Metropolitan Research Center
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WHITE PAPER ON REGIONAL CENTERS, TOWN CENTERS, AND TRANSIT-ORIENTED DEVELOPMENTS

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REGIONAL TRANSPORTATION PLANS AND DEFINITIONS OF CENTERS

A review of the general and transportation plans of 123 cities across the nation shows that the term "center" is used in connection with various geographic levels--region, city, subregion, town, community, and village. Generally, no matter the geographic level, the center is described as the densest part of an area, characterized by compact, mixed-use development, multiple transit options and employment opportunities. These centers are nuclei, drawing people, goods, and activity towards them, thus generating and attracting trips. Alternatively, the term 'center' is used to signify clusters of certain activities or functions--an area with a single concentrated use, such as an employment center, transit center, residential center, or entertainment center. Unlike geographic-level centers, these types of centers are not necessary dense or mixed-use. For example, a city's Central Business District may be described as an employment or economic center; a sprawling subdivision may be considered a city's housing or population center; and the convergence of an airport and train station may constitute a city's transit center.

Among the surveyed plans, incidences of specific, quantitative definitions of 'centers' are rare. The most useful quantitative definition is provided by the City of Los Angeles which defines different geographic centers on the basis of dwelling units and jobs per acre. The most intense center--the urban urban center--has 82-120+ housing units per acre and provides at least 260 jobs; a city center provides 120-260 jobs acres and 48-82 dwelling units per acre; and a town center contains 16-48 units of housing and 30-120 jobs per acre. These benchmarks seem consistent with other cities' use of the term.

Figure 1 Regional transporation plan (Flagstaff, AZ)

Urban Center (82-120+ DU/acre; 260-320+ jobs/acre)

"Center" most frequently refers to the urban center. Urban centers are described as mid- to high-density, pedestrian friendly, and mixed-use. These centers boast diverse populations and extensive employment opportunities, and intermodal transportation options ensure that residents, workers, and visitors have convenient access to retail, recreation, and employment. An urban centers implies regional significance, and may include airports, universities, major employers, arenas, amusements parks, and performance venues.

City Center (48-82 DU/acre; 120-260 jobs/acre)

City centers are essentially similar to urban centers though on a smaller scale--around half the intensity. Though still dense, mixed-use, and transit heavy, these centers serve a smaller population and geographic area. City centers provide a high proportion of jobs to dwelling units, ensuring that a mixed-use balance is maintained. Some plans talk about city centers in terms of a "downtown," "urban sub-center," or "live/work center."

Town Center (16-48 DU/acre; 30-120 jobs/acre)

Village or town centers also contain multiple land uses, some density, and transit options, but cater especially to pedestrians by providing walkable connections to surrounding neighborhoods. These centers are roughly one-third the density of city centers. Though small, town and village centers will likely have the infrastructure necessary to handle future growth and adequately provide for the day-to-day needs of the surrounding neighborhoods. They function as the center of economic and civic activity, effectively the focal point of a community. Transit may be more limited than in city and urban centers, but should include at least one high capacity transit option. The town or village center provides some housing, often on the stories above retail establishments.

Suburban Center (Up to 16 DU/acre; Up to 30 jobs/acre)

Suburban centers may contain a variety of uses, but are less dense and more auto-oriented than town centers, though they may be served by limited bus service or even commuter rail. A suburban center may extend over multiple municipalities, but is perceived as a single "place" or destination. Development within these centers is typically no more than two stories, and lacks an integrated mix of uses. The center may be home to a concentration of office, retail, and light industrial uses, or it may instead act as the housing hub for the region. Typically, however, jobs outnumber residents, and the commercial and employment opportunities draw visitors from outside the community.

Rural Center (6 people + 3 employees/acre)

Rural centers have a relatively high density compared with the surrounding agricultural areas, and provide essential services and a commercial hub to the rural population. Post offices, schools, libraries, banks, offices, and even historic sites may make up the center, though commercial and civic uses are likely limited. The sense of place is strong in the rural center, typically anchored by a main street.

Neighborhood Activity Centers (Less than 10 acres)

Neighborhood activity centers are primarily residential, though they may incorporate small retail and service uses. The center may include parks, transit stops, schools, churches, or other informal gathering places that help anchor the neighborhood and provide a sense of community.

(*No definition of an "economic center," though the term is used in many of the plans.)

SPRAWL VERSUS CENTERED DEVELOPMENT

As the costs of sprawl have become more apparent, the term urban sprawl has gone from urban planning construct to public policy concern. But what exactly is urban sprawl? In the early 1990s, sprawl was defined qualitatively for purposes of growth management in Florida (Ewing 1997). The definition ultimately adopted by the State encompassed the following urban

forms: (1) leapfrog or scattered development, (2) commercial strip development, (3) expanses of low-density development and (4) expanses of single-use development (as in bedroom communities, regional malls, and business parks).

Figure 2 Publications by Reid Ewing and colleagues

All four prototypical patterns (leapfrog, etc.) are characterized by poor accessibility. In scattered or leapfrog development, residents and service providers must pass vacant land on their way from one developed use to another. In classic strip development, the consumer must pass other uses on the way from one store to the next; it is the antithesis of multipurpose travel to an activity center. Of course, in low-density, single-use development, everything is far apart due to large private land holdings and segregation of land uses. The potential link to public policy is clear. In sprawl, poor accessibility of land uses to one another may leave residents with no alternative to miles and miles of automobile travel.

An early effort was that of Ewing et al. (2002). They quantified sprawl in two steps: first, using principal component analysis, they developed indices for four components of urban form—development density, land use mix, activity centering, and street accessibility. They then combined the four factors into an overall compactness/sprawl index. Both the individual factors and overall index were then validated against transportation outcome measures.

More recently, Shima Hamidi, Reid Ewing, and colleagues (2015) presented refined compactness/sprawl indices based on definitions and procedures in Ewing et al. (2002). It had been more than a decade since the original indices were developed, and much has changed since then. Also, new data sources have become available since the early 2000s, and these allow us to improve the construct validity of the original indices. In Hamidi and Ewing's 2015 study, they updated the indices to 2010, refine and enhanced the four original compactness factors (density, mix use, degree of centering and street connectivity) using the most recent databases and adding new metrics, and finally validated the sprawl indices against commuting data from the American Community Survey.

Compactness indices were also developed for urbanized areas, counties, and census tracts, and all are posted on a National Institutes of Health website in the hope that other researchers will use the indices to study the costs and benefits of sprawl. Practitioners may also wish to check their success in containing sprawl in each of its four dimensions. The literature suggests that there will be benefits as well as costs to sprawl, particularly in the areas of housing affordability and desegregation. Nothing as widely embraced by consumers as sprawl can be all bad. However, sprawl may be primarily associated with private benefits for sprawl dwellers and social costs for the rest of us. If so, it makes sense for government to intervene in the market to mitigate the latter (Ewing 1997).

