

Spot Safety Project Evaluation

Order # 41000001412

Spot Safety Project # 12-93-048

**Spot Safety Project Evaluation of the Signal Installation
NC 273 (Park Street) at Abbey Shopping Plaza (Hawley Ave)
City of Belmont, Gaston 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

7-27-2010

Date

Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 12-93-048 located at the Intersection of NC 273 (Park Street) and the Abbey Plaza Shopping Center (Roses) / Wendy's Parking Lot in Gaston County, in the City of Belmont. The intersection is located on NC 273 as the major link between I-85 and the US 29/74 intersections.

Hawley Avenue was rerouted in late 2005 to intersect at this signal intersection and currently is the same approach as the Abbey Plaza Shopping Center (see aerial diagram).

The Sig ID is 12-1415 for this newly installed traffic signal.





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. NC 273 (Park Street) is a five lane facility with a center turn lane and a 45 mph posted speed limit. The Abbey Plaza / Hawley Avenue approach presents a right turn lane and a thru-left lane at this location with the Wendy's approach providing a single lane approach. The subject location is a four-leg intersection, which was controlled by stop signs on the shopping center approaches in the before period.

The original statement of problem was the occurrence of side street delay at this location. The intersection was initially investigated for a signal in 1993 but this signal placement was postponed. As stated in the Subject Location section, Hawley Avenue was later realigned to intersect NC 273 at this intersection.

The secondary crash analysis was completed from March 1, 1995 to February 28, 1998 with two (2) reported crashes. The signal met volume warrants 1, 2, 9, and 11. The final completion date for the improvement at the subject intersection was on April 13, 2004 with a total cost of \$30,000.

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 March through April 2004. The before period consisted of reported crashes from February 1, 1998 through February 29, 2004 (6 years and 1 month); and the after period consisted of reported crashes from May 1, 2004 through May 30, 2010 (6 years and 1 month). 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 subject intersection. These limits include the closest PVA entrance to the Eastwood Village Shopping Center (Food Lion). *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 signal) 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; U-turn; and Angle.

<u>Treatment Information</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	23	49	113.0 %
Total Severity Index	5.26	2.21	- 58.0 %
Target Crashes	13	24	84.6 %
Target Crash Severity Index	7.97	2.85	- 64.2 %
Volume (2001, 2007)	24,000	26,000	8.3 %

<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	1	1	0.0 %
Class C Injury Crashes	2	7	250.0 %
Total Injury Crashes	4	8	100.0 %

The naive before and after analysis at the treatment location resulted in a 113 percent increase in Total Crashes, an 85 percent increase in Target Crashes, but a 58 percent decrease in the Total Severity Index. The before period ADT year was 2001 and the after period ADT year was 2007.

Results and Discussion

Referencing the *Collision Diagrams*, the before period presented a pattern of thirteen (13) frontal impact collisions at the subject location, eleven (11) of which resulted from motorists improperly exiting from the shopping center areas. The Eastwood Village entrance, approximately 65 feet to the south of the intersection, also had three (3) left turn collisions.

During the after period, this location experienced a crash history that doubled the before period. Of the twenty-four (24) after period frontal impact crashes, thirteen (13) resulted from a southbound NC 273 motorist running the red light. Other noteworthy figures, NC 273 left-turn same road crashes increased from one (1) to three (3) and left-turn same road crashes from Hawley Avenue increased from zero (0) to two (2) collisions.

The southern Eastwood Village Shopping Center also experienced seven (7) left turn collisions, which doubled from the before period. Rear-end crashes approaching this intersection did increase as well along this segment from zero (0) in the before period to seven (7) crashes in the after period.

The calculated benefit to cost ratio for this project is **9.72 considering total crashes**. The benefit to cost ratio **considering only target crashes is 11.51**. 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. The b-c ratio remained positive with this evaluation due to the elimination of the single A-injury collision in the before period.

