

Spot Safety Project Evaluation

Project Log # 200703097

Spot Safety Project # 10-01-217

Spot Safety Project Evaluation of the Traffic Signal Installation At the Intersection of SR 1305 (Pitts School Rd) and SR 1431 (Weddington Rd) Cabarrus 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

Jason B. Schronce

7-26-2007
Date

Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 10-01-217 – The Intersection of SR 1305 (Pitts School Rd) and SR 1431 (Weddington Rd) near Concord in Cabarrus County.

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 actuated traffic signal. SR 1305 and SR 1431 intersect in this rural location to form a crossroads type intersection. These roads previously intersected at two different locations to form tee intersections. The City of Concord relocated Weddington Road in July of 2000 to form the current intersection and roadway geometry. SR 1431 (Weddington Road) is a 3-lane section with designated left turn lanes at the intersection. SR 1305 (Pitts School Road) is a 2-lane roadway that widens to provide left turn lanes on both approaches with an additional right turn lane on the eastbound approach.

The original statement of problem was the insufficient gaps in Pitts School Road traffic to allow for safe entry by motorists from Weddington Road, resulting in angle collisions.

The initial crash analysis was completed from July 1, 2000 to September 1, 2001 with eleven (11) reported crashes, all of which were Angle Crashes and deemed correctable by the signal installation. These angle collisions resulted in 2 “B” and 13 “C” class injuries.

The final completion date for the improvement at the subject intersection was on September 20, 2002 with a total cost of \$45,000.00.

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 June 1, 2002 to December 31, 2002. The before period consisted of reported crashes from July 1, 2000 through May 31, 2002 (1 year and 11 months) and the after period consisted of reported crashes from January 1, 2003 through December 31, 2006 (4 years). The ending date for this analysis was determined by the crash data available at the time of analysis and the start date of the before period was determined by the relocation of Weddington Road to form the subject intersection.

The treatment data consisted of all crashes within 150 feet of the subject intersection. *Please see attached location map and photos for further details.*

The following data table depicts the Naive Before and After Analysis for the treatment location. Please note that Frontal Impact Crashes were the target crashes for the applied countermeasure.

The Frontal Impact Crash types considered are as follows: Left turn, same roadway; Left turn, different roadways; Right turn, same roadway; Right turn, different roadways; Head on; and Angle.

Treatment Information					
	Before (1.92 yrs)	Before Crashes / Yr.	After (4 yrs)	After Crashes / Yr.	Percent Change (+/-)
Total crashes	29	15.10	23	5.75	- 61.92 %
Total Severity Index	5.08		3.90		- 23.23 %
Target Crashes	28	14.58	12	3.00	- 79.42 %
Target Crash Severity Index	4.96		4.70		- 5.24 %
Volume	11,800		17,530		48.56 %
<u>Injury Crash Summary / Yr.</u>					
Fatal injury Crashes / Yr.		0		0	N/A
Class A injury Crashes / Yr.		0		0	N/A
Class B injury Crashes / Yr.		3.13		0.75	- 76.04 %
Class C Injury Crashes / Yr.		5.21		1.50	- 71.21 %
Total Injury Crashes / Yr.		8.33		2.25	- 72.99 %

The naive before and after analysis at the treatment location resulted in a 62 percent decrease in Total Crashes per year, a 79 percent decrease in Target Crashes per year, and a 23 percent decrease in the Total Severity Index. The before period ADT year was 2000 and the after period ADT year was 2004.

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 62 percent decrease in Total Crashes per year and a 79 percent decrease in Target Crashes per year. 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*, all but one of the crashes at the intersection in the before period were the result of a vehicle improperly entering SR 1305 from SR 1431. After the signal installation, this pattern was significantly reduced (28 to 12), a majority of which were Left Turn, Same Roadway crashes due to permissive signal phasing. There was a pattern of vehicles running the red indication signal involving northbound SR 1431 and westbound SR 1305 traffic. These four crashes constituted for the majority of injuries during the after period study.

Due to the limiting factor of the intersection relocation as described in the *background section*, the after period collision diagram can be broken into two different crash sets. Crashes 1 through 8 represent the first 1.92 years of the 4 years of after period data to match the before period's 1.92 years limitation. Crashes 9 through 23 occurred during the remaining time of the 4 years of analysis.

