

Spot Safety Project Evaluation

Order # 41000011932

Spot Safety Project # 04-04-211

**Evaluation of the Rumble Strip Installation on US 70 Bypass
West of US 301 (MP 40.19) to SR 2305 (MP 43.46)
Johnston County**

Documents Prepared By:

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

Principal Investigator

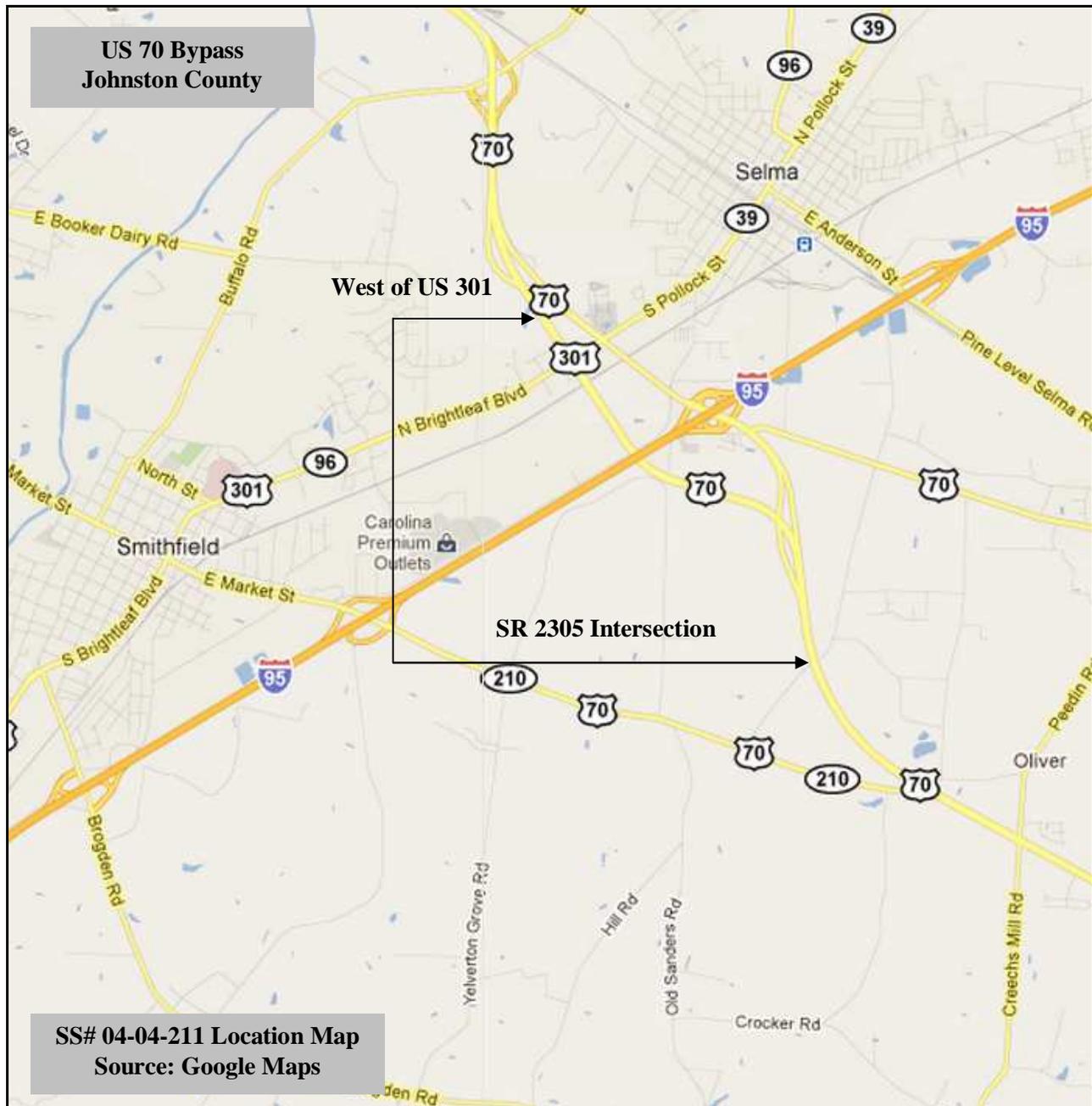


Jason B. Schronce

8-10-2011
Date

Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation



Subject Location

The treatment location includes the US 70 Bypass segment as shown above around Selma. The evaluation study begins at 0.3 mile west of the US 301 bridge (MP 40.19) and continues to 0.1 mile west of the SR 2305 (Firetower Road) intersection (MP 43.46). US 70 Bypass is a 4-lane fully controlled access bi-directional freeway with paved median shoulders and outside shoulders. This section of freeway has an approximately 40-45 foot wide grass median with cable barrier as the primary protection. The speed limit is 55 mph.

