

Spot Safety Project Evaluation

Project Log # 200611053

Spot Safety Project # 11-00-209

Spot Safety Project Evaluation of the Installation of Truck-Actuated Warning Flashers on Existing Truck Warning Signs on the US 321/421 Approaches to NC 194 Watauga 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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3/24/08
Date

Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 11-00-209 – The approaches of US 321/421 to NC 194 in Watauga County.

Project Information and Background from the Project File Folder

The spot safety project improvement countermeasure chosen for the subject location was the installation of truck-actuated warning beacons on existing truck warning signs.

NC 194 is a narrow two-lane road with sharp horizontal curves and steep grades. Signs are located on US 321/421 recommending vehicles over 35 feet in length not use NC 194. It was on these signs on which the truck-actuated warning beacons were installed.

The original statement of problem was that trucks would enter and attempt to travel along NC 194, often resulting in an overturn in a sharp horizontal curve. Trucks which did not overturn would often have to back up, sometimes with the help of law enforcement, after realizing that they could not continue traveling on NC 194 due to the sharp curves.

The initial crash analysis was completed from January 1, 1997 to January 1, 2000 with three reported truck crashes. All three of these crashes involved a truck overturning. The final completion date for the improvement at the subject location was on April 24, 2002 with a total cost of \$32,000.00.

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 March 1, 2002 to May 31, 2002. The before period consisted of reported crashes from December 1, 1996 through February 28, 2002 (5 years and 3 months) and the after period consisted of reported crashes from June 1, 2002 through August 31, 2007 (5 years and 3 months). The ending date for this analysis was determined by the available crash data at the time the analysis was completed.

The treatment data consisted of all crashes on NC 194 from US 321/421 to SR 1112 (Broadstone), a distance of approximately 3.75 miles. *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 crashes involving trucks were the target crashes for the applied countermeasure.

Treatment Information			
	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	37	36	-2.7
Total Severity Index	4.65	7.27	56.3
Target Crashes	4	2	-50.0
Target Crash Severity Index	1	1	0.0
Volume	1,800	2,100	16.7

The naive before and after analysis at the treatment location resulted in a 3 percent decrease in Total Crashes, a 50 percent decrease in Target Crashes, and a 17 percent increase in the Average Daily Traffic (ADT). The before period ADT year was 1999 and the after period ADT year was 2005.

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 3 percent decrease in Total Crashes and a 50 percent decrease in Target Crashes. The summary results above demonstrate that both Total Crashes and Target Crashes appear to have decreased at the treatment location from the before to the after period.

The calculated benefit to cost ratio for this project is 0.28 considering target crashes. The benefit to cost ratio was not calculated for total crashes due to the warning flashers having no affect on regular (non-truck) traffic on NC 194. 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.

