

Spot Safety Project Evaluation

Project Log # 200611062

Spot Safety Project # 10-02-200

**Evaluation of the Closure of One Full Access Crossover, the Installation of a Directional Crossover at a Second Full Access Crossover, and the Installation of a Traffic Signal at a Third Full Access Crossover on SR 1223 (Dickerson Blvd) From US 74 to Commerce Dr
Union County**

Documents Prepared By:

Safety Evaluation Group
Traffic Safety Systems Management Section
Traffic Engineering and Safety Systems Branch
North Carolina Department of Transportation

Principal Investigator

Brad Robinson, EI

9/6/2007
Date

Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 10-02-200– SR 1223 (Dickerson Blvd) from US 74 to Commerce Dr in Union County.

Project Information and Background from the Project File Folder

The spot safety project improvement countermeasure chosen for the subject location was the closure of one full access crossover (Intersection 2), the installation of a directional crossover at a second full access crossover (Intersection 1), and the installation of a traffic signal at a third full access crossover (Intersection 3). SR 1223 is a five-lane facility through the treatment section, with a raised center median and a speed limit of 35 mph. There are shopping centers located on both side of SR 1223 at the treatment segment.

The initial statement of problem was that vehicles were entering and crossing a high volume multilane roadway at various points, resulting in a high number of angle collisions and congestion.

The initial crash analysis for this strip was completed from October 1, 1998 to October 1, 2001. There were 79 reported crashes during this time period, with 41 of these considered correctable.

The final completion date for the improvements at the subject location was on December 12, 2002 with a total cost of \$105,000.

Naive Before and After Analysis

After reviewing the 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 from September 1, 2002 through March 31, 2003. The before period consisted of reported crashes from October 1, 1998 through August 31, 2002 (3 Years, 11 Months) and the after period consisted of reported crashes from April 1, 2003 through February 28, 2007 (3 Years, 11 Months). The ending date for this analysis was determined by the available crash data at the time the analysis was conducted.

The treatment data consisted of all crashes on a strip of SR 1223 (Dickerson Blvd) from US 74 to Commerce drive, a distance of approximately .24 miles. A 150 feet Y-line was used in the analysis except for at the intersection of US 74, where only crashes that took place south of the northbound stop bar were included. Please see attached *Location Map* and *Collision Diagrams* for further detail.

The following data tables depict the Naive Before and After Analysis for the treatment location. Table one gives data for the entire strip. Tables two, three, and four give crash data within 150' of each of the three crossovers. It should be noted that Intersection 1 (the first crossover when driving from US 74) and Intersection 2 (the second crossover when traveling from US 74) were very similar, as they were both entrances/exits to the shopping centers on either side of the road. Because of this it was difficult to determine at which crossover some crashes occurred, especially in

the before period. Engineering judgement was used to best place the crashes with the information given on the crash reports.

Please note that because a different countermeasure was used at each crossover, the Target Crashes were also different. At Intersection 1, where a directional crossover was used, the Target Crashes were Angle Crashes and Left Turn Crashes involving a vehicle turning onto SR 1223 from the side streets. At Intersection 2, where the crossover was closed, the Target Crashes were Frontal Impact Crashes with the exception of Right Turn Crashes. At Intersection 3 (the crossover at Commerce Dr), where a signal was installed, the Target Crashes were all Frontal Impact Crashes. The crash types considered Frontal Impact are as follows: Left Turn, same roadway; Left Turn, different roadway; Right Turn, same roadway; Right Turn, different roadway; Head On, and Angle. The target crashes are clearly identified in the before and after period collision diagrams.

