

Spot Safety Project Evaluation

Order # 41000010098

Spot Safety Project # 12-05-202

**Spot Safety Project Evaluation of the Traffic Signal Installation
NC 16 at SR 1453 (Saint Peters Church Road)
Catawba 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

12-20-2010

Date

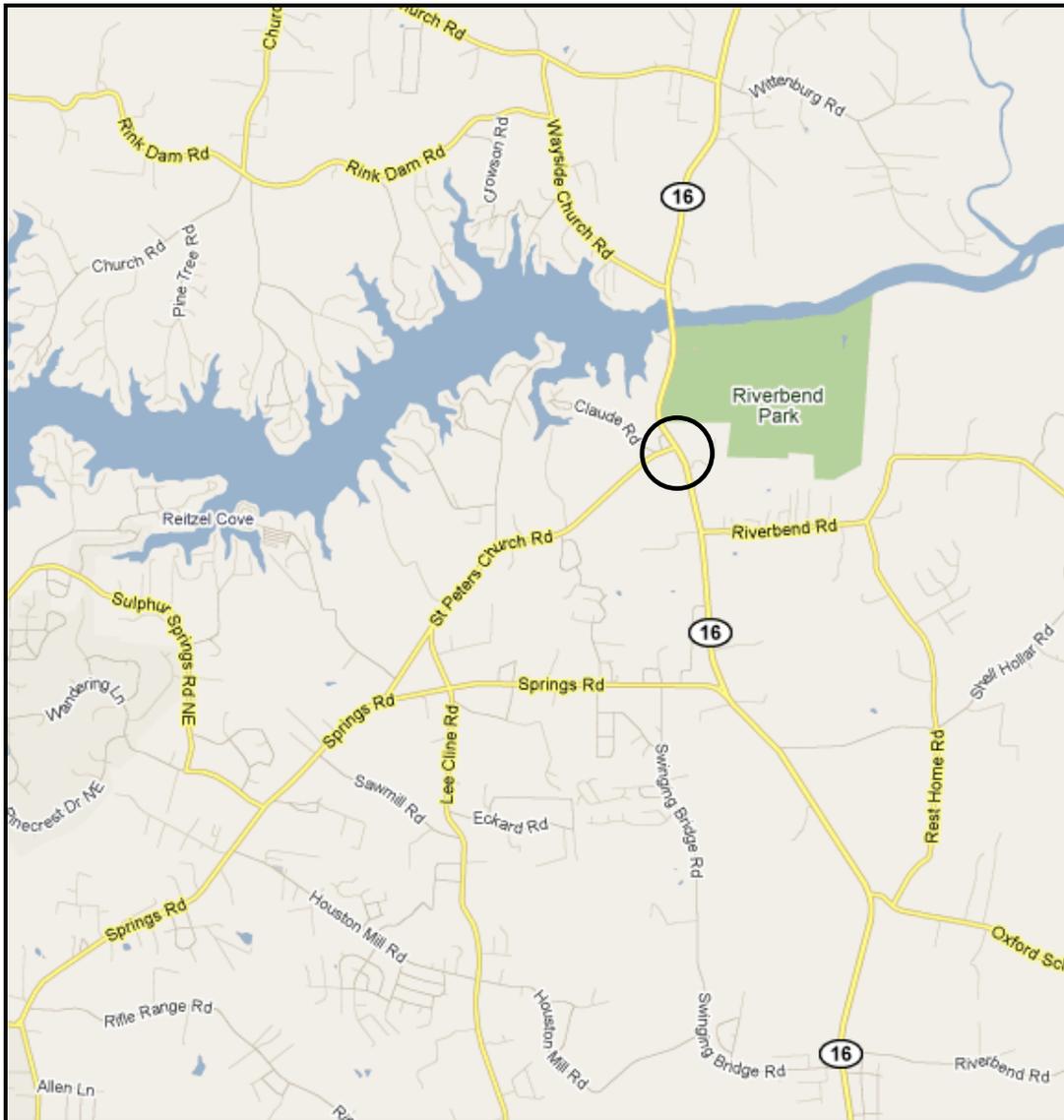
Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 12-05-202 located at the Intersection of NC 16 and SR 1453 (Saint Peters Church Road) in Catawba County, north of the City of Conover.