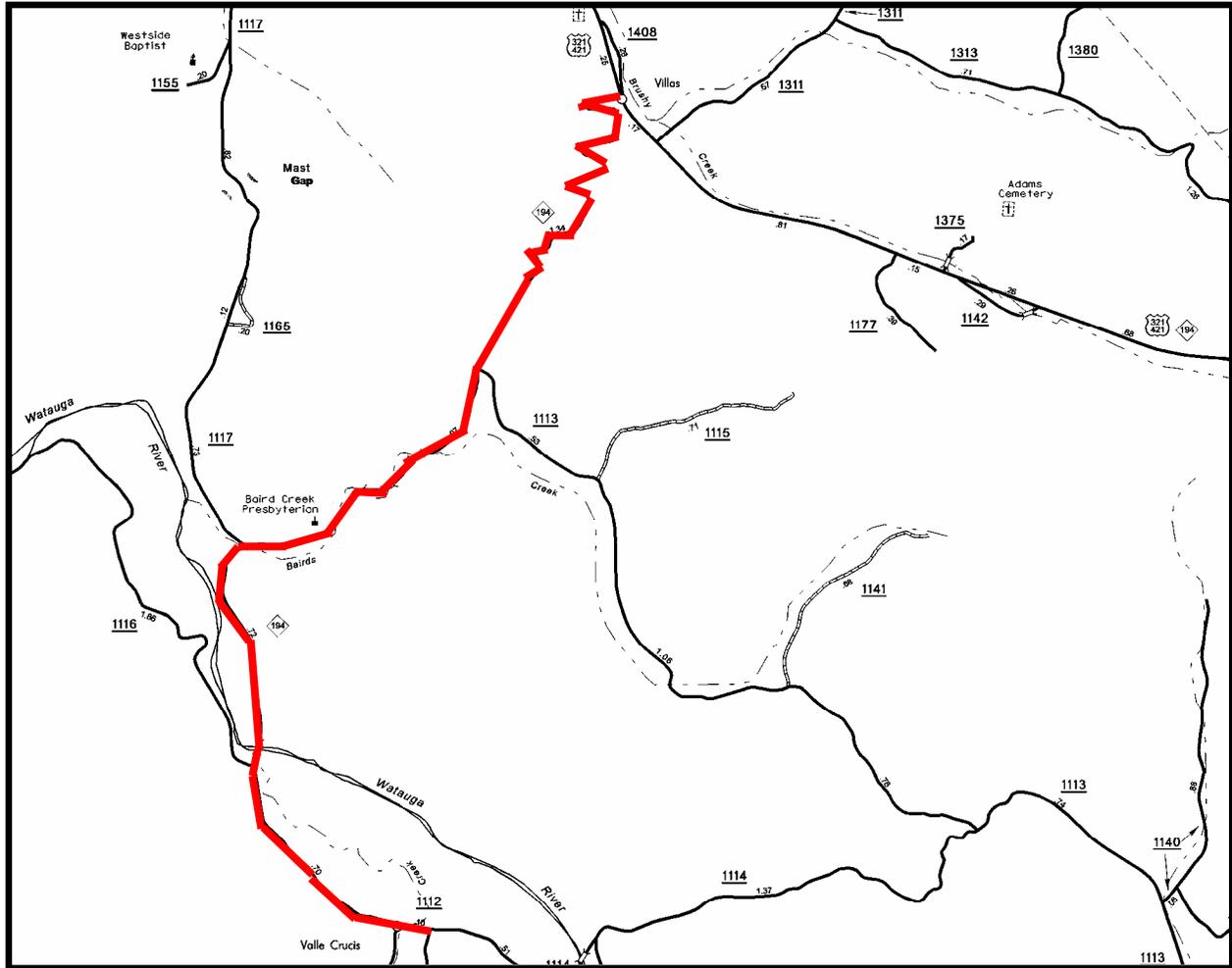
After closer examination of the crash reports and diagrams, it appears that all the truck crashes in both the before and the after periods involved trucks that were traveling north on NC 194. Trucks traveling north on NC 194 would not see the truck-actuated warning beacons installed on US 321/421. It is possible that the trucks were originally traveling south on NC 194 and decided to turn around, although no indication is given on the crash reports that this was the case.

Please note that the naïve before and after analysis does not show any operational benefits that the roadway might have experienced due to the project. As stated in the above *Project Background* section, trucks would sometimes turn onto NC 194 only to have to back up when the drivers realized that they could not make it around the curves. This analysis cannot show if this movement was reduced due to the installation of the warning flashers

Please see the attached *Treatment Site Photos*. Photos are provided for both approaches to NC 194 on US 321/421, as well as photos traveling on NC 194

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 section.

