I-95 Corridor Coalition

I-95 Corridor Coalition Vehicle Probe Project: Validation of INRIX Data

Monthly Report

Delaware

I-95 CORRIDOR COALITION

May 2009

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

Monthly Report

Prepared for:

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Sponsored by:

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May 2009

Evaluation Results for the State of Delaware

Summary

Travel time samples were collected along approximately 15 miles of freeways in Delaware from Tuesday, February 3, 2008 to Saturday, February 14, 2009 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 790 hours of observations along 10 freeway segments in Delaware. The table below summarizes the result of the comparison between the validation data and the INRIX data for the same period. The average absolute speed error (AASE) and the speed error bias (SEB) fall outside contract specification for the 0 to 30mph speed bin as measured against the SEM band, and the SEB is slightly over spec in the 30-45 mph speed bin. These results will be used in combination with validation results from other states to assess overall quality on an on-going basis.

Delaware 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	12.00	13.40	9.40	10.10	8.6
30-45 MPH	7.60	10.50	5.60	7.80	7.7
45-60 MPH	1.90	4.30	-0.50	-0.50	215.8
> 60 MPH	2.70	5.70	-2.50	-5.00	559.0
All Speeds	2.63	5.45	-1.75	-3.48	791.0
Based upon data collected in February 2009					

Data Collection

Bluetooth sensor deployments in Delaware started on Tuesday, February 3, 2009. The actual deployments in Delaware were performed with the assistance of Delaware Department of Transportation (DelDOT) personnel. Sensors remained in the same position until they were retrieved the following week on Saturday, February 14, 2009. This round of data collection in Delaware 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 Delaware.

Table 1 presents a list of specific TMC segments that were selected as the validation sample in Delaware. In total, results of validation on ten freeway TMC segments are reported in this document. These segments cover a total length of over 15 miles. The coordinates of the locations at which the Bluetooth sensors were deployed throughout the state of Delaware 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 speed bins over 45 mph, INRIX data passes 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. INRIX speeds do not meet the requirements of the contract in the two slowest speed bins. One should note that in 30 to 45 mph speed bin, error in INRIX data is just slightly over the acceptable 5 mph speed error bias criterion.

Table 4 shows the percentage of time intervals that fall within 5 mph of the SEM band and the mean for each speed bin for all TMCs in Delaware. Tables 5 and 6 present detailed data for individual TMC segments in Delaware 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 Delaware, respectively. These figures correspond to Table 3.