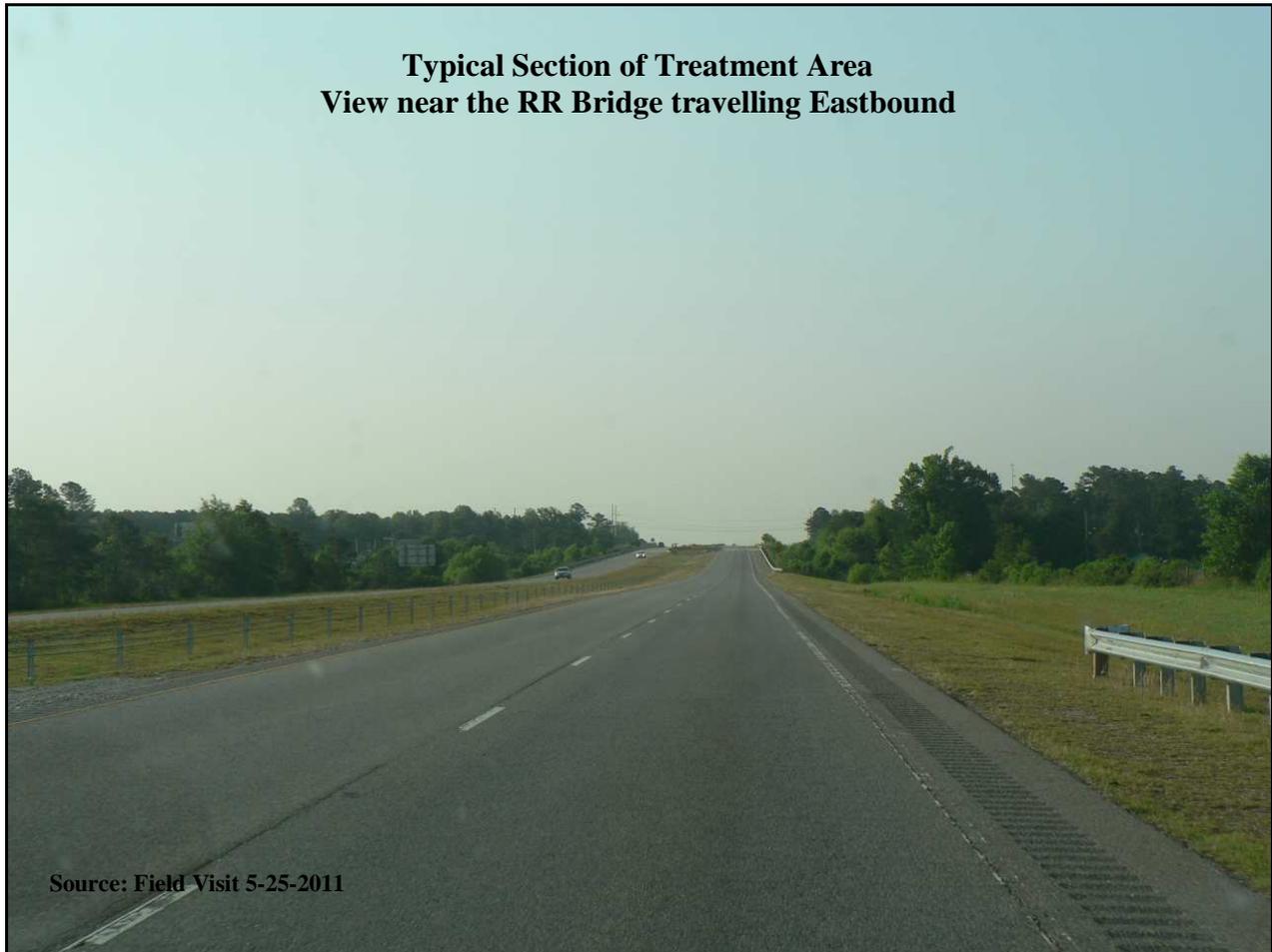
Project Information and Background from the Project File Folder

