

Spot Safety Project Evaluation

Order # 41000012186

Spot Safety Project # 02-05-212

**Spot Safety Project Evaluation of the Construction of a Directional Crossover, the Closing of a Crossover, and the Revision of Two Traffic Signals on US 70 in the Vicinity of SR 1140 and SR 1141
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



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8/2/2011

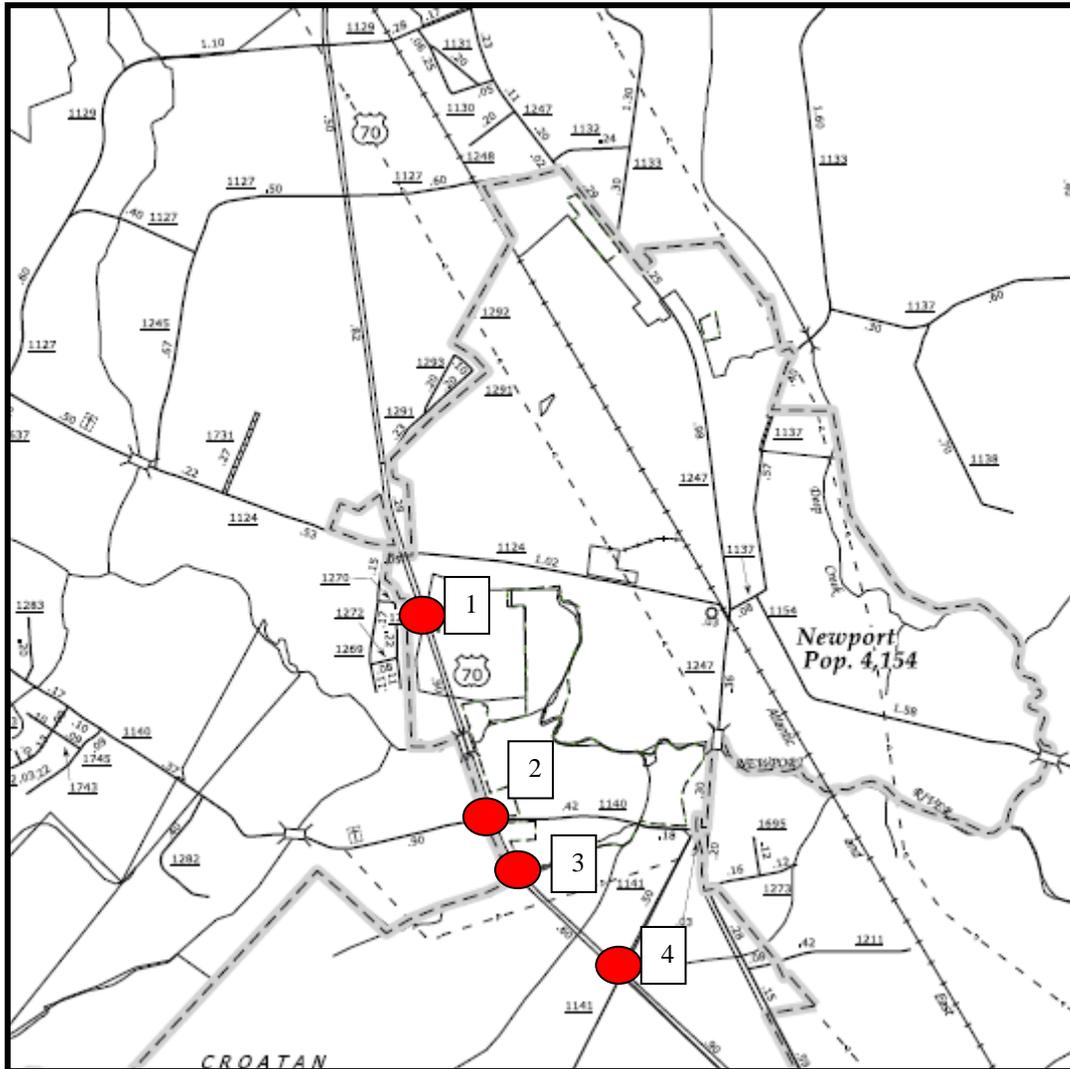
Date

Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 02-05-212 – US 70 in the vicinity of SR 1140 and SR 1141.



1. US 70 at the Newport River Shoppes
2. US 70 at SR 1140 (Roberts Rd)
3. US 70 at Median Cross-over
4. US 70 at SR 1141 (Hibbs Rd)

Project Information and Background from the Project File Folder

Spot safety project improvement countermeasures were constructed at four locations:

1. Construct mainline left-overs on US 70 at the Newport River Shoppes crossover
2. Re-time existing signal timing at SR 1140 (Roberts)
3. Close crossover located between SR 1140 and SR 1141
4. Revise traffic signal at SR 1141 to provide fully protected left turns on both approaches of US 70 and install a “Prepare to Stop” warning sign on westbound US 70

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

The original statement of problem was that due to traffic volumes and turning movements at the subject locations, coupled with existing traffic signal phasing and timing at SR 1140 and SR 1141, there were numerous points of conflict for motorists.

