



I-95 Corridor Coalition

I-95 Corridor Coalition Vehicle
Probe Project: Validation of
INRIX Data
Monthly Report
North Carolina



August 2009

I-95 CORRIDOR COALITION VEHICLE PROBE PROJECT: VALIDATION OF INRIX DATA AUGUST 2009

Monthly Report

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I-95 Corridor Coalition

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August 2009

Evaluation Results for the State of North Carolina

Summary

Travel time samples were collected along approximately 42 miles of freeways in North Carolina from Friday, July 10, 2009 to Tuesday, July 21, 2009 and compared with travel time and speed data reported by INRIX as part of the I-95 Vehicle Probe project. The validation data represents approximately 885 hours of observations along nine freeway segments in North Carolina. The segments range in length from 2.5 to 6.8 miles. Much of the I-95 corridor in North Carolina consists of rural sections of freeway. The validation data reflects a significant amount of congestion, over 40 hours with speeds less than 45 mph. The congestion observed is primarily the result of road construction activities in the region, and non-recurrent in nature. The table below summarizes the result of the comparison between the validation data and the INRIX data for the same period. Both the absolute average speed error and the speed error bias as measured against the SEM band are within the acceptable limits of the contract specifications. The ability to maintain the data quality specifications in North Carolina for this validation cycle are significant given the non-recurring nature of the congestion.

NC Evaluation Summary						
State	Absolute Speed Error (<10mph)		Speed Error Bias (<5mph)		Number of 5 Minute Samples	Hours of Data Collection
	Comparison with SEM Band	Comparison with Mean	Comparison with SEM Band	Comparison with Mean		
0-30 MPH	4.10	4.80	2.20	2.30	288	24.0
30-45 MPH	9.40	11.20	-1.60	-1.50	214	17.8
45-60 MPH	4.30	7.10	0.40	1.70	551	45.9
> 60 MPH	3.10	5.90	-2.90	-5.20	9571	797.6
All Speeds	3.32	6.04	-2.56	-4.56	10624	885.3

Based upon data collected from Friday, July 10, 2009 through Tuesday, July 21, 2009 across 46 miles of roadway.

Data Collection

Bluetooth sensor deployments in North Carolina started on Friday, July 10, 2009. The actual deployments in North Carolina were performed with the assistance of North Carolina Department of Transportation (NCDOT) personnel. Sensors remained in the same position until they were retrieved two weeks later on Tuesday, July 21, 2009. This round of data collections in North Carolina was designed to cover segments of the highways along which both recurrent and non-recurrent congestions could be expected during both peak and off-peak periods.

Figure 1 presents snapshots of the roadway segments over which Bluetooth sensors were deployed in North Carolina.

Table 1 presents a list of specific TMC segments that were selected as the validation sample in North Carolina. In total, results of validation on nine freeway TMC segments are reported in this document. These segments cover a total length of about 42 miles. The coordinates of the locations at which the Bluetooth sensors were deployed throughout the state of North Carolina are reported in Table 2 which also presents the distances that have been used in the estimation of Bluetooth speeds based on travel times.

Analysis of Results

Table 3 summarizes the data quality measures obtained as a result of comparison between Bluetooth and all reported INRIX speeds. In all speed bins, INRIX data meets the data quality measures set forth in the contract when errors are measured as a distance from the 1.96 times the standard error band. It should be noted that while the total number of observations in the low speed bins across all TMC segments are reasonable, as Table 3 indicates, the number of observations in low speed bins for some of the individual TMC segments are low.

Table 4 shows the percentage of the time intervals that fall within 5 mph of the SEM band and the mean for each speed bin for all TMC segments in North Carolina. Tables 5 and 6 present detailed data for individual TMC segments in North Carolina in similar format as Tables 3 and 4 respectively. Note that for some TMC segments in some speed bins the comparison results may not be reliable due to small number of observations.

Figures 2 and 3 show the overall speed error bias for different speed bins, and the average absolute speed errors for all segments in North Carolina, respectively. These figures correspond to Table 3.

