

# Spot Safety Project Evaluation

Order # 41000007074

Spot Safety Project # 14-04-200

**Spot Safety Project Evaluation of the  
Traffic Signal Installation with US 64 Left Turn Lane  
US 64 (New Hendersonville Hwy) at SR 1525/1528 (Crab Creek Rd)  
Transylvania 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

8-19-2010

Date

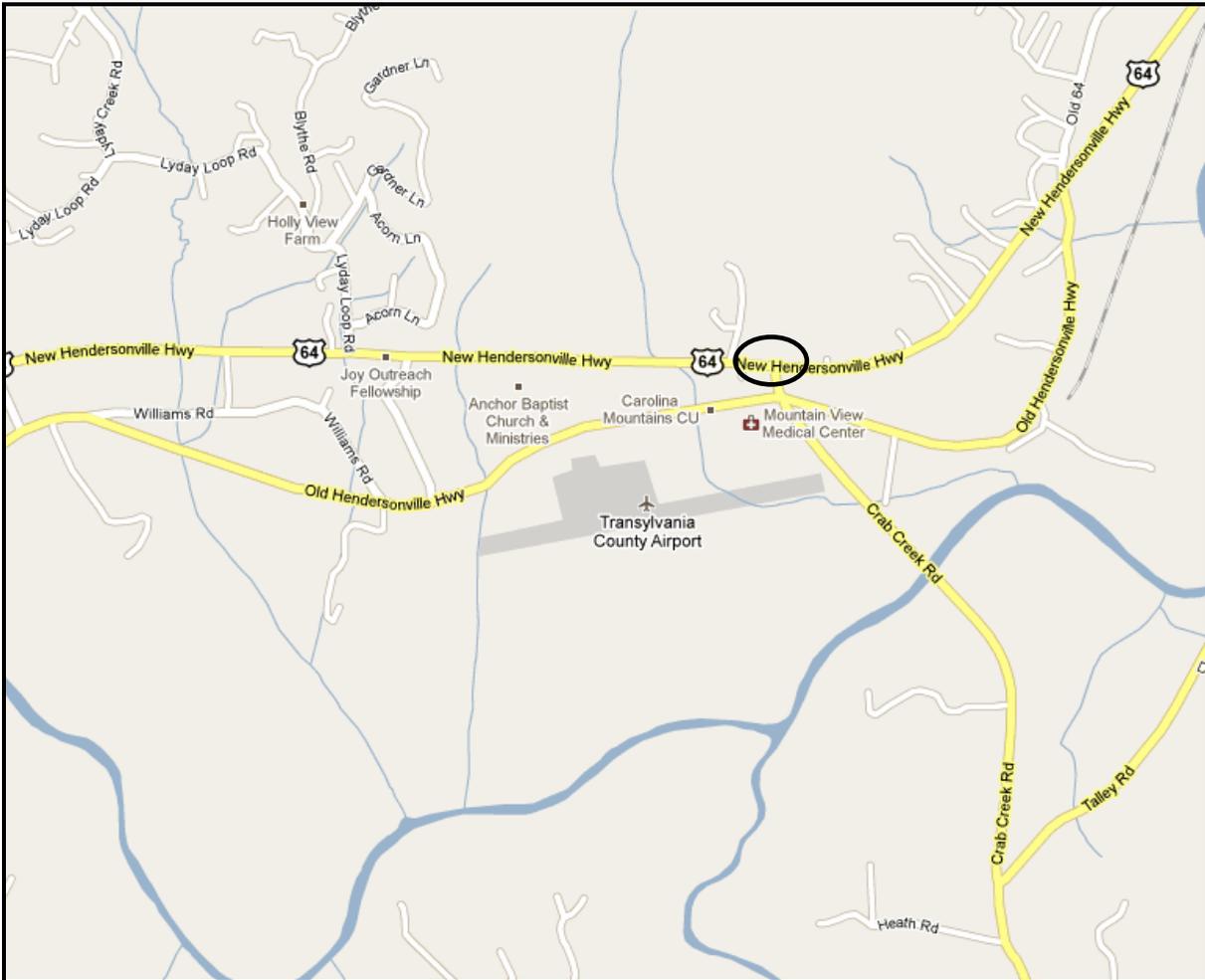
Traffic Safety Project Engineer

# Spot Safety Project Evaluation Documentation

## Subject Location

Evaluation of Spot Safety Project Number 14-04-200 located at the Intersection of US 64 (New Hendersonville Highway) and SR 1525/1528 (Crab Creek Road) in Transylvania County, Community of Penrose (by the Transylvania County Airport).

