A TYPOLOGY OF CHANGE IN SUBURBAN NEIGHBORHOODS

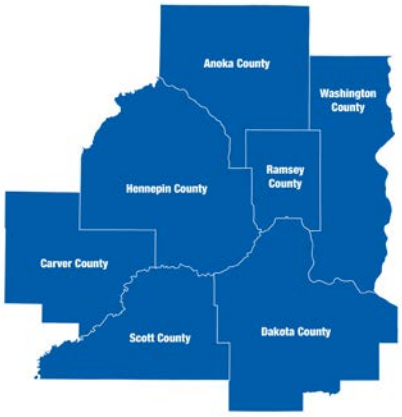
METROPOLITAN COUNCIL

July 2018

The Council's mission is to foster efficient and economic growth for a prosperous metropolitan region

Metropolitan Council Members

Alene Tchourumoff	Chair	Edward Reynoso	District 9
Katie Rodriguez	District 1	Marie McCarthy	District 10
Lona Schreiber	District 2	Sandy Rummel	District 11
Jennifer Munt	District 3	Harry Melander	District 12
Deb Barber	District 4	Richard Kramer	District 13
Steve Elkins	District 5	Jon Commers	District 14
Gail Dorfman	District 6	Steven T. Chávez	District 15
Gary L. Cunningham	District 7	Wendy Wulff	District 16
Cara Letofsky	District 8		



The Metropolitan Council is the regional planning organization for the seven-county Twin Cities area. The Council operates the regional bus and rail system, collects and treats wastewater, coordinates regional water resources, plans and helps fund regional parks, and administers federal funds that provide housing opportunities for low- and moderate-income individuals and families. The 17-member Council board is appointed by and serves at the pleasure of the governor.

On request, this publication will be made available in alternative formats to people with disabilities. Call Metropolitan Council information at 651-602-1140 or TTY 651-291-0904.

The Purpose of the Study

This study examines how the demographic, built environment, and housing market characteristics of small areas in suburban communities changed in the seven-county metropolitan area. It classifies the type of changes these areas experienced between 2000 and 2015 to help inform local planners about the changing needs of various parts of their communities. The study intends to achieve two goals. The first goal is to provide more granular information to planners to help them tailor targeted planning strategies to address the needs of specific parts of their communities. The second one is to identify similar patterns of small area changes across the region to facilitate information sharing and best practices among communities.

Background

Our region's suburbs have been changing for quite a while. The changes these communities experience, however, can vary from one small area to another.[1] These areas often differ based on their demographic, built environment, and housing market characteristics. These differences shape the types of change they go through. This project investigates these changes to identify and examine patterns across the suburbs of the seven-county metropolitan area.[2]

The Metropolitan Council offers technical assistance to communities for the preparation of their comprehensive plans to ensure consistency with regional system plans. The *Local Planning Handbook* provides information on the region's physical assets, infrastructure, natural resources, and generalized land use. This study focuses on changes in small areas of suburban communities to offer additional technical assistance to communities within the Council's jurisdiction.

Planning for different types of small areas requires different approaches to achieving locally identified outcomes. While local planners know about issues in their communities to some extent, many jurisdictions lack the capacity to collect and analyze extensive data to systematically evaluate the needs of various parts of their communities. This project intends to fill this gap by providing a baseline description of the types of changes taking place in small areas of communities.

Analysis

One needs to first examine the characteristics of census tracts to understand how they change over time. Figuring out the characteristics that most concisely define a tract and capture how it changes over time, however, is not a straightforward task. It requires an investigation of a host of characteristics that describe the multifaceted nature of census tracts in a holistic fashion. It also entails prioritizing the characteristics that are most crucial in differentiating census tracts from one another to make succinct comparisons possible.

For this project, a team of planners, researchers, and policy analysts explored an extensive list of census tract characteristics. The team identified 20 characteristics that capture the demographic,

---

1 In this study, small area refers to census tracts. The initial goal of this project was to analyze neighborhood-level changes that would be best captured by using census block-group data. However, margins of error at the block-group level are significant enough to potentially undermine the accuracy of data. The study refers to census tract boundaries as small areas rather than neighborhoods because the size of census tracts can change significantly from community to community. In less densely populated communities, where census tracts can be as large as an entire city, census tracts are not a good representation of neighborhoods. In most suburban areas, however, census tract-level analysis helps examine the dynamics of areas smaller than cities or townships.

2 In this study, the seven-county metropolitan area refers to the seven counties within the Metropolitan Council's jurisdiction. These counties are: Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, and Washington.

physical, and housing market characteristics of each census tract. Team researchers collected data on 38 variables that measure these characteristics. Data sources included the American Community Survey, the MetroGIS Regional Parcel Dataset, as well as the Council's Generalized Land Use Inventory and Transportation Forecast Model datasets.

The team first categorized census tracts based on their similarities and differences at two points in time—2000 and 2015—to analyze how they changed. Council researchers used a method called cluster analysis to assign census tracts to different groups.[3] Team researchers reduced the number of variables that characterize a census tract by eliminating those that captured the same aspect of a tract as another variable. They identified these duplicative variables by using statistical tests and excluded those that were less important in forming the clusters.

The cluster analysis process also revealed which variables were more important in assigning a census tract to one group as opposed to another. After extensive discussions based on these statistical analyses, the team selected five variables that most concisely capture census tract change: three demographic variables (race, age, and income), one housing market variable (housing costs), and a built environment variable (recent construction activity). These five variables are stand-ins for many of the variables that were explored and eliminated.

Race, age, income, housing costs, and recent construction activity interact with each other to drive change in census tracts. In different combinations, these variables can produce different types of change. While the demographic traits of census tracts shape the programmatic services planners use to serve the needs of their residents, the housing market characteristics and the built environment of census tracts can influence infrastructure needs and priorities in different parts of communities.

Demographic factors such as race, age, and income are relevant because the success of local programs offered by the cities depends on recognizing the specific needs of residents. The race and ethnicity of the residents, for instance, might require changes in community outreach methods or the mix of local recreational facilities. Success of housing programs depends on the age and income of the residents because these characteristics affect how much residents can invest in the upkeep of their homes.

Housing markets matter because housing costs provide a summary measure of a census tract's perceived value. These costs reflect the combined value of public investments made in a census tract, existing market demand for its location, and the quality of its housing stock. Public investments, market demand, and housing quality can affect how census tracts change because the cost of housing in a census tract plays an important role in determining who can afford to live there.

