# Spot Safety Project Evaluation

Order # 41000004518

Spot Safety Project # 10-03-204

**Spot Safety Project Evaluation of the**
**Traffic Signal and Left Turn Lane Installation**
**SR 3156 (Margaret Wallace Road) at SR 3168 (Sam Newell Road)**
**City of Charlotte / Matthews, Mecklenburg County**

Documents Prepared By:

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

**Principal Investigator**

_____ 2-16-2010

Jason B. Schronce Date

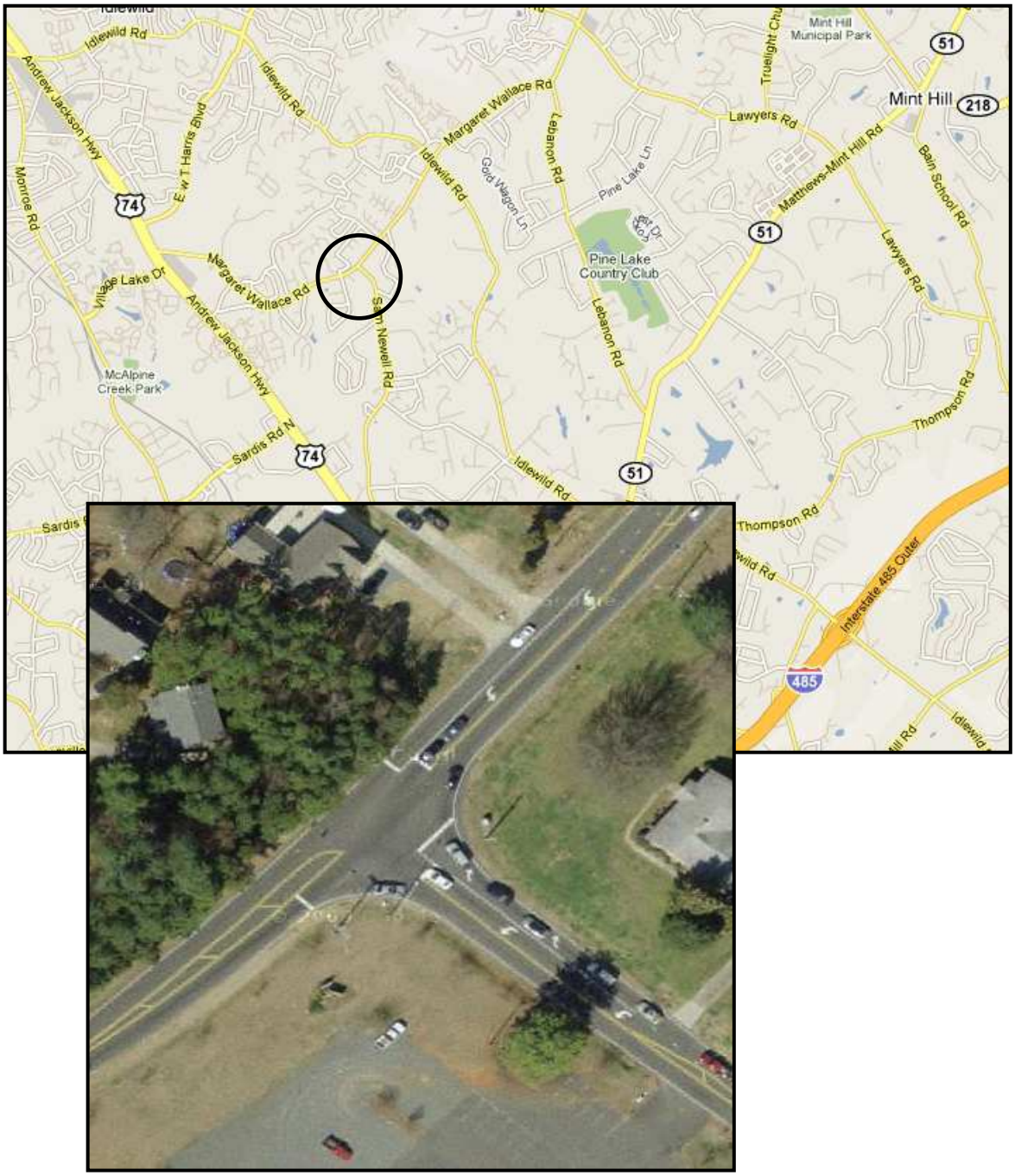
Traffic Safety Project Engineer

# *Spot Safety Project Evaluation Documentation*

**Subject Location**

Evaluation of Spot Safety Project Number 10-03-204 located at the Intersection of SR 3156 (Margaret Wallace Rd) and SR 3168 (Sam Newell Rd) in Mecklenburg County, City of Charlotte.

