

# Spot Safety Project Evaluation

Order # 41000006304

Spot Safety Project # 10-03-212

**Spot Safety Project Evaluation of the Crossover Installation  
NC 24 (W.T. Harris Blvd) at SR 2458 (David Cox Road)  
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**



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Jason B. Schronce

8-27-2010

Date

Traffic Safety Project Engineer

# Spot Safety Project Evaluation Documentation

## Subject Location

Evaluation of Spot Safety Project Number 10-03-212 located at the Intersection of NC 24 (W.T. Harris Boulevard) and SR 2485 (David Cox Road) in Mecklenburg County, City of Charlotte.

The U-Turn East location analyzed for this evaluation was NC 24 (W.T. Harris Blvd) at Norcroft Drive (subdivision access). The location is a four-leg intersection with an existing crossover.

The U-Turn West location analyzed for this evaluation was NC 24 (W.T. Harris Blvd) at SR 2480 (Sugar Creek Road). This location is an existing four-leg signaled (Sig ID 10-0950) intersection.





**Aerial of Intersection with installed countermeasure**

### **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 directional crossover. NC 24 (W.T. Harris Blvd) is a four-lane divided facility with a speed limit of 45 mph. SR 2485 (David Cox Road) is a two-lane facility with a speed limit of 35 mph. The subject location is a three-leg intersection, which is controlled by a stop sign on the David Cox Road approach. The four leg of the subject intersection is a driveway to a church.

The original statement of problem concluded that SR 2485 motorists were having difficulties turning left from David Cox Road across a high volume - high speed roadway, and doing so safely. In 1990, the Charlotte DOT and the NCDOT agreed that when signal warrants were met at this location, the median crossover would be closed or a directional crossover installed. The intersection now meets signal warrants and has a strong pattern of correctable collisions.

The initial crash analysis was completed from January 1, 2000 to January 1, 2003 with forty-seven (47) reported crashes, thirty (30) of which were deemed correctable. The final completion date for the improvement at the subject intersection was on February 15, 2005 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 January through February 2005. The before period consisted of reported crashes from April 1, 2001 through December 31, 2004 (3 years and 9 months); and the after period consisted of reported crashes from March 1, 2005 through November 30, 2008 (3 years and 9 months). The ending date for this analysis was limited by crash reporting 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-Different Roadway Crashes were the target crashes for the applied countermeasure. The crash types considered are as follows: Left turn, different roadways; Median Rear-Ends (pausing to complete left turn); and Ran-off Roadway (avoidance of left turn vehicle).

<u>Treatment Information</u>	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-) Percent Increase (+)</b>
Total Crashes	65	11	- 83.1 %
Total Severity Index	5.35	10.58	97.8 %
Target Crashes	44	0	- 100.0 %
Target Crash Severity Index	4.53	0.00	- 100.0 %
Volume (2003, 2007)	49,100	52,700	7.3 %

<u>Injury Crash Summary</u>	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-) Percent Increase (+)</b>
Fatal injury Crashes	0	1	100.0 %
Class A injury Crashes	1	0	- 100.0 %
Class B injury Crashes	5	1	- 80.0 %
Class C Injury Crashes	23	3	- 87.0 %
Total Injury Crashes	29	5	- 82.8 %

The naive before and after analysis at the treatment location resulted in a 83 percent decrease in Total Crashes, a 100 percent decrease in Target Crashes, but a 98 percent increase in the Total Severity Index. The before period ADT year was 2003 and the after period ADT year was 2007.

## Results and Discussion

Referencing the *Collision Diagrams*, the before period presented a significant pattern of collisions as motorists attempted to access NC 24 from David Cox Road. Of the forty-four (44) target crashes, there were twenty (20) left turn collisions involving westbound Harris motorists, six (6) left turn crashes involving eastbound Harris vehicles, and seventeen (17) rear-end collisions in the median after a David Cox vehicle made it half way through the intersection. After the directional crossover installation, all of the crashes were eliminated by the removal of the left turning movement at the intersection.

There was one fatal collision in the after period. The crash occurred when a southbound motorist ran the stop sign on David Cox Road and was struck by a responding police car with emergency lights activated. The angle collision resulted in the death of the civilian driver. In reference to the fatal accident investigation, no roadway improvements were recommended due to speed being a factor in the collision.

