



I-95 Corridor Coalition

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



March 2010

I-95 CORRIDOR COALITION VEHICLE PROBE PROJECT: VALIDATION OF INRIX DATA MARCH 2010

Monthly Report

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I-95 Corridor Coalition

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March 2010

Evaluation Results for the State of Pennsylvania

Executive Summary

Travel time samples were collected using Bluetooth Traffic Monitoring technology along 10 miles of freeways and six miles of arterials in Pennsylvania from Wednesday, January 6, 2010 to Wednesday, January 20, 2010 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 1650 hours of observations along eight freeway segments in Pennsylvania. When necessary, consecutive TMC segments were combined in order to obtain test segments greater than one mile in length.

ES Table 1, below summarizes the results of the comparison between the validation data and the INRIX data for freeway segments for the same period. Both the absolute average speed error and speed error bias were within specification for all speed bins.

ES Table 1 - Pennsylvania 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	6.50	7.70	2.50	2.50	300	25.0
30-45 MPH	7.00	8.60	1.10	1.40	414	34.5
45-60 MPH	2.30	4.30	-0.30	0.00	4576	381.3
> 60 MPH	3.30	5.90	-3.20	-5.50	14576	1214.7
All Speeds	3.20	5.61	-2.36	-3.97	19866	1655.5

Based upon data collected from Jan 6, 2010 through Jan 20, 2010 across 10.3 miles of roadway.

As mentioned, travel time samples were also collected along six miles of arterials in Pennsylvania from Wednesday, January 6, 2010 to Wednesday, January 20, 2010 and compared with travel time and speed data reported by INRIX as part of this project. The arterial data is included for informational purposes noting that INRIX has volunteered arterial data at no cost to the Coalition for the first three years, and that the method to evaluate quality on arterial roadways has not been fully evaluated. As the Coalition collects additional data on arterials, more appropriate quality metrics will be developed.

Data Collection

Bluetooth sensor deployments in Pennsylvania started on Wednesday, January 6, 2010. The actual deployments in Pennsylvania were performed with the assistance of Pennsylvania Department of Transportation (PennDOT) personnel. Sensors remained in the same position until they were retrieved two weeks later on Wednesday, January 20, 2010. This round of data collections in Pennsylvania 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 Pennsylvania. In this figure, red segments represent freeway segments while blue segments are the ones that are chosen on arterials.

Table 1 presents a list of specific TMC segments that were selected as the validation sample in Pennsylvania. These segments cover a total length of approximately 10 freeway miles as well as about six miles of arterials. Since some TMC segments in this corridor are less than one mile long, when appropriate, consecutive TMC segments are combined to form path segments longer than one mile. In total, in this document results of validation performed on eight freeway segments are reported. One of these segments is a standard TMC segment and the other seven are path segments combined from multiple standard TMC segments. The coordinates of the locations at which the Bluetooth sensors were deployed throughout the state of Pennsylvania are reported in Table 2. It should be noted that the configuration of consecutive TMC segments is such that the endpoint of one TMC segment and the start point of the next TMC segment are overlapping, so one Bluetooth sensor in that location is covering both TMC segments.

Finally, Table 3 summarizes the segment definitions used in the validation process which also presents the distances that have been used in the estimation of Bluetooth speeds based on travel times. Details of the algorithm used to estimate equivalent path travel times based on INRIX feeds for individual TMC segment are provided in the report titled “Estimation of Travel Times for Multiple TMC Segments” (dated February 2010) and available on the I-95 Corridor Coalition website. This algorithm finds an equivalent INRIX travel time (and therefore travel speed) corresponding to each sample Bluetooth travel time observation on the path segment of interest.

Analysis of Results

Table 4 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. Even when errors are measured as a distance from the mean, INRIX data quality is deemed as satisfactory based on the same requirements.

It should be noted that while the total number of observations in the low speed bins across all TMC segments are reasonable, as Table 6 indicates, the number of observations in low speed bins for some individual TMC segments may be low.

