I-95 Corridor Coalition

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

Monthly Report: Georgia

I-95 CORRIDOR COALITION

August 2013

I-95 CORRIDOR COALITION VEHICLE PROBE PROJECT VALIDATION OF INRIX DATA AUGUST 2013

Monthly Report

Prepared for:

I-95 Corridor Coalition

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Evaluation Results for the State of Georgia

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 16 different segments along the I-20 corridor. The Bluetooth sensor deployment covers the range from Exit 74/Evans Mill Rd to Exit 90/US-278/GA-12 along I-20. Travel time data was collected for both directions along the freeway from May 20, 2013 through May 30, 2013. The dataset collected represents approximately 2,251 hours of observations along sixteen freeway segments, totaling approximately 31 miles. The number of effective five-minute travel time samples observed was 27,013 in total.

ES Table 1 summarizes the results of the comparison between the validation data and the INRIX data for freeway segments during the above noted periods. As shown, the average absolute speed error (AASE) and Speed Error Bias (SEB) were within specification in all speed bins except for the 30-45 MPH category. The quantity of data in the congested speed bands of 0-30 and 30-45 was limited, with less than 5 hours cumulative in each band across all 16 segments. Upon review of the base level data, the nature of the congestion within the 30-45 mph band were relatively abrupt, short duration slow downs lasting less than 30 minutes in most instances. In each instance, the vehicle probe data captured the slowdown, but achieving accurate speed measures was difficult given the dynamic speed changes into and out of the short duration congestion periods.

ES Table 1 - Georgia Evaluation Summary for Freeway

Speed Bin	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	**4.7**	6.8	**3.8**	5.2	59	4.9
30-45 MPH	**10.1**	14.4	**8.6**	12.1	51	4.3
45-60 MPH	**3.7**	8.4	**3.6**	8.2	776	64.7
>60 MPH	**0.9**	3.1	**0.2**	0.4	26127	2177.3
All Speeds	1.0	3.3	0.3	0.6	27013	2251.1

Based upon data collected from May 20, 2013 through May 30, 2013 across 31.3 miles of roadway.

As part of the on-going validation process, vehicle probe data from each state is validated on a rotating basis. This is the first time that data has been validated in Georgia. As additional validation is performed, a summary of the cumulative validation effort will be provided.

Data Collection

The data from the Vehicle Probe Project (VPP) is validated using Bluetooth™ Traffic Monitoring (BTM) technology on a near monthly basis. BTM sensors were deployed on the beginning and ending points of 16 different segments along the I-20 freeway corridor. The Bluetooth sensor deployment covers the range from Exit 74/Evans Mill Rd- to Exit 90/US-278/GA-12- along I-20. Travel time data was collected for both directions along the freeway. The data was collected from May 20, 2013 through May 30, 2013 with the assistance of Georgia Department of Transportation (GDOT) personnel. This round of data collection in Georgia was designed to capture the traffic data on a sample of freeway anticipated to have significant traffic. However, due to the limited geographic coverage in of the VPP in Georgia, primarily on I-20 outside the I-285 Beltway in Atlanta, the opportunity to observe congestion was limited.

Figures 1 and 2 present an overview snapshot of the roadway segments, over which Bluetooth sensors were deployed along the I-20 corridor in Georgia, eastbound and westbound respectively. Blue segments represent freeway segments selected for analysis.

