

Transportation Affordability

Evaluation and Improvement Strategies

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Walking, cycling and public transit are affordable transport modes. Compact, mixed use development increases affordability by reducing travel distances and improving mobility options.

Abstract

Transportation affordability refers to the financial burden households bear in purchasing transportation services, particularly those required to access basic goods and activities (healthcare, shopping, school, work and social activities). This generally means that households spend less than 20% of their budgets on transport, or less than 45% on transport and housing combined. Several factors can affect affordability including people's travel demands, the quality and price of transport options, land use accessibility, and housing affordability. Surveys indicate that transport system users consider affordability an important planning objective, but conventional transport planning tends to give little consideration to affordability and considers a limited set of transportation costs and cost saving strategies. More comprehensive analysis can provide better guidance for incorporating affordability as a transport planning objective. Some transportation affordability strategies are economic transfers that shift costs to other economic sectors. Strategies that improve affordable modes (walking, cycling and public transport) tend to provide co-benefits and so tend to maximize overall benefits.

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*The difference between a little money and an enormous amount of money is very slight,
but the difference between a little money and no money at all is enormous.*

- Dolly Levi, in *Hello Dolly*

Executive Summary

Transportation affordability refers to the financial burden households bear in purchasing transportation services, particularly those required to access basic goods and activities (healthcare, shopping, school, work and social activities). This generally means that households, including those with low incomes, can spend less than 20% of their budgets on transport, or less than 45% on transport and housing combined, in recognition that households often make trade-offs between these costs and overall affordability does not really increase if affordable transportation requires unaffordable housing, or vice versa. Increased affordability reduces household financial stress and increases freedom, equivalent to increased incomes. Surveys indicate that transport system users consider affordability an important planning objective.

Various data are available for evaluating transportation cost burdens. In modern, industrialized economies the portion of household budgets devoted to transportation typically varies from 10-20%, depending on various factors including employment (commuters tend to spend more on transportation than people who don't commute), income (lower-income households tend to spend less in total but more as a portion of income than higher income households), vehicle ownership (vehicle owning households tend to spend a greater portion of income than zero-vehicle households), geography (suburban and rural households spend more than urban households) and the quality of local transportation options (residents of neighborhoods with better mobility options tend to spend less than in automobile-dependent communities).

Conventional transportation planning generally gives little consideration to affordability. If considered at all, it is usually evaluated based on vehicle operating costs and transit fares although these are a minor portion of total transport costs. The largest portion of vehicle expenses are fixed costs, including depreciation, financing, insurance, registration fees, maintenance and residential parking, so the most effective transportation affordability strategies tend to reduce these costs, by converting fixed vehicle costs into variable costs, or by reducing the number of vehicles households must own to meet their access needs. Conventional planning tends to evaluate transport system performance based primarily on travel speeds, which favors faster but more expensive modes, such as automobile travel, over slower but more affordable modes such as walking, cycling and public transit. This emphasis on speed tends to be a major obstacle to increasing transport affordability.

It is important to use comprehensive analysis when evaluating affordability. Some transportation cost reduction strategies are *economic transfers*, they shift costs to other economic sectors. For example, roads and parking facilities are costly to build and maintain; they can be financed either directly through user fees such as fuel taxes, road tolls and parking fees, or indirectly through general taxes and rents. Indirect financing makes driving more affordable but increases other costs: it increases general taxes and rents; it induces additional vehicle travel which increases traffic congestion, facility costs, accident and pollution costs; and it tends to reduce the quality of affordable modes, since wider roads and increased vehicle traffic tend to degrade walking and cycling conditions, and by reducing public transit demand tend to reduce transit service. All of these impacts should be considered when evaluating transportation affordability.

