

Spot Safety Project Evaluation

Project Log # 200703106

Spot Safety Project # 08-99-211

Spot Safety Project Evaluation of the Left Turn Lane Installation At the Intersection of US 421 and the Hill Forest Rest Home Driveway Chatham 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

10-27-2008

Date

Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 08-99-211 located at the Intersection of US 421 and the Hill Forest Rest Home (Milepost 7.405) near the Town of Goldston in Chatham County.

Project Information and Background from the Project File Folder

The spot safety project improvement countermeasure chosen for the subject location was the roadway widening for the installation of a left turn lane. In the study period, US 421 was a two lane roadway traveling north and south with a posted 55 mph speed limit. At the entrance to the Hill Forest Rest Home a sharp vertical curve to the north limits sight distance for southbound traveling traffic. In December 2004, US 421 was widened to a four-lane divided facility at the subject location under TIP R-2601B. The access to the driveway was removed at this time and a crossover for u-turn movements was placed just south of the Bear Creek Bridge.

The original statement of problem was that a pattern of rear end crashes was emerging due to the roadway vertical alignment, increased volumes, and lack of storage for left turning motorists. The necessity of this countermeasure was seen by a particular rear end collision in April 1999 involving seven vehicles that resulted in three fatalities and four class A injuries.

The initial crash analysis was completed from April 30, 1991 to May 1, 2000 with ten (10) reported crashes, four (4) of which were deemed correctable rear end collisions. The final completion date for the improvement at the subject location was on May 30, 2002 with a total cost of \$150,000.00.

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 May and June 2002. The before period consisted of reported crashes from May 1, 1998 through April 30, 2002 (4 years); and the after period consisted of reported crashes from July 1, 2002 through November 30, 2004 (2 years and 5 months). The ending date for this analysis was determined by the widening of US 421 to a four-lane divided facility in December 2004.

The treatment data consisted of all crashes within 300 feet of the subject driveway. The milepost range for the study on US 421 is 7.348 to 7.462. *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 Driveway Relevant Crashes were the target crashes for the applied countermeasure. The Driveway Crash types considered are as follows: Left turn, same roadway; Rear End, Slow or Stop; and Rear End, Turn.

<u>Treatment Information</u>			
	Before 4 Years	After 2.42 Years	Percent Reduction (-) Percent Increase (+)
Total Crashes	4	4	N/A
Total Crashes per Year	1.00	1.65	65.0 %
Total Severity Index	23.65	4.70	- 80.1 %
Target Crashes	3	0	N/A
Target Crashes per Year	0.75	0.00	- 100.0 %
Target Crash Severity Index	31.20	0.00	- 100.0 %
Volume	9,400	9,700	3.2 %
<u>Injury Crash Summary</u>			
Fatal injury Crashes	1	0	- 100.0 %
Class A injury Crashes	0	0	N/A
Class B injury Crashes	1	0	- 100.0 %
Class C Injury Crashes	1	2	100.0 %
Total Injury Crashes	3	2	- 33.3 %

The naive before and after analysis at the treatment location resulted in a 65 percent increase in Total Crashes per year, elimination of Target Crashes per year, and an 80 percent decrease in the Total Severity Index. The before period ADT year was 2000 and the after period ADT year was 2003.

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 65 percent increase in Total Crashes per year and complete elimination of Target Crashes per year. The summary results above demonstrate that both Target Crashes and Crash Severity appear to have decreased at the treatment location from the before to the after period.

Referencing the *Collision Diagrams*, the left turn lane successfully eliminated the severe injury rear end crash potential present in the before period from the vertical alignment at this location. The after period crashes at the rest home entrance were random in nature including an animal crash, a rear end collision from a driver picking up a hitchhiker, and a movable object collision from a vehicle striking a tractor-trailers brake drum.

The calculated benefit to cost ratio for this project is **5.14 considering total crashes**. The benefit to cost ratio **considering only target crashes is 5.89**. 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 location, although the configuration of US 421 191 shown is different from the configuration that was analyzed for this study, as explained in the *Project Background* section.

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 TAKEN 9/18/2008



Hill Forest Rest Home Sign



Rest Home Driveway Approaching US 421



Driveway Sight Distance looking North – Vertical Curve



Driveway Sight Distance looking South at Bear Creek Bridge



Traveling South on US 421 – Stop Sign to Left is Entrance



Traveling South on US 421
New Crossover for U-turns south of Bear Creek Bridge



Traveling North on US 421 at New Crossover



Traveling North on US 421 at Rest Home – old position of left turn lane

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: US 421 at Hill Forest Rest Home
 COUNTY: Chatham
 FILE NO.: SS 08-99-211

BY: JBS
 DATE: 10/22/2008
 NOTES: Total Crashes

DETAILED COST: TYPE IMPROVEMENT - Left Turn Lane

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$150,000	10	0.149	\$22,354
Right-of-Way	\$0	0	0.000	\$0
TOTALS	\$150,000	10	0.149	\$22,354

