

# Spot Safety Project Evaluation

Order # 41000006109

Spot Safety Project # 09-03-203

**Spot Safety Project Evaluation of the Traffic Signal Upgrade  
US 64 Left Turn Phase Change to Protected-Permitted  
US 64 (Mocksville Rd) at SR 1237 (Forest Hill Rd)  
Davidson County, City of Lexington**

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

5-11-2010

Date

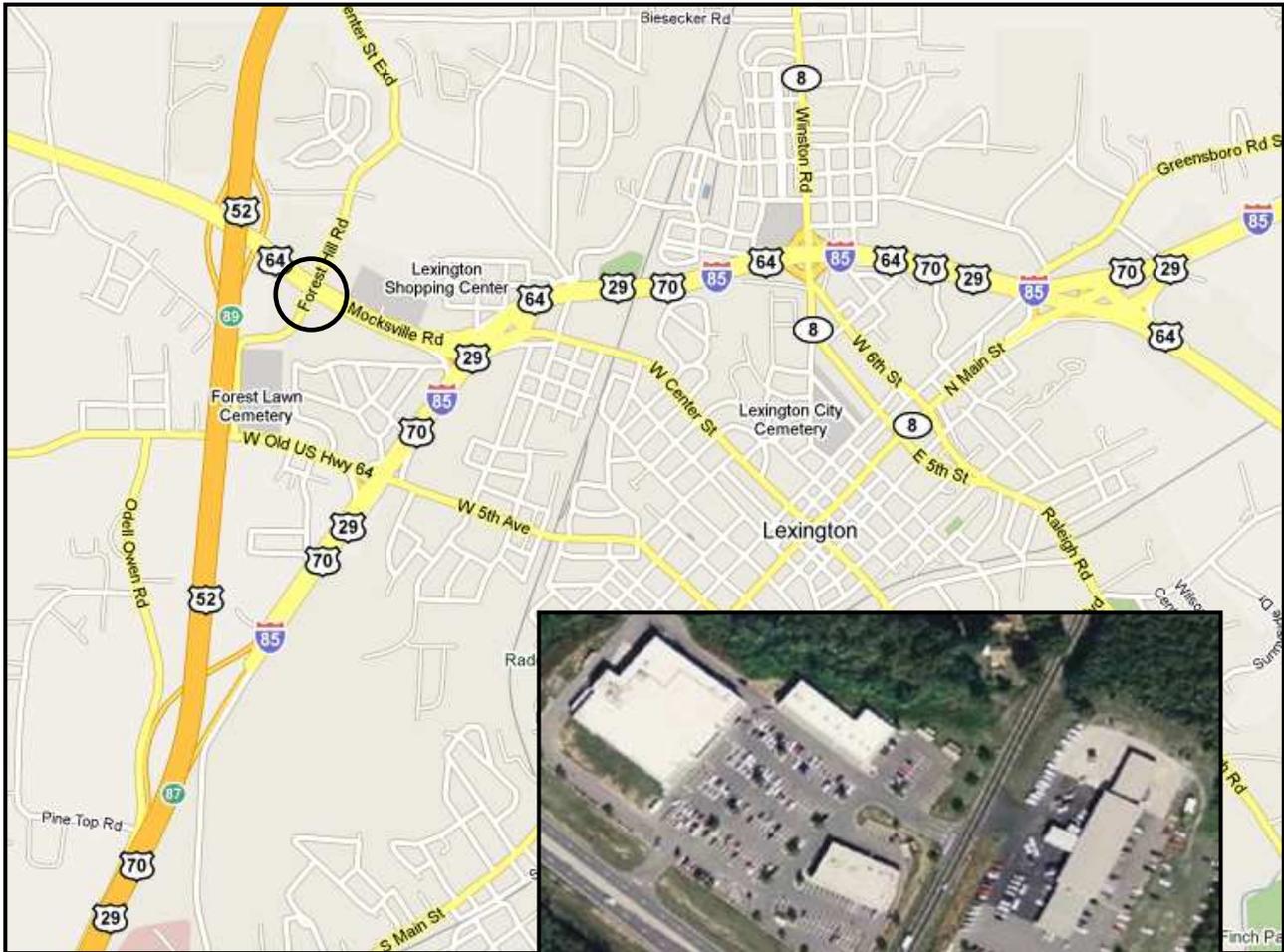
Traffic Safety Project Engineer

# Spot Safety Project Evaluation Documentation

## Subject Location

Evaluation of Spot Safety Project Number 09-03-203 located at the Intersection of US 64 (Mocksville Road) and SR 1237 (Forest Hill Road) in Davidson County, in the City of Lexington. The intersection is located between US 52 and I-85 Business.

The Sig ID is 09-1222 for this existing traffic signal.



## Project Information and Background from the Project File Folder

The spot safety project improvement countermeasure chosen for the subject location was the signal upgrade with the installation of protected-permitted US 64 left turn signal phasing on both approaches. US 64 (Mocksville Rd) in the vicinity of the intersection is a four-lane concrete median divided facility that presents left and right turn lanes on both approaches and a speed limit of 45 mph. SR 1237 (Forest Hill Rd) is a two-lane roadway with a 35 mph speed limit. The subject location is a four-leg intersection, which is controlled by an existing traffic signal.

The original statement of problem was that traffic turning left from US 64 onto SR 1237 were experiencing delay with the permissive signal phase resulting from insufficient gaps in oncoming US 64 traffic. The primary purpose of this improvement was to reduce congestion and delay issues at the intersection.

The initial crash analysis was completed from March 1, 1999 to February 28, 2002 with eight (8) reported crashes, four (4) of which were deemed correctable. The final completion date for the improvement at the subject intersection was on May 5, 2005 with a total cost of \$9,000.

