

Spot Safety Project Evaluation

Project Log # 200704300

Spot Safety Project # 05-00-222

**Spot Safety Project Evaluation of the Traffic Signal Installation and Construction of Left Turn Lanes at the Intersection of SR 1348 (Trailwood Dr) and Thistledown/Main Campus Dr
Wake County**

Documents Prepared By:

Safety Evaluation Group
Traffic Safety Systems Management Section
Traffic Engineering and Safety Systems Branch
North Carolina Department of Transportation

Principal Investigator

Brad Robinson, EI

10/31/2007
Date

Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 05-00-222 – The Intersection of SR 1348 (Trailwood Dr) at Thistledown/Main Campus Dr in Wake County.

Project Information and Background from the Project File Folder

The spot safety project improvement countermeasure chosen for the subject location was to install a traffic signal and to construct left turn lanes on SR 1348 (Trailwood Dr).

The subject location is a four-leg intersection which was controlled by stop signs on Thistledown Dr/Main Campus Dr in the before period. Eastbound Thistledown Dr is a two lane approach with a thru-right and a left turn lane. The three other approaches were all single lane approaches in the before period, with left turn lanes added on SR 1348 in the after period. The Speed limits was 35 mph for Thistledown during the study periods, with SR 1348 having a speed limit of 45 mph in the before period and 35 mph in the after period.

The east leg of the intersection (Main Campus Dr) serves as the only entrance to Centennial Middle School. According to letters from several citizens, traffic on Main Campus Drive would be backed up on this leg all the way to the school (about a half-mile) during peak hours. In the future, this leg will be connected to the rest of NCSU's Centennial Campus and become the main thoroughfare.

The original statement of problem was that traffic volumes had increased to the point where motorists could not safely maneuver through the intersection. At the request of private citizens, a signal warrant investigation was conducted and it was determined that the intersection satisfied traffic signal warrants 6, 9, and 11.

The initial crash analysis was conducted from August 1, 1997 to July 31, 2000 with a total of 17 crashes, 7 of which were Angle Crashes and considered correctable by the chosen countermeasure. The final completion date for the improvements at the subject intersection was on August 22, 2002 with a total cost of \$140,000.00.

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 from July 1, 2002 to October 31, 2002. The before period consisted of reported crashes from January 1, 1998 through June 30, 2002 (4 years and 6 months) and the after period consisted of reported crashes from November 1, 2002 through April 30, 2007 (4 years and 6 months). The ending date for this analysis was limited by the available crash data at the time the analysis was conducted.

The treatment data consisted of all reported crashes within 150 feet of the subject intersection.

The following data table depicts the Naive Before and After Analysis for the treatment location. Please note that there were two types of Target Crashes for the applied countermeasure. The first were Frontal Impact crash types. These crash types considered are as follows: Left Turn, same roadway; Left Turn, different roadway; Right Turn, same roadway; Right Turn, different roadway; Head On and Angle. The second type of Target Crashes were Rear-End Crashes involving vehicles on SR 1348 approaching the intersection. The target crashes are clearly identified in the before and after period collision diagrams.

<u>Treatment Information</u>			
	Before	After	Percent Reduction (-) Percent Increase (+)
Total crashes	28	20	-28.6
Total Severity Index	5.29	3.59	-32.1
Frontal Impact Crashes			
Frontal Impact Crashes	13	7	-46.2
Frontal Impact Severity Index	9.68	5.23	-46.0
Rear-Ends Crashes on SR 1348			
Rear-Ends Crashes on SR 1348	7	4	-42.9
Rear-End Crashes Severity Index	1	2.85	185.0
Volume			
Volume	8,200	9,700	18.3
<u>Crash Severity Summary</u>			
Fatal Crashes	0	0	N/A
Class A Crashes	1	0	-100.0
Class B Crashes	4	5	25.0
Class C Crashes	2	2	0.0
PDO Crashes	21	13	-38.1

The naive before and after analysis at the treatment location resulted in a 29 percent decrease in Total Crashes, a 46 percent decrease in Frontal Impact Crashes, a 43 percent decrease in Rear-End Target Crashes, and a 18 percent increase in Average Daily Traffic (ADT). 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 29 percent decrease in Total Crashes, a 46 percent decrease in Frontal Impact Crashes, and a 43 percent decrease in Rear-End Target Crashes. The summary results above demonstrate that Total Crashes and both types of Target Crashes appear to have decreased at the treatment location from the before to the after period.

