

Spot Safety Project Evaluation

Project Log # 200906132

Spot Safety Project # 04-02-200

Spot Safety Project Evaluation of the Signal Installation US 264A (former US 264) at I-95 Southbound Ramps (Exit 121) Wilson 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

7-15-2009

Date

Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 04-02-200 located at the Intersection of US 264A (Raleigh Road and former US 264) at the I-95 Southbound Ramps (Exit 121) in Wilson County.

The Sig ID is 04-0924 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 a new traffic signal with camera detection. US 264A (formally US 264 before bypass constructed) is a four-lane divided facility with a westbound left turn lane for the I-95 Southbound On-Ramp. US 264A has a speed limit of 45 mph and was controlled by a flasher in the before period. The I-95 Southbound Off-Ramp provides an exclusive right turn slip lane separated by a concrete median and also a through-left turn lane at the intersection.

The original statement of problem was the existing pattern of frontal impact collisions at this location. The intended purpose of the new traffic signal is to alleviate the accident patterns and provide enhanced operational control. The intersection met signal warrants 1B, 2, and 3B.

The initial crash analysis was completed from November 1, 1998 to October 31, 2002 with twenty-five (25) reported crashes, fourteen (14) of which were deemed correctable. The final completion date for the improvement at the subject intersection was on July 2, 2003 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 was the months of June through July 2003. The before period consisted of reported crashes from September 1, 1997 through May 31, 2003 (5 years and 9 months); and the after period consisted of reported crashes from August 1, 2003 through April 30, 2009 (5 years and 9 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; U-turn; Angle; and Ran-off Roadway or Sideswipe as an evasive reaction to avoid an angle collision.

<u>Treatment Information</u>	Before	After	Percent Reduction (-) Percent Increase (+)
Total crashes	52	48	- 7.7 %
Total Severity Index	4.73	3.47	- 26.6 %
Target Crashes – Frontal Impact	28	32	14.3 %
Target Crash Severity Index	6.61	3.78	- 42.8 %
Volume	25,000	18,500	- 26.0 %

<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	2	5	150 %
Class C Injury Crashes	14	11	- 21.4 %
Total Injury Crashes	17	16	- 5.9 %

The naive before and after analysis at the treatment location resulted in an 8 percent decrease in Total Crashes, a 14 percent increase in Target Crashes, but a 27 percent decrease in the Total Severity Index. The before period ADT year was 2000 and the after period ADT year was 2006.

Results and Discussion

The naive before and after analysis involving the comparison of treatment actual before data versus treatment actual after data resulted in an 8 percent decrease in Total Crashes but a 14 percent increase in Target Crashes. The summary results above demonstrate that both Total Crashes and Crash Severity appear to have decreased at the treatment location from the before to the after period; but an increase in the frequency of Target Frontal Impact collisions.

Referencing the *Collision Diagrams*, the before period consisted of frontal impact crashes as vehicles exiting I-95 attempted to access US 264. The majority of these collisions (22 of 28) occurred in the westbound direction travel lane. After the signal installation the frontal impact collisions split into two main patterns; red-light run collisions in the westbound travel lane and left-turn same roadway collisions in the eastbound travel lane. The left-turn same roadway collisions increased from one (1) in the before period to eighteen (18) in the after period. This movement is currently controlled by protected-permissive signal phasing.

From the Collision Diagrams, rear-end collisions on the I-95 Off-ramp also show significant improvement from thirteen (13) before period crashes to two (2) after period collisions. This is a secondary type benefit seen from the enhanced control of signal operations.

The analysis also indicates a significant decrease in the intersection ADT by twenty-six (26) percent from the before to the after period. This is due to the opening of the US 264 bypass around the City of Wilson in late 2003 which diverted through motorists off this roadway.