The built environment of a census tract also plays an important role in how it changes over time. For instance, suburban tracts that can accommodate greenfield development deal with different issues than more established census tracts with opportunities for only brownfield development. The recent construction activity variable captures two important aspects of the built environment that directly affect

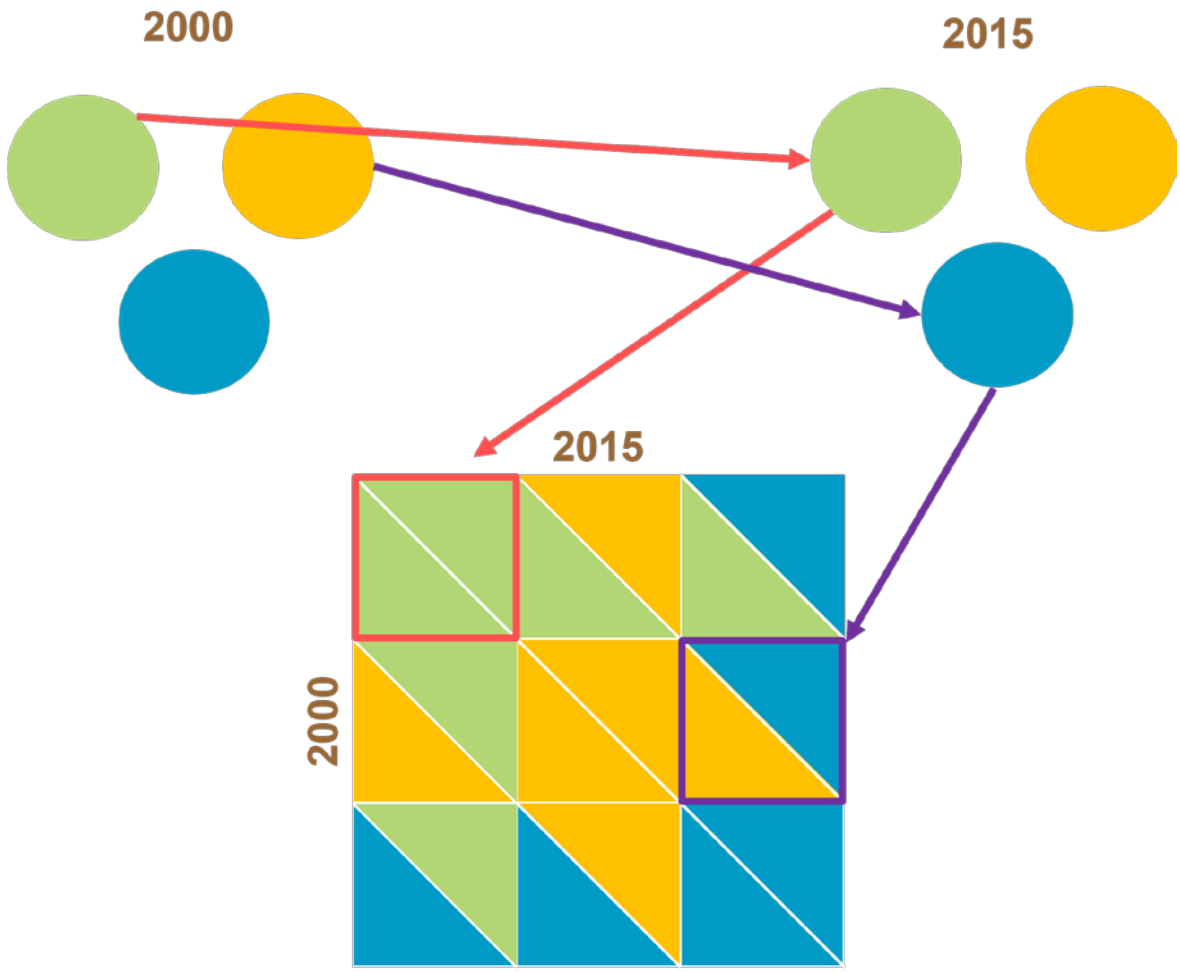
---

3 Researchers traditionally use cluster analysis when they want to group data (in this case census tracts) with common characteristics into clusters. Cluster analysis identifies group similarities based on multiple traits. In this study, the goal is to group census tracts based on a few dimensions in a way where tracts in each cluster are most alike and tracts in different clusters differ most from those in other clusters.

change: the age of a census tract on the development spectrum and the strength of new construction activity in a tract's housing market.

Council staff used these five variables to conduct the cluster analysis, which rendered three clusters for each year. They used these clusters, which demonstrated the static characteristics of census tracts in each year, to examine what happened to each census tract from 2000 to 2015. The comparison of the three 2000 clusters with the three 2015 clusters generated nine different types of census tract change. Staff reassigned two of these nine types to other types because there were very few census tracts that belonged to these types (See Figure 1).

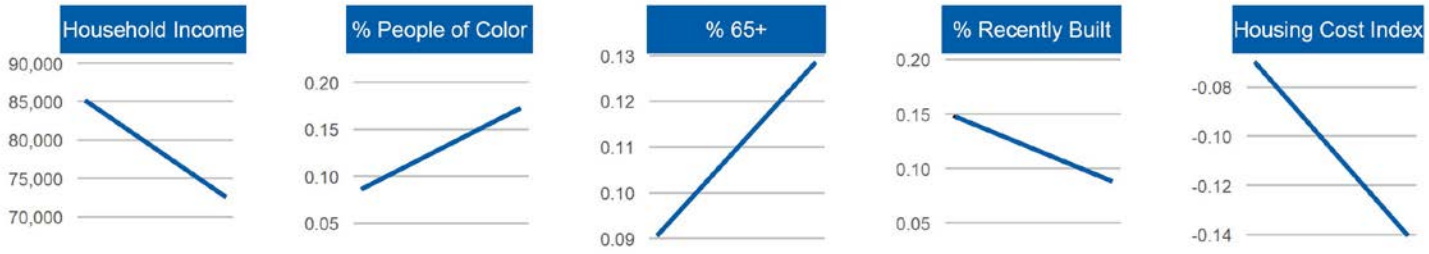
Figure 1: Clustering and Change Types



Council staff then mapped these seven types of census tract change and examined their spatial distribution across the region. Based on their regional and local knowledge, the project team investigated census tracts in each type to ground-truth if their change patterns aligned closely with the types to which they were assigned. The team then created a narrative describing the specific changes each type experienced between 2000 and 2015. Team members used the additional data that was collected but not used in the cluster analysis to enrich and fine tune these narratives.