More comprehensive evaluation tends to favor affordability strategies that reduce total transportation costs by:

- Improving resource-efficient transport modes, including walking, cycling, public transit, taxi and delivery services.
- Encouraging more accessible development, for example, by creating more compact, mixed communities, and increasing the supply of affordable-accessible housing (more affordable housing in accessible, multi-modal neighborhoods).
- Improving vehicle rental options, such as carsharing, so it is easier to occasionally use an automobile without owning it.
- More efficient pricing, so consumers have greater financial incentives to choose cheaper transport options, for example, with *parking cash out* (commuters who are offered a parking subsidy can choose instead to receive the cash equivalent if they use an alternative mode), unbundled parking (parking is rented separately from building space, so residents save if they don't own a motor vehicle) and *distance-based vehicle insurance and registration fees* (motorists save if they reduce their annual vehicle mileage).

By reducing total transportation costs these strategies tend to help achieve other planning objectives, including congestion reductions, road and parking facility cost savings, accident and pollution reductions, and so are *win-win* transportation solutions.

No single strategy can increase transportation affordability for all transport system users. The following strategies can help achieve this objective:

- Recognize transportation affordability as an important planning goal, of equal or greater importance than increasing travel speed to many transport system users.
- Evaluate ways that common planning decisions (roadway expansion, parking requirements in zoning codes, the location of public facilities such as schools) affect transport and housing affordability.
- Support affordable modes (walking, cycling and public transit), for example, by applying complete streets policies which insure that roadways accommodate diverse modes, users and uses.
- Support vehicle rental services, such as carsharing, which reduce the need to own a vehicle for occasional use, and pricing reforms such as distance-based vehicle insurance and registration fees, which give motorists a new opportunity to save money when they reduce their annual vehicle travel.
- Support smart growth (compact, mixed, multi-modal development) and transit-oriented development which reduce the distances that people must travel to reach services and activities, and improves their travel options.
- Reduce or eliminate parking requirements, and encourage parking unbundling (parking is rented separately from building space), particularly for lower-priced housing, so residents are not forced to pay for parking they do not need.
- Encourage stores to offer delivery services.

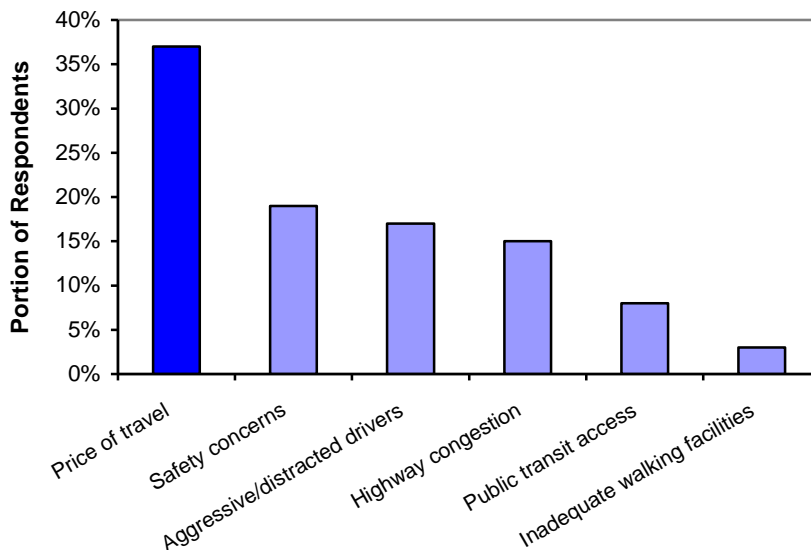
“Annual income twenty pounds, annual expenditure nineteen six, result happiness. Annual income twenty pounds, annual expenditure twenty pound ought and six, result misery.”
- Charles Dickens (1849), *David Copperfield*

Introduction

Entertainer Will Rogers once observed that Americans are the first people to drive cars to the poorhouse. This is ironic because automobiles are generally associated with affluence, but also tragic because in practice many lower income households are financially stressed by excessive transportation cost burdens. This harms them directly, reducing their ability to purchase essential goods such as medicine and healthy food, and it can contribute to larger financial problems such as home foreclosures.

This is an important planning issue. Transport system users are concerned about transportation inaffordability. For example, 2009 *National Household Travel Survey* respondents ranked “Price of Travel” as by far the most important of six transport planning issues, as indicated in Figure 1.

