



I-95 Corridor Coalition

I-95 Corridor Coalition Vehicle
Probe Project: Validation of
INRIX Data
Monthly Report
New Jersey



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 New Jersey

Summary

Travel time samples were collected along 63 miles of the southern section of the New Jersey Turnpike from Wednesday, June 3, 2009 to Tuesday, June 16, 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 1870 hours of observations along ten freeway segments in southern New Jersey. These segments are relatively long in comparison to the typical segment length for the project as a whole. The segments in this analysis range in length from 3.7 to 12.9 miles. Only 5% of all segments in the project are as long as the shortest segment in this analysis (3.7 miles). The table below summarizes the results 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 for the 45 – 60 MPH bin and the > 60 MPH bin. The data in the 0-30 MPH bin and 30 – 45 MPH bin were of minimal quantity as compared to validation in previous states. The data that was collected in these lower speed bins did not meet the data quality specifications. The data observed in these lower speed bins came from a small number of congestion events all of which were less than an hour in duration. As noted in the detailed results, "... while the total number of observations in the low speed bins across all TMC segments are reasonable ..., the number of observations in low speed bins for many of the individual TMC segments are low." "In speed bins above 45 mph, the quality of INRIX data has been satisfactory." Although these results are of concern and are being studied further, they will not have a significant impact the overall quality metrics due to the small sample size.

(Note: INRIX commented that sampled vehicle speeds along longer segments can result in greater variable in reported speeds, particularly during short duration congestion events where it is likely that only a portion of the long segment actually contains the slowdown. Processing speeds with a wide variance is a challenge and results from this test are being used to improve processing algorithms on longer segments.)

NJ Turnpike 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	20.10	21.00	19.10	19.70	26	2.2
30-45 MPH	16.20	17.80	10.80	11.80	51	4.3
45-60 MPH	3.90	7.10	1.40	3.50	254	21.2
> 60 MPH	2.80	5.20	-2.70	-4.70	22084	1840.3
All Speeds	2.86	5.27	-2.60	-4.54	22415	1867.9

Based upon data collected in June 2009

Data Collection

Bluetooth sensor deployments along the New Jersey Turnpike started on Wednesday, June 3, 2009. The actual deployments in New Jersey were performed with the assistance of New Jersey Department of Transportation (NJDOT) personnel. Sensors remained in the same position until they were retrieved two weeks later on Tuesday, June 16, 2009. This round of data collection in New Jersey 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 New Jersey.

Table 1 presents a list of specific TMC segments that were selected as the validation sample in New Jersey. In total, results of validation on ten freeway TMC segments are reported in this document. These segments cover a total length of about 63 miles. The coordinates of the locations at which the Bluetooth sensors were deployed throughout the state of New Jersey are reported in Table 2 that 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 less than 45 mph speed bins, 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 while the total number of observations in the low speed bins across all TMC segments are reasonable, as Table 5 indicates, the number of observations in low speed bins for many of the individual TMC segments are low. In speed bins above 45 mph, the quality of INRIX data has been satisfactory.

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 New Jersey. Tables 5 and 6 present detailed data for individual TMC segments in New Jersey 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 New Jersey, respectively. These figures correspond to Table 3.

