Spot Safety Project Evaluation

Order # 41000000446
Project Log # 200906128

Spot Safety Project # 04-01-206

Spot Safety Project Evaluation of the Center Turn Lane Installation
US 701 from I-95 to 0.3 mile South (MP 12.44 - 12.78)
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

_____ 9-22-2009
Jason B. Schronce Date

Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 04-01-206 located along the segment of US 701 from the I-95 Northbound Ramp Terminal (Exit 90) / NC 96 / SR 1009 (Devils Racetrack Road) to the Holiday Travel Park entrance located approximately 0.3 mile south. This strip is near the Town of Four Oaks.

Project Information and Background from the Project File Folder

The spot safety project improvement countermeasure chosen for the subject segment was the installation of a US 701 center two-way left turn lane. US 701 is a two-lane, two-way facility in this location with multiple business, including two gas stations and a towing company, surrounding the I-95 Northbound Ramps / NC 96 / SR 1009 intersection. The Holiday Travel Park, an overnight RV facility, is located approximately 0.3 mile south of the ramp intersection. US 701 has a posted speed limit of 40 mph.

The original statement of problem was the existing severe injury crash pattern. The goal with the center turn lane installation was to remove turning vehicles from the through lane of the congested two-lane roadway. By providing storage for the turning motorists, they would not fill rushed to take an insufficient gap. This was mainly an accident problem.

The initial crash analysis was completed from July 31, 1997 to June 31, 2000 with sixteen (16) reported crashes, nine (9) of which were deemed correctable including two fatality rear-end collisions. The center turn lane improvement was requested following the investigation of the second fatal collision. The final completion date for the improvement at the subject intersection was on July 2, 2003 with a total cost of $65,000.

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 May through July 2003. The before period consisted of reported crashes from July 1, 1997 through April 30, 2003 (5 years and 10 months); and the after period consisted of reported crashes from August 1, 2003 through May 31, 2009 (5 years and 10 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 along the segment, US 701 milepost 12.44 to 12.78, with a zero (0) foot y-line. *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 crashes related to the Center Turn Lane were those selected as Target Crashes. The particular crash types chosen included: Rear-End, Slow or Stop; Rear-End, Turn; and Left Turn, Same Roadway collisions.

Treatment Information	**Before**	**After**	**Percent Reduction (-) Percent Increase (+)**
Total crashes	36	17	- 52.8 %
Total Severity Index	12.30	7.64	- 37.9 %
Target Crashes	17	1	- 94.1 %
Target Crash Severity Index	12.96	8.40	- 35.2 %
Volume	5,700	5,700	0.0 %

Injury Crash Summary	Before	After	Percent Reduction (-) Percent Increase (+)
Fatal injury Crashes	3	1	- 66.7 %
Class A injury Crashes	1	0	- 100.0 %
Class B injury Crashes	3	1	- 66.7 %
Class C Injury Crashes	11	4	- 63.6 %
Total Injury Crashes	18	6	- 66.7 %

The naive before and after analysis at the treatment location resulted in a 53 percent decrease in Total Crashes, a 94 percent decrease in Target Crashes, and a 39 percent decrease 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 53 percent decrease in Total Crashes and a 94 percent decrease in Target Crashes. The summary results above demonstrate that both Total and Target Crashes appear to have decreased at the treatment location from the before to the after period.

Referencing the *Collision Diagrams,* the before period showed a high concentration of collisions near the ramp terminal intersection including nine (9) rear-end collisions resulting in two fatalities. Left turn – same roadway crashes were also prominent in this area due to motorist accessing the multiple gas stations. After the center turn lane installation, only one (1) left turn crash occurred while attempting to access a gas station.

Angle and Left Turn–Different Roadway collisions at the NC 96 intersection with US 701 did decrease slightly through the analysis as well, from ten (10) in the before period to seven (7) in the after period. However, an after period collision at this location did result in a fatality. Signing improvements were made following this fatality collision but they were unrelated to the countermeasure under evaluation. Overall, the countermeasure successfully reduced total and specifically target crashes as indicated by the benefit-cost ratio below.

The calculated benefit to cost ratio for this project is **36.31 considering total crashes**. The benefit to cost ratio **considering only target crashes is 24.49**. 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.

