

Spot Safety Project Evaluation

Order # 41000002811

Spot Safety Project # 04-00-225

**Spot Safety Project Evaluation of the Additional Left Turn Lane Installation
US 70 Business at NC 42 / Rose Street
Johnston County**

Documents Prepared By:

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

Principal Investigator



Jason B. Schronce

3-11-2010

Date

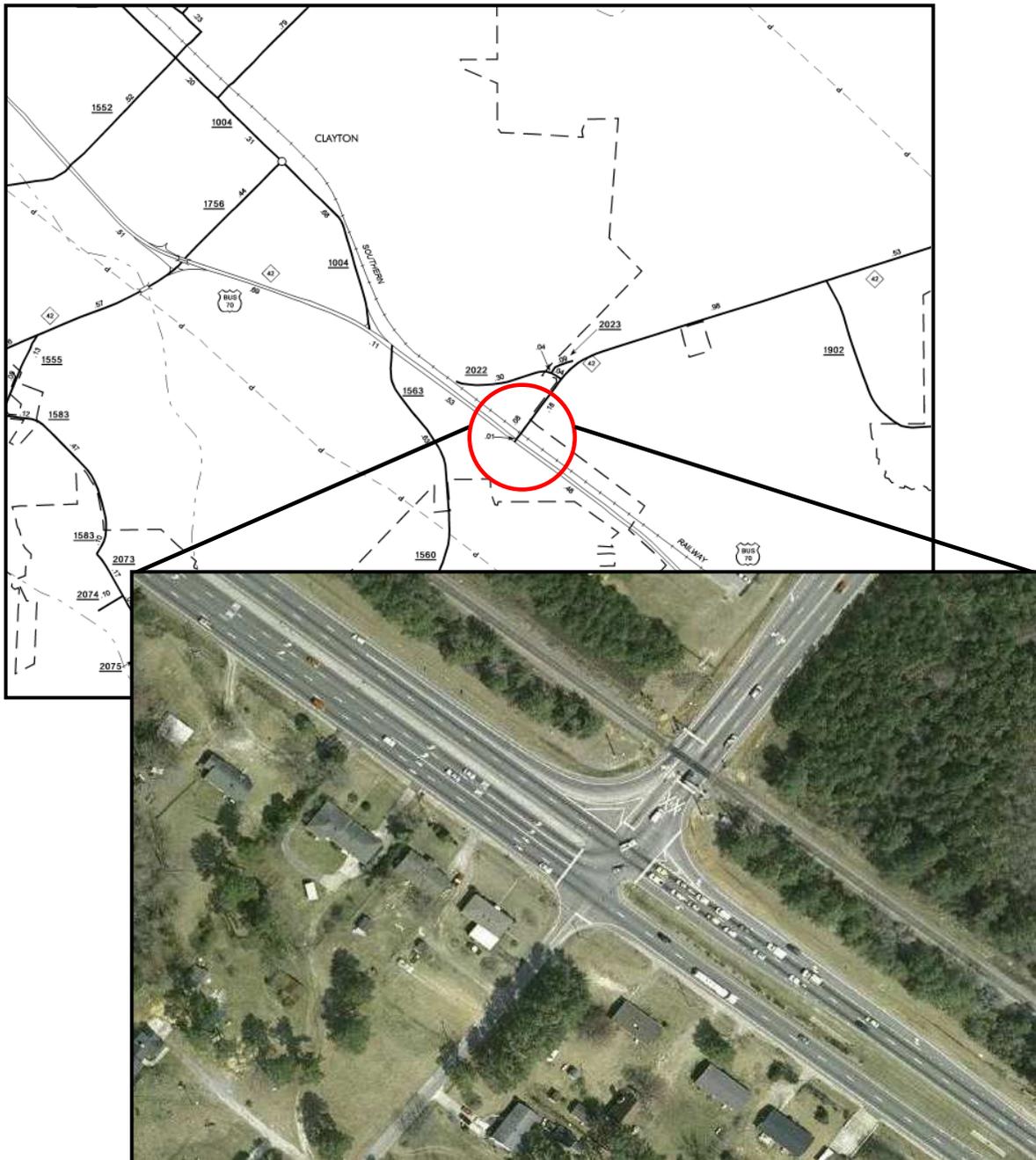
Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 04-00-225 located at the Intersection of US 70 Business at NC 42 / Rose Street in Johnston County, within the City of Clayton.