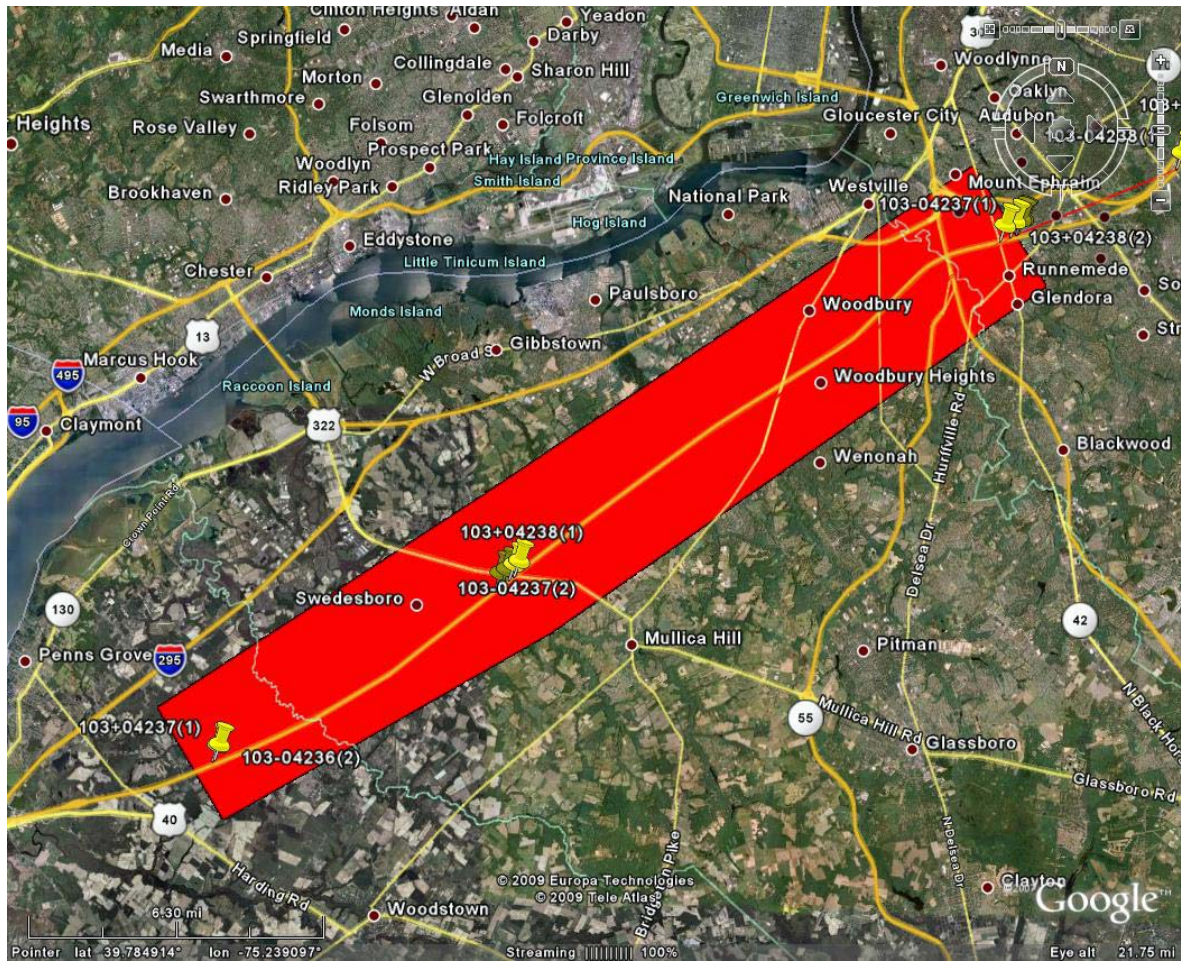


Figure 1
TMC segments selected for validation in New Jersey

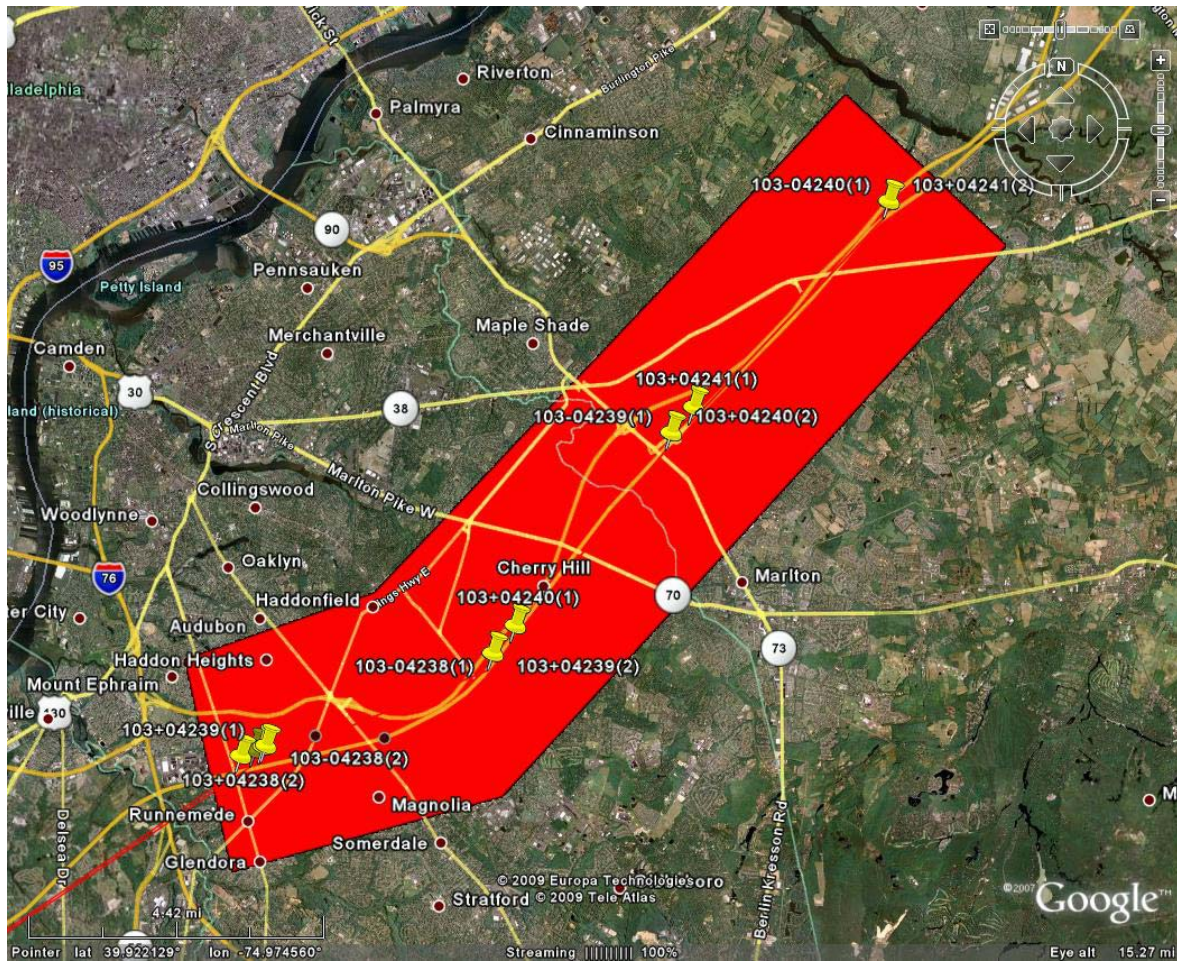


Figure 1 (Cont'd)
TMC segments selected for validation in New Jersey

Table 1
Traffic Message Channel segments picked for validation in New Jersey

TYPE	TMC	HIGHWAY	STARTING AT	ENDING AT	COUNTY	DIRECTION	LENGTH (mile)
Freeway	103+04237	NJ Turnpike	JOHN FENWICK SERVICE AREA	US 322/EXIT 2	GLOUCESTER	NORTHBOUND	7.2
Freeway	103+04238	NJ Turnpike	US 322/EXIT 2	HWY 168/EXIT 3	CAMDEN	NORTHBOUND	12.7
Freeway	103+04239	NJ Turnpike	HWY 168/EXIT 3	WALT WHITMAN SERVICE AREA	CAMDEN	NORTHBOUND	3.8
Freeway	103+04240	NJ Turnpike	WALT WHITMAN SERVICE AREA	HWY 73/EXIT 4	BURLINGTON	NORTHBOUND	3.7
Freeway	103+04241	NJ Turnpike	HWY 73/EXIT 4	HARTFORD RD	BURLINGTON	NORTHBOUND	4.2
Freeway	103-04236	NJ Turnpike	US 322/EXIT 2	JOHN FENWICK SERVICE AREA	SALEM	SOUTHBOUND	7.1
Freeway	103-04237	NJ Turnpike	HWY 168/EXIT 3	US 322/EXIT 2	GLOUCESTER	SOUTHBOUND	12.8
Freeway	103-04238	NJ Turnpike	WALT WHITMAN SERVICE AREA	HWY 168/EXIT 3	CAMDEN	SOUTHBOUND	3.8
Freeway	103-04239	NJ Turnpike	HWY 73/EXIT 4	WALT WHITMAN SERVICE AREA	CAMDEN	SOUTHBOUND	3.7
Freeway	103-04240	NJ Turnpike	HARTFORD RD	HWY 73/EXIT 4	BURLINGTON	SOUTHBOUND	4.3
TOTAL							63.3

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

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	103+04237	39.69923	-75.39213	39.75333	-75.27677	7.23	39.69826	-75.39136	39.75300	-75.27700	7.20	-0.4%
Freeway	103+04238	39.75594	-75.27181	39.85939	-75.07627	12.71	39.75586	-75.27220	39.85936	-75.07594	12.75	0.4%
Freeway	103+04239	39.86139	-75.06985	39.88163	-75.00501	3.80	39.86063	-75.07051	39.88235	-75.00428	3.92	3.0%
Freeway	103+04240	39.88765	-74.99867	39.92941	-74.95466	3.71	39.88899	-74.99764	39.92996	-74.95489	3.63	-2.3%
Freeway	103+04241	39.93494	-74.94824	39.97944	-74.89317	4.24	39.93489	-74.94823	39.97914	-74.89328	4.22	-0.4%
Freeway	103-04236	39.75215	-75.27929	39.69891	-75.39282	7.11	39.75188	-75.27958	39.69806	-75.39222	7.09	-0.3%
Freeway	103-04237	39.86067	-75.07216	39.75486	-75.27385	12.80	39.85973	-75.07519	39.75521	-75.27386	12.90	0.8%
Freeway	103-04238	39.88160	-75.00510	39.86161	-75.06915	3.76	39.88226	-75.00478	39.86101	-75.06834	3.77	0.4%
Freeway	103-04239	39.92932	-74.95475	39.88761	-74.99871	3.71	39.92931	-74.95592	39.88944	-74.99767	3.53	-4.7%
Freeway	103-04240	39.97956	-74.89299	39.93489	-74.94830	4.26	39.97977	-74.89314	39.93446	-74.94906	4.31	1.3%
TOTAL		63.32					63.32					

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

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	19.1	20.1	19.7	21.0	26
30-45	10.8	16.2	11.8	17.8	51
45-60	1.4	3.9	3.5	7.1	254
60+	-2.7	2.8	-4.7	5.2	22084

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

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	0%	19%	0%	12%	26
30-45	10%	20%	0%	18%	51
45-60	33%	72%	0%	41%	254
60+	31%	78%	0%	53%	22084

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

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+04237	7.23	7.20	0-30					1*
			30-45	10.7	10.7	12.0	12.0	
			45-60	1.8	3.1	3.6	6.3	13
			60+	-2.4	2.5	-4.5	5.0	1696
103+04238	12.71	12.75	0-30					4*
			30-45	7.7	7.7	11.2	11.2	
			45-60	3.8	5.7	5.8	8.2	41
			60+	-2.6	2.7	-4.5	4.8	2421
103+04239	3.80	3.92	0-30					4*
			30-45	6.5	11.8	7.6	13.4	
			45-60	0.6	2.3	3.0	6.2	21
			60+	-2.3	2.5	-4.1	4.8	1483
103+04240	3.71	3.63	0-30	17.4	19.1	17.7	20.0	13
			30-45	12.9	13.4	13.5	14.9	11
			45-60	0.4	2.8	3.1	6.9	29
			60+	-3.6	3.6	-6.2	6.6	2276
103+04241	4.24	4.22	0-30					4*
			30-45	1.7	3.5	2.0	4.1	
			45-60	1.3	2.3	4.5	5.9	24
			60+	-2.5	2.7	-4.4	5.0	2469
103-04236	7.11	7.09	0-30	38.5	38.5	40.4	40.4	1*
			30-45	27.0	27.0	28.5	28.5	4*
			45-60	-0.1	3.9	3.6	8.3	12
			60+	-2.9	3.0	-5.2	5.6	2518
103-04237	13.07	12.90	0-30	23.1	23.1	23.5	23.5	9
			30-45	23.7	23.7	24.5	24.5	8
			45-60	2.6	2.8	5.7	6.1	21
			60+	-2.3	2.4	-3.9	4.5	2311
103-04238	3.76	3.77	0-30					7
			30-45	13.7	15.7	15.3	17.8	
			45-60	-0.4	5.0	0.6	7.4	31
			60+	-2.7	2.8	-4.7	5.2	2333
103-04239	3.71	3.53	0-30					5
			30-45	-12.7	26.5	-13.4	27.7	
			45-60	0.6	5.4	1.8	8.0	38
			60+	-2.6	2.8	-4.5	5.1	2332
103-04240	4.26	4.31	0-30	8.5	9.2	10.1	11.4	3*
			30-45	1.2	12.2	2.6	14.9	3*
			45-60	1.8	2.3	3.8	5.8	24
			60+	-2.5	2.6	-4.5	5.0	2245

*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 New Jersey

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+04237	0-30									
	30-45	0	0%	0	0%	0	0%	0	0%	
	45-60	2	15%	12	92%	0	0%	5	38%	
	60+	566	33%	1378	81%	0	0%	902	53%	
103+04238	0-30									
	30-45	0	0%	1	25%	0	0%	0	0%	
	45-60	9	22%	20	49%	0	0%	14	34%	
	60+	733	30%	1911	79%	0	0%	1343	55%	
103+04239	0-30									
	30-45	0	0%	1	25%	0	0%	1	25%	
	45-60	9	43%	19	90%	0	0%	9	43%	
	60+	540	36%	1197	81%	0	0%	857	58%	
103+04240	0-30	0	0%	4	31%	0	0%	2	15%	
	30-45	1	9%	3	27%	0	0%	3	27%	
	45-60	12	41%	22	76%	0	0%	11	38%	
	60+	631	28%	1519	67%	0	0%	872	38%	
103+04241	0-30									
	30-45	2	50%	3	75%	0	0%	3	75%	
	45-60	14	58%	19	79%	0	0%	12	50%	
	60+	802	32%	1963	80%	0	0%	1359	55%	
103-04236	0-30	0	0%	0	0%	0	0%	0	0%	
	30-45	0	0%	0	0%	0	0%	0	0%	
	45-60	5	42%	9	75%	0	0%	4	33%	
	60+	697	28%	1886	75%	0	0%	1176	47%	
103-04237	0-30	0	0%	0	0%	0	0%	0	0%	
	30-45	0	0%	0	0%	0	0%	0	0%	
	45-60	10	48%	15	71%	0	0%	9	43%	
	60+	762	33%	1927	83%	0	0%	1425	62%	
103-04238	0-30									
	30-45	1	14%	1	14%	0	0%	1	14%	
	45-60	9	29%	20	65%	0	0%	12	39%	
	60+	724	31%	1805	77%	0	0%	1234	53%	
103-04239	0-30									
	30-45	1	20%	1	20%	0	0%	1	20%	
	45-60	6	16%	25	66%	0	0%	17	45%	
	60+	743	32%	1829	78%	0	0%	1265	54%	
103-04240	0-30	0	0%	1	33%	0	0%	1	33%	
	30-45	0	0%	0	0%	0	0%	0	0%	
	45-60	9	38%	22	92%	0	0%	11	46%	
	60+	693	31%	1810	81%	0	0%	1211	54%	

