



I-95 Corridor Coalition

I-95 Corridor Coalition Vehicle
Probe Project: Validation of
INRIX Data
Monthly Report
Central Virginia



February 2009

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

Monthly Report

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Evaluation Results for Central Virginia

Summary

Travel time samples were collected along 17 miles of freeways in central Virginia from Tuesday, November 18, 2008 to Monday, December 1, 2008 and compared against travel time and speed data reported by INRIX as part of the I-95 Vehicle Probe project. The validation data represents approximately 730 hours of observations along 10 freeway segments in central Virginia. 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.

Central Virginia Evaluation Summary					
State	Absolute Speed Error (<10mph)		Speed Error Bias (<5mph)		Hours of Data Collection
	Comparison with SEM Band	Comparison with Mean	Comparison with SEM Band	Comparison with Mean	
0-30 MPH	7.00	11.40	4.20	6.80	8.5
30-45 MPH	5.80	10.10	1.40	3.60	9.3
45-60 MPH	1.60	4.00	-0.30	0.10	128.9
> 60 MPH	1.90	4.40	-1.70	-3.60	582.7
All Speeds	1.96	4.48	-1.34	-2.73	729.3
Based upon data collected in November 2008					

Data Collection

Bluetooth sensor deployments in central Virginia started on Tuesday, November 18, 2008. Deployments in central Virginia were performed with the assistance of Virginia Department of Transportation (VDOT) personnel. Sensors remained in the same position until they were retrieved the following week on Monday, December 1, 2008. This round of data collection in Virginia was designed to cover segments of the highways along which both recurrent and non-recurrent congestion 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 central Virginia.

The coordinates of the locations at which the Bluetooth sensors were deployed throughout the state of Virginia are reported in Table 2, which also presents the distances that have been used in the estimation of Bluetooth speeds based on travel times. Table 1 presents a list of specific TMC segments that were selected as the validation sample in central Virginia. In total, results of validation on ten freeway TMC segments are reported in this report. These segments cover a total length of 17 miles.

Analysis of Results

Table 3 summarizes the data quality measures obtained as a result of comparison between Bluetooth and all reported INRIX speeds, including all confidence scores. In all speed bins, INRIX data passes the data quality measures set forth by the contract when errors are measured as a distance from the 1.96 times the standard error band.

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 TMCs in central Virginia. Tables 5 and 6 present detailed data for individual TMC segments in central Virginia in similar format as Tables 3 and 4, respectively

