

# **Spot Safety Project Evaluation**

Project Log # 200408074

Spot Safety Project # 07-91-040

**Spot Safety Project Evaluation, of the Traffic Signal Installation and Intersection Improvements,  
At the Intersection of NC 86 and NC 57, near Hillsborough, Orange County**

Documents Prepared By:

Safety Evaluation Group  
Traffic Safety Systems Management Section  
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**Principal Investigator**

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Carrie L. Goodrich

04/06/2005  
Date

Traffic Safety Project Engineer

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

## **Subject Location**

Evaluation of Spot Safety Project Number 07-91-040 – The Intersection of NC 86 and NC 57, near Hillsborough, Orange County

## **Introduction**

In an attempt to assess the safety of our roads, the Safety Evaluation Group of the Traffic Safety Systems Management Section has evaluated the above project. The methodologies used in this evaluation offer various philosophies and ideas, in an effort to provide objective countermeasure crash reduction results. A naive before and after analysis and an Odds Ratio comparison analysis have been completed to measure the effectiveness of the spot safety improvement. This information is provided to you so the benefit or lack of benefit for this type of project can be recognized and utilized for future projects.

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

The spot safety project improvement countermeasures chosen for the subject location were the installation of a two-phase traffic signal and the improvement of the intersection alignment. Left-turn lanes were also added to the treatment intersection through other funding sources. D.B. Kelly, Division 7 Traffic Engineer, originally requested the improvements. NC 57 was a two-lane facility at the intersection with NC 86. NC 86 was a two-lane facility with a right-turn bay on the northbound approach of the treatment intersection. Old NC 57 (which now serves as a service road) intersects NC 86 several hundred feet to the south of the current NC 57. The subject location was controlled by stop signs on NC 57. Currently, NC 57 has an exclusive left-turn lane and a thru and right turn lane at the treatment intersection. The northbound approach of NC 86 has a left-turn lane, and a thru lane, and a right-turn lane. The southbound approach of NC 86 has a left-turn lane and a thru and right turn lane. NC 57 has a speed limit of 55 mph. NC 86 has a speed limit of 45 mph. The Orange County Public Works Facility constructed a road on the west leg of the intersection to form a four-legged intersection. The Orange County Public Works Facility is a two-lane road with no turn lanes at the intersection. A raised concrete island was added to old NC 57 (as part of the spot safety project) to block traffic from accessing NC 86 from old NC 57. Traffic may still turn right onto old NC 57 from NC 86. Old NC 57 provides access to a church and a small residential community.

It was felt that installing a traffic signal and improving geometrics at the treatment intersection may help reduce the number of Angle and Rear-End type crashes. The initial crash analysis for this location was completed from June 29, 1992 through June 30, 1995 with a total of 11 reported crashes. There were seven Angle type crashes, three Rear-End type crashes, and one Head-On crash. The final completion date for the improvement at the subject intersection was on February 13, 1997.

## Comparison 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, 1995 through December 1, 1997. The before period consisted of reported crashes from January 1, 1990 through August 31, 1995 (5 Years, 8 Months) and the after period consisted of reported crashes from January 1, 1998 through August 31, 2003 (5 Years, 8 Months). The ending date for this analysis was determined by the available crash data at the time the crash analysis was completed.

The analysis also consisted of two different sets of data, the treatment and the comparison data. The treatment data consisted of all crashes within 150 feet of the subject intersection, including crashes occurring within 150 feet of the intersections of Old NC 57 with NC 86 and NC 57. The comparison data consisted of all crashes within a 150 feet Y-line on NC 57, from 500 feet north of the treatment intersection to 150 feet north of NC 157. Please see attached *Location Map* for further detail. The following data table depicts the Naive Before and After Analysis for the treatment and comparison intersections. 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.

### Treatment Information

	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-)/ Percent Increase (+)</b>
Total Crashes	28	10	- 64.3
Total Severity Index	4.96	3.96	- 20.2
Frontal Impact Crashes	16	2	- 87.5
Frontal Severity Index	4.70	4.70	0.0
Volume	9700	13,800	42.3

### Comparison Information

	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-)/ Percent Increase (+)</b>
Total Crashes	88	129	46.6
Total Severity Index	11.44	4.96	- 56.6
Frontal Impact Crashes	33	30	- 9.1
Frontal Severity Index	18.59	9.51	- 48.8
Volume	2400	3700	54.2

### Odds Ratio: Treatment versus Comparison

	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-)/ Percent Increase (+)</b>
Treatment Total Crashes	28	10	---
Comparison Total Crashes	88	129	- 75.6 %
Treatment Frontal Impact Crashes	16	2	---
Comparison Frontal Impact Crashes	33	30	- 86.3 %

The naive before and after analysis at the treatment location resulted in a 64.3 percent decrease in Total Crashes, a 20.2 percent decrease in the Total Severity Index, and a 42.3 percent increase in Average Daily Traffic (ADT). The comparison location experienced a 46.6 percent increase in Total Crashes, a 56.6 percent decrease in the Total Severity Index, and a 54.2 percent increase in ADT. The before period ADT year was 1992 and the after period ADT year was 2000.

