

Spot Safety Project Evaluation

Spot Safety Project # 03-07-213

**Spot Safety Project Evaluation of Signal Changes
(Install Advance Signal Ahead Warning Signs with Actuated Flashers
and Long Vehicle Detection Systems)**

**US 17 (Ocean Highway) at US 17 Business (Main Street)/Frontage Road
Brunswick County**

Documents Prepared By:

Hatch Mott MacDonald for

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

Principal Investigator

Amy Faulkner

Amy Faulkner

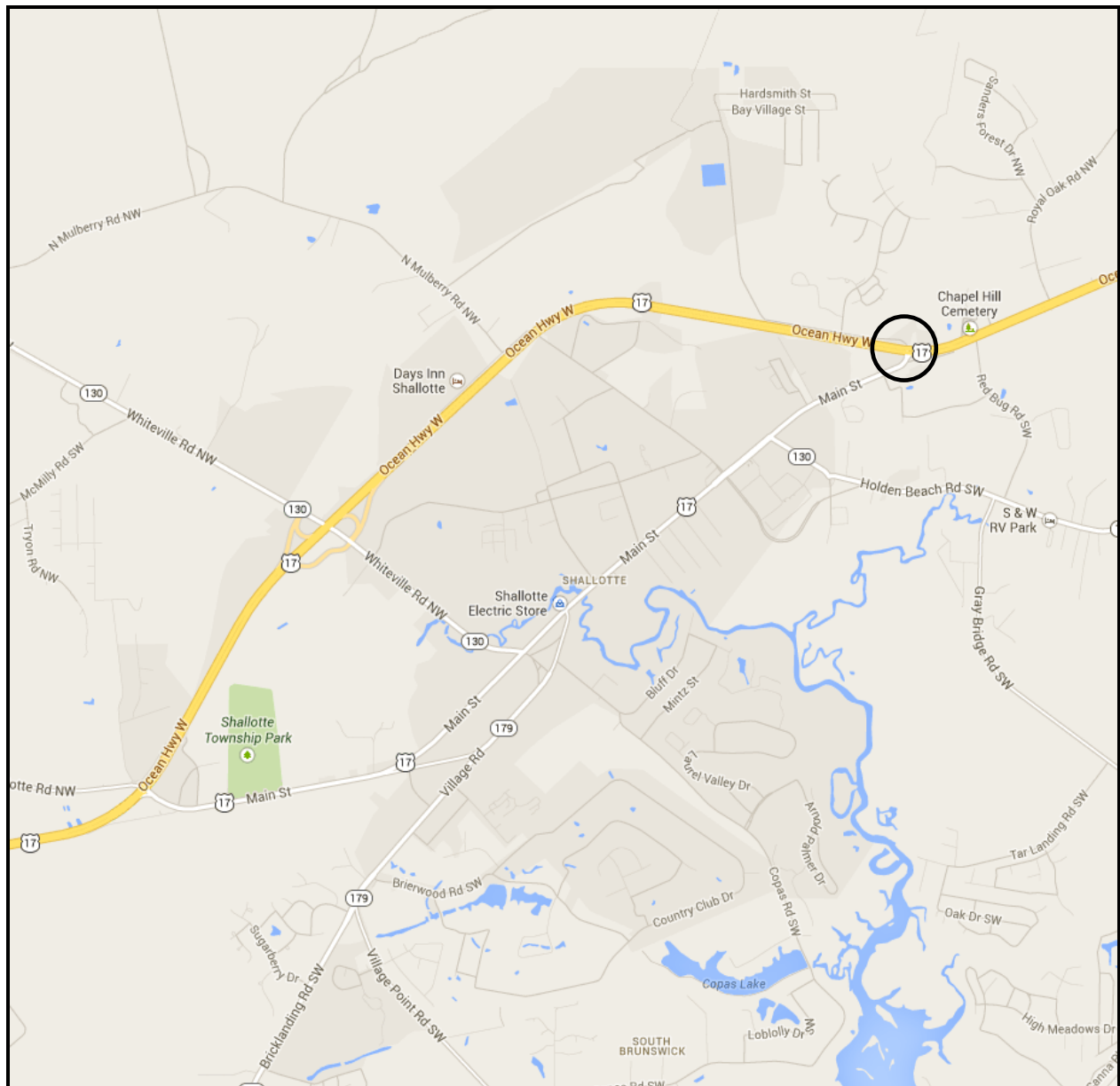
10-1-2013
Date

Spot Safety Project Evaluation Documentation

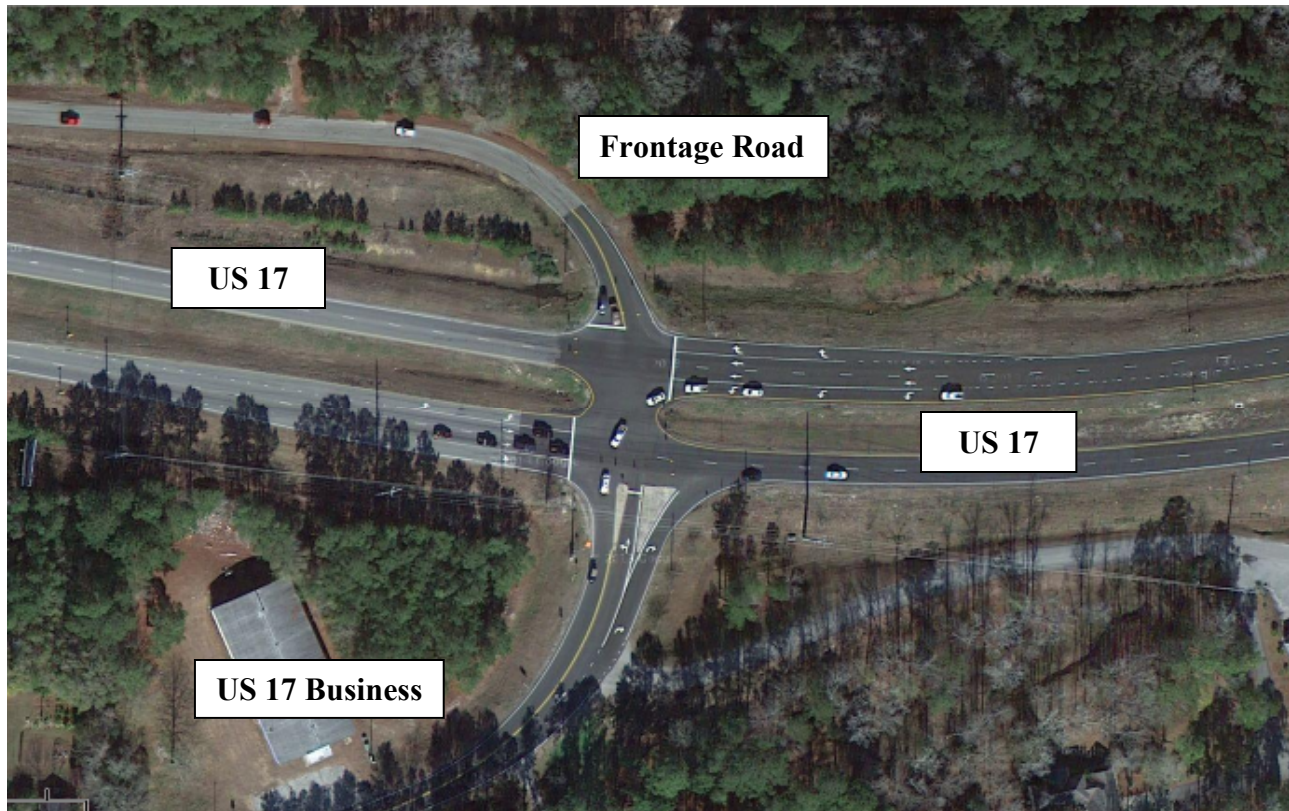
Subject Location

Evaluation of Spot Safety Project Number 03-07-213 located at the intersection of US 17 Ocean Highway) at US 17 Business (Main Street)/Frontage Road in Brunswick County, at the north end of Shallotte.

The Signal ID is 03-0594 for this 5-Phase Fully Actuated Traffic Signal.



Map Provided from Google Maps



Aerial Provided from Google Maps

Project Information and Background from the Project File Folder

The spot safety project improvement countermeasure chosen for the subject location was the installation of Advance Signal Ahead (W3-3) warning signs with actuated flashers and long vehicle detection systems on both US 17 approaches.

The subject location is a four-leg intersection controlled by an existing traffic signal. US 17 (Ocean Highway) is a 4-lane divided facility that widens to include left and right turn lanes on both approaches at the intersection. US 17 Business (Main Street) is a 2-lane facility that widens to include a right turn lane at the intersection. This leg has a traffic island separating opposing traffic as well as a traffic island that channels the right turn lane away from the through and left lane at the intersection. The right turn lane from US 17 Business (Main Street) is also controlled by a yield sign. Frontage Road is a 2-lane facility. The speed limit on US 17 (Ocean Highway) is 55 mph. The speed limit is 35 mph on US 17 Business (Main Street) and on Frontage Road.

