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| RE: | 2015 TM 1.5 TAZ 1454 Land Use Documentation | | |
|  | This memorandum documents the process for creating the Travel Model 1.5 TAZ Land Use data for the 2015 base year. Data are collected and aggregated via the R script “ACS 2013-2017 create TAZ data for 2015.R.” Where data are available, variables were derived from Census 2010 decennial data, and from American Community Survey (ACS) 2013-2017 data. Some variables were carried forward from previous Plan Bay Area 2040 land use datasets, and others were derived from other datasets, as is documented in the “TAZ1454 2015 Land Use.xlsx” document.  For decennial- and ACS-derived variables, block group-level data were used when available (not suppressed by the Census Bureau) and tract-level data otherwise. A block/TAZ equivalency was created for use in translating block and tract data to TAZs. The block share of a block group or tract was determined by the block’s population share from 2010. This share was then applied to decennial and ACS variables to build up TAZ variables. The R script above references how this is done.  After the above step, data is rounded, and then categorical totals are adjusted to match univariate totals. For example, households by income should sum to total households.  If the sums are unequal, the constituent cell with the highest value is adjusted up or down such that the category sums match the marginal total.  The description below helps explain non-intuitive steps that were taken for some TAZ variables. It does not describe how straightforward variables (e.g., total households) were derived, but documentation in the above R script provides a supplement to this memorandum. School Enrollment School enrollment data includes high school, part-time college, and full-time college enrollment. Separate processes were used to gather high school and college enrollment data:   1. Public and private high school location and enrollment data are provided by the California Department of Education. The school address information was used to geocode the school locations, and school enrollment information was then summarized by TAZ. 2. College enrollment data were obtained from various university websites. Part-time and full-time enrollment numbers were largely carried over from 2010 data. Where updated part-time and full-time enrollment data were found, they replaced the 2010 data. Where updated aggregate enrollment data were found for a school, but the part-/full-time distribution was lacking, the 2010 part-time and full-time proportions were applied to 2015 totals to derive updated cell values.  Parking Cost Parking cost data are taken from Plan Bay Area 2040, the 2015 land use data. EmploymentGroup Quarters Population Group quarters population by institutional/non-institutional type is not provided for small-area ACS data. In order to overcome this data limitation, the following steps were undertaken to develop TAZ-level non-institutional group quarters population:   1. Non-institutional group quarters (university, military, and other) were summed from the 2010 decennial data and partitioned to TAZs, as is described above for other variables. 2. MTC staff researched college dorm (non-institutional) growth in three TAZs – 353, 354, and 1008. The GQ growth was added to these TAZs. 3. Non-institutional GQ population for 2015 was determined at the county level using PUMS 2015 data. County-level correction factors were created by comparing the adjusted 2010 numbers (determined in steps 1 and 2) with the 2015 totals. 4. County-level correction factors were then applied at the TAZ level to produce the final GQ values.  