The Sig ID is 12-1730 for this newly installed traffic signal.





2009 Aerial Photo from Catawba County GIS

Project Information and Background from the Project File Folder

The spot safety project improvement countermeasure chosen for the subject location was the installation of an intersection 2-phase traffic signal. NC 16 and SR 1453 are both two-lane facilities at the subject intersection with speed limits of 55 mph on all approaches. NC 16 did provide a northbound left turn lane during the before period and was repainted to also include a southbound left turn lane into the PVAs with the signal installation. The subject location is a three-leg state maintained intersection (fourth leg consisting of businesses), which was controlled by a stop sign on SR 1453 (Saint Peters Church Rd) prior to the signal.

The original statement of problem was the significant existence of side street delay and the development of an “angle” crash pattern at the intersection. The intended purpose of the improvement was to alleviate crashes and assign vehicle right-of-way.

The initial crash analysis was completed from December 1, 1999 to November 30, 2004 with thirteen (13) reported angle crashes. The final completion date, as indicated from the police crash reports for the improvement at the subject intersection, was during the first quarter of 2006 with a total cost of \$43,500.

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 January through March 2006. The before period consisted of reported crashes from June 1, 2001 through December 31, 2005 (4 years and 7 months); and the after period consisted of reported crashes from April 1, 2006 through October 31, 2010 (4 years and 7 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, 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 Frontal Impact Crashes were the target crashes for the applied countermeasure. The Frontal Impact Crash types considered are as follows: Left turn, same roadway; Left turn, different roadways; Right turn, same roadway; Right turn, different roadways; Head on; and Angle.

<u>Treatment Information</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	21	20	- 4.8 %
Total Severity Index	4.17	7.38	77.0 %
Target Crashes	12	6	- 50.0 %
Target Crash Severity Index	4.08	7.17	75.7 %
Volume (2003, 2008)	14,400	14,100	- 2.1 %

<u>Injury Crash Summary</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Fatal injury Crashes	0	0	N/A
Class A injury Crashes	0	1	100.0 %
Class B injury Crashes	4	2	- 50.0 %
Class C Injury Crashes	5	5	0.0 %
Total Injury Crashes	9	8	- 11.1 %

The naive before and after analysis at the treatment location resulted in a 5 percent decrease in Total Crashes, a 50 percent decrease in Target Crashes, but a 77 percent increase in the Total Severity Index. The before period ADT year was 2003 and the after period ADT year was 2008.

Results and Discussion

Referencing the *Collision Diagrams*, the before period presented a strong pattern of eleven (11) left turn different roadway collisions and one (1) head-on crash, due to a NC 16 southbound motorist avoidance, resulting from vehicles on SR 1453 choosing insufficient gaps to safely make the left

turn onto northbound NC 16. All vehicles in the before period did come to a complete stop prior to attempting the left turn movement.

After the signal installation, frontal impact collisions reduced by half with three (3) permissive left turn collisions and three (3) red light run angle crashes. The intersection however experienced nearly the same number of total crashes including an increase in rear-end collisions from four (4) in the before period to eight (8) in the after period. The total severity index also nearly doubled resulting from an A-injury pedestrian crash involving a northbound NC 16 motorist.

