

# Spot Safety Project Evaluation

Order # 41000004470

Spot Safety Project # 10-02-203

**Spot Safety Project Evaluation of the Directional Crossover Installation  
US 29 (N. Tryon Street) at Grove Lake Drive  
City of Charlotte, 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

2-25-2010

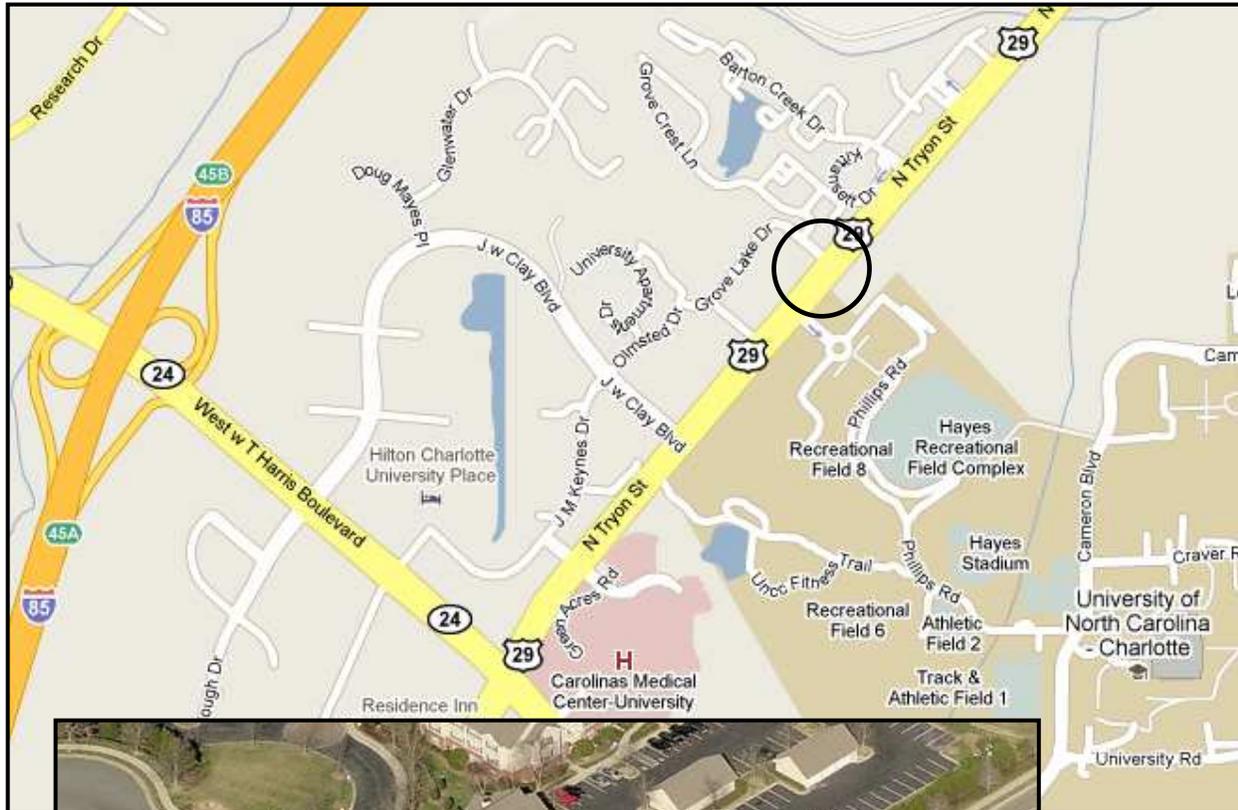
Date

Traffic Safety Project Engineer

# Spot Safety Project Evaluation Documentation

## Subject Location

Evaluation of Spot Safety Project Number 10-02-203 located at the Intersection of US 29 (North Tryon Street) and Grove Lake Drive in Mecklenburg County, City of Charlotte. This location borders the UNC-Charlotte Campus.



## Project Information and Background from the Project File Folder

The spot safety project improvement countermeasure chosen for the subject location was the installation of a directional crossover. US 29 is a four lane median divided facility with left turn lanes on both approaches, a southbound right turn lane, and a speed limit of 55 mph. Grove Lake Drive is a four lane median divided roadway that services an apartment complex and a commercial shopping plaza. The subject location is a three-leg intersection, which is controlled by a stop sign on Grove Lake Drive.

The original statement of problem stated that left turning motorists from Grove Lake Drive were entering a high speed, high volume roadway resulting in many collisions. The intended purpose of the crossover was to alleviate crashes by prohibiting left turns from the side street onto US 29.

