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# **Housing + Transportation Affordability in Washington, DC**

Full Report

**PREPARED BY  
THE CENTER FOR NEIGHBORHOOD TECHNOLOGY  
JULY 2011**

COVER: L'ENFANT PLAZA METRO Photo by Andertho

# Acknowledgments

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## **ABOUT THE CENTER FOR NEIGHBORHOOD TECHNOLOGY**

CNT's mission is to promote more livable and sustainable urban communities. For over 30 years, the Center for Neighborhood Technology (CNT) has taken a holistic, solution-oriented approach that reflects a commitment to both cities and nature. CNT is a creative think-and-do tank that combines rigorous research and analysis with effective actions that offer paths to scale. We have tackled a wide range of issues, always with an eye toward simultaneously improving the environment, strengthening the economy, and advancing equity. We work across disciplines and issues, including transportation and community development, energy, natural resources, and climate change.

CNT has a strong reputation as a leader in promoting urban sustainability—the more effective use of existing resources and community assets to improve the health of natural systems and the wealth of people, today and in the future. CNT is a recipient of the 2009 MacArthur Award for Creative and Effective Institutions.

CNT has pioneered map-based tools that enable citizens, communities, service providers, and policymakers to communicate issues, understand needs, and create more effective implementation plans for urban sustainability.

More information about CNT is available at [www.cnt.org](http://www.cnt.org).

# Foreword

The Center for Neighborhood Technology (CNT) is known for groundbreaking work regarding the effects of neighborhood characteristics on a household's transportation costs. But CNT's original efforts on the DC region were based on increasingly dated statistics from the 2000 US Census and did not have the benefit of local data such as the region's bus network and land use patterns. The Office of Planning (OP) believes it is critical to understand how the region's housing and transportation costs changed throughout the decade beginning in 2000, with particular emphasis on the turbulent period between 2006 and 2008—when gasoline prices spiked and the recession began to really bite in our region. During that time some outer jurisdictions experienced drops in the median home sales price of 41%, while the District's median sales price dropped by only 2%; this happened while real gas prices grew by 18%. Though some areas of the region's housing market are showing signs of recovery, as the nation's economy improves, gas prices are once again very likely to grow faster than inflation and to stress the budgets of many households living in car-dependent neighborhoods.

OP is excited to present CNT's work to citizens, stakeholders, and elected officials of the region. The study has several potential policy implications for our region as it grows. Some of those implications: how a better mix of land uses could help reduce transportation costs; how future transit expansions could best serve to lower household transportation expenses; and how to identify locations where an investment in affordable housing might provide the most value for lower income households. OP hopes that the study will spark a serious discussion of ways to ensure the economic resilience of households and local governments as the region develops.

Sincerely,

Harriet Tregoning

*Director, DC Office of Planning*



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# Executive Summary



# Introduction to H+T

## Significance of Transportation Costs and the Lack of Transparency

Today, the real estate market knows how to incorporate the value of land into the price of the home—based on its location and proximity to jobs and amenities—but there is less clarity about how the accompanying transportation costs also contribute to the desirability of a location. In most cases, the very same features that make the land and home more attractive, and likely more expensive per square foot, also make the transportation costs lower. Being close to jobs and commuter transit options reduces the expenses associated with daily commuting. And being within walking distance of an urban or suburban downtown or neighborhood shopping district allows a family to replace some of their daily auto trips with more walking trips. Walking, bicycling, taking transit, or using car sharing instead of driving a private automobile reduces gasoline and auto maintenance costs, and may even allow a family to get by with one less automobile.

By contrast, places where single-family homes are more “affordable” are often found in outlying areas where land is cheaper. However, the lack of amenities and access to necessities common in these neighborhoods often results in households having transportation costs that are much higher and can often outweigh the savings on housing costs. In many of the areas where households “drive to qualify” for affordable housing, transportation costs can exceed 32% of household income, 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 household income.<sup>1</sup>

1. High and low transportation expenditure percentages calculated from the 337 metropolitan areas presented on the H+T Affordability Index website (<http://htaindex.cnt.org>).

This information gap on location efficiency, which is measured here as the cost of transportation associated with each place, leads to unexpected financial burdens and time constraints for households, poor location decisions by developers, and missed and misplaced opportunities for municipalities. Furthermore, it leads to misinformed criticisms of the cost of building transit, since these critiques do not fully account for the benefits or take into account the hidden costs associated with sprawl and auto dependency. Not only are the high costs of transportation hidden, but so are the low costs, and therefore so is the inherent value of more convenient in-town urban, inner-suburban, and other urbanizing locations. Consequently, many of these convenient but undervalued areas suffer from disinvestment and lack the ability to attract new investment and redevelopment.

## Expanding the Definition of Affordability

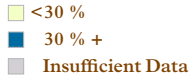
From an affordability perspective, the lack of transparency in transportation costs puts households at significant financial risk. Traditionally, a home is deemed affordable if its costs consume no more than 30% of a household's income. This measure, however, ignores transportation costs—typically a household's second largest expenditure<sup>2</sup>—which are largely a function of the area in which a household chooses to locate. This report proposes expanding the definition of housing affordability to include transportation costs to better reflect the true cost of households' location choices. Based on data from 337 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), CNT has found 15% of the Area Median Income (AMI) to be an attainable goal for transportation affordability. By combining this 15% level with the 30% housing affordability standard, this report recommends a **new view of affordability**, one defined as **H+T costs consuming no more than 45% of household income**.

Considering housing and transportation costs in conjunction changes the picture of affordability significantly. Many areas in which low home prices make the area appear affordable are no longer so attractive when transportation costs are added to the equation. Conversely, areas in which housing prices may seem out of reach for many households can actually become more affordable when high levels of location efficiency allow households to experience significantly lower transportation costs.

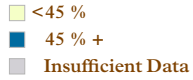
2. Consumer Expenditure Survey from the Bureau of Labor Statistics, <http://www.bls.gov/cex/home.htm>