The Sig ID is 10-1478 for this newly installed traffic signal.



## Project Information and Background from the Project File Folder

The spot safety project improvement countermeasures chosen for the subject location were the installation an intersection traffic signal and left turn lanes on both approaches. SR 3156 (Margaret Wallace Rd) and SR 3168 are both two-lane facilities at the subject intersection with speed limits of 45 mph and 35 mph respectfully. The subject location is a three-leg intersection, which was controlled by a stop sign on SR 3168 (Sam Newell Rd). The city limit dividing Matthews and Charlotte runs along SR 3156 at this location.

The original statement of problem emphasized a significant crash problem at this location resulting from a high volume of motorists turning left from the single approach lane of SR 3156 and insufficient gaps for SR 3168 turning vehicles. The intended purposes of the intersection improvements were to alleviate the frequency and severity of all crash types.

The initial crash analysis was completed from January 1, 2000 to January 1, 2003 with twenty-eight (28) reported crashes, twenty-two (22) of which were deemed correctable. The final completion date for the improvement at the subject intersection was on August 1, 2004 with a total cost of $136,000. Of the total cost, Spot Safety Funds provided $45,000 for the traffic signal installation and Small Urban Funds supplied $91,000 for the left turn lane installations on both approaches.

## 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 the months of July through August 2004. The before period consisted of reported crashes from April 1, 2000 through June 30, 2004 (4 years and 3 months); and the after period consisted of reported crashes from September 1, 2004 through November 30, 2008 (4 years and 3 months). The ending date for this analysis was limited by crash reporting issues with the City of Charlotte.

The treatment data consisted of all crashes within 150 feet of the subject intersection. *Please see attached location map, aerial map, and photos for further details.*

The following data tables depict the Naive Before and After Analysis for the treatment location. Please note that the crash data was split into three different target crash categories to account for the multiple countermeasures completed at the intersection.

Target 1 Crashes – Intersection Frontal Impact Crashes for the Signal Installation.
Target 2 Crashes – Westbound SR 3156 Rear-End Crashes for the SR 3156 Left Turn Lane.
Target 3 Crashes – Northbound SR 3168 Rear-End Crashes for the SR 3168 Left Turn Lane.

| Treatment Information | Before | After | Percent Reduction (-) Percent Increase (+) |
|---|---|---|---|
| Total crashes | 55 | 11 | - 80.0 % |
| Total Severity Index | 7.42 | 4.36 | - 41.2 % |
| | | | |
| Volume | 23,900 | 21,550 | - 9.8 % |

| Target Crash Information | Before | After | Percent Reduction (-) Percent Increase (+) |
|---|---|---|---|
| Target Crashes Combined | 50 | 8 | - 84.0 % |
| Combined Target Severity Index | 7.62 | 4.70 | - 38.2 % |
| | | | |
| Target 1: Frontal Impact - Signal | 20 | 6 | - 70.0 % |
| Target 1 Crash Severity Index | 15.33 | 4.70 | - 69.3 % |
| | | | |
| Target 2: WB SR 3156 Rear-End | 13 | 1 | - 92.3 % |
| Target 2 Crash Severity Index | 2.71 | 8.40 | 100.0+ % |
| | | | |
| Target 3: NB SR 3168 Rear-End | 17 | 1 | - 94.1 % |
| Target 3 Crash Severity Index | 2.31 | 1.00 | - 56.7 % |

| Injury Crash Summary | Before | After | Percent Reduction (-) Percent Increase (+) |
|---|---|---|---|
| Fatal injury Crashes | 0 | 0 | N/A |
| Class A injury Crashes | 3 | 0 | - 100.0 % |
| Class B injury Crashes | 3 | 1 | - 66.7 % |
| Class C Injury Crashes | 14 | 4 | - 71.4 % |
| Total Injury Crashes | 20 | 5 | - 75.0 % |

The naive before and after analysis at the treatment location resulted in an 80 percent decrease in Total Crashes, an 84 percent decrease in Target Crashes, and a 41 percent decrease in the Total Severity Index. The before period ADT year was 2002 and the after period ADT year was 2006.

## Results and Discussion

The naive before and after analysis involving the comparison of treatment actual before data versus treatment actual after data resulted in an 80 percent decrease in Total Crashes and an 84 percent decrease in Target Crashes. The summary results above demonstrate that both Total and Target Crashes appear to have decreased at the treatment location from the before to the after period.

Referencing the *Collision Diagrams*, the before period presented multiple crash patterns at this location. Two rear-end crash patterns existed; the SR 3156 collisions resulting from vehicles stopped or queued while waiting to turn left and the SR 3168 collisions resulting from motorists expecting others had already cleared the intersection. These patterns of thirteen (13) and seventeen (17) respectfully were each reduced to one (1) collision in the after period with the addition of a left turn lane on both approaches. The left turn lanes were funded and installed with Small Urban Funds.

The intersection in the before period also was experiencing a significant pattern of frontal impact collisions from both left turning Sam Newell and Margaret Wallace vehicles misjudging distance. These collisions resulted in three (3) A-injury crashes during the analysis period. With the signal installation, the number and severity of theses collisions reduced by 70 percent. The after period

does indicate a small pattern of six (6) crashes from westbound SR 3156 vehicles choosing the wrong permissive green traffic gaps.

The calculated benefit to cost ratio for this project is **17.81 considering total crashes**. The benefit to cost ratio **considering only target crashes is 17.46**. 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.

Overall, these improvements combined were very successful in their quest to reduce collisions at this heavily traveled intersection. This statement is evident by the high benefit-cost ratio stated above.

Please see the attached *Treatment Site Photos*. Photos are provided from Google Street View for all three approaches to the treatment intersection. 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

Looking West on SR 3156 (Margaret Wallace Rd)

Looking West on SR 3156 – Protected/Permissive Left Turn Phase

Traveling East/Northeast on SR 3156 (Margaret Wallace Rd)

Traveling North on SR 3168 (Sam Newell Rd)

## BENEFIT-COST ANALYSIS WORKSHEET - Total Crashes

LOCATION: SR 3156 at SR 3168
COUNTY: Mecklenburg
FILE NO.: SS 10-03-204

BY: JBS
DATE: 2/10/2010
NOTES: Total Crashes

DETAILED COST: TYPE IMPROVEMENT - Traffic Signal / Left Turn Lanes

| ITEMS | TOTAL | SERVICE | CRF | ANNUAL COST |
|---|---|---|---|---|
| Construction | $136,000 | 10 | 0.149 | $20,268 |
| | $0 | 0 | 0.000 | $0 |
| Right-of-Way | $0 | 0 | 0.000 | $0 |
| TOTALS | $136,000 | 10 | 0.149 | $20,268 |

ESTIMATED INCREASE IN ANNUAL MAINT. COST = $3,000
ESTIMATED INCREASE IN ANNUAL UTILITY COST = $900

TOTAL ANNUAL COST= $24,168
TOTAL COST OF PROJECT= $136,000

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 | 4.25 | 3 | 0.71 | 17 | 4.00 | 35 | 8.24 | $457,059 |
| AFTER | 4.25 | 0 | 0.00 | 5 | 1.18 | 6 | 1.41 | $26,682 |

Annual Benefits from Crash Cost Savings $430,376

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = $406,208

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 17.81

TOTAL COST OF PROJECT - $136,000 COMPREHENSIVE B/C RATIO - 17.81

## BENEFIT-COST ANALYSIS WORKSHEET - Target Crashes

LOCATION: SR 3156 at SR 3168
COUNTY: Mecklenburg
FILE NO.: SS 10-03-204

BY: JBS
DATE: 2/10/2010
NOTES: Target Crashes - Combined

DETAILED COST: TYPE IMPROVEMENT - Traffic Signal / Left Turn Lanes

| ITEMS | TOTAL | SERVICE | CRF | ANNUAL COST |
|---|---|---|---|---|
| Construction | $136,000 | 10 | 0.149 | $20,268 |
| | $0 | 0 | 0.000 | $0 |
| Right-of-Way | $0 | 0 | 0.000 | $0 |
| TOTALS | $136,000 | 10 | 0.149 | $20,268 |

ESTIMATED INCREASE IN ANNUAL MAINT. COST = $3,000
ESTIMATED INCREASE IN ANNUAL UTILITY COST = $900

TOTAL ANNUAL COST= $24,168
TOTAL COST OF PROJECT= $136,000

COMPREHENSIVE COST REDUCTION:

ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES

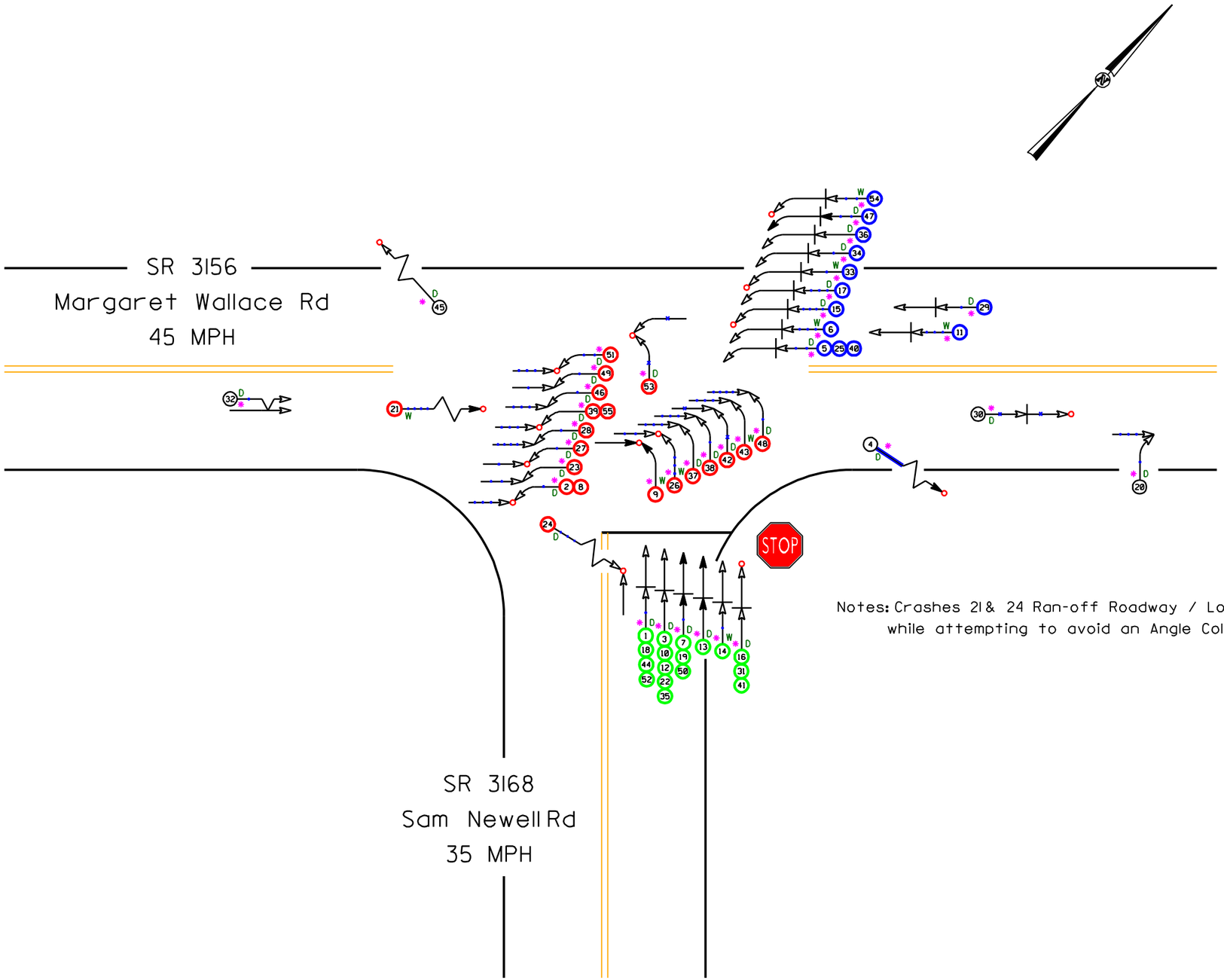
| TIME PERIOD | YEARS | K & A CRASHES | K & A CRASHES PER YR | B & C CRASHES | B & C CRASHES PER YR | PDO CRASHES | PDO CRASHES PER YR | ANNUAL COSTS |
|---|---|---|---|---|---|---|---|---|
| BEFORE | 4.25 | 3 | 0.71 | 14 | 3.29 | 33 | 7.76 | $442,518 |
| AFTER | 4.25 | 0 | 0.00 | 4 | 0.94 | 4 | 0.94 | $20,612 |

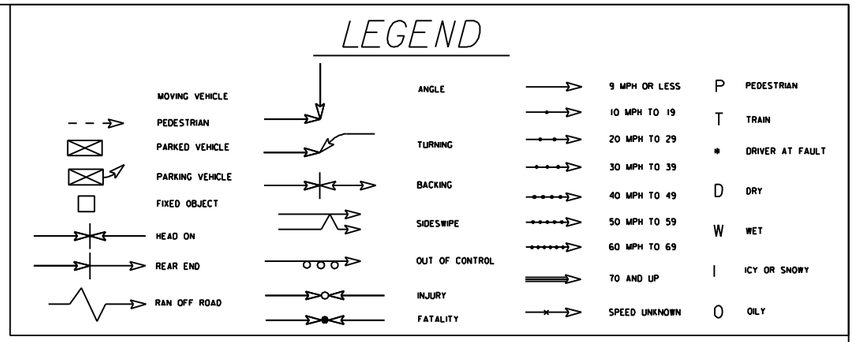
Annual Benefits from Crash Cost Savings $421,906

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = $397,738

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 17.46

TOTAL COST OF PROJECT - $136,000 COMPREHENSIVE B/C RATIO - 17.46




# SS# 10-03-204
# Mecklenburg County
# City of Charlotte
# BEFORE Period
# 4/1/00 - 6/30/04

Notes: Crashes 21 & 24 Ran-off Roadway / Lost Control while attempting to avoid an Angle Collision

