

Spot Safety Project Evaluation

Project Log # 200906069

Spot Safety Project # 03-02-201

**Spot Safety Project Evaluation of the 1.5 Foot Paved Shoulder Installation
SR 1509 (Queens Creek Road) – Milepost 1.40 to 4.00
Onslow County, near Swansboro**

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

8-17-2009

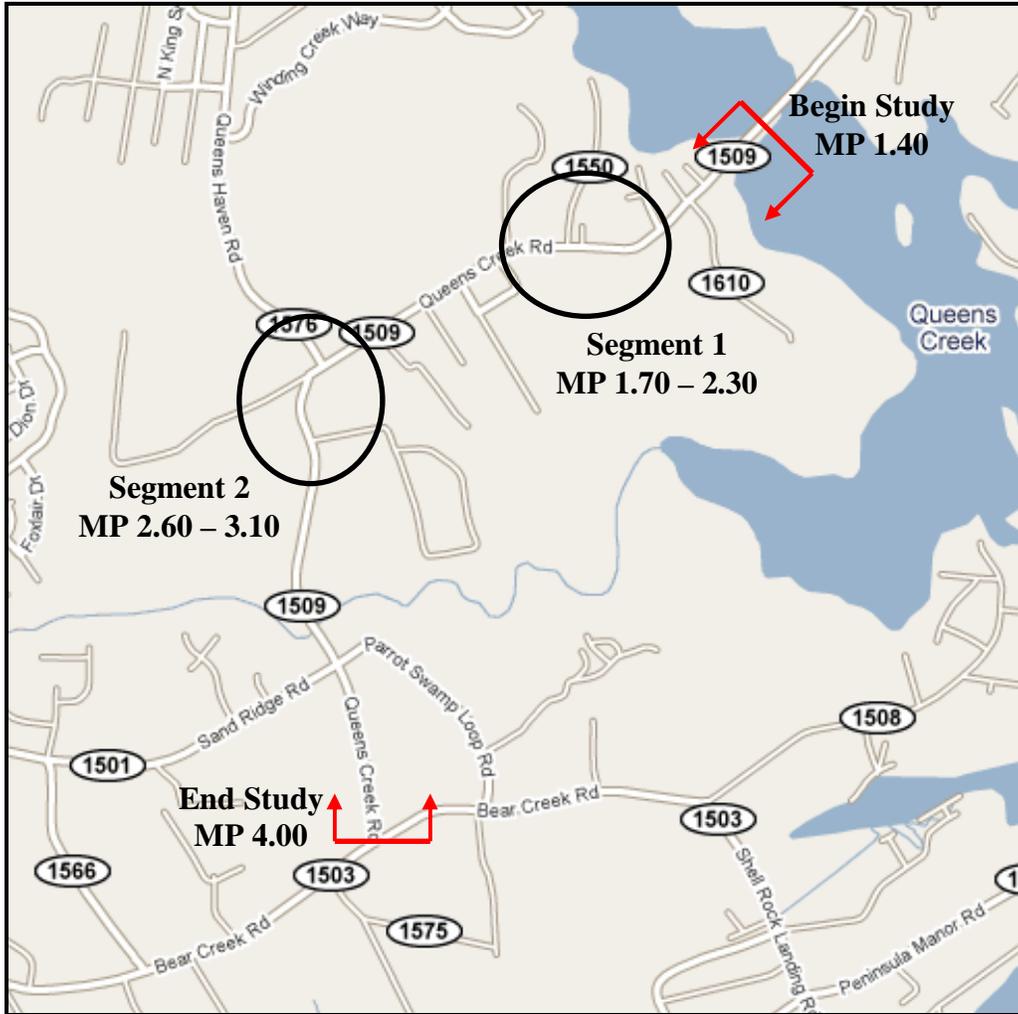
Date

Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 03-02-201 located on SR 1509 (Queens Creek Road) from the Bridge over Queens Creek (MP 1.40) to the SR 1503 intersection (MP 4.00) in Onslow County, near the City of Swansboro.



Project Information and Background from the Project File Folder

The spot safety project improvement countermeasure chosen for the subject location was the installation 1.5 foot paved shoulders on both sides of the roadway. SR 1509 (Queens Creek Road) is two-lane, two-way facility with a posted 55 mph speed limit. The route contains many driveways which are mostly residential with a few small private commercial businesses.

The original statement of problem was the existing issue of motorists repeatedly running off the edge of roadway resulting in rutting on both sides of the route. Vehicles tend to over-react causing a ran-off roadway type collision. The intended purpose was to give motorists more room to correct their maneuvers to eliminate the ran-off roadway crash pattern.