The calculated benefit to cost ratio for this project is **4.94 considering total crashes**. The benefit to cost ratio **considering only target crashes is 4.51**. 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 in the three directions that vehicles approach the subject 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 South on I-95 Southbound Off-Ramp (Exit 121)



Looking East on US 264A – Turn Right to Access I-95 Southbound



Looking West on US 264A – Turn Left to Access I-95 Southbound



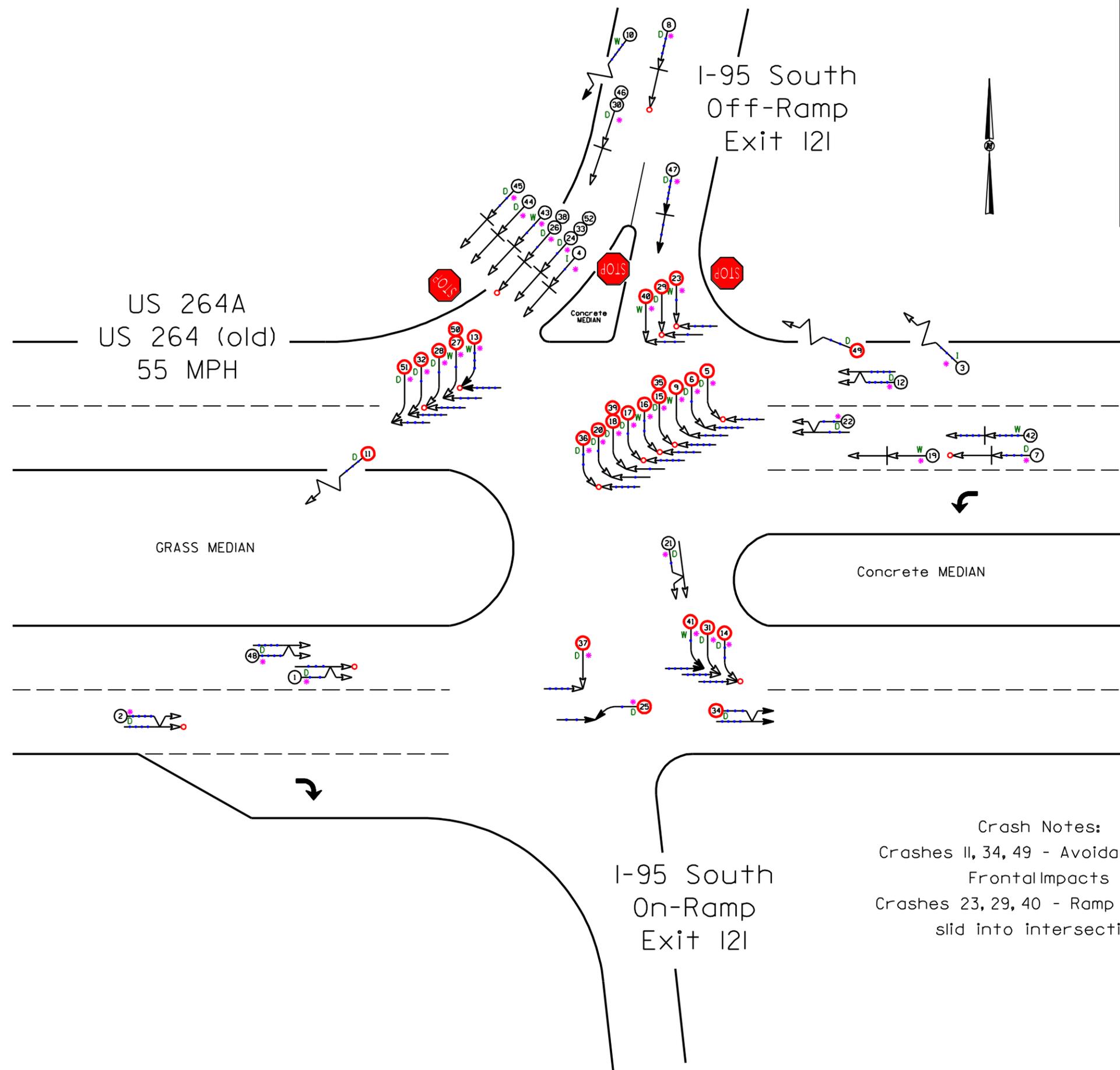
Looking West on US 264A
Protected / Permissive Phasing for Left Turning Motorists