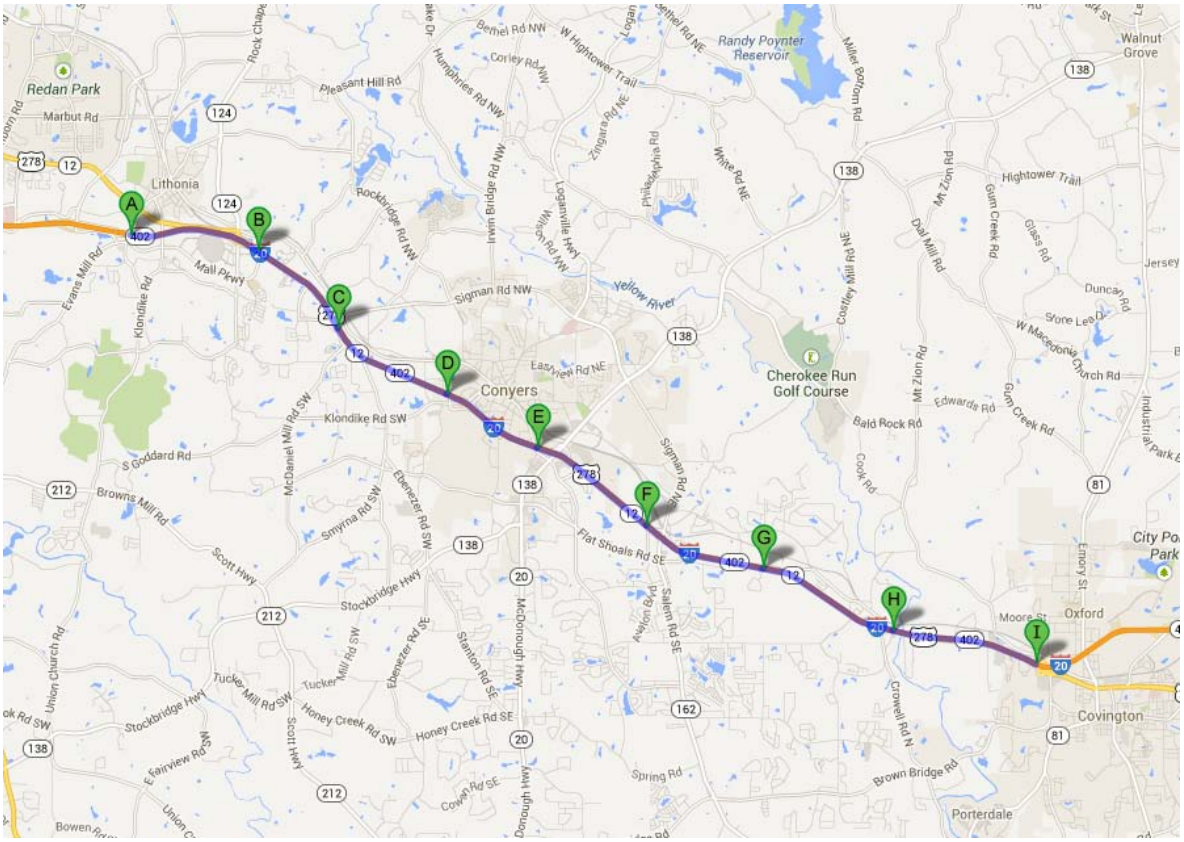

Figure 1 — Locations of all segments selected for analysis in Georgia

TMC segments selected for validation in Georgia

Table 1 presents a list of data collection segments in Georgia. In total, these segments cover a length of 31.3 freeway 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 freeway. The results of validation performed on the 16 freeway segments are included in this report. Table 1 contains summary information on each data collection segment. The latitude/longitude coordinates of the locations at which the Bluetooth sensors were deployed throughout the state of Georgia 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 Georgia

SEGMENT (Map Link)	DESCRIPTION			TMC CODES		Deployment		
	Highway Direction	State County	Starting at Ending at	Begin End	Number Length	Begin Lat/Lon End Lat/Lon		Length % Diff
FREEWAY								All Lengths in Miles
F1	I-20	Georgia	Evans Mill Rd/Exit 74	101N04159	3	33.701262	-84.116752	2.11
GA01-0001	Eastbound	Dekalb	US-278/Turner Hill Rd/Exit 75	101N04158	2.00	33.697666	-84.083461	5.16%
F2	I-20	Georgia	US-278/Turner Hill Rd/Exit 75	101-04157	2	33.697666	-84.083461	1.64
GA01-0002	Eastbound	Rockdale	Sigman Rd/Exit 78	101N04157	1.70	33.681018	-84.062419	-3.93%
F3	I-20	Georgia	Sigman Rd/Exit 78	101-04156	1	33.681018	-84.062419	2.04
GA01-0003	Eastbound	Rockdale	West Ave/Exit 80	101-04157	1.95	33.666673	-84.034208	4.27%
F4	I-20	Georgia	West Ave/Exit 80	101N04156	2	33.666673	-84.034208	1.62
GA01-0004	Eastbound	Rockdale	GA-20/GA-138/Exit 82	101-04155	1.60	33.655035	-84.010508	1.16%
F5	I-20	Georgia	GA-20/GA-138/Exit 82	101N04155	2	33.655035	-84.010508	2.00
GA01-0005	Eastbound	Rockdale	GA-162/Salem Rd/Exit 84	101-04154	2.04	33.638183	-83.981896	-1.77%
F6	I-20	Georgia	GA-162/Salem Rd/Exit 84	101N04154	2	33.638183	-83.981896	1.90
GA01-0006	Eastbound	Rockdale	Newton/Rockdale County Line (Conyers)	101-04153	1.92	33.628754	-83.951496	-0.89%
F7	I-20	Georgia	Newton/Rockdale County Line (Conyers)	101-04971	2	33.628754	-83.951496	2.22
GA01-0007	Eastbound	Newton	Almon Rd/Exit 88	101N04971	2.21	33.615127	-83.917398	0.37%
F8	I-20	Georgia	Almon Rd/Exit 88	101-04970	1	33.615127	-83.917398	2.25
GA01-0008	Eastbound	Newton	US-278/GA-12/Exit 90	101-04970	2.23	33.60791	-83.880092	0.96%
F9	I-20	Georgia	US-278/GA-12/Exit 90	101+04971	1	33.60955	-83.883968	1.91
GA01-0009	Westbound	Newton	Almon Rd/Exit 88	101+04971	1.93	33.615114	-83.916579	-1.24%

