

Spot Safety Project Evaluation

Project Log # 200702027
Spot Safety Project # 06-02-214

Spot Safety Project Evaluation of the Left Turn Traffic Signal Phasing Addition for Eastbound US 401 Traffic at the Intersection of US 401 (Raeford Rd) and SR 1411 (Bunce Rd) Cumberland 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

5-7-2007
Date

Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 06-02-214 – The Intersection of US 401 (Raeford Road) and SR 1411 (Bunce Rd) in Cumberland County.

Project Information and Background from the Project File Folder

The spot safety project improvement countermeasure chosen for the subject location was the addition of a left turn protected / permissive phase for eastbound US 401 (Raeford Rd) vehicles to the existing traffic signal. US 401 (Raeford Rd) is a multi-lane, major thoroughfare for the city of Fayetteville with many businesses along its corridor. US 401 has 5 through lanes, left turn lanes and a right turn lane at the intersection with a speed limit of 45 mph. SR 1411 (Bunce Road) is a two-lane facility that widens at the “T” intersection to provide dual left turn lanes and a right turn lane, with a speed limit of 35 mph. Prior to the spot safety improvements, the subject location was controlled by a traffic signal with permissive left turns on US 401.

The initial statement of problem was that an accident problem exists for motorists attempting to turn left onto SR 1411 from US 401 due to the high volume of traffic and insufficient gaps.

The initial crash analysis for this location was completed from November 30, 1998 through November 30, 2001 with a total of 27 reported crashes; 13 of which are considered correctable by the current countermeasure. The thirteen correctable accidents involved left turning vehicles and resulted in 5 “B” and 10 “C” type injuries.

Also, note that Spot Safety Project 06-93-010 was completed at this intersection during the before period for this study on November 2, 1998. After review, it was concluded that the modifications that it provided did not directly affect any crashes used as before period data for this analysis.

Upon the field investigation, construction was observed that will eventually lead to the realignment and extension of SR 1411 to create a 4-leg intersection with US 401 (Raeford Road). This project is not being funded through spot safety and did not have any direct impact on our after period crashes. Please see the *Site Photos* and *After Period Collision Diagram* for more details.

The final completion date for the improvement at the subject intersection was on October 15, 2002 at a cost of \$30,000.

Naïve 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 September 1, 2002 through November 30, 2002. The before period consisted of reported crashes from September 1, 1998 through August 31, 2002 (4 Years) and the after period consisted of

reported crashes from December 1, 2002 through November 30, 2006 (4 Years). The ending date for this analysis was determined by the data available at the time of this analysis.

The treatment data consisted of all crashes within 150 feet of the subject intersection. Please see attached *Location Map* for further detail.

The following data table depicts the Naive Before and After Analysis for the intersection. Please note that Left Turn, Same Roadway crashes with vehicles turning left onto SR 1411 were the target crashes for the applied countermeasure.

Treatment Information			
	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	36	39	8.33
Total Severity Index	6.60	4.42	- 33.03
Target Crashes	14	8	- 42.86
Target Severity Index	5.23	5.63	7.65
Volume	38,700	45,800	18.35

Injury Summary	Before	After	Percent Change
Fatal Injuries	0	0	N/A
Class A Injuries	1	0	100.00
Class B Injuries	12	9	- 25.00
Class C Injuries	24	40	66.67
Total Injuries	37	49	32.43

The naive before and after analysis at the treatment location resulted in an 8 percent increase in Total Crashes, a 43 percent decrease in Target Crashes, and an 18 percent increase in Average Daily Traffic (ADT). The before period ADT year was 2000 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 8 percent increase in Total Crashes, 33 percent decrease in the Total Severity Index, and a 43 percent decrease in Left Turn, Same Roadway Crashes. The summary results above demonstrate that the treatment location appears to have had a decrease in the number of Target Crashes from the before to the after period.

