



I-95 Corridor Coalition

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



August 2010

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

Monthly Report

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Prepared by:

Ali Haghani, Masoud Hamedi, Kaveh Farokhi Sadabadi
University of Maryland, College Park

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Evaluation Results for the State of New Jersey

Executive Summary

Travel time samples were collected along approximately 17 freeway miles including a pair of mile-long freeway ramp segments in New Jersey for two weeks from Wednesday, June 16, 2010 through Wednesday, June 30, 2010. Data collected from freeways were 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 2000 hours of observations along ten freeway TMC segments, totaling 14.4 miles.

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, both the average absolute speed error and speed error bias were within specification for all speed bins. Even when errors are measured against the mean (rather than the SEM band), INRIX data quality meets contract quality standards in all but the 0-30 MPH speed bin.

ES Table 1 - New Jersey Evaluation Summary						
Speed	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	5.90	6.90	4.60	5.10	605	50.4
30-45 MPH	5.40	7.20	2.20	2.90	602	50.2
45-60 MPH	2.30	4.00	0.00	0.40	3636	303.0
> 60 MPH	3.30	5.60	-2.60	-4.30	19084	1590.3
All Speeds	3.27	5.43	-1.90	-3.17	23927	1993.9

Based upon data collected from June 16, 2010 through June 30, 2010 across 14.4 miles of roadway.

As part of the on-going validation process, vehicle probe data from each state is validated on a rotating basis. Since the inception of the validation process, data on roadways in the State of New Jersey were validated on seven occasions: September/October 2008, April 2009, June 2009, September 2009, and October 2009, May/June 2010 and June 2010. This represents more than 10,100 hours of observations along nearly 165 miles of freeway segments in New Jersey. ES Table 2 provides a summary of the cumulative validation effort. As shown, the absolute average speed error is within specification for all speed bins. The speed error bias is within specification for all speed bins except the 0-30 MPH bin.

ES Table 2 - New Jersey - Cumulative to Date

Speed	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	7.41	8.48	5.33	5.80	2516	209.7
30-45 MPH	8.03	10.43	4.82	6.04	2026	168.8
45-60 MPH	2.69	4.97	0.57	1.56	13336	1111.3
> 60 MPH	2.82	5.30	-2.49	-4.36	103580	8631.7
All Speeds	2.99	5.42	-1.87	-3.32	121458	10121.5

The validation data collected from the pair of freeway ramp segments were analyzed separately and not included in this analysis described above. In all speed bins less than 60mph, INRIX data meets the data quality measures on these two ramps. There were only three observations of speeds greater than 60mph during the data collection period (which is not unusual for ramps) so the results from this speed band were not a reliable indication of data quality.

Data Collection

Bluetooth sensor deployments in New Jersey started on Wednesday, June 16, 2010. 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 Wednesday, June 30, 2010. This round of data collections 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. In this figure, red segments represent freeway segments while the blue color indicates the pair of ramp segments selected for analysis in this round of validation.

Table 1 presents a list of specific TMC segments that were selected as the validation sample in New Jersey. These segments cover a total length of approximately 17 freeway miles including two mile long freeway ramp segments. 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 ten freeway segments are reported; two of which are standard TMC segments and the other eight 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 New Jersey are highlighted 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 a separate 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.

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 New Jersey. Tables 6 and 7 present detailed data for individual TMC segments in New Jersey 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 New Jersey, respectively. These figures correspond to Table 4.