The Sig ID is 14-0993 for this newly installed traffic signal.





### **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. US 64 and SR 1525/1528 were both two-lane facilities at the subject intersection in the before period with speed limits of 55 and 45 mph respectively. US 64 was additionally widened with the signal installation for a westbound left turn lane, eastbound right turn lane, and a center turn lane to the east of the intersection for multiple PVA access. The subject location is a three-leg intersection, which was controlled by a stop sign on SR 1525/1528 (Crab Creek Rd) previously.

The original statement of problem proclaimed that increased vehicle use of this intersection was leading to congestion and delay. Also, a left turn-different roadway crash pattern had started to develop including a fatality crash on October 8, 2003. The intended purpose was to alleviate the congestion-delay issue and increase motorist safety through this location.

The initial crash analysis was completed from June 1, 2000 to May 31, 2003 with twelve (12) reported crashes, three (3) of which were deemed correctable including one fatality crash. The final completion date for the improvement at the subject intersection was on January 24, 2005 with a total cost of \$132,000.

## 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 January through February 2005. The before period consisted of reported crashes from October 1, 1999 through December 31, 2004 (5 years and 3 months); and the after period consisted of reported crashes from March 1, 2005 through May 31, 2010 (5 years and 3 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 traffic signal countermeasure (Target Crash 1). 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.

Also, Target Crash 2 represents the left turn lane installation with Rear-End collisions on US 64 in the westbound direction.

<u>Treatment Information</u>	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-) Percent Increase (+)</b>
Total Crashes	21	10	- 52.4 %
Total Severity Index	7.08	2.48	- 65.0 %
Target Crashes 1 – Frontal Impact	9	1	- 88.9%
Frontal Impact Crash Severity Index	11.89	1.00	- 91.6 %
Target Crashes 2 – WB Rear-End	6	3	- 50.0 %
WB Rear-End Crash Severity Index	4.70	3.47	- 26.2 %
Volume (2002, 2007)	10,700	10,400	- 2.8 %

<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	3	0	- 100.0 %
Class C Injury Crashes	4	2	- 50.0 %
Total Injury Crashes	8	2	- 75.0 %

The naive before and after analysis at the treatment location resulted in a 52 percent decrease in Total Crashes, an 89 percent decrease in Target 1 Crashes, and a 65 percent decrease in the Total Severity Index. The before period ADT year was 2002 and the after period ADT year was 2007.

## Results and Discussion

Referencing the *Collision Diagrams*, the before period presented two defined crash patterns. First, the intersection frontal impact crash pattern consisted of six (6) left turn collisions from SR 1525 attempting to access US 64. This pattern also presented the fatal collision. All of these crashes were eliminated with the signal installation. The only frontal impact crash in the after period resulted from a westbound US 64 motorist who improperly turned on the permissive green signal.

Second, the before period showed a pattern of westbound US 64 rear-end crashes expressed by Target Crash 2. There were four (4) rear-ends of vehicle waiting to turn left onto SR 1525 and another two (2) rear-ends in the stopped vehicle queue. After the left turn lane installation, the westbound US 64 approach experienced three (3) rear-end collisions at the signal. These three (3) after period collisions did occur in the through lane and not the left turn lane.

Overall, this intersection experienced significant crash improvement with the countermeasures installed. Of note, frontal impact crashes in reference to the gas station in the southwest quadrant did increase through the evaluation from one (1) to three (3) crashes.

