

Spot Safety Project Evaluation

Order # 41000012493

Spot Safety Project # 05-02-214

**Spot Safety Project Evaluation of the Traffic Signal Installation
SR 2542 (Rock Quarry Road) at SR 2036 (New Hope Road)
City of Raleigh, Wake 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

7-14-2011

Date

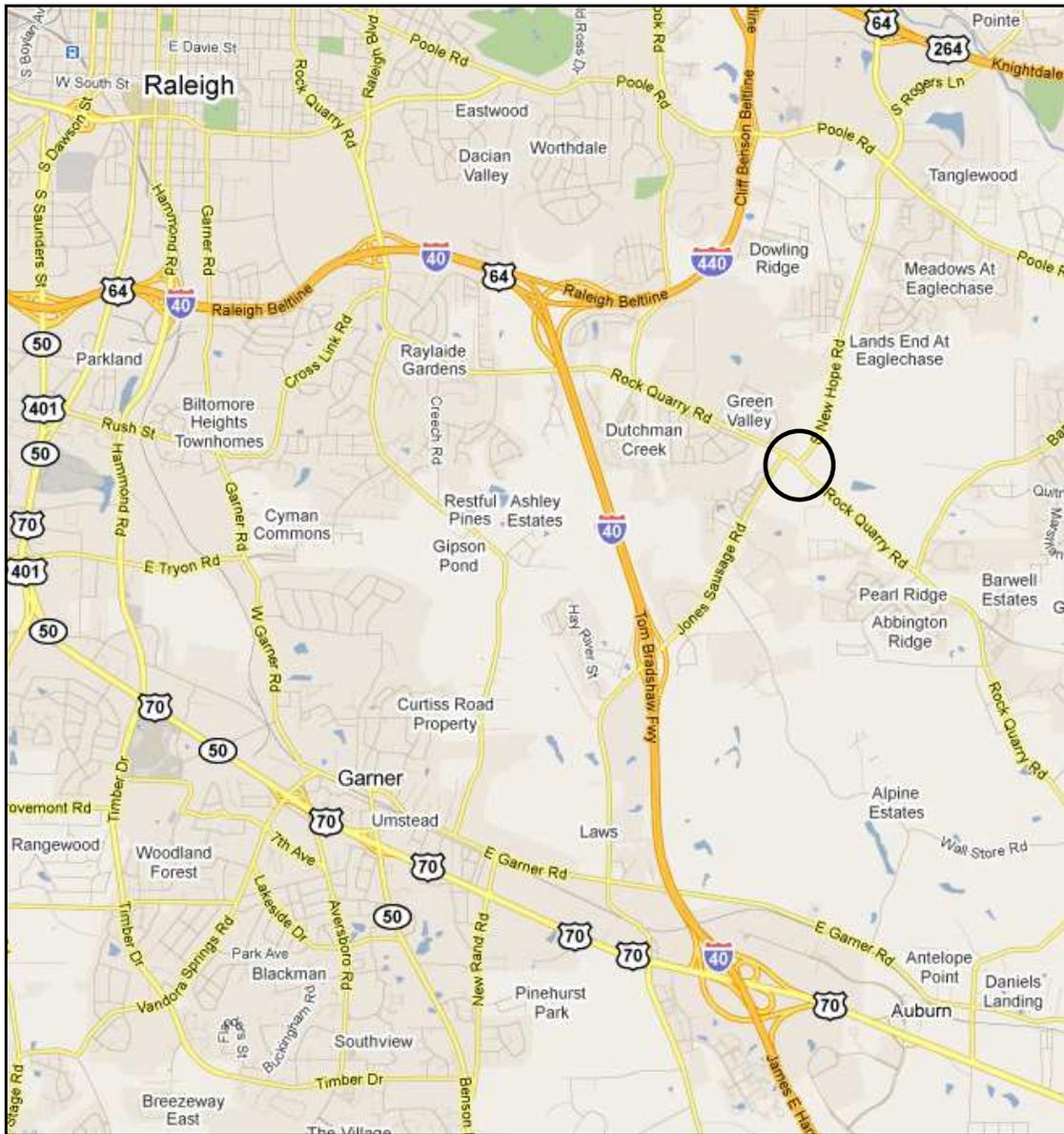
