



# I-95 Corridor Coalition

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

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



*February 2016*

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

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

*Prepared for:*

I-95 Corridor Coalition

*Sponsored by:*

I-95 Corridor Coalition

*Prepared by:*

Masoud Hamed, Ali Haghani, Kiana Roshan Zamir, Zhongxiang Wang  
University of Maryland, College Park

*Acknowledgements:*

The research team would like to express its gratitude for the assistance it received from the state highway officials in North Carolina during the course of this study. Their effort was instrumental during the data collection phase of the project. This report would not have been completed without their help.

*February 2016*

# 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.

BTMs sensor were deployed at the beginning and ending points of 15 different segments along the US-29 and US-74 corridors. 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 2,569 hours of observations along 15 arterial segments, totaling approximately 23 miles. The total number of effective five-minute travel time samples observed was 30,831. 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 INRIX 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 also within specifications for all speed bins. 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.

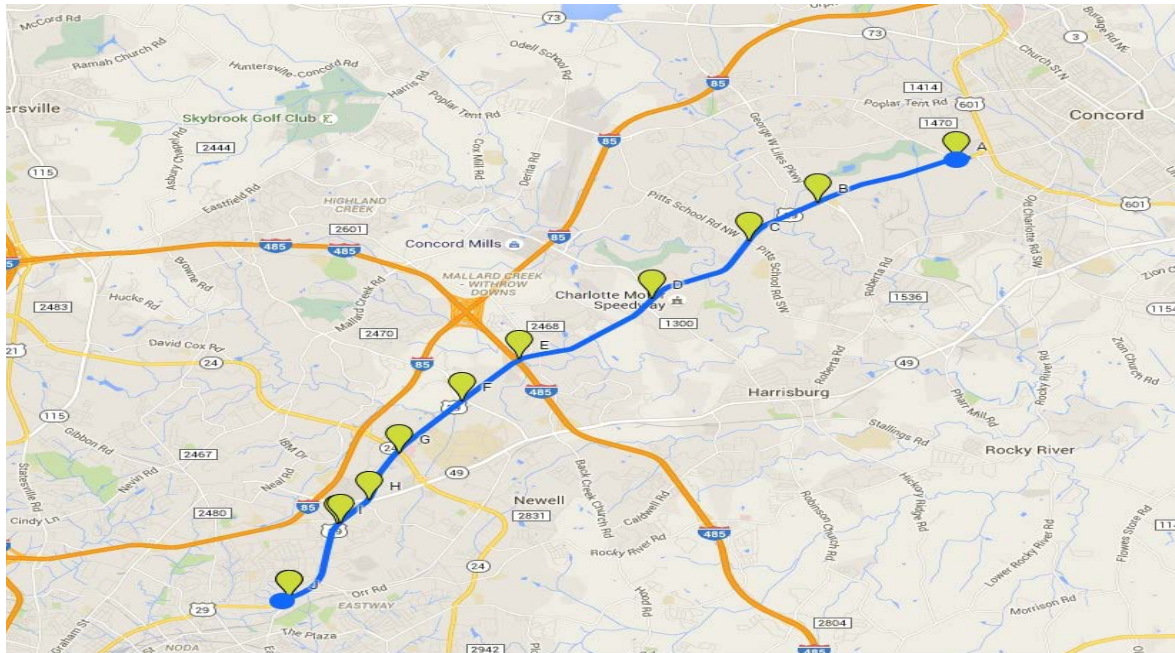
Speed Bin	Average Absolute Speed Error (<10mph)		Speed Error Bias (<5mph)		Number of 5 Minute Samples	Hours of Data Collection
	Comparison with SEM Band	Comparison with Mean	Comparison with SEM Band	Comparison with Mean		
0-15 MPH	2.7	4.2	2.6	3.8	1857	155
15-25 MPH	1.8	4.0	1.1	1.8	4653	388
25-35 MPH	2.0	4.7	0.9	2.0	7152	596
>35 MPH	2.3	4.7	-1.8	-3.1	17169	1431
All Speeds	2.2	4.6	-0.5	-0.8	30831	2569