The spot safety project improvement chosen was the installation of milled-in rumble strips on the median and outside shoulders of the US 70 Bypass route. This section of the US 70 corridor has experienced numerous run-off-road crashes resulting in continued property damage and the potential for serious injuries.

The intended purpose of the improvement was to warn motorists when their vehicle drifts out of the travel lane and to alleviate the frequency of run-off-road crashes.

The initial crash analysis was completed from August 1, 2000 to July 31, 2003 with twenty-three (23) Total Crashes; ten (10) of which were correctable Ran-Off-Road crashes. The improvement was completed on December 5, 2007 with a total cost of \$72,500.00.

Location Photograph



Naive Before and After Analysis

After reviewing the 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 October through December 2007. The before period consisted of reported crashes from August 1, 2004 through September 30, 2007 (3 years and 2 months); and the after period consisted of reported crashes from January 1, 2008 through February 28, 2011 (3 years and 2 months). The ending date for this analysis was limited by available crash data at the time of analysis. The before period ADT year was 2006 and the after period ADT year was 2009.

For the purposes of this evaluation, the Safety Evaluation Group also did a comprehensive search for other TIP Projects completed on this segment during our analysis periods and found no other projects. The treatment data consisted of all mainline crashes with a 0' y-line which eliminates ramp crashes. Target crashes were identified as lane departure crash types which include Angle, Fixed Object, Overturn/Rollover, Parked Motor Vehicle, Ran-Off Road (Left/Right), and Sideswipe (Same Direction).

US 70 Bypass: Johnston County, 3.27 Miles

<u>US 70 Bypass Both Directions</u>	Before	After	Percent Reduction (-)/ Percent Increase (+)
Total Crashes – Both Directions	26	39	50.0 %
Total Severity Index	7.90	1.97	- 75.1 %
Lane Departure Crashes – Both Directions	22	30	36.4 %
Lane Departure Severity Index	5.37	2.23	- 58.5 %
Lane Departure Wet / Winter Crashes	10	20	100.0 %
Lane Departure Wet / Winter Severity	6.18	1.37	- 77.8 %
Volume (2006, 2009)	15,000	14,000	- 6.7 %

<u>US 70 Bypass Both Directions</u>	Before	After	Percent Reduction (-)/ Percent Increase (+)
Injuries			
Fatal Injury Crashes	1	0	- 100.0 %
Class-A Injury Crashes	0	0	N/A
Class-B Injury Crashes	6	2	- 66.7 %
Class-C Injury Crashes	8	3	- 62.5 %
Property Damage Only Crashes	11	33	200.0 %
Contributing Factors			
Night Crashes	7	10	42.9 %
Wet Road Crashes (Rain & Water Only)	9	8	- 11.1 %
Winter Road Crashes (Ice / Snow)	1	12	500+ %
Alcohol Related	1	0	- 100.0 %

Lane Departure Crash Types	Before	After	Percent Change
Angle	2	0	- 100.0 %
Fixed Object	15	25	66.7 %
Overturn / Rollover	1	0	- 100.0 %
Parked Motor Vehicle	1	0	- 100.0 %
Sideswipe, Same Direction	3	5	66.7 %

The following two tables divide the crash data for US-70 Bypass by direction of travel:

<u>US 70 Bypass Eastbound</u>	Before	After	Percent Reduction (-)/ Percent Increase (+)
Total Crashes	16	16	0.0 %
Total Severity Index	9.90	1.46	- 85.3 %
Lane Departure Crashes	14	12	- 14.3 %
LD Wet Crashes (Rain & Water Only)	6	4	- 33.3 %
LD Ice / Snow Crashes	1	5	300.0 %

<u>US 70 Bypass Westbound</u>	Before	After	Percent Reduction (-)/ Percent Increase (+)
Total Crashes	10	22	120.0 %
Total Severity Index	4.70	2.35	- 50.0 %
Lane Departure Crashes	8	18	125.0 %
LD Wet Crashes (Rain & Water Only)	3	4	33.3 %
LD Ice / Snow Crashes	0	7	300+ %

The naive before and after analysis for the US-70 Bypass segment through Johnston County resulted in an overall 50 percent increase in Total Crashes but a 75 percent decrease in the Total Severity Index. There was also a 36 percent increase in Target Lane Departure Crashes with an 58.5 percent decrease in the Target Severity Index.