Traffic Safety Project Engineer

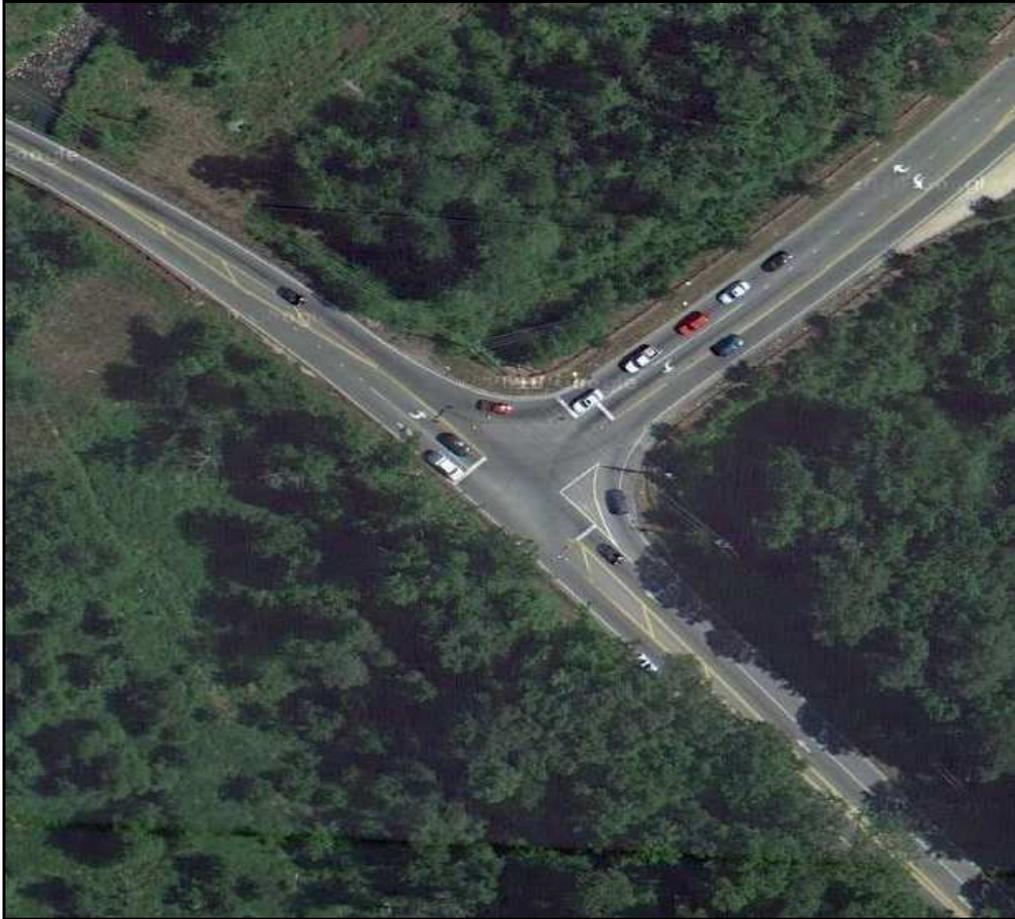
Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 05-02-214 located at the Intersection of SR 2542 (Rock Quarry Road) and SR 2036 (New Hope Road) in Wake County, City of Raleigh.

The Sig ID is 05-2276 for this newly installed traffic signal.





