

# Spot Safety Project Evaluation

Order # 41000011945

Spot Safety Project # 02-05-211

**Spot Safety Project Evaluation of the Signal Revision and Median Channelization on US 70 at  
Its Intersections with SR 1124, SR 1291, and Cannon Blvd  
Carteret County**

Documents Prepared By:

Safety Evaluation Group  
Traffic Safety Systems Management Section  
Transportation Mobility and Safety Division  
North Carolina Department of Transportation

**Principal Investigator**



Brad Robinson, PE

8/2/2011

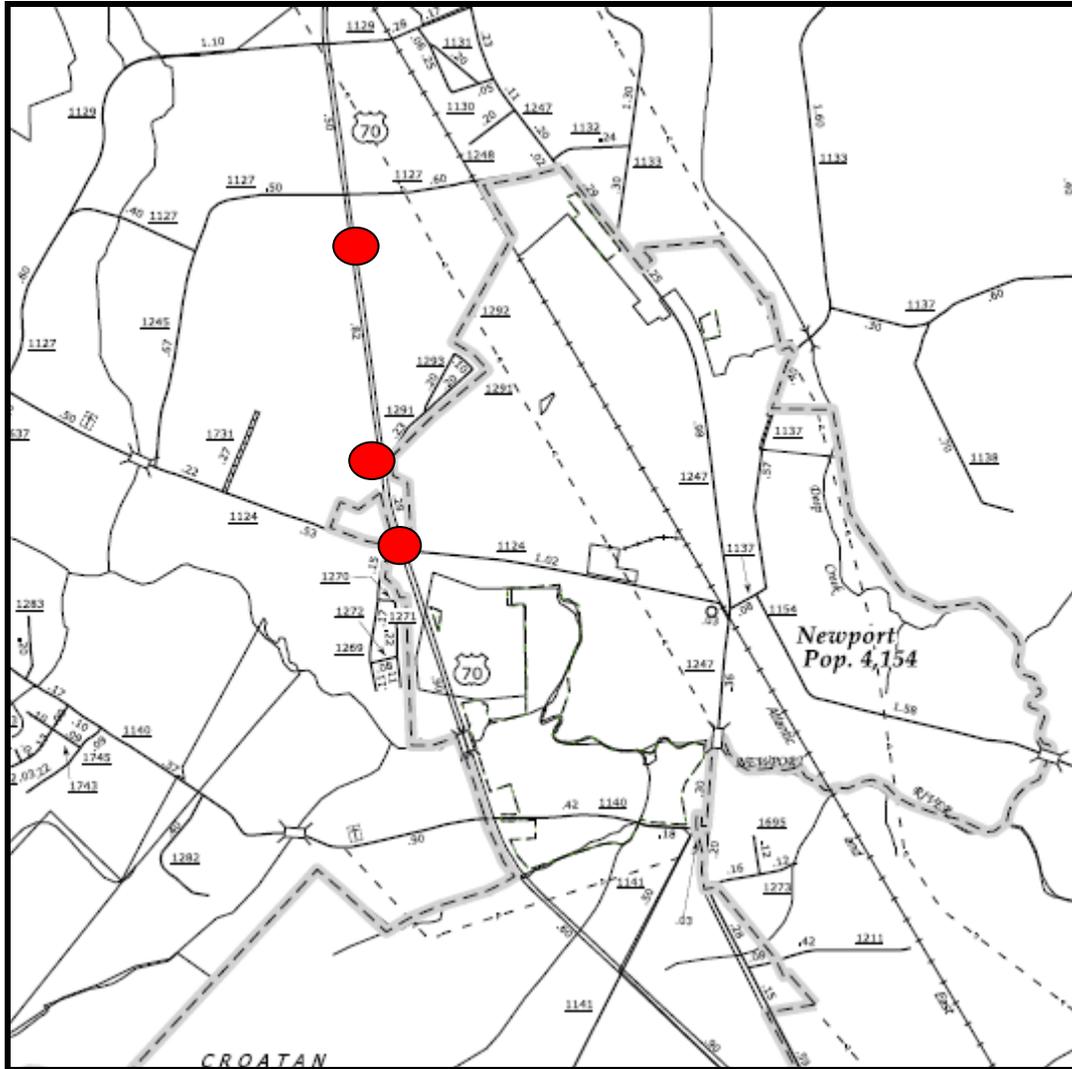
Date

Traffic Safety Project Engineer

# *Spot Safety Project Evaluation Documentation*

## **Subject Location**

Evaluation of Spot Safety Project Number 02-05-211 – US 70 at Cannon Blvd, SR 1291 (Bayberry St), and SR 1124 (Nine Foot Rd/Howard Blvd) in Carteret County.



