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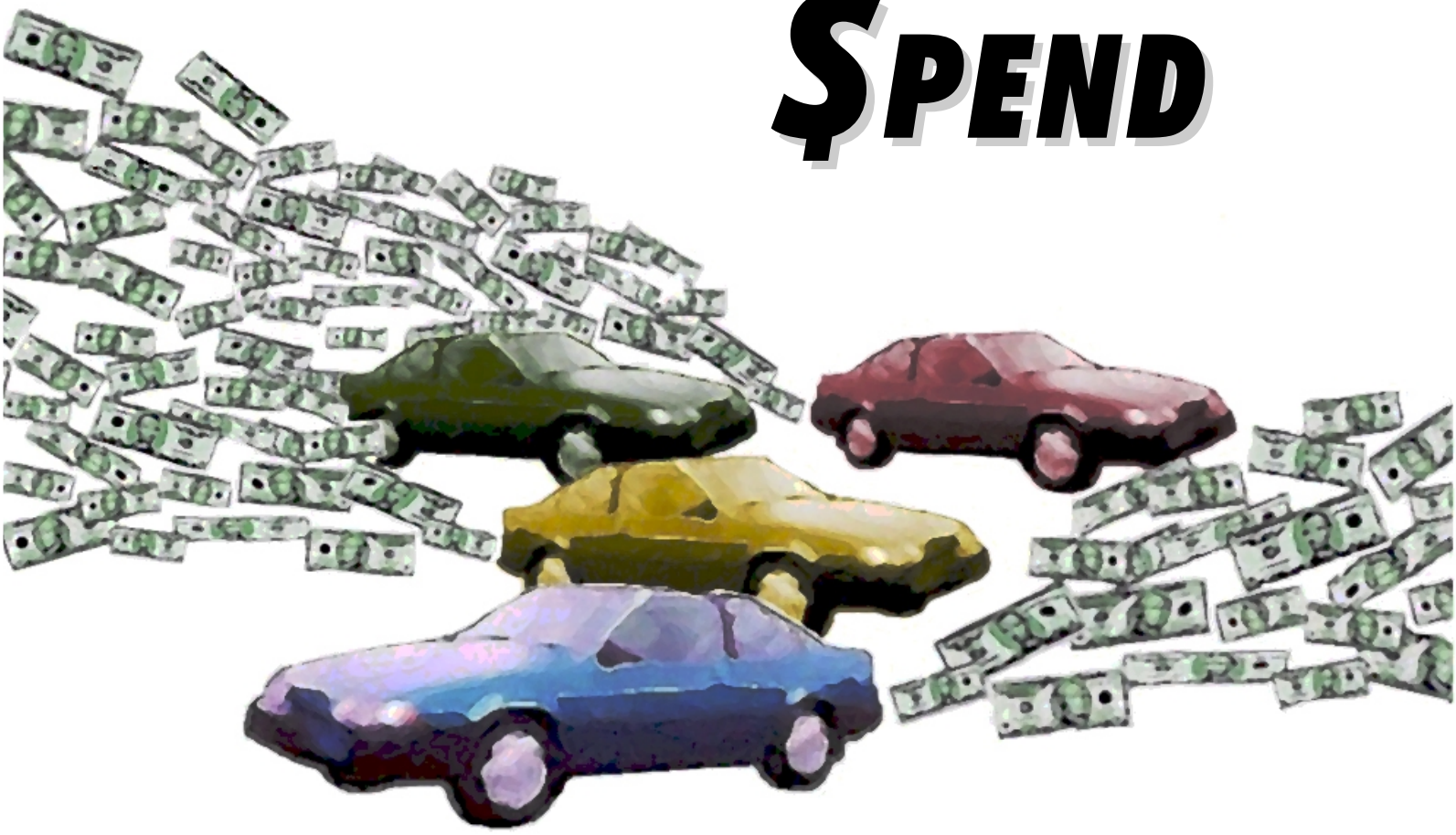

A Transportation and Quality of Life Publication

2000

Surface Transportation Policy Project
Center for Neighborhood Technology

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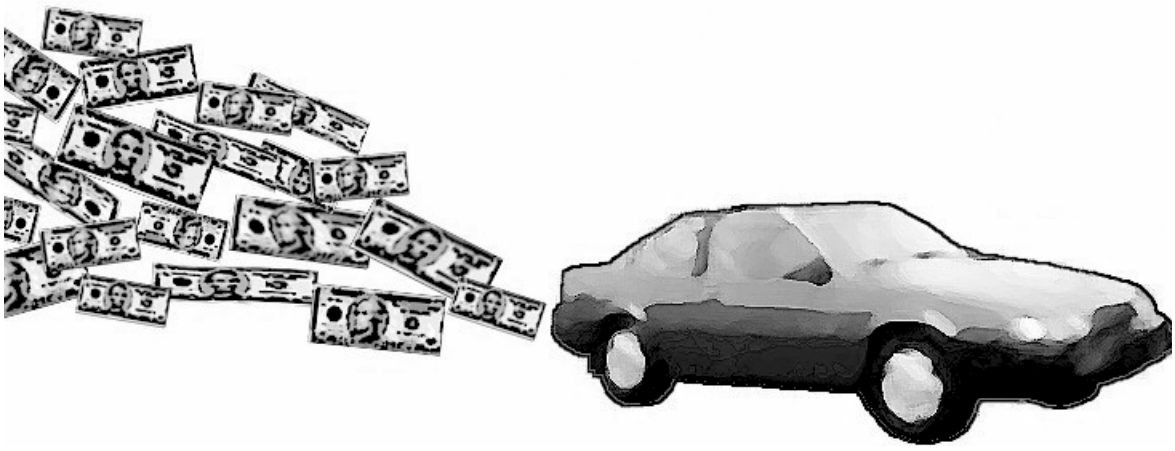

The Impact of Sprawl on Household Transportation Expenses

A TRANSPORTATION AND QUALITY OF LIFE PUBLICATION

Surface Transportation Policy Project
Center for Neighborhood Technology

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Executive Summary

Transportation is a big expense for America's families, and it is getting bigger. This study finds that a major factor driving up transportation costs is sprawling development. Sprawl makes driving the only practical form of transportation, and owning several cars per family is expensive, particularly for the poor. New research presented here shows that personal transportation costs are highest in sprawling places pursuing a highway oriented transportation strategy. Less sprawling places that offer an array of transportation choices cost families less, and the difference can be thousands of dollars each year. Better transportation and growth polices could help families spend less on transportation and direct more money to investments that build wealth, such as home ownership.

Transportation is Expensive

Most American families spend more on driving than on health care, education or food.

The high cost of housing makes headlines and dominates water-cooler conversations across the United States every day. Transportation costs do not get the same level of attention, even though for most Americans transportation is an expense second only to housing. The average American household devotes 18 cents out of every dollar it spends to getting around. In some metro areas, households are spending more on transportation than shelter. The vast majority of that spending, 98 percent, is for the purchase, operation, and maintenance of automobiles. Most American families spend more on driving than on health care, education or food. And the poorest families spend the most — sometimes more than one-third of their income goes to transportation.

For this report, the authors used several data sources, including the Consumer Expenditure Survey performed by the U.S. Bureau of Labor Statistics, to take a closer look at transportation expenses: what transportation costs, where transportation is more expensive than average, and, most importantly, what drives up transportation costs. This analysis excludes spending for air travel and ship travel.

Where Households Spend the Largest Portion of Their Budgets on Transportation

Rank	Metro Area (MSA)	Household Transportation Expenditures (Avg. 1997-1998)	Transportation as a Percent of Expenditures
1	Houston-Galveston-Brazoria, TX	$8,840	**22.1%**
2	Atlanta, GA	$8,513	**21.7%**
3	Dallas-Fort Worth, TX	$8,717	**19.7%**
4	Miami-Fort Lauderdale, FL	$6,684	**19.0%**
5	Detroit-Ann Arbor-Flint, MI	$6,710	**18.8%**
6	Minneapolis-St. Paul, MN-WI	$8,683	**18.4%**
7	Phoenix, AZ	$6,826	**18.2%**
8	Philadelphia-Wilmington-Atlantic City, PA-NJ-DE-MD	$6,904	**18.1%**
9	Kansas City, MO-KS	$6,489	**18.1%**
10	Tampa-St. Petersburg-Clearwater, FL	$5,864	**17.8%**

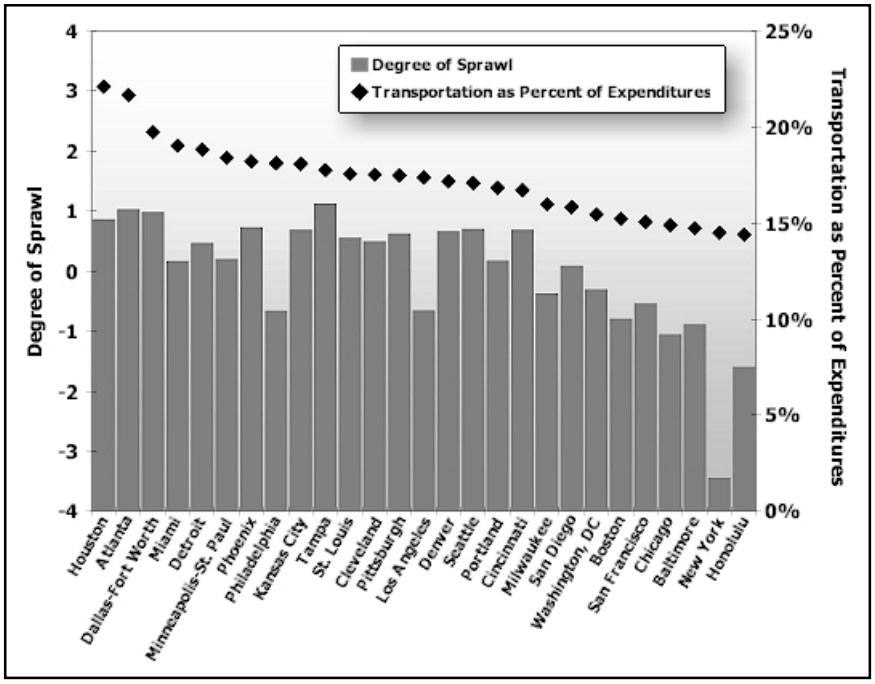
Where Transportation is Most Expensive

Consumer Expenditure Survey data show that in 1997 and 1998 households devoted the highest portion of their budget to transportation in Houston, Atlanta, Dallas-Fort Worth, Miami, and Detroit. The average Houston area household used 22 cents out of every dollar it spent on transportation, spending well over $8,800 each year to get around, or $2,528 more than the national average. The three least expensive metro areas in the survey, Honolulu, New York, and Baltimore, spent almost one-third less: Baltimore households used less than 15 cents out of every spending dollar on transportation, spending $5,236 annually.

Sprawl Drives Up Transportation Spending

An analysis of socio-economic, land use, and transportation factors in these communities finds that the most powerful source of differences in household transportation spending is the spread-out development pattern commonly called sprawl. Less sprawling places with more efficient land use tend to cost people less. In places with more characteristics of sprawl, households use more of their spending power to pay for transportation. To document this linkage, we measured sprawl through a multi-variate analysis of a composite of land use characteristics. These factors are compared in the figure to the left.

Sprawling Places Are More Expensive



Places with more sprawl factors have higher transportation expenses.
[Source: Consumer Expenditure Survey 1997-1998, and from land use measures compiled by STPP and affiliated researchers. See Appendix A, page 30 for more information.]

Altogether, 28 metro areas were studied. In the one-third of these metro areas that were found to be most sprawling, households devote 20 percent more of their spending dollar to transportation than do the one-third of metro areas with the fewest sprawl characteristics. The average American family living in a highly sprawling area pays roughly $1,300 more per year in transportation expenses. While the high price of gasoline or car insurance has been a target of consumer outrage, our analysis showed these had little effect on overall transportation expenses.

The most expensive places for transportation in the Consumer Expenditure Survey also provide little transportation choice, as measured by the ratio of transit service to roads. As shown in Figure I (page 19), places where road systems dominate have higher transportation expenses.

Wide variations are also clear within metropolitan regions. A sophisticated automobile cost model based on federal census data and state automobile records allowed us to look at differences in automobile expenses between neighborhoods within a few metropolitan areas. This analysis shows that households in some parts of a metro area spend well over

twice as much on owning and operating vehicles as households in other areas. Detailed maps of automobile costs in Chicago, San Francisco, and Los Angeles show that the higher cost areas tend to be in outlying neighborhoods where sprawling development means everything is far apart and other transportation options are few. The lower cost areas tend to be near active transit lines, where neighborhoods are walkable and destinations are close by. These differences are only partially explained by varying income levels; some of the neighborhoods with highest incomes also have the lowest transportation spending.

Households in some areas spend well over twice as much on owning and operating vehicles as households in other areas.

Fewer Choices Mean Higher Costs

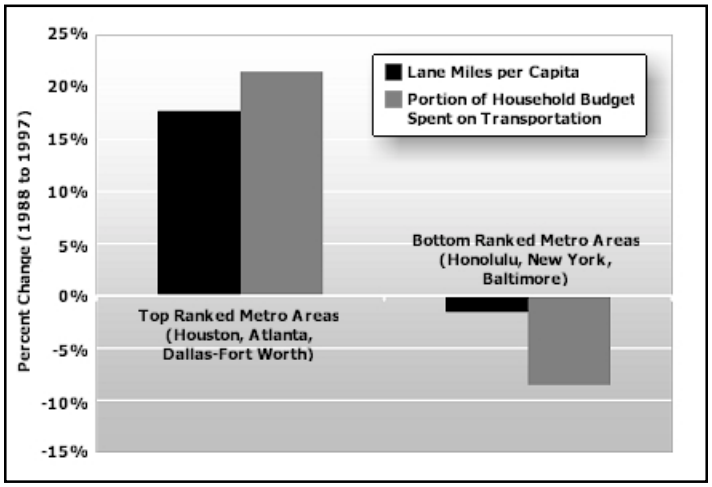
Sprawl increases costs by making automobile travel a necessity. Sheer distance often precludes the most inexpensive forms of transportation, walking or bicycling. Metropolitan areas dominated by a uniform spread of subdivisions, office parks, and strip malls are harder to serve with transit and necessitate driving between every destination.

While the government builds the roads, private individuals buy, fuel, and maintain the automobiles that are needed to drive on them. Transportation takes a big bite out of household spending as families end up owning small fleets of vehicles. These high up-front expenses make it difficult to economize on travel. According to the Federal Highway Administration, three-quarters of all automobile expenses stem from the fixed cost of simply owning a car, regardless of how much it is driven. These patterns show how government decisions about community design and transportation investments affect personal pocketbooks. Taxes are just one way government decisions cost people money. Decisions about transportation infrastructure and growth have a big effect on family budgets.

Transportation Expenses Are Rising

Government investments in road building may be contributing to an increase in transportation expenses. Between 1990 and 1998, the portion of household budgets going to transportation in the metro areas surveyed grew by an average of eight percent. Both expenses and road building grew far faster in the top ranked areas - Houston, Atlanta, and Dallas. Spending in these areas grew by an average of almost eighteen percent since 1988, while highway mileage per person increased by more than 21 percent. In the metro areas with the smallest portion of household budgets going to transportation, (Honolulu, New York, and Baltimore), the highway mileage per person dropped slightly over the decade, and the percentage of household expenses going to transportation actually fell — by almost nine percent (see figure to the right).

Added Roads, Added Costs



Road building and transportation expenses are both growing in the top-ranked metro areas in our survey, while the opposite is true in the areas at the bottom of the list.
[Source: Consumer Expenditure Survey 1986-1987 to 1996-1997, and data from the Texas Transportation Institute Annual Mobility Survey, 1999. Note: figures for lane miles per capita based on Urbanized Areas.]

High Transportation Spending Hurts Family Finances

High transportation costs can have a significant effect on families' long term financial outlook. Spending on vehicles erodes wealth, while spending in the other major household

category — housing — can build wealth. For example, over ten years, for every $10,000 invested in a home, the homeowner can get a return of over $4,730 in equity. For every $10,000 spent on an automobile, a car-owner receives equity of just $910. Automobile loans are the largest category of household debt outside of home mortgages, and such debt obligations can stand in the way of qualifying for a mortgage.

The impact of transportation expenses on housing generally goes unrecognized. New houses in new subdivisions far from central cities are seen as a "good deal," but their high transportation expenses are not accounted for. Conversely, the lower expenditures made possible by living in a convenient, walkable neighborhood with good transportation choices are not taken into account in mortgage lending decisions, putting such homes out of the reach of many buyers who could actually afford them. Taking this financial advantage into account shows that in selected cities, home buyers can expect to save between $100 and $500 per month if they choose a home in a convenient location.

This calculation has been used by the Institute for Location Efficiency to create the Location Efficient Mortgage℠ (LEM), a mortgage now offered through Fannie Mae in several U.S. cities.

Recommendations

This report shows how sprawling metro areas with limited transportation choices cost people money. In light of these findings, we make the following recommendations:

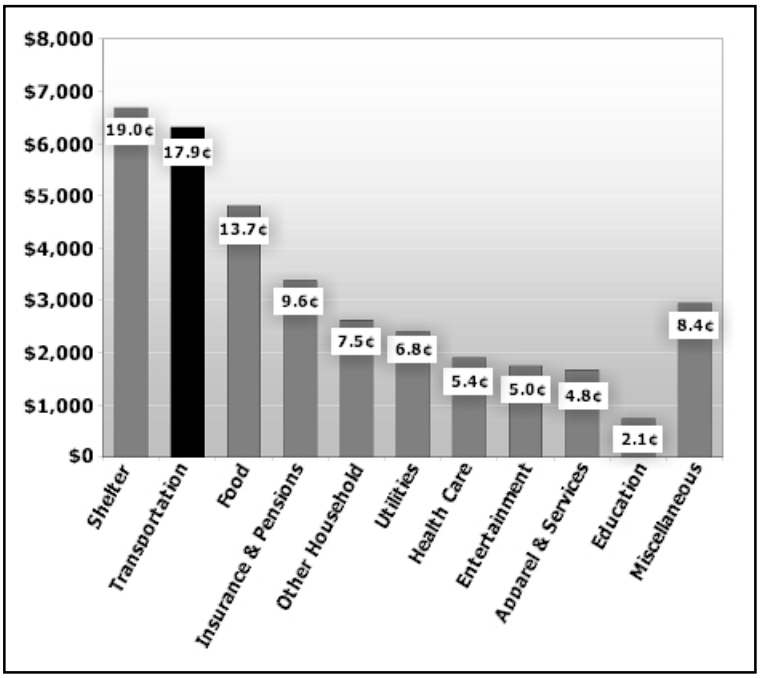
1. **Invest in Transportation Choice**
   Governments should invest in public transit, bicycle facilities, and walkable neighborhoods as strategies that can help families save money, and should stop investing in sprawl-inducing highway expansions that are shown to cost families more money
2. **Grow Smarter**
   Developers should build according to the principles of smart growth, and include a variety of affordable housing options so everyone can benefit. Cities should revise their building and zoning codes to make this easier.
3. **Offer Location Efficient Mortgages**
   Banks should offer Location-Efficient Mortgages and other programs that take into account the savings made possible by living in a transportation efficient location.
4. **Give People a Chance to Save Through Driving Less**
   Businesses and government should encourage programs that help reduce the high fixed costs of driving, such as pay-as-you-go auto insurance, and car-sharing programs.
5. **Collect Better Information**
   Federal, state, and local governments should collect and analyze more detailed data about the personal costs of transportation, including expanding the metropolitan level survey beyond the 28 areas currently surveyed.

Chapter One
TRANSPORTATION IS EXPENSIVE

Personal and public expenditures on transportation amounted to almost $805 billion in 1998.[1] The vast majority, 84 percent, came out of the pockets of individuals. Households spent more than five times as much of their own money on transportation, more than $675 billion in 1998, than the government spent on all roads, highways, and transit systems combined ($128 billion). These two figures are not independent: Government investments in transportation have a direct bearing on what families end up paying to move around their communities. In this report, we focus on personal expenditures, and on how decisions about growth and the public investment in transportation have influenced how, and how much, Americans spend on transportation each year.

Within the family budget, transportation looms large. Transportation, including the ownership and operation of vehicles and expenses for public transit, is the second largest expense category for most American households. According to the U.S. Bureau of Labor Statistics' Consumer Expenditure Survey, out of every dollar American households spend annually, almost 18 cents go to getting around in their communities. Only shelter eats up a larger chunk of expenditures (19¢), with food a distant third place (13.7¢).[2] (See Figure A)

Figure A. How Households Use Each Dollar



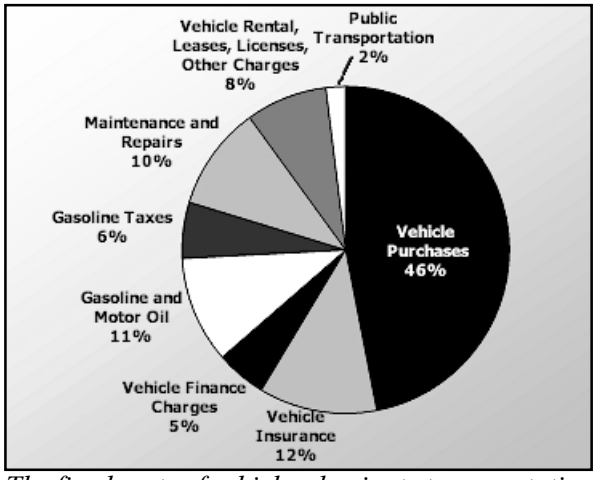
Transportation spending is second only to shelter.
[Source: Consumer Expenditure Survey 1998.]

What Households Buy with their Transportation Dollar

In 1997 and 1998, the typical American household spent an average of $6,312 out-of-pocket per year on transportation. The vast majority of that expense, almost $6,200, went towards buying, fueling, and maintaining personal cars and trucks. Vehicle purchases, both new and used, comprise 46 percent of transportation expenditures. Seventeen percent of transportation expenditures went to gasoline, motor oil, and taxes on those products. Vehicle insurance, at twelve percent, takes the next largest chunk, followed by maintenance and repairs at ten percent. In all, about 98 percent of all personal transportation expenses goes toward automobiles. The smallest piece of the pie went to public transportation, which made up just two percent of personal transportation expenditures. This analysis, which focuses on everyday travel, excludes air-fare and cruise ship expenses.

American households spend fives times more on transportation than the government spends on all highways and transit systems.

Figure B. Transportation Expenses

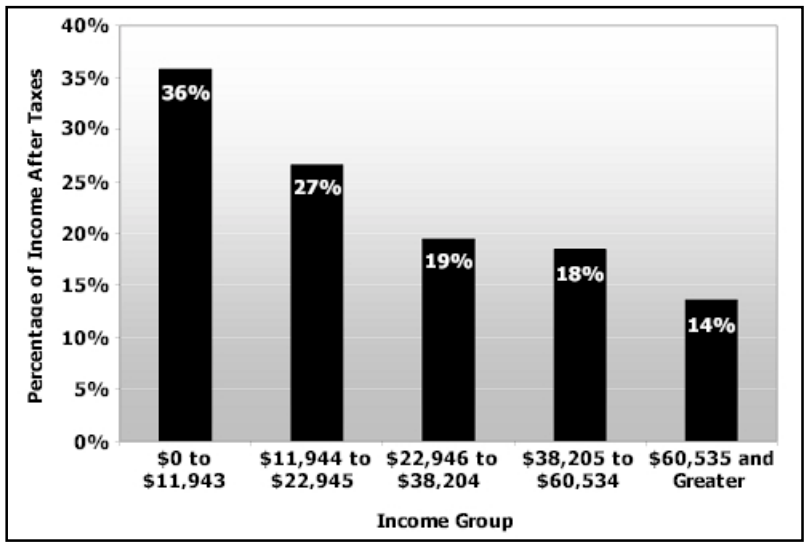


The fixed costs of vehicles dominate transportation spending.
[Source:Consumer Expenditure Survey 1998.]

Once car ownership is a necessity, it is relatively difficult to bring down transportation expenses. The costs of owning and driving a personal vehicle do vary for different car models: the American Automobile Association finds that it costs between 43.9 cents and 61.7 cents per mile, depending on car size and type, to own and operate a car.[3] But beyond this initial choice of the type of car to buy, costs are hard to control. According to the Federal Highway Administration, vehicle operation costs, which vary with the amount of driving, account for just one-quarter of total auto costs. Three-quarters of all automobile expenses stem from the fixed cost of simply owning a car. While a few places are experimenting with ways to bring down these fixed costs (see Appendix B, page 35), the need to own a car leaves many people with few ways to save.

High Transportation Costs Hit Poor Families the Hardest

Figure C. Transportation Spending by Income



The poorest Americans use the highest portion of their income on transportation.
[Source: Consumer Expenditure Survey 1998.]

Forty percent of American households spend more than one-quarter of their income on transportation, and most of that expense goes to vehicles. The Consumer Expenditure Survey shows the lower the household income, the greater the portion of income that is devoted to transportation. Households earning between $12,000 and $23,000,spend 27 cents of every dollar they earn on transportation. For the very poor, transportation costs are an even greater burden; these households spend 36 cents of every dollar they earn on transportation, most of it on vehicles. Sixty-two percent of households in this group own at least one automobile. Households in the highest income group, those making at least $60,500 per year, spend just 14 percent of their income on transportation.

Transportation Costs Are Rising

When looked at over time, the data show a disturbing trend of increasing transportation expenses. Since the early 1990's, the Consumer Expenditure Survey has shown that the portion of total spending devoted to transportation has increased steadily. During the eight-year period between 1990 and 1998, the portion of total expenditures going to transportation grew by an average of 8.1 percent in the metro areas surveyed, from 16.8 percent of expenditures to 18.2 percent. Meanwhile, the portion going to shelter also increased, but at a lower rate (6.7 percent). If this trend continues, spending on transportation could surpass spending on shelter.

In a handful of metro areas – Houston, Dallas-Fort Worth, Pittsburgh, Atlanta, St. Louis, Minneapolis-St. Paul, and Kansas City – this is already the case (see Table 1). Households in Houston, for example, spent more than $8,800 on transportation in 1998, while they spent not quite $6,500 on shelter. One might expect that this gap reflects Houston's cheap housing stock. The gap actually reflects just how expensive transportation is in Houston – Houston households spent almost 27 percent more than the national average on transportation, and only two percent less than the national average on shelter. We'll discuss why this might be the case in Chapter Three.

Table 1. Spending More on Transportation than Shelter

Metro Area (MSA)	Household Expenditures on Transportation	Household Expenditures on Shelter
Houston-Galveston-Brazoria, TX	$8,840	$6,536
Dallas-Fort Worth, TX	$8,717	$7,200
Pittsburgh, PA	$6,331	$5,329
Atlanta, GA	$8,513	$7,716
St. Louis, MO-IL	$6,489	$5,911
Kansas City, MO-KS	$6,489	$6,036
Minneapolis-St. Paul, MN-WI	$8,683	$8,135
Tampa-St. Petersburg-Clearwater, FL	$5,864	$5,761
Cleveland-Akron, OH	$6,384	$6,345

Other analysis, conducted independently, reaffirms this assertion. A recent report by the U.S. Department of Housing and Urban Development found that a six-fold increase in the amount of driving between 1950 and 1993 resulted in an increase in transportation costs in many cities, although less so in communities with strong public transit systems.[4]

How to Save: Teaching by Example

Seattle has launched a program that is paying a few families to leave their second car at home, to show the rest of the city how to save money by getting along with just one car. Under the program, "Way to Go Seattle," participating households must pledge to leave their extra car parked for six weeks, and will receive $85 a week in return for keeping a diary of the alternative ways they traveled - by bus, foot, bicycle, or taxi. The diaries will help the city craft an educational campaign to show how people can use other means of travel and save money if they get rid of their second car. For more information, visit http://www.cityofseattle.net/carsmart/waytogo.htm.

