



I-95 Corridor Coalition

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



April 2011

I-95 CORRIDOR COALITION VEHICLE PROBE PROJECT: VALIDATION OF INRIX DATA APRIL 2011

Monthly Report

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April 2011

Evaluation Results for the State of South Carolina

Executive Summary

Travel time samples were collected along approximately 23 freeway miles from Tuesday, February 1, 2011 through Monday, February 14, 2011 in South Carolina. Freeway segments were located along I-20 in Richmond and Lexington Counties. Data collected was compared with travel time and speed data reported by INRIX as part of the I-95 Vehicle Probe project. The freeway validation data below represents nearly 1200 hours of observations along ten freeway segments, totaling approximately 23 miles. It is noted that out of the total hours of data observations, there were only ten hours of congestion, which indicates an insignificant sampling of low-speed data. A sample of 50 hours or more of congestion (data when speeds are less than 45 mph) is considered significant to characterize performance in the lower speed bins.

ES Table 1, below summarizes the results of the comparison between the validation data and the INRIX data for freeway segments during this period. As shown, the INRIX data are within specification for the average absolute speed error for all speed bins. However, for the evaluation of the speed error bias, in speed bins below 45 mph, INRIX data does not meet 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 in the 'less than 30 mph' speed bin, the error measures are based on a small number of observations and as such results may not be reliable.

ES Table 1 - South Carolina Evaluation Summary						
Speed Bin	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	6.20	7.40	5.50	6.10	19	1.6
30-45 MPH	7.00	9.80	6.50	9.10	99	8.3
45-60 MPH	1.90	4.90	1.90	4.60	2230	185.8
> 60 MPH	1.10	3.30	-0.60	-1.50	11911	992.6
All Speeds	1.27	3.60	-0.15	-0.46	14259	1188.3

Based upon data collected from February 1, 2011 through February 14, 2011 across 23 miles of roadway.

As part of the ongoing validation process, vehicle probe data from each state is validated on a rotating basis. This report presents the first validation effort for South Carolina. As additional validation is conducted in South Carolina, a summary of the cumulative effort will be included.

Data Collection

Bluetooth sensor deployments in South Carolina started on Tuesday, February 1, 2011. The actual deployments in South Carolina were performed with the assistance of South Carolina Department of Transportation (SCDOT) personnel. Sensors remained in the same position until they were retrieved two weeks later on Monday, February 14, 2011. This round of data collections in South 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 South Carolina. In this figure, red segments represent freeway segments selected for analysis in this round of validation.

Table 1 presents a list of specific TMC segments along I-20 that were selected as the validation sample in South Carolina. The validation sample consists of ten segments and covers a total length of 23 freeway miles. The coordinates of the locations at which the Bluetooth sensors were deployed throughout the state of South Carolina are highlighted in Table 2. It should be noted that the configuration of consecutive TMC segments is overlapping, such that the start point of one TMC segment is located prior to the endpoint of the previous TMC segment, allowing one Bluetooth sensor in that location to cover both TMC segments.

Finally, Table 3 summarizes the segment definitions used in the validation process while also presenting the distances that have been used in the estimation of Bluetooth speeds based on travel times.

Analysis of Results

Table 4 summarizes the data quality measures obtained as a result of comparison between Bluetooth and all reported INRIX speeds. The INRIX data are within specification for the average absolute speed error for all speed bins. However, for the evaluation of the speed error bias, in speed bins below 45 mph, INRIX data does not meet 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 in less than 30 mph speed bin error measures are based on a small number of observations and as such results may not be reliable. A sample of 50 hours or more of congestion (data when speeds are less than 45 mph) is considered significant to characterize performance in the lower speed bins.

Table 5 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 South Carolina. Tables 6 and 7 present detailed data for individual TMC segments in South Carolina in similar format as Tables 4 and 5, respectively. Note that for some segments and 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 biases for different speed bins, and the average absolute speed errors for all validation segments in South Carolina, respectively. These figures correspond to Table 4.