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

The spot safety project included improvements at three adjacent intersections on US 70:

1. Construct left-overs in the existing median opening at Cannon Blvd
2. Construct left-overs in the existing median opening at SR 1291 (Bayberry St)

3. Install 'Prepare to Stop' warning sign on US 70 EB at SR 1124 (Nine Foot Rd/Howard Blvd) and revise existing traffic signal to provide protected/permitted left-turn phase for both approaches of SR 1124.

US 70 is a four-lane divided facility that has right and left turn lanes at the subject intersections. The speed limit is 55 mph.

The initial crash analysis was conducted from August 1, 2000 to July 31, 2005 with a total of 59 reported crashes. The final completion date for the improvements at the subject intersection was on November 1, 2007 with a total cost of \$208,000.00.

### 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 September 1, 2007 to November 30, 2007. The before period consisted of reported crashes from June 1, 2004 through August 31, 2007 (3 years and 3 months) and the after period consisted of reported crashes from December 1, 2007 through February 28, 2011 (3 years and 3 months). The ending date for this analysis was limited by the available crash data at the time the analysis was conducted.

The three intersections were analyzed separately. The treatment data consisted of all crashes within 150 feet of each intersection.

The following data table depicts the Naive Before and After Analysis for the intersection of US 70 and Cannon Blvd. Target Crashes were Frontal Impact Crashes that involved vehicles turning left from Cannon Blvd.

<b>Treatment Information 1 (at Cannon)</b>			
	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-) Percent Increase (+)</b>
Total Crashes	1	1	0.0
Total Severity Index	8.4	1	-88.1
Target Crashes	1	0	-100.0
Target Crash Severity Index	8.4	0	-100.0
Volume	23,500	20,500	-12.8
<b>Target Crash Severity Summary</b>			
Fatal Crashes	0	0	N/A
Class A Crashes	0	0	N/A
Class B Crashes	0	0	N/A
Class C Crashes	1	0	-100.0
PDO Crashes	0	0	N/A

The following data table depicts the Naive Before and After Analysis for the intersection of US 70 and SR 1291 (Bayberry). Target Crashes were all Frontal Impact Crashes with the exception of left turn-same roadway crashes involving vehicles on US 70.

<b>Treatment Information 2 (at SR 1291)</b>			
	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-) Percent Increase (+)</b>
Total Crashes	14	2	-85.7
Total Severity Index	4.7	1	-78.7
<b>Target Crashes</b>			
Target Crashes	12	1	-91.7
Target Crash Severity Index	4.7	1	-78.7
<b>Volume</b>			
Volume	23,500	20,500	-12.8
<b>Target Crash Severity Summary</b>			
Fatal Crashes	0	0	N/A
Class A Crashes	0	0	N/A
Class B Crashes	2	0	-100.0
Class C Crashes	4	0	-100.0
PDO Crashes	6	1	-83.3

The following data table depicts the Naive Before and After Analysis for the intersection of US 70 and SR 1124 (Nine Foot/Howard). There were two types of Target Crashes chosen for the countermeasures. The target crashes for the signal revision were left turn-same roadway crashes on SR 1124. The target crashes for the 'Prepare to Stop' warning sign included both frontal impact crashes involving eastbound US 70 vehicles running the signal and eastbound US 70 rear-end crashes involving vehicles approaching the intersection.

<b>Treatment Information 3 (at SR 1124)</b>			
	<b>Before</b>	<b>After</b>	<b>Percent Reduction (-) Percent Increase (+)</b>
Total Crashes	35	31	-11.4
Total Severity Index	9.61	5.83	-39.3
<b>Target Crashes 1 (Signal Revision)</b>			
Target Crashes 1 (Signal Revision)	2	1	-50.0
Target Crash 1 Severity Index	1	1	0.0
<b>Target Crashes 2 ('Prepare to Stop')</b>			
Target Crashes 2 ('Prepare to Stop')	13	8	-38.5
Target Crash 2 Severity Index	9.68	1.92	-80.2
<b>Volume</b>			
Volume	28,400	25,400	-10.6
<b>Target Crash Severity Summary</b>			
Fatal Crashes	1	0	-100.0
Class A Crashes	0	0	N/A
Class B Crashes	0	1	N/A
Class C Crashes	5	0	-100.0
PDO Crashes	9	8	14.3

The naive before and after analysis at the treatment location resulted in no change in total crashes at the Cannon Blvd intersection, an 86 percent decrease in crashes at the SR 1291 intersection, and an 11 percent decrease in crashes at the SR 1124 intersection. Target crashes experienced a 100 percent decrease at Cannon Blvd, a 92 percent decrease at SR 1291, and a 40 percent decrease at SR 1124.

