Spot Safety Project Evaluation

Order # 41000007977

Spot Safety Project # 12-02-205

Spot Safety Project Evaluation of the Positive Bridge Pier Protection Median Barrier, Guardrail, and Tracc System Installation US 321 from 14th Street SW Overpass to Main Avenue SW Catawba County, City of Hickory

Documents Prepared By:

Safety Evaluation Group
Traffic Safety Systems Management Section
Transportation Mobility and Safety Division
North Carolina Department of Transportation

Principal Investigator

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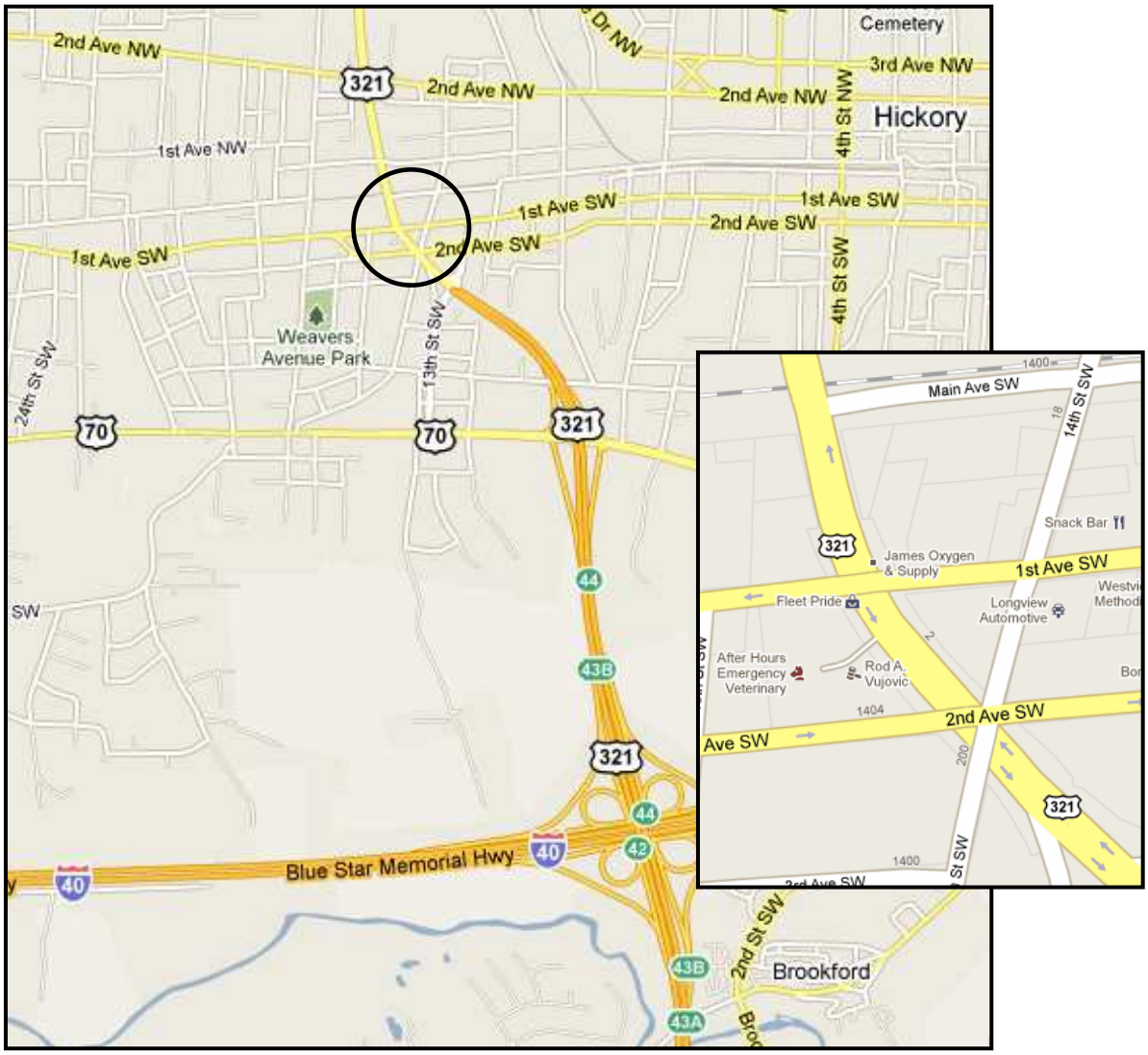
Traffic Safety Project Engineer

