

# **Spot Safety Project Evaluation**

Project Log # 200704281

Spot Safety Project # 04-97-264

## **Spot Safety Project Evaluation of the Traffic Signal update at NC 4 and NC 48 in Nash 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**

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Samuel D. Coleman, EI

2/29/2008

Date

Traffic Safety Project Engineer

# ***Spot Safety Project Evaluation Documentation***

## **Subject Location**

Evaluation of Spot Safety Project Number 04-97-264 – Traffic Signal update at NC 4 and NC 48 in Nash County.

## **Project Information and Background from the Project File Folder**

NC 4 is a four lane divided roadway with a speed limit of 45 mph. NC 4 has two through lanes and dedicated left and right turn lanes at the intersection from the east approach. The west leg of the intersection is the access point for I 95's on and off ramps. NC 48 is a two lane roadway with a speed limit of 45 mph. NC 4 turns right at the intersection to coincide with NC 48 for the north leg of the intersection.

The original problem statement shows there was a congestion/delay problem at the intersection. The countermeasure chosen to alleviate the problem was to update the signal to be compatible with the city of Rocky Mount's closed loop system to allow for a better flow of traffic. The traffic signal update was completed on 5/14/2002 at a cost of \$40,000.

## **Naive Before and After Analysis**

After reviewing the spot safety project file folder along with all the crashes along the subject road, the crash data omitted from this analysis to consider for an adequate construction period was from April 2002 through June 2002. The before period consisted of reported crashes from July 1, 1997 through March 31, 2002 (4 years, 9 months) and the after period consisted of reported crashes from July 1, 2002 through March 31, 2007 (4 years, 9 months). The ending date for this analysis was determined by the available crash data at the time the crash analysis was completed.

The treatment data consisted of all crashes within 150 feet of the subject intersection. The following data table depicts the Naive Before and After Analysis for the above information. Please note that Frontal Impact crash types influenced by the implemented countermeasure were the target crashes for the treatment location. These crash types considered are as follows: Left Turn, same roadway; Left Turn, different roadway; Right Turn, same roadway; Right Turn, different roadway; Head On, and Angle. The target crashes are clearly identified in the before and after period collision diagrams.

\*Please note to properly evaluate the intersection background information would be needed in regards to the previous delays at the intersection. However, this evaluation will convey all data collected from the crash reports and field investigation.

<u>Treatment Information</u>			
	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-) Percent Increase (+)</b>
Total Crashes	33	28	-15.2
Total Severity Index	7.1	2.3	-67.3
Target Crashes	19	14	-26.3
Target Severity Index	5.7	3.1	-45.1
Volume	12400	14800	19.4
<u>Treatment Injury Crashes</u>			
	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-) Percent Increase (+)</b>
Fatal	1	0	-100.0
Class A	0	0	N/A
Class B	6	3	-50.0
Class C	11	2	-81.8
Property Damage Only	15	23	53.3
<u>Target Injury Crashes</u>			
	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-) Percent Increase (+)</b>
Fatal	0	0	N/A
Class A	0	0	N/A
Class B	4	2	-50.0
Class C	8	2	-75.0
Property Damage Only	7	10	42.9

Table 1.

The naive before and after analysis at the treatment location resulted in a 15 percent decrease in Total Crashes, a 26 percent decrease in Frontal Impact Crashes, and a 19 percent increase in Average Daily Traffic (ADT). The before period ADT year was 1999 and the after period ADT year was 2005.

## Results and Discussion

The naïve before and after analysis involving the comparison of treatment actual before data versus treatment actual after data resulted in a 15 percent decrease in Total Crashes and a 26 percent decrease in Frontal Impact Crashes. The summary results above demonstrate that the treatment location appears to have had a decrease in the number of Total Crashes and a decrease in the number of Frontal Impact Crashes from the before to the after period.

Referencing table 1, there has been a significant decrease in severity from the before to the after period. If the one fatal crash (pedestrian) was not included in the total before and after severity index row, the results would be a 53 percent reduction from an index of 4.9 to 2.3. This information shows that the reduction may be a result of better traffic flow within the intersection.