The calculated benefit to cost ratio for this project is **6.18 considering total crashes**. The benefit to cost ratio **considering only target crashes (combined) is also 6.18**. 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 West on US 64 showing Left Turn Lane



Looking West on US 64 showing Intersection



Traveling East on US 64 (New Hendersonville Hwy)



Traveling North on SR 1525/1528 (Crab Creek Rd)

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

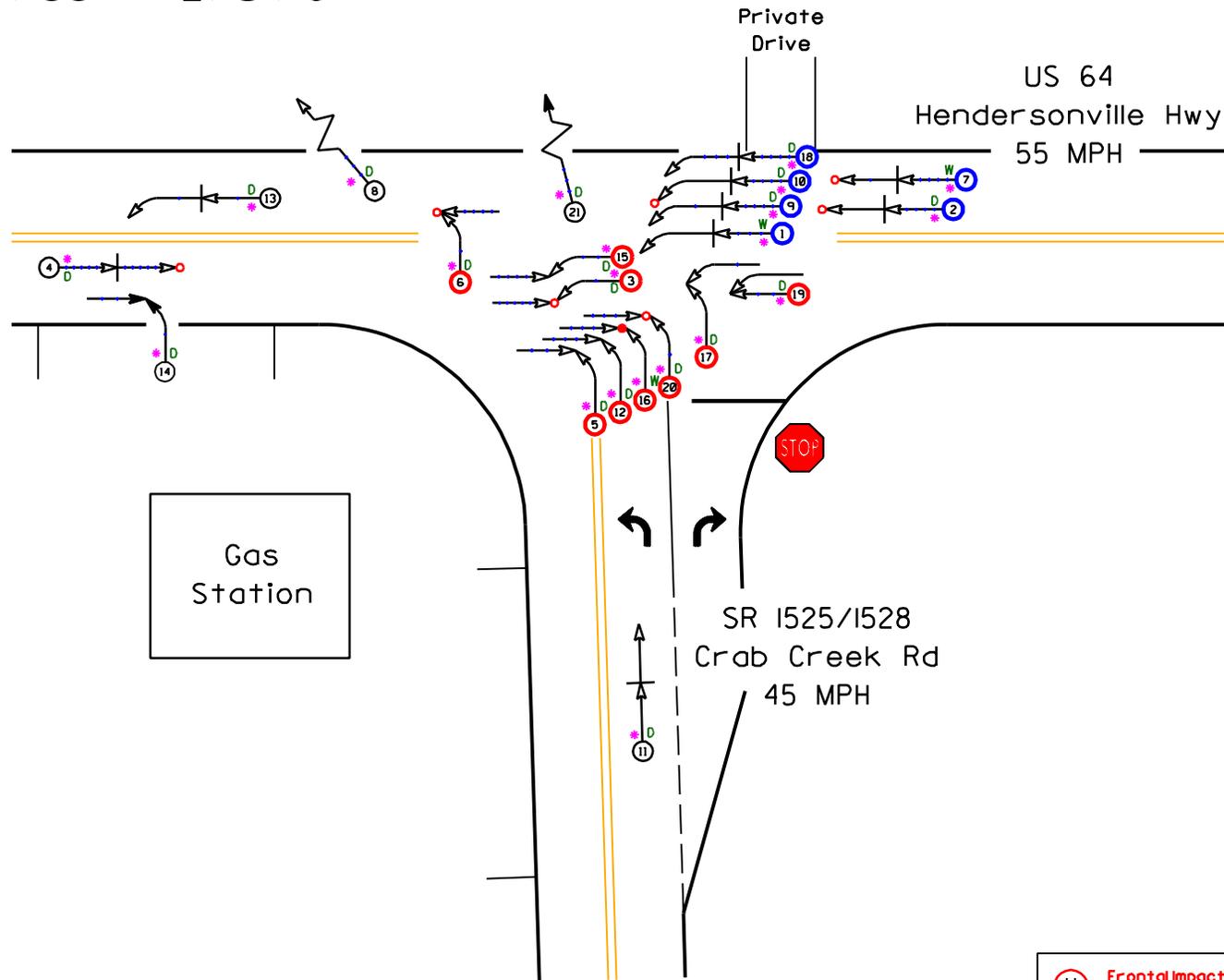
LOCATION: US 64 at SR 1525/1528		BY: JBS						
COUNTY: Transylvania		DATE: 8/18/2010						
FILE NO.: SS 14-04-200								
DETAILED COST:	TYPE IMPROVEMENT - <b>New Traffic Signal, US-64 Left Turn Lane</b>							
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$132,000	10	0.149	\$19,672			
	Right-of-Way	\$0	0	0.000	\$0			
		\$0	0	0.000	\$0			
	TOTALS	\$132,000	10	0.149	\$19,672			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$2,600			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$900			
	TOTAL ANNUAL COST=				\$23,172			
	TOTAL COST OF PROJECT=				\$132,000			
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	5.25	1	0.19	7	1.33	13	2.48	\$157,314
AFTER	5.25	0	0.00	2	0.38	8	1.52	\$14,171
						Annual Benefits from Crash Cost Savings		\$143,143
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$119,971		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	6.18		
TOTAL COST OF PROJECT		-	\$132,000	COMPREHENSIVE B/C RATIO		-	6.18	