The initial crash analysis was conducted from August 1, 2000 to July 31, 2005 with a total of 69 crashes at the four locations (68 at the signals and 1 at the crossovers). The final completion date for the improvements at the subject location was on November 1, 2007 with a total cost of \$116,750.00.

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 following data tables depict the Naive Before and After Analysis for the treatment locations. Each location was analyzed separately. The treatment data consisted of all reported crashes within 150 feet of each of the subject locations. There is no data table or collision diagram for the crossover located between SR 1140 and SR 1141 that was closed. No crashes were found to have occurred at this location in the before period and with the crossover closed in the after period it was difficult to determine if crashes occurred within 150’ of its former location.

Treatment Information TOTAL	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	40	42	5.0
Total Severity Index	7.75	4.52	-41.7
Target Crashes	16	4	-75.0
Target Crash Severity Index	13.25	4.7	-64.5

The following data table depicts the Naive Before and After Analysis for the crossover at US 70 and the Newport River Shoppes driveway. Target crashes for the leftovers were frontal impact crashes that involved vehicles turning left from the driveway.

Treatment Information 1 (@ Shoppes PVA)			
	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	1	2	100.0
Total Severity Index	1	1	0.0
Target Crashes	0	0	N/A
Target Crash Severity Index	0	0	N/A
Volume	23,500	20,500	-12.8
Target Crash Severity Summary			
Fatal Crashes	0	0	N/A
Class A Crashes	0	0	N/A
Class B Crashes	0	0	N/A
Class C Crashes	0	0	N/A
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 1140 (Roberts). There were no target crashes chosen for the signal re-timing.

Treatment Information 2 (@ SR 1140)			
	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	15	17	13.3
Total Severity Index	3.96	5.35	35.1
Volume	26,200	23,300	-11.1
Total Crash Severity Summary			
Fatal Crashes	0	0	N/A
Class A Crashes	0	0	N/A
Class B Crashes	2	2	0.0
Class C Crashes	4	8	100.0
PDO Crashes	9	7	-22.2

The following data table depicts the Naive Before and After Analysis for the intersection at US 70 and SR 1141 (Hibbs). 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 US 70. The target crashes for the 'Prepare to Stop' warning sign included both frontal impact crashes involving westbound US 70 vehicles running the signal and westbound US 70 rear-end crashes involving vehicles approaching the intersection.

Treatment Information 4 (@ SR 1141)			
	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	24	23	-4.2
Total Severity Index	10.40	4.22	-59.4
Target Crashes 1 (Signal Revision)	11	0	-100.0
Target Crash 1 Severity Index	18.15	0	-100.0
Target Crashes 2 ('Prepare to Stop')	5	4	-20.0
Target Crash 2 Severity Index	2.48	4.7	89.5
Volume	28,000	25,200	-10.0
Target Crash Severity Summary			
Fatal Crashes	1	0	-100.0
Class A Crashes	1	0	-100.0
Class B Crashes	2	0	-100.0
Class C Crashes	4	2	-50.0
PDO Crashes	8	2	-75.0

Results and Discussion

Total crashes at the treatment locations increased by 5 percent while target crashes decreased by 75 percent. The total severity index decreased by 42 percent and the target severity index decreased by 65 percent.

There were no target crashes at the crossover located at the Newport River Shoppes in either the before or the after period. There were no reported crashes at the former crossover between SR 1140 and SR 1141 in either time period.

Total crashes increased by two from the before to the after period at SR 1140. Target crashes were not chosen for the signal re-timing at SR 1140. However, it appears that the left turn phasing for vehicles on US 70 was changed from protected-permitted to protected only around the time of this project. There was one left turn-same roadway on US 70 in both the before and the after period at this intersection.

Total crashes only decreased by one from the before to the after period at SR 1141. However, the severity index decreased by 60 percent and target crashes decreased from 16 in the before period to four in the after.

At SR 1140 in the before period there was a total of 11 left turn-same roadway crashes involving US 70 vehicles turning left. Nine involved westbound left turns and two involved eastbound left turns. The left turning driver was faulted in every crash for failing to yield during the permitted phase. One of the westbound left turn crashes resulted in a fatality and a second resulted in an 'A' injury crash. This target crash pattern was reduced to zero in the after period.

