

# Spot Safety Project Evaluation

Order # 41000005191

Spot Safety Project # 07-03-202

**Spot Safety Project Evaluation of the  
Intersection Realignment, Sight Distance Improvements,  
Center Channelization Island, and Dual Posted Stop Signs  
NC 54 (Harden Street) at Oakgrove Drive  
Alamance County, City of Graham**

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

3-29-2010

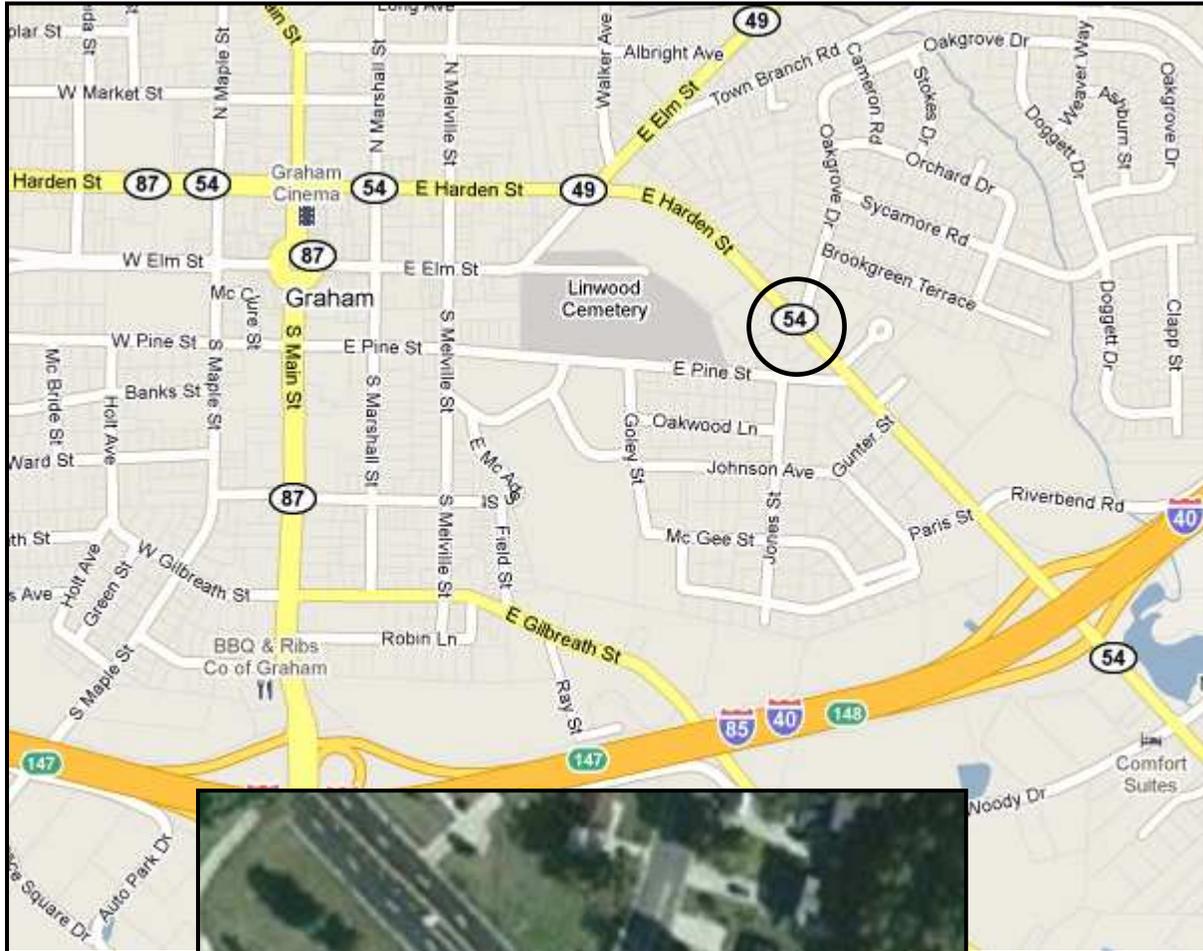
Date

Traffic Safety Project Engineer

# Spot Safety Project Evaluation Documentation

## Subject Location

Evaluation of Spot Safety Project Number 07-03-202 located at the Intersection of NC 54 (Harden Street) and Oakgrove Drive in Alamance County, in the City of Graham.



## **Project Information and Background from the Project File Folder**

The spot safety project improvement countermeasure chosen for the subject location was the realignment of Oakgrove Drive to intersect NC 54 at a 90 degree angle. As part of the realignment, a raised median channelization island and dual posted stop signs were installed. Also, the dirt bank was cut back in the southeast quadrant of the intersection to provide sight distance enhancement for left turning motorists. NC 54 (Harden Street) is a four lane roadway with a southbound left turn lane and a speed limit of 45 mph. Oakgrove Drive is a wide residential access facility with a speed limit of 45 mph and pavement markings at the intersection to show left and right turn lanes. The subject location is a three-leg intersection, which is controlled by a stop condition on Oakgrove Drive.