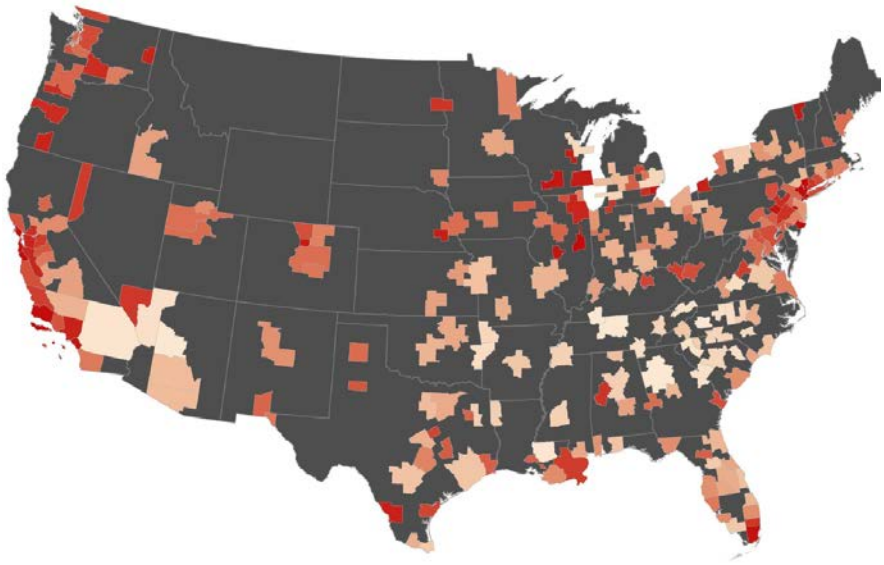

Figure 3 Compactness Scores for 221 Metropolitan Areas and Divisions in the U.S.

SPRAWL AND ITS CONSEQUENCES

In recent years, the United States has had a relatively poor performance in respect to life expectancy compared with other developed nations. Urban sprawl is one of the potential causes of the high rate of mortality in the United States. In a 2014 study, "Relationship between urban sprawl and physical activity, obesity, and morbidity – Update and refinement," Reid Ewing and colleagues modeled multiple health outcomes and behaviors in terms of the updated, refined, and validated county compactness/sprawl measures. After controlling for observed confounding influences, both original and new compactness measures were found to be related to body mass index (BMI), heart disease, high blood pressure, and diabetes. The indices were not found to be significantly related to physical activity, perhaps because physical activity was not defined broadly to include active travel to work, shopping, and other destinations. Nevertheless, developing urban and suburban areas in a more compact manner may have some salutary effect on obesity and chronic disease trends.

Other potential health risks exist as well. In a separate study, "Urban sprawl as a risk factor in motor vehicle crashes," Reid Ewing, Shima Hamidi, and James Grace (2016) found that a relationship exists between urban sprawl and motor vehicle crashes. Controlling for covariates, they found that sprawl is associated with significantly higher direct and indirect effects on fatal crash rates. The direct effect is likely due to the higher traffic speeds in sprawling areas, and the indirect effect is due to greater vehicle miles driven in such areas. Conversely, sprawl has negative direct relationships with total crashes and non-fatal injury crashes, and these offset (and sometimes overwhelm) the positive indirect effects of sprawl on both types of crashes through the mediating effect of increased vehicle miles driven. The most likely explanation is the greater prevalence of fender benders and other minor accidents in the low speed, high conflict traffic environments of compact areas, negating the lower vehicle miles travelled per capita in such areas.

Extending this work on life expectancy, Shima Hamidi, Reid Ewing, and colleagues investigated cross-sectional associations between sprawl, transportation, and life expectancy for metropolitan counties in the U.S. in 2010, in a working paper entitled "Associations between urban sprawl, transportation, and life expectancy in the United States." They modeled average life expectancy with a structural equation model that included four mediators of sprawl: annual vehicle miles traveled (VMT) per household, average body mass index, crime rate, and an air quality index. After controlling for sociodemographic characteristics, they found that life expectancy is significantly higher in compact counties than in sprawling counties. As the compactness index doubles, life expectancy increases by about 3 percent. For the average metropolitan American with a life expectancy of 78 years, this translates into a difference of two and half years. Compactness affects mortality directly, but the causal mechanism is unclear. It may be that sprawling areas have higher traffic speeds and longer emergency response times, lower quality and less accessible health care facilities, or less availability of healthy foods. Compactness also affects mortality indirectly through vehicle miles traveled, a contributor to traffic fatalities, and through body mass index, a contributor to many chronic

diseases. Hamidi and colleagues identified significant direct and indirect associations between urban sprawl and life expectancy.

Additionally, there may be financial and socioeconomic consequences as well. Contrary to the general perception, the United States has a much more class-bound society than other wealthy countries. The chance of upward mobility for Americans is just half that of the citizens of the Denmark and many other European countries. In addition to other influences, the built environment may contribute to the low rate of upward mobility in the U.S. In their 2015 study, "Does urban sprawl hold down upward mobility," Reid Ewing and colleagues tested the relationship between urban sprawl and upward mobility for commuting zones in the U.S. They examined potential pathways through which sprawl may have an effect on mobility. They used structural equation modeling to account for both direct and indirect effects of sprawl on upward mobility, finding that upward mobility is significantly higher in compact areas than sprawling areas. The direct effect, which they attributed to better job accessibility in more compact commuting zones, is stronger than the indirect effects. Of the indirect effects, only one, through the mediating variable income segregation, was significant. Their findings shed light on the built-environmental dimension of upward mobility. Its strong direct relationship to the compactness index carries important consequences for planners and development strategies. Higher density/mixed-use development has been shown to generate incrementally more jobs, higher wages, economic resilience, and lower unemployment rates, all of which advance upward mobility.

MIXED-USE DEVELOPMENTS AND TOWN CENTERS

Reid Ewing and colleagues also studied the traffic generated by mixed-use developments. Mixed-use development (MXD) is a signature feature of smart growth, New Urbanism, and other contemporary land-use movements aimed at reducing the private automobile's dominance in suburban America. Mixed-use developments have a particularly close relationship with town centers. By putting offices, shops, restaurants, and other codependent activities in close proximity to each other, MXD shortens trips and thus allows what might otherwise be external car trips to become internal walk, bike, or transit trips. This in turn can reduce the vehicle miles generated by an MXD relative to what it would be if the same activities were separated in single-use environments. Fewer vehicle miles traveled (VMT) not only relieves traffic congestion, but also reduces greenhouse gas (GHG) emissions, air pollution, and fuel consumption.