Figure 1 Transportation Issues Ratings (Mattson 2012)

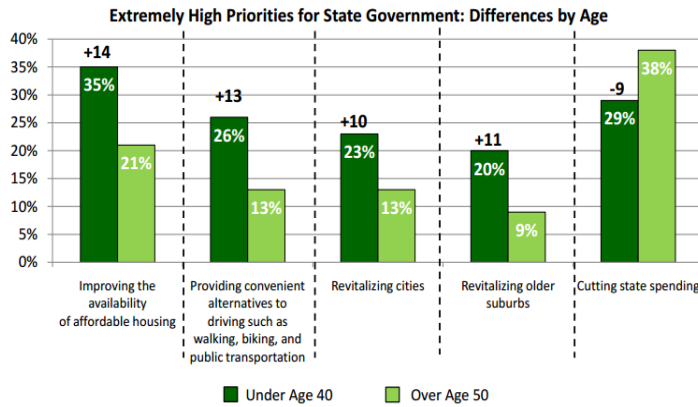


National Household Travel Survey respondents ranked “Price of Travel” as the most important of six transport issues considered, indicating that affordability is an important concern to transport system users.

Common planning decisions such as roadway design, parking requirements, and the location of public facilities such as schools and hospitals, affect transportation affordability by influencing the quality of lower-cost transport options available and the distances people must travel to reach destinations. Yet, affordability is seldom an explicit transportation planning objective. If considered at all, it is usually evaluated based on fuel prices or transit fares, although these represent a minor portion of total transportation costs. More comprehensive evaluation is needed to understand how planning decisions affect overall affordability.

Surveys indicate that many residents want public policies that increase affordable housing and mobility options (NAR 2013).

Figure 2 Community Preference Generation Gap (NAR 2013)



The 2013 National Community Preference Survey indicates that younger Americans (under 40 years of age) place higher priority on affordable housing, alternatives to driving, and urban/suburban revitalization than older people.

Here are some issues INSERT STATE will be facing over the next few years. For each one please indicate how much of a priority it should be for your state to address: Should it be an extremely high priority, a high priority, a middle priority, a low priority, or an extremely low priority for your state government?



Slide 47



This report investigates these issues. It defines transportation affordability, discusses ways to measure it, and recommends policies and planning strategies for achieving affordability objectives.

Defining and Measuring Transportation Affordability

Affordability refers to households' ability to purchase basic (or *essential*) goods and services. *Transportation affordability* refers to the financial burden households bear in purchasing transportation services, particularly those required to access *basic* (also called *essential*) goods and activities such as healthcare, shopping, school, work and social activities. Since affordability refers to household's *ability* to save money, it is particularly evident in the expenditure patterns of lower-income household, and their response to financial shocks such as reduced income or new cost burdens; for example, public transit services tend to provide affordability because they provide a fallback option to lower-income commuters when their vehicles are unavailable. Although cost savings may benefit all income classes (even affluent travelers appreciate cheaper fuel for their limousines and discounts on first-class air fares), only savings for lower-income households can be considered to increase affordability.

Many experts define affordability as households being able spend less than 35% of their budgets on housing (including rents or mortgages, property taxes, insurance and basic utilities), 20% of their budgets on transport, or less than 45% on transport and housing combined, in recognition that households often make trade-offs between these costs and overall affordability does not really increase if affordable transportation requires unaffordable housing, or vice versa (CTOD and CNT 2006). Higher spending levels do not necessarily indicate a problem: some households willingly devote more than 20% of their budgets to transport, for example, because they enjoy recreational travel or collect vehicles as a hobby, or if higher transport costs provide offsetting savings such as low housing cost. Affordability can therefore be evaluated based on consumers' ability to save money if desired, which is sometimes called *option value* (DfT 2006; Litman 2001).