Please note that crash and severity percent change were analyzed on a per year basis to allow for proper comparison.

There was a slight development of Rear-End and Sideswipe Crashes at the intersection in the after period. These crashes occurred on all four approaches and do not appear to form a distinctive crash pattern.

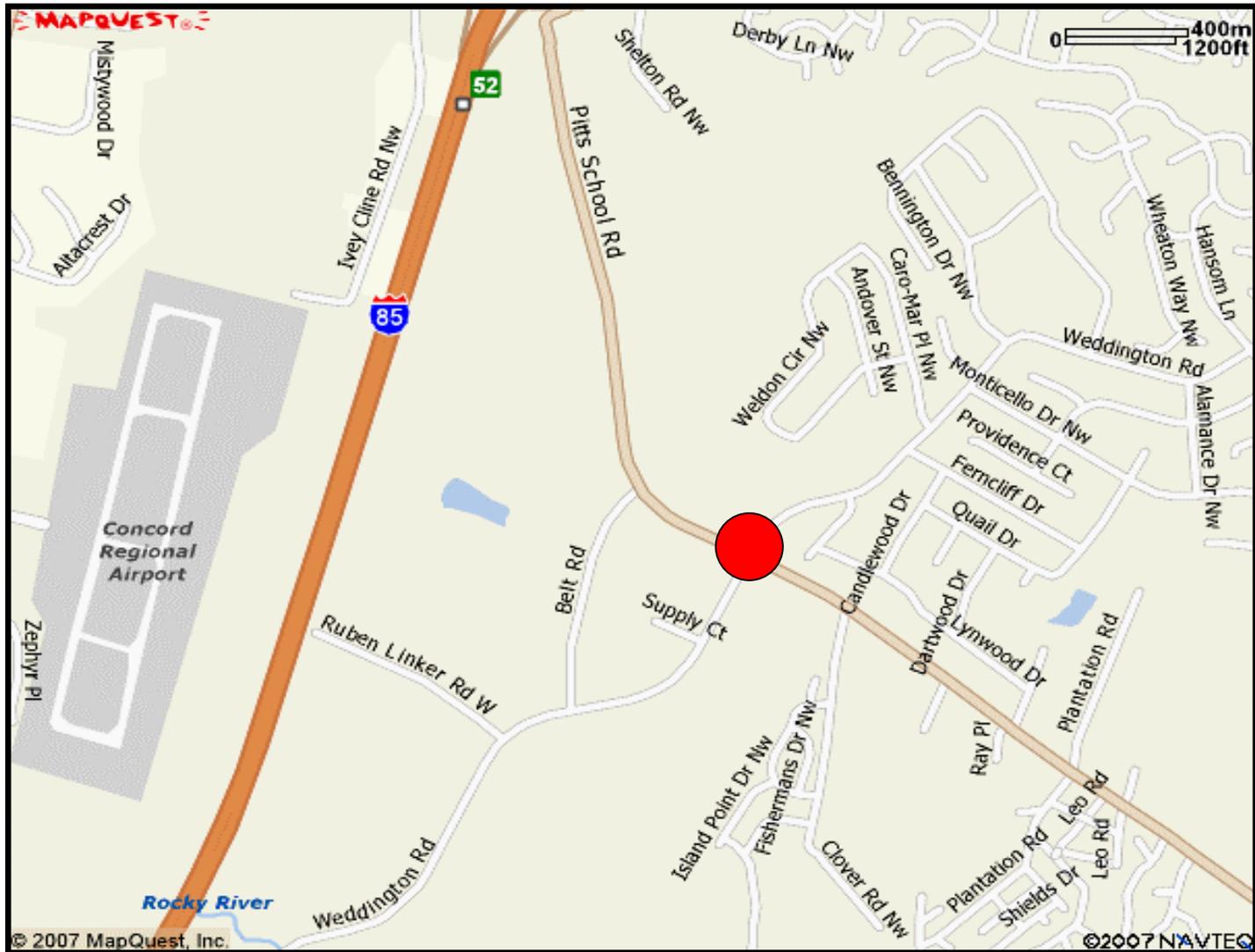
Overall, this location showed major improvement by the installation of the signal. One multiplier that is not easily quantified is the significant increase in ADT through the analysis. The signal appeared to handle the nearly 50% increase in volume effectively.