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

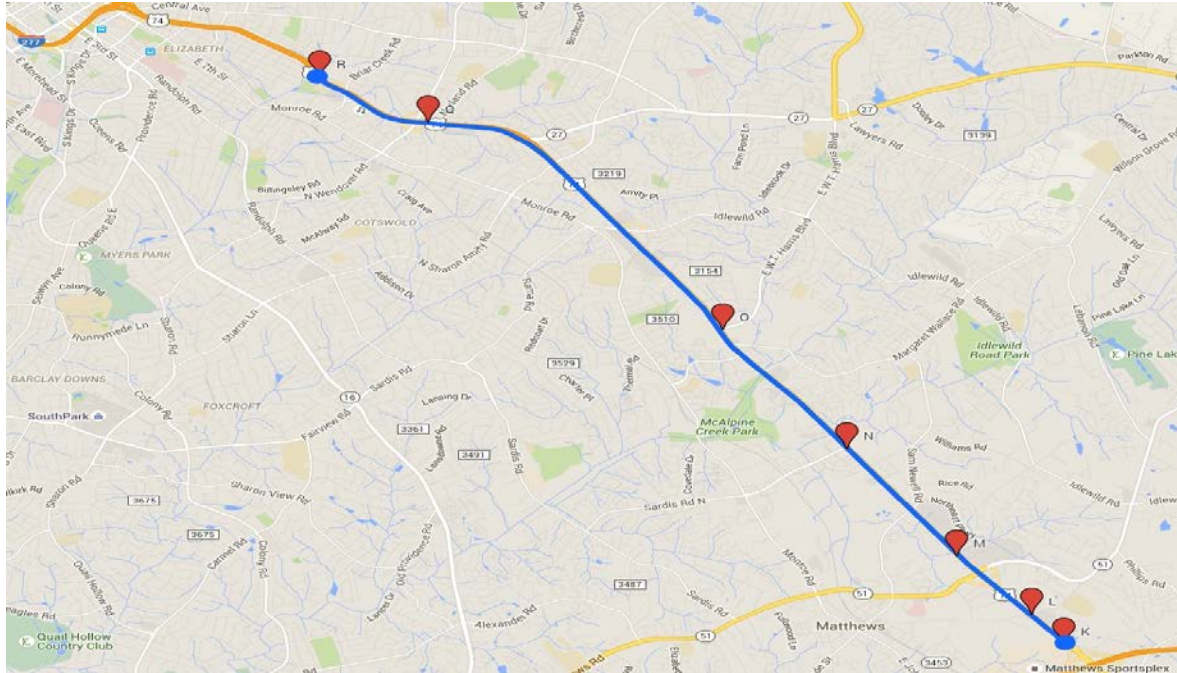
## Data Collection

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 the 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 in most cases one mile long or greater 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<sup>TM</sup> Traffic Monitoring (BTM) sensors placed on the roadway. An algorithm was developed and documented in a separate report<sup>1</sup> as part of the initial VPP project and is being used for the validation of all vendors in VPPIL. Details of the algorithm used to estimate equivalent path travel times based on INRIX data feeds for individual data collection segments are provided in this 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.