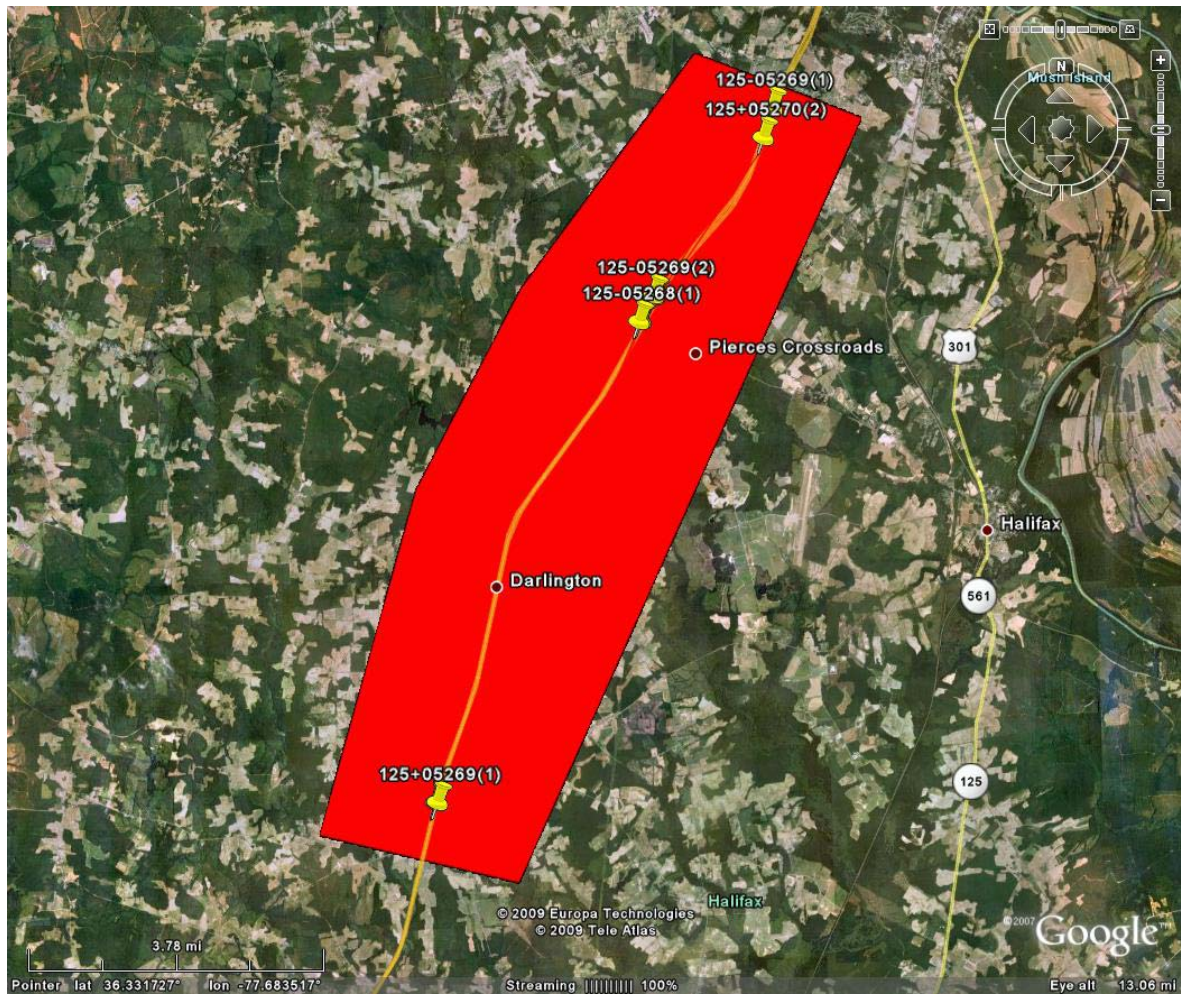


Figure 1
TMC segments selected for validation in North Carolina

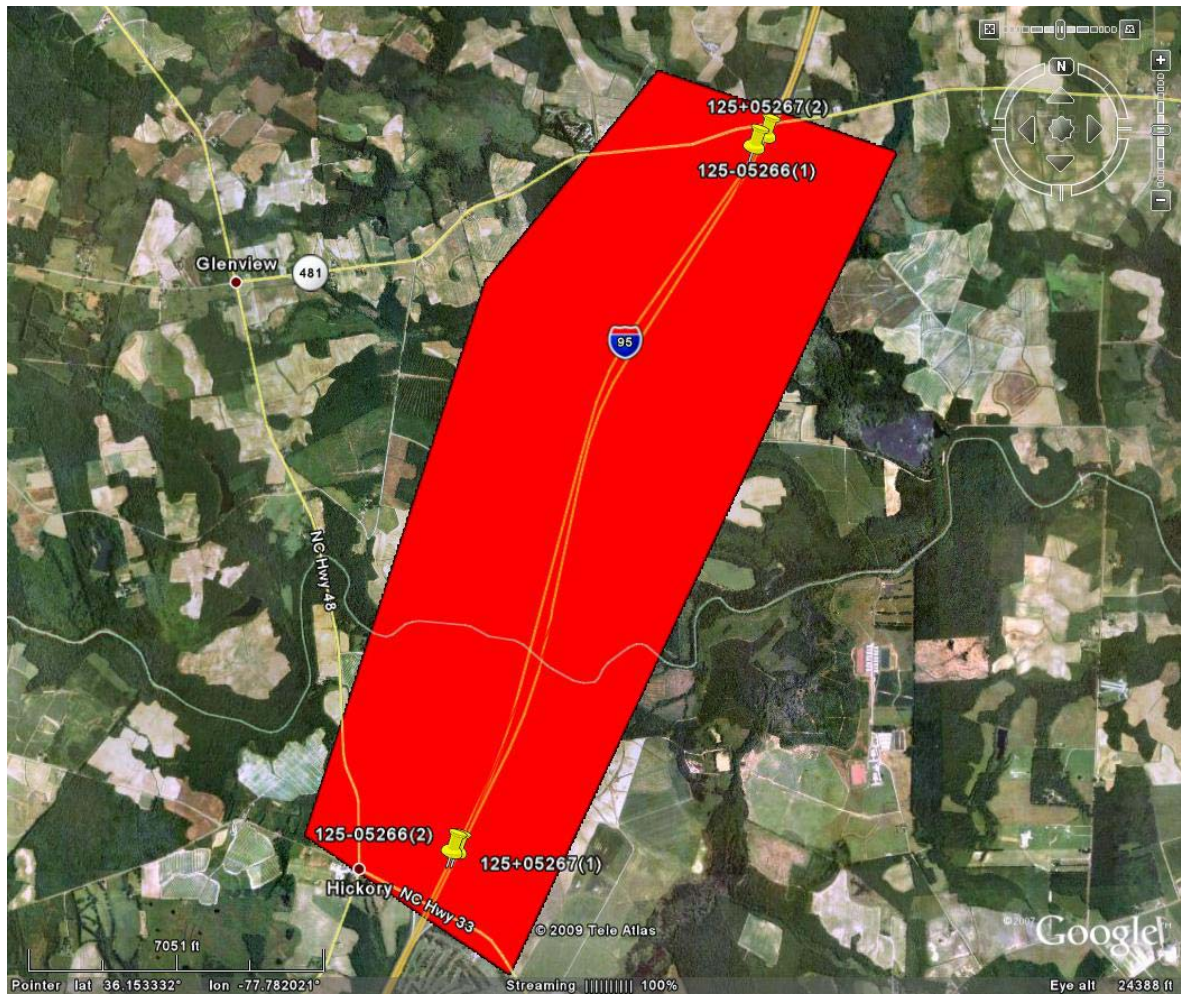


Figure 1 (Cont'd)
TMC segments selected for validation in North Carolina

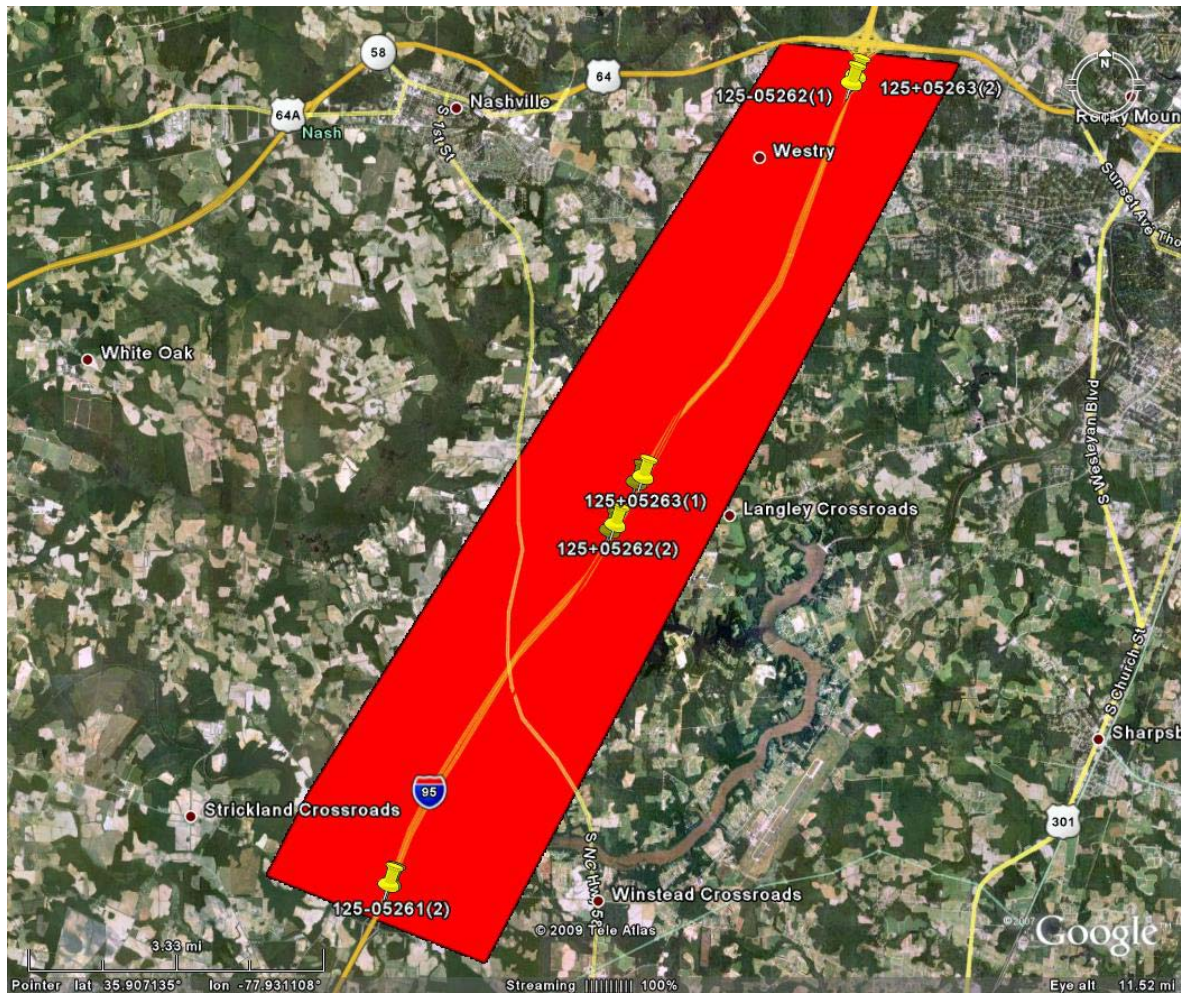


Figure 1 (Cont'd)
TMC segments selected for validation in North Carolina

Table 1
Traffic Message Channel segments picked for validation in North Carolina

TYPE	TMC	HIGHWAY	STARTING AT	ENDING AT	COUNTY	DIRECTION	LENGTH (mile)
Freeway	125-05269	I-95	NC-125/EXIT 171	NC-903/EXIT 168	HALIFAX	SOUTHBOUND	2.9
Freeway	125-05268	I-95	NC-903/EXIT 168	NC-561/EXIT 160	HALIFAX	SOUTHBOUND	6.8
Freeway	125-05262	I-95	US-64/EXIT 138	W MOUNT DR/EXIT 132	NASH	SOUTHBOUND	5.2
Freeway	125-05261	I-95	W MOUNT DR/EXIT 132	NC-97/EXIT 127	NASH	SOUTHBOUND	4.8
Freeway	125+05262	I-95	NC-97/EXIT 127	W MOUNT DR/EXIT 132	NASH	NORTHBOUND	4.8
Freeway	125+05263	I-95	W MOUNT DR/EXIT 132	US-64/EXIT 138	NASH	NORTHBOUND	5.2
Freeway	125+05267	I-95	NC-33/EXIT 150	NC-481/EXIT 154	HALIFAX	NORTHBOUND	3.6
Freeway	125+05269	I-95	NC-561/EXIT 160	NC-903/EXIT 168	HALIFAX	NORTHBOUND	6.8
Freeway	125+05270	I-95	NC-903/EXIT 168	NC-125/EXIT 171	HALIFAX	NORTHBOUND	2.5
TOTAL							42.4

Table 2
TMC segment lengths and distances between sensor deployment locations in the state of North Carolina

SEGMENT TYPE	TMC	STANDARD TMC					SENSOR DEPLOYMENT					ERROR IN SEGMENT LENGTH (%)	
		Endpoint (1)		Endpoint (2)		Length (mile)	Endpoint (1)		Endpoint (2)		Length (mile)		
		Lat	Long	Lat	Long		Lat	Long	Lat	Long			
Freeway	125-05269	36.40120	-77.64392	36.36644	-77.67132	2.87	36.40126	-77.64413	36.36720	-77.67096	2.81	-2.0%	
Freeway	125-05268	36.36164	-77.67465	36.27243	-77.72152	6.78	36.36046	-77.67564	36.27335	-77.72138	6.61	-2.6%	
Freeway	125-05262	35.97260	-77.88055	35.90733	-77.92387	5.17	35.97109	-77.88133	35.90856	-77.92341	4.96	-4.0%	
Freeway	125-05261	35.89943	-77.92927	35.84146	-77.97383	4.76	35.89990	-77.92919	35.84273	-77.97339	4.69	-1.4%	
Freeway	125+05262	35.84161	-77.97339	35.90038	-77.92821	4.82	35.84504	-77.97161	35.89973	-77.92860	4.50	-6.5%	
Freeway	125+05263	35.90820	-77.92259	35.97385	-77.87967	5.19	35.90856	-77.92241	35.97207	-77.88010	5.03	-3.0%	
Freeway	125+05267	36.12921	-77.79377	36.17614	-77.76865	3.57	36.13185	-77.79206	36.17481	-77.76944	3.26	-8.8%	
Freeway	125+05269	36.27254	-77.72119	36.36176	-77.67422	6.78	36.27410	-77.72059	36.36076	-77.67469	6.59	-2.9%	
Freeway	125+05270	36.36623	-77.67112	36.39573	-77.64598	2.49	36.36902	-77.66915	36.39484	-77.64634	2.20	-11.6%	
TOTAL							42.42						40.64

Table 3
Data quality measures for freeway segments greater than one mile in North Carolina