The seven distinct types of change took place within the context of larger trends that shaped the study area. Figure 2 summarizes these trends. Between 2000 and 2015, median incomes in the study area declined, while the percent share of people of color and of residents who are 65 or older increased. Meanwhile, housing costs went up and the pace of new construction activity declined across the study area. This analysis used the study area trends as a reference to allow comparisons across types and to demonstrate the extent to which trends in each type resembled or differed from study area trends.

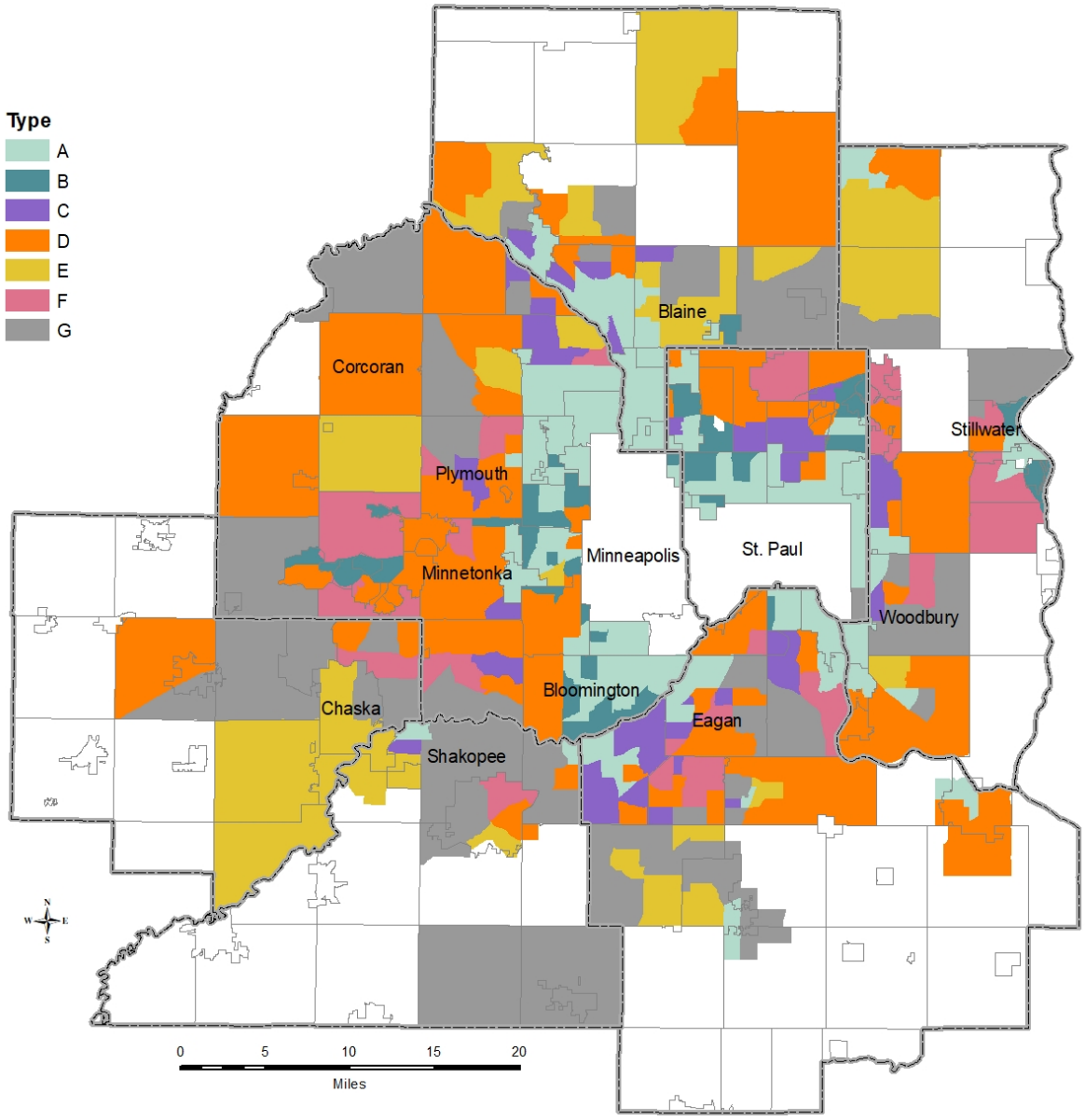
Figure 2: Study Area Trends



Types of Change

The narratives summarized below describe in detail how different combinations of demographic, housing market, and built environment factors drove census tract change in seven distinct ways. Figure 3 shows the types of change census tracts experienced in different parts of the region. Each narrative starts with a summary of how demographic, housing market, and built environment characteristics changed and lays out the opportunities and challenges presented by this specific type of change.

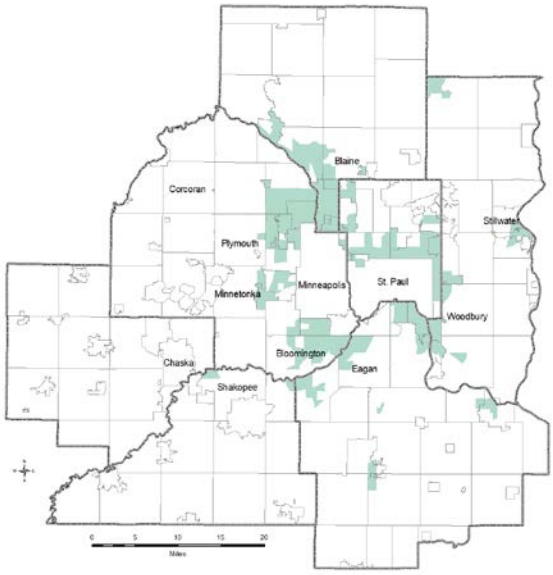
Figure 3: Types of Change in the Twin Cities Metro Area



Type A

Type A census tracts are in areas that mostly developed in the second half of the 20th century. These census tracts have already experienced a generational transition as former residents aged, and new and younger residents replaced them. Growing racial and ethnic diversity has been part of this transition as residents of color have continued to move into these neighborhoods. Type A census tracts have continued to have the lowest incomes among all types in the study area during the study period.