Referencing the *Collision Diagrams* and the above tables, it is apparent that the addition of a left turn protected / permitted phase helped reduce Left Turn, Same Roadway crashes at the subject intersection. In the before period, there was a dominate pattern of crashes involving vehicles on the eastern leg of US 401 (Raeford Rd) turning left onto SR 1411. In the after period, this pattern has reduced 43 percent (from 14 to 8).

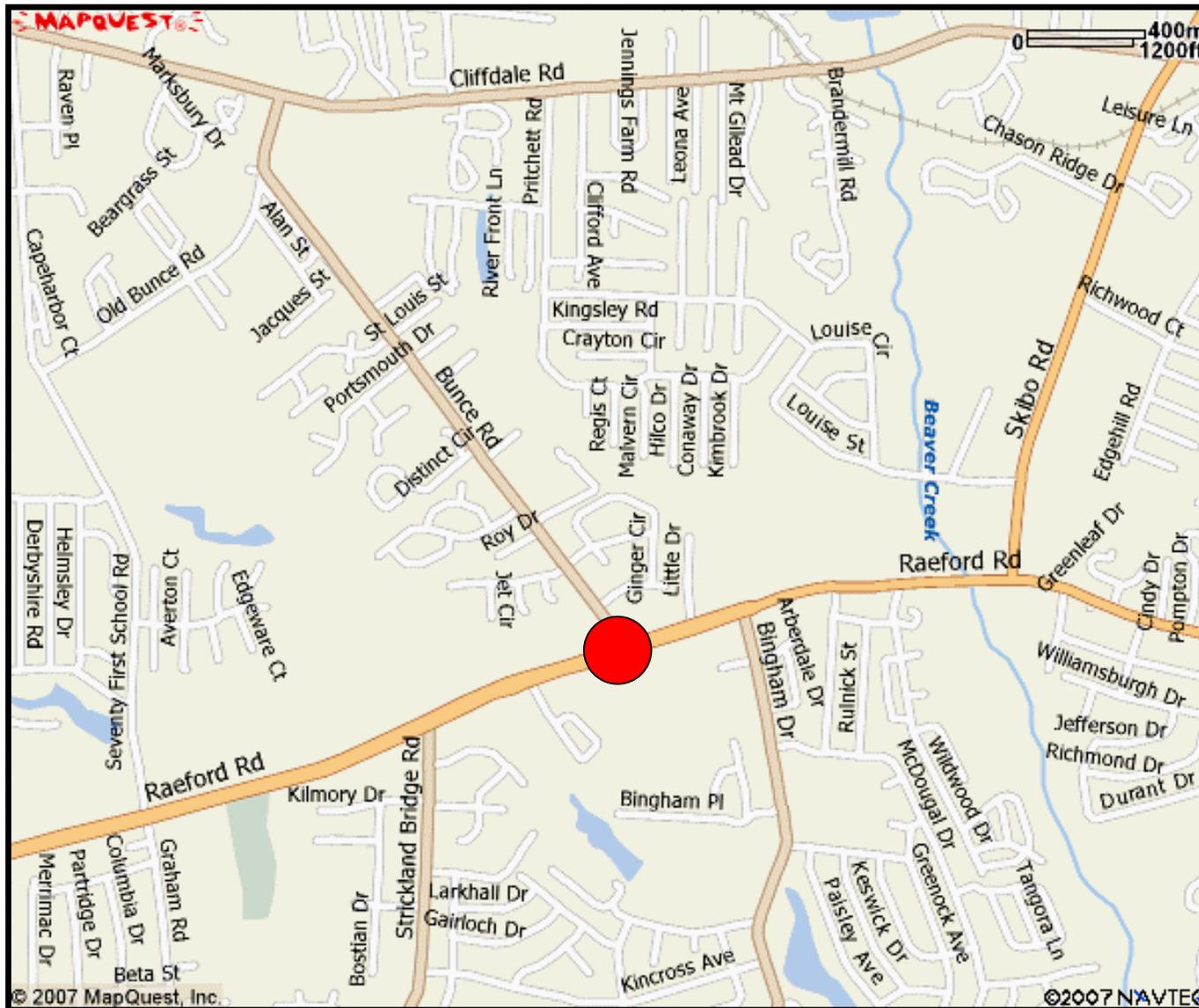
Referencing the *Collision Diagrams*, in the after period there was development of a rear-end crash pattern involving eastbound US 401 vehicles. This pattern increased from one to eight crashes.