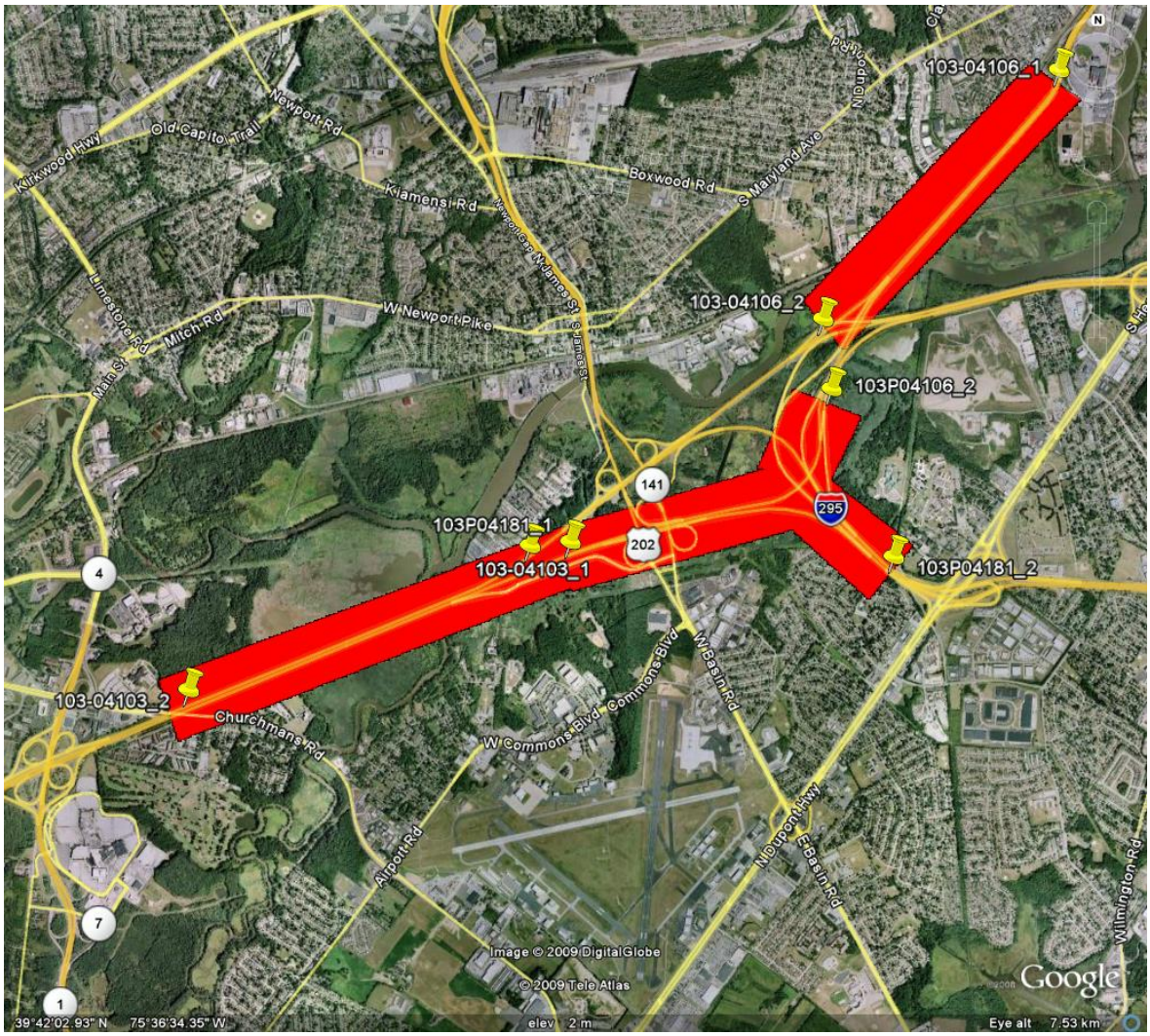

Figure 1
TMC segments selected for validation in Delaware

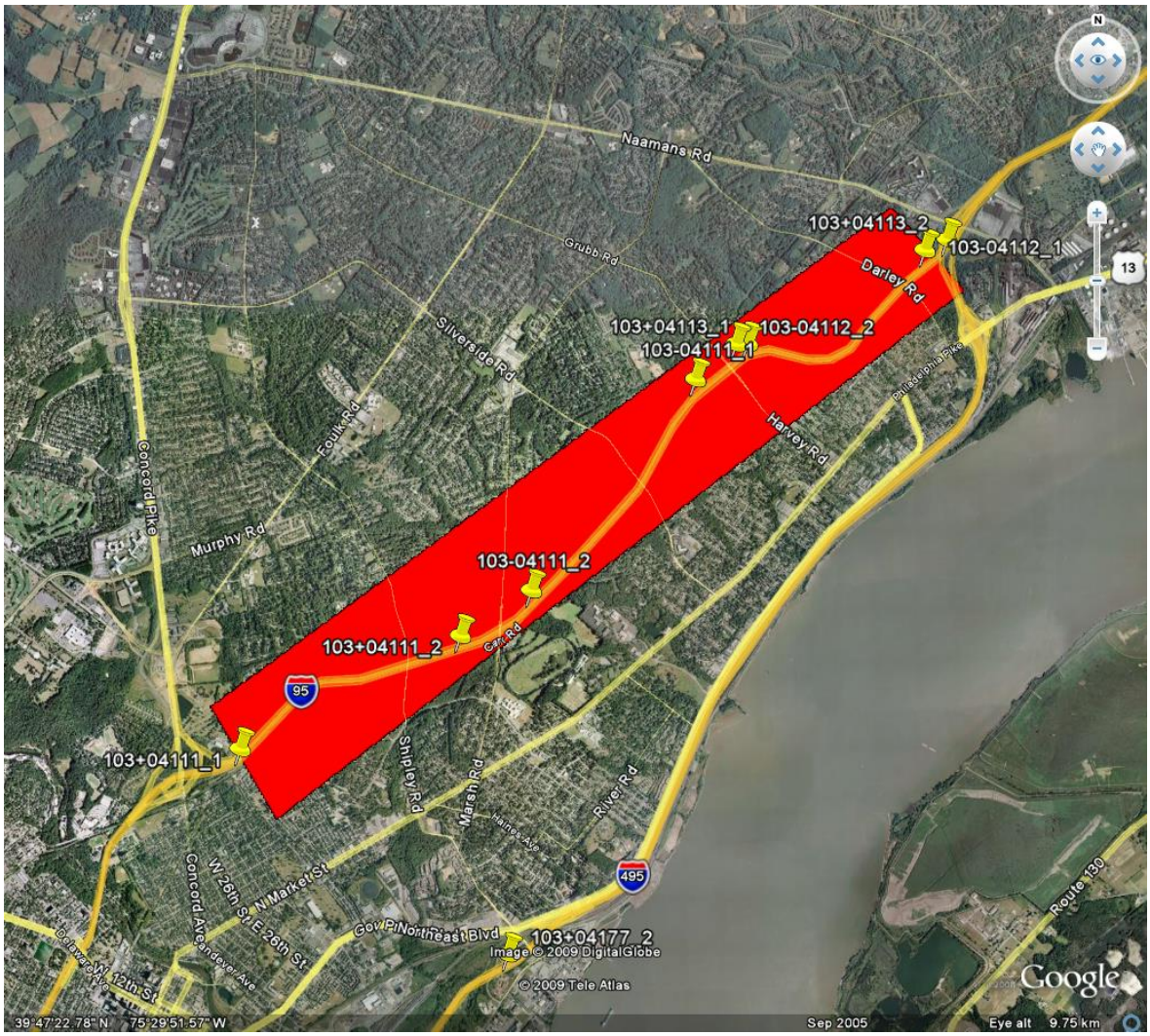

Figure 1 (Cont'd)
TMC segments selected for validation in Delaware

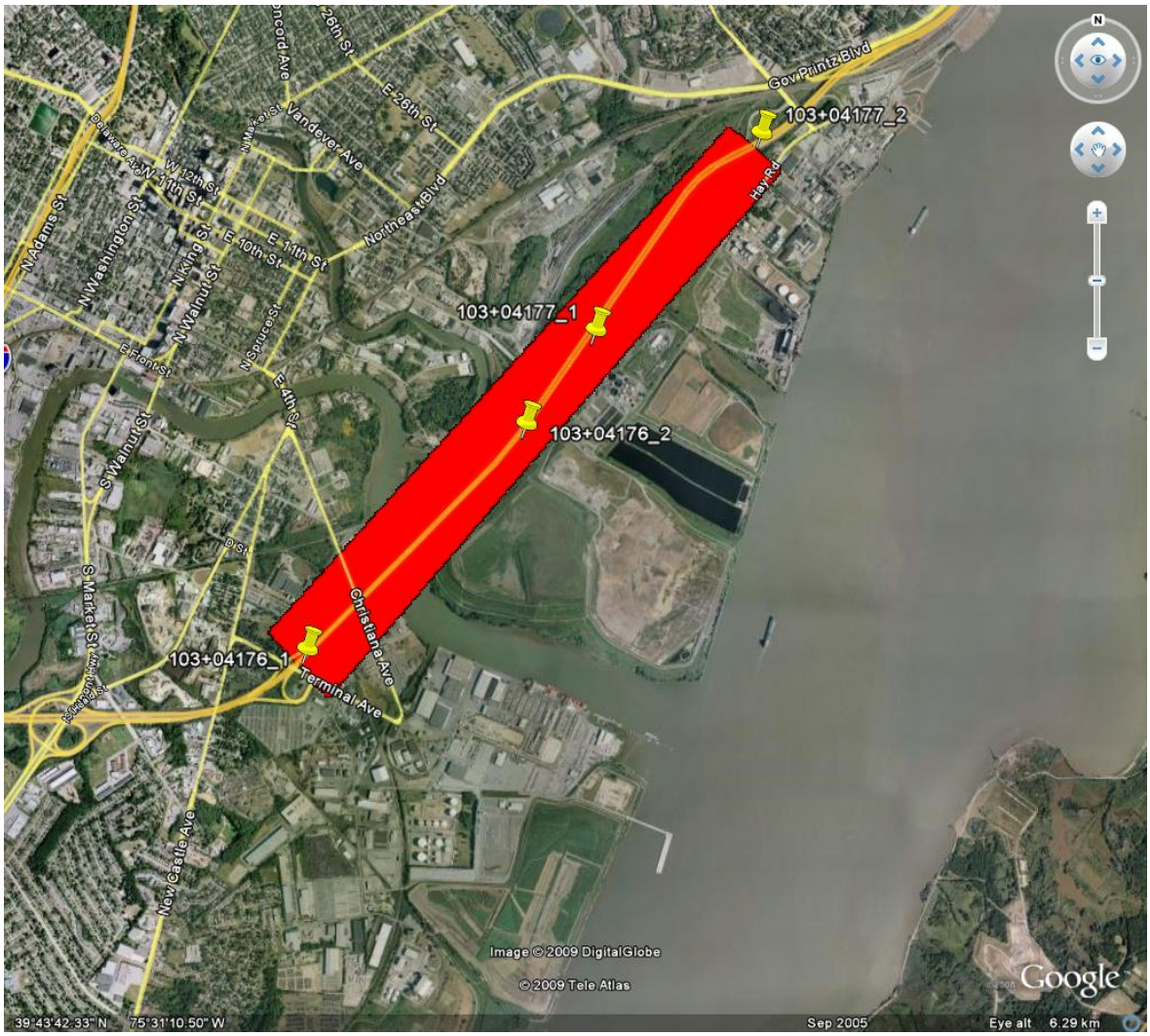

Figure 1 (Cont'd)
TMC segments selected for validation in Delaware

Table 1
Traffic Message Channel segments picked for validation in Delaware

TYPE	TMC	HIGHWAY	STARTING AT	ENDING AT	COUNTY	DIRECTION	LENGTH (mile)