The initial crash analysis was completed from April 1, 1998 to April 1, 2001 with forty-six (46) reported crashes, thirty (30) of which were deemed correctable. The final completion date for the improvement at the subject intersection was on September 15, 2004 with a total cost of \$150,000.

## 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 August through October 2004. The before period consisted of reported crashes from July 1, 2000 through July 31, 2004 (4 years and 1 month); and the after period consisted of reported crashes from November 1, 2004 through November 30, 2008 (4 years and 1 month). The ending date for this analysis was limited by crash data issues with the City of Charlotte.

The treatment data consisted of all crashes within 150 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 Left Turn Crashes from Grove Lake Drive were the target crashes for the applied countermeasure. The Left Turn Crash types considered are as follows: Left turn, different roadways; Ran-off Roadway (Avoidance); and Median Rear-end collisions.

<b><u>Treatment Information</u></b>	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-) Percent Increase (+)</b>
Total crashes	50	23	- 54.0 %
Total Severity Index	4.88	4.22	- 13.5 %
Target Crashes	32	0	- 100.0 %
Target Crash Severity Index	4.24	0.00	- 100.0 %
Volume	29,000	27,000	- 6.9 %

<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	5	3	- 40.0 %
Class C Injury Crashes	11	7	- 36.4 %
Total Injury Crashes	17	10	- 41.2 %

The naive before and after analysis at the treatment location resulted in a 54 percent decrease in Total Crashes, complete elimination of Target Crashes, and a 13.5 percent decrease in the Total Severity Index. The before period ADT year was 2002 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 54 percent decrease in Total Crashes and a 100 percent decrease in Target Crashes. The summary results above demonstrate that both Total and Target Crashes appear to have decreased at the treatment location from the before to the after period.

Referencing the *Collision Diagrams*, the before period showed a significant pattern of twenty-eight (28) left turn different roadway collisions as Grove Lake vehicles unsuccessfully entered US 29. After the directional crossover installation, this pattern was completely eliminated. The only after period crash pattern at the intersection consisted of rear-end crashes on Grove Lake Drive. This pattern increased slightly from eight (8) to eleven (11) through the analysis periods.

The Safety Evaluation Group also analyzed the adjacent signalized intersection of US 29 at JW Clay Boulevard as the first available u-turn location to check for crash migration. This existing signalized location is where former left turning vehicles from Grove Lake Drive would be able to make a u-turn to travel north on US 29 during the after period. The following table shows the result of this analysis. As you can see, crashes did not increase but actually decreased slightly during the evaluation period.

<u>U-Turn Location Information</u> <u>US 29 at J.W. Clay</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Total crashes	62	61	- 1.6 %
SB US-29 Rear-End Crashes	14	10	- 28.6 %
SB US-29 U-Turn Movement Crashes	1	0	- 100.0 %

The calculated benefit to cost ratio for this project is **7.49 considering total crashes**. The benefit to cost ratio **considering only target crashes is 3.52**. 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 all three 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.

### **Intersection Follow-up**

It appears from aerial photography that during the calendar year of 2009 the City of Charlotte made other modifications to this intersection. The southern access road (also listed as Grove Lake Drive on the map above) was relocated to create a four-way intersection with the access drive to UNC-Charlotte. The new intersection is signalized with turn lanes on all approaches. The directional crossover under evaluation was removed during this process as motorists now access the new signalized intersection.



## TREATMENT SITE PHOTOS



Traveling North on US 29 (N. Tryon Street)



