

METROPOLITAN COUNCIL'S ANNUAL POPULATION ESTIMATES METHODOLOGY

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Metropolitan Council's Annual Population Estimates Methodology

Metropolitan Council prepares local households and population estimates for the Twin Cities seven-county area. Metropolitan 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 households and population estimates for State government purposes (Minnesota Statutes 473.24).

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

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

$$\mathbf{Housing\ Units}_{2013} = \mathbf{Housing\ Units}_{2010} + \Sigma(\mathbf{Housing\ Changes}_{\text{Since}2010})$$

$$\mathbf{Households}_{2013} = \mathbf{Housing\ Units}_{2013} \times \mathbf{Occupancy\ Rates}$$

$$\mathbf{Total\ Population}_{2013} = (\mathbf{Households}_{2013} \times \mathbf{Persons\ Per\ Household}) + \mathbf{Group\ Quarters\ Pop}_{2013}$$

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 are fully replaced by the most recent Census ACS 5-Year rates and multipliers. These rates and multipliers are calibrated to reconcile population estimates with Census 2010 counts.

Estimation of housing stock.

For the April 1, 2013 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)
- Manufactured homes
- Other shelters (boats, RVs, and other situations that would not normally be considered)

¹ Previous-year estimates are prepared the following year and certified by July 15. For example, population as of April 1, 2013, is estimated in Spring 2014 and certified by July 15, 2014. This due date is specified in Minnesota Statutes 473.24.

For the first four housing types, the Council's model starts with base year (2010) housing stock, then adds (or debits) housing stock changes since 2010. These include:

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

Apart from built housing stock, many cities and towns have manufactured homes. Manufactured homes are fully recounted each year.

Base year housing stock. The base year (2010) housing stock is controlled to the Census 2010 100% count of all housing units.²

Base year housing stock *by type* is calculated by multiplication of the 100% count with percentage shares representing each housing type. These percentage shares were calculated 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.³

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:

- 85% completion for multi-family developments (5 or more units)
- 90% for townhomes, duplexes, 3- and 4-unit buildings
- 95% for single family detached

These multipliers are suggested by cycle-time (permit to start to completion) distributions from the US Commerce Department's Survey of Construction. Single-family detached are the most likely to be completed in the same year permitted; multi-family construction has the longest cycle-times. Remaining permitted units are assumed completed and occupiable later, and will be counted in subsequent years.

During years 1999-2004, across a national sample of cities, the Census Bureau's Survey of Construction (SOC) documented an 85% permit-to-start-to-completion rate in multi-family housing; the 15% shortfall was mostly due to design changes, units not started, and starts abandoned.⁴ Unfortunately, Metropolitan Council staff lack full information about where permitted construction fails to occur. Over the long-term, Council staff assumes 100% eventual completion.

² Some counts in Washington County were revised through the post-decennial census Count Question Resolution program.

³ The Council has found that some cities and towns underreport to US Commerce Department. The data are online at <http://socds.huduser.org/permits/>

⁴ US Census Bureau, "Relationship Between Building Permits, Housing Starts, and Housing Completions," online at www.census.gov/construction/nrc/nrcdatarelationships.html

Gross additions and gross losses. Gross additions include moved-in housing units and conversions reported to the Council’s annual survey, as well as units annexed in and reported to Minnesota State Demographer’s survey.⁵

Gross losses include moved-out units and demolitions reported to the Council’s annual survey as well as units annexed out.

Other adjustments. Council Research is able to make other needed, but date-uncertain adjustments to housing stock. There are three situations where Council Research has done this:

- Evidence of housing units missed by Census 2010 or missed by local building permits record-keeping may warrant an upward adjustment to housing unit counts.
- Comparison of estimated total housing vs. homestead counts may warrant an adjustment.⁶
- Evidence of unreported demolitions may warrant a downward adjustment.

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

$$\text{SFD}_{2013} = \text{SFD}_{2010} + (\text{SFD Permit}_{\text{Since2010}}) + (\text{SFD Permit}_{2012} \times 95\% \text{ Same-Year-Completion}) + (\text{SFD Additions}_{\text{Since2010}}) + (\text{SFD Loss}_{\text{Since2010}}) + \text{SFD Other Adjustments}$$

Where:

- SFD_{2013} = 2013 housing units
- SFD Permit = Number of units permitted in and since 2010
- 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 Multi-family housing stock use comparable formula specification — but assume 85% or 90% same-year completion.

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 a survey of park operators/managers. Manufactured homes outside of parks are counted through Council Research’s annual survey of cities and towns.

Council Research does not estimate 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 5-Year statistics.

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 (in definition) 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

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

⁶ Homestead counts come from Minnesota Department of Revenue’s Abstract of Assessments database.

- Duplex, triplex, quads units *multiplied by* occupancy rate
- Multi-family (apartment) units *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 of built housing stock are calculated from Census ACS statistics. The Council’s model averages each housing-type-specific occupancy rate with the overall (all housing types) occupancy rate, and then additionally calibrates to reconcile ACS occupancy rates with Census 2010 occupancy rates.

The averaging of the housing-type-specific occupancy rate with the overall rate is introduced for two reasons: first, to mitigate uncertainty and erratic results for locally uncommon housing types; second, to mitigate respondent error, which occurs as ACS survey participants complete the survey and introduce their interpretation of what type of housing they inhabit.

Council staff finds that occupancy rates calculated as described here are generally consistent with the Census 2010 overall households/housing ratio. However, in 17 communities (out of 193), there were absolute differences exceeding 5 percent. The Council model resolves the discrepancies with calibration adjustments: Rates are adjusted up or down by a constant amount or factor determined with Census 2010 data, which is assumed to offer “true” measurements.

There are two main sources of discrepancy that necessitate calibration adjustment: First, there is statistical inference error in the ACS; the most significant calibration adjustments are needed in small communities with the smallest ACS sample sizes. Second, there are data collection and processing differences between ACS and Decennial Census that could lead to different occupancy rate calculations.⁷

A final adjustment to occupancy rates is introduced to represent economic cycle changes. From comparison of ACS 2010 estimates and ACS 2012 estimates, Council staff finds that occupancy rates have risen significantly in all categories of housing type. Accordingly, Council staff have adjusted the 2013 occupancy rates for each housing type. The adjustments are regionwide constants, applied to all communities: Single family occupancy rates are adjusted upward by 0.8 points in 2013; multifamily (5+ units) occupancy rates are adjusted upward by 2.0 points. This adjustment is reassessed annually.

Population in group quarters.

Metropolitan Council Research enumerates known group quarters in order to account 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.⁸

⁷ See: Cresce, Arthur (2012). *Evaluation of Gross Vacancy Rates from the 2010 Census versus Current Surveys: Early Findings from Comparisons with the 2010 Census and the 2010 ACS 1-Year Estimates*. Paper presented at Federal Committee on Statistical Methodology, January 2012, Washington, DC. Accessed online at https://docs.google.com/open?id=0B5dJml_pt0CeMWFMS3Q0OGhqFU

⁸ 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.

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 calculation of population in households. Households 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. The Council’s model no longer uses average size multipliers from Census 2000.

The ACS 5-Year estimates are adjusted with a calibration to address differences between ACS average household sizes vs. Census 2010 average household sizes. Calibration adjustment involves adjusting multipliers by a constant factor determined with Census 2010 data, which is assumed to offer “true” measurements.

Council staff finds that ACS-based average household sizes are usually comparable to Census 2010 average household sizes. However, in 43 communities (out of 193), calibration adjustments exceeded 5 percent. The discrepancy occurs because of statistical inference error in the ACS (typically in small communities with the smallest ACS sample sizes) and/or because of data currency. For 2013 estimates, Metropolitan Council staff relies mainly on ACS 2008-12 data – data collected 1 to 5 years prior to 2013. In future years, the ACS 5-Year data inputs will continue to be 1 to 5 years old.

The additional calibration adjustment mitigates the statistical inference error associated with ACS estimates. As for data currency, the calibration will become less valid as the decade advances. Therefore, in future years, Council staff will gradually phase out the use of this calibration.

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 Microsoft Access database. When input tables are loaded, subsequent calculations and compilations are performed as a series of Microsoft Access queries.

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 100% 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

Starting with the 2011-12 annual estimates cycle, the Council has replaced Census 2000 local data with decennial Census 2010 counts. The Council's model is designed to allow annual adjustment of local assumptions – specifically occupancy rates and persons-per-household multipliers.



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