Please see the attached *Treatment Site Photos*. Photos are provided by Google Streetview for multiple locations along the segment. 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 US 701 at Holiday Travel Park – Approx MP 12.78

Looking North on US 701 – notice multiple residential driveways

Looking North on US 701 approaching section of businesses

Looking North on US 701 at I-95 NB Ramp Terminal / NC 96 Intersection

BENEFIT-COST ANALYSIS WORKSHEET - Total Crashes

LOCATION: US 701 (MP 12.44-12.78) BY: JBS
COUNTY: Johnston DATE: 9/15/2009
FILE NO.: SS 04-01-206 NOTES: Total Crashes

DETAILED COST: TYPE IMPROVEMENT - Center Turn Lane - 3-Lane Segment

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	$65,000	20	0.102	$6,620
	$0	0	0.000	$0
Right-of-Way	$0	0	0.000	$0
TOTALS	$65,000	20	0.102	$6,620

ESTIMATED INCREASE IN ANNUAL MAINT. COST = $1,360
ESTIMATED INCREASE IN ANNUAL UTILITY COST = $0

TOTAL ANNUAL COST= $7,980
TOTAL COST OF PROJECT= $65,000

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	5.83	4	0.69	14	2.40	18	3.09	$398,319
AFTER	5.83	1	0.17	5	0.86	11	1.89	$108,559

Annual Benefits from Crash Cost Savings $289,760

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = $281,779

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 36.31

TOTAL COST OF PROJECT - $65,000 COMPREHENSIVE B/C RATIO - 36.31

BENEFIT-COST ANALYSIS WORKSHEET - Target Crashes

LOCATION: US 701 (MP 12.44-12.78) BY: JBS
COUNTY: Johnston DATE: 9/15/2009
FILE NO.: SS 04-01-206 NOTES: Target Crashes - Rear-End / Left Turn; Same Road

DETAILED COST: TYPE IMPROVEMENT - Center Turn Lane - 3-Ln Segment

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	$65,000	20	0.102	$6,620
	$0	0	0.000	$0
Right-of-Way	$0	0	0.000	$0
TOTALS	$65,000	20	0.102	$6,620

ESTIMATED INCREASE IN ANNUAL MAINT. COST = $1,360
ESTIMATED INCREASE IN ANNUAL UTILITY COST = $0

TOTAL ANNUAL COST= $7,980
TOTAL COST OF PROJECT= $65,000

COMPREHENSIVE COST REDUCTION:

ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES

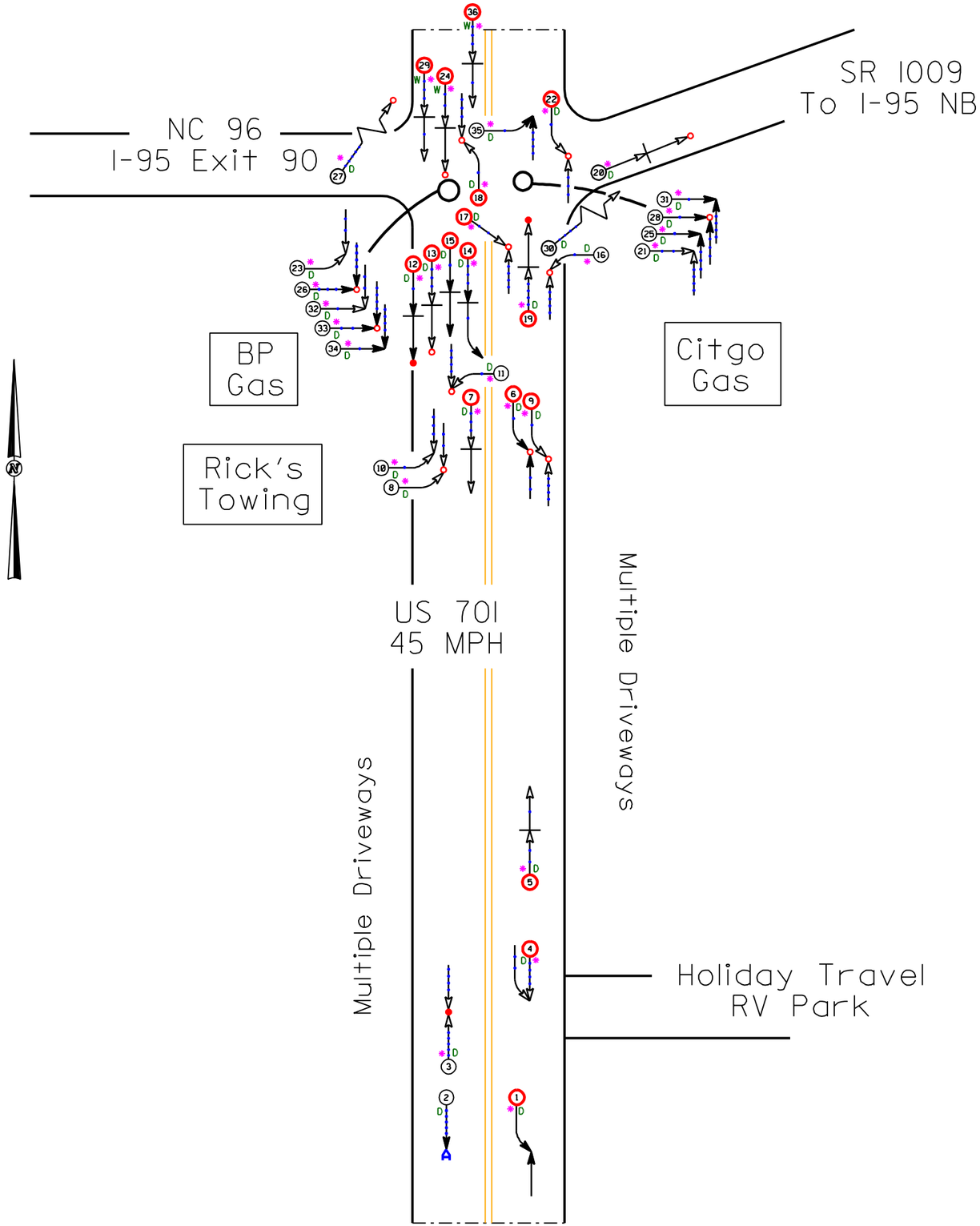
TIME PERIOD	YEARS	K & A CRASHES	K & A CRASHES PER YR	B & C CRASHES	B & C CRASHES PER YR	PDO CRASHES	PDO CRASHES PER YR	ANNUAL COSTS
BEFORE	5.83	2	0.34	7	1.20	8	1.37	$198,491
AFTER	5.83	0	0.00	1	0.17	0	0.00	$3,087