Traveling South on US 29



Looking onto Grove Lake Drive from the intersection

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

LOCATION: <b>US 29 at Grove Lake Drive</b>		BY: <b>JBS</b>						
COUNTY: <b>Mecklenburg</b>		DATE: <b>2/25/2010</b>						
FILE NO.: <b>SS 10-02-203</b>		NOTES: <b>Total Crashes</b>						
DETAILED COST:	TYPE IMPROVEMENT - <b>Directional Crossover</b>							
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	<b>Construction</b>	<b>\$150,000</b>	<b>10</b>	<b>0.149</b>	<b>\$22,354</b>			
		<b>\$0</b>	<b>0</b>	<b>0.000</b>	<b>\$0</b>			
	<b>Right-of-Way</b>	<b>\$0</b>	<b>0</b>	<b>0.000</b>	<b>\$0</b>			
	<b>TOTALS</b>	<b>\$150,000</b>	<b>10</b>	<b>0.149</b>	<b>\$22,354</b>			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				<b>\$100</b>			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				<b>\$0</b>			
	TOTAL ANNUAL COST=				<b>\$22,454</b>			
	TOTAL COST OF PROJECT=				<b>\$150,000</b>			
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
<b>BEFORE</b>	<b>4.08</b>	<b>1</b>	<b>0.25</b>	<b>16</b>	<b>3.92</b>	<b>33</b>	<b>8.09</b>	<b>\$224,681</b>
<b>AFTER</b>	<b>4.08</b>	<b>0</b>	<b>0.00</b>	<b>10</b>	<b>2.45</b>	<b>13</b>	<b>3.19</b>	<b>\$56,544</b>
						Annual Benefits from Crash Cost Savings		<b>\$168,137</b>
	NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	<b>\$145,683</b>	
	BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	<b>7.49</b>	
	<b>TOTAL COST OF PROJECT</b>	<b>-</b>	<b>\$150,000</b>	<b>COMPREHENSIVE B/C RATIO</b>	<b>-</b>			<b>7.49</b>

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

LOCATION: <b>US 29 at Grove Lake Drive</b>		BY: <b>JBS</b>						
COUNTY: <b>Mecklenburg</b>		DATE: <b>2/25/2010</b>						
FILE NO.: <b>SS 10-02-203</b>		NOTES: <b>Target Crashes - Left Turn</b>						
DETAILED COST:	TYPE IMPROVEMENT - <b>Directional Crossover</b>							
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	<b>Construction</b>	<b>\$150,000</b>	<b>10</b>	<b>0.149</b>	<b>\$22,354</b>			
		<b>\$0</b>	<b>0</b>	<b>0.000</b>	<b>\$0</b>			
	<b>Right-of-Way</b>	<b>\$0</b>	<b>0</b>	<b>0.000</b>	<b>\$0</b>			
	<b>TOTALS</b>	<b>\$150,000</b>	<b>10</b>	<b>0.149</b>	<b>\$22,354</b>			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				<b>\$100</b>			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				<b>\$0</b>			
	TOTAL ANNUAL COST=				<b>\$22,454</b>			
	TOTAL COST OF PROJECT=				<b>\$150,000</b>			
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
<b>BEFORE</b>	<b>4.08</b>	<b>0</b>	<b>0.00</b>	<b>14</b>	<b>3.43</b>	<b>18</b>	<b>4.41</b>	<b>\$78,971</b>
<b>AFTER</b>	<b>4.08</b>	<b>0</b>	<b>0.00</b>	<b>0</b>	<b>0.00</b>	<b>0</b>	<b>0.00</b>	<b>\$0</b>
						Annual Benefits from Crash Cost Savings		<b>\$78,971</b>
	NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	<b>\$56,516</b>	
	BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	<b>3.52</b>	
	<b>TOTAL COST OF PROJECT</b>	<b>-</b>	<b>\$150,000</b>	<b>COMPREHENSIVE B/C RATIO</b>	<b>-</b>			<b>3.52</b>