---

<sup>1</sup> Ali Haghani, Masoud Hamed, 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			TMC CODES		Deployment		
	Highway North Carolina	State County	Starting at Ending at	Begin End	Length Number	Begin Lat/Lon End Lat/Lon	Length % Diff	
<b>Arterials</b>								All Lengths in Miles
A1 <a href="#">NC07-0001</a>	US-29 Southbound	North Carolina Cabarrus	US-601 George W Liles Pkwy	125-08378 125-08378	3.93 1	35.399811 35.381990	-80.608533 -80.648813	2.06 -47.59%
A2 <a href="#">NC07-0002</a>	US-29 Southbound	North Carolina Cabarrus	George W Liles Pkwy Pitts School Rd	125-08378 125-08378	3.93 1	35.381990 35.370183	-80.648813 -80.665625	1.28 -67.43%
A3 <a href="#">NC07-0003</a>	US-29 Southbound	North Carolina Cabarrus	Pitts School Rd Speedway Blvd	125N08378 125-08377	1.86 2	35.370183 35.352531	-80.665625 -80.688302	1.88 1.08%
A4 <a href="#">NC07-0004</a>	US-29 Southbound	North Carolina Mecklenburg	Speedway Blvd I-485	125-08376 125-08375	2.24 2	35.352531 35.334259	-80.688302 -80.719634	2.28 1.79%
A5 <a href="#">NC07-0005</a>	US-29 Southbound	North Carolina Mecklenburg	I-485 Mallard Creek Church Rd	125N08375 125N08374	1.22 3	35.334259 35.321355	-80.719634 -80.733914	1.19 -2.47%
A6 <a href="#">NC07-0006</a>	US-29 Southbound	North Carolina Mecklenburg	Mallard Creek Church Rd Wt Harris Blvd	125-08373 125N08373	1.41 2	35.321355 35.305577	-80.733914 -80.749961	1.40 -0.71%
A7 <a href="#">NC07-0007</a>	US-29 Southbound	North Carolina Mecklenburg	Wt Harris Blvd NC-49/University City Blvd	125-08372 125N08372	1.21 2	35.305577 35.290902	-80.749961 -80.756885	1.08 -10.79%
A8 <a href="#">NC07-0008</a>	US-29 Southbound	North Carolina Mecklenburg	NC-49/University City Blvd US-29	125N08372 125-08370	2.28 3	35.290902 35.285736	-80.756885 -80.762466	0.61 -73.19%
A9 <a href="#">NC07-0009</a>	US-29 Southbound	North Carolina Mecklenburg	US-29 Eastway Dr	125-08370 125-08369	2.02 3	35.285736 35.260209	-80.762466 -80.776593	1.80 -10.89%
A10 <a href="#">NC07-0010</a>	US-29 Northbound	North Carolina Mecklenburg	Eastway Dr US-29	125+08370 125+08371	2.10 3	35.260096 35.286415	-80.776459 -80.761076	1.80 -14.31%
A11 <a href="#">NC07-0011</a>	US-29 Northbound	North Carolina Mecklenburg	US-29 NC-49/University City Blvd	125+08371 125+08372	2.17 2	35.286415 35.290519	-80.761076 -80.756774	0.60 -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	
<b>Arterials</b>								All Lengths in Miles
<a href="#">A12 NC07-0012</a>	US-29 Northbound	North Carolina Mecklenburg	NC-49/University City Blvd Wt Harris Blvd	125P08372 125+08373	1.11 2	35.290519 -80.756774 35.305389 -80.749874	1.08 -2.71%	
<a href="#">A13 NC07-0013</a>	US-29 Northbound	North Carolina Mecklenburg	Wt Harris Blvd Mallard Creek Church Rd	125P08373 125+08374	1.42 2	35.305389 -80.749874 35.321291 -80.734030	1.40 -1.41%	
<a href="#">A14 NC07-0014</a>	US-29 Northbound	North Carolina Mecklenburg	Mallard Creek Church Rd I-485	125P08374 125P08375	1.21 3	35.321291 -80.734030 35.334150 -80.719522	1.19 -1.65%	
<a href="#">A15 NC07-0015</a>	US-29 Northbound	North Carolina Mecklenburg	I-485 Speedway Blvd	125+08376 125+08377	2.24 2	35.334150 -80.719522 35.352420 -80.688128	2.28 1.79%	
<a href="#">A16 NC07-0016</a>	US-29 Northbound	North Carolina Cabarrus	Speedway Blvd Pitts School Rd	125+08378 125P08378	1.85 2	35.352420 -80.688128 35.370078 -80.665506	1.88 1.62%	
<a href="#">A17 NC07-0017</a>	US-29 Northbound	North Carolina Cabarrus	Pitts School Rd George W Liles Pkwy	125+08379 125+08379	3.94 1	35.370078 -80.665506 35.381990 -80.648813	1.26 -67.99%	
<a href="#">A18 NC07-0018</a>	US-29 Northbound	North Carolina Cabarrus	George W Liles Pkwy US-601	125+08379 125+08379	3.94 1	35.381990 -80.648813 35.399789 -80.608379	2.07 -47.41%	
<a href="#">A19 NC07-0019</a>	US-74 Westbound	North Carolina Mecklenburg	I-485 Matthews Mint Hill Rd	125-05816 125-05816	0.43 1	35.114310 -80.692880 35.118969 -80.697913	0.43 0.00%	
<a href="#">A20 NC07-0020</a>	US-74 Westbound	North Carolina Mecklenburg	Matthews Mint Hill Rd NC-51	125-05815 125N05815	0.97 2	35.118969 -80.697913 35.129748 -80.708904	0.91 -6.18%	
<a href="#">A21 NC07-0021</a>	US-74 Westbound	North Carolina Mecklenburg	NC-51 Sardis Rd	125N05815 125-05813	2.18 3	35.129748 -80.708904 35.147134 -80.724211	1.55 -29.00%	
<a href="#">A22 NC07-0022</a>	US-74 Westbound	North Carolina Mecklenburg	Sardis Rd E Wt Harris Blvd	125N05813 125-05812	1.71 2	35.147134 -80.724211 35.166873 -80.742367	1.72 0.58%	



