

# Spot Safety Project Evaluation

Order # 41000016238

Spot Safety Project # 14-05-201

**Spot Safety Project Evaluation of the Traffic Signal Installation  
SR 1006 (Howard Gap Rd) at SR 1734 (Sugarloaf Rd)  
Henderson County**

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

1-23-2012

Date

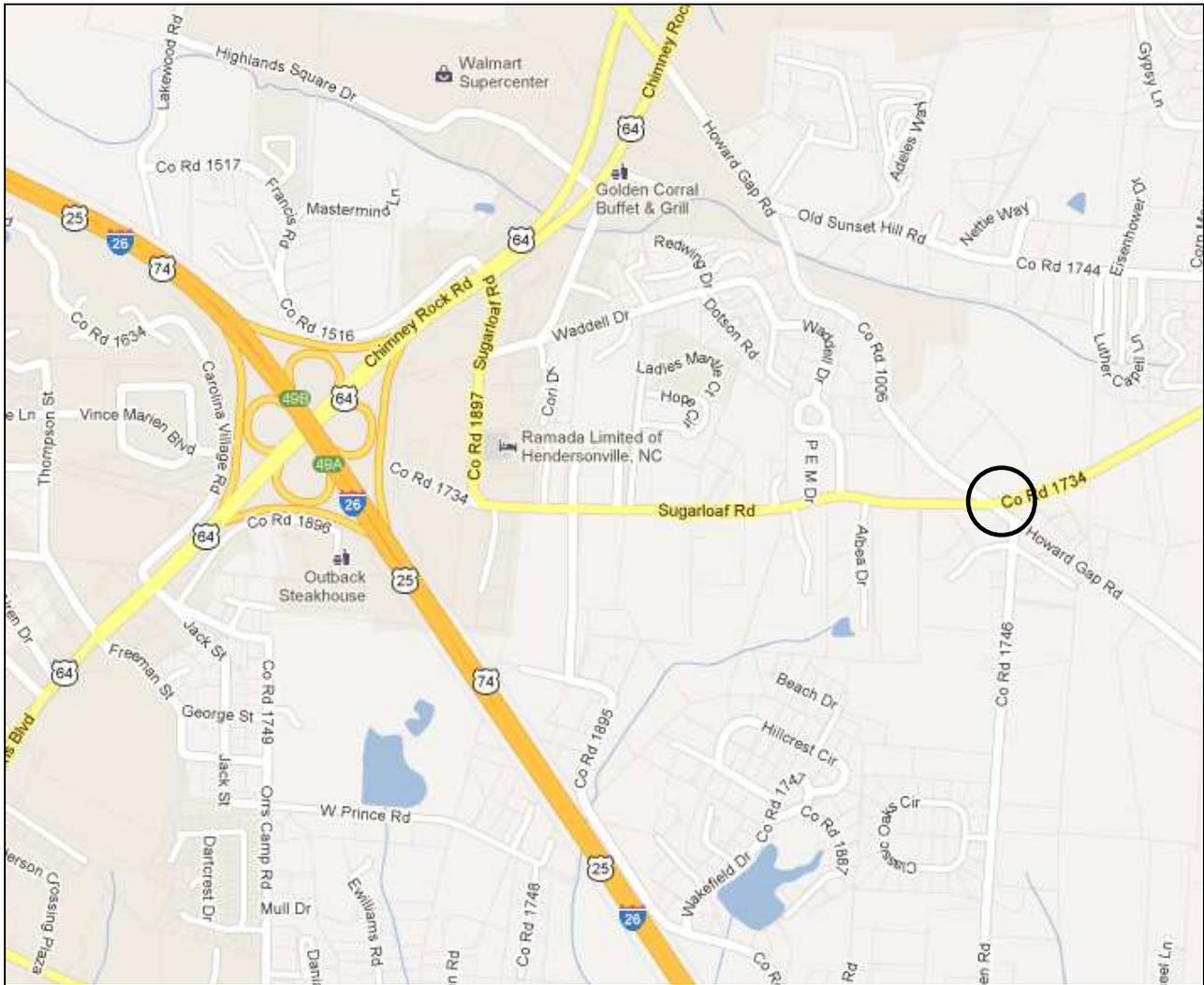
Traffic Safety Project Engineer

# Spot Safety Project Evaluation Documentation

## Subject Location

Evaluation of Spot Safety Project Number 14-05-201 located at the Intersection of SR 1006 (Howard Gap Road) and SR 1734 (Sugarloaf Road) in Henderson County, east of Hendersonville.

The Sig ID is 14-1020 for this newly installed traffic signal.





**Aerial Photo provided from Google Maps**

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

The spot safety project improvement countermeasures chosen for the subject location were the installation of an actuated traffic signal, removal of the existing raised islands on SR 1006, and repainting the sidestreet approaches to better align the intersection. SR 1006 and SR 1734 (Sugarloaf Rd) are both two-lane facilities at the subject intersection with speed limits of 35-mph and 45-mph respectively. The subject location is a four-leg skewed intersection, which was controlled by dual posted stop signs on SR 1006 (Howard Gap Rd) in the before period.

The original statement of problem was the existence of angle crashes at the intersection. The skew of the intersection as well as the roads being slightly offset have contributed to the present crash patterns. The intersection met Signal Warrants 1A, 2, 3, and 7. The signal was installed with protected-permissive phasing for the SR 1006 (Howard Gap Road) approaches.

The initial crash analysis was completed from August 1, 2000 to July 31, 2005 with thirteen (13) reported angle crashes. The final completion date for the improvement at the subject intersection was on January 8, 2007 with a total cost of \$100,000.