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

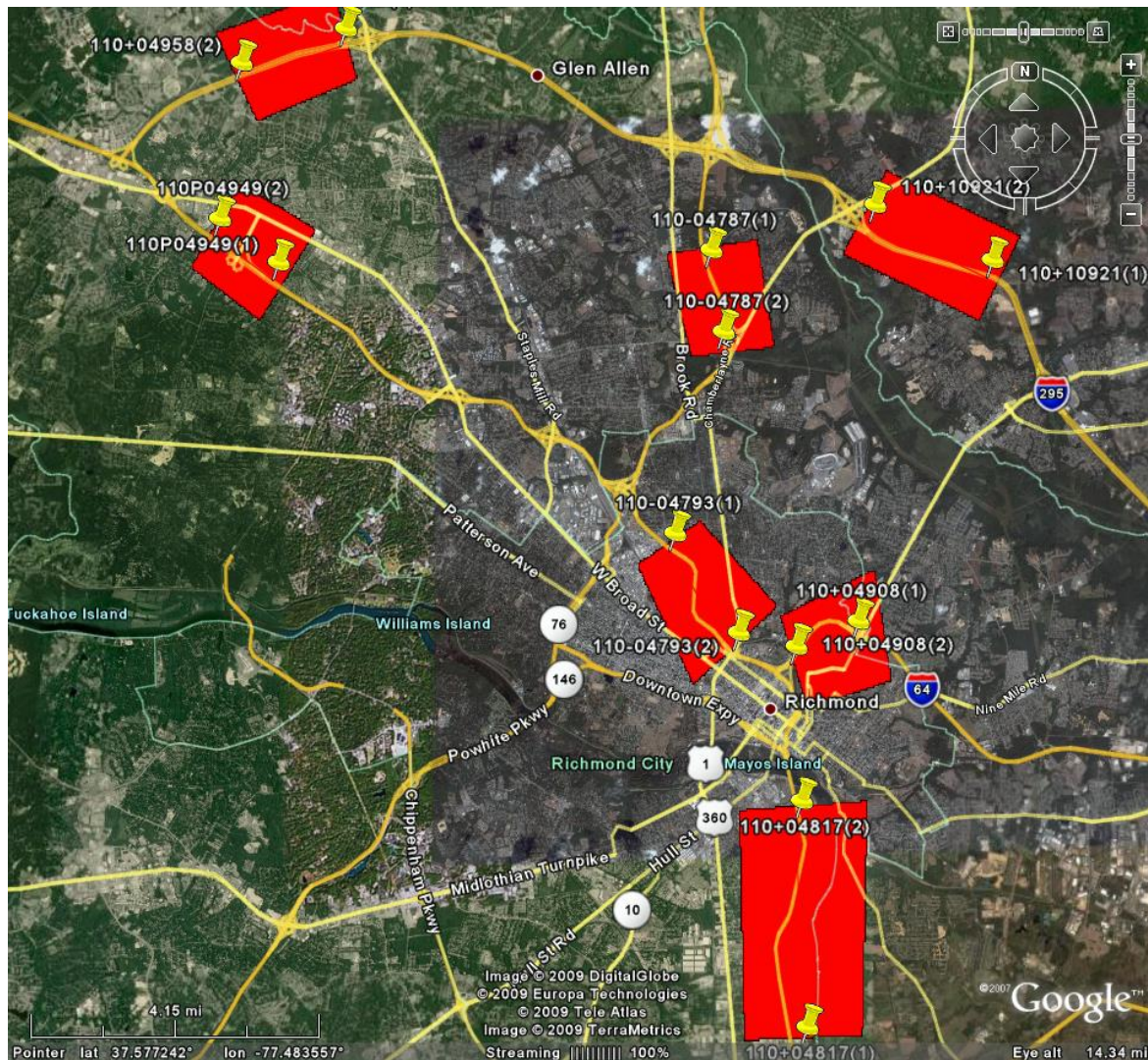


Figure 1
TMC segments selected for validation in Central Virginia

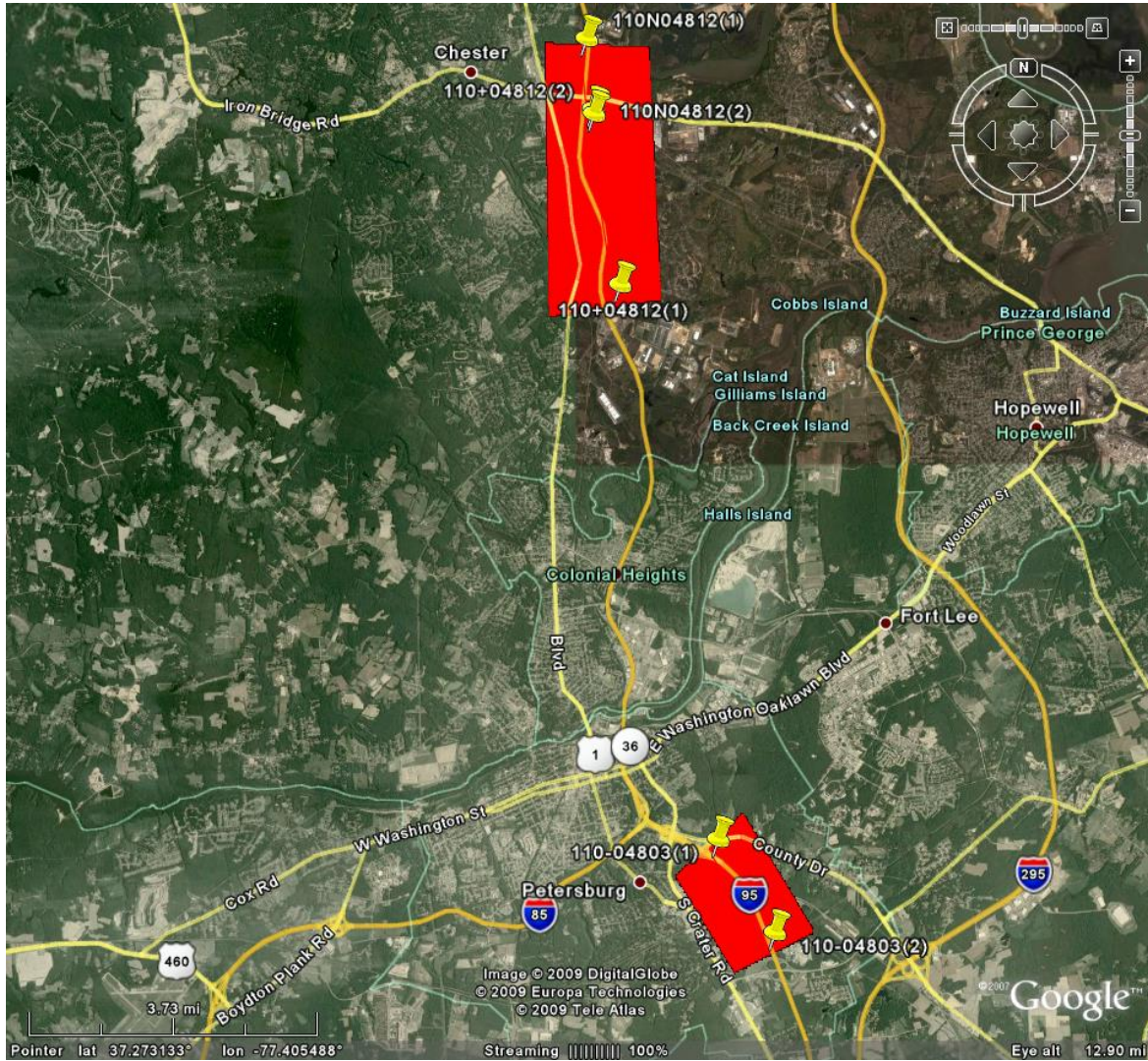


Figure 1 (Cont'd)
TMC segments selected for validation in Central Virginia

Table 1
Traffic Message Channel segments picked for validation in Central Virginia

TYPE	TMC	HIGHWAY	STARTING AT	ENDING AT	COUNTY	DIRECTION	LENGTH (mile)
Freeway	110+04908	I 64	US 360/EXIT 192	I 95/EXIT 190	RICHMOND	WESTBOUND	1.2
Freeway	110+04958	I 295	US 33/EXIT 49	NUCKOLS RD/EXIT 51	HENRICO	NORTHBOUND	1.6
Freeway	110-04793	I 64/I 95	HERMITAGE RD/EXIT 78	US 1/US 301/N BELVIDERE ST/EXIT 76	RICHMOND	SOUTHBOUND	1.9