**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	
<b>Arterials</b>								All Lengths in Miles
A23 <a href="#">NC07-0023</a>	US-74 Westbound	North Carolina Mecklenburg	E Wt Harris Blvd NC-27/NC-24/Albemarle Rd	125N05812 125N05808	3.85 8	35.166873 35.201710	-80.742367 -80.782985	3.57 -7.27%
A24 <a href="#">NC07-0024</a>	US-74 Westbound	North Carolina Mecklenburg	NC-27/NC-24/Albemarle Rd Briar Creek Rd/Television Ln	125N05808 125-05807	1.13 4	35.201710 35.209215	-80.782985 -80.799964	1.06 -6.21%
A25 <a href="#">NC07-0025</a>	US-74 Eastbound	North Carolina Mecklenburg	Briar Creek Rd/Television Ln Eastway Dr/N Wendover Rd	125+10232 125P05808	2.37 4	35.208519 35.201606	-80.799499 -80.784384	1.09 -54.01%
A26 <a href="#">NC07-0026</a>	US-74 Eastbound	North Carolina Mecklenburg	Eastway Dr/N Wendover Rd NC-27/NC-24/Albemarle Rd	125+05809 125P05812	3.54 7	35.201606 35.166762	-80.784384 -80.742552	3.57 0.85%
A27 <a href="#">NC07-0027</a>	US-74 Eastbound	North Carolina Mecklenburg	NC-27/NC-24/Albemarle Rd Sardis Rd	125P05813 125+05813	1.71 2	35.166762 35.147033	-80.742552 -80.724340	1.72 0.58%
A28 <a href="#">NC07-0028</a>	US-74 Eastbound	North Carolina Mecklenburg	Sardis Rd NC-51	125+05814 125+05815	1.86 2	35.147033 35.128707	-80.724340 -80.708461	1.54 -17.17%
A29 <a href="#">NC07-0029</a>	US-74 Eastbound	North Carolina Mecklenburg	NC-51 Matthews Mint Hill Rd	125+05815 125+05816	1.53 3	35.128707 35.118919	-80.708461 -80.698108	0.91 -40.55%

## ***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 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 95<sup>th</sup> 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) was within specification for all the speed bins. The Speed Error Bias (SEB) was also within specifications for all speed bins.

