I-95 Corridor Coalition

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

Monthly Report: Maryland

I-95 CORRIDOR COALITION

July 2014

I-95 CORRIDOR COALITION VEHICLE PROBE PROJECT VALIDATION OF INRIX DATA JULY 2014

Monthly Report

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I-95 Corridor Coalition

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July 2014

Evaluation Results for the State of Maryland

Executive Summary

The data from the Vehicle Probe Project is validated using Bluetooth™ Traffic Monitoring (BTM) technology on a near monthly basis. BTM sensors were deployed at the beginning and ending points of 14 segments of the MD-140 corridor for both directions. The Bluetooth sensor deployment covers the range from Fallstaff Rd to MD-27/Manchester Rd along MD-140. Travel time data was collected for both directions along the arterial, between June 5 and June 17, 2014. The dataset collected represents approximately 2,399 hours of observations along 14 arterial segments, totaling approximately 32 miles. The number of effective five-minute travel time samples observed was 28,787 in total.

ES Table 1 summarizes the results of the comparison between the BTM reference and the INRIX data for arterial segments during the above time periods. As shown, the average absolute speed error (AASE) were within specification in all speed bins. Speed Error Bias (SEB) were within specification in all speed bins except for the 0-15 MPH category.

ES Table 1 - Maryland Evaluation Summary for Arterials

	Absolute Speed Error (<10mph)		**Speed Error Bias (<5mph)**			
Speed Bin	Comparison with SEM Band	Comparison with Mean	Comparison with SEM Band	Comparison with Mean	Number of 5 Minute Samples	Hours of Data Collection
0-30 MPH	6.5	10.3	6.4	10.2	1010.0	84.2
30-45 MPH	2.2	5.4	2.0	4.5	4566.0	380.5
45-60 MPH	1.3	4.4	-0.1	-1.0	7167.0	597.3
>60 MPH	3.0	7.0	-1.9	-3.8	16044.0	1337.0
All Speeds	2.6	6.2	-0.6	-1.3	28787	2398.9

Based upon data collected from June 5, 2014 through June 17, 2014 across 32.05 miles of roadway.

Data Collection

The data from the Vehicle Probe Project is validated using Bluetooth™ Traffic Monitoring (BTM) technology on a near monthly basis. BTM sensors were deployed on the beginning and ending points of 14 different segments along the MD-140 arterials corridor. The Bluetooth sensor deployment covers the range from Fallstaff Rd to MD-27/Manchester Rd along MD-140. Travel time data was collected for both directions along the arterial. The data was collected between June 5 and June 17, 2014 with the assistance of Maryland Department of Transportation (MDOT) personnel. Segment locations were chosen with a high-likelihood of observing recurrent and non-recurrent congestions during peak or off-peak periods.

Figure 1 presents snapshots of the placement of sensors for the collection of data on the MD-140 corridor in Maryland. Red segments represent arterial segments selected for analysis.

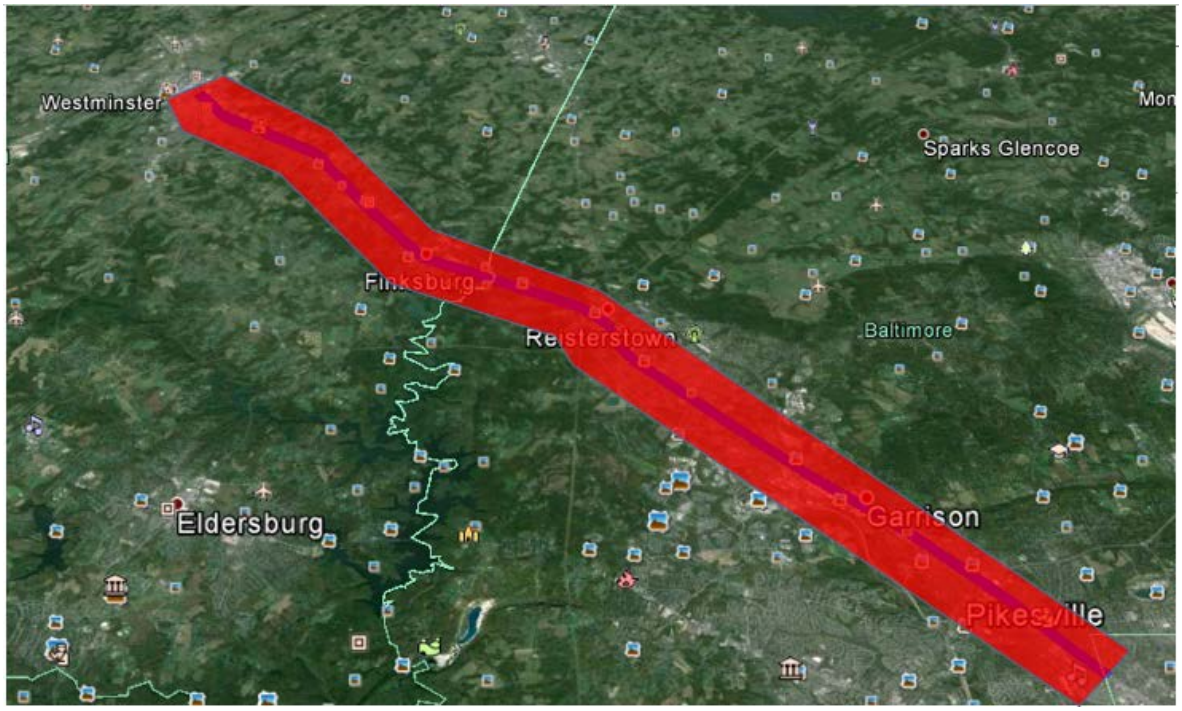

Figure 1 — Locations of segments selected for analysis on MD-140 in Maryland

TMC segments selected for validation in Maryland

Table 1 presents a list of data collection segments from Maryland. In total, these segments cover a length of 32.05 arterial miles. Data collection segments are comprised of one or more Traffic Message Channel (TMC) base segments, such that total length of the data collection segment is one mile long or greater on the arterial. When appropriate, consecutive TMC segments are combined to form a data collection segment longer than one mile. The results of the validation performed on 14 arterial segments for both directions are included in this report. Table 1 contains the summary information on each data collection segments. The latitude/longitude coordinates of the locations at which the Bluetooth sensors were deployed throughout the state of Maryland are provided in Table 1 as well as an active map link to view the data collection segment in detail. Click on the map link to see a detailed map for the respective data collection segment. It should be noted that the configuration of test segments is often such that the endpoint of one segment coincides with the start point of the next segment, so that one Bluetooth sensor covers both data collection segments.

Table 1 also provides data on the precise length of the TMCs comprising the test segment as compared to the measured length between Bluetooth™ Traffic Monitoring (BTM) sensors placed on the roadway. Details of the algorithm used to estimate equivalent path travel times based on INRIX data feeds for individual data collection segments are provided in a separate report. This algorithm finds an equivalent INRIX travel time (and therefore travel speed) corresponding to each sample BTM travel time observation on the test segment of interest.

Table 1
Segments selected for validation in Maryland

SEGMENT (Map Link)	GEOMETRIC DESCRIPTION						TMC CODES		Bluetooth Data	
	Crossroads	Lanes	AADT	Signals					Sensor	
	Starting at	Min	Min	#	# Access Points	Median Barrier	Begin	Length	Begin	Length
	Ending at	Max	Max	Density	Speed Limit	Major junctions	End	#	End	% Diff
										All Lengths in Miles / Speeds in MPH
MD-140 Westbound, Arterial Roadway in Maryland known as Reistertown Rd										
MD08-01	Fallstaff Rd	2	26750	4	16	NO	110+04974	0.61	A	0.61
	Milford Mill Rd/Slade Ave	2	26750	6.6	30	NO	110P04974	2	B	0.001978
MD08-02	Milford Mill Rd/Slade Ave	2	26750	6	10	NO	110+04975	0.86	B	0.83
	Old Court Rd	2	26750	7.0	30	NO	110P04976	3	C	0.0293204
MD08-03	Old Court Rd	2	40810	3	13	NO	110+04977	0.62	C	0.63
	I-695	3	43660	4.8	30	YES	110P04977	2	D	-0.0126354
MD08-04	I-695	3	43660	3	16	NO	110+04978	1.13	D	1.16
	Craddocks Ln/McDonogh Rd	3	43660	2.7	40	NO	110+04978	1	E	-0.0302054
MD08-07	Painters Mill Rd	2	37120	5	17	NO	110+04982	1.77	G	1.78
	Gwynnbrook Ave	2	37120	2.8	40	YES	110+04984	4	H	-0.003686
MD08-08	Gwynnbrook Ave	2	33030	4	21	NO	110+04985	1.29	H	1.33
	Cherry Hill Rd/Franklin Blvd	2	33030	3.1	40	NO	110+04985	1	I	-0.0308176
MD08-09	Cherry Hill Rd/Franklin Blvd	2	19110	3	14	NO	110+06272	0.64	I	0.64
	Walgrove Rd	2	19110	4.7	40	NO	110+06272	1	J	0.0067388
MD08-10	Walgrove Rd	1	19110	2	10	NO	110+06273	0.49	J	0.50
	Glyndon Dr	2	19110	4.1	30	NO	110+06274	3	K	-0.0123611
MD08-11	Glyndon Dr	1	19110	2	4	NO	110+06275	0.50	K	0.51
	Chatsworth Ave	1	19110	4.0	30	NO	110+06275	1	L	-0.0212752

Table 1 (Cont'd)
Segments selected for validation in Maryland

SEGMENT (Map Link)	GEOMETRIC DESCRIPTION						TMC CODES		Bluetooth Data	
	Crossroads	Lanes	AADT	Signals					Sensor	
	Starting at	Min	Min	#	# Access Points	Median Barrier	Begin	Length	Begin	Length
	Ending at	Max	Max	Density	Speed Limit	Major junctions	End	#	End	% Diff
										All Lengths in Miles / Speeds in MPH
MD-140 Westbound, Arterial Roadway in Maryland known as Reistertown Rd										
MD08-12	Chatsworth Ave	1	19110	2	10	NO	110+06276	0.77	L	0.76
	MD-795	2	19110	2.6	40	YES	110+09796	5	M	0.0076557
MD-140 Westbound, Arterial Roadway in Maryland known as Baltimore Blvd										
MD08-13	MD-795	2	52930	2	1	YES	110P09796	0.89	M	0.89
	Gores Mill Rd	3	52930	2.2	50	NO	110+09797	2	N	-0.0042347
MD08-14	Gores Mill Rd	2	40345	4	8	NO	110+07113	2.39	N	2.44
	MD-91/Emory Rd/Gamber Rd	2	41671	1.7	50	NO	110+07113	1	O	-0.022719
MD08-15	MD-91/Emory Rd/Gamber Rd	2	40080	1	4	YES	110P07113	1.98	O	1.94
	Green Mill Rd/Suffolk Rd	2	40080	0.5	55	YES	110+07964	2	P	0.0225321
MD08-17	Reese Rd	2	41090	2	7	YES	110+07966	2.54	Q	2.58
	MD-97/Malcolm Dr	2	41090	0.8	55	YES	110+07966	1	R	-0.0138417
MD-140 Eastbound, Arterial Roadway in Maryland known as Baltimore Blvd										
MD08-20	MD-97/Malcolm Dr	2	41090	2	7	YES	110-07965	2.44	R	2.58
	Reese Rd	2	41090	0.8	55	YES	110-07965	1	Q	-0.0561577
MD08-22	Green Mill Rd/Suffolk Rd	2	40080	1	14	YES	110-07113	1.99	P	1.94
	MD-91/Emory Rd/Gamber Rd	2	40080	0.5	55	YES	110N07113	2	O	0.02481

Table 1 (Cont'd)
Segments selected for validation in Maryland

SEGMENT (Map Link)	GEOMETRIC DESCRIPTION						TMC CODES		Bluetooth Data	
	Crossroads	Lanes	AADT	Signals					Sensor	
	Starting at	Min	Min	#	# Access Points	Median Barrier	Begin	Length	Begin	Length
	Ending at	Max	Max	Density	Speed Limit	Major junctions	End	#	End	% Diff
										All Lengths in Miles / Speeds in MPH
MD-140 Eastbound, Arterial Roadway in Maryland known as Baltimore Blvd										
MD08-23	MD-91/Emory Rd/Gamber Rd	2	40345	4	7	NO	110-09797	2.39	O	2.44
	Gores Mill Rd	2	41671	1.7	50	NO	110-09797	1	N	-0.0202503
MD08-24	Gores Mill Rd	2	52930	2	4	YES	110-09796	0.91	N	0.89
	MD-795	3	52930	2.2	50	NO	110N09796	2	M	0.0239601
MD-140 Eastbound, Arterial Roadway in Maryland known as Reistertown Rd										
MD08-25	MD-795	1	19110	2	12	NO	110-09795	0.75	M	0.76
	Chatsworth Ave	2	19110	2.6	40	YES	110-06275	5	L	-0.0093377
MD08-26	Chatsworth Ave	1	19110	2	7	NO	110-06274	0.50	L	0.51
	Glyndon Dr	1	19110	4.0	30	NO	110-06274	1	K	-0.0212746
MD08-27	Glyndon Dr	1	19110	2	4	NO	110-06273	0.50	K	0.50
	Walgrove Rd	2	19110	4.1	30	NO	110-06272	3	J	-0.0075587
MD08-28	Walgrove Rd	2	19110	3	10	NO	110-04985	0.64	J	0.64
	Cherry Hill Rd/Franklin Blvd	2	19110	4.7	40	NO	110-04985	1	I	0.0067387
MD08-29	Cherry Hill Rd/Franklin Blvd	2	33030	4	8	NO	110-04984	1.29	I	1.33
	Gwynnbrook Ave	2	33030	3.1	40	NO	110-04984	1	H	-0.0308176

Table 1 (Cont'd)
Segments selected for validation in Maryland

SEGMENT (Map Link)	GEOMETRIC DESCRIPTION						TMC CODES		Bluetooth Data	
	Crossroads	Lanes	AADT	Signals					Sensor	
	Starting at	Min	Min	#	# Access Points	Median Barrier	Begin	Length	Begin	Length
	Ending at	Max	Max	Density	Speed Limit	Major junctions	End	#	End	% Diff
										All Lengths in Miles / Speeds in MPH
MD-140 Eastbound, Arterial Roadway in Maryland known as Reistertown Rd										
MD08-30	Gwynnbrook Ave	2	37120	5	8	NO	110-04983	1.77	H	1.78
	Painters Mill Rd	2	37120	2.8	40	YES	110-04981	4	G	-0.0038298
MD08-33	Craddocks Ln/McDonogh Rd	3	43660	3	8	NO	110-04977	1.08	E	1.16
	I-695	3	43660	2.7	40	NO	110-04977	1	D	-0.072877
MD08-34	I-695	2	40810	3	10	NO	110N04977	0.67	D	0.63
	Old Court Rd	3	43660	4.8	30	YES	110-04976	2	C	0.0584691
MD08-35	Old Court Rd	2	26750	6	14	NO	110N04976	0.86	C	0.83
	Milford Mill Rd/Slade Ave	2	26750	7.0	30	NO	110-04974	3	B	0.0293204
MD08-36	Milford Mill Rd/Slade Ave	2	26750	4	9	NO	110N04974	0.61	B	0.61
	Fallstaff Rd	2	26750	6.6	30	NO	110-04973	2	A	0.0009532

Analysis of Arterial Results

Table 2 summarizes the data quality measures obtained as a result of comparison between Bluetooth and all reported INRIX speeds. Specifications include the Average Absolute Speed Error (AASE) and the Speed Error Bias (SEB).

> Average Absolute Speed Error (AASE)
> The AASE is defined as the mean absolute value of the difference between the mean speed reported from the VPP and the ground truth mean speed for a specified time period. The AASE is the primary accuracy metric. Based on the contract specifications, the speed data from the VPP shall have a maximum average absolute error of 10 miles per hour (MPH) in each of four speed ranges: 0-15 MPH, 15-25 MPH, 25-35 MPH, and > 35 MPH.
>
> Speed Error Bias (SEB)
> The SEB is defined as the average speed error (not the absolute value) in each speed bin. SEB is a measure of whether the speed reported in the VPP consistently under or over estimates speed as compared to ground truth speed. Based on the contract specifications, the VPP data shall have a maximum SEB of +/- 5 MPH in each of speed ranges as defined above.

The results are presented as compared against the mean of the ground truth data as well as the 95th percent confidence interval for the mean, referred to as the Standard Error of the Mean (SEM) band. The SEM band takes into account any uncertainty in the ground truth speed as measured by BTM equipment due to limited samples and/or data variance. Contract specifications are assessed against the SEM band. (See the *Vehicle Probe Project: Data Use and Application Guide* for additional details on the validation process.) The AASE in the lower two speed bins have proven to be the critical specification (and most difficult) to attain, and are highlighted in Table 2. The AASE below 10 MPH met contract specifications. The AASE below 5 MPH are considered exceptional quality. As shown, the average absolute speed error (AASE) was within specification for all the speed bins.

TABLE 2
Data quality measures for arterial segments in Maryland

SPEED BIN	Data Quality Measures for				No. of 5 Minute Samples	Hours of Data Collection
	1.96 SEM Band		Mean			
	SEB 5 mph (contract specifications)	AASE 10 mph (contract specifications)	SEB	AASE		
0-15	6.4	6.5	10.2	10.3	1010	84.2
15-25	2	2.2	4.5	5.4	4566	380.5
25-35	-0.1	1.3	-1	4.4	7167	597.3
35+	-1.9	3	-3.8	7	16044	1337

Table 3 shows the percentage of the time INRIX data falls within 5 mph of the SEM band and the mean for each speed bin for all arterial data segments in Maryland.

Table 3 Percent observations meeting data quality criteria for freeway segments in Maryland

	Data Quality Measures for				No. of Obs.
	1.96 SEM 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	
0-15	15%	48%	0%	18%	1010
15-25	48%	84%	0%	54%	4566
25-35	64%	91%	0%	66%	7167
35+	47%	76%	0%	45%	16044

Tables 4 and 5 present detailed data for individual TMC segments in Maryland in a similar format as Tables 2 and 3, respectively. Note that for some segments and in some speed bins the comparison results may not be reliable due to small number of observations.

Table 4
Data quality measures for individual arterial validation segments in the state of Maryland

TMC	Standard TMC length	Bluetooth distance	SPEED BIN	Data Quality Measures for				No. of Obs.
				1.96 SEM Band		Mean		
				Speed Error Bias	Average Absolute Speed Error	Speed Error Bias	Average Absolute Speed Error	
MD08-0001	0.61	0.61	0-15	5.2	5.2	6.7	6.7	1*
			15-25	0.3	0.4	1.2	2.9	115
			25-35	-1.4	1.5	-5.9	6.3	363
			35+	-5.7	5.7	-13.9	13.9	126
MD08-0002	0.86	0.83	0-15	5.6	5.6	10.1	10.1	122
			15-25	1.7	1.8	3.9	4.4	674
			25-35	-0.6	0.7	-2.1	3.1	210
			35+	-5.0	5.0	-10.1	10.1	13*
MD08-0003	0.62	0.63	0-15	4.9	4.9	7.8	7.9	338
			15-25	1.3	1.7	3.1	4.8	679
			25-35	-1.1	1.3	-2.5	4.9	93
			35+	-9.6	9.6	-14.7	14.7	4*
MD08-0004	1.13	1.16	0-15	5.3	5.3	11.4	11.4	42
			15-25	1.5	1.5	4.5	4.8	458
			25-35	-0.1	0.7	-1.3	3.6	871
			35+	-3.6	3.7	-7.5	7.9	222
MD08-0007	1.77	1.78	0-15	-	-	-	-	-
			15-25	2.5	2.5	8.6	8.6	39
			25-35	0.3	0.7	1.0	2.8	453
			35+	-2.0	2.1	-4.5	4.8	110
MD08-0008	1.29	1.33	0-15	-	-	-	-	-
			15-25	1.9	2.0	6.3	6.6	33
			25-35	-0.1	0.6	0.1	2.9	213
			35+	-2.9	2.9	-6.7	6.8	107
MD08-0009	0.64	0.64	0-15	-	-	-	-	-
			15-25	-0.5	0.7	5.0	6.8	8*
			25-35	0.0	0.3	-0.1	2.8	241
			35+	-3.3	3.3	-8.9	9.0	642
MD08-0010	0.49	0.5	0-15	14.8	14.8	18.9	18.9	2*
			15-25	2.5	2.5	7.6	7.6	53
			25-35	-0.1	0.6	0.3	3.0	411
			35+	-2.9	3.0	-6.9	7.1	137

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

Table 4 (Cont'd)
Data quality measures for individual arterial validation segments in the state of Maryland

TMC	Standard TMC length	Bluetooth distance	SPEED BIN	Data Quality Measures for				No. of Obs.
				1.96 SEM Band		Mean		
				Speed Error Bias	Average Absolute Speed Error	Speed Error Bias	Average Absolute Speed Error	
MD08-0011	0.50	0.51	0-15	6.8	7.5	9.4	10.7	14*
			15-25	1.0	1.6	3.5	4.6	94
			25-35	-1.0	1.0	-3.3	4.0	383
			35+	-3.4	3.4	-10.9	10.9	107
MD08-0012	0.77	0.76	0-15	13.3	13.3	20.6	20.6	1*
			15-25	5.4	5.4	11.3	11.3	33
			25-35	1.9	2.4	5.5	6.3	35
			35+	0.0	0.0	-0.4	0.4	1*
MD08-0013	0.89	0.89	0-15	16.1	16.1	17.9	17.9	21*
			15-25	8.4	8.4	9.7	10.9	19*
			25-35	6.2	6.2	15.2	15.2	9*
			35+	-4.8	4.9	-10.5	11.0	1581
MD08-0014	2.39	2.44	0-15	-	-	-	-	-
			15-25	26.8	26.8	28.7	28.7	2*
			25-35	3.2	3.2	16.9	17.0	23*
			35+	-1.4	1.9	-2.5	4.6	1874
MD08-0015	1.98	1.94	0-15	17.3	17.3	19.4	19.4	41
			15-25	10.1	10.2	13.8	13.9	86
			25-35	5.3	5.8	11.0	11.8	93
			35+	-0.5	2.0	-0.8	4.5	1580
MD08-0017	2.54	2.58	0-15	-	-	-	-	-
			15-25	-	-	-	-	-
			25-35	2.2	2.2	10.4	10.4	6*
			35+	-4.9	5.1	-8.2	9.1	1747
MD08-0020	2.44	2.58	0-15	-	-	-	-	-
			15-25	-	-	-	-	-
			25-35	13.2	13.2	19.4	19.4	13*
			35+	2.0	2.6	4.8	6.8	1638

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

Table 4 (Cont'd)
Data quality measures for individual arterial validation segments in the state of Maryland

TMC	Standard TMC length	Bluetooth distance	SPEED BIN	Data Quality Measures for				No. of Obs.
				1.96 SEM Band		Mean		
				Speed Error Bias	Average Absolute Speed Error	Speed Error Bias	Average Absolute Speed Error	
MD08-0022	1.99	1.94	0-15	-	-	-	-	-
			15-25	10.0	10.0	11.8	12.0	47
			25-35	7.0	8.1	11.9	13.9	82
			35+	-0.1	2.1	0.3	5.2	1735
MD08-0023	2.39	2.44	0-15	-	-	-	-	-
			15-25	-	-	-	-	-
			25-35	8.6	8.6	10.9	10.9	12*
			35+	-1.0	1.9	-1.7	4.7	1879
MD08-0024	0.91	0.89	0-15	-	-	-	-	-
			15-25	-	-	-	-	-
			25-35	-	-	-	-	-
			35+	-1.9	2.5	-4.9	7.6	1564
MD08-0025	0.75	0.76	0-15	-	-	-	-	-
			15-25	3.2	3.2	9.5	9.5	19*
			25-35	0.6	0.6	2.5	3.4	31
			35+	0.0	0.0	-2.1	2.1	3*
MD08-0026	0.50	0.51	0-15	8.4	8.4	11.0	11.0	2*
			15-25	1.1	1.3	3.8	4.5	118
			25-35	-0.6	0.6	-3.1	3.7	357
			35+	-2.7	2.7	-11.0	11.1	104
MD08-0027	0.50	0.5	0-15	-	-	-	-	-
			15-25	0.2	0.4	2.9	3.5	37
			25-35	-1.1	1.2	-3.6	4.5	398
			35+	-4.9	4.9	-10.8	10.8	121
MD08-0028	0.64	0.64	0-15	7.0	7.0	13.4	13.4	1*
			15-25	0.6	0.8	2.5	3.9	106
			25-35	-1.1	1.3	-3.9	5.0	551
			35+	-5.8	5.8	-11.7	11.7	217
MD08-0029	1.29	1.33	0-15	-	-	-	-	-
			15-25	6.6	6.6	9.6	9.6	2*
			25-35	-0.6	1.2	-1.4	3.2	149
			35+	-2.7	2.8	-5.3	5.8	111

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

Table 4 (Cont'd)
Data quality measures for individual arterial validation segments in the state of Maryland

TMC	Standard TMC length	Bluetooth distance	SPEED BIN	Data Quality Measures for				No. of Obs.
				1.96 SEM Band		Mean		
				Speed Error Bias	Average Absolute Speed Error	Speed Error Bias	Average Absolute Speed Error	
MD08-0030	1.77	1.78	0-15	11.3	11.3	17.0	17.0	3*
			15-25	4.8	4.8	10.2	10.2	188
			25-35	1.3	1.6	3.6	4.5	332
			35+	-1.3	1.3	-3.3	3.5	23*
MD08-0033	1.08	1.16	0-15	9.0	9.0	12.1	12.1	112
			15-25	3.4	3.4	6.4	6.6	540
			25-35	0.7	1.5	1.5	4.0	912
			35+	-2.0	2.2	-4.5	5.5	155
MD08-0034	0.67	0.63	0-15	5.2	5.2	9.7	9.7	158
			15-25	0.9	1.3	2.0	3.8	569
			25-35	-1.2	1.6	-3.9	5.0	345
			35+	-7.2	7.2	-12.1	12.1	22*
MD08-0035	0.86	0.83	0-15	5.7	5.7	10.6	10.6	151
			15-25	1.6	1.7	4.2	4.9	558
			25-35	-0.5	0.9	-1.1	3.2	268
			35+	-3.2	3.2	-7.2	7.4	31
MD08-0036	0.61	0.61	0-15	0.0	0.0	5.3	5.3	1*
			15-25	0.4	0.5	1.7	3.6	89
			25-35	-1.9	2.3	-6.1	7.1	313
			35+	-6.2	6.3	-13.4	13.5	190

Table 5
Observations meeting data quality criteria for individual arterial validation segments in the state of Maryland

TMC	Standard TMC length	Bluetooth distance	SPEED BIN	Data Quality Measures for				No. of Obs.
				1.96 SEM Band		Mean		
				Speed Error Bias	Average Absolute Speed Error	Speed Error Bias	Average Absolute Speed Error	
MD08-0001	0.61	0.61	0-15	5.2	5.2	6.7	6.7	1*
			15-25	0.3	0.4	1.2	2.9	115
			25-35	-1.4	1.5	-5.9	6.3	363
			35+	-5.7	5.7	-13.9	13.9	126
MD08-0002	0.86	0.83	0-15	5.6	5.6	10.1	10.1	122
			15-25	1.7	1.8	3.9	4.4	674
			25-35	-0.6	0.7	-2.1	3.1	210
			35+	-5.0	5.0	-10.1	10.1	13*
MD08-0003	0.62	0.63	0-15	4.9	4.9	7.8	7.9	338
			15-25	1.3	1.7	3.1	4.8	679
			25-35	-1.1	1.3	-2.5	4.9	93
			35+	-9.6	9.6	-14.7	14.7	4*
MD08-0004	1.13	1.16	0-15	5.3	5.3	11.4	11.4	42
			15-25	1.5	1.5	4.5	4.8	458
			25-35	-0.1	0.7	-1.3	3.6	871
			35+	-3.6	3.7	-7.5	7.9	222
MD08-0007	1.77	1.78	0-15	-	-	-	-	-
			15-25	2.5	2.5	8.6	8.6	39
			25-35	0.3	0.7	1.0	2.8	453
			35+	-2.0	2.1	-4.5	4.8	110
MD08-0008	1.29	1.33	0-15	-	-	-	-	-
			15-25	1.9	2.0	6.3	6.6	33
			25-35	-0.1	0.6	0.1	2.9	213
			35+	-2.9	2.9	-6.7	6.8	107
MD08-0009	0.64	0.64	0-15	-	-	-	-	-
			15-25	-0.5	0.7	5.0	6.8	8*
			25-35	0.0	0.3	-0.1	2.8	241
			35+	-3.3	3.3	-8.9	9.0	642
MD08-0010	0.49	0.5	0-15	14.8	14.8	18.9	18.9	2*
			15-25	2.5	2.5	7.6	7.6	53
			25-35	-0.1	0.6	0.3	3.0	411
			35+	-2.9	3.0	-6.9	7.1	137

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

Table 5 (Cont'd)
Observations meeting data quality criteria for individual arterial validation segments in the state of Maryland

TMC	Standard TMC length	Bluetooth distance	SPEED BIN	Data Quality Measures for				No. of Obs.
				1.96 SEM Band		Mean		
				Speed Error Bias	Average Absolute Speed Error	Speed Error Bias	Average Absolute Speed Error	
MD08-0011	0.50	0.51	0-15	6.8	7.5	9.4	10.7	14*
			15-25	1.0	1.6	3.5	4.6	94
			25-35	-1.0	1.0	-3.3	4.0	383
			35+	-3.4	3.4	-10.9	10.9	107
MD08-0012	0.77	0.76	0-15	13.3	13.3	20.6	20.6	1*
			15-25	5.4	5.4	11.3	11.3	33
			25-35	1.9	2.4	5.5	6.3	35
			35+	0.0	0.0	-0.4	0.4	1*
MD08-0013	0.89	0.89	0-15	16.1	16.1	17.9	17.9	21*
			15-25	8.4	8.4	9.7	10.9	19*
			25-35	6.2	6.2	15.2	15.2	9*
			35+	-4.8	4.9	-10.5	11.0	1581
MD08-0014	2.39	2.44	0-15	-	-	-	-	-
			15-25	26.8	26.8	28.7	28.7	2*
			25-35	3.2	3.2	16.9	17.0	23*
			35+	-1.4	1.9	-2.5	4.6	1874
MD08-0015	1.98	1.94	0-15	17.3	17.3	19.4	19.4	41
			15-25	10.1	10.2	13.8	13.9	86
			25-35	5.3	5.8	11.0	11.8	93
			35+	-0.5	2.0	-0.8	4.5	1580
MD08-0017	2.54	2.58	0-15	-	-	-	-	-
			15-25	-	-	-	-	-
			25-35	2.2	2.2	10.4	10.4	6*
			35+	-4.9	5.1	-8.2	9.1	1747
MD08-0020	2.44	2.58	0-15	-	-	-	-	-
			15-25	-	-	-	-	-
			25-35	13.2	13.2	19.4	19.4	13*
			35+	2.0	2.6	4.8	6.8	1638

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Table 5 (Cont'd)
Observations meeting data quality criteria for individual arterial validation segments in the state of Maryland

TMC	Standard TMC length	Bluetooth distance	SPEED BIN	Data Quality Measures for				No. of Obs.
				1.96 SEM Band		Mean		
				Speed Error Bias	Average Absolute Speed Error	Speed Error Bias	Average Absolute Speed Error	
MD08-0022	1.99	1.94	0-15	-	-	-	-	-
			15-25	10.0	10.0	11.8	12.0	47
			25-35	7.0	8.1	11.9	13.9	82
			35+	-0.1	2.1	0.3	5.2	1735
MD08-0023	2.39	2.44	0-15	-	-	-	-	-
			15-25	-	-	-	-	-
			25-35	8.6	8.6	10.9	10.9	12*
			35+	-1.0	1.9	-1.7	4.7	1879
MD08-0024	0.91	0.89	0-15	-	-	-	-	-
			15-25	-	-	-	-	-
			25-35	-	-	-	-	-
			35+	-1.9	2.5	-4.9	7.6	1564
MD08-0025	0.75	0.76	0-15	-	-	-	-	-
			15-25	3.2	3.2	9.5	9.5	19*
			25-35	0.6	0.6	2.5	3.4	31
			35+	0.0	0.0	-2.1	2.1	3*
MD08-0026	0.50	0.51	0-15	8.4	8.4	11.0	11.0	2*
			15-25	1.1	1.3	3.8	4.5	118
			25-35	-0.6	0.6	-3.1	3.7	357
			35+	-2.7	2.7	-11.0	11.1	104
MD08-0027	0.50	0.5	0-15	-	-	-	-	-
			15-25	0.2	0.4	2.9	3.5	37
			25-35	-1.1	1.2	-3.6	4.5	398
			35+	-4.9	4.9	-10.8	10.8	121
MD08-0028	0.64	0.64	0-15	7.0	7.0	13.4	13.4	1*
			15-25	0.6	0.8	2.5	3.9	106
			25-35	-1.1	1.3	-3.9	5.0	551
			35+	-5.8	5.8	-11.7	11.7	217
MD08-0029	1.29	1.33	0-15	-	-	-	-	-
			15-25	6.6	6.6	9.6	9.6	2*
			25-35	-0.6	1.2	-1.4	3.2	149
			35+	-2.7	2.8	-5.3	5.8	111

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

Table 5 (Cont'd)
Observations meeting data quality criteria for individual arterial validation segments in the state of Maryland

TMC	Standard TMC length	Bluetooth distance	SPEED BIN	Data Quality Measures for				No. of Obs.
				1.96 SEM Band		Mean		
				Speed Error Bias	Average Absolute Speed Error	Speed Error Bias	Average Absolute Speed Error	
MD08-0030	1.77	1.78	0-15	11.3	11.3	17.0	17.0	3*
			15-25	4.8	4.8	10.2	10.2	188
			25-35	1.3	1.6	3.6	4.5	332
			35+	-1.3	1.3	-3.3	3.5	23*
MD08-0033	1.08	1.16	0-15	9.0	9.0	12.1	12.1	112
			15-25	3.4	3.4	6.4	6.6	540
			25-35	0.7	1.5	1.5	4.0	912
			35+	-2.0	2.2	-4.5	5.5	155
MD08-0034	0.67	0.63	0-15	5.2	5.2	9.7	9.7	158
			15-25	0.9	1.3	2.0	3.8	569
			25-35	-1.2	1.6	-3.9	5.0	345
			35+	-7.2	7.2	-12.1	12.1	22*
MD08-0035	0.86	0.83	0-15	5.7	5.7	10.6	10.6	151
			15-25	1.6	1.7	4.2	4.9	558
			25-35	-0.5	0.9	-1.1	3.2	268
			35+	-3.2	3.2	-7.2	7.4	31
MD08-0036	0.61	0.61	0-15	0.0	0.0	5.3	5.3	1*
			15-25	0.4	0.5	1.7	3.6	89
			25-35	-1.9	2.3	-6.1	7.1	313
			35+	-6.2	6.3	-13.4	13.5	190