Accurately estimating the proportion of trips captured internally by MXDs is vitally important if communities are to accurately assess their traffic impacts and reward such projects through lower exactions and development fees or expedited project approvals. However, lacking a reliable methodology for adjusting trip generation estimates, communities face a dilemma when assessing MXD proposals: do they err on the conservative side by downplaying internal capture and thereby potentially discourage worthwhile projects, or err on the liberal side and

risk unmitigated traffic impacts? In addition to getting internal capture estimates right, accurate assessments of MXD projects also depend on estimating the share of external trips served by alternative modes (e.g., transit and walking). These must also be subtracted from nominal trip generation rates to estimate the net impacts of MXDs on traffic and VMT.

Figure 4 Gateway district, Salt Lake City

In a 2010 study entitled, "Traffic generated by mixed-use developments—Six-region study using consistent built environmental measures," Ewing and his colleagues found that an average of three out of 10 trips generated by MXDs put no strain on the external street network and generate relatively few vehicle miles traveled. Statistical equations derived from the data revealed that the primary factors affecting this reduction in automobile travel are:

1. The total and the relative amounts of population and employment on the site;
2. The site size and activity density;
3. The size of households and their auto ownership;
4. The amount of employment within walking distance of the site;
5. The block size on the site; and
6. The access to employment within a 30 min transit ride of the site.

For traffic impact, greenhouse gas, and energy analyses, the VMT generated by a mixed-use site depends, in addition to the previously described factors, on the site's placement within the region, specifically, on the share of jobs located within a 20- to 30-mindrive of the site. Greater destination accessibility translates into shorter auto trips external to the site. This effect is as significant as the effects associated with internal capture of trips within mixed-use developments, and conversion of some external trips from auto to alternate modes. Ewing and his colleagues' findings regarding the factors that influence mixed-use trip generation have been validated through field surveys at illustrative sites in California, Florida, Georgia, and Texas.

In a 2015 study, "Traffic generated by mixed-use developments: Thirteen-region study using consistent measures of built environment," Guang Tian, Reid Ewing, and colleagues furthered the work of the previous study. This more recent study built on the earlier work of Ewing et al. by more than doubling the number of regions in the database from six to 13, increasing the number of MXDs from 239 to 412, and increasing the number of trip records from 35,877 to 70,074. It also updated household trip records for three regions whose earlier travel surveys

dated from the 1990s: Boston, Massachusetts (1991); Houston, Texas (1995); and Portland, Oregon (1994). All data in the more recent study date from the 2000s or later. Other advantages of the more recent study over the earlier one include the following:

- The researchers' database now has enough regions so that regional variables may prove statistically significant in a multilevel analysis. This means that for the first time, traffic analysts can tailor their analyses to the unique characteristics of their home regions.

- The database now has enough bike trips to model the probability that an external trip will be by bicycle. Previously, only external walk and transit mode shares could be modeled.