The initial crash analysis was completed from September 30, 1998 to September 30, 2001 with forty-two (42) reported crashes, eight (8) of which were deemed correctable. The final completion date for the improvement at the subject intersection was on March 17, 2003 with a total cost of \$115,000.

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 February through March 2003. The before period consisted of reported crashes from January 1, 1997 through January 31, 2003 (6 years and 1 month); and the after period consisted of reported crashes from April 1, 2003 through April 30, 2009 (6 years and 1 month). 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 along the SR 1509 route from MP 1.50 (0.1 mile west of bridge) to MP 3.972 (150 feet from SR 1503 intersection) with a zero foot y-line. *Please see attached location map and photos for further details.*

The following data table depicts the Naive Before and After Analysis for the treatment location. Please note that SR 1509 Lane Departure Crashes were the target crashes for the applied countermeasure. The Target Crash types considered are as follows: Ran-off Roadway, Left; Ran-off Roadway, Right; Ran-off Roadway, Straight; Fixed Object, Sideswipe, Opposite Direction; and Head-on Collisions.

<u>Treatment Information</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Total crashes	107	162	51.4 %
Total Severity Index	5.46	7.48	37.0 %
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Target Crashes	52	83	59.6 %
Target Crash Severity Index	6.16	8.87	44.0 %
<hr/>			
Volume	6,000	7,800	30.0 %

<u>Injury Crash Summary</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Fatal injury Crashes	1	0	- 100.0 %
Class A injury Crashes	1	8	300+ %
Class B injury Crashes	14	24	71.4 %
Class C Injury Crashes	30	36	20.0 %
Total Injury Crashes	46	68	47.8 %

The naive before and after analysis at the treatment location resulted in a 51 percent increase in Total Crashes, a 60 percent increase in Target Crashes, and a 37 percent increase in the Total Severity Index. The before period ADT year was 2000 and the after period ADT year was 2006.

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 51 percent increase in Total Crashes and a 60 percent increase in Target Crashes. The summary results above demonstrate that both Total and Target Crashes appear to have increased at the treatment location from the before to the after period.

The calculated benefit to cost ratio for this project is **(-49.45) considering total crashes**. 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.

As seen from *Treatment Information* Table above, this strip has experienced a significant increase in crashes through the evaluation period. There were no fatal crashes in the after period; but total A-injury collisions increased from one (1) to eight (8) along this route.

<u>Crash Occurrence Percentage</u>	Before	After
Segment 1 Percentage of Total	31.8 %	38.9 %
Segment 2 Percentage of Total	28.0 %	34.6 %
Combined Segments % of Total	59.8 %	73.5 %

The Safety Evaluation Group examined that two half-mile segments of this route contained the majority of the crashes with 60 percent in the before period and 73.5 percent in the after period. The only Collision Diagrams created show the before-after analysis of these two segments. Both segments, between milepost 1.70 - 2.30 and 2.60 - 3.10, contain reverse s-curves with multiple roadway intersections existing along the strip.

The follow two tables further breakdown the crash data by independent segment. It was also discovered that Segment 2 was upgraded with a center turn lane under Spot Safety Project 03-02-218. This was completed in October 2007 at a cost of \$100,000. The Segment 2 analysis is broken down into crashes per year to compensate for this improvement.

<u>Segment 1: MP 1.70 – 2.30</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes on Segment 1	34	63	85.3 %
Total Segment 1 Severity Index	5.84	8.40	43.8 %
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Target Crashes on Segment 1	21	44	109.5 %
Target Segment 1 Severity Index	7.78	11.25	44.6 %

<u>Segment 2: MP 2.60 – 3.10</u>	Before 6.08 Yrs	After 1 (Shoulders) 4.58 Yrs	After 2 (Center Turn) 1.50 Yrs
Total Crashes on Segment 2	30	50	6
Total Segment 2 Severity Index	5.44	5.77	4.70
Total Crashes Per Year – Segment 2	4.93	10.92	4.00
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Target Crashes on Segment 2	22	24	2
Target Segment 2 Severity Index	5.04	4.70	1.00
Target Crashes Per Year – Segment 2	3.62	5.24	1.33

As seen from the Segment 1 analysis and *Collision Diagrams*, crashes along this half-mile stretch have increased by 85 percent with target crashes doubling.

From the Segment 2 analysis and *Collision Diagrams*, it appears that crashes per year more than doubled with just the paved shoulders. There did appear to be a strong rear-end crash pattern at the intersection of SR 1576 (Queens Haven Road) which was eliminated with the installation of the center turn lane in October 2007.

The additional Spot Safety Project also had a positive impact on the ran-off road collisions with a reduction in the target crashes per year from 5.24 to 1.33. Another factor with the installation of the three-lane cross-section is that a total resurfacing of Segment 2 occurred. When the paved shoulders were installed, extra pavement was solely added to the edge of roadway without a full overlay being installed. This could be why the ran-off roadway crashes in Segment 1 did not change since a resurfacing did not take place.