## 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 December 2006 through January 2007. The before period consisted of reported crashes from April 1, 2002 through November 30, 2006 (4 years and 8 months); and the after period consisted of reported crashes from February 1, 2007 through September 30, 2011 (4 years and 8 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 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>	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-) Percent Increase (+)</b>
Total Crashes	30	22	- 26.7 %
Total Severity Index	3.71	2.68	- 27.8 %
Target Crashes	20	9	- 55.0 %
Target Crash Severity Index	3.22	2.64	- 18.0 %
Volume (2004, 2009)	11,200	11,300	0.9 %

<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	3	1	- 66.7 %
Class C Injury Crashes	8	4	- 50.0 %
Total Injury Crashes	11	5	- 54.5 %

The naive before and after analysis at the treatment location resulted in a 27 percent decrease in Total Crashes, a 55 percent decrease in Target Crashes, and a 28 percent decrease in the Total Severity Index. The before period ADT year was 2004 and the after period ADT year was 2009.

## Results and Discussion

Referencing the *Collision Diagrams*, the before period presented strong patterns of vehicles pulling out into the roadway from SR 1006 with insufficient gaps after coming to a stop at the intersection. The before period included nine (9) left turn different roadway crashes southbound and six (6) left

turn different roadway crashes northbound. There was also four (4) crossing angle crashes and one (1) left turn same roadway collision on SR 1734 (Sugarloaf Road). After the signal installation, there was only one (1) angle crash caused by a westbound Sugarloaf vehicle running the red light. However, there were two (2) eastbound left turn same roadway and six (6) westbound collisions on SR 1734 (Sugarloaf Road).

The intersection also experienced a slight increase in rear-end collisions approaching the intersection from seven (7) in the before period to ten (10) in the after period. The after period intersection is single lane approaches with no turn lanes. The SR 1006 (Howard Gap Rd) approaches did include a protected-permissive left turn signal phase.

