

Spot Safety Project Evaluation

Order # 41000006673

Spot Safety Project # 10-02-205

**Spot Safety Project Evaluation of the
Traffic Signal and Delineator Installation
NC 73 at SR 2128 (Beatties Ford Road) & SR 2181 (Brown Mill Rd)
City of Huntersville, 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



Jason B. Schronce

10-28-2010

Date

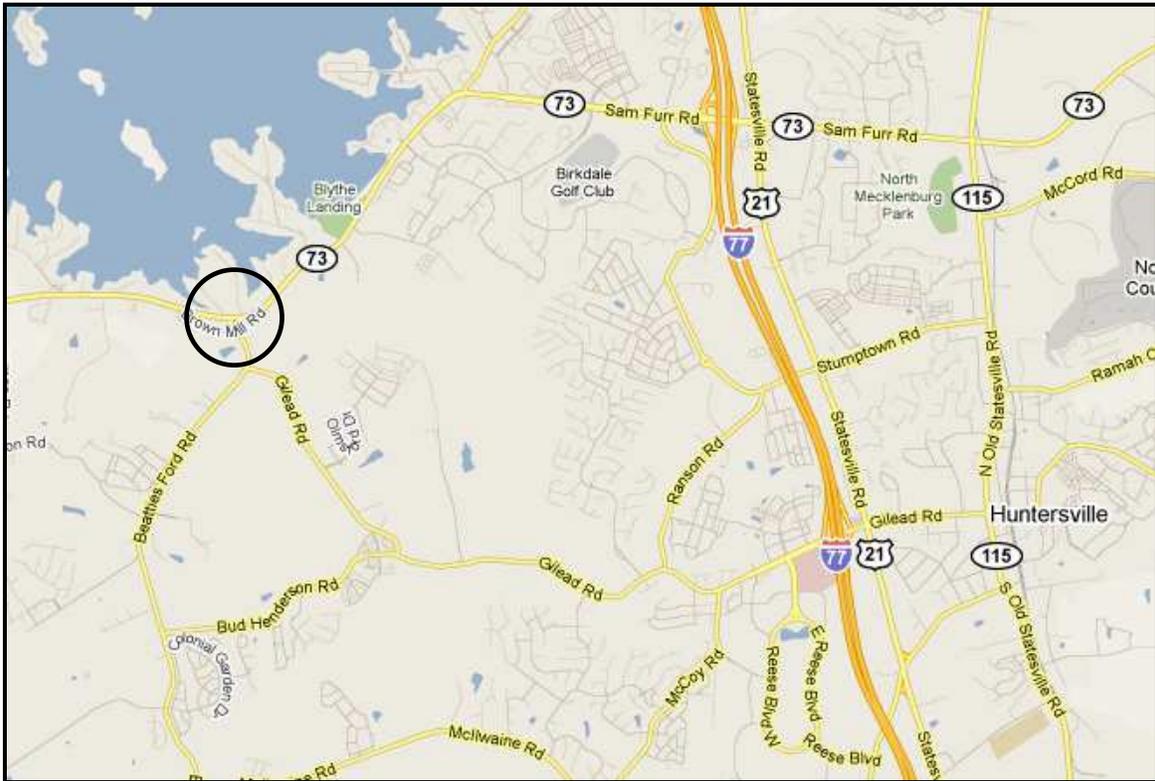
Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 10-02-205 located at the Intersections of NC 73 (Sam Furr Rd) at SR 2128 (Beatties Ford Road) and SR 2181 (Brown Mill Road) in Mecklenburg County, near Lake Norman and the City of Huntersville.

The Sig ID is 10-1842 for the newly installed signal at Beatties Ford Road.





2004 Mecklenburg County GIS



2005 Mecklenburg County GIS

Project Information and Background from the Project File Folder

The spot safety project improvement countermeasure chosen for the subject location was the installation of an intersection traffic signal at SR 2128 (Beatties Ford Road) and extension of the NC 73 left turn lanes to include the SR 2128 intersection. Also, breakaway pole delineators were installed at SR 2181 (Brown Mill Road) to prevent the left turn for westbound NC 73 vehicles.