BENEFIT-COST ANALYSIS WORKSHEET - Total Crashes

LOCATION: US-264(A) at I95 SB Ramps		BY: JBS						
COUNTY: Wilson		DATE: 7/14/2009						
FILE NO.: SS 04-02-200		NOTES: Total Crashes						
DETAILED COST:	TYPE IMPROVEMENT - New Traffic Signal							
	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	5.75	1	0.17	16	2.78	35	6.09	\$160,783
AFTER	5.75	0	0.00	16	2.78	32	5.57	\$71,791
						Annual Benefits from Crash Cost Savings		\$88,991
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$70,988		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	4.94		
TOTAL COST OF PROJECT		-	\$100,000	COMPREHENSIVE B/C RATIO		-	4.94	

BENEFIT-COST ANALYSIS WORKSHEET - Target Crashes

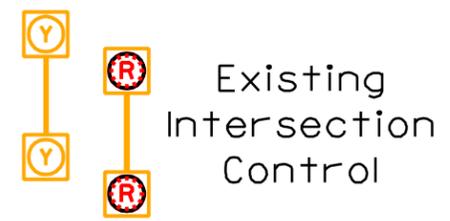
LOCATION: US-264(A) at I-95 SB Ramps		BY: JBS						
COUNTY: Wilson		DATE: 7/14/2009						
FILE NO.: SS 04-02-200		NOTES: Target Crashes - Frontal Impact & Avoidance						
DETAILED COST:	TYPE IMPROVEMENT - New Traffic Signal							
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$100,000	10	0.149	\$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	5.75	1	0.17	11	1.91	16	2.78	\$132,243
AFTER	5.75	0	0.00	12	2.09	20	3.48	\$51,130
						Annual Benefits from Crash Cost Savings		\$81,113
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$63,110		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	4.51		
TOTAL COST OF PROJECT		-	\$100,000	COMPREHENSIVE B/C RATIO		-	4.51	



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		OILY
	RAN OFF ROAD		SPEED UNKNOWN		70 AND UP		

SS# 04-02-200
 Wilson County
 City of Wilson
 BEFORE Period
 9/1/97 - 5/31/03
 I-95 Exit 121