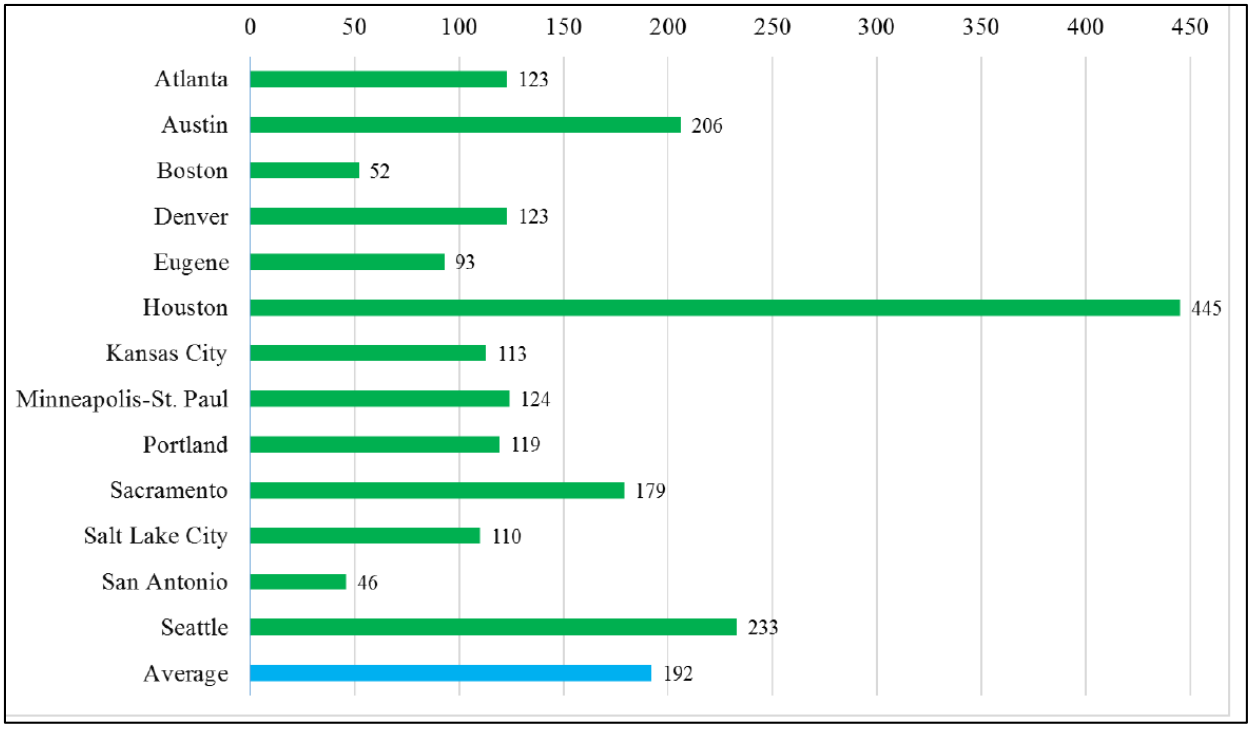

Figure 5 Average acreage for MXDs

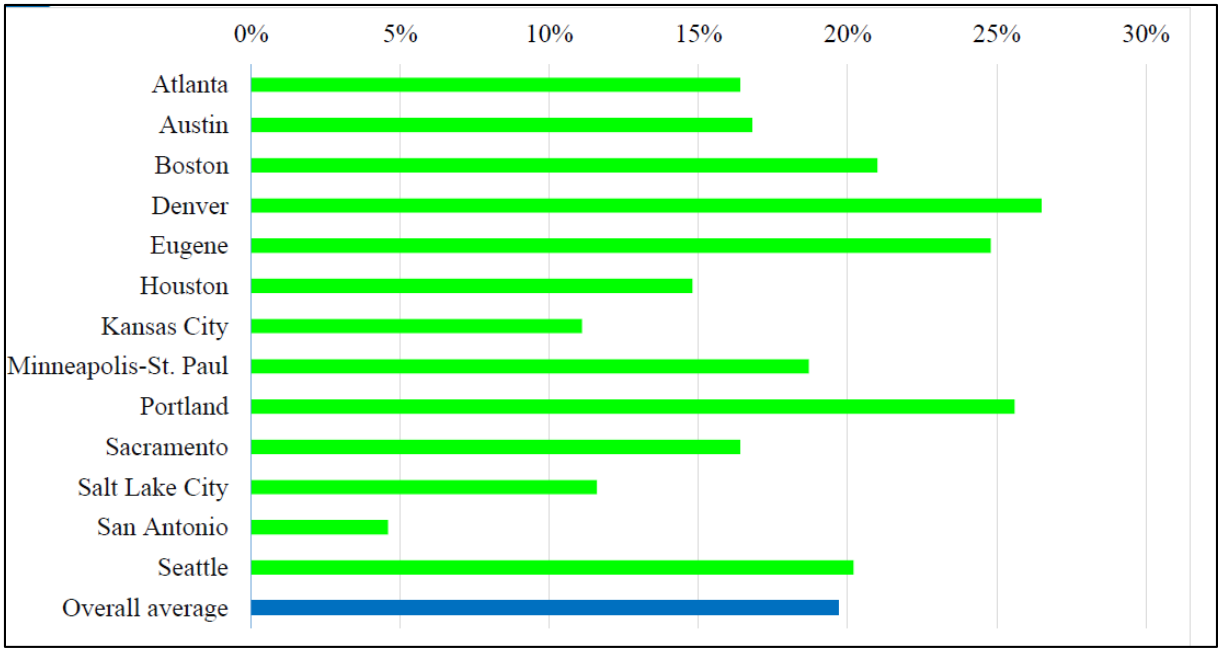

Figure 6 Internal capture rates of trips by MXDs

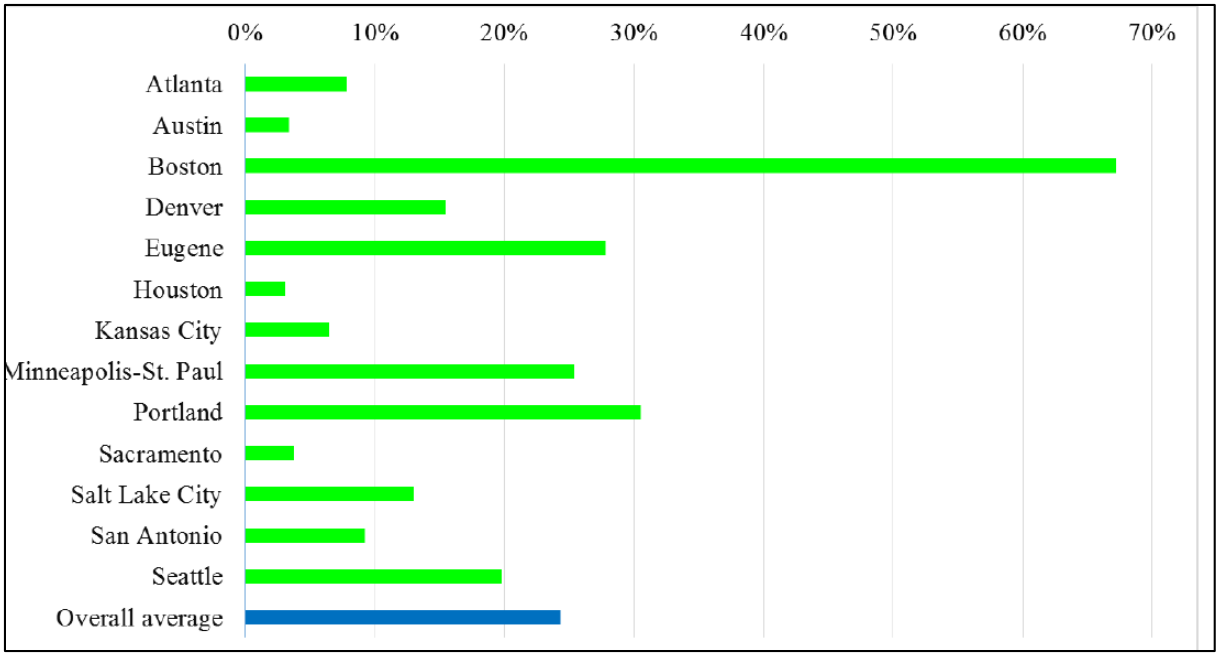

Figure 7 Total share of walk, bike and transit for external trips to/from MXDs

With the more recent study, Ewing, Tian, and colleagues concluded that The bibles of traffic impact analysis, the ITE's *Trip Generation* report and *Trip Generation Handbook*, are sorely lacking in relation to MXDs. Except for a handful of master-planned projects in Florida,

Georgia, and Texas, actual studies of internal-capture rates are rare. Traffic engineers are thus largely required to manage on their own when quantifying the trip reductions that might result from mixing land uses. Therefore, to err on the conservative side and to avoid possible liability charges from under-designing road capacity, they often make no adjustment. This decision results in overestimates of the traffic impacts of MXD proposals and thus leads to higher development fees than necessary, raising opposition among those who fear potential adverse impacts. Failure to account for internal capture and external walk, bike, and transit trips eventually penalizes MXDs and can force MXD developers, in effect, to cross subsidize single-use projects through disproportionate exactions. In addition, lack of accounting for the trip-reducing benefits of MXDs can result in an oversupply of parking.

The results of these studies will help guide planners and developers of mixed-use projects on design features likely to minimize traffic generation, greenhouse gas emissions, and energy impacts, and will produce new analysis techniques for traffic engineers to more realistically quantify infrastructure impacts of mixed-use development proposals.

TRANSIT-ORIENTED DEVELOPMENTS

How best to allocate land around transit stations is a debated topic, with transit officials often opting for park-and-ride lots over active uses such as multifamily housing, office, and retail organized into transit-oriented developments (TODs). Guidelines for trip and parking generation come mainly from the Institute of Transportation Engineers (ITE). However, their trip and parking manuals focus on suburban locations with limited transit and pedestrian access. The question of how much vehicle trip and parking demand reduction occurs with TOD is largely unexplored in the literature. A study by Guang Tian, Reid Ewing, and colleagues (2016) gives hard numbers, albeit for only five TODs in five different regions. The Tian, et al. (2016) study aims to determine how many fewer vehicle trips are generated at transit-oriented developments (TODs), and how much less parking is required at TODs, than ITE guidelines would suggest.

Figure 8 The five TODs studied by Tian, et al.