Location Map
Watauga County
Evaluation of Spot Safety Project #11-00-209



Treatment Location: NC 194 from US 321/421 to SR 1112 (Broadstone)

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: NC 194 from US 321/421 to SR 1112
 COUNTY: Watauga
 FILE NO.: SS11-00-209

BY: Brad Robinson
 DATE: 3/19/2008

DETAILED COST: TYPE IMPROVEMENT - truck-actuated warning flashers

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$0	0	0.000	\$0
	\$32,000	10	0.149	\$4,769
Right-of-Way	\$0	0	0.000	\$0
TOTALS	\$32,000	10	0.149	\$4,769

ESTIMATED INCREASE IN ANNUAL MAINT. COST = \$500
 ESTIMATED INCREASE IN ANNUAL UTILITY COST = \$350
 TOTAL ANNUAL COST= \$5,619
 TOTAL COST OF PROJECT= \$32,000

COMPREHENSIVE COST REDUCTION:

ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES

TIME PERIOD	YEARS	ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES				PDO		ANNUAL COSTS
		K & A CRASHES	K & A CRASHES PER YR	B & C CRASHES	B & C CRASHES PER YR	CRASHES	CRASHES PER YR	
BEFORE	5.25	0	0.00	0	0.00	4	0.76	\$3,124
AFTER	5.25	0	0.00	0	0.00	2	0.38	\$1,562

Annual Benefits from Crash Cost Savings \$1,562

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = (\$4,057)

