ANNUAL POPULATION ESTIMATES METHODOLOGY

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METROPOLITAN COUNCIL

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The Metropolitan Council prepares local household 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 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. While it is difficult to estimate the three components of population change (birth, death, and migration) at the local level, it is much easier to know how many housing units there are. We can then use what we know about those units to estimate how many people live in them.

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

Housing Units$_{2024}$ = Housing Units$_{2020}$ + Σ(Housing Changes$_{2020-2024}$)

Households$_{2024}$ = Housing Units$_{2024}$ X Occupancy Rates

Total Population$_{2024}$ = (Households$_{2024}$ X Persons Per Household) + Group Quarters Pop$_{2024}$

The population grows when:

- More housing units are added (measured by building permits); and/or
- More of those housing units are occupied by households (measured by occupancy/vacancy rates); and/or
- Those households have more people (measured by average household size).

Methodology improvements
Over the past two decades, we have worked to continually improve our annual estimates methodology.

- With the 2011-12 cycle, Census 2000 occupancy rates and household size multipliers were fully replaced with the most recent American Community Survey (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, we began using multiple data resources to estimate occupancy rates and average household size multipliers. 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.
- Starting with the 2021-22 cycle, housing stock estimates and lists of group quarters facilities have been refreshed along with occupancy rates and household multipliers. Additionally, we began starting with estimates for counties (for which more reliable data is available) and ensuring that city/township estimates align with county totals.

Estimation of housing stock

For the April 1, 2024 estimates, we have worked to estimate housing unit counts, segmented by type. Housing types are:

- Single-family detached houses
- Townhomes (single-family attached)
- Units in duplexes and 3- and 4-unit buildings
- Units in multi-family buildings (5 or more units, including both condominiums and 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 (2020) housing stock, then adds (or subtracts) housing stock changes since 2020. These include:

- Housing units permitted
- Other gross additions to housing stock, such as conversions from commercial uses
- Gross losses to housing stock, such as demolitions

Base year housing stock

The base year (2020) housing stock is controlled to the Census 2020 count of all housing units.[1]

Base year housing stock *by type* is calculated by multiplication of the count with percentage shares representing each housing type. Because the 2020 Census did not gather data on housing type, these percentage shares needed to be estimated. See Appendix A for more information.

These estimates may not align perfectly with other data sources. One reason for this is the need for consistency with the 2020 Census, which provides the baseline data for our estimates. If the 2020 Census counted too few or too many housing units, these estimates will be off as well. Another reason is how local governments report building permits to us. We attempt to standardize the definitions of housing types used in building permit reports, and we attempt to reconcile the numbers of units reported with other data sources. Still, our estimates ultimately depend on the accuracy of the data local governments submit to us, and we are grateful for their efforts.

Discrepancies in total numbers of housing units are possible. Evaluating the estimates model process used prior to 2020, there were 23 communities (out of 186) with housing counts differing from the Census 2020 enumeration by at least 100 units.[2] In 10 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 13 cases, the Council previously underestimated housing counts, likely due to incompleteness of building permit record-keeping or reporting by local governments. The

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[1] We have corrected an issue that erroneously placed several hundred housing units in Dahlgren Township in the City of Carver. We have also made a small number of much more minor edits. These decisions are detailed here: *https://metrocouncil.org/Data-and-Maps/Research-and-Data/Census-Data/How-we-edited-initial-2020-Census-Data.aspx*

[2] In our 2011 evaluation of our housing unit estimates against the 2010 Census, there were 31 communities where our estimates diverged from the 2010 Census counts by at least 100 units.

