontal Impact Collisions. The Frontal Impact Crash types considered are as follows: Left turn, same roadway; Left turn, different roadways; Right turn, same roadway; Right turn, different roadways; Head on; and Angle.

<u>Crash Summary Data</u>	Before	After	Percent Reduction (-)/ Percent Increase (+)
Total Crashes	9	1	- 88.9 %
Total Severity Index	12.71	1.00	- 92.1 %
Target Crashes – Frontal Impact	7	0	- 100.0 %
Target Severity Index	15.00	0.00	- 100.0 %
Rear End Crashes	2	0	- 100.0 %
Left Turn, Different Rd Crashes	5	0	- 100.0 %
Volume (2004, 2008)	3,700	3,500	- 5.4 %

<u>Total Crash Info</u>	Before	After	Percent Reduction (-)/ Percent Increase (+)
Fatal Injury Crashes	1	0	- 100.0 %
Non-Fatal Injury Crashes	4	0	- 100.0 %
Total Injury Crashes	5	0	- 100.0 %
Night Crashes	6	1	- 83.3 %
Wet Crashes	1	0	- 100.0 %

RESULTS AND DISCUSSION

The naïve before and after analysis for the treatment location resulted in a 89 percent decrease in Total Crashes, complete elimination of Target Crashes, with a 5.4 percent decrease in Average Daily Traffic (ADT). The Total Severity Index and Target Severity Index decreased by 92 percent and 100 percent, respectively. 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 crashes. By removing the longer distance for side street motorists to make the left turn and eliminating the sight distance restrictions, safety at this intersection has experienced significant improvement.

The calculated benefit to cost ratio for this project is **2.45 considering Total Crashes**. The benefit to cost ratio **considering only Target Crashes is 2.38**. 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.

TREATMENT SITE PHOTOS



Traveling South on NC-87 approaching new SR 1501



Looking North on NC-87 approaching new SR 1557 intersection



Traveling North on NC-87 nearing SR 1501 (new alignment)



Traveling North / Northeast on SR 1557 (Westerly Park) – New Intersection



Traveling East on SR 1501 (Garrett Rd)
Viewing Former Alignment (Dead End)



Traveling East on SR 1501 (Garrett Rd) – new alignment

BENEFIT-COST ANALYSIS WORKSHEET - Total Crashes

LOCATION: NC-87 at SR 1501 / SR 1557		BY: JBS						
COUNTY: Rockingham		DATE: 2/25/2011						
FILE NO.: W-4708								
DETAILED COST:	TYPE IMPROVEMENT - Intersection Realignment & Left Turn Lanes							
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$490,000	10	0.149	\$73,024			
		\$0	0	0.000	\$0			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$490,000	10	0.149	\$73,024			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$800			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$0			
	TOTAL ANNUAL COST=				\$73,824			
	TOTAL COST OF PROJECT=				\$490,000			
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	4.00	1	0.25	4	1.00	4	1.00	\$181,800
AFTER	4.00	0	0.00	0	0.00	1	0.25	\$1,075
						Annual Benefits from Crash Cost Savings		\$180,725
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$106,901		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	2.45		
TOTAL COST OF PROJECT		-	\$490,000	COMPREHENSIVE B/C RATIO		-	2.45	