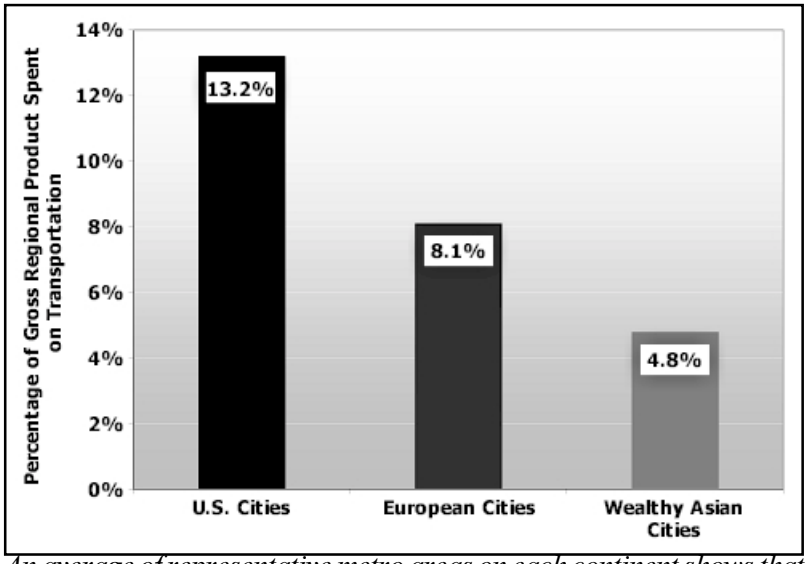
Chapter Two
WHERE YOU LIVE MATTERS

While transportation is a major expense for most American households, the cost of getting around varies dramatically depending on where you live. To understand how this works, we compared community expenditure patterns on different geographical scales. First, we compared transportation expenses in U.S. metro areas to metro areas in other countries. Then we compared different U.S. metro areas to one another; this became the centerpiece of our analysis. Finally, we looked at selected U.S. metro areas and compared transportation expenses from neighborhood to neighborhood. These three different analyses resulted in very similar conclusions.

Transportation Costs Americans More

When looked at on a global scale, differences in transportation expenditures are striking. According to data collected by researchers Peter Newman and Jeffrey Kenworthy, residents of American metro areas spend more on transportation than their counterparts in European or in developed Asian cities.[1] While data regarding household level expenditures are not available for all countries, we can get a sense of those expenditures by looking at the portion of each city's Gross Regional Product (GRP) that goes to transportation. Data for 1990 shows that in the United States, more than thirteen percent of the GRP in the thirteen cities studied was used for transportation expenses, while in Europe the portion was nearly forty percent lower, at about eight percent. In developed Asian metro areas, just five percent of GRP was used for transportation expenses. These expenses include both the personal costs of driving and taking transit, and the shared costs of running transit service.

Figure D. Americans Spend More to Get Around



An average of representative metro areas on each continent shows that U.S. metro areas use a higher portion of the GRP on transportation.
[Source: An International Sourcebook of Automobile Dependency in cities, 1960-1990.]

The Most Expensive U.S. Metropolitan Areas

Our analysis of the most recent U.S. Bureau of Labor Statistics Consumer Expenditure Survey of 28 major metro areas shows that households devote the highest portion of their household budget to transportation in Houston, Atlanta, Dallas-Fort Worth, and Miami. (See Table 2) In ranking the most expensive places for personal transportation, we used the share of total expenditures devoted to transportation as the most accurate

way to compare regions.[2] The Consumer Expenditure Survey is limited to the 28 Metropolitan Statistical Areas listed; data are not available for other metro areas.

In 1997 and 1998, the average Houston area household devoted 22 cents out of every dollar it spent annually to transportation, spending well over $8,800 per year to get around. The overwhelming majority of these expenses was for automobiles: $8,740 was spent annually on car-related expenses. Families in Atlanta spent almost 22 cents out of every dollar, while those in Dallas-Fort Worth used almost 20 cents out of every dollar to pay for transportation. The three least expensive metro areas in the survey were Baltimore, New York and Honolulu, where households used less than 15 cents of each dollar they spent for transportation, spending between $5,236 and $6,136 per year. In these areas, a majority of the expenses went for vehicles as well, but a slightly larger portion went for other modes. Transportation expenditures in the three most expensive areas were almost one-third greater than in the three least expensive areas.

Households in Houston, Atlanta, and Dallas-Fort Worth devote the highest portion of their household budgets to transportation.

Table 2. Household Spending on Transportation in 28 Metropolitan Areas

Rank	Metro Area	Household Transportation Expenditures (Avg. 1997-1998)	Transportation Spending as a Percent of Expenditures
1	Houston-Galveston-Brazoria, TX	$8,840	22.1%
2	Atlanta, GA	$8,513	21.7%
3	Dallas-Fort Worth, TX	$8,717	19.7%
4	Miami-Fort Lauderdale, FL	$6,684	19.0%
5	Detroit-Ann Arbor-Flint, MI	$6,710	18.8%
6	Minneapolis-St. Paul, MN-WI	$8,683	18.4%
7	Phoenix, AZ	$6,826	18.2%
8	Philadelphia-Wilmington-Atlantic City, PA-NJ-DE-MD	$6,904	18.1%
9	Kansas City, MO-KS	$6,489	18.1%
10	Tampa-St. Petersburg-Clearwater, FL	$5,864	17.8%
11	Anchorage, AK	$8,770	17.7%
12	St. Louis, MO-IL	$6,489	17.6%
13	Cleveland-Akron, OH	$6,384	17.5%
14	Pittsburgh, PA	$6,331	17.5%
15	Los Angeles-Riverside-Orange County, CA	$7,224	17.4%
16	Denver-Boulder-Greeley, CO	$7,361	17.2%
17	Seattle-Tacoma-Bremerton, WA	$7,387	17.1%
18	Portland-Salem, OR-WA	$6,848	16.8%
19	Cincinnati-Hamilton, OH-KY-IN	$6,145	16.7%
20	Milwaukee-Racine, WI	$5,800	16.0%
21	San Diego, CA	$6,319	15.8%
22	Washington, DC-MD-VA	$7,207	15.4%
23	Boston, MA-NH	$5,788	15.2%
24	San Francisco-Oakland-San Jose, CA	$7,150	15.1%
25	Chicago-Gary-Kenosha, IL-IN-WI	$5,436	14.9%
26	Baltimore, MD	$5,236	14.7%
27	New York-No. New Jersey-Long Island, NY-NJ-CT-PA	$5,956	14.5%
28	Honolulu, HI	$6,136	14.4%

Households in the three top ranked metro areas spent more on transportation than on shelter. Households in Houston paid $2,528 more than the national average for transportation, and paid just $145 less than the national average for housing. The relationship between housing and transportation cost is explored more fully in Chapter Four.

The Most Expensive Neighborhoods

Transportation costs also vary widely within metro areas. This can be seen most easily by looking at the biggest expense category, how much households spend on vehicles.

The costs of owning and operating a car in selected metro areas are illustrated in Figures E through G, for Chicago, Los Angeles, and San Francisco. These figures show that, on average, households in some places spend more than twice as much on owning and operating automobiles than households in other places. These differences are only partially explained by different income levels: Some of the neighborhoods with the highest incomes also have the lowest transportation spending.

These figures were calculated using vehicle ownership and usage rates per household as predicted by the Location Efficiency Value (LEV) model. The model uses a set of community characteristics to estimate how many cars an average household owns, how far that household drives, and how much that household spends on transportation.[3] To ensure the accuracy of the model, researchers compared its estimates to automobile ownership data from the Census Bureau, and odometer readings from the Illinois EPA and the California Bureau of Automotive Repair. The models explained 93 percent of the variation in both average number of vehicles owned and average number of miles driven within the area analyzed. The methodology and results were also validated by a number of peer reviewers.[4] See Chapter Four, page 23 for more on Location Efficiency.

In the Chicago region, (Figure E) households of average income in outer-ring suburbs spend more than twice as much per year, or 242 percent more, driving their cars than do families living in the city along transit lines. For example, an average family living in Chicago's Edgewater neighborhood spends $4,000 yearly on getting around, while the average family in Schaumburg, Illinois spends $6,800. In the Bay Area, residents of the North Beach neighborhood in San Francisco spend an average of just $3,800 per

Transit: Slightly Higher Taxes Result in Big Personal Savings

In metro areas with large transit systems, such as New York, families do pay higher taxes to support these systems, and some of these taxes are not counted by the Consumer Expenditure Survey as transportation expenditures. But these taxes do not come close to outweighing the almost $2,900 less that New Yorkers pay for transportation than the average Houston family.

STPP took a closer look at all public spending on transit in both New York and Houston. Public spending on transit in 1998 amounted to about $5.1 billion in New York, or $655 per household. It was just $413 million in Houston, or $250 per household. In New York, transit costs about $400 per household per year more than it does in Houston, but even after accounting for this difference, Houston families are still paying $2,500 more per year for transportation, even when the full cost of transit is included.

year on automobiles, while residents of the suburban city of Livermore spend an average of $6,300 per year.[5]

Significant differences in car costs also exist between suburbs of different kinds. Outer suburbs with limited transit service exhibit significantly higher average household car costs than suburbs closer to the urban core with good transit service and mixed-use development. These lower-cost suburbs are also places with activity centers, where shops, workplaces and other amenities are in close proximity to each other and to residential areas. The cost maps for Chicago, Los Angeles, and San Francisco do not take into account the transit expenditures of households. However, the low expense associated with transit indicates that higher transit costs would only partially offset savings from decreased auto dependence.

Results from all three levels of analysis – international, U.S. metro areas, and neighborhood to neighborhood – show that household transportation budgets vary greatly based on where a household is located. In the next chapter we'll examine the reasons for this.

Figure E. How Much Does It Cost to Drive in Chicago?

The green areas on these maps show areas in which the average household spends less on driving. The red and orange areas depict neighborhoods in which the average household typically spends more on driving.

[Source: CNT LEV Model, 1998. For more information, see Appendix A, page 30.]

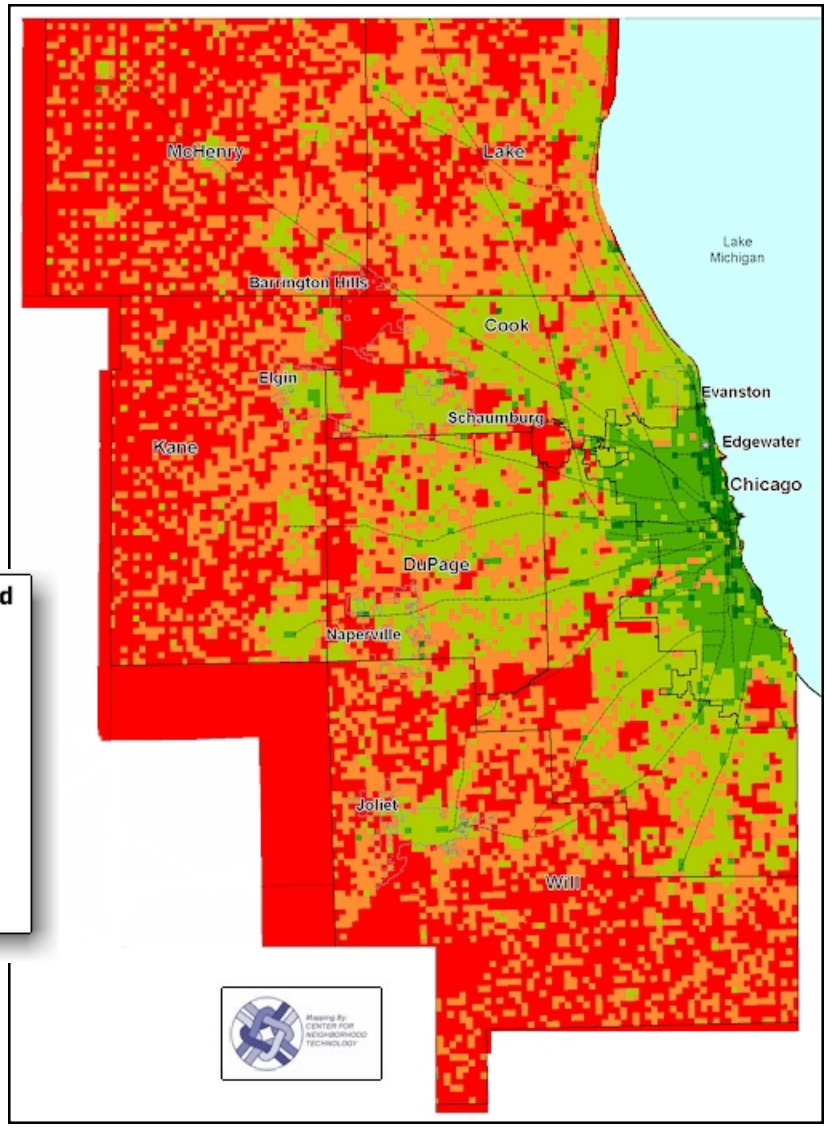
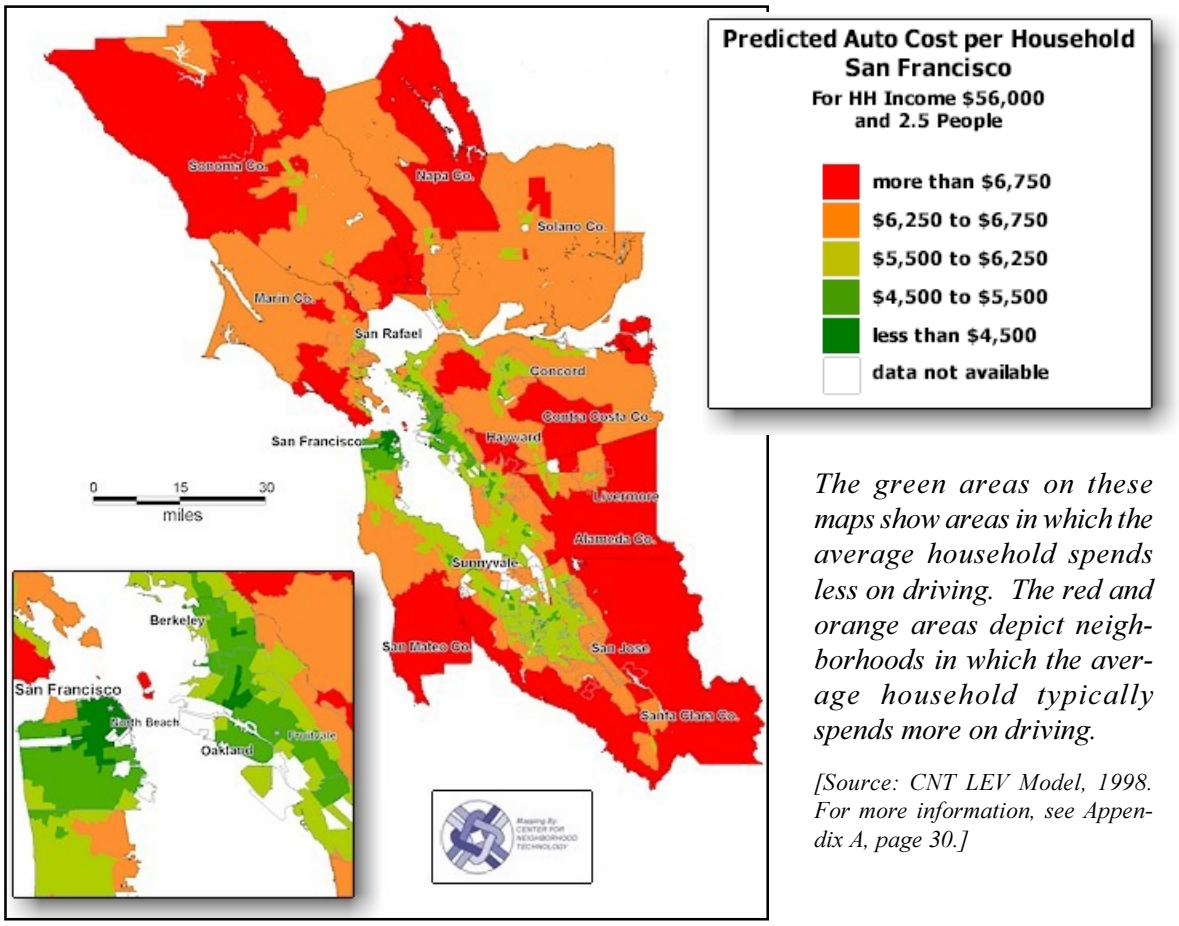