Aerial Map provided from Google

Project Information and Background from the Project File Folder

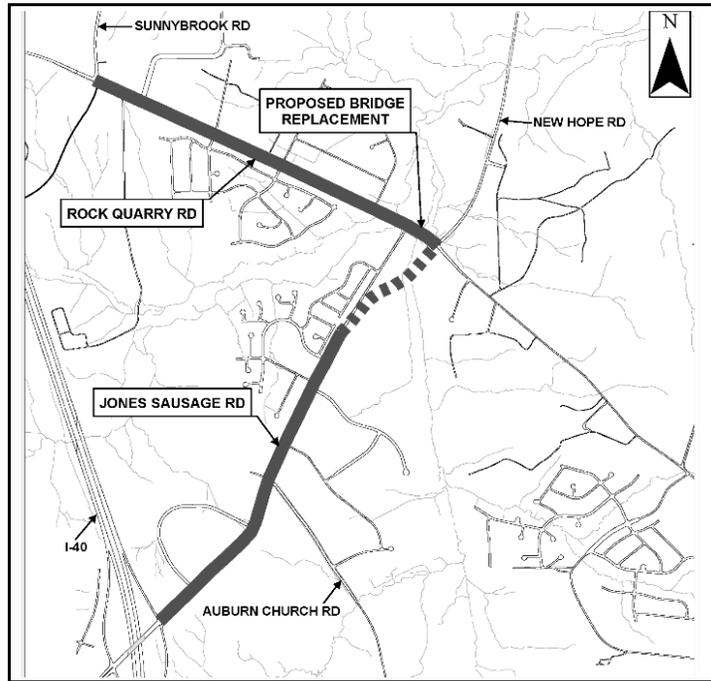
The spot safety project improvement countermeasure chosen for the subject location was the installation of an intersection traffic signal. SR 2542 (Rock Quarry Road) and SR 2036 (New Hope Road) are both two-lane facilities with speed limits of 45-mph on all approaches. The intersection also provides a southbound New Hope left turn lane, an eastbound Rock Quarry left turn lane, and a westbound Rock Quarry right turn lane. The subject location is a three-leg “T” intersection, which was controlled by a stop sign on SR 2036 in the before period.

The original statement of problem expressed concern that intersection traffic volumes had increased to the point that motorists could no longer maneuver the intersection safely. The intersection met signal warrants 1A, 1C, 2, and 3B.

The initial crash analysis was completed from October 1, 2001 to September 30, 2004 with two (2) reported left turn-different roadway crashes. The final completion date for the improvement as seen by the police crash reports was during the second quarter of 2007 with a total cost of \$52,980.

Additional Current Roadwork

The subject intersection is currently under construction from a City of Raleigh transportation project that is widening Rock Quarry Road and relocating Jones Sausage Road to create a four-leg intersection with New Hope Road. This project began construction in March 2011; post our evaluation analysis. The estimated total project cost is \$16,930,000 and funding comes from the 2000 and 2005 Transportation Bonds.



Project Scope from City of Raleigh Website



Construction Photo showing Intersection – Field Visit 7-6-2011

Location Photographs (Google Street View)



Looking East on SR 2542 (Rock Quarry Road)



Looking West on SR 2542 (Rock Quarry Road)



Looking North onto SR 2036 (New Hope Road)

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 May through September 2007. The before period consisted of reported crashes from January 1, 2004 through April 30, 2007 (3 years and 4 months); and the after period consisted of reported crashes from October 1, 2007 through January 31, 2011 (3 years and 4 months).

The ending date for this analysis was limited by the upcoming City of Raleigh widening and relocation project which began construction in March 2011.

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 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.

<u>Treatment Information</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	25	28	12.0 %
Total Severity Index	6.99	1.79	- 74.4 %
Target Crashes	11	3	- 72.7 %
Target Crash Severity Index	12.60	5.93	- 52.9 %
Volume (2005, 2009)	17,900	18,500	3.4 %

<u>Injury Crash Summary</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Fatal injury Crashes	0	0	N/A
Class A injury Crashes	1	0	- 100.0 %
Class B injury Crashes	1	0	- 100.0 %
Class C Injury Crashes	9	3	- 66.7 %
Total Injury Crashes	11	3	- 72.7 %

The naive before and after analysis at the treatment location resulted in a 12 percent increase in Total Crashes; but a 73 percent decrease in Target Crashes and a 74 percent decrease in the Total Severity Index. The before period ADT year was 2005 and the after period ADT year was 2009.

Results and Discussion

Referencing the *Collision Diagrams*, the before period presented a strong crash pattern of nine (9) left turning vehicles from New Hope Road that collided while attempting to access eastbound Rock Quarry Road. There were also two (2) crashes that “ran the stop sign;” one ran-off roadway straight and the other resulted in an A-injury angle collision. After the signal installation, frontal impact target crashes experienced a significant decrease with only three (3) collisions. The left turn different roadway pattern reduced to just one (1) crash and two (2) Rock Quarry left turn-same road crashes also occurred.