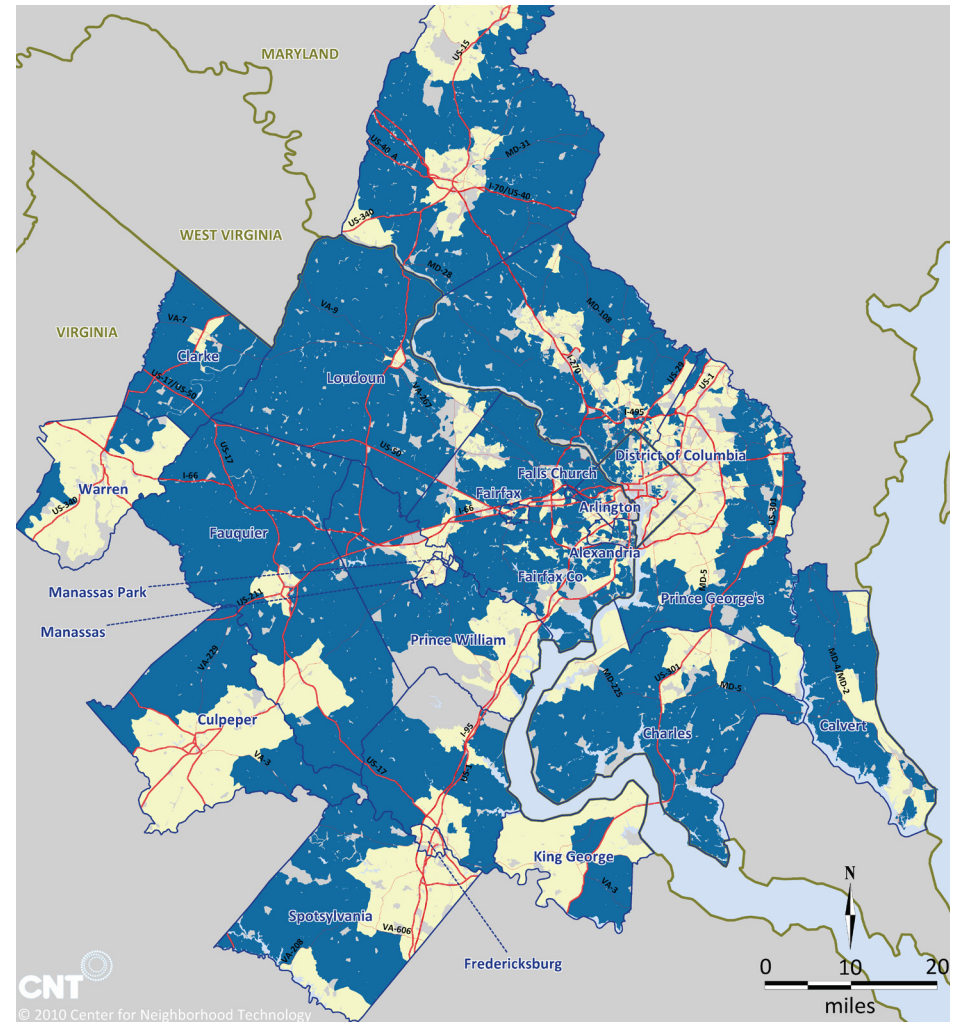
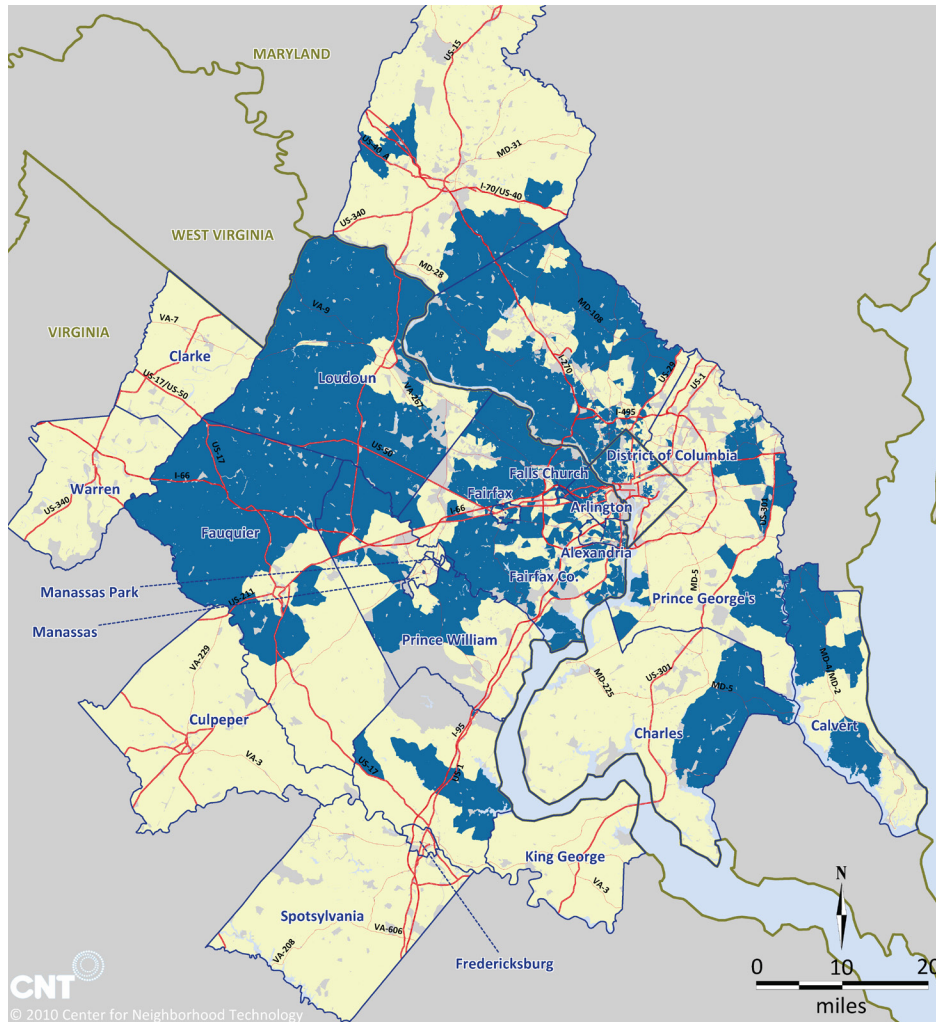
**FIGURE 1**  
Traditional view of affordability:  
housing costs as a percentage  
of AMI



**FIGURE 2**  
New view of affordability:  
H+T costs as a percentage  
of AMI



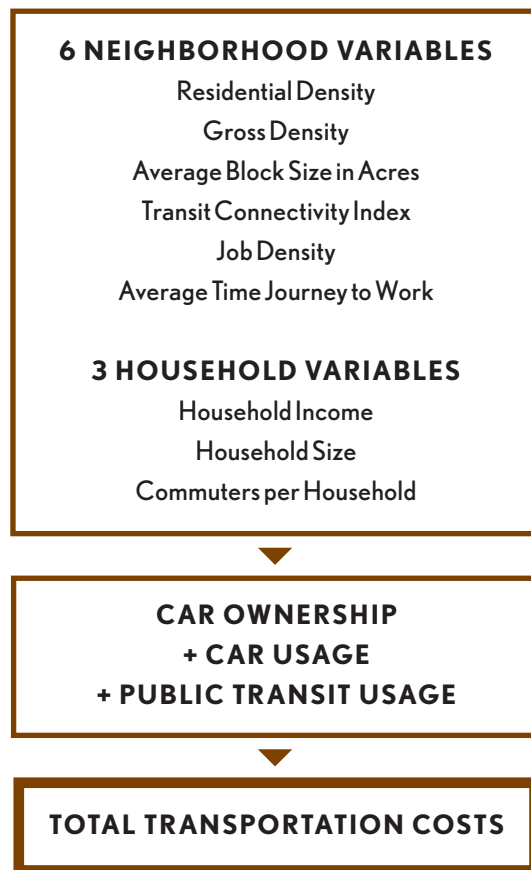
The maps below present the *two views of affordability*: the traditional definition showing where average housing costs are deemed affordable for households earning the AMI (indicated by the areas shaded in yellow in figure 1); and the new view in which affordability is defined as average H+T costs consuming no more than 45% of AMI (fig. 2).<sup>3</sup> Between the two maps, the shift in areas from yellow to blue represent the change in areas with average costs affordable to the AMI-earning household when the measure of affordability is expanded to include transportation costs.



3. For the purposes of this research, a value of \$87,623 has been utilized as AMI, representing the regional average of block group level household median incomes. Because this value was constructed as an average median for the study area, it differs from the HUD-defined AMI for a family of four.

# Transportation Costs Vary by Location

FIGURE 3  
Transportation cost model



The Center for Neighborhood Technology (CNT) has developed a unique tool, the Housing + Transportation (H+T®) Affordability Index, which has so far been applied to all 337 metro areas in the United States.

The transportation cost model, the T in the H+T Index, describes the relationship between independent neighborhood and household characteristics and three dependent variables: auto ownership, auto use, and transit use. Building off of years of research on location efficiency, the transportation cost model considers factors such as household density, average block size, transit access, job access and journey to work time and explains how they influence transportation behavior (see fig. 3).

These three factors of transportation behavior—auto ownership, auto use, and transit use—estimated at the neighborhood level, are combined to illuminate the cost of transportation associated with that location.

## Neighborhood Variables

Six neighborhood characteristics are utilized in the transportation model to predict transportation behavior, as measured through auto ownership, auto use, and transit use. Household density (both residential and gross measures), average block size, transit access (as measured in the Transit Connectivity Index developed by CNT), job access, and average work commute time have all been found to be determining factors of transportation behavior. (The specific definitions of each measurement can be found in the Detailed Methods section.)

## Household Variables

Three household characteristics have also been found to be significant indicators of transportation behavior: household income, household size, and the number of commuters per household. However, in the transportation model, these three variables are fixed at regional average values. Therefore, by holding these characteristics constant and examining transportation costs for the “typical household,” this report focuses on and highlights the variation resulting from the built environment, or neighborhood characteristics. (See the Detailed Methods section for further explanation.)

## Total Transportation Costs

The transportation model results with values estimating average auto ownership, auto use, and transit use, to which cost components are multiplied to estimate total household transportation costs. Auto ownership costs, for the purposes of this research, are defined as depreciation, finance charges, insurance, license, registration, and taxes (state fees). Auto use costs are composed of gas, maintenance, and repairs. Transit costs factor the average cost of transit use per household using a regional average price as derived from the National Transit Database. (See details in the Cost Components section of the Detailed Methods.)