The calculated benefit to cost ratio for this project is **1.53 considering total crashes**. The benefit to cost ratio **considering only target crashes is 1.31**. 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 our Field Visit on December 12<sup>th</sup>, 2011 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 (Field Visit 12/12/2011)**



**Travelling East on SR 1734 (Sugarloaf Road)**



**Travelling North on SR 1006 (Howard Gap Road)**



**Travelling South on SR 1006 (Howard Gap Road)**



**Travelling West on SR 1734 (Sugarloaf Road)**

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

LOCATION: SR 1006 at SR 1734		BY: JBS						
COUNTY: Henderson		DATE: 1/3/2012						
FILE NO.: SS 14-05-201								
DETAILED COST:	TYPE IMPROVEMENT - <b>New Signal</b>							
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$100,000	10	0.149	\$14,903			
		\$0	0	0.000	\$0			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$100,000	10	0.149	\$14,903			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$2,200			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$900			
	TOTAL ANNUAL COST=				\$18,003			
	TOTAL COST OF PROJECT=				\$100,000			
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	4.67	0	0.00	11	2.36	19	4.07	\$64,604
AFTER	4.67	0	0.00	5	1.07	17	3.64	\$37,066
						Annual Benefits from Crash Cost Savings		\$27,537
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$9,535		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	1.53		
TOTAL COST OF PROJECT		-	\$100,000	COMPREHENSIVE B/C RATIO		-	1.53	

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

LOCATION: SR 1006 at SR 1734		BY: JBS						
COUNTY: Henderson		DATE: 1/3/2012						
FILE NO.: SS 14-05-201		Target Crashes - Frontal Impact Crashes						
DETAILED COST:	TYPE IMPROVEMENT - <b>New Signal</b>							
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$100,000	10	0.149	\$14,903			
		\$0	0	0.000	\$0			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$100,000	10	0.149	\$14,903			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$2,200			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$900			
	TOTAL ANNUAL COST=				\$18,003			
	TOTAL COST OF PROJECT=				\$100,000			
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	4.67	0	0.00	6	1.28	14	3.00	\$38,587
AFTER	4.67	0	0.00	2	0.43	7	1.50	\$15,011
						Annual Benefits from Crash Cost Savings		\$23,576
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$5,573		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	1.31		
TOTAL COST OF PROJECT		-	\$100,000	COMPREHENSIVE B/C RATIO		-	1.31	