However, the total number of crashes at the intersection increased slightly through the evaluation. Southbound SR 2036 rear-end collisions increased from six (6) to seven (7) and westbound SR 2542 rear-end crashes increased from one (1) to four (4) in the analysis.

The calculated benefit to cost ratio for this project is **19.74 considering total crashes**. The benefit to cost ratio **considering only target crashes is 20.17**. 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.

Please see the included *Location Photographs*. 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.

BENEFIT-COST ANALYSIS WORKSHEET - Total Crashes

LOCATION: Rock Quarry at New Hope		BY: JBS						
COUNTY: Wake		DATE: 7/7/2011						
FILE NO.: SS 05-05-015								
DETAILED COST:	TYPE IMPROVEMENT -	New Signal Installation						
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$52,980	10	0.149	\$7,896			
		\$0	0	0.000	\$0			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$52,980	10	0.149	\$7,896			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$2,200			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$900			
	TOTAL ANNUAL COST=				\$10,996			
	TOTAL COST OF PROJECT=				\$52,980			
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	3.33	1	0.30	10	3.00	14	4.20	\$267,327
AFTER	3.33	0	0.00	3	0.90	25	7.51	\$50,300
						Annual Benefits from Crash Cost Savings		\$217,027
	NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST				=	\$206,031		
	BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST				=	19.74		
	TOTAL COST OF PROJECT	-	\$52,980		COMPREHENSIVE B/C RATIO	-		19.74

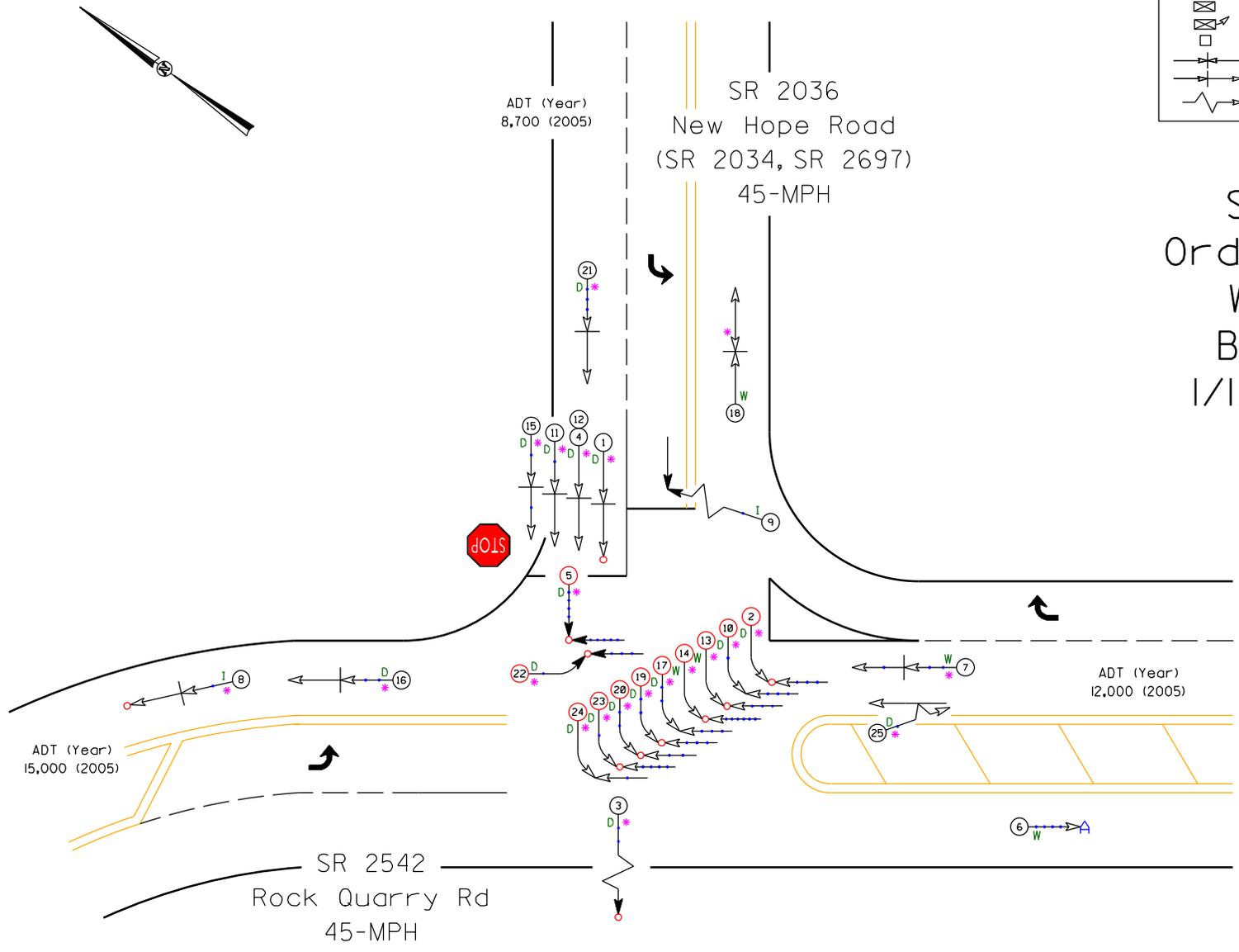
BENEFIT-COST ANALYSIS WORKSHEET - Target Crashes