It is apparent from the above table and the *Collision Diagrams* that the installation of the traffic signal and the addition of left turn lanes were effective in reducing both Frontal Impact Crashes and Rear-End Crashes at the intersection.

In the before period there were two notable patterns of Frontal Impact Crashes. There were four Frontal Impact Crashes between eastbound Thistledown vehicles and southbound SR 1348 vehicles. There were five Frontal Impact Crashes involving eastbound Thistledown vehicles and northbound SR 1348 vehicles. Over half of the crashes (5 out of 9) involved the eastbound vehicle running the stop sign (Before Crash #s 3, 4, 13, 15, and 17). In the after period there was only one crash each for these two types, although a new Frontal Impact Crash pattern emerged. There were four Left Turn-Same Roadway Crashes involving left turning northbound vehicles in the after period, as opposed to only one in the before period.

All seven Rear-End Target Crashes in the before period involved northbound vehicles approaching the intersection. This pattern reduced to only three in the after period, plus one Rear-End Target Crash on southbound SR 1348. The reduction in Rear-End Target crashes can probably be attributed to the left turn lanes providing a safe refuge for left turning vehicles to wait in, allowing through vehicles to travel through the intersection unobstructed.

The calculated benefit to cost ratio for this project is 6.28 considering total crashes. The benefit to cost ratio considering only target crashes is 6.49. 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 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 roadway.

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: SR 1348 (Trailwood) at Thistledown
 COUNTY: Wake
 FILE NO.: SS 05-00-222

BY: Brad Robinson
 DATE: 10/26/2007

DETAILED COST: TYPE IMPROVEMENT - Signal and Left Turn Lanes

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$140,000	15	0.117	\$16,356
	\$0	0	0.000	\$0
Right-of-Way	\$0	0	0.000	\$0
TOTALS	\$140,000	15	0.117	\$16,356

ESTIMATED INCREASE IN ANNUAL MAINT. COST = \$2,000
 ESTIMATED INCREASE IN ANNUAL UTILITY COST = \$900
 TOTAL ANNUAL COST= \$19,256
 TOTAL COST OF PROJECT= \$140,000

COMPREHENSIVE COST REDUCTION:

ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES

TIME PERIOD	YEARS	ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES				PDO		ANNUAL COSTS
		K & A CRASHES	K & A CRASHES PER YR	B & C CRASHES	B & C CRASHES PER YR	CRASHES	CRASHES PER YR	
BEFORE	4.50	1	0.22	6	1.33	21	4.67	\$162,244
AFTER	4.50	0	0.00	7	1.56	13	2.89	\$41,400

Annual Benefits from Crash Cost Savings \$120,844

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = \$101,588

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 6.28

TOTAL COST OF PROJECT - \$140,000 COMPREHENSIVE B/C RATIO - 6.28

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 COUNTY: Wake
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COMPREHENSIVE COST REDUCTION:

ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES

TIME PERIOD	YEARS	ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES				PDO CRASHES	PDO CRASHES PER YR	ANNUAL COSTS
		K & A CRASHES	K & A CRASHES PER YR	B & C CRASHES	B & C CRASHES PER YR			
BEFORE	4.50	1	0.22	5	1.11	14	3.11	\$151,644
AFTER	4.50	0	0.00	5	1.11	6	1.33	\$26,578