ESTIMATED INCREASE IN ANNUAL MAINT. COST = \$400
 ESTIMATED INCREASE IN ANNUAL UTILITY COST = \$0
 TOTAL ANNUAL COST= \$22,754
 TOTAL COST OF PROJECT= \$150,000

COMPREHENSIVE COST REDUCTION:

ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES

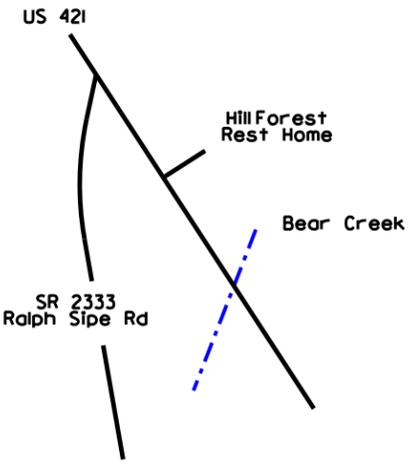
TIME PERIOD	YEARS	K & A CRASHES	K & A CRASHES PER YR	B & C CRASHES	B & C CRASHES PER YR	PDO CRASHES	PDO CRASHES PER YR	ANNUAL COSTS
BEFORE	4.00	1	0.25	2	0.50	1	0.25	\$134,975
AFTER	2.42	0	0.00	2	0.83	2	0.83	\$18,099

Annual Benefits from Crash Cost Savings \$116,876

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = \$94,121

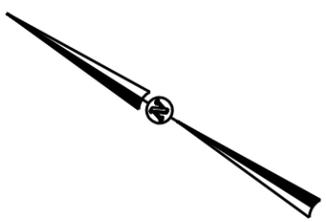
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 5.14

TOTAL COST OF PROJECT - \$150,000 COMPREHENSIVE B/C RATIO - 5.14



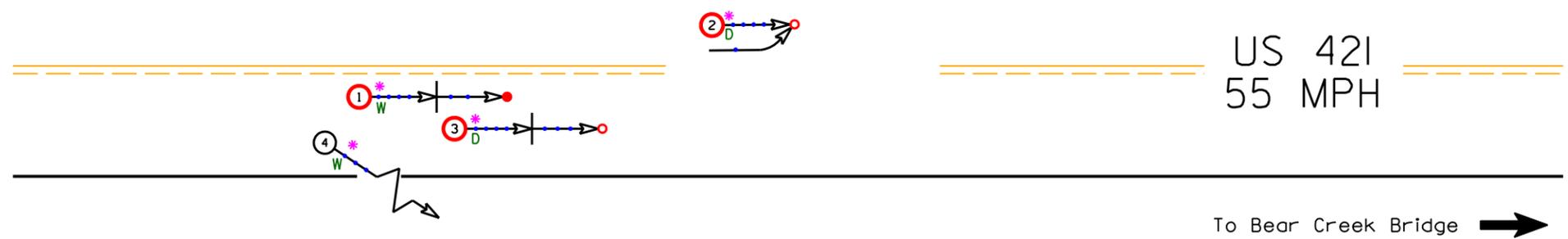
LEGEND

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



SS# 08-99-211
 Chatham County
 near Town of Goldston
 BEFORE Period
 5/1/98 - 4/30/02
 US 421 MP: 7.405

← To SR 2333 (Ralph Sipe Rd)



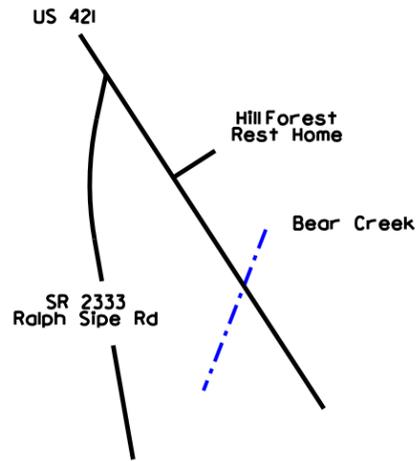
→ To Bear Creek Bridge

Target Crashes

TRANSPORTATION MOBILITY and SAFETY DIVISION

	COLLISION DIAGRAM	
	DIVISION: 8	AREA: 1
STUDY PERIOD: 5/1/1998 - 4/30/2002		
DISTANCE: Y-LINE = 300FT		
ANALYSIS PREPARED BY: JBS		
ANALYSIS CHECKED BY: BR		
DIAGRAM PREPARED BY: JBS		
DIAGRAM REVIEWED BY: ST		
SCALE: NOT TO SCALE		
DATE: 10-22-2008		
LOG NUMBER: SS* 08-99-211BEFORE		