NC 73, SR 2128, and SR 2181 are all two-lane facilities near the subject location with a short 3-lane segment accessing Henry Lane (residential dead end street) and the two gas station entrances. The speed limits are 45-mph for NC 73 and Beatties Ford Road and 35-mph on Brown Mill Road. The subject area is a 0.27 mile segment with the through movement as NC 73 and stop control on all intersection approaches. In the after period, Henry Lane and Brown Mill Road remained under stop control condition.

The original statement of problem stated that a high number of crashes were occurring at the intersection of NC 73 and Brown Mill Road related to motorists turning left from the through lane of a high volume roadway against a high volume of traffic. The intended purpose of the combined countermeasures was to alleviate collisions by forcing motorists to use the traffic signal at Beatties Ford Road and eliminating the left turn movement at Brown Mill Road.

The initial crash analysis was completed from October 1, 1998 to October 1, 2001 with twenty-five (25) reported crashes, twenty (20) of which were deemed correctable including one A-injury crash. The final completion date for the improvement at the subject intersection was on July 25, 2005 with a total cost of \$115,000.

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 June through July 2005. The before period consisted of reported crashes from June 1, 2002 through May 31, 2005 (3 years); and the after period consisted of reported crashes from August 1, 2005 through July 31, 2008 (3 years). The ending date for this analysis was limited by the before period installation of the center turn lane by Henry Lane and the gas station.

The treatment data consisted of all crashes on NC 73 along the segment from 150 feet west of Beatties Ford Rd (MP 2.190) to 150 feet east of Brown Mill Road (MP 2.460). *Please see attached location maps, aerial maps, and photos for further details.*

The following data table depicts the Naive Before and After Analysis for the treatment location. Please note that Frontal Impact Crashes were the target crashes for the applied traffic signal countermeasure and left turn crashes (left turn-same road and westbound rear-ends) at Brown Mill Road were the target crashes for the delineators. The Frontal Impact Crash types considered are as follows: Left turn, same roadway; Left turn, different roadways; Right turn, same roadway; Right turn, different roadways; Head on; and Angle.

<u>Treatment Information</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	47	35	- 25.5 %
Total Severity Index	5.29	1.85	- 65.0 %
Frontal (Signal) Target Crashes	3	1	- 66.7 %
Frontal Target Crash Severity Index	3.47	1.00	- 71.2 %
Delineator Target Crashes	22	1	- 95.5 %
Delineator Target Crash Severity Index	7.81	8.40	7.6 %
Volume (2002, 2007)	26,000	29,300	12.7 %

<u>Injury Crash Summary</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Fatal injury Crashes	0	0	N/A
Class A injury Crashes	1	0	- 100.0 %
Class B injury Crashes	4	0	- 100.0 %
Class C Injury Crashes	13	4	- 69.2 %
Total Injury Crashes	18	4	- 77.8 %

The naive before and after analysis at the treatment location resulted in a 25.5 percent decrease in Total Crashes, an 92 percent decrease in Combined Target Crashes, and a 65 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 indicated a significant pattern of left turn related crashes at the Brown Mill Road intersection. There were eight (8) left turn same road collisions, thirteen (13) westbound NC 73 rear-ends, and one (1) ran off roadway in avoidance. After the breakaway pole delineators were installed to prevent the left turn onto SR 2181, there was only one (1) rear-end collision from a vehicle that was unfamiliar with the area and still tried to make the left turn from NC 73. Frontal impact crashes also reduced at the Beatties Ford Road intersection from three (3) to one (1) through the analysis.

With the significant target crash reductions, this segment is still experiencing a high rear-end crash pattern. Rear-end collisions approaching the Beatties Ford intersection doubled from three (3) to six (6) through the evaluation; with five (5) of the after period crashes traveling eastbound. Also, the strong patterns of low-speed rear-end crashes on the skewed Brown Mill Road intersection remains consistent. There were fifteen (15) crashes in the before period and seventeen (17) in the after period.