Freeway	110P04949	I 64	GASKINS RD/EXIT 180	GASKINS RD/EXIT 180	HENRICO	WESTBOUND	1.1
Freeway	110N04812	I 95	HWY 10/EXIT 61	HWY 10/EXIT 61	CHESTERFIELD	SOUTHBOUND	1.0
Freeway	110-04787	I 95	PARHAM RD/EXIT 83	US 301/CHAMBERLAYNE RD/EXIT 82	HENRICO	SOUTHBOUND	1.2
Freeway	110+04812	I 95	EXIT 58	HWY 10/EXIT 61	CHESTERFIELD	NORTHBOUND	2.4
Freeway	110+04817	I 95	EXIT 69	MAURY ST/EXIT 73	RICHMOND	NORTHBOUND	3.4
Freeway	110-04803	I 95	US 460 BUS/COUNTY DR/EXIT 50	WAGNER RD/EXIT 48	PETERSBURG	SOUTHBOUND	1.4
Freeway	110+10921	I 295	MEADOWBRIDGE RD/POLE GREEN RD/EXIT 38	US 301/HWY 2/CHAMBERLAYNE RD	HANOVER	NORTHBOUND	1.9
TOTAL							17.0

Table 2
TMC segment lengths and distances between sensor deployment locations in Central Virginia

