

METROPOLITAN COUNCIL'S ANNUAL POPULATION ESTIMATES METHODOLOGY

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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:

$$\text{Housing Units}_{2018} = \text{Housing Units}_{2010} + \Sigma(\text{Housing Changes}_{\text{Since2010}})$$

$$\text{Households}_{2018} = \text{Housing Units}_{2018} \times \text{Occupancy Rates}$$

$$\text{Total Population}_{2018} = (\text{Households}_{2018} \times \text{Persons Per Household}) + \text{Group Quarters Pop}_{2018}$$

Methodology improvements

Over the past several years, Council staff have worked to continuously improve its annual estimates methodology.

- With the 2006-07 estimates cycle¹, 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 5-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.

Estimation of housing stock

For the April 1, 2018 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)

¹ Estimates for a given year are prepared the following year and certified by July 15. For example, population as of April 1, 2018, is estimated in spring 2019 and certified by July 15, 2019. This due date is specified in *Minnesota Statutes* 473.24.

- Alternative 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

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

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, Council staff assume 100% eventual completion.

² Council Research 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 The Council has found that some cities and towns underreport to US Commerce Department. The data are online at <http://socds.huduser.org/permits/>

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, 2018. Region-wide, there were 1,951 multifamily units permitted between 2010 and 2016, and 8,717 multifamily units permitted in 2017, that had not received a certificate of occupancy by April 1, 2018. These units will count toward next year's estimates if they received a certificate of occupancy by April 1, 2019.

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:

$$\text{SFD}_{2018} = \text{SFD}_{2010} + (\text{SFD Permit}_{2010-2016}) + (\text{SFD Permit}_{2017} \times 95\% \text{ Same-Year-Completion}) + (\text{SFD Additions}_{\text{Since2010}}) + (\text{SFD Loss}_{\text{Since2010}}) + \text{SFD Other Adjustments}$$

Where:

- SFD_{2018} = 2018 housing units
- $\text{SFD Permit}_{2010-2016}$ = Number of units permitted in the 2010-2016 period
- SFD Permit_{2017} = Number of units permitted in 2017
- 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.

Housing units outside of built housing stock

In addition to the built housing stock, Council Research also estimates 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 Council Research's annual survey of residential construction.

Council Research does not estimate the number of other shelters; these are boats, RVs, and other situations that would not normally be considered. Instead, the Council takes the "other" number from the most recent local ACS 5-Year statistics, counting such units only if they are occupied.

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

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 2013-2017 estimates and ACS 2017 estimates, the most recent Current Population Survey/Housing Vacancy Survey data, and reports from the Minneapolis Area Association of Realtors, Council staff found that occupancy rates are slightly higher in 2018 than in the 2013-2017 period from which the communities' housing-type-specific occupancy rates come. Accordingly, Council staff have adjusted the 2018 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 downward by 0.1 percentage points; duplex/triplex/quadplex occupancy rates are adjusted downward by 0.5 percentage points; and multifamily (5+ units) occupancy rates are unchanged. 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 2010-2018 trend from U.S. Postal Service vacancy data to the 2010 Census⁸

⁶ Council Research assumes 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.

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. Council staff's 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 2018 in the USPS data, then

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, Council staff 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, Council staff 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:

$$\text{Households} = \sum_{\text{housing type}} (\text{Housing units}_{\text{h.t.}} \times \text{OccRt}_{\text{h.t.}})$$

Population in group quarters

Metropolitan Council Research enumerates 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.

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. Council Research favors this approach because changes in housing units by type are associated with differing household sizes.

Household size

Average household sizes *by housing type* are primarily based on the most recent published Census ACS 5-Year statistics.¹⁰

The ACS 5-Year estimates are adjusted to mitigate statistical inference error in the ACS. This calibration reconciles the resulting *overall* average household size with two other figures:

- The average household size from the 2010 Census

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, Council Research carries over the group quarters population from the previous annual survey.

¹⁰ Council Research assumes that alternative dwelling units (ADUs) have the same average household size as multifamily units.

- The average household size found after applying the 2010-2017 trend in one-year ACS estimates for the community's county¹¹

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 2010.¹² In these communities, Council Research staff 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.

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:

$$\text{Population in Households} = \sum_{\text{housing type}} (\text{Households}_{\text{h.t.}} \times \text{PPH}_{\text{h.t.}})$$

Total population

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

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

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

¹¹ 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.

¹² The coefficient of variation is the standard error of average household size divided by the average household size estimate. The standard error of average household size is the published margin of error (which yields a 90% confidence interval) divided by 1.645.



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