However, the collision diagrams show the east approach may still have an issue. In the before period 8 of the 19 (42%) frontal impact crashes involved a vehicle from the east approach at fault. In the after period there were 7 of the 14 (50%) frontal impact crashes that involved a vehicle from the east approach. During the field investigation there were no sight distance issues noted. Driving west on NC 4 there was enough time to see the signal head and react in time to stop.

The calculated benefit to cost ratio for this project is 24.98 considering total crashes. The benefit to cost ratio considering only target crashes is 4.81. 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 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 road.



Location Map: NC 4 at NC 48 in Nash County.

**TREATMENT SITE BENEFIT-COST ANALYSIS**

LOCATION: NC 4 and NC 48  
 COUNTY: Nash  
 FILE NO.: SS 04-97-264

BY: S Coleman  
 DATE: 10/29/2007

DETAILED COST: TYPE IMPROVEMENT - Signal Interconnection

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$40,000	10	0.149	\$5,961
	\$0	0	0.000	\$0
Right-of-Way	\$0	0	0.000	\$0
<b>TOTALS</b>	<b>\$40,000</b>	<b>10</b>	<b>0.149</b>	<b>\$5,961</b>

ESTIMATED INCREASE IN ANNUAL MAINT. COST = \$0  
 ESTIMATED INCREASE IN ANNUAL UTILITY COST = \$150  
 TOTAL ANNUAL COST= \$6,111  
 TOTAL COST OF PROJECT= \$40,000

COMPREHENSIVE COST REDUCTION:

TIME PERIOD	YEARS	ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES						ANNUAL COSTS
		K & A CRASHES	K & A CRASHES PER YR	B & C CRASHES	B & C CRASHES PER YR	PDO CRASHES	PDO CRASHES PER YR	
BEFORE	4.75	1	0.21	17	3.58	15	3.16	\$192,526
AFTER	4.75	0	0.00	5	1.05	23	4.84	\$39,853

Annual Benefits from Crash Cost Savings \$152,674

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = \$146,563  
 BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 24.98

