

Spot Safety Project Evaluation

Project Log # 200704311

Spot Safety Project # 02-98-261

**Spot Safety Project Evaluation of the Roadway Geometry Changes and
Signal Additions at the Intersection of US 70 (Arendell St) and 24th Street
Morehead City, Carteret 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

Jason B. Schronce

11-8-2007
Date

Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 02-98-261 – The Intersection of US-70 (Arendell Street) and 24th Street in Morehead City, Carteret County.

Project Information and Background from the Project File Folder

The spot safety project improvement countermeasure chosen for the subject location was the revision of the existing intersection geometry and traffic signal to allow for one-way outbound traffic from 24th Street. These improvements will allow left and right turns as well as through movements from 24th Street onto US 70 (Arendell Street). This will also add a new signal for US 70 west at the intersection.

In the before period, US 70 (Arendell Street) is a four lane divided highway with a through-right lane, an exclusive through lane, and two left turn lanes westbound; and two through lanes and a right turn lane eastbound on the approaches to the intersection with 24th Street. The intersection has a speed limit of 35 mph on all approaches and a single at-grade railroad track running through the median. 24th Street was a two-lane, two-way roadway that allowed only right turns onto US 70 in the before period. Across from 24th Street is the one-way ramp to the Atlantic Beach Causeway Bridge.

The original statement of concern is the increasing volume added by the extension of the SR 1176 (Bridges Street) parallel to US 70. The anticipation is that the accident situation will deteriorate from one of many minor crashes to one with major injuries.

The initial crash analysis was completed from August 1, 1995 to July 31, 1998 with sixteen (16) reported crashes, resulting in three (3) “B” class and seven (7) “C” class injuries. The final completion date for the improvement at the subject intersection was on February 1, 2002 with a total cost of \$80,000.00.

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 was from November 1, 2001 to April 30, 2002. The before period consisted of reported crashes from December 1, 1996 through October 31, 2001 (4 years and 11 months) and the after period consisted of reported crashes from May 1, 2002 through March 31, 2007 (4 years and 11 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 within 150 feet of the subject intersection. *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 no particular crash type was analyzed as Target Crashes for this project. However, in Table 2, defining crash patterns at the intersection are compared in the Before and After Analysis including US 70 U-turn Crashes and US 70 Westbound Angle, Rear-ends, and Red Light Running collisions.

Treatment Information			
	Before	After	Percent Reduction (-) Percent Increase (+)
Total crashes	18	52	188.89 %
Total Severity Index	4.29	4.42	3.03 %
Volume (No ADT for Ramp)			
	25,400	27,700	9.06 %
Injury Crash Summary			
Fatal injury Crashes	0	0	N/A
Class A injury Crashes	0	0	N/A
Class B injury Crashes	3	5	66.67 %
Class C Injury Crashes	5	19	280.00 %
Total Injury Crashes	8	24	200.00 %

Target Crash Comparison			
	Before	After	Percent Reduction (-) Percent Increase (+)
US-70 U-turn Crashes	5	0	- 100.00 %
US-70 West Rear-End Crashes	2	8	300.00 %
US-70 West Angle	0	26	100.00+ %
US-70 West Red Light Running	0	25	100.00+ %

The naive before and after analysis at the treatment location resulted in a 189 percent increase in Total Crashes, a 200 percent increase in Total Injury Crashes, and a 3 percent increase in the Total Severity Index. The before period ADT year was 1999 and the after period ADT year was 2004.

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 189 percent increase in Total Crashes and a 3 percent increase in the Total Severity Index. The summary results above demonstrate that both Total Crashes and Crash Severity appear to have increased at the treatment location from the before to the after period.

Referencing the *Collision Diagrams*, five (5) before period collisions occurred by eastbound vehicles traveling the wrong direction into the US 70 westbound turn lanes in order to make a U-turn and access 24th Street traveling northbound. By making 24th Street a one-way roadway in the after period, this crash pattern was totally eliminated.

However, the geometry changes at the intersection created an additional traffic signal for westbound traffic on US 70. This has led to twenty-five (25) red light running crashes by westbound US 70 vehicles colliding into southbound 24th Street traffic. Angle collisions for US 70 Eastbound traffic has remained consistent at four (4) crashes through the analysis.