Weather Data

From the charts above, the data highlights a significant increase in snow/ice crashes along the corridor segment. The Safety Evaluation Group researched data compiled by the State Climate Office of NC to discover the number of “Winter Weather Events” that occurred in each time period. The results indicated the before period experienced five (5) events of snow/ice/freezing rain/sleet while thirteen (13) individual events occurred during the after period.

Results and Discussion

From the tables above and the *collision diagrams*, the overall crashes along this roadway segment increased by 50 percent with a steady increase in the lane departure collisions. The increase in crashes occurred in the westbound direction where lane departure crashes increased from eight (8) to eighteen (18). In the westbound direction, ice/snow crashes rose from zero (0) in the before period to seven (7) in the after period. Over the whole segment, winter weather crashes doubled during the analysis period from ten (10) to twenty (20) collisions.

Even with the increase in crashes along this strip, the project produced a positive benefit-cost ratio. This is concluded from the reduction of injury crashes from fifteen (15) to five (5) through the analysis even with property damage collisions increasing by 200 percent.

The calculated benefit to cost ratio for SS# 04-04-211 is **2.49 considering Total Crashes**. The benefit to cost ratio **considering only Target Lane Departure Crashes is 2.66**. 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 when applicable.

As the Safety Evaluation Group completes additional 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 treatment.

BENEFIT-COST ANALYSIS WORKSHEET - Target Crashes

LOCATION: US-70 Bypass around Selma		BY: JBS						
COUNTY: Johnston		DATE: 8/8/2011						
FILE NO.: SS 04-04-211		Target - Lane Departure						
DETAILED COST:	TYPE IMPROVEMENT - Median and Outside Rumblestrips							
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$72,500	10	0.149	\$10,805			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$72,500	10	0.149	\$10,805			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$0			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$0			
	TOTAL ANNUAL COST=				\$10,805			
	TOTAL COST OF PROJECT=				\$72,500			
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	3.17	0	0.00	14	4.42	11	3.47	\$103,249
AFTER	3.17	0	0.00	5	1.58	33	10.41	\$76,309
						Annual Benefits from Crash Cost Savings		\$26,940
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$16,135		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	2.49		
TOTAL COST OF PROJECT		-	\$72,500	COMPREHENSIVE B/C RATIO		-	2.49	

