



I-95 Corridor Coalition

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



October 2009

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

Monthly Report

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Evaluation Results for the State of New Jersey

Summary

Travel time samples were collected along nearly 17 miles of freeways in New Jersey from Tuesday, September 8, 2009 to Thursday, September 17, 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 770 hours of observations along seven freeway segments in New Jersey. Table 1, below summarizes the results of the comparison between the validation data and the INRIX data for the same period. The absolute average speed error as measured against the SEM band is within the acceptable limits of the contract specifications for all speed bins. The speed error bias as measured against the SEM band is within the acceptable limits for all bins except the 0 – 30 MPH bin.

Table ES-1 New Jersey Evaluation Summary – September 2009						
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	8.20	10.20	6.00	7.10	38	3.2
30-45 MPH	6.90	10.80	2.20	5.00	10	0.8
45-60 MPH	2.20	5.30	1.60	4.00	460	38.3
> 60 MPH	1.90	4.60	-1.60	-3.40	8708	725.7
All Speeds	1.95	4.66	-1.40	-2.98	9216	768.0

Based upon data collected from Sept 8, 2009 through Sept 17, 2009 across 17 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 four occasions: September/October 2008, April 2009, June 2009 and September 2009. This represents nearly 4800 hours of observations along 123 miles of freeway segments in New Jersey. Table 2, below provides a summary of the cumulative validation effort. As shown, the absolute average speed error as measured against the SEM band is within the acceptable limits of the contract specifications for all speed bins. The speed error bias as measured against the SEM band is within the acceptable limits for the 45 – 60 MPH bin and the > 60 MPH bin.

Table ES-2 – New Jersey Cumulative Validation Results (through September 2009)						
State	Absolute Speed Error		Speed Error Bias		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	9.3	11.2	7.4	8.7	227	18.9
30-45 MPH	9.6	12.4	5.9	7.8	288	24.0
45-60 MPH	2.4	5.1	0.8	2.4	2887	240.6
> 60 MPH	2.5	5.0	-2.3	-4.2	54128	4510.7
All Speeds	2.5	5.0	-2.1	-3.7	57530	4794.2

Based upon data collected in September/October 2008, April 2009, June 2009, and September 2009.

Data Collection

Bluetooth sensor deployments in New Jersey started on Tuesday, September 8, 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 a week later on Thursday, September 17, 2009. 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.

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 seven freeway TMC segments are reported in this document. These segments cover a total length of approximately 17 miles. The coordinates of the locations at which the Bluetooth sensors were deployed throughout the state of New Jersey 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 less than 30 mph speed bin, INRIX data fails to 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 for the speed error bias. In the rest of speed bins, INRIX data quality is deemed as satisfactory based on the same requirements for both the absolute average speed error and the speed error bias. 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 some individual TMC segments are low.

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.

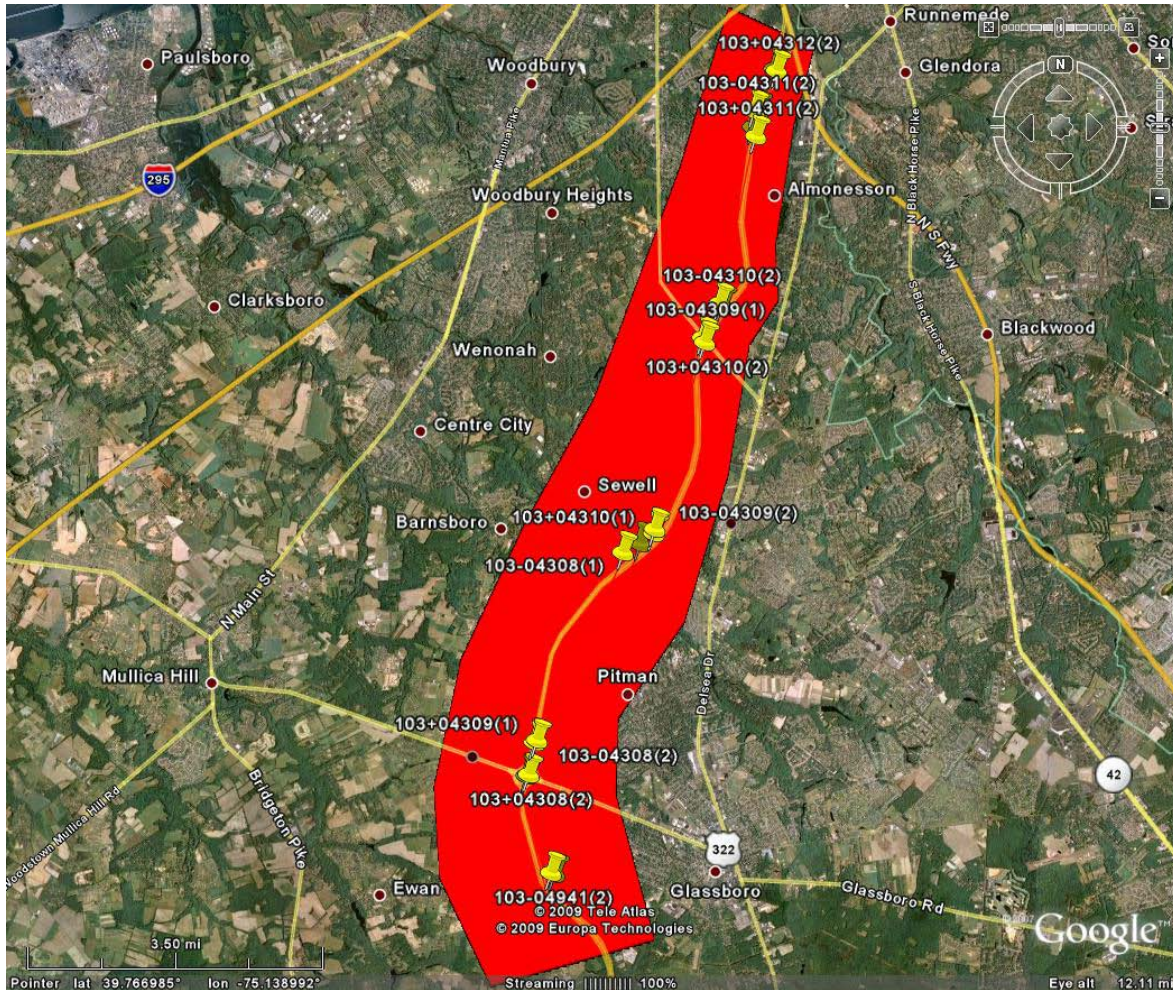


Figure 1
TMC segments selected for validation in New Jersey

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+04308	NJ-55	EXIT 48	US-322/EXIT 50	GLOUCESTER	NORTHBOUND	1.2
Freeway	103+04309	NJ-55	US 322/EXIT 50	EXIT 53	GLOUCESTER	NORTHBOUND	2.8
Freeway	103+04310	NJ-55	EXIT 53	NJ-47/EXIT 56	GLOUCESTER	NORTHBOUND	2.4
Freeway	103+04311	NJ-55	HWY 47/EXIT 56	DEPTFORD CENTER RD/EXIT 58	GLOUCESTER	NORTHBOUND	2.1
Freeway	103-04308	NJ-55	EXIT 53	US-322/EXIT 50	GLOUCESTER	SOUTHBOUND	2.6
Freeway	103-04309	NJ-55	HWY 47/EXIT 56	EXIT 53	GLOUCESTER	SOUTHBOUND	2.4
Freeway	103-04310	NJ-55	DEPTFORD CENTER RD/EXIT 58	NJ-47/EXIT 56	GLOUCESTER	SOUTHBOUND	2.2
Freeway	103-04941	NJ-55	US 322/EXIT 50	EXIT 48	GLOUCESTER	SOUTHBOUND	1.2
TOTAL							16.9

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+04308	39.699389	-75.149128	39.716468	-75.154888	1.23	39.699145	-75.148615	39.715525	-75.155000	1.20	-2.8%
Freeway	103+04309	39.722391	-75.153026	39.756200	-75.129984	2.75	39.723453	-75.152568	39.755888	-75.130583	2.63	-4.3%
Freeway	103+04310	39.757922	-75.126924	39.790741	-75.115525	2.43	39.758330	-75.126250	39.790545	-75.115492	2.37	-2.6%
Freeway	103+04311	39.797155	-75.111688	39.826202	-75.104072	2.14	39.798367	-75.110433	39.824962	-75.104118	1.95	-9.2%
Freeway	103-04308	39.754641	-75.133842	39.721996	-75.153564	2.57	39.754618	-75.134170	39.723143	-75.153320	2.47	-3.8%
Freeway	103-04309	39.791555	-75.115967	39.758658	-75.126709	2.42	39.791508	-75.116152	39.758975	-75.126537	2.39	-1.3%
Freeway	103-04310	39.827749	-75.104661	39.797434	-75.112206	2.23	39.827260	-75.104742	39.797658	-75.112055	2.17	-2.5%
Freeway	103-04941	39.716282	-75.155323	39.699584	-75.149894	1.20	39.715030	-75.155578	39.699517	-75.149875	1.12	-7.0%
TOTAL		16.97					16.29					

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	6.0	8.2	7.1	10.2	38
30-45	2.2	6.9	5.0	10.8	10
45-60	1.6	2.2	4.0	5.3	460
60+	-1.6	1.9	-3.4	4.6	8708

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	16%	50%	0%	42%	38
30-45	10%	40%	0%	10%	10
45-60	38%	84%	0%	52%	460
60+	50%	87%	0%	63%	8708

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+04308	1.23	1.20	0-30					36	
			30-45				837		
			45-60	1.9	1.9	4.4			4.8
			60+	-1.5	1.8	-3.7			5.1
103+04309	2.75	2.63	0-30						25
			30-45				1034		
			45-60	1.7	1.8	5.0		5.8	
			60+	-2.0	2.1	-4.5		5.4	
103+04310	2.43	2.37	0-30						51
			30-45				1223		
			45-60	1.3	2.6	3.7		5.9	
			60+	-1.8	2.0	-3.7		4.7	
103+04311	2.14	1.95	0-30	4.5	7.0	5.6		9.1	32
			30-45	3.2	6.8	6.5	11.1	9*	
			45-60	0.4	2.2	1.0	4.6	52	
			60+	-2.4	2.6	-4.6	5.3	1467	
103-04308	2.57	2.47	0-30					12	
			30-45				1174		
			45-60	1.6	1.6	4.5			5.6
			60+	-2.0	2.2	-4.3			5.2
103-04309	2.42	2.39	0-30						23
			30-45				975		
			45-60	1.6	1.6	5.3		5.3	
			60+	-1.3	1.5	-3.2		4.3	
103-04310	2.23	2.17	0-30	14.1	14.7	15.1		16.2	6*
			30-45	-7.2	7.2	-8.8	8.8	1*	
			45-60	1.9	2.4	4.3	5.3	216	
			60+	-0.6	1.3	-0.8	3.2	1553	
103-04941	1.20	1.12	0-30					45	
			30-45				445		
			45-60	2.1	2.1	4.8			5.5
			60+	-0.8	1.1	-2.5			4.2

*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+04308	0-30									
	30-45									
	45-60	16	44%	31	86%	1	3%	24	67%	
	60+	464	55%	737	88%	0	0%	474	57%	
103+04309	0-30									
	30-45									
	45-60	11	44%	22	88%	0	0%	10	40%	
	60+	475	46%	873	84%	0	0%	554	54%	
103+04310	0-30									
	30-45									
	45-60	16	31%	41	80%	0	0%	23	45%	
	60+	594	49%	1060	87%	0	0%	757	62%	
103+04311	0-30	6	19%	17	53%	0	0%	14	44%	
	30-45	1	11%	4	44%	0	0%	1	11%	
	45-60	26	50%	43	83%	0	0%	32	62%	
	60+	595	41%	1193	81%	1	0%	816	56%	
103-04308	0-30									
	30-45									
	45-60	7	58%	11	92%	0	0%	6	50%	
	60+	554	47%	997	85%	0	0%	666	57%	
103-04309	0-30									
	30-45									
	45-60	12	52%	22	96%	0	0%	12	52%	
	60+	545	56%	878	90%	0	0%	656	67%	
103-04310	0-30	0	0%	2	33%	0	0%	2	33%	
	30-45	0	0%	0	0%	0	0%	0	0%	
	45-60	65	30%	178	82%	0	0%	107	50%	
	60+	871	56%	1451	93%	0	0%	1298	84%	
103-04941	0-30									
	30-45									
	45-60	23	51%	39	87%	0	0%	24	53%	
	60+	291	65%	416	93%	0	0%	307	69%	

