ANNUAL POPULATION ESTIMATES METHODOLOGY

Revised May 2020

METROPOLITAN
C O U N C I L

ANNUAL POPULATION ESTIMATES METHODOLOGY

The Metropolitan Council prepares local households and population estimates for the Twin Cities seven-county area. The Council has the statutory responsibility to develop the estimates, distribute them for local government review, receive comments or challenges, revise estimates as warranted, and certify final estimates. These estimates are the official household and population estimates for State government purposes (*Minnesota Statutes* 473.24).

Since the 1970s, the Metropolitan Council has used a housing stock-based model to estimate households and population. In 2005-06, Metropolitan Council Research reviewed and redesigned the Council's methodology with Minnesota Population Center demographers. The model was redesigned again during the 2011-12 cycle, making use of the best available, most current data resources, with ongoing modifications to take advantage of new data. The model remains a housing stock-based model and allows for a multi-year review of housing gains and losses.

In reduced form, the Council's model determines housing units, households and population as follows:

Housing Units $_{2019}$ = Housing Units $_{2010}$ + Σ(Housing Changes $_{Since2010}$)

Households $_{2019}$ = Housing Units $_{2019}$ X Occupancy Rates

Total Population $_{2019}$ = (Households $_{2019}$ X Persons Per Household) + Group Quarters Pop$_{2019}$

Methodology improvements
Over the past several years, we have worked to continuously improve our annual estimates methodology.

- With the 2006-07 estimates cycle[1], the Council began using Census American Community Survey (ACS) data to adjust, up or down, housing occupancy rates and household size multipliers drawn from Census 2000. These improvements allowed a more dynamic representation of changes since 2000.
- With the 2011-12 cycle, Census 2000 occupancy rates and household size multipliers were fully replaced with the most recent Census ACS five-year rates and multipliers. These rates and multipliers are calibrated to reconcile population estimates with Census 2010 counts and other data resources.
- With the 2015-16 cycle, occupancy rates and household size multipliers are now estimated using multiple data resources. The "weight" given to each data resource is locally customized and depends on the suitability and statistical reliability of each data resource for each city.

---

[1] Estimates for a given year are prepared the following year and certified by July 15. For example, population as of April 1, 2019, is estimated in spring 2020 and certified by July 15, 2020. This due date is specified in *Minnesota Statutes* 473.24.

Estimation of housing stock

For the April 1, 2019 estimates, the Council works to estimate housing unit counts, segmented by type. Housing types are:

- Single-family detached houses
- Townhomes and single-family attached
- Units in duplexes and 3- and 4-unit buildings
- Units in multi-family buildings (5 or more units, condos or apartments)
- Accessory dwelling units (ADUs, small housing units on the same lot as a single-family home)
- Manufactured homes
- Other shelters (boats, RVs, and other situations that would not normally be considered)

For the first five housing types, the Council's model starts with base year (2010) housing stock, then adds (or subtracts) housing stock changes since 2010.[2] These include:

- Housing units permitted
- Other gross additions to housing stock
- Gross losses to housing stock

Base year housing stock

The base year (2010) housing stock is controlled to the Census 2010 count of all housing units.[3]

Base year housing stock *by type* is calculated by multiplication of the count with percentage shares representing each housing type. Because the 2010 Census did not gather data on housing type, these percentage shares were calculated from American Community Survey statistics and the Council's own time-series of housing stock from the previous decade.

Discrepancies in total numbers of housing units are possible. Evaluating the estimates model process used prior to 2010, there were 31 communities (out of 193) with housing counts differing from Census 2010 enumeration by at least 100 units. In 11 of these cases, the Council previously overestimated housing counts; this was likely due to an assumption that all permitted units are eventually completed. In the other 20 cases, the Council previously underestimated housing counts, likely due to incompleteness of building permits recordkeeping or reporting by local governments. In summary, the Council's method for estimating housing counts relies on the accuracy and completeness of city- and town-provided data inputs.

Housing units permitted

We collect data on housing units permitted through an annual survey of cities and towns. Where cities or towns do not participate, we substitute data from the US Commerce Department's Building Permits Survey. The substitute data are comparable but not always complete.[4]

---

[2] We began tracking alternative dwelling units in 2016.

[3] Some counts in Washington County were revised through the post-decennial census Count Question Resolution program. Council estimates reflect these revisions.

[4] We have found that some cities and towns underreport to US Commerce Department. The data are online at *http://socds.huduser.org/permits/*

The Council's model assumes that not all housing units permitted will be built in the year permitted. In crediting the most recent year of permitting and construction, the Council assumes:

- 90% same-year completion for townhomes, duplexes, 3- and 4-unit permits; 10% later completion
- 95% same-year completion for single family detached permits; 5% later completion

These multipliers are suggested by cycle-time distributions from the US Commerce Department's Survey of Construction. Single-family detached homes are the most likely to be completed in the same year permitted; multi-family construction has the longest cycle-times. The remaining permitted units are assumed to be completed and occupiable later, and will be counted in subsequent years. Unfortunately, there is not information about where permitted construction failed to occur. Over the long term, we assume 100% eventual completion.

Assumptions differ for multifamily permits, which often take longer to build than other developments. These are counted only if they received a certificate of occupancy by April 1, 2019. Region-wide, there were 12,807 multifamily units permitted between 2010 and 2018 that had not received a certificate of occupancy by April 1, 2019. We will inspect 2020 Census data to ensure that these units were counted in 2020; if they were not, they will be added to the estimates for 2021 (to be developed in 2022).

Gross additions and losses to housing stock
Gross additions include physically moved structures, conversions reported to the Council's annual survey, and units annexed in and reported to the Minnesota State Demographer's survey.[5]

Gross losses include physically moved structures and demolitions reported to the Council's annual survey as well as units moved or annexed out.

Housing stock calculated
As an example, for Single-Family Detached (SFD) housing stock, the calculation can be specified:

$$\text{SFD}_{2019} = \text{SFD}_{2010} + (\text{SFD Permit}_{2010\text{-}2017}) + (\text{SFD Permit}_{2018} \times 95\% \text{ Same-Year-Completion}) +$$

$$(\text{SFD Additions}_{Since2010}) + (\text{SFD Loss}_{Since2010}) + \text{SFD Other Adjustments}$$

Where:
- SFD_{2019} = 2019 housing units
- $\text{SFD Permit}_{2010\text{-}2017}$ = Number of units permitted in the 2010-2017 period
- SFD Permit_{2018} = Number of units permitted in 2018
- SFD Additions = Other gross additions in and since 2010
- SFD Loss = Gross losses in and since 2010
- Completion rate assumes that not all permitted units from previous year will be completed by April 1 of estimates year.

The calculations of Townhomes, Duplex/Triplex/Quads, and Multifamily housing stock are comparable – but with different assumptions about same-year completion, as described previously.

---

[5] The annexations survey is authorized by *Minnesota Statutes* 4A.02, paragraph (b)(10).

Housing units outside of built housing stock

In addition to the built housing stock, we also estimate manufactured home units. Manufactured homes in manufactured home parks are counted through an annual survey of park operators/managers. Manufactured homes outside of parks are counted through our annual survey of residential construction.

We do not estimate directly the number of other shelters (boats, RVs, and other situations that would not normally be considered). Instead, the Council takes the "other" number from the most recent local ACS five-year estimates, counting such units only if they are occupied.

Estimation of households

Following the completion of housing stock estimation, the Council model applies occupancy rates to city- and town-level housing units, segmented by type. The number of households is equivalent to occupied, non-institutional housing units. It is calculated as the sum of:

- Single family detached units *multiplied by* occupancy rate
- Townhome units *multiplied by* occupancy rate
- Duplex, triplex, quads units *multiplied by* occupancy rate
- Multi-family (apartment) units *multiplied by* occupancy rate
- Alternative dwelling units (ADUs) *multiplied by* occupancy rate
- Manufactured homes *multiplied by* occupancy rate
- Other shelters serving as housing units *multiplied by* 100%.

For manufactured homes, occupancy rates are calculated using Metropolitan Council's annual survey of manufactured home parks. The survey counts total and occupied manufactured homes.

Occupancy rates

Occupancy rates of built housing stock are calculated from Census ACS statistics.[6] The Council's model averages each housing-type-specific occupancy rate with the overall (all housing types) occupancy rate to mitigate uncertainty and erratic results for locally uncommon housing types. The Council also subscribes to CoStar, a proprietary source of data with more up-to-date information on rental apartments across the region than the ACS. To refine the estimated occupancy rate for multifamily units, we average the ACS and CoStar occupancy rates.[7]

We make two further adjustments to these occupancy rates. The first represents economic cycle changes. From comparison of ACS 2014-2018 estimates and ACS 2018 estimates, the most recent Current Population Survey/Housing Vacancy Survey data, and reports from the Minneapolis Area Association of Realtors, we found that occupancy rates are slightly higher in 2019 than in the 2014-2018 period from which the communities' housing-type-specific occupancy rates come. Accordingly, we have adjusted the 2019 occupancy rates for each housing type. The adjustments are region-wide constants, applied to all communities: Single-family detached occupancy rates are adjusted upward by 0.3 percentage points; townhome occupancy rates are adjusted upward by 0.7 percentage points; duplex/triplex/quadplex occupancy rates are adjusted downward by 1.0 percentage point; and

---

[6] We assume that alternative dwelling units (ADUs) have the same occupancy rate as multifamily units.

[7] CoStar occupancy data is not available for all multifamily properties, so we weight the CoStar data in proportion to the share of a community's multifamily units for which CoStar occupancy data is available.

multifamily (5+ units) occupancy rates are adjusted downward by 1.1 percentage points. These adjustments are reassessed annually.

The second adjustment reconciles the resulting *overall* occupancy rate for each community with two other data sources:

- The occupancy rate from the 2010 Census
- The occupancy rate found after applying the 2010-2019 trend from U.S. Postal Service vacancy data to the 2010 Census[8]

This second adjustment is minimized where ACS occupancy rates are more reliable (as measured by published margins of error), where the housing stock mix has changed substantially since 2010, and/or where the census tract geography of the U.S. Postal Service data does not align well with the community's borders. In these communities, we believe that the ACS is a better indicator of current conditions than the other two data sources.

Conversely, where ACS occupancy rates are less reliable (this is the case with very small communities), where the housing stock mix has not changed substantially, and the census tract geography of the U.S. Postal Service data aligns well with the community's borders, the adjustment is maximized. In these communities, we believe that the other two data sources are a better indicator of current conditions than the ACS data.

Households calculated
Estimates of housing units, segmented by housing type, are multiplied by housing-type-specific occupancy rate multipliers. The product is the estimated households:

$$\textbf{Households} = \Sigma_{housing\ type} (\text{Housing units }_{h.t.} \text{ X OccRt }_{h.t.,})$$

Population in group quarters

We enumerate known group quarters in order to account for persons living in institutional or non-household settings. The list is refreshed annually to include licensed group homes known to the Minnesota Department of Human Services (DHS). Small group homes (less than 10 beds) are assumed to be occupied at the capacity identified by DHS. Other types of group quarters, as well as medium and larger group homes (at least 10 beds), are surveyed annually.[9]

Since the Council's survey is conducted annually, the resulting counts fully replace the counts from previous years and from Census 2010.

---

[8] The U.S. Department of Housing and Urban Development makes available U.S. Postal Service (USPS) vacancy data summarized to census tracts. While these data are current and offer complete coverage of all housing units, they were gathered for administrative purposes rather than research purposes. Our examination of these vacancy data showed that the 2010 USPS occupancy rates were unrealistically high for many tracts compared with Census 2010 data, so we do not use these rates directly. Rather, we examine the trend in occupancy rates between 2010 and 2019 in the USPS data, then apply that trend to each tract's occupancy rate in the 2010 Census. We then apportion the resulting tract-level occupancy rates to communities based on each community's share of the tract's housing units in the 2010 Census.

[9] If a survey for a facility is not returned and field follow-up does not result in participation, we carry over the group quarters population from the previous annual survey.

Estimation of population in households

The final step in the Council's model is calculating the population in households. Household estimates are segmented by housing type, and household size multipliers are applied. We favor this approach because changes in housing units by type are associated with differing household sizes; building 100 single-family units will likely add more occupants than building the same number of multifamily units.

Household size

Average household sizes *by housing type* are based primarily on the most recent published ACS five-year statistics.[10] The ACS estimates are smoothed to compensate for what are occasionally large changes from year to year: we allow them to increase or decrease by no more than 0.05 persons per household per year.[11]

The smoothed ACS five-year estimates are adjusted to mitigate statistical inference error in the ACS. This calibration reconciles the resulting *overall* average household size with three other figures:

- The average household size from the 2010 Census
- The average household size found after applying half of the 2000-2010 trend to the 2010 Census average household size
- The average household size found after applying the 2010-2018 trend in one-year ACS estimates for the community's county[12]

The calibration adjustment is minimized for communities where the ACS household size estimates are more reliable (as measured by the coefficient of variation) and/or where the housing stock mix has changed substantially since 2010.[13] In these communities, we believe that the ACS provides a better picture of current conditions than Census 2010, the trend between Census 2000 and Census 2010, or the county-level trend. Conversely, where ACS household size estimates are less reliable (this is the case with very small communities) and the housing stock mix has not changed substantially, the adjustment is maximized, placing more weight on the other three measures.

Population in households calculated

Estimates of households, segmented by housing type, are multiplied by housing-type-specific persons per household (PPH) multipliers. The product is the population in households:

Population in Households = $\Sigma_{\text{housing type}}$ (Households $_{\text{h.t.}}$ X PPH $_{\text{h.t.,}}$)

---

[10] We assume that alternative dwelling units (ADUs) have the same average household size as multifamily units.

[11] For example, if the average household size were 2.90 in the 2012-2016 ACS five-year data, 2.65 in the 2013-2017 data, and 2.50 in the 2014-2018 data, we would use instead an average household size of 2.80 (2.90 – (0.05 x 2)) as the smoothed ACS five-year estimate for 2019. (We limit the annual change to 0.05 persons per household because almost no community's average household size has changed by more than 0.05 persons per household per year between decennial censuses.) We use the 2010 Census as the starting point of this series, so a community's 2019 estimated average household size cannot be more than 0.45 persons per household more or less than the 2010 Census figure.

[12] The 2010 one-year ACS average household size estimates for Carver, Scott, and Washington Counties diverged from the 2010 Census by at least 0.05 persons per household. For these counties, we used the 2009-2011 three-year ACS estimates.

[13] The coefficient of variation is the standard error of average household size divided by the average household size estimate. In ACS data, the standard error of average household size is the published margin of error (which yields a 90% confidence interval) divided by 1.645.

Total population

Total population requires one additional term: group quarters population summarized annually by Metropolitan Council (as described earlier):

$$\textbf{Total Population} = \Sigma_{\text{housing types}} (\text{Households }_{h.t.} \times \text{PPH }_{h.t.}) + \text{Group Quarters Pop}$$

Maintenance of the model

The Council's model is maintained as a set of SAS programs that load data from input tables, perform calculations, and compile the results.

Input tables include minor-civil-division data on:

- Permitted housing units, segmented by housing type
- Other gross changes, segmented by housing type
- Manufactured home counts
- Census 2010 revised count statistics on housing units
- Metropolitan Council's estimation of 2010 housing units, segmented by type
- The most recent Census ACS occupancy rates and persons-per-household multipliers
- Counts of residents in group quarters facilities

METROPOLITAN
C O U N C I L

390 Robert Street North
St Paul, MN 55101-1805

651.602.1000
TTY 651.291.0904

research@metc.state.mn.us