LOCATION: Rock Quarry at New Hope		BY: JBS						
COUNTY: Wake		DATE: 7/7/2011						
FILE NO.: SS 05-05-015		Frontal Impact Target Crashes						
DETAILED COST:	TYPE IMPROVEMENT -	New Signal Installation						
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$52,980	10	0.149	\$7,896			
		\$0	0	0.000	\$0			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$52,980	10	0.149	\$7,896			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$2,200			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$900			
	TOTAL ANNUAL COST=				\$10,996			
	TOTAL COST OF PROJECT=				\$52,980			
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	3.33	1	0.30	7	2.10	3	0.90	\$235,105
AFTER	3.33	0	0.00	2	0.60	1	0.30	\$13,303
						Annual Benefits from Crash Cost Savings		\$221,802
	NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST				=	\$210,806		
	BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST				=	20.17		
	TOTAL COST OF PROJECT	-	\$52,980		COMPREHENSIVE B/C RATIO	-		20.17

LEGEND

	MOVING VEHICLE		ANGLE		5 MPH OR LESS		PEDESTRIAN
	PEDESTRIAN		TURNING		10 MPH TO 19		TRAIN
	PARKING 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		OUT OF CONTROL		50 MPH TO 59		ICY OR SNOWY
	RAN OFF ROAD		INJURY		60 MPH TO 69		ICY OR SNOWY
			FATALITY		TO AND UP		ONLY
					SPEED UNKNOWN		ONLY

SS# 05-02-214
 Order# 41000012493
 Wake County
 BEFORE Period
 1/1/04 - 4/30/07



Frontal Impact
 Target Crashes

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

TRAFFIC SAFETY UNIT

Date: 6-28-2011

Prepared By: J. Schrone

LEGEND

	MOVING VEHICLE		ANGLE		5 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		RUNAWAY		50 MPH TO 59		ICY OR SNOWY
	RAN OFF ROAD		FATALITY		60 MPH TO 69		TO AND UP
			SPEED UNKNOWN		ONLY		

SS# 05-02-214
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 Wake County
 AFTER Period
 10/1/07 - 1/31/11