The calculated benefit to cost ratio for this project is **7.23 considering total crashes**. The benefit to cost ratio **considering only target crashes is 6.16**. 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 following tables show the crash analysis results for both after period u-turn locations to the east and west of the subject intersection:

<b><u>U-Turn East (Norcroft)</u></b>	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-) Percent Increase (+)</b>
Total Crashes	10	7	- 30.0 %
Total Severity Index	3.22	2.06	- 36.0 %
U-Turn Target Crashes	0	1	100.0 %
U-Turn Severity Index	0.00	8.40	100.0 %

<b><u>U-Turn West (Sugar Creek)</u></b>	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-) Percent Increase (+)</b>
Total Crashes	73	97	32.9 %
Total Severity Index	5.18	3.06	- 40.9 %
U-Turn Target Crashes	0	0	0.0 %

From the tables above, the U-turn East location of Norcroft Drive yielded a total crash reduction of 30 percent with one u-turn crash in the after period. The U-turn West location of Sugar Creek Road experienced a 33 percent increase in total crashes; however there were zero u-turn collisions.

The Safety Evaluation Group has provided collision diagrams for both u-turn intersections as a reference. To note, improvements or intersection upgrades to the u-turn locations were not

independently investigated and are not represented in this analysis. The time periods were set to match the evaluation periods of the subject crossover installation. With this understanding, the collision diagrams for the Sugar Creek Road intersection do indicate significant after period rear-end crash patterns but a strong reduction in left turn-same road collisions from the before period.

Please see the attached *Treatment Site Photos*. Photos are provided from Google Street View for both NC 24 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



Traveling East on NC 24 (W.T. Harris Blvd) at David Cox Road



Traveling West on NC 24 (W.T. Harris Blvd) at Crossover

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

LOCATION: <b>WT Harris at David Cox</b>		BY: <b>JBS</b>						
COUNTY: <b>Mecklenburg</b>		DATE: <b>8/27/2010</b>						
FILE NO.: <b>SS 10-03-212</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>3.75</b>	<b>1</b>	<b>0.27</b>	<b>28</b>	<b>7.47</b>	<b>36</b>	<b>9.60</b>	<b>\$358,613</b>
<b>AFTER</b>	<b>3.75</b>	<b>1</b>	<b>0.27</b>	<b>4</b>	<b>1.07</b>	<b>6</b>	<b>1.60</b>	<b>\$196,213</b>
						Annual Benefits from Crash Cost Savings		<b>\$162,400</b>
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST						=	<b>\$139,946</b>	
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST						=	<b>7.23</b>	
TOTAL COST OF PROJECT		-	<b>\$150,000</b>	COMPREHENSIVE B/C RATIO		-	<b>7.23</b>	

