I-95 Corridor Coalition

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

Report for North Carolina (#7)
US-29 and US-74

I-95 CORRIDOR COALITION

February 2016

I-95 CORRIDOR COALITION VEHICLE PROBE PROJECT VALIDATION OF HERE DATA FEBRUARY 2016

Report for North Carolina (#7) US-29 and US-74

Prepared for:

I-95 Corridor Coalition

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Evaluation Results for the State of North Carolina

Executive Summary

The data from the Vehicle Probe Project is validated using Bluetooth™ Traffic Monitoring (BTM) technology on a near monthly basis. The validation of arterial data is similar to that of freeway data, however the following should be noted. The boundaries of the speed bins used for arterials are different than those used for freeways to accommodate the lower speeds on this type of corridor.

BTM sensors were deployed at the beginning and ending points of 15 different segments along the US-29 and US-74 corridor. The number of lanes for these corridors varies between 2 and 4 per direction with average signal density of 1 signal per mile. Average Annual Daily Traffic (AADT) along these corridors is 42,500 and the speed limit is 45 MPH.

The Bluetooth sensor deployment covers the range from US-601 to Eastway Dr. along US-29 and I-485 to Briar Creek Rd along US-74. Travel time data was collected for both directions along each arterial, between November 11 and November 25, 2015. The dataset collected represents approximately 2,568 hours of observations along 15 arterial segments, totaling approximately 23 miles. The total number of effective five-minute travel time samples observed was 30,810. Due to data quality considerations, one segment was dropped from final validation.

ES Table 1, below summarizes the results of the comparison between the BTM reference data and the HERE data for arterial segments during the above noted time period. As shown, the average absolute speed error (AASE) was within specification in all speed bins. The Speed Error Bias (SEB) was within specifications for all the speed bins when compared with the Standard Error of the Mean (SEM) Band. Although the data are compared to these specifications, caution should be used when using probe data on arterial roadways. Other factors including signal density and traffic volume should be considered.

ES Table 1 – North Carolina Evaluation Summary for Arterial

Speed Bin	Average 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		
0-15 MPH	4.7	6.8	4.7	6.8	1859	155
15-25 MPH	2.1	4.6	2.1	4.3	4654	388
25-35 MPH	1.1	3.2	0.7	2.1	7139	595
>35 MPH	1.9	4.2	-1.8	-3.5	17158	1430
All Speeds	1.9	4.2	-0.2	-0.4	30810	2568

Based upon data collected from November 11, 2015 through November 25, 2015 across 23 miles of roadway.

Data Collection

Travel time samples were collected along 15 arterial segments with the assistance of North Carolina Department of Transportation (NCDOT) personnel. Arterial segments studied were located on US-29 corridor from US-601 to Eastway Dr. and on US-74 corridor from I-485 to Briar Creek Rd. Travel time data was collected for both directions along US-29 and US-74 between November 11 and November 25, 2015. Segment locations were chosen with a high-likelihood of observing recurrent and non-recurrent congestion during peak and off-peak periods.

Figure 1 and 2 present an overview snapshot of the placement of sensors for the collection of data on the US-29 and US-74 corridors in North Carolina. Blue segments represent arterial segments selected for analysis. The number of lanes for these corridors varies between 2 and 4 per direction with average signal density of 1 signal per mile. Average Annual Daily Traffic (AADT) along these corridors is 42,500 and the speed limit is 45 MPH.