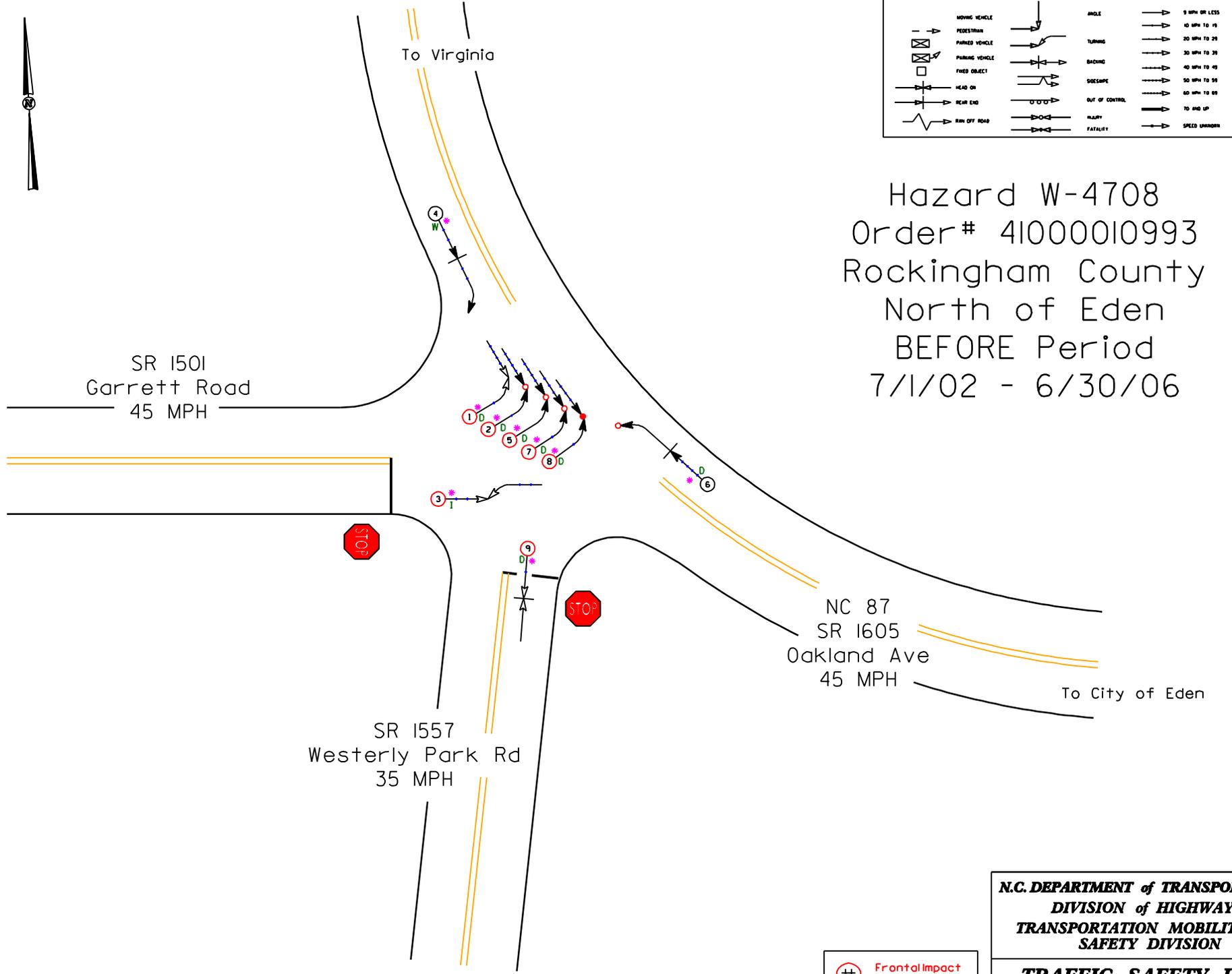
BENEFIT-COST ANALYSIS WORKSHEET - Target Crashes

LOCATION: NC-87 at SR 1501 / SR 1557		BY: JBS						
COUNTY: Rockingham		DATE: 2/25/2011						
FILE NO.: W-4708								
DETAILED COST:	TYPE IMPROVEMENT - Intersection Realignment & Left Turn Lanes							
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$490,000	10	0.149	\$73,024			
		\$0	0	0.000	\$0			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$490,000	10	0.149	\$73,024			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$800			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$0			
	TOTAL ANNUAL COST=				\$73,824			
	TOTAL COST OF PROJECT=				\$490,000			
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	4.00	1	0.25	3	0.75	3	0.75	\$175,725
AFTER	4.00	0	0.00	0	0.00	0	0.00	\$0
						Annual Benefits from Crash Cost Savings		\$175,725
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$101,901		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	2.38		
TOTAL COST OF PROJECT		-	\$490,000	COMPREHENSIVE B/C RATIO		-	2.38	

LEGEND

	MOVING VEHICLE		ANGLE		0 MPH OR LESS		PEDESTRIAN
	PEDESTRIAN		TURNING		15 MPH TO 25		TRAIN
	PARKEED VEHICLE		BACKING		25 MPH TO 35		OTHER AT FAULT
	PARKEED VEHICLE		SWAYING		35 MPH TO 45		DRY
	FIXED OBJECT		OUT OF CONTROL		45 MPH TO 55		WET
	HEAD ON		FLIPPED		55 MPH TO 65		ICY OR SHINY
	REAR END		HAZARD		65 MPH TO 75		SPEED LIMIT
	RAN OFF ROAD		FATALITY		75 MPH OR MORE		

Hazard W-4708
 Order# 41000010993
 Rockingham County
 North of Eden
 BEFORE Period
 7/1/02 - 6/30/06



Frontal Impact
 Target Crashes

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

TRAFFIC SAFETY UNIT

Date: 2-25-2011 Prepared By: J. Schronce

LEGEND

	MOVING VEHICLE		ANGLE		5 MPH OR LESS		PEDESTRIAN
	PEDESTRIAN		TURNING		30 MPH TO 35		TRAIN
	PAKED VEHICLE		BACKING		30 MPH TO 35		OTHER AT FAULT
	PAKED VEHICLE		SIDESWIPE		40 MPH TO 45		DIRT
	FIXED OBJECT		OUT OF CONTROL		50 MPH TO 55		WET
	HEAD ON		RAN OFF ROAD		60 MPH TO 65		TO AND UP
	NEAR END		REAR END		HURRY		FATALITY
	RAN OFF ROAD		SPEED EXCEEDED		SPEED EXCEEDED		ONLY



To Virginia

NC 87
SR 1605
Oakland Ave
45 MPH

Hazard W-4708
Order# 41000010993
Rockingham County
North of Eden
AFTER Period
1/1/07 - 12/31/10

SR 1501
Garrett Road
45 MPH

SR 1501
Former Alignment
(Driveway Access)

SR 1557
Westerly Park Rd
35 MPH

To City of Eden

Frontal Impact
Target Crashes

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

TRAFFIC SAFETY UNIT

Date: 2-25-2011

Prepared By: J. Schronce