The calculated benefit to cost ratio for this project is **(-13.73) considering total crashes**. The benefit to cost ratio **considering only target crashes is 0.60**. 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 from Google Street View for all three approaches to the treatment intersection. 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 South on NC 16



Looking North on NC 16



Traveling East on SR 1453 (St. Peters Church Road)

BENEFIT-COST ANALYSIS WORKSHEET - Total Crashes

LOCATION: NC 16 at SR 1453		BY: JBS						
COUNTY: Catawba		DATE: 12/14/2010						
FILE NO.: SS 12-05-202								
DETAILED COST:	TYPE IMPROVEMENT -	New Signal						
ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST				
Construction	\$43,500	10	0.149	\$6,483				
Right-of-Way	\$0	0	0.000	\$0				
TOTALS	\$43,500	10	0.149	\$6,483				
ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$2,000				
ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$900				
TOTAL ANNUAL COST=				\$9,383				
TOTAL COST OF PROJECT=				\$43,500				
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	4.58	0	0.00	9	1.97	12	2.62	\$50,568
AFTER	4.58	1	0.22	7	1.53	12	2.62	\$179,389
Annual Benefits from Crash Cost Savings								(\$128,821)
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	(\$138,204)		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	-13.73		
TOTAL COST OF PROJECT	-	\$43,500		COMPREHENSIVE B/C RATIO	-			-13.73

BENEFIT-COST ANALYSIS WORKSHEET - Target Crashes

LOCATION: NC 16 at SR 1453		BY: JBS						
COUNTY: Catawba		DATE: 12/14/2010						
FILE NO.: SS 12-05-202								
DETAILED COST:	TYPE IMPROVEMENT -	New Signal						
ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST				
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Right-of-Way	\$0	0	0.000	\$0				
TOTALS	\$43,500	10	0.149	\$6,483				
ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$2,000				
ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$900				
TOTAL ANNUAL COST=				\$9,383				
TOTAL COST OF PROJECT=				\$43,500				
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	4.58	0	0.00	5	1.09	7	1.53	\$28,406
AFTER	4.58	0	0.00	5	1.09	1	0.22	\$22,773
Annual Benefits from Crash Cost Savings								\$5,633
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	(\$3,750)		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	0.60		
TOTAL COST OF PROJECT	-	\$43,500		COMPREHENSIVE B/C RATIO	-			0.60



ADT (Year)
13,000 (2003)

Little
Market
Store

Gas
Station

Dollar
General

SR 1453
St. Peters Church Rd
55 MPH

ADT (Year)
4,500 (2003)



NC 16
55 MPH

ADT (Year)
9,900 (2003)