Developments are often characterized in terms of D variables. The Ds all bear a relationship to travel demand. The five TODs studied in the Tian, et al., project are more or less exemplary of the Ds. They are characterized by land-use diversity and pedestrian-friendly designs. They minimize distance to transit, literally abutting transit stations. They have varying measures of destination accessibility to the rest of the region via transit. Three have progressive parking policies, which fall under the heading of demand management. Two have high residential densities, and one has a high intensity of commercial development.

For planned TODs in the same or other regions, the findings from the Tian, et al. (2016) study may be used in tandem with regional travel model forecasts. Perhaps conservatively, one could set a floor on alternative mode shares and percentages trip and parking reductions equal to the minimum values for the five TODs, or could set a cap on these equal to the maximums from this study. Also, one could look for the best match to a particular TOD being proposed from among this sample of TODs.

Tian, Ewing, and colleagues found that TODs (even the most auto-oriented) create significantly less demand for parking and driving than do conventional suburban developments. With one exception, peak parking demand in TODs is less than one half the parking supply guideline in the ITE Parking Generation manual. Also, with one exception, vehicle trip generation rates are about half or less of what is predicted in the ITE Trip Generation Manual. Automobile mode shares are as low as one quarter of all trips, with the remainder being mostly transit and walk trips. Reducing the number of required parking spaces, and vehicle trips for which mitigation is required, creates the potential for significant savings when developing TODs.

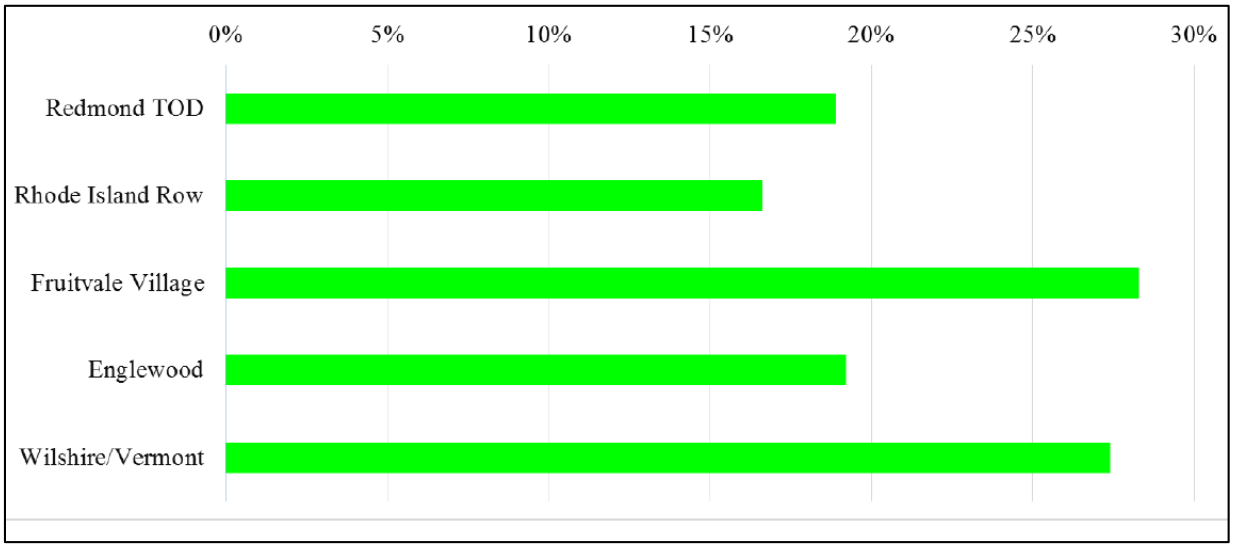

Figure 9 Walk mode share

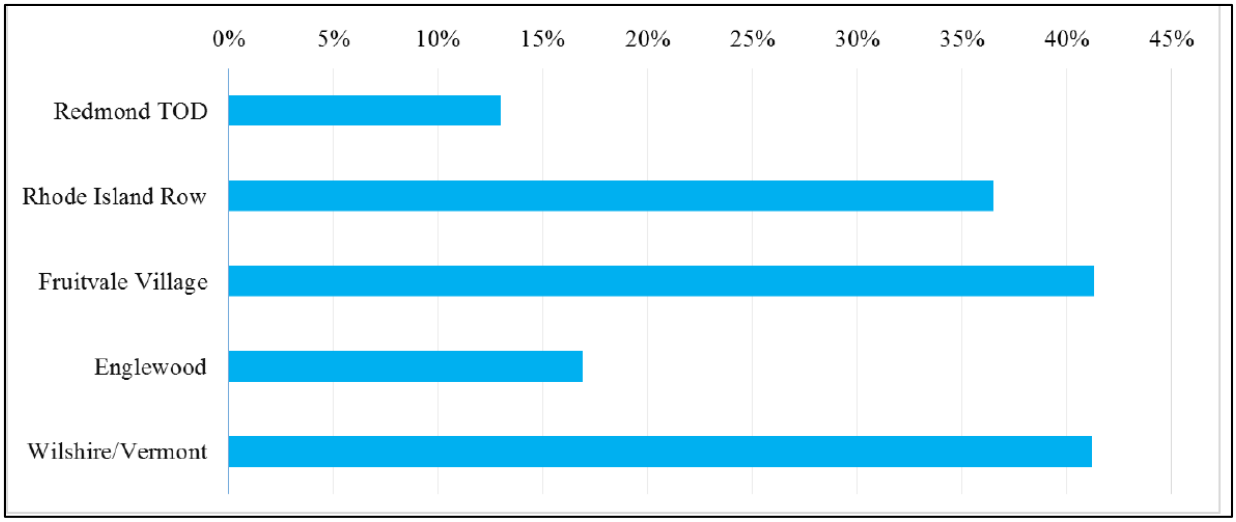

Figure 10 Transit (bus and rail) mode share)

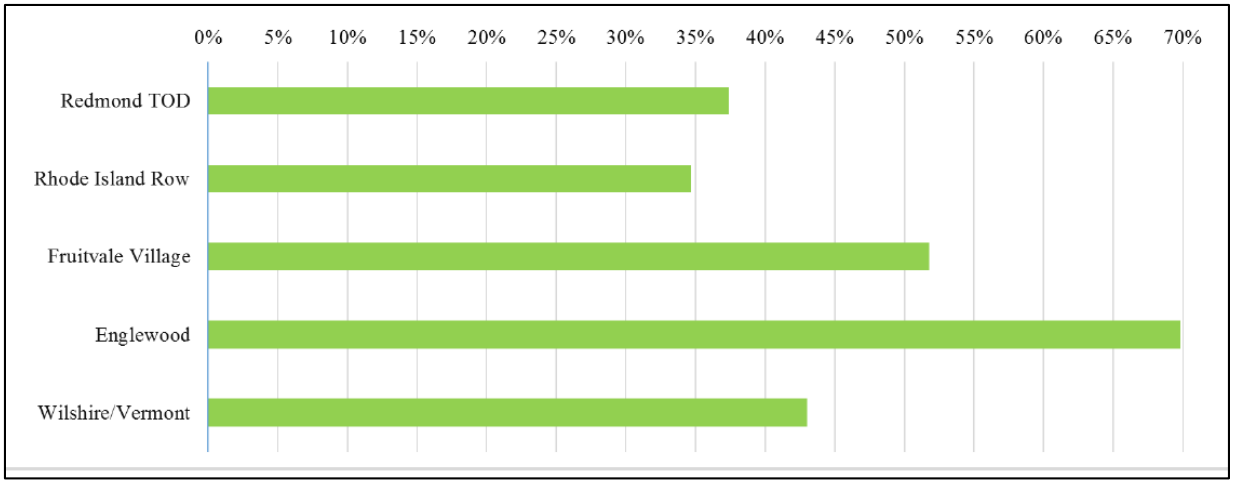

Figure 11 Vehicle trip rates as percentage of ITE rates

RESIDENTIAL PREFERENCES

Centered development is an alternative to sprawling development. Centered development in the form of smart growth combines mixed residential and nonresidential land uses in walkable communities with transit options and nearby key destinations, such as working, shopping, and services. Increasingly, planners, scholars, innovative developers, and some governors promote smart growth as an antidote to many of the ills associated with urban sprawl. However, our understanding of public attitudes toward this kind of living option is still limited. Does the American Dream still involve a large house on a large lot in the suburbs, or are Americans

increasingly drawn to smart growth alternatives? If they are drawn to smart growth alternatives, does this trend vary from region to region and cohort to cohort?

In a 2015 article, "Desire for smart growth: A survey of residential preferences in the Salt Lake region of Utah," Guang Tian, Reid Ewing, and William Greene operationalize smart growth in six dimensions. The measures distinguishing smart growth from suburban sprawl are proximity to work, proximity to shopping and other destinations, neighborhood housing mix, shared and paid parking, complete street designs, and proximity to public transit. They drew on data from an online survey of residents living in the Salt Lake City, Utah, region to determine their residential preferences and the factors that influence their choice of residence.

Tian and his colleagues' findings provides insights into public preferences for smart growth versus suburban sprawl by studying stated choices of residents of the Salt Lake region of Utah. Respondents were presented with choice sets and asked to choose between hypothetical housing situations with different attributes. The sociodemographic characteristics of respondents were also collected, which allowed the research team to conduct a separate analysis by life cycle cohorts.

In a mixed logit analysis, not surprisingly, the results showed that respondents prefer single-family home neighborhoods to a mix of housing types. What surprised the team is that convenient parking is the first concern when choosing a place to live. Respondents also showed positive attitudes toward certain aspects of smart growth, preferring to be close to work and other destinations and to live in neighborhoods that accommodate pedestrians and bicyclists.

