

APPENDIX A – SUMMARY OF SURVEY METHODOLOGY

The geographic scope of COG's responsibility encompasses the 11 independent cities and counties that make up the Washington metropolitan region. All households within this geographic area that had at least one employed person residing in the household were eligible for selection in the 2010 study. A minimum of 600 random telephone surveys were conducted in each of the 11 jurisdictions of the study area, resulting in 6,629 completed interviews. Sample points were chosen randomly from the database developed by CIC Research. A total of 367,139 sample points were generated internally through CIC's random digit dialing sampling system, GENESYS. This system was used to randomly draw telephone numbers by county and, where prefixes overlapped counties, by ZIP code, from all working prefixes.

Questionnaire Design

The 2010 SOC questionnaire was based on the questionnaire used in 2007, with modifications and additions as needed. LDA Consulting, CIC Research, and COG/TPB staff modified the survey questionnaire, with input from a TDM Evaluation Group comprised of representatives from the District of Columbia, Maryland, and Virginia. The survey was intended to meet multiple objectives, including trend analysis and evaluation of two TERMS: Telework and Mass Marketing.

Wherever possible, the study team retained the 2007 SOC questions to allow trend analysis, but changes were made when the revisions were expected to add substantially to the accuracy of the data. Minor changes were made to the 2007 questionnaire to enhance respondents' understanding of the question and several questions were deleted to shorten the survey. Several new questions were added to examine significant new transportation topics, including quality of life and satisfaction with the regional transportation system.

Before the full survey was conducted, CIC completed a pretest of the questionnaire. The pretest was conducted on January 22 and 23, 2010 resulting in 128 completed interviews. Using the responses to these interviews, the questionnaire was finalized with the study team and translated into Spanish. The survey instrument was designed for telephone administration using Computer Assisted Telephone Interviewing (CATI). A copy of the English questionnaire is included in Appendix C. The Spanish version of the questionnaire is available upon request.

Survey Administration

Interviews were conducted using the Voxco CATI system. The Voxco system is an integrated survey system encompassing both CATI and Web applications which simplifies survey management while boosting interviewer performance. Before beginning the full survey effort, CIC conducted an interviewer-training session. Items included in the session were:

- Explanation of the purpose of the study
- Identification of the group to be sampled
- Overview of COG and its function
- Review of the definition and instruction sheet to familiarize interviewers with the terminology
- Verbatim reading of the questionnaire
- Paper/CATI review of skip-patterns to familiarize interviewers with questionnaire flow
- Practice session on CATI systems in full operational mode

Interviews were conducted between January 22 and April 30, 2010. A survey pretest was conducted on January 22 and 23 to test changes to the questionnaire and sample administration. Following the successful pretest, interviewing continued on January 28, 2010.

All calls were made to the respondents' home numbers. Weekday calls were made from 5:30 pm to 8:30 pm local time and weekend calls from 10:00 am to 6:30 pm local time. CIC interviewers conducted a minimum of five callback attempts at different times and over different days throughout the data collection period. CIC adopted measures to assure confidentiality of responses. Bilingual interviewers surveyed all Spanish-speaking respondents using the Spanish version of the questionnaire. A total of 74 interviews (1.1%) were completed in Spanish.

All interviewing was conducted with survey supervisors present. The survey supervisor was responsible for overseeing the CATI server, checking quotas, editing call-back appointment times, monitoring interviews, answering questions, reviewing completed surveys, and passing respondents to an available station when they called in on the 1-800 line. To ensure quality control, survey supervisors monitored a minimum of 10% of each surveyor's interviews. Other quality assurance logical checks were applied as the survey data was collected. Overall, the interview took an average of 21.1 minutes to complete in 2010 as compared to 16.5 minutes in 2007.

A minimum of 600 interviews were completed in each of the 11 jurisdictions, resulting in a total sample size of 6,629. The refusal rate for the 2010 survey was 14.3 percent² compared with 14.8 percent in the 2007 study. An average of 73.0 call attempts was made for each completed interview. This was an increase from 62.2 call attempts in the 2007 study. This trend toward an increasing number of call attempts is likely due to higher use of personal answering machines, caller-ID services, and other technical services that make it possible for respondents to screen telephone calls and avoid answering calls from unknown persons.

Survey Data Expansion

The 2013 SOC Survey was conducted using an overlapping, dual frame sampling design, that is, a random sample was drawn from two separate sample groups – cellular phone respondents and landline phone respondents. Survey responses were adjusted for the overlap in the dual frame sampling and then, expanded numerically by expansion and weighting factors. The expansion and weighting factors were applied to each survey interview to align them with published, employment and ethnic information for each of the 11 study areas. The procedure for the dual frame sampling adjustment, expansion to employment, and weighting for ethnic distribution for the 11-area, Washington, DC, metropolitan region is described below in detail.

The dual frame sampling design was a change from the 2010 study, which surveyed only landline respondents. The change was necessary, however, because the proportion of "cell phone only" (CPO) households, that is, households that do not have a landline phone, has greatly increased in the past few years and now is estimated at 30% region-wide. Cell phone survey research has shown that CPO households have different demographics from those with landline phones – younger, higher share of non-White, and lower incomes - thus their travel patterns also could be different.

After the survey fieldwork was completed, the dataset was prepared for pre-weighting, a necessary step to account for the use of dual frame sampling. The pre-weight calculations equalize sample selection bias due to multiple telephone access and overlapping sample frames. The calculation for the pre-weighting step is described below. Figure A-1 shows the overlap of the two sample groups.

² Refusal rates are calculated as the number of initial refusals plus the number terminated during the interview, divided by the total sample. See Appendix B.

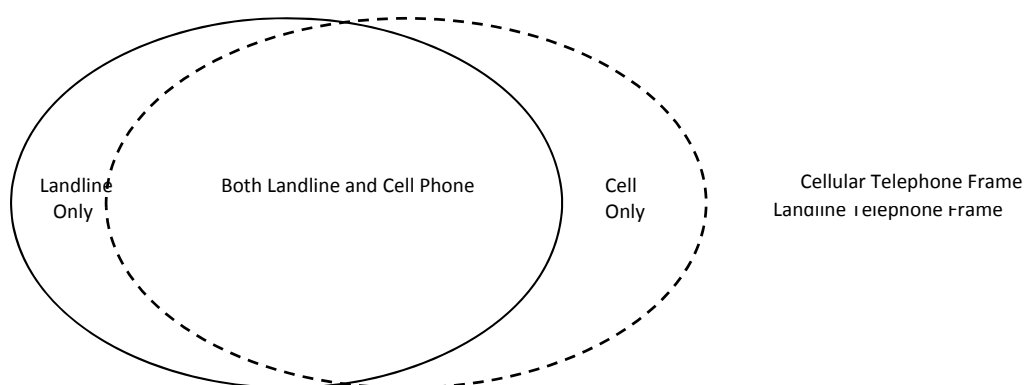


Figure A-1 - Overlapping Dual Frame Sample

A pre-weighting factor is calculated for both the landline and cell phone sample groups. The factor is comprised of two components. The first component adjusts for the ratio of individuals to phones. That is, for each sample group, a number is calculated to express the ratio between the number of adults to the number of phone lines. For cell phones, one adult is assumed to be the owner and only user of the cell phone, resulting in the first, pre-weight component equaling one. For landlines, multiple adults may use the same landline or landlines within the household, resulting in a first, pre-weight component equaling the calculated ratio.

The second component adjusts for the increase in the probability of selection for respondents who have both cell phones and landlines, since the sample groups are not mutually exclusive. This adjustment calculation uses the number of interviews within the overlap (interviews where the respondent indicates both landline and cell phone access), creating two adjustment proportions, where: $\lambda^l + \lambda^c = 1$.

The adjustment factor for landlines, λ^l , is calculated by taking the number of interviews made by landline within the overlap and dividing by the total number of interviews within the overlap. The adjustment factor for cell phones, λ^c , is calculated by taking the number of cell phone interviews within the overlap and dividing by the total number of interviews within the overlap. The formula for the two pre-weight calculations is shown below:

$$\text{Landline Pre-weight Dual Frame Sample: } \frac{\# \text{ Adults}}{\# \text{ Landlines}} \times \lambda^l$$

$$\text{Cell Phone Pre-weight Dual Frame Sample: } \frac{1 \text{ Adult}}{1 \text{ Cell Phone}} \times \lambda^c$$

After completing the initial dual frame sampling adjustment, the Bureau of Labor Statistics' Local Area Unemployment Statistics (LAUS) for January-March, 2013, was used to calculate the expansion factor needed. This timeframe was chosen to approximate the survey period. Dividing the BLS estimate by the number of interviews after the dual frame adjustment yields the expansion factor by jurisdiction. These factors were then applied to each survey response, allowing the survey results to be expanded to the employment total for each of the 11 areas. After the dual frame adjustment, the expansion methodology is the same as the method used for the 2007 and 2010 State of the Commute Surveys. Table A-1 shows the number of employed workers living in each of the 11 areas and the number of employed persons surveyed. These figures were used in computing the expansion factors applied to each survey response.

Table A-1 – Estimate of Workers by Survey Area and Expansion Factors

Survey Area	Estimated Employed Workers Totals from Bureau of Labor Statistics Local Area Unemployment Statistics (LAUS) Program (1st Qtr 2013)	Number of Working Persons Interviewed	Dual Frame Adjustment Factor	Initial Adjustment and Expansion Factors
Alexandria City, VA	86,907	575	753	115
Arlington Co., VA	131,217	576	772	170
Calvert Co., MD	45,071	577	868	52
Charles Co., MD	75,356	575	855	88
District of Columbia	338,466	577	735	460
Fairfax Co., VA	597,827	579	790	757
Frederick Co., MD	121,740	575	845	144
Loudoun Co., VA	180,598	575	839	215
Montgomery Co., MD	507,671	575	810	627
Prince George's Co., MD	434,642	576	847	513
Prince William Co., VA	219,548	575	855	257
Total	2,739,042	6,335		

Weight factors for ethnicity were applied to survey results where statistical differences were found when compared to the published U.S. Census Bureau's American Community Survey (ACS). The ACS is an on-going study which surveys populations throughout the United States, and thus includes the 11 study areas. Based on chi-squared calculations, eight areas were found to be significantly different, and three areas were not when comparing the 2013 SOC ethnicity distribution to the ACS ethnicity distribution. The three areas where no statistical differences were found were Calvert, District of Columbia, and Frederick.

For the majority of jurisdictions, the 3-year, 2009-2011 ACS series was used, while for jurisdictions with lower overall populations, the 5-year 2007-2011 ACS series was substituted. A distribution of employment status by ethnicity found in the ACS "Table S2301" was applied to the SOC distribution for ethnicity, and tested using the chi-squared test. The ethnicity weighting factor was developed by calculating the ratio of the ACS ethnic distribution and the survey ethnic distribution. The ratio for the three areas without a need for a statistical adjustment remains at 1.00. This is shown in Table A-2 below.

Table A-2 – Ethnicity Weighting Factors by Survey Area

Survey Area	Ethnicity Weighting Factors*			
	Hispanic	Black	White	Other
Alexandria City, VA	2.25	1.79	0.73	2.30
Arlington Co., VA	1.86	1.15	0.83	1.96
Calvert Co., MD	1.00	1.00	1.00	1.00
Charles Co., MD	1.10	1.77	0.74	1.06
District of Columbia	1.00	1.00	1.00	1.00
Fairfax Co., VA	1.92	1.35	0.74	1.80
Frederick Co., MD	1.00	1.00	1.00	1.00
Loudoun Co., VA	2.51	1.00	0.83	1.51
Montgomery Co., MD	2.12	1.40	0.70	1.92
Prince George's Co., MD	2.15	1.00	0.58	1.97
Prince William Co., VA	1.68	1.26	0.77	1.41

*Rounded to the nearest two decimals.

The product of the BLS expansion factor and the ethnicity weighting factor generates the final expansion/weighting factor. Table A-3 shows the value for each of these factors by area.

The initial adjustment for the dual frame sampling selection and the expansion/weighting factors allow for the proper representation of workers in each geographical area when analyzing the survey results. For example, without the adjustment and the expansion/weighting factor, the final estimated 45,071 workers in Calvert County would have the same representation as the estimated 597,827 workers in Fairfax County. By using the expansion/weighting factors shown in the table above for each sub-area, the number of workers by type of telephone access and ethnicity has been adjusted so that each worker is equally represented within the region.

Table A-3 – Final Expansion/Weighting Factors by Ethnicity and Survey Area

Survey Area	Final Expansion/Weighting Factors*			
	Hispanic	Black	White	Other
Alexandria City, VA	259	207	84	266
Arlington Co., VA	316	196	142	334
Calvert Co., MD	52	52	52	52
Charles Co., MD	97	156	65	93
District of Columbia	460	460	460	460
Fairfax Co., VA	1454	1018	561	1364
Frederick Co., MD	144	144	144	144
Loudoun Co., VA	541	216	179	325
Montgomery Co., MD	1330	880	438	1202
Prince George's Co., MD	1106	513	298	1011
Prince William Co., VA	432	324	198	361

*Weighting factors used in these calculations are not rounded and therefore, when multiplying the rounded expansion factors (Table A-1) by the ethnic weighting factors (Table A-2), numbers will be slightly different to those using the rounded weighting factors.

Level Of Confidence For Analysis

The level of confidence for analysis of the region and the county/city sub-areas will differ because the sample sizes in each category differ. Table A-4 shows the level of confidence for each of these geographic divisions for the State of the Commute 2013 survey sample. In addition, the level of confidence has been calculated for several other non-geographic key sub-populations of interest in the study. Note that some questions were answered by smaller numbers of respondents, and therefore the confidence level for these questions will be lower.

Table A-4 – Level of Confidence for Analysis

Sub-Area or Sub-Population	Sample Size	Level of Confidence
<i>Geographic Sub-Areas</i>		
Study Region – Eleven Areas	6,335	95% $\pm$ 1.2%
Study Portion of Virginia	2,880	95% $\pm$ 1.8%
Study Portion of Maryland	2,878	95% $\pm$ 1.8%
Individual County or City Level	575	95% $\pm$ 4.1%

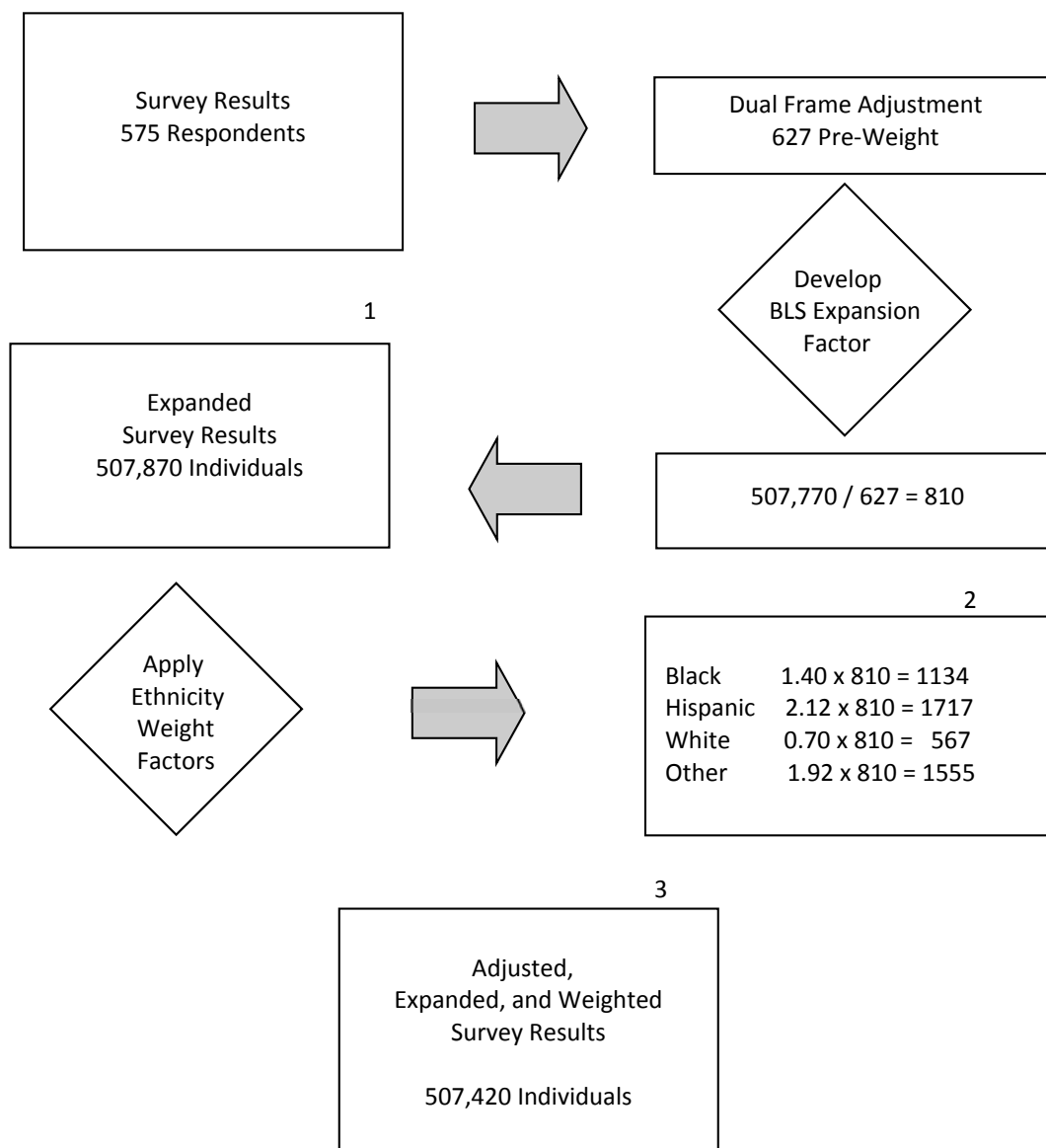
Summary

Survey responses from each of the 11 study areas within the Washington, DC, metropolitan region comprising the State of the Commute 2013 were expanded numerically by an expansion and weighting factor. Additionally, in 2013 an adjustment factor was applied to account for overlapping, dual frame sample. These factors were applied to survey results to ensure they aligned with published employment and ethnicity information for the study area.

Figure A-1. Figure of Weighting and Expansion for Working Households

Example: Montgomery County, MD

Objective: Apply the survey results (575 respondents) to the Bureau of Labor Statistics (507,770) with adjustments for ethnicity from the U.S. Census Bureau's American Community Survey to represent employed individuals by ethnicity living in Montgomery County (507,420).



Note: 1. $810 \times 627 = 507,870$ individuals.

2. Final expansion/weight factors estimates workers by ethnicity for Montgomery County.

3. Note: the difference from 507,870 individuals is due to rounding.