## 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 April through May 2005. The before period consisted of reported crashes from June 1, 2000 through March 31, 2005 (4 years and 10 months); and the after period consisted of reported crashes from June 1, 2005 through March 31, 2010 (4 years and 10 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 64 Left Turn-Same Roadway Crashes were the target crashes for the applied countermeasure.

<u>Treatment Information</u>	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-) Percent Increase (+)</b>
Total crashes	33	24	- 27.3 %
Total Severity Index	4.14	3.78	- 8.7 %
Target Crashes	18	7	- 61.1 %
Target Crash Severity Index	4.29	5.23	21.9 %
Volume (2002, 2007)	18,800	19,300	2.7 %

<u>Injury Crash Summary</u>	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-) Percent Increase (+)</b>
Fatal injury Crashes	0	0	N/A
Class A injury Crashes	0	0	N/A
Class B injury Crashes	5	0	- 100.0 %
Class C Injury Crashes	9	9	0.0 %
Total Injury Crashes	14	9	- 35.7 %

The naive before and after analysis at the treatment location resulted in a 27 percent decrease in Total Crashes, a 61 percent decrease in Target Crashes, and a 9 percent decrease in the Total Severity Index. The before period ADT year was 2002 and the after period ADT year was 2007.

## **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 27 percent decrease in Total Crashes and a 61 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 left turn-same roadway crash pattern was prevalent with nine (9) collisions in each direction of US 64. The addition of the protected-permitted signal phasing helped to reduce these crashes by more than 60 percent with the greatest reduction for westbound US 64 left turning motorists, declining from nine (9) to two (2) collisions. Red light run collisions (angle crashes) did increase slightly through the evaluation from three (3) to five (5) crashes.

The calculated benefit to cost ratio for this project is **11.87 considering total crashes**. The benefit to cost ratio **considering only target crashes is 11.17**. 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.

As of note, this intersection is also in the process of being upgraded once more. The traffic signal will be modified with the flashing yellow arrow for the US 64 left turning vehicle movement. This upgrade was sent to the Division on December 15, 2009 but had not been activated at the time of this evaluation.