TOTAL COST OF PROJECT - \$40,000 COMPREHENSIVE B/C RATIO - 24.98



*Treatment Site Photos taken November 1, 2007*



Driving north on NC 48



Driving south on NC 48



Driving south on NC 48



Driving west on NC 4



Driving west on NC 4



Driving east on NC 4

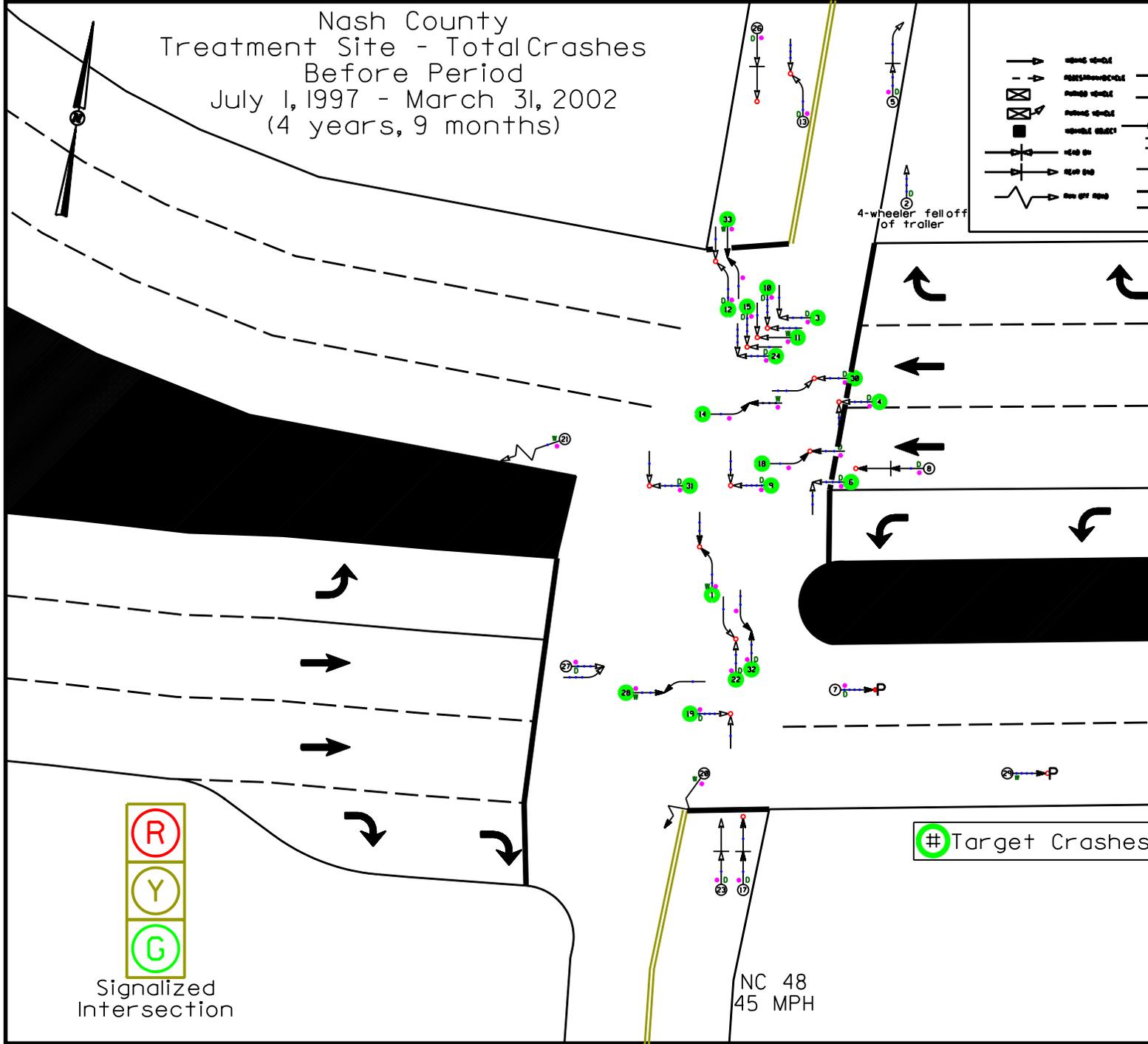


Driving east on NC 4

Nash County  
Treatment Site - Total Crashes  
Before Period  
July 1, 1997 - March 31, 2002  
(4 years, 9 months)

**LEGEND**

	vehicle type		crash type		9 mph or less		P position
	vehicle type		crash type		10 mph to 19		B bicycle
	vehicle type		crash type		20 mph to 29		T train
	vehicle type		crash type		30 mph to 39		A animal
	vehicle type		crash type		40 mph to 49		• OTHER AT FAULT
	vehicle type		crash type		50 mph to 59		D driver
	vehicle type		crash type		60 mph to 69		W west
	vehicle type		crash type		70 mph or more		I east
	vehicle type		crash type		SPD0 unknown		
	vehicle type		crash type		Out of Control		
	vehicle type		crash type		single		
	vehicle type		crash type		fatality		



TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT		COLLISION DIAGRAM	
ROADWAY SAFETY IMPROVEMENT PROGRAM	SAFETY PROMOTION MANAGEMENT AND SUPPORT	DIVISION:	AREA:
		STUDY PERIOD:	7/1/1997 TO 3/31/2002
		DISTANCE:	1-MILE: 150 FT
SAFETY EVALUATION		ANALYSIS PREPARED BY:	S. COLEMAN
TRAFFIC SAFETY		DIAGRAM PREPARED BY:	S. COLEMAN
BEFORE SIGNAL REVISION		DIAGRAM REVIEWED BY:	
SCALE:		NOT TO SCALE	
DATE:		MARCH 2007	
LOG NUMBER:			
<p><b>N.C. DEPARTMENT of TRANSPORTATION</b>  <b>DIVISION of HIGHWAYS</b>  <b>TRAFFIC ENGINEERING AND SAFETY</b>  <b>SYSTEMS BRANCH</b></p>			