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

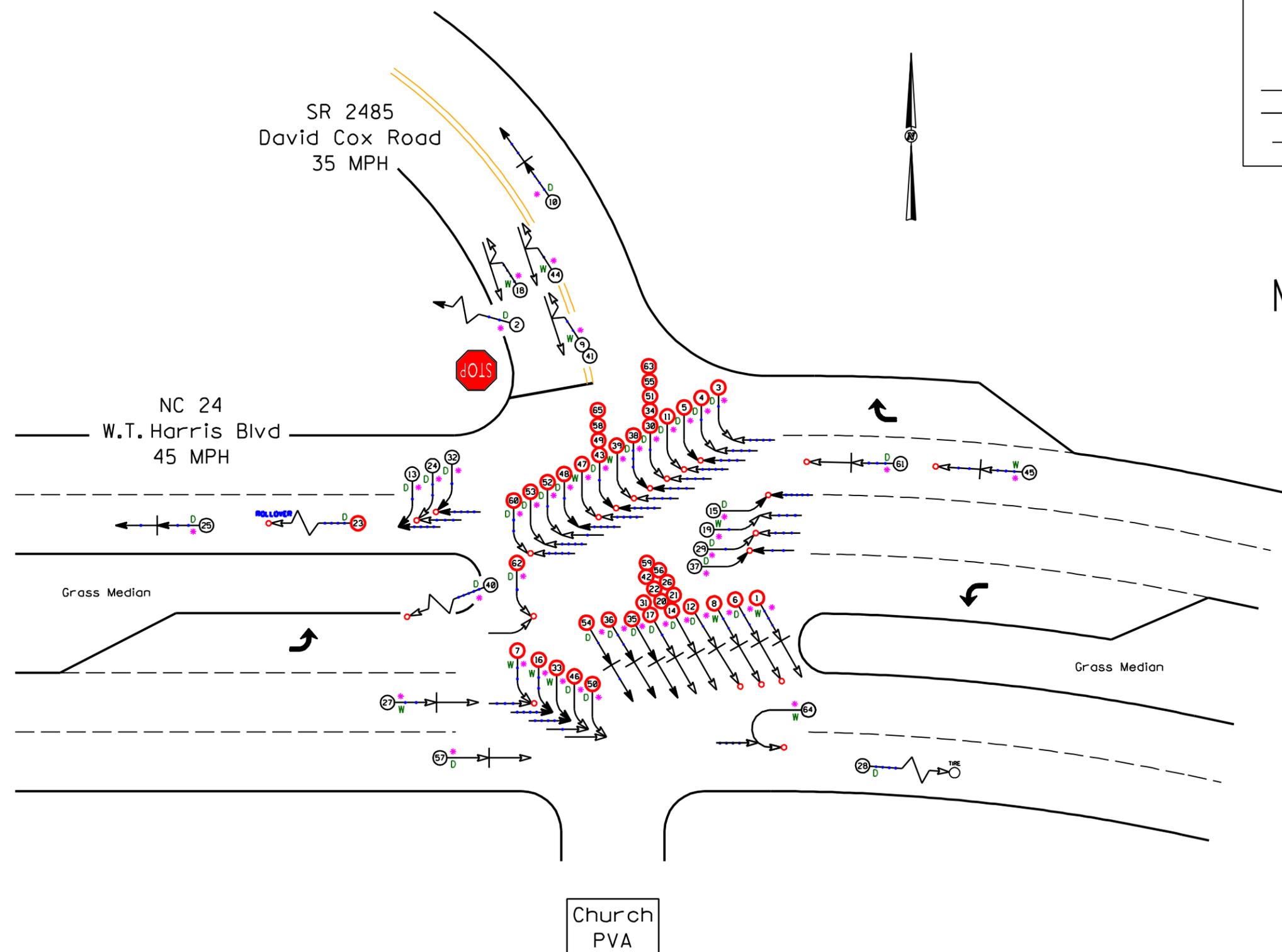
LOCATION: <b>WT Harris at David Cox</b>		BY: <b>JBS</b>						
COUNTY: <b>Mecklenburg</b>		DATE: <b>8/27/2010</b>						
FILE NO.: <b>SS 10-03-212</b>								
DETAILED COST:	TYPE IMPROVEMENT - <b>Directional Crossover</b>							
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	<b>Construction</b>	<b>\$150,000</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>3.75</b>	<b>0</b>	<b>0.00</b>	<b>21</b>	<b>5.60</b>	<b>23</b>	<b>6.13</b>	<b>\$138,373</b>
<b>AFTER</b>	<b>3.75</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>\$138,373</b>
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST						=	<b>\$115,919</b>	
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST						=	<b>6.16</b>	
TOTAL COST OF PROJECT		-	<b>\$150,000</b>	COMPREHENSIVE B/C RATIO		-	<b>6.16</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		SPEED UNKNOWN		70 AND UP		

SR 2485  
David Cox Road  
35 MPH

NC 24  
W.T. Harris Blvd  
45 MPH



SS# 10-03-212  
Mecklenburg County  
City of Charlotte  
BEFORE Period  
4/1/01 - 12/31/04

Church  
PVA

Left Turn  
Target Crashes

Order Number: 41000006304
Created By: J. Schronce
Date: 6-9-2010
<b>N.C. DEPARTMENT of TRANSPORTATION</b> <b>DIVISION of HIGHWAYS</b> <b>TRANSPORTATION MOBILITY and</b> <b>SAFETY DIVISION</b>