The calculated benefit to cost ratio for this project is **13.96 considering total crashes**. The benefit to cost ratio **considering only combined target crashes is 13.97**. 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.

The Safety Evaluation Group is also providing with this report an evaluation of the crash data up to current available data since the initial evaluation was limited to 3 years by the before period installation of the short center turn lane. The following table shows a comparison from the after period (3 years) to the extra period (2.08 yrs: August 1, 2008 to August 31, 2010) in crashes per year format. The collision diagram of the extra period is also attached.

<u>Additional Evaluation of Treatment Segment</u>	After 3.0 Yrs	Extra 2.08 Yrs	Percent Reduction (-) Percent Increase (+)
Total Crashes	35	12	
Total Crashes per Year	11.67	5.77	- 50.6 %
Total Severity Index	1.85	5.93	220.5 %
Frontal (Signal) Target Crashes	1	1	
Frontal Target Crashes per Year	0.33	0.48	45.5 %
Frontal Target Crash Severity Index	1.00	1.00	0.0 %
Delineator Target Crashes	1	0	
Delineator Target Crashes per Year	0.33	0.00	- 100.0 %
Delineator Target Crash Severity Index	8.40	0.00	- 100.0 %

From the table above, the overall crashes at this location during the extra period reduced by half. The collision diagram of the extra period shows only two (2) small crash patterns during this time period. There were four (4) rear-end collisions eastbound NC 73 approaching the Beatties Ford Road intersection and seven (7) low-speed impact collisions at the skewed Brown Mill Road intersection with NC 73.

In addition, the Safety Evaluation Group also examined the intersection of SR 2128 (Beatties Ford Road) and SR 2181 (Brown Mill Road) located approximately 500 feet south of NC 73. We chose to evaluate this location since the countermeasure by nature changed motorists' behavior for this intersection. This is a four-leg crossroads intersection with both 2-lane roadways and the stop condition on SR 2181. The analysis was conducted to match the original study and collision diagrams have been provided of this additional analysis.

<u>SR 2128 at SR 2181</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	5	9	80.0 %
Total Severity Index	2.48	2.64	6.5 %
Volume (2003, 2007)	11,400	14,300	25.4 %

The table above indicates an eighty (80) percent increase in crashes at this secondary location. The collision diagrams show a slight increase in frontal impact crashes from three (3) to four (4) through the analysis; however the after period collisions appear to be more random in nature.

Please see the attached *Treatment Site Photos*. Photos are provided from Google Street View for multiple points along the NC 73 segment. 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



Traveling West on NC 73 approaching Brown Mill Rd (No Left Turn)