The 'Prepare to Stop' sign on the westbound US 70 was installed to prevent vehicles from running the red signal. In the before period there was one frontal impact crash where a westbound US 70 vehicle was faulted for running the signal. There were also four rear-end crashes on the westbound approach. In the after period there were no frontal impact crashes involving westbound vehicles running the signal and four rear-end target crashes.

The calculated benefit to cost ratio for this project is 27.34 considering total crashes. The benefit to cost ratio considering only target crashes is 22.30. 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.

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 1140, 1141, River Shoppes PVA		BY: bdr						
COUNTY: Carteret		DATE: 7/29/2011						
FILE NO.: SS 02-05-212								
DETAILED COST:	TYPE IMPROVEMENT - Signal Revision, left-overs							
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$0	0	0.000	\$0			
		\$116,750	10	0.149	\$17,399			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$116,750	10	0.149	\$17,399			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$800			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$650			
	TOTAL ANNUAL COST=				\$18,849			
	TOTAL COST OF PROJECT=				\$116,750			
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	2	0.62	16	4.92	22	6.77	\$515,262
AFTER	3.25	0	0.00	0	0.00	0	0.00	\$0
							Annual Benefits from Crash Cost Savings	\$515,262
	NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST							\$496,412
	BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST							27.34
	TOTAL COST OF PROJECT -	\$116,750		COMPREHENSIVE B/C RATIO -				27.34

BENEFIT-COST ANALYSIS WORKSHEET - TARGET

LOCATION: US 70 at SR 1140, 1141, River Shoppes PVA		BY: bdr						
COUNTY: Carteret		DATE: 7/29/2011						
FILE NO.: SS 02-05-212								
DETAILED COST:	TYPE IMPROVEMENT - Signal Revision, left-overs							
	ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST			
	Construction	\$0	0	0.000	\$0			
		\$116,750	10	0.149	\$17,399			
	Right-of-Way	\$0	0	0.000	\$0			
	TOTALS	\$116,750	10	0.149	\$17,399			
	ESTIMATED INCREASE IN ANNUAL MAINT. COST =				\$800			
	ESTIMATED INCREASE IN ANNUAL UTILITY COST =				\$650			
	TOTAL ANNUAL COST=				\$18,849			
	TOTAL COST OF PROJECT=				\$116,750			
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	2	0.62	6	1.85	8	2.46	\$435,200
AFTER	3.25	0	0.00	2	0.62	2	0.62	\$14,954
							Annual Benefits from Crash Cost Savings	\$420,246
	NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST							\$401,397
	BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST							22.30
	TOTAL COST OF PROJECT -	\$116,750		COMPREHENSIVE B/C RATIO -				22.30

Treatment Site Photos Taken June 15, 2011



Looking west on US 70, approaching SR 1141 (Hibbs). 'Prepare to Stop' sign pictured



Looking west on US 70, approaching SR 1141 (Hibbs).



Looking north on SR 1141 (Hibbs)



Looking south on SR 1141 (Hibbs)



Looking west on US 70, approaching SR 1140 (Roberts)



