

# Spot Safety Project Evaluation

Order # 41000008842

Spot Safety Project # 08-04-215

**Spot Safety Project Evaluation of the Traffic Signal Installation  
NC 24/27 at Montgomery Crossing Shopping Plaza (Wal-Mart)  
Montgomery County, Town of Biscoe**

Documents Prepared By:

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

**Principal Investigator**



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Jason B. Schronce

11-10-2010

Date

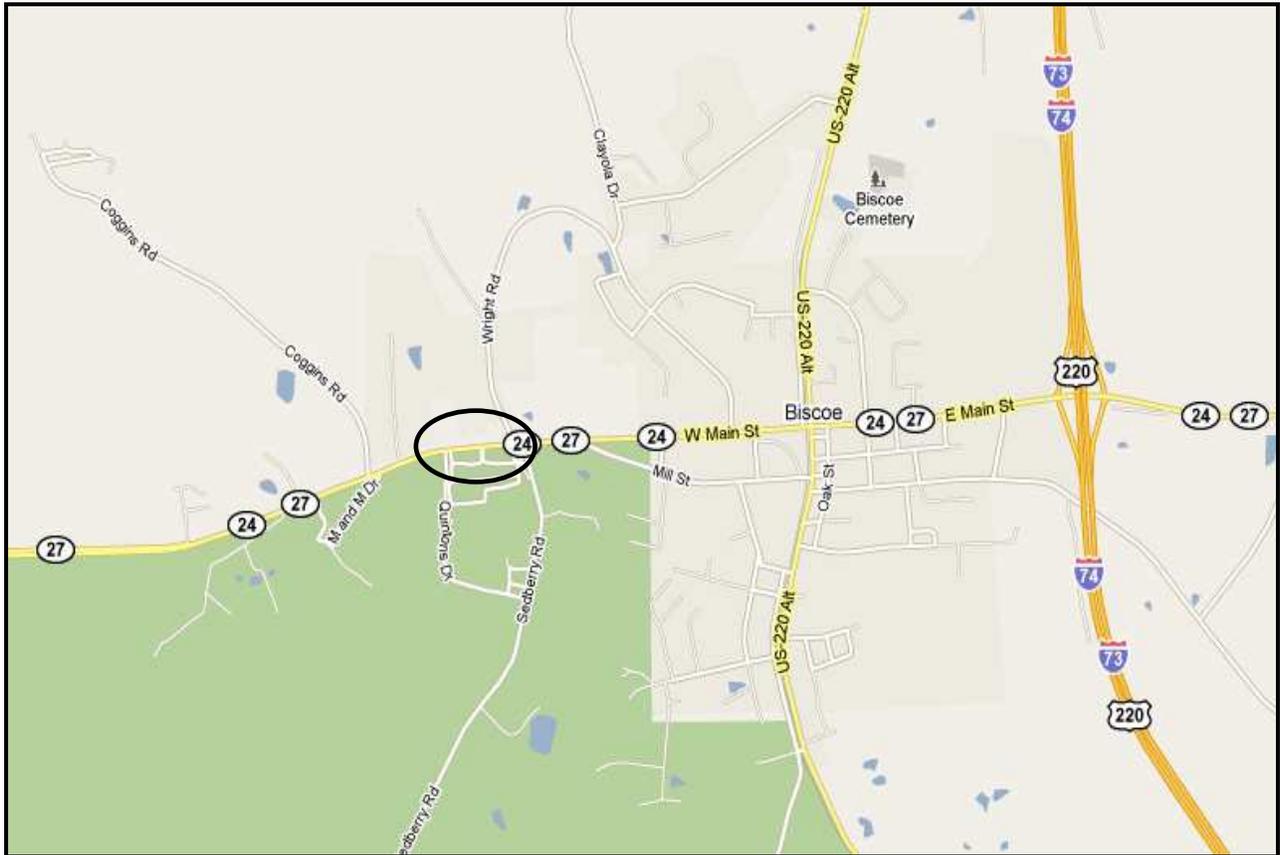
Traffic Safety Project Engineer

# Spot Safety Project Evaluation Documentation

## Subject Location

Evaluation of Spot Safety Project Number 08-04-215 located at the Intersection of NC 24/27 (West Main Street) and Montgomery Crossing (Wal-Mart Shopping Plaza) main entrance in Montgomery County, City of Biscoe.