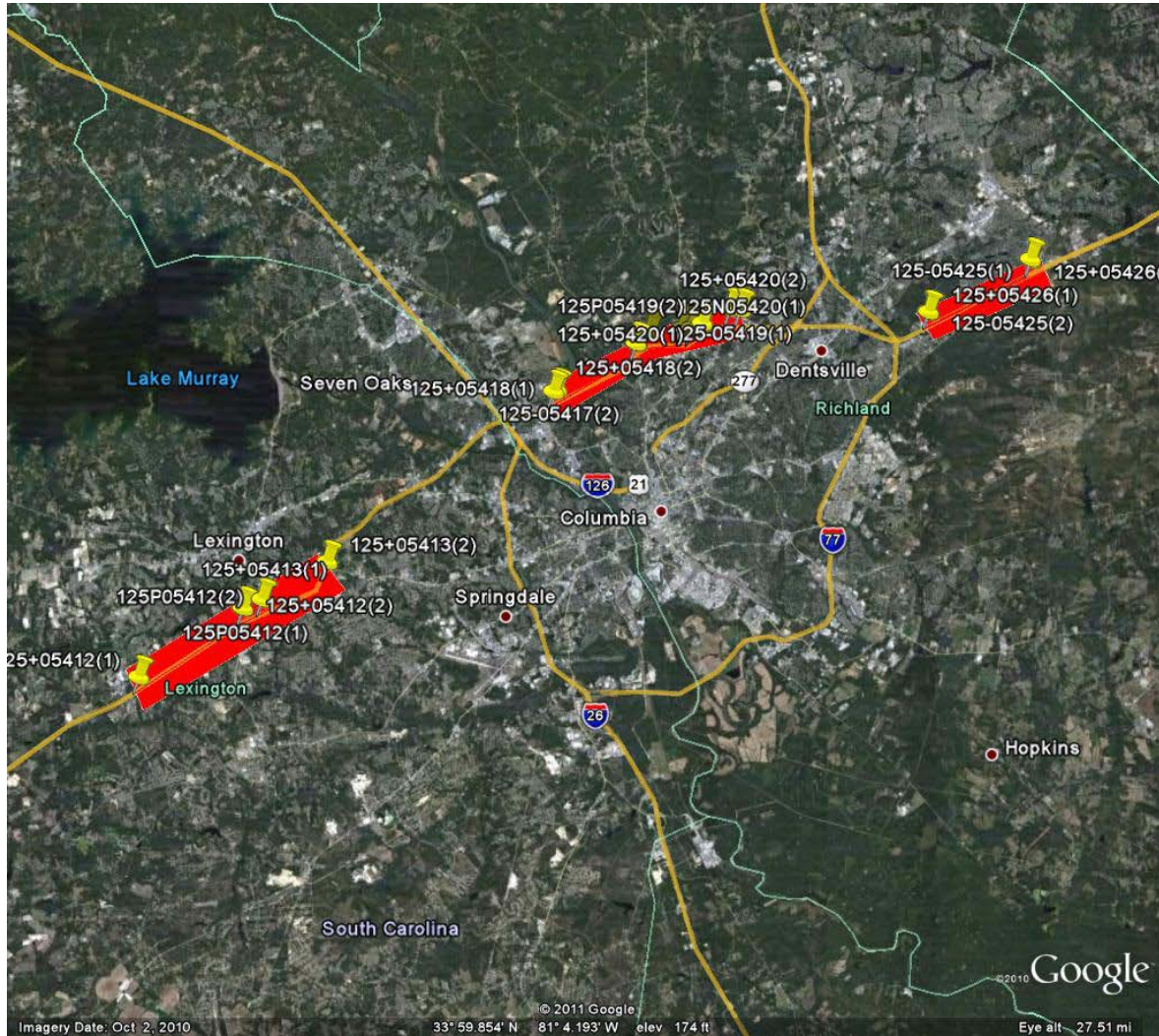


Figure 1
TMC segments selected for validation in South Carolina

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

TYPE	TMC	HIGHWAY	STARTING AT	ENDING AT	COUNTY	DIRECTION	LENGTH (mile)
Freeway	125+05412	I-20	SC-204/EXIT 51	SC-6/EXIT 55	LEXINGTON	EASTBOUND	3.4
Freeway	125P05412	I-20	SC-6/EXIT 55	SC-6/EXIT 55	LEXINGTON	EASTBOUND	0.6
Freeway	125+05413	I-20	SC-6/EXIT 55	US-1/EXIT 58	LEXINGTON	EASTBOUND	2.1
Freeway	125+05418	I-20	US-176/BROAD RIVER RD/EXIT 65	SC-215/MONTICELLO RD/EXIT 68	RICHLAND	EASTBOUND	2.6
Freeway	125+05419	I-20	SC-215/MONTICELLO RD/EXIT 68	US-321/FAIRFIELD RD/EXIT 70	RICHLAND	EASTBOUND	1.2
Freeway	125P05419	I-20	US-321/FAIRFIELD RD/EXIT 70	US-321/FAIRFIELD RD/EXIT 70	RICHLAND	EASTBOUND	0.3
Freeway	125+05420	I-20	US-321/FAIRFIELD RD/EXIT 70	US-21/MAIN ST/EXIT 71	RICHLAND	EASTBOUND	1.1
Freeway	125+05426	I-20	ALPINE RD/EXIT 76B	CLEMSON RD/EXIT 80	RICHLAND	EASTBOUND	3.1
Freeway	125-05425	I-20	CLEMSON RD/EXIT 80	ALPINE RD/EXIT 76B	RICHLAND	WESTBOUND	3.1
Freeway	125N05420	I-20	US-21/MAIN ST/EXIT 71	US-21/MAIN ST/EXIT 71	RICHLAND	WESTBOUND	0.3
Freeway	125-05419	I-20	US-21/MAIN ST/EXIT 71	US-321/FAIRFIELD RD/EXIT 70	RICHLAND	WESTBOUND	1.2
Freeway	125N05419	I-20	US-321/FAIRFIELD RD/EXIT 70	US-321/FAIRFIELD RD/EXIT 70	RICHLAND	WESTBOUND	0.3
Freeway	125-05418	I-20	US-321/FAIRFIELD RD/EXIT 70	SC-215/MONTICELLO RD/EXIT 68	RICHLAND	WESTBOUND	0.9
Freeway	125-05417	I-20	SC-215/MONTICELLO RD/EXIT 68	US-176/BROAD RIVER RD/EXIT 65	RICHLAND	WESTBOUND	2.5
Total							23.0

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

SEGMENT TYPE	TMC	STANDARD TMC					Sensor Actual Location					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+05412	33.928752	-81.286468	33.955956	-81.23682	3.4	33.9287	-81.2863	33.9561	-81.23764	3.39	-0.54%
Freeway	125P05412	33.955956	-81.23682	33.959381	-81.227691	0.6	33.9561	-81.23764			0.60	4.44%
Freeway	125+05413	33.959381	-81.227691	33.974231	-81.196594	2.1			33.97393	-81.19666	2.11	-1.21%
Freeway	125+05418	34.041469	-81.088604	34.060434	-81.049159	2.6	34.04168	-81.08773	34.06123	-81.04813	2.65	0.99%
Freeway	125+05419	34.065057	-81.042603	34.066335	-81.022738	1.2	34.06451	-81.04344	34.06624	-81.02283	1.18	2.48%
Freeway	125P05419	34.066339	-81.022738	34.068395	-81.017495	0.3	34.06624	-81.02283			0.33	-1.18%
Freeway	125+05420	34.068395	-81.017495	34.073601	-80.999352	1.1			34.07367	-81.00018	1.10	-3.12%
Freeway	125+05426	34.072446	-80.909309	34.092662	-80.860567	3.1	34.07188	-80.91003	34.09164	-80.86118	3.10	-0.59%
Freeway	125-05425	34.093225	-80.860723	34.0726	-80.909411	3.1	34.09266	-80.8626	34.07288	-80.9092	3.00	-4.10%
Freeway	125N05420	34.073749	-80.999566	34.073878	-81.004269	0.3	34.07412	-80.99947			0.27	0.35%
Freeway	125-05419	34.073878	-81.004269	34.066501	-81.022629	1.2			34.06676	-81.02212	1.15	-2.67%
Freeway	125N05419	34.066501	-81.022629	34.066242	-81.027114	0.3	34.06676	-81.02212			0.27	4.60%
Freeway	125-05418	34.066242	-81.027114	34.064892	-81.043349	0.9			34.06448	-81.04456	1.05	10.85%
Freeway	125-05417	34.060337	-81.049478	34.042265	-81.087054	2.5	34.06041	-81.04934	34.04084	-81.09071	2.75	10.03%
Total						22.8					23.0	0.81%

Table 3
Path segments identified for validation in South Carolina

Type	Validation Segment	STANDARD SEGMENTS INCLUDED		STARTING AT	ENDING AT	LENGTH (MILE)		
		TMC(1)	TMC(2)			Standard	Deployment	Error (%)
Freeway	125+05412	125+05412	125+05413	SC-204/EXIT 51	SC-6/EXIT 55	3.4	3.39	-0.54%
Freeway	SC01-0001	125P05412		SC-6/EXIT 55	US-1/EXIT 58	2.7	2.71	-0.02%
Freeway	125+05418	125+05418	125+05419	US-176/BROAD RIVER RD/EXIT 65	SC-215/MONTICELLO RD/EXIT 68	2.6	2.65	0.99%
Freeway	125+05419	125+05419		SC-215/MONTICELLO RD/EXIT 68	US-321/FAIRFIELD RD/EXIT 70	1.2	1.18	2.48%
Freeway	SC01-0002	125P05419	125+05420	US-321/FAIRFIELD RD/EXIT 70	US-21/MAIN ST/EXIT 71	1.5	1.43	-2.68%
Freeway	125+05426	125+05426		ALPINE RD/EXIT 76B	CLEMSON RD/EXIT 80	3.1	3.10	-0.59%
Freeway	125-05425	125-05425	125-05419	CLEMSON RD/EXIT 80	ALPINE RD/EXIT 76B	3.1	3.00	-4.10%
Freeway	SC01-0003	125N05420		US-21/MAIN ST/EXIT 71	US-321/FAIRFIELD RD/EXIT 70	1.5	1.42	-2.11%
Freeway	SC01-0004	125N05419	125-05418	US-321/FAIRFIELD RD/EXIT 70	SC-215/MONTICELLO RD/EXIT 68	1.2	1.32	9.51%
Freeway	125-05417	125-05417		SC-215/MONTICELLO RD/EXIT 68	US-176/BROAD RIVER RD/EXIT 65	2.5	2.75	10.03%
Total						22.8	23.0	0.81%

Table 4
Data quality measures for freeway segments greater than one mile in South 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	5.5	6.2	6.1	7.4	19*
30-45	6.5	7.0	9.1	9.8	99
45-60	1.9	1.9	4.6	4.9	2230
60+	-0.6	1.1	-1.5	3.3	11911

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

Table 5
Percent observations meeting data quality criteria for freeway segments greater than one mile in South 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	11%	74%	0%	63%	19*
30-45	15%	45%	0%	34%	99
45-60	39%	89%	0%	58%	2230
60+	59%	94%	0%	78%	11911

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

Table 6
Data quality measures for individual freeway validation segments greater than one mile in the state of South 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+05412	3.41	3.39	0-30					1* 1135
			30-45					
			45-60	0.0	0.0	10.8	10.8	
			60+	-2.1	2.2	-4.8	5.5	
125+05418	2.62	2.65	0-30					210 1518
			30-45					
			45-60	1.8	1.9	4.8	4.9	
			60+	-0.2	0.7	-0.6	2.5	
125+05419	1.15	1.18	0-30					11* 898 1235
			30-45	10.7	10.7	15.3	15.3	
			45-60	1.7	1.7	4.1	4.3	
			60+	0.0	0.8	-0.3	2.7	
125+05426	3.12	3.10	0-30	1.3	1.3	1.4	2.2	3* 45 207 1075
			30-45	5.8	5.9	6.8	7.2	
			45-60	2.8	3.0	5.3	5.6	
			60+	0.3	0.7	0.7	2.4	
125-05417	2.50	2.75	0-30					3* 226 1082
			30-45	13.5	13.5	16.0	16.0	
			45-60	2.0	2.0	4.7	4.7	
			60+	-0.3	0.6	-0.9	2.4	
125-05425	3.13	3.00	0-30	6.3	7.1	7.0	8.4	16* 30 80 1528
			30-45	5.6	6.9	6.8	8.7	
			45-60	1.8	3.0	3.1	5.0	
			60+	-0.6	0.9	-1.7	2.9	
SC01-0001	2.71	2.71	0-30					6* 22* 703
			30-45	7.3	7.3	12.1	12.5	
			45-60	3.3	3.3	7.4	7.4	
			60+	-0.7	1.2	-1.8	3.7	
SC01-0002	1.47	1.43	0-30					292 1162
			30-45					
			45-60	1.8	1.8	5.6	5.6	
			60+	0.1	0.6	0.1	2.7	
SC01-0003	1.45	1.42	0-30					3* 241 812
			30-45	5.2	5.2	26.2	26.2	
			45-60	1.7	1.7	4.9	5.0	
			60+	0.0	0.7	-0.1	2.7	
SC01-0004	1.21	1.32	0-30					1* 53 1661
			30-45	0.0	0.0	20.2	20.2	
			45-60	0.7	1.0	5.3	5.7	
			60+	-2.1	2.2	-4.7	5.3	

