Hazard Elimination Project Evaluation

Project Information

Order ID:	41000024753
Project ID:	Hazard W-4711 (Spot Safety 09-08-206)
Location:	I-40 from Mile-Marker 154 in Iredell County to Mile-Marker 175 in Davie County (I-40 Milepost Range: Iredell MP 14.515 – 22.875 / Davie MP 0.00 – 12.648 / Total Distance = 21.008 Miles / Combined TEAAS MP Range: 14.515 – 35.523)
County:	Iredell / Davie
City:	Near the City of Mocksville
Division:	Iredell-12 / Davie-9
Signal ID:	N/A
Countermeasures:	W-4711: i. Replace sections of concrete pavement as needed and provide longitudinal grooving, five (5.0) miles in each direction, at the identified high-wet crash concentrations (See Map) ii. Mill both inside and outside shoulders to a depth of 3 inches for the entire segment iii. Replace milled out material with 3 inches of pavement to strengthen shoulders iv. Install shoulder rumble strips (4 shoulders total) for entire 21-mile segment
Project Completion:	November 22, 2011 Project Cost: $7,780,000
Note:	Spot Safety Project 09-08-206 installed dual posted SLIPPERY WHEN WET signs at various locations as “an interim safety measure until the diamond grinding project.” The sign impacts were not independently accounted for in this analysis of W-4711.

<u>Map Information</u> (from Google Maps) – Coordinates 35.874050, -80.697563

ATTACHMENT TO TREATMENT DAIGRAM

IDENTIFIED HIGH WET CRASH CONCENTRATIONS FOR PROPOSED
I-40 IREDELL/DAVIE COUNTY GROOVING PROJECT, 5 MILES EACH DIRECTION

EB IREDELL

milepost		milepost	length	crashes	crashes/mile	comments
15.39	to	16.23	0.84	36	42.9	
19.07	to	19.56	0.49	6	12.2	

EB DAVIE

3.42	to	3.74	0.32	10	31.3	end of this concentration is the beginning of existing grooving
5.05	to	5.89	0.84	14	16.7	beginning of this concentration is the end of existing grooving
7.59	to	8.45	0.86	23	26.7	
10.28	to	11.13	0.85	10	11.8	end of this concentration is at the west end of the bridge
11.13	to	11.16				bridge....do not groove
11.16	to	11.63	0.47	11	23.4	beginning of this concentration is at the east end of the bridge
12.49	to	12.82	0.33	14	42.4	end of this concentration is where asphalt begins near MM 175
			5.00			

WB IREDELL

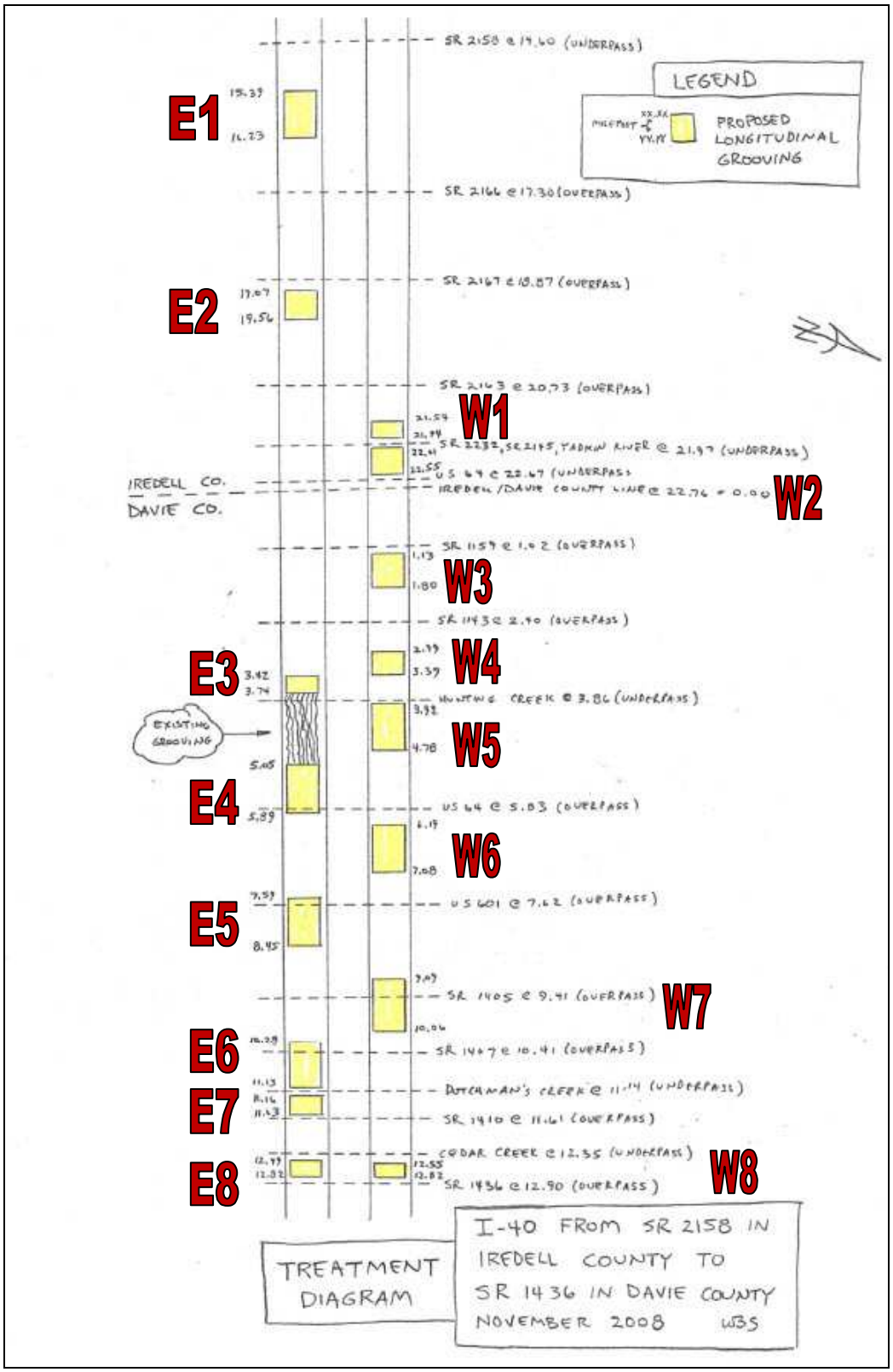
milepost		milepost	length	crashes	crashes/mile	comments
21.54	to	21.94	0.40	9	22.5	end of this concentration is at the west end of the bridge
21.94	to	22.01				bridge....do not groove
22.01	to	22.55	0.54	7	13.0	beginning of this concentration is at the east end of the bridge

WB DAVIE

1.13	to	1.80	0.67	14	20.9	
2.99	to	3.39	0.40	6	15.0	
3.92	to	4.78	0.86	17	19.8	beginning of this concentration is at the east end of the bridge
6.19	to	7.08	0.89	16	18.0	
9.09	to	10.06	0.97	19	19.6	
12.55	to	12.82	0.27	7	25.9	end of this concentration is where asphalt begins near MM 175
			5.00			
			TOTAL	219		

List of Pavement Grooving by County, Direction, and MP Limits

Chart obtained from Project Background File



Milepost Map of Pavement Grooving (5 miles each direction)
Map obtained from Project Background File

Naive Before and After Analysis

Before Period: July 1, 2007 through June 30, 2010 (3 years)

Const. Period: July 1, 2010 through November 30, 2011

After Period: December 1, 2011 through November 30, 2014 (3 years)

Analysis Criteria: Treatment data consisted of all crashes with a 0-foot y-line (no ramp crashes) on the subject roadway.

Target Crashes: Since the countermeasures were selected concerning wet roadway crashes, the following tables also show Lane Departure crashes, Lane Departure Wet (Codes 2-3), and Lane Departure Winter (Codes 4-6) for each section of highlighted data. The lane departure crashes were independently verified.