LEGEND

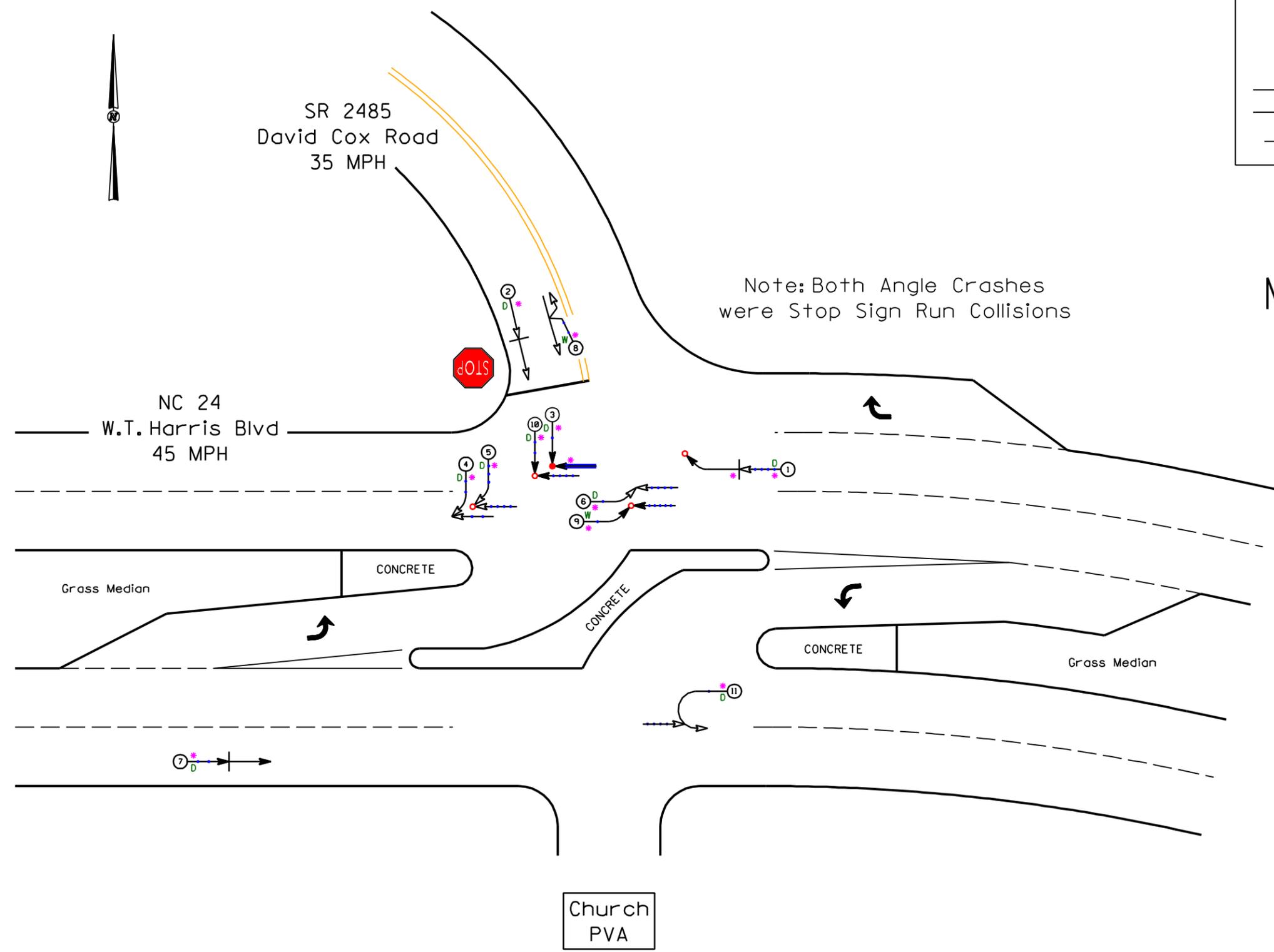
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	PEDESTRIAN		TURNING		10 MPH TO 19		TRAIN
	PARKED VEHICLE		BACKING		20 MPH TO 29		DRIVER AT FAULT
	PARKING VEHICLE		SIDESWIPE		30 MPH TO 39		DRY
	FIXED OBJECT		OUT OF CONTROL		40 MPH TO 49		WET
	HEAD ON		FATALITY		50 MPH TO 59		ICY OR SNOWY
	REAR END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

SR 2485  
David Cox Road  
35 MPH

NC 24  
W.T. Harris Blvd  
45 MPH

Note: Both Angle Crashes  
were Stop Sign Run Collisions

SS# 10-03-212  
Mecklenburg County  
City of Charlotte  
AFTER Period  
3/1/05 - 11/30/08