The original statement of problem was that motorists turning left onto NC 54 could not enter the intersection safely due to limited sight distance. Also, the skew angle of the intersection provided issues for vehicles turning onto Oakgrove Drive at an unsafe speed. The intended purpose of the intersection improvements was to alleviate the accident pattern of left turn different roadway collisions at this location.

The initial crash analysis was completed from June 1, 1999 to May 31, 2002 with seven (7) reported crashes, five (5) of which were deemed correctable. The final completion date for the improvement at the subject intersection was on August 31, 2004 with a total cost of \$40,000.

## **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 July through September 2004. The before period consisted of reported crashes from March 1, 1999 through June 30, 2004 (5 years and 4 months); and the after period consisted of reported crashes from October 1, 2004 through January 31, 2010 (5 years and 4 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 Intersection Frontal Impact Crashes were the target crashes for the applied countermeasure. Also, crashes caused by turning NC 54 motorists onto Oakgrove Drive were included in target crashes. The Frontal Impact and Turning Crash types considered are as follows: Left turn, same roadway; Left turn, different roadways; Right turn, same roadway; Right turn, different roadways; Head on; Sideswipe (Oakgrove waiting vehicle); and Angle.

<u>Treatment Information</u>	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-) Percent Increase (+)</b>
Total crashes	18	7	- 61.1 %
Total Severity Index	7.27	4.17	- 42.6 %
Target Crashes	15	3	- 80.0 %
Target Crash Severity Index	8.03	3.47	- 56.8 %
Volume	14,600	12,700	- 13.0 %

<u>Injury Crash Summary</u>	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-) Percent Increase (+)</b>
Fatal injury Crashes	1	0	- 100.0 %
Class A injury Crashes	0	0	N/A
Class B injury Crashes	1	1	0.0 %
Class C Injury Crashes	4	2	- 50.0 %
Total Injury Crashes	6	3	- 50.0 %

The naive before and after analysis at the treatment location resulted in a 61 percent decrease in Total Crashes, an 80 percent decrease in Target Crashes, and a 43 percent decrease in the Total Severity Index. The before period ADT year was 2001 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 61 percent decrease in Total Crashes and an 80 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 presented an intersection crash pattern of twelve (12) left turn-different roadway type collisions, including a fatality crash. After the realignment, this pattern was reduced to two (2) crashes. Also, the three (3) before period target crashes from vehicles turning onto Oakgrove Drive were eliminated in the after period. The project appears to have successfully reduced the frequency and severity of collisions at this location.

The calculated benefit to cost ratio for this project is **15.71 considering total crashes**. The benefit to cost ratio **considering only target crashes is 16.21**. 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.