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 0.28

TOTAL COST OF PROJECT - \$32,000 COMPREHENSIVE B/C RATIO - 0.28

Treatment Site Photos Taken March 17, 2008



Traveling Eastbound on US 321/421



Traveling Westbound on US 321/421



Traveling Southbound on NC 194



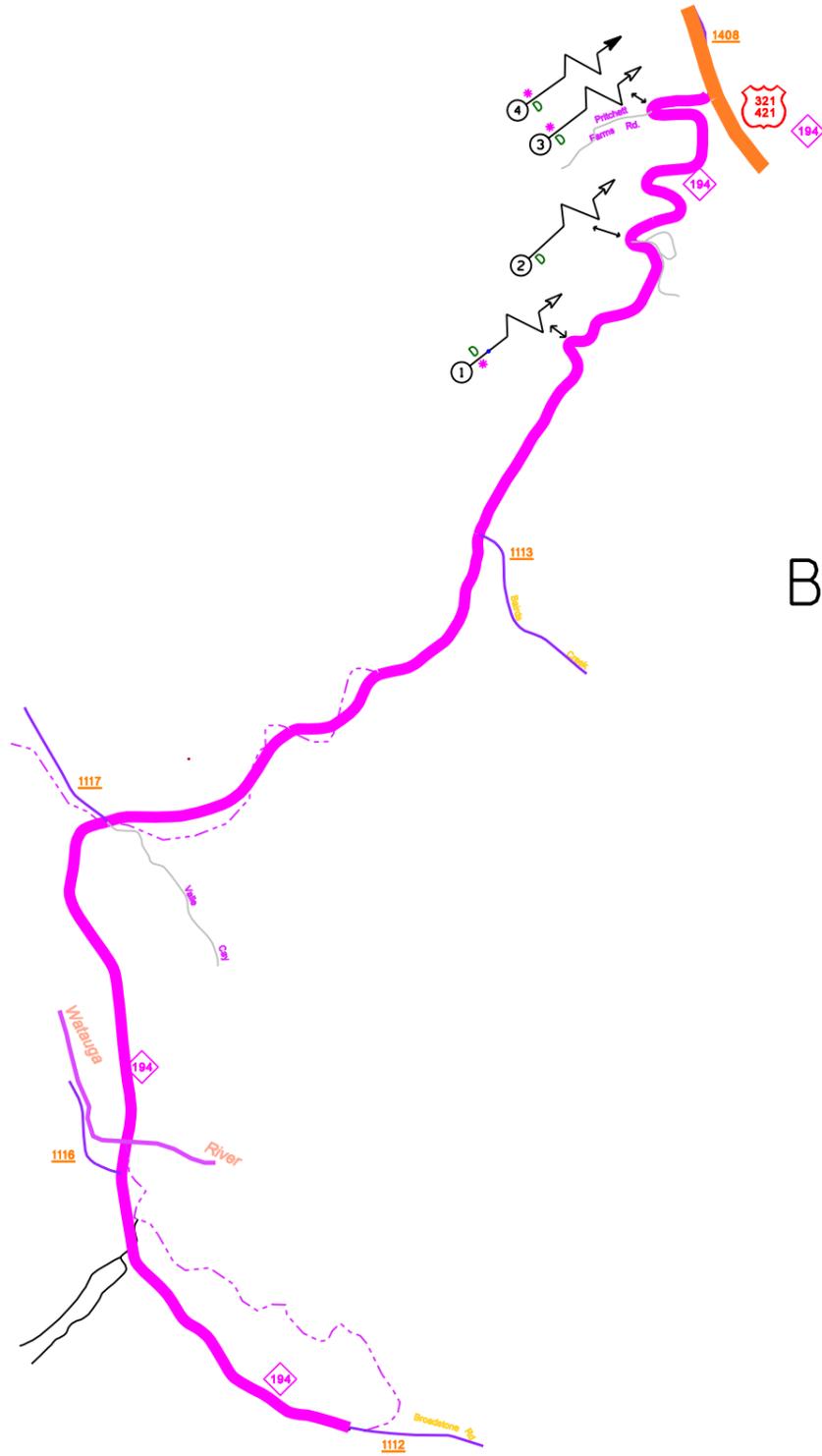
Traveling Southbound on NC 194



Traveling Southbound on NC 194



Traveling Southbound on NC 194



LEGEND

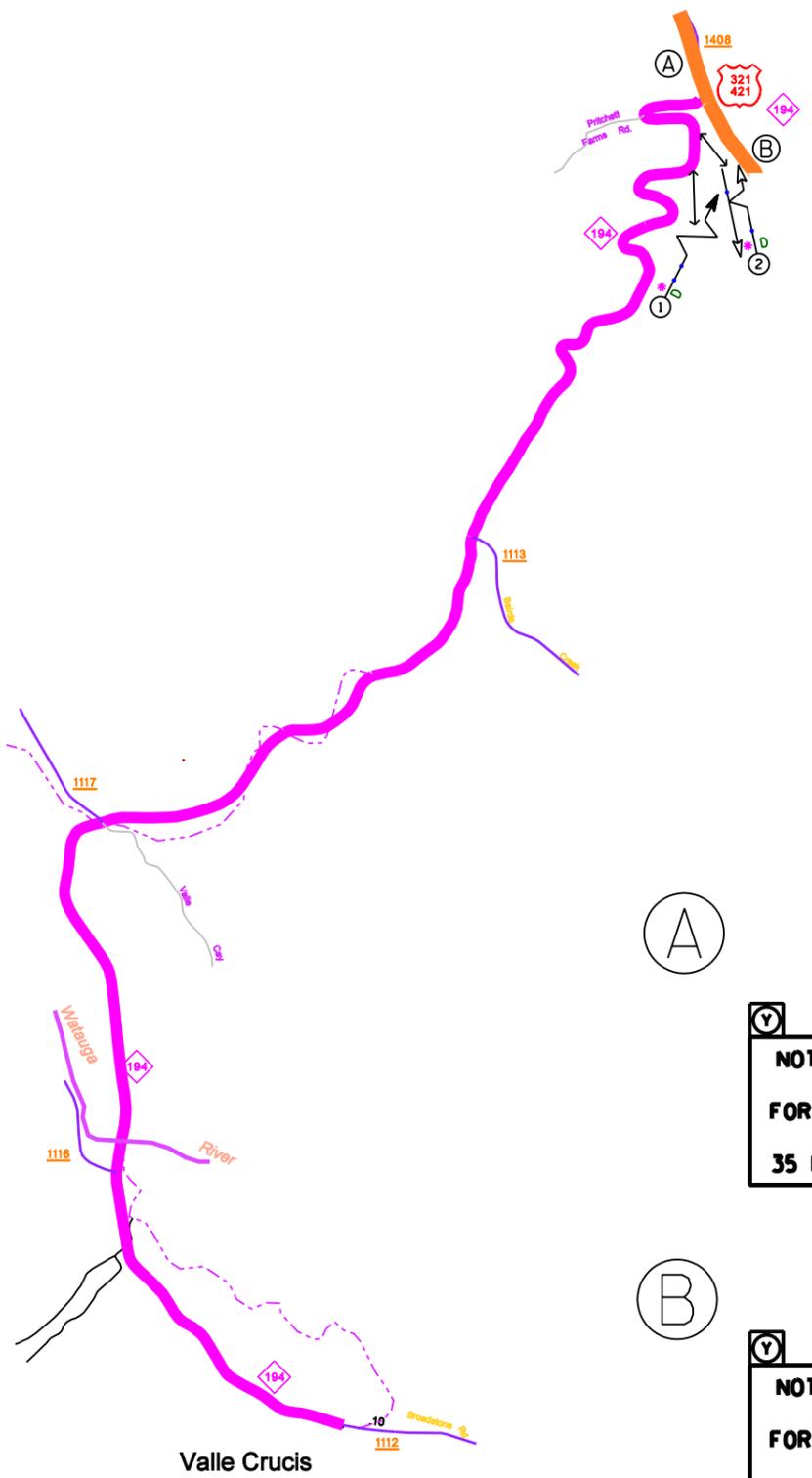
	MOVING VEHICLE		ANGLE		9 MPH OR LESS		PEDESTRIAN
	PEDESTRIAN		TURNING		10 MPH TO 19		TRAIN
	PARKED VEHICLE		BACKING		20 MPH TO 29		DRIVER AT FAULT
	PARKING VEHICLE		SIDESWIPE		30 MPH TO 39		DRY
	FIXED OBJECT		OUT OF CONTROL		40 MPH TO 49		WET
	HEAD ON		INJURY		50 MPH TO 59		ICY OR SNOWY
	REAR END		FATALITY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