SPEED BIN	Data Quality Measures for				No. of Obs.
	1.96 SE Band		Mean		
	Speed Error Bias	Average Absolute Speed Error	Speed Error Bias	Average Absolute Speed Error	
0-30	2.2	4.1	2.3	4.8	288
30-45	-1.6	9.4	-1.5	11.2	214
45-60	0.4	4.3	1.7	7.1	551
60+	-2.9	3.1	-5.2	5.9	9571

Table 4
Percent observations meeting data quality criteria for freeway segments greater than one mile in North Carolina

SPEED BIN	Data Quality Measures for				No. of Obs.
	1.96 SE Band		Mean		
	Percentage falling inside the band	Percentage falling within 5 mph of the band	Percentage equal to the mean	Percentage within 5 mph of the mean	
0-30	15%	75%	0%	71%	288
30-45	11%	43%	0%	30%	214
45-60	31%	70%	0%	47%	551
60+	34%	73%	0%	46%	9571

Table 5
Data quality measures for individual freeway segments greater than one mile in the
state of North Carolina

TMC	Standard TMC length	Bluetooth distance	SPEED BIN	Data Quality Measures for				No. of Obs.
				1.96 SE Band		Mean		
				Speed Error Bias	Average Absolute Speed Error	Speed Error Bias	Average Absolute Speed Error	
125+05262	4.82	4.50	0-30					5* 414
			30-45					
			45-60	3.7	3.7	4.8	5.3	
			60+	-3.2	3.2	-6.1	6.7	
125+05263	5.19	5.03	0-30					5* 919
			30-45					
			45-60	0.2	0.2	5.7	5.7	
			60+	-3.3	3.3	-6.1	6.6	
125+05267	3.57	3.26	0-30	2.2	3.5	2.3	4.1	122
			30-45	9.5	9.5	13.8	17.1	10
			45-60	-2.3	3.4	2.0	13.3	42
			60+	-6.1	6.2	-9.0	10.4	47
125+05269	6.78	6.59	0-30	0.7	3.2	0.8	3.9	131
			30-45	1.2	8.0	1.4	10.1	35
			45-60	-0.4	4.9	-0.1	7.5	61
			60+	-4.0	4.1	-6.6	7.1	1074
125+05270	2.49	2.20	0-30	5.2	7.6	5.5	8.7	16
			30-45	-3.0	9.6	-3.2	11.0	168
			45-60	0.5	4.6	1.3	6.5	393
			60+	-2.9	3.1	-5.0	5.7	1231
125-05261	4.76	4.69	0-30					9* 1046
			30-45					
			45-60	2.3	2.4	5.6	6.1	
			60+	-3.0	3.1	-5.6	6.3	
125-05262	5.17	4.96	0-30	9.8	11.6	9.9	12.3	19
			30-45					
			45-60	1.1	1.1	5.6	5.6	9*
			60+	-3.4	3.5	-5.9	6.5	1650
125-05268	6.78	6.61	0-30					1* 8* 916
			30-45	23.4	23.4	25.5	25.5	
			45-60	4.8	5.1	7.7	8.3	
			60+	-2.6	2.8	-4.9	5.6	
125-05269	2.87	2.81	0-30					19 2274
			30-45					
			45-60	3.1	3.6	6.1	6.8	
			60+	-1.9	2.2	-3.2	4.5	

*Results in the specified row may not be reliable due to small number of observations

Table 6
Observations meeting data quality criteria for individual freeway segments greater than one mile in the state of North Carolina