The attached data Table 1 also depicts the Naive Before and After Analysis for the above information. The data in Table 1 consists of an overall crash summary and a crash type summary for the treatment intersection.

The Odds Ratio is used as another means of calculating the treatment effect. The number of crashes in the before and after period from the Comparison Strip are used to calculate the percent reduction in crashes for the Treatment Intersection. As shown in the previous table, using the Odds Ratio calculation, there is a 75.6 percent decrease in Total Treatment Intersection crashes and an 86.3 percent decrease in Frontal Impact Treatment Intersection crashes.

### **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 64.3 percent decrease in Total Crashes and an 87.5 percent decrease in Frontal Impact Crashes. Using the Odds Ratio to calculate the treatment effect resulted in a 75.6 percent decrease in Total Crashes and an 86.3 percent decrease in Frontal Impact Crashes at the Treatment Intersection. The summary results above demonstrate that the treatment location appears to have had a substantial decrease in the number of Total and Frontal Impact Crashes from the before to the after period using both analysis methods.

Please see the attached Treatment Site Photos. Photos are provided for each leg of the intersection, including photos taken from Old NC 57 and Orange County Public Works Facility.

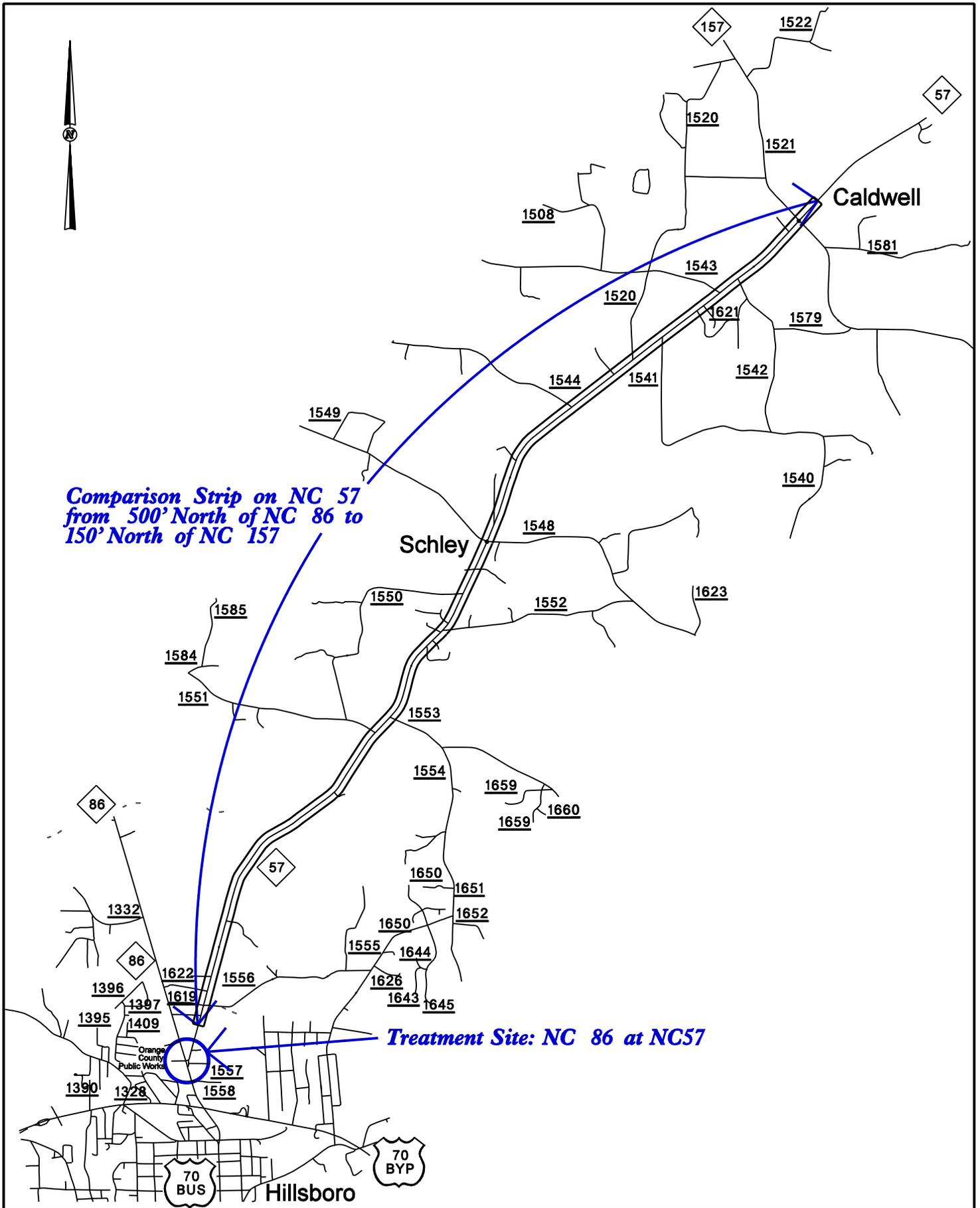
The countermeasure crash reduction for Total Crashes at the subject intersection can be in the range of a 64.3 percent decrease to a 75.6 percent decrease in crashes. The countermeasure crash reduction for Frontal Impact Crashes at the subject intersection can be in the range of an 86.3 percent decrease to an 87.5 percent decrease in crashes. 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.