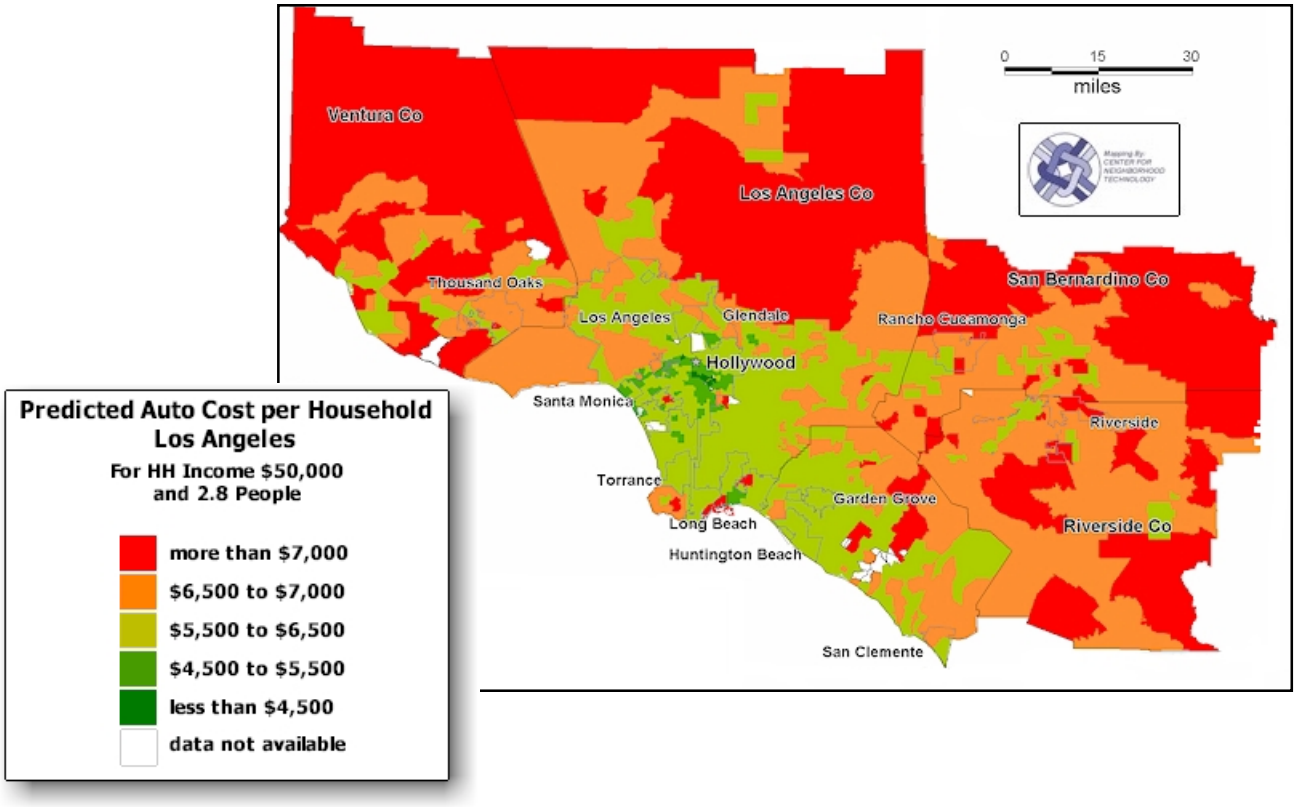
Figure F. How Much Does It Cost to Drive in the San Francisco Bay Area?



The green areas on these maps show areas in which the average household spends less on driving. The red and orange areas depict neighborhoods in which the average household typically spends more on driving.

[Source: CNT LEV Model, 1998. For more information, see Appendix A, page 30.]

Figure G. How Much Does It Cost to Drive in Los Angeles?



Chapter Three
SPRAWL MAKES TRANSPORTATION EXPENSIVE

Households in places with more characteristics of sprawl have higher transportation expenses.

What accounts for the marked differences in transportation expenditures in different places? Our analysis indicates that the biggest effect comes from the spread-out development pattern commonly called sprawl.

The relationship between sprawl and expenditures on transportation can be seen both through the statistical analysis described in the following paragraphs and by a cursory look at the country's most expensive metropolitan areas (see Table 2, page 13). Nearly all the places at the top of the list are sprawling metropolitan areas that offer their residents relatively few transportation choices. Houston, Atlanta and Phoenix in particular have been marked in recent decades by extraordinary growth in both their physical boundaries and the extent of their highway networks.

In contrast, the places where households spend the smallest portion of their budgets on transportation are more likely to have a compact form and a good public transportation system. Chicago and Boston fit this profile, as do neighborhoods such as Westwood and Belmont Shores in the Los Angeles metro area, and North Beach and Rockridge in the San Francisco metro area. We could expect similar savings in similar neighborhoods across the country, from Silver Spring, Maryland to Montclair, New Jersey.

This intuitive picture is borne out by a statistical analysis comparing household transportation expenditure data to a number of geographic and demographic factors. For this analysis, we compared data from the Consumer Expenditure Survey to socio-economic, land use, and transportation data gathered by our researchers.[1] Some factors, such as household size, were found to have no significant effect on household expenditures. Others, especially the land use pattern that constitutes sprawl, were found to have a powerful effect.

What Is Sprawl?

To determine the exact relationship between sprawl and personal costs, we compiled several measures of sprawl developed by STPP and affiliated researchers.[2] This composite measure summarizes the efficiency of land use in metropolitan areas in terms of several different indicators:

Mix of Land Uses. Sprawling metro areas tend to segregate housing, workplaces and stores from one another in single-use districts. Jobs are far away from homes, and residential neighborhoods contain housing but no jobs or stores.

Clustering and Centeredness. Sprawling metro areas spread subdivisions, office parks, and malls over the landscape in a relatively even layer. Few town centers exist that might make walking trips between various destinations feasible. Less sprawling metro areas have more concentrated downtowns as well

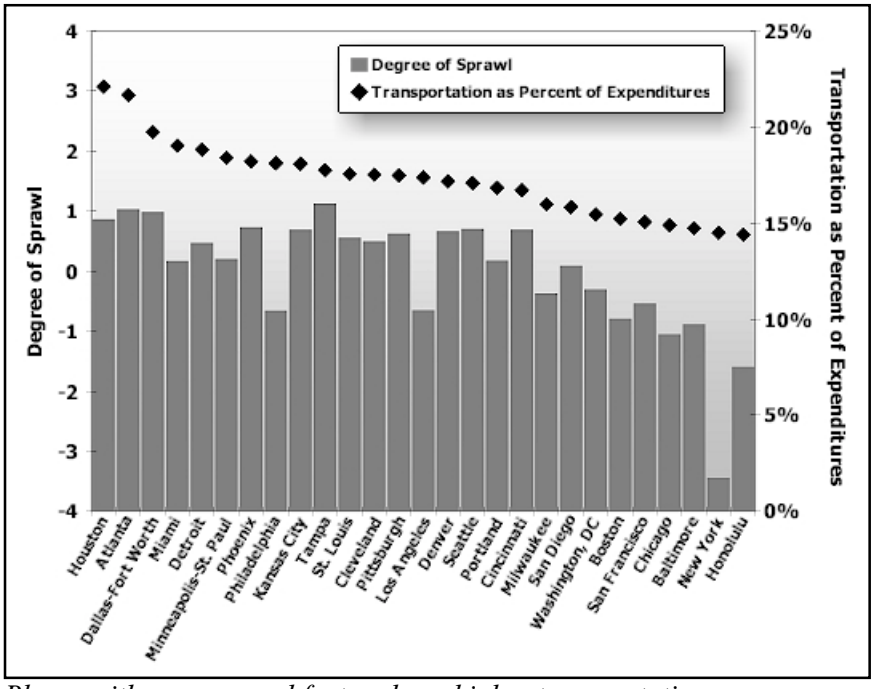
as smaller town centers where residents, employees, and shoppers can walk between various destinations.

Compactness. Sprawling metro areas generally have fewer homes per acre, and all types of development tend to be more spread out in the city, inner suburbs, and outer suburbs. This simply puts everything further apart. Compact metro areas have, on average, more development in less space.

The Impact of Sprawl

As shown in Figure H, the places with more characteristics of sprawl tend to be places where households use more of their budget to pay for transportation. Less sprawling places, those with more efficient land use, tend to have lower costs. This analysis shows almost 50 percent (R^2 = .482) of the variation in the share of household expenditures devoted to transportation is explained by sprawl. This analysis excluded Anchorage because of a lack of land-use data. For a more detailed description of the sprawl factors used, see Appendix A, page 30.

Figure H. Sprawling Places Are More Expensive



Places with more sprawl factors have higher transportation expenses.
[Sources: Consumer Expenditure Survey1997-1998, and from land use measures compiled by STPP and affiliated researchers. See Appendix A, page 30 for more information.]

The three metro areas where families use the highest portion of their spending dollar on transportation (Houston, Atlanta, and Dallas) are among the four most sprawling metro areas surveyed. The places with the lowest portion of household budgets spent on transportation, New York and Honolulu, also exhibit the least sprawling development patterns. Households in the one-third of metro areas that are the most sprawling devote about 20 percent more of their expenditures to transportation than do households in the one-third of the areas that are the least-sprawling. In the one-third of metro areas with more sprawl, households spend more on buying automobiles (36.5 percent more), buy more gasoline (13.8 percent), and spend more on miscellaneous automobile expenses (12 percent). This is not a function of higher income, these areas actually had slightly lower average incomes than less sprawling places. As a result, the average American family living in a highly sprawling area pays roughly $1,300 more per year in transportation expenses.

Why Sprawl Drives Up Costs

Greater distances between destinations and a lack of transportation choices means households have little choice but to own and operate a number of automobiles. This makes sprawl expensive.

Distance necessitated by sprawl means higher spending on gasoline and upkeep of vehicles. For example, the two metro areas ranked as the most expensive, Houston and Atlanta, both scored poorly in the sprawl measure, and are also the two metro areas where people drive the farthest each day. The average Houstonite travels 38.4 miles in a car per day, while the average Atlantan travels 36 miles by car each day.

The average American family living in a highly sprawling area pays roughly $1,300 more per year in transportation expenses.

But distance drives up costs in more significant ways. Sprawl means more trips are made by car, because long distances often make automobiles the only practical way to travel. Many studies have shown that when destinations are far apart and homes are located far from stores, businesses, schools and other destinations, more trips are made by automobile.[3] Sheer distance often precludes the most inexpensive forms of transportation, walking and bicycling. In addition, communities with a uniform spread of subdivisions, office parks, and strip malls require more driving than regions that have focused development around town centers. In such sprawling areas, even traveling across the street between stores can mean a car trip across a couple of parking lots and a major road.

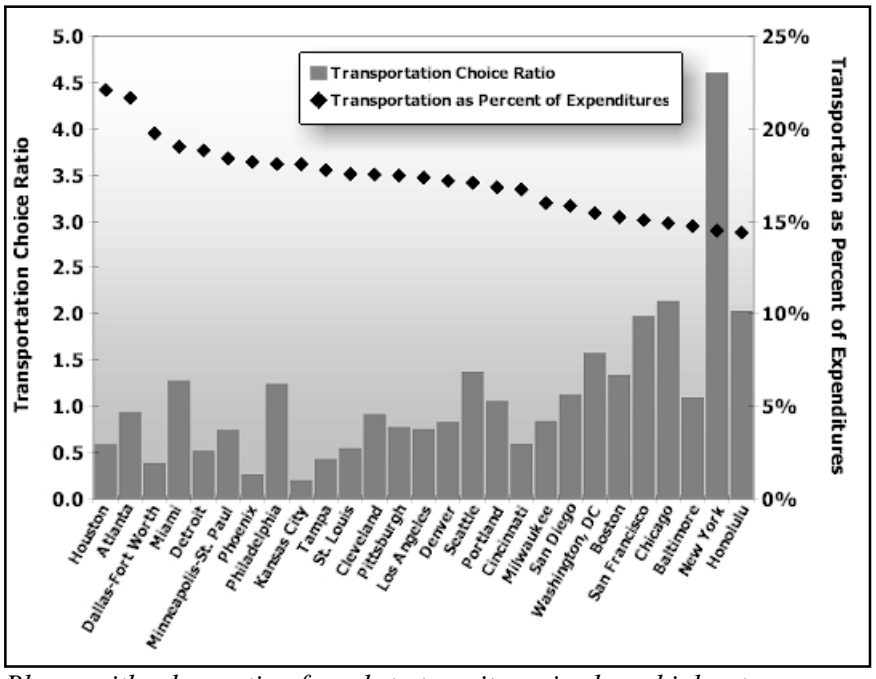
Fewer Choices Mean Higher Costs

The problems presented by distance are compounded by a lack of transportation choices in sprawling areas. Sprawling locations usually lack frequent bus service, continuous, pleasant sidewalks, or safe bike lanes.