The Sig ID is 04-1037 for this existing 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 of an additional 750 foot US 70 Business eastbound left turn lane and also an additional 1950 foot through lane on NC 42 to match the new dual intersection left turn movement. US 70B at this location is a four-lane divided facility with intersection left and right turn lanes. NC 42 is a two-lane highway that forms a continuous yield right turn movement with US 70B. Rose Street is a small residential street with single lane approaches accessing approximately 30 homes. Both major roadways have a 45 mph posted speed limit.

The original statement of problem stated that during peak periods the US 70B left turning vehicle are enduring queues of more than 0.25 mile and sitting through three signal cycles. Motorists have been known to take unnecessary risk in order to travel onto NC 42.

The initial crash analysis was completed from November 1, 1996 to October 31, 1999 with sixty-one (61) reported crashes, twenty-seven (27) of which were rear-ends. The final completion date for the improvement at the subject intersection was on June 25, 2003 with a total cost of \$355,000. Only \$150,000 was funded by the Spot Safety Program.

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 February through July 2003. The before period consisted of reported crashes from December 1, 1996 through January 31, 2003 (6 years and 2 months); and the after period consisted of reported crashes from August 1, 2003 through September 30, 2009 (6 years and 2 months). The ending date for this evaluation was determined by the date of available crash data at the time of analysis.

The treatment data consisted of all crashes within 350 feet of the subject intersection. *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 there were two selected Target Crashes for this location. "Target 1" consists of Rear-end Collisions in the left turn lane on US 70B accessing NC 42. "Target 2" consists of Sideswipe Collisions created with the dual left turning movement.

| <u>Treatment Information</u> | Before | After | Percent Reduction (-) Percent Increase (+) |
|-------------------------------------|---------------|--------------|---|
| Total crashes | 90 | 87 | - 3.3 % |
| Total Severity Index | 4.39 | 3.49 | - 20.5 % |
| | | | |
| Volume | 51,300 | 54,400 | 6.0 % |

| <u>Injury Crash Summary</u> | Before | After | Percent Reduction (-) Percent Increase (+) |
|-----------------------------|-----------|-----------|---|
| Fatal injury Crashes | 0 | 0 | N/A |
| Class A injury Crashes | 1 | 1 | 0.0 % |
| Class B injury Crashes | 5 | 2 | - 60.0 % |
| Class C Injury Crashes | 26 | 17 | - 34.6 % |
| Total Injury Crashes | 32 | 20 | - 37.5 % |

| <u>Target Crash Information</u> | Before | After | Percent Reduction (-) Percent Increase (+) |
|--------------------------------------|--------|-------|---|
| Target 1 Crashes – Turn Ln Rear-ends | 17 | 13 | - 23.5 % |
| Target 1 Severity Index | 4.48 | 2.14 | - 52.2 % |
| | | | |
| Target 2 Crashes – Sideswipes | 0 | 8 | 100.0 % |
| Target 2 Severity Index | 0.00 | 1.00 | 100.0 % |

The naive before and after analysis at the treatment location resulted in a 3 percent decrease in Total Crashes, an 24 percent decrease in Rear-end Target Crashes, and a 21 percent decrease in the Total Severity Index. The before period ADT year was 2000 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 a 3 percent decrease in Total Crashes and an 24 percent decrease in Rear-end Target Crashes. The summary results above demonstrate that both Total Crashes and initial Target Crashes appear to have decreased slightly at the treatment location from the before to the after period.

Referencing the *Collision Diagrams*, the before period presented a heavy pattern of eastbound rear-end collisions at the intersection, of which seventeen (17) occurred in the left turn lane. After the additional left turn lane installation, the pattern was reduced to thirteen (13) crashes. However, with the dual left turning movement, eight (8) new sideswipe collisions occurred in the intersection as motorists improperly merged or drifted lanes.

Also, westbound US 70 Business rear-end collisions remained consistent through the analysis from nineteen (19) in the before period to twenty (20) in the after period. However, southbound NC 42 rear-end collisions did increase dramatically from two (2) to eleven (11) within the evaluation.

The calculated benefit to cost ratio for this project is **1.21 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.