Freeway	**103P04181**	I 295	I 295/I 495/EXIT 5	I 95	NEW CASTLE	NORTHBOUND	1.6
Freeway	**103-04106**	I 95	HWY 4/MARYLAND AVE/6TH AVE/EXIT 6	I 295/I 495/EXIT 5	NEW CASTLE	SOUTHBOUND	1.7
Freeway	**103-04103**	I 95	EXIT 5A	HWY 58/EXIT 4	NEW CASTLE	SOUTHBOUND	1.8
Freeway	**103-04111**	I 95	HARVEY RD/EXIT 10	HWY 3/MARSH RD/EXIT 9	NEW CASTLE	SOUTHBOUND	1.6
Freeway	**103-04112**	I 95	I 495/HWY 92/NAAMANS RD/EXIT 11	HARVEY RD/EXIT 10	NEW CASTLE	SOUTHBOUND	1.5
Freeway	**103+04111**	I 95	US 202/CONCORD PIKE/EXIT 8	HWY 3/MARSH RD/EXIT 9	NEW CASTLE	NORTHBOUND	1.6
Freeway	**103+04177**	I 495	12TH ST/EXIT 3	HWY 3/EDGEMOOR RD/EXIT 4	NEW CASTLE	NORTHBOUND	1.0
Freeway	**103+04176**	I 495	TERMINAL AVE/EXIT 2	12TH ST/EXIT 3	NEW CASTLE	NORTHBOUND	1.3
Freeway	**103P04106**	I 95	I 295/I 495/EXIT 5	I 295/I 495/EXIT 5	NEW CASTLE	NORTHBOUND	1.7
Freeway	**103+04113**	I 95	HARVEY RD/EXIT 10	I 495/HWY 92/NAAMANS RD/EXIT 11	NEW CASTLE	NORTHBOUND	1.5
TOTAL							**15.3**

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

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	**103P04181**	39.69800	-75.61110	39.69578	-75.58322	1.59	39.69809	-75.61043	39.69707	-75.58169	1.66	4.0%
Freeway	**103-04106**	39.73726	-75.56411	39.71573	-75.58032	1.70	39.73035	-75.56701	39.71335	-75.58795	1.62	-4.6%
Freeway	**103-04103**	39.69994	-75.61057	39.68859	-75.64184	1.85	39.69783	-75.61401	39.68797	-75.64432	1.75	-5.2%
Freeway	**103-04111**	39.79982	-75.48416	39.78355	-75.50456	1.62	39.80051	-75.48438	39.78182	-75.50334	1.65	1.4%
Freeway	**103-04112**	39.81196	-75.45768	39.80323	-75.47981	1.45	39.81194	-75.45790	39.80363	-75.47969	1.42	-2.1%
Freeway	**103+04111**	39.76792	-75.53703	39.77772	-75.51188	1.56	39.76778	-75.53693	39.77780	-75.51152	1.58	1.3%
Freeway	**103+04177**	39.73818	-75.51876	39.74881	-75.50624	1.02	39.73832	-75.51841	39.74956	-75.50609	1.04	2.0%
Freeway	**103+04176**	39.71992	-75.54075	39.73380	-75.52397	1.31	39.72009	-75.53986	39.73296	-75.52358	1.24	-5.3%
Freeway	**103P04106**	39.69800	-75.61110	39.70902	-75.58538	1.74	39.69809	-75.61043	39.70857	-75.58719	1.58	-9.4%
Freeway	**103+04113**	39.80329	-75.47966	39.81223	-75.45701	1.48	39.80370	-75.47835	39.81286	-75.45533	1.50	1.5%
TOTAL						**15.33**					**15.04**	

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

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	9.4	12.0	10.1	13.4	103
30-45	5.6	7.6	7.8	10.5	92
45-60	-0.5	1.9	-0.5	4.3	2589
60+	-2.5	2.7	-5.0	5.7	6708

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

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%	36%	0%	28%	103
30-45	13%	39%	0%	22%	92
45-60	48%	87%	0%	68%	2589
60+	39%	78%	0%	50%	6708

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

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	
103+04111	1.56	1.58	0-30					
			30-45	5.7	5.7	7.2	7.2	10
			45-60	-0.1	0.9	-0.4	3.4	134
			60+	-3.1	3.2	-6.2	6.6	636
103+04113	1.48	1.50	0-30					
			30-45	6.7	6.7	18.5	18.5	1
			45-60	0.3	1.3	0.7	3.8	111
			60+	-3.4	3.5	-6.4	6.8	680
103+04176	1.31	1.24	0-30					
			30-45	5.7	5.7	10.5	10.5	2
			45-60	1.0	1.0	4.2	5.5	49
			60+	-2.6	2.7	-5.6	6.1	919
103+04177	1.02	1.04	0-30					
			30-45					
			45-60	2.5	2.5	5.8	6.1	34
			60+	-0.8	1.3	-2.1	4.2	629
103-04103	1.85	1.75	0-30	-6.0	7.1	-6.9	9.3	10
			30-45	-2.3	4.2	0.4	8.9	19
			45-60	-0.4	1.6	0.2	4.3	133
			60+	-3.4	3.5	-6.0	6.3	1246
103-04106	1.70	1.62	0-30	8.1	9.8	8.9	11.1	67
			30-45	10.2	11.4	11.5	13.5	34
			45-60	0.6	1.8	1.5	3.8	249
			60+	-1.2	1.4	-2.8	3.7	511
103-04111	1.62	1.65	0-30					
			30-45	8.5	8.5	10.2	10.2	1
			45-60	0.1	1.0	0.3	3.4	135
			60+	-2.5	2.6	-5.2	5.8	586
103-04112	1.45	1.42	0-30					
			30-45	5.1	5.1	16.6	16.6	2
			45-60	0.1	0.7	0.2	3.0	353
			60+	-2.7	2.9	-5.2	5.9	468
103P04106	1.74	1.58	0-30					
			30-45					
			45-60	-0.1	1.7	0.2	3.8	115
			60+	-2.1	2.2	-4.1	4.8	949
103P04181	1.59	1.66	0-30	18.9	19.5	19.5	21.0	26
			30-45	5.4	5.9	7.0	8.0	23
			45-60	-1.3	2.6	-1.8	4.9	1276
			60+	-4.9	4.9	-7.5	7.5	84