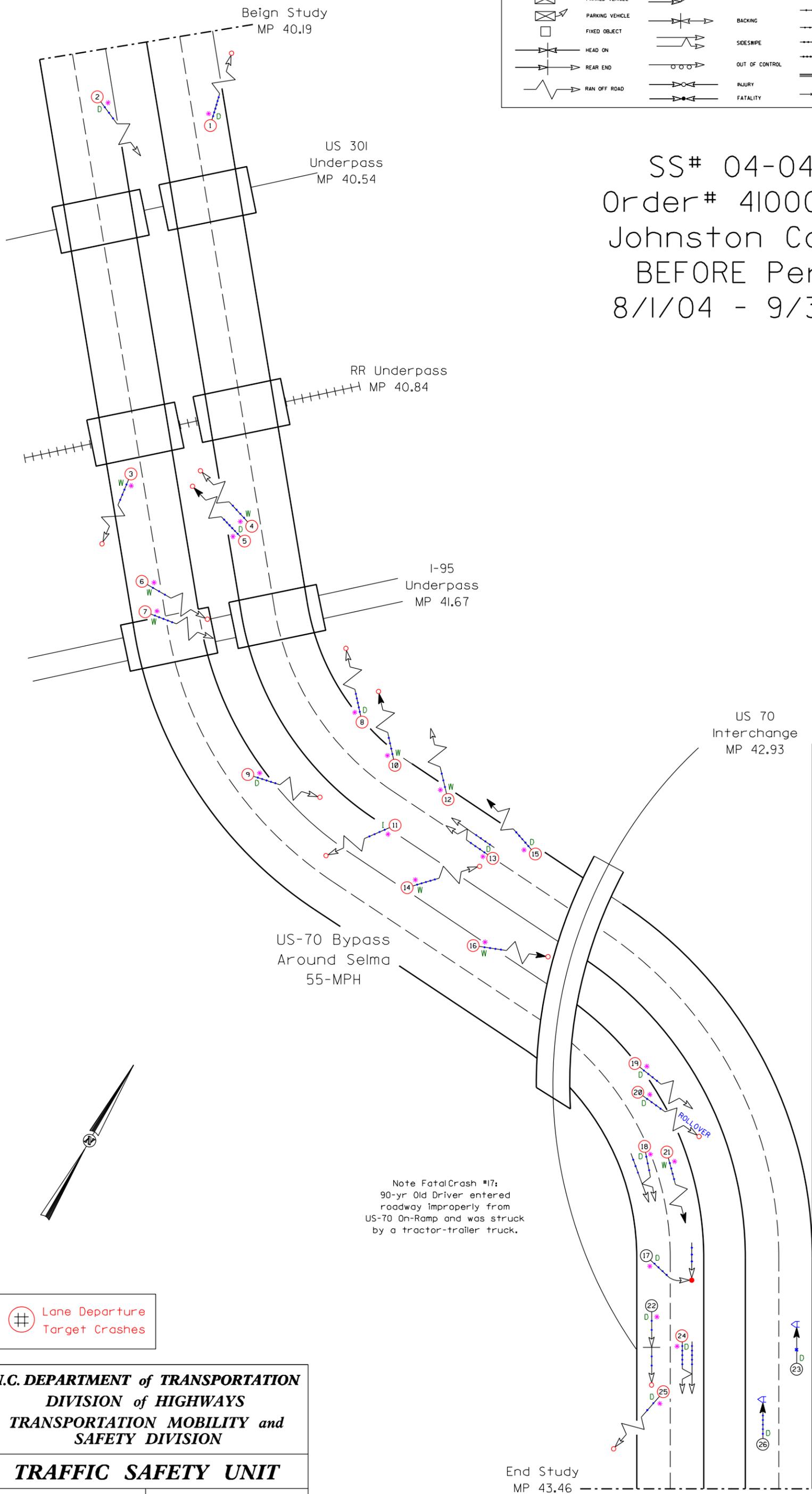
BENEFIT-COST ANALYSIS WORKSHEET - Total Crashes

LOCATION: US-70 Bypass around Selma		BY: JBS						
COUNTY: Johnston		DATE: 8/8/2011						
FILE NO.: SS 04-04-211								
DETAILED COST:	TYPE IMPROVEMENT - Median and Outside Rumblestrips							
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$72,500	10	0.149	\$10,805			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$72,500	10	0.149	\$10,805			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$0			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$0			
	TOTAL ANNUAL COST=				\$10,805			
	TOTAL COST OF PROJECT=				\$72,500			
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	3.17	0	0.00	13	4.10	9	2.84	\$94,227
AFTER	3.17	0	0.00	5	1.58	25	7.89	\$65,457
						Annual Benefits from Crash Cost Savings		\$28,770
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$17,965		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	2.66		
TOTAL COST OF PROJECT		-	\$72,500	COMPREHENSIVE B/C RATIO		-	2.66	

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		SPEED UNKNOWN
	RAN OFF ROAD				70 AND UP		OILY

SS# 04-04-211
 Order# 41000011932
 Johnston County
 BEFORE Period
 8/1/04 - 9/30/07



Note Fatal Crash #17:
 90-yr Old Driver entered roadway improperly from US-70 On-Ramp and was struck by a tractor-trailer truck.



Lane Departure Target Crashes

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

TRAFFIC SAFETY UNIT

Date: 8-4-2011

Prepared By: J. Schronce

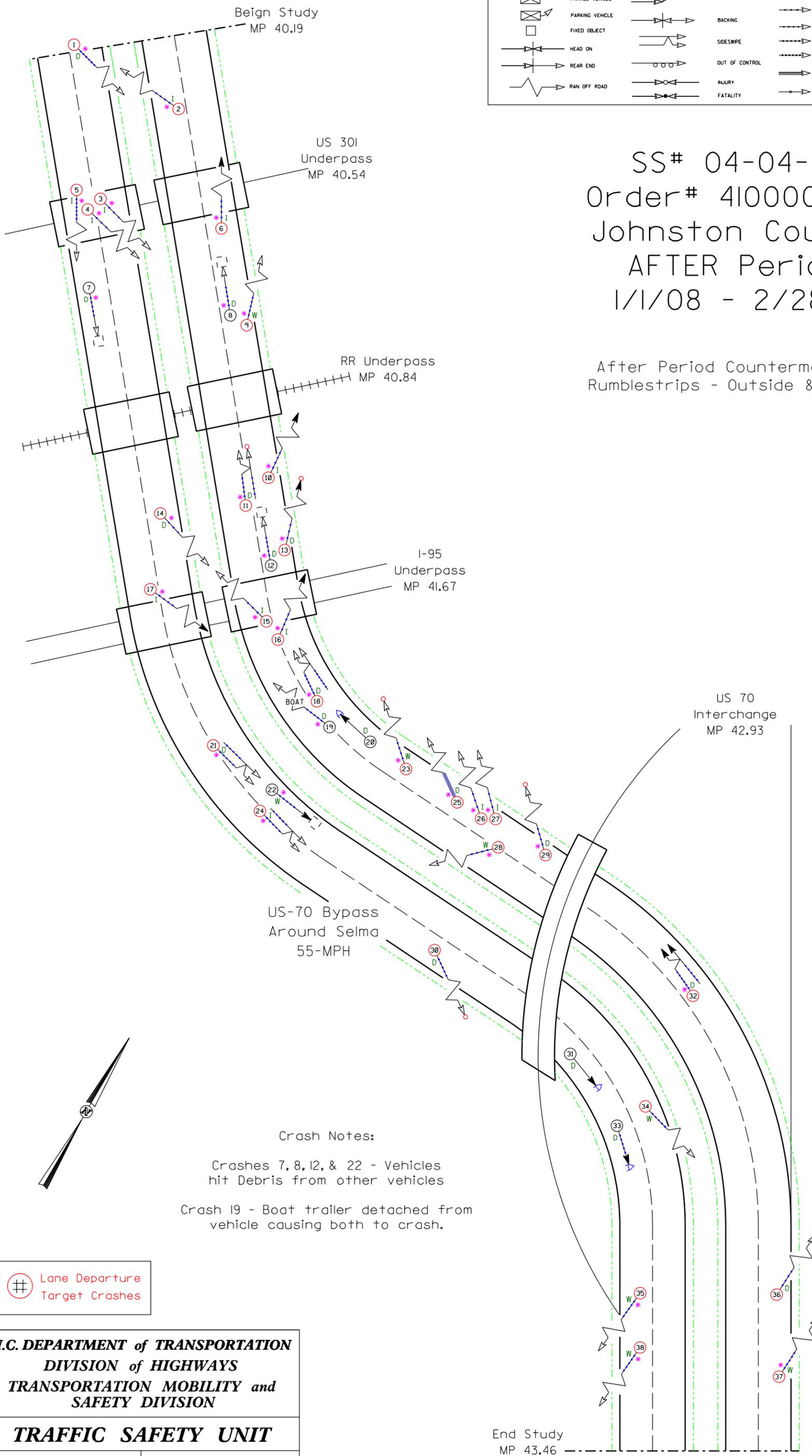
End Study
 MP 43.46

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		SPEED UNKNOWN
	RAN OFF ROAD				70 AND UP		OILY

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 AFTER Period
 1/1/08 - 2/28/11

After Period Countermeasure:
 Rumblestrips - Outside & Median



Crash Notes:

Crashes 7, 8, 12, & 22 - Vehicles hit Debris from other vehicles

Crash 19 - Boat trailer detached from vehicle causing both to crash.

Lane Departure Target Crashes

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Date: 8-4-2011

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