The calculated benefit to cost ratio for this project is 24.39 considering total crashes. The benefit to cost ratio considering only target crashes is 3.41. 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.

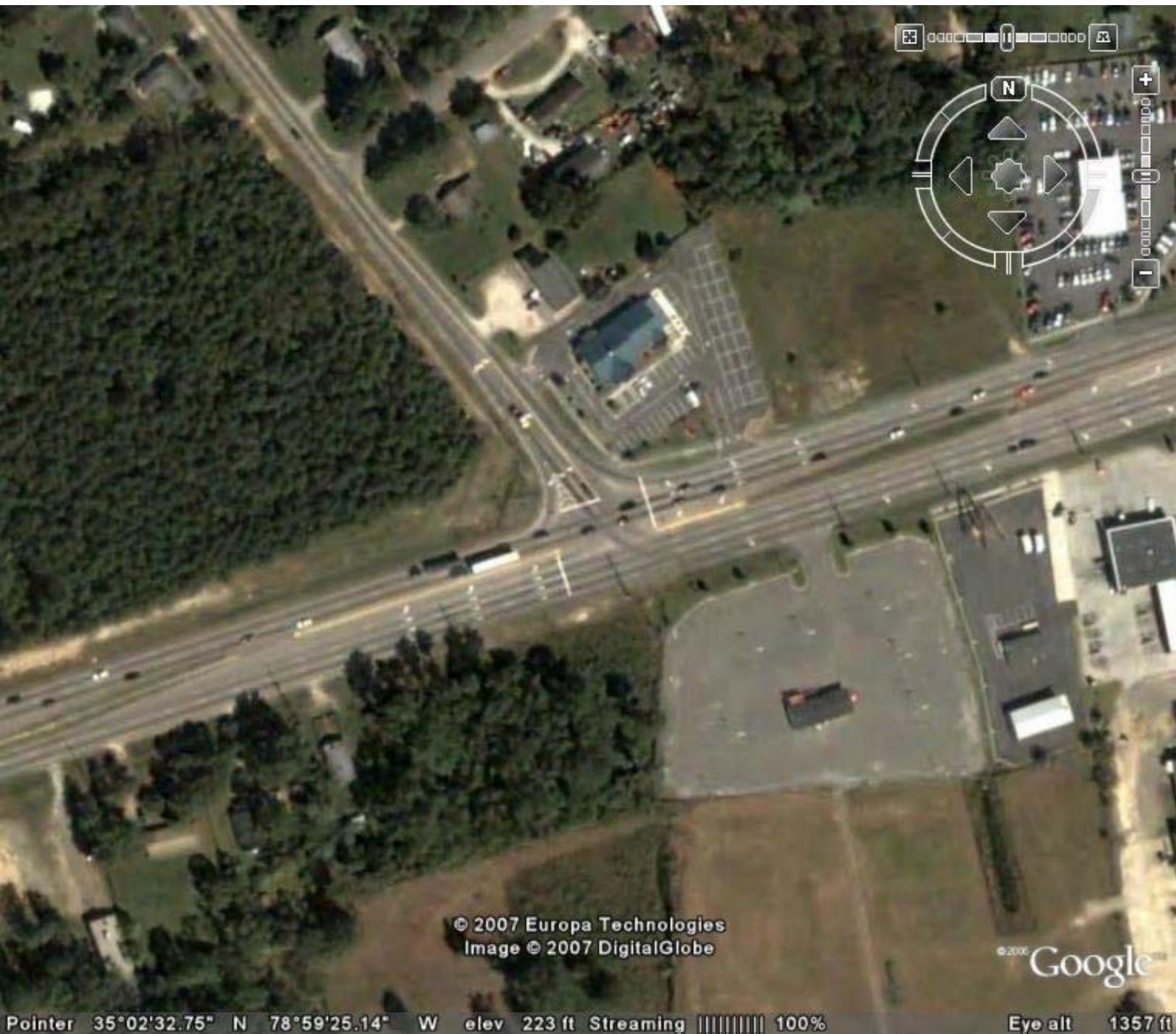
Please see the attached *Treatment Site Photos*. Photos are provided for the three approaches to the intersection and the future realignment and extension of SR 1411 (Bunce Rd).