In reference to the realignment of Hawley Avenue, the Safety Evaluation Group also analyzed the intersection to the north: NC 273 (Park Street) at SR 2094 (Browntown Road). From the crash data, the realignment occurred in late 2005 at which this intersection went from a 4-leg approach to a 3-leg approach with slip ramps and no left turns onto Hawley Avenue.

Therefore, the date ranges for this secondary analysis are:

Before Period (4-Leg Approach): September 1, 2001 to November 30, 2005 (4.25 Years)

Construction Period: December 2005 to February 2006

After Period (3-Leg Approach): March 1, 2006 to May 31, 2010 (4.25 Years)

<u>NC 273 at Browntown Rd Realignment Information</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	23	18	- 21.7 %
Total Severity Index	2.61	2.23	- 14.6 %
Target Crashes - Realignment	7	1	- 85.7 %
Target Crash Severity Index	2.06	1.00	- 51.5 %
Volume (2003, 2008)	24,000	26,000	8.3 %

As shown in the table above, overall crashes did decrease slightly with the removal of one approach lane. From the collision diagrams of this intersection, total frontal impact collisions decreased from fifteen (15) in the before period to five (5) in the after period. There was one (1) target crash in the after period from a vehicle that attempted an illegal left turn onto the Access Road (formally Hawley Avenue). The intersection did experience an increase in rear-end and sideswipe crashes from six (6) to twelve (12) through the evaluation.

We were attempting to correlate the increase in crashes at the treatment signal location by examining the Browntown intersection with NC 273 by looking for crash migration. Although, from the data, the Browntown intersection's crash totals did not decrease significantly enough after the Hawley Avenue realignment for this to be plausible. The high reduction in realignment target crashes at the secondary location was expected since the traffic movement had been eliminated.

Please see the attached *Treatment Site Photos*. Photos are provided from Google Street View for both 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 South on NC 273 (Park Street)



Traveling South on NC 273 approaching signal



Looking North on NC 273 (Park Street)
Showing Additional Eastwood Village Entrance/Exit within study limits



Looking West onto Hawley Avenue

BENEFIT-COST ANALYSIS WORKSHEET - Total Crashes

LOCATION: NC 273 at Hawley		BY: JBS							
COUNTY: Gaston		DATE: 7/20/2010							
FILE NO.: SS 12-93-048									
DETAILED COST:	TYPE IMPROVEMENT -	New Signal							
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST				
	Construction	\$30,000	10	0.149	\$4,471				
		\$0	0	0.000	\$0				
	Right-of-Way	\$0	0	0.000	\$0				
	TOTALS	\$30,000	10	0.149	\$4,471				
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$2,000				
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$900				
	TOTAL ANNUAL COST=				\$7,371				
	TOTAL COST OF PROJECT=				\$30,000				
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	6.08	1	0.16	3	0.49	19	3.13	\$126,924	
AFTER	6.08	0	0.00	8	1.32	41	6.74	\$55,313	
						Annual Benefits from Crash Cost Savings		\$71,612	
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$64,241			
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	9.72			
TOTAL COST OF PROJECT		-	\$30,000	COMPREHENSIVE B/C RATIO		-	9.72		

BENEFIT-COST ANALYSIS WORKSHEET - Target Crashes

LOCATION: NC 273 at Hawley		BY: JBS							
COUNTY: Gaston		DATE: 7/20/2010							
FILE NO.: SS 12-93-048									
DETAILED COST:	TYPE IMPROVEMENT -	New Signal							
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST				
	Construction	\$30,000	10	0.149	\$4,471				
		\$0	0	0.000	\$0				
	Right-of-Way	\$0	0	0.000	\$0				
	TOTALS	\$30,000	10	0.149	\$4,471				
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$2,000				
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$900				
	TOTAL ANNUAL COST=				\$7,371				
	TOTAL COST OF PROJECT=				\$30,000				
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	6.08	1	0.16	2	0.33	10	1.64	\$117,270	
AFTER	6.08	0	0.00	6	0.99	18	2.96	\$32,467	
						Annual Benefits from Crash Cost Savings		\$84,803	
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$77,432			
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	11.51			
TOTAL COST OF PROJECT		-	\$30,000	COMPREHENSIVE B/C RATIO		-	11.51		