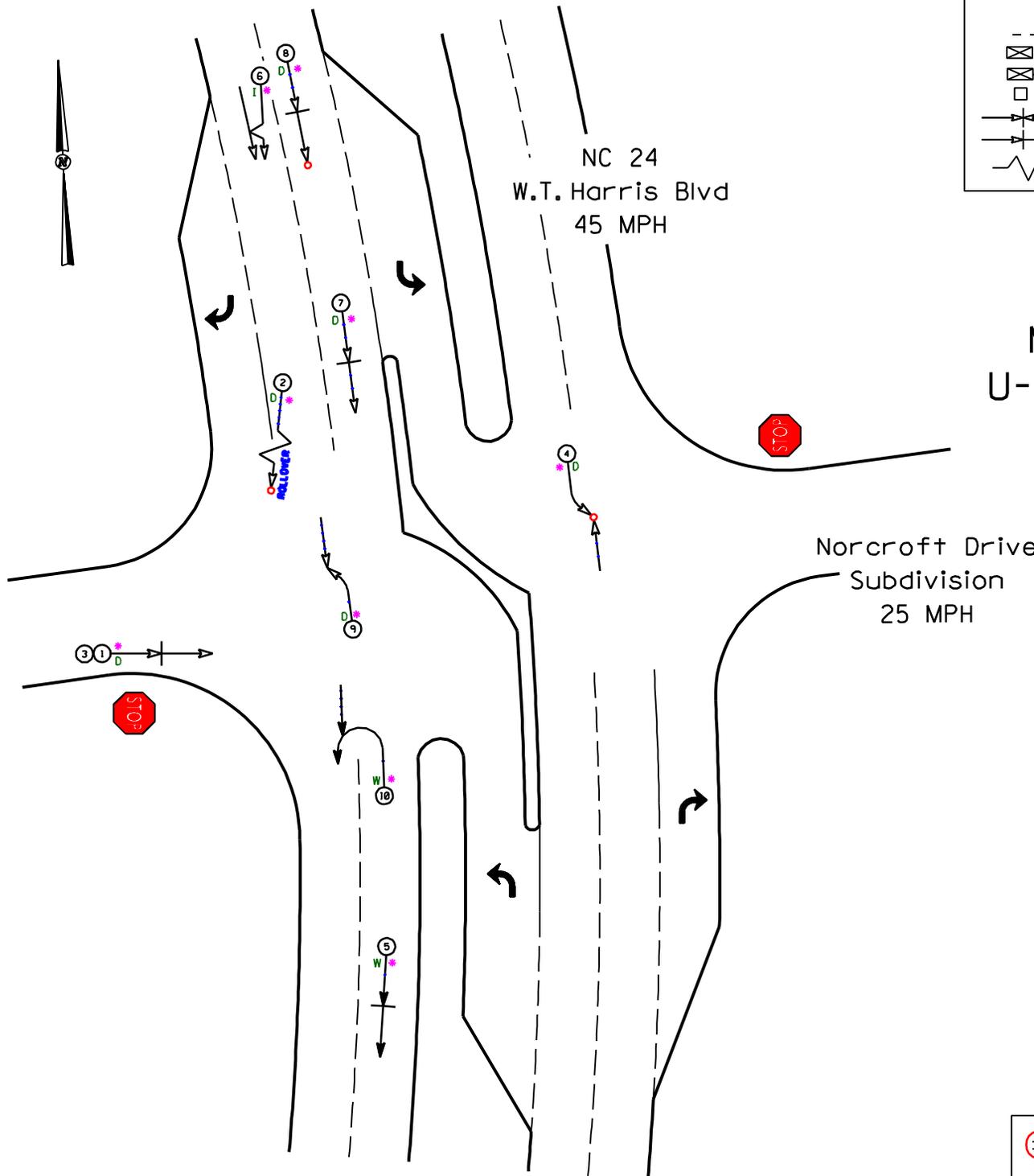
Left Turn  
Target Crashes

Order Number: 41000006304
Created By: J. Schronce
Date: 6-9-2010
<b>N.C. DEPARTMENT of TRANSPORTATION</b> <b>DIVISION of HIGHWAYS</b> <b>TRANSPORTATION MOBILITY and</b> <b>SAFETY DIVISION</b>

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		HIT AND RUN		50 MPH TO 59		ICY OR SNOWY
	REAR END		HURT		60 MPH TO 69		SPEED UNKNOWN
	RAN OFF ROAD		FATALITY		SPEED UNKNOWN		ONLY

SS# 10-03-212  
 Order# 41000006304  
 Mecklenburg County  
 U-Turn East (Norcroft)  
 BEFORE Period  
 4/1/01 - 12/31/04