Traveling West on NC 73 approaching Henry Lane



Traveling West on NC 73 – Delineators preventing left from store entrance



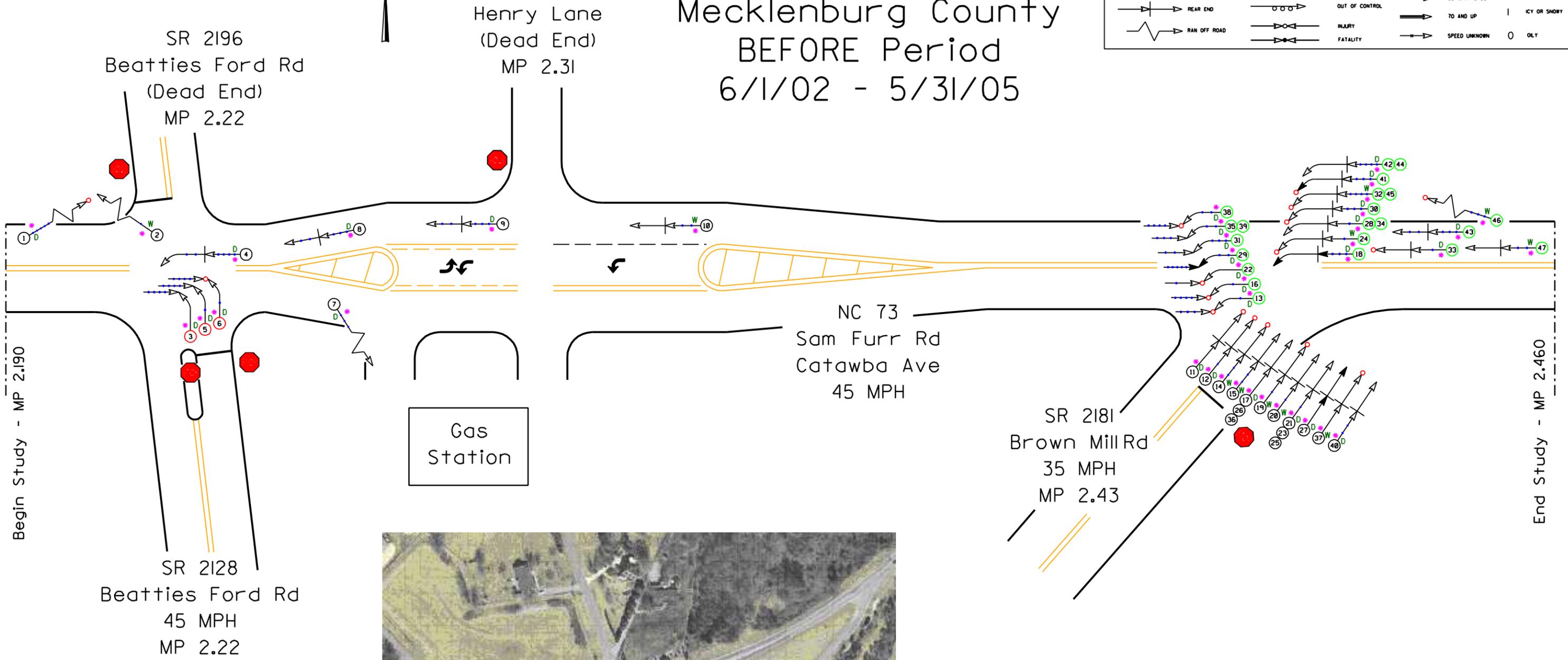
Traveling West on NC 73 approaching SR 2128 (Beatties Ford Rd)

BENEFIT-COST ANALYSIS WORKSHEET - Total Crashes

LOCATION: NC 73 at SR 2128 / 2181		BY: JBS	
COUNTY: Mecklenburg		DATE: 10/15/2010	
FILE NO.: SS-10-02-205			
DETAILED COST:	TYPE IMPROVEMENT -	Shoulder Guardrail	
	ITEMS	TOTAL	SERVICE
	Construction	\$115,000	10
	Right-of-Way	\$0	0
			CRF
			0.149
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SS# 10-02-205
 Order# 41000006673
 Mecklenburg County
 BEFORE Period
 6/1/02 - 5/31/05