The calculated benefit to cost ratio for this project is 12.73 considering total crashes. The benefit to cost ratio considering only target crashes is 13.97. 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 a four approaches to the treatment intersection taken during a field visit on July 11th, 2007.

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.

**Location Map
Cabarrus County
Evaluation of Spot Safety Project # 10-01-217**



Treatment Location: SR 1305 (Pitts School Road) at SR 1431 (Weddington Road)

TREATMENT SITE PHOTO TAKEN 7/11/2007



Traveling East on SR 1305 (Pitts School Rd)



Traveling West on SR 1305 (Pitts School Rd)



Traveling North on SR 1431 (Weddington Road)



Traveling North on SR 1431



Traveling South on SR 1431 (Weddington Rd)



Traveling South on SR 1431 (Weddington Rd)

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: SR 1305 at SR 1431
 COUNTY: Cabarrus
 FILE NO.: SS 10-01-217

BY: JBS
 DATE: 7/23/2007
 NOTES: Target Crashes

DETAILED COST: TYPE IMPROVEMENT - New Signal

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	\$45,000	10	0.149	\$6,706
Right-of-Way	\$0	0	0.000	\$0
TOTALS	\$45,000	10	0.149	\$6,706

ESTIMATED INCREASE IN ANNUAL MAINT. COST = \$2,000
 ESTIMATED INCREASE IN ANNUAL UTILITY COST = \$900
 TOTAL ANNUAL COST= \$9,606
 TOTAL COST OF PROJECT= \$45,000

COMPREHENSIVE COST REDUCTION:

ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES

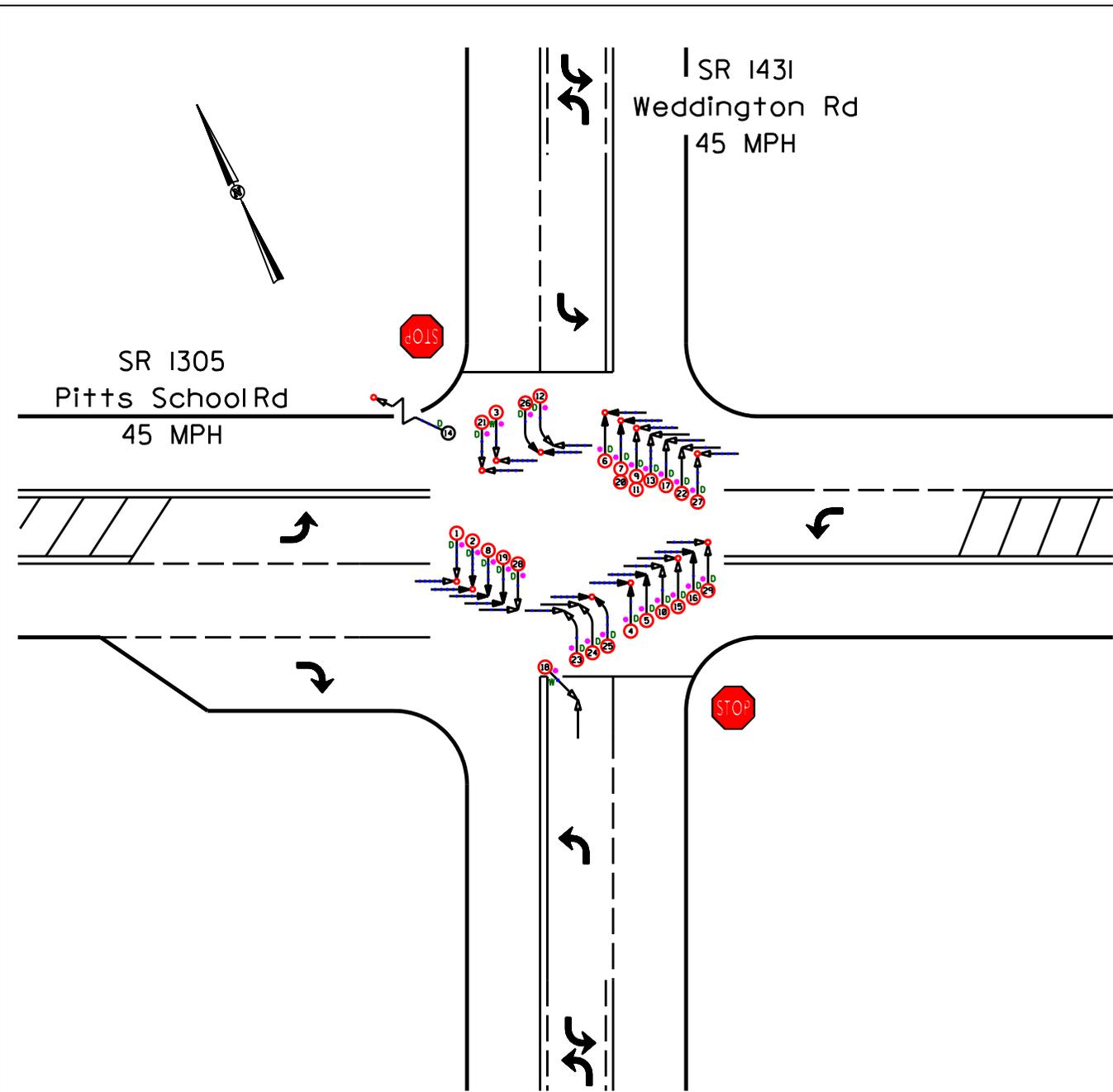
TIME PERIOD	YEARS	K & A CRASHES	K & A CRASHES PER YR	B & C CRASHES	B & C CRASHES PER YR	PDO CRASHES	PDO CRASHES PER YR	ANNUAL COSTS
BEFORE	1.92	0	0.00	15	7.81	13	6.77	\$167,031
AFTER	4.00	0	0.00	6	1.50	6	1.50	\$32,850