LEGEND							
	MOVING VEHICLE		ANGLE		5 MPH OR LESS		PEDESTRIAN
	PAKED VEHICLE		TURNING		10 MPH TO 19		TRAIN
	PAKED VEHICLE		BACKING		20 MPH TO 29		OTHER AT FAULT
	FIXED OBJECT		SIDESWIPE		30 MPH TO 39		DRY
	HEAD ON		OUT OF CONTROL		40 MPH TO 49		WET
	NEAR END		RUNAWAY		50 MPH TO 59		HIT
	RAN OFF ROAD		OUT OF CONTROL		60 MPH TO 69		HIT
			RUNAWAY		70 MPH TO 79		HIT
			RUNAWAY		80 MPH TO 89		HIT
			RUNAWAY		90 MPH TO 99		HIT
			RUNAWAY		100 MPH TO 109		HIT
			RUNAWAY		110 MPH TO 119		HIT
			RUNAWAY		120 MPH TO 129		HIT
			RUNAWAY		130 MPH TO 139		HIT
			RUNAWAY		140 MPH TO 149		HIT
			RUNAWAY		150 MPH TO 159		HIT
			RUNAWAY		160 MPH TO 169		HIT
			RUNAWAY		170 MPH TO 179		HIT
			RUNAWAY		180 MPH TO 189		HIT
			RUNAWAY		190 MPH TO 199		HIT
			RUNAWAY		200 MPH TO 209		HIT
			RUNAWAY		210 MPH TO 219		HIT
			RUNAWAY		220 MPH TO 229		HIT
			RUNAWAY		230 MPH TO 239		HIT
			RUNAWAY		240 MPH TO 249		HIT
			RUNAWAY		250 MPH TO 259		HIT
			RUNAWAY		260 MPH TO 269		HIT
			RUNAWAY		270 MPH TO 279		HIT
			RUNAWAY		280 MPH TO 289		HIT
			RUNAWAY		290 MPH TO 299		HIT
			RUNAWAY		300 MPH TO 309		HIT
			RUNAWAY		310 MPH TO 319		HIT
			RUNAWAY		320 MPH TO 329		HIT
			RUNAWAY		330 MPH TO 339		HIT
			RUNAWAY		340 MPH TO 349		HIT
			RUNAWAY		350 MPH TO 359		HIT
			RUNAWAY		360 MPH TO 369		HIT
			RUNAWAY		370 MPH TO 379		HIT
			RUNAWAY		380 MPH TO 389		HIT
			RUNAWAY		390 MPH TO 399		HIT
			RUNAWAY		400 MPH TO 409		HIT
			RUNAWAY		410 MPH TO 419		HIT
			RUNAWAY		420 MPH TO 429		HIT
			RUNAWAY		430 MPH TO 439		HIT
			RUNAWAY		440 MPH TO 449		HIT
			RUNAWAY		450 MPH TO 459		HIT
			RUNAWAY		460 MPH TO 469		HIT
			RUNAWAY		470 MPH TO 479		HIT
			RUNAWAY		480 MPH TO 489		HIT
			RUNAWAY		490 MPH TO 499		HIT
			RUNAWAY		500 MPH TO 509		HIT
			RUNAWAY		510 MPH TO 519		HIT
			RUNAWAY		520 MPH TO 529		HIT
			RUNAWAY		530 MPH TO 539		HIT
			RUNAWAY		540 MPH TO 549		HIT
			RUNAWAY		550 MPH TO 559		HIT
			RUNAWAY		560 MPH TO 569		HIT
			RUNAWAY		570 MPH TO 579		HIT
			RUNAWAY		580 MPH TO 589		HIT
			RUNAWAY		590 MPH TO 599		HIT
			RUNAWAY		600 MPH TO 609		HIT
			RUNAWAY		610 MPH TO 619		HIT
			RUNAWAY		620 MPH TO 629		HIT
			RUNAWAY		630 MPH TO 639		HIT
			RUNAWAY		640 MPH TO 649		HIT
			RUNAWAY		650 MPH TO 659		HIT
			RUNAWAY		660 MPH TO 669		HIT
			RUNAWAY		670 MPH TO 679		HIT
			RUNAWAY		680 MPH TO 689		HIT
			RUNAWAY		690 MPH TO 699		HIT
			RUNAWAY		700 MPH TO 709		HIT
			RUNAWAY		710 MPH TO 719		HIT
			RUNAWAY		720 MPH TO 729		HIT
			RUNAWAY		730 MPH TO 739		HIT
			RUNAWAY		740 MPH TO 749		HIT
			RUNAWAY		750 MPH TO 759		HIT
			RUNAWAY		760 MPH TO 769		HIT
			RUNAWAY		770 MPH TO 779		HIT
			RUNAWAY		780 MPH TO 789		HIT
			RUNAWAY		790 MPH TO 799		HIT
			RUNAWAY		800 MPH TO 809		HIT
			RUNAWAY		810 MPH TO 819		HIT
			RUNAWAY		820 MPH TO 829		HIT
			RUNAWAY		830 MPH TO 839		HIT
			RUNAWAY		840 MPH TO 849		HIT
			RUNAWAY		850 MPH TO 859		HIT
			RUNAWAY		860 MPH TO 869		HIT
			RUNAWAY		870 MPH TO 879		HIT
			RUNAWAY		880 MPH TO 889		HIT
			RUNAWAY		890 MPH TO 899		HIT
			RUNAWAY		900 MPH TO 909		HIT
			RUNAWAY		910 MPH TO 919		HIT
			RUNAWAY		920 MPH TO 929		HIT
			RUNAWAY		930 MPH TO 939		HIT
			RUNAWAY		940 MPH TO 949		HIT
			RUNAWAY		950 MPH TO 959		HIT
			RUNAWAY		960 MPH TO 969		HIT
			RUNAWAY		970 MPH TO 979		HIT
			RUNAWAY		980 MPH TO 989		HIT
			RUNAWAY		990 MPH TO 999		HIT
			RUNAWAY		1000 MPH TO 1009		HIT