The original statement of problem was that the existing horizontal curve along the eastern leg of the intersection reduces the sight distance for motorists. Entering vehicles have the potential of being struck by westbound vehicles on US 17 (Ocean Highway) that did not have an opportunity to come to a complete stop. The initial crash analysis was completed from November 1, 2001 to November

1, 2006 with twenty-six (26) reported crashes. The final completion date for the improvement at the subject intersection was on June 26, 2008 with a total cost of \$50,000.00.

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 were the months of May through July 2008. The before period consisted of reported crashes from June 1, 2003 through April 30, 2008 (4 years, 11 months); and the after period consisted of reported crashes from August 1, 2008 through June 30, 2013 (4 years, 11 months). 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 within 150 feet of the intersection of US 17 (Ocean Highway) at US 17 Business (Main Street)/Frontage Road for all approaches. *Please see attached location map and aerial map for further details.*

The following data table depicts the Naive Before and After Analysis for the treatment location. Please note that Target Crashes for the applied countermeasure include Frontal Impact crashes in which mainline (US 17) through vehicles ran the red light as well as Rear-End crashes involving US 17 through vehicles. Crashes were also included in which the mainline vehicle appeared to run the red light, but fault could not be determined from the crash report. In addition, one before period Sideswipe-Same Direction Crash (caused by hard braking of a tractor-trailer) was also included as a target crash. As a subset of these target crashes, collisions involving heavy trucks (coded as Truck/trailer, Truck/tractor, Tractor/semi-trailer, Tractor/doubles, or Unknown heavy truck) were also identified to further evaluate the addition of the Long Vehicle Detection Systems.

<u>Treatment Information</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	57	73	+ 28.1 %
Total Severity Index	5.06	5.31	+ 4.9 %
Target Crashes	22	18	- 18.2 %
Target Crash Severity Index	6.80	8.50	+ 25.0 %
Volume (2005, 2011)	26,400	26,500	+ 0.4 %

<u>Injury Crash Summary</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Fatal Injury Crashes	0	2	N/A
Class A Injury Crashes	1	0	-100.0%
Class B Injury Crashes	6	5	- 16.7 %
Class C Injury Crashes	15	17	+ 13.3 %
Property Damage Only	35	49	+ 40.0%

The naive before and after analysis shows a 28.1 percent increase in Total Crashes at the intersection and a 4.9 percent increase in the Total Severity Index. There was an 18.2 percent

reduction in Total Target Crashes with a 25.0 percent increase in the Total Target Crash Severity Index. The before period AADT year was 2005 and the after period AADT year was 2011.

To further analyze the intersection crash patterns, the following chart shows different traffic movements and the change in crash totals through the study:

<u>Additional Information</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Red Light Run Frontal Impact Crashes (Target)	8	8	0
Westbound US 17 Rear-End Crashes (Target)	6	5	- 16.7 %
Eastbound US 17 Rear-End Crashes (Target)	8	5	- 37.5 %
Target Crashes Involving Heavy Trucks	2	0	-100.0 %
Rear-End Crashes in WB US 17 Left Turn Lane	12	8	- 33.3 %
Rear-End Crashes on NB US 17 Business	12	31	+158.3 %

Results and Discussion

Referencing the *Collision Diagrams* and the above tables, the Target Crashes were reduced from twenty-two (22) in the before period to eighteen (18) in the after period. The severity index for these target crash types increased from 6.80 in the before period to 8.50 in the after period.

The evaluation shows that the number of Red Light Run Frontal Impact crashes stayed the same from the before period to the after period. Westbound US 17 Rear-End Crashes decreased by 16.7 percent while Eastbound Rear-End crashes experienced a greater decrease of 37.5 percent. The Target Crashes Involving Heavy Trucks decreased from two (2) in the before period to zero (0) in the after period which may indicate a benefit from the installation of the Long Vehicle Detection Systems.

As also shown in the *Collision Diagrams*, Rear-End Crashes in the westbound US 17 Left Turn Lane experienced a 33.3 percent reduction from the before period to the after period. On the northbound US 17 Business (Main Street) approach, Rear-End crashes experienced an increase of 158.3 percent from twelve (12) in the before period to thirty-one (31) in the after period.

