

Spot Safety Project Evaluation

Project Information

Order ID: 41000033707

Project ID: 05-09-203

Location: US 1 (Capital Blvd) at I-540 EB Ramp and I-540 WB Ramp

County: Wake

City: Raleigh

Division: 5

Signal ID: 05-2017 (EB Ramp) & 05-2018 (WB Ramp)

Countermeasure: Install an additional signal head at each intersection for northbound US 1, center heads over the travel lanes, and install backplates.

Project Completion: Between May 16, 2010 – March 30, 2011

Project Cost: \$22,400

Map and Aerial (from Google maps – Coordinates are 35.875417, -78.576706)



Naive Before and After Analysis

- Before Period: July 1, 2006 through March 31, 2010 (3.75 years)
- Const. Period: April 1, 2010 through March 31, 2011
- After Period: April 1, 2011 through December 31, 2014 (3.75 years)
- Analysis Criteria: Treatment data consists of all crashes within 150 feet of the subject intersections
- Target Crashes: (1) Angle Crashes (at the WB I-540 Ramp) and Left Turn Same Roadway (LTSR) Crashes (at the EB I-540 Ramp) involving a red light runner on Northbound US 1 (including crashes with fault unknown)
(2) Rear End Crashes on Northbound US 1, approaching the study intersections

Overall – Both Intersections Combined

<u>Treatment Information</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	170	206	+ 21.2 %
Total Severity Index	4.37	2.40	- 45.1 %
Target Crash 1 (Red Light Runner)	33	21	- 36.4 %
Target Crash 1 Severity Index	8.01	5.58	- 30.3 %
Target Crash 2 (Rear End)	22	12	- 45.5 %
Target Crash 2 Severity Index	4.36	2.85	- 34.6 %
Volume (2008, 2013)	60,400	57,700	- 4.5 %

<u>Injury Crash Summary</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Fatal injury Crashes	2	0	- 100.0 %
Class A injury Crashes	0	0	0.0 %
Class B injury Crashes	16	9	- 43.8 %
Class C Injury Crashes	41	30	- 26.8 %
Property Damage Only	111	167	+ 50.5 %

US 1 at EB I-540 Ramp

<u>Treatment Information - EB Ramp</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	111	166	+ 49.5 %
Total Severity Index	3.75	2.25	- 40.0 %
Target Crash 1 (Red Light Runner)	17	13	- 23.5 %
Target Crash 1 Severity Index	8.94	6.12	- 31.5 %
Target Crash 2 (Rear End)	14	8	- 42.9 %
Target Crash 2 Severity Index	4.17	2.85	- 31.7 %

US 1 at WB I-540 Ramp

<u>Treatment Information - WB Ramp</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	59	40	- 32.2 %
Total Severity Index	5.55	3.03	- 45.4 %
Target Crash 1 (Red Light Runner)	16	8	- 50.0 %
Target Crash 1 Severity Index	7.01	4.70	- 33.0 %
Target Crash 2 (Rear End)	8	4	- 50.0 %
Target Crash 2 Severity Index	4.70	2.85	- 39.4 %

Additional Information

<u>Additional Information</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Night Crashes - Target Crash 1 & 2	18	10	- 44.4 %
Wet Crashes - Target Crash 1 & 2	16	8	- 50.0 %

Overall Summary Results

Overall - Both Intersections Combined

Total Crashes:	+ 21 %	(increase)
Total Crash Severity:	- 45 %	(reduction)
Target Crash 1 (Red Light Runner):	- 36 %	(reduction)
Target Crash 1 Severity:	- 30 %	(reduction)
Target Crash 2 (Rear End):	- 46 %	(reduction)
Target Crash 2 Severity:	- 35 %	(reduction)
Volume:	- 5 %	(reduction)

US 1 at EB I-540 Ramp

Total Crashes:	+ 50 %	(increase)
Total Crash Severity:	- 40 %	(reduction)
Target Crash 1 (Red Light Runner):	- 24 %	(reduction)
Target Crash 1 Severity:	- 32 %	(reduction)
Target Crash 2 (Rear End):	- 43 %	(reduction)
Target Crash 2 Severity:	- 32 %	(reduction)

US 1 at WB I-540 Ramp

Total Crashes:	- 32 %	(reduction)
Total Crash Severity:	- 45 %	(reduction)
Target Crash 1 (Red Light Runner):	- 50 %	(reduction)
Target Crash 1 Severity:	- 33 %	(reduction)
Target Crash 2 (Rear End):	- 50 %	(reduction)
Target Crash 2 Severity:	- 39 %	(reduction)

Additional Summary Results

Night Crashes – Target Crash 1 & 2:	- 44 %	(reduction)
Wet Crashes – Target Crash 1 & 2:	- 50 %	(reduction)

Items for Discussion/Concerns

The additional signal head and backplates installed at both ramp intersections appears to have reduced the overall number of northbound US 1 red light running crashes (Target Crash 1) and northbound rear end crashes approaching the intersections (Target Crash 2). Target crashes include those that may be impacted by improved signal visibility and conspicuity on northbound US 1 during all hours of the day. Target crashes that occurred under reduced visibility (night and wet conditions) were also reduced substantially.