The Sig ID is 08-1077 for this newly installed traffic signal.



## Evaluation Study Limits

NC 24 Milepost:	
Begin Study	MP 17.860 (150' West of Secondary Entrance)
Secondary Entrance	MP 17.888
Main Wal-Mart Entrance	MP 17.967
End Study	MP 17.995 (150' East of Main Entrance)



**2005 Aerial from Montgomery County GIS  
Aerial prior to Signal Installation at the Main Entrance (on the right)**

### **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 the main entrance to Montgomery Crossing Shopping Center. NC 24/27 is a five-lane facility along the segment with a speed limit of 45 mph. The main entrance to the Wal-Mart Shopping Center is a four-lane median divided driveway with left and right exit turn lanes. The subject location is a three-leg intersection, which was controlled by a stop sign in the before period.

The original statement of problem stated that an angle crash pattern was developing from motorists leaving the Wal-Mart driveway as they were failing to yield to on-coming vehicles. The intended purpose was to reduce the number of crashes involving traffic entering NC 24/27.

The initial crash analysis was completed from January 1, 2001 to December 31, 2003 with eighteen (18) reported crashes in the project area, eight (8) of which were deemed correctable. The final completion date for the improvement at the subject intersection was on November 22, 2006 with a total cost of \$117,500.

## 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 October through November 2006. The before period consisted of reported crashes from January 1, 2003 through September 30, 2006 (3 years and 9 months); and the after period consisted of reported crashes from December 1, 2006 through August 31, 2010 (3 years and 9 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 the two shopping center entrances from 150 feet west of the secondary entrance (MP 17.860) to 150 feet east of the main entrance (MP 17.995). *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 Frontal Impact Crashes at the Main Entrance were the target crashes for the applied countermeasure. 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.

<b><u>Treatment Information</u></b>	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-) Percent Increase (+)</b>
Total Crashes	25	15	- 40.0 %
Total Severity Index	3.07	13.57	342.0 %
Target Crashes	6	8	33.3 %
Target Crash Severity Index	2.23	21.80	877.6 %
Volume (2004, 2008)	16,000	16,000	0.0 %

<b><u>Injury Crash Summary</u></b>	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-) Percent Increase (+)</b>
Fatal injury Crashes	0	0	N/A
Class A injury Crashes	0	2	200.0 %
Class B injury Crashes	2	2	0.0 %
Class C Injury Crashes	5	3	- 40.0 %
Total Injury Crashes	7	7	0.0 %

The naive before and after analysis at the treatment location resulted in a 40 percent decrease in Total Crashes along the segment, an 33 percent increase in Target Crashes at the main entrance, and a 342 percent increase in the Total Severity Index. The before period ADT year was 2004 and the after period ADT year was 2008.

## Results and Discussion

Referencing the *Collision Diagrams*, the before period indicated a small pattern of six (6) frontal impact collisions at the main entrance to Montgomery Crossing. The crashes included three (3) left turn different roadway, two (2) right turn different roadway, and one (1) right turn same roadway collision involving a tractor-trailer.

After the signal installation, all the crashes from vehicles attempting to access NC 24/27 from the Wal-Mart main entrance driveway were eliminated. However, the after period did present eight (8) frontal impact crashes at this location including one (1) red light run crash. The other seven (7) collisions were left turn same roadway crashes which resulted in two (2) A-injury collisions. These A-injury crashes are the reason the project indicates a negative benefit-cost ratio.