Looking west on US 70, approaching crossover at Newport Rivers Shoppes



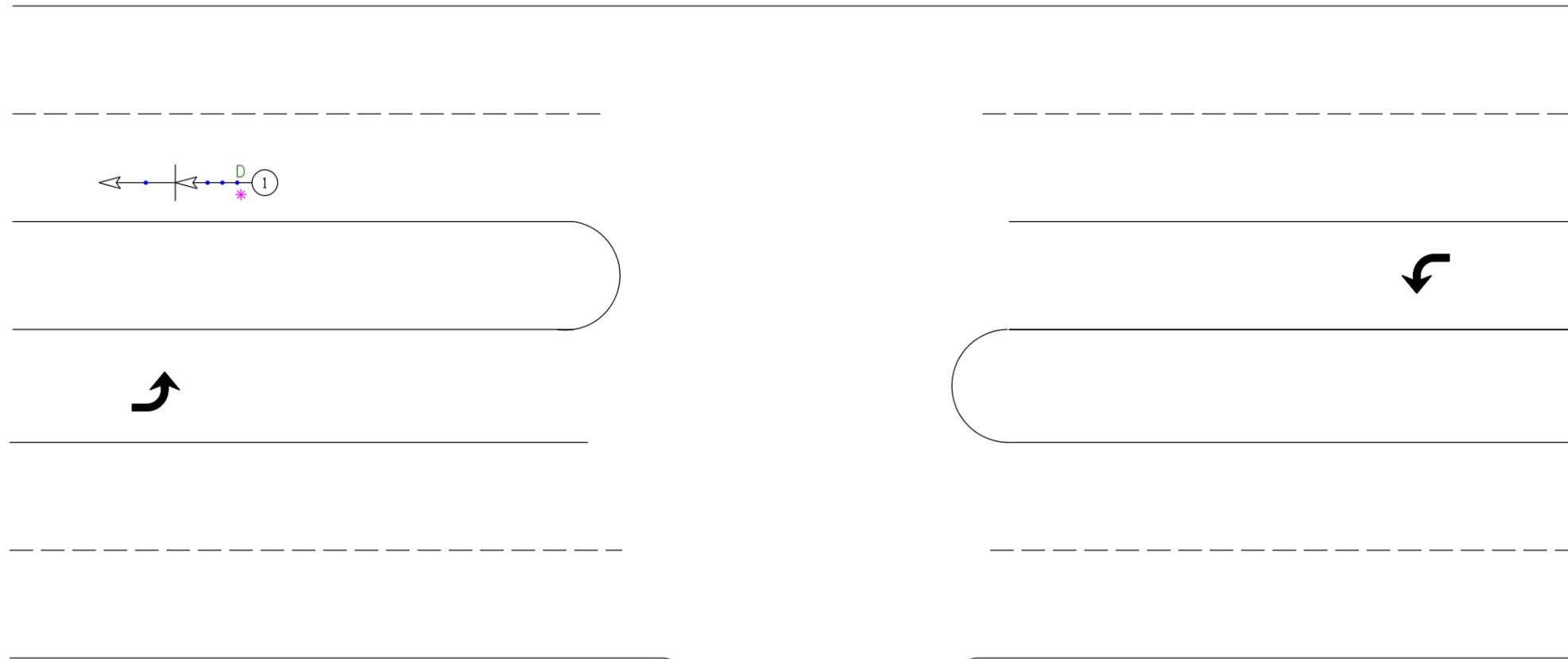
Looking west on US 70 at approximate location of former crossover

Carteret County
 US 70 (Arendell) at
 Newport River Shoppes PVA
 BEFORE Period
 6/1/2004-8/31/2007

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		SPEED UNKNOWN
	RAN OFF ROAD				70 AND UP		ONLY