FIGURE 3 REPEATED  
Transportation cost model



# Customizing the H+T Index for DC

This project used the H+T Index and customized and recalibrated it to estimate housing and transportation costs in the Washington, DC, metropolitan area.

## UPDATED DATA

The H+T Index, thus far, has primarily used 2000 US Census data. For this project, CNT also used American Community Survey (ACS) data from 2006–2008. The small-scale variation available in the 2000 Census data was therefore preserved while the ACS data enabled a more current consideration.

## LOCAL DATA

The addition of detailed local datasets as independent variables can help improve the accuracy of the H+T analyses. To further expand existing H+T work in the DC region, this analysis was refined through the use of detailed datasets obtained from local agencies and organizations, along with national datasets, to serve as independent variables in the customized transportation model. Local datasets included regional bus networks and land use patterns.

## MARKET RATE HOUSING COSTS

Another significant aspect of the customization of the Index was the incorporation of market rate housing costs. The original Index uses Selected Monthly Owner Costs (SMOC) and Gross Rent from the US Census to estimate housing costs. However, because SMOC represent the average costs for all households with a mortgage, regardless of the age of the mortgage, these values can diminish recent housing trends. To capture these housing market trends, multiple listing service (MLS) sales data were utilized to calculate average homeownership costs. Updated values for Gross Rent were utilized to capture renting costs.

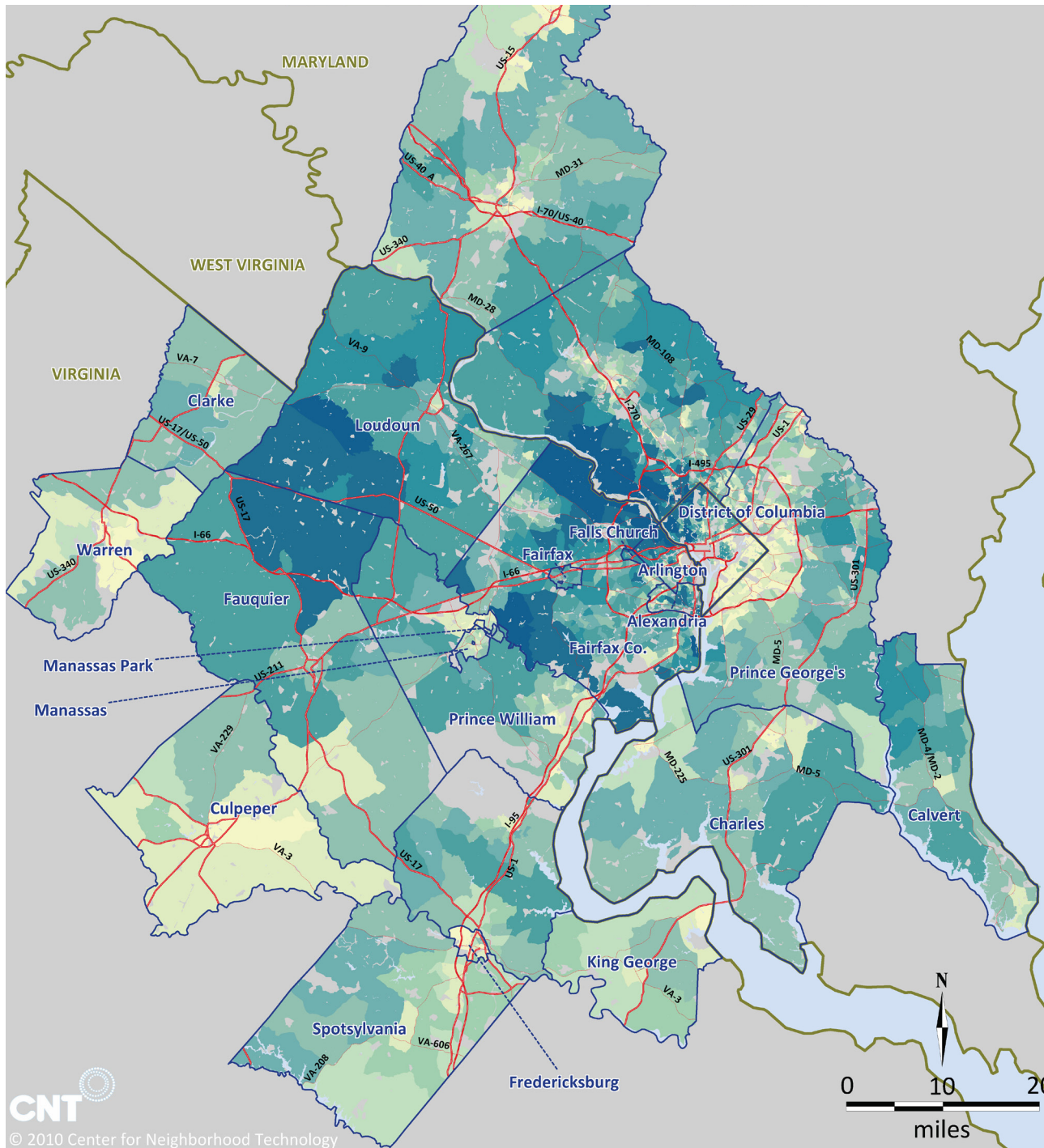


**DC CIRCULATOR**  
Photo by Fredo Alvarez

# Housing Costs

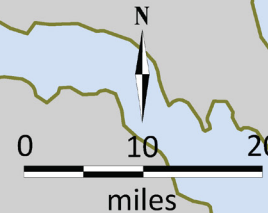
As the DC area is known for having a strong housing market, it is not surprising that average monthly housing costs are high throughout the region. As figure 4 shows, average housing costs are highest, exceeding \$5,200 monthly, in the northwest areas of the District and spreading northwest into Fairfax and Montgomery counties. Costs are lowest in the eastern portion of the District, where average monthly housing costs of less than \$1,200 can be found. Also, the furthest reaching areas of the region, such as Warren and Culpeper counties contain areas with average monthly housing costs of less than \$1,200.





**FIGURE 4**  
Average monthly housing costs

- < \$1,200
- \$1,200 to \$1,400
- \$1,400 to \$1,500
- \$1,500 to \$1,600
- \$1,600 to \$1,900
- \$1,900 to \$2,200
- \$2,200 to \$2,700
- \$2,700 to \$3,600
- \$3,600 to \$5,200
- \$5,200 +
- Insufficient Data



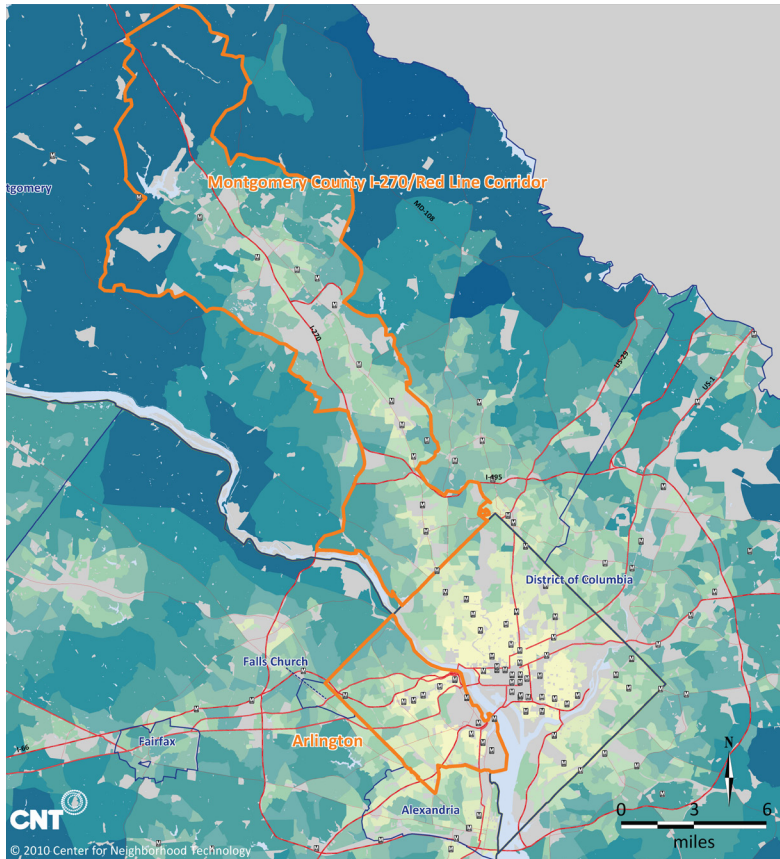
# Transportation Costs

Transportation costs present a near converse image to housing costs (see fig. 5). Average transportation costs are lowest in the District of Columbia where households have convenient access to jobs and amenities. Households here, on average, own fewer cars and drive them less because they are largely able to walk, bike, and use transit to meet their daily needs. Areas of compact, mixed-use development outside of the District, such as in Arlington and parts of Fairfax counties, the I-270/Red Line corridor extending out through Montgomery County, in the center of Frederick County, and in Fredericksburg, also have development patterns that enable their residents to have lower transportation costs. Average transportation costs are highest in the dispersed, auto dependent areas of the region. Residents in the farthest-reaching counties of the region, such as Clarke, Warren, Calvert, and Charles, must rely on automobiles and drive long distances, creating high transportation expenditures.