## **Results and Discussion**

The median channelization appears to have been effective at reducing crashes at the two crossovers they were constructed at. At Cannon Blvd target crashes were reduced from one in the before period to none in the after. At SR 1291 target crashes were reduced from 12 in the before period to one in the after. The single after period target crash involved a driver not realizing that the movement was restricted while attempting to cross over US 70 from the PVA entrance. He was hit by an eastbound US 70 vehicle.

At the SR 1124 intersection total target crashes decreased from 15 in the before period to nine in the after. The left turn-same roadway target crashes associated with the signal revision decreased from two in the before period to one in the after.

Target Crashes associated with the eastbound warning sign decreased from 13 in the before period (5 rear ends and 8 involving signal running) to eight in the after period (7 rear ends and 1 involving signal running). One of the before period target crashes resulted in a fatality. It involved a westbound US 70 vehicle turning left and being hit by an eastbound vehicle that failed to stop for a red signal.

There was a second, non-target, fatal crash at the SR 1124 intersection in the before period. It involved an eastbound US 70 vehicle hitting a dark-clothed pedestrian at night.

The next intersection to the northwest of the subject intersections also had a spot safety project involving median channelization constructed at it at approximately the same time as this project. Please see the evaluation for Spot Safety Project #02-05-210.

The calculated benefit to cost ratio for this project is 13.12 considering total crashes. The benefit to cost ratio considering only target crashes is 7.95. 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*. 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 roadway.

**BENEFIT-COST ANALYSIS WORKSHEET - TOTAL**

LOCATION: US 70 at SR 1124, SR 1291, Cannon		BY: bdr						
COUNTY: Carteret		DATE: 7/27/2011						
FILE NO.: SS 02-05-211								
DETAILED COST:	TYPE IMPROVEMENT - Signal Revision, left-overs							
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$0	0	0.000	\$0			
		\$208,000	10	0.149	\$30,998			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$208,000	10	0.149	\$30,998			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$2,000			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$900			
	TOTAL ANNUAL COST=				\$33,898			
	TOTAL COST OF PROJECT=				\$208,000			
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	3.25	3	0.92	18	5.54	29	8.92	\$730,677
AFTER	3.25	1	0.31	10	3.08	23	7.08	\$285,815
							Annual Benefits from Crash Cost Savings	\$444,862
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$410,963		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	13.12		
TOTAL COST OF PROJECT		-	\$208,000	COMPREHENSIVE B/C RATIO		-	13.12	

**BENEFIT-COST ANALYSIS WORKSHEET - TARGET**

LOCATION: US 70 at SR 1124, SR 1291, Cannon		BY: bdr						
COUNTY: Carteret		DATE: 7/27/2011						
FILE NO.: SS 02-05-211								
DETAILED COST:	TYPE IMPROVEMENT - Signal Revision, left-overs							
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$0	0	0.000	\$0			
		\$208,000	10	0.149	\$30,998			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$208,000	10	0.149	\$30,998			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$2,000			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$900			
	TOTAL ANNUAL COST=				\$33,898			
	TOTAL COST OF PROJECT=				\$208,000			
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	3.25	1	0.31	12	3.69	15	4.62	\$287,538
AFTER	3.25	0	0.00	1	0.31	9	2.77	\$18,062
							Annual Benefits from Crash Cost Savings	\$269,477
NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST					=	\$235,579		
BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST					=	7.95		
TOTAL COST OF PROJECT		-	\$208,000	COMPREHENSIVE B/C RATIO		-	7.95	