Table 1 – Strip Totals			
	Before Period	After Period	Percent Reduction (-)/ Percent Increase (+)
Total Crashes	148	67	-54.7
Total Severity Index	4.05	4.89	20.7
Target Crashes	92	11	-88.0
Target Severity Index	3.98	4.36	9.5
Volume	13,400	14,400	7.5

Table 2 – Intersection 1			
	Before Period	After Period	Percent Reduction (-)/ Percent Increase (+)
Total Crashes	75	29	-61.3
Total Severity Index	4.16	6.93	66.6
Target Crashes	52	0	-100.0
Target Severity Index	3.56	N/A	N/A

Table 3 – Intersection 2			
	Before Period	After Period	Percent Reduction (-)/ Percent Increase (+)
Total Crashes	44	1	-97.7
Total Severity Index	4.03	1	-75.2

Target Crashes	33	1	-97.0
Target Severity Index	4.81	1	-79.2
<u>Table 4 – Intersection 3</u>			
	Before Period	After Period	Percent Reduction (-)/ Percent Increase (+)
Total Crashes	9	15	66.7
Total Severity Index	3.47	3.96	14.1
Target Crashes	7	10	42.9
Target Severity Index	3.11	4.7	51.1

The naive before and after analysis at the treatment location resulted in a 55 percent decrease in Total Crashes and an 88 percent decrease in Target Crashes, with an 8 percent increase in Average Daily Traffic (ADT). The before period ADT year was 2000 and the after period ADT year was 2005. Please note that the ADT given is for the strip of SR 1223 only, as traffic counts were not known for the side streets.

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 55 percent decrease in Total Crashes and an 88 percent decrease in Target Crashes. Both Total and Target Crashes were significantly reduced at the first two intersections, but increased at the third. The summary results above demonstrate that the treatment location appears to have had a decrease in both Total Crashes and Target Crashes from the before to the after period.

Intersection 1

Total Crashes at Intersection 1 decreased by 61 percent and Target Crashes decreased 100 percent. The directional crossover appears effective in preventing vehicles exiting the shopping centers from crossing the roadway. There is still a pattern of Left Turn-Same Roadway Crashes involving vehicles turning left from SR 1223 into the shopping centers. This pattern increased 50 percent, from 16 in the before period to 24 in the after period.

Intersection 2

Total Crashes at Intersection 2 decreased by 98 percent and Target Crashes decreased by 97 percent. The crash report for the single crash at this intersection did not clarify if this crash was truly an angle crash caused by a vehicle going straight into the median or if it was actually turning right. The closure of this crossover appears to have been very effective at reducing crashes at this intersection.

Intersection 3 (at Commerce Dr)

Total Crashes at Intersection 3 increased by 67 percent and Target Crashes increased by 43 percent. The increase in both might be the result of the countermeasures at the other two crossovers. There were two crashes in the after period that involved southbound vehicles on SR 1223 attempting to make U-turns at the intersection. There were also four Left Turn-Same Roadway crashes involving southbound vehicles on SR 1223 making a left turn onto Commerce Dr, which also leads to the shopping center on the east side of SR 1223. Both of these patterns are relatively small considering the time period of nearly 5 years.

Other Comments

A pattern of Rear-End Crashes increased 55 percent for northbound SR 1223 traffic approaching US 74 (from 11 to 17).

The calculated benefit to cost ratio for this project is 4.15 considering total crashes. The benefit to cost ratio considering only target crashes is 9.71. 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 the analysis. The costs of the project include the actual construction costs as well as the increase in annual maintenance and utility costs.

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 road.

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: SR 1223 From US 74 to Commerce
 COUNTY: Union
 FILE NO.: SS 10-02-200

BY: Brad Robinson
 DATE: 8/23/2007

DETAILED COST: TYPE IMPROVEMENT - 3 Crossovers - 1 closure, 1 made into directional, and 1 signalized

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$105,000	10	0.149	\$15,648
	\$0	0	0.000	\$0
Right-of-Way	\$0	0	0.000	\$0
TOTALS	\$105,000	10	0.149	\$15,648

ESTIMATED INCREASE IN ANNUAL MAINT. COST = \$3,600
 ESTIMATED INCREASE IN ANNUAL UTILITY COST = \$900
 TOTAL ANNUAL COST= \$20,148
 TOTAL COST OF PROJECT= \$105,000

COMPREHENSIVE COST REDUCTION:

ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES

TIME PERIOD	YEARS	ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES				PDO		ANNUAL COSTS
		K & A CRASHES	K & A CRASHES PER YR	B & C CRASHES	B & C CRASHES PER YR	CRASHES	CRASHES PER YR	
BEFORE	3.92	0	0.00	61	15.56	87	22.19	\$366,658
AFTER	3.92	1	0.26	25	6.38	41	10.46	\$283,138

Annual Benefits from Crash Cost Savings \$83,520

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = \$63,372
 BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 4.15

TOTAL COST OF PROJECT - \$105,000 COMPREHENSIVE B/C RATIO - 4.15

BENEFIT-COST ANALYSIS WORKSHEET TARGET

LOCATION: SR 1223 From US 74 to Commerce
 COUNTY: Union
 FILE NO.: SS 10-02-200

BY: Brad Robinson
 DATE: 8/23/2007

DETAILED COST: TYPE IMPROVEMENT - 3 Crossovers - 1 closure, 1 made into directional, and 1 signalized

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$105,000	10	0.149	\$15,648
	\$0	0	0.000	\$0
Right-of-Way	\$0	0	0.000	\$0
TOTALS	\$105,000	10	0.149	\$15,648

ESTIMATED INCREASE IN ANNUAL MAINT. COST = \$3,600
 ESTIMATED INCREASE IN ANNUAL UTILITY COST = \$900
 TOTAL ANNUAL COST= \$20,148
 TOTAL COST OF PROJECT= \$105,000

COMPREHENSIVE COST REDUCTION:

ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES

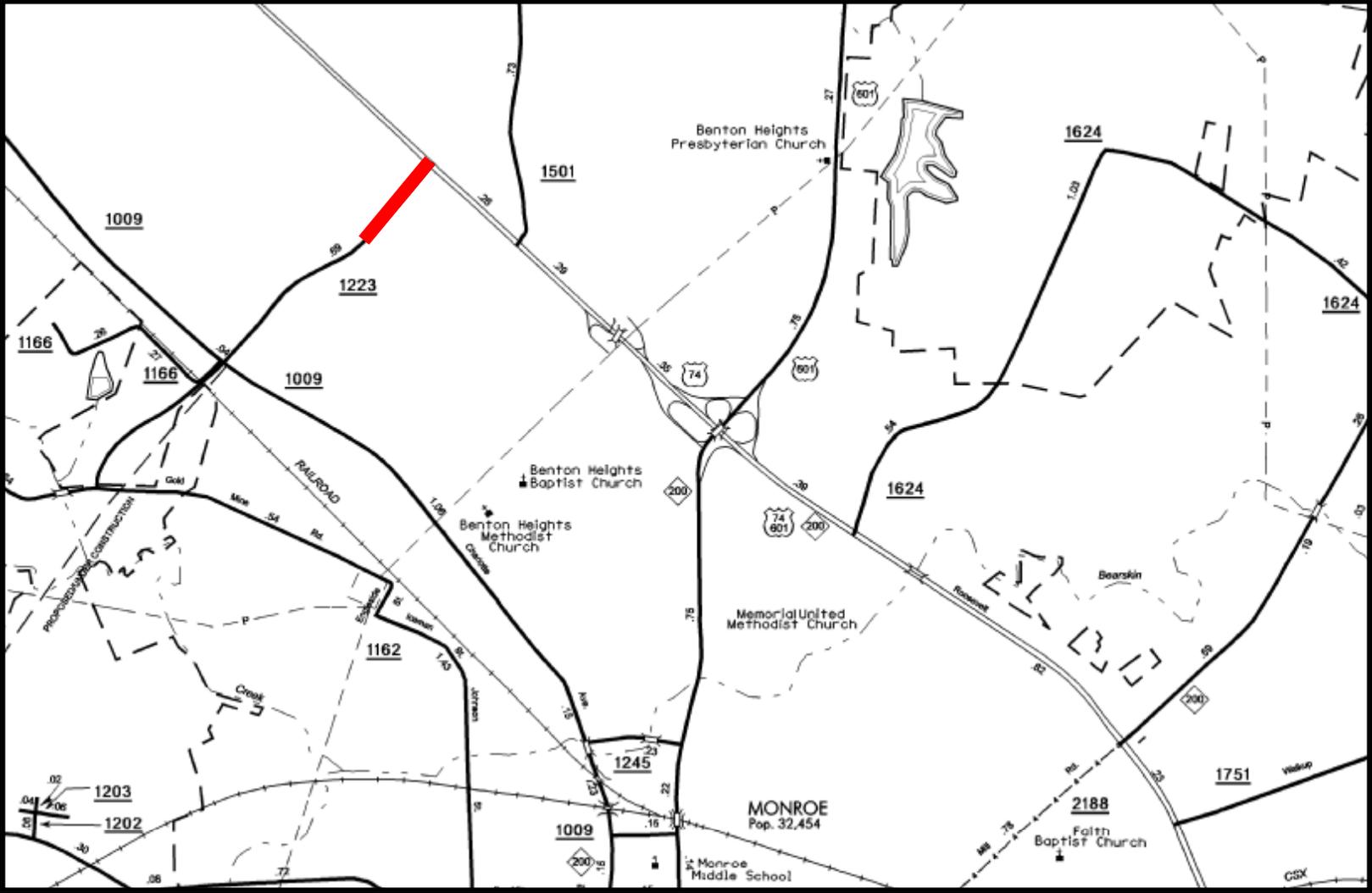
TIME PERIOD	YEARS	ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES				PDO		ANNUAL COSTS
		K & A CRASHES	K & A CRASHES PER YR	B & C CRASHES	B & C CRASHES PER YR	CRASHES	CRASHES PER YR	
BEFORE	3.92	0	0.00	37	9.44	55	14.03	\$224,617
AFTER	3.92	0	0.00	5	1.28	6	1.53	\$28,929