## TREATMENT SITE PHOTOS



Looking Northeast onto Oakgrove Drive from intersection



Traveling Southeast on NC 54 (Harden Street) approaching Oakgrove Drive



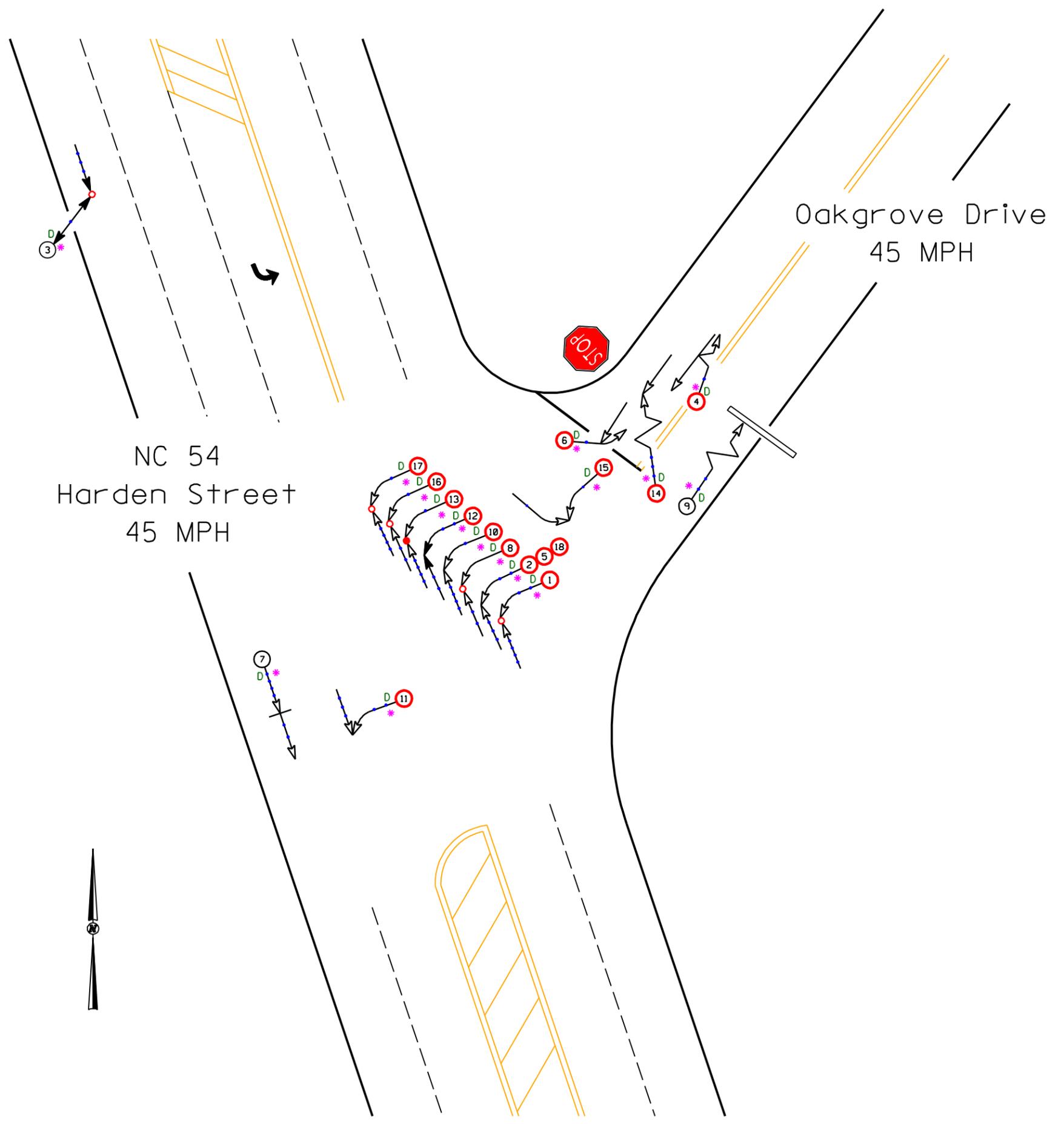
Looking Northwest on NC 54 at Oakgrove Intersection

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

LOCATION: NC 54 at Oakgrove		BY: JBS						
COUNTY: Alamance		DATE: 3/24/2010						
FILE NO.: SS 07-03-202		NOTES: Total Crashes						
DETAILED COST:	TYPE IMPROVEMENT - Intersection Realignment & Bank Cut Back							
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$40,000	10	0.149	\$5,961			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$40,000	10	0.149	\$5,961			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$800			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$0			
	TOTAL ANNUAL COST=				\$6,761			
	TOTAL COST OF PROJECT=				\$40,000			
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	5.34	1	0.19	5	0.94	12	2.25	\$119,251
AFTER	5.34	0	0.00	3	0.56	4	0.75	\$13,034
						Annual Benefits from Crash Cost Savings		\$106,217
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$99,456		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	15.71		
TOTAL COST OF PROJECT		-	\$40,000	COMPREHENSIVE B/C RATIO		-	15.71	

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

LOCATION: NC 54 at Oakgrove Drive		BY: JBS						
COUNTY: Alamance		DATE: 3/24/2010						
FILE NO.: SS 07-03-202		NOTES: Target Crashes						
DETAILED COST:	TYPE IMPROVEMENT - Intersection Realignment & Sight Distance Improvements							
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$40,000	10	0.149	\$5,961			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$40,000	10	0.149	\$5,961			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$800			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$0			
	TOTAL ANNUAL COST=				\$6,761			
	TOTAL COST OF PROJECT=				\$40,000			
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	5.34	1	0.19	4	0.75	10	1.87	\$114,419
AFTER	5.34	0	0.00	1	0.19	2	0.37	\$4,831
						Annual Benefits from Crash Cost Savings		\$109,588
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$102,827		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	16.21		
TOTAL COST OF PROJECT		-	\$40,000	COMPREHENSIVE B/C RATIO		-	16.21	