**Treatment Site Photos Taken July 15, 2011**



**Looking northwest on US 70, approaching SR 1124**



**Looking southeast on US 70, approaching SR 1124 ('Prepare to Stop' sign pictured)**



Looking east from SR 1124 toward US 70



Looking west from SR 1124 toward US 70



**Looking northwest on US 70, approaching crossover at SR 1291 (Bayberry)**

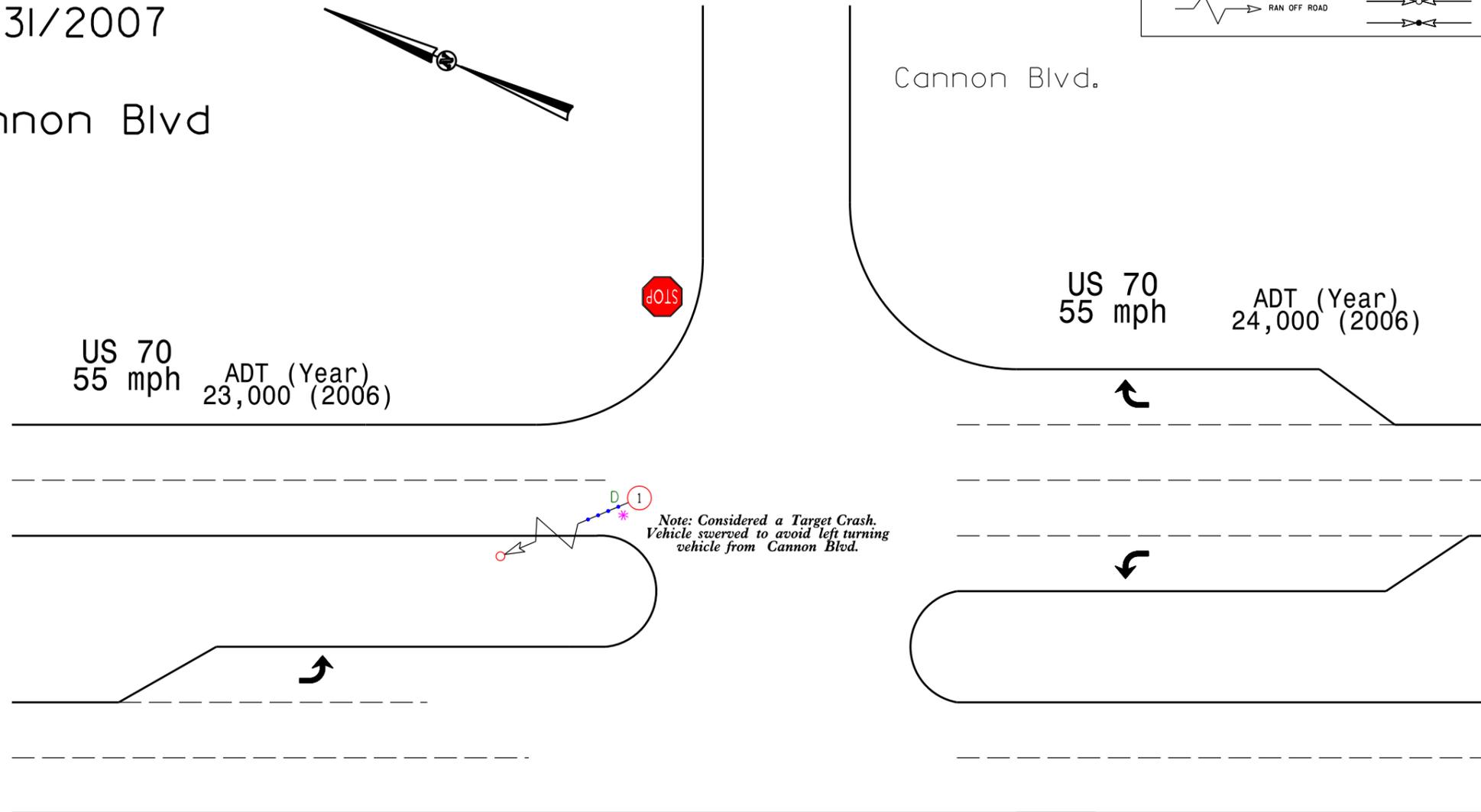


**Looking northwest on US 70, approaching crossover at Canon St.**

SS# 02-05-211  
 Order# 41000011945  
 Carteret County  
 BEFORE Period  
 6/1/2004-8/31/2007

US 70 at Cannon Blvd

MOVING VEHICLE		ANGLE		SPEED		OTHER	
	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		



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**DIVISION of HIGHWAYS**  
**TRANSPORTATION MOBILITY and**  
**SAFETY DIVISION**