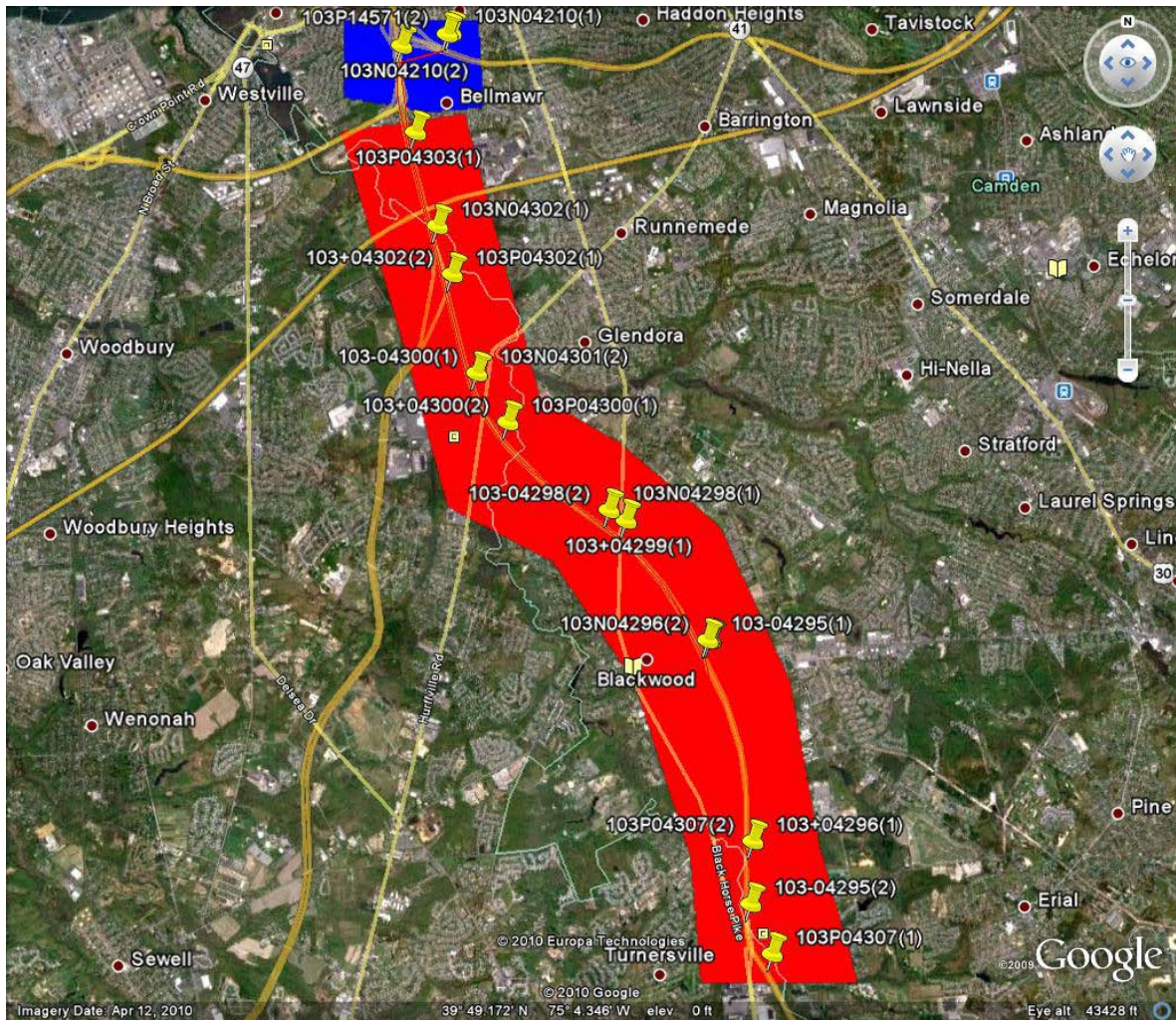


Figure 1
TMC segments selected for validation in New Jersey

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

TYPE	TMC	HIGHWAY	STARTING AT	ENDING AT	COUNTY	DIRECTION	LENGTH (mile)
Ramp	103N04210	I-295	EXIT 1B	I-76/EXIT 26	CAMDEN	SOUTHBOUND	1.0
Freeway	103-04304	NJ-42	I-76/EXIT 26	I-295/I-76/EXIT 26	CAMDEN	SOUTHBOUND	0.3
Freeway	103-04303	NJ-42	I-295/I-76/EXIT 26	CREEK RD	CAMDEN	SOUTHBOUND	0.3
Freeway	103N04303	NJ-42	CREEK RD	CREEK RD	CAMDEN	SOUTHBOUND	0.1
Freeway	103-04302	NJ-42	CREEK RD	NJ-55/EXIT 13	GLOUCESTER	SOUTHBOUND	0.8
Freeway	103N04302	NJ-42	NJ-55/EXIT 13	NJ-55/EXIT 13	GLOUCESTER	SOUTHBOUND	0.4
Freeway	103-04301	NJ-42	NJ-55/EXIT 13	CLEMENTS BRIDGE RD/EXIT 12	GLOUCESTER	SOUTHBOUND	0.6
Freeway	103N04301	NJ-42	CLEMENTS BRIDGE RD/EXIT 12	CLEMENTS BRIDGE RD/EXIT 12	GLOUCESTER	SOUTHBOUND	0.2
Freeway	103-04300	NJ-42	CLEMENTS BRIDGE RD/EXIT 12	RTE-41/HURFFVILLE RD	GLOUCESTER	SOUTHBOUND	0.2
Freeway	103N04300	NJ-42	RTE-41/HURFFVILLE RD	RTE-41/HURFFVILLE RD	GLOUCESTER	SOUTHBOUND	0.3
Freeway	103-04299	NJ-42	RTE-41/HURFFVILLE RD	LOWER LANDING RD/EXIT 10B	CAMDEN	SOUTHBOUND	0.2
Freeway	103N04299	NJ-42	LOWER LANDING RD/EXIT 10B	LOWER LANDING RD/EXIT 10B	CAMDEN	SOUTHBOUND	0.1
Freeway	103-04298	NJ-42	LOWER LANDING RD/EXIT 10B	NJ-168/BLACK HORSE PIKE	CAMDEN	SOUTHBOUND	0.8
Freeway	103N04298	NJ-42	NJ-168/BLACK HORSE PIKE	NJ-168/BLACK HORSE PIKE	CAMDEN	SOUTHBOUND	0.2
Freeway	103-04297	NJ-42	NJ-168/BLACK HORSE PIKE	COLES RD	CAMDEN	SOUTHBOUND	0.5
Freeway	103N04297	NJ-42	COLES RD	COLES RD	CAMDEN	SOUTHBOUND	0.2
Freeway	103-04296	NJ-42	COLES RD	CHURCH ST	CAMDEN	SOUTHBOUND	0.4
Freeway	103N04296	NJ-42	CHURCH ST	CHURCH ST	CAMDEN	SOUTHBOUND	0.0
Freeway	103-04295	NJ-42	CHURCH ST	NJ-168/ATLANTIC CITY EXPY	GLOUCESTER	SOUTHBOUND	2.2
Freeway	103+04296	NJ-42	NJ-42/EXIT 44	CHURCH ST	CAMDEN	NORTHBOUND	1.7
Freeway	103P04296	NJ-42	CHURCH ST	CHURCH ST	CAMDEN	NORTHBOUND	0.2
Freeway	103+04297	NJ-42	CHURCH ST	COLES RD	CAMDEN	NORTHBOUND	0.4
Freeway	103P04297	NJ-42	COLES RD	COLES RD	CAMDEN	NORTHBOUND	0.0

Table 1
Traffic Message Channel segments picked for validation in New Jersey (Cont'd)

TYPE	TMC	HIGHWAY	STARTING AT	ENDING AT	COUNTY	DIRECTION	LENGTH (mile)
Freeway	103+04298	NJ-42	COLES RD	NJ-168/BLACK HORSE PIKE	CAMDEN	NORTHBOUND	0.4
Freeway	103P04298	NJ-42	NJ-168/BLACK HORSE PIKE	NJ-168/BLACK HORSE PIKE	CAMDEN	NORTHBOUND	0.2
Freeway	103+04299	NJ-42	NJ-168/BLACK HORSE PIKE	LOWER LANDING RD/EXIT 10B	CAMDEN	NORTHBOUND	1.0
Freeway	103P04299	NJ-42	LOWER LANDING RD/EXIT 10B	LOWER LANDING RD/EXIT 10B	CAMDEN	NORTHBOUND	0.1
Freeway	103+04300	NJ-42	LOWER LANDING RD/EXIT 10B	RTE-41/HURFFVILLE RD	GLOUCESTER	NORTHBOUND	0.2
Freeway	103P04300	NJ-42	RTE-41/HURFFVILLE RD	RTE-41/HURFFVILLE RD	GLOUCESTER	NORTHBOUND	0.4
Freeway	103+04301	NJ-42	RTE-41/HURFFVILLE RD	CLEMENTS BRIDGE RD/EXIT 12	GLOUCESTER	NORTHBOUND	0.2
Freeway	103P04301	NJ-42	CLEMENTS BRIDGE RD/EXIT 12	CLEMENTS BRIDGE RD/EXIT 12	GLOUCESTER	NORTHBOUND	0.3
Freeway	103+04302	NJ-42	CLEMENTS BRIDGE RD/EXIT 12	NJ-55/EXIT 13	GLOUCESTER	NORTHBOUND	0.3
Freeway	103P04302	NJ-42	NJ-55/EXIT 13	NJ-55/EXIT 13	GLOUCESTER	NORTHBOUND	0.4
Freeway	103+04303	NJ-42	NJ-55/EXIT 13	CREEK RD	CAMDEN	NORTHBOUND	0.8
Freeway	103P04303	NJ-42	CREEK RD	CREEK RD	CAMDEN	NORTHBOUND	0.1
Freeway	103+04304	NJ-42	CREEK RD	I-295/I-76/EXIT 26	CAMDEN	NORTHBOUND	0.2
Freeway	103-04293	I-76	I-295/I-76/EXIT 26	I-295/EXIT 1	CAMDEN	WESTBOUND	0.3
Ramp	103P14571		I-295/EXIT 1	EXIT 1B	CAMDEN	I-295 NORTHBOUND	0.5
							16.6

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		
Ramp	103N04210	39.873840	-75.094757	39.872287	-75.102286	1.04	39.87335	-75.09305			1.18	13.0%
Freeway	103-04304	39.871996	-75.102100	39.868229	-75.102112	0.26	39.87167	-75.10204				
Freeway	103-04303	39.868229	-75.102112	39.864213	-75.101000	0.28						
Freeway	103N04303	39.864213	-75.101000	39.862333	-75.100527	0.13						
Freeway	103-04302	39.862333	-75.100527	39.851143	-75.096806	0.80			39.85214	-75.09733		
Freeway	103N04302	39.851143	-75.096806	39.844931	-75.094714	0.44	39.85214	-75.09733				
Freeway	103-04301	39.844931	-75.094714	39.836369	-75.091837	0.61						
Freeway	103N04301	39.836369	-75.091837	39.833883	-75.090809	0.18			39.83492	-75.09141		
Freeway	103-04300	39.833883	-75.090809	39.831010	-75.089027	0.22	39.83492	-75.09141				
Freeway	103N04300	39.831010	-75.089027	39.827911	-75.086294	0.26						
Freeway	103-04299	39.827911	-75.086294	39.825406	-75.083199	0.24						
Freeway	103N04299	39.825406	-75.083199	39.824840	-75.082457	0.06						
Freeway	103-04298	39.824840	-75.082457	39.817834	-75.070600	0.80			39.81727	-75.06980		
Freeway	103N04298	39.817834	-75.070600	39.816341	-75.068174	0.16	39.81727	-75.06980				
Freeway	103-04297	39.816341	-75.068174	39.811064	-75.061704	0.50						
Freeway	103N04297	39.811064	-75.061704	39.808608	-75.059567	0.20						
Freeway	103-04296	39.808608	-75.059567	39.802815	-75.055684	0.45						
Freeway	103N04296	39.802815	-75.055684	39.802570	-75.055516	0.02			39.80313	-75.05595		
Freeway	103-04295	39.802570	-75.055516	39.771630	-75.048974	2.20	39.80313	-75.05595	39.77211	-75.04912	2.21	0.3%
Freeway	103+04296	39.778994	-75.048656	39.802589	-75.055137	1.69	39.77860	-75.04857	39.80372	-75.05586	1.81	6.9%
Freeway	103P04296	39.802589	-75.055137	39.805587	-75.057116	0.23	39.80372	-75.05586				
Freeway	103+04297	39.805587	-75.057116	39.810876	-75.061126	0.42						

Table 2
TMC segment lengths and distances between sensor deployment locations in the state of New Jersey (Cont'd)

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	103P04297	39.810876	-75.061126	39.811057	-75.061302	0.02						
Freeway	103+04298	39.811057	-75.061302	39.814940	-75.065684	0.36						
Freeway	103P04298	39.814940	-75.065684	39.816577	-75.068003	0.17			39.81766	-75.06960		
Freeway	103+04299	39.816577	-75.068003	39.825002	-75.082203	0.95	39.81766	-75.06960				
Freeway	103P04299	39.825002	-75.082203	39.825583	-75.082966	0.06						
Freeway	103+04300	39.825583	-75.082966	39.828140	-75.086056	0.24			39.82810	-75.08584		
Freeway	103P04300	39.828140	-75.086056	39.833494	-75.090244	0.43	39.82810	-75.08584				
Freeway	103+04301	39.833494	-75.090244	39.836936	-75.091667	0.25						
Freeway	103P04301	39.836936	-75.091667	39.840585	-75.092907	0.26						
Freeway	103+04302	39.840585	-75.092907	39.845483	-75.094547	0.35			39.84600	-75.09477		
Freeway	103P04302	39.845483	-75.094547	39.851385	-75.096570	0.42	39.84600	-75.09477				
Freeway	103+04303	39.851385	-75.096570	39.862138	-75.100168	0.77			39.86159	-75.09979		
Freeway	103P04303	39.862138	-75.100168	39.864221	-75.100698	0.15	39.86159	-75.09979				
Freeway	103+04304	39.864221	-75.100698	39.867704	-75.101022	0.24						
Freeway	103-04293	39.867704	-75.101022	39.872281	-75.101811	0.32						
Ramp	103P14571	39.872281	-75.101811	39.873631	-75.095328	0.49			39.87383	-75.09583		
16.68												

Table 3
Path segments identified for validation in New Jersey

Type	Validation Segment	STANDARD SEGMENTS INCLUDED					STARTING AT	ENDING AT	LENGTH (MILE)		
		TMC(1)	TMC(2)	TMC(3)	TMC(4)	TMC(5)			Standard	Deployment	Error (%)
Ramp	103N04210	103N04210					EXIT 1B	I-76/EXIT 26	1.0	1.18	13.00%
Freeway	NJ07-0001	103-04304	103-04303	103N04303	103-04302		I-76/EXIT 26	NJ-55/EXIT 13	1.5	1.38	-6.71%
Freeway	NJ07-0002	103N04302	103-04301	103N04301			NJ-55/EXIT 13	CLEMENTS BRIDGE RD/EXIT 12	1.2	1.23	-0.51%
Freeway	NJ07-0003	103-04300	103N04300	103-04299	103N04299	103-04298	CLEMENTS BRIDGE RD/EXIT 12	NJ-168/BLACK HORSE PIKE	1.6	1.70	8.59%
Freeway	NJ07-0004	103N04298	103-04297	103N04297	103-04296	103N04296	NJ-168/BLACK HORSE PIKE	CHURCH ST	1.3	1.24	-7.69%
Freeway	103-04295	103-04295					CHURCH ST	NJ-168/ATLANTIC CITY EXPY	2.2	2.21	0.29%
Freeway	103+04296	103+04296					NJ-42/EXIT 44	CHURCH ST	1.7	1.81	6.86%
Freeway	NJ07-0005	103P04296	103+04297	103P04297	103+04298	103P04298	CHURCH ST	NJ-168/BLACK HORSE PIKE	1.2	1.21	1.61%
Freeway	NJ07-0006	103+04299	103P04299	103+04300			NJ-168/BLACK HORSE PIKE	RTE-41/HURFFVILLE RD	1.3	1.13	-9.77%
Freeway	NJ07-0007	103P04300	103+04301	103P04301	103+04302		RTE-41/HURFFVILLE RD	NJ-55/EXIT 13	1.3	1.34	3.54%
Freeway	NJ07-0008	103P04302	103+04303				NJ-55/EXIT 13	CREEK RD	1.2	1.11	-6.83%
Ramp	NJ07-0009	103P04303	103+04304	103-04293	103P14571		CREEK RD	EXIT 1B	1.2	1.21	0.93%
TOTAL									16.68	16.73	

Table 4
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	4.6	5.9	5.1	6.9	605
30-45	2.2	5.4	2.9	7.2	602
45-60	0.0	2.3	0.4	4.0	3636
60+	-2.6	3.3	-4.3	5.6	19084