Please see the attached *Treatment Site Photos*. Photos are provided from Google Street View for all four approaches to the study intersection. As the Safety Evaluation Group facilitates additional spot safety reviews for these types of countermeasures, it is the goal to be able to provide objective and definite information regarding actual crash reduction factors for these types of treatments.

Treatment Site Photos from Google Street View



Google Maps (August 2011) – Signal Ahead Signs and Flashers on US 17 Westbound Approach



Google Maps (August 2011) – Looking West on US 17 Approach



Google Maps (August 2011) – Signal Ahead Signs and Flashers on US 17 Eastbound Approach



Google Maps (August 2011) – Looking East from US 17 Approach



Google Maps (August 2011) – Looking North from US 17 Business Approach



Google Maps (June 2013) – Looking North toward Frontage Road from Intersection

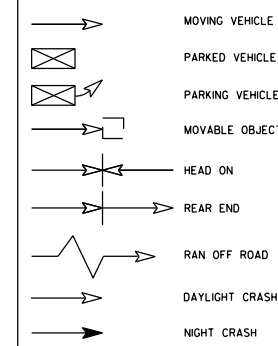
SS# 03-07-213
 Brunswick County
 BEFORE Period
 6/1/03 - 4/30/08

AAADT (Year)
 800 (2005 est.)

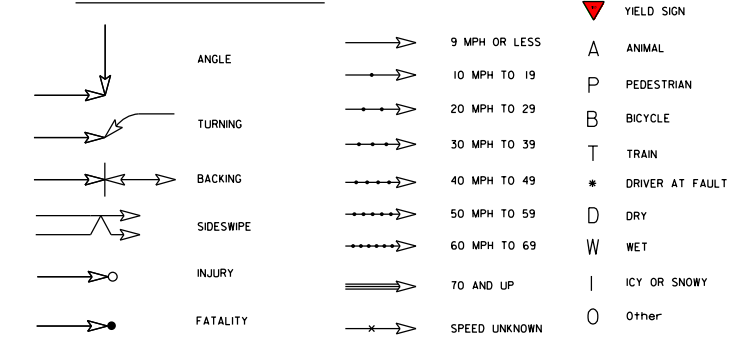
Frontage Road
 35 MPH



Target Crashes



LEGEND



US 17 (Ocean Hwy)
 55 MPH

AAADT (Year)
 21000 (2005)

US 17 (Ocean Hwy)
 55 Mph

AAADT (Year)
 21000 (2005)

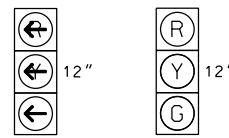
Us 17 Business
 (Main Street) 35 MPH

AAADT (Year)
 10000 (2005)

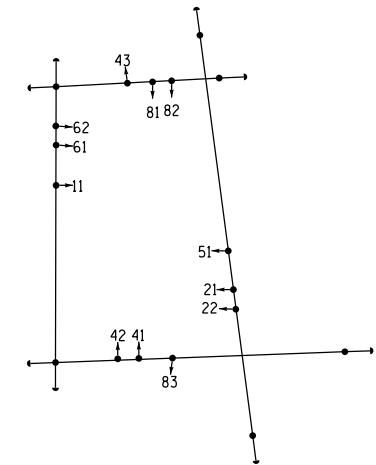
SIG. INVENTORY NO. 03-0594

SIGNAL FACE I.D.

All Heads L.E.D.



11, 51, 21, 22, 41, 42, 43, 61, 62, 81, 82, 83



NOTES-
 1. Crashes #14 and #54 involve trucks as defined in the Spot Safety Evaluation Report.
 2. Crash #14 is included as a target crash because Vehicle 1 (truck) was attempting to stop for the signal at the time of collision.