Annual Benefits from Crash Cost Savings \$195,689

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = \$175,541
 BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 9.71

TOTAL COST OF PROJECT - \$105,000 COMPREHENSIVE B/C RATIO - 9.71

Location Map
Union County
Evaluation of Spot Safety Project #10-02-200



Treatment Location: SR 1223 (Dickerson Blvd) from US 74 to Commerce Dr.

Treatment Site Photos Taken 7/11/07



Driving North on SR 1223 at Intersection 3 (Commerce Drive)



Driving North on SR 1223 at Intersection 2



Driving North on SR 1223 Approaching Intersection 1



Driving North on SR 1223 at Intersection 1



Driving North on SR 1223 approaching US 70



Driving South on SR 1223 from US 70



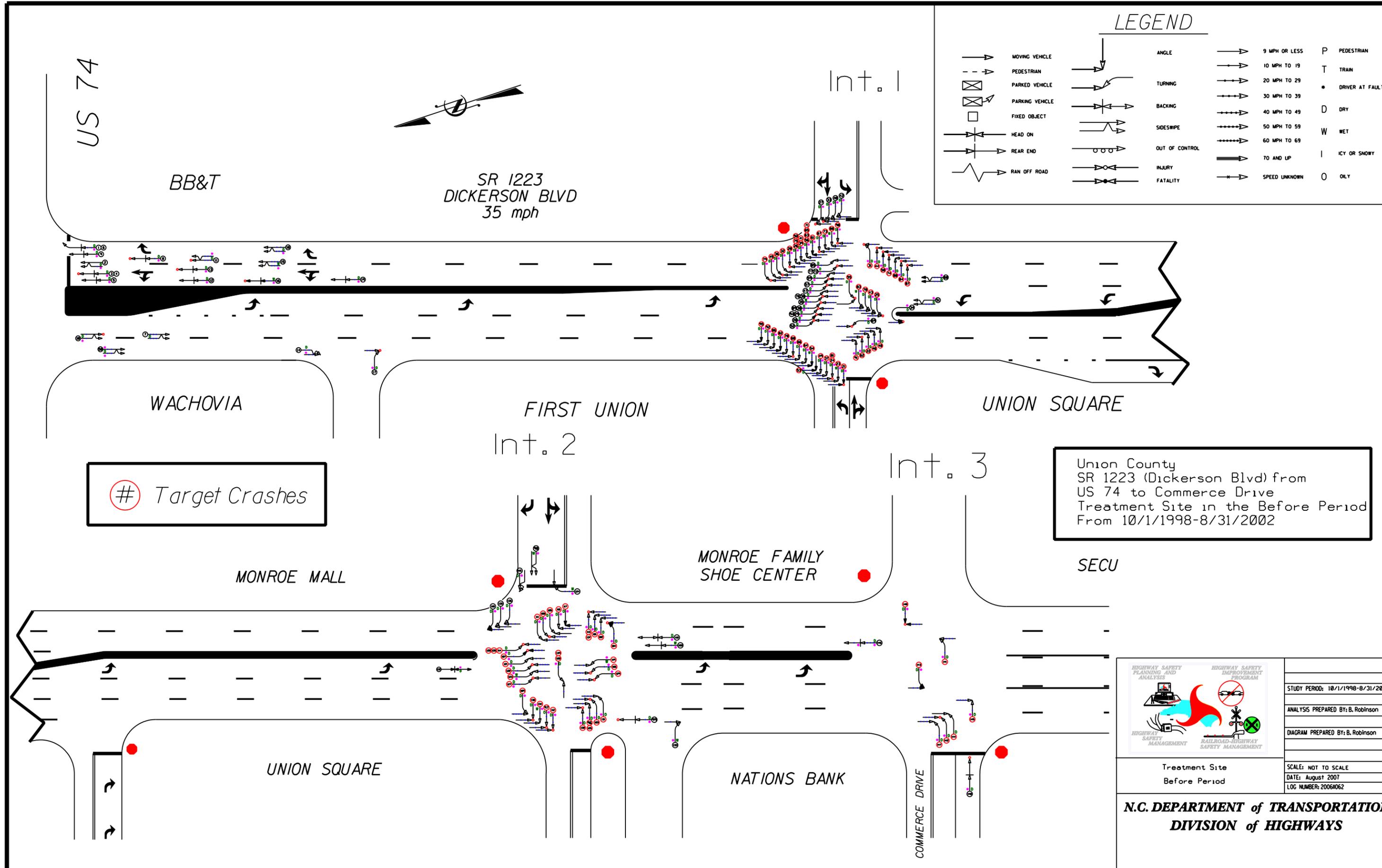
Driving South on SR 1223 at Intersection 1



Driving South on SR 1223 at Intersection 2, approaching Intersection 3

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		ONLY
	RAN OFF ROAD				70 AND UP		