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. In the rare cases when cities or towns do not respond to the survey, we substitute 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. 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 they will be counted in subsequent years. In crediting the most recent year of permitting and construction, the Council assumes:[4]

- 85% same-year completion for townhomes, duplexes, 3- and 4-unit permits; 15% later completion
- 90% same-year completion for single family detached permits; 10% later completion
- Multifamily permits are counted only if they had opened for occupancy by April 1, 2024, as determined by city-issued certificates of occupancy and/or CoStar data.[5] Almost all multifamily units permitted in 2023 had not yet opened by April 1, 2024 and did not count toward the 2024 estimates but will count toward future years' estimates. However, we estimate that there were approximately 17,500 multifamily units regionwide permitted *before* 2020 and open by April 1, 2024 that were not included in the 2020 Census. We have incorporated them into the 2024 estimates.

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 as determined by the *Municipal Boundary Adjustment unit* in the Office of Administrative Hearings.

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

Housing stock calculated

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

$\textbf{SFD}_{2024} = \text{SFD}_{2020} + (\text{SFD Permit}_{2020\text{-}2022}) + (\text{SFD Permit}_{2023} \times 90\% \text{ Same-Year-Completion}) +$

$(\text{SFD Additions}_{2020\text{-}2023}) + (\text{SFD Losses}_{2020\text{-}2023}) + \text{SFD Other Adjustments}$

Where:

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

[4] These are region-wide assumptions. Unfortunately, there is not information about where permitted construction failed to occur. Over the long term, we assume 100% eventual completion.

[5] CoStar is a proprietary source of data with more up-to-date information on rental apartments across the region than the ACS provides.

- SFD$_{2020}$ = 2020 housing units
- SFD Permit$_{2020\text{-}2022}$ = Number of units permitted in 2020-2022
- SFD Permit$_{2023}$ = Number of units permitted in 2023
- SFD Additions$_{2020\text{-}2023}$ = Other gross additions in 2020-2023
- SFD Losses$_{2020\text{-}2023}$ = Gross losses in 2020-2023
- As described above, the 90% completion rate assumes that not all units permitted in 2023 were completed by April 1, 2024.

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, we also estimate manufactured home units. Manufactured homes in manufactured housing parks are counted through an annual survey of park operators/managers.

We do not estimate directly the number of other shelters (boats, RVs, and other situations that would not normally be considered). Instead, we take 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 those housing units in order to estimate the number of households. (By definition, the number of households is identical to the number of occupied housing units.)

County occupancy rates for each housing type
Because data for large geographic areas is more reliable than data for smaller geographic areas, we start by estimating occupancy rates and households for counties – first for 2020 and then for 2024. (Data specific to housing types is not available in the 2020 Census and requires estimation.) Manufactured housing occupancy rates came from our survey, multifamily occupancy rates came from a blend of CoStar and American Community Survey data, and occupancy rates for other housing types came from the 2015-2019 American Community Survey.[6] These housing type-specific occupancy rates were then adjusted so that they matched the county's overall 2020 Census occupancy rate (regardless of housing type) when applied to the county's housing stock.

To estimate each county's occupancy rate in 2024, we used the same sources as with the 2020 occupancy rates, substituting the most recent American Community Survey data (covering the 2019-2023 period). To adjust the 2019-2023 ACS data so that it better reflects 2024 housing market conditions, we subtracted 0.3 percentage points from ACS single-family detached and townhome occupancy rates and 1.5 percentage points from ACS duplex/triplex/quadplex and multifamily occupancy rates. We also imposed a constraint that a given county's type-specific occupancy rate could change by no more than 4 percentage points (for single-family detached and townhome units) or 8 percentage points for duplex/triplex/quadplex and multifamily units, relative to the type-specific

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[6] We used the 2015-2019 vintage of ACS data because sampling error tended to be considerably smaller than 2016-2020 data. The specific vintage used influences only the *relative* occupancy rates of different housing types; all occupancy rates are adjusted so that the county's *absolute* occupancy rate matches the 2020 Census occupancy rate.

occupancy rate estimated for 2020. This mitigates the rapid swings in ACS data that can come from sampling error rather than actual, on-the-ground change.

Local occupancy rates

Initial calculations of local occupancy rates were the same as the calculations of county occupancy rates, this time using locally specific data. Following this, the local occupancy rates were adjusted so that they yielded the same county-level occupancy rates estimated as described above.

Households calculated

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

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

That is, the estimated number of households for cities and townships is the sum of:

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

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; 100 single-family units accommodate more occupants than the same number of multifamily units.

County average household sizes

As with occupancy rates, we start by estimating the average household sizes of each housing type for counties, first for 2020 and then for 2024. The foundation of the 2020 average household size estimates is the 2015-2019 American Community Survey, except that the manufactured home average household size comes from our survey. These housing type-specific average household sizes are adjusted so that they match the county's overall average household size (regardless of housing type) in the 2020 Census.

For average household sizes in 2024, we start with the 2019-2023 American Community Survey data, lowering each number by 0.02 persons per household to reflect the 2023-2024 trend evident in Current Population Survey data. We also impose a constraint that no housing type-specific average household size can change by more than 0.12 persons per household relative to its 2020 value estimated previously. As with occupancy rates, this smooths out occasional rapid swings in ACS data that could be an artifact of sampling error.

To arrive at the final average household size, we calculate the overall average household size (regardless of housing type) from the housing type-specific figures and average them with the 2020 Census average household size as well as the average household size calculated by extrapolating the 2010-2020 trend. Then we adjust the housing type-specific average household sizes to match that average.

Local average household sizes

Average household sizes for each type of housing in each community are calculated in the same way as the county-level figures described previously.[7] We then adjusted them to align with the county-level average household sizes estimated as described above.

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 $_{h.t.}$ X PPH $_{h.t.,}$)

That is, the estimated number of people in households for each city and township is the sum of:

- Households in single family detached units *multiplied by* average household size
- Households in townhome units *multiplied by* average household size
- Households in duplex/triplex/quadplex units *multiplied by* average household size
- Households in multi-family (apartment) units *multiplied by* average household size
- Households in accessory dwelling units (ADUs) *multiplied by* average household size
- Households in manufactured homes *multiplied by* average household size

Population in group quarters

We enumerate known group quarters in order to account for persons living in institutional or non-household settings. The list of group quarters has been refreshed in light of the 2020 Census results; see Appendix B for a description of how we did this. These facilities are surveyed annually, and the resulting counts fully replace the counts from previous years and from the 2020 Census.[8]

Total population

The total population estimate adds together the household population estimate with the group quarters population estimate:

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

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[7] The only exception is that we halve the constraint on year-to-year change in average household size for any given household type, from 0.12 to 0.06 persons per household. This is to avoid large swings that can be generated from small sample sizes in the ACS.

[8] 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.

Small area estimates

We also prepare household and population estimates for small areas (such as census tracts and Transportation Analysis Zones) in the Twin Cities seven-county area. We do this to inform our planning efforts, publicize the region's main demographic trends, and assist local governments in analyzing their communities.

The housing stock model is still used: as with city and township estimates, we take the number of housing units, multiply it by occupancy rates to estimate households, and multiply the number of households by average household sizes to estimate the population in households. We then add the group quarters population to arrive at the total population.

The geographic framework differs, though. Rather than carry out these calculations separately for each geographic level, which would run the risk of inconsistencies across different geographic levels, we create a single set of estimates for census blocks, which are designed to sum precisely to the official city/township estimates and can be aggregated to calculate estimates for any other set of geographic areas.[9] These block-level estimates are only an intermediate step; their sole purpose is to serve as the foundation of estimates for higher levels of geography, like census tracts. As such, we do not publish block estimates, only those estimates for other geographic levels.

Block-level estimates

Housing units

To create block-level housing unit estimates, we use exactly the same method as for city/township estimates. We start with the 2020 Census count of housing units and add the number of units identified in building permit data (both additions and subtractions), using the same assumptions about completion rates described above for the city/township estimates. We also incorporate the change in the number of manufactured homes in each block.

The estimates of housing units are then raked to the official city/township estimates.

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[9] Census blocks used to tabulate 2020 Census data were designed to nest within cities and townships. Subsequent boundary changes (annexations and detachments) have resulted in some blocks that include portions of two cities/townships. To ensure that all small area estimates sum precisely to city/township totals, the foundational unit for them is actually the intersection of cities/townships and blocks. For simplicity, we refer to these as "blocks" in this document.

Households

Estimates of housing units by housing type are not available at the census block level, so we cannot apply housing type-specific occupancy rates to all housing units as we did with the city/township estimates. Instead, we take the number of households in the 2020 Census and add (or subtract) the number of households gained (or lost) through housing stock changes. The latter is estimated from housing type-specific occupancy rates applied to changes in the housing stock.[10] For example:

Housing type	(A) Change in housing units	(B) Estimated occupancy rate	(C) Estimated change in households (A × B)
Single-family detached	50	96%	48
Townhome	20	95%	19
Duplex/triplex/quadplex	0	92%	0
Multifamily	150	80%	120
Accessory dwelling unit	0	80%	0
Manufactured home	0	93%	0
Total	**220**		**187**

The additional 187 households would be added to the 2020 Census household count to produce the estimated number of households in the block. These block-level estimates are then raked so that they add up precisely to the city/township controls.

Population

To estimate the population in households for census blocks, we use essentially the same approach as for households, multiplying the housing type-specific change in households by average household sizes.[11] Continuing the hypothetical example from above:

Housing type	(A) Change in households	(B) Estimated average household sizes	(C) Estimated change in household population (A × B)
Single-family detached	48	3.50	168
Townhome	19	3.00	57
Duplex/triplex/quadplex	0	2.75	0
Multifamily	120	1.60	192
Accessory dwelling unit	0	1.25	0
Manufactured home	0	3.50	0
Total	**187**		**432**

The additional 432 people in households would be added to the 2020 Census household population count to produce the estimated population in households in the block. To create the block-level total population estimates, we add on the population in group quarters, estimated at the block level directly from our survey data.

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[10] Occupancy rates for new multifamily units are taken from block-specific CoStar data. Occupancy rates for new units of all other housing types are taken from the corresponding occupancy rates for the block's city/township.
[11] These average household sizes are taken from the corresponding average household sizes for the block's city/township.

These block-level estimates are then raked so that they add up precisely to the city/township controls.

Other geographic levels

Estimates for other geographic areas can be aggregated directly from these block-level estimates. We currently produce estimates for census block groups, census tracts, school districts, Transportation Analysis Zones (TAZs), and ZIP Code Tabulation Areas (ZCTAs).[12] After summing all the blocks within each area, we round the resulting numbers and adjust the estimates as needed to make the rounded numbers equal to the city/township estimates.

To assist transportation planners who need to examine the transportation of people outside the seven-county Twin Cities region, we also create estimates for TAZs in all counties contiguous to the region, sometimes called "collar counties." These include Chisago, Goodhue, Isanti, Le Sueur, McLeod, Rice, Sherburne, Sibley, and Wright counties in Minnesota as well as Pierce and St. Croix counties in Wisconsin.

We do not have access to detailed building permit or group quarters data at the block level for the collar counties. Instead, we use the Census Bureau's address count listing files[13] as a proxy for housing units. We apply the 2020 Census occupancy rates to estimate households, then apply 2020 Census average household sizes to estimate the population in households, then finally add the 2020 Census group quarters population to estimate the total population.

These estimates are raked to the city/township estimates created by Minnesota's *State Demographic Center* (in which only households and total population are available) and Wisconsin's *Demographic Services Center* (in which only total population is available).

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[12] ZCTAs are collections of census blocks designed to group areas with the same five-digit ZIP code.
[13] This dataset summarizes for each census block the number of residential addresses in the Census Bureau's Master Address File. See *https://www.census.gov/geographies/reference-files/2024/geo/addcountlisting.html* for more information.