Table 5
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	12%	67%	0%	61%	605
30-45	15%	63%	0%	50%	602
45-60	37%	85%	0%	73%	3636
60+	29%	74%	0%	52%	19084

Table 6
Data quality measures for individual freeway validation 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+04296	1.67	1.81	0-30	1.9	4.3	2.0	4.9	33
			30-45	5.5	12.4	6.4	14.7	15*
			45-60	0.8	2.2	1.8	4.0	107
			60+	-2.6	2.7	-4.4	5.0	1692
103-04295	2.19	2.21	0-30	1.6	1.6	2.9	2.9	12*
			30-45	3.4	5.2	4.0	7.2	20*
			45-60	0.4	1.7	1.5	3.2	135
			60+	-1.7	2.0	-3.0	3.8	2195
NJ07-0001	1.49	1.38	0-30	1.3	3.5	1.4	4.4	45
			30-45	-0.5	4.3	-0.7	5.9	134
			45-60	-0.4	1.8	-0.3	3.3	1229
			60+	-1.4	1.6	-3.2	3.9	456
NJ07-0002	1.21	1.23	0-30	6.9	7.6	8.4	9.8	75
			30-45	4.3	5.0	5.6	6.9	41
			45-60	-0.5	2.3	-0.4	4.2	112
			60+	-4.5	4.5	-7.0	7.2	1553
NJ07-0003	1.58	1.70	0-30	7.8	8.2	8.3	8.7	39
			30-45	4.0	4.6	4.4	5.5	101
			45-60	1.2	2.2	2.3	3.8	1050
			60+	-1.1	2.0	-1.9	3.7	1423
NJ07-0004	1.31	1.24	0-30	4.5	7.2	5.0	8.0	9*
			30-45	3.0	5.2	3.7	6.5	66
			45-60	-1.8	3.3	-2.3	5.2	158
			60+	-5.7	5.8	-8.5	8.7	2333
NJ07-0005	1.16	1.21	0-30	6.7	7.6	7.6	8.9	93
			30-45	2.1	6.8	3.7	9.9	25*
			45-60	-0.9	2.5	-0.9	4.5	126
			60+	-2.8	3.0	-4.9	5.6	2421
NJ07-0006	1.36	1.13	0-30	6.4	7.2	6.8	7.8	90
			30-45	9.0	12.5	10.3	14.5	54
			45-60	3.2	5.5	4.6	7.7	126
			60+	0.9	2.3	1.5	4.4	2620
NJ07-0007	1.22	1.34	0-30	3.1	4.9	3.3	5.5	138
			30-45	-0.1	3.5	1.0	5.7	63
			45-60	-1.9	2.4	-2.1	4.0	296
			60+	-3.5	3.6	-5.5	5.9	2389
NJ07-0008	1.20	1.11	0-30	1.9	3.4	2.1	4.7	71
			30-45	-0.4	3.7	0.2	6.1	83
			45-60	-1.0	3.0	-0.9	5.0	297
			60+	-3.4	3.5	-6.1	6.5	2002

*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 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+04296	0-30	3	9%	26	79%	0	0%	23	70%	33
	30-45	0	0%	3	20%	0	0%	1	7%	15*
	45-60	40	37%	89	83%	0	0%	81	76%	107
	60+	512	30%	1355	80%	0	0%	993	59%	1692
103-04295	0-30	4	33%	11	92%	0	0%	11	92%	12*
	30-45	3	15%	12	60%	0	0%	9	45%	20*
	45-60	52	39%	122	90%	0	0%	113	84%	135
	60+	748	34%	1932	88%	0	0%	1563	71%	2195
NJ07-0001	0-30	10	22%	31	69%	0	0%	30	67%	45
	30-45	18	13%	95	71%	0	0%	76	57%	134
	45-60	511	42%	1108	90%	0	0%	990	81%	1229
	60+	183	40%	418	92%	0	0%	332	73%	456
NJ07-0002	0-30	5	7%	42	56%	0	0%	28	37%	75
	30-45	10	24%	24	59%	0	0%	15	37%	41
	45-60	42	38%	93	83%	0	0%	80	71%	112
	60+	274	18%	943	61%	0	0%	529	34%	1553
NJ07-0003	0-30	1	3%	17	44%	0	0%	16	41%	39
	30-45	16	16%	68	67%	0	0%	60	59%	101
	45-60	331	32%	908	86%	0	0%	765	73%	1050
	60+	599	42%	1283	90%	0	0%	1077	76%	1423
NJ07-0004	0-30	0	0%	4	44%	0	0%	4	44%	9*
	30-45	7	11%	40	61%	0	0%	36	55%	66
	45-60	52	33%	119	75%	0	0%	96	61%	158
	60+	353	15%	1153	49%	0	0%	597	26%	2333
NJ07-0005	0-30	8	9%	61	66%	0	0%	57	61%	93
	30-45	5	20%	15	60%	0	0%	10	40%	25*
	45-60	47	37%	108	86%	0	0%	86	68%	126
	60+	797	33%	1832	76%	3	0%	1214	50%	2421
NJ07-0006	0-30	9	10%	59	66%	0	0%	57	63%	90
	30-45	6	11%	17	31%	0	0%	13	24%	54
	45-60	10	8%	60	48%	0	0%	39	31%	126
	60+	1030	39%	2181	83%	0	0%	1705	65%	2620
NJ07-0007	0-30	16	12%	93	67%	0	0%	90	65%	138
	30-45	12	19%	46	73%	0	0%	36	57%	63
	45-60	148	50%	255	86%	0	0%	231	78%	296
	60+	529	22%	1667	70%	1	0%	1120	47%	2389
NJ07-0008	0-30	18	25%	59	83%	0	0%	52	73%	71
	30-45	13	16%	59	71%	0	0%	46	55%	83
	45-60	99	33%	235	79%	0	0%	183	62%	297
	60+	593	30%	1436	72%	0	0%	850	42%	2002

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

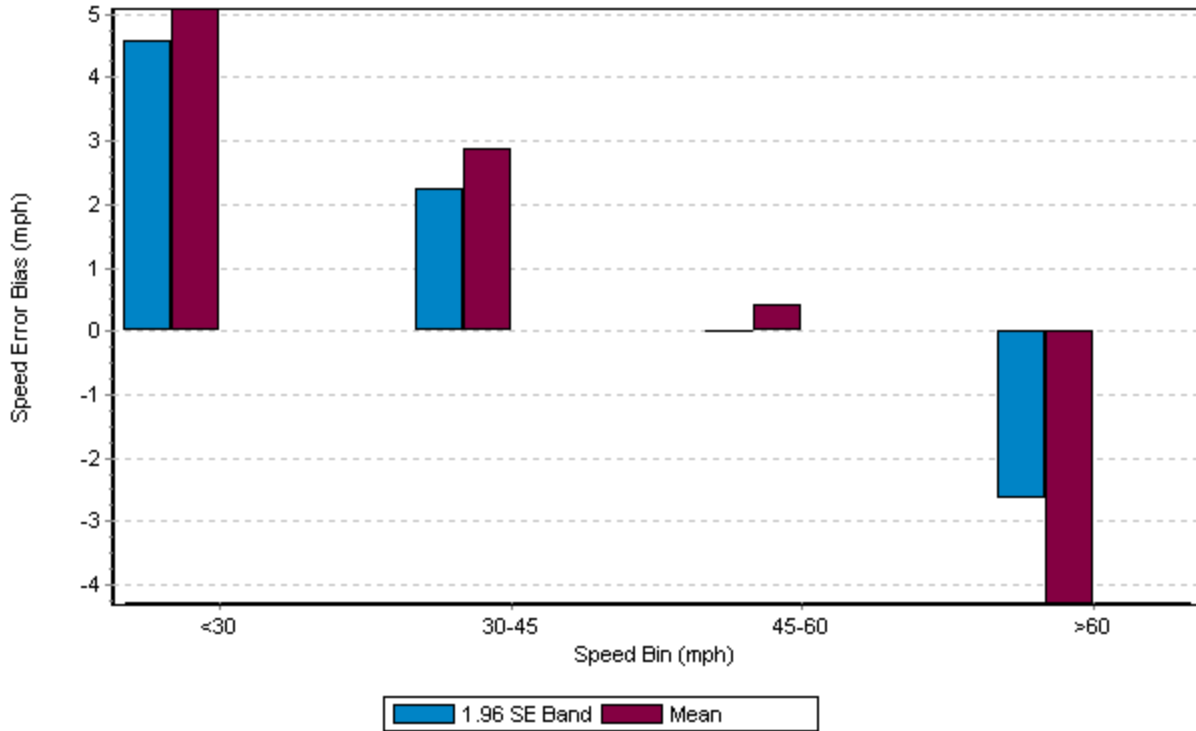


Figure 2
Speed error bias for freeway segments greater than one mile in New Jersey

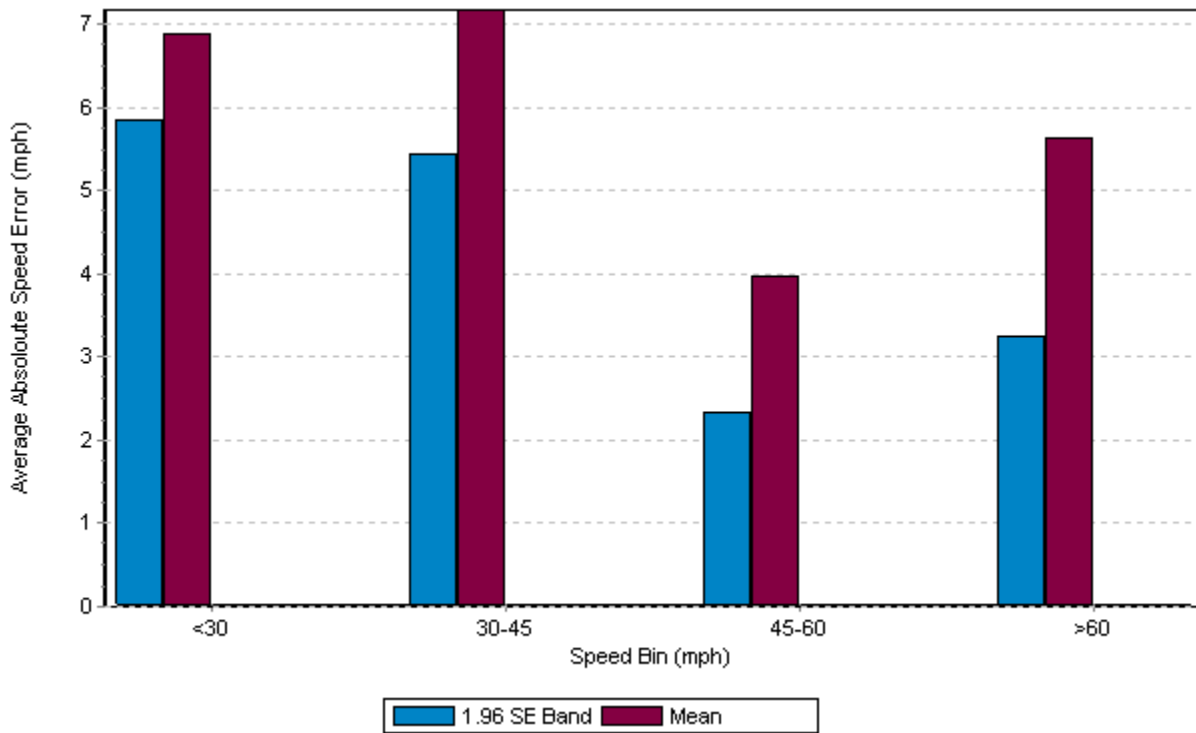


Figure 3
Average absolute speed error for freeway segments greater than one mile in New Jersey

Analysis of Results for a Freeway Ramp Segment

Table 8 summarizes the data quality measures obtained as a result of comparison between Bluetooth and all reported INRIX speeds on a pair of freeway ramp segments considered in this round of validations. In all speed bins less than 60 mph, INRIX data meets the data quality measures set forth in the contract when errors are measured from the 1.96 times the standard error band. Comparison results for speeds above 60 mph are not be reliable due to small number of observations. The low numbers of observations of speeds above 60 mph indicate that normal ramps speeds (even without congestion) are constrained to less than 60 mph.

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 the pair of freeway ramp segments in New Jersey. Tables 10 and 11 present detailed data for individual ramp segments in New Jersey in similar format as Tables 8 and 9, respectively. Note that for some segments in some speed bins the comparison results may not be reliable due to small number of observations.

Figures 4 and 5 show the speed error biases for different speed bins, and the average absolute speed errors for the pair of freeway ramp segments in New Jersey, respectively. These figures correspond to Table 8.

Table 8
Data quality measures for a pair of freeway ramp segments 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	1.8	2.7	3.5	5.2	257
30-45	-0.3	1.6	0.0	3.4	573
45-60	-2.2	2.4	-3.8	4.4	2960
60+	-10.5	10.5	-13.2	13.2	3*

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

Table 9
Percent observations meeting data quality criteria for a pair of freeway ramp segments 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	31%	84%	0%	68%	257
30-45	43%	89%	0%	77%	573
45-60	33%	84%	0%	63%	2960
60+	0%	0%	0%	0%	3*

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

Table 10
Data quality measures for individual freeway ramp segments 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	
103N04210	1.05	1.18	0-30	1.5	3.0	1.8	4.1	133
			30-45	-0.4	1.8	-0.3	3.1	366
			45-60	-2.5	2.7	-4.1	4.6	2029
			60+	-12.1	12.1	-14.8	14.8	2*
NJ07-0009	1.15	1.21	0-30	2.1	2.3	5.4	6.2	124
			30-45	-0.1	1.4	0.5	3.8	207
			45-60	-1.4	1.6	-2.9	3.9	931
			60+	-7.3	7.3	-10.2	10.2	1*

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

Table 11
Observations meeting data quality criteria for individual freeway ramp segments 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	
103N04210	0-30	28	21%	112	84%	0	0%	99	74%	133
	30-45	128	35%	326	89%	0	0%	295	81%	366
	45-60	556	27%	1624	80%	0	0%	1205	59%	2029
	60+	0	0%	0	0%	0	0%	0	0%	2*
NJ07-0009	0-30	51	41%	105	85%	0	0%	75	60%	124
	30-45	119	57%	186	90%	2	1%	148	72%	207
	45-60	414	44%	849	91%	0	0%	666	72%	931
	60+	0	0%	0	0%	0	0%	0	0%	1*