SEGMENT TYPE	TMC	STANDARD TMC					SENSOR DEPLOYMENT					ERROR IN SEGMENT LENGTH (%)
		Endpoint (1)		Endpoint (2)		Length	Endpoint (1)		Endpoint (2)		Length	
		Lat	Long	Lat	Long	(mile)	Lat	Long	Lat	Long	(mile)	
Freeway	110+04908	37.55537	-77.41215	37.55007	-77.42850	1.18	37.5576	-77.4126	37.5508	-77.4289	1.19	1.2
Freeway	110+04958	37.67919	-77.54737	37.67198	-77.57488	1.59	37.6799	-77.5475	37.6731	-77.5751	1.59	0.0
Freeway	110-04793	37.57373	-77.46044	37.55294	-77.44368	1.89	37.5729	-77.4586	37.5518	-77.4423	1.89	-0.3
Freeway	110P04949	37.63029	-77.56501	37.63940	-77.58050	1.06	37.6301	-77.5644	37.6391	-77.5807	1.09	3.0
Freeway	110N04812	37.36225	-77.40530	37.34813	-77.40355	1.01	37.3614	-77.4040	37.3485	-77.4057	0.89	-11.7
Freeway	110-04787	37.63292	-77.45094	37.61586	-77.44770	1.21	37.6330	-77.4510	37.6167	-77.4446	1.20	-0.6
Freeway	110+04812	37.31607	-77.39739	37.34896	-77.40371	2.36	37.3168	-77.4004	37.3481	-77.4052	2.23	-5.3
Freeway	110+04817	37.47050	-77.42560	37.51783	-77.42707	3.38	37.4707	-77.4283	37.5175	-77.4259	3.32	-1.6
Freeway	110-04803	37.21206	-77.37436	37.19452	-77.36102	1.44	37.2109	-77.3728	37.1953	-77.3601	1.31	-9.6
Freeway	110+10921	37.63087	-77.37677	37.64240	-77.40771	1.87	37.6319	-77.3770	37.6406	-77.4080	1.82	-2.5
TOTAL						16.98						16.53

Table 3
Data quality measures for freeway segments greater than one mile in Central Virginia

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	4.2	7.0	6.8	11.4	102
30-45	1.4	5.8	3.6	10.1	111
45-60	-0.3	1.6	0.1	4.0	1547
60+	-1.7	1.9	-3.6	4.4	6992

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

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	25%	51%	0%	30%	102
30-45	30%	60%	0%	35%	111
45-60	58%	91%	0%	74%	1547
60+	48%	88%	0%	64%	6992

Table 5
Data quality measures for individual freeway segments greater than one mile in Central Virginia

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		
110+04812	2.36	2.23	0-30					103	
			30-45				892		
			45-60	0.9	1.1	2.1			3.4
			60+	-1.0	1.3	-2.4			3.5
110+04817	3.38	3.32	0-30						5
			30-45	-1.8	8.4	-1.6	9.6		
			45-60	1.5	1.8	3.0	3.9		
			60+	-1.9	2.1	-3.6	4.2		
110+04908	1.18	1.19	0-30	5.0	8.6	8.2	14.1	56	
			30-45	-0.4	8.1	2.2	13.8		
			45-60	-1.2	2.1	-1.5	4.4		
			60+	-3.3	3.3	-6.0	6.3		
110+04958	1.59	1.59	0-30					1	
			30-45						
			45-60	0.0	0.0	9.5	9.5		
			60+	-0.7	0.9	-2.1	3.6		
110+10921	1.87	1.82	0-30					1	
			30-45						
			45-60	0.0	0.0	5.1	5.1		
			60+	-1.2	1.4	-3.0	3.8		
110-04787	1.21	1.20	0-30	-1.8	4.9	-2.2	6.5	9	
			30-45	19.6	19.6	23.3	23.3		
			45-60	1.2	1.2	6.9	6.9		
			60+	-1.8	1.9	-3.8	4.7		
110-04793	1.89	1.89	0-30	2.1	3.0	4.0	5.9	31	
			30-45	2.3	3.0	4.4	6.7		
			45-60	0.2	1.1	0.5	3.4		
			60+	-1.8	1.9	-3.7	4.7		
110-04803	1.44	1.31	0-30					211	
			30-45						
			45-60	0.2	1.1	1.3	3.3		
			60+	-1.4	1.5	-3.8	4.3		
110N04812	1.01	0.89	0-30					87	
			30-45						
			45-60	0.4	1.1	2.2	4.3		
			60+	-1.7	1.9	-3.6	4.8		
110P04949	1.06	1.09	0-30	16.5	16.5	21.5	21.5	6	
			30-45	4.4	13.0	5.0	16.4		
			45-60	-3.8	5.5	-2.8	8.6		
			60+	-1.7	2.0	-3.6	4.9		