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



- Traffic Signal Target Crashes
- Delineator Target Crashes

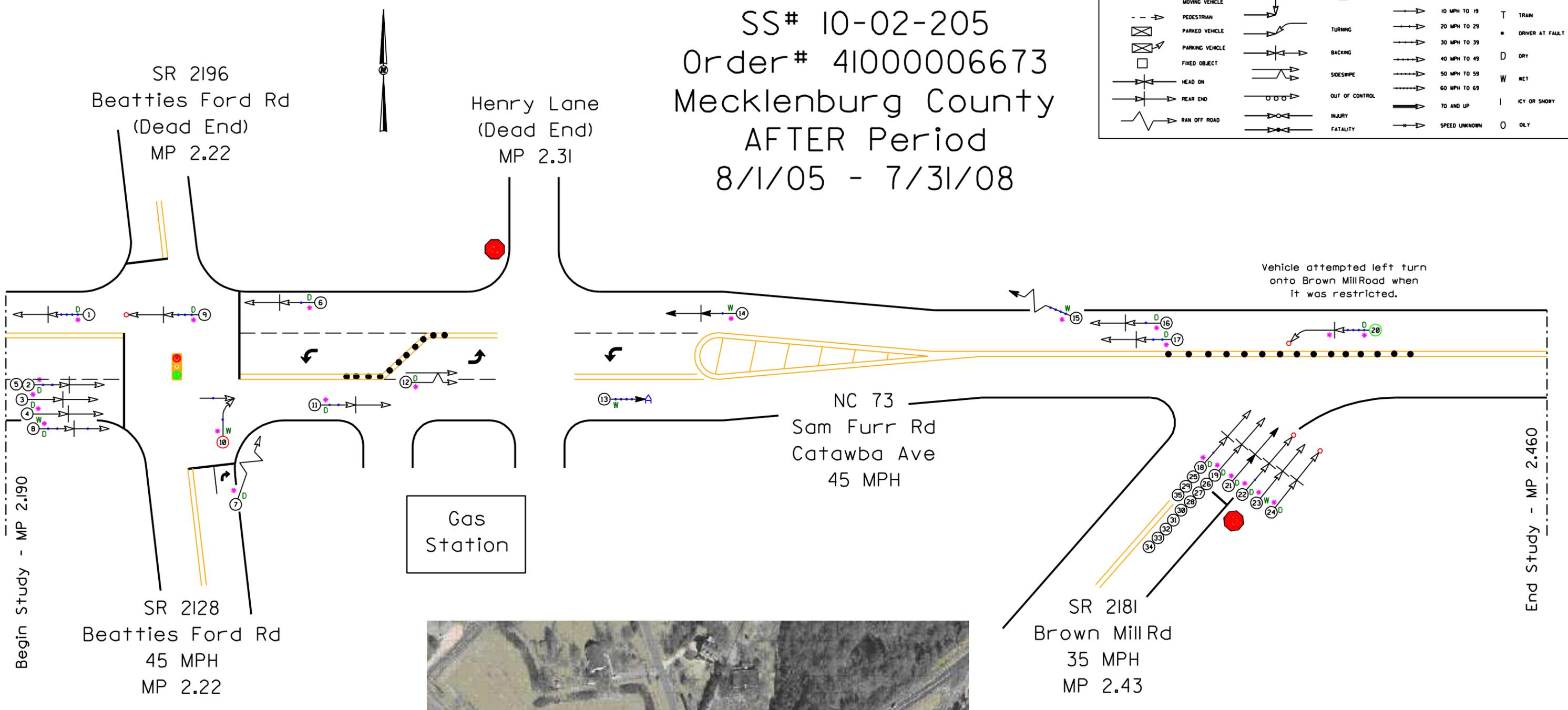
N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRANSPORTATION MOBILITY and SAFETY DIVISION

TRAFFIC SAFETY UNIT

Date: 10-13-2010 Prepared By: J. Schronce

SS# 10-02-205
 Order# 41000006673
 Mecklenburg County
 AFTER Period
 8/1/05 - 7/31/08

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		BACKSLIDE		30 MPH TO 39		DRY
	FIXED OBJECT		SKIDS/SLIPE		40 MPH TO 49		WET
	HEAD ON		OUT OF CONTROL		50 MPH TO 59		ICY OR SNOWY
	REAR END		INJURY		60 MPH TO 69		ONLY
	RAN OFF ROAD		FATALITY		70 AND UP		
					SPEED UNKNOWN		