Please see the attached *Treatment Site Photos*. Photos are provided from Google Street View 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



Traveling East / Southeast on US 64 (Mocksville Rd)



Traveling West /Northwest on US 64 approaching intersection



Traveling South on SR 1237 (Forest Hill Road)



Traveling North on SR 1237 at intersection

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

LOCATION: US 64 at SR 1237		BY: JBS						
COUNTY: Davidson		DATE: 5/10/2010						
FILE NO.: SS 09-03-203		NOTES: Total Crashes						
DETAILED COST:	TYPE IMPROVEMENT - US 64 Left Turn Protected-Permitted							
ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST				
Construction	\$9,000	10	0.149	\$1,341				
	\$0	0	0.000	\$0				
Right-of-Way	\$0	0	0.000	\$0				
TOTALS	\$9,000	10	0.149	\$1,341				
ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$200				
ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$300				
TOTAL ANNUAL COST=				\$1,841				
TOTAL COST OF PROJECT=				\$9,000				
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	4.83	0	0.00	14	2.90	19	3.93	\$67,516
AFTER	4.83	0	0.00	9	1.86	15	3.11	\$45,652
Annual Benefits from Crash Cost Savings								\$21,863
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$20,022		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	11.87		
TOTAL COST OF PROJECT		-	\$9,000	COMPREHENSIVE B/C RATIO		-	11.87	

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

LOCATION: US 64 at SR 1237		BY: JBS						
COUNTY: Davidson		DATE: 5/10/2010						
FILE NO.: SS 09-03-203		NOTES: Target Crashes - US 64 Left Turn-Same Rd						
DETAILED COST:	TYPE IMPROVEMENT - US 64 Left Turn Phase Change - Protected-Permitted							
ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST				
Construction	\$9,000	10	0.149	\$1,341				
	\$0	0	0.000	\$0				
Right-of-Way	\$0	0	0.000	\$0				
TOTALS	\$9,000	10	0.149	\$1,341				
ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$200				
ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$300				
TOTAL ANNUAL COST=				\$1,841				
TOTAL COST OF PROJECT=				\$9,000				
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	4.83	0	0.00	8	1.66	10	2.07	\$37,888
AFTER	4.83	0	0.00	4	0.83	3	0.62	\$17,329
Annual Benefits from Crash Cost Savings								\$20,559
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$18,718		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	11.17		
TOTAL COST OF PROJECT		-	\$9,000	COMPREHENSIVE B/C RATIO		-	11.17	



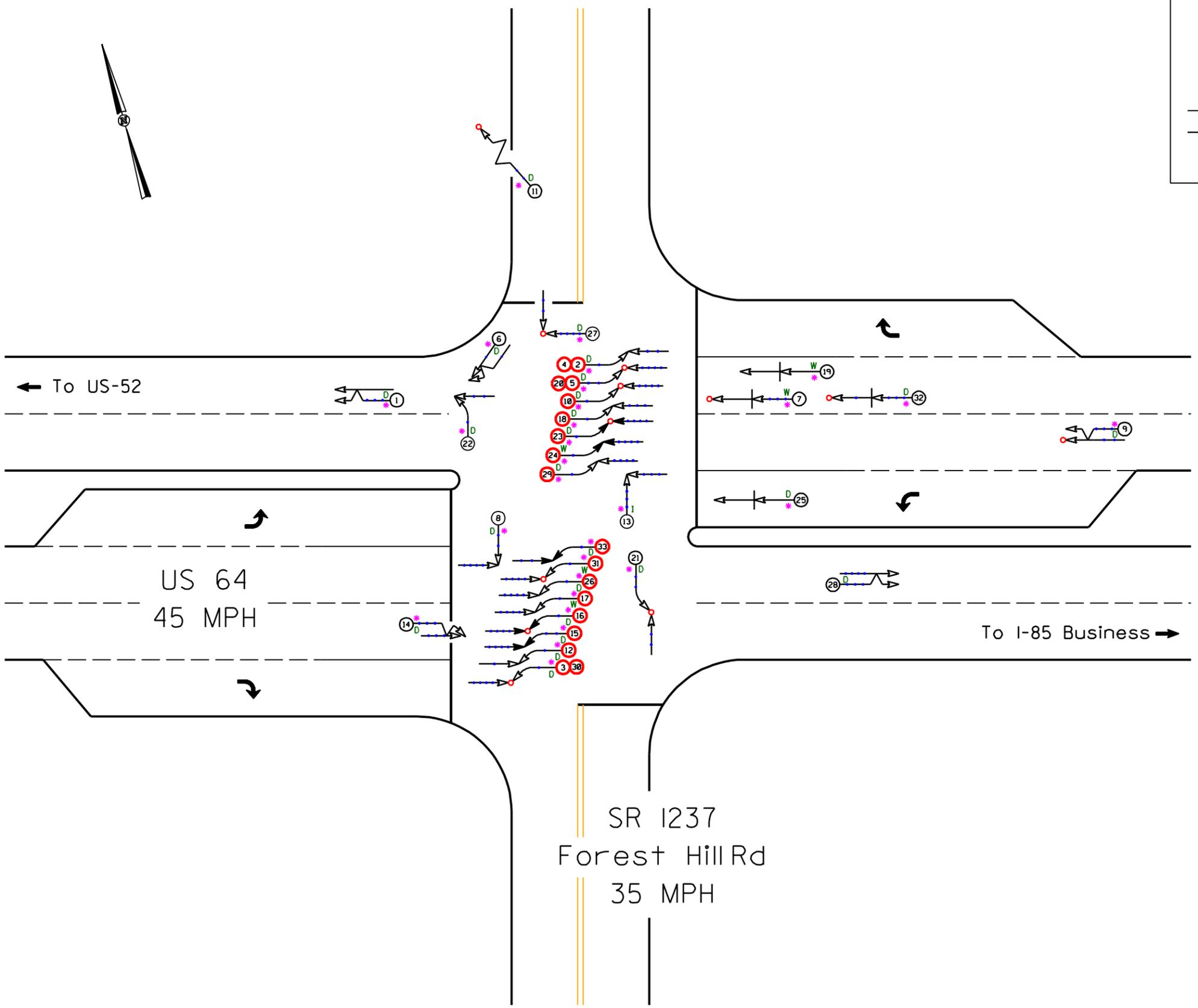
**LEGEND**

	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# 09-03-203  
 Davidson County  
 City of Lexington  
 BEFORE Period  
 6/1/00 - 3/31/05



Existing  
 Intersection  
 Traffic Signal  
 Sig ID 09-1222



US 64 Left Turn  
 Same Roadway  
 Target Crashes

**TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT**

	<b>COLLISION DIAGRAM</b>	
	DIVISION: 9	AREA:
	STUDY PERIOD: 6/1/2000 - 3/31/2005	
	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: 5-7-2010		
LOG NUMBER: SS* 09-03-203 BEFORE		