In addition, this signal appears to have created a secondary improvement at the 2<sup>nd</sup> Wal-Mart entrance located approximately 415 feet west of the signalized intersection. This location sits on the edge of a NC 24/27 horizontal curve and had a pattern of eleven (11) left turn different roadway collisions in the before period. After the signal installation, this pattern was reduced to three (3) crashes. This reduction can be attributed to shoppers preferring to use the signalized intersection from the parking lot and potentially the creation of NC 24/27 traffic platooning which helps to make the left turn safer.

The calculated benefit to cost ratio for this project is **(-15.23) considering total crashes**. The benefit to cost ratio **considering only target crashes is (-16.51)**. 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.

Please see the attached *Treatment Site Photos*. Photos are provided from Google Street View for both NC 24/27 approaches to the treatment segment and main entrance signalized 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



Traveling East on NC 24/27 approaching Secondary Wal-Mart Entrance



Traveling East on NC 24/27 between access points



Traveling East on NC 24/27 at new traffic signal (Main Entrance)



Looking West on NC 24/27 approaching Main Entrance

**BENEFIT-COST ANALYSIS WORKSHEET - Total Crashes**

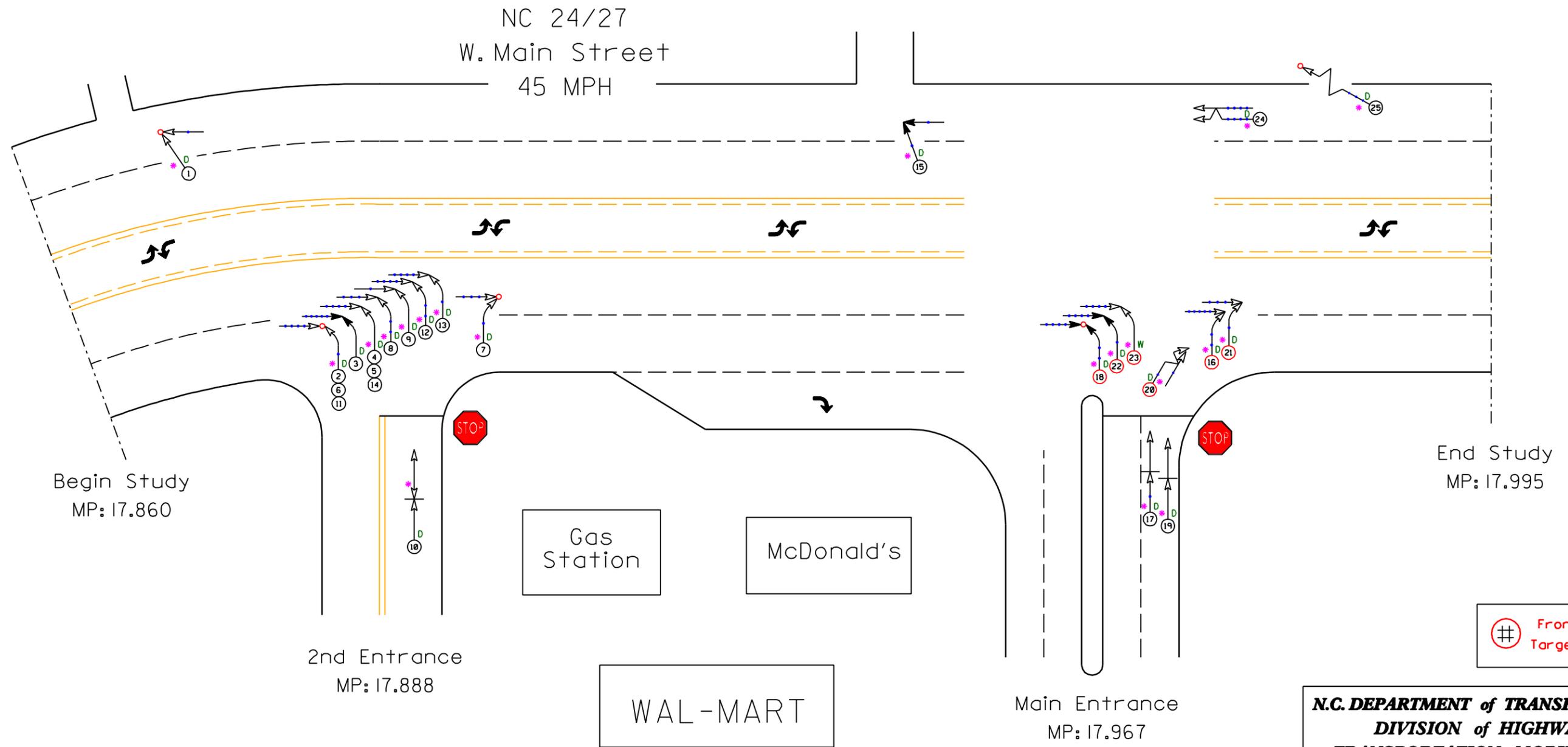
LOCATION: NC 24/27 at Biscoe Wal-Mart		BY: JBS						
COUNTY: Montgomery		DATE: 11/9/2010						
FILE NO.: SS 08-04-215								
DETAILED COST:	TYPE IMPROVEMENT -	Signal Installation						
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$117,500	10	0.149	\$17,511			
	Right-of-Way	\$0	0	0.000	\$0			
		\$0	0	0.000	\$0			
	TOTALS	\$117,500	10	0.149	\$17,511			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$2,200			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$900			
	TOTAL ANNUAL COST=				\$20,611			
	TOTAL COST OF PROJECT=				\$117,500			
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	3.75	0	0.00	7	1.87	18	4.80	\$57,973
AFTER	3.75	2	0.53	5	1.33	8	2.13	\$371,840
						Annual Benefits from Crash Cost Savings		(\$313,867)
	NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST				=	(\$334,478)		
	BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST				=	-15.23		
	TOTAL COST OF PROJECT	-	\$117,500	COMPREHENSIVE B/C RATIO	-			-15.23

**BENEFIT-COST ANALYSIS WORKSHEET - Target Crashes**

LOCATION: NC 24/27 at Biscoe Wal-Mart		BY: JBS						
COUNTY: Montgomery		DATE: 11/9/2010						
FILE NO.: SS 08-04-215								
DETAILED COST:	TYPE IMPROVEMENT -	Signal Installation						
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$117,500	10	0.149	\$17,511			
	Right-of-Way	\$0	0	0.000	\$0			
		\$0	0	0.000	\$0			
	TOTALS	\$117,500	10	0.149	\$17,511			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$2,200			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$900			
	TOTAL ANNUAL COST=				\$20,611			
	TOTAL COST OF PROJECT=				\$117,500			
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	3.75	0	0.00	1	0.27	5	1.33	\$11,067
AFTER	3.75	2	0.53	2	0.53	4	1.07	\$351,253
						Annual Benefits from Crash Cost Savings		(\$340,187)
	NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST				=	(\$360,798)		
	BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST				=	-16.51		
	TOTAL COST OF PROJECT	-	\$117,500	COMPREHENSIVE B/C RATIO	-			-16.51

SS# 08-04-215  
 Order# 41000008842  
 Montgomery County  
 Town of Biscoe  
 BEFORE Period  
 1/1/03 - 9/30/06

MOVING VEHICLE		ANGLE		SPEED	
	PEDESTRIAN		9 MPH OR LESS		PEDESTRIAN
	PARKED VEHICLE		10 MPH TO 19		TRAIN
	PARKING VEHICLE		20 MPH TO 29		DRIVER AT FAULT
	FIXED OBJECT		30 MPH TO 39		DRY
	HEAD ON		40 MPH TO 49		WET
	REAR END		50 MPH TO 59		ICY OR SNOWY
	RAN OFF ROAD		60 MPH TO 69		ONLY
			70 AND UP		
			SPEED UNKNOWN		