At the WB Ramp intersection, Total Crashes and Target Crashes decreased in the after period.

At the EB Ramp intersection, Target Crashes decreased in the after period, although Total Crashes increased substantially and created an overall increase in Total Crashes for the project. The increase in crashes at the EB Ramp intersection is due mainly to an increase in crashes on the ramp. The crash types with the largest increase in crash frequency are Rear End crashes on the ramp and Right Turn Different Road (RTDR) Crashes involving right turners from the ramp not yielding to southbound vehicles. Below is a breakdown of crashes on the EB Ramp, involving at fault vehicles on (or coming from) the ramp.

<u>US 1 @ I-540 EB Ramp Crashes Involving Ramp Vehicles at Fault</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Crash Types			
Total Crashes	63	112	+ 78 %
Rear End Crashes	50	84	+ 68 %
Right Turn Different Road (RTDR) Crashes	6	18	+ 200 %
Sideswipe Crashes	5	8	+ 60 %
Other Crashes	2	2	0 %
Time of Day Information			
4 AM – 10 AM	10	21	+ 110 %
10 AM – 4 PM	27	50	+ 85 %
4 PM – 10 PM	24	41	+ 71 %
10 PM – 4 AM	2	0	- 100 %
Peak Hour 1 (# of Crashes)	4 - 5 PM (8)	3 - 4 PM (12)	n/a
Peak Hour 2 (# of Crashes)	5 - 6 PM (7)	6 - 7 PM (12)	n/a

At the EB Ramp intersection, Target Crash 1 includes Left Turn Same Roadway Crashes (LTSR) with a northbound vehicle at fault (note: LTSR Crashes are the only crash type for Target Crash 1 at this intersection because thru and left movements are prohibited from the ramp). This target crash type decreased by 24% from 17 to 13 crashes; however, LTSR with a southbound left turner at fault increased by 450% from 2 to 11 crashes. Southbound tractor/trailers were at fault in 4 of the 11 after period crashes where a left turner was at fault. Also, 8 of 11 after period crashes occurred from 3-8 pm.

Data Prepared For

The Traffic Safety Unit *of the*
Transportation Mobility and Safety Division *of the*
Division of Highways *of the*
North Carolina Department of Transportation

Data Prepared By

Principal Investigator: Carrie L. Simpson, PE

Work Group/Consultant: NCDOT - Safety Evaluation Group

Date: July 21, 2015

SS #05-09-203
 Order # 41000033707
 Wake County

Capital Blvd at I-540 EB Ramps

Eastbound Off Ramp	
Rear End Crashes:	Before 50 / After 84
Sideswipe Crashes:	Before 5 / After 8
Other Crashes:	Before 2 / After 2

I-540 EB Ramp
 No Posted Speed
 -4% Grade

AADT (Year)
 14,000 (2008)
 15,000 (2013)

LEGEND

MOVING VEHICLE	ANGLE	9 MPH OR LESS	P PEDESTRIAN
PEDESTRIAN	TURNING	10 MPH TO 19	A ANIMAL
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 SNOW
REAR END	FATALITY	60 MPH TO 69	O ONLY
RAN OFF ROAD		70 AND UP	
		SPEED UNKNOWN	

Southbound Capital	
Rear End Crashes:	Before 4 / After 5
Sideswipe Crashes:	Before 3 / After 7
Other Crashes:	Before 1 / After 2

US I (Capital Blvd)
 55 mph
 -3% Grade

AADT (Year)
 55,000 (2008)
 49,000 (2013)

Right Turn from Ramp	
EB At Fault Crashes:	Before 6 / After 18
SB At Fault Crashes:	Before 0 / After 1

Northbound Capital	
Rear End Crashes:	Before 14 / After 8
Sideswipe Crashes:	Before 1 / After 1
Other Crashes:	Before 3 / After 1

US I (Capital Blvd)
 55 mph
 +3% Grade

AADT (Year)
 45,000 (2008)
 44,000 (2013)

Left Turn-Same Roadway	
NB At Fault Crashes:	Before 17 / After 13
SB At Fault Crashes:	Before 2 / After 11

All Other Crashes	
Before 3 / After 5	

Target Crash 1 - NB Capital Blvd Red Light Runner (Includes Crashes with Fault Unknown)

Target Crash 2 - NB Capital Blvd Rear End

05-2017 SIGNAL FACE I.D. (3 Phase Fully Actuated-Raleigh Signal System)

<p>Before (7/1/2006 - 3/31/2010)</p> <p>All Heads L.E.D.</p>	<p>After (4/1/2011 - 12/31/2014)</p> <p>All Heads L.E.D.</p>
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I-540 EB Ramp
 No Posted Speed