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.

**Location Map
Cumberland County
Evaluation of Spot Safety Project # 06-02-214**



Treatment Location: US 401 (Raeford Road) at SR 1411 (Bunce Road) in Fayetteville



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Image © 2007 DigitalGlobe

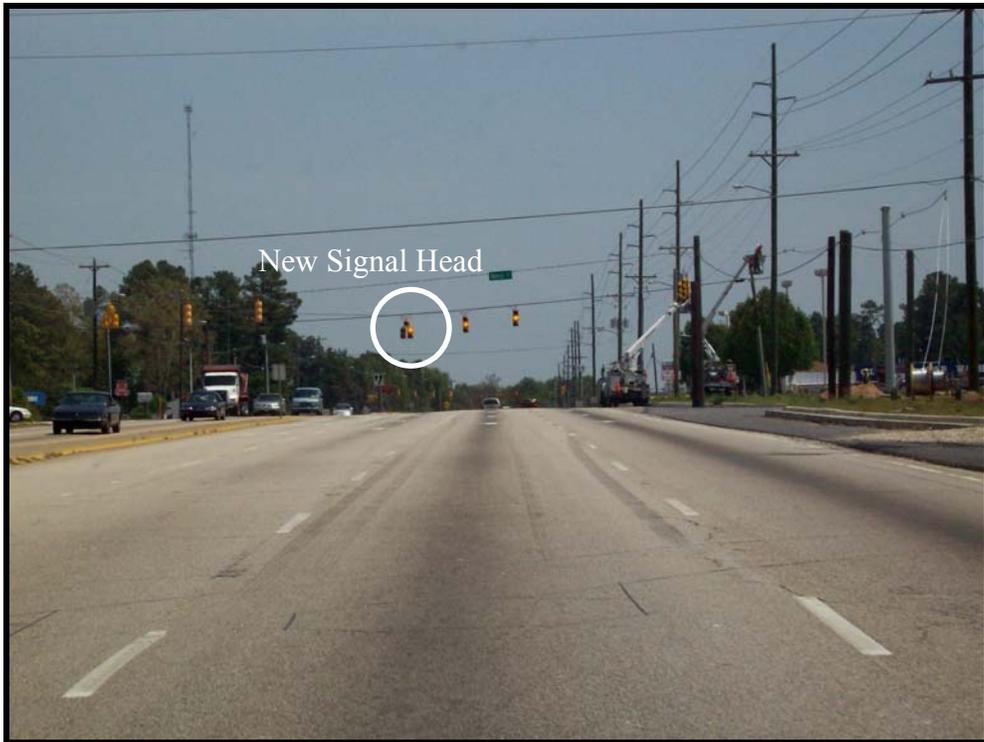
© 2006 Google

Pointer 35°02'32.75" N 78°59'25.14" W elev 223 ft Streaming ||||| 100% Eye alt 1357 ft

TREATMENT SITE PHOTO TAKEN 4/25/2007



Traveling West on US 401 (Raeford Rd)



Traveling East on US 401 (Raeford Rd)



Traveling South on SR 1411 (Bunce Road)



Future Realignment of SR 1411 (Bunce Rd)



Future SR 1411 (Bunce Road) Extension

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: US 401 (Raeford) at SR 1411
 COUNTY: Cumberland
 FILE NO.: SS 06-02-214