SB U-Turn  
 Target Crashes

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

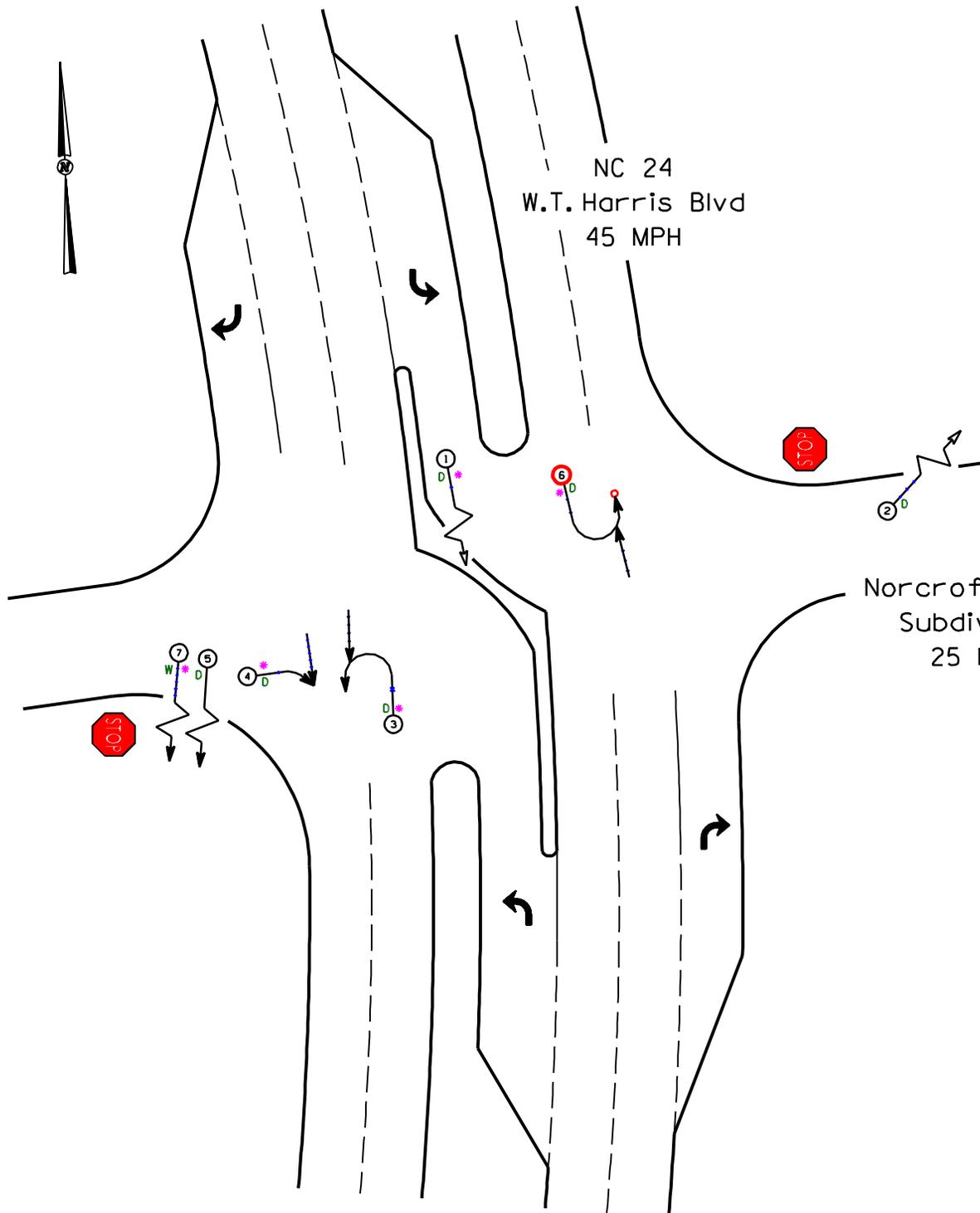
**TRAFFIC SAFETY UNIT**

Date: 8-6-2010      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		HIT AND RUN		50 MPH TO 59		ICY OR SNOWY
	REAR END		HURT		60 MPH TO 69		SPEED UNKNOWN
	RAN OFF ROAD		FATALITY		70 MPH TO 79		ONLY

SS# 10-03-212  
 Order# 41000006304  
 Mecklenburg County  
 U-Turn East (Norcroft)  
 AFTER Period  
 3/1/05 - 11/30/08