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

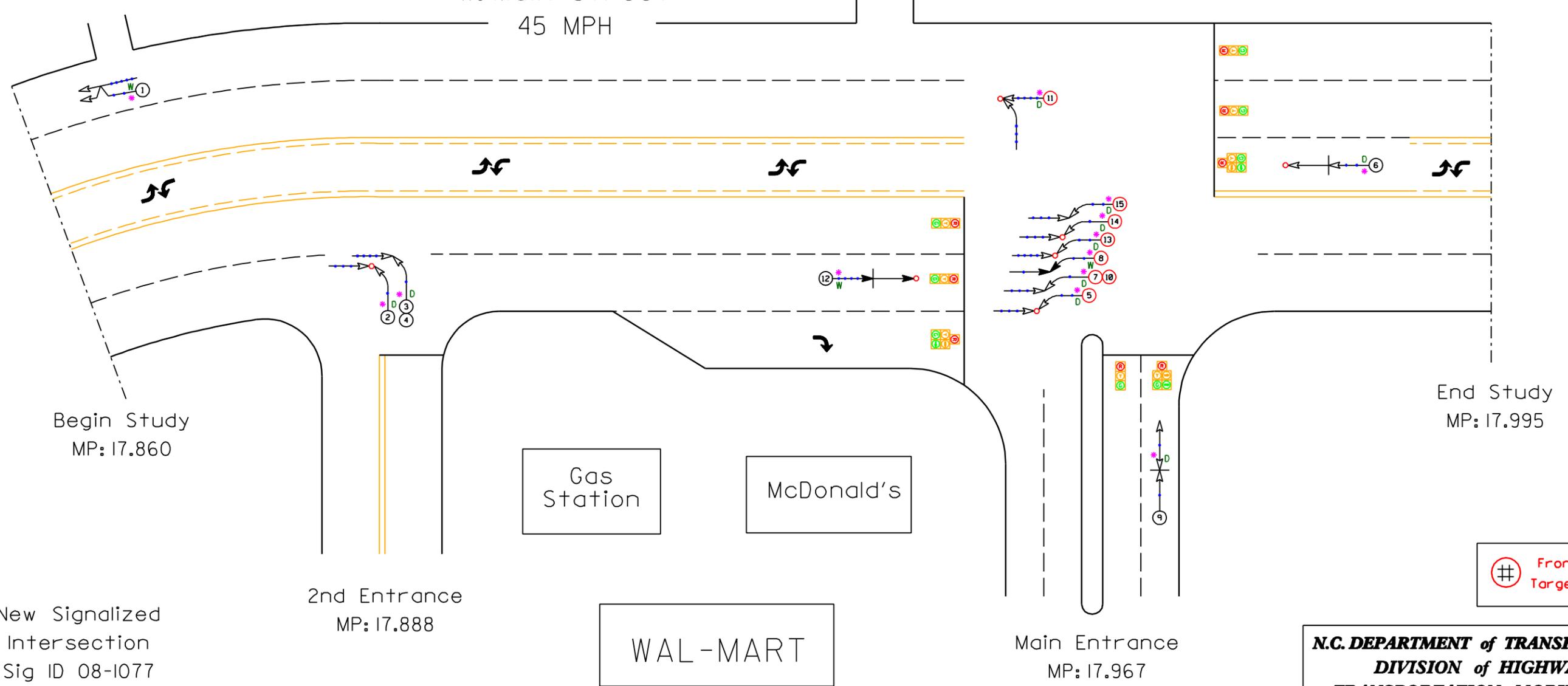
**TRAFFIC SAFETY UNIT**

Date: 11-5-2010      Prepared By: J. Schronce

SS# 08-04-215  
 Order# 41000008842  
 Montgomery County  
 Town of Biscoe  
 AFTER Period  
 12/1/06 - 8/31/10

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

NC 24/27  
 W. Main Street  
 45 MPH



New Signalized Intersection  
 Sig ID 08-1077

Frontal Impact Target Crashes

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

**TRAFFIC SAFETY UNIT**

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