Also note that the speed limit along this entire study route was reduced from 55 mph to 45 mph in July 2008. This speed reduction could have been yet another contributing factor in the positive benefit from After 1 to After 2 on Segment 2.

Please see the attached *Treatment Site Photos*. Photos are provided from Google Street View and show different points along this strip. 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 countermeasure.

TREATMENT SITE PHOTOS



Looking Southwest on SR 1509 at SR 1610 – Entering Segment 1



Looking West on SR 1509 in Segment 1 at SR 1550 Intersection



Looking Southwest on SR 1509 at SR 1576 – Entering Segment 2



Looking South on SR 1509 at SR 1620 – Exiting Segment 2



Looking South on SR 1509 approaching SR 1503 – End of Study Limits

BENEFIT-COST ANALYSIS WORKSHEET - Total Crashes

LOCATION: SR 1509 (1.4 - 4.0)
 COUNTY: Onslow
 FILE NO.: SS 03-02-201

BY: JBS
 DATE: 8/12/2009
 NOTES: Total Crashes

DETAILED COST: TYPE IMPROVEMENT - 1.5 Foot of Paved Shoulder

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$115,000	20	0.102	\$11,713
Right-of-Way	\$0	0	0.000	\$0
TOTALS	\$115,000	20	0.102	\$11,713

ESTIMATED INCREASE IN ANNUAL MAINT. COST = (\$350)
 ESTIMATED INCREASE IN ANNUAL UTILITY COST = \$0
 TOTAL ANNUAL COST= \$11,363
 TOTAL COST OF PROJECT= \$115,000

COMPREHENSIVE COST REDUCTION:

ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES

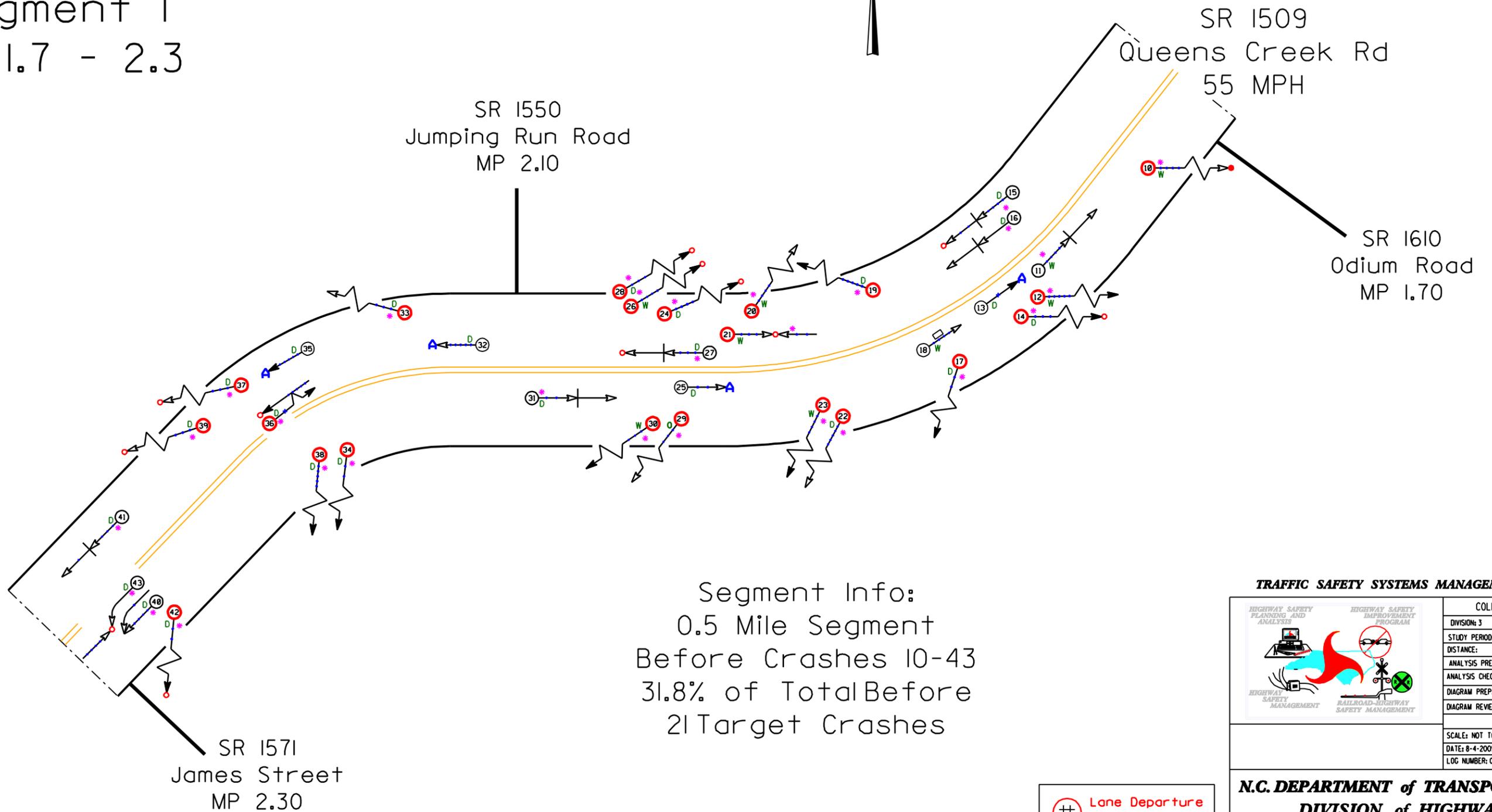
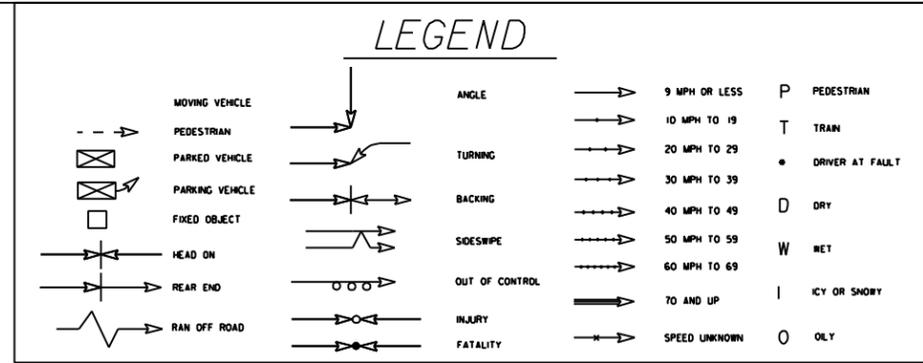
TIME PERIOD	YEARS	K & A CRASHES	K & A CRASHES PER YR	B & C CRASHES	B & C CRASHES PER YR	PDO CRASHES	PDO CRASHES PER YR	ANNUAL COSTS
BEFORE	6.08	2	0.33	44	7.24	61	10.03	\$333,865
AFTER	6.08	8	1.32	60	9.87	94	15.46	\$895,822