SR 1006  
Howard Gap Rd  
35-mph

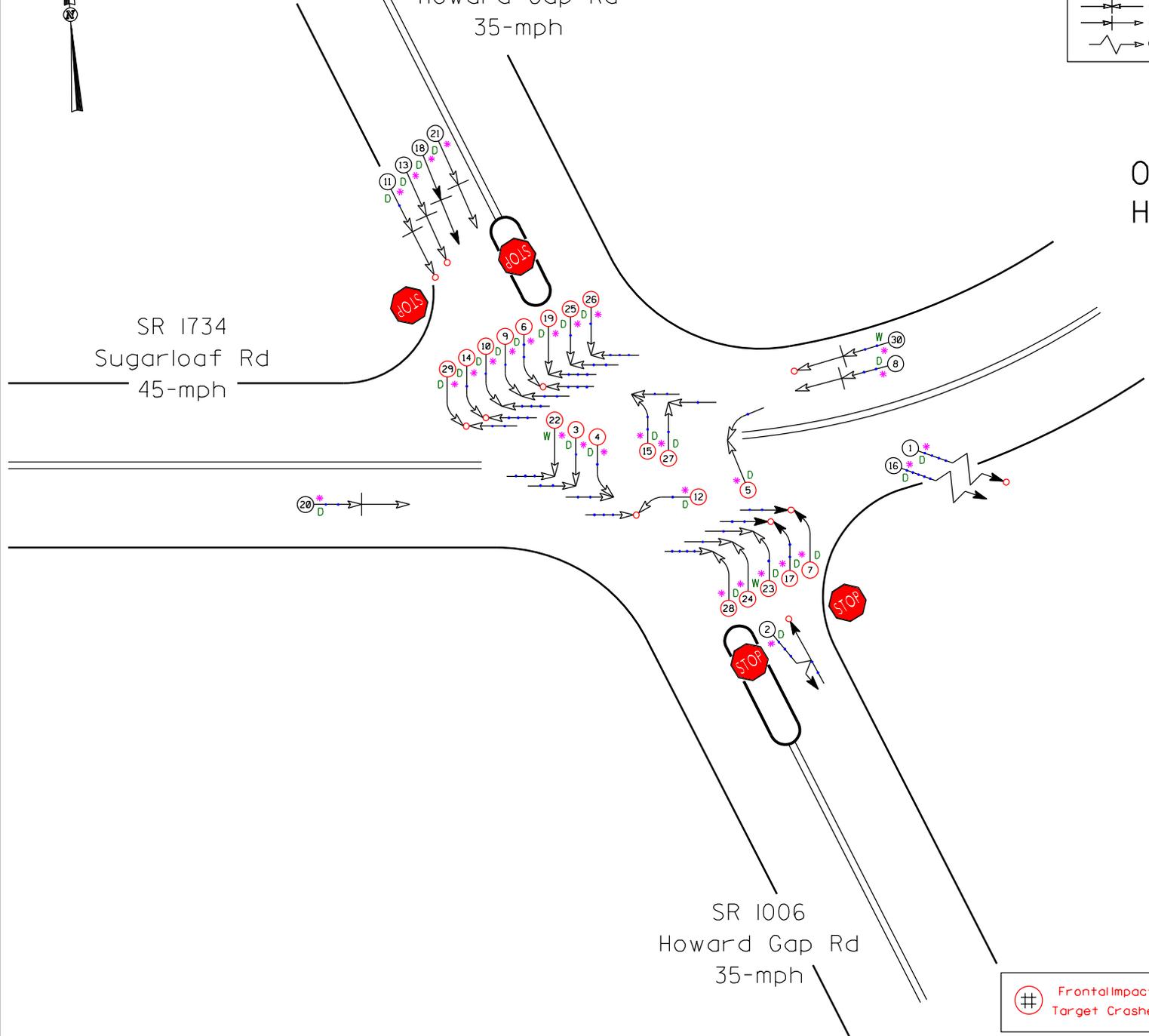
SR 1734  
Sugarloaf Rd  
45-mph

SR 1006  
Howard Gap Rd  
35-mph

**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		INJURY		60 MPH TO 69		FATALITY
			SPEED UNKNOWN		TO AND UP		ICY OR SNOWY
					ONLY		

SS# 14-05-201  
Order# 41000016238  
Henderson County  
BEFORE Period  
4/1/02 - 11/30/06