TMC	SPEED BIN	Data Quality Measures for								No. of Obs.
		1.96 SE Band				Mean				
		Speed Error Bias		Average Absolute Speed Error		Speed Error Bias		Average Absolute Speed Error		
		No. falling inside the band	% falling inside the band	No. falling within 5 mph of the band	% falling within 5 mph of the band	No. equal to the mean	% equal to the mean	No. within 5 mph of the mean	% within 5 mph of the mean	
125+05262	0-30									
	30-45									
	45-60	2	40%	3	60%	0	0%	3	60%	
	60+	161	39%	293	71%	0	0%	153	37%	
125+05263	0-30									
	30-45									
	45-60	3	60%	5	100%	0	0%	2	40%	
	60+	322	35%	643	70%	0	0%	341	37%	
125+05267	0-30	25	20%	98	80%	0	0%	95	78%	
	30-45	2	20%	5	50%	0	0%	1	10%	
	45-60	32	76%	36	86%	0	0%	8	19%	
	60+	20	43%	28	60%	0	0%	18	38%	
125+05269	0-30	14	11%	103	79%	0	0%	95	73%	
	30-45	5	14%	15	43%	0	0%	11	31%	
	45-60	15	25%	36	59%	0	0%	20	33%	
	60+	299	28%	668	62%	0	0%	376	35%	
125+05270	0-30	2	13%	8	50%	0	0%	7	44%	
	30-45	16	10%	71	42%	0	0%	53	32%	
	45-60	104	26%	267	68%	0	0%	210	53%	
	60+	395	32%	889	72%	1	0%	578	47%	
125-05261	0-30									
	30-45									
	45-60	4	44%	7	78%	0	0%	4	44%	
	60+	382	37%	748	72%	0	0%	432	41%	
125-05262	0-30	2	11%	8	42%	0	0%	8	42%	
	30-45									
	45-60	4	44%	9	100%	0	0%	4	44%	
	60+	498	30%	1133	69%	0	0%	632	38%	
125-05268	0-30									
	30-45	0	0%	0	0%	0	0%	0	0%	
	45-60	2	25%	6	75%	0	0%	3	38%	
	60+	346	38%	698	76%	0	0%	423	46%	
125-05269	0-30									
	30-45									
	45-60	3	16%	14	74%	0	0%	7	37%	
	60+	866	38%	1893	83%	0	0%	1429	63%	

*Results in the specified row may not be reliable due to small number of observations