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

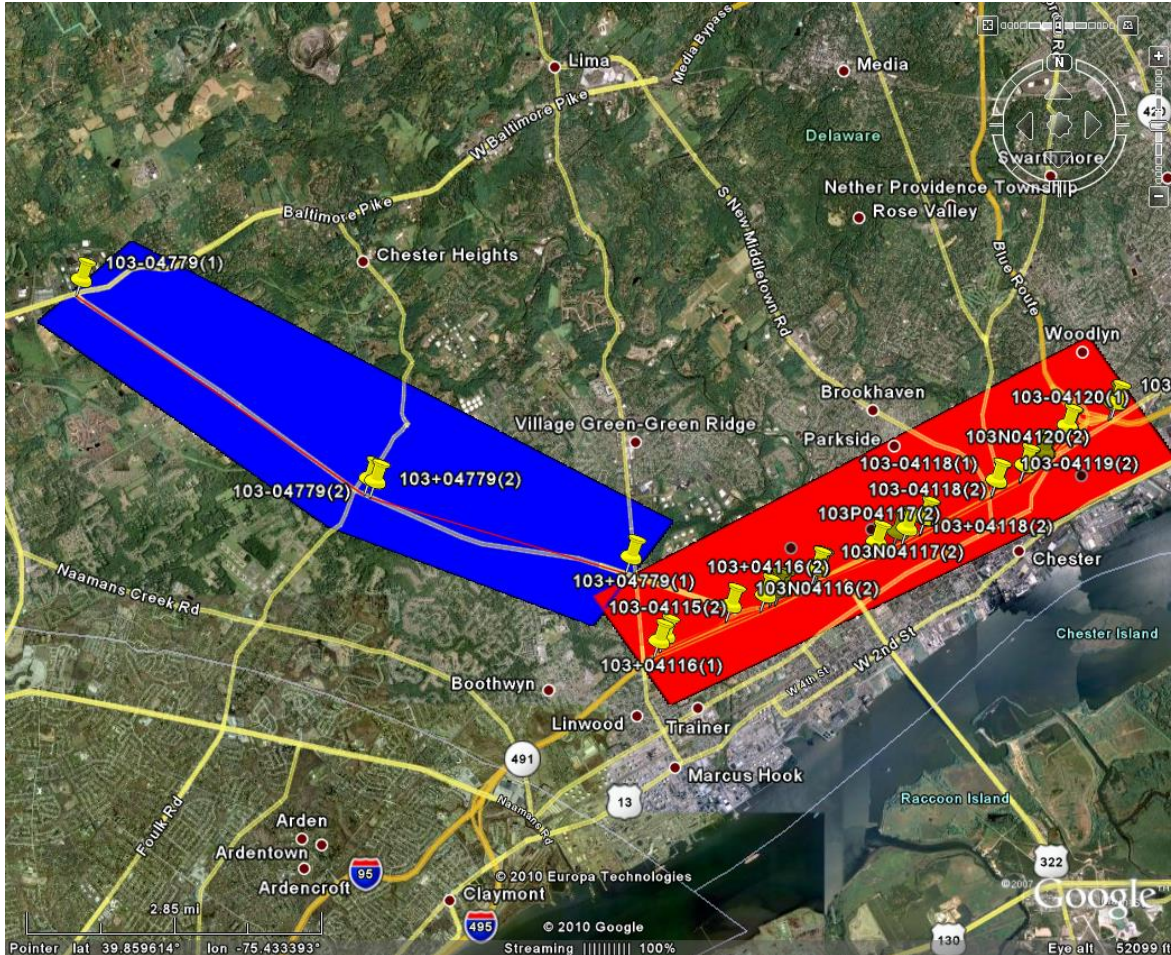


Figure 1
TMC segments selected for validation in Pennsylvania

Table 1
Traffic Message Channel segments picked for validation in Pennsylvania

TYPE	TMC	HIGHWAY	STARTING AT	ENDING AT	COUNTY	DIRECTION	LENGTH (mile)
Freeway	103N04121	I-95	I-476/EXIT 7	I-476/EXIT 7	DELAWARE	SOUTHBOUND	0.6
Freeway	103-04120	I-95	I-476/EXIT 7	CHESTNUT ST/EXIT 6	DELAWARE	SOUTHBOUND	0.3
Freeway	103N04120	I-95	CHESTNUT ST/EXIT 6	CHESTNUT ST/EXIT 6	DELAWARE	SOUTHBOUND	0.2
Freeway	103-04119	I-95	CHESTNUT ST/EXIT 6	PA-320/E 6TH ST/EXIT 6	DELAWARE	SOUTHBOUND	0.3
Freeway	103-04118	I-95	PA-320/E 6TH ST/EXIT 6	KERLIN ST/5TH ST/EXIT 5	DELAWARE	SOUTHBOUND	0.8
Freeway	103N04118	I-95	KERLIN ST/5TH ST/EXIT 5	KERLIN ST/5TH ST/EXIT 5	DELAWARE	SOUTHBOUND	0.3
Freeway	103N04117	I-95	KERLIN ST/5TH ST/EXIT 5	US-322/EXIT 4	DELAWARE	SOUTHBOUND	0.9
Freeway	103-04116	I-95	US-322/EXIT 4	US-322/EXIT2/EXIT3	DELAWARE	SOUTHBOUND	0.5
Freeway	103N04116	I-95	US-322/EXIT2/EXIT3	US-322/EXIT2/EXIT3	DELAWARE	SOUTHBOUND	0.5
Freeway	103-04115	I-95	US-322/EXIT2/EXIT3	PA-452/MARKET ST/EXIT 2	DELAWARE	SOUTHBOUND	0.7
Freeway	103+04116	I-95	PA-452/MARKET ST/EXIT 2	US-322/EXIT2/EXIT3	DELAWARE	NORTHBOUND	1.1
Freeway	103P04116	I-95	US-322/EXIT2/EXIT3	US-322/EXIT2/EXIT3	DELAWARE	NORTHBOUND	0.2
Freeway	103+04117	I-95	US-322/EXIT2/EXIT3	US-322/EXIT 4	DELAWARE	NORTHBOUND	0.4
Freeway	103P04117	I-95	US-322/EXIT 4	US-322/EXIT 4	DELAWARE	NORTHBOUND	0.6
Freeway	103+04118	I-95	US-322/EXIT 4	KERLIN ST/5TH ST/EXIT 5	DELAWARE	NORTHBOUND	0.3
Freeway	103P04118	I-95	KERLIN ST/5TH ST/EXIT 5	KERLIN ST/5TH ST/EXIT 5	DELAWARE	NORTHBOUND	0.2
Freeway	103+04119	I-95	KERLIN ST/5TH ST/EXIT 5	PA-320/E 6TH ST/EXIT 6	DELAWARE	NORTHBOUND	0.8
Freeway	103+04120	I-95	PA-320/E 6TH ST/EXIT 6	CHESTNUT ST/EXIT 6	DELAWARE	NORTHBOUND	0.3
Freeway	103P04120	I-95	CHESTNUT ST/EXIT 6	CHESTNUT ST/EXIT 6	DELAWARE	NORTHBOUND	0.2
Freeway	103+04121	I-95	CHESTNUT ST/EXIT 6	I-476/EXIT 7	DELAWARE	NORTHBOUND	0.3
Freeway	103P04121	I-95	I-476/EXIT 7	I-476/EXIT 7	DELAWARE	NORTHBOUND	0.5
SUBTOTAL							10.0
Arterial	103-04779	US-322		PA-261/FOULK RD	DELAWARE	EASTBOUND	3.39
Arterial	103+04779	US-322		PA-261/FOULK RD	DELAWARE	WESTBOUND	2.60
SUBTOTAL							6.0
							16.0

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

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	103N04121	39.868051	-75.338915	39.864781	-75.347786	0.55	39.868062	-75.337870	39.864848	-75.347990	0.61	10.6%
Freeway	103-04120	39.864781	-75.347786	39.861179	-75.352166	0.34	39.864848	-75.347990				
Freeway	103N04120	39.861179	-75.352166	39.859228	-75.355579	0.23			39.859668	-75.355155		
Freeway	103-04119	39.859228	-75.355579	39.857120	-75.360794	0.31	39.859668	-75.355155				
Freeway	103-04118	39.857120	-75.360794	39.851864	-75.373863	0.78			39.852477	-75.372277		
Freeway	103N04118	39.851864	-75.373863	39.849905	-75.378848	0.30	39.852477	-75.372277	39.849000	-75.381730	0.56	87.5%
Freeway	103N04117	39.849905	-75.378848	39.844786	-75.393636	0.86	39.849000	-75.381730	39.845178	-75.392970	0.65	-24.2%
Freeway	103-04116	39.844786	-75.393636	39.841797	-75.401290	0.46	39.845178	-75.392970	39.841935	-75.401010	0.48	6.1%
Freeway	103N04116	39.841797	-75.401290	39.839669	-75.409225	0.46	39.841935	-75.401010				
Freeway	103-04115	39.839669	-75.409225	39.835391	-75.421295	0.71			39.835333	-75.421662		
Freeway	103+04116	39.834636	-75.422400	39.841053	-75.402948	1.12	39.834380	-75.422602	39.840827	-75.403337	1.12	-0.5%
Freeway	103P04116	39.841053	-75.402948	39.841942	-75.400278	0.15	39.840827	-75.403337				
Freeway	103+04117	39.841942	-75.400278	39.844808	-75.393211	0.42			39.844392	-75.393975		
Freeway	103P04117	39.844808	-75.393211	39.848497	-75.382687	0.61	39.844392	-75.393975	39.848443	-75.382517	0.67	9.2%
Freeway	103+04118	39.848497	-75.382687	39.850420	-75.377158	0.32	39.848443	-75.382517				
Freeway	103P04118	39.850420	-75.377158	39.851763	-75.373797	0.20						
Freeway	103+04119	39.851763	-75.373797	39.857005	-75.360766	0.78			39.857383	-75.359763		
Freeway	103+04120	39.857005	-75.360766	39.859126	-75.355512	0.31	39.857383	-75.359763				
Freeway	103P04120	39.859126	-75.355512	39.861177	-75.351945	0.24			39.860357	-75.353047		
Freeway	103+04121	39.861177	-75.351945	39.864686	-75.347692	0.33	39.860357	-75.353047				
Freeway	103P04121	39.864686	-75.347692	39.867856	-75.339340	0.52			39.867018	-75.335530		
SUBTOTAL						10.02						
Arterial	103-04779	39.885220	-75.527870	39.857382	-75.475209	3.39	39.885150	-75.528087	39.857725	-75.475183	3.39	-0.1%
Arterial	103+04779	39.846441	-75.427481	39.857033	-75.474180	2.60	39.846505	-75.427718	39.856752	-75.473608	2.55	-1.8%
SUBTOTAL						5.99						
						16.01						

Table 3
Path segments identified for validation in Pennsylvania

Type	Validation Segment	STANDARD SEGMENTS INCLUDED				STARTING AT	ENDING AT	LENGTH (MILE)		
		TMC(1)	TMC(2)	TMC(3)	TMC(4)			Standard	Deployment	Error (%)
Freeway	PA01-0001	103N04121	103-04120	103N04120		I-476/EXIT 7	CHESTNUT ST/EXIT 6	1.12	1.14	1.64%
Freeway	PA01-0002	103-04119	103-04118	103N04118		CHESTNUT ST/EXIT 6	KERLIN ST/5TH ST/EXIT 5	1.39	1.59	14.27%
Freeway	PA01-0003	103N04117	103-04116			KERLIN ST/5TH ST/EXIT 5	US-322/EXIT2/EXIT3	1.32	1.14	-13.49%
Freeway	PA01-0004	103N04116	103-04115			US-322/EXIT2/EXIT3	PA-452/MARKET ST/EXIT 2	1.16	1.20	3.14%
Freeway	103+04116	103+04116				PA-452/MARKET ST/EXIT 2	US-322/EXIT2/EXIT3	1.12	1.12	-0.24%
Freeway	PA01-0005	103P04116	103+04117	103P04117		US-322/EXIT2/EXIT3	US-322/EXIT 4	1.19	1.22	2.26%
Freeway	PA01-0006	103+04118	103P04118	103+04119		US-322/EXIT 4	PA-320/E 6TH ST/EXIT 6	1.30	1.36	4.38%
Freeway	PA01-0007	103+04120	103P04120	103+04121	103P04121	PA-320/E 6TH ST/EXIT 6	I-476/EXIT 7	1.40	1.56	11.11%
SUBTOTAL								10.02	10.33	3.13%
Arterial	103-04779	103-04779					PA-261/FOULK RD	3.39	3.39	-0.03%
Arterial	103+04779	103+04779					PA-261/FOULK RD	2.60	2.55	-1.87%
SUBTOTAL								5.99	5.94	-0.83%
TOTAL								16.01	16.27	1.64%

Table 4
Data quality measures for freeway segments greater than one mile in Pennsylvania

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	2.5	6.5	2.5	7.7	300
30-45	1.1	7.0	1.4	8.6	414
45-60	-0.3	2.3	0.0	4.3	4576
60+	-3.2	3.3	-5.5	5.9	14576

Table 5
Percent observations meeting data quality criteria for freeway segments greater than one mile in Pennsylvania

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%	53%	0%	46%	300
30-45	13%	51%	0%	39%	414
45-60	40%	85%	0%	69%	4576
60+	29%	73%	0%	47%	14576

Table 6
Data quality measures for individual freeway validation segments greater than one mile in the state of Pennsylvania

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+04116	1.12	1.12	0-30	0.4	5.4	0.0	6.5	74
			30-45	1.3	9.2	1.1	11.3	35
			45-60	-2.5	4.3	-2.5	6.6	173
			60+	-3.6	3.8	-6.1	6.6	1921
PA01-0001	1.12	1.14	0-30	2.2	5.9	2.3	6.9	133
			30-45	3.9	7.1	4.4	8.6	144
			45-60	-0.3	1.8	-0.2	3.7	1244
			60+	-1.7	2.1	-3.5	4.5	910
PA01-0002	1.39	1.59	0-30	1.4	4.7	1.2	5.5	10*
			30-45	-2.3	4.6	-2.5	5.3	116
			45-60	-1.7	3.1	-1.8	4.7	291
			60+	-3.8	3.9	-6.1	6.3	2207
PA01-0003	1.32	1.14	0-30	2.3	7.6	2.1	8.7	20*
			30-45	3.1	8.6	4.3	10.5	27*
			45-60	-1.7	2.5	-2.1	4.4	398
			60+	-3.3	3.4	-5.7	6.0	2280
PA01-0004	1.16	1.20	0-30	17.1	22.0	18.8	25.8	4*
			30-45	4.9	15.7	6.0	19.7	15*
			45-60	1.2	2.2	2.4	4.2	1561
			60+	-0.6	1.0	-1.4	3.0	840
PA01-0005	1.19	1.22	0-30	5.6	9.1	6.1	10.6	45
			30-45	-1.2	7.0	-1.5	8.6	41
			45-60	-1.8	3.1	-2.1	4.8	473
			60+	-3.5	3.6	-6.0	6.4	2116
PA01-0006	1.30	1.36	0-30	3.5	7.6	3.7	8.9	7*
			30-45	0.9	7.7	0.9	9.2	27*
			45-60	-1.1	2.1	-1.0	3.9	152
			60+	-2.9	3.0	-5.1	5.4	2215
PA01-0007	1.40	1.56	0-30	2.7	4.3	2.9	5.0	7*
			30-45	-2.4	6.6	2.2	12.8	9*
			45-60	-1.3	1.9	-1.6	3.9	284
			60+	-3.6	3.7	-6.7	6.8	2087

*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 Pennsylvania

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+04116	0-30	5	7%	42	57%	0	0%	39	53%	74
	30-45	4	11%	15	43%	0	0%	10	29%	35
	45-60	67	39%	123	71%	0	0%	104	60%	173
	60+	621	32%	1358	71%	2	0%	859	45%	1921
PA01-0001	0-30	17	13%	71	53%	0	0%	62	47%	133
	30-45	22	15%	75	52%	0	0%	58	40%	144
	45-60	602	48%	1118	90%	1	0%	922	74%	1244
	60+	378	42%	779	86%	0	0%	582	64%	910
PA01-0002	0-30	1	10%	7	70%	0	0%	7	70%	10*
	30-45	19	16%	74	64%	0	0%	62	53%	116
	45-60	86	30%	217	75%	0	0%	178	61%	291
	60+	491	22%	1476	67%	0	0%	946	43%	2207
PA01-0003	0-30	0	0%	12	60%	0	0%	7	35%	20*
	30-45	5	19%	12	44%	0	0%	11	41%	27*
	45-60	150	38%	319	80%	0	0%	259	65%	398
	60+	593	26%	1634	72%	0	0%	1016	45%	2280
PA01-0004	0-30	0	0%	0	0%	0	0%	0	0%	4*
	30-45	0	0%	2	13%	0	0%	1	7%	15*
	45-60	590	38%	1359	87%	4	0%	1061	68%	1561
	60+	479	57%	802	95%	1	0%	687	82%	840
PA01-0005	0-30	6	13%	20	44%	0	0%	17	38%	45
	30-45	1	2%	18	44%	0	0%	11	27%	41
	45-60	152	32%	371	78%	0	0%	318	67%	473
	60+	565	27%	1487	70%	6	0%	891	42%	2116
PA01-0006	0-30	2	29%	4	57%	0	0%	3	43%	7*
	30-45	1	4%	12	44%	0	0%	9	33%	27*
	45-60	49	32%	133	88%	0	0%	114	75%	152
	60+	642	29%	1692	76%	2	0%	1133	51%	2215
PA01-0007	0-30	1	14%	4	57%	0	0%	4	57%	7*
	30-45	1	11%	3	33%	0	0%	0	0%	9*
	45-60	118	42%	249	88%	0	0%	200	70%	284
	60+	495	24%	1429	68%	0	0%	758	36%	2087