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

Table 7
Observations meeting data quality criteria for individual freeway validation segments
greater than one mile in the state of South 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+05412	0-30									
	30-45									
	45-60	1	100%	1	100%	0	0%	0	0%	
	60+	545	48%	919	81%	0	0%	564	50%	
									1*	
									1135	
125+05418	0-30									
	30-45									
	45-60	72	34%	187	89%	0	0%	125	60%	
	60+	981	65%	1487	98%	0	0%	1355	89%	
									210	
									1518	
125+05419	0-30									
	30-45	0	0%	2	18%	0	0%	0	0%	
	45-60	394	44%	812	90%	2	0%	586	65%	
	60+	774	63%	1197	97%	0	0%	1065	86%	
									11*	
									898	
									1235	
125+05426	0-30	1	33%	3	100%	0	0%	3	100%	
	30-45	8	18%	23	51%	0	0%	19	42%	
	45-60	47	23%	162	78%	0	0%	103	50%	
	60+	681	63%	1056	98%	2	0%	972	90%	
									3*	
									45	
									207	
									1075	
125-05417	0-30									
	30-45	0	0%	0	0%	0	0%	0	0%	
	45-60	78	35%	200	89%	0	0%	132	58%	
	60+	700	65%	1059	98%	0	0%	972	90%	
									3*	
									226	
									1082	
125-05425	0-30	1	6%	11	69%	0	0%	9	56%	
	30-45	5	17%	14	47%	0	0%	13	43%	
	45-60	17	21%	66	83%	0	0%	50	63%	
	60+	925	61%	1479	97%	0	0%	1274	83%	
									16*	
									30	
									80	
									1528	
SC01-0001	0-30									
	30-45	1	17%	3	50%	0	0%	2	33%	
	45-60	5	23%	17	77%	0	0%	4	18%	
	60+	415	59%	651	93%	0	0%	500	71%	
									6*	
									22*	
									703	
SC01-0002	0-30									
	30-45									
	45-60	120	41%	261	89%	0	0%	134	46%	
	60+	803	69%	1128	97%	0	0%	999	86%	
									292	
									1162	
SC01-0003	0-30									
	30-45	0	0%	2	67%	0	0%	0	0%	
	45-60	97	40%	220	91%	0	0%	129	54%	
	60+	560	69%	785	97%	0	0%	692	85%	
									3*	
									241	
									812	
SC01-0004	0-30									
	30-45	1	100%	1	100%	0	0%	0	0%	
	45-60	35	66%	50	94%	0	0%	24	45%	
	60+	675	41%	1387	84%	3	0%	847	51%	
									1*	
									53	
									1661	