**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	2.6	2.7	3.8	4.2	1857	155
15-25	1.1	1.8	1.8	4.0	4653	388
25-35	0.9	2.0	2.0	4.7	7152	596
35+	-1.8	2.3	-3.1	4.7	17169	1431

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 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	42%	81%	0%	64%	1857
15-25	58%	87%	0%	55%	4653
25-35	57%	84%	0%	45%	7152
35+	55%	83%	0%	50%	17169

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	28.9	28.9	29.6	29.6	1*
			15-25	4.4	4.4	9.2	9.8	24*
			25-35	1.9	2.6	3.3	7.1	52
			35+	-2.7	3.0	-5.5	7.1	653
NC07-0002	1.26	1.28	0-15	-	-	-	-	-
			15-25	1.2	1.2	4.4	4.4	2*
			25-35	1.5	2.0	3.9	7.2	120
			35+	-2.9	3.0	-5.8	7.7	1074
NC07-0003	1.84	1.88	0-15	-	-	-	-	-
			15-25	-	-	-	-	-
			25-35	6.3	6.3	11.4	11.5	185
			35+	0.5	1.3	2.7	5.9	710
NC07-0004	2.24	2.28	0-15	26.8	26.8	29.1	29.1	1*
			15-25	1.5	1.5	24.2	24.2	1*
			25-35	3.0	3.4	7.5	8.8	45
			35+	-1.0	1.9	-2.5	6.0	478
NC07-0005	1.20	1.19	0-15	-	-	-	-	-
			15-25	5.1	5.1	11.9	11.9	19*
			25-35	1.4	1.7	5.3	7.0	341
			35+	-0.9	1.1	-3.2	6.0	305
NC07-0006	1.36	1.40	0-15	4.3	4.3	8.8	9.0	103
			15-25	1.2	1.9	2.5	4.6	65
			25-35	-0.2	0.4	-1.2	3.6	19*
			35+	-4.4	4.4	-7.7	7.7	1*
NC07-0007	1.01	1.08	0-15	6.0	6.0	9.6	9.9	123
			15-25	1.5	1.9	3.8	6.1	42
			25-35	-1.6	1.6	-6.8	6.8	5*
			35+	-	-	-	-	-
NC07-0008	0.61	0.61	0-15	6.7	6.8	10.5	11.0	94
			15-25	1.3	1.3	6.0	7.0	720
			25-35	-0.3	0.6	-1.4	5.2	519
			35+	-3.5	3.5	-11.2	11.4	103
NC07-0009	1.74	1.80	0-15	1.4	1.4	6.1	6.5	15*
			15-25	0.9	1.7	2.7	5.0	232
			25-35	-0.7	1.4	-1.1	4.3	273
			35+	-1.6	1.6	-5.9	5.9	8*
NC07-0010	1.76	1.80	0-15	3.6	3.6	5.6	5.7	134
			15-25	1.6	2.1	3.7	5.4	176
			25-35	0.3	1.6	1.3	4.5	151
			35+	-2.4	2.5	-4.7	5.2	22*
NC07-0011	0.60	0.60	0-15	0.2	0.4	0.7	2.7	261
			15-25	-0.7	0.7	-4.2	4.8	990
			25-35	-3.7	3.7	-11.0	11.0	170
			35+	-14.7	14.7	-19.8	19.8	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	3.7	3.7	6.8	6.8	84
			15-25	0.0	1.0	0.5	4.4	131
			25-35	-3.2	3.3	-6.1	6.9	74
			35+	-5.5	5.5	-11.6	11.6	5*
NC07-0013	1.39	1.40	0-15	3.4	3.4	6.5	6.6	52
			15-25	1.2	1.7	3.1	5.5	218
			25-35	-1.6	1.9	-3.5	5.6	109
			35+	-4.4	4.4	-9.9	9.9	7*
NC07-0014	1.21	1.19	0-15	-	-	-	-	-
			15-25	7.3	7.3	14.8	15.0	64
			25-35	2.0	2.1	7.7	9.0	342
			35+	-0.6	1.1	-0.9	5.3	241
NC07-0015	2.24	2.28	0-15	-	-	-	-	-
			15-25	4.1	4.1	19.3	19.3	1*
			25-35	2.4	3.0	6.6	7.9	36
			35+	-1.1	2.1	-2.5	5.8	308
NC07-0016	1.84	1.88	0-15	-	-	-	-	-
			15-25	1.8	1.8	4.5	4.5	1*
			25-35	6.3	6.3	12.5	12.5	37
			35+	0.1	1.7	1.3	5.8	875
NC07-0017	1.26	1.26	0-15	10.0	10.0	12.0	12.0	43
			15-25	4.4	4.5	7.6	8.5	57
			25-35	0.8	1.2	3.7	5.7	191
			35+	-2.3	2.3	-5.4	6.9	846
NC07-0018	2.07	2.07	0-15	2.2	2.2	6.9	6.9	6*
			15-25	3.0	3.5	6.6	7.7	29*
			25-35	0.5	1.8	1.4	5.5	232
			35+	-1.2	1.6	-2.5	4.8	550
NC07-0019	0.43	0.43	0-15	1.7	1.8	3.2	4.3	380
			15-25	0.9	1.7	0.7	5.8	514
			25-35	-1.1	2.2	-3.9	8.2	366
			35+	-4.5	5.2	-8.3	10.9	861
NC07-0020	0.91	0.91	0-15	3.2	3.7	3.0	5.4	3*
			15-25	6.0	6.3	13.9	14.9	46
			25-35	1.8	1.9	9.2	10.0	543
			35+	-1.2	1.3	-1.6	5.5	1337
NC07-0021	1.48	1.55	0-15	4.4	4.5	5.7	6.0	73
			15-25	3.2	3.6	4.8	5.7	199
			25-35	2.0	2.6	4.6	6.7	599
			35+	-1.1	2.0	-1.9	5.4	710
NC07-0022	1.70	1.72	0-15	2.5	2.5	3.8	3.9	56
			15-25	3.7	3.9	6.5	7.0	161
			25-35	1.9	2.4	4.5	6.2	957
			35+	-0.3	1.6	-0.4	5.4	460