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		

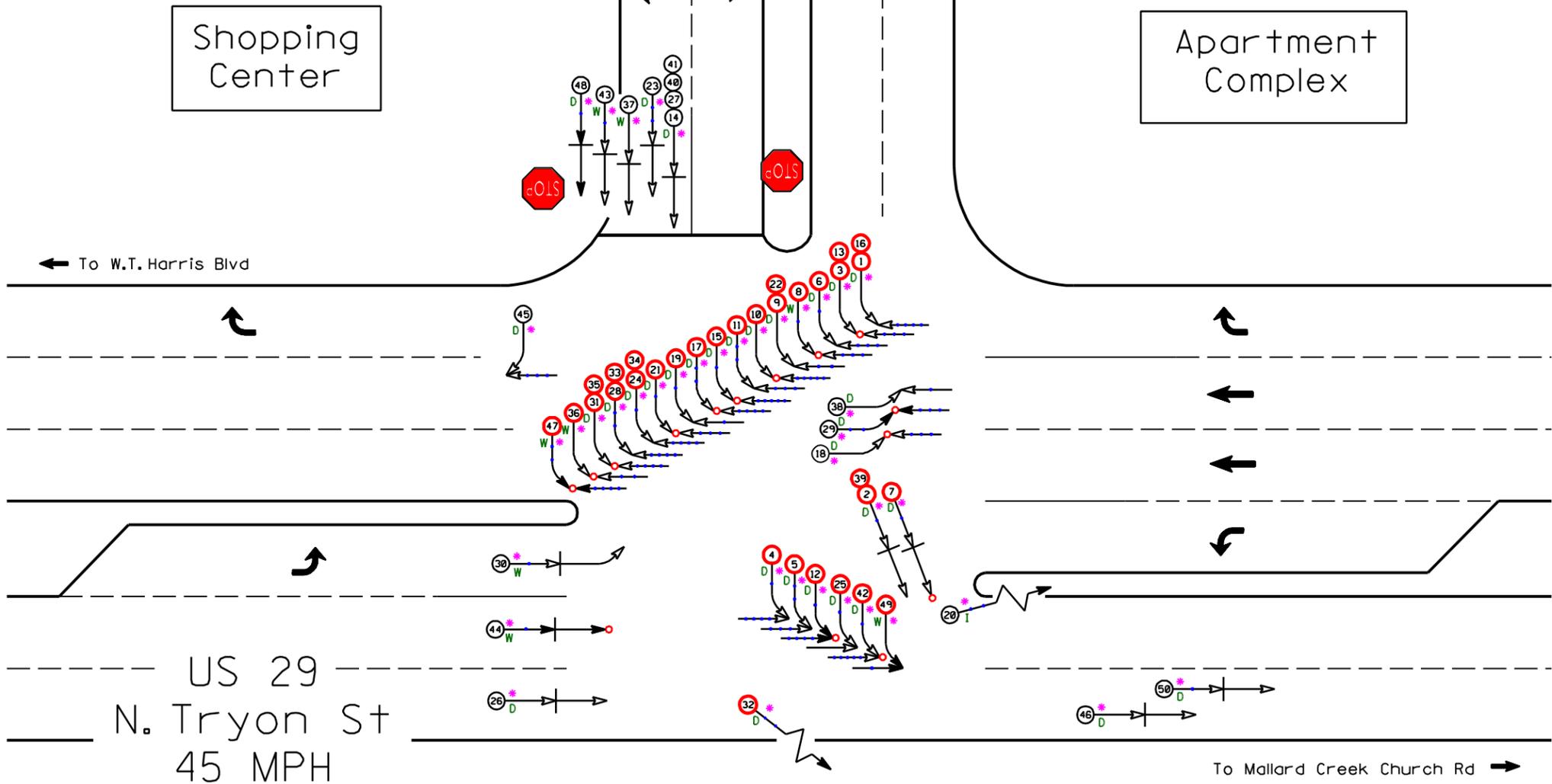


Grove Lake Dr  
35 MPH

Shopping Center

Apartment Complex

SS# 10-02-203  
Mecklenburg County  
City of Charlotte  
BEFORE Period  
7/1/00 - 7/31/04