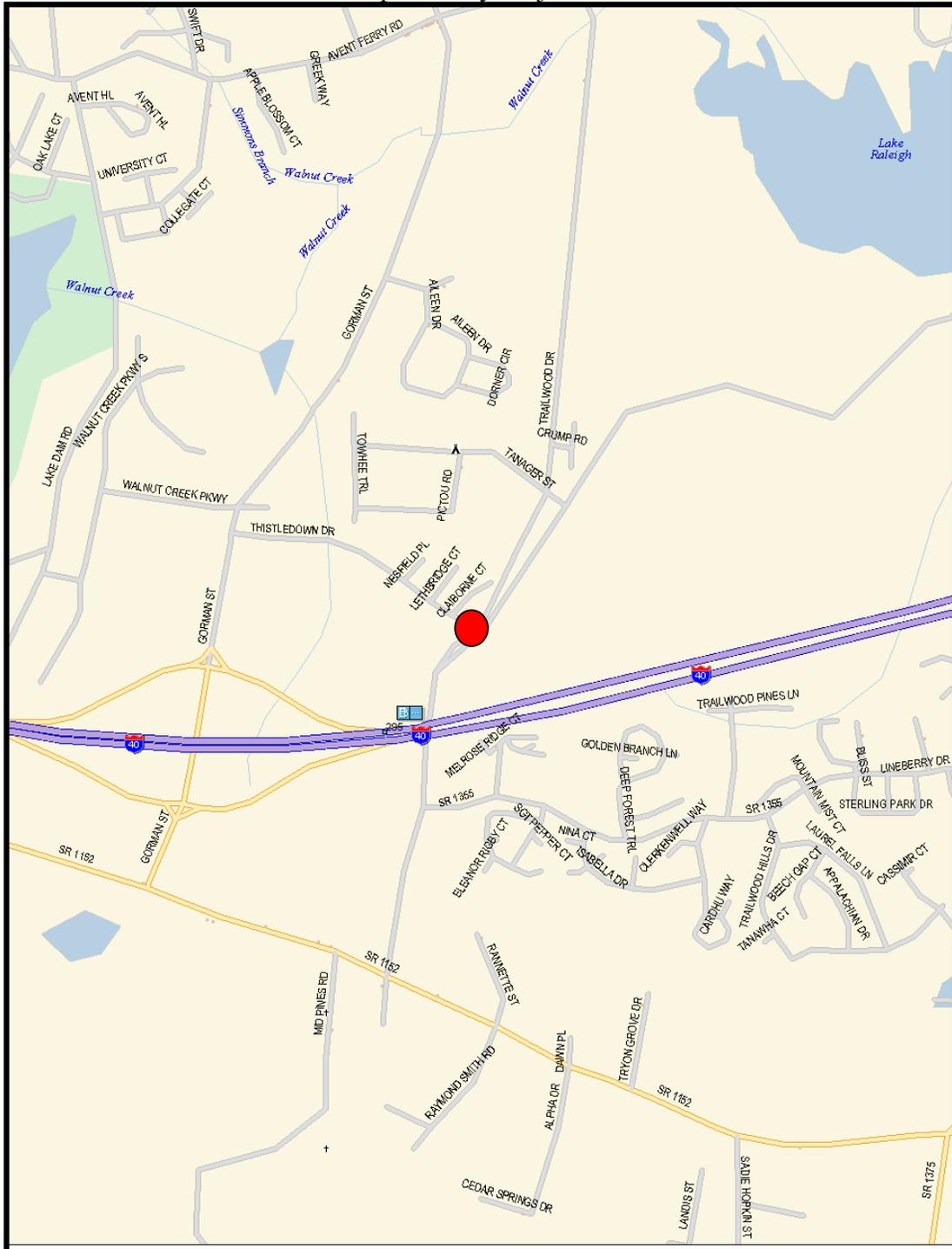
Annual Benefits from Crash Cost Savings \$125,067