NC 273
Park Road
45 MPH

To I-85

Captain's Cap
Seafood

Wendy's

Eastwood Shopping Village
(Food Lion)

Bank of America

Abbey Plaza
25 MPH

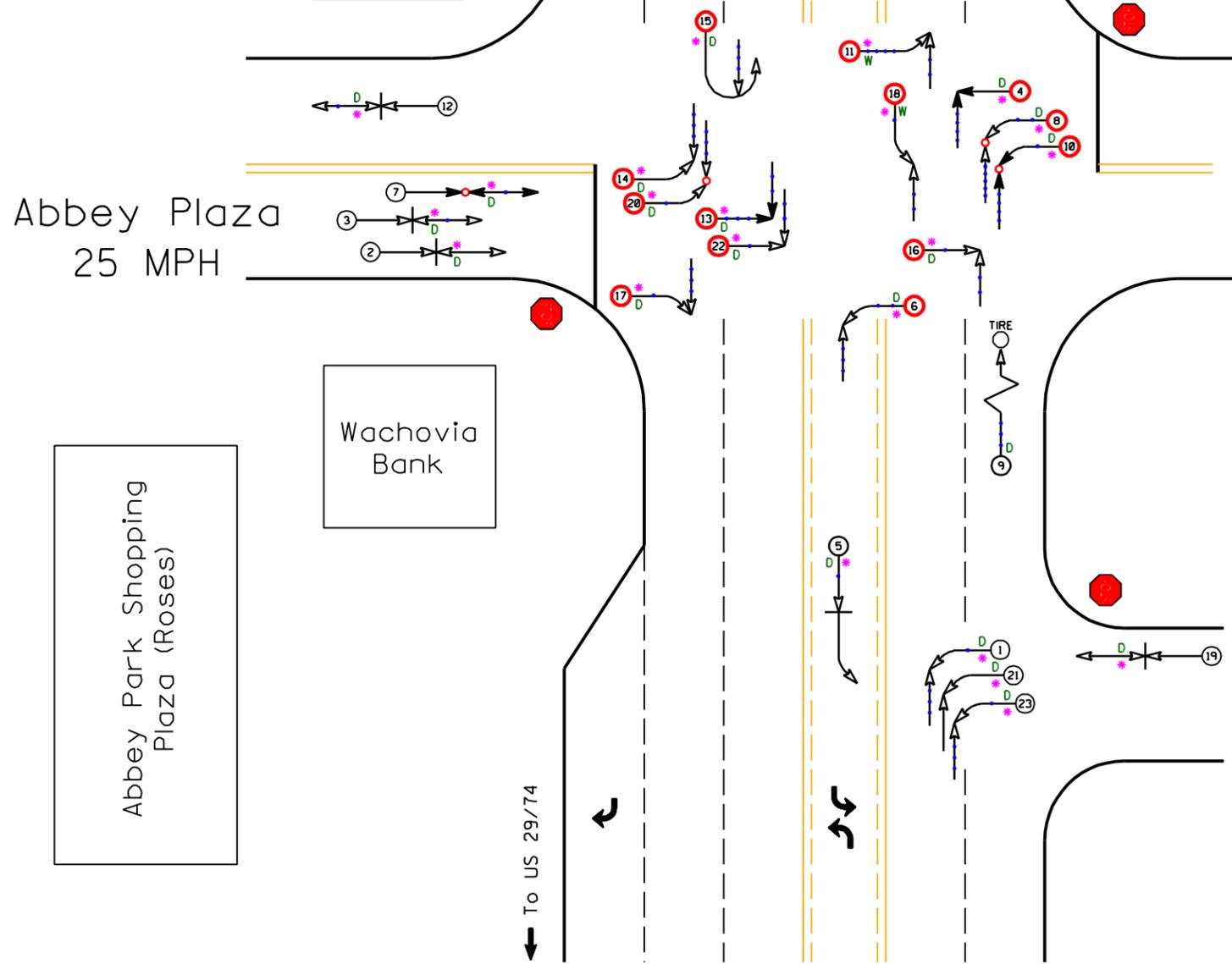
Wachovia Bank

Abbey Park Shopping Plaza (Roses)

To US 29/74

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		OILY
	RAN OFF ROAD		70 AND UP		SPEED UNKNOWN		

SS# 12-93-048
Order# 41000001412
Gaston County
BEFORE Period
2/1/98 - 2/29/04



Frontal Impact
Target Crashes

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

TRAFFIC SAFETY UNIT

Date: 7-13-2010 Prepared By: J. Schronce



NC 273
Park Road
45 MPH

To I-85

Hawley Ave
25 MPH

Captain's Cap
Seafood

Wendy's

Bank of
America

Wachovia
Bank

Abbey Park Shopping
Plaza (Roses)

Eastwood Shopping
Village
(Food Lion)