BY: JBS
 DATE: 5/3/2007
 NOTES: Total Crashes

DETAILED COST: TYPE IMPROVEMENT - EB Protected / Permitted Phasing

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$30,000	10	0.149	\$4,471
	\$0	0	0.000	\$0
Right-of-Way	\$0	0	0.000	\$0
TOTALS	\$30,000	10	0.149	\$4,471

ESTIMATED INCREASE IN ANNUAL MAINT. COST = \$200
 ESTIMATED INCREASE IN ANNUAL UTILITY COST = \$150
 TOTAL ANNUAL COST= \$4,821
 TOTAL COST OF PROJECT= \$30,000

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	17	4.25	18	4.50	\$219,050
AFTER	4.00	0	0.00	18	4.50	21	5.25	\$101,475

Annual Benefits from Crash Cost Savings \$117,575

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = \$112,754
 BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 24.39

TOTAL COST OF PROJECT - \$30,000 COMPREHENSIVE B/C RATIO - 24.39

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: US 401 (Raeford) at SR 1411
 COUNTY: Cumberland
 FILE NO.: SS 06-02-214

BY: JBS
 DATE: 5/3/2007
 NOTES: Target Crashes

DETAILED COST: TYPE IMPROVEMENT - EB US 401 Protected / Permitted Phasing

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$30,000	10	0.149	\$4,471
	\$0	0	0.000	\$0
Right-of-Way	\$0	0	0.000	\$0
TOTALS	\$30,000	10	0.149	\$4,471

ESTIMATED INCREASE IN ANNUAL MAINT. COST = \$200
 ESTIMATED INCREASE IN ANNUAL UTILITY COST = \$150
 TOTAL ANNUAL COST= \$4,821
 TOTAL COST OF PROJECT= \$30,000

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	0	0.00	8	2.00	6	1.50	\$41,850
AFTER	4.00	0	0.00	5	1.25	3	0.75	\$25,425