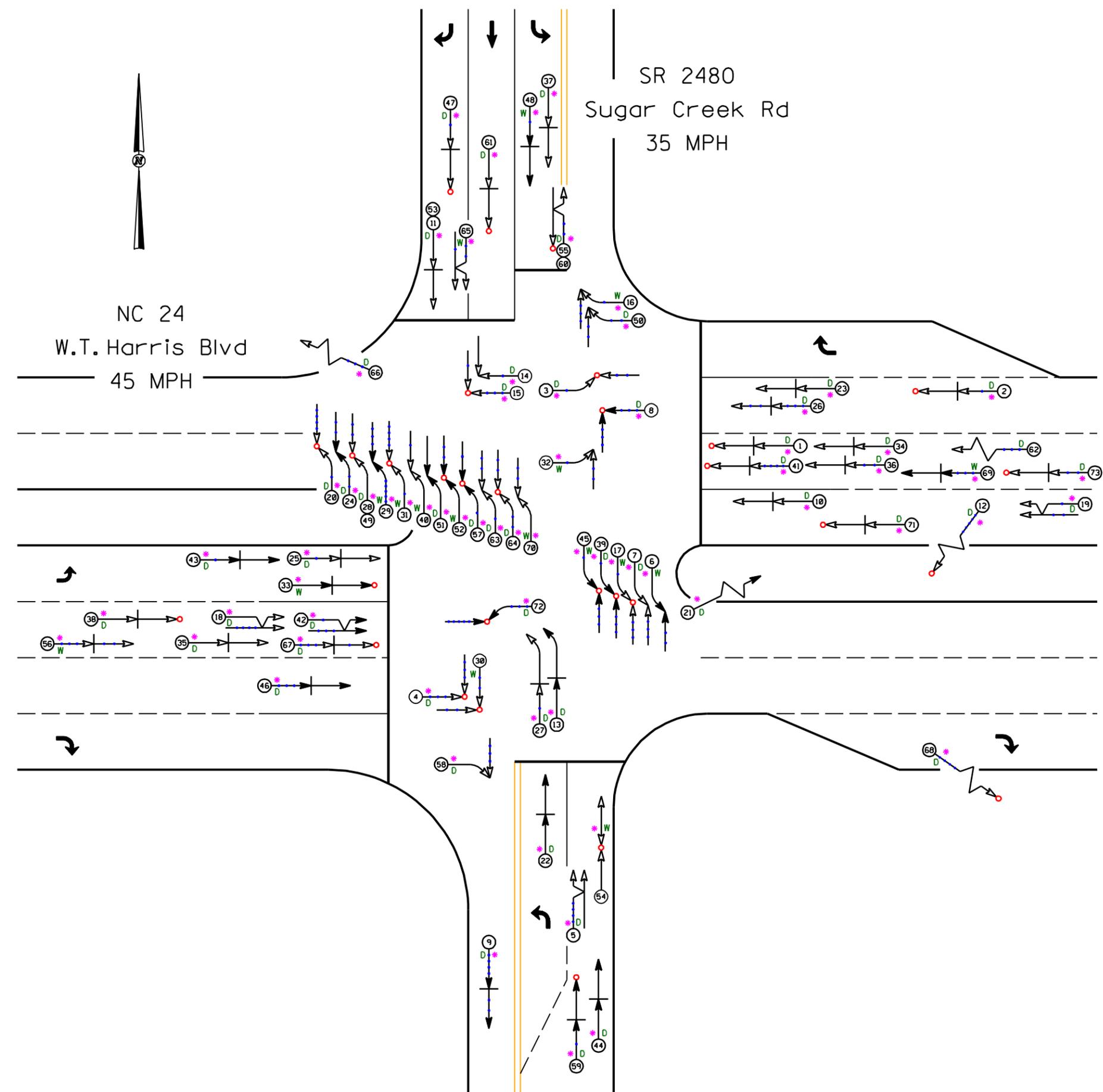


SB U-Turn  
Target Crashes

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

**TRAFFIC SAFETY UNIT**

Date: 8-6-2010      Prepared By: J. Schronce



**LEGEND**

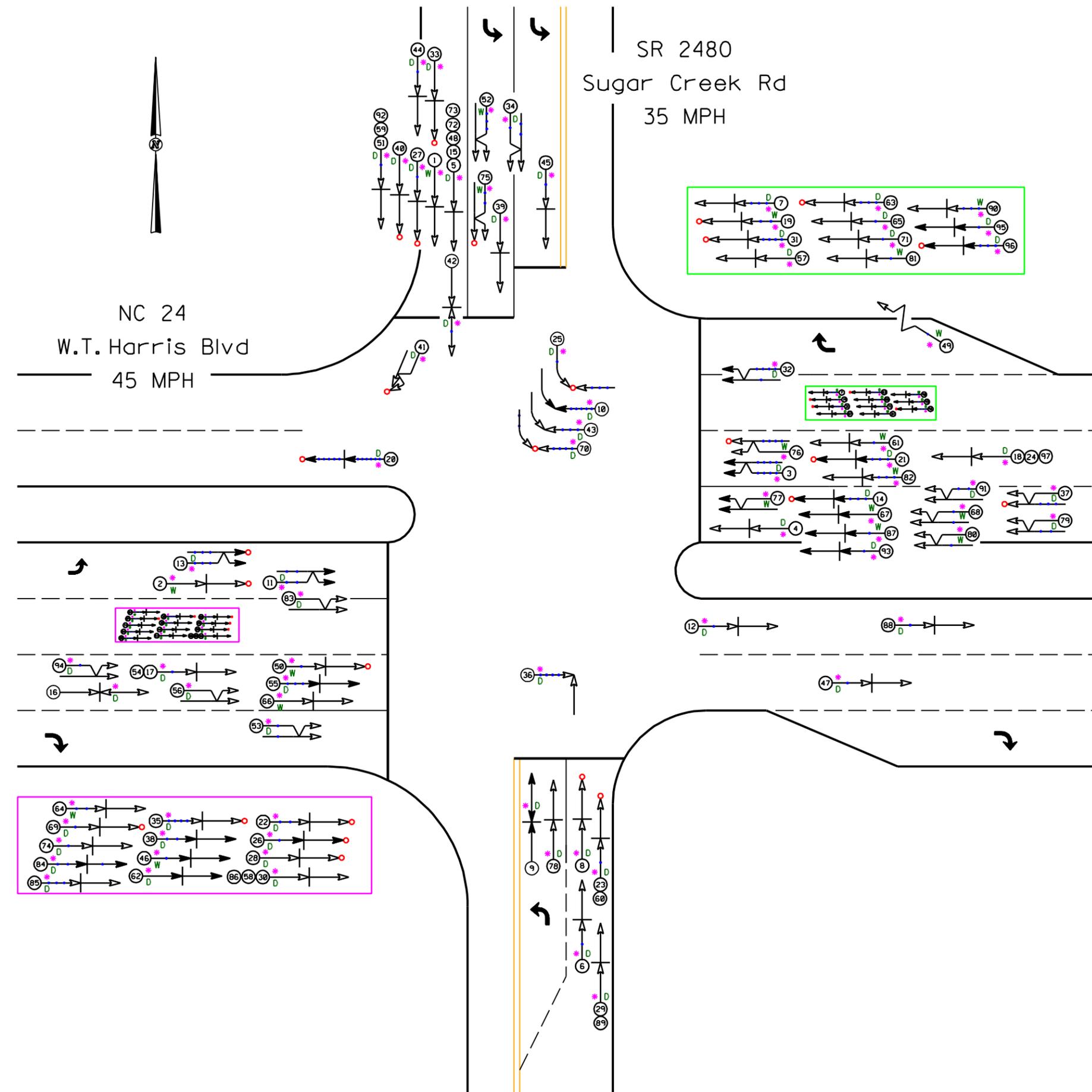
	MOVING VEHICLE		ANGLE		9 MPH OR LESS		PEDESTRIAN
	PEDESTRIAN		TURNING		10 MPH TO 19		TRAIN
	PARKED VEHICLE		BACKING		20 MPH TO 29		DRIVER AT FAULT
	PARKING VEHICLE		SIDESWIPE		30 MPH TO 39		DRY
	FIXED OBJECT		OUT OF CONTROL		40 MPH TO 49		WET
	HEAD ON		INJURY		50 MPH TO 59		ICY OR SNOWY
	REAR END		FATALITY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

SS# 05-03-220  
 Order# 41000006304  
 Mecklenburg County  
 City of Charlotte  
 U-Turn West: Sugar Crk  
 BEFORE Period  
 4/1/01 - 12/31/04

Existing  
 Signalized  
 Intersection

U-Turn  
 Target Crashes

**N.C. DEPARTMENT of TRANSPORTATION**  
**DIVISION of HIGHWAYS**  
**TRANSPORTATION MOBILITY and SAFETY DIVISION**  
**TRAFFIC SAFETY UNIT**  
 Date: 8-23-2010      Prepared By: J. Schronce



**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		SPEED UNKNOWN		70 AND UP		

SS# 05-03-220  
 Order# 41000006304  
 Mecklenburg County  
 City of Charlotte  
 U-Turn West: Sugar Crk  
 AFTER Period  
 3/1/05 - 11/30/08

Existing  
 Signalized  
 Intersection

U-Turn  
 Target Crashes

**N.C. DEPARTMENT of TRANSPORTATION**  
**DIVISION of HIGHWAYS**  
**TRANSPORTATION MOBILITY and SAFETY DIVISION**  
**TRAFFIC SAFETY UNIT**  
 Date: 8-26-2010      Prepared By: J. Schronce