Annual Benefits from Crash Cost Savings \$134,181

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = \$124,575

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 13.97

TOTAL COST OF PROJECT - \$45,000 COMPREHENSIVE B/C RATIO - 13.97



LEGEND

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

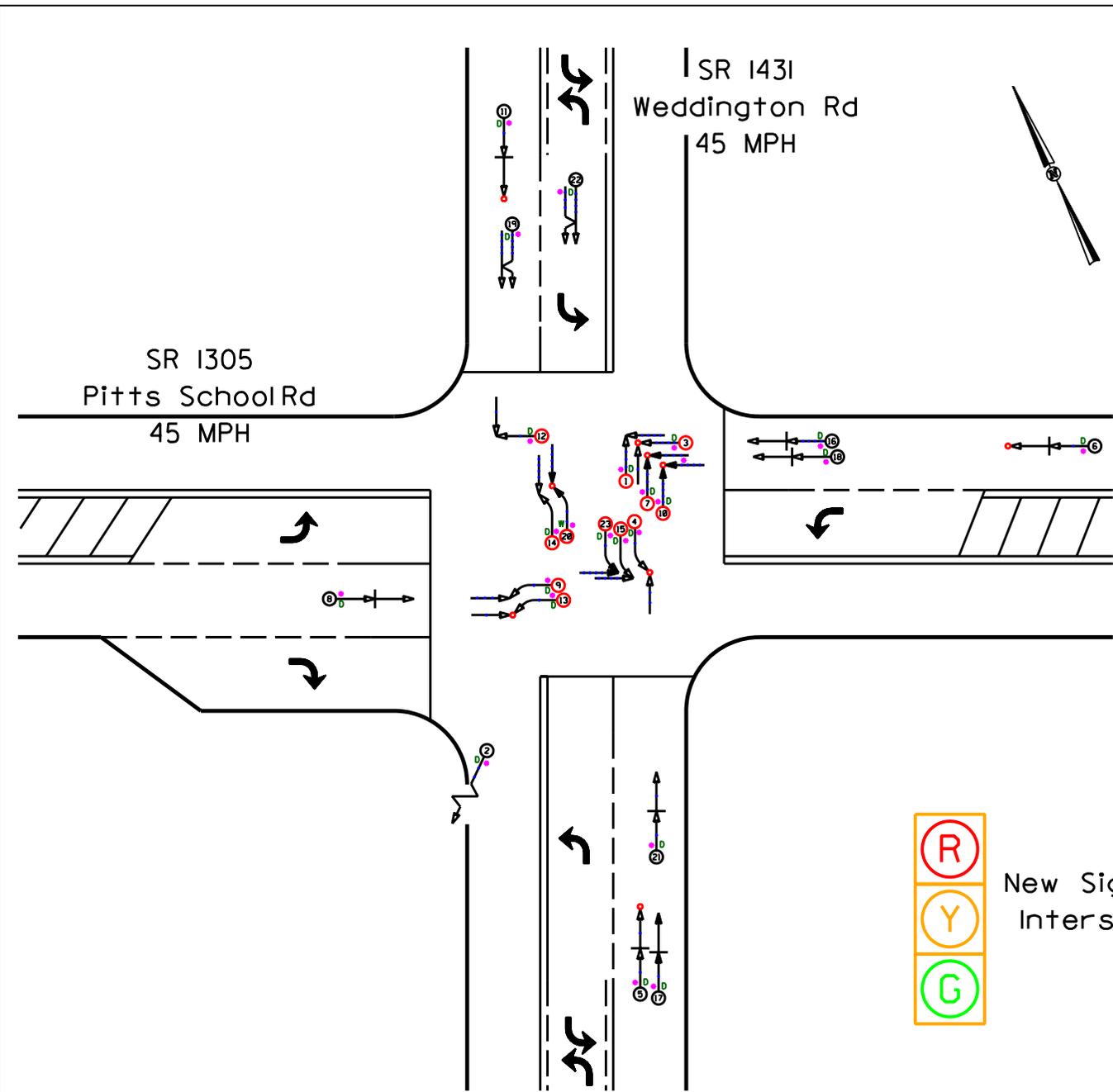
SS# 10-01-217
 Cabarrus County
 Before Period
 7/1/00 - 5/31/02
 SR 1305 at SR 1431