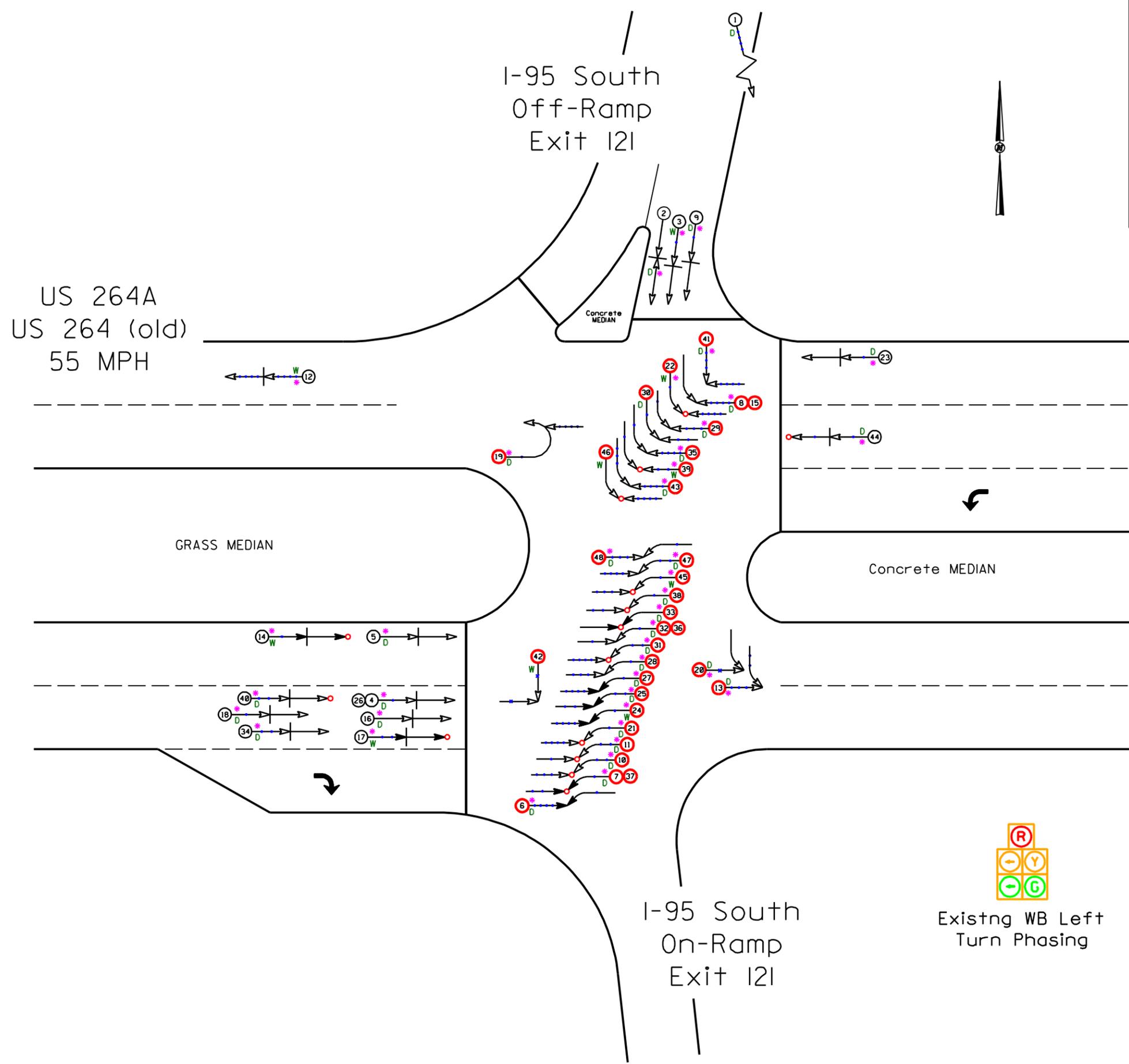


Crash Notes:
 Crashes 11, 34, 49 - Avoidance of Frontal Impacts
 Crashes 23, 29, 40 - Ramp Vehicle slid into intersection



TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT	
COLLISION DIAGRAM	
DIVISION: 4	AREA:
STUDY PERIOD: 9/1/1997 - 5/31/2003	
DISTANCE: Y-LINE = 150 FT	
ANALYSIS PREPARED BY: JBS	
ANALYSIS CHECKED BY: BR	
DIAGRAM PREPARED BY: JBS	
DIAGRAM REVIEWED BY: ST	
SCALE: NOT TO SCALE	
DATE: 7-9-2009	
LOG NUMBER: SS* 04-02-200 BEFORE	

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



LEGEND

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

SS# 04-02-200
 Wilson County
 City of Wilson
 AFTER Period
 8/1/03 - 4/30/09
 I-95 Exit 121

New Signalized Intersection
 Sig ID 04-0924

Existing WB Left Turn Phasing

Frontal Impact Target Crashes

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

	COLLISION DIAGRAM	
	DIVISION: 4	AREA:
	STUDY PERIOD: 8/1/2003 - 4/30/2009	
	DISTANCE: Y-LINE = 150FT	
ANALYSIS PREPARED BY: JBS		
ANALYSIS CHECKED BY: BR		
DIAGRAM PREPARED BY: JBS		
DIAGRAM REVIEWED BY: ST		
SCALE: NOT TO SCALE		
DATE: 7-9-2009		
LOG NUMBER: SS* 04-02-200 AFTER		

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