To allow us to compare family transportation costs with the degree of transportation choice available in a given region, our research team developed a "Transportation Choice Ratio" for 27 of the metro areas covered by this study. This ratio compares the relative supply of public transportation to roads in a metropolitan area. It is calculated by dividing the miles of public transportation service per household offered over the period of one hour by the number of lane miles of freeways, expressways and principle arterials per household in that area.[4]

A low Transportation Choice Ratio means that an area's road network dwarfs its public transportation system. A high Transportation Choice Ratio means an area offers a relatively high level of transit service in relation to the size of its road network. By this measure, the Kansas City metro area offers the lowest level of transportation choice, with a ratio of just 0.2 miles of transit service per mile of roadway. Not surprisingly,

Figure I. Places Offering Few Transportation Choices Are More Expensive



Places with a low ratio of roads to transit service have higher transportation expenditures.

[Source: Consumer Expenditure Survey, 1997-1998, FHWA highway statistics, and FTA highway statistics.

New York City offers the most choice, with a ratio of about 4.6 miles of transit service provided each hour for each mile of major roadway.

The Transportation Choice Ratio is highly correlated to the sprawl measure.[5] Transit cannot serve sprawling areas effectively, and the absence of choice in sprawling areas can force families to own multiple cars, and then use their cars for almost every trip. This drives up household transportation expenditures.

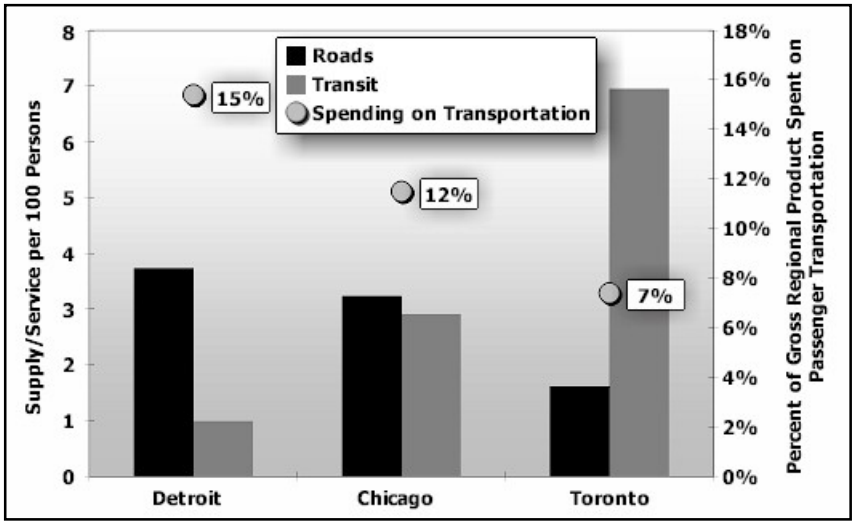
This is illustrated by a direct comparison of the Transportation Choice Ratio with the Consumer Expenditure Survey figures. Places with less choice (a low ratio) tend to be places where households spend more on transportation. (See Figure I). Even when New York, with its extraordinary transit use, is taken out of the equation, the relationship remains strong. Places with few transportation choices have higher transportation expenses.

Transportation Choice: An International Comparison

European, American, and Asian metro areas provide a very different balance of transportation options, and as shown in Chapter Two, transportation expenses vary markedly. While the median US transportation choice ratio is 0.47, European metro areas average a ratio of more than four to one, while Asian metro areas provide far more transit capacity than road capacity. In terms of the Gross Regional Product (GRP), Americans spent 38 percent more on transportation than Europeans.

Since so many factors come into play in cross-continent comparisons, we chose to also compare three metro areas that are geographically close but offer very different options to their residents: Detroit, Chicago, and Toronto, Canada, just across the border. In 1990, Detroit used fifteen percent of its GRP on transportation, while Chicago used about twelve percent, and Toronto used seven percent. Toronto's share of total expenses as measured by the GRP is less than half of Detroit's. The transportation balance[6] is markedly different in the three metro areas. Detroit provides far more roads per capita than transit, having a ratio of 0.27; Chicago has a ratio of 0.90, and Toronto shows a ratio of 4.30.

Figure J. Transportation Balance and Spending: A Regional Comparison



In the same region, transportation spending drops as the ratio of transit service to roads rises.
[Source: An International Sourcebook of Automobile Dependency in Cities, 1960-1990.]

Factors with Little Influence on Transportation Expenses

In preparing this report, the authors examined several types of expenses that generate attention when transportation costs are compared: the variation in gas taxes, gas prices and automobile insurance in different parts of the country. While these factors have gotten a lot of public attention and sparked

public outrage, they actually account for only a small portion of the variation in overall transportation expenditures across metro areas. In the fourteen metro areas with higher expenses as recorded by the Consumer Expenditure Survey, gasoline (including taxes) cost an average of eight cents *less* per gallon than in the less expensive metro areas. Among the high expense areas, average insurance costs measured on a statewide basis were almost $20 per year less than in the rest of the sample.[7] So while gas prices, gas taxes, and insurance rates have all been targets of consumer complaints and even political campaigns in recent years, they do not appear to account for the differences in transportation expenditures between metro areas.

Places with few transportation choices have higher transportation expenses.

Putting the Transportation Burden on Families

Sprawling places with a heavy reliance on roads tend to privatize transportation expenses: While the government builds the roads, private individuals buy, fuel, and maintain the automobiles that drive on them. As demonstrated in Chapter One, automobile ownership and operation are the biggest items in the household transportation budget. The popularity of large, expensive sport-utility vehicles and minivans may in part reflect the need for private cars to serve for all types of trips.

In places with a compact and convenient layout, where shops, schools and homes are closer together, there are other, less expensive, ways to get around. Walking and bicycling, both extremely inexpensive travel modes, are much more practical, and good transit tends to be more available as well. If some family members get to work or school on the train or by foot, the family may be able to own fewer cars. Or it might be more practical for the family's "second car" to be smaller, less expensive, or both.

Public transit allows individuals to pay a fare that reflects just a small share of the purchase, fueling, and maintenance costs of the buses and rail cars that they ride. While residents in these areas may pay slightly higher taxes to help pay for the transit service, this relatively minor increase in taxes is greatly outweighed by the large savings they are able to achieve in their overall transportation budget (see box, page 14). A recent economic analysis concluded that "the public realizes five dollars in cash savings for each tax dollar invested in transit services. These are the costs of owning, operating and accommodating automobiles that several million Americans avoid with the help of transit services."[8] The evidence presented in this chapter suggests that sprawl transforms driving from a convenient choice into an expensive necessity.

Road Building May Be Costing You Money

Government policies should help people get the best value for their money. But a heavy investment in road-building may increase personal costs for residents.

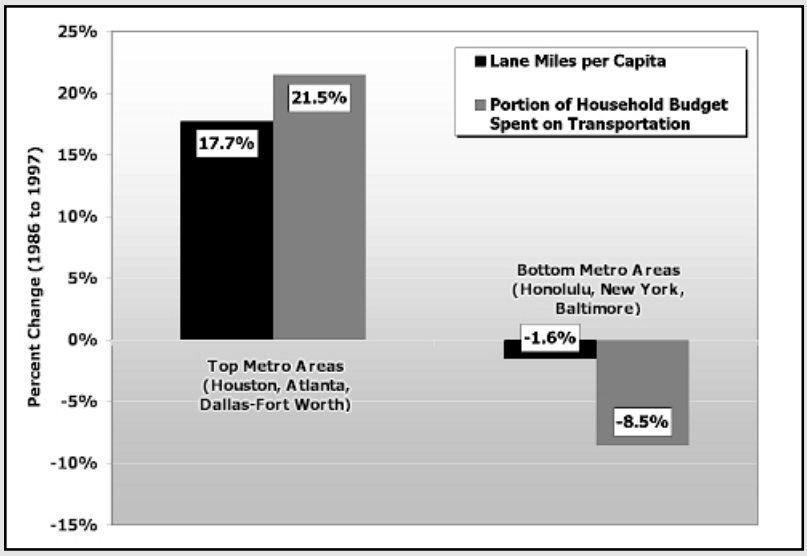
The number one metro area in the expenditure ranking, Houston, stands out in another way: of 68 urban areas nationwide surveyed by the Texas Transportation Institute, Houston is one of only two that has built roads fast enough to keep pace with the growth in traffic. Houston has used nearly $1 billion in transportation funding per year, generated by a dedicated sales tax, tolls, and a big bump-up in federal gas tax revenue, to build what is arguably the most extensive freeway/HOV system in the United States.

STPP took a closer look at the three metro areas with the highest portion of expenditures going to transportation (Houston, Atlanta, and Dallas-Fort Worth). Since 1988, those metro areas added a significant amount of roadway per person. In fact, the miles of roadway per person in those metro areas grew by almost eighteen percent during that period. At the same time, the share of personal expenditures devoted to transportation grew by more than 21 percent.

In contrast, the metro areas where residents dedicated the smallest portion of their personal expenditures to transportation (Honolulu, New York, Baltimore) actually had slightly less roadway capacity per person in 1997 than they did in 1988 (1.6 percent less). Residents of these metro areas also experienced a decline in the share of their personal expenditures going to transportation, dropping by 8.5 percent during that ten year period.

This suggests that a highway-heavy transportation system may put a financial burden on individuals who must buy and maintain vehicles in order to travel. A road-building strategy may cost residents more not only in taxes, but also in personal expenditures on transportation.

Added Roads, Added Costs



[Source: Consumer Expenditure Survey 1986-1987 to 1996-1997, and data from the Texas Transportation Institute Annual Mobility Survey, 1999. Note: figures for lane miles per capita based on Urbanized Areas.]

Chapter Four
EXPENSIVE CARS AND INCONVENIENT HOMES

Conventional wisdom dictates that people buy new houses in new subdivisions far from central cities to get more for their money. But this calculation is generally made without serious consideration of the transportation costs that come with that house. After factoring in those costs, houses in places with few transportation choices are less of a bargain, both in monetary and quality of life terms. Many families also cannot find affordable housing within a reasonable distance of their jobs, and so trade high transportation expenses and long commutes for lower housing costs. The necessity of owning a car may actually prevent lower income Americans from being able to attain home ownership. Since home purchases are all about "location," new programs that rate the "location efficiency" of a home are a promising way of taking transportation costs into account.

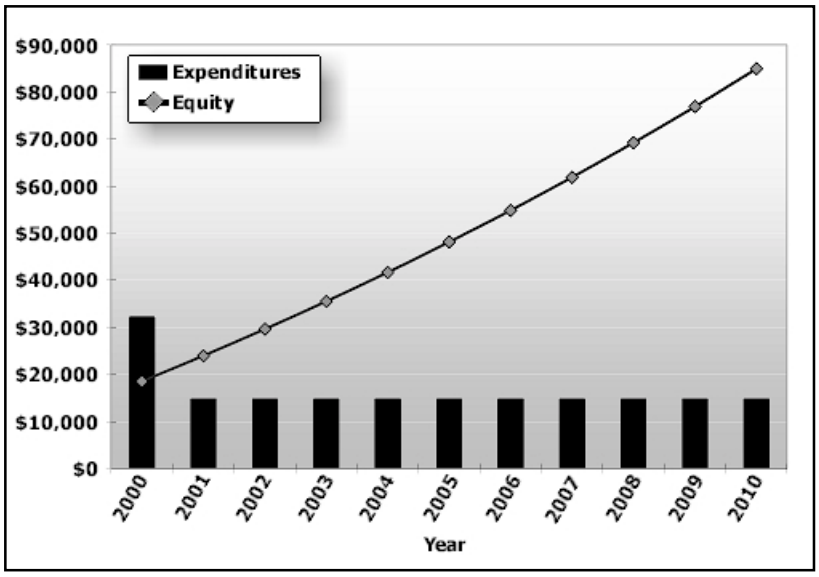
After factoring in all costs, houses located in places with few transportation choices are less of a bargain, both in monetary and quality of life terms.

Homes Are A Better Deal Than Cars

Car ownership is often presented as a lifestyle decision, not a financial one. But automobiles have a real impact on the financial well-being of families. For homeowners, spending on buying and maintaining a home (about 20 cents of each dollar spent) has long-term benefits: Mortgage interest is tax-deductible, and the value of a well-maintained home appreciates. Buying and maintaining an automobile imparts no such benefit.