Residential Workers The number of total employed residents is derived from ACS 2013-2017, Table B23025. The initial distribution of households by household workers comes from Table B08202 for the same period. This household distribution, however, is skewed (relative to PUMS data) toward zero-worker households because its universe only includes workers at work during the ACS survey reference week. That is, workers with a job but not at work (e.g., employees who are ill, on vacation, at personal appointments, etc.) are not included here. In addition, household weights from ACS data appear to undercount workers in larger households (with more 3-plus workers), and the person weights appear more accurate. The approach used for reconciling households by number of workers relies on PUMS person weights to correct for worker undercounts.  PUMS data from 2012-2016 (2013-2017 PUMS weren’t available as of this writing) were used to develop correction factors for TAZ-level households by number of workers. The process is described in the below steps (with a supporting data summary in Table 1, below):   1. The number of households by workers and implied workers in each household category are derived from ACS 2013-2017 Table B08202 (Column 1). The average number of workers for the 3-plus worker category was calculated from the 2012-2016 PUMS as approximately 3.41 (3.40695036711661 was applied). 2. Total workers within each household category (from the person weights in the 2012-2016 PUMS), along with implied households (1-worker / 1, 2-worker / 2, and 3-plus worker / 3.41) are listed in Column 2. 0-worker households are calculated as the difference of total households minus the sum of the 1-, 2-, and 3-plus-worker households. 3. In Column 3, the ACS 2013-2017 aggregate household county totals come from Table B08202, and the aggregate worker county totals for the same period come from Table B23025. Only the relative distributions within each county need to be reconciled. In order to do this, worker distribution shares from the PUMS 2012-2016 within each county are assumed correct for 2013-2017. Category values are then inflated so they sum to county totals; the inflation factor is Column 3 Total Workers / Column 2 Total Workers, respective to each county (e.g., 827,795 / 802,511 for Alameda County). The implied household distribution is derived from the worker counts as above, in Step 2. 4. The final step creates factors for correcting ACS 2013-2017 Table B08202 values at the TAZ level (Column 4). These factors are the quotient of Column 3 Implied Households divided by Column 1 Total Households. The resulting factors were applied in the TAZ-building script, respective to each county and workers per household category. 5. It is noteworthy that group quarters workers (e.g., working college students in dorms) are included in the employed residents data, ACS Table B23025, and in the PUMS person weights. They are, however, excluded from households by number of workers, Table B08202, and from the household weights in the PUMS data (group quarters records are actually given a 0-weight placeholder value in the household file). The approach outlined here uses the full worker universe, those in both households and group quarters, and includes group quarters workers in the final outputted dataset – both in total employed residents and in households by number of workers. “Households” in the latter case include both households and group quarters units. | | |
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**Table 1: Households by Number of Workers**

|  |  | 1 | | 2 | | 3 | | 4 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | ACS 2013-2017 Table B08202 - HH Size by Number of Workers in HH | | PUMS 2012-2016 Workers (ESR==1,2,4,5), Using Person Weights | | ACS 2013-2017 Refactored with County Total Households (Table B08202) and Workers (Table B23025) | | County-Level Correction Factors for TAZ Application |
| County | HH Workers | Total Households | Implied Workers | Implied Households | Total Workers | Implied Households | Workers | Households |
| Alameda | 0\_workers | 140,827 | 0 | 89,345 | 0 | 79,159 | 0 | 0.562 |
|  | 1\_worker | 213,190 | 213,190 | 227,654 | 227,654 | 234,826 | 234,826 | 1.101 |
|  | 2\_workers | 168,962 | 337,924 | 190,241 | 380,481 | 196,234 | 392,468 | 1.161 |
|  | 3p\_workers | 46,091 | 157,030 | 57,053 | 194,376 | 58,850 | 200,500 | 1.277 |
| Alameda Total | | 569,070 | 708,144 | 564,292 | 802,511 | 569,070 | 827,795 | 1.000 |
| Contra Costa | 0\_workers | 92,670 | 0 | 76,635 | 0 | 70,245 | 0 | 0.758 |
|  | 1\_worker | 145,079 | 145,079 | 150,795 | 150,795 | 154,891 | 154,891 | 1.068 |
|  | 2\_workers | 117,893 | 235,786 | 123,855 | 247,709 | 127,219 | 254,438 | 1.079 |
|  | 3p\_workers | 33,955 | 115,683 | 36,256 | 123,524 | 37,241 | 126,880 | 1.097 |
| Contra Costa Total | | 389,597 | 496,548 | 387,541 | 522,028 | 389,597 | 536,209 | 1.000 |
| Marin | 0\_workers | 27,347 | 0 | 22,933 | 0 | 22,657 | 0 | 0.829 |
|  | 1\_worker | 41,727 | 41,727 | 42,776 | 42,776 | 43,155 | 43,155 | 1.034 |
|  | 2\_workers | 30,126 | 60,252 | 31,982 | 63,963 | 32,265 | 64,529 | 1.071 |
|  | 3p\_workers | 5,646 | 19,236 | 6,710 | 22,861 | 6,769 | 23,063 | 1.199 |
| Marin Total |  | 104,846 | 121,215 | 104,401 | 129,600 | 104,846 | 130,747 | 1.000 |
| Napa | 0\_workers | 12,572 | 0 | 9,623 | 0 | 8,700 | 0 | 0.692 |
|  | 1\_worker | 16,470 | 16,470 | 17,628 | 17,628 | 17,890 | 17,890 | 1.086 |
|  | 2\_workers | 15,313 | 30,626 | 16,278 | 32,555 | 16,519 | 33,039 | 1.079 |
|  | 3p\_workers | 4,689 | 15,975 | 5,847 | 19,921 | 5,934 | 20,217 | 1.266 |
| Napa Total |  | 49,044 | 63,071 | 49,376 | 70,104 | 49,044 | 71,146 | 1.000 |
| San Francisco | 0\_workers | 82,119 | 0 | 62,273 | 0 | 55,581 | 0 | 0.677 |
|  | 1\_worker | 139,605 | 139,605 | 147,713 | 147,713 | 152,059 | 152,059 | 1.089 |
|  | 2\_workers | 106,022 | 212,044 | 111,596 | 223,192 | 114,880 | 229,759 | 1.084 |
|  | 3p\_workers | 31,026 | 105,704 | 35,216 | 119,980 | 36,252 | 123,510 | 1.168 |
| San Francisco Total | | 358,772 | 457,353 | 356,798 | 490,885 | 358,772 | 505,329 | 1.000 |
| San Mateo | 0\_workers | 50,750 | 0 | 37,149 | 0 | 32,948 | 0 | 0.649 |
|  | 1\_worker | 95,393 | 95,393 | 98,428 | 98,428 | 100,621 | 100,621 | 1.055 |
|  | 2\_workers | 86,422 | 172,844 | 91,986 | 183,971 | 94,035 | 188,070 | 1.088 |
|  | 3p\_workers | 29,231 | 99,589 | 33,448 | 113,954 | 34,193 | 116,493 | 1.170 |
| San Mateo Total | | 261,796 | 367,826 | 261,010 | 396,353 | 261,796 | 405,183 | 1.000 |
| Santa Clara | 0\_workers | 118,875 | 0 | 80,898 | 0 | 68,980 | 0 | 0.580 |
|  | 1\_worker | 240,595 | 240,595 | 254,546 | 254,546 | 261,911 | 261,911 | 1.089 |
|  | 2\_workers | 204,894 | 409,788 | 217,338 | 434,676 | 223,627 | 447,254 | 1.091 |
|  | 3p\_workers | 66,087 | 225,155 | 73,797 | 251,423 | 75,932 | 258,698 | 1.149 |
| Santa Clara Total | | 630,451 | 875,538 | 626,579 | 940,645 | 630,451 | 967,863 | 1.000 |
| Solano | 0\_workers | 37,665 | 0 | 29,363 | 0 | 28,171 | 0 | 0.748 |
|  | 1\_worker | 54,266 | 54,266 | 56,558 | 56,558 | 58,133 | 58,133 | 1.071 |
|  | 2\_workers | 41,863 | 83,726 | 45,329 | 90,657 | 46,591 | 93,182 | 1.113 |
|  | 3p\_workers | 13,558 | 46,191 | 14,065 | 47,919 | 14,457 | 49,254 | 1.066 |
| Solano Total |  | 147,352 | 184,183 | 145,315 | 195,134 | 147,352 | 200,569 | 1.000 |
| Sonoma | 0\_workers | 51,489 | 0 | 41,782 | 0 | 40,335 | 0 | 0.783 |
|  | 1\_worker | 69,025 | 69,025 | 72,614 | 72,614 | 73,828 | 73,828 | 1.070 |
|  | 2\_workers | 53,747 | 107,494 | 57,596 | 115,192 | 58,559 | 117,118 | 1.090 |
|  | 3p\_workers | 15,797 | 53,820 | 17,051 | 58,093 | 17,336 | 59,064 | 1.097 |
| Sonoma Total | | 190,058 | 230,339 | 189,043 | 245,899 | 190,058 | 250,010 | 1.000 |
| Bay Area | 0\_workers | 614,314 | 0 | 450,001 | 0 | 406,776 | 0 |  |
|  | 1\_worker | 1,015,350 | 1,015,350 | 1,068,712 | 1,068,712 | 1,097,315 | 1,097,315 |  |
|  | 2\_workers | 825,242 | 1,650,484 | 886,198 | 1,772,396 | 909,928 | 1,819,857 |  |
|  | 3p\_workers | 246,080 | 838,382 | 279,444 | 952,051 | 286,966 | 977,679 |  |
| Bay Area Total | | 2,700,986 | 3,504,216 | 2,684,355 | 3,793,159 | 2,700,986 | 3,894,851 |  |

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