New Signalized Intersection
 Intersection
 Sig ID 10-1842

Traffic Signal Target Crashes
 Delineator Target Crashes

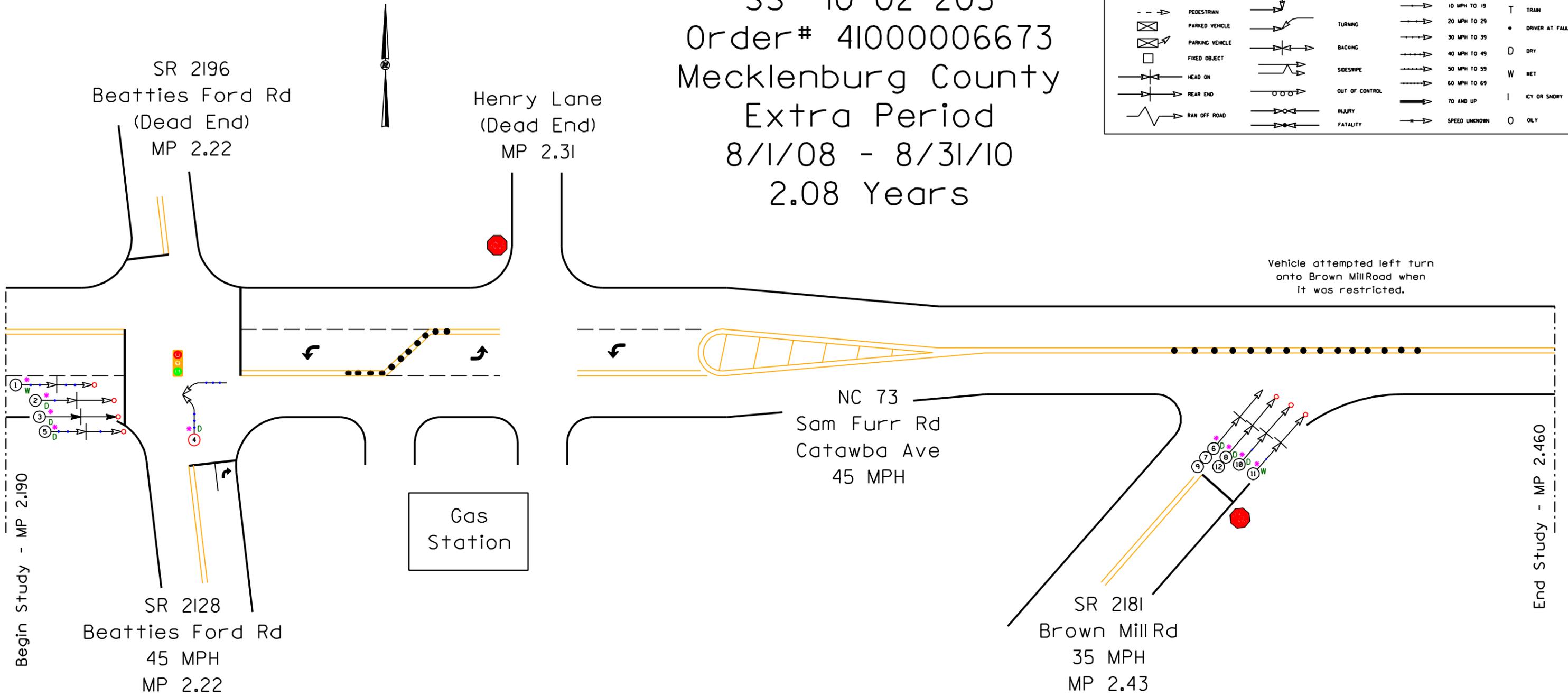
N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRANSPORTATION MOBILITY and SAFETY DIVISION

TRAFFIC SAFETY UNIT

Date: 10-13-2010 Prepared By: J. Schronce

SS# 10-02-205
 Order# 41000006673
 Mecklenburg County
 Extra Period
 8/1/08 - 8/31/10
 2.08 Years