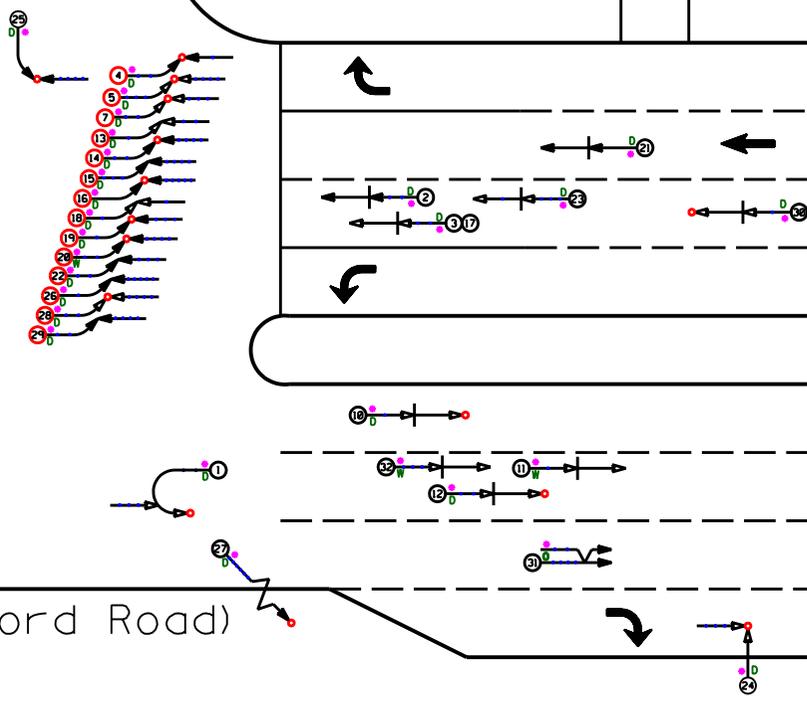
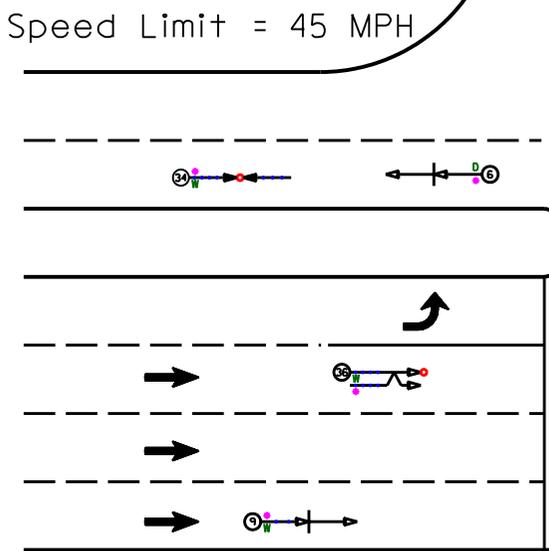
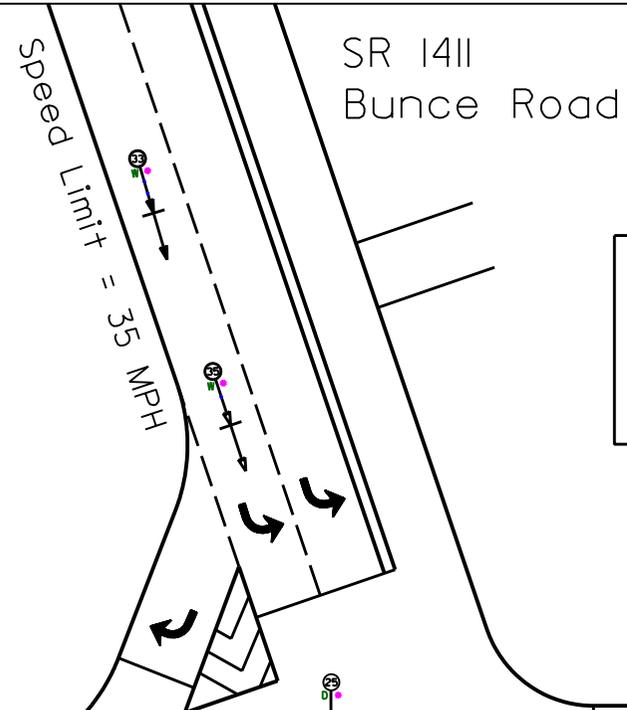
Annual Benefits from Crash Cost Savings \$16,425

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = \$11,604

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 3.41

TOTAL COST OF PROJECT - \$30,000 COMPREHENSIVE B/C RATIO - 3.41

Target Crashes



LEGEND

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

SS# 06-02-214
 BEFORE PERIOD
 9/1/98 - 8/31/02
 CUMBERLAND COUNTY
 US 401 at SR 1411

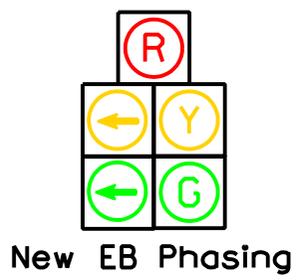


TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

	COLLISION DIAGRAM	
	DIVISION: 6	AREA:
STUDY PERIOD: 9/1/98 TO 8/31/2002		
DISTANCE: 1/4 MI - 1/8 MI		
ANALYSIS PREPARED BY: JS		
ANALYSIS CHECKED BY: ST		
DIAGRAM PREPARED BY: JS		
DIAGRAM REVIEWED BY: ST		
SCALE:	NOT TO SCALE	
DATE:	3-8-2007	
LOG NUMBER:	SS# 06-02-214	