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

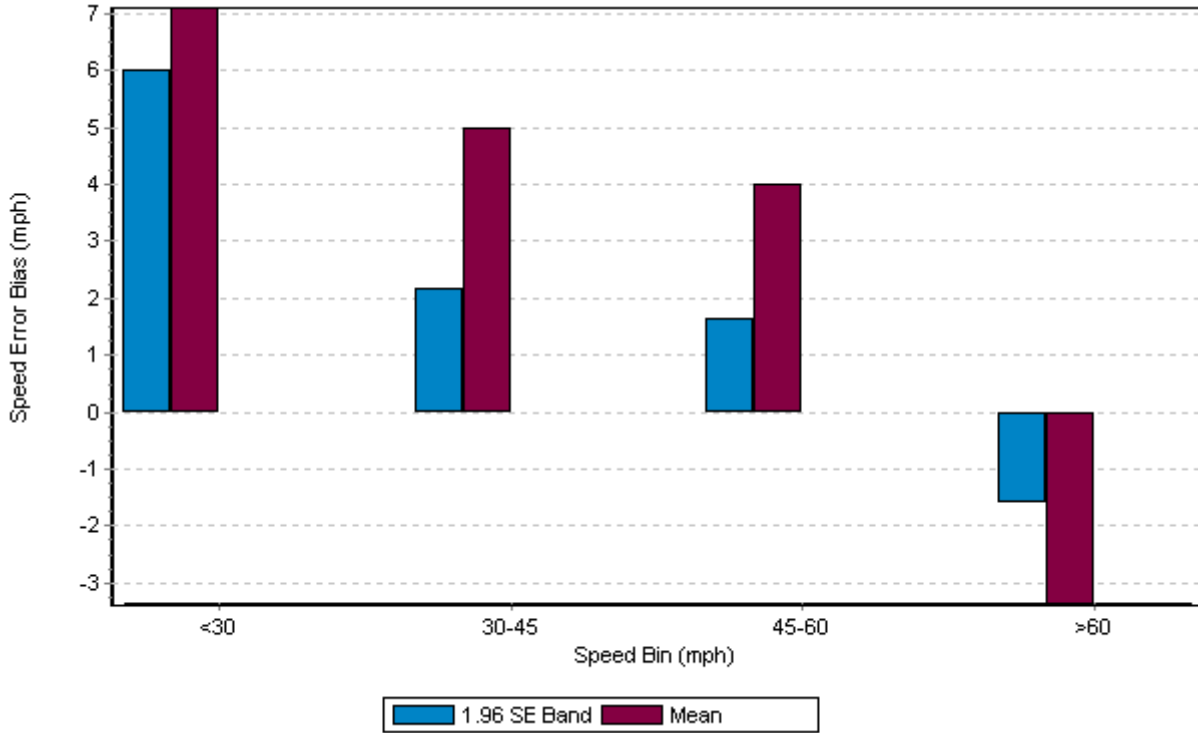


Figure 2
Speed error bias for freeway segments greater than one mile in New Jersey

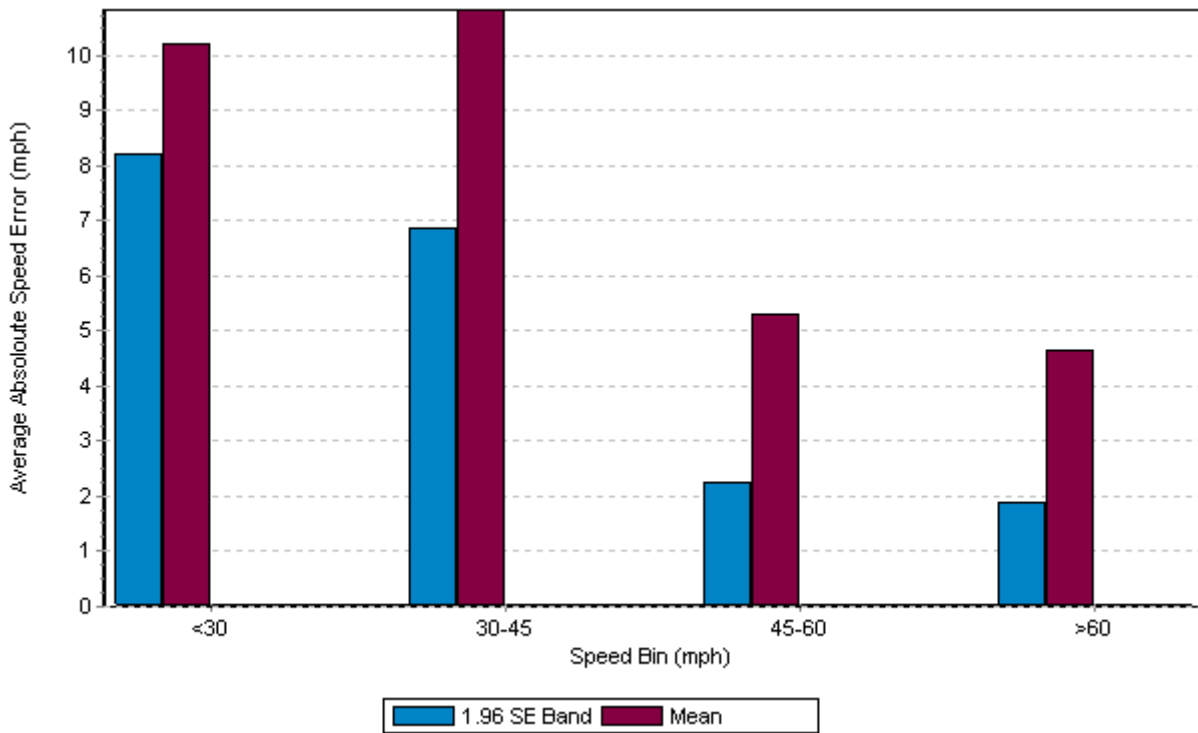


Figure 3
Average absolute speed error for freeway segments greater than one mile in New Jersey