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

LOCATION: US 64 at SR 1525/1528		BY: JBS						
COUNTY: Transylvania		DATE: 8/18/2010						
FILE NO.: SS 14-04-200								
DETAILED COST:	TYPE IMPROVEMENT - <b>New Traffic Signal, US-64 Left Turn Lane</b>							
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$132,000	10	0.149	\$19,672			
	Right-of-Way	\$0	0	0.000	\$0			
		\$0	0	0.000	\$0			
	TOTALS	\$132,000	10	0.149	\$19,672			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$2,600			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$900			
	TOTAL ANNUAL COST=				\$23,172			
	TOTAL COST OF PROJECT=				\$132,000			
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	5.25	1	0.19	6	1.14	8	1.52	\$149,410
AFTER	5.25	0	0.00	1	0.19	3	0.57	\$6,267
						Annual Benefits from Crash Cost Savings		\$143,143
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$119,971		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	6.18		
TOTAL COST OF PROJECT		-	\$132,000	COMPREHENSIVE B/C RATIO		-	6.18	

SS# 14-04-200  
 Order# 41000007074  
 Transylvania County  
 BEFORE Period  
 10/1/99 - 12/31/04

LEGEND							
	MOVING VEHICLE		ANGLE		9 MPH OR LESS		P PEDESTRIAN
	PEASTRIAN		TURNING		10 MPH TO 19		T TRAIN
	PAKED VEHICLE		BACKING		20 MPH TO 29		= DRIVER AT FAULT
	PAKED VEHICLE		SIDESWIPE		30 MPH TO 39		D DRY
	FIXED OBJECT		OUT OF CONTROL		40 MPH TO 49		W WET
	HEAD ON		HURT		50 MPH TO 59		I ICY OR SHORT
	REAR END		FATALITY		60 MPH TO 69		↑ TO AND UP
	RAN OFF ROAD		SPEED UNKNOWN		70 AND UP		O ONLY