\*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	2.1	2.5	2.7	3.6	25*
			15-25	2.1	2.3	4.0	4.7	75
			25-35	1.0	1.4	2.4	4.0	165
			35+	-0.5	1.1	-1.5	3.7	800
NC07-0024	1.06	1.06	0-15	0.8	1.5	1.3	2.9	51
			15-25	0.5	1.6	0.2	3.1	151
			25-35	1.8	4.0	2.3	6.5	82
			35+	-1.4	1.6	-3.2	4.8	1995
NC07-0025	1.08	1.09	0-15	2.7	2.7	5.2	5.2	11*
			15-25	3.5	3.6	5.3	6.0	29*
			25-35	1.1	3.6	1.4	6.0	58
			35+	-1.9	2.0	-4.6	5.1	2204
NC07-0026	3.52	3.57	0-15	3.6	3.6	6.6	6.6	5*
			15-25	1.3	1.4	2.4	3.2	154
			25-35	1.2	1.6	2.9	4.3	181
			35+	-0.2	1.1	-0.5	4.1	322
NC07-0027	1.70	1.72	0-15	0.7	0.8	1.7	2.8	56
			15-25	1.3	1.6	3.1	4.5	272
			25-35	0.9	1.2	3.1	5.4	439
			35+	-1.3	1.5	-4.0	6.6	414
NC07-0028	1.55	1.54	0-15	0.5	0.7	1.1	1.7	280
			15-25	0.7	1.2	1.3	3.5	255
			25-35	-0.6	0.9	-1.4	4.2	718
			35+	-3.3	3.3	-8.6	8.7	275
NC07-0029	0.89	0.91	0-15	-	-	-	-	-
			15-25	3.3	3.3	6.8	7.3	25*
			25-35	0.3	0.8	0.7	5.5	143
			35+	-4.0	4.1	-8.3	9.2	1591