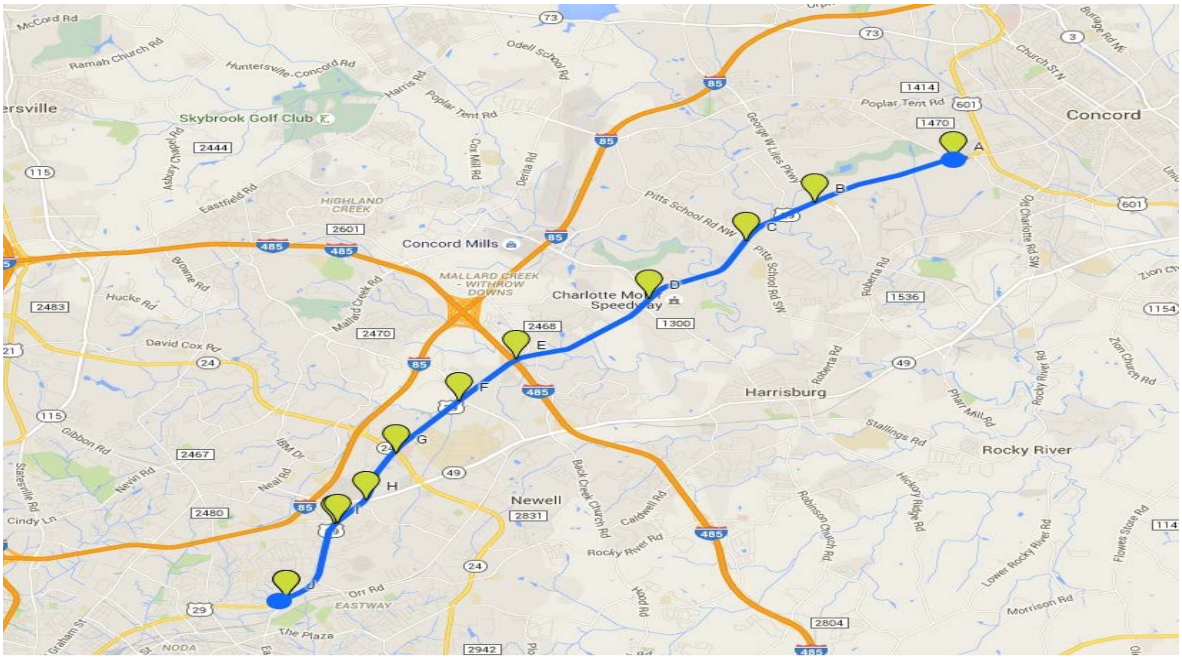

Figure 1 — Locations of all segments selected on US-29 for analysis in North Carolina

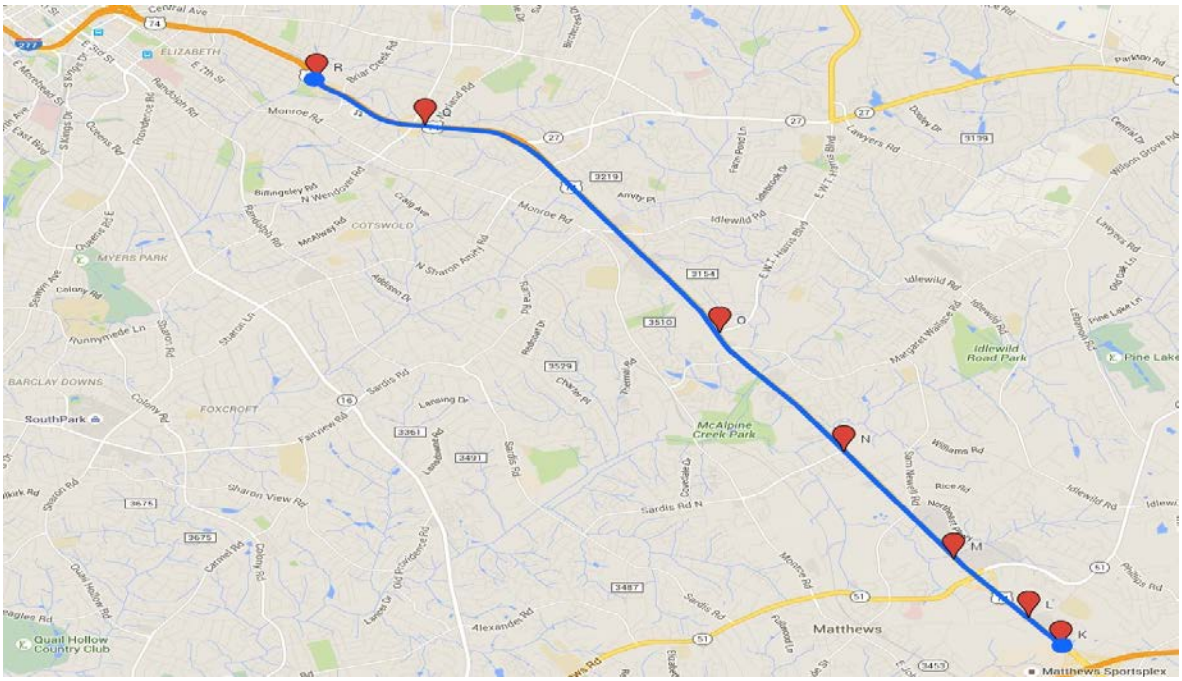

Figure 2 — Locations of all segments selected on US-74 for analysis in North Carolina