US 70
 55 mph



Target Crash

Newport River Shoppes PVA

US 70
 55 mph

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

TRAFFIC SAFETY UNIT

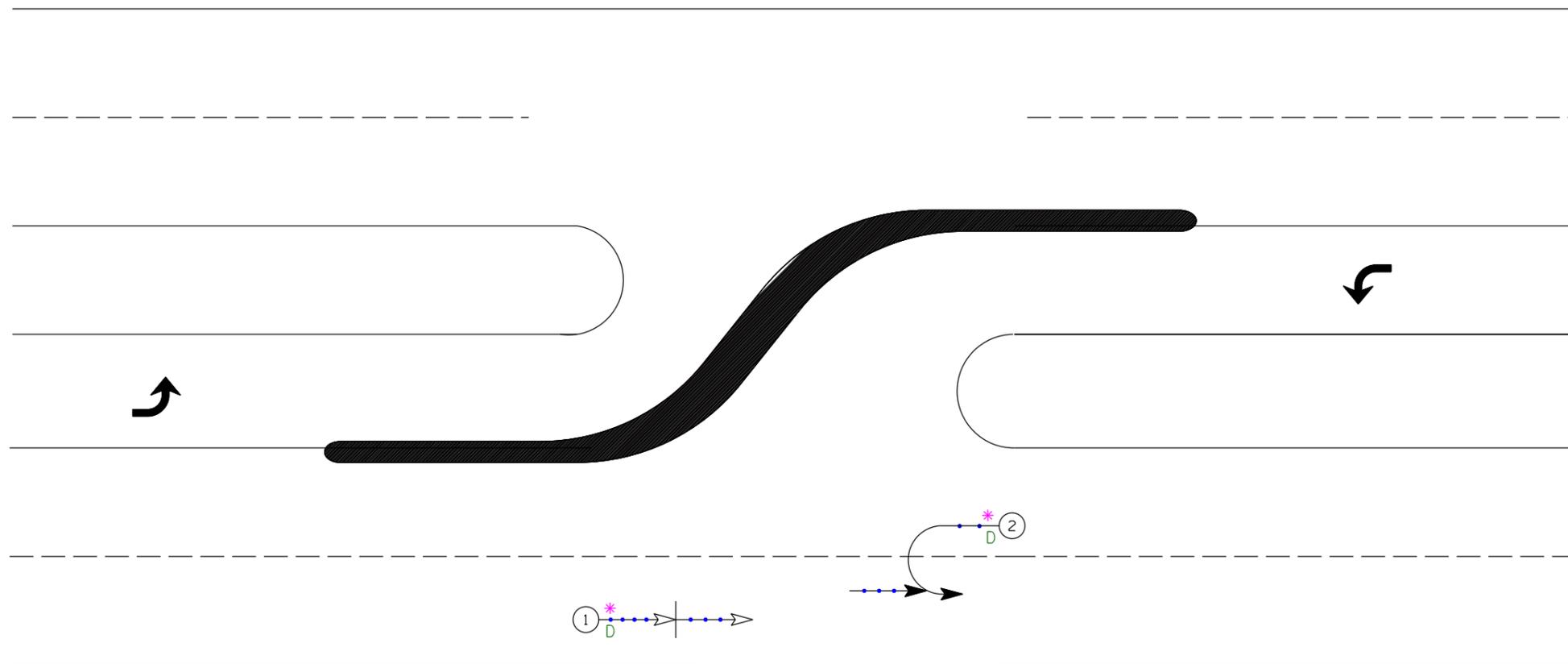
Date: July 2011

Prepared By: BDR

Carteret County
 US 70 (Arendell) at
 Newport River Shoppes PVA
 AFTER Period
 12/1/2007-2/28/2011

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

US 70
 55 mph



Target Crash

US 70
 55 mph

Newport River Shoppes PVA

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

TRAFFIC SAFETY UNIT

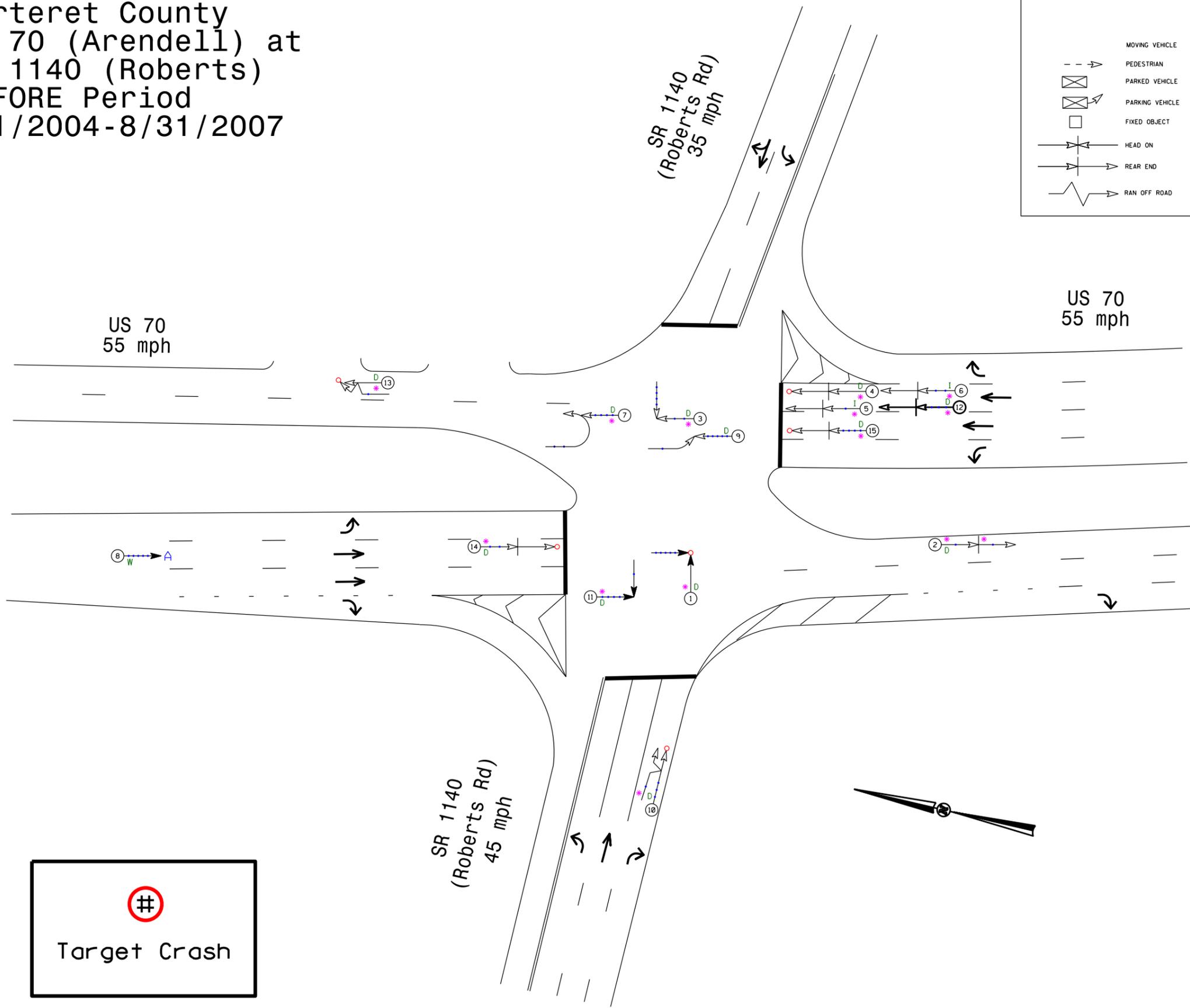
Date: July 2011

Prepared By: BDR

Carteret County
 US 70 (Arendell) at
 SR 1140 (Roberts)
 BEFORE Period
 6/1/2004-8/31/2007

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		SPEED UNKNOWN		70 AND UP		



SIGNAL FACE I.D.

Denotes L.E.D.

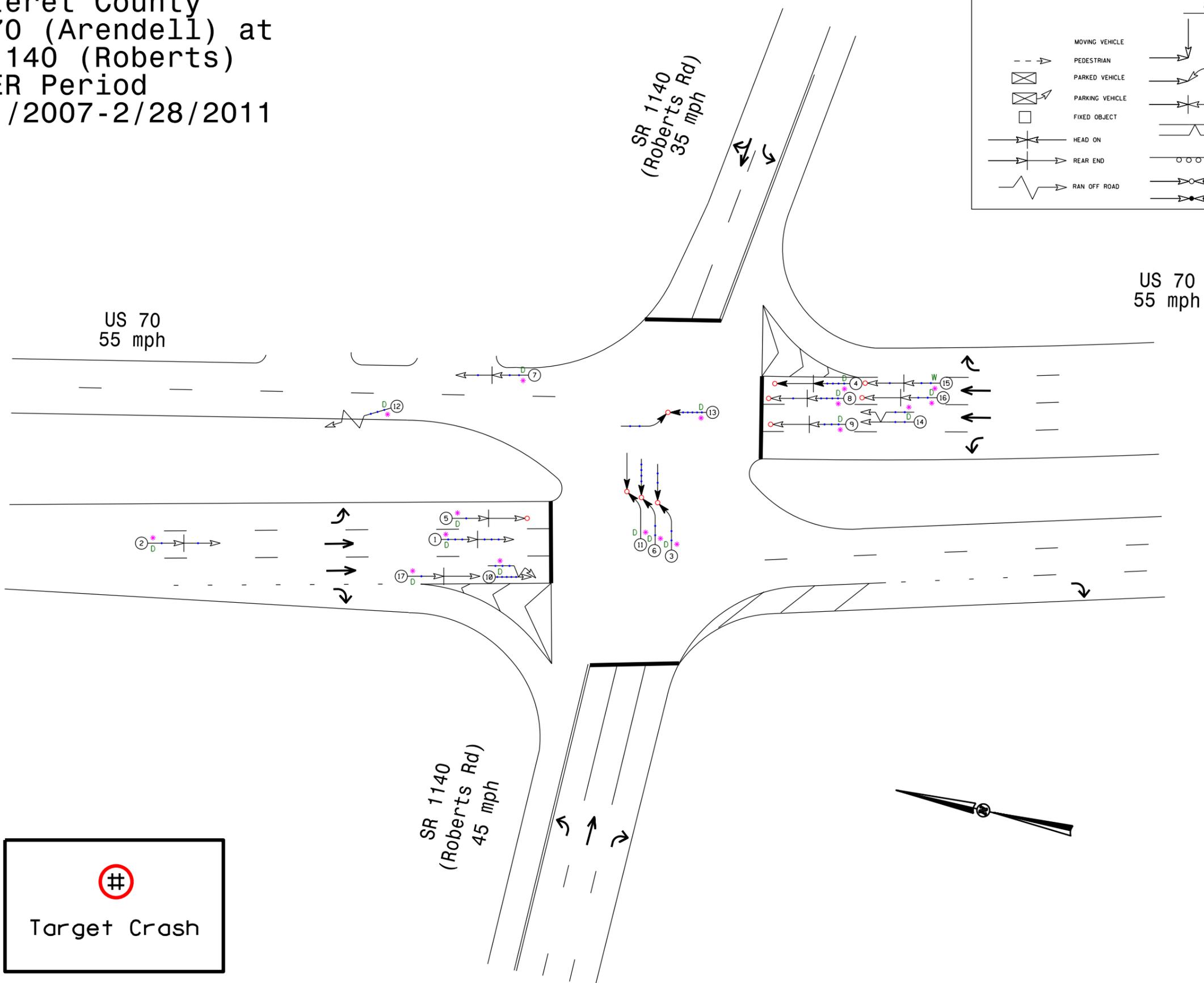
21	22, 23	82
61	41, 42	
	62, 63	
	81	
	62	
	42, 41	
		23


 Target Crash

Carteret County
 US 70 (Arendell) at
 SR 1140 (Roberts)
 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		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				70 AND UP		
					SPEED UNKNOWN		



SIGNAL FACE I.D.