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

SEGMENT (Map Link)	DESCRIPTION Highway Direction	State County	Starting at Ending at	TMC CODES Begin End	Number Length	Deployment Begin Lat/Lon End Lat/Lon		Length % Diff
FREEWAY								All Lengths in Miles
F10	I-20	Georgia	Almon Rd/Exit 88	101P04971	2	33.615114	-83.916579	2.29
GA01-0010	Westbound	Newton	Newton/Rockdale County Line (Covington)	101+04972	2.25	33.628882	-83.95139	1.57%
F11	I-20	Georgia	Newton/Rockdale County Line (Covington)	101+04154	2	33.628882	-83.95139	1.96
GA01-0011	Westbound	Rockdale	GA-162/Salem Rd/Exit 84	101P04154	1.97	33.638829	-83.982568	-0.77%
F12	I-20	Georgia	GA-162/Salem Rd/Exit 84	101+04155	2	33.638829	-83.982568	1.87
GA01-0012	Westbound	Rockdale	GA-20/GA-138/Exit 82	101P04155	1.83	33.654468	-84.007985	2.12%
F13	I-20	Georgia	GA-20/GA-138/Exit 82	101+04156	2	33.654468	-84.007985	1.81
GA01-0013	Westbound	Rockdale	West Ave/Exit 80	101P04156	1.71	33.666599	-84.033555	5.30%
F14	I-20	Georgia	West Ave/Exit 80	101+04157	1	33.666599	-84.033555	1.78
GA01-0014	Westbound	Rockdale	Sigman Rd/Exit 78	101+04157	1.94	33.680547	-84.0619	-9.04%
F15	I-20	Georgia	Sigman Rd/Exit 78	101P04157	2	33.680547	-84.0619	1.82
GA01-0015	Westbound	Rockdale	US-278/Turner Hill Rd/Exit 75	101+04158	1.81	33.698242	-84.084218	0.56%
F16	I-20	Georgia	US-278/Turner Hill Rd/Exit 75	101P04158	3	33.698242	-84.084218	2.11
GA01-0016	Westbound	Dekalb	Evans Mill Rd/Exit 74	101P04159	1.94	33.701385	-84.116693	7.85%
TOTAL					30			31.33
					31.07			0.88%

Analysis of Freeway 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: 0-30 MPH, 30-45 MPH, 45-60 MPH, and > 60 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, and are highlighted in Table 2. AASE below 10 MPH meet contract specifications. AASE below 5 MPH are considered exceptional quality. As shown, the average absolute speed error (AASE) was within specification for speed bins 0-30 MPH, 45-60 MPH and 60+ MPH. AASE for speed bin 30-45 MPH falls out of the specifications by a small margin.

The quantity of data in the congested speed bands of 0-30 and 30-45 was limited, with less than 5 hours cumulative in each band across all 16 segments. Upon review of the base level data, the nature of the congestion within the 30-45 mph band were relatively abrupt, short duration slow downs lasting less than 30 minutes in most instances. In each instance, the vehicle probe data captured the slowdown, but achieving accurate speed measures was difficult given the dynamic speed changes into and out of the short duration congestion periods.

TABLE 2
Data quality measures for freeway segments in Georgia

SPEED BIN	Data Quality Measures for 1.96 SEM Band SEB 5 mph (contract specifications)	AASE 10 mph (contract specifications)	Mean SEB	Mean AASE	No. of 5 Minute Samples	Hours of Data Collection
0-30	3.8	4.7	5.2	6.8	59	5
30-45	8.6	10.1	12.1	14.4	51	4
45-60	3.6	3.7	8.2	8.4	776	65
60+	0.2	0.9	0.4	3.1	26127	2177

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 freeway data segments in Georgia.

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

SPEED BIN	Data Quality Measures for 1.96 SEM Band: Percentage falling inside the band	1.96 SEM Band: Percentage falling within 5 mph of the band	Mean: Percentage equal to the mean	Mean: Percentage within 5 mph of the mean	No. of Obs.
0-30	25%	71%	0%	63%	59
30-45	14%	33%	0%	25%	51
45-60	22%	69%	0%	11%	776
60+	61%	96%	0%	80%	26127

Tables 4 and 5 present detailed data for individual TMC segments in Georgia 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 freeway validation segments in the state of Georgia

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	
GA01-0001	2.00	2.11	0-30	3.9	6.8	6.4	10.8	5*
			30-45	7.2	7.2	9.4	9.5	5*
			45-60	4.3	4.7	7.2	7.7	89
			60+	0.6	1.1	1.6	3.1	1330
GA01-0002	1.70	1.64	0-30	1.6	3.2	1.8	4.6	21*
			30-45	-1.7	4.0	-2.2	6.3	6*
			45-60	1.9	2.6	8.4	9.6	45
			60+	-0.6	0.9	-1.8	3.1	2194
GA01-0003	1.95	2.04	0-30	3.9	4.1	4.3	4.9	22*
			30-45	13.7	13.7	39.2	39.2	1*
			45-60	3.6	3.8	8.1	8.5	25*
			60+	0.4	0.9	0.9	2.9	1975
GA01-0004	1.60	1.62	0-30	-	-	-	-	-
			30-45	13.4	13.4	16.0	16.0	11*
			45-60	3.1	3.1	7.0	7.1	119
			60+	-0.1	1.0	-0.2	3.4	1665
GA01-0005	2.04	2.00	0-30	-	-	-	-	-
			30-45	-	-	-	-	-
			45-60	1.5	1.5	6.4	6.4	4*
			60+	0.3	0.7	0.6	2.8	1347
GA01-0006	1.92	1.90	0-30	-	-	-	-	-
			30-45	-	-	-	-	-
			45-60	8.6	8.6	11.1	11.1	4*
			60+	-0.1	0.7	-0.4	3.0	1141
GA01-0007	2.21	2.22	0-30	-	-	-	-	-
			30-45	-	-	-	-	-
			45-60	2.2	2.2	13.6	13.6	14*
			60+	-0.1	0.8	-0.4	3.1	1309
GA01-0008	2.23	2.25	0-30	-	-	-	-	-
			30-45	-	-	-	-	-
			45-60	2.9	2.9	8.8	8.8	32*
			60+	0.7	0.9	1.7	3.2	1232
GA01-0009	1.93	1.91	0-30	-	-	-	-	-
			30-45	-	-	-	-	-
			45-60	5.9	5.9	8.8	8.8	4*
			60+	-0.2	0.7	-0.8	3.0	1467

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

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

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	
GA01-0010	2.25	2.29	0-30	-	-	-	-	-
			30-45	-	-	-	-	-
			45-60	3.7	3.7	8.9	9.0	68
			60+	0.5	1.0	1.4	3.4	1408
GA01-0011	1.97	1.96	0-30	-	-	-	-	-
			30-45	0.0	0.0	27.2	27.2	1*
			45-60	2.7	2.7	9.9	9.9	63
			60+	0.6	0.9	2.0	3.3	1083
GA01-0012	1.83	1.87	0-30	-	-	-	-	-
			30-45	-	-	-	-	-
			45-60	2.0	2.0	7.1	7.1	14*
			60+	0.0	0.8	-0.1	3.1	1514
GA01-0013	1.71	1.81	0-30	6.8	6.8	10.8	10.8	4*
			30-45	11.5	11.5	13.3	13.3	4*
			45-60	4.1	4.1	8.5	8.5	36
			60+	-0.5	1.1	-1.1	3.5	2164
GA01-0014	1.94	1.78	0-30	6.2	6.2	8.1	8.1	1*
			30-45	1.7	5.6	1.9	8.6	10*
			45-60	4.3	4.4	7.6	7.6	173
			60+	1.2	1.3	2.7	3.4	2149
GA01-0015	1.81	1.82	0-30	-	-	-	-	-
			30-45	-	-	-	-	-
			45-60	3.0	3.0	7.8	7.8	6*
			60+	-0.2	0.8	-0.6	2.9	2170
GA01-0016	1.94	2.11	0-30	8.7	8.7	15.2	15.2	6*
			30-45	14.6	14.6	20.5	20.5	13*
			45-60	3.8	3.8	9.1	9.2	80
			60+	0.5	0.9	1.4	3.0	1979

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

Table 5
Observations meeting data quality criteria for individual freeway validation segments in the state of Georgia

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	
GA01-0001	0-30	0	0%	2	40%	0	0%	2	40%	5*
	30-45	2	40%	2	40%	0	0%	2	40%	5*
	45-60	8	9%	56	63%	0	0%	6	7%	89
	60+	726	55%	1273	96%	0	0%	1078	81%	1330
GA01-0002	0-30	7	33%	17	81%	0	0%	16	76%	21*
	30-45	2	33%	3	50%	0	0%	3	50%	6*
	45-60	25	56%	34	76%	0	0%	9	20%	45
	60+	1323	60%	2109	96%	0	0%	1740	79%	2194
GA01-0003	0-30	7	32%	19	86%	0	0%	18	82%	22*
	30-45	0	0%	0	0%	0	0%	0	0%	1*
	45-60	5	20%	18	72%	0	0%	2	8%	25*
	60+	1179	60%	1890	96%	10	1%	1650	84%	1975
GA01-0004	0-30	-	-	-	-	-	-	-	-	-
	30-45	0	0%	2	18%	0	0%	2	18%	11*
	45-60	29	24%	91	76%	0	0%	27	23%	119
	60+	1030	62%	1570	94%	0	0%	1271	76%	1665
GA01-0005	0-30	-	-	-	-	-	-	-	-	-
	30-45	-	-	-	-	-	-	-	-	-
	45-60	2	50%	3	75%	0	0%	0	0%	4*
	60+	927	69%	1305	97%	1	0%	1120	83%	1347
GA01-0006	0-30	-	-	-	-	-	-	-	-	-
	30-45	-	-	-	-	-	-	-	-	-
	45-60	1	25%	1	25%	0	0%	1	25%	4*
	60+	770	67%	1104	97%	0	0%	949	83%	1141
GA01-0007	0-30	-	-	-	-	-	-	-	-	-
	30-45	-	-	-	-	-	-	-	-	-
	45-60	5	36%	13	93%	0	0%	0	0%	14*
	60+	841	64%	1265	97%	1	0%	1074	82%	1309
GA01-0008	0-30	-	-	-	-	-	-	-	-	-
	30-45	-	-	-	-	-	-	-	-	-
	45-60	13	41%	23	72%	0	0%	0	0%	32
	60+	747	61%	1169	95%	0	0%	993	81%	1232

*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 freeway validation segments in the state of Georgia

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	
GA01-0009	0-30	-	-	-	-	-	-	-	-	-
	30-45	-	-	-	-	-	-	-	-	-
	45-60	0	0%	0	0%	0	0%	0	0%	4*
	60+	977	67%	1424	97%	0	0%	1188	81%	1467
GA01-0010	0-30	-	-	-	-	-	-	-	-	-
	30-45	-	-	-	-	-	-	-	-	-
	45-60	15	22%	43	63%	0	0%	5	7%	68
	60+	899.0	64%	1330.0	94%	0.0	0%	1089.0	77%	1408
GA01-0011	0-30	-	-	-	-	-	-	-	-	-
	30-45	1	100%	1	100%	0	0%	0	0%	1*
	45-60	22	35%	49	78%	0	0%	2	3%	63
	60+	670	62%	1020	94%	1	0%	853	79%	1083
GA01-0012	0-30	-	-	-	-	-	-	-	-	-
	30-45	-	-	-	-	-	-	-	-	-
	45-60	5	36%	13	93%	0	0%	3	21%	14*
	60+	1021	67%	1454	96%	2	0%	1207	80%	1514
GA01-0013	0-30	0	0%	2	50%	0	0%	0	0%	4*
	30-45	1	25%	2	50%	0	0%	2	50%	4*
	45-60	6	17%	24	67%	0	0%	4	11%	36
	60+	1249	58%	2035	94%	0	0%	1604	74%	2164
GA01-0014	0-30	0	0%	0	0%	0	0%	0	0%	1*
	30-45	1	10%	7	70%	0	0%	4	40%	10*
	45-60	18	10%	108	62%	0	0%	18	10%	173
	60+	1062.0	49%	1993.0	93%	0.0	0%	1636.0	76%	2149
GA01-0015	0-30	-	-	-	-	-	-	-	-	-
	30-45	-	-	-	-	-	-	-	-	-
	45-60	1	17%	4	67%	0	0%	1	17%	6*
	60+	1379	64%	2103	97%	1	0%	1806	83%	2170
GA01-0016	0-30	1	17%	2	33%	0	0%	1	17%	6*
	30-45	0	0%	0	0%	0	0%	0	0%	13*
	45-60	19	24%	55	69%	0	0%	8	10%	80
	60+	1179.0	60%	1911.0	97%	0.0	0%	1651.0	83%	1979

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