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

		COLLISION DIAGRAM											
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>DIVISION ID</td> <td>AREA</td> </tr> <tr> <td>STUDY PERIOD: 1/1/2000 TO 5/31/2002</td> <td></td> </tr> <tr> <td>DISTANCE: 1-LINE = 150FT</td> <td></td> </tr> <tr> <td>ANALYSIS PREPARED BY: JBS</td> <td></td> </tr> <tr> <td>DIAGRAM PREPARED BY: JBS</td> <td></td> </tr> <tr> <td>DIAGRAM REVIEWED BY: ST</td> <td></td> </tr> </table>		DIVISION ID	AREA	STUDY PERIOD: 1/1/2000 TO 5/31/2002		DISTANCE: 1-LINE = 150FT		ANALYSIS PREPARED BY: JBS		DIAGRAM PREPARED BY: JBS		DIAGRAM REVIEWED BY: ST
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N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRAFFIC ENGINEERING AND SAFETY
SYSTEMS BRANCH





LEGEND

	MOVING VEHICLE		ANGLE		9 MPH OR LESS		PEDESTRIAN
	PEDESTRIAN		TURNING		10 MPH TO 19		TRAIN
	PAKED VEHICLE		BACKING		20 MPH TO 29		DRIVER AT FAULT
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	HEAD ON		REAR END		50 MPH TO 59		TO AND UP
	REAR END		REAR END		60 MPH TO 69		ICY OR SNOW
	RAN OFF ROAD		FATALITY		SPEED UNKNOWN		ONLY

SS# 10-01-217
 Cabarrus County
 After Period
 1/1/03 - 12/31/06
 SR 1305 at SR 1431

Crashes 1-8: First 1.92 yrs
 Crashes 9-23: Remaining 4 yr
 After Period

New Signalized Intersection

Target Crashes

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

	COLLISION DIAGRAM	
	DIVISION ID	AREA
	STUDY PERIOD: 1/1/2003 TO 12/31/2006	DISTANCE: 1-LINE = 150FT
	ANALYSIS PREPARED BY: JBS	DIAGRAM PREPARED BY: JBS
	DIAGRAM REVIEWED BY: ST	
SCALE: NOT TO SCALE		
DATE: 5-2-2007		
LOG NUMBER: SS# 10-01-217		

N.C. DEPARTMENT of TRANSPORTATION
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