Denotes L.E.D.

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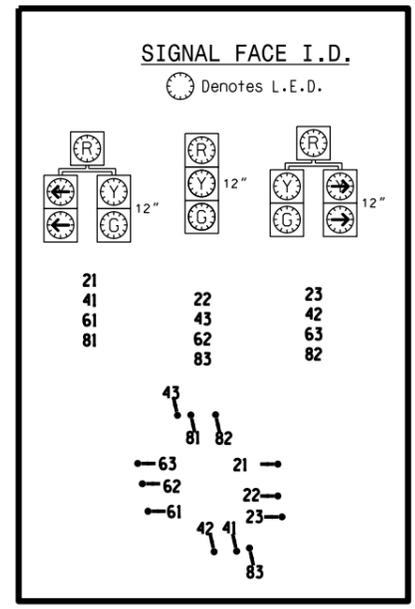
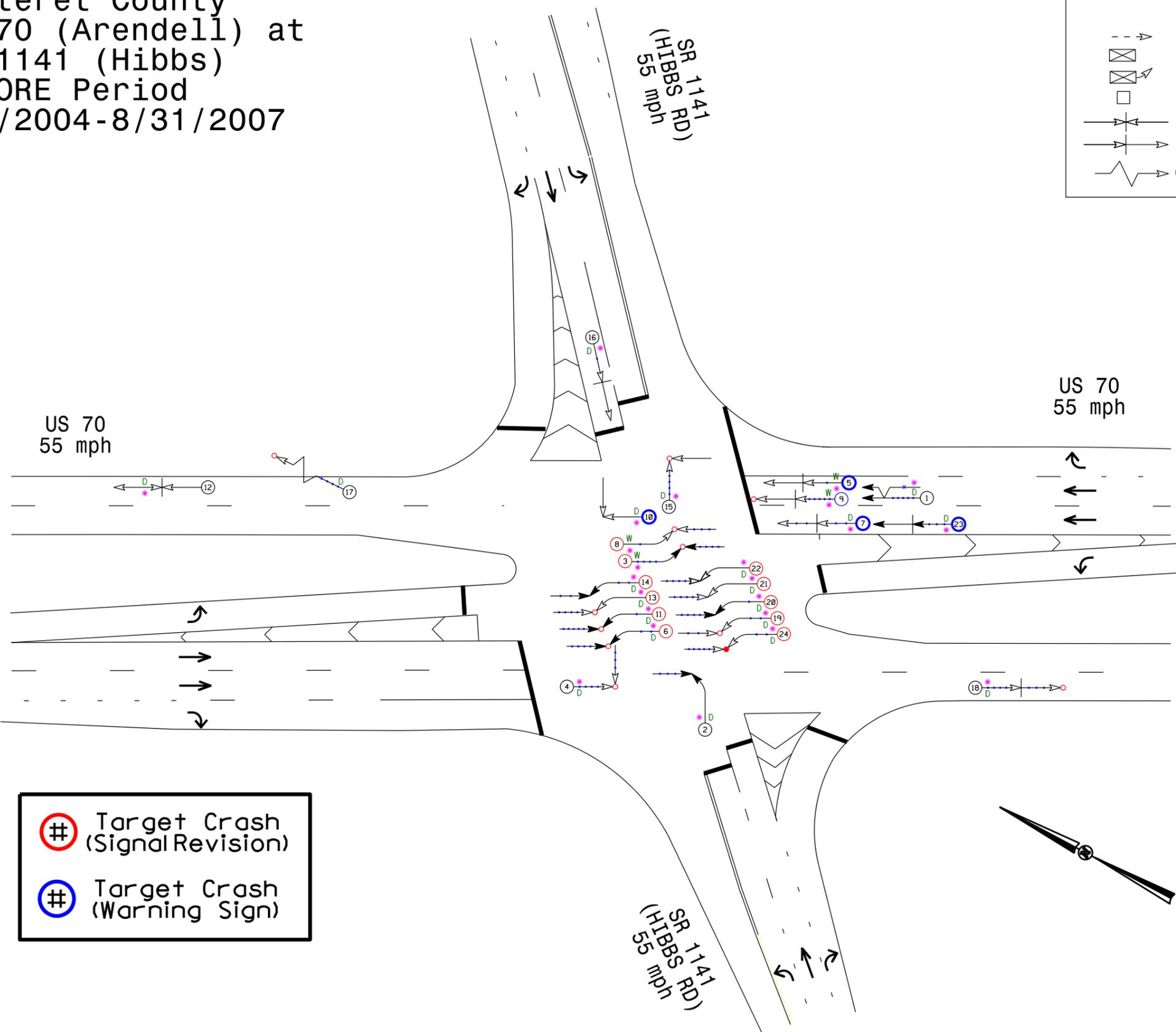