11-10-2010
Date

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 12-02-205 located along the segment of US 321 from the 14th Street SW overpass to the Railroad Bridge north of Main Ave SW in Catawba County, City of Hickory.



Project Limits: US 321 Milepost

Begin Study: MP 14.322 (150 feet South of 14th Street SW Overpass)
End Study: MP 14.738 (150 feet North of Railroad Track Overpass)

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 concrete median barrier, approach guardrail, and Tracc System guardrail along the unprotected bridge piers of US 321. US 321 is a four-lane divided facility at this location with a 45 mph posted speed limit. The before period presented median and shoulder guardrail along this strip but the bridge piers were not positively protected themselves. The overpasses of SR 2231 (2nd Ave SW), SR 1692 (1st Ave SW), and the C&NW Railroad Overpass were all improved.

The original statement of problem was that the exposed bridge piers were within the 30 foot shoulder recovery area for errant vehicles. This was a safety improvement to protect motorists in the case of a ran-off roadway type collision.

The initial crash analysis was completed from January 1, 1999 to December 31, 2001 with ten (10) reported crashes, one (1) of which was deemed correctable. The final completion date for the improvement at the subject intersection was on June 14, 2005 with a total cost of $140,000.

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 May through June 2005. The before period consisted of reported crashes from May 1, 2000 through April 30, 2005 (5 years); and the after period consisted of reported crashes from July 1, 2005 through June 30, 2010 (5 years). 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 along the segment from 150 feet south of the 14th Street SW overpass (MP 14.322) to 150 feet north of the Railroad Overpass (MP 14.738). *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 a particular crash type was not selected as a Target Crash. However, in the tables below we separated out ran-off road crashes that struck the bridge piers in the before period and the ran-off roadway crashes that struck the protective countermeasures of the bridge piers in the after period.

Treatment Information	**Before**	**After**	**Percent Reduction (-) Percent Increase (+)**
Total crashes	24	24	0.0 %
Total Severity Index	6.01	1.93	- 67.9 %
Vehicles Striking Bridge Piers	3	0	- 100.0 %
Bridge Strike Crash Severity Index	31.20	0.00	- 100.0 %
Vehicles Hit Bridge Protection Items	0	4	100.0 %
Protection Crash Severity Index	0.00	4.70	100.0 %
Volume (2002, 2007)	39,700	39,700	0.0 %

Injury Crash Summary	**Before**	**After**	**Percent Reduction (-) Percent Increase (+)**
Fatal injury Crashes	1	0	- 100.0 %
Class A injury Crashes	0	0	N/A
Class B injury Crashes	3	0	- 100.0 %
Class C Injury Crashes	3	3	0.0 %
Total Injury Crashes	7	3	- 57.1 %

The naive before and after analysis at the treatment location resulted in a zero percent change in Total Crashes but a 68 percent decrease in the Total Severity Index. The before period ADT year was 2002 and the after period ADT year was 2007.

Results and Discussion

Referencing the *Collision Diagrams*, the before period presented three (3) collisions along this segment of vehicles striking the exposed bridge piers. Of these crashes, one (1) resulted in a fatality injury where the driver of the vehicle crashed into the concrete bridge pier at over 80 mph. The other two before period collisions resulted in C-class injuries. After the barrier and guardrail improvements, there were four (4) crashes that explicitly indicated striking at a bridge pier. There were two C-class and two PDO after period collisions.