Annual Benefits from Crash Cost Savings $195,403

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = $187,423

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 24.49

TOTAL COST OF PROJECT - $65,000 COMPREHENSIVE B/C RATIO - 24.49



LEGEND

MOVING VEHICLE
PEDESTRIAN
PARKED VEHICLE
PARKING VEHICLE
FIXED OBJECT
HEAD ON
REAR END
RAN OFF ROAD

ANGLE
TURNING
BACKING
SIDESWIPE
OUT OF CONTROL
INJURY
FATALITY

9 MPH OR LESS
10 MPH TO 19
20 MPH TO 29
30 MPH TO 39
40 MPH TO 49
50 MPH TO 59
60 MPH TO 69
70 AND UP
SPEED UNKNOWN

P PEDESTRIAN
T TRAIN
* DRIVER AT FAULT
D DRY
W WET
I ICY OR SNOWY
O OILY

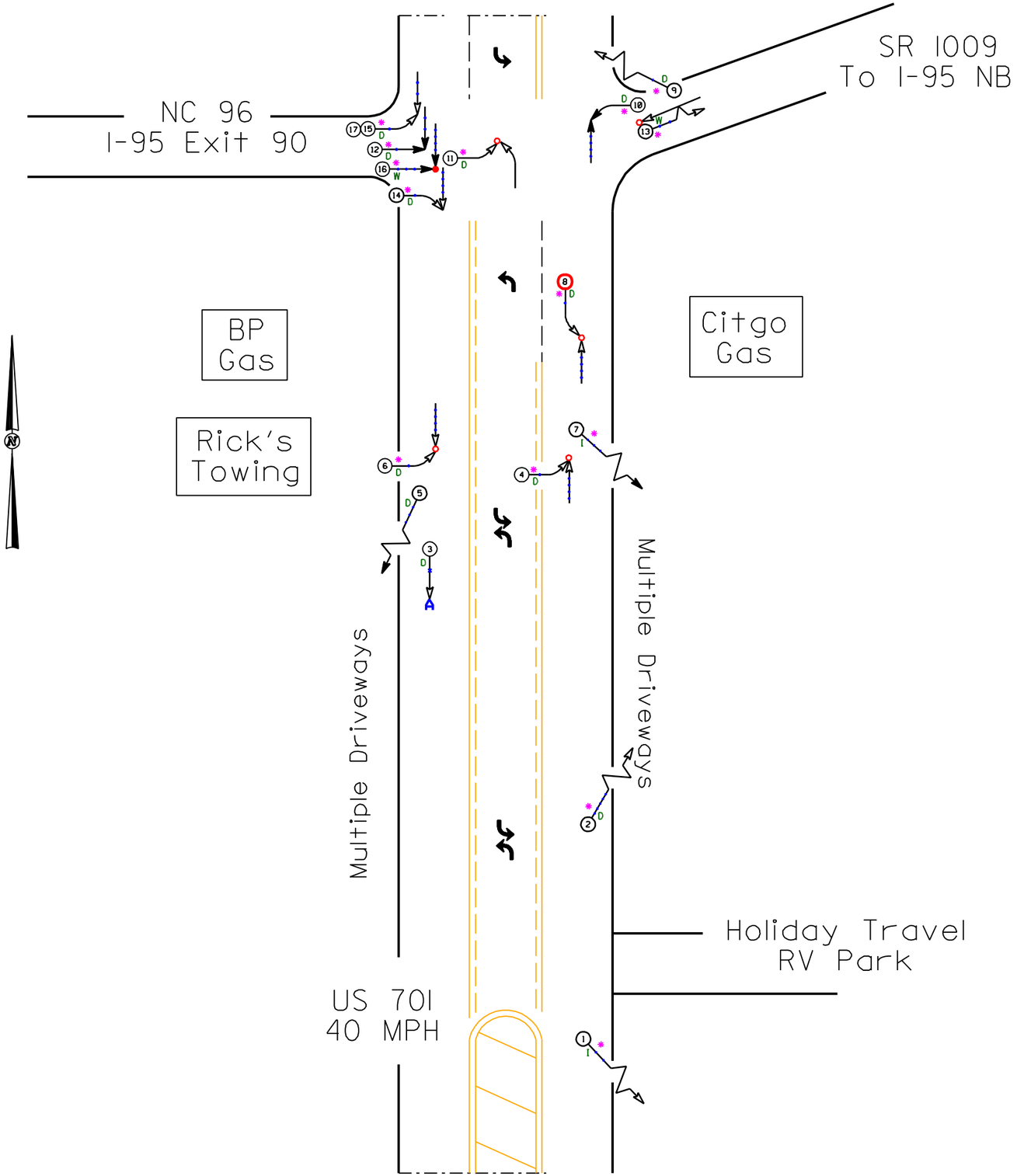
SS# 04-01-206
Johnston County
BEFORE Period
7/1/97 - 4/30/03
US 701
MP 12.44 - 12.78

Target Crashes

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

COLLISION DIAGRAM	
DIVISION: 4	AREA:
STUDY PERIOD: 7/1/1997 - 4/30/2003	
DISTANCE: Y-LINE : OFT	
ANALYSIS PREPARED BY: JBS	
ANALYSIS CHECKED BY: ST	
DIAGRAM PREPARED BY: JBS	
DIAGRAM REVIEWED BY: BR	
SCALE: NOT TO SCALE	
DATE: 9-15-2009	
LOG NUMBER: SS# 04-01-206 BEFORE	

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



LEGEND

MOVING VEHICLE
PEDESTRIAN
PARKED VEHICLE
PARKING VEHICLE
FIXED OBJECT
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SPEED UNKNOWN

P PEDESTRIAN
T TRAIN
* DRIVER AT FAULT
D DRY
W WET
I ICY OR SNOWY
O OILY

SS# 04-01-206
Johnston County
AFTER Period
8/1/03 - 5/31/09
US 701
MP 12.44 - 12.78

Target Crashes

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

COLLISION DIAGRAM	
DIVISION: 4	AREA:
STUDY PERIOD: 8/1/2003 - 5/31/2009	
DISTANCE: Y-LINE : 0FT	
ANALYSIS PREPARED BY: JBS	
ANALYSIS CHECKED BY: BR	
DIAGRAM PREPARED BY: JBS	
DIAGRAM REVIEWED BY: ST	
SCALE: NOT TO SCALE	
DATE: 9-15-2009	
LOG NUMBER: SS# 04-01-206 AFTER	

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