Annual Benefits from Crash Cost Savings (\$561,957)

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = (\$573,320)
 BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = -49.45

TOTAL COST OF PROJECT - \$115,000 COMPREHENSIVE B/C RATIO - -49.45

SS# 03-02-201
 Onslow County
 BEFORE Period
 1/1/97 - 1/31/03
 Segment 1
 MP 1.7 - 2.3



⊕ Lane Departure
 ⊕ Target Crashes

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

	COLLISION DIAGRAM	
	DIVISION: 3	AREA:
	STUDY PERIOD: 1/1/1997 - 1/31/2003	DISTANCE: Y-LINE : OFT
	ANALYSIS PREPARED BY: JBS	ANALYSIS CHECKED BY: N/A
	DIAGRAM PREPARED BY: ST	
	DIAGRAM REVIEWED BY: JBS	
	SCALE: NOT TO SCALE	
	DATE: 8-4-2009	
	LOG NUMBER: 03-02-201 Before Seg 1	

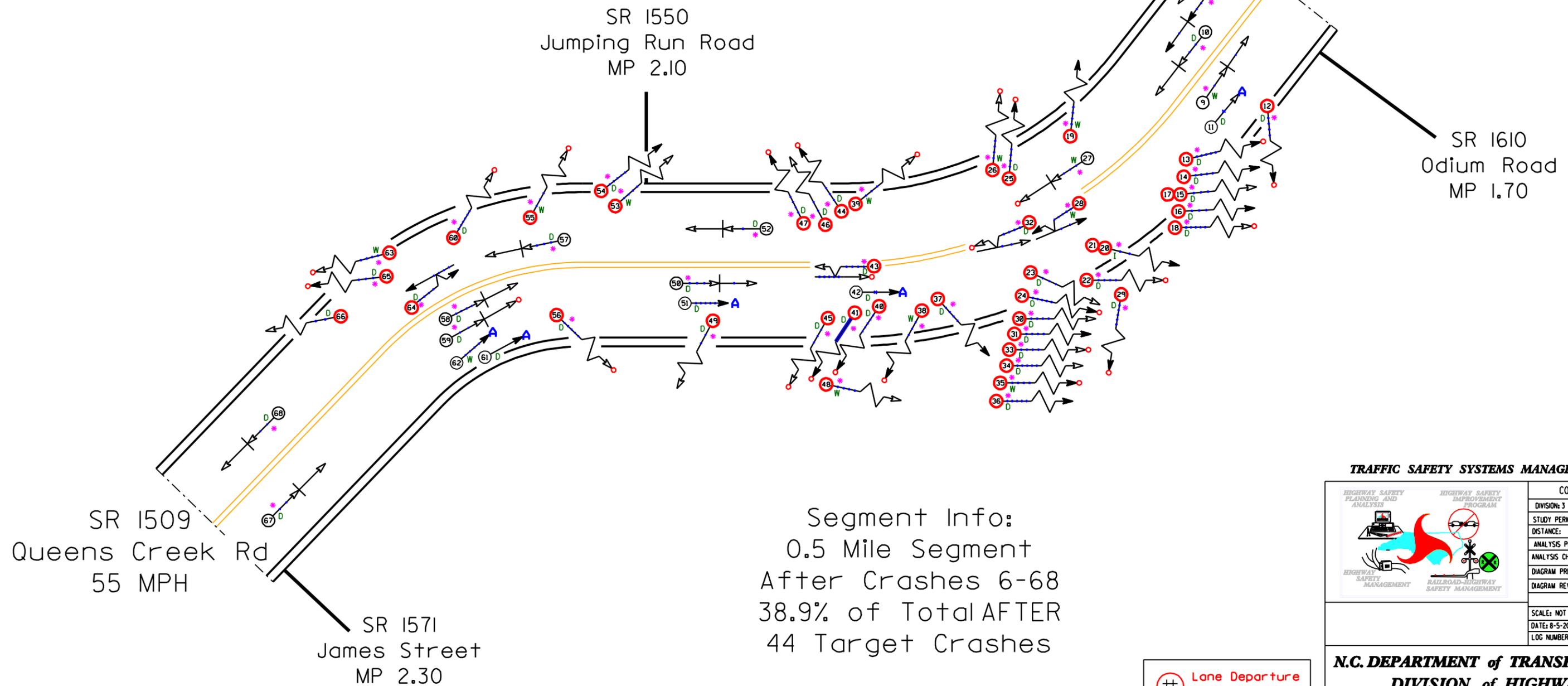
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DIVISION of HIGHWAYS
TRANSPORTATION MOBILITY and SAFETY DIVISION

SS# 03-02-201
 Onslow County
 AFTER Period
 4/1/03 - 4/30/09
 Segment 1
 MP 1.7 - 2.3

After Period Changes:
 Add 1.5 Foot Paved Shoulders
 to both sides of roadway

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		INJURY		50 MPH TO 59		ICY OR SNOWY
	REAR END		FATALITY		60 MPH TO 69		70 AND UP
	RAN OFF ROAD		SPEED UNKNOWN		9 MPH OR LESS		ONLY



Segment Info:
 0.5 Mile Segment
 After Crashes 6-68
 38.9% of Total AFTER
 44 Target Crashes

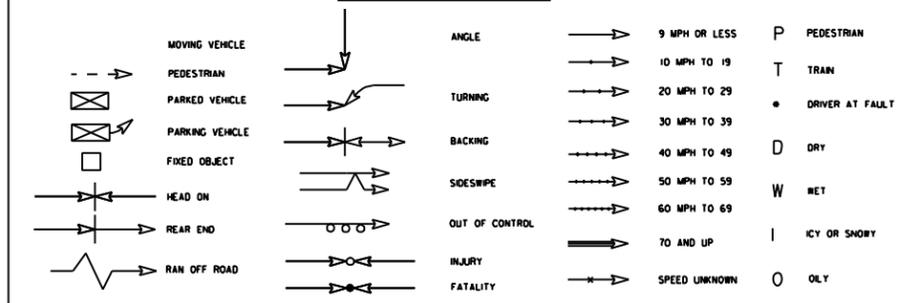
Lane Departure
 Target Crashes

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

 	COLLISION DIAGRAM	
	DIVISION: 3	AREA:
	STUDY PERIOD: 4/1/2003 - 4/30/2009	
	DISTANCE: Y-LINE : OFT	
ANALYSIS PREPARED BY: JBS		
ANALYSIS CHECKED BY: N/A		
DIAGRAM PREPARED BY: ST		
DIAGRAM REVIEWED BY: JBS		
SCALE: NOT TO SCALE		
DATE: 8-5-2009		
LOG NUMBER: 03-02-201AFTER Seg 1		