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

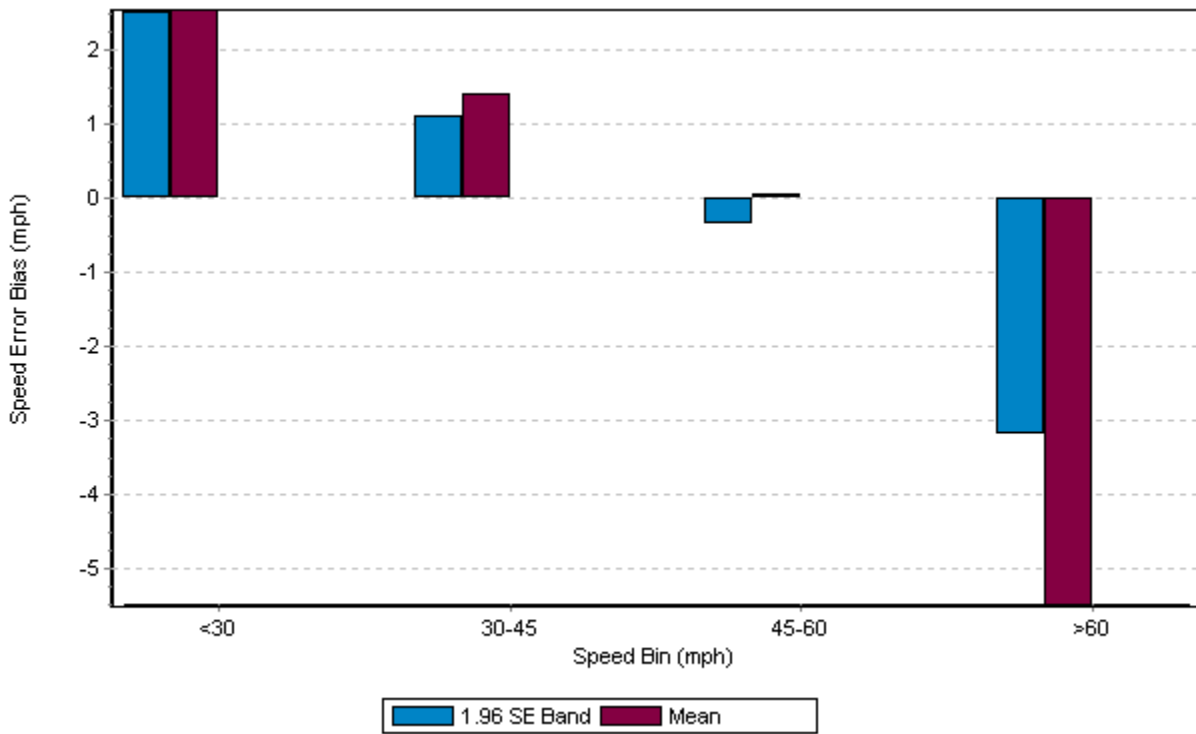


Figure 2
Speed error bias for freeway segments greater than one mile in Pennsylvania