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



Existing
 Signalized
 Intersection
 Sig ID 10-1842

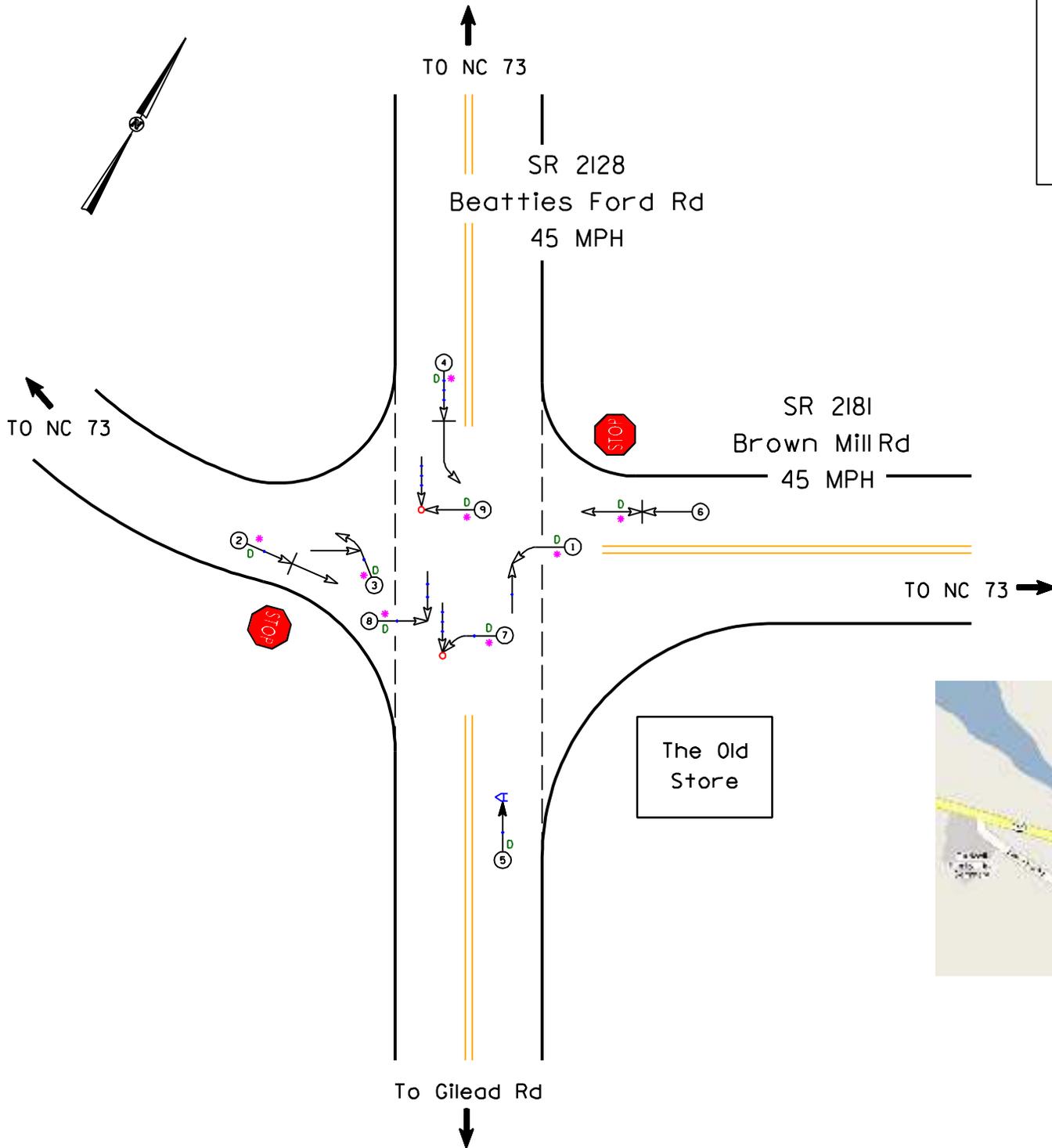
Traffic Signal
Target Crashes

Delineator
Target Crashes

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

TRAFFIC SAFETY UNIT

Date: 10-14-2010 Prepared By: J. Schronce



LEGEND

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

SS# 10-02-205
 2nd Intersection
 Order# 41000006673
 Mecklenburg County
 AFTER Period
 8/1/05 - 7/31/08



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

TRAFFIC SAFETY UNIT

Date: 10-7-2010	Prepared By: J. Schronce
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