**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		SPEED UNKNOWN
	RAN OFF ROAD				70 AND UP		OILY

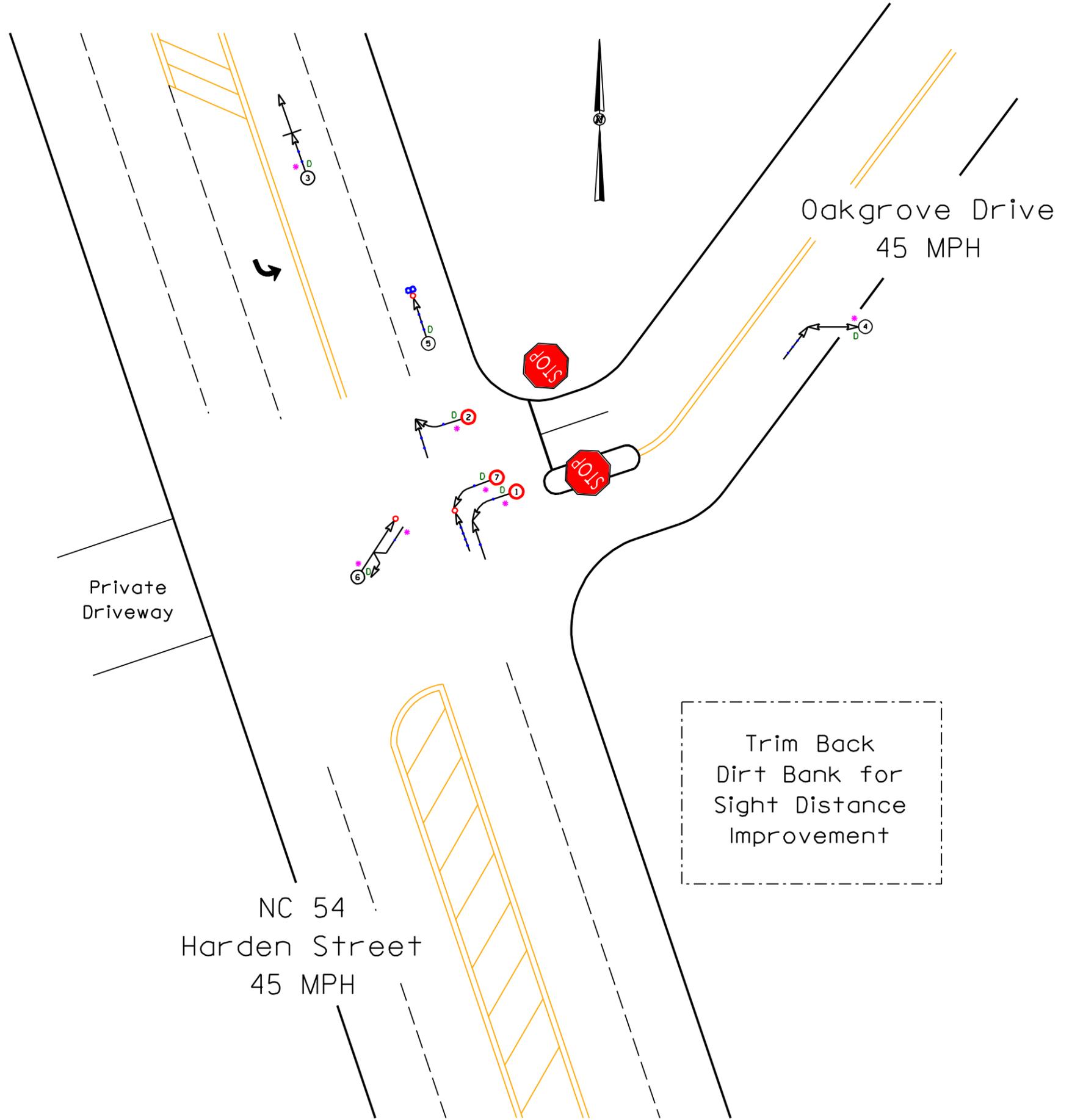
SS# 07-03-202  
 Alamance County  
 City of Graham  
 BEFORE Period  
 3/1/99 - 6/30/04

Frontal Impact  
 Target Crashes

**TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT**

	COLLISION DIAGRAM	
	DIVISION: 7	AREA:
	STUDY PERIOD: 3/1/1999 - 6/30/2004	
	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: 3-23-2010		
LOG NUMBER: SS* 07-03-202 BEFORE		

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



**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		SPEED UNKNOWN
	RAN OFF ROAD				70 AND UP		OILY

SS# 07-03-202  
 Alamance County  
 City of Graham  
 AFTER Period  
 10/1/04 - 1/31/10

Trim Back  
 Dirt Bank for  
 Sight Distance  
 Improvement

Frontal Impact  
 Target Crashes

**TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT**

	<b>COLLISION DIAGRAM</b>	
	DIVISION: 7	AREA:
	STUDY PERIOD: 10/1/2004 - 1/31/2010	
	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: 3-23-2010		
LOG NUMBER: SS* 07-03-202 AFTER		

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