Having developed earlier, Type A census tracts have an older and more affordable housing stock. Housing cost trends suggest weak housing markets in these census tracts. Yet, most of these tracts have good access to transportation networks and are in centrally located areas near established job centers. Since these areas are mostly developed, growing interest in these locations is likely to be met through redevelopment or rehabilitation of existing properties and infill development.



These census tracts may face the risk of losing naturally occurring affordable housing if their central locations make them attractive to higher-income residents. For instance, an investor purchased Crossroads, a naturally occurring affordable housing complex in a Type A census tract in Richfield, and transformed it into a less affordable apartment complex with improved amenities. This renovation project, which displaced many of the Crossroads residents who could not afford the higher rents, reduced the number of affordable units in this census tract.

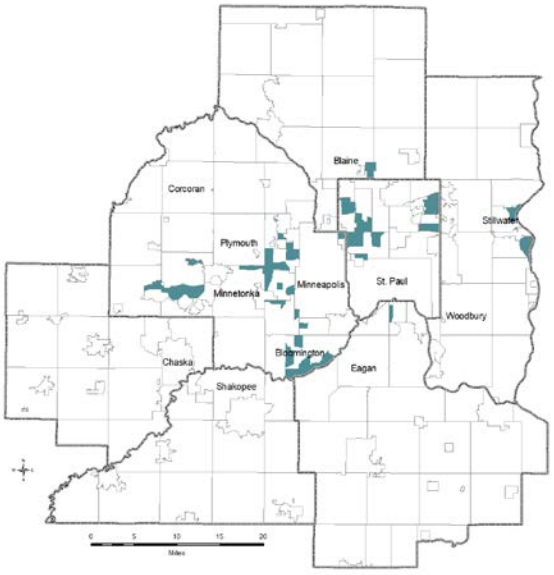
Planning needs of Type A census tracts are likely to change as the demographics of their residents change. Growing racial and cultural diversity can present new opportunities for these tracts. For instance, place-making investments, such as public spaces and artist programs, that aim to create culture-specific hubs can capitalize on the cultural assets of these census tracts. Changing preferences and needs of the residents might also require different types of investments. For instance, retooling existing recreation facilities to build soccer fields as well as baseball diamonds may be one way of accommodating resident demand.

Type B

Type B census tracts are in areas that mostly developed in the second half of the 20th century. The demographic makeup of these tracts has not changed much during the study period; they have remained mostly white and middle-income. However, the age profiles of these tracts suggest that they have not yet experienced the generational transition that comparable suburbs have. These census tracts continue to have high percentages of residents who are 65 or over, suggesting that many of the residents are aging in place.

The central location of these tracts near transportation networks and established and growing job centers has been a large draw for large-scale, high-density infill and redevelopment projects. For example, the growing job hub along I-394 continues to attract apartment complexes in Golden Valley. Similarly, Type B census tracts in Saint Louis Park have been home to clusters of large-scale, high-

density condominium and apartment projects as well as luxury mixed-use complexes such as Excelsior and Grand.



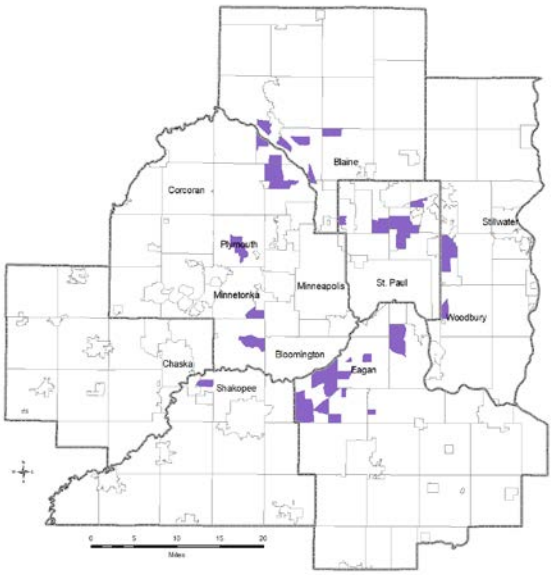
Strong infill and redevelopment activity has boosted housing markets in Type B census tracts. Housing costs, especially in rental markets, have increased noticeably between 2000 and 2015. However, the combination of their aging housing stock and the growing shares of their fixed-income older residents might make it harder for these tracts to maintain the quality of their housing stock. Programs to help with the maintenance of aging homes might be especially useful to prevent the deterioration of existing housing stock and meet the needs of an aging population.

Careful planning of large-scale, high-density infill and redevelopment projects offer multiple opportunities for improving the built environment of these census tracts. Smooth integration of new projects into the existing fabric of these tracts could be occasions for increasing walkability, enriching the streetscape, and ensuring the continuing vitality of Type B census tracts. Programming for older adults including volunteer opportunities could also be useful to meet the changing needs of residents in Type B tracts.

Type C

Type C census tracts mostly developed between 1970s and 2000s. Unlike older census tracts where the generational transition had already happened or has been happening, these tracts are in the earlier phases of this type of transition. The share of older adults, which has been relatively low, has increased during the study period. Type C tracts, which were composed of mostly white residents in 2000, became much more racially and ethnically diverse by 2015. These census tracts have also been low-income areas historically and experienced the sharpest decline in incomes in the study area between 2000 and 2015.

Type C census tracts are mostly in areas with easy access to highways. Although their accessible locations had attracted significant new development during the 1990s, development activity slowed considerably between 2000 and 2015. While home values in 2000 were solid, housing markets in these neighborhoods have slipped between 2000 and 2015. Home values appreciated very little and rents, which increased across the region, barely changed. Housing stock in these census tracts has remained affordable.