**TRAFFIC SAFETY UNIT**

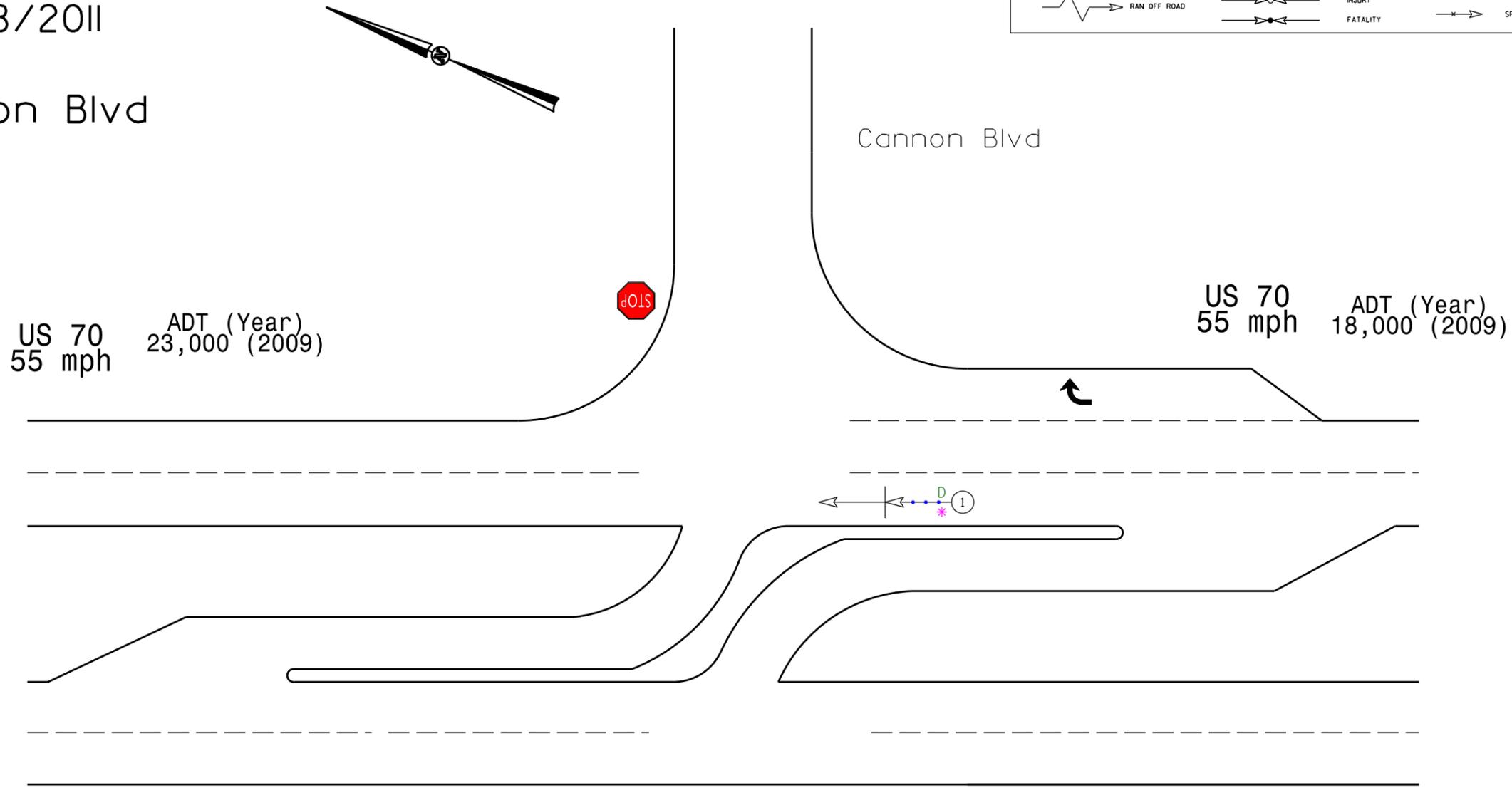
Date: July 2011      Prepared By: bdr

SS# 02-05-211  
 Order# 41000011945  
 Carteret County  
 AFTER Period  
 12/1/2007-2/28/2011

**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		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		70 AND UP
	RAN OFF ROAD				SPEED UNKNOWN		O OILY

US 70 at Cannon Blvd



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 BEFORE Period  
 6/1/2004-8/31/2007

US 70 at SR 1291

US 70  
 55 mph ADT (Year)  
 23,000 (2006)