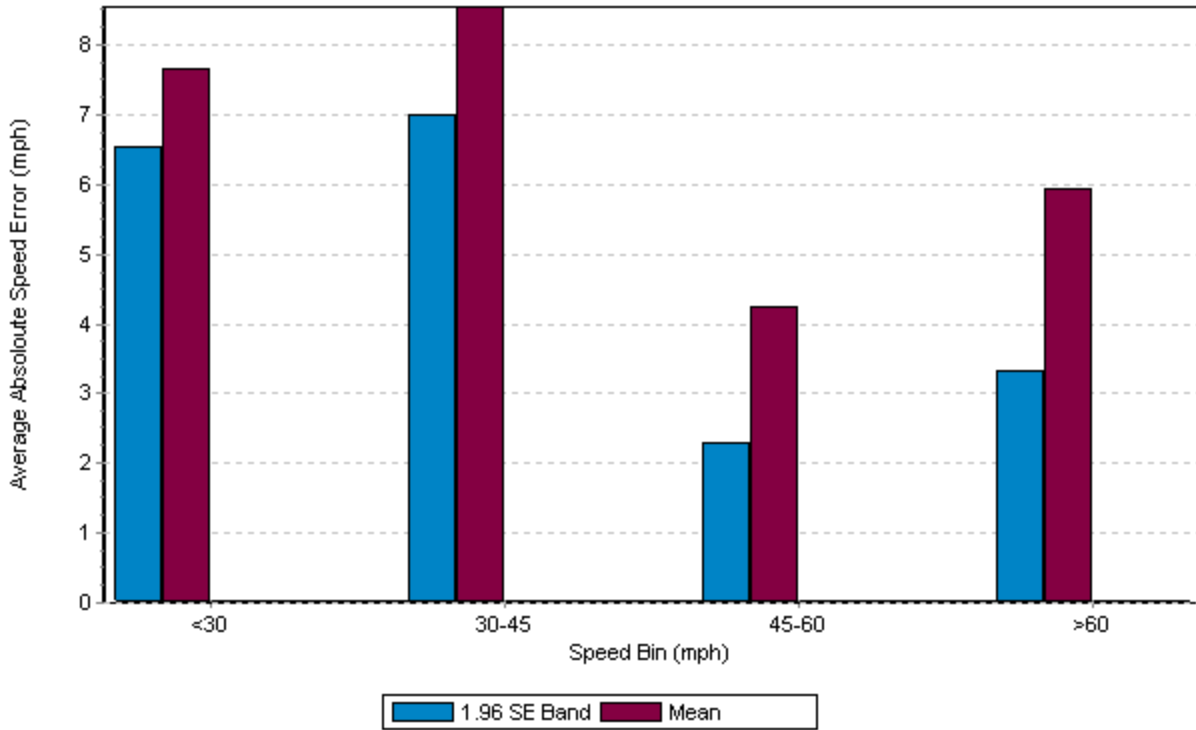


Figure 3
Average absolute speed error for freeway segments greater than one mile in Pennsylvania

Analysis of Results for Arterials

Table 8 summarizes the data quality measures obtained as a result of comparison between Bluetooth and all reported INRIX speeds on two arterial segments considered in this round of validations. In all speed bins above 30mph, 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. In the speed bin below 30mph, INRIX data quality marginally fails to pass validation requirements solely on the basis of speed error bias measure. In addition, as the posted speed limit is less than 60 mph, no observations would be made in the 60+ mph bin.

Table 9 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 arterial segments in Pennsylvania. Tables 10 and 11 present detailed data for individual arterial segments in Pennsylvania in similar format as Tables 8 and 9, 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 4 and 5 show the overall speed error biases for different speed bins, and the average absolute speed errors for all considered arterial segments in Pennsylvania, respectively. These figures correspond to Table 8.

Table 8
Data quality measures for arterial segments greater than one mile in Pennsylvania

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	6.8	8.5	9.6	12.0	714
30-45	0.1	3.8	0.4	6.2	898
45-60	-2.5	3.0	-3.7	5.1	621
60+					

Table 9
Percent observations meeting data quality criteria for arterial segments greater than one mile in Pennsylvania

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	17%	46%	0%	26%	714
30-45	32%	71%	0%	51%	898
45-60	38%	80%	0%	64%	621
60+					

Table 10
Data quality measures for individual arterial validation segments greater than one mile in the state of Pennsylvania

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+04779	2.60	2.55	0-30	6.8	8.6	9.5	11.9	702
			30-45	0.3	4.0	0.6	6.5	607
			45-60	-3.1	3.8	-5.8	6.9	51
			60+					
103-04779	3.39	3.39	0-30	2.4	2.4	18.0	18.0	12*
			30-45	-0.5	3.3	0.2	5.5	291
			45-60	-2.4	3.0	-3.5	5.0	570
			60+					

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

Table 11
Observations meeting data quality criteria for individual arterial validation segments greater than one mile in the state of Pennsylvania

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+04779	0-30	117	17%	314	45%	0	0%	188	27%	702
	30-45	184	30%	408	67%	0	0%	275	45%	607
	45-60	13	25%	34	67%	0	0%	20	39%	51
	60+									
103-04779	0-30	6	50%	11	92%	0	0%	0	0%	12*
	30-45	105	36%	233	80%	0	0%	179	62%	291
	45-60	221	39%	463	81%	0	0%	378	66%	570
	60+									