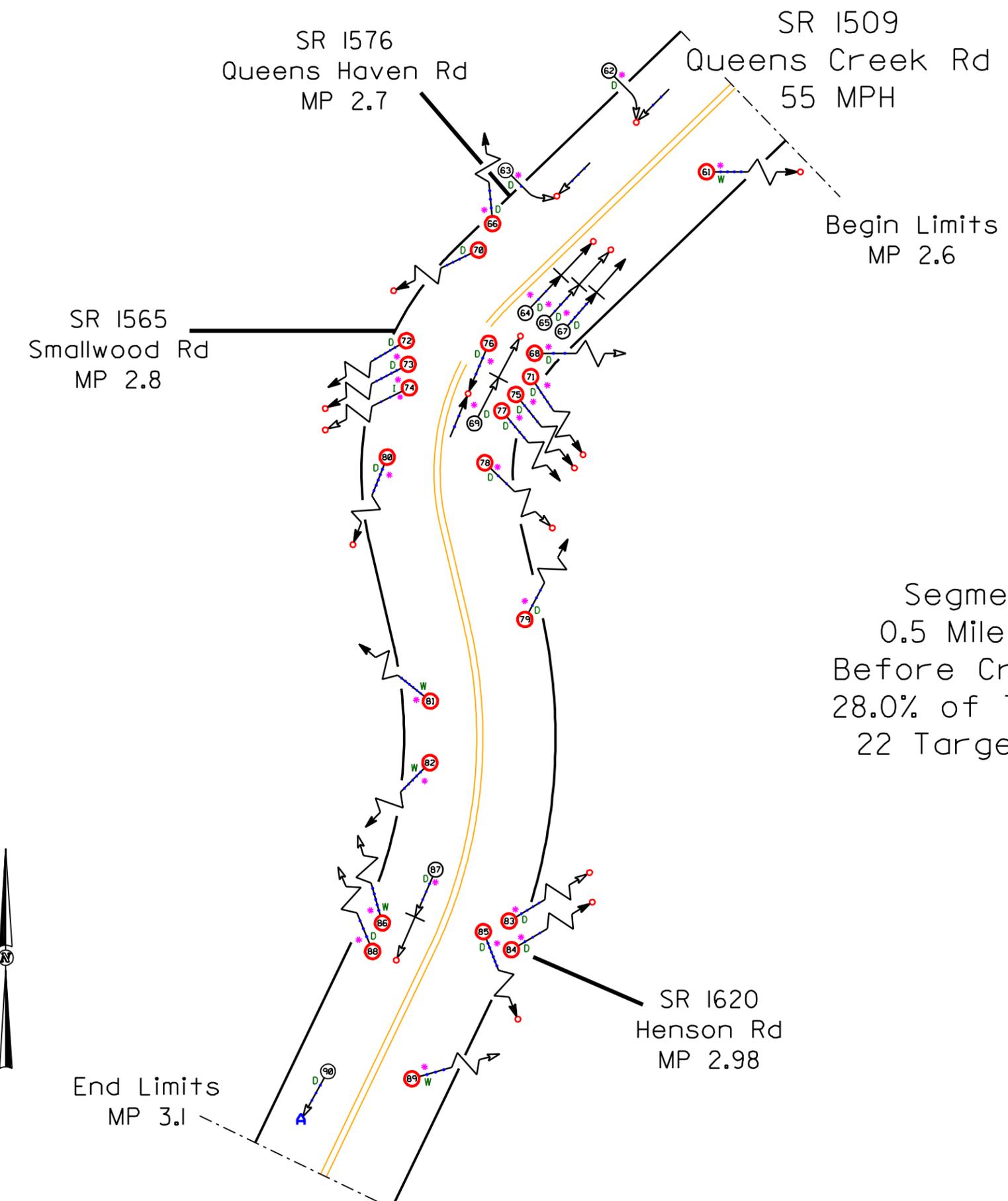
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LEGEND



SS# 03-02-201
 Onslow County
 BEFORE Period
 1/1/97 - 1/31/03
 Segment 2
 MP 2.6 - 3.1

Segment Info:
 0.5 Mile Segment
 Before Crashes 61-90
 28.0% of Total Before
 22 Target Crashes