**Table 1. Treatment Intersection Overall Crash Summary and Crash Type Summary**

<b>OVERALL CRASH SUMMARY</b>	<b>Before Period</b>	<b>After Period</b>	<b>Percent Change</b>
Total Crashes	28	10	-64.3
Fatal Crashes	0	0	n/a
Non-Fatal Injury Crashes	15	4	-73.3
Total Injury Crashes	15	4	-73.3
PDO Crashes	13	6	-53.8
Night Crashes	3	1	-66.7
Wet Crashes	5	3	-40.0
Total Crash Rate	139.52	35.02	-74.9
Fatal Crash Rate	0	0	n/a
Non Fatal Crash Rate	74.74	14.01	-81.3
Night Crash Rate	14.95	3.5	-76.6
Wet Crash Rate	24.91	10.51	-57.8
Annual ADT	9700	13800	42.3
Total Vehicle Exposure	20.07	28.55	42.3
Severity Index	4.96	3.96	-20.2

<b>CRASH TYPE SUMMARY</b>	<b>Before Period</b>	<b>After Period</b>	<b>Percent Change</b>
Angle	3	2	-33.3
Backing Up	1	0	-100.0
Fixed Object	0	1	n/a
Head On	1	0	-100.0
Left Turn, Different Roadways	11	0	-100.0
Left Turn, Same Roadways	1	0	-100.0
Overturn/Rollover	0	1	n/a
Ran Off Road-Left	3	0	-100.0
Ran Off Road-Right	1	1	0.0
Rear End, Slow or Stop	7	5	-28.6

*Location Map, near Hillsborough, Orange County*  
*Evaluation of Spot Safety Project Number 07-91-040*



*Treatment Site Location Photos (Taken on August 25, 2004)*



**Looking North on NC 86**



**Looking South on NC 86**

*Treatment Site Location Photos (Taken on August 25, 2004)*



**Looking West on NC 57 (toward Orange County Public Works Facility)**



**Looking East on Orange County Public Works Facility (toward NC 57)**

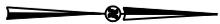
*Treatment Site Location Photos (Taken on August 25, 2004)*



Photo looking Northeast from the Old NC 57 (which is now a service road).



Treatment Site  
 After Period  
 1/1/1998 to 8/31/2003  
 (5 Years, 8 Months)



Orange County  
 Public Works Facility

LEGEND			
	MOVING VEHICLE		ANGLE
	PEDESTRIAN		TURNING
	PAKED VEHICLE		BACKING
	PAKED VEHICLE		SLOPESIDE
	DEER		OUT OF CONTROL
	FIXED OBJECT		REARITY
	HEAD ON		FATALITY
	NEAR END		9 MPH OR LESS
	RAN OFF ROAD		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
			PEDESTRIAN
			TRAIN
			DRIVER AT FAULT
			DRY
			WET
			ICY OR SNOWY
			ONLY

NC 86

45 MPH

45 MPH

NC 57

NC 86

55 MPH

NC 57

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

COLLISION DIAGRAM	
DIVISION: 7	AREA: 4
STUDY PERIOD: 1/1/1998 to 8/31/2003	
DISTANCE: 1/4 MILE - 0.11	
ANALYSIS PREPARED BY: C. COBBEN	
ANALYSIS CHECKED BY: H. SCHMIDT	
DIAGRAM PREPARED BY: H. SCHMIDT	
DIAGRAM REVIEWED BY:	
SCALE: NOT TO SCALE	DATE: September 9, 2004
LOG NUMBER: 200408014	

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