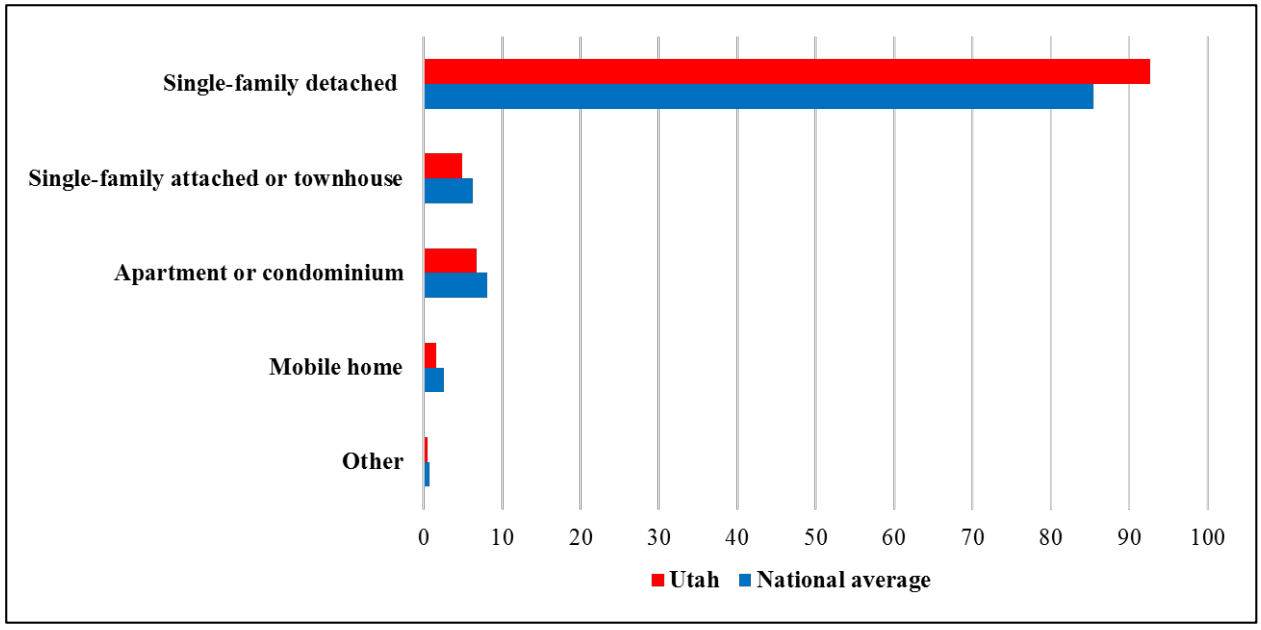

Figure 12 Housing preferences

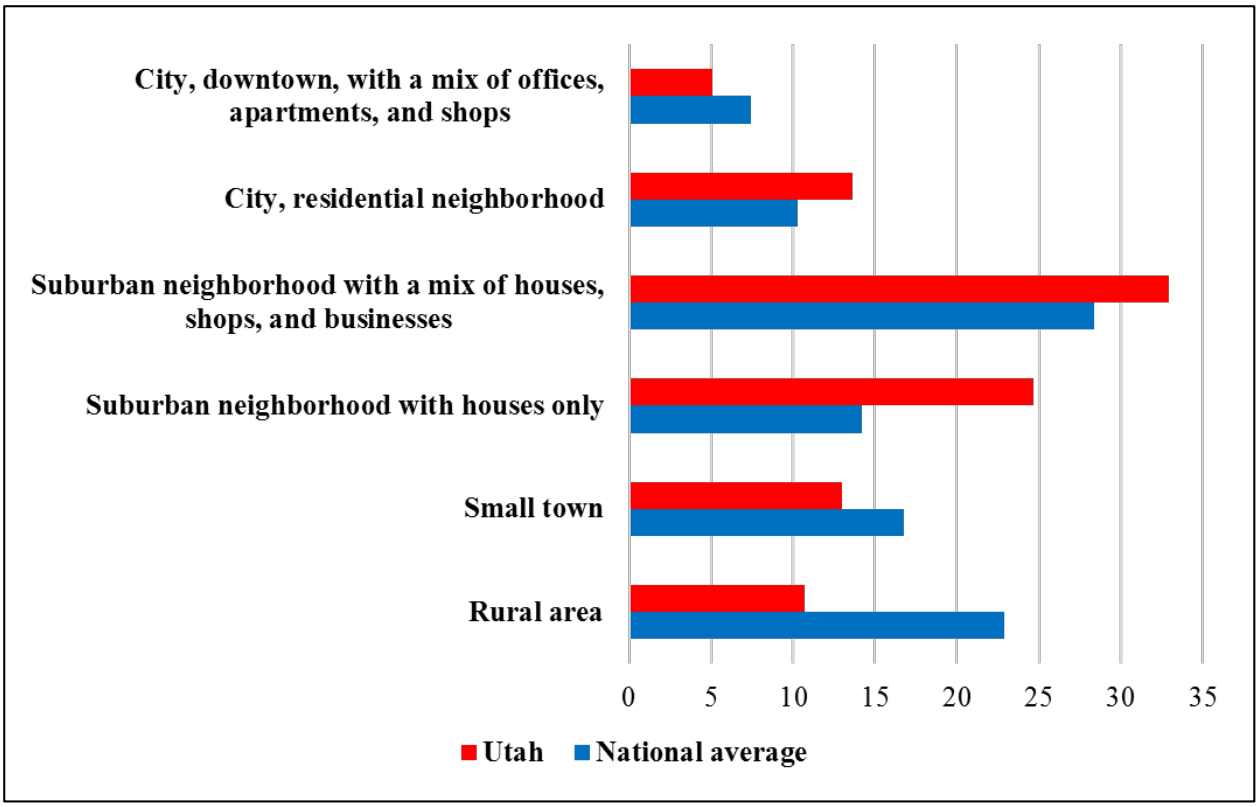

Figure 13 Location preferences

Different life cycle cohorts have different preferences. Proximity to work is more important for childless young adults. Young families with children place a higher value on living in a neighborhood with only single-family homes and transit access. Retired empty nesters favor a mix of housing types over single-family housing on one-acre-plus lots. Compared with a national survey, the Salt Lake region respondents indicated a greater preference for living in single-family houses and placed more emphasis on parking.

The lifestyle model that seems to be most preferred is not downtown living in developments such as the Gateway District and City Creek Center, or even urban living in the The Avenues or Sugarhouse, but rather smart growth in suburban communities such as Daybreak, a new urbanist community 25 miles from downtown. Daybreak is a 4,000-acre, master-planned community (actually a new town) of mostly single-family residences within easy walking distance of shops, schools, a Mormon temple, and a light-rail station and with a street grid that accommodates all users. Daybreak was the sixth Best-Selling Master-Planned Community in the Nation for 2009. Nearly one in every five homes sold in Salt Lake County that year were in Daybreak.