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = \$105,811

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 6.49

TOTAL COST OF PROJECT - \$140,000 COMPREHENSIVE B/C RATIO - 6.49

Location Map
Wake County
Evaluation of Spot Safety Project # 05-00-222



Treatment Site Location: SR 1348 (Trailwood Dr) at Thistledown/Main Campus Dr

Treatment Site Photos Taken October 19, 2007



Driving Southbound on SR 1348 (Trailwood Dr)



Driving Southbound on SR 1348 (Trailwood)



Driving Northbound on SR 1348 (Trailwood)



Driving Northbound on SR 1348 (Trailwood)



Driving Eastbound on Thistledown Drive

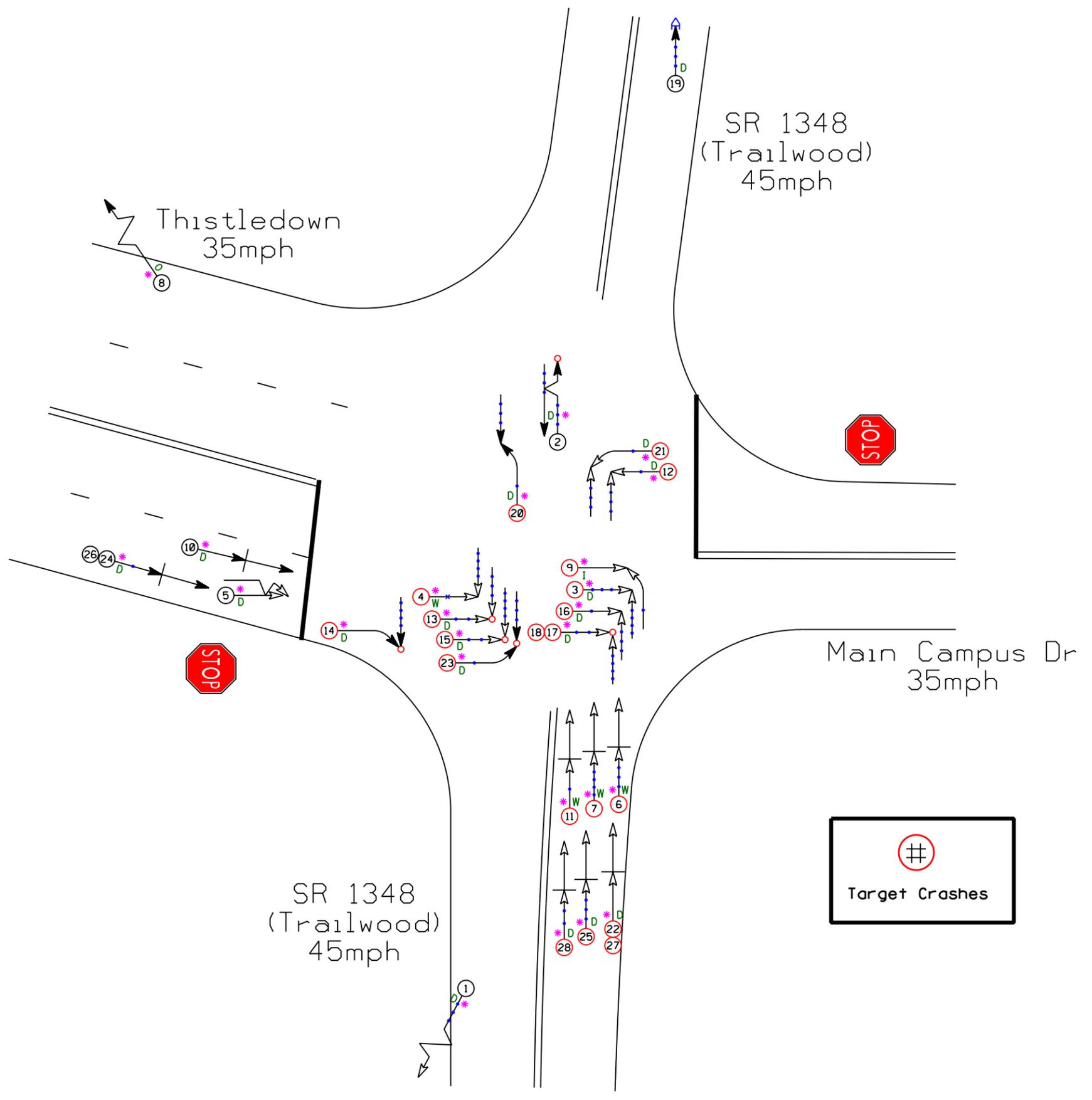


Driving Westbound on Main Campus Drive

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				70 AND UP		
					SPEED UNKNOWN		