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

Target Crashes



Future Bunce Road
Realignment

SR 1411
Bunce Road

Speed Limit = 35 MPH

Funeral Home

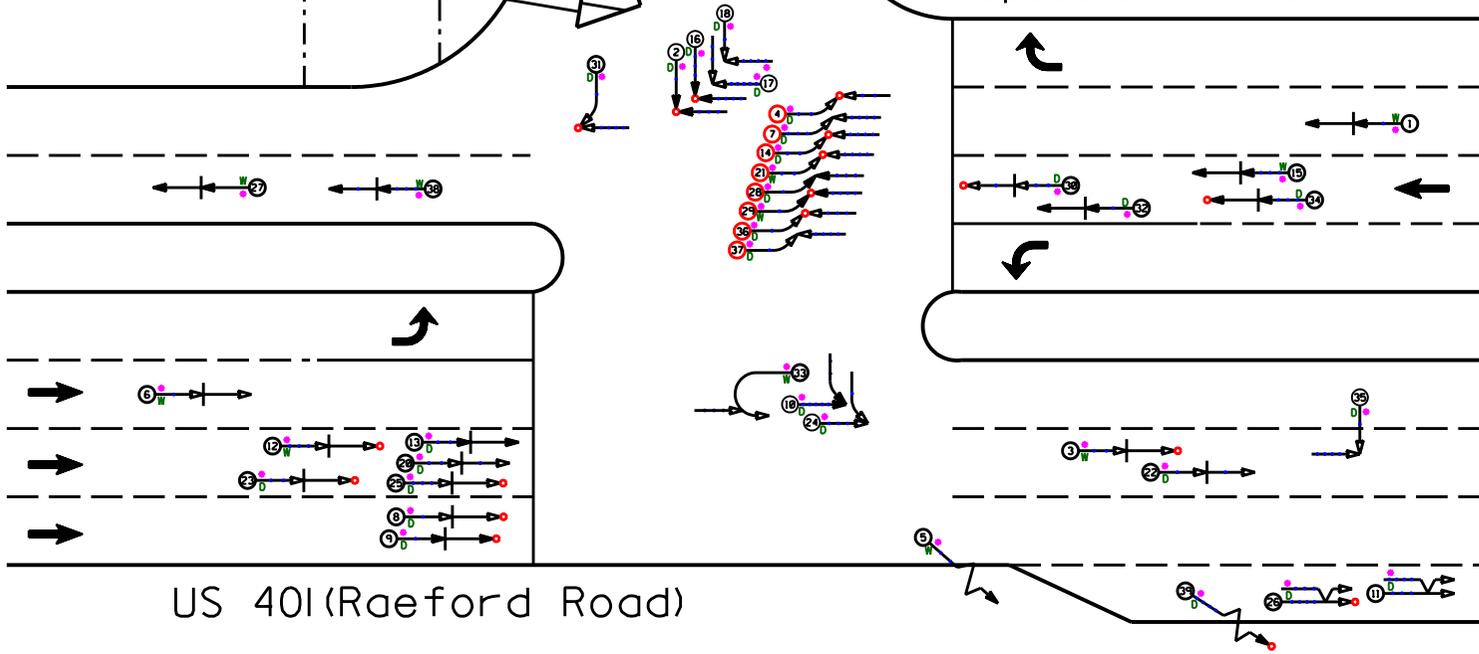
Speed Limit = 45 MPH

LEGEND

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

SS# 06-02-214
AFTER PERIOD
CUMBERLAND COUNTY
US 401 at SR 1411

Intersection Modifications
included modifying signal
phasing to included
protected / permitted
left turns for EB vehicles
on Raeford Road



US 401 (Raeford Road)

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

	COLLISION DIAGRAM	
	DIVISION: 6	AREA:
	STUDY PERIOD: 02/2002 TO 12/30/2006	
	DISTANCE: 1-LINE - 150FT	
	ANALYSIS PREPARED BY: JBS	
	ANALYSIS CHECKED BY: ST	
	DIAGRAM PREPARED BY: JBS	
	DIAGRAM REVIEWED BY: ST	
SCALE:	NOT TO SCALE	
DATE:	3-8-2007	
LOG NUMBER:	SS# 06-02-214	

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