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

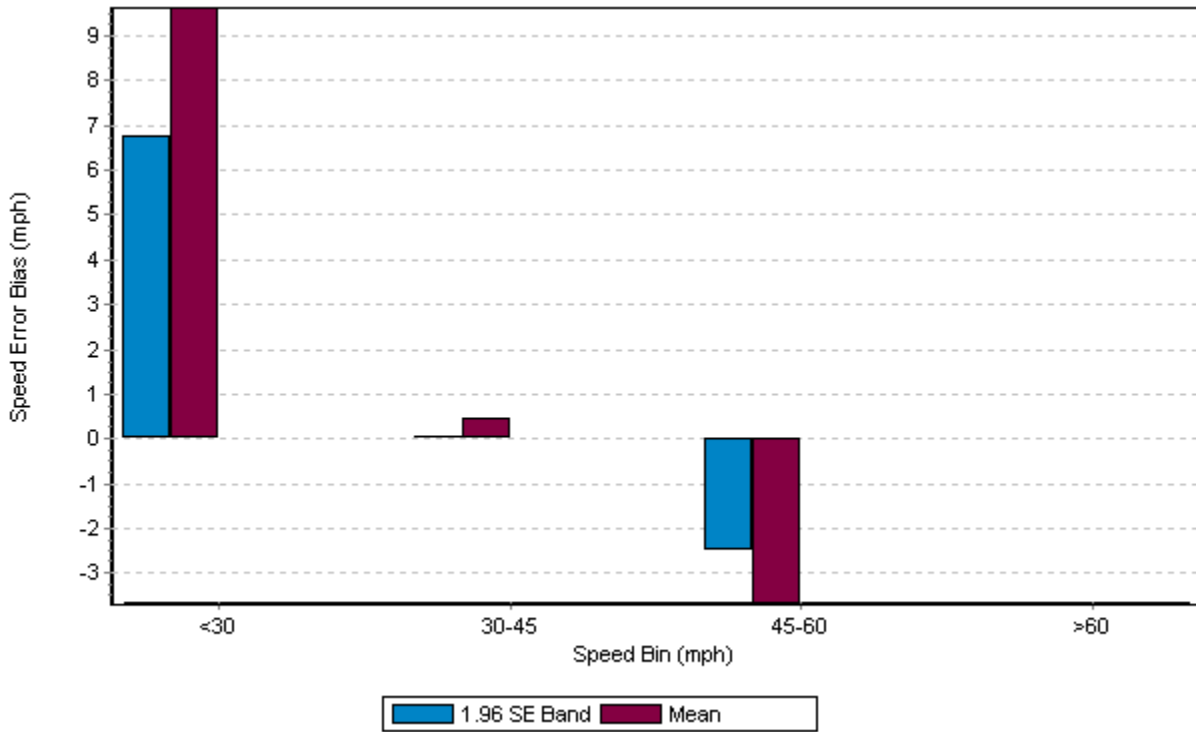


Figure 4
Speed error bias for arterial segments greater than one mile in Pennsylvania

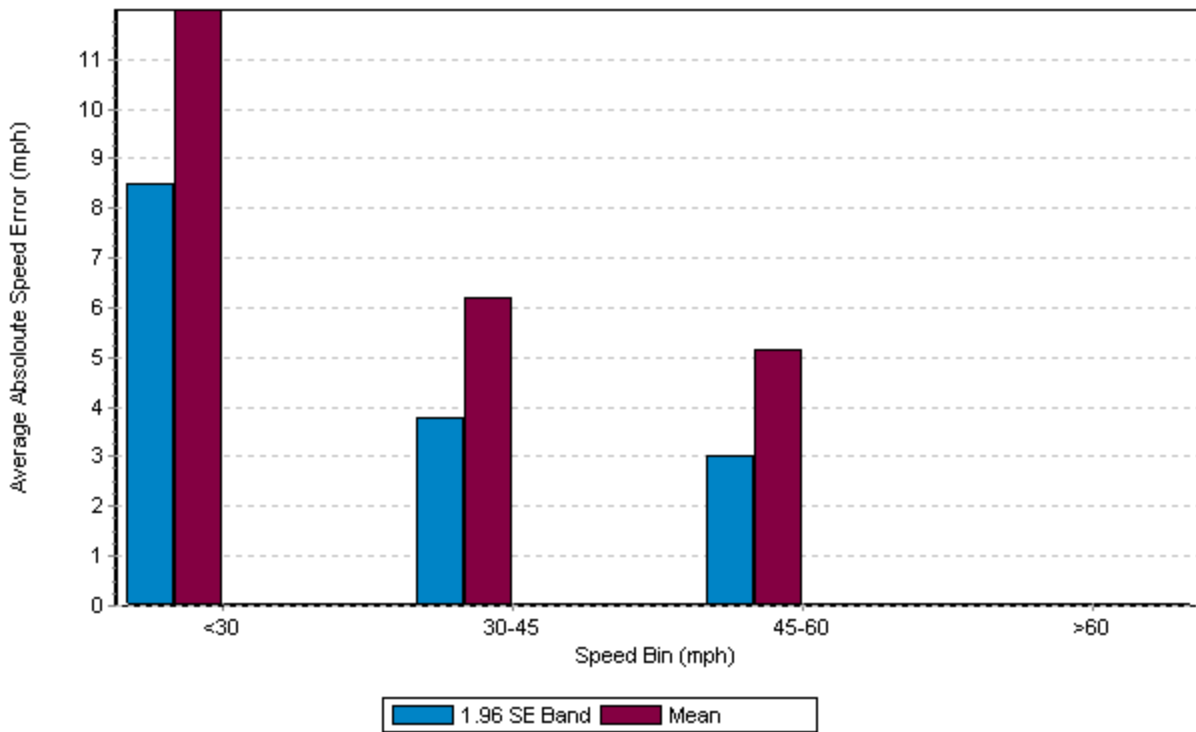


Figure 5
Average absolute speed error for arterial segments greater than one mile in Pennsylvania