SR 2036
 New Hope Road
 (SR 2034, SR 2697)
 45-MPH

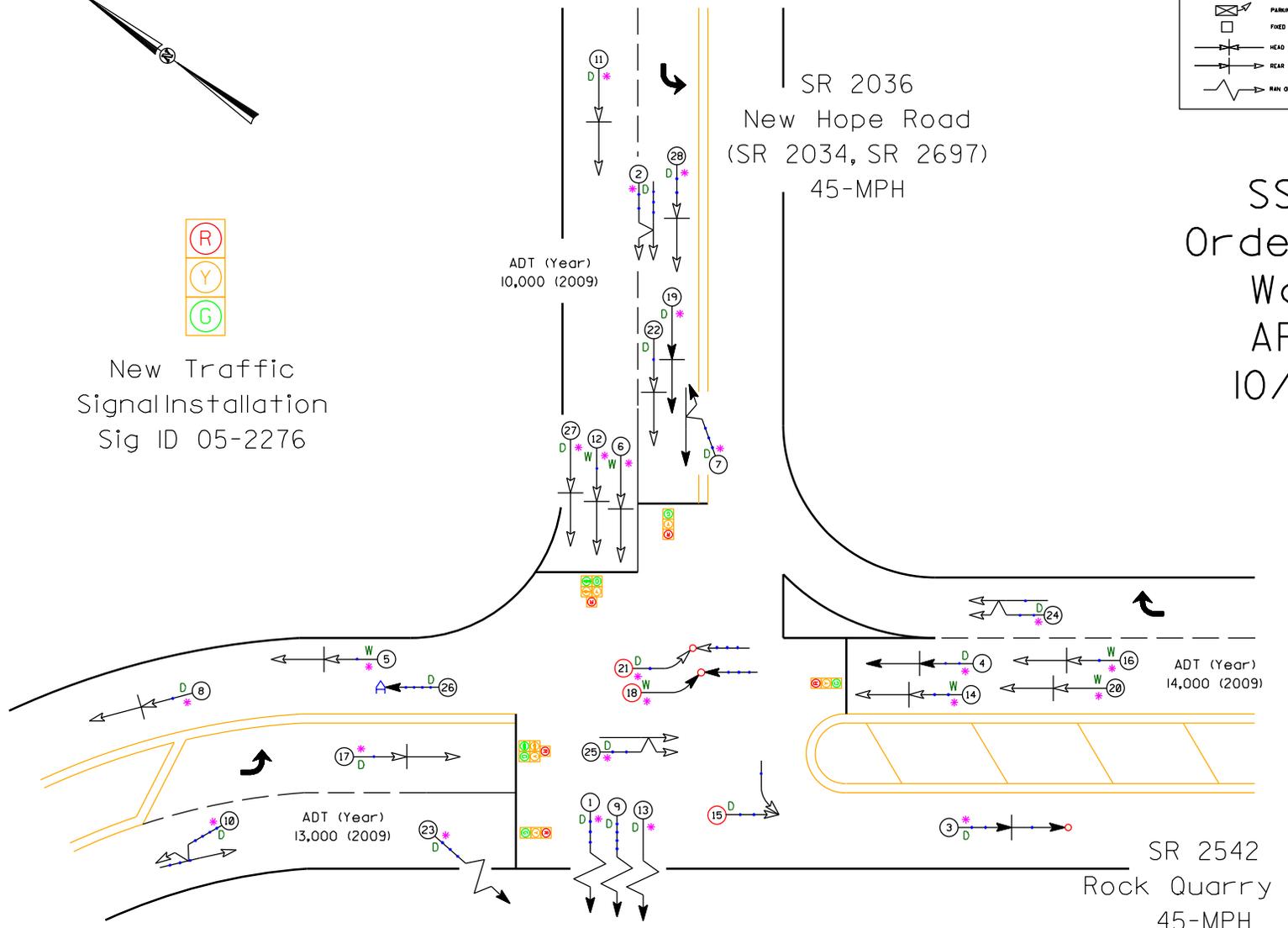
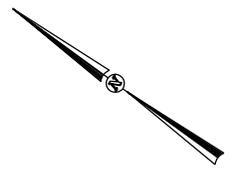
SR 2542
 Rock Quarry Rd
 45-MPH

ADT (Year)
 10,000 (2009)

ADT (Year)
 14,000 (2009)

ADT (Year)
 13,000 (2009)

New Traffic
 Signal Installation
 Sig ID 05-2276



Frontal Impact
 Target Crashes

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

TRAFFIC SAFETY UNIT

Date: 6-28-2011 Prepared By: J. Schronce