

Spot Safety Project Evaluation

Project Log # 200901018

Spot Safety Project # 07-01-207

**Spot Safety Project Evaluation of the Left Turn Lane Installation
and Signal Phase Change at the Intersection of
US 15/501 and SR 1141 / SR 2256
City of Chapel Hill, Orange 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

5-12-2009

Date

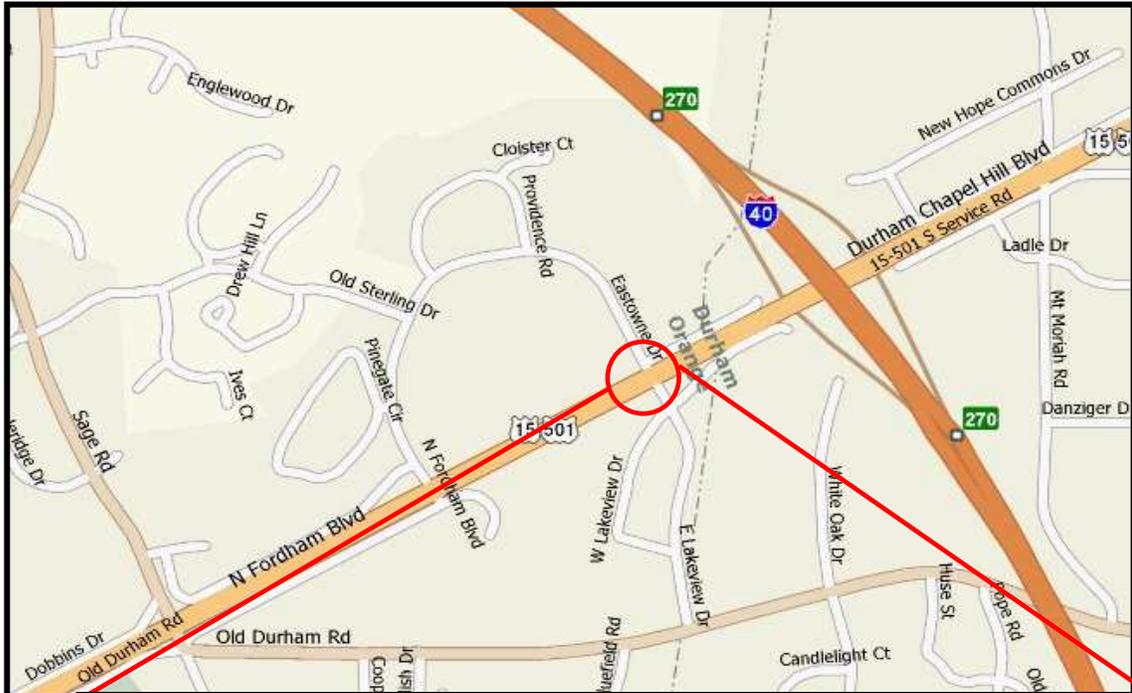
Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 07-01-207 located at the Intersection of US 15/501 (Fordham Blvd / Durham-Chapel Hill Road) and SR 1141 (E. Lakeview Road) / SR 2256 (Eastowne Drive) in Orange County, in the City of Chapel Hill.

The Sig ID is 07-1011 for the subject location.



Project Information and Background from the Project File Folder

The spot safety project improvement countermeasures chosen for the subject location were the installation of a northbound US 15/501 left turn lane and protected only phasing for both US 15/501 approaches. US 15/501 (Fordham Blvd) is a four-lane median divided facility with dedicated left and right turn lanes on the southbound approach and a speed limit of 45 mph. SR 1141 and SR 2256 are both wide and unmarked two-way facilities at the subject intersection with speed limits of 25 mph that contain painted dedicated left turn lanes at the signal. The subject location is a four-leg crossroads type intersection, which is controlled by a fully actuated traffic signal.

The original statement of problem was the presence of left turn type collisions as vehicles on US 15/501 could not negotiate the movement safely due to insufficient gaps in traffic. The intended purpose of the new left turn lane and protective phasing is to alleviate the existing accident occurrence of left turn collisions.

The initial crash analysis was completed from April 1, 1998 to March 31, 2001 with twenty-six (26) reported crashes, eight (8) of which were deemed correctable. The final completion date for the improvement at the subject intersection was on January 6, 2003 with a total cost of \$75,000.00.

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 was the months of December 2002 through January 2003. The before period consisted of reported crashes from March 1, 1997 through November 30, 2002 (5 years and 9 months); and the after period consisted of reported crashes from February 1, 2003 through October 31, 2008 (5 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 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 US 15/501 Left Turn-Same Roadway Type Crashes were the target crashes for the applied countermeasure. The Target Crashes only include collisions where the at-fault driver was turning left from US 15/501.

<u>Treatment Information</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Total crashes	100	84	- 16.0 %
Total Severity Index	5.18	3.29	- 36.5 %
Target Crashes	24	6	- 75.0 %
Target Crash Severity Index	10.71	4.70	- 56.1 %
Volume	47,500	51,200	7.8 %

<u>Injury Crash Summary</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Fatal injury Crashes	0	0	N/A
Class A injury Crashes	2	0	- 100.0 %
Class B injury Crashes	6	3	- 50.0 %
Class C Injury Crashes	30	23	- 23.3 %
Total Injury Crashes	38	26	- 31.6 %

The naive before and after analysis at the treatment location resulted in a 16 percent decrease in Total Crashes, a 75 percent decrease in Target Crashes, and a 36.5 percent increase in the Total Severity Index. The before period ADT year was 2000 and the after period ADT year was 2005.

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 16 percent decrease in Total Crashes and a 75 percent decrease in Target Crashes. The summary results above demonstrate that both Total Crashes and Target Crashes appear to have decreased at the treatment location from the before to the after period.

Referencing the *Collision Diagrams*, the addition of the protective phasing for US 15/501 left turning motorist did reduce collisions, especially in the southbound direction, from twenty-four (24) in the before period to only six (6) in the after. All six of these were caused by vehicles making the left turn after the signal had turned to the red indication.

However, overall this intersection is still experiencing a high frequency of crashes. Northbound US 15/501 rear-end collisions has remained consistent from forty-four (44) in the before period to forty-five (45) in the after. Angle collisions from vehicles running the red light also remained steady at nine (9) collisions in both study periods. Southbound US 15/501 rear-end collisions approaching the signal increased slightly from seven (7) to nine (9). Although, the high benefit-cost ratio as seen below is due to the elimination of severe injury crashes (fatality and A-injury) in the after period.

The calculated benefit to cost ratio for this project is **17.43 considering total crashes**. The benefit to cost ratio **considering only target crashes is 17.14**. 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 for all four 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 TAKEN 1-26-2009



Traveling Northeast on US 15/501
(Fordham Blvd / Durham-Chapel Hill Road)



Traveling Northeast on US 15/501



Traveling Southwest on US 15/501 from I-40



Traveling Southwest on US 15/501



Traveling East on SR 2256 (Eastowne Drive)



Traveling East on SR 2256 (Eastowne Drive)



Traveling West on SR 1141 (E. Lakeview Drive)



Traveling West on SR 1141 (E. Lakeview Drive)

BENEFIT-COST ANALYSIS WORKSHEET (Total Crashes)

LOCATION: US 15/501 at Lakeview		BY: JBS							
COUNTY: Orange		DATE: 5/11/2009							
FILE NO.: SS 07-01-207		NOTES: Total Crashes							
DETAILED COST:	TYPE IMPROVEMENT - Left Turn Lane & Phasing								
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST				
	Construction	\$75,000	10	0.149	\$11,177				
	Right-of-Way	\$0	0	0.000	\$0				
	TOTALS	\$75,000	10	0.149	\$11,177				
ESTIMATED INCREASE IN ANNUAL MAINT. COST =					\$600				
ESTIMATED INCREASE IN ANNUAL UTILITY COST =					\$150				
TOTAL ANNUAL COST=					\$11,927				
TOTAL COST OF PROJECT=					\$75,000				
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	5.75	2	0.35	36	6.26	62	10.78	\$328,661	
AFTER	5.75	0	0.00	26	4.52	58	10.09	\$120,730	
Annual Benefits from Crash Cost Savings								\$207,930	
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$196,003			
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	17.43			
TOTAL COST OF PROJECT		-	\$75,000	COMPREHENSIVE B/C RATIO		-	17.43		

BENEFIT-COST ANALYSIS WORKSHEET (Target Crashes Only)

LOCATION: US 15/501 at Lakeview		BY: JBS							
COUNTY: Orange		DATE: 5/11/2009							
FILE NO.: SS 07-01-207		NOTES: Target Crashes - Left Turn, Same Roadway							
DETAILED COST:	TYPE IMPROVEMENT - New Left Turn Lane & Phasing								
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST				
	Construction	\$75,000	10	0.149	\$11,177				
	Right-of-Way	\$0	0	0.000	\$0				
	TOTALS	\$75,000	10	0.149	\$11,177				
ESTIMATED INCREASE IN ANNUAL MAINT. COST =					\$600				
ESTIMATED INCREASE IN ANNUAL UTILITY COST =					\$150				
TOTAL ANNUAL COST=					\$11,927				
TOTAL COST OF PROJECT=					\$75,000				
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	5.75	2	0.35	11	1.91	11	1.91	\$215,809	
AFTER	5.75	0	0.00	3	0.52	3	0.52	\$11,426	
Annual Benefits from Crash Cost Savings								\$204,383	
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$192,456			
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	17.14			
TOTAL COST OF PROJECT		-	\$0	COMPREHENSIVE B/C RATIO		-	17.14		

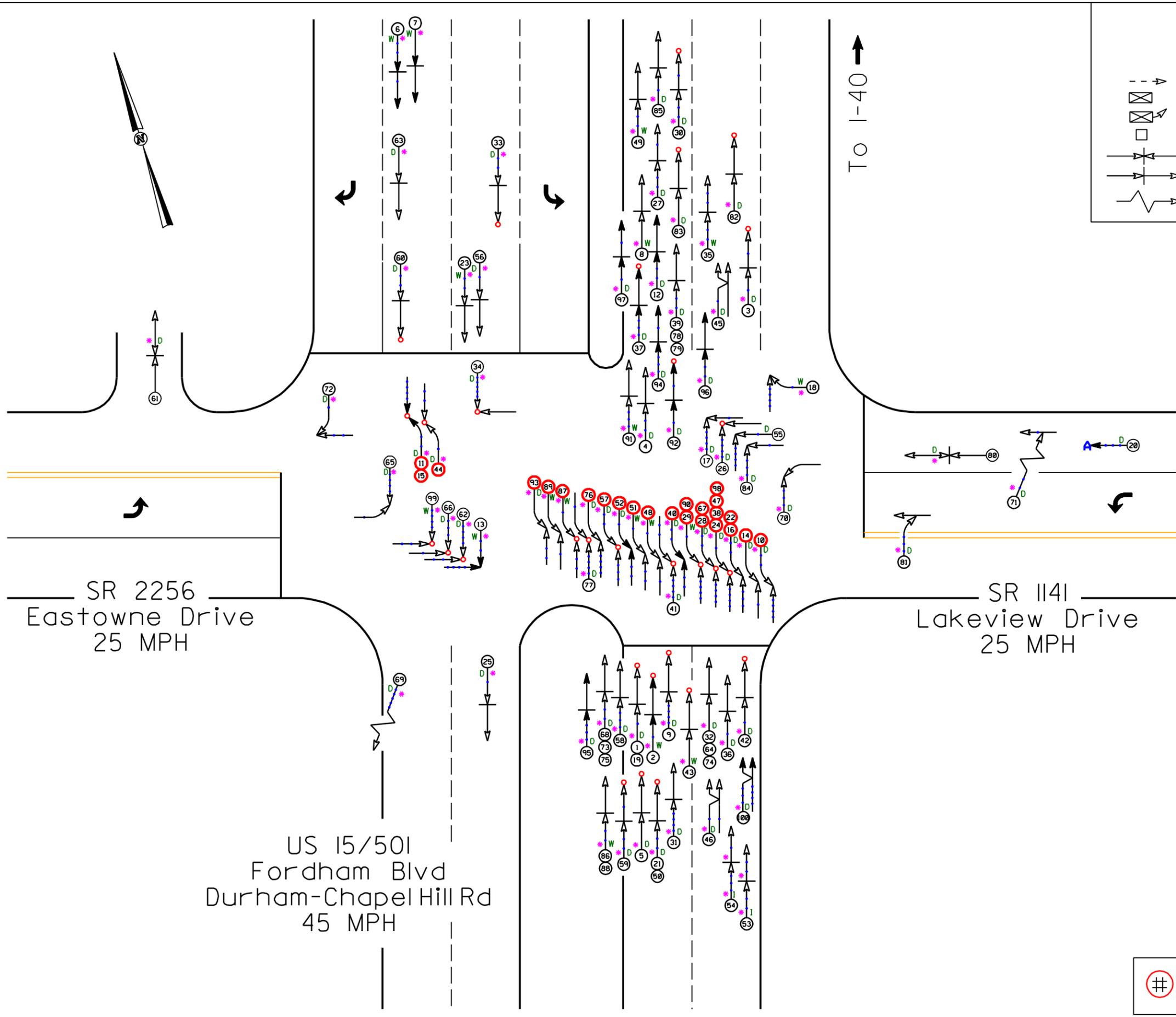
LEGEND

	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# 07-01-207
 Orange County
 City of Chapel Hill
 BEFORE Period
 3/1/97 - 11/30/02



Existing
 Traffic Signal
 Sig ID 07-1011

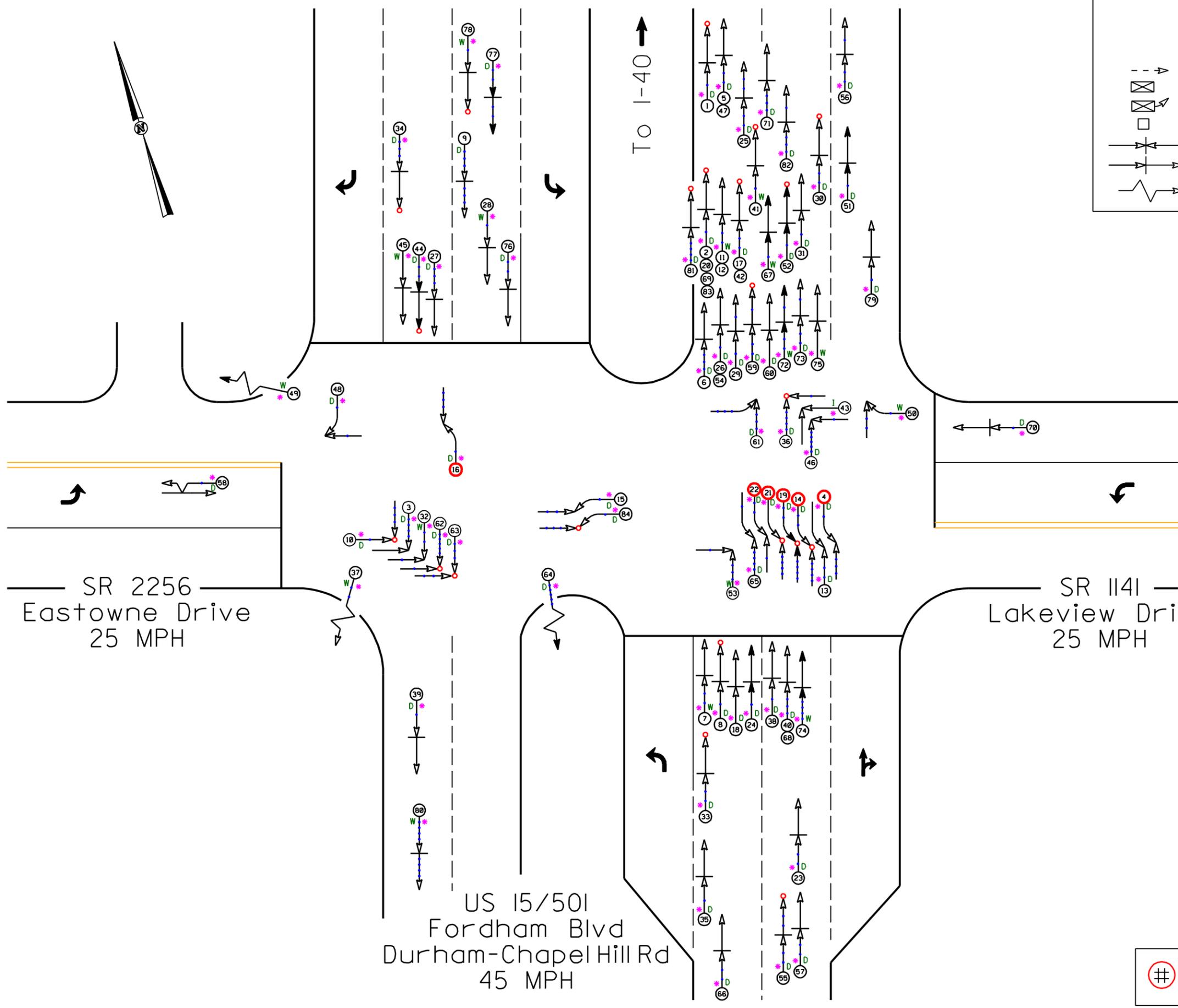


Target Crashes

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

	COLLISION DIAGRAM	
	DIVISION: 7	AREA:
	STUDY PERIOD: 3/1/1997 - 11/30/2002	
	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: 4-14-2009		
LOG NUMBER: SS* 07-01-207 BEFORE		

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



To I-40

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		

SS# 07-01-207
 Orange County
 City of Chapel Hill
 AFTER Period
 2/1/03 - 10/31/08



Existing
 Traffic Signal
 Sig ID 07-1011

Phase Changes to
 Protected Only
 on US 15/501

SR 2256
 Eastowne Drive
 25 MPH

SR 1141
 Lakeview Drive
 25 MPH

US 15/501
 Fordham Blvd
 Durham-Chapel Hill Rd
 45 MPH

Target Crashes

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

	COLLISION DIAGRAM	
	DIVISION: 7	AREA:
	STUDY PERIOD: 2/1/2003 - 10/31/2008	
	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: 5-7-2009		
LOG NUMBER: SS* 07-01-207 AFTER		

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