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

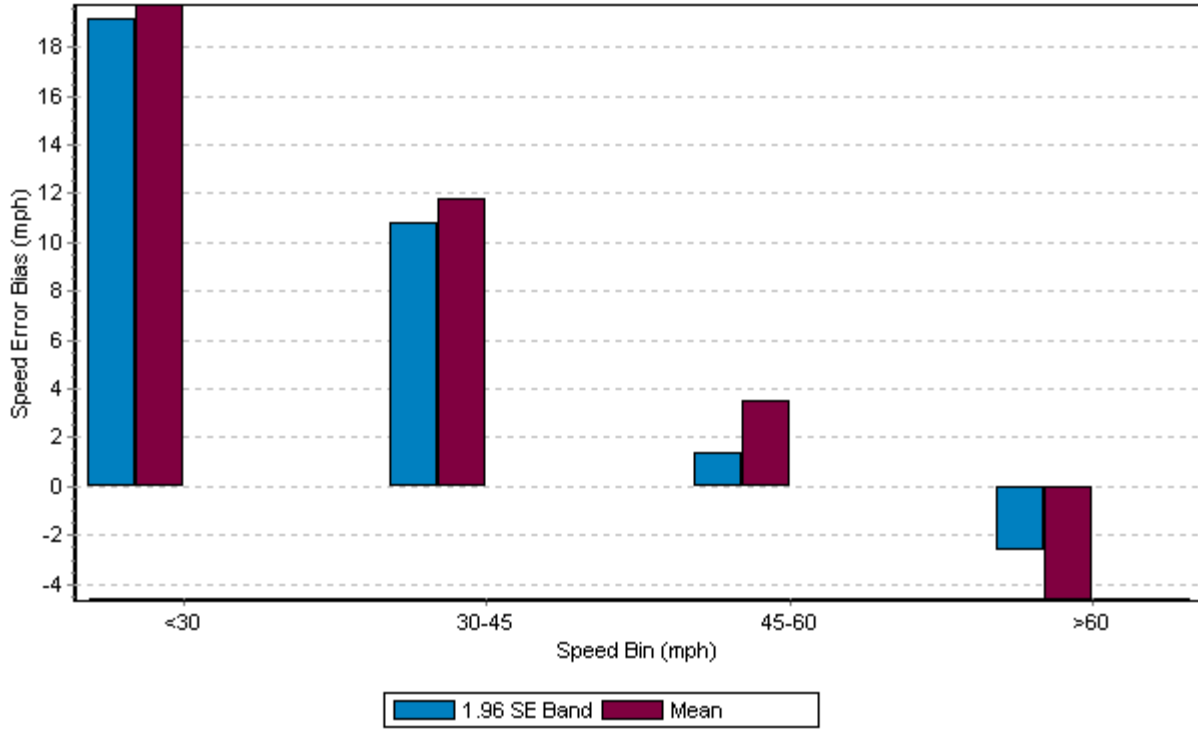


Figure 2
Speed error bias for freeway segments greater than one mile in New Jersey

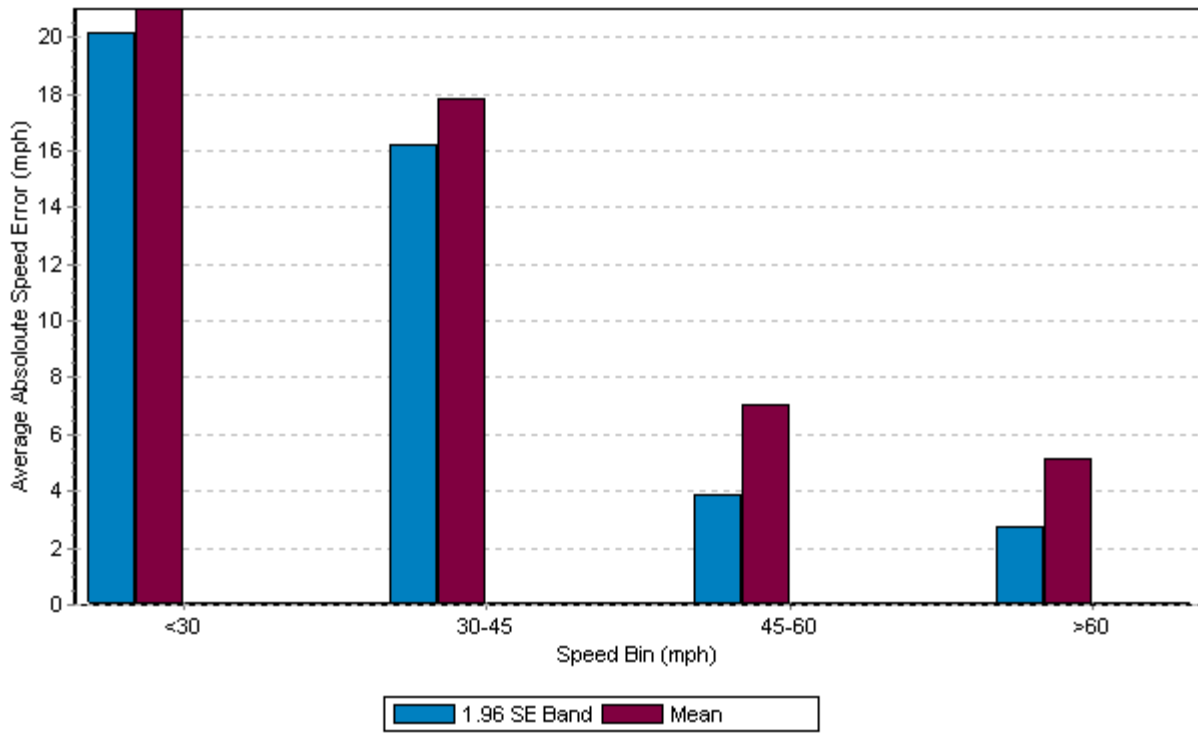


Figure 3
Average absolute speed error for freeway segments greater than one mile in New Jersey