Frontal Impact  
Target Crashes

US-64 WB Rear-End  
Target Crashes

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

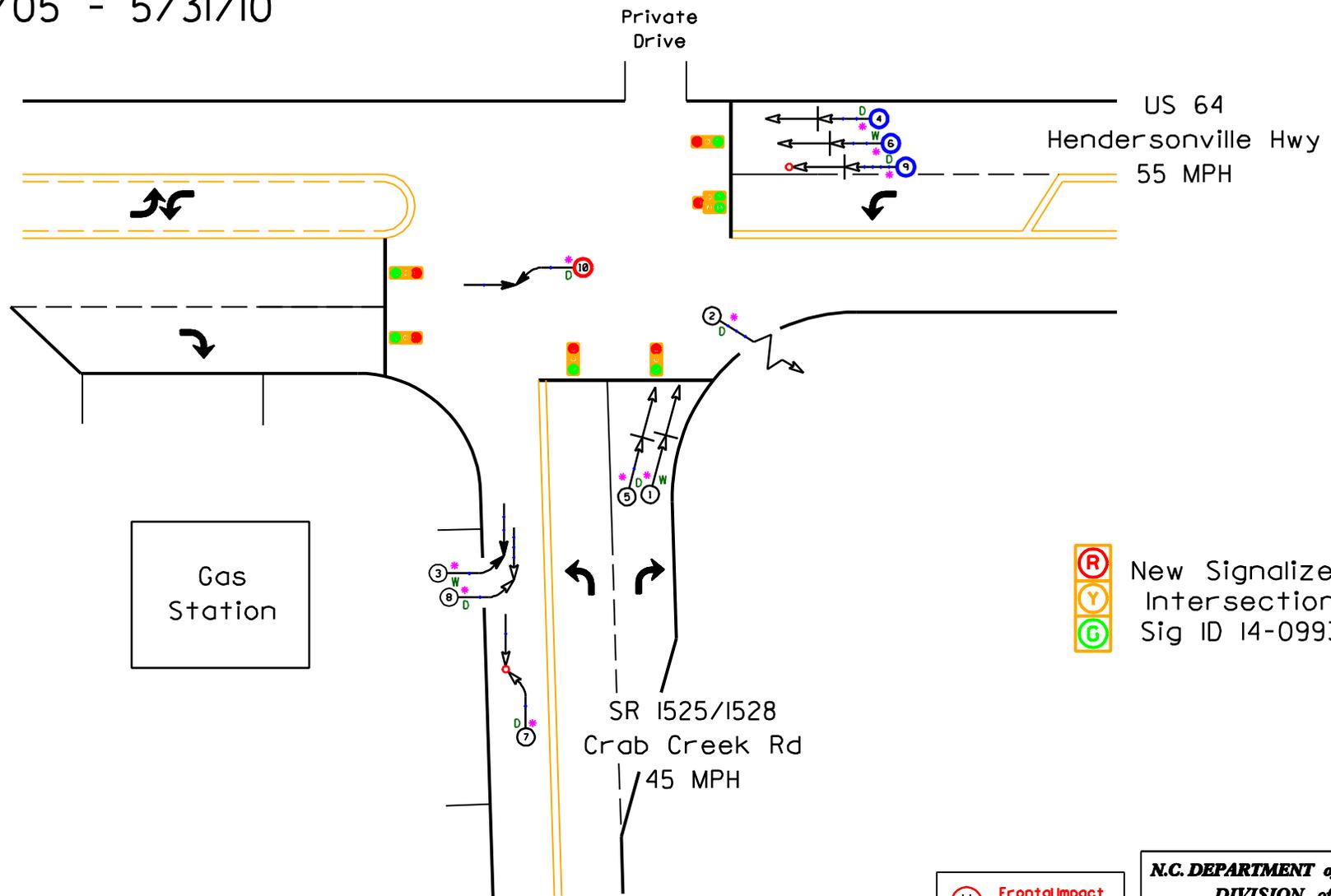
**TRAFFIC SAFETY UNIT**

Date: 8-17-2010

Prepared By: J. Schronce

SS# 14-04-200  
 Order# 41000007074  
 Transylvania County  
 AFTER Period  
 3/1/05 - 5/31/10

LEGEND			
	MOVING VEHICLE		ANGLE
	PEDESTRIAN		TURNING
	PAKED VEHICLE		BACKING
	PARKING VEHICLE		SIDESWIPE
	FIXED OBJECT		OUT OF CONTROL
	HEAD ON		INJURY
	REAR END		FATALITY
	RAN OFF ROAD		9 MPH OR LESS
			10 MPH TO 19
			20 MPH TO 29
			30 MPH TO 39
			40 MPH TO 49
			50 MPH TO 59
			60 MPH TO 69
			70 AND UP
			SPEED UNKNOWN
			P PEDESTRIAN
			T TRAIN
			* DRIVER AT FAULT
			D DRY
			W WET
			I ICE OR SNOW
			O ONLY



- Frontal Impact Target Crashes
- US-64 WB Rear-End Target Crashes

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

**TRAFFIC SAFETY UNIT**

Date: 8-17-2010      Prepared By: J. Schronce