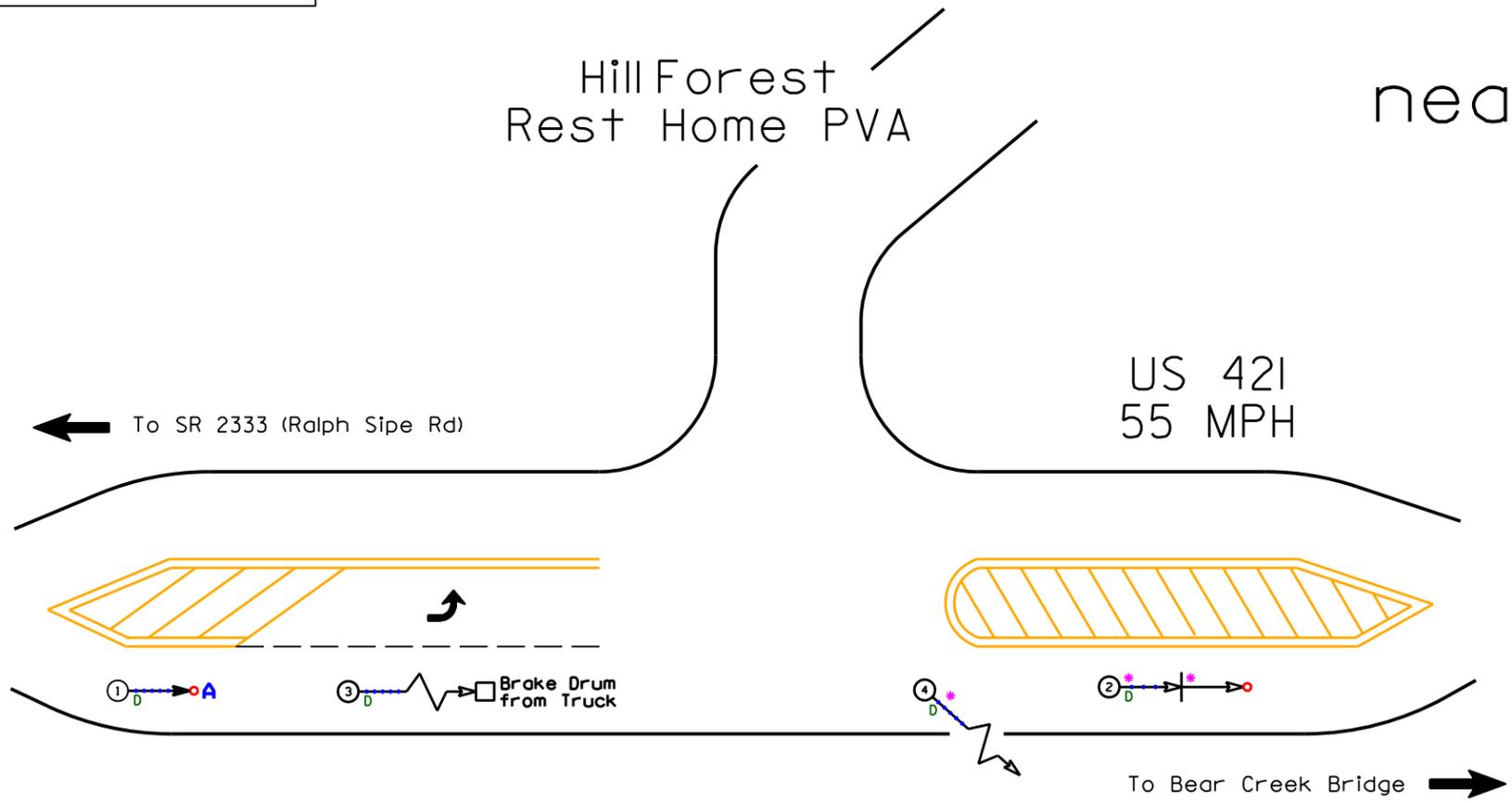
N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRAFFIC ENGINEERING AND SAFETY
SYSTEMS BRANCH



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
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	RAN OFF ROAD				70 AND UP		OILY

SS# 08-99-211
 Chatham County
 near Town of Goldston
 AFTER Period
 7/1/02 - 11/30/04
 US 421 MP: 7.405



Target Crashes

TRANSPORTATION MOBILITY and SAFETY DIVISION

	COLLISION DIAGRAM	
	DIVISION: 8	AREA: 1
	STUDY PERIOD: 7/1/2002 - 11/30/2004	
	DISTANCE: Y-LINE = 300FT	
ANALYSIS PREPARED BY: JBS		
ANALYSIS CHECKED BY: BR		
DIAGRAM PREPARED BY: JBS		
DIAGRAM REVIEWED BY: ST		
SCALE: NOT TO SCALE		
DATE: 10-22-2008		
LOG NUMBER: SS* 08-99-211AFTER		

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