Wake County
SR 1348 (Trailwood Dr) at
Thistledown/Main Campus Dr
Before Period
1/1/1998-6/30/2002



TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT	
	COLLISION DIAGRAM
DIVISION: 5	AREA:
STUDY PERIOD: 1/1/1998 TO 6/30/2002	
DISTANCE: T-LINE = 150FT	
ANALYSIS PREPARED BY: BDR	
ANALYSIS CHECKED BY:	
DIAGRAM PREPARED BY: BDR	
DIAGRAM REVIEWED BY: BDR	
SCALE: NOT TO SCALE	
DATE: September 2007	
LOG NUMBER: 200704300	

N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRAFFIC ENGINEERING AND SAFETY
SYSTEMS BRANCH

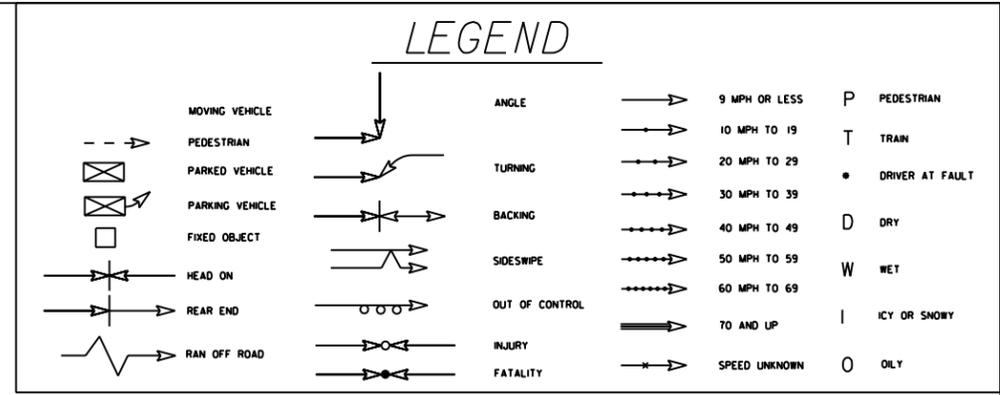
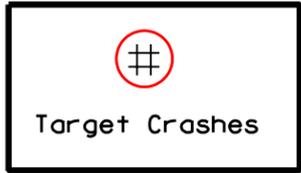
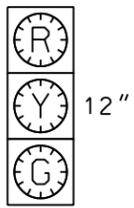
Note: Crash #5 involved a vehicle hitting a pot hole

SR 1348
(TRAILWOOD DRIVE)
35 mph

MAIN CAMPUS DRIVE
35 mph

THISTLEDOWN DRIVE
35 mph

SR 1348
(TRAILWOOD DRIVE)
35 mph



Wake County
SR 1348 (Trailwood Dr) at
Thistledown/Main Campus Dr
After Period
11/1/2002-4/30/2007



TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT



COLLISION DIAGRAM	
DIVISION: 5	AREA:
STUDY PERIOD: 11/1/2002 TO 4/30/2007	
DISTANCE: T-LINE = 150FT	
ANALYSIS PREPARED BY: BDR	
ANALYSIS CHECKED BY:	
DIAGRAM PREPARED BY: BDR	
DIAGRAM REVIEWED BY: BDR	
SCALE: NOT TO SCALE	
DATE: September 2007	
LOG NUMBER: 200704300	

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