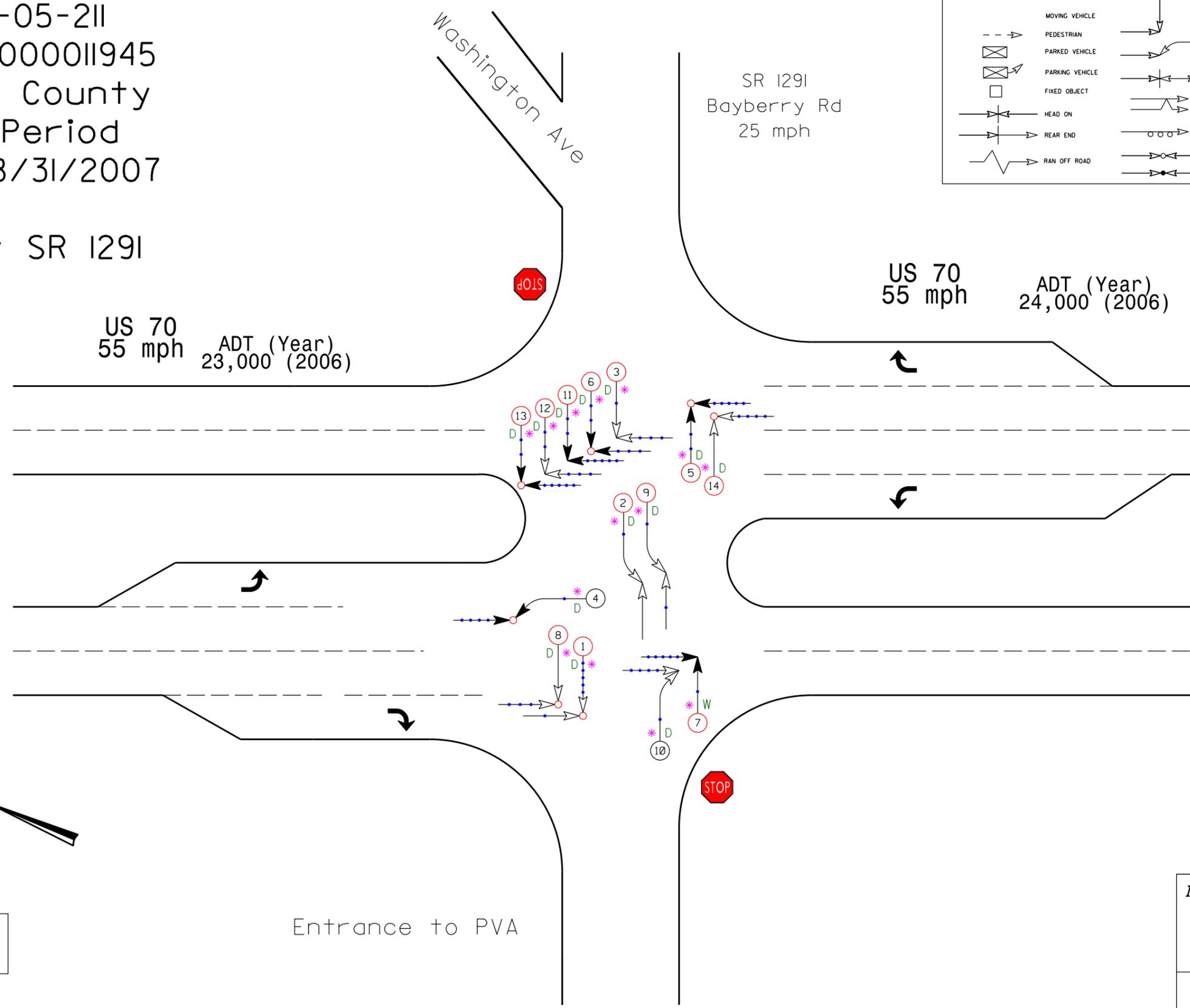
SR 1291  
 Bayberry Rd  
 25 mph

US 70  
 55 mph ADT (Year)  
 24,000 (2006)

Washington Ave

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		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		



Target Crashes

Entrance to PVA

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 AFTER Period  
 12/1/2007-2/28/2011

US 70 at SR 1291

US 70  
 55 mph  
 ADT (Year)  
 23,000 (2009)

SR 1291  
 Bayberry Rd  
 25 mph  
 US 70  
 55 mph  
 ADT (Year)  
 18,000 (2009)

		LEGEND	
	MOVING VEHICLE		ANGLE
	PEDESTRIAN		TURNING
	PARKED 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 ICY OR SNOWY
			O OILY

Washington Ave



D  
 \*

Note: Driver said he did not realize that he could not drive through crossover

D  
 \*



Entrance to PVA



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 Carteret County  
 BEFORE Period  
 6/1/2004-8/31/2007