There was also a slight increase in Rear-End Crashes at the intersection in the US 70 Westbound direction (from 2 to 8). The turn lanes leading to the Atlantic Beach Causeway Bridge represented an increase in rear-end collisions from two (2) to four (4) and four (4) rear-end crashes approaching the new signal on the US 70 Westbound through lanes.

The calculated benefit to cost ratio for this project is -5.51 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.

Please see the attached *Treatment Site Photos*. Photos are provided for all approaches to the treatment intersection. Notice 24th Street as a one-way street approaching the intersection and the signal addition to US 70 Westbound traffic.

This countermeasure design is specific to this intersection and the Safety Evaluation Group does not anticipate having enough data to accurately calculate actual crash reduction factors in the future.

TREATMENT SITE PHOTOS TAKEN 10/3/2007



Traveling East on US-70 (Arendell Street)



Traveling West on US-70 Left Turn Lanes onto Atlantic Beach Bridge



Traveling West on US-70 Through Lanes



Traveling West on US-70
Notice area between stop bar and 24th Street



Traveling South on 24th Street
Geometry changes include making 24th St. a one-way roadway



Traveling South on 24th Street over new median crossover

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: US-70 at 24th Street
 COUNTY: Carteret
 FILE NO.: SS 02-98-261

BY: JBS
 DATE: 10/4/2007
 NOTES: Total Crashes

DETAILED COST: TYPE IMPROVEMENT - Intersection Geomerty Changes, New Signal

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$80,000	10	0.149	\$11,922
Right-of-Way	\$0	0	0.000	\$0
TOTALS	\$80,000	10	0.149	\$11,922

ESTIMATED INCREASE IN ANNUAL MAINT. COST = \$400 Increase from 3 to 5 phase signal
 ESTIMATED INCREASE IN ANNUAL UTILITY COST = \$900 New Signal

TOTAL ANNUAL COST= \$13,222
 TOTAL COST OF PROJECT= \$80,000

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	4.92	0	0.00	8	1.63	10	2.03	\$37,195
AFTER	4.92	0	0.00	24	4.88	28	5.69	\$110,000

Annual Benefits from Crash Cost Savings (\$72,805)

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = (\$86,027)

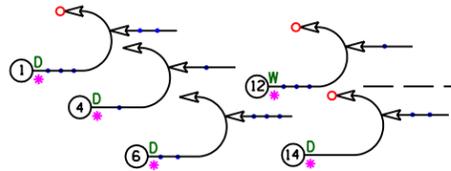
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = -5.51

TOTAL COST OF PROJECT - \$80,000 COMPREHENSIVE B/C RATIO - -5.51

Exxon Station

24th Street
35 MPH

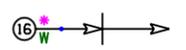
Shell Station



US 70 West
Arendell St.
35 MPH

Railroad Tracks (at grade)

US 70 East
Arendell St.
35 MPH



On Ramp to Atlantic
Beach Bridge
45 MPH

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# 02-98-261
Carteret County
Morehead City
Before Period
12/1/96 - 10/31/01
US 70 at 24th