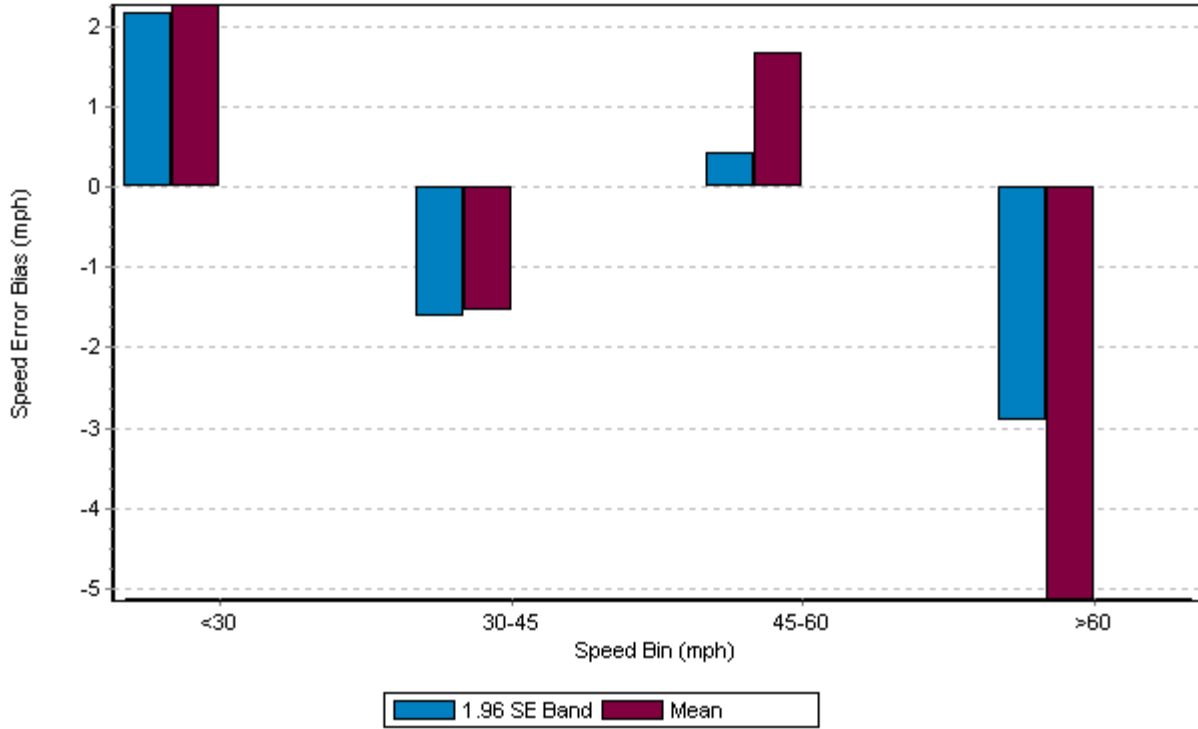


Figure 2
Speed error bias for freeway segments greater than one mile in North Carolina

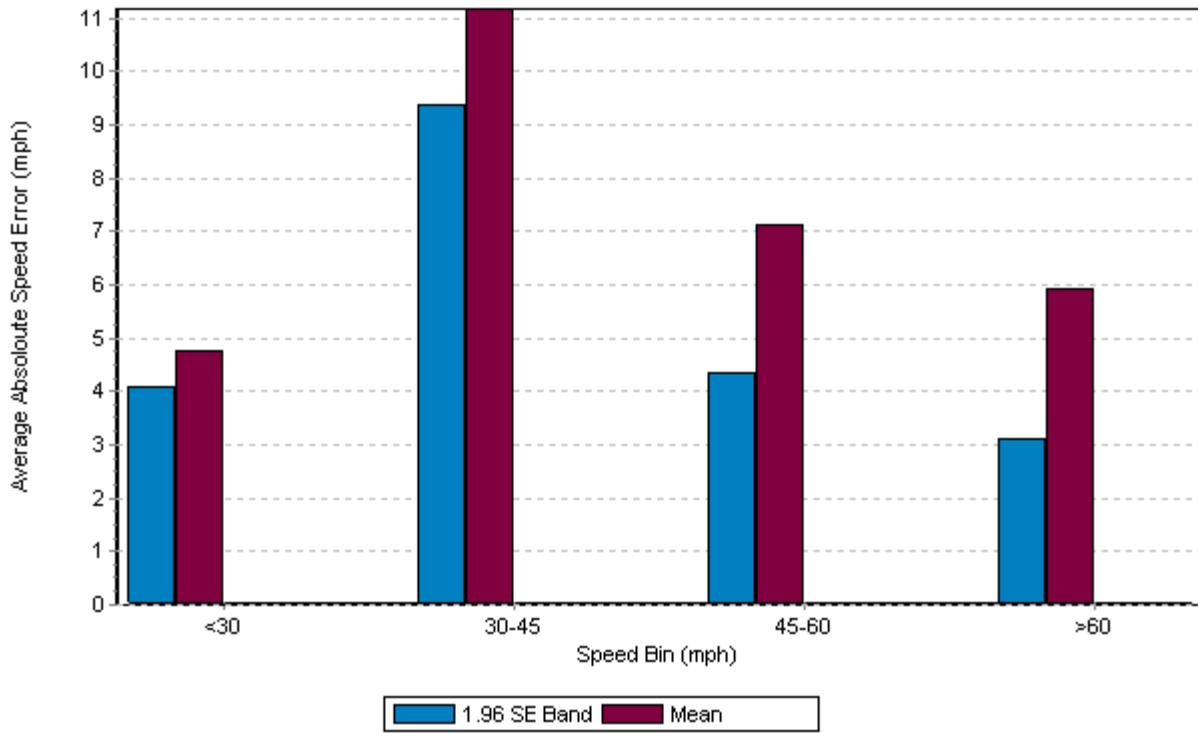


Figure 3
Average absolute speed error for freeway segments greater than one mile in North Carolina