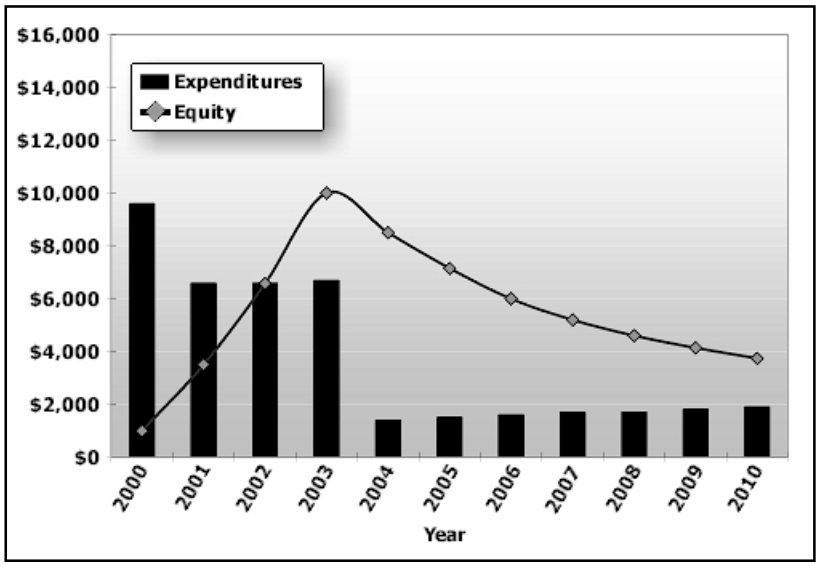
Dollar for dollar, houses are a better investment. The U.S. Department of Housing and Urban Development estimates that the typical home value grew by 3.2 percent per year in the 1990s.[1] If this rate can be sustained, in ten years, a home of average value (worth 133,000 in 1998) would be worth $189,000. Under a standard mortgage, the owner of such a home will have nearly $85,000 in equity at the end of ten years, for a total investment of $180,000 (including mortgage payments, insurance, and maintenance costs) (see Figure K). In contrast, vehicles depreciate rapidly: A new $20,000 car will lose almost 25 percent of its value in the first year, and almost 80 percent of its value over ten years (see Figure L). A car owner who invests more than $41,000 in a car (including payments, insurance and repairs) over ten years ends up with an asset worth only slightly more than $3,700.[2] Under this scenario, for every $10,000 invested in a home, the ho-

Figure K. Ten Years of Investment in a House



An initial investment in a $133,000 home, together with ongoing payments and appropriate repairs results in steadily growing equity. [Source: U.S. Department of Housing and Urban Development, FinanCenter.]

Figure L. Ten Years of Investment in an Automobile



Spending on a $20,000 new car produces little equity over time.
[Source: FinanCenter.]

meowner gets a return of over $4,730 in equity. For every $10,000 invested in an automobile, a car owner receives equity of $910. And the equation just gets better for homeowners if values continue to rise; over the life of a 30-year mortgage, a homeowner could get a return of $7,298 for every $10,000 invested.

While purchasing a suburban home reachable only by automobile can appear to be a good deal, it can have negative financial consequences if it results in higher expenditures on cars.

How Automobile Purchases Affect Home Ownership

There is evidence that the need to own automobiles makes buying a home more difficult for families. Vehicles play a large role both in the average household's expenditures and in its debt load, factors examined when home mortgage lenders assess an applicant's wealth. A family's total wealth is calculated by subtracting its total debt load from its assets. The inability to accumulate wealth, largely due to large debt loads, has been identified as the leading constraint in attaining homeownership.[3] This subject, and the effect of transportation expenditures on the working poor, will be addressed in more depth in a forthcoming paper from the Brookings Institute.

The largest category of debt outside of real estate is vehicle debt, which makes up 7.5 percent of all debt. Eighty-six percent of all families own or lease vehicles.[4] In 1999, Americans held $465.7 billion in automobile debt outstanding.[5] The Center for Neighborhood Technology has calculated that decreasing the amount of automobile debt held by families by 2.5 percent could free up enough money to cover more than a million down payments on the average first home. If used in this way, the decrease in automobile debt could increase the home ownership rate in the United States by one percent.

Families who can go from three cars to two, or two cars to one, will have more income available for mortgage payments, and more savings available for down payments. They become more attractive mortgage applicants than families with large amounts of credit outstanding and high monthly expenses.

Every $10,000 invested in a home can return $4,730. Every $10,000 spent on a car yields just $910.

However, buying fewer cars is an option only if families have other travel options. Unfortunately, the lower expenditures made possible by living in a convenient, walkable neighborhood with good transportation choices are not taken into account in mortgage lending decisions, putting these homes out of the reach of many buyers. This situation makes it difficult for potential buyers to take advantage of their ability to lower their transportation expenses.

Recognizing the Savings Available from "Location Efficiency"

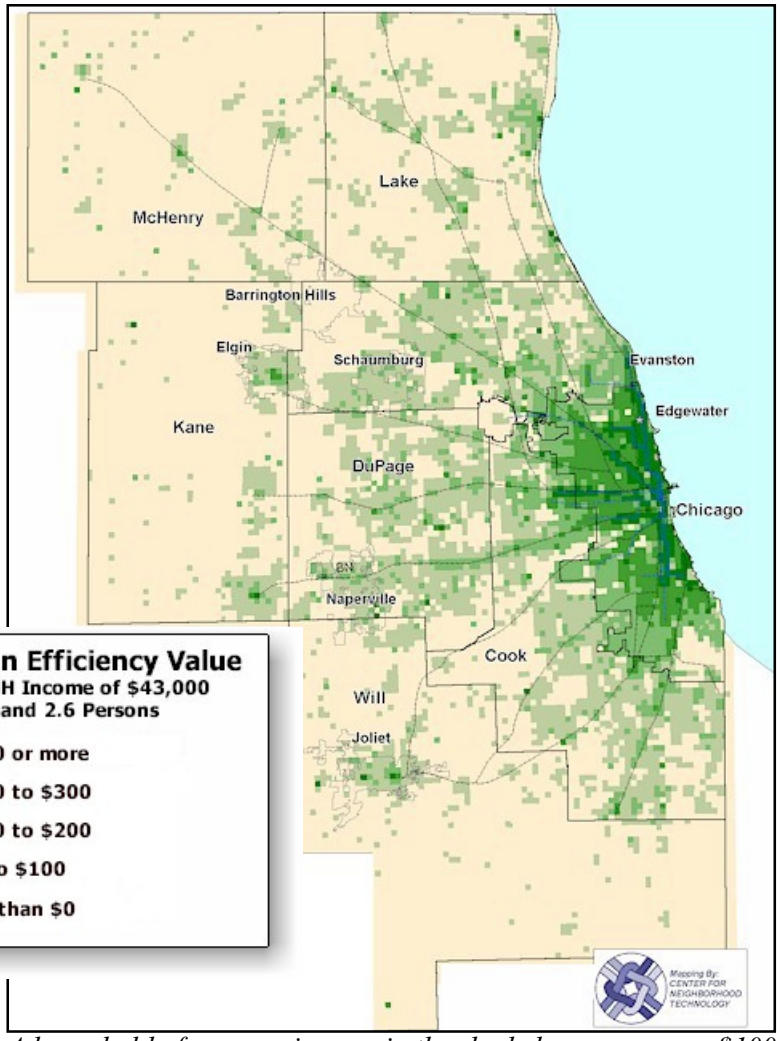
The necessity of owning a car may prevent lower income Americans from becoming homeowners.

Capturing the financial impact of location can be addressed through a market-based strategy. The Center for Neighborhood Technology, STPP, and the Natural Resources Defense Council have created a model to quantify the "Location Efficiency Value" (LEV) of areas within metropolitan regions. Just as determining a home's energy efficiency helps homebuyers gauge heating and cooling costs, "location efficiency" helps homebuyers gauge future transportation costs. In constructing the LEV model, the research team collected an unprecedented amount of data about community characteristics such as compact residential design, availability of shops and other amenities, and pedestrian friendliness. By integrating these factors with travel demand and demographic data, researchers were able to construct a model that predicts cost savings associated with land use efficiency. The Federal National Mortgage Association and local mortgage underwriters have accepted LEV as an accurate and useful indicator of household transportation savings, and with the help of the Institute of Location Efficiency, now offer Location Efficient Mortgages[SM] in certain areas.

This chapter presents a location efficiency map for Chicago; maps for Los Angeles, and San Francisco are available on-line. The LEV model shows that on average, households in places with high location efficiency in the Chicago region can spend much less on automobiles than their counterparts in places with low location efficiency – where automobiles are the only way to travel. In Chicago, savings for an average household can range from $100 to $500 per month over what similar households spend in neighborhoods with a low location efficiency.[6] These savings are calculated for the metro area's average household; in Chicago's case, the typical household has an income of $43,000 and is made up of 2.6 people. The savings are calculated by the smallest neighborhood designation available for Chicago, the Census Bureau quarter section (a half-mile square).[7]

Annually, households in places with high location efficiency can spend between $1,200 and $6,000 less on transportation than their counterparts in poorly planned developments where shops, schools, and workplaces are far away and generally accessible only by automobile. These savings can be attributed to

Figure M. Location Efficiency Value in Chicago



A household of average income in the shaded area can save $100 to $500 per month on transportation, when compared to a location with a low location efficiency.
[Source: CNT Location Efficiency Model. For more information, see Appendix A, page 30.]

the option to own fewer cars and take more trips by walking, bicycling, and using public transit.

The Location Efficient Mortgage℠

The financial benefits of location efficiency are being used in a few cities to help families get ahead. The Location Efficient Mortgage℠ (LEM) allows people looking to buy homes in location efficient communities to borrow more money because they are likely to have lower than average spending on transportation.[8] This recognition can increase credit availability by $36,000 to $48,000 for a first-time homebuyer with a household income of $50,000.[9] This has the effect of lowering the minimum annual income needed to purchase a home by as much as $5,000. If widely used, the LEM could result in a five percent increase in the home ownership rate in each region where the LEM is offered.[10] For more on LEM, visit the LEM web page at www.locationefficiency.com.

As of late 2000, potential homebuyers can apply for LEMs in Chicago, Los Angeles, the San Francisco Bay Area, and Seattle. In Chicago, the LEM is available to homebuyers in areas with Location Efficient Values greater than $100 (amounting to 59 percent of the households in the region).

Other Ways Location Efficiency Helps Homebuyers

Other programs are also taking location efficiency into account, mainly through "walk to work" loan programs. Loyola University in Chicago and the University of Cincinnati make low-interest loans for home purchase or improvement available to employees living within a certain distance from the campus.[11] Programs are targeted at lower-income workers, and strive to increase investment in the community surrounding the university. Another program in Cincinnati allows potential homeowners of any income to qualify for a bigger mortgage if they are buying within ten blocks of their downtown job. The "Downtown Walk to Work Program" was created by Fannie Mae. In Milwaukee, Wisconsin, many employers are offering $3,000 no-interest loans to help cover

How Employers Can Help Workers Save on Transportation Costs

Employers can help workers save on transportation by offering commuter benefits beyond a free parking space. A federal transit commute benefit allows employers to make a tax-free $65 a month subsidy to workers for a monthly transit pass, carpool or vanpool program (for more information, visit www.commuterchoice.com and www.wageworks.com).

Employers can also offer the option to employees to cash-in their parking space, allowing them to really save if they bike or walk to work. Some employers are simply offering cash, or even bicycles or new walking shoes, to employees who walk or bike to work. Some states are helping business offer additional benefits by offering tax credits. Maryland's Commuter Choice Tax Credit offers businesses a 50 percent tax credit for the cost of subsidizing their employees who travel to or from a worksite via bus, train, or vanpool. More information on this program can be found at www.mtamaryland.com.

A number of major private employers are beginning to offer commuter choice benefit packages, including Disney, Intel, and Kaiser-Permanente. Programs like these can help workers get the most out of their transportation dollars.

down payments and closing costs for workers who buy homes near their workplaces. The program is a collaboration between Select Milwaukee, a non-profit housing organization, Freddie Mac and the Mortgage Guaranty Insurance Corporation.[12] These programs do not directly address transportation costs, but encourage smart growth by ensuring that jobs and desirable residential communities remain neighbors. See Appendix B, page 35 for more ways employers can help employees save.

Picking a Home to Save Money on Driving

While Location Efficient Mortgages are now available in only a few places, families everywhere can still look for a home with an eye to lowering transportation costs. Asking a few of these questions can help determine whether the new home would make it easy to save money by driving less or owning fewer cars.

- Are neighborhood schools in walking distance? Can a child walk there safely?
- Are sidewalks in good repair? Are crosswalks well-marked?
- Is there a grocery store within walking distance? A dry cleaner?
- Are there neighborhood parks, basketball courts, and/or ball fields? Are there neighborhood sports leagues?
- How close is the nearest bus stop or rail station? How often does the bus or train run? How much is the fare?
- If someone in the family needed to take transit to work or school, how long would it take them? Is transit convenient for going downtown to a festival or a ball game?
- Do the main streets have bike lanes? Do the neighborhood streets provide back routes for biking to school, the park, or shops? Is work within a bikeable distance of three or four miles, and how hilly is the route?

Chapter Five
RECOMMENDATIONS

This report shows how sprawling metro areas with limited transportation choices cost families money. But there are a variety of actions that governments, the financial sector, and businesses can take to help families save on transportation, invest in better housing, and create more affordable, livable communities.

1. ***Invest in Transportation Choice.*** Governments should invest in public transit, bicycle facilities, and walkable neighborhoods as strategies that can help families save money. Conversely, governments should stop investing in sprawl-inducing roadway projects in ex-urban areas, as these kinds of projects have been shown to add to household transportation costs.

   Federal transportation dollars are available for a wide variety of transportation projects, yet most states continue to use the lion's share of this funding for roads.[1] Using more of this money, as well as state and local funds, for alternatives will help families get more for their money. Some officials are beginning to recognize this; the new DART rail line in Dallas is attracting walkable development near its stops, and DART's executive director Roger Snoble believes this could help families financially. "Instead of a family having two or three cars, it might have one car and still be able to do everything."[2] Transportation investments should be scored and ranked on a range of factors, including the effect that they have on accessibility, convenience and transportation costs for families.

2. ***Grow Smarter.*** Developers should build new communities under the principles of smart growth, and include a variety of affordable housing options.

   This analysis shows that building under the principles of smart growth can pay dividends to families by allowing them to spend less on getting around. Designing communities to be convenient and walkable, with a variety of shops and services nearby makes sense. But for lower income Americans to reap these benefits, smart growth communities must include affordable housing options.

   Cities should revise their zoning codes and street standards to permit Traditional Neighborhood Development and Transit Oriented Development to take place as a matter of right. Examples of these kinds of changes are available from the Congress for the New Urbanism at http://www.cnu.org and from the American Planning Association at http://www.planning.org, through its Growing Smart project.

3. ***Offer Location Efficient Mortgages.*** Mortgage lenders should take into account transportation expenses in counseling buyers and approving loans.

   The Location Efficient Mortgage and other programs that allow buyers to take advantage of the savings offered by living in a "location-efficient" place are

now available in very limited locations. Routine consideration of transportation expense in both rental and mortgage applications would help many more families reap the benefits of choosing to live in a convenient neighborhood. The Institute for Location Efficiency is prepared to bring the Location Efficient Mortgage to additional metropolitan areas where viable partnerships have been formed. Visit http://www.locationefficiency.com for more information.