SS# II-00-209
 Watauga County
 BEFORE Period-Target Crashes only
 12/1/1996 - 2/28/2002
 NC 194 From US 321/421 to SR 1112

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

	COLLISION DIAGRAM	
	DIVISION: II	AREA:
STUDY PERIOD: 12/1/1996 TO 2/28/2002		
DISTANCE: Y-LINE + OF 1		
ANALYSIS PREPARED BY: BDR		
ANALYSIS CHECKED BY:		
DIAGRAM PREPARED BY: BDR		
DIAGRAM REVIEWED BY:		
SCALE: NOT TO SCALE		
DATE: January 2008		
LOG NUMBER: 2006R053		

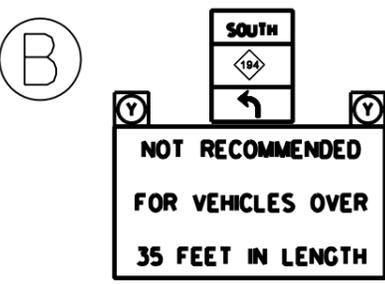
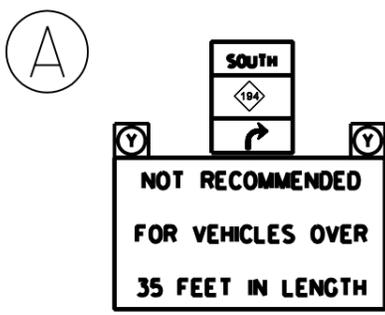
N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRAFFIC ENGINEERING AND SAFETY
SYSTEMS BRANCH



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		SPEED UNKNOWN		

SS# II-00-209
 Watauga County
 AFTER Period - Target Crashes Only
 6/1/2002 - 8/31/2007
 NC 194 From US 321/421 to SR 1112



TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

	COLLISION DIAGRAM	
	DIVISION: II	AREA:
STUDY PERIOD: 6/1/2002 TO 8/31/2007		
DISTANCE: Y-LINE : OF T		
ANALYSIS PREPARED BY: BDR		
ANALYSIS CHECKED BY:		
DIAGRAM PREPARED BY: BDR		
DIAGRAM REVIEWED BY:		
SCALE: NOT TO SCALE		
DATE: January 2008		
LOG NUMBER: 2006R053		
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