US 70 at SR 1124

ADT (Year) US 70  
 23,000 (2006) 55 mph

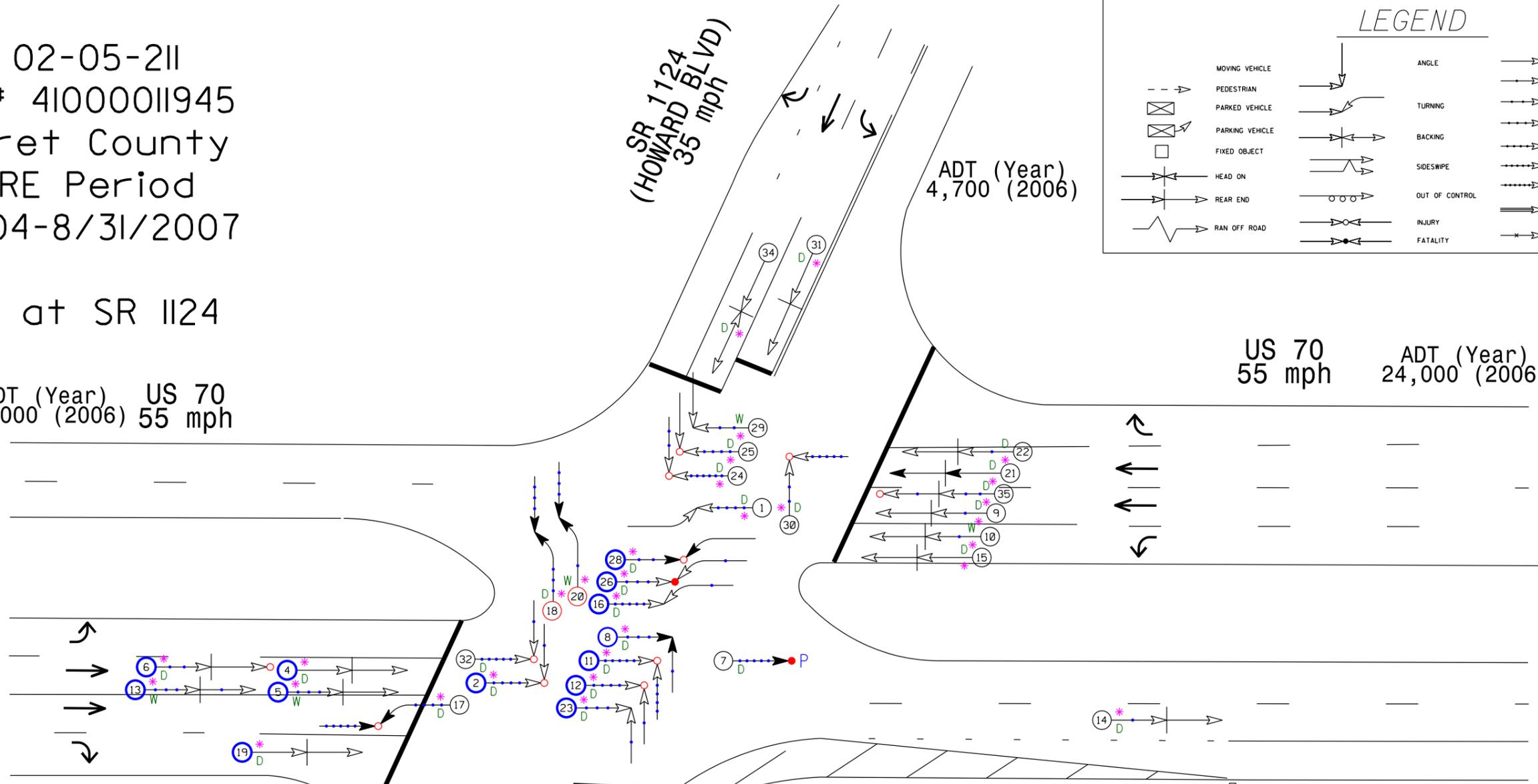
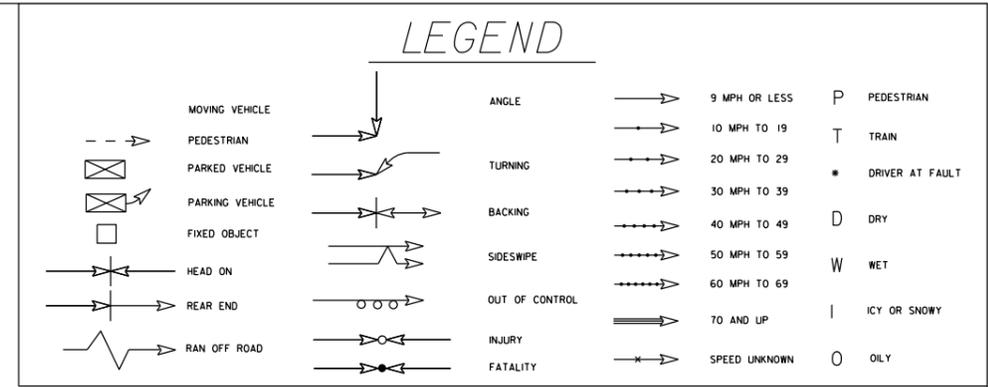
SR 1124  
 (HOWARD BLVD)  
 35 mph