Table-1

Combined Treatment: Full 21-Miles Both Counties / Both Directions	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	542	485	- 10.5 %
Total Severity Index	4.49	3.05	- 32.1 %
Lane Departure Crashes	379	265	- 30.1 %
Lane Departure Severity Index	4.73	3.17	- 33.0 %
Lane Departure WET Crashes (Code 2-3)	226	160	- 29.2 %
LD-WET Severity Index	3.70	3.20	- 13.5 %
Lane Departure WINTER Crashes (Codes 4-6)	55	36	- 34.5 %
LD-WINTER Severity Index	3.15	2.23	- 29.2 %
Segment ADT (2008, 2012)	28,600	31,500	10.1 %
Total Crash Rate (100 Million Vehicle Miles)	82.31	66.87	- 18.8 %
Wet Crash Rate (100 Million Vehicle Miles)	38.12	26.47	- 30.6 %
Fatal injury Crashes	5	3	- 40.0 %
Class A injury Crashes	6	3	- 50.0 %
Class B injury Crashes	55	26	- 52.7 %
Class C Injury Crashes	88	47	- 46.6 %
Property Damage Only Crashes	388	406	4.6 %
Animal Crashes	56	60	7.1 %
Sideswipe / Merge Crashes	34	47	38.2 %
Rear-End Crashes	48	44	- 8.3 %
Debris in Roadway Crashes	23	58	152.2 %
Night Crashes	182	150	- 17.6 %
Wet Road Crashes (All Types)	251	192	- 23.5 %
Alcohol / Drug Involvement Crashes	16	11	- 31.3 %

Table-2

Eastbound Groove Segments (5.0 Miles)	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	92	82	- 10.9 %
Total Severity Index	3.27	1.90	- 41.9 %
Lane Departure Crashes	67	44	- 34.3 %
Lane Departure Severity Index	2.44	2.01	- 17.6 %
Lane Departure WET Crashes (Code 2-3)	48	26	- 45.8 %
LD-WET Severity Index	2.70	1.57	- 41.9 %
Lane Departure WINTER Crashes (Codes 4-6)	12	5	- 58.3 %
LD-WINTER Severity Index	1.62	3.96	144.4 %
Fatal injury Crashes	1	0	- 100.0 %
Class A injury Crashes	0	0	N/A
Class B injury Crashes	9	3	- 66.7 %
Class C Injury Crashes	9	7	- 22.2 %
Property Damage Only Crashes	73	72	- 1.4 %
E1 LD-Wet – Iredell MP 15.39-16.23 (0.84 mile)	20	11	- 45.0 %
E2 LD-Wet – Iredell MP 19.07-19.56 (0.49 mile)	2	0	- 100.0 %
E3 LD-Wet – Davie MP 3.42-3.74 (0.32 mile)	6	0	- 100.0 %
E4 LD-Wet – Davie MP 5.05-5.89 (0.84 mile)	8	3	- 62.5 %
E5 LD-Wet – Davie MP 7.59-8.45 (0.86 mile)	6	6	0.0 %
E6 LD-Wet – Davie MP 10.28-11.13 (0.85 mile)	2	1	- 50.0 %
E7 LD-Wet – Davie MP 11.16-11.63 (0.47 mile)	3	2	- 33.3 %
E8 LD-Wet – Davie MP 12.49-12.82 (0.33 mile)	1	3	200.0 %

Table-3

Eastbound Non-Groove Segments (16.008 Miles)	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	172	174	1.2 %
Total Severity Index	5.92	3.93	- 33.6 %
Lane Departure Crashes	119	92	- 22.7 %
Lane Departure Severity Index	6.80	4.18	- 38.5 %
Lane Departure WET Crashes (Code 2-3)	63	51	- 19.0 %
LD-WET Severity Index	5.99	5.57	- 7.0 %
Lane Departure WINTER Crashes (Codes 4-6)	16	15	- 6.3 %
LD-WINTER Severity Index	4.24	2.48	- 41.5 %
Fatal injury Crashes	3	1	- 66.7 %
Class A injury Crashes	3	3	0.0 %
Class B injury Crashes	21	10	- 52.4 %
Class C Injury Crashes	32	18	- 43.8 %
Property Damage Only Crashes	113	142	25.7 %

Table-4

Westbound Groove Segments (5.0 Miles)	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	98	67	- 31.6 %
Total Severity Index	3.74	3.47	- 7.2 %
Lane Departure Crashes	71	40	- 43.7 %
Lane Departure Severity Index	4.26	2.67	- 37.3 %
Lane Departure WET Crashes (Code 2-3)	50	31	- 38.0 %
LD-WET Severity Index	2.78	2.91	4.7 %
Lane Departure WINTER Crashes (Codes 4-6)	6	0	- 100.0%
LD-WINTER Severity Index	2.23	0.00	- 100.0 %
Fatal injury Crashes	0	1	100.0 %
Class A injury Crashes	1	0	- 100.0 %
Class B injury Crashes	11	3	- 72.7 %
Class C Injury Crashes	15	9	- 40.0 %
Property Damage Only Crashes	71	54	- 23.9 %
W1 LD-Wet – Iredell MP 21.54-21.94 (0.40 mile)	4	9	125.0 %
W2 LD-Wet – Iredell MP 22.01-22.55 (0.54 mile)	0	6	500.0 %
W3 LD-Wet – Davie MP 1.13-1.80 (0.67 mile)	15	1	- 93.3 %
W4 LD-Wet – Davie MP 2.99-3.39 (0.40 mile)	2	0	- 100.0 %
W5 LD-Wet – Davie MP 3.92-4.78 (0.86 mile)	4	4	0.0 %
W6 LD-Wet – Davie MP 6.19-7.08 (0.89 mile)	12	4	- 66.7 %
W7 LD-Wet – Davie MP 9.09-10.06 (0.97 mile)	13	7	- 46.2 %
W8 LD-Wet – Davie MP 12.55-12.82 (0.27 mile)	0	0	0.0 %

Table-5

Westbound Non-Groove Segments (16.008 Miles)	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	180	162	- 10.0 %
Total Severity Index	4.15	2.52	- 39.3 %
Lane Departure Crashes	122	89	- 27.0 %
Lane Departure Severity Index	4.24	2.93	- 30.9 %
Lane Departure WET Crashes (Code 2-3)	65	52	- 20.0 %
LD-WET Severity Index	2.94	1.85	- 37.1 %
Lane Departure WINTER Crashes (Codes 4-6)	21	16	- 23.8 %
LD-WINTER Severity Index	3.47	1.46	- 57.9 %
Fatal injury Crashes	1	1	0.0 %
Class A injury Crashes	2	0	- 100.0%
Class B injury Crashes	14	10	- 28.6 %
Class C Injury Crashes	32	13	- 59.4 %
Property Damage Only Crashes	131	138	5.3 %

In addition to examining crashes along the subject segment, Weather Data was also evaluated to compare the before period to the rainfall totals in the 3.0-year after period. The Weather Data was requested from the State Climate Office of NC and a station located near the City of Statesville was chosen. This station is located on the western point of study roadway segment. The following table describes the result:

TABLE-6

Weather Data (Greater than 0.01in)	Before 3.0 Yrs	After 3.0 Yrs	Percent Reduction (-) Percent Increase (+)
Total Calendar Days	1,096	1,096	N/A
Total Precipitation (inches)	143.39	140.91	N/A
Total Wet Days	335	363	N/A
Average Rain Total Per Event (inches)	***0.43***	***0.39***	***- 9.3 %***
Percentage of Rain Days	***30.6 %***	***33.1 %***	***2.5 %***

Overall Summary Results

Total Crashes:	- 11 %	(reduction)
Total Crash Severity:	- 32 %	(reduction)
Lane Departure Crashes:	- 30 %	(reduction)
LD Crash Severity:	- 33 %	(reduction)
Volume:	10 %	(increase)

Additional Summary Results

Lane Departure Wet Crashes	- 29 %	(reduction)
Lane Departure Winter Crashes:	- 35 %	(reduction)

Items for Discussion/Concerns

Overall, the effects of the grooving and improved shoulders positively impact crashes along this segment including wet roadway lane departure collisions. The 5.0 miles of concrete/pavement grooving appears to have a greater reduction in crashes than just the areas of shoulder improvements. Also to show the effectiveness, there were 2.5 percent more days of rainfall in the after period with a 24 percent reduction in wet roadway crashes.

From Table-2 and Table-4 above, thirteen (13) out of the sixteen (16) Grooved Treatment Segments experienced a reduction or no change in Lane Departure Wet Crashes during the analysis period. Segments E8, W1, and W2 experienced an increase in Lane Departure Wet Crashes.

Severe (Fatal and A-injury) Crashes were reduced on this segment from 11 in the before period to 6 in the after period. Since the crashes occurred on an interstate, fatal investigations were not performed. The after period crashes included one fatal rear-end, one fatal sideswipe merge with a motorcycle, and one fatal lane departure dry collision. There were additionally two A-injury lane departure wet crashes and one A-injury rear-end collision.

From the Table-1 above, sideswipe merge crashes did increase by 38 percent and crashes involving debris in the roadway more than doubled.

GIS Collision Diagrams are provided that show Lane Departure Wet and Lane Departure Winter Crashes only. They are additionally labelled to indicate if they occurred in a Groove or Non-Groove treated segment.

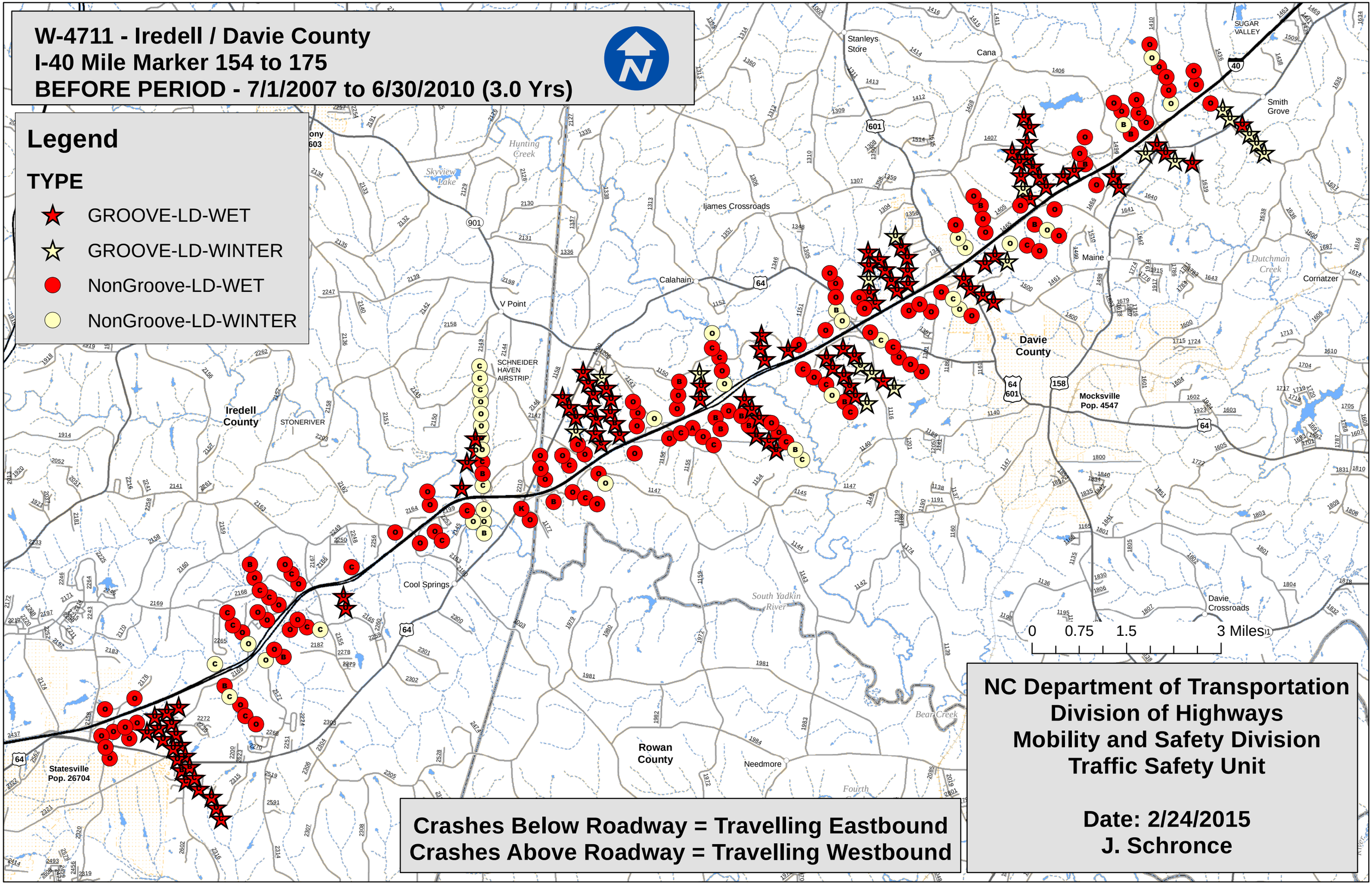
Data Prepared For

The Traffic Safety Unit *of the*
Transportation Mobility and Safety Division *of the*
Division of Highways *of the*
North Carolina Department of Transportation