\*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	1	4%	9	38%	0	0%	7	29%	24*
	25-35	9	17%	28	54%	0	0%	21	40%	52
	35+	94	14%	364	56%	0	0%	288	44%	653
NC07-0002	0-15	-	-	-	-	-	-	-	-	-
	15-25	0	0%	1	50%	0	0%	1	50%	2*
	25-35	19	16%	68	57%	0	0%	42	35%	120
	35+	202	19%	576	54%	0	0%	416	39%	1074
NC07-0003	0-15	-	-	-	-	-	-	-	-	-
	15-25	-	-	-	-	-	-	-	-	-
	25-35	6	3%	28	15%	0	0%	17	9%	185
	35+	137	19%	446	63%	1	0%	353	50%	710
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%	16	36%	0	0%	10	22%	45
	35+	91	19%	312	65%	0	0%	246	51%	478
NC07-0005	0-15	-	-	-	-	-	-	-	-	-
	15-25	0	0%	4	21%	0	0%	4	21%	19*
	25-35	55	16%	205	60%	0	0%	136	40%	341
	35+	78	26%	216	71%	0	0%	169	55%	305
NC07-0006	0-15	7	7%	32	31%	0	0%	29	28%	103
	15-25	13	20%	42	65%	0	0%	38	58%	65
	25-35	7	37%	14	74%	0	0%	12	63%	19*
	35+	0	0%	0	0%	0	0%	0	0%	1*
NC07-0007	0-15	11	9%	46	37%	0	0%	38	31%	123
	15-25	8	19%	28	67%	0	0%	22	52%	42
	25-35	0	0%	3	60%	0	0%	2	40%	5*
	35+	-	-	-	-	-	-	-	-	-
NC07-0008	0-15	8	9%	29	31%	0	0%	22	23%	94
	15-25	166	23%	435	60%	0	0%	268	37%	720
	25-35	210	40%	417	80%	0	0%	316	61%	519
	35+	8	8%	32	31%	0	0%	15	15%	103
NC07-0009	0-15	1	7%	8	53%	0	0%	5	33%	15*
	15-25	36	16%	157	68%	0	0%	132	57%	232
	25-35	44	16%	208	76%	0	0%	183	67%	273
	35+	1	13%	6	75%	0	0%	4	50%	8*
NC07-0010	0-15	6	4%	79	59%	0	0%	72	54%	134
	15-25	17	10%	117	66%	0	0%	101	57%	176
	25-35	22	15%	105	70%	0	0%	91	60%	151
	35+	7	32%	15	68%	0	0%	14	64%	22*
NC07-0011	0-15	78	30%	250	96%	1	0%	230	88%	261
	15-25	222	22%	756	76%	1	0%	568	57%	990
	25-35	2	1%	26	15%	0	0%	9	5%	170
	35+	0	0%	0	0%	0	0%	0	0%	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	12	14%	43	51%	0	0%	35	42%	84
	15-25	27	21%	98	75%	0	0%	87	66%	131
	25-35	10	14%	38	51%	0	0%	33	45%	74
	35+	0	0%	0	0%	0	0%	0	0%	5*
NC07-0013	0-15	1	2%	28	54%	0	0%	23	44%	52
	15-25	40	18%	140	64%	0	0%	113	52%	218
	25-35	20	18%	75	69%	0	0%	61	56%	109
	35+	1	14%	2	29%	0	0%	1	14%	7*
NC07-0014	0-15	-	-	-	-	-	-	-	-	-
	15-25	1	2%	7	11%	0	0%	4	6%	64
	25-35	35	10%	142	42%	1	0%	74	22%	342
	35+	75	31%	181	75%	0	0%	137	57%	241
NC07-0015	0-15	-	-	-	-	-	-	-	-	-
	15-25	0	0%	0	0%	0	0%	0	0%	1*
	25-35	3	8%	15	42%	0	0%	8	22%	36
	35+	63	20%	204	66%	0	0%	179	58%	308
NC07-0016	0-15	-	-	-	-	-	-	-	-	-
	15-25	0	0%	1	100%	0	0%	1	100%	1*
	25-35	4	11%	8	22%	0	0%	6	16%	37
	35+	151	17%	574	66%	1	0%	453	52%	875
NC07-0017	0-15	0	0%	5	12%	0	0%	4	9%	43
	15-25	7	12%	24	42%	0	0%	19	33%	57
	25-35	36	19%	125	65%	0	0%	93	49%	191
	35+	206	24%	520	61%	1	0%	385	46%	846
NC07-0018	0-15	0	0%	3	50%	0	0%	2	33%	6*
	15-25	2	7%	15	52%	0	0%	13	45%	29*
	25-35	35	15%	149	64%	0	0%	112	48%	232
	35+	99	18%	404	73%	0	0%	361	66%	550
NC07-0019	0-15	109	29%	299	79%	0	0%	265	70%	380
	15-25	149	29%	375	73%	0	0%	270	53%	514
	25-35	65	18%	193	53%	0	0%	118	32%	366
	35+	86	10%	360	42%	0	0%	240	28%	861
NC07-0020	0-15	1	33%	2	67%	0	0%	2	67%	3*
	15-25	1	2%	12	26%	0	0%	9	20%	46
	25-35	62	11%	202	37%	0	0%	101	19%	543
	35+	378	28%	974	73%	1	0%	722	54%	1337
NC07-0021	0-15	3	4%	41	56%	0	0%	37	51%	73
	15-25	25	13%	119	60%	0	0%	109	55%	199
	25-35	65	11%	329	55%	0	0%	251	42%	599
	35+	142	20%	475	67%	0	0%	381	54%	710
NC07-0022	0-15	1	2%	45	80%	0	0%	39	70%	56
	15-25	11	7%	89	55%	0	0%	73	45%	161
	25-35	134	14%	558	58%	1	0%	443	46%	957
	35+	95	21%	320	70%	0	0%	259	56%	460