# Frontal Impact  
Target Crashes

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

**TRAFFIC SAFETY UNIT**

Date: 12-29-2011      Prepared By: J. Schronce



SR 1006  
Howard Gap Rd  
35-mph

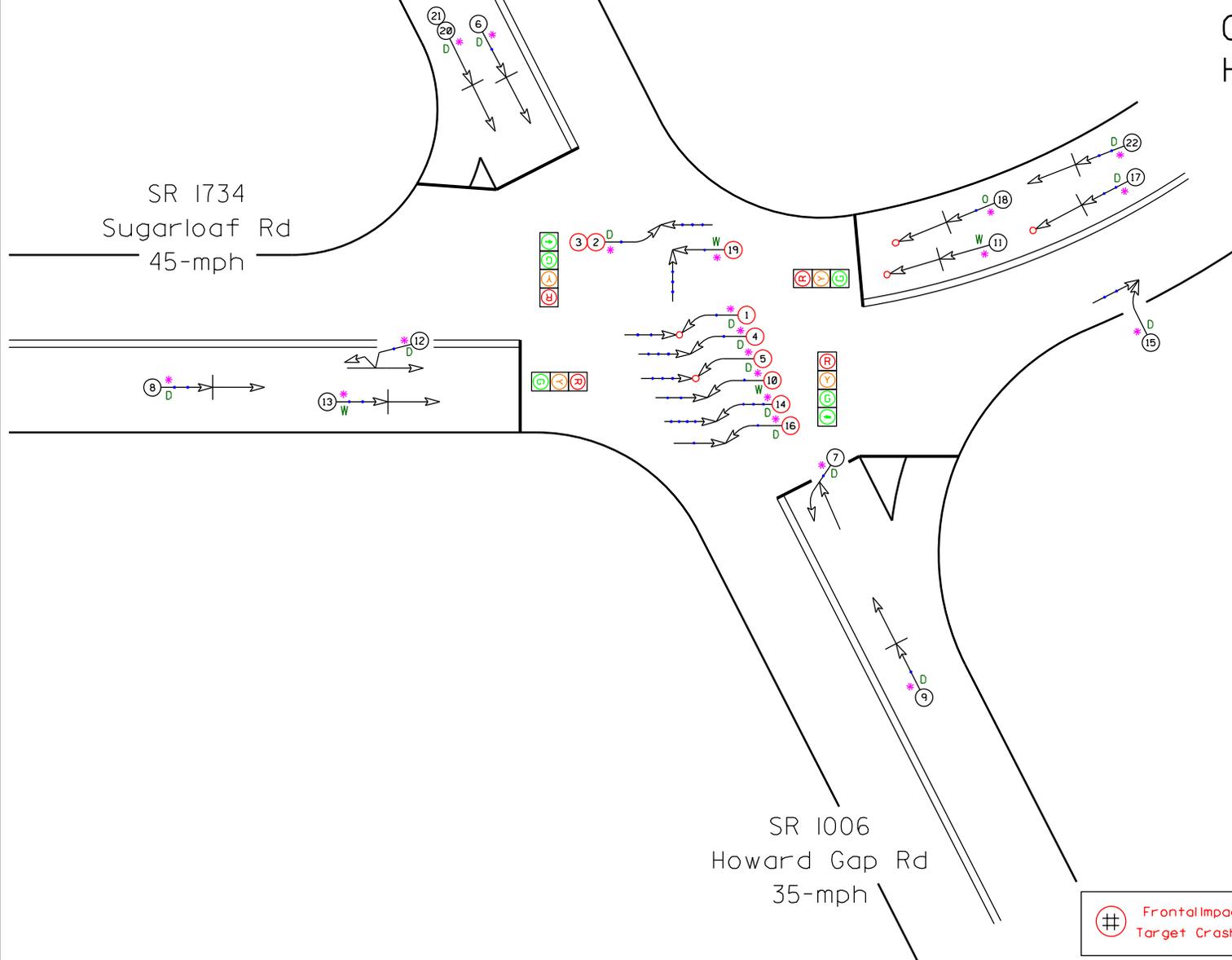
SR 1734  
Sugarloaf Rd  
45-mph

SR 1006  
Howard Gap Rd  
35-mph

**LEGEND**

	MOVING VEHICLE		ANGLE		0 MPH OR LESS		P PEDESTRIAN
	PEDESTRIAN		TURNING		10 MPH TO 15		T TRAIN
	PAKED VEHICLE		BACKING		20 MPH TO 25		* DRIVER AT FAULT
	PARKING VEHICLE		SIDESWIPE		30 MPH TO 35		D DRY
	FIXED OBJECT		OUT OF CONTROL		40 MPH TO 45		W WET
	HEAD ON		RAN OFF ROAD		50 MPH TO 55		I ICY OR SNOWY
	REAR END		HAZY		60 MPH TO 65		F FATALITY
	RAN OFF ROAD		TO AND UP		SPEED UNKNOWN		O ONLY

SS# 14-05-201  
Order# 41000016238  
Henderson County  
AFTER Period  
2/1/07 - 9/30/11



New Signalized  
Intersection  
Sig ID 14-1020

Frontal Impact  
Target Crashes

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

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**TRAFFIC SAFETY UNIT**

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Date: 12-29-2011      Prepared By: J. Schronce