As an example, a household owning two automobiles (at an average annual cost of \$5,598 per auto), driving a total of 20,000 miles annually (at an average cost of 5.5 cents per mile), and never taking transit has average annual transportation costs of \$12,296. Compared to this, a household owning one automobile, driving 10,000 miles annually, and spending \$100 per month on transit has annual transportation costs of \$7,348, or nearly \$5,000 less.







**FIGURE 6**  
Average monthly transportation costs, as modeled for the AMI-earning household

- < \$920
- \$920 to \$1,020
- \$1,020 to \$1,100
- \$1,100 to \$1,170
- \$1,170 to \$1,230
- \$1,230 to \$1,280
- \$1,280 to \$1,370
- \$1,370 to \$1,500
- \$1,500 to \$1,770
- \$1,770 +
- Insufficient Data

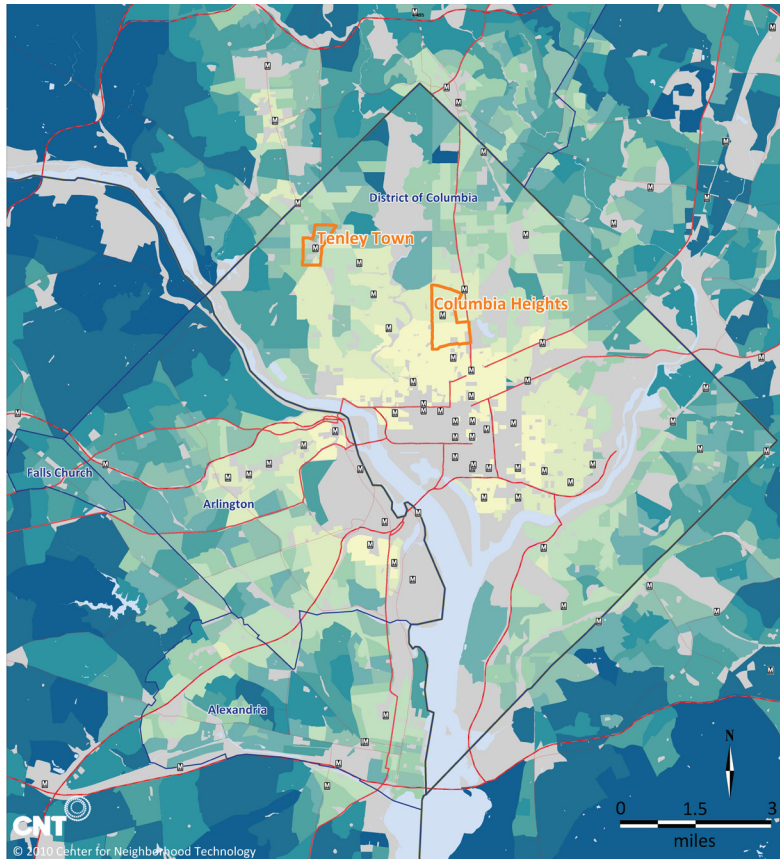
## Local Case Study Examples

Figure 6 shows the average monthly transportation costs, focusing in on the Montgomery County I-270/Red Line corridor and Arlington County. While Montgomery County has been effective at directing development along the corridor and protecting the surrounding farmland, average transportation costs are higher than they are in Arlington County. To help explain this disparity, table 1 below shows average values for the six neighborhood characteristics significant in determining transportation costs. Residential and gross density in Arlington are both higher, transit access is higher, and average blocks are smaller, suggesting that Arlington is a more walkable, bikeable, and transit-oriented area with more destinations in close proximity. Perhaps the most significant difference is in job access. With its greater proximity to the District and the high concentration of jobs there and in Arlington, commuters have less distance to travel and more transit options.

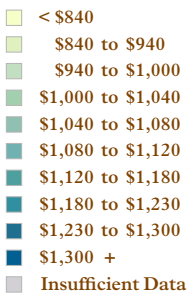
Comparing both the Montgomery County I-270/Red Line corridor and Arlington County to the region as whole, however, highlights the impact of focused, location-efficient development on overall transportation costs. As shown in the table below, households in these central communities have lower average transportation costs than the region as a whole. Higher density development and smaller block sizes are factors contributing to these lower transportation costs. Transportation costs in Arlington County are significantly lower than the regional average due to high levels of transit connectivity and job access.

	Montgomery County I-270/Red Line Corridor	Arlington County	Full Region
Average Monthly Transportation Costs	<b>\$1,177</b>	<b>\$975</b>	<b>\$1,246</b>
Average Residential Density (HHs/Res. Acre)	<b>4.2</b>	<b>7.6</b>	<b>3.9</b>
Average Gross Density (HHs/Land Acre)	<b>1.9</b>	<b>5.8</b>	<b>0.5</b>
Average Block Size (Acres)	<b>22.4</b>	<b>8.4</b>	<b>75.5</b>
Average Transit Connectivity Index	<b>1,199</b>	<b>3,529</b>	<b>1,420</b>
Average Job Access (Gravity Index)	<b>51,754</b>	<b>120,881</b>	<b>54,052</b>
Average Time for Journey to Work (Mins.)	<b>31.1</b>	<b>26.2</b>	<b>33.1</b>

**TABLE 1**  
Average values for neighborhood characteristics



**FIGURE 7**  
Average monthly transportation costs, as modeled for the AMI-earning household



While the Montgomery County I-270/Red Line corridor and Arlington County provide good regional comparisons, nowhere in the region illustrates location efficiency as well as the District of Columbia. All of these factors—high density, small blocks, extensive transit access, high job concentrations, and short commute times—come together to enable households in the District to own fewer cars and drive them less. Households here benefit from convenient access to goods, services, and general daily needs in a non-auto dependent setting, therefore experiencing significantly lower transportation costs than their surrounding regional neighbors.

### COLUMBIA HEIGHTS AND TENLEY TOWN

While DC, as a whole, is an extremely location-efficient area, much variation exists within it. Table 2 and figure 7 provide a comparison between the neighborhoods of Columbia Heights and Tenley Town. Both neighborhoods have Metro stations, but three factors distinguish Columbia Heights and save residents over \$160 per month in estimated transportation costs. First, known for row houses and apartment buildings, Columbia Heights has significantly higher residential density. Second, it is half the distance to the jobs in the core of downtown as well as close to Howard University and Washington Hospital Center. Finally, while each has a Metro station, Columbia Heights also has access to four more bus routes.

	Columbia Heights	Tenley Town	DC
Average Monthly Transportation Costs	<b>\$840</b>	<b>\$1,003</b>	<b>\$922</b>
Average Residential Density (HHs/Res. Acre)	<b>26.6</b>	<b>5.9</b>	<b>10.7</b>
Average Gross Density (HHs/Land Acre)	<b>22.6</b>	<b>3.2</b>	<b>7.0</b>
Average Block Size (Acres)	<b>5.0</b>	<b>5.3</b>	<b>6.7</b>
Average Transit Connectivity Index	<b>9,161</b>	<b>4,307</b>	<b>5,477</b>
Average Job Access (Gravity Index)	<b>200,150</b>	<b>106,238</b>	<b>171,717</b>
Average Time for Journey to Work (Mins.)	<b>31.4</b>	<b>28.6</b>	<b>30.2</b>

**TABLE 2**  
Average values for neighborhood characteristics

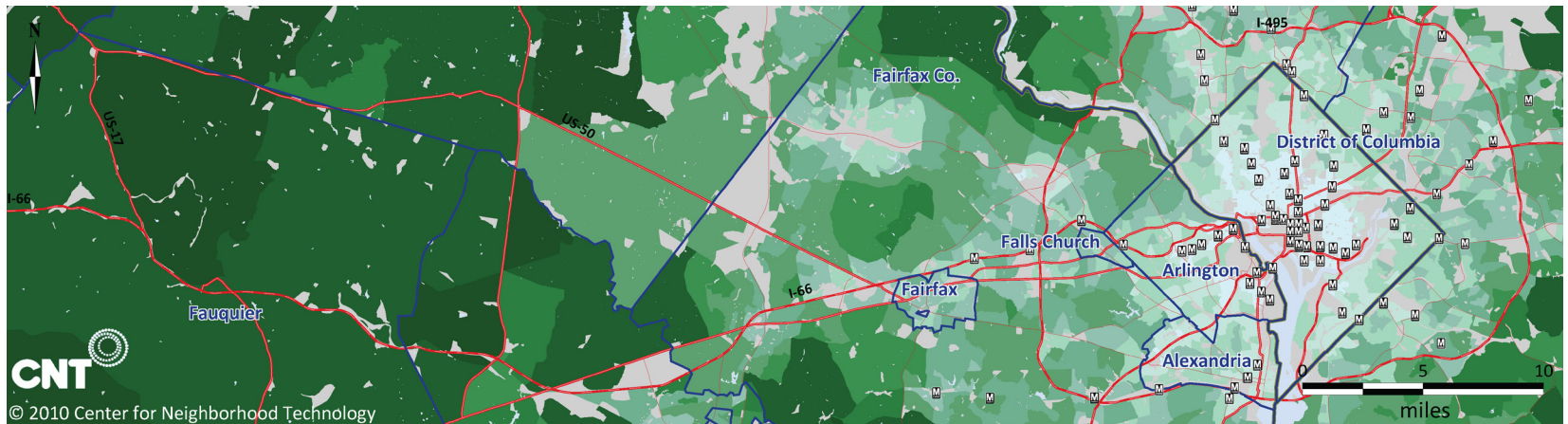
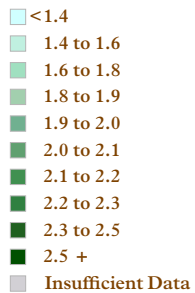


# Determining Factors: What Drives Transportation Costs?

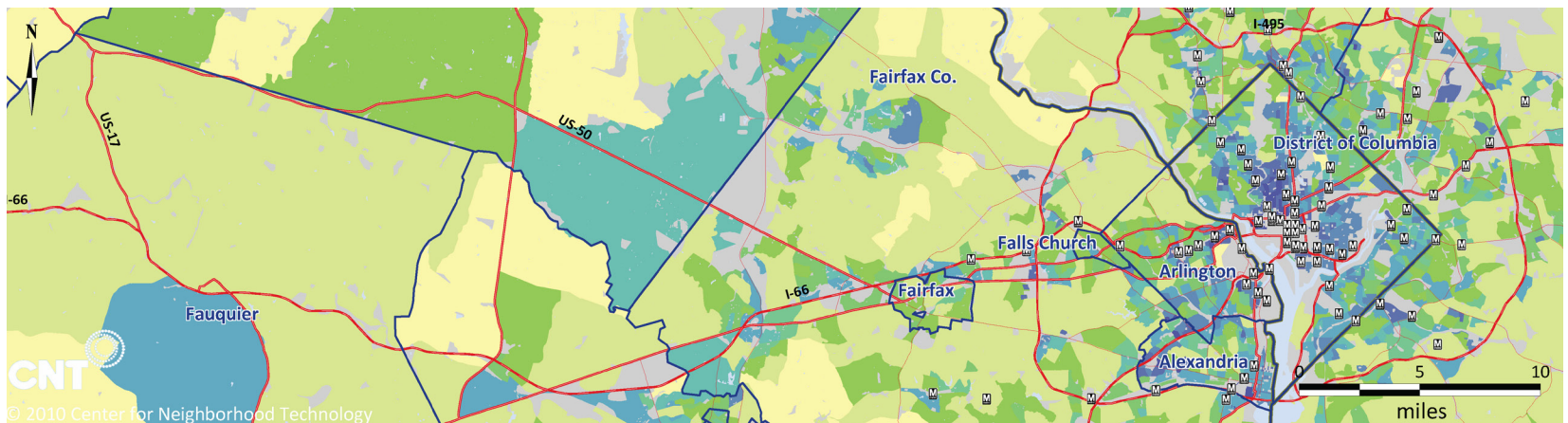
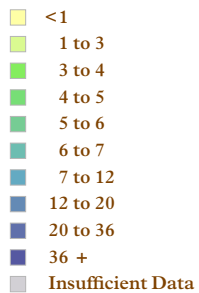
## AVERAGE AUTOS PER HOUSEHOLD AND RESIDENTIAL DENSITY

As the examples below illustrate, residential density is a key determinant of transportation costs. Specifically, residential density tends to affect the number of automobiles households own. A comparison of figures 8 and 9 show this trend: households, on average, own fewer autos where residential density is high; and where residential density is low, households own more automobiles.

**FIGURE 8**  
Average autos per household,  
as modeled for the AMI-earning  
household



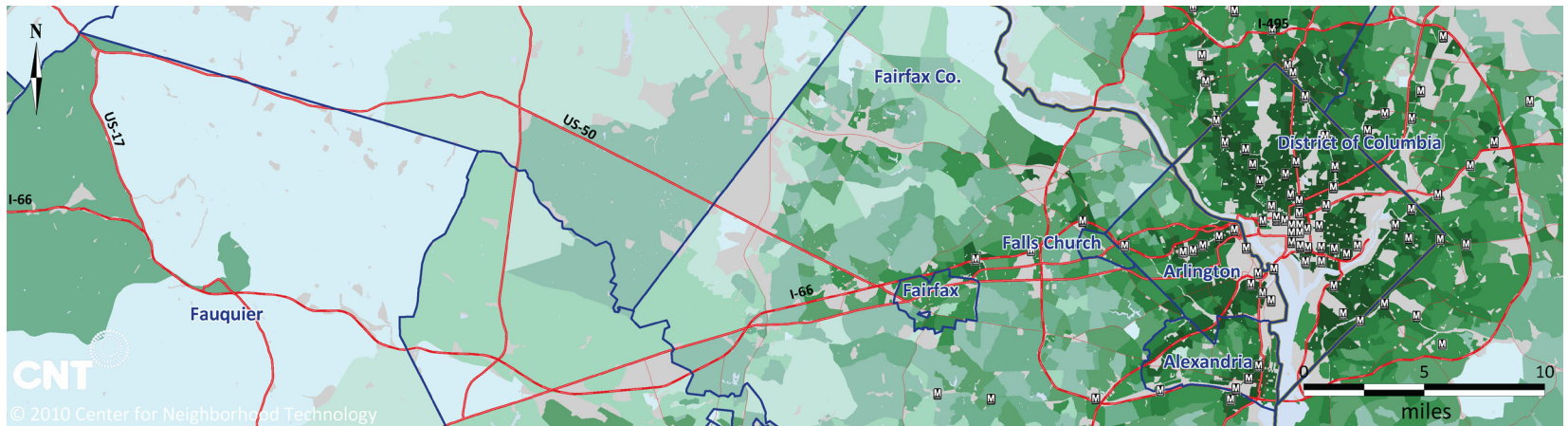
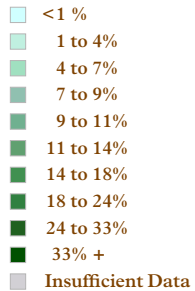
**FIGURE 9**  
Residential density,  
households per residential acre



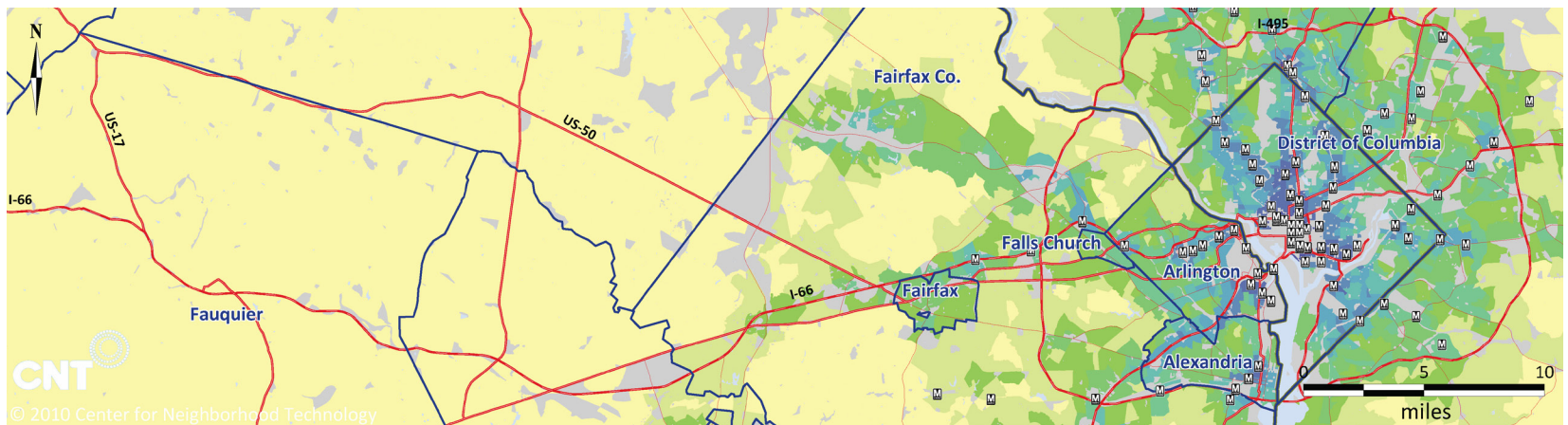
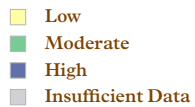
## AVERAGE TRANSIT USE AND TRANSIT CONNECTIVITY INDEX

Another component of transportation costs is average transit use, specifically as a means of transportation to work. While higher transit use clearly leads to higher costs for the transit portion of overall transportation costs, it is important to note that these costs are extremely small relative to the reduction in auto use and auto ownership costs resulting from increased transit use. Not surprisingly, the maps below (figs. 10 and 11) show the strong correlation between transit use and transit access, as measured by the Transit Connectivity Index developed by CNT. In the core of the region in the District, households experience the greatest transit access, and therefore utilize it the most.

**FIGURE 10**  
Average percentage journey to work by transit, as modeled for the AMI-earning household



**FIGURE 11**  
Transit Connectivity Index

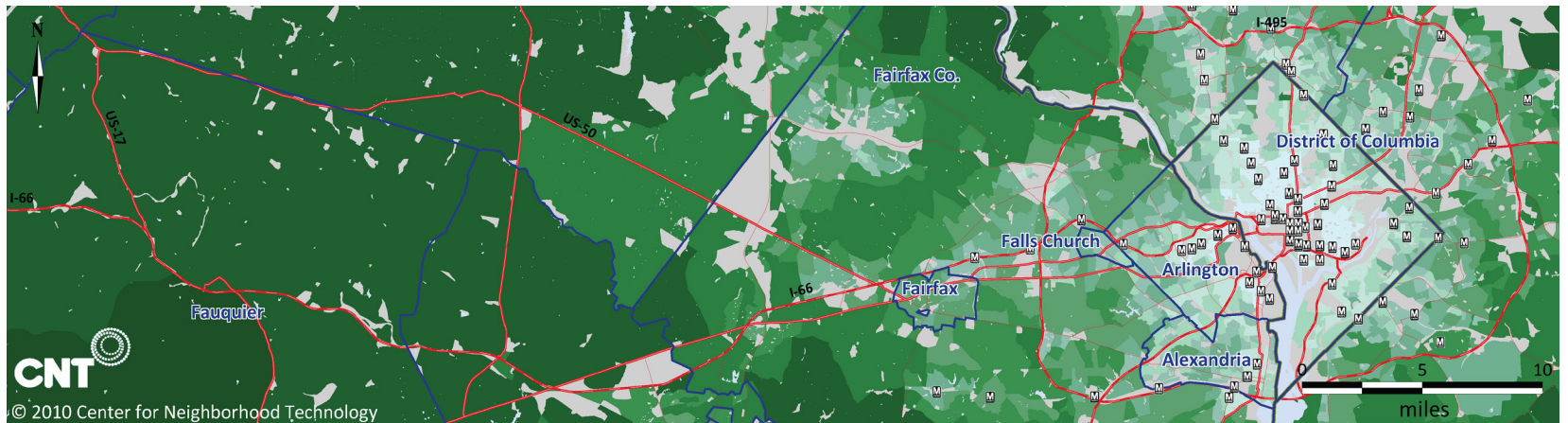
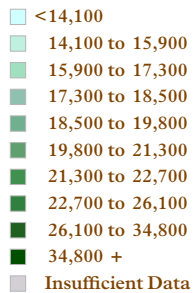




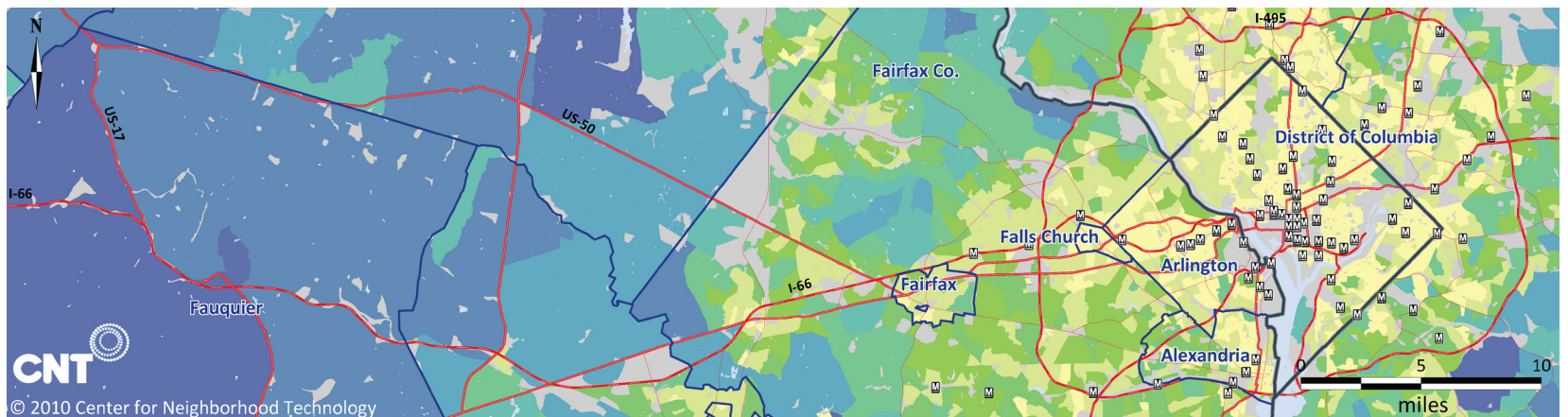
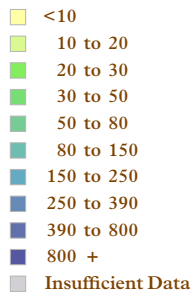
## AVERAGE AUTO USE AND AVERAGE BLOCK SIZE

The third component of transportation costs is auto use, or vehicle miles traveled (fig. 12). Like auto ownership, household density is the largest determinant of vehicle miles traveled. Average block size (fig. 13) is also an important determinant of auto use. As the maps below show, smaller block areas correspond to lower average vehicle miles traveled. Smaller blocks typically mean greater street connectivity, more intersections, and shorter routes between points, thus enabling households to drive fewer miles.

**FIGURE 12**  
Average annual vehicle miles traveled per household, as modeled for the AMI-earning household



**FIGURE 13**  
Average block size in acres



# Bringing It All Together: H+T

## H+T Costs as a Percentage of Income

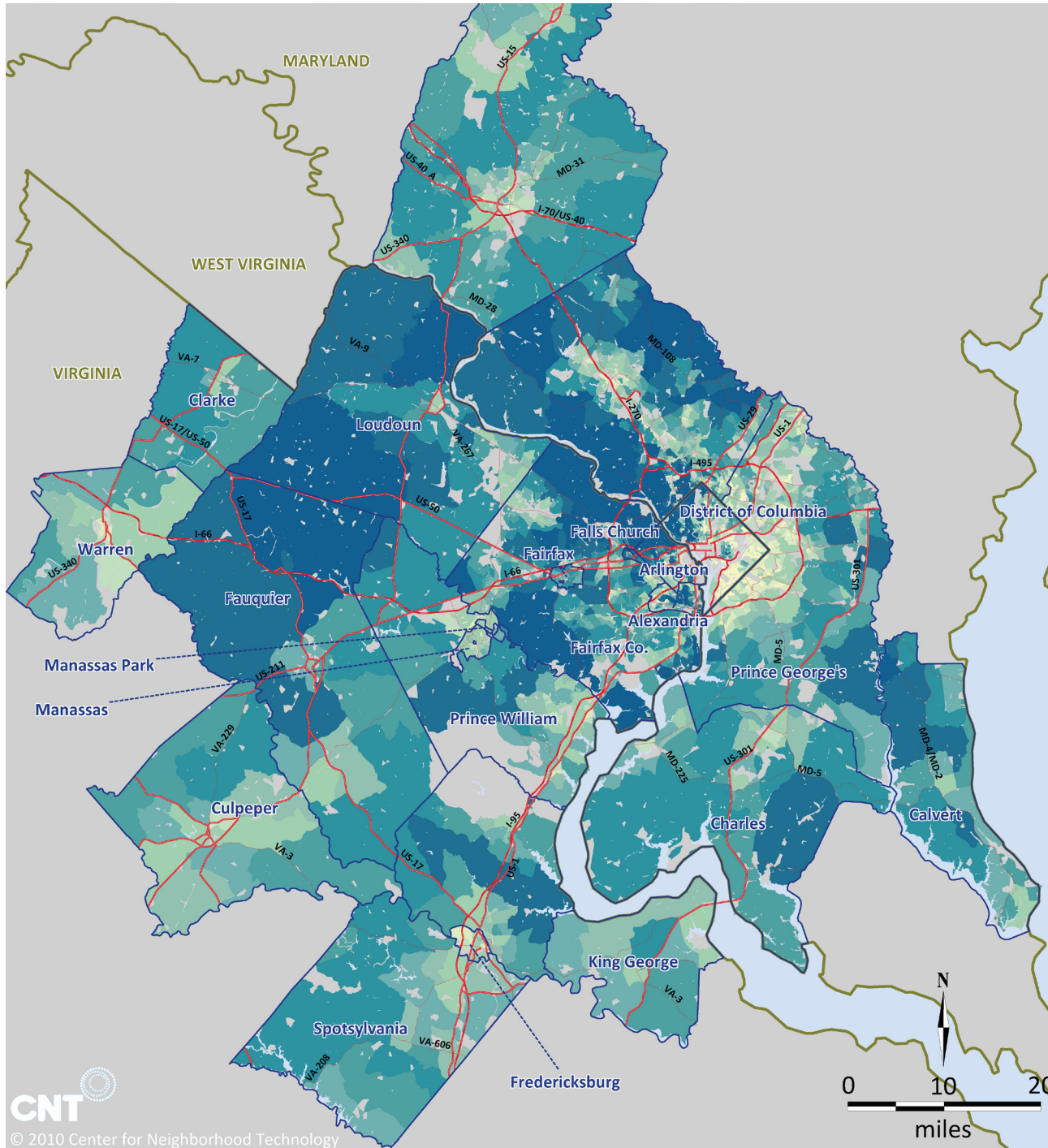
Combining the two costs, both housing and transportation (H+T), gives a much more complete picture of the costs associated with the location in which a household chooses to live. Considering these costs together provides a means to evaluate the tradeoffs households make—do the lower housing costs pursued far from the city center pay off? Do the lower transportation costs of centrally located neighborhoods offset higher housing costs?

The areas in the northwest of the District and extending northwest into Montgomery and Fairfax counties where housing costs are high also have some of the highest H+T costs in the region. Here, housing costs are so high that they likely overwhelm any savings these households may experience from being in location-efficient areas with low transportation costs. However, in areas in the District of Columbia, Arlington County and Alexandria, low transportation costs help keep overall H+T costs low. The outlying counties that present some of the lowest housing costs in the region look much different when considered through the lens of combined H+T costs. High average transportation costs in these areas erode the perceived savings on housing, and these areas become some of the more expensive places to live in the region.

When considering H+T, looking at these combined costs as a percentage of AMI, as in figure 14, presents a useful metric—the burden experienced by typical households in the region. As previously mentioned, CNT has defined a goal for affordability as spending no more than 45% of income on the combined costs of H+T. Here, it becomes apparent that “affordable” housing in the farthest-reaching areas of the region is much less so when transportation costs are added. Average H+T burdens in Spotsylvania, Charles, and Calvert counties are largely

**FIGURE 14**  
Average H+T costs as  
a percentage of AMI

- <30 %
- 30 to 33%
- 33 to 35%
- 35 to 40%
- 40 to 42%
- 42 to 45%
- 45 to 48%
- 48 to 55%
- 55 to 65%
- 65% +
- Insufficient Data



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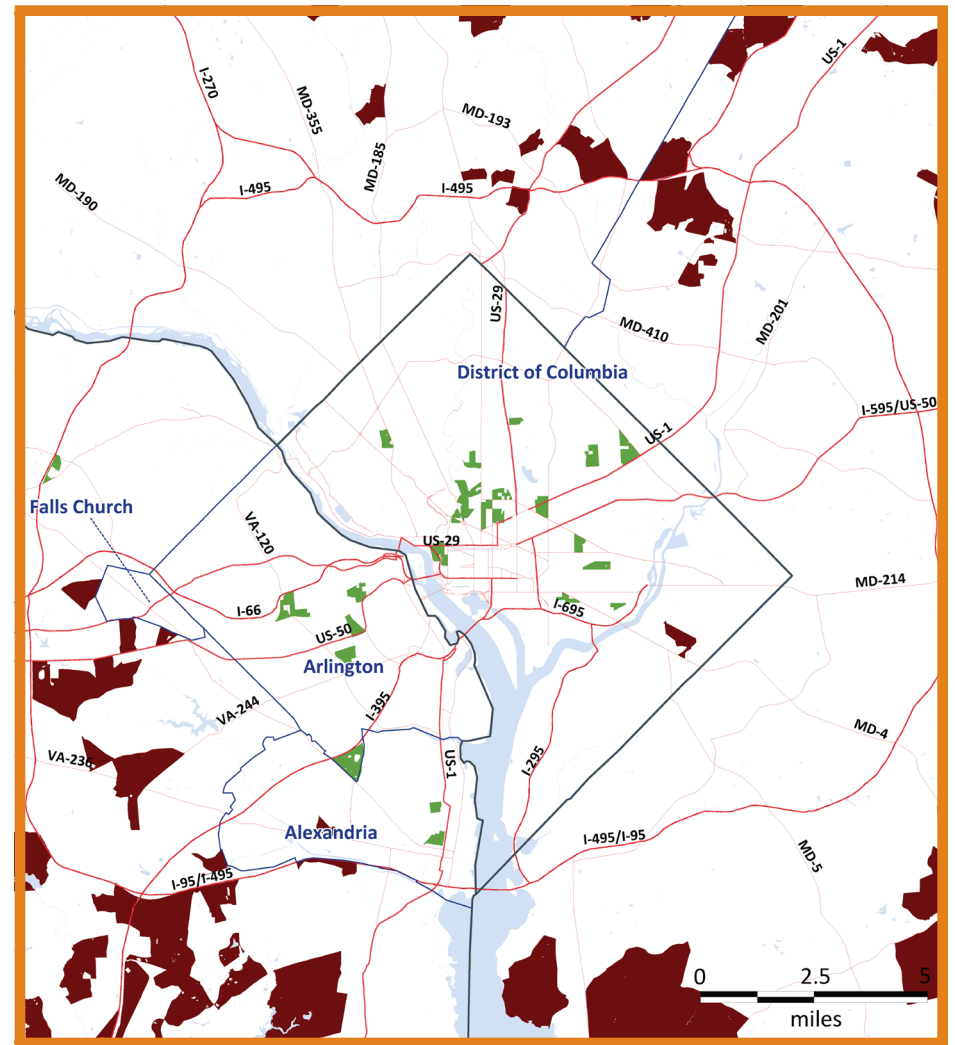
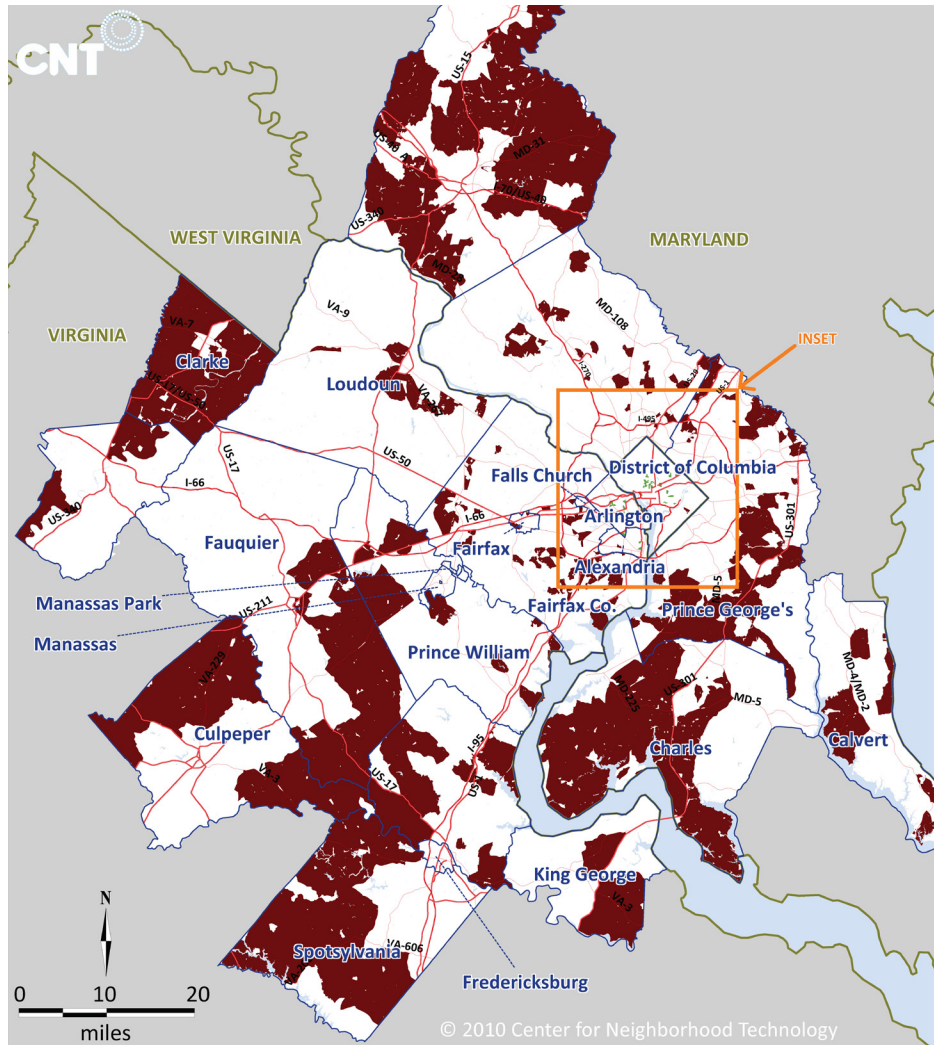
**RESIDENTIAL DEVELOPMENT  
IN DOWNTOWN DC**  
Photo by Maxwell MacKenzie