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

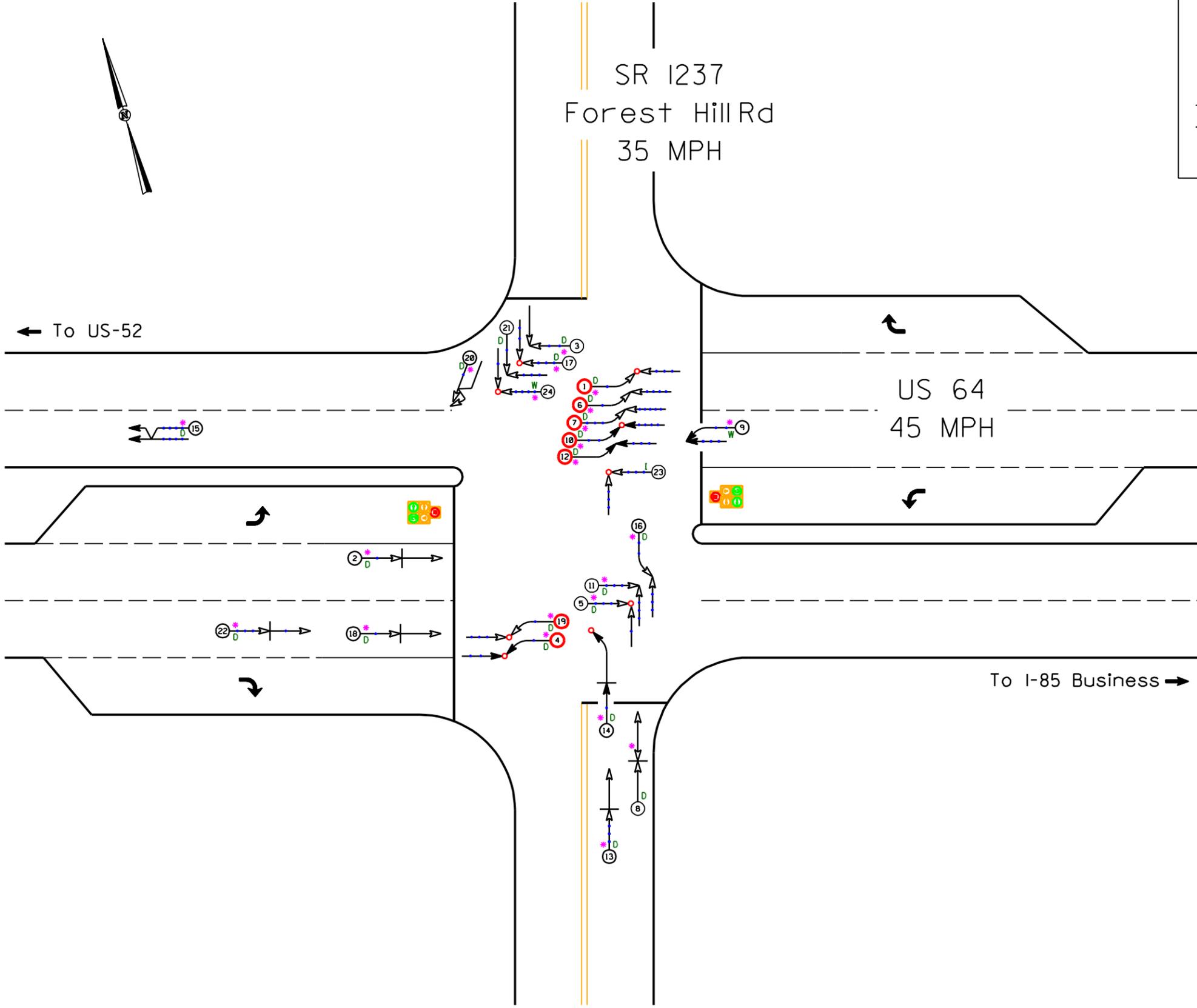


SR 1237  
Forest Hill Rd  
35 MPH

← To US-52

US 64  
45 MPH

To I-85 Business →



**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	→	SPEED UNKNOWN	→	70 AND UP		

SS# 09-03-203  
Davidson County  
City of Lexington  
AFTER Period  
6/1/05 - 3/31/10



Modified  
Intersection  
Traffic Signal  
Sig ID 09-1222

⊠ US 64 Left Turn  
Same Roadway  
Target Crashes

**TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT**

	COLLISION DIAGRAM	
	DIVISION: 9	AREA:
	STUDY PERIOD: 6/1/2005 - 3/31/2010	
	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: 5-7-2010		
LOG NUMBER: SS* 09-03-203 AFTER		

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