Transportation cost data are available from several sources. Automobile associations publish vehicle cost estimates (AAA 2013; CAA 2013), but these reflect newish vehicles (the first four or five years of vehicles' operating life) with full insurance, which exaggerates costs compared with actual fleet averages. For example, the American Automobile Association estimates that owning and operating a medium-size sedan driven 10,000 miles costs about \$7,800, nearly twice the \$4,094 reported in consumer expenditure surveys (BLS 2012; Stats Canada 2014). Table 1 summarizes results of such a survey. These data sources usually ignore parking, toll and citation costs, so actual vehicle costs are probably 5-15% higher than these published estimates.

Table 1 2011 U.S. Transport Expenditures by Income Quintile (BLS 2012)

	Average	Lowest	Second	Third	Fourth	Fifth
After tax income	\$61,673	\$10,074	\$27,230	\$45,563	\$72,169	\$153,326
Expenditures	\$49,705	\$22,001	\$32,092	\$42,403	\$57,460	\$94,551
Persons	2.5	1.7	2.2	2.6	2.8	3.2
Vehicles	1.9	1.0	1.5	1.9	2.3	2.8
Owens at least one vehicle	0.88	0.65	0.89	0.94	0.96	0.98
Annual vehicle-miles driven ¹	15,085	6,972	11,256	15,307	18,722	23,142
Vehicle purchases	\$2,669	\$827	\$1,358	\$2,208	\$3,392	\$5,557
Vehicle rental, leases and fees	\$433	\$139	\$240	\$363	\$466	\$956
Vehicle finance charges	\$233	\$45	\$119	\$228	\$325	\$447
Maintenance and repairs	\$805	\$315	\$526	\$739	\$1,017	\$1,427
Vehicle insurance	\$983	\$522	\$714	\$992	\$1,236	\$1,451
Gasoline and motor oil	\$2,655	\$1,227	\$1,981	\$2,694	\$3,295	\$4,073
<i>Total vehicle expenses</i>	<i>\$7,778</i>	<i>\$3,075</i>	<i>\$4,938</i>	<i>\$7,224</i>	<i>\$9,731</i>	<i>\$13,911</i>
<i>Expenses per vehicle</i>	<i>\$4,094</i>	<i>\$3,075</i>	<i>\$3,292</i>	<i>\$3,802</i>	<i>\$4,231</i>	<i>\$4,961</i>
<i>Average cost per vehicle-mile</i>	<i>\$0.52</i>	<i>\$0.44</i>	<i>\$0.44</i>	<i>\$0.47</i>	<i>\$0.52</i>	<i>\$0.60</i>
Public transportation	\$516	\$182	\$204	\$367	\$475	\$1,352
<i>Total Transportation expenses</i>	<i>\$8,294</i>	<i>\$3,257</i>	<i>\$5,142</i>	<i>\$7,591</i>	<i>\$10,206</i>	<i>\$15,263</i>

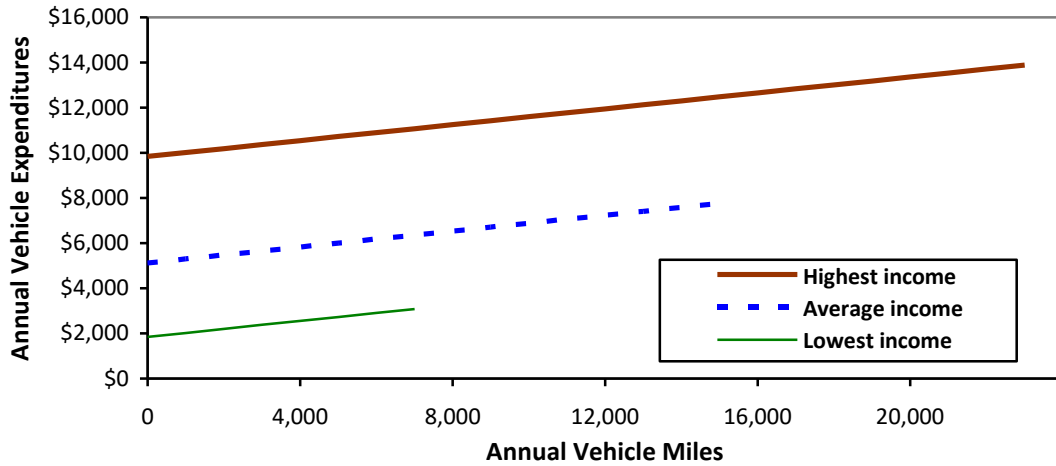
This table summarizes household transportation expenditures by income quintile (fifth of households)