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

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	
103+04111	0-30									
	30-45	1	10%	5	50%	0	0%	3	30%	10
	45-60	82	61%	129	96%	0	0%	109	81%	134
	60+	186	29%	459	72%	0	0%	227	36%	636
103+04113	0-30									
	30-45	0	0%	0	0%	0	0%	0	0%	1
	45-60	63	57%	104	94%	0	0%	82	74%	111
	60+	190	28%	480	71%	0	0%	226	33%	680
103+04176	0-30									
	30-45	0	0%	1	50%	0	0%	0	0%	2
	45-60	31	63%	45	92%	0	0%	25	51%	49
	60+	397	43%	713	78%	0	0%	438	48%	919
103+04177	0-30									
	30-45									
	45-60	18	53%	27	79%	0	0%	13	38%	34
	60+	382	61%	573	91%	3	0%	429	68%	629
103-04103	0-30	1	10%	4	40%	0	0%	3	30%	10
	30-45	6	32%	13	68%	0	0%	6	32%	19
	45-60	70	53%	120	90%	0	0%	91	68%	133
	60+	375	30%	900	72%	0	0%	551	44%	1246
103-04106	0-30	12	18%	29	43%	0	0%	23	34%	67
	30-45	0	0%	4	12%	0	0%	2	6%	34
	45-60	121	49%	220	88%	0	0%	184	74%	249
	60+	263	51%	473	93%	0	0%	379	74%	511
103-04111	0-30									
	30-45	0	0%	0	0%	0	0%	0	0%	1
	45-60	76	56%	130	96%	0	0%	102	76%	135
	60+	221	38%	452	77%	1	0%	272	46%	586
103-04112	0-30									
	30-45	0	0%	1	50%	0	0%	0	0%	2
	45-60	242	69%	343	97%	0	0%	287	81%	353
	60+	158	34%	349	75%	0	0%	208	44%	468
103P04106	0-30									
	30-45									
	45-60	65	57%	101	88%	0	0%	88	77%	115
	60+	399	42%	794	84%	0	0%	565	60%	949
103P04181	0-30	2	8%	4	15%	0	0%	3	12%	26
	30-45	5	22%	12	52%	0	0%	9	39%	23
	45-60	465	36%	1034	81%	0	0%	780	61%	1276
	60+	21	25%	45	54%	0	0%	30	36%	84