If these trends in declining income persist, Type C census tracts might face the risk of deterioration. Maintaining the quality of housing is essential for fending off this risk. Since these census tracts have had modest and declining incomes, they might face issues related to deferred maintenance. Housing

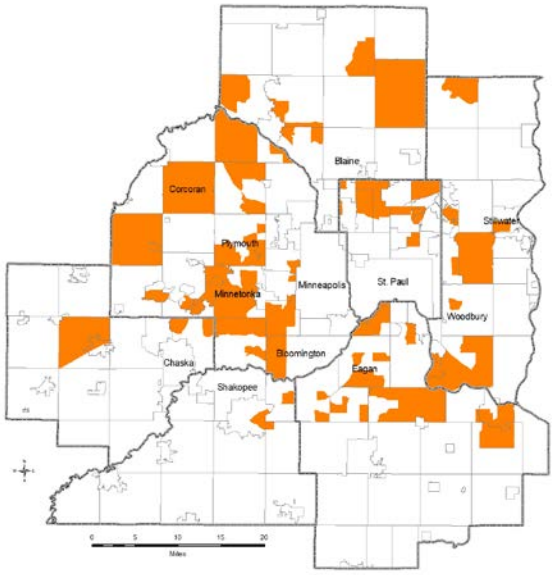
rehabilitation, maintenance, and weatherization programs might help residents catch up with deferred maintenance and enable home improvements necessary to maintain the quality of housing in Type C tracts.

Ensuring the vitality of these census tracts might also require public subsidies that can help stimulate market demand in these areas. For instance, strategic place-making investments that take advantage of their accessible locations and growing racial and cultural diversity can boost private investment in Type C tracts. Alternatively, supporting and attracting businesses oriented toward the needs of a more racially diverse clientele might not only enhance the economic standing of these areas, but also appeal to the changing preferences of residents.

Type D

Type D census tracts mostly developed between 1970s and 2000s. These tracts are at the very early stages of the generational transition. The fact that the share of older adults almost doubled even though there was little population growth in these neighborhoods suggests that older residents in these census tracts are aging in place. Type D tracts remained mostly white between 2000 and 2015. They were higher-income areas and remained so despite losing some ground in this period.

While development activity slowed down in Type D census tracts, there is still room for infill development. In tracts with easy access to highways, there is strong demand for rental housing. In Type D areas that are further away from the region's core, census tracts have older town centers and manufactured housing parks, which exhibit different housing stock and built environment characteristics than the rest of the tracts in this Type.



Housing markets in Type D census tracts have remained very strong throughout the study period. Home values, which have already been high, appreciated significantly; rents, which were on the high end of the spectrum to begin with, held steady. Old town centers with older housing stock and manufactured home parks continued to provide naturally occurring affordable housing in Type D census tracts. Preserving affordability in these areas can be an effective way of maintaining income diversity.

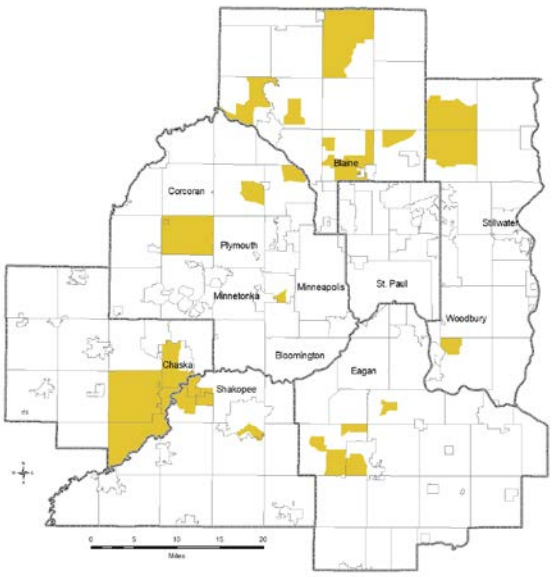
Small area plans identifying reinvestment needs may be useful for redevelopment in old town centers. This can also open new prospects for increasing the walkability of communities that can especially be attractive to older adults. Senior housing for those who are aging in place can be part of these redevelopment efforts as well. Programming for older adults including volunteer opportunities might serve the needs of residents.

Type E

Type E census tracts are among the most recently developed areas, with most of their housing built since the 1990s. They have been among the fastest growing tracts in the study area. Residents in these tracts have remained mostly white despite some increase in racial and ethnic diversity. These

census tracts have some of the youngest populations both in 2000 and 2015. Residents in Type E tracts had moderate incomes which held steady between 2000 and 2015.

Housing markets in these census tracts have been strong due to moderate housing costs that appeal to younger families. Housing construction activity, which had been robust during the 1990s, accelerated between 2000 and 2015. Despite ongoing housing construction, however, housing costs have continued to rise. This strong upward pressure on housing costs suggests that market demand for these tracts remains high.

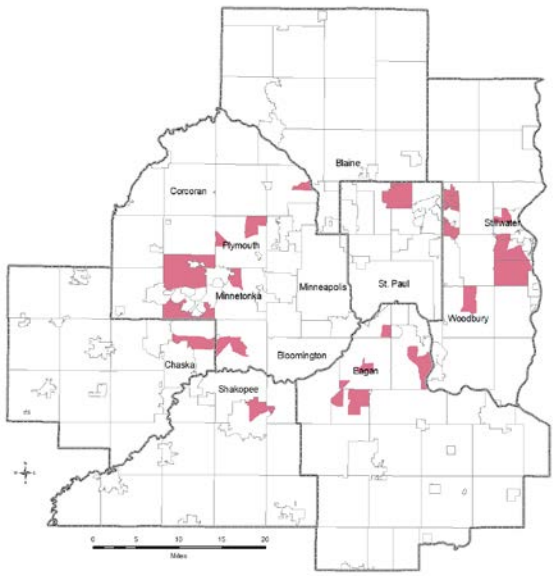


Keeping up with the infrastructure needs generated by rapid growth is likely to be a challenge for Type E census tracts. These tracts could benefit from strategic and proactive planning of investments in storm water infrastructure, sewer connections, and preservation of natural resources. Planning for active recreation facilities such as practice fields as well as providing youth-oriented programming could help serve the younger population of Type E tracts.

Communication and coordination with school districts regarding the siting of new schools could be a vehicle for shaping future growth in Type E tracts. In rapidly growing, younger communities with abundant opportunities for greenfield development, school sites impact not only the location of new housing developments, but also the traffic patterns within the community. It might also be useful to focus on connecting new subdivisions to the rest of the community to ensure sufficient street connectivity.

Type F

Type F census tracts, where most of the development took place between 1970 and 2000, are stable communities with very little growth since 2000. Despite slow population growth, the share of older adults in these tracts has increased, which suggests that residents are aging in place. Type F census tracts have stayed primarily white, despite experiencing a modest increase in racial and ethnic diversity. These tracts continue to have the highest median income among all types in the study area.



Type F census tracts have exceptional access to natural amenities such as lakes, parks, and other bodies of water. The housing stock in these tracts is expensive, and their desirable locations have kept housing markets strong. As aging residents eventually downsize, these areas might experience a surplus of high-end single-family housing since the high prices might suppress demand. If residents

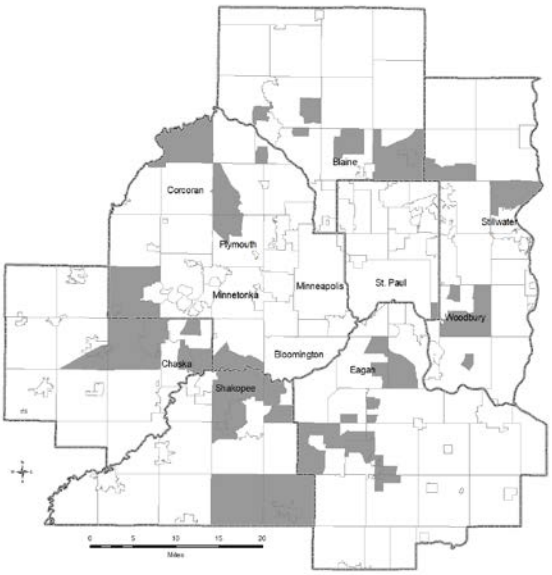
choose to age in community, there may be demand for high-end multifamily housing that is not currently served.

These census tracts are not likely to have significant development-related challenges other than natural resource protection. For instance, water quality management and storm water management are issues that might need to be prioritized. Recreational opportunities as well as programmatic services for older adults might serve the interests of the residents well in these tracts.

Type G

Most Type G census tracts are in the region's edge, in areas further out from the region's core. These are rapidly growing new tracts which developed primarily between 1990 and 2015. Demographically, Type G census tracts are on the youngest end of the age spectrum. Despite some increase in racial and ethnic diversity between 2000 and 2015, they remain mostly white. Type G tracts have remained high-income areas during the study period.

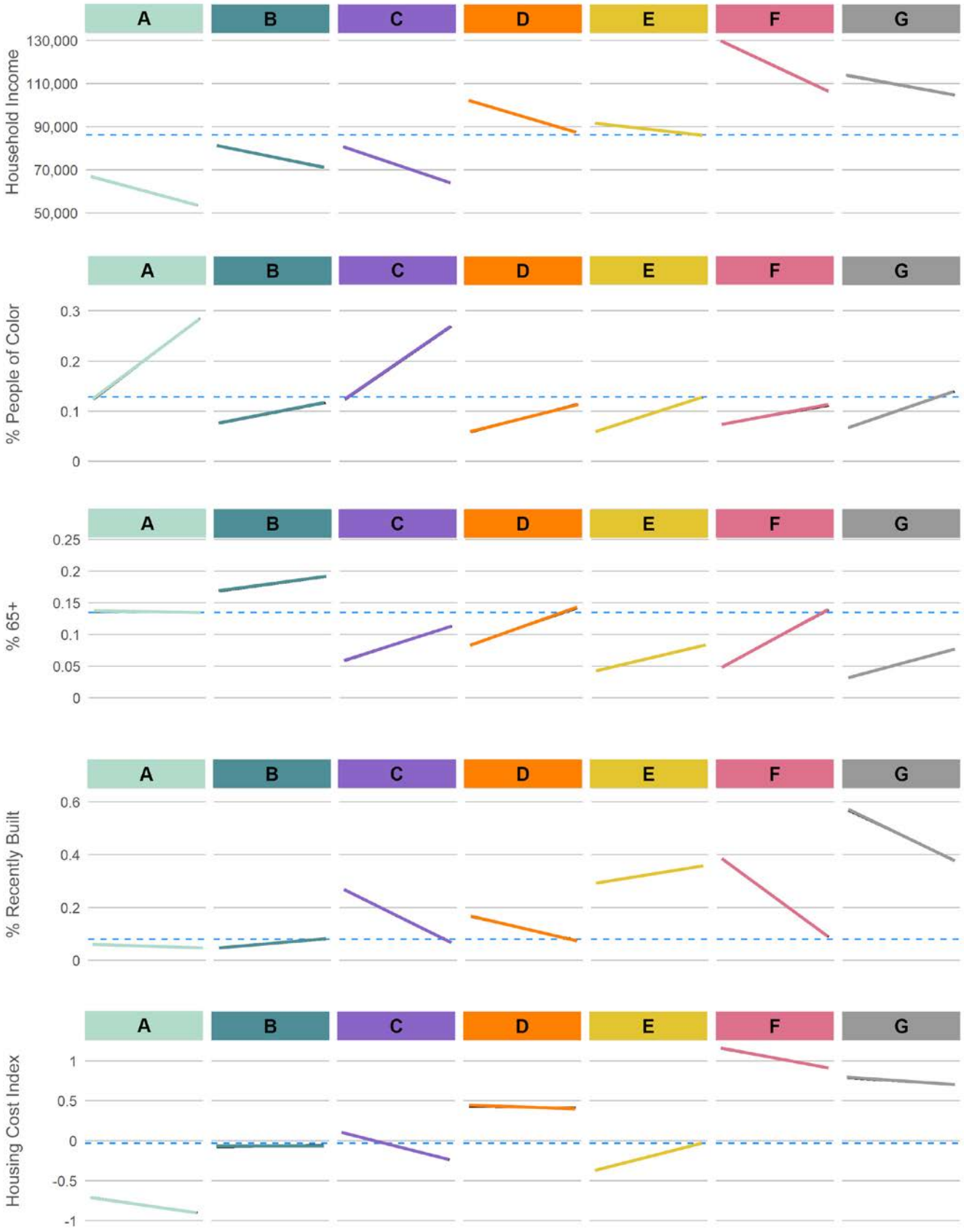
Housing markets in these census tracts have been very strong both during the study period and the decade preceding it. Type G tracts had very robust housing construction activity during the 1990s, and continued to attract considerable development between 2000 and 2015, with a slight slowing of construction activity compared to the 1990s. Demand for these tracts has been high despite their expensive high-end housing stock.



Since these census tracts still have large undeveloped areas, new development is likely to be greenfield development. This means that in addition to maintaining their existing infrastructure, these tracts will need to keep up with the infrastructure needs of greenfield development. Strategic and proactive planning of investments in storm water management infrastructure, sewer connections, and preservation of natural resources will help them avoid future complications.

The housing stock of these census tracts tend to be primarily single-family subdivisions. These tracts may need to diversify their housing stock since the homogeneity of their existing stock might limit residents' ability to stay in these areas as they progress through different lifecycle needs. These neighborhoods may consider planning for service-oriented neighborhood commercial nodes to serve the residents.

Figure 4: Characteristics of Types



Methodology

The goal of this study is to explore changes taking place in small areas across suburban communities. Analyses of small area change have mostly focused on central cities and have been framed within the binary of gentrification versus neighborhood decline. This study intends to break out of this binary framework to explore the multiple ways small areas in suburbs changed between 2000 and 2015. It aims to classify specific types of small area transitions by using a cluster analysis.

It is necessary to first identify what small areas looked like in 2000 and 2015 to be able to analyze how they changed from 2000 to 2015. The goal of this study is to create clusters of small areas in two different points in time and then compare the cluster an area was in 2000 with the cluster it was in 2015. These comparisons are meant to reveal distinct types of small area change, which can inform communities in planning for their residents.

In this study, small area refers to a census tract.4 While it would have been much more valuable to planners to investigate changes at a smaller geography, the margins of error at the block-group level are significant enough to potentially undermine the accuracy of data. The geographic scope of this study extends to the seven counties within the Metropolitan Council's jurisdiction: Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, and Washington.

The study area excludes the cities of Saint Paul and Minneapolis, where census tract-level changes have already been extensively studied. Moreover, including these two cities would have skewed the cluster analysis and made it difficult to observe the subtle variations in the dynamics of suburban tracts the study is meant to reveal. The study also excludes census tracts in rural areas because the large size of the census tracts and the low numbers of residents in these tracts diminish the added value of this analysis in these areas.5

The project team for this study included regional planners, policy analysts, researchers, and GIS specialists. Team members collaborated to identify the characteristics that define a census tract and affect the changes it might undergo. Extensive discussions among team members informed by a comprehensive literature review rendered a list of 20 characteristics and 38 measures that captured these characteristics (See Table 1 for a list of these characteristics and measures).

The team classified these characteristics into four groups that reflect various aspects of census tracts: demographic characteristics, neighborhood characteristics, housing market conditions, and built environment. Researchers collected land use, census, and parcel data for the 38 measures used in the analysis. Data sources included the US Census datasets, the MetroGIS Regional Parcel Dataset, as well as the Council's Generalized Land Use Inventory and Transportation Forecast Model datasets.

Comparisons of clusters in 2000 and 2015 required modification of the 2000 data because the geographies used for the collection of 2000 and 2015 data were not the same. Some tract boundaries changed following the 2010 Census. Since the 2015 data was based on the most recent (2010) tract

---

4 The study refers to census tract boundaries as small areas rather than neighborhoods because the size of census tracts can change significantly from community to community. In less densely populated communities, where census tracts can be as large as an entire city, census tracts are not a good representation of neighborhoods. In most suburban areas, however, census tract-level analysis helps examine the dynamics of areas smaller than cities or townships.

5 This study only includes census tracts where at least one half of the tract acreage falls within the Council's Metropolitan Urban Service Area (MUSA). Rural census tracts outside the MUSA are sparsely populated and unlikely to change.

boundaries, the team normalized the 2000 data to 2010 boundaries. This involved converting the 2000 tract boundaries to the 2010 tract boundaries by using block group data from the 2000 Census.

For 2000 block groups that spanned multiple 2010 tracts, the team apportioned 2000 block groups across 2010 tracts in proportion with the share of the 2000 block group's total population that was inside the 2010 tract boundary. The team determined these shares by using both block-level data from the 2000 Census and the Census Bureau file which converted 2000 tracts to 2010 tracts. Council researchers used these normalized datasets to conduct the cluster analysis.

Cluster analysis allows the grouping of census tracts based on a variety of characteristics, making it possible to examine the similarities and differences of tracts in each cluster. The analysis places census tracts that are most alike in the same cluster while maximizing the differences between clusters. An important part of the analysis involves describing what each cluster means in a clear and concise fashion. In other words, analysts need to interpret the clusters for those who use them.

Team researchers focused on the measures that mattered most in creating simple and coherent descriptions of the clusters. The 38 measures identified at this stage of the study were too many for the analysis to generate concise descriptions. The team reduced the number of measures by eliminating duplicative measures that captured the same characteristics. They eliminated the measures that were redundant by using a correlation matrix that helped identify the measures that were correlated.

In addition, cluster analysis process itself helped identify which measures were more important in assigning a census tract to one cluster as opposed to another. The research team produced numerous preliminary clusters using the large set of measures. Team members then visually compared the distribution of each of these measures across each cluster group to determine which measures contributed most to meaningful distinctions between clusters.

After extensive conversations informed by these statistical analyses, the team eliminated several measures, including all neighborhood characteristics. The project team selected five variables that most concisely captured census tract change: three demographic variables (race, age, and income), one housing market variable (housing costs), and a built environment variable (recent construction activity). These five variables are stand-ins for many of the variables that were explored and eliminated.

Researchers normalized all variables to transform each variable to a comparable range of value. Variables measured at different scales are likely to skew the clustering process since a variable with a larger scale might outweigh variables with a smaller scale. For instance, while home values run in thousands of dollars, percentage of people of color could only range between 0 and 1. The team used the z-scores of each variable to eliminate scale effects that would skew the cluster analysis.6

The research team used the percentage of total census tract population who are people of color, percentage of total census tract population who are 65 years of age or older, and the census tract median household income to measure the race, age, and income variables. The 2000 values for these

---

6 Normalizing variables means expressing the distribution of each variable in terms of z-scores. A z-score summarizes how far a specific value of a variable is from the mean of that variable’s distribution and then converts that distance to a number of standard deviations. Unlike variables that have units of measurement such as dollars or percentages, the unit of a z-score is the number of standard deviations. By expressing all values in standard deviation terms, z-scores standardize the measurement unit across variables and allow comparisons of values with different units of measurement.

variables came from the 2000 National Historical Geographic Information System (NHGIS) block group data while the values for 2015 came from the 5 Year American Community Survey, 2011-2015.7

The housing cost variable reflected a combination of the census tract median home value and median gross rent. The research team first normalized median home value and median gross rent variables by creating z-scores for these variables. They then calculated a weighted average of these z-scores, where the weights were apportioned based on the percentage of owned vs. rented housing stock in a census tract. The team used the weighted average of these two variables as the final measure of housing costs.

Members of the team used 2000 and 2015 County Assessors' Parcel Data to calculate census tract median home values for single family detached homes only.8 They inflated the 2000 values by using the Case Schiller Index before they compared them to the 2015 values. The team used median values from neighboring tracts when tracts were outliers and contained fewer than 30 data points or when they had no data on median home values.

Median gross rent data came from two different resources. Team members calculated 2000 values by using the 2000 NHGIS block group data and aggregating it to 2010 census tracts.9 The values for 2015 came from the 5 Year American Community Survey, 2011-2015. The team inflated the 2000 median gross rent values by using the Consumer Price Index (CPI) rather than the Case Schiller index because the purchasing power of a renter is better captured by the CPI that reflects the cost of living for individuals.10

The team chose to represent recent construction activity by measuring the percent of a tract's total housing units that were built most recently. For 2000, recent activity covered construction between 1990 and 2000. For 2015, the team chose a longer period (2000-2015) to make sure the negative impact of the mid-2000s housing crisis on construction activity dissipated and the market values returned to the norms of a traditional housing market.

Team members used the percent of total housing units in 2000 that were built between 1990 and 2000 to capture recent construction activity in 2000. They calculated 2000 values by using the 2000 NHGIS block group data and aggregating it to 2010 census tracts.11 They used the year structure built variable from the 5 Year American Community Survey, 2011-2015 to calculate the share of 2015 total housing units that were built between 2000 and 2015.

---

7 Minnesota Population Center. National Historical Geographic Information System: Version 11.0 [Database]. Minneapolis: University of Minnesota.
8 The research team could not use parcel level data for multifamily properties for 2000 because of two reasons. In some cases, parcel level representations of multifamily properties were not consistent across counties. In other cases, it was impossible to determine the tenure status of multifamily properties because homestead status of residences was not available for all counties in 2000. The team used the values for only single family detached properties for the sake of consistency.
9 Minnesota Population Center. National Historical Geographic Information System: Version 11.0 [Database]. Minneapolis: University of Minnesota. Aggregating median values from block groups to census tracts is not a straightforward exercise, especially when census tract boundaries change over time. The team consulted data analysts and statisticians from Minnesota Population Center's IPUMS National Historical Geographic Information System project and wrote specific SAS codes to perform these aggregations. The SAS codes are available from staff upon request.
10 The team used the CPI value for 1999 rather than 2000 because the Census collects the median gross rent data in 1999 and reports it in 2000.
11 Minnesota Population Center. National Historical Geographic Information System: Version 11.0 [Database]. Minneapolis: University of Minnesota.

The research team used the Partition Around Medoids (PAM) method of clustering by using these five variables. The team initially explored two methods of clustering—K Means and (PAM). Yet, it eventually chose the PAM because this method tends to create clusters that are more robust, especially when data has outliers. The spatial distribution of clusters generated by the two methods looked very similar.

The cluster analysis which used these five variables produced three clusters in each year. This implied nine different types of census tract change. Two of the nine types had a total of five census tracts. The team investigated these tracts and determined it was appropriate to reassign them to other types based on local knowledge. The team examined the census tracts that belonged to each of the seven types on a map and confirmed that their characteristics matched the distinct cluster to which they were assigned.

Team members then created a narrative for each type of small area change based on the trajectories of the five variables used in clustering. They complemented the information derived from these five variables with the information they collected on the other variables that were not used in the cluster analysis. This additional information helped enrich and fine tune the narratives and provided a gauge of how much census tracts in each cluster resembled each other.

Table 1: List of Variables Explored

Demographic Variables		
Population	1	Population
	2	Population density (per residential land use acres)
Race	3	Percent of people of color
English Proficiency	4	Percent of people with limited English proficiency
Age	5	Percent of people who are 18 or younger
	6	Percent of people who are 65 or older
Educational Attainment	7	Percent of people with a Bachelor's Degree or more
Income & Poverty	8	Percent of people below poverty level (Poverty defined as 185% of the Federal Poverty Threshold)
	9	Median household income
	10	Percent of people with incomes at 500% of poverty level and above
Housing Tenure	11	Percent of households who rent
Neighborhood Characteristics		
Proximity to Transit	12	Number of bus trips within 1/4 mile walking distance
	13	Transitway station area in tract
	14	Number of people living within walking distance to stops
	15	Percent of tract within 1/2 mile of BRT, LRT, Northstar, Arterial BRT or A Line station area
Proximity to Core Businesses	16	Number of groceries, pharmacies, and medical clinics within 2 miles
Proximity to Civic Infrastructure	17	Number of elementary schools within 1 mile; number of middle schools, community centers, centers of worship and libraries within 2 miles; number of high schools within 5 miles
Proximity to Natural Amenities	18	Percent of tract land acreage that falls within a 50 meter buffer of open water
	19	Total tract acreage consisting of park land (per Metropolitan Council's Land Use definition)
Job Accessibility	20	Number of jobs accessible within 30-minute driving distance
	21	Number of jobs accessible by a 45-minute transit ride
	22	Number of jobs accessible within 30-minute driving distance or by a 45-minute transit ride
Flood Vulnerability	23	Council flood vulnerability maps (not supplemented with storm water data)
Land Use Mix	24	Percent of tract zoned for commercial and industrial use
Housing Market Conditions		
Land Value	25	Median building value to land value for single family detached residential parcels
Residential Construction/ Home Improvement Investments	26	Total number of housing units
	27	Ratio of total home improvement mortgage loans to total home values
Home Values	28	Inflation-adjusted median house value
	29	Inflation-adjusted median gross rent
	30	Single family detached home price per square foot
Housing Affordability	31	Percent of housing stock affordable at 50% of the regional median income
	32	Number of households paying less than 30% of their income in rent
Housing Diversity	33	Age diversity of buildings for all residential use
	34	Housing size diversity
	35	Single family detached generalized land use acres divided by total residential land use
Built Environment		
Construction Activity	36	Percent of housing built between 1990-1999
	37	Percent of housing built between 2000-2015

32390 Robert Street North
Sa33nt Paul, MN 55101-1805

651.602.1000
TTY 651.291.0904
public.info@metc.state.mn.us
metrocouncil.org

Follow us on:
twitter.com/metcouncilnews
facebook.com/MetropolitanCouncil
youtube.com/MetropolitanCouncil