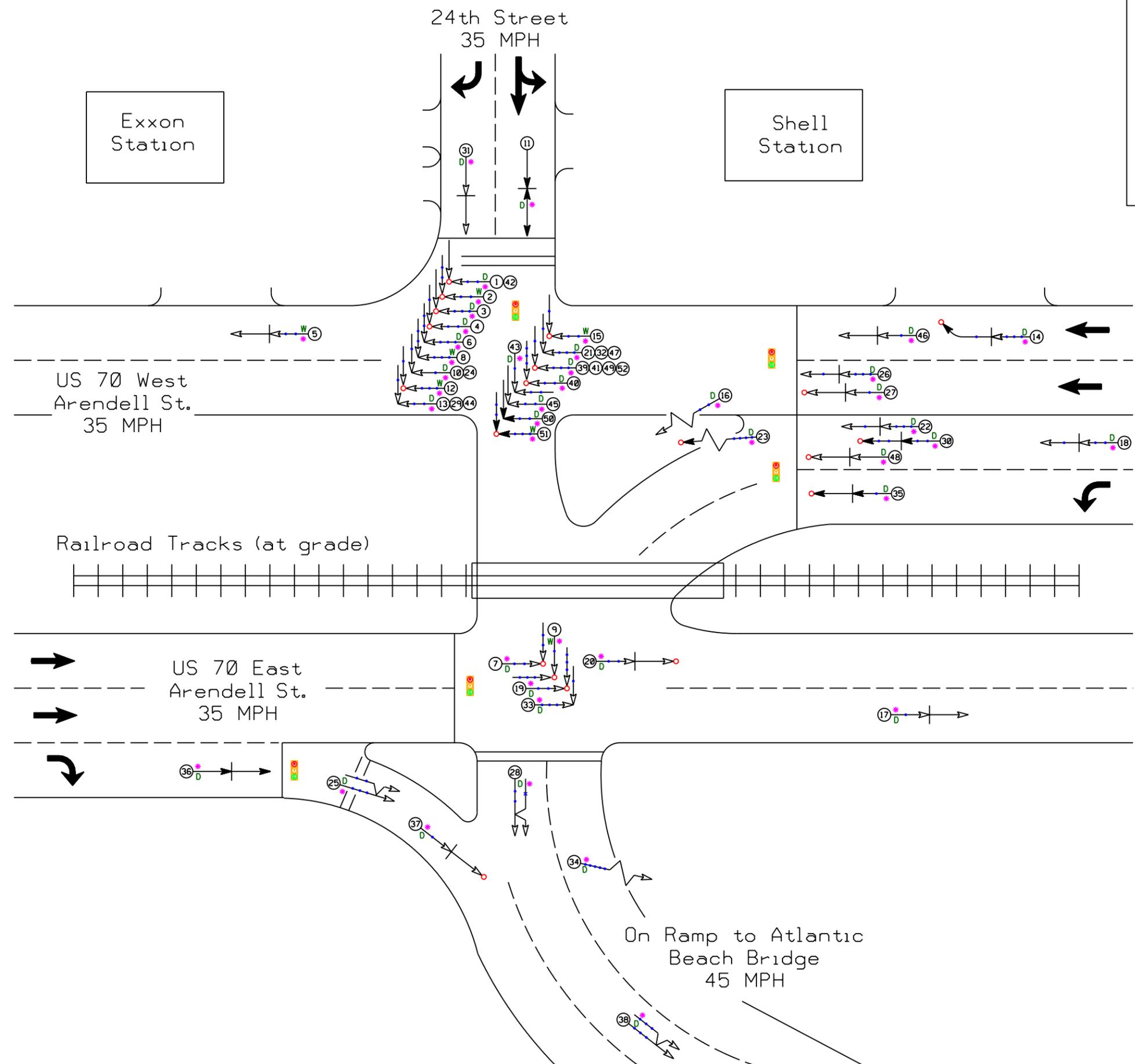
TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

	COLLISION DIAGRAM	
	DIVISION: 2	AREA: 4
STUDY PERIOD: 12/1/1996 TO 10/31/2001		
DISTANCE: Y-LINE = 150FT		
ANALYSIS PREPARED BY: JBS		
ANALYSIS CHECKED BY: BR		
DIAGRAM PREPARED BY: JBS		
DIAGRAM REVIEWED BY: ST		
SCALE: NOT TO SCALE		
DATE: 10/4/2007		
LOG NUMBER: SS* 02-98-261		

N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRAFFIC ENGINEERING AND SAFETY
SYSTEMS BRANCH

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# 02-98-261
Carteret County
Morehead City
After Period
5/1/02 - 3/31/07
US 70 at 24th



TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

	COLLISION DIAGRAM	
	DIVISION: 2	AREA: 1
	STUDY PERIOD: 5/1/2002 TO 3/31/2007	
	DISTANCE: Y-LINE = 150FT	
ANALYSIS PREPARED BY: JBS		
ANALYSIS CHECKED BY: BR		
DIAGRAM PREPARED BY: JBS		
DIAGRAM REVIEWED BY: ST		
SCALE: NOT TO SCALE		
DATE: 10-4-2007		
LOG NUMBER: SS* 02-98-261		

N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRAFFIC ENGINEERING AND SAFETY
SYSTEMS BRANCH