ADT (Year)  
 4,700 (2006)

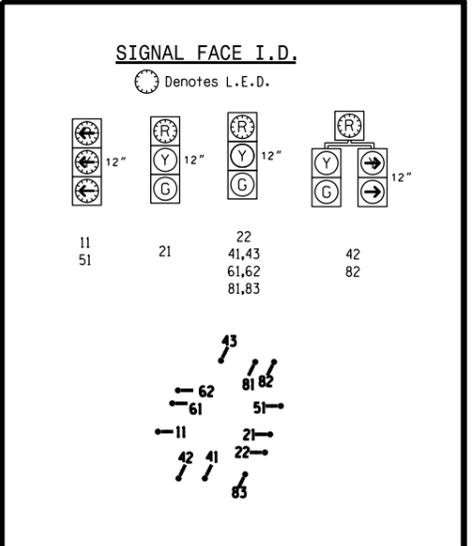
US 70  
 55 mph ADT (Year)  
 24,000 (2006)

SR 1124  
 (NINE FOOT ROAD)  
 45 mph

ADT (Year)  
 5,000 (2006)



Target Crashes (Signal Revision)  
 Target Crashes (EB US 70 Warning Sign)



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SS# 02-05-211  
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 Carteret County  
 AFTER Period  
 12/1/2007-2/28/2011

US 70 at SR 1124

US 70  
 55 mph  
 ADT (Year)  
 23,000 (2009)

SR 1124  
 (HOWARD BLVD)  
 35 mph

ADT (Year)  
 5,200 (2009)

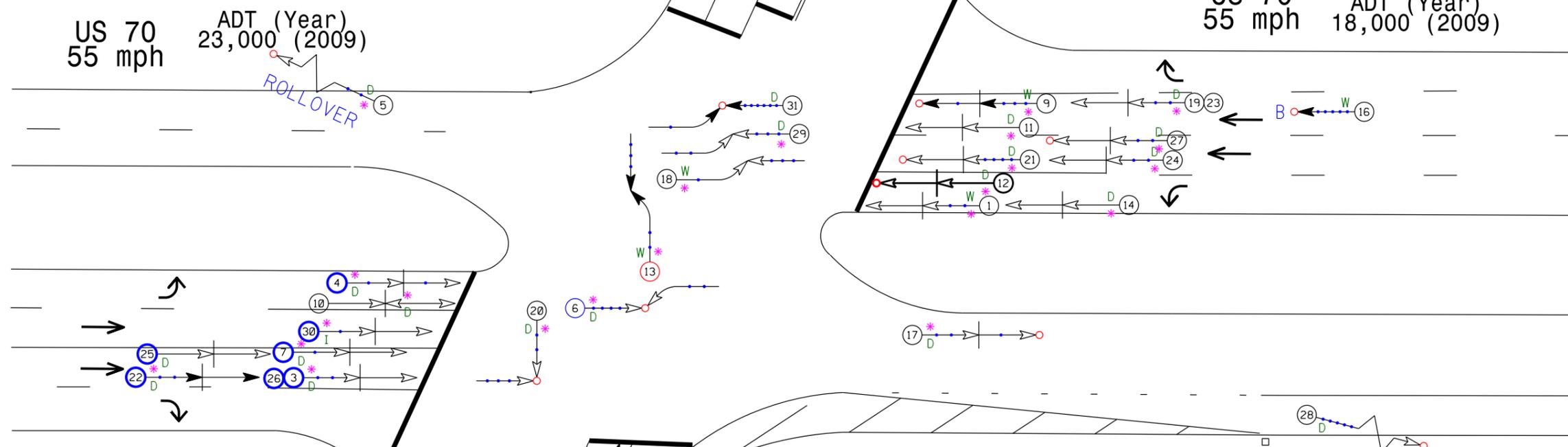
US 70  
 55 mph  
 ADT (Year)  
 18,000 (2009)

SR 1124  
 (NINE FOOT ROAD)  
 45 mph

ADT (Year)  
 4,500 (2009)

**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		70 AND UP		ONLY
	RAN OFF ROAD				SPEED UNKNOWN		



PREPARE  
 TO STOP

**SIGNAL FACE I.D.**  
 Denotes L.E.D.

41	11	21	22
81	51	43	42
		61	62
		83	82

43  
 62  
 81 82  
 61 51  
 11 21  
 42 22  
 85

Target Crashes (Signal Revision)

Target Crashes (EB US 70 Warning Sign)

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