\*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	2	8%	21	84%	0	0%	21	84%	25*
	15-25	7	9%	54	72%	0	0%	51	68%	75
	25-35	20	12%	128	78%	0	0%	107	65%	165
	35+	179	22%	655	82%	0	0%	573	72%	800
NC07-0024	0-15	6	12%	44	86%	0	0%	44	86%	51
	15-25	29	19%	135	89%	0	0%	127	84%	151
	25-35	13	16%	51	62%	0	0%	38	46%	82
	35+	461	23%	1501	75%	1	0%	1185	59%	1995
NC07-0025	0-15	1	9%	6	55%	0	0%	6	55%	11*
	15-25	7	24%	19	66%	0	0%	19	66%	29*
	25-35	11	19%	34	59%	0	0%	28	48%	58
	35+	259	12%	1545	70%	0	0%	1192	54%	2204
NC07-0026	0-15	1	20%	2	40%	0	0%	2	40%	5*
	15-25	17	11%	131	85%	0	0%	125	81%	154
	25-35	20	11%	132	73%	0	0%	121	67%	181
	35+	59	18%	254	79%	0	0%	216	67%	322
NC07-0027	0-15	11	20%	50	89%	0	0%	48	86%	56
	15-25	45	17%	200	74%	0	0%	183	67%	272
	25-35	98	22%	304	69%	0	0%	243	55%	439
	35+	101	24%	271	65%	0	0%	195	47%	414
NC07-0028	0-15	57	20%	270	96%	0	0%	266	95%	280
	15-25	40	16%	212	83%	0	0%	192	75%	255
	25-35	186	26%	575	80%	0	0%	482	67%	718
	35+	19	7%	97	35%	0	0%	62	23%	275
NC07-0029	0-15	-	-	-	-	-	-	-	-	-
	15-25	3	12%	12	48%	0	0%	9	36%	25*
	25-35	37	26%	103	72%	0	0%	70	49%	143
	35+	167	11%	678	43%	0	0%	477	30%	1591

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