Target Crashes

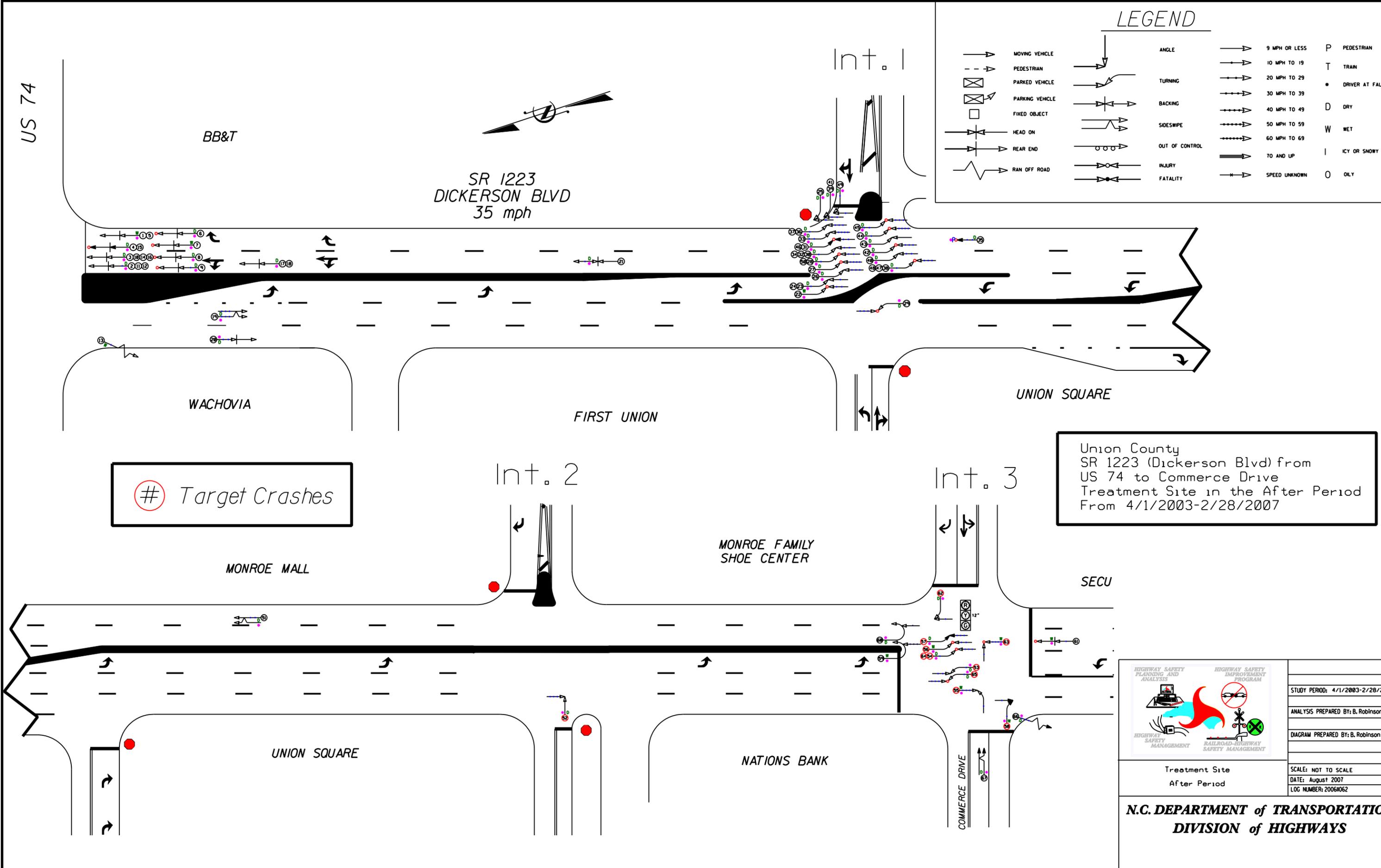
Union County
 SR 1223 (Dickerson Blvd) from
 US 74 to Commerce Drive
 Treatment Site in the Before Period
 From 10/1/1998-8/31/2002



STUDY PERIOD: 10/1/1998-8/31/2002
ANALYSIS PREPARED BY: B. Robinson
DIAGRAM PREPARED BY: B. Robinson
SCALE: NOT TO SCALE
DATE: August 2007
LOG NUMBER: 20061062

Treatment Site
 Before Period

N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS



LEGEND

- | | | | | | | | |
|---------|-----------------|---|----------------|---|---------------|---|-----------------|
| → | MOVING VEHICLE | ↘ | ANGLE | → | 9 MPH OR LESS | P | PEDESTRIAN |
| - - - → | PEDESTRIAN | ↙ | TURNING | → | 10 MPH TO 19 | T | TRAIN |
| ⊠ | PARKED 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 | ↔ | INJURY | → | 50 MPH TO 59 | I | ICY OR SNOWY |
| — — | REAR END | ↔ | FATALITY | → | 60 MPH TO 69 | O | ONLY |
| ↘ | RAN OFF ROAD | → | | → | 70 AND UP | | |
| | | → | | → | SPEED UNKNOWN | | |

Target Crashes

Union County
 SR 1223 (Dickerson Blvd) from
 US 74 to Commerce Drive
 Treatment Site in the After Period
 From 4/1/2003-2/28/2007



STUDY PERIOD:	4/1/2003-2/28/2007
ANALYSIS PREPARED BY:	B. Robinson
DIAGRAM PREPARED BY:	B. Robinson
SCALE:	NOT TO SCALE
DATE:	August 2007
LOG NUMBER:	2006062

Treatment Site
 After Period
N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS