Housing + Transportation Affordability in Tucson Metropolitan Area, Pima County, and Pinal County

Prepared by the Center for Neighborhood Technology
for the Drachman Institute, College of Architecture & Landscape Architecture, The University of Arizona

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The Drachman Institute, in particular, focuses its research and outreach activities on the proposition that housing is the building block of neighborhoods and neighborhoods are the building blocks of communities. The work of the Drachman Institute therefore facilitates the development of demographically diverse neighborhoods, rich in environmental amenities and built from good-quality, well-designed, regionally-appropriate housing that conserves land, energy, and water. It is our contention that good quality and innovative architectural design and technology, sensible community planning, and a landscape architecture that fosters beautiful and healthy private and public space is the cornerstone of this work. We engage our students, our staff, our faculty, and our citizens in a collaborative, research-based outreach enterprise to make our communities healthier, safer, more equitable and more beautiful places to live.

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INTRODUCTION

Summary

As the Tucson Metropolitan Area and Pima and Pinal Counties in Arizona continue to grow, they have the opportunity to develop in such a way that residents can reduce the environmental impacts of travel, while also reducing household transportation costs. This report provides information on the combined housing and transportation (H+T) costs in the region south of Maricopa County, including Pima and Pinal Counties, demonstrating that these two household expenses are closely linked. While housing developments spreading out from the urban core tend to be newer and larger, transportation infrastructure makes car ownership a necessity. In contrast, both housing and transportation costs are lower in the compact neighborhoods within the urban core. Housing in these neighborhoods is often smaller and older, but residents can more easily get to jobs, shopping and amenities by transit and walking.

For years, real estate market pricing has incorporated the value of land into the price of a home—based on its location and proximity to jobs and amenities—but there is less clarity about the effect of accompanying transportation costs associated with an efficient or inefficient location on these values. In many places where single-family homes are more “affordable,” or offer “more house for your money”, usually in outlying areas, costs are lower in part because land is cheaper. However, the transportation costs can be much higher and can often outweigh the savings on housing costs. In order to provide a better picture of affordability in the Pima/Pinal region, a measure that models the full costs of transportation and combines it with the cost of housing is utilized. This tool is called the Housing + Transportation Affordability Index.

Much of the data used in this study is by necessity from the 2000 US Census. The analysis of 2000 data provides very clear and consistent structural relationships that will likely be reflected in 2010, although actual figures will change. This lack of more recent data should not prevent planners from moving ahead using this information about the relationships between housing, land use, and transportation.

The Tucson metropolitan statistical area (MSA), including just Pima County, average median income was $39,993 according to the 2000 US Census. The Phoenix MSA median income was $44,752, while Pinal County had an average median income of $36,615. Because the maps and data here report for Pima and Pinal Counties, a weighted average median income for the two counties of $39,466 was used as the area median income (AMI). Given this income, housing in the Pima/Pinal region is broadly affordable when measured using a widely accepted standard of affordability of 30% or less of household income.

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3 All data, statistics, and maps presented in this report reference 2000 data unless otherwise noted.
In contrast to the relative affordability of housing, Tucson and Pima and Pinal County residents are largely overburdened by transportation costs. In the Tucson region, household transportation costs average $800 per month, and range from as little as $521 per month to more than $1,000 per month. For example, using the AAA “Your Driving Costs 2006” estimates, a household owning two cars driving a total of 20,000 miles per year will spend an average of over $14,000 annually, or more than $1,100 monthly. As a percent of income, in many areas in Pima and Pinal Counties, households spend more than 28% of their income on transportation. This cost actually reaches a high of more than 32% of the area median income, making it a greater cost burden than the cost of housing in some areas.

Because housing and transportation costs both vary so greatly by location, and often in conflicting directions, considering the two costs jointly is key in measuring and understanding the affordability of a location. The H+T maps in this report show that H+T together can range from less than 30% in the central city to more than 60% in outlying areas for the household earning the area median income. This indicates that there are many areas, particularly those areas outside of the city limits, where average households become quite overburdened by housing and transportation costs.

High housing and transportation costs have a direct effect on individual household budgets. They restrict the opportunity to save and to build assets. And, since high H+T is heavily correlated with high rates of car ownership, families often find themselves investing in automobiles that depreciate rapidly, rather than in investments that build wealth, like homeownership, savings, or education.

Low combined housing and transportation costs in Tucson correspond to specific neighborhood characteristics: they are more compact (with more households per acre) and tend to have a range of stores and amenities in close proximity. Many of these communities with low combined H+T values are walkable neighborhoods with access to public transit. Low H+T scores and expanded mobility options are closely related.

As Tucson and Pima and Pinal Counties plan for the future, maintaining low housing and transportation costs could be a strategic objective. This can be accomplished planning compact mixed use development with access to transit, which encourages and supports vital neighborhoods. Expanding public transportation options is also essential, both increasing

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4 High and low transportation expenditures calculated from the H+T Affordability Index.
5 Bullock, Ryan Mooney and Bernstein, Scott. Driven to Debt. CNT, 2002.
6 The Metropolitan Transportation Commission, which is the Metropolitan Planning Organization for the San Francisco Bay Area, this year formally adopted a goal of reducing the combined cost of housing and transportation as a percentage of median income by 10 percent by 2035. Various cities have started considering such a goal for municipal policy, or are considering adopting a policy defining housing affordability as including the cost of transportation.
scheduled service and ridership as well as establishing new options such as car sharing, van pooling and other demand-responsive services.

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7 In San Francisco, independent non-profit car sharing organizations have documented considerable cost of living reduction benefits. See: Cervero, R., Golub, A., and Nee, B. San Francisco City CarShare: Longer-Term Travel-Demand and Car Ownership Impacts. Institute of Urban and Regional Development, University of California at Berkeley. Department of Transportation and Parking, City of San Francisco.
Mobility Assets

The design of Tucson’s street network and land use encourages a dependence on the auto throughout much of the city and metro area. According to the 2000 US Census, in Pima County, 92% of workers, who do not work at home, commute by a car, truck or van, and in Pinal County this figure is 95% (see Figure 1). In these areas, households own an average of 1.61 autos per household in Pima County and 1.69 autos per household in Pinal County (see Figure 2). Within the City of Tucson, however, there are areas where less than 50% of workers commute to work in a private vehicle, and here, households, on average, own less than one auto per household. One factor in the City of Tucson that may contribute to the lower auto ownership rates is the percentage of workers who commute to work by public transportation (see Figure 3). In much of Pima and Pinal Counties, this is less than 1%, but in the City of Tucson, there are areas where more than 15% of workers commute by transit.

One factor that impacts mode choice and auto ownership is the level of transit availability. In the H+T Index, a measure of transit service was developed called the Transit Connectivity Index (TCI). Transit service levels for the purposes of the TCI are based on access and intensity of transit service in a given census block group. Access is captured by a quarter mile buffer around each bus stop, and intensity is based on the number of lines that serve the census block. For a given census block group, the index accounts for the percentage of land area within walking access to a bus route and the number of bus lines. However, it is important to note that TCI is not a descriptive or a literal definition of service, but rather a calculated prediction of transit service levels. Figure 4 shows the results of the TCI application within the Tucson area (all areas outside of this view have a TCI value of 0 - 1). Not surprisingly, the highest levels of TCI run through the urban core, areas where auto ownership and the percent of people driving to work are both the lowest.

Maintaining current and encouraging more transportation options will be critical as gasoline prices continue to fluctuate. Figure 5 shows the gasoline expenditures in 2000 based on an average gasoline price of $1.59/gallon. Figure 6, factoring in all of the same assumptions for vehicle miles traveled, shows how these expenditures change simply based on an increase in fuel prices. This map shows annual expenditures based on a gasoline price of $4.18/gallon, a price frequently reached and even surpassed in 2008.

---

8 Vehicle miles traveled calculated in the Housing + Transportation Affordability Index model.
Figure 1: Percent of Workers Commuting by Automobile
Figure 2: Average Automobiles per Household
Figure 3: Percent of Workers Commuting by Public Transit
Figure 4: Transit Connectivity Index

Transit Connectivity Index
- Less than 1
- 1 to 2
- 2 to 5
- 5 to 10
- 10 and greater

Legend:
- Blue: Counties
- Purple: Interstate Highway
- Red: State Highway
- Black: US Highway
Figure 5: Annual Gasoline Expenditures Based on a 2000 Gas Price
Figure 6: Annual Gasoline Expenditures Based on a 2008 Gas Price
AFFORDABILITY IN TUCSON AND PIMA AND PINAL COUNTIES

Housing and Transportation Affordability: A New Understanding

For years, real estate market pricing has incorporated the value of land into the price of a home—based on its location, proximity to jobs, and a complex set of other amenities. Outside of the luxury markets (such as the Tucson foothills), the features that make the land and home more attractive, and likely more valuable per square foot, also bring lowered transportation costs. The Sam Hughes neighborhood in Tucson is a good example. Being close to jobs and commuter transit options reduces the expenses associated with daily commuting; this is a cornerstone of transit-oriented development (TOD). In fact, being within walking distance of a downtown or neighborhood shopping district allows a household to replace some of the typical five to eight daily auto trips with one or more walking trips, and may even allow a family to get by with one less automobile.

By contrast, in many places where single-family homes are more “affordable,” or offer “more house for your money,” usually in outlying areas, costs are lower in part because land is cheaper. However, the transportation costs can be much higher and can often outweigh the savings on housing costs. In many of these areas where households are driving to find affordable housing (in real estate language “drive til you qualify”), transportation costs can increase to over 32%, making it, at times, a greater burden than housing. Conversely, for some communities where households benefit from less automobile dependency, transportation can represent as little as 10% of median household income.\(^9\)

In order to provide a better picture of affordability in the Pima/Pinal region, a measure that models the full costs of transportation and combines it with the cost of housing is utilized. This tool is called the Housing + Transportation Affordability Index (the “H+T Index” or the “Index”). The Index is reported here as the percentage of household income consumed by Housing Costs (H) plus Transportation Costs (T), as shown in the formula below (see Figure 7). For example, for a particular census block group, the Index may be 45% for a median household income, where 30% of income is for housing and 15% of income is for transportation.

Housing and transportation costs considered together, as in this index, are a useful measure of the relative affordability of different locations in the Pima/Pinal region. However, determining how to define what is considered affordable is extremely complicated, and clearly varies by income, household choices and characteristics, and options available in a given area. Based on comparisons of 53 metro areas, ranging from large cities with extensive transit (such as the New York metro area) to small metro areas with extremely limited transit options (such as Fort Wayne, IN), all with widely ranging incomes, 18% of area median income being consumed by transportation has been selected as an attainable goal for transportation costs. This percentage was chosen due to the fact that all metro areas considered, to varying extents, exhibit areas where this level of affordability has currently been reached, but also, all metros have great potential to

\(^9\) High and low transportation expenditure percents calculated from the 53 metropolitan areas presented on the H+T Affordability Index website [http://htaindex.cnt.org](http://htaindex.cnt.org).
expand the extent of these areas. Therefore, taking this level of 18% and combining it with the standard of 30% or less of income being consumed by housing creates a benchmark of affordability being defined as spending no more than 48% of the median income on housing and transportation combined.

**Figure 7: Affordability Index Formula**

\[
\text{Affordability Index} = \frac{\text{Housing Costs} + \text{Transportation Costs*}}{\text{Income}}
\]

*Transportation Costs include the modeled cost of Auto Ownership, Auto Use, and Transit Use*
Applying the H+T Affordability Index to Tucson and Pima and Pinal Counties

Using the factors described above, the Affordability Index was developed for Pima and Pinal Counties by Census block group. As described above, the formula for the Index is simple: housing plus transportation divided by income equals the true cost of where one chooses to live.

Transportation

Figure 8 shows the monthly transportation costs, modeled for a household making the average median income (AMI) of $39,466, by Census block group in the Tucson/Pima/Pinal area. In the region, these household transportation costs average $800 per month. There are clear differences, however, in the transportation costs between the City of Tucson and the suburban-style development around the city border and the more dispersed areas in Pima and Pinal Counties. Not surprisingly, absolute transportation costs are lowest in the transit service area of downtown Tucson, where average costs are generally under $800 per month based on 2000 gas prices. They are particularly low in the downtown neighborhood of Armory Park where households can spend as little as $521 per month on transportation. These lower transportation costs are due to higher densities and access to amenities and employment centers.

Transportation costs are highest on the outskirts of the counties where households generally need to spend over $1,000 per month on transportation. This is partly a function of lower density and the absence of nearby services, shopping, and jobs. This is compounded by the lack of viable non-automobile mobility.

Figure 9 shows modeled monthly transportation costs, for the year 2000, as a percent of the area median income by Census block group. Household transportation burdens in the region are striking. There are very few places where households spend 18% or less of the AMI on transportation, and these areas are primarily limited to the City of Tucson. In any other part of the region, the average household can expect to spend at least 20% of their income on transportation, and in many areas, more than 28% of the area median income.

Figure 10 shows an even more striking view – transportation costs as a percent of 80% of the area median income ($31,573). This view is significant because this is the transportation burden that most closely represents what working households can expect in the Pima/Pinal County area. Here, the areas where households can anticipate spending more than 18% of their income on transportation cover the entire area for which data is available. This indicates that a large majority of households making less than the area median income (and even many earning AMI) will be significantly overburdened by the cost of transportation.
Figure 8: Monthly Transportation Costs
Figure 9: Monthly Transportation Costs as a Percent of AMI
Figure 10: Monthly Transportation Costs as a Percent of 80% AMI
Housing

Housing is significantly more affordable than transportation in the Pima/Pinal region. Figure 11 shows that housing costs are significantly less in the downtown and central neighborhoods of Tucson and urban cores than around city borders and in inner ring suburbs. Housing costs are also relatively low outside of these inner ring suburbs where development is much more spread out.

Figure 12 shows that households earning the AMI pay less than the accepted national standard of 30% of their income on housing in a large portion of the region. In the inner ring suburbs to the north, northwest and northeast of the Tucson area, average housing costs do become slightly out of reach for the AMI-earning household, but overall, the region is still largely affordable in terms of housing alone.

Figure 13, a map of housing burdens faced by households earning 80% of the AMI, indicates that there is a smaller area where these households can live and spend 30% or less of their income on housing. However, comparing this map to Figure 10 indicates that finding an area with affordable housing leaves the working household much more choice than when attempting to find an area where they will spend an affordable amount on transportation.
Figure 11: Annual Housing Costs
Figure 13: Annual Housing Costs as a Percent of 80% AMI
**Housing + Transportation**

As seen in previously-referred-to maps, housing and transportation affordability can both vary greatly by location, making it extremely difficult for households to make informed decisions about the true affordability of housing location choices. The combined H+T Affordability Index maps (Figures 14 and 15) show the burdens the working households earning AMI pay for combined housing and transportation in any given area throughout the Pima/Pinal region.

If it is assumed that spending no more than 48% of a household’s income for both housing and transportation combined is affordable, Figure 14 indicates that a household earning the AMI has a relatively small area of the region (outside of Tohono O’odham, Gila River, and other Native Nations land) to choose from, primarily limited to the central Tucson, Marana, Eloy, Casa Grande, and Kearney areas.

Figure 15, representing the H+T affordability for households earning 80% of AMI, shows an even more restricted area of affordability limited to small pockets within the City of Tucson and a few isolated areas of Tohono O’odham and Gila River native lands. These figures clearly indicate that simply considering housing costs alone does not give a complete view of affordability.

High Housing + Transportation costs affect not only individual household savings and their potential for wealth creation, but also the overall economic well being of the metro areas. Government, however, has the ability to influence high transportation costs. Government can encourage and implement multimodal transportation options for residents and create streetscapes that encourage walking and bicycling. Government can also adopt an aggressive policy to market the benefits of riding public transit and promote mixed-use development with restaurants and shopping in urban (and small town) cores to provide residents an alternative to driving to outlying shopping centers to meet their household needs. Finally, jurisdictions can support a regional planning policy that directs future growth in a manner that promotes pedestrian-oriented, compact, mixed use development in areas with access to intra- and inter-city transit.
Figure 14: Housing + Transportation Costs as a Percent of AMI
Figure 15: Housing + Transportation Costs as a Percent of 80% AMI
Profiles of Transportation Costs for Sample Communities

Table 1 below shows the average transportation costs around the Tucson Metropolitan Area and in other Pima and Pinal County communities. The table indicates how two Index variables, average block size in acres (see Figure 16) and average vehicles per household (Figure 2), influence the average household transportation costs. In the City of Tucson, for example, where the average block is 19 acres large, there are 1.47 vehicles per household and the average transportation cost is $706 per month. In Pima County, where blocks average 382 acres, there are 1.61 vehicles per household and average transportation cost is $784 per month. While the city makes up a large proportion of the county population, including the households outside of the city makes the county more dispersed with larger blocks and households, on average, own more vehicles, and therefore, have slightly higher average transportation costs. The same pattern holds true, although less significantly, for Apache Junction in Pinal County.

Table 1: Transportation Costs for Sample Communities

<table>
<thead>
<tr>
<th>Place</th>
<th>Households</th>
<th>Average Block Size (acres)</th>
<th>Average Vehicles per Household</th>
<th>Average Transportation Costs/ Month</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sample Communities</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tucson</td>
<td>190,256</td>
<td>19</td>
<td>1.47</td>
<td>$706</td>
</tr>
<tr>
<td>Apache Junction</td>
<td>15,155</td>
<td>27</td>
<td>1.62</td>
<td>$779</td>
</tr>
<tr>
<td>Casa Grande</td>
<td>8,151</td>
<td>54</td>
<td>1.63</td>
<td>$820</td>
</tr>
<tr>
<td>Marana</td>
<td>4,581</td>
<td>146</td>
<td>1.92</td>
<td>$949</td>
</tr>
<tr>
<td>Oro Valley</td>
<td>9,803</td>
<td>68</td>
<td>1.87</td>
<td>$958</td>
</tr>
<tr>
<td>Sahuarita</td>
<td>1,026</td>
<td>98</td>
<td>2.03</td>
<td>$1,009</td>
</tr>
<tr>
<td><strong>Counties</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pima</td>
<td>332,347</td>
<td>382</td>
<td>1.61</td>
<td>$784</td>
</tr>
<tr>
<td>Pinal</td>
<td>61,365</td>
<td>353</td>
<td>1.69</td>
<td>$836</td>
</tr>
<tr>
<td><strong>Tucson Neighborhoods</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Armory Park</td>
<td>(center city)*</td>
<td>3</td>
<td>1.06</td>
<td>$521</td>
</tr>
<tr>
<td>Catalina Foothills</td>
<td>(edge of city)</td>
<td>45</td>
<td>1.78</td>
<td>$889</td>
</tr>
<tr>
<td>Rita Ranch</td>
<td>(edge of city)*</td>
<td>242</td>
<td>2.21</td>
<td>$1,042</td>
</tr>
</tbody>
</table>

Source: US Census Bureau, 2000. Transportation costs are modeled based on Affordability Index. *Specific household counts are not provided because specific neighborhood boundaries were not available.

There are also significant differences in transportation costs within the City of Tucson. Transportation costs are the highest around the outer edges where the average block size increases (see Figure 16). In city-edge areas such as Rita Ranch, transportation costs average $1,042 per month. Transportation costs reach a low of $521 per month in the center city neighborhood of Armory Park where the average block size is only 3 acres, a very small block size for the metro area. Armory Park is an example of more compact areas with services and amenities within walking distance where households have fewer vehicles and benefit from more transit options. Research shows that households in these more compact neighborhoods will own fewer vehicles and drive fewer miles – resulting in lower monthly transportation expenditures.
Figure 16: Average Block Size
Changing Affordability with Changing Fuel Prices

While it is intuitively clear that increasing fuel prices impacts households’ transportation cost burdens, what may be less clear is the extent to which people will be impacted and how exposure to such variability can impact people differently. Households in largely auto dependent areas are left in a position of great vulnerability to fluctuations in fuel prices because they have few options other than to drive. However, households in compact, mixed-use areas with access to transit, jobs and services have much more transportation mode choice, much less dependency on automobiles, and therefore, much less exposure to changing costs.

Figure 17 shows the monthly transportation costs if a gas price of $4.18 is factored, a price reached in June 2008 and very likely to be reached again. When compared to Figure 8, the tremendous impact of this increased fuel price is immediately apparent. Figure 18 further illustrates this point, showing the actual percent change in values between Figure 8 and Figure 17. In other words, Figure 18 shows the change in transportation costs when raising gas prices from $1.59 to $4.18. In this scenario, all other variables, such as income or vehicle miles traveled (VMT), are held at the same value, making the change in transportation costs a sole function of the change in gasoline prices. Therefore, the areas that show the greatest change in transportation costs can be interpreted as the areas most vulnerable to changing gas prices. For example, downtown Tucson shows a much smaller change in transportation costs than outer reaching areas, indicating that downtown Tucson is less impacted by increasing gas prices or less vulnerable to such changes.

It is reasonable to expect that gas prices will rise again, and these households with high VMT are extremely vulnerable to increasing household transportation costs. For those households already struggling to meet housing costs, this will be an additional strain upon their monthly budget.
Figure 17: Monthly Transportation Costs Based on a 2008 Gas Price
Figure 18: Percent Change in Transportation Costs Considering Select 2000 to 2008 Gas Prices
CONCLUSIONS

Summary of Affordability Index Results

In the Tucson area, housing costs are in an affordable range in many areas for an average earning household; in most places, a household earning the AMI could expect to spend 30% or less on housing. But, the majority of these households could also expect to pay more than 28% of their income on transportation in much of the area, and at least 20% in nearly the entire area, with the exception of a small pocket in the center City of Tucson.

Figures 19 and 20 present a unique, new view of affordability. Figure 19 presents a traditional view of affordability – housing costs consuming no more than 30% of a household income. Here, areas shaded yellow represent the areas where households earning the AMI could expect to find affordable housing. Compared to this, Figure 20 presents a new view of affordability – housing + transportation costs consuming no more than 48% of household income. Here, the yellow area shrinks significantly, indicating the change in areas that are affordable to households earning the AMI. This change in land area actually represented 109,463 households, or nearly 28% of the total households in the year 2000.

While 48% or less of income being consumed by housing and transportation has been utilized as a standard for affordability for this index, it is important to realize that this should not be seen as an ultimate goal. With fluctuating fuel prices, increasing economic instability, and increasing problems associated with automobile use, clearly individuals and communities should be striving for a goal more significant than affordability. One way to view this is to decrease what is considered an acceptable cost burden. Figure 21 illustrates housing and transportation costs when 45% of income is selected as the index level of interest. This figure indicates that this level is attainable in Tucson, and is currently accomplished within the city core. There are also small pockets in Pinal County communities of Eloy and Casa Grande. The other areas shown in Figure 21 with housing and transportation costs less than 45% of AMI are the tribal lands of the Tohono O’odham and Gila River. Considerations of the characteristics in these areas, such as transit access, high density, as well as access to services and jobs in walkable neighborhoods, should serve as a model for expanding areas in which this level of affordability is attainable.

This new view is significant and unique in that it allows examination of the combined costs of housing and transportation by location, a result of differing characteristics of the local environment, such as density and proximity to employment centers. The Housing + Transportation Affordability Index also allows comparison for different income levels and household characteristics, significant for analyzing how different families may be impacted by affordability differently.
Figure 19: Traditional View of Affordability: Housing Costs Above and Below 30% of AMI
Figure 20: New View of Affordability: Housing + Transportation Costs Above and Below 48% of AMI
APPENDIX

Brief Overview of H+T Affordability Index Methodology

The H+T Affordability Index was created for the Tucson, Pima County, and Pinal County region at the Census block group level. Information specific to the region on residential density, commercial services, infrastructure, transit service, and job access were used to predict auto ownership, auto use (vehicle miles traveled per year per vehicle), and transit use. Because the Index is specific to both household size and income, analysis was done for a number of household sizes and income levels.

The results from the Index highlight areas where development patterns, job access, and land use patterns are especially conducive to transit use, walking, biking, and lower auto use. The results also indicate areas where new development patterns likely necessitate higher auto ownership, multiple daily trips by auto, long distances to work, and are difficult to serve by transit.

The Index interactive maps can be used to provide two types of valuable information: 1) a single number to score each neighborhood’s affordability, represented by an estimated monthly household transportation cost; and 2) as an unbundled set of indicators (e.g. transit connectivity, block size, distance to employment, housing density) used to determine which of these factors are contributing to the cost of the area, e.g. large block sizes, low job access, low density, few nearby services.

The Affordability Index was calculated using the eight variables shown in Figure 22. The independent, input variables utilized were obtained from the 2000 US Census. Specifically, four neighborhood variables (residential density, average block size, transit connectivity index, and job density) and four household variables (household income, household size, workers per household, and average journey to work time) were utilized as independent variables. These variables are used to predict, at a neighborhood level (Census block group), three dependent variables – auto ownership, auto use, and public transit usage – that determine the total transportation costs. The costs resulting from these calculations in conjunction with the well defined housing costs provide a picture of the affordability of the region.
Figures 22: H+T Affordability Model

For a full description of the methodology and to view the results of this research as part of an interactive website, visit: http://htaindex.cnt.org.