AADT (Year)
 6,800 (2008)
 7,300 (2013)

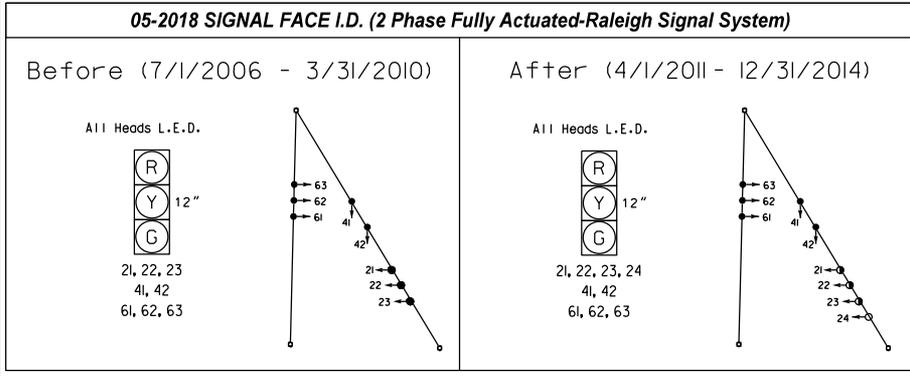
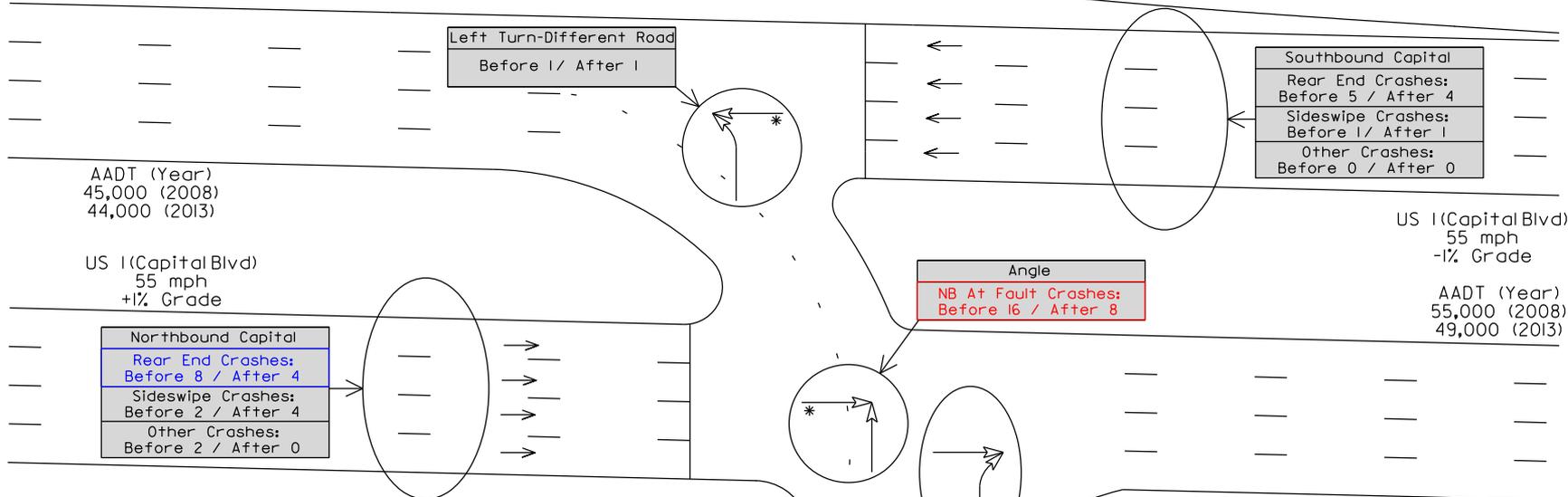
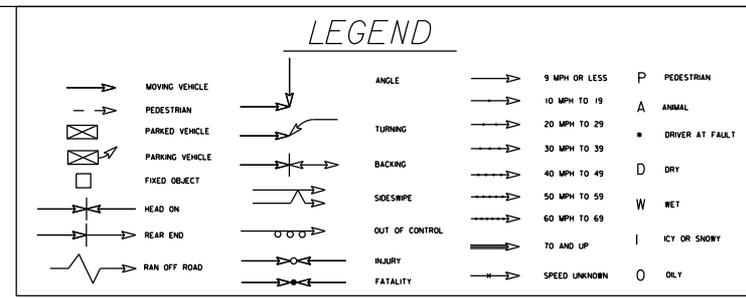
N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRANSPORTATION MOBILITY and SAFETY DIVISION

TRAFFIC SAFETY UNIT

Date: 07-10-2015 Prepared By: C Simpson

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Capital Blvd at I-540 WB Ramps



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