4. ***Give People a Chance to Save through Driving Less.*** Insurance companies, auto-rental companies, and local governments should encourage programs that help reduce the high fixed costs of driving. Employers should offer employees a range of commuter benefits, including tax-free subsidized transit passes.

   Programs such as car-sharing and pay-as-you-go auto insurance are already in place in limited areas, and are helping reduce the fixed costs of driving that make it so difficult for many households to lower their transportation expenses. Wider availability of these programs would help more Americans take control of their transportation budgets. See Appendix B, page 35, "Innovations to Reduce the Fixed Costs of Driving," and "How Employers Can Help Workers Save," page 26.

5. ***Collect Better Information.*** The Bureau of Labor Statistics (BLS) and the Bureau of Transportation Statistics need to collect more detailed data about the personal costs of transportation. And these organizations should explore the relationship between transportation expenditures and housing costs. In particular, the BLS should expand the metropolitan level Consumer Expenditure Survey to at least the 100 largest metropolitan areas, and the BLS should work with the Bureau of Transportation Statistics to explore the variations in household expenditures on transportation within metropolitan areas by conducting more extensive surveys in a limited set of metropolitan areas.

Appendix A
METHODOLOGY

Chapter One: Transportation Is Expensive

The Bureau of Labor Statistics, an agency of the U.S. Department of Labor, conducts the Consumer Expenditure Survey (CES) annually. This data is available at the national, regional, and metro area level for 28 selected metro areas. At the national level, the data is further broken down by income quintile, housing tenure, age of reference person, household composition, and other factors. The most recently available data is for 1998 for national-level statistics, and 1997-1998 for regional and metro area statistics. Regional and metro area data are averaged over two years so that the sample sizes are statistically significant.

Our nationwide analysis uses aggregate data for all consumer units. The percentage of expenditures used for transportation is derived by dividing the household expenditures on transportation by total household expenditures. Likewise, expenditures on shelter, food, and other categories was calculated using the same procedure.

As reported in the CES, personal transportation spending includes expenditures on ship- and air-fare. STPP removed these expenditures as they were not reflective of day-to-day transportation. This was done by estimating the percentage of public transportation spent on ship- and air-fare, using regional figures from the CES, and applying those to national figures. At the metro area level, we used the appropriate regional figure from the CES, and applied that percentage to each metro area.

Our breakdown of transportation expenditures was calculated by dividing each transportation expenditure, such as gasoline and motor oil, by total transportation expenditures.

Expenditures by income quintile were calculated using Table 45 of the Consumer Expenditure Survey. For this analysis, we looked at transportation expenditures as a percent of *income* rather than as a percent of *expenditures*. This was done to show the different burden transportation expenses place on people of different incomes. However, since most of our analysis sought to determine locational differences, our primary measure, percent of expenditures, helps lessen regional income and income tax disparities that might skew results.

Chapter Two: Where You Live Matters

International Analysis

For our comparison of American cities to cities in other countries, we used Peter Newman and Jeffrey Kenworthy's analysis of metro areas around the world as published in An International Sourcebook of Automobile Dependence in Cities, 1960-1990 and Sustainability in Cities. Professor Newman and Professor Kenworthy were unable to calculate the percentage of consumer expenditures going to transportation, but they were able to calculate the percentage of Gross Regional Product (GRP) devoted to passenger transportation. This serves as an adequate proxy by which we can compare metro areas and continents to each other.

U.S. Metro Area Analysis

The metro area analysis of the CES data followed the parameters set forth above for the national analysis. The areas covered are U.S. Metropolitan Statistical Areas as defined by the U.S. Census Bureau. The geographical areas covered by MSAs can be found at http://www.census.gov/geo/www/mapGallery/ma_1999.pdf. Rankings are based on the portion of household expenditures that went toward transportation (excluding ship- and air-fare), rather than absolute dollars, in order to avoid income and income tax disparities in different regions. The analysis of income groups was conducted according to the portion of income after taxes that was devoted to transportation.

Intra-Metro Area Analysis

For the analysis of auto cost differences, the Center for Neighborhood Technology relied on automobile cost models developed as part of the Location Efficient Value model. Researchers at the Center for Neighborhood Technology, STPP and the Natural Resources Defense Council developed a formula for assessing the Location Efficiency Value (LEV) of a place: how expensive it is to live in a place based on a set of characteristics. By looking at the demographic characteristics (income and household size), land use (households per residential acre and households per total acre), pedestrian friendliness (existence of a block grid, access to amenities), and transit service (location and frequency) of a place, we can accurately predict how many cars a typical household in a given neighborhood would own, how far that household would drive, and how much that household would spend on transportation.[1]

Analysts began with the goal of predicting auto ownership and travel demand for each geographic unit. We performed multiple regression analyses in order to determine the relationship between the different community characteristics listed above, and household automobile ownership and use. The results in Chicago: $R^2 = 0.963$ for Vehicles per household, and $R^2 = 0.935$ for VMT/HH. The R^2 figure represents a comparison with available data sources: the 1990 Census auto ownership data and 1995-96 odometer reading data from the Illinois EPA and the California Bureau of Automotive Repair. There were 1 million odometer reading records available in Chicago, 2 million in San Francisco, and 3 million for Los Angeles. For more information about the LEV regression analysis or data sources please contact Peter Haas at the Center For Neighborhood Technology, pmh@cnt.org or (773) 278-4800.

The LEV model has proven to be a reliable way of predicting automobile ownership and use based on community characteristics, and can be used to predict automobile expenditures at the community level.

The costs of owning and operating a car, which are illustrated by maps in this report, were calculated using the vehicles and VMT per household as predicted by the LEV model. We applied the Federal Highway Administration's 1991 formula for calculating auto expenses: $2,207 per car per year + 12.7 cents per mile driven, to derive an annual cost per household.[2]

One important note is that all of the Modeled Auto Cost maps published in this report were generated using a standard income and household size. This technique allows us to see more clearly the effect of place, as opposed to income level, on car dependence and cost.

Chapter Three: Sprawl Makes Transportation Expensive

To determine what is influencing transportation expenditures, STPP and affiliated researchers compared the CES metro-level data to a wide variety of transportation, land use, and demographic data available for these metro areas. The most significant correlations are reflected in this report.

Sprawl Factors

The effect of sprawl was calculated using a composite of five land use variables[3] available in each metro area represented in the CES (except Anchorage, Alaska). We performed a bivariate correlation of this composite measure and the percent of expenditures spent on transportation. This analysis supports the hypothesis that there is a significant relationship between the land use efficiency index and the percent of expenditures devoted to transportation ($R^2 = 0.482$, significant at the 0.01 level).

The five land-use variables that comprise the composite measure are:

1) Extent of large-lot and scattered suburban development in a metropolitan area: Percentage of the metropolitan area population living in census tracts with densities of less than 750 persons per square mile, or just under one household per half acre. Census tracts with less than 100 persons per square mile were excluded to eliminate rural and largely undeveloped areas.
2) Degree of clustering in a metropolitan area: Standard deviation of population density across census tracts in a metropolitan area. Again, census tracts with less than 100 persons per square mile were excluded to eliminate rural and largely undeveloped areas.
3) The extent of medium-to-high density residential density in a metropolitan area: Percentage of the metropolitan area population living in census tracts with densities greater than 10,000 persons per square mile, or just over six households per acre of total area. In this calculation as well, census tracts with less than 100 persons per square mile were excluded. These are densities which will support transit.
4) Degree of centeredness in a metropolitan area: Population density gradient as a function of distance from the central business district of the metropolitan area's dominant city, measured by fitting a negative-exponential function to density data for census tracts.
5) Degree of mixing of six sectors—retail, personal services, entertainment, health, education, and other professional service—within subareas of a metropolitan area: An "entropy" formula, often used in travel research, was used to measure the degree of land-use mixing within traffic analysis zones.

The values of the composite sprawl measure range from -3.44 for New York to 1.12 for Tampa. The presence of negative values is a function of the analytical technique employed, factor analysis. The resulting "factor scores" have no intrinsic meaning, but are only meaningful relative to one another.

The weight assigned to each variable was derived via factor analysis with varimax rotation. The first four variables were estimated with data from the 1990 U.S. Census of Population and Housing. The last variable was estimated with data from the 1990 Census Transportation Planning Package.

In addition, to illustrate that the relationship between sprawl and spending on transportation holds true even for the transportation sub-categories, STPP performed an additional analysis. We divided the metro areas surveyed into three groups, according to their sprawl factors. For the highest and lowest groups, we calculated average household spending on car and truck purchases, gasoline, and miscellaneous automobile expenses, and compared these values.

Transportation Choice Factors

We also wanted to look at how public decisions about providing transportation choice would affect personal expenditures. For this analysis, we calculated the transportation choice ratio, which is a measure of the amount of transit service provided, relative to the amount of roadway capacity in a given metro area. Transit service was measured as the hourly revenue service miles of transit per household. In other words, the number of miles traveled by all buses, subway cars, or light-rail cars in an hour, per household. These numbers were available from the Federal Transit Administration's Transit Database. Roadway capacity was measured by the number of lane-miles of freeways, expressways, principal arterials, and Interstates per household, in a given metro area. Dividing the transit service by the roadway capacity gives the transportation choice ratio for each metro area. Anchorage, Alaska was excluded from this particular analysis because we were unable to find roadway capacity for that metro area.

The Transportation Choice Ratio was found to be highly correlated with the sprawl measure. Performing a bivariate correlation also found a significant relationship between the transportation choice ratio and the percent of expenditures spent on transportation ($R^2 = 0.336$, significant at the 0.01 level).

Using Newman and Kenworthy's international data, we found that these same patterns held true even across national boundaries. To determine if there was a relationship between transportation balance and household spending on transportation, we examined the ratio between roadway capacity and transit service for three Great Lakes metro areas: Detroit, Chicago, and Toronto. This transportation balance differs slightly from the Transportation Choice Ratio and uses data from Newman and Kenworthy's database. Comparing this transportation balance to the portion of GDP spent on transportation in these three geographically similar metro areas, demonstrates the relationship between the two variables.

Other Factors

To ensure that the differences among metro areas were not just an artifact of significantly different insurance rates or gasoline prices, STPP acquired average gasoline prices by metro area (from the BLS Consumer Price Index) and average insurance rates by state (from the National Association for Insurance Commissioners). Dividing the metro areas into two groups according to their transportation expenditure ranking, and then comparing average gasoline prices and insurance rates assured us that these factors were of minor significance.

Chapter Four: Expensive Cars and Inconvenient Homes

STPP calculated the changing "equity" of automobile ownership by estimating the approximate depreciation of a new $20,000 car. We used an average depreciation rate, as supplied by FinanCenter. Subtracting the amount owed on the car from the value of the

car, adjusted for depreciation gives the approximated equity value of the car. This same methodology was used to calculate home equity, with one major difference. Rather than depreciate, home values increase at a rate of approximately 3.2 percent per year, as estimated by the U.S. Department of Housing and Urban Development.

The location efficiency value (LEV) of a place is based on the modeled auto costs described above. In the LEV maps in this report, each range represents the amount a household saves each month by living in places with varying degrees of location efficiency. The model functions such that there is a typical household income and size, which is described in the legend for each city, and comparisons of cost are performed based on that household's description. The representative household is based on the 1997-1998 Consumer Expenditure Survey average. In Chicago, a typical household had an income of $43,000 with 2.6 members. Typical households in Los Angeles had incomes of $50,000 and 2.8 members. For the San Francisco Bay Area, the figures were an income of $56,000 with 2.5 members. As in the auto costs model, the household income and size are variables used to predict vehicle ownership and use for each place.

In the Chicago region, we applied the models at quarter section, a half-mile, by half-mile square. In the San Francisco Bay Area and Los Angeles metro area, we used Traffic Analysis Zones, a unit defined by each region's Metropolitan Planning Organization. Further information about LEVs can be found at www.locationefficiency.com.

In calculating how lower automobile debt might translate into higher home ownership, we looked at the consequences of lowering automobile credit outstanding by one percent. Here is a walk-through the calculations step-by-step.

The value of an average first home is $113,300, and a first-time homebuyer can expect to make a down payment of about 10 percent, or $11,330. One percent of automobile credit outstanding is $4.657 billion. Therefore, a 1 percent decrease in credit used for cars would be enough money to pay for 411,032 down payments of $11,330. In order to increase the homeownership rate by 1 percent, 1,050,000 households would have to buy a home, and therefore make a down payment. 2.55 percent of total automobile credit is $11.9 billion, which is enough to pay for 1.05 million down payments.

Appendix B
EXISTING PROGRAMS TO SAVE ON TRANSPORTATION COSTS

How the Location Efficient Mortgage Works

Joe and Susan Torres (a fictional couple) live in the Edgewater neighborhood on Chicago's north side. Both are in their early 30's, both have jobs downtown working for financial services firms. They have one son in their early teens who attends a local high school. They rent a somewhat crowded two-bedroom apartment for $800 per month, but would like to put that money into home ownership. They like their neighborhood very much; it has shopping and schools they can walk to, it is ethnically and racially diverse, the parks are great, and importantly, mass transit is close by and frequent, so they do not need to own a car to get to where they need to go.

They earn $58,000 per year between them, and have savings of $5,000. Real estate prices have skyrocketed, and single-family homes in their neighborhood sell for between $145,000 and $350,000; while condominiums large enough for three persons sell for around $90,000 to $150,000. Convinced of the benefits of home ownership, with the help of a home ownership counselor they search for homes and apply for financing at the local savings bank. Given their income and level of savings, they can only qualify for a $71,000 home using standard financing.

Determined to succeed, they decide to look in another neighborhood. The situation is no better in other north-side neighborhoods, so they begin looking in the nearby suburbs of Evanston, Skokie, and Morton Grove. Not until they get to the "land beyond O'Hare," in the area of Des Plaines Illinois, do prices start dropping significantly. When they arrive near Schaumburg, they are pleased to see whole fields of dream houses - new condos selling for $80,000, no down payment required, and they can get financing on the spot.