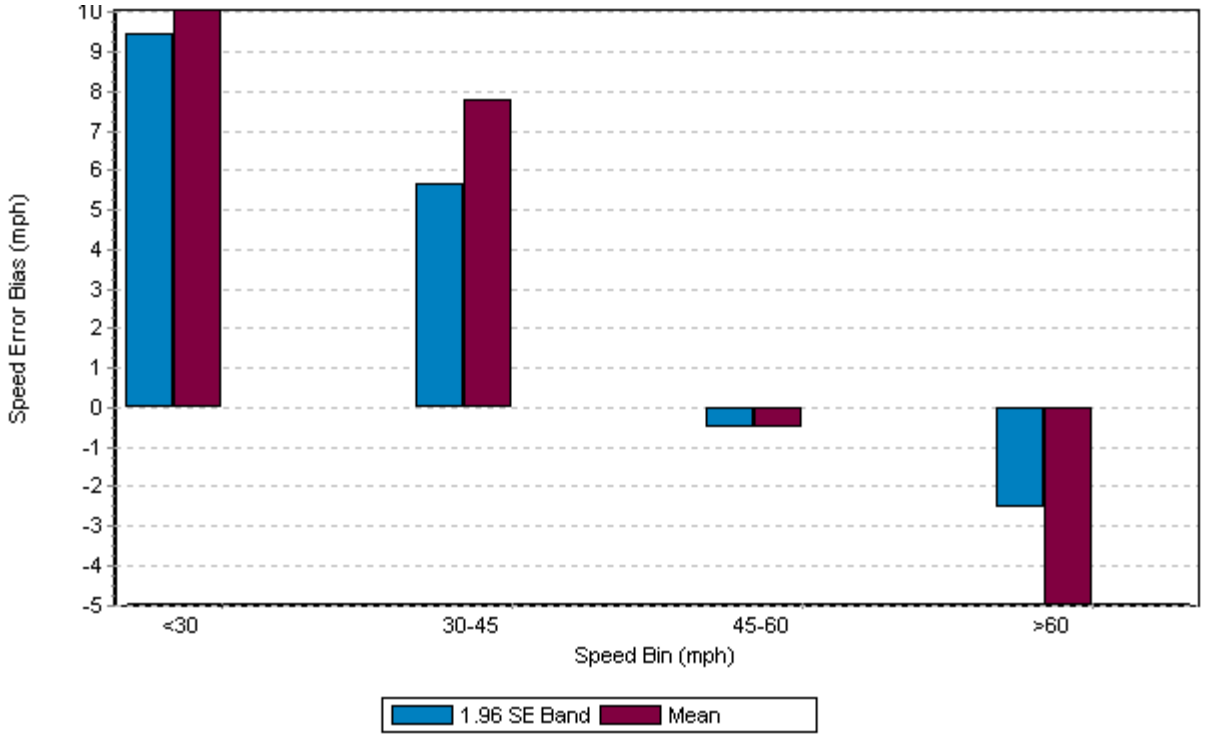

Figure 2
Speed error bias for freeway segments greater than one mile in Delaware

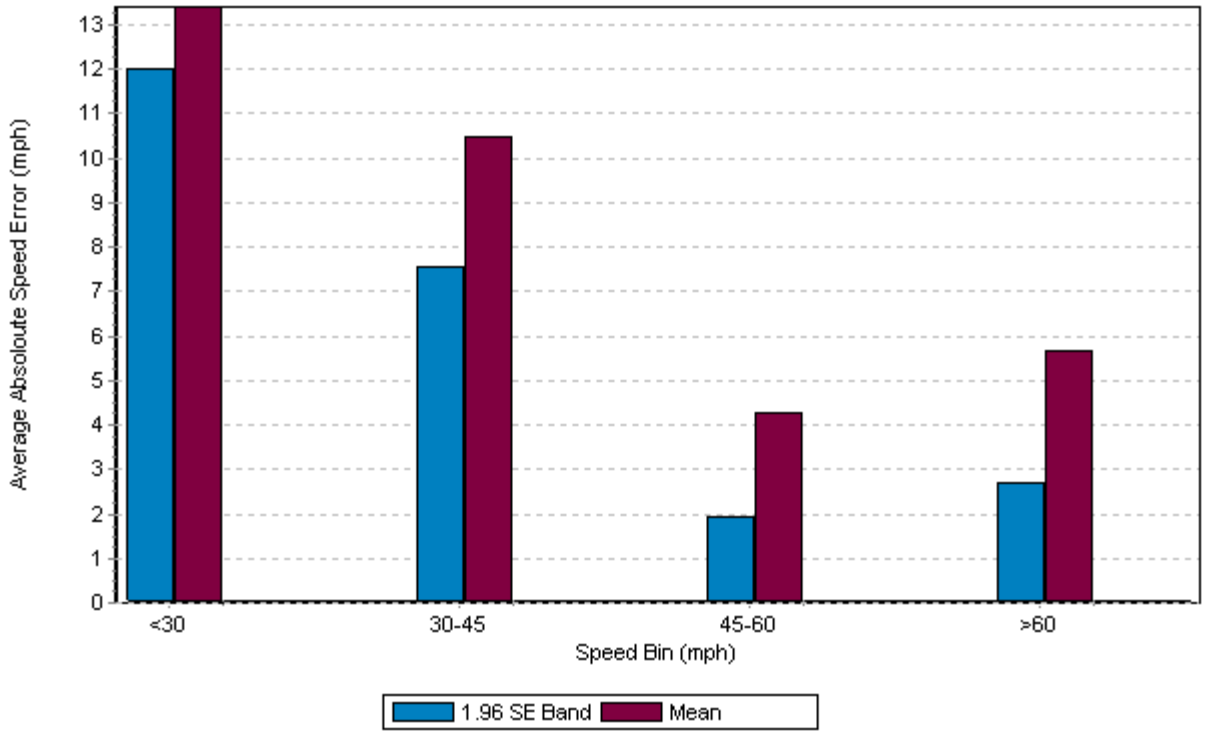

Figure 3
Average absolute speed error for freeway segments greater than one mile in Delaware