over 45% of AMI, and even exceed 55% of AMI in areas. Conversely, the District of Columbia, Prince George's County, Arlington County, and Alexandria present some of the most affordable areas in the region. Here, even where housing costs are relatively high, average H+T burdens are largely less than 45% of AMI.

As shown in earlier maps (figs. 1 and 2), in many areas, the average affordability changes when transportation costs are added to the affordability definition. The two maps below (fig. 15) highlight these places of change: areas highlighted in red represent neighborhoods where average housing costs are affordable for typical households (less than 30% of AMI) but the addition of transportation costs puts the average combined H+T costs out of an affordable range (greater than 45% of AMI). Zooming in on the District, Arlington, and Alexandria, the map on the right shows (highlighted in green) where the opposite is true: average housing costs are more than 30% of AMI, but average H+T costs are affordable (less than 45%) for households earning the AMI.

**FIGURE 15**  
Changes in affordability  
with new definition

- Housing costs < 30% of AMI  
H+T costs > 45% of AMI
- Housing costs > 30% of AMI  
H+T costs < 45% of AMI



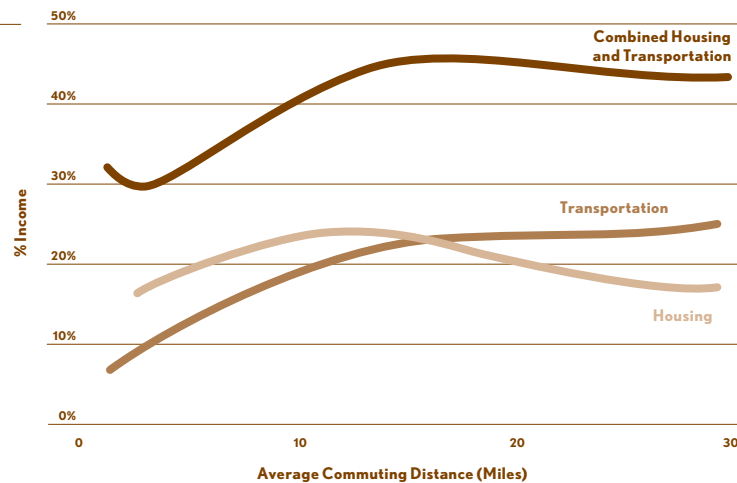
# Impact of Varying Transportation Costs on Cost of Living

This analysis shows that, to have a more complete understanding of their cost of living, households must understand their transportation costs, and how these costs are intrinsically connected to location. Without full transparency of transportation costs, households can unexpectedly and unknowingly be putting themselves in a position of financial risk. By illuminating the full cost of location decisions, this work helps to put households in financial control.

Previous research on H+T costs in the greater Washington, DC, area illustrates just how significant a burden transportation costs can be. As figure 16 shows, at an average commute distance of approximately 15–18 miles, average household transportation costs can actually exceed housing costs. At an average cost of nearly \$5,600 per year, auto ownership is, by and large, the most significant component of these transportation costs. Areas far from job centers, with low density and little access to goods, services, and transit, leave residents largely dependent on automobiles to meet their daily needs. On the other hand, location-efficient neighborhoods, or compact, mixed-use communities in which residents can walk, bike, or use transit, enable households to get by with fewer automobiles and therefore experience significantly lower transportation costs.

**FIGURE 16**  
H+T cost burdens  
by commute distance

Source: *Belway Burden: The Combined Cost of Housing and Transportation in the Greater Washington, DC, Metropolitan Area*, Urban Land Institute Terwilliger Center for Workforce Housing, 2009.



## Implications for Future Growth

Future growth must be planned strategically. By taking into consideration H+T and the factors that impact transportation costs, communities have the potential to grow in a way that is both more location efficient and more affordable for their residents. Communities can increase affordability by targeting growth in location-efficient areas where households are not auto dependent. At the same time, considering the factors that make for location-efficient areas and expanding these characteristics elsewhere can also increase the number of affordable areas.

The District of Columbia can and should serve as a good example of this. While average housing costs are quite high in much of the District and seemingly out of reach for many households, high location efficiency and low transportation costs can actually offset this expense in places, as seen through affordable H+T costs. Expanding the definition of housing affordability to include the transportation costs of a given location will also be helpful to those coming to the region from other areas. First and foremost, the results of this study will help households understand that there is more to housing affordability than “drive ‘til you qualify.” This study helps them understand that transportation costs have a significant impact on their budget and will enable them to consider a broader range of housing choices to better suit their needs. Second, it provides actual estimates of transportation costs by neighborhood and an understanding of the neighborhood characteristics that affect transportation costs the most.

Finally, this report, combined with the knowledge that transportation costs in auto-dependent neighborhoods will only worsen with rising energy prices, reemphasizes the point that location efficiency of urban walkable neighborhoods (like many in the District), does not just reduce household costs now. The location efficiency of these neighborhoods also provides economic resilience to those households that live in them, enabling them to better accumulate wealth or weather future adversity—from a temporary rise in household costs (e.g., to assist an aging parent) to a nationwide recession.