TMC segments selected for validation in North Carolina

Table 1 presents the data collection segments from North Carolina. As a whole, these segments cover a total length of 23 arterial miles. Data collection segments are comprised of one or more Traffic Message Channel (TMC) base segments, such that the total length of the data collection segment is one mile long or greater in most segments for arterials. When appropriate, consecutive TMC segments are combined to form a data collection segment longer than one mile. The results of the validation performed on 15 bidirectional arterial segments are included in this report. Table 1 contains the summary information on each data collection segment including the latitude/longitude coordinates of the locations at which the Bluetooth sensors were deployed along US-29 and US-74 in North Carolina 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 the 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. An algorithm was developed and documented in a separate report[1] as part of the initial VPP project and is being used for the validation of all vendors in VPPII. Details of the algorithm used to estimate equivalent path travel times based on HERE data feeds for individual data collection segments are provided in this separate report. This algorithm finds an equivalent HERE travel time (and therefore travel speed) corresponding to each sample BTM travel time observation on the test segment of interest.

[1] Ali Haghani, Masoud Hamedi, Kaveh Farokhi Sadabadi, Estimation of Travel Times for Multiple TMC Segments, prepared for I-95 Corridor Coalition, February 2010 (link)

Table 1
Segments selected for validation in North Carolina

SEGMENT (Map Link)	DESCRIPTION Highway / North Carolina	State / County	Starting at / Ending at	TMC CODES Begin / End	Length / Number	Deployment Begin Lat/Lon / End Lat/Lon		Length / % Diff
Arterials								All Lengths in Miles
A1	US-29	North Carolina	US-601	125N08378	3.93	35.399811	-80.608533	2.06
NC07-0001	Southbound	Cabarrus	George W Liles Pkwy	125N08378	1	35.381990	-80.648813	-47.59%
A2	US-29	North Carolina	George W Liles Pkwy	125N08378	3.93	35.381990	-80.648813	1.28
NC07-0002	Southbound	Cabarrus	Pitts School Rd	125N08378	1	35.370183	-80.665625	-67.43%
A3	US-29	North Carolina	Pitts School Rd	125N08377	1.86	35.370183	-80.665625	1.88
NC07-0003	Southbound	Cabarrus	Speedway Blvd	125N08377	1	35.352531	-80.688302	1.08%
A4	US-29	North Carolina	Speedway Blvd	125N08376	2.24	35.352531	-80.688302	2.28
NC07-0004	Southbound	Mecklenburg	I-485	125N08375	2	35.334259	-80.719634	1.79%
A5	US-29	North Carolina	I-485	125N08375	1.22	35.334259	-80.719634	1.19
NC07-0005	Southbound	Mecklenburg	Mallard Creek Church Rd	125N08374	2	35.321355	-80.733914	-2.47%
A6	US-29	North Carolina	Mallard Creek Church Rd	125N08373	1.41	35.321355	-80.733914	1.40
NC07-0006	Southbound	Mecklenburg	Wt Harris Blvd	125N08373	1	35.305577	-80.749961	-0.71%
A7	US-29	North Carolina	Wt Harris Blvd	125N08372	1.21	35.305577	-80.749961	1.08
NC07-0007	Southbound	Mecklenburg	NC-49/University City Blvd	125N08372	1	35.290902	-80.756885	-10.79%
A8	US-29	North Carolina	NC-49/University City Blvd	125N08372	2.28	35.290902	-80.756885	0.61
NC07-0008	Southbound	Mecklenburg	US-29	125N08370	3	35.285736	-80.762466	-73.19%
A9	US-29	North Carolina	US-29	125N08370	2.02	35.285736	-80.762466	1.80
NC07-0009	Southbound	Mecklenburg	Eastway Dr	125N08369	2	35.260209	-80.776593	-10.89%
A10	US-29	North Carolina	Eastway Dr	125P08370	2.10	35.260096	-80.776459	1.80
NC07-0010	Northbound	Mecklenburg	US-29	125P08371	2	35.286415	-80.761076	-14.31%
A11	US-29	North Carolina	US-29	125P08371	2.17	35.286415	-80.761076	0.60
NC07-0011	Northbound	Mecklenburg	NC-49/University City Blvd	125P08372	2	35.290519	-80.756774	-72.35%