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

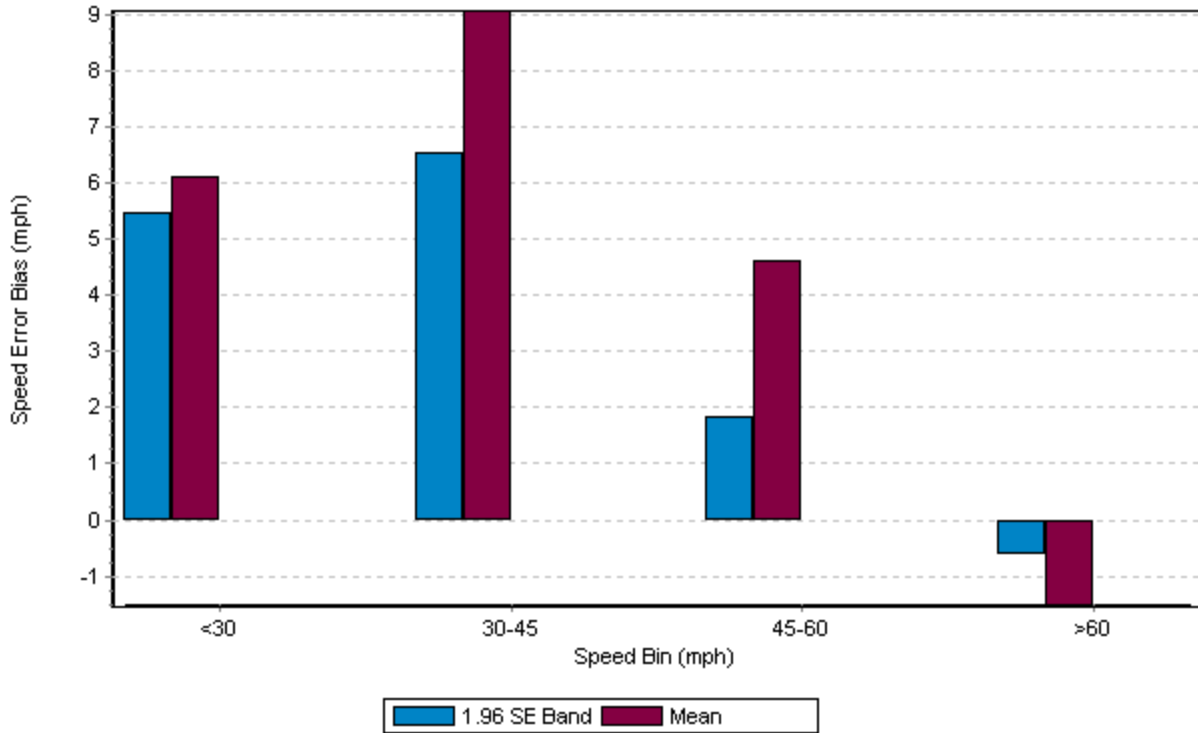


Figure 2
Speed error bias for freeway segments greater than one mile in South Carolina

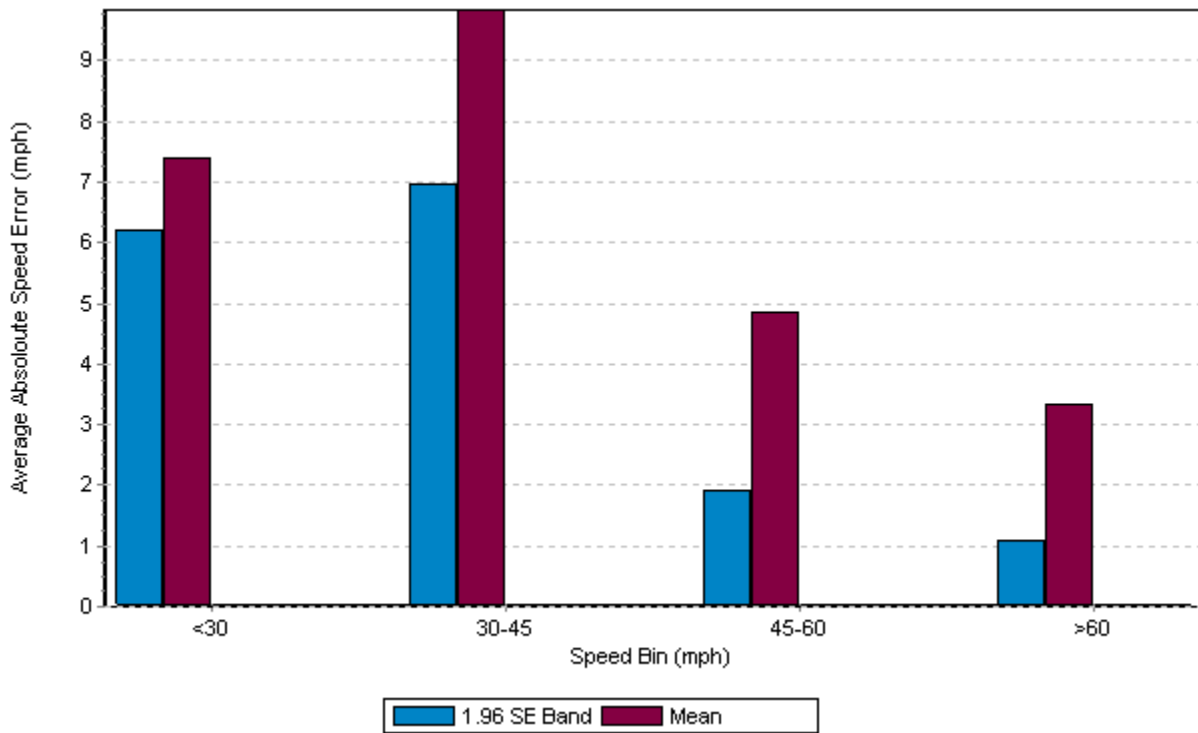


Figure 3
Average absolute speed error for freeway segments greater than one mile in South Carolina