Also examining the *Collision Diagrams*, there appears to be an increase in wet-roadway type accidents during the after period. Traveling northbound, wet lane departure crashes (including ice) increased from two (2) to eight (8) through the analysis. Southbound wet lane departure crashes also increased from zero (0) to two (2) in the after period. Of note, none of the bridge pier or protection strikes occurred during wet roadway conditions. Overall, total crashes along this segment remained the same through the evaluation.

The calculated benefit to cost ratio for this project is **6.39 considering total crashes**. 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 multiple points along the segment showing the approaches to the overpass treatment spots. 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 location.

TREATMENT SITE PHOTOS

Traveling North on US 321 approaching 14th Street SW Overpass

Traveling North on US 321 approaching 1st Avenue SW Overpass

Traveling North on US 321 approaching Railroad Overpass
Intersection of Main Avenue SW to the right

Traveling South on US 321 approaching 2nd Avenue SW Overpass

BENEFIT-COST ANALYSIS WORKSHEET - Total Crashes

LOCATION: US 321 - MP 14.322 - 14.738 BY: JBS
COUNTY: Catawba DATE: 11/9/2010
FILE NO.: SS 12-02-205

DETAILED COST: TYPE IMPROVEMENT - Guardrail Protecting Bridge Piers

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	$140,000	10	0.149	$20,864
	$0	0	0.000	$0
Right-of-Way	$0	0	0.000	$0
TOTALS	$140,000	10	0.149	$20,864

ESTIMATED INCREASE IN ANNUAL MAINT. COST = $200
ESTIMATED INCREASE IN ANNUAL UTILITY COST = $0

TOTAL ANNUAL COST= $21,064
TOTAL COST OF PROJECT= $140,000

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	5.00	1	0.20	6	1.20	17	3.40	$164,620
AFTER	5.00	0	0.00	3	0.60	21	4.20	$30,060

Annual Benefits from Crash Cost Savings $134,560

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = $113,496

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 6.39

TOTAL COST OF PROJECT - $140,000 COMPREHENSIVE B/C RATIO - 6.39

SS# 12-02-205
Order# 41000007977
Catawba County
City of Hickory
BEFORE Period
5/1/00 - 4/30/05

LEGEND

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

END STUDY
MP 14.738

BEGIN STUDY
MP 14.322

To
2nd Ave NW

To
13th St. SW

Main Ave SW

Railroad Overpass

1st Avenue SW Overpass

2nd Avenue SW Overpass

14th Street SW Overpass

US 321
45 MPH

Coal from passing train struck vehicle

Bridge Strike
Target Crashes

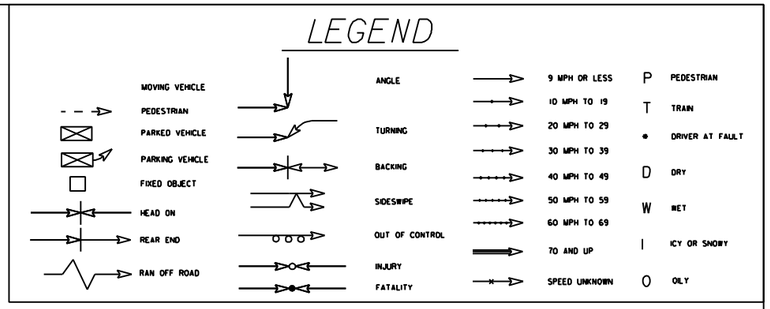
N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRANSPORTATION MOBILITY and SAFETY DIVISION

TRAFFIC SAFETY UNIT

Date: 11-8-2010

Prepared By: J. Schronce

SS# 12-02-205
Order# 41000007977
Catawba County
City of Hickory
AFTER Period
7/1/05 - 6/30/10



Countermeasure:
Add Concrete Median Barrier,
approach guardrail, & Tracc System
for positive protection of bridge piers

Bridge Strike
Target Crashes

N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
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TRAFFIC SAFETY UNIT

Date: 11-8-2010 | **Prepared By: J. Schronce**