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

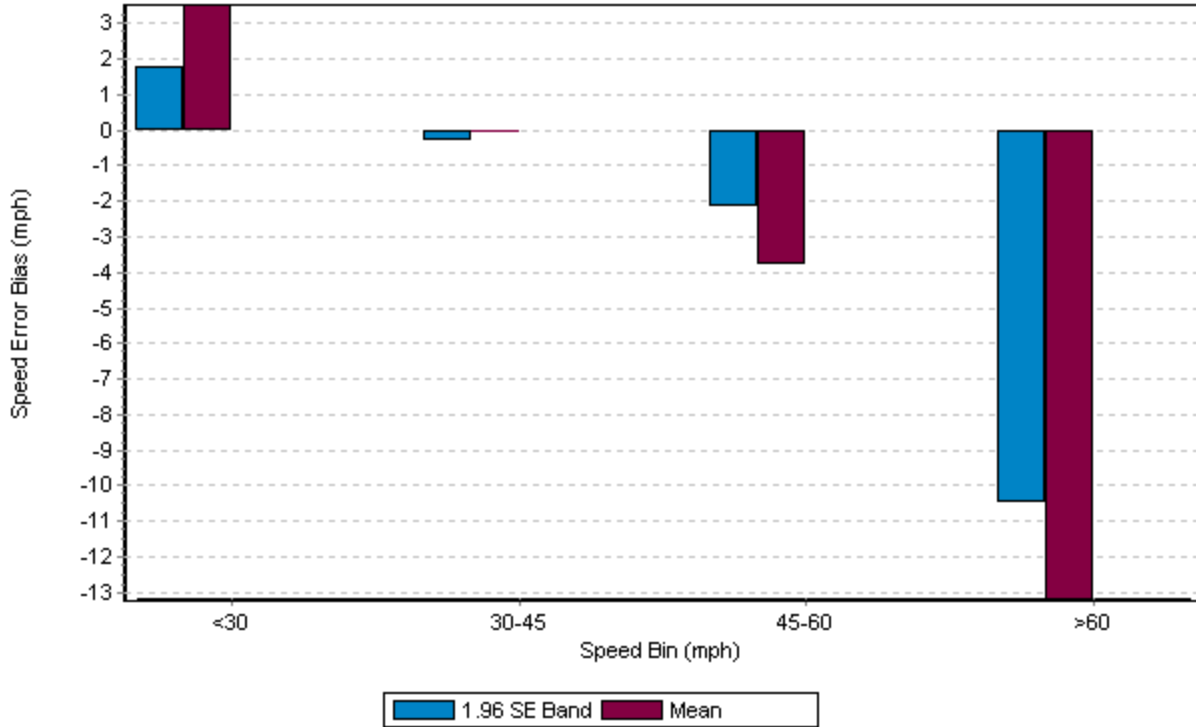


Figure 4
Speed error bias for a pair of freeway ramp segments in New Jersey

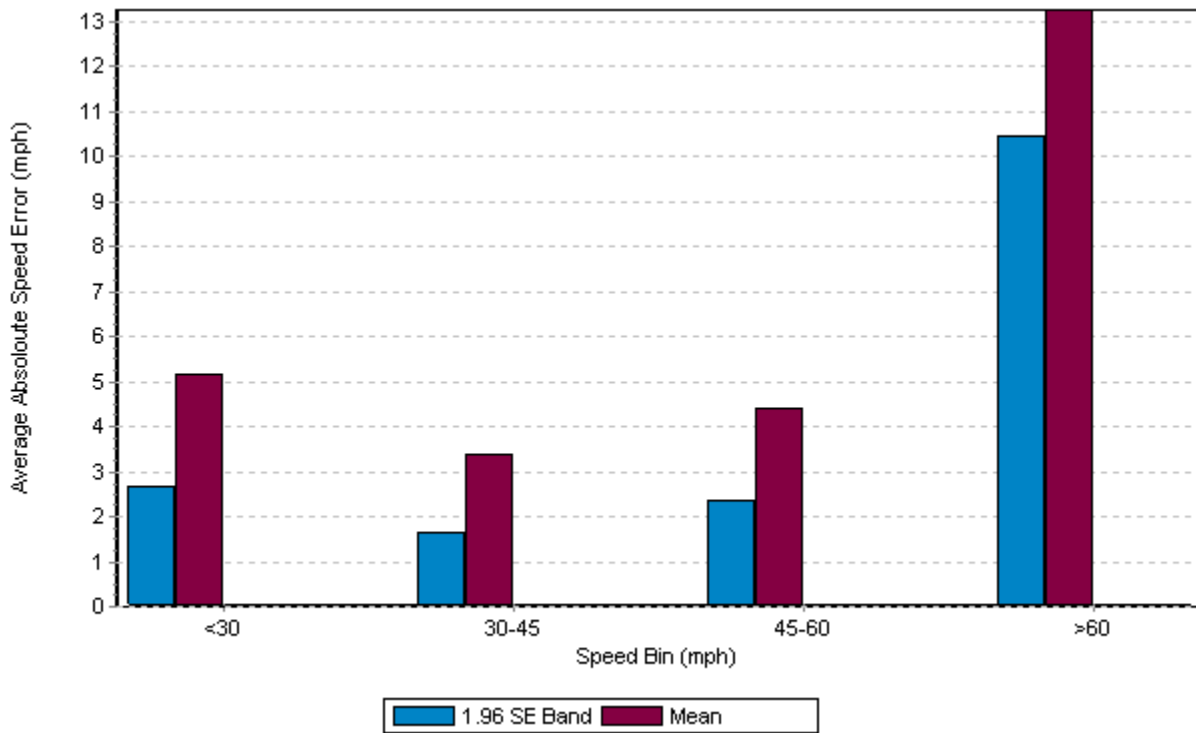


Figure 5
Average absolute speed error for a pair of freeway ramp segments in New Jersey