Due to the original statement of problem mentioning US 70 Business eastbound vehicle queues of 0.25 mile, we further analyzed US 70 Business eastbound from the 350 foot mark to 0.25 mile west of the NC 42 intersection. The following tables summarize the results:

| <u>EB US 70 Business Queue Crashes</u> <u>350 ft to 0.25 miles</u> | Before | After | Percent Reduction (-) Percent Increase (+) |
|---|---------------|--------------|---|
| Queue Crashes along segment | 14 | 6 | - 57.1 % |
| Queue Crash Severity Index | 14.47 | 2.23 | - 84.6 % |
| | | | |
| EB 70 Rear-Ends in Turn Lane | 7 | 1 | - 85.7 % |
| EB 70 Sideswipes accessing Turn Lane | 3 | 0 | - 100.0 % |
| | | | |
| EB 70 Rear-Ends in Through Lanes | 2 | 3 | 50.0 % |
| EB 70 Sideswipes in Through Lanes | 1 | 1 | 0.0 % |

| <u>Queue Injury Summary</u> | Before | After | Percent Reduction (-) Percent Increase (+) |
|------------------------------------|---------------|--------------|---|
| Fatal injury Crashes | 0 | 0 | N/A |
| Class A injury Crashes | 2 | 0 | - 100.0 % |
| Class B injury Crashes | 0 | 0 | N/A |
| Class C Injury Crashes | 5 | 1 | - 80.0 % |
| Total Injury Crashes | 7 | 1 | - 85.7 % |

As evident from the tables above, the installation of the additional turn lane showed crash frequency and severity improvement all through the eastbound US 70 Business pre-project queue length. There was a 57 percent reduction in total crashes along this strip and significant reduction (ten crashes to one crash) related to the eastbound turn lane onto NC 42. The severity also showed great improvement (86 percent reduction) with the elimination of two (2) before period A-injury collisions in the queue segment.

Please see the attached *Treatment Site Photos*. Photos are provided from Google Street View for the three major 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 East on US 70 Business at start of Dual Left Turn Lanes



Looking East on US 70 Business at intersection with NC 42



Looking South on NC 42 approaching US 70 Business



Looking West on US 70 Business at Intersection with NC 42 / Rose Street

BENEFIT-COST ANALYSIS WORKSHEET - Total Crashes

LOCATION: US 70B at NC 42 / Rose Street
 COUNTY: Johnston
 FILE NO.: SS 04-00-225

BY: JBS
 DATE: 1/4/2010
 NOTES: Total Crashes

DETAILED COST: TYPE IMPROVEMENT - Left Turn Lane Installation

| ITEMS | TOTAL | SERVICE | CRF | ANNUAL COST |
|--------------|-----------|---------|-------|-------------|
| Construction | \$150,000 | 10 | 0.149 | \$22,354 |
| Right-of-Way | \$0 | 0 | 0.000 | \$0 |
| TOTALS | \$150,000 | 10 | 0.149 | \$22,354 |

ESTIMATED INCREASE IN ANNUAL MAINT. COST = \$1,880
 ESTIMATED INCREASE IN ANNUAL UTILITY COST = \$0
 TOTAL ANNUAL COST= \$24,234
 TOTAL COST OF PROJECT= \$150,000

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 | 6.17 | 1 | 0.16 | 31 | 5.02 | 58 | 9.40 | \$208,136 |
| AFTER | 6.17 | 1 | 0.16 | 19 | 3.08 | 67 | 10.86 | \$178,817 |