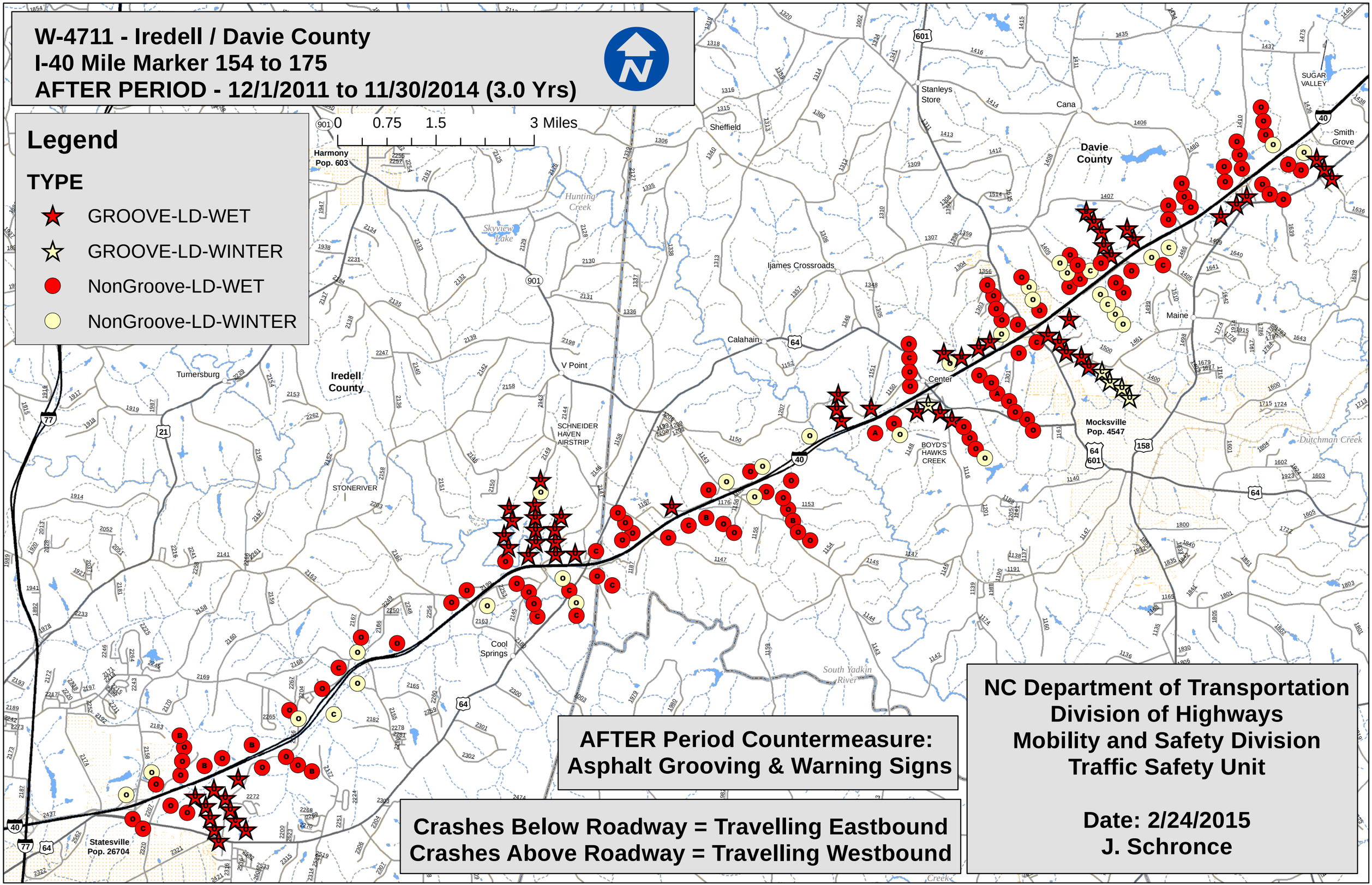
Data Prepared By

Principal Investigator:	Jason B. Schronce, PE
Work Group/Consultant:	NCDOT - Safety Evaluation Group
Date:	February 25, 2015

W-4711 - Iredell / Davie County
I-40 Mile Marker 154 to 175
BEFORE PERIOD - 7/1/2007 to 6/30/2010 (3.0 Yrs)



NC Department of Transportation
Division of Highways
Mobility and Safety Division
Traffic Safety Unit

Date: 2/24/2015
J. Schronce

W-4711 - Iredell / Davie County
I-40 Mile Marker 154 to 175
AFTER PERIOD - 12/1/2011 to 11/30/2014 (3.0 Yrs)