But they realize if they buy there, they will be at least thirty miles from work, without transit to get them there. The development does not include a grocery store, and the school is several miles away. They would need at least one and maybe two cars in the suburbs. The counselor back home informs them that if they take the deal, including the debt for car purchase, there is a very good chance they would be in default within two years.

The good news - the counselor sits them down with the computer, logs on to www.locationefficiency.com, and loads in the address of the home they really want in their current neighborhood, in the 5600 block of Broadway within walking distance of the Chicago Transit Authority stop, shopping and schools. The new Location Efficient Mortgage[SM] moves them in the right direction: instead of being limited to a $71,000 home, they can now afford to finance a $100,000 home. The reason is that the new kind of mortgage recognizes that the savings in the Edgewater community due to convenience and transit access is the equivalent of $378 of extra monthly income, or $4,536 per year. The smart choice for them is to buy a home in their current neighborhood,

using the LEM to reap the benefits of owning property instead of losing that value to the costs of owning one or two cars. They will also reap the benefits of avoiding losing time in long commutes, which will allow them to continue to be active in their local community organization and to be available to help their son succeed in school.

Innovations to Reduce the Fixed Costs of Driving

The costs of owning and driving a personal car or truck can be roughly divided into two categories – fixed costs and variable costs. Fixed costs are those that are not dependent on the amount of driving. They will be about the same regardless of whether you drive 1,500 or 15,000 miles per year. Examples of fixed costs are vehicle purchase, insurance, financing, and registration and taxes. In contrast, variable costs go up and down depending on the amount of driving. Gasoline and gas taxes are the most obvious variable costs, but repairs and maintenance are also included. Shifting some of the costs of driving from fixed to variable would allow people to save more money by driving less. Two noteworthy programs are attempting to reduce the fixed cost of driving.

Pay-As-You-Drive Insurance

According to the Federal Highway Administration, up to 22.8 percent of the cost of owning and operating a car goes to insurance, so shifting insurance costs from fixed to variable could really make a difference. Pay-As-You-Drive auto insurance does this by tying the cost of insurance to the number of miles driven. Insurers would use traditional factors, such as age and driving record, to charge drivers a baseline rate. But unlike conventional insurance plans, most of the charge is per mile, so the less you drive, the less you pay. At present, only one insurance company, Progressive Auto Insurance, is offering a mileage-based insurance plan through its "Autograph" plan. Currently, Autograph is available only to Houston area drivers, though the company has plans to expand the program nationally in the near future. (Litman, Todd. "Distance-based Vehicle Insurance as a TDM Strategy." *Transportation Quarterly*. v51 n3: 119-137.)

Car-Sharing

The second program, car-sharing, was born in Europe, where some 70,000 members in 500 cities belong to car-sharing organizations. Car-sharing allows many people to share a pool of vehicles, split the costs, and avoid the hassles and expense of owning and maintaining a car. Unlike traditional rental cars, car-sharing cars and trucks are parked in the neighborhood and are quick and easy to reserve and pick-up. Most operations charge members a fixed yearly fee, and then charge by the hour, by the mile, or both when a vehicle is used. Car-sharing has great potential for reducing congestion and improving air quality in cities. And, because it provides the convenience of a private auto while avoiding much of the cost of ownership and maintenance, car-sharing can also be a real money saver. In the United States, members of CarSharing Portland estimate that they save an average of $154 per month in transportation costs compared to private auto ownership. Over the course of a year, that savings adds up to more than $1,800.

Currently, car-sharing programs exist in less than a dozen cities across the country. Portland, Seattle, San Francisco, Chicago, San Diego, Honolulu and Boston all have programs in place or programs in the works, with smaller programs in Boulder, CO, Kokomo, IN, and Traverse City, MI. For more information about car-sharing, visit http://www.carsharing.net.

Endnotes

Chapter One

1. Federal Highway Administration. *Highway Statistics Series 1998, Table HF-2*. Federal Transit Administration. *National Transit Summaries and Trends*. 1998
2. Unless otherwise noted, spending figures in this report are from the 1998 Consumer Expenditure Survey conducted annually by the U.S. Bureau of Labor Statistics, an agency of the U.S. Department of Labor. Metropolitan area spending figures are averaged over a two-year time period, 1997-98.
3. AAA. *Your Driving Costs: Figuring It Out*. 2000.
4. U.S. Dept of Housing and Urban Development. *The State of the Cities 2000: Megaforces Shaping the Future of the Nation's Cities.* 2000.

Chapter Two

1. All data in this section are derived from the research of Peter Newman, Jeffrey R. Kenworthy, and Felix B. Laube, as published in Sustainability in Cities. Island Press. 1999, and An International Sourcebook of Automobile Dependence in Cities 1960-1999 University Press of Colorado. 1999.
2. We avoided using raw dollar figures, because these figures are skewed by varying income levels in the different metro areas. We also chose not to compare the percentage of *income* spent on transportation because these figures are distorted by differing tax rates. By looking at the percent of expenditures we can see how much of a household's actual spending must go to transportation.
3. Characteristics include demographic (income and household size), land use (households per residential acre and households per total acre), pedestrian friendliness (existence of a block grid, access to amenities), and transit service (location and frequency).
4. CNT, NRDC and STPP established a Research Review Committee to review and guide the development of the modeling protocol and variable definition. Review Committee members, whom hail from a variety of sectors and fields of expertise. A complete list of members is available from Ryan Tracey-Mooney at the Center For Neighborhood Technology. In addition, the Transportation Planning and Technology journal is conducting a peer review of the final LEV explanatory paper which will be published in a forthcoming report.

Chapter Three

1. Because of data limitations, our analysis was limited to 27 of the 28 major metropolitan areas in the U.S. for which the Department of Labor reports household expenditure data (Anchorage, Alaska is excluded).
2. The development of the composite sprawl measure was a collaborative effort of Professor Reid Ewing, Rutgers University; Professor John Ottensmann, Indiana University; and Professor Rolf Pendall, Cornell University. While this analysis gives us a way to compare metro areas, it is not intended as an absolute measure of sprawl. The research team continues to add variables to the database, and continues to refine the measure.
3. Reid Ewing and Robert Cervero, "Travel and the Built Environment," literature review prepared for the 2001 Annual Meeting, Transportation Research Board, Washington, D.C., 2000.
4. Transit service miles are from the National Transit Database and are measured by how many miles all the buses and trains in a region travel in one day of service. Roadway capacity was supplied by the Federal Highway Administration. While this analysis gives us a way to compare metro areas, it is not intended to be used as a measure of the correct balance of transit to roads. Such a judgement is beyond the scope of this paper.
5. A bivariate correlation analysis shows that more than 76 percent of the variation in the transportation choice ratio can be explained by the composite sprawl measure ($R^2 = 0.762$).
6. This transportation balance differs slightly from the Transportation Choice Ratio and uses data from Newman and Kenworthy's database.
7. Bureau of Labor Statistics. *Consumer Price Index*. "Average Price Data for Unleaded Regular Gasoline per Gallon." 1998. National Association of Insurance Commissioners. *State Average Expenditures & Premiums for Personal Automotive Insurance in 1998*. 2000.
8. David Lewis and Fred Laurence Williams, *Policy and Planning as Public Choice: Mass Transit in the United States.* Brookfield, VT: Ashgate Publishing Company, 1999.

Chapter Four

1. U.S. Department of Housing and Urban Development. *U.S. Housing Market Conditions Summary*. August 2000.
2. Analysis performed using software developed by FinanCenter.
3. The authors use an econometric model and the results from the 1989 Survey of Consumer Finance to evaluate the influence of income and wealth on home tenure decisions and homeownership rates. They conclude that wealth constraints have a larger effect on both outcomes. Megbolugbe Linneman, Wachter and Cho. "Do Borrowing Constraints Change U.S. Homeownership Rates?" *Journal of Housing Economics* 6, 318-333 (1997).
4. "Recent Changes in U.S. Family Finances: Results from the 1998 Survey of Consumer Finances." *Federal Reserve Bulletin*. January 2000, 15, 24.
5. Seasonally Adjusted. Council of Economic Advisers. *Economic Indicators*. June 1999. Source of data: Federal Reserve Board of Governors. In 1995, total automobile consumer credit outstanding was $364.2 billion, while total personal consumption expenditures for user-operated transportation were $514.2 billion. Council of Economic Advisors. *Economic Indicators*. June 1999. Bureau of Economic Analysis data cited in American Automobile Manufacturers Association's *Motor Vehicle Facts & Figures.* 1996.
6. Analysis done by Peter Haas and Scott Bernstein of the Center for Neighborhood Technology, 1999.
7. In Los Angeles and San Francisco, the unit of measurement was Traffic Analysis Zones. TAZs are often equivalent to census tracts: they are based on population and so are smaller in dense cities and larger in suburban areas.
8. For conventional mortgages, the qualifying ratio, (PITI+debt)/monthly income, must be less than or equal to 35 percent of the home purchase price. The LEM increases the approvable ratio to 45 percent and accounts for the LEV: (PITI+debt-LEV)/monthly income, must be less than or equal to 45 percent of the purchase price. The LEM program also decreases the down payment to three percent of the purchase price.
9. LEM calculator available at http://www.locationefficiency.com
10. Estimates of homeownership potential based on GIS analysis by Scott Bernstein, Peter Haas, and James Hoeveler at the Center for Neighborhood Technology, 1999.
11. For more information, visit http://www.luc.edu/info/walktowork.html or http://www.uc.edu/info-services/walkwork.htm
12. Luann Lanke, "Select Milwaukee joins MGIC, Freddie Mac to boost home ownership," *Milwaukee Business Journal*, July 28, 1997. Article available at http://www.bizjournals.com/milwaukee/stories/1997/07/28/focus1.html

Chapter Five

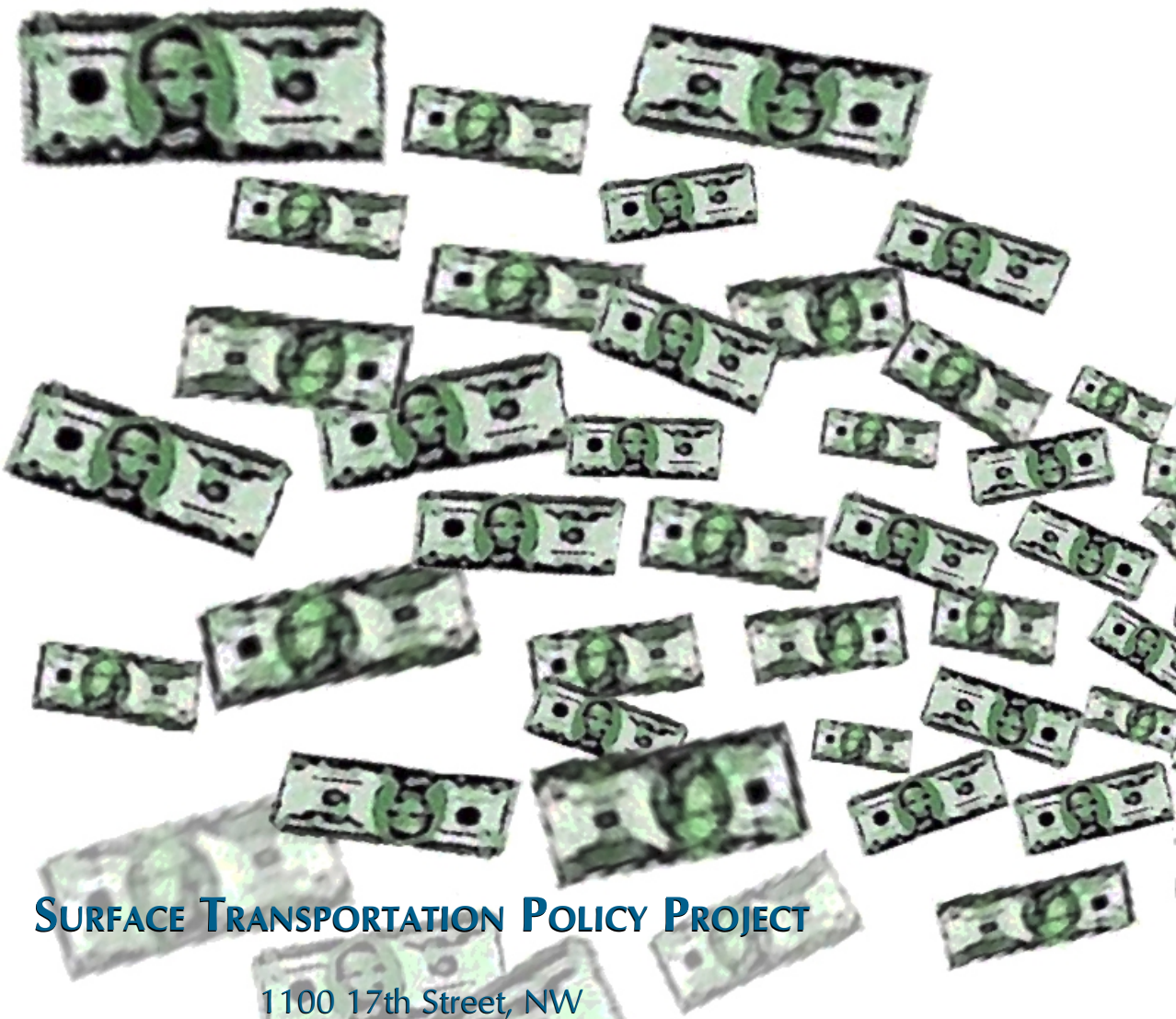
1. Surface Transportation Policy Project, *Changing Direction: Federal Transportation Spending in the 1990s*. March 2000. Report available at http://www.transact.org
2. Neal Peirce. "Designing a Transit Future — Is the Light Green?" September 24, 2000.

Methodology

1. The data for the regression analyses was collected from the Census Bureau, local transit agencies and metropolitan planning associations.
2. FHWA. "Cost of Owning and Operating Automobiles, Vans and Light Trucks." 1991. In 1991 dollars, does not include expenses for parking or tickets.
3. The development of the composite sprawl measure was a collaborative effort of Professor Reid Ewing, Rutgers University; Professor John Ottensmann, Indiana University; and Professor Rolf Pendall, Cornell University.

Notes

Notes



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