Table 6
Observations meeting data quality criteria for individual freeway segments greater than
one mile in Central Virginia

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	
110+04812	0-30									
	30-45									
	45-60	59	57%	97	94%	0	0%	77	75%	
	60+	493	55%	825	92%	0	0%	667	75%	
110+04817	0-30									
	30-45	0	0%	2	40%	0	0%	2	40%	
	45-60	21	42%	44	88%	0	0%	39	78%	
	60+	537	38%	1240	87%	0	0%	924	65%	
110+04908	0-30	9	16%	24	43%	0	0%	12	21%	
	30-45	10	26%	18	46%	0	0%	6	15%	
	45-60	312	54%	506	87%	0	0%	421	72%	
	60+	166	31%	416	77%	0	0%	244	45%	
110+04958	0-30									
	30-45									
	45-60	1	100%	1	100%	0	0%	0	0%	
	60+	86	62%	130	94%	0	0%	105	76%	
110+10921	0-30									
	30-45									
	45-60	1	100%	1	100%	0	0%	0	0%	
	60+	538	53%	929	91%	0	0%	708	69%	
110-04787	0-30	1	11%	4	44%	0	0%	3	33%	
	30-45	0	0%	0	0%	0	0%	0	0%	
	45-60	5	71%	6	86%	0	0%	2	29%	
	60+	550	48%	992	87%	0	0%	696	61%	
110-04793	0-30	14	45%	23	74%	0	0%	15	48%	
	30-45	22	37%	46	78%	0	0%	30	51%	
	45-60	285	60%	451	95%	0	0%	364	76%	
	60+	46	41%	96	86%	0	0%	64	58%	
110-04803	0-30									
	30-45									
	45-60	135	64%	196	93%	0	0%	172	82%	
	60+	297	54%	500	90%	0	0%	367	66%	
110N04812	0-30									
	30-45									
	45-60	61	70%	82	94%	0	0%	56	64%	
	60+	320	55%	509	88%	0	0%	357	62%	
110P04949	0-30	1	17%	1	17%	0	0%	1	17%	
	30-45	1	14%	1	14%	0	0%	1	14%	
	45-60	12	40%	24	80%	0	0%	10	33%	
	60+	321	55%	514	88%	0	0%	371	63%	