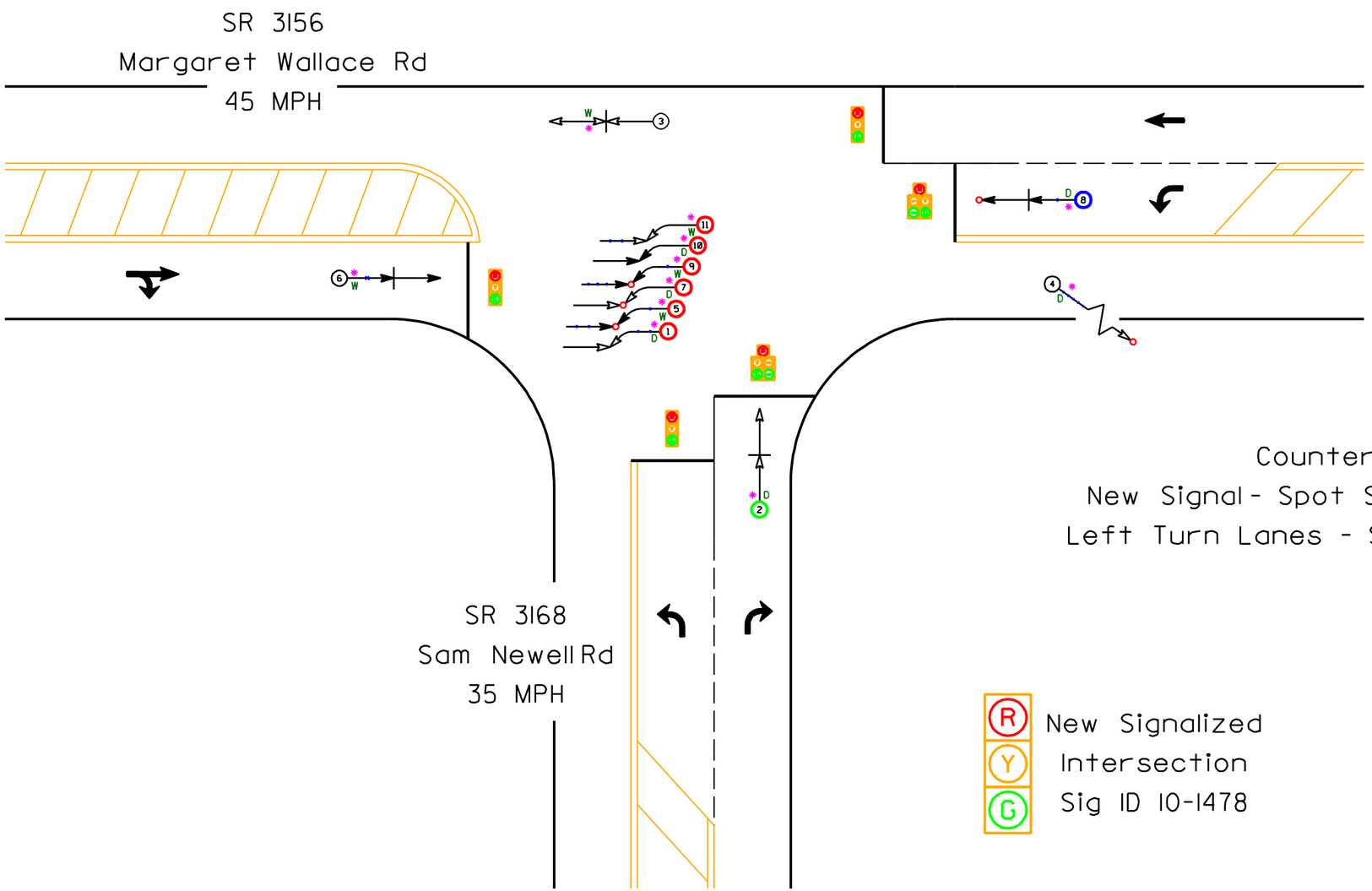
TARGET CRASHES

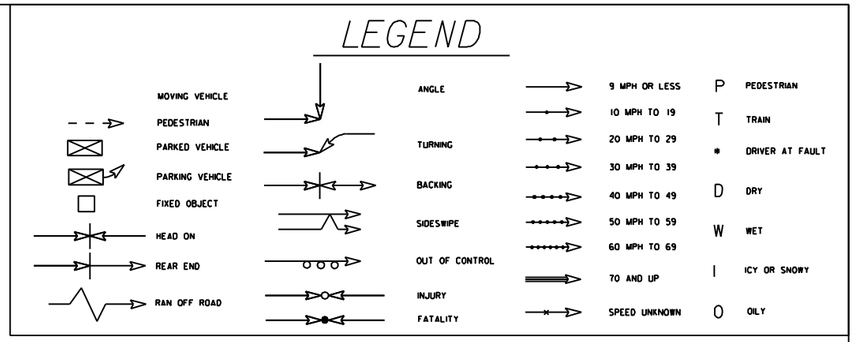
- # Frontal Impact (Signal)
- # WB Rear-Ends (SR 3156 Left)
- # NB Rear-Ends (SR 3168 Left)

***TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT***

| COLLISION DIAGRAM | |
|---|---|
| DIVISION: 10 | AREA: |
| STUDY PERIOD: 4/1/2000 - 6/30/2004 | |
| DISTANCE: Y-LINE = 150FT | |
| ANALYSIS PREPARED BY: JBS | |
| ANALYSIS CHECKED BY: | |
| DIAGRAM PREPARED BY: JBS | |
| DIAGRAM REVIEWED BY: ST | |
| | |
| SCALE: NOT TO SCALE | |
| DATE: 2-9-2010 | |
| LOG NUMBER: SS# 10-03-204 BEFORE | |

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




# SS# 10-03-204
# Mecklenburg County
# City of Charlotte
# AFTER Period
# 9/1/04 - 11/30/08

Countermeasures:

New Signal - Spot Safety Funding ($45K)

Left Turn Lanes - Small Urban Funds ($91K)

R New Signalized
Y Intersection
G Sig ID 10-1478

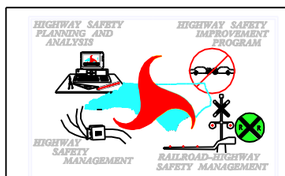
TARGET CRASHES

# Frontal Impact (Signal)

# WB Rear-Ends (SR 3156 Left)

# NB Rear-Ends (SR 3168 Left)

**TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT**




| COLLISION DIAGRAM | |
|---|---|
| DIVISION: 10 | AREA: |
| STUDY PERIOD: 9/1/2004 - 11/30/2008 | |
| DISTANCE: Y-LINE = 150FT | |
| ANALYSIS PREPARED BY: JBS | |
| ANALYSIS CHECKED BY: | |
| DIAGRAM PREPARED BY: JBS | |
| DIAGRAM REVIEWED BY: ST | |
| | |
| SCALE: NOT TO SCALE | |
| DATE: 2-9-2010 | |
| LOG NUMBER: SS# 10-03-204 AFTER | |

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