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

SEGMENT (Map Link)	DESCRIPTION			TMC CODES		Deployment		
	Highway North Carolina	State County	Starting at Ending at	Begin End	Length Number	Begin Lat/Lon End Lat/Lon		Length % Diff
Arterials								All Lengths in Miles
A12	US-29	North Carolina	NC-49/University City Blvd	125P08373	1.11	35.290519	-80.756774	1.08
NC07-0012	Northbound	Mecklenburg	Wt Harris Blvd	125P08373	1	35.305389	-80.749874	-2.71%
A13	US-29	North Carolina	Wt Harris Blvd	125P08374	1.42	35.305389	-80.749874	1.40
NC07-0013	Northbound	Mecklenburg	Mallard Creek Church Rd	125P08374	1	35.321291	-80.734030	-1.41%
A14	US-29	North Carolina	Mallard Creek Church Rd	125P08375	1.21	35.321291	-80.734030	1.19
NC07-0014	Northbound	Mecklenburg	I-485	125P08375	1	35.334150	-80.719522	-1.65%
A15	US-29	North Carolina	I-485	125P08376	2.24	35.334150	-80.719522	2.28
NC07-0015	Northbound	Mecklenburg	Speedway Blvd	125P08377	2	35.352420	-80.688128	1.79%
A16	US-29	North Carolina	Speedway Blvd	125P08378	1.85	35.352420	-80.688128	1.88
NC07-0016	Northbound	Cabarrus	Pitts School Rd	125P08378	1	35.370078	-80.665506	1.62%
A17	US-29	North Carolina	Pitts School Rd	125P08379	3.94	35.370078	-80.665506	1.26
NC07-0017	Northbound	Cabarrus	George W Liles Pkwy	125P08379	1	35.381990	-80.648813	-67.99%
A18	US-29	North Carolina	George W Liles Pkwy	125P08379	3.94	35.381990	-80.648813	2.07
NC07-0018	Northbound	Cabarrus	US-601	125P08379	1	35.399789	-80.608379	-47.41%
A19	US-74	North Carolina	I-485	125N05816	0.43	35.114310	-80.692880	0.43
NC07-0019	Westbound	Mecklenburg	Matthews Mint Hill Rd	125N05816	1	35.118969	-80.697913	0.00%
A20	US-74	North Carolina	Matthews Mint Hill Rd	125N05815	0.97	35.118969	-80.697913	0.91
NC07-0020	Westbound	Mecklenburg	NC-51	125N05815	1	35.129748	-80.708904	-6.18%
A21	US-74	North Carolina	NC-51	125N05814	2.18	35.129748	-80.708904	1.55
NC07-0021	Westbound	Mecklenburg	Sardis Rd	125N05813	2	35.147134	-80.724211	-29.00%
A22	US-74	North Carolina	Sardis Rd	125N05812	1.71	35.147134	-80.724211	1.72
NC07-0022	Westbound	Mecklenburg	E Wt Harris Blvd	125N05812	1	35.166873	-80.742367	0.58%

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

SEGMENT (Map Link)	DESCRIPTION			TMC CODES		Deployment		
	Highway	State	Starting at	Begin	Length	Begin Lat/Lon		Length
	North Carolina	County	Ending at	End	Number	End Lat/Lon		% Diff
Arterials								All Lengths in Miles
A23	US-74	North Carolina	E Wt Harris Blvd	125N05811	3.85	35.166873	-80.742367	3.57
NC07-0023	Westbound	Mecklenburg	NC-27/NC-24/Albemarle Rd	125N05808	4	35.201710	-80.782985	-7.27%
A24	US-74	North Carolina	NC-27/NC-24/Albemarle Rd	125N05808	1.13	35.201710	-80.782985	1.06
NC07-0024	Westbound	Mecklenburg	Briar Creek Rd/Television Ln	125N10232	2	35.209215	-80.799964	-6.21%
A25	US-74	North Carolina	Briar Creek Rd/Television Ln	125P10232	2.37	35.208519	-80.799499	1.09
NC07-0025	Eastbound	Mecklenburg	Eastway Dr/N Wendover Rd	125P05808	2	35.201606	-80.784384	-54.01%
A26	US-74	North Carolina	Eastway Dr/N Wendover Rd	125P05809	3.54	35.201606	-80.784384	3.57
NC07-0026	Eastbound	Mecklenburg	NC-27/NC-24/Albemarle Rd	125P05812	5	35.166762	-80.742552	0.85%
A27	US-74	North Carolina	NC-27/NC-24/Albemarle Rd	125P05813	1.71	35.166762	-80.742552	1.72
NC07-0027	Eastbound	Mecklenburg	Sardis Rd	125P05813	1	35.147033	-80.724340	0.58%
A28	US-74	North Carolina	Sardis Rd	125P05814	1.86	35.147033	-80.724340	1.54
NC07-0028	Eastbound	Mecklenburg	NC-51	125P05815	2	35.128707	-80.708461	-17.17%
A29	US-74	North Carolina	NC-51	125P05815	1.53	35.128707	-80.708461	0.91
NC07-0029	Eastbound	Mecklenburg	Matthews Mint Hill Rd	125P05816	2	35.118919	-80.698108	-40.55%