Figure 3 illustrates average vehicle expenditures and mileage for high-, middle- and low-income classes. The lowest income class spends \$1,848 in fixed costs and 17.6¢ per mile to drive approximately 7,000 annual miles, while the highest income class spends \$9,838 in fixed costs plus 17.6¢ per mile to drive approximately 23,000 annual miles.² As a result, vehicle mileage reductions generally provide relatively small financial savings; for example, a 20% reduction, from 15,085 to 12,068 annual miles only saves about \$530 dollars in operating costs, a 7% reduction in total costs.

¹ Based on fuel expenditures, assuming \$3.52/gallon fuel prices and 20 averages miles per gallon.

² This analysis classifies all expenditures besides fuel and oil as “fixed costs,” although some are partly variable since increased annual vehicle travel increases depreciation and repair costs, and sometimes insurance premiums, as discussed in “Vehicle Costs,” Litman (2009).

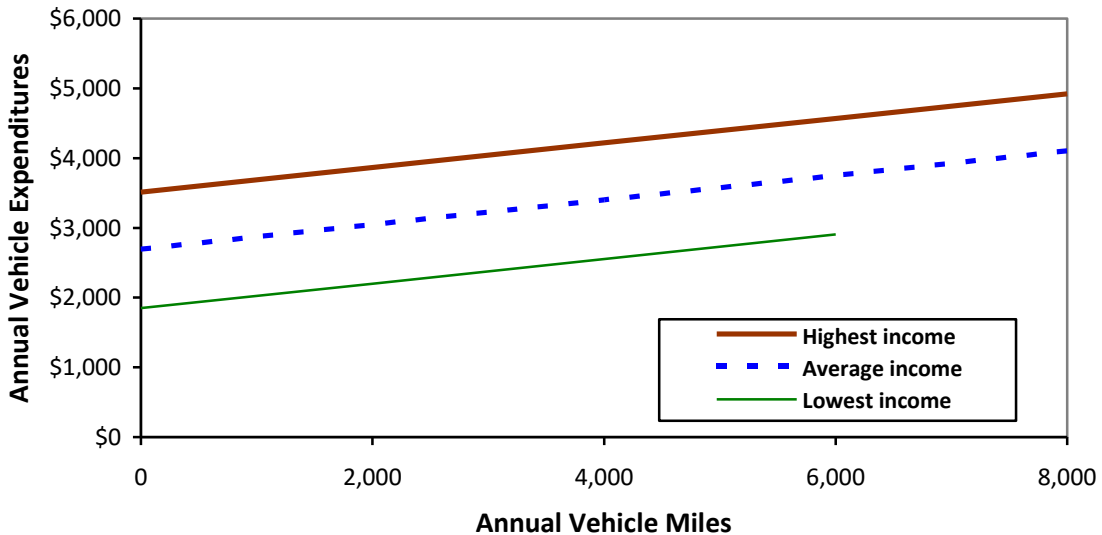
Figure 3 Average Vehicle Expenditures Per Household (BLS 2012)



This graph illustrates average annual vehicle expenditures and mileage per household.

The differences in vehicle expenditure and annual mileage between different income classes result, in part, from differences in household size and vehicle ownership rates. Figure 4 illustrates per vehicle expenditures and mileage.