US 29  
N. Tryon St  
45 MPH

Crossover / Left Target Crashes

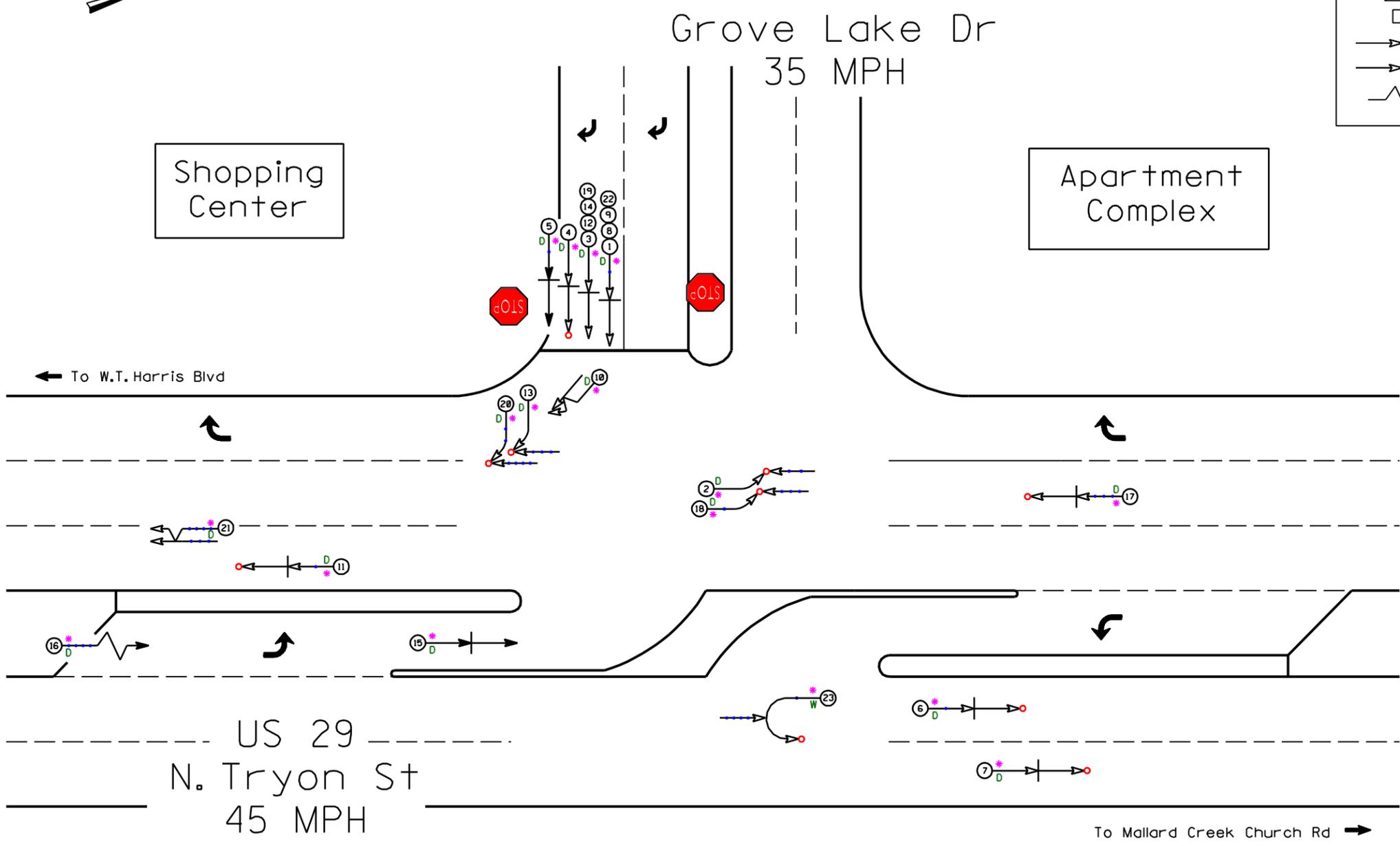
TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

	COLLISION DIAGRAM	
	DIVISION: 10	AREA:
	STUDY PERIOD: 7/1/2000 - 7/31/2004	
	DISTANCE: Y-LINE = 150 FT	
ANALYSIS PREPARED BY: JBS		
ANALYSIS CHECKED BY: BR		
DIAGRAM PREPARED BY: JBS		
DIAGRAM REVIEWED BY: ST		
SCALE: NOT TO SCALE		
DATE: 2-8-2010		
LOG NUMBER: SS* 10-02-203 BEFORE		

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

LEGEND

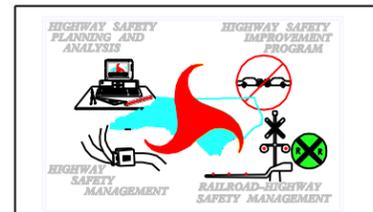
	MOVING VEHICLE		ANGLE		9 MPH OR LESS	P	PEDESTRIAN
	PEDESTRIAN		TURNING		10 MPH TO 19	T	TRAIN
	PARKED VEHICLE		BACKING		20 MPH TO 29	*	DRIVER AT FAULT
	PARKING VEHICLE		SIDESWIPE		30 MPH TO 39	D	DRY
	FIXED OBJECT		OUT OF CONTROL		40 MPH TO 49	W	WET
	HEAD ON		INJURY		50 MPH TO 59	I	ICY OR SNOWY
	REAR END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



SS# 10-02-203  
 Mecklenburg County  
 City of Charlotte  
 AFTER Period  
 11/1/04 - 11/30/08

Analysis limited by crash data reporting issues with the City of Charlotte.

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT



COLLISION DIAGRAM	
DIVISION: 10	AREA:
STUDY PERIOD: 11/1/2004 - 11/30/2008	
DISTANCE: Y-LINE = 150FT	
ANALYSIS PREPARED BY: JBS	
ANALYSIS CHECKED BY: BR	
DIAGRAM PREPARED BY: JBS	
DIAGRAM REVIEWED BY: ST	
SCALE: NOT TO SCALE	
DATE: 2-11-2010	
LOG NUMBER: SS* 10-02-203 AFTER	

Crossover / Left Target Crashes

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