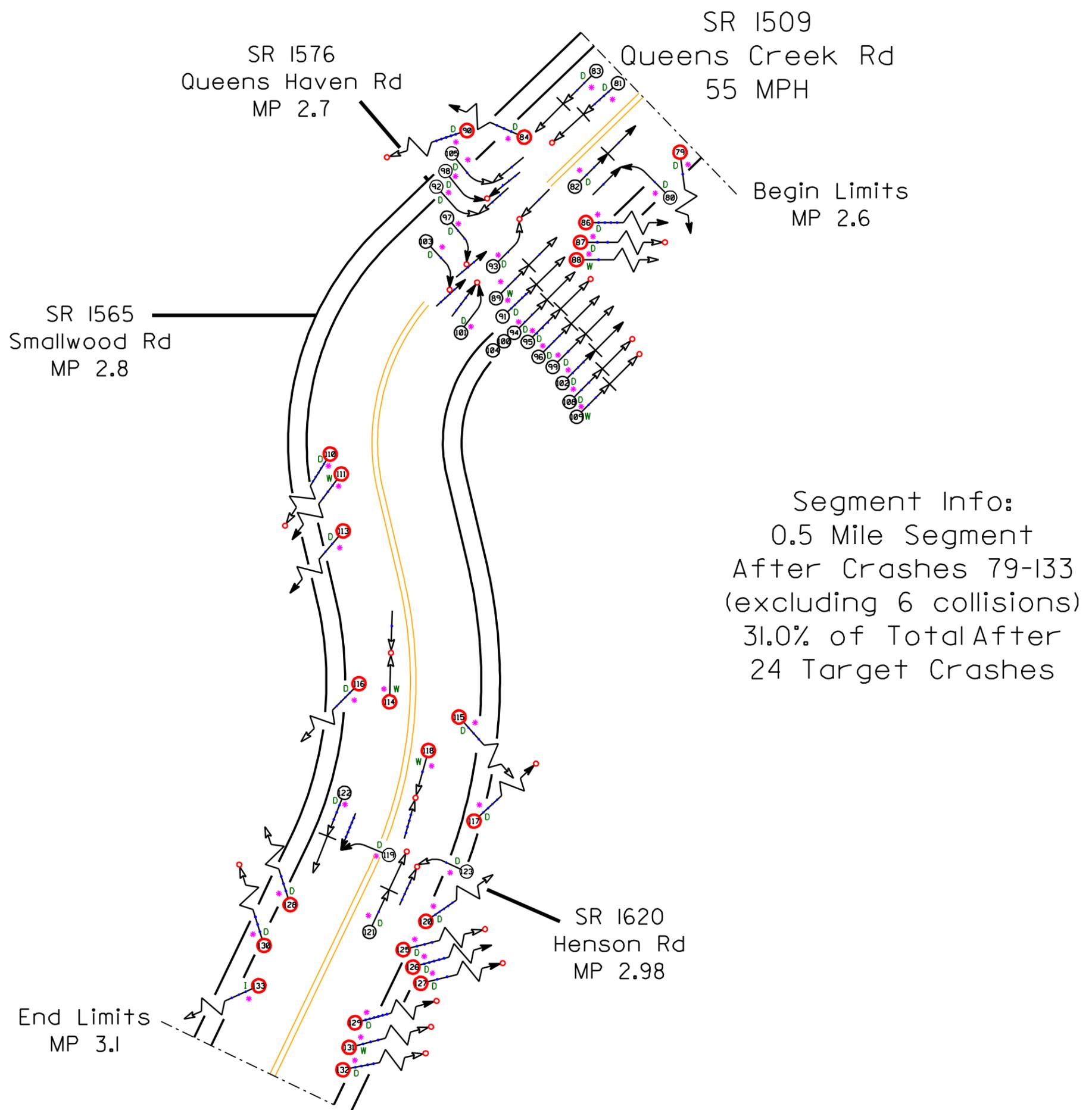


⊕ Lane Departure
 ⊕ Target Crashes

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

	COLLISION DIAGRAM	
	DIVISION: 3	AREA: 2
	STUDY PERIOD: 1/1/1997 - 1/31/2003	
	DISTANCE: Y-LINE : OFT	
ANALYSIS PREPARED BY: JBS		
ANALYSIS CHECKED BY: N/A		
DIAGRAM PREPARED BY: ST		
DIAGRAM REVIEWED BY: JBS		
SCALE: NOT TO SCALE		
DATE: 8-5-2009		
LOG NUMBER: 03-02-201Before Seq2		

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SAFETY DIVISION



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		INJURY		50 MPH TO 59		ICY OR SNOWY
	REAR END		FATALITY		60 MPH TO 69		ONLY
	RAN OFF ROAD		SPEED UNKNOWN		70 AND UP		

SS# 03-02-201
Onslow County
After 1 Period
4/1/03 - 10/31/07
4.58 Years
Segment 2
MP 2.6 - 3.1