Annual Benefits from Crash Cost Savings \$29,319

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = \$5,085

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 1.21

TOTAL COST OF PROJECT - \$150,000 COMPREHENSIVE B/C RATIO - 1.21

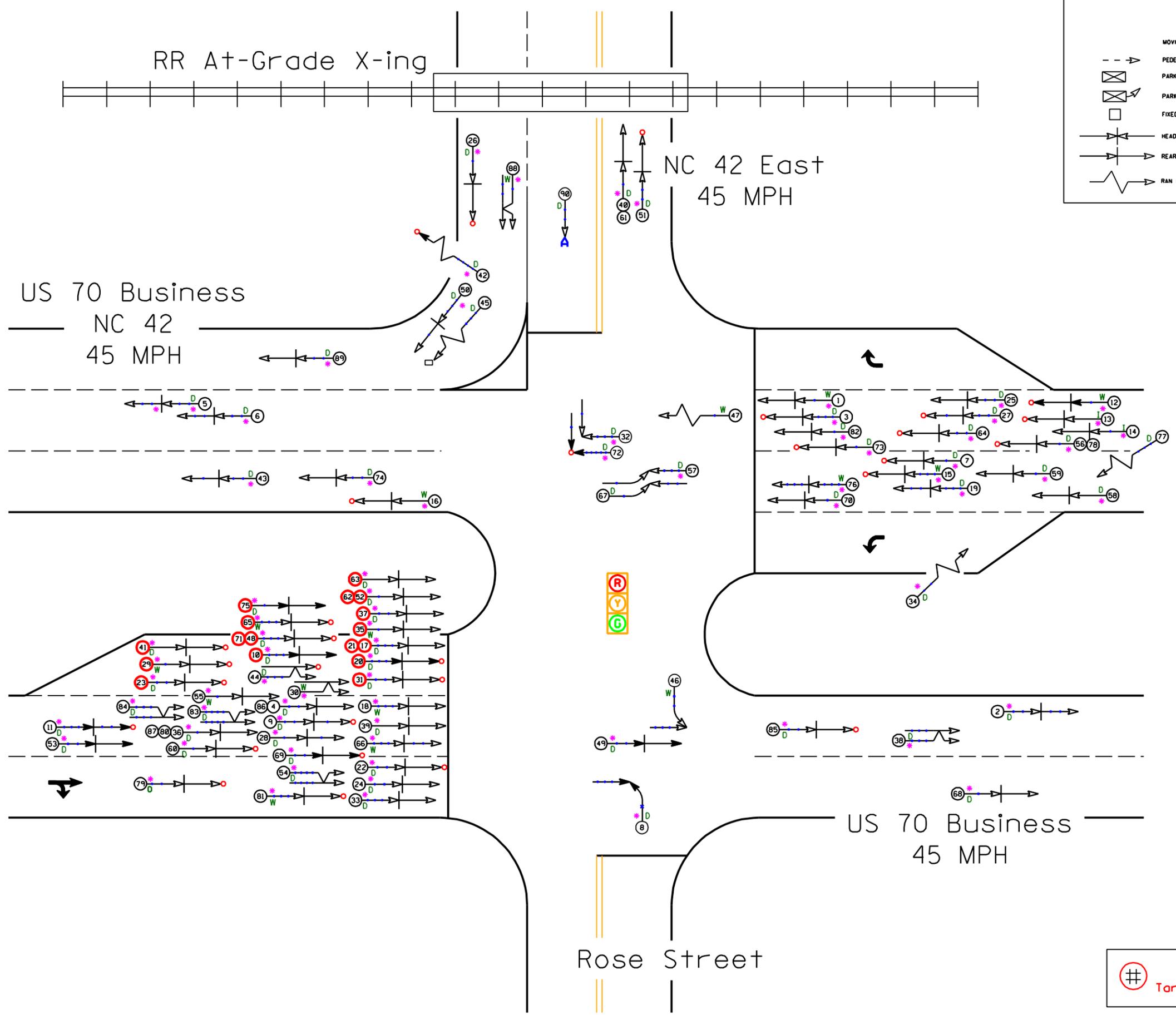
LEGEND

| | | | | | | | |
|--|-----------------|--|----------------|--------------|---------------|-----------------|------------|
| | 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 | D | DRY | |
| | FIXED OBJECT | | SIDESWIPE | 40 MPH TO 49 | W | WET | |
| | HEAD ON | | OUT OF CONTROL | 50 MPH TO 59 | I | ICY OR SNOWY | |
| | REAR END | | INJURY | 60 MPH TO 69 | 0 | OILY | |
| | RAN OFF ROAD | | FATALITY | 70 AND UP | | | |

SS# 04-00-225
 Johnston County
 City of Clayton
 BEFORE Period
 US 70B at NC 42
 12/1/96 - 1/31/03