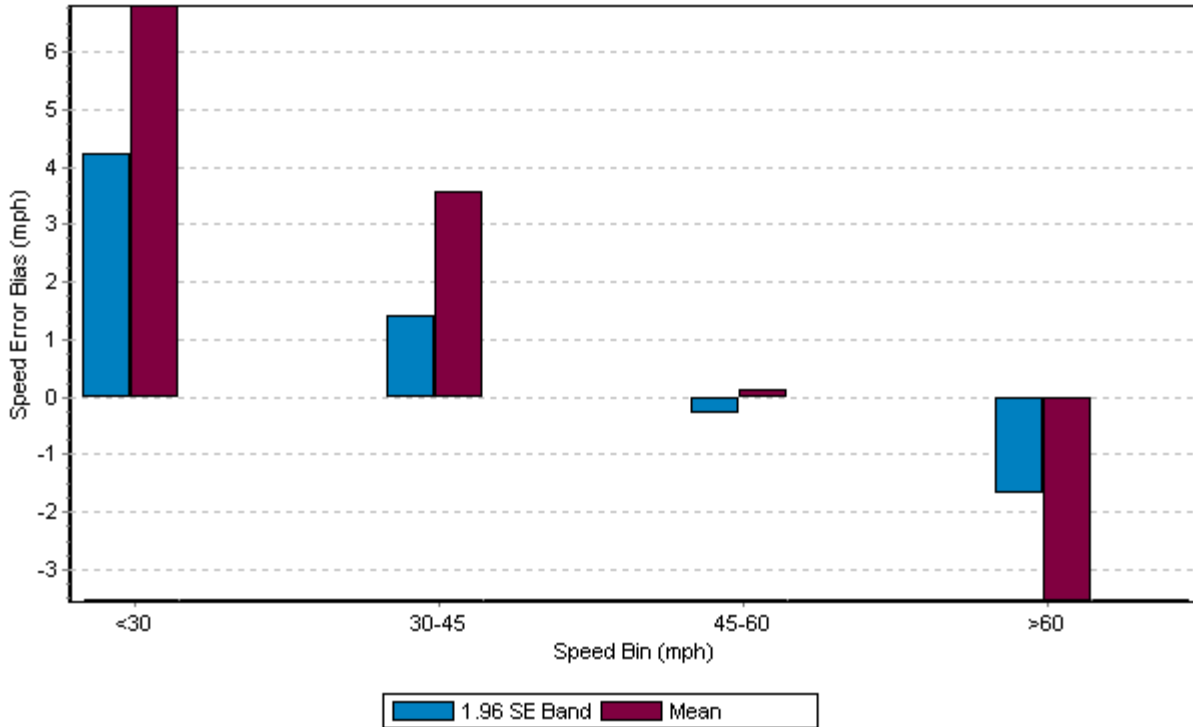


Figure 2
Speed error bias for freeway segments greater than one mile in Central Virginia

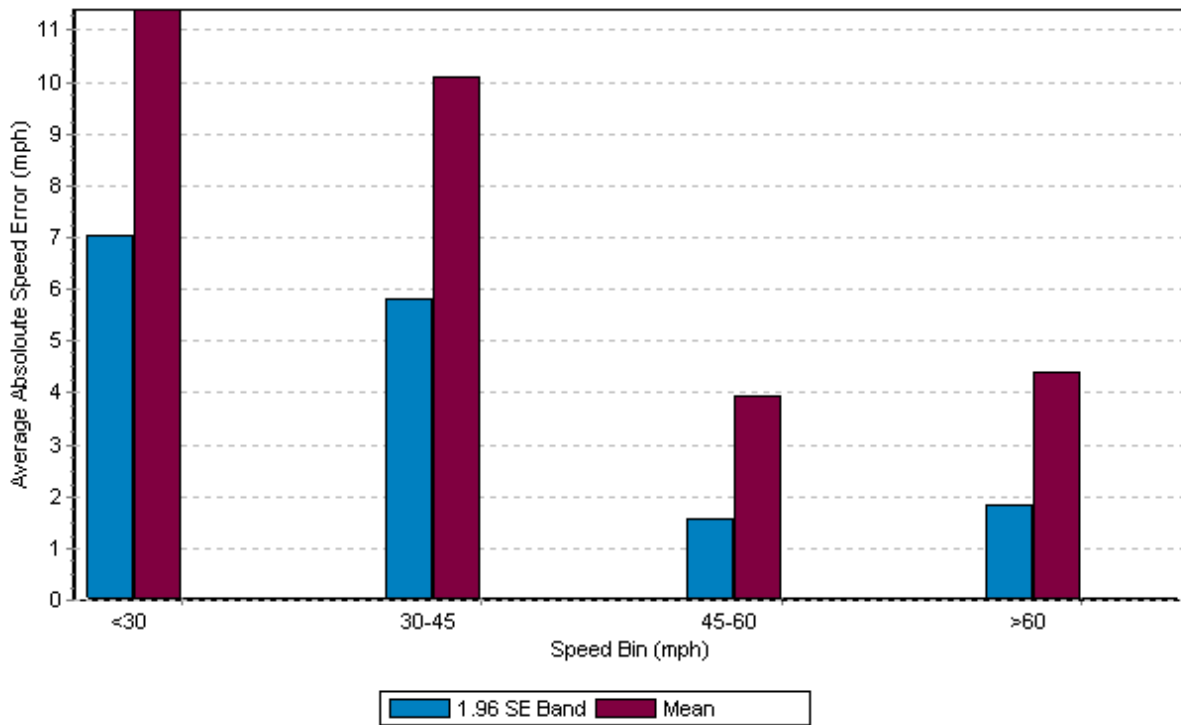


Figure 3
Average absolute speed error for freeway segments greater than one mile in Central Virginia