Target Crash

Carteret County
 US 70 (Arendell) at
 SR 1141 (Hibbs)
 BEFORE Period
 6/1/2004-8/31/2007

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		

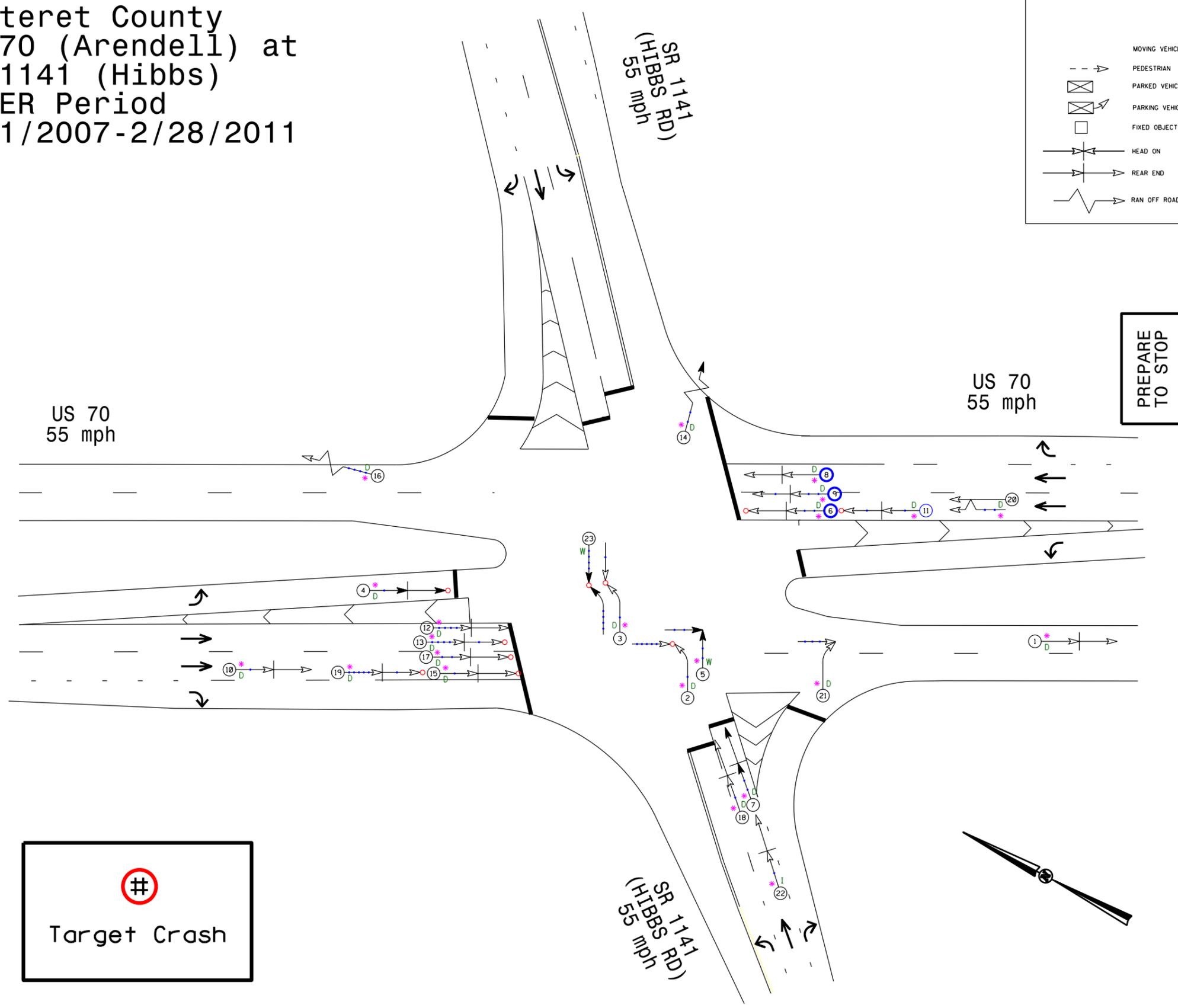


	Target Crash (Signal Revision)
	Target Crash (Warning Sign)

Carteret County
 US 70 (Arendell) at
 SR 1141 (Hibbs)
 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		O OILY
	RAN OFF ROAD		SPEED UNKNOWN		70 AND UP		





Target Crash