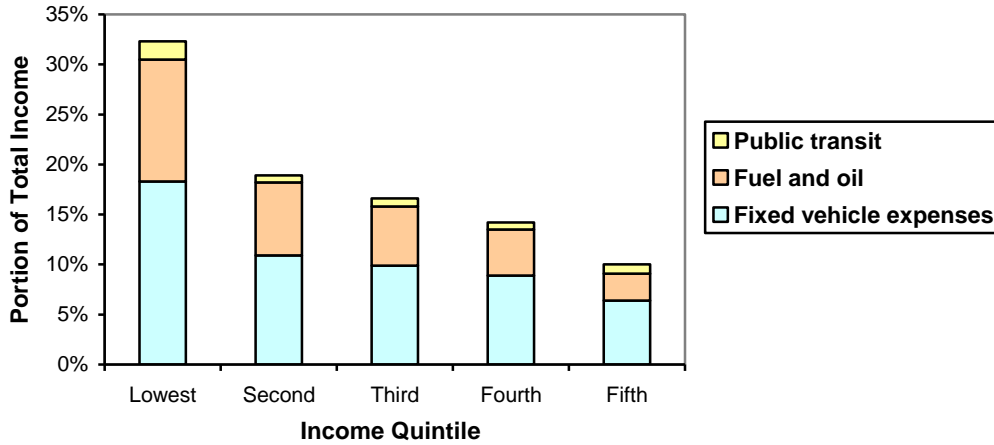
Figure 4 Average Vehicle Expenditures Per Vehicle (BLS 2012)



This graph illustrates average vehicle expenditures and mileage per vehicle.

These expenses can be compared with either household incomes or expenditures. Incomes tend to vary since even relatively affluent households sometimes have low incomes, for example, when a worker takes an extended leave to attend university or travel, and when wealthy households' investments performs poorly during a particular year, so expenditures are generally a better indicator of long-term wealth. Transportation costs tend to be very regressive (they are a much larger portion of lower-income household budgets) measured relative to household incomes, as indicated in Figure 5.

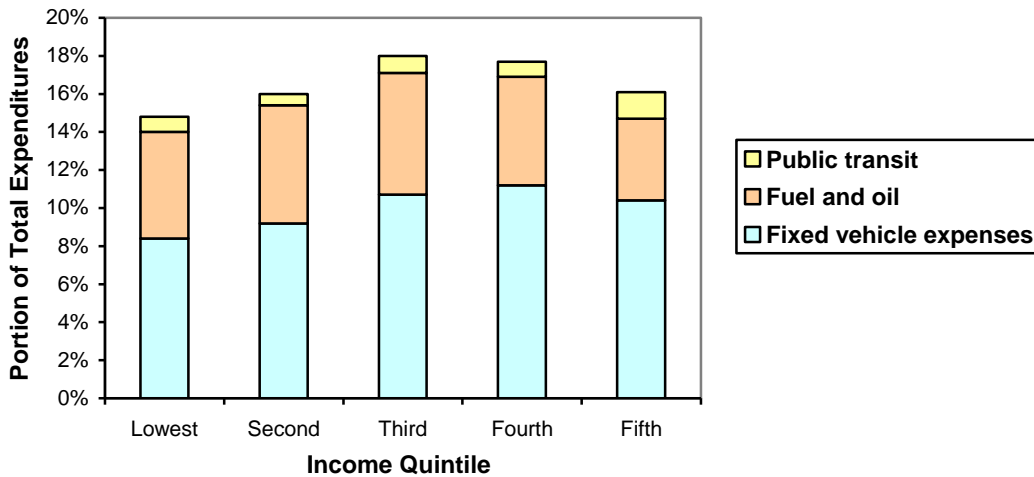
Figure 5 Transport Expenditures Relative To Incomes (BLS 2007)



This figure shows the portion of total household income devoted to transportation.

However, transportation costs are not regressive relative to household expenditures, as indicated in Figure 6. There is no single correct way to measure these impacts, it is probably best to consider income and expenditures as upper and lower bounds for affordability analysis.