Analysis of Arterial Results

Table 2 summarizes the data quality measures obtained as a result of a comparison between Bluetooth and all reported HERE speeds. Specifications used for comparison 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 range. 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 bands have proven to be the critical specification (and most difficult) to attain. As shown, the average absolute speed error (AASE) and the Speed Error Bias (SEB) were both within specifications for all speed bins when compared with the Standard Error of the Mean (SEM) Band.

TABLE 2 Data quality measures for arterial segments in North Carolina

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	SEB	AASE		
0-15	4.7	4.7	6.8	6.8	1859	155
15-25	2.1	2.1	4.3	4.6	4654	388
25-35	0.7	1.1	2.1	3.2	7139	595
35+	-1.8	1.9	-3.5	4.2	17158	1430

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

Table 3 Percent observations meeting data quality criteria for arterial segments in North Carolina

SPEED BIN	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	18.83%	62.02%	0%	36.58%	1859
15-25	51.48%	83.71%	0%	47.77%	4654
25-35	68.13%	92.14%	0%	56.55%	7139
35+	57.27%	84.74%	0%	52.84%	17158

Tables 4 and 5 present detailed data for individual TMC segments in this validation 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 the small number of observations.

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

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	
NC07-0001	2.07	2.06	0-15	25.9	25.9	26.6	26.6	1*
			15-25	5.9	5.9	11.5	11.5	24*
			25-35	1.9	1.9	5.8	6.0	52
			35+	-1.7	1.9	-3.8	5.3	652
NC07-0002	1.26	1.28	0-15	-	-	-	-	-
			15-25	7.1	7.1	12.4	12.4	2*
			25-35	2.0	2.0	6.7	7.1	119
			35+	-2.0	2.1	-4.2	6.1	1074
NC07-0003	1.84	1.88	0-15	-	-	-	-	-
			15-25	-	-	-	-	-
			25-35	3.8	3.8	8.9	8.9	185
			35+	-0.2	0.8	0.5	4.3	709
NC07-0004	2.24	2.28	0-15	19.8	19.8	22.1	22.1	1*
			15-25	0.0	0.0	18.2	18.2	1*
			25-35	1.4	1.4	6.1	6.2	45
			35+	-1.2	1.3	-4.3	5.2	476
NC07-0005	1.20	1.19	0-15	-	-	-	-	-
			15-25	6.7	6.7	13.9	13.9	19*
			25-35	1.5	1.5	7.1	7.3	342
			35+	-0.3	0.5	-1.6	4.3	305
NC07-0006	1.36	1.40	0-15	8.5	8.5	13.9	13.9	103
			15-25	3.1	3.1	6.5	6.7	66
			25-35	0.1	0.1	1.7	2.6	19*
			35+	0.0	0.0	-0.7	0.7	1*
NC07-0007	1.01	1.08	0-15	6.4	6.4	10.8	10.8	123
			15-25	0.7	0.7	3.1	4.7	42
			25-35	-0.9	0.9	-3.6	5.2	5*
			35+	-	-	-	-	-
NC07-0008	0.61	0.61	0-15	6.8	6.8	11.4	11.4	94
			15-25	1.5	1.5	7.2	7.5	718
			25-35	-0.1	0.3	-0.4	4.7	519
			35+	-3.2	3.2	-11.3	11.4	103
NC07-0009	1.74	1.80	0-15	4.1	4.1	10.0	10.0	15*
			15-25	1.8	1.9	5.1	5.3	232
			25-35	0.4	0.9	1.1	3.4	272
			35+	-1.2	1.2	-5.0	6.5	8*
NC07-0010	1.76	1.80	0-15	4.3	4.3	6.6	6.6	135
			15-25	1.5	1.6	4.2	4.7	176
			25-35	0.4	0.9	1.2	3.3	151
			35+	-1.5	1.5	-2.7	3.6	22
NC07-0011	0.60	0.60	0-15	5.1	5.1	9.4	9.4	261
			15-25	2.2	2.3	6.9	7.3	990
			25-35	0.3	0.7	2.7	5.1	169
			35+	-1.4	1.4	-3.2	4.3	14*

*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 North Carolina

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	
NC07-0012	1.10	1.08	0-15	4.8	4.8	8.5	8.5	84
			15-25	0.4	0.5	0.8	3.1	131
			25-35	-3.3	3.3	-7.4	7.5	74
			35+	-3.8	3.8	-9.0	9.0	5*
NC07-0013	1.39	1.40	0-15	6.6	6.6	10.1	10.1	52
			15-25	0.9	1.2	3.3	4.8	218
			25-35	-2.0	2.1	-5.1	5.9	109
			35+	-4.0	4.0	-8.9	8.9	7*
NC07-0014	1.21	1.19	0-15	-	-	-	-	-
			15-25	4.1	4.1	11.0	11.0	65
			25-35	0.6	0.7	4.4	5.3	342
			35+	-0.8	0.8	-3.7	4.8	241
NC07-0015	2.24	2.28	0-15	-	-	-	-	-
			15-25	0.1	0.1	15.3	15.3	1*
			25-35	1.4	1.4	5.4	5.5	36
			35+	-1.1	1.2	-3.3	4.5	309
NC07-0016	1.84	1.88	0-15	-	-	-	-	-
			15-25	1.8	1.8	4.5	4.5	1*
			25-35	2.3	2.3	7.1	7.1	37
			35+	-0.8	1.1	-2.3	4.4	875
NC07-0017	1.26	1.26	0-15	15.4	15.4	17.2	17.2	43
			15-25	8.3	8.3	12.5	13.0	57
			25-35	1.3	1.3	5.8	6.4	191
			35+	-1.5	1.5	-4.2	5.5	845
NC07-0018	2.07	2.07	0-15	17.1	17.1	21.9	21.9	6*
			15-25	5.4	5.4	10.8	10.8	29*
			25-35	1.3	1.4	4.4	5.1	232
			35+	-0.5	0.7	-1.6	3.4	549
NC07-0019	0.43	0.43	0-15	2.1	2.1	4.7	4.9	378
			15-25	0.6	0.6	2.4	4.0	514
			25-35	-0.3	0.7	-2.6	4.9	366
			35+	-3.6	3.6	-8.8	9.2	861
NC07-0020	0.91	0.91	0-15	3.9	3.9	5.7	5.7	3*
			15-25	3.4	3.4	10.9	11.0	46
			25-35	0.9	0.9	6.6	7.0	542
			35+	-1.9	2.0	-3.9	5.8	1336
NC07-0021	1.48	1.55	0-15	5.3	5.3	6.9	7.0	73
			15-25	3.1	3.1	5.1	5.3	199
			25-35	0.2	0.5	0.8	3.2	597
			35+	-2.2	2.2	-5.4	5.9	710
NC07-0022	1.70	1.72	0-15	4.5	4.5	5.9	5.9	57
			15-25	3.4	3.4	6.6	6.7	161
			25-35	0.9	0.9	3.3	4.1	955
			35+	-0.6	0.8	-2.2	3.9	459

*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 North Carolina

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	
NC07-0023	3.47	3.57	0-15	6.6	6.6	7.7	7.7	24*
			15-25	1.6	1.6	3.2	3.6	75
			25-35	0.5	0.9	1.5	3.3	164
			35+	-1.0	1.1	-3.0	3.8	802
NC07-0024	1.06	1.06	0-15	4.3	4.3	5.8	5.8	51
			15-25	2.4	2.4	3.5	3.8	149
			25-35	1.8	2.3	2.9	4.5	81
			35+	-1.4	1.5	-3.4	4.6	1996
NC07-0025	1.08	1.09	0-15	6.3	6.3	9.1	9.1	12*
			15-25	3.8	3.8	6.8	6.9	31
			25-35	0.6	1.5	1.3	3.8	58
			35+	-2.5	2.6	-5.6	5.9	2201
NC07-0026	3.52	3.57	0-15	3.4	3.4	6.6	6.6	5*
			15-25	2.1	2.1	4.1	4.2	155
			25-35	0.8	0.8	2.5	3.0	181
			35+	-0.3	0.5	-1.6	3.3	322
NC07-0027	1.70	1.72	0-15	1.5	1.5	3.5	3.7	57
			15-25	2.0	2.1	4.6	5.3	272
			25-35	0.4	0.6	2.0	3.9	437
			35+	-1.2	1.2	-5.4	6.4	413
NC07-0028	1.55	1.54	0-15	3.6	3.6	5.1	5.1	281
			15-25	3.5	3.6	6.3	6.5	255
			25-35	1.7	1.7	5.0	5.5	716
			35+	0.0	0.5	0.2	3.6	274
NC07-0029	0.89	0.91	0-15	-	-	-	-	-
			15-25	1.8	1.8	5.2	5.2	25*
			25-35	-0.1	0.3	0.2	3.6	143
			35+	-4.2	4.2	-9.6	9.7	1589

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

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

TMC	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		
		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	
NC07-0001	0-15	0	0%	0	0%	0	0%	0	0%	1*
	15-25	0	0%	3	13%	0	0%	1	4%	24*
	25-35	10	19%	32	62%	0	0%	23	44%	52
	35+	133	20%	438	67%	0	0%	353	54%	652
NC07-0002	0-15	-	-	-	-	-	-	-	-	-
	15-25	0	0%	0	0%	0	0%	0	0%	2*
	25-35	22	18%	61	51%	0	0%	37	31%	119
	35+	270	25%	671	62%	0	0%	521	49%	1074
NC07-0003	0-15	-	-	-	-	-	-	-	-	-
	15-25	-	-	-	-	-	-	-	-	-
	25-35	1	1%	39	21%	0	0%	18	10%	185
	35+	196	28%	572	81%	1	0%	452	64%	709
NC07-0004	0-15	0	0%	0	0%	0	0%	0	0%	1*
	15-25	0	0%	0	0%	0	0%	0	0%	1*
	25-35	4	9%	26	58%	0	0%	17	38%	45
	35+	101	21%	345	72%	0	0%	260	55%	476
NC07-0005	0-15	-	-	-	-	-	-	-	-	-
	15-25	0	0%	0	0%	0	0%	0	0%	19*
	25-35	33	10%	167	49%	1	0%	96	28%	342
	35+	115	38%	259	85%	0	0%	215	70%	305
NC07-0006	0-15	0	0%	6	6%	0	0%	5	5%	103
	15-25	6	9%	26	39%	0	0%	21	32%	66
	25-35	8	42%	18	95%	0	0%	17	89%	19*
	35+	1	100%	1	100%	0	0%	1	100%	1*
NC07-0007	0-15	0	0%	16	13%	0	0%	9	7%	123
	15-25	6	14%	34	81%	0	0%	28	67%	42
	25-35	0	0%	3	60%	0	0%	3	60%	5*
	35+	-	-	-	-	-	-	-	-	-
NC07-0008	0-15	0	0%	18	19%	0	0%	9	10%	94
	15-25	154	21%	413	58%	0	0%	273	38%	718
	25-35	209	40%	428	82%	0	0%	306	59%	519
	35+	9	9%	29	28%	0	0%	14	14%	103
NC07-0009	0-15	0	0%	0	0%	0	0%	0	0%	15*
	15-25	27	12%	148	64%	0	0%	115	50%	232
	25-35	58	21%	226	83%	1	0%	203	75%	272
	35+	1	13%	5	63%	0	0%	4	50%	8*
NC07-0010	0-15	3	2%	61	45%	0	0%	53	39%	135
	15-25	23	13%	116	66%	0	0%	98	56%	176
	25-35	35	23%	128	85%	0	0%	119	79%	151
	35+	5	23%	17	77%	0	0%	16	73%	22
NC07-0011	0-15	8	3%	84	32%	0	0%	44	17%	261
	15-25	129	13%	522	53%	1	0%	353	36%	990
	25-35	32	19%	123	73%	0	0%	92	54%	169
	35+	2	14%	10	71%	0	0%	10	71%	14*

*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 North Carolina

TMC	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		
		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	
NC07-0012	0-15	1	1%	23	27%	0	0%	18	21%	84
	15-25	37	28%	123	94%	0	0%	113	86%	131
	25-35	4	5%	28	38%	0	0%	18	24%	74
	35+	0	0%	1	20%	0	0%	1	20%	5*
NC07-0013	0-15	0	0%	8	15%	0	0%	5	10%	52
	15-25	35	16%	153	70%	0	0%	127	58%	218
	25-35	16	15%	64	59%	0	0%	48	44%	109
	35+	2	29%	2	29%	0	0%	2	29%	7*
NC07-0014	0-15	-	-	-	-	-	-	-	-	-
	15-25	3	5%	15	23%	0	0%	6	9%	65
	25-35	96	28%	243	71%	1	0%	178	52%	342
	35+	77	32%	181	75%	0	0%	147	61%	241
NC07-0015	0-15	-	-	-	-	-	-	-	-	-
	15-25	0	0%	0	0%	0	0%	0	0%	1*
	25-35	3	8%	24	67%	0	0%	15	42%	36
	35+	78	25%	235	76%	0	0%	195	63%	309
NC07-0016	0-15	-	-	-	-	-	-	-	-	-
	15-25	0	0%	1	100%	0	0%	1	100%	1*
	25-35	4	11%	18	49%	0	0%	10	27%	37
	35+	236	27%	676	77%	0	0%	574	66%	875
NC07-0017	0-15	1	2%	3	7%	0	0%	3	7%	43
	15-25	1	2%	6	11%	0	0%	5	9%	57
	25-35	25	13%	113	59%	0	0%	70	37%	191
	35+	252	30%	605	72%	2	0%	456	54%	845
NC07-0018	0-15	0	0%	0	0%	0	0%	0	0%	6*
	15-25	0	0%	9	31%	0	0%	5	17%	29*
	25-35	26	11%	155	67%	0	0%	116	50%	232
	35+	135	25%	482	88%	0	0%	426	78%	549
NC07-0019	0-15	67	18%	271	72%	0	0%	229	61%	378
	15-25	206	40%	440	86%	0	0%	351	68%	514
	25-35	139	38%	282	77%	0	0%	212	58%	366
	35+	83	10%	364	42%	1	0%	226	26%	861
NC07-0020	0-15	0	0%	2	67%	0	0%	2	67%	3*
	15-25	4	9%	14	30%	0	0%	4	9%	46
	25-35	125	23%	336	62%	0	0%	194	36%	542
	35+	422	32%	911	68%	0	0%	714	53%	1336
NC07-0021	0-15	1	1%	25	34%	0	0%	18	25%	73
	15-25	13	7%	114	57%	0	0%	101	51%	199
	25-35	189	32%	544	91%	0	0%	478	80%	597
	35+	104	15%	429	60%	0	0%	333	47%	710
NC07-0022	0-15	1	2%	33	58%	0	0%	25	44%	57
	15-25	5	3%	68	42%	0	0%	47	29%	161
	25-35	194	20%	775	81%	0	0%	634	66%	955
	35+	108	24%	378	82%	0	0%	327	71%	459

*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 North Carolina

TMC	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		
		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	
NC07-0023	0-15	0	0%	15	63%	0	0%	15	63%	24*
	15-25	13	17%	65	87%	0	0%	64	85%	75
	25-35	31	19%	141	86%	0	0%	132	80%	164
	35+	146	18%	655	82%	1	0%	573	71%	802
NC07-0024	0-15	6	12%	38	75%	0	0%	35	69%	51
	15-25	21	14%	125	84%	0	0%	115	77%	149
	25-35	16	20%	61	75%	0	0%	53	65%	81
	35+	493	25%	1515	76%	1	0%	1247	62%	1996
NC07-0025	0-15	0	0%	1	8%	0	0%	1	8%	12*
	15-25	3	10%	15	48%	0	0%	14	45%	31
	25-35	14	24%	47	81%	0	0%	43	74%	58
	35+	180	8%	1365	62%	0	0%	1006	46%	2201
NC07-0026	0-15	0	0%	2	40%	0	0%	2	40%	5*
	15-25	13	8%	120	77%	0	0%	109	70%	155
	25-35	33	18%	158	87%	0	0%	152	84%	181
	35+	76	24%	283	88%	1	0%	247	77%	322
NC07-0027	0-15	10	18%	44	77%	0	0%	40	70%	57
	15-25	32	12%	181	67%	0	0%	147	54%	272
	25-35	135	31%	365	84%	0	0%	298	68%	437
	35+	99	24%	279	68%	1	0%	209	51%	413
NC07-0028	0-15	4	1%	181	64%	0	0%	167	59%	281
	15-25	16	6%	132	52%	0	0%	111	44%	255
	25-35	131	18%	465	65%	2	0%	351	49%	716
	35+	72	26%	245	89%	1	0%	204	74%	274
NC07-0029	0-15	-	-	-	-	-	-	-	-	-
	15-25	5	20%	19	76%	0	0%	14	56%	25*
	25-35	60	42%	128	90%	0	0%	104	73%	143
	35+	120	8%	519	33%	1	0%	333	21%	1589

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