Existing Signal
 Sig ID 04-1037

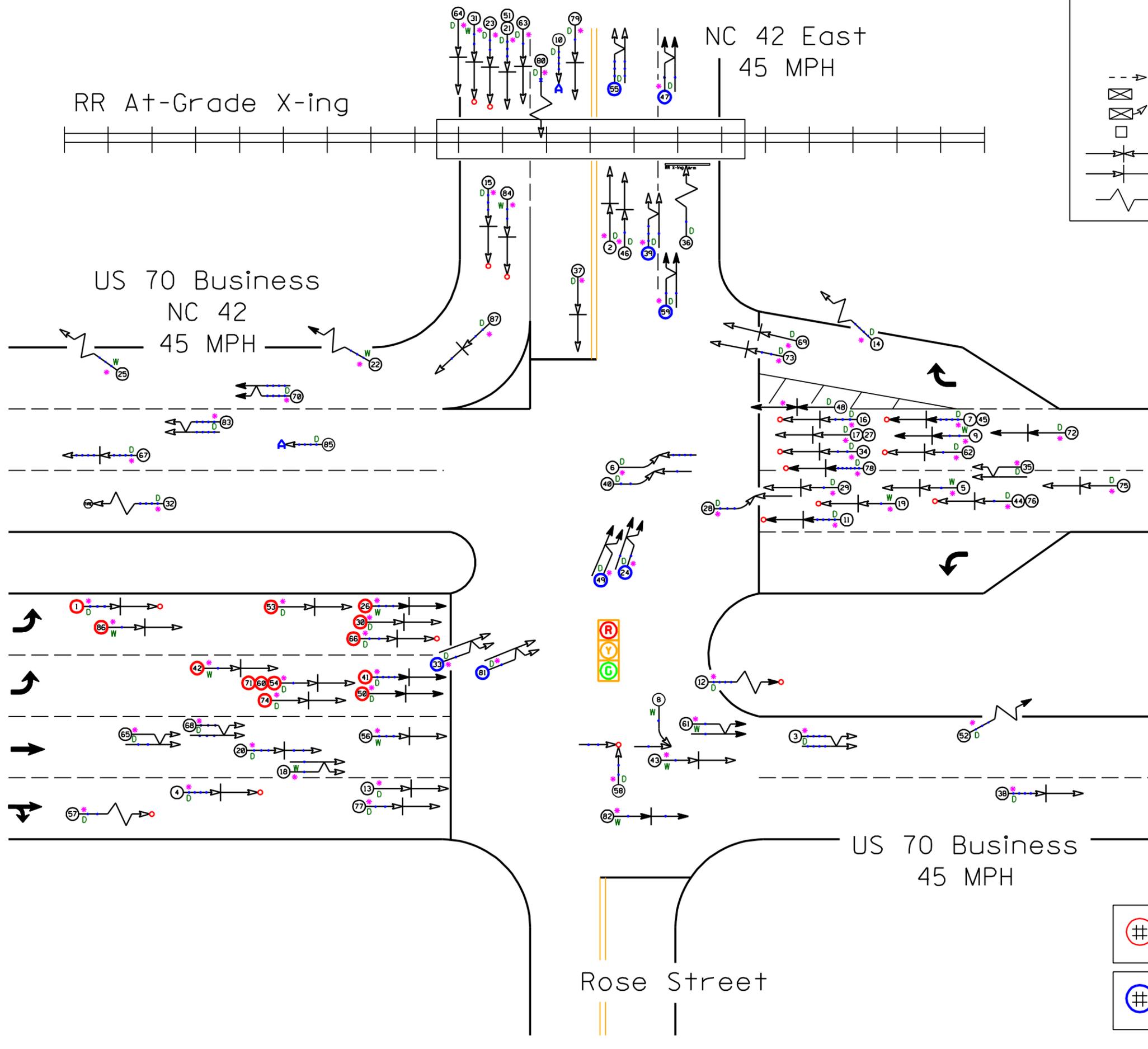


Rear-End
Target Crashes

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

| | | |
|--|-------------------------------------|-------|
| | COLLISION DIAGRAM | |
| | DIVISION: 4 | AREA: |
| | STUDY PERIOD: 12/1/1996 - 1/31/2003 | |
| | DISTANCE: Y-LINE = 350FT | |
| | ANALYSIS PREPARED BY: JBS | |
| | ANALYSIS CHECKED BY: N/A | |
| | DIAGRAM PREPARED BY: JBS | |
| | DIAGRAM REVIEWED BY: ST | |
| | SCALE: NOT TO SCALE | |
| | DATE: 12-28-2009 | |
| | LOG NUMBER: SS* 04-00-225 BEFORE | |

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



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 | | SPEED UNKNOWN |
| | RAN OFF ROAD | | | | 70 AND UP | | |

SS# 04-00-225
 Johnston County
 City of Clayton
 AFTER Period
 US 70B at NC 42
 8/1/03 - 9/30/09

Existing Signal
 Sig ID 04-1037



Rear-End
 Target Crashes

Sideswipe
 Target Crashes

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

| | | |
|---------------------------------|------------------------------------|-------|
| | COLLISION DIAGRAM | |
| | DIVISION: 4 | AREA: |
| | STUDY PERIOD: 8/1/2003 - 9/30/2009 | |
| | DISTANCE: Y-LINE = 350FT | |
| ANALYSIS PREPARED BY: JBS | | |
| ANALYSIS CHECKED BY: N/A | | |
| DIAGRAM PREPARED BY: JBS | | |
| DIAGRAM REVIEWED BY: ST | | |
| SCALE: NOT TO SCALE | | |
| DATE: 1-4-2010 | | |
| LOG NUMBER: SS* 04-00-225 AFTER | | |

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