To US 29/74

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		70 AND UP		OILY

SS# 12-93-048
Order# 41000001412
Gaston County
AFTER Period
5/1/04 - 5/31/10



New Signalized
Intersection
Sig ID 12-1415



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

TRAFFIC SAFETY UNIT

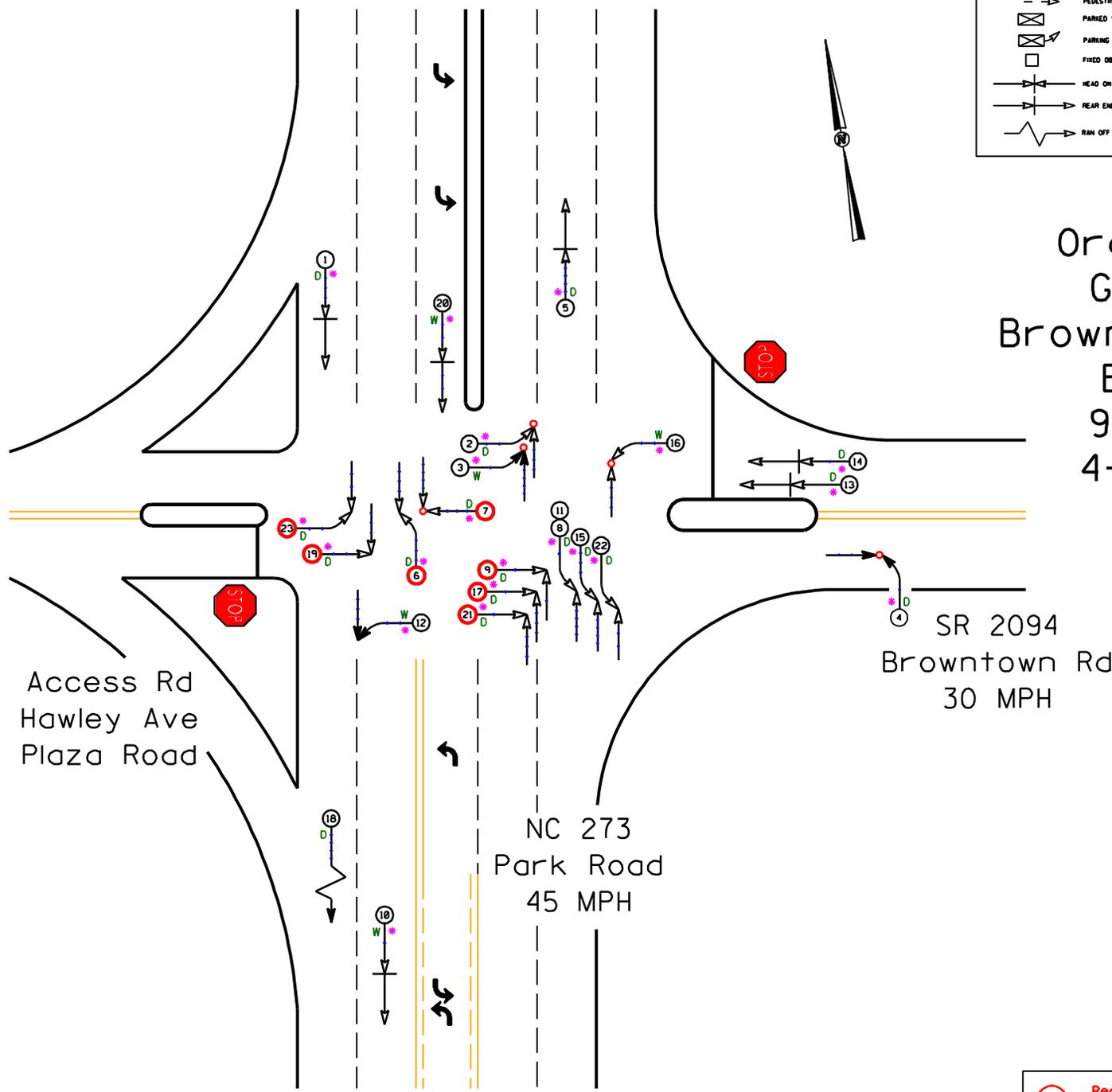
Date: 7-19-2010

Prepared By: J. Schronce

LEGEND

	MOVING VEHICLE		ANGLE		9 MPH OR LESS		PEDESTRIAN
	PEDESTRIAN		TURNING		10 MPH TO 19		TRAM
	PAKED VEHICLE		BACKING		20 MPH TO 29		DRIVER AT FAULT
	PARKING VEHICLE		SIDESWIPE		30 MPH TO 39		D DRY
	FIXED OBJECT		OUT OF CONTROL		40 MPH TO 49		W WET
	HEAD ON		REAR END		50 MPH TO 59		I ICY OR SNOW
	REAR END		HIT AND RUN		60 MPH TO 69		S SPEED UNKNOWN
	RAN OFF ROAD		HURT		70 AND UP		F FATALITY
			FATALITY		8 MPH OR LESS		

SS# 12-93-048
 Order# 41000001412
 Gaston County
 Browntown Rd Analysis
 BEFORE Period
 9/1/01 - 11/30/05
 4-Leg Approach



Realignment
Target Crashes

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DIVISION of HIGHWAYS
TRANSPORTATION MOBILITY and SAFETY DIVISION

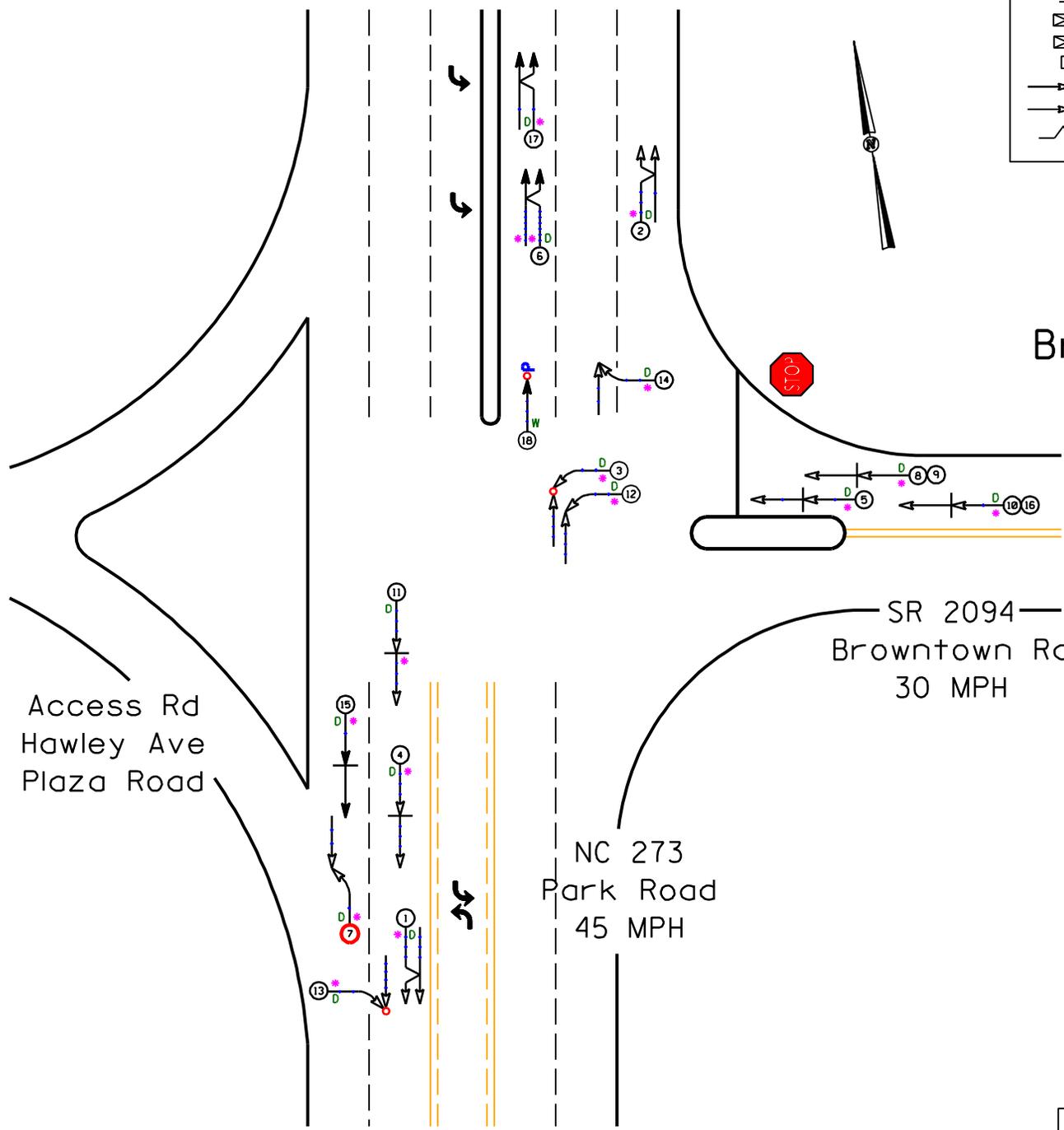
TRAFFIC SAFETY UNIT

Date: 7-27-2010 Prepared By: J. Schronce

LEGEND

	MOVING VEHICLE		ANGLE		9 MPH OR LESS		PEDESTRIAN
	PEDESTRIAN		TURNING		10 MPH TO 19		TRAM
	PAKED 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		RAN OFF ROAD		50 MPH TO 59		ICY OR SNOW
	REAR END		HURRY		60 MPH TO 69		TO AND UP
	RAN OFF ROAD		FATALITY		SPEED UNKNOWN		ONLY

SS# 12-93-048
 Order# 410000001412
 Gaston County
 Browntown Rd Analysis
 AFTER Period
 3/1/06 - 5/31/10
 3-Leg Approach



SR 2094
 Browntown Rd
 30 MPH

NC 273
 Park Road
 45 MPH

Access Rd
 Hawley Ave
 Plaza Road

Realignment
 Target Crashes

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

TRAFFIC SAFETY UNIT

Date: 7-27-2010 Prepared By: J. Schronce