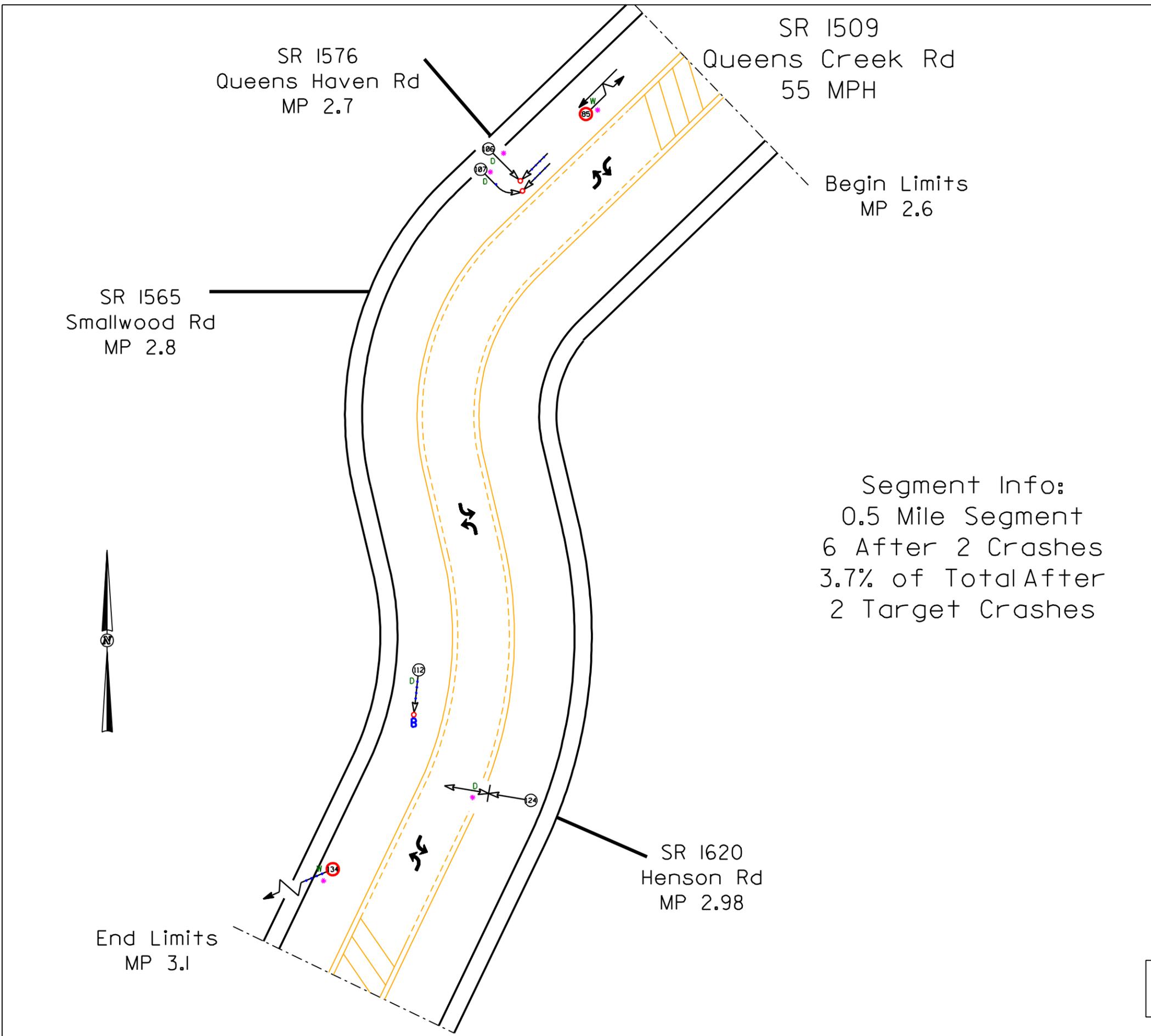


Lane Departure
 Target Crashes

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

	COLLISION DIAGRAM	
	DIVISION: 3	AREA:
	STUDY PERIOD: 4/1/2003 - 10/31/2007	
	DISTANCE: Y-LINE : OFT	
ANALYSIS PREPARED BY: JBS		
ANALYSIS CHECKED BY: N/A		
DIAGRAM PREPARED BY: ST		
DIAGRAM REVIEWED BY: JBS		
SCALE: NOT TO SCALE		
DATE: 8-8-2009		
LOG NUMBER: 03-02-201AFTER 1 Seg 2		

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DIVISION of HIGHWAYS
TRANSPORTATION MOBILITY and SAFETY DIVISION



LEGEND

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

SS# 03-02-201
Onslow County
After 2 Period
11/1/07 - 4/30/09
1.50 Years
Segment 2
MP 2.6 - 3.1



Lane Departure
 Target Crashes

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

	COLLISION DIAGRAM	
	DIVISION: 3	AREA:
	STUDY PERIOD: 11/1/2007 - 4/30/2009	
	DISTANCE: Y-LINE : OFT	
ANALYSIS PREPARED BY: JBS		
ANALYSIS CHECKED BY: N/A		
DIAGRAM PREPARED BY: ST		
DIAGRAM REVIEWED BY: JBS		
SCALE: NOT TO SCALE		
DATE: 8-11-2009		
LOG NUMBER: 03-02-201AFTER 2 Seg 2		

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