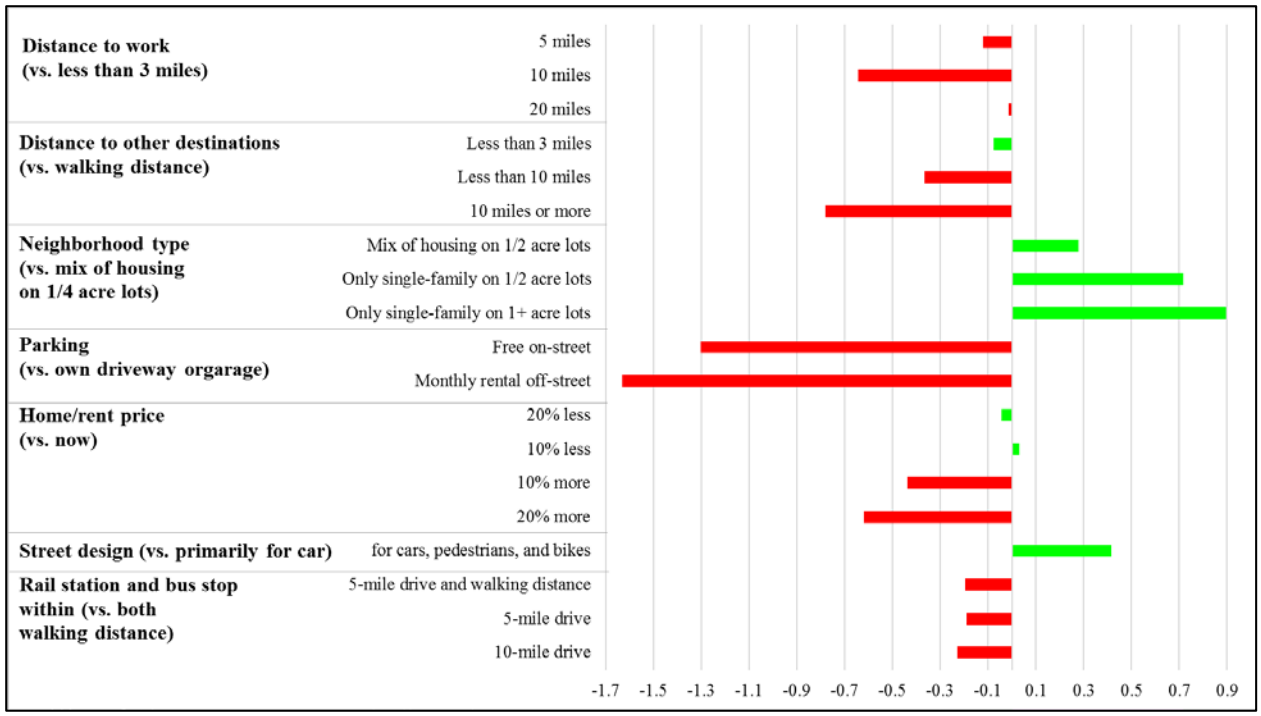

Figure 14 Young families with children

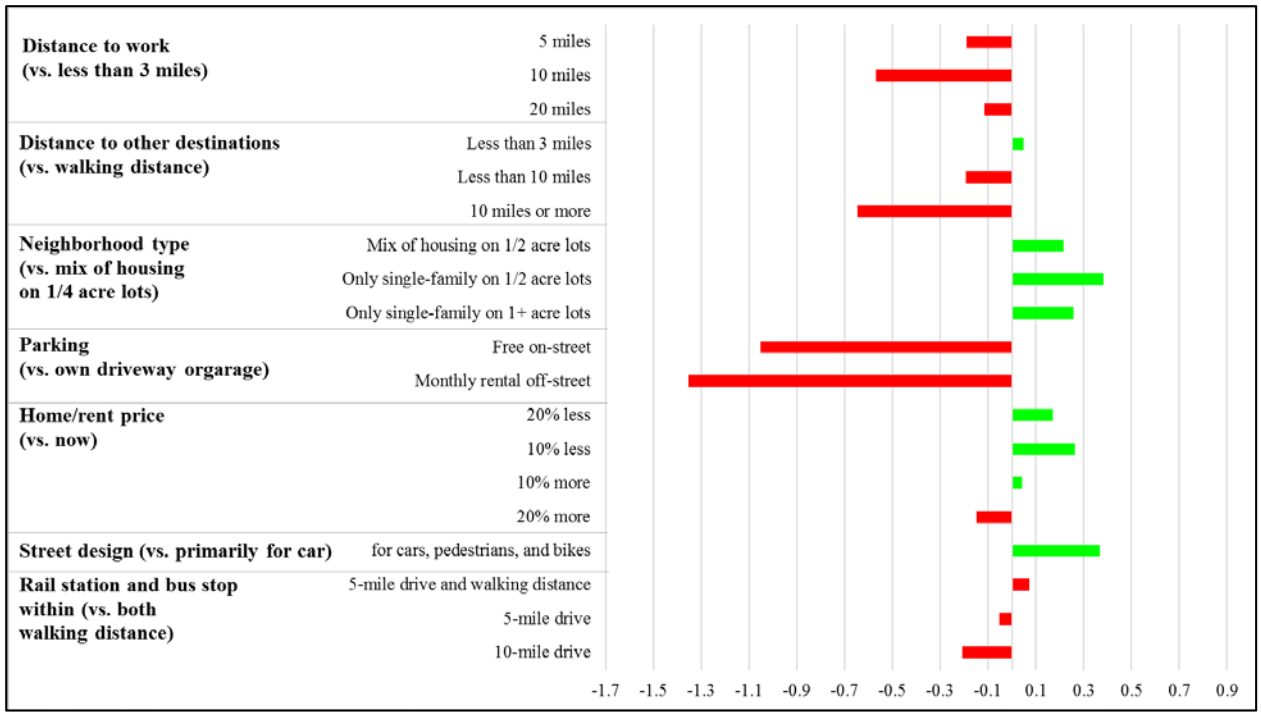

Figure 15 Baby boomers

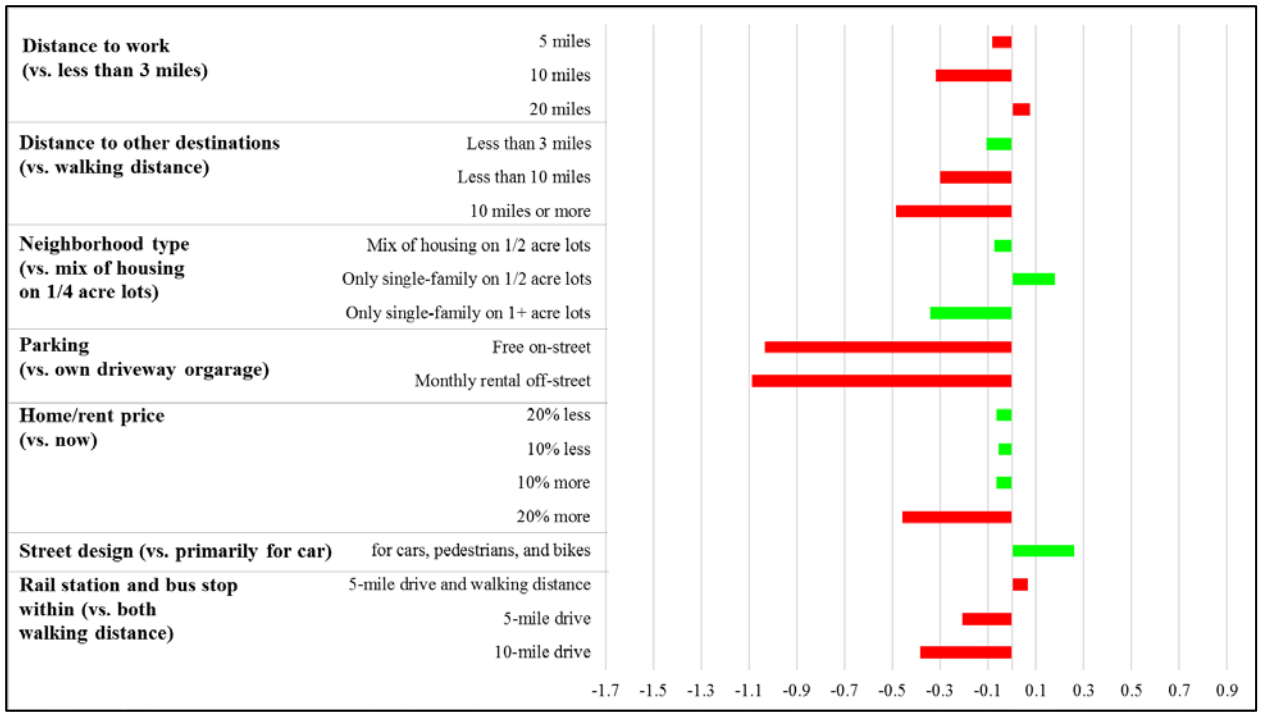

Figure 16 Retired empty nesters

This is not to suggest that everyone in the Salt Lake region prefers suburban living. The researchers know from another question on the survey that 5.1% of residents prefer downtown living, and 13.6% prefer living in an urban neighborhood. In a medium-size region such as Salt Lake, these represent substantial populations. However, it does suggest that these are niche markets and that the population at large prefers the suburbs.

There are several possibilities that may explain these findings and differences. First, the Salt Lake region has the largest household size in the country. There is much evidence showing that the presence of children in the household is an important factor in determining housing. Second, the Salt Lake region developed extensively as an autodependent city, without many good examples of urban living. City blocks are large, densities are low, and several generations have now grown up in a region dependent on automobiles. While the region has experienced one of the most ambitious rail expansion programs in the nation, transit-oriented development is still in its infancy. It is possible that many respondents have little familiarity with alternative forms of neighborhood development. A good share of the Salt Lake region residents indicated a preference for suburban living but with improved accessibility to goods and services. Again, the preferred model is Daybreak, not City Creek or The Avenues.

Tian and his colleagues' study provides evidence that residential choice varies from region to region and that regions should be careful before making decisions based on national housing preference surveys. Future research in the Salt Lake region can ascertain whether this preference changes over time, but at this time, respondents have positive attitudes toward certain aspects of smart growth but are still wed to single-family homes and large lots with off-

street parking. It appears that the American Dream neighborhood is alive with improved accessibility in the Salt Lake region of Utah.

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