SS# 12-05-202
Order# 41000010098
Catawba County
BEFORE Period
6/1/01 - 12/31/05

Frontal Impact
Target Crashes

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

TRAFFIC SAFETY UNIT

Date: 12-13-2010

Prepared By: J. Schronce



Little Market Store

ADT (Year)
13,000 (2009)

Gas Station

SR 1453
St. Peters Church Rd
55 MPH

Dollar General

ADT (Year)
4,500 (2009)

NC 16
55 MPH

ADT (Year)
9,300 (2009)

LEGEND

	MOVING VEHICLE		ANGLE		10 MPH OR LESS		PEDESTRIAN
	PAUSED VEHICLE		TURNING		20 MPH TO 25		TRAIN
	FIXED OBJECT		BACKING		30 MPH TO 35		OTHER AT FAULT
	HEAD ON		SIDESWIPE		40 MPH TO 45		DOT
	REAR END		OUT OF CONTROL		50 MPH TO 55		WET
	RAN OFF ROAD		LOSS OF CONTROL		60 MPH TO 65		TO AND UP
			INJURY		70 MPH TO 75		FATALITY
			80 MPH TO 85		90 MPH TO 95		100 MPH TO 105
			110 MPH TO 115		120 MPH TO 125		130 MPH TO 135
			140 MPH TO 145		150 MPH TO 155		160 MPH TO 165
			170 MPH TO 175		180 MPH TO 185		190 MPH TO 195
			200 MPH TO 205		210 MPH TO 215		220 MPH TO 225
			230 MPH TO 235		240 MPH TO 245		250 MPH TO 255
			260 MPH TO 265		270 MPH TO 275		280 MPH TO 285
			290 MPH TO 295		300 MPH TO 305		310 MPH TO 315
			320 MPH TO 325		330 MPH TO 335		340 MPH TO 345
			350 MPH TO 355		360 MPH TO 365		370 MPH TO 375
			380 MPH TO 385		390 MPH TO 395		400 MPH TO 405
			410 MPH TO 415		420 MPH TO 425		430 MPH TO 435
			440 MPH TO 445		450 MPH TO 455		460 MPH TO 465
			470 MPH TO 475		480 MPH TO 485		490 MPH TO 495
			500 MPH TO 505		510 MPH TO 515		520 MPH TO 525
			530 MPH TO 535		540 MPH TO 545		550 MPH TO 555
			560 MPH TO 565		570 MPH TO 575		580 MPH TO 585
			590 MPH TO 595		600 MPH TO 605		610 MPH TO 615
			620 MPH TO 625		630 MPH TO 635		640 MPH TO 645
			650 MPH TO 655		660 MPH TO 665		670 MPH TO 675
			680 MPH TO 685		690 MPH TO 695		700 MPH TO 705
			710 MPH TO 715		720 MPH TO 725		730 MPH TO 735
			740 MPH TO 745		750 MPH TO 755		760 MPH TO 765
			770 MPH TO 775		780 MPH TO 785		790 MPH TO 795
			800 MPH TO 805		810 MPH TO 815		820 MPH TO 825
			830 MPH TO 835		840 MPH TO 845		850 MPH TO 855
			860 MPH TO 865		870 MPH TO 875		880 MPH TO 885
			890 MPH TO 895		900 MPH TO 905		910 MPH TO 915
			920 MPH TO 925		930 MPH TO 935		940 MPH TO 945
			950 MPH TO 955		960 MPH TO 965		970 MPH TO 975
			980 MPH TO 985		990 MPH TO 995		1000 MPH TO 1005

SS# 12-05-202
Order# 41000010098
Catawba County
AFTER Period
4/1/06 - 10/31/10

New Traffic Signal Installation
Sig ID: 12-1730

Frontal Impact Target Crashes

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

TRAFFIC SAFETY UNIT

Date: 12-13-2010 Prepared By: J. Schronce