Nash County  
Treatment Site - Total Crashes  
After Period  
July 1, 1997 - March 31, 2002  
(4 years, 9 months)

LEGEND

	vehicle		vehicle		0 mph to 15		P Pedestrian
	motorcycle		motorcycle		15 mph to 20		B Bicycle
	motorcycle		motorcycle		20 mph to 25		T Tractor
	motorcycle		motorcycle		25 mph to 30		A Animal
	motorcycle		motorcycle		30 mph to 35		Other at Fault
	motorcycle		motorcycle		35 mph to 40		D Driver
	motorcycle		motorcycle		40 mph to 45		W Wet
	motorcycle		motorcycle		45 mph to 50		I Ice
	motorcycle		motorcycle		50 mph to 55		
	motorcycle		motorcycle		55 mph to 60		
	motorcycle		motorcycle		60 mph to 65		
	motorcycle		motorcycle		65 mph to 70		
	motorcycle		motorcycle		70 mph to 75		
	motorcycle		motorcycle		75 mph to 80		
	motorcycle		motorcycle		80 mph to 85		
	motorcycle		motorcycle		85 mph to 90		
	motorcycle		motorcycle		90 mph to 95		
	motorcycle		motorcycle		95 mph to 100		
	motorcycle		motorcycle		100 mph to 105		
	motorcycle		motorcycle		105 mph to 110		
	motorcycle		motorcycle		110 mph to 115		
	motorcycle		motorcycle		115 mph to 120		
	motorcycle		motorcycle		120 mph to 125		
	motorcycle		motorcycle		125 mph to 130		
	motorcycle		motorcycle		130 mph to 135		
	motorcycle		motorcycle		135 mph to 140		
	motorcycle		motorcycle		140 mph to 145		
	motorcycle		motorcycle		145 mph to 150		
	motorcycle		motorcycle		150 mph to 155		
	motorcycle		motorcycle		155 mph to 160		
	motorcycle		motorcycle		160 mph to 165		
	motorcycle		motorcycle		165 mph to 170		
	motorcycle		motorcycle		170 mph to 175		
	motorcycle		motorcycle		175 mph to 180		
	motorcycle		motorcycle		180 mph to 185		
	motorcycle		motorcycle		185 mph to 190		
	motorcycle		motorcycle		190 mph to 195		
	motorcycle		motorcycle		195 mph to 200		
	motorcycle		motorcycle		200 mph to 205		
	motorcycle		motorcycle		205 mph to 210		
	motorcycle		motorcycle		210 mph to 215		
	motorcycle		motorcycle		215 mph to 220		
	motorcycle		motorcycle		220 mph to 225		
	motorcycle		motorcycle		225 mph to 230		
	motorcycle		motorcycle		230 mph to 235		
	motorcycle		motorcycle		235 mph to 240		
	motorcycle		motorcycle		240 mph to 245		
	motorcycle		motorcycle		245 mph to 250		
	motorcycle		motorcycle		250 mph to 255		
	motorcycle		motorcycle		255 mph to 260		
	motorcycle		motorcycle		260 mph to 265		
	motorcycle		motorcycle		265 mph to 270		
	motorcycle		motorcycle		270 mph to 275		
	motorcycle		motorcycle		275 mph to 280		
	motorcycle		motorcycle		280 mph to 285		
	motorcycle		motorcycle		285 mph to 290		
	motorcycle		motorcycle		290 mph to 295		
	motorcycle		motorcycle		295 mph to 300		
	motorcycle		motorcycle		300 mph to 305		
	motorcycle		motorcycle		305 mph to 310		
	motorcycle		motorcycle		310 mph to 315		
	motorcycle		motorcycle		315 mph to 320		
	motorcycle		motorcycle		320 mph to 325		
	motorcycle		motorcycle		325 mph to 330		
	motorcycle		motorcycle		330 mph to 335		
	motorcycle		motorcycle		335 mph to 340		
	motorcycle		motorcycle		340 mph to 345		
	motorcycle		motorcycle		345 mph to 350		
	motorcycle		motorcycle		350 mph to 355		
	motorcycle		motorcycle		355 mph to 360		
	motorcycle		motorcycle		360 mph to 365		
	motorcycle		motorcycle		365 mph to 370		
	motorcycle		motorcycle		370 mph to 375		
	motorcycle		motorcycle		375 mph to 380		
	motorcycle		motorcycle		380 mph to 385		
	motorcycle		motorcycle		385 mph to 390		
	motorcycle		motorcycle		390 mph to 395		
	motorcycle		motorcycle		395 mph to 400		
	motorcycle		motorcycle		400 mph to 405		
	motorcycle		motorcycle		405 mph to 410		
	motorcycle		motorcycle		410 mph to 415		
	motorcycle		motorcycle		415 mph to 420		
	motorcycle		motorcycle		420 mph to 425		
	motorcycle		motorcycle		425 mph to 430		
	motorcycle		motorcycle		430 mph to 435		
	motorcycle		motorcycle		435 mph to 440		
	motorcycle		motorcycle		440 mph to 445		
	motorcycle		motorcycle		445 mph to 450		
	motorcycle		motorcycle		450 mph to 455		
	motorcycle		motorcycle		455 mph to 460		
	motorcycle		motorcycle		460 mph to 465		
	motorcycle		motorcycle		465 mph to 470		
	motorcycle		motorcycle		470 mph to 475		
	motorcycle		motorcycle		475 mph to 480		
	motorcycle		motorcycle		480 mph to 485		
	motorcycle		motorcycle		485 mph to 490		
	motorcycle		motorcycle		490 mph to 495		
	motorcycle		motorcycle		495 mph to 500		
	motorcycle		motorcycle		500 mph to 505		
	motorcycle		motorcycle		505 mph to 510		
	motorcycle		motorcycle		510 mph to 515		
	motorcycle		motorcycle		515 mph to 520		
	motorcycle		motorcycle		520 mph to 525		
	motorcycle		motorcycle		525 mph to 530		
	motorcycle		motorcycle		530 mph to 535		
	motorcycle		motorcycle		535 mph to 540		
	motorcycle		motorcycle		540 mph to 545		
	motorcycle		motorcycle		545 mph to 550		
	motorcycle		motorcycle		550 mph to 555		
	motorcycle		motorcycle		555 mph to 560		
	motorcycle		motorcycle		560 mph to 565		
	motorcycle		motorcycle		565 mph to 570		
	motorcycle		motorcycle		570 mph to 575		
	motorcycle		motorcycle		575 mph to 580		
	motorcycle		motorcycle		580 mph to 585		
	motorcycle		motorcycle		585 mph to 590		
	motorcycle		motorcycle		590 mph to 595		
	motorcycle		motorcycle		595 mph to 600		
	motorcycle		motorcycle		600 mph to 605		
	motorcycle		motorcycle		605 mph to 610		
	motorcycle		motorcycle		610 mph to 615		
	motorcycle		motorcycle		615 mph to 620		
	motorcycle		motorcycle		620 mph to 625		
	motorcycle		motorcycle		625 mph to 630		
	motorcycle		motorcycle		630 mph to 635		
	motorcycle		motorcycle		635 mph to 640		
	motorcycle		motorcycle		640 mph to 645		
	motorcycle		motorcycle		645 mph to 650		
	motorcycle		motorcycle		650 mph to 655		
	motorcycle		motorcycle		655 mph to 660		
	motorcycle		motorcycle		660 mph to 665		
	motorcycle		motorcycle		665 mph to 670		
	motorcycle		motorcycle		670 mph to 675		
	motorcycle		motorcycle		675 mph to 680		
	motorcycle		motorcycle		680 mph to 685		
	motorcycle		motorcycle		685 mph to 690		
	motorcycle		motorcycle		690 mph to 695		
	motorcycle		motorcycle		695 mph to 700		
	motorcycle		motorcycle		700 mph to 705		
	motorcycle		motorcycle		705 mph to 710		