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

TRAFFIC SAFETY UNIT

Date: 10-1-13 Prepared By: Amy Faulkner, EI



SS# 03-07-213
Brunswick County
AFTER Period
8/1/08 - 6/30/13

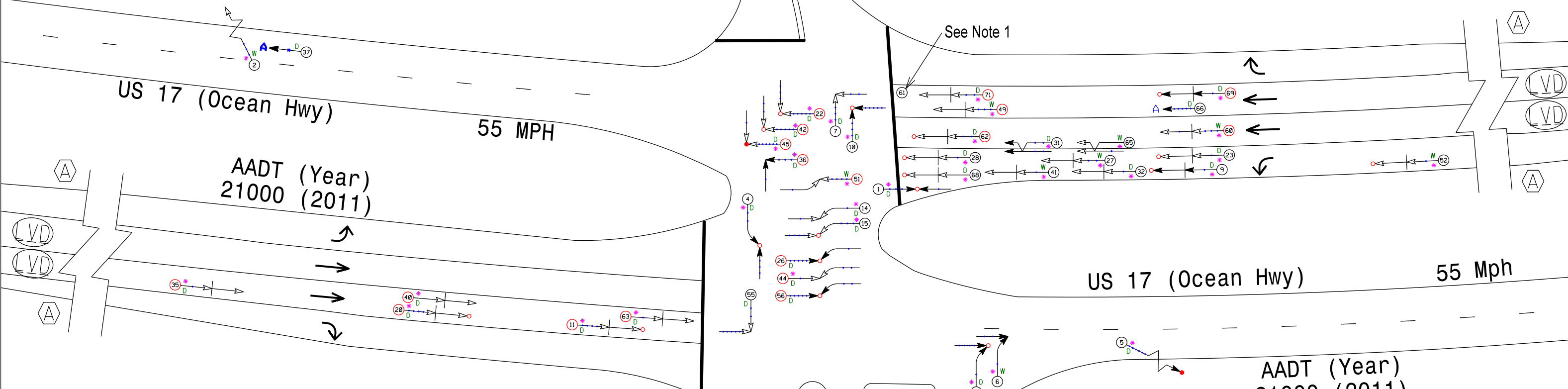
AADT (Year)
1000 (2011 est.)

Frontage Road
35 MPH



Target Crashes

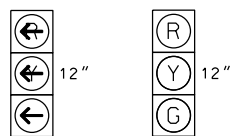
MOVING VEHICLE		ANGLE		9 MPH OR LESS	
	MOVING VEHICLE		ANGLE		9 MPH OR LESS
	PARKED VEHICLE		TURNING		10 MPH TO 19
	PARKING VEHICLE		BACKING		20 MPH TO 29
	MOVABLE OBJECT		SIDESWIPE		30 MPH TO 39
	HEAD ON		INJURY		40 MPH TO 49
	REAR END		FATALITY		50 MPH TO 59
	RAN OFF ROAD		60 MPH TO 69		70 AND UP
	DAYLIGHT CRASH		SPEED UNKNOWN		YIELD SIGN
	NIGHT CRASH				A ANIMAL
					P PEDESTRIAN
					B BICYCLE
					T TRAIN
					* DRIVER AT FAULT
					D DRY
					W WET
					I ICY OR SNOWY
					O Other



SIG. INVENTORY NO. 03-0594

SIGNAL FACE I.D.

All Heads L.E.D.



11
51

21, 22
41, 42, 43
61, 62
81, 82, 83

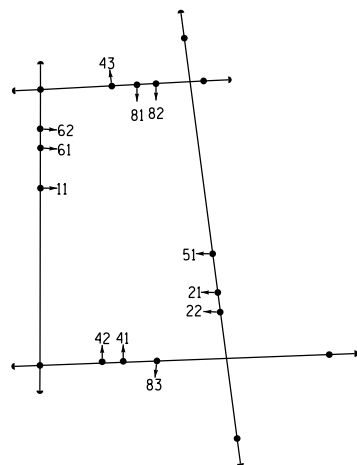
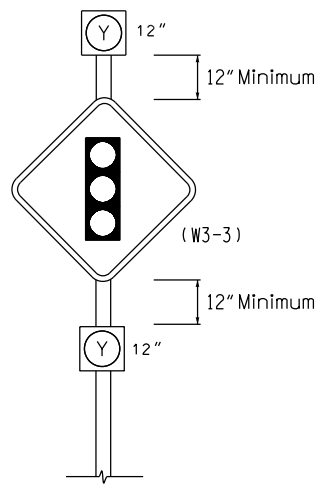


Figure A



US 17 Business
(Main Street) 35 MPH

AAADT (Year)
10000 (2011)

NOTES-

1. Crash #61 - Crash type unknown. First and Most Harmful Events listed as "Other collision with vehicle." Contributing circumstances listed as "Unknown." Diagram and Narrative do not include any additional information.
2. Yellow flashers and warning signs (Figure A) installed at +/- 450' from intersection.
3. Long Vehicle Detection System (LVD) installed +/- 1000' from intersection.

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

TRAFFIC SAFETY UNIT

Date: 10-1-13

Prepared By: Amy Faulkner, EI

Hatch Mott
MacDonald