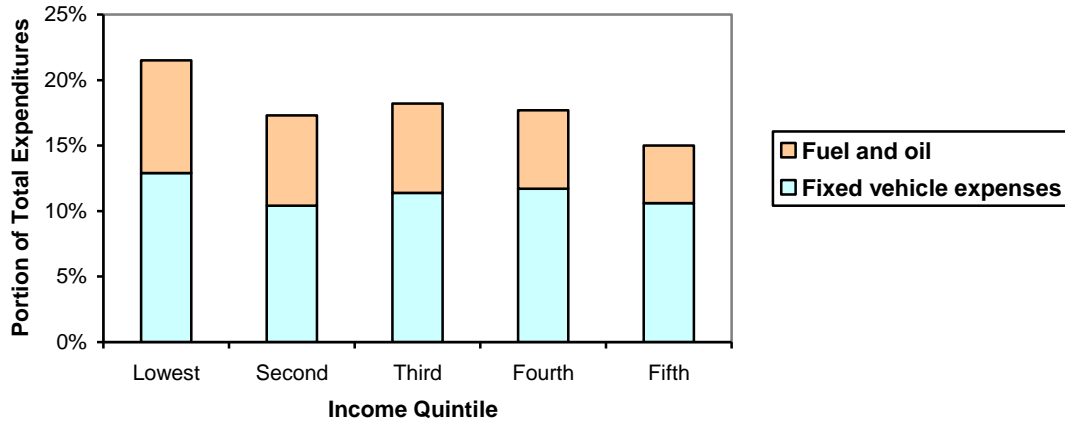
Figure 6 Transport As A Portion of Total Household Expenditures (BLS 2007)



This figure shows the portion of total household expenditures devoted to transportation.

About 11% of all households and 35% of low-income households own no motor vehicle, called *zero-vehicle households*. If all vehicle expenditures are assigned to vehicle-owning households (zero-vehicle households do spend small amounts of money on motor vehicles, but these are assumed to be insignificant for this analysis) these costs are regressive, representing 21.5% of the lowest income households' budget, a significantly larger portion than for other income classes, as illustrated in Figure 7.

Figure 7 Vehicle Expenditures By Vehicle Owning Households (BLS 2007)

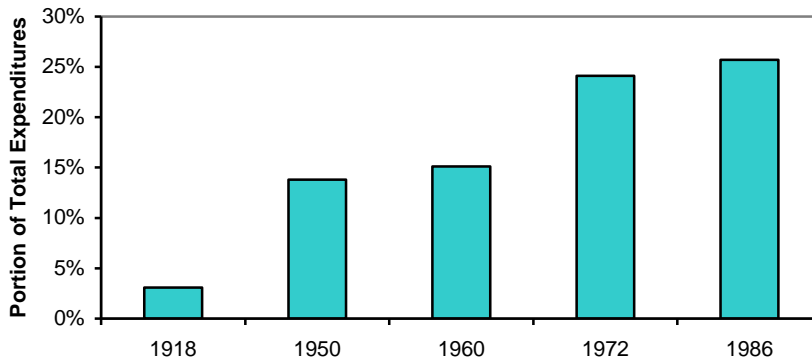


For vehicle-owning households, vehicle costs are regressive, representing a larger portion of household expenditures for the lowest-income quintile.

Regardless of how regressivity is measured, there is no doubt that many lower-income households are burdened by high transport costs and value opportunities to reduce these costs. Low-income households use various strategies to reduce these cost burdens, they minimize vehicle ownership and mileage, purchase used vehicles, perform their own maintenance and repairs when possible, and choose minimal insurance coverage, but some costs are difficult to avoid. Driver's licenses, vehicle registration fees, and basic insurance are fixed costs unaffected by incomes or the amount a vehicle is driven. Older vehicles tend to have high repair costs and lower fuel economy, poorer drivers often have high insurance risk ratings, and motorists sometimes have crashes and traffic citations. As a result, it is difficult to legally drive a motor vehicle for less than about \$3,000 annually, the approximate amount spent per vehicle by the lowest income quintile households.

Some data are available for comparing transportation cost burdens between different times and locations, although their results should be evaluated with caution since definitions and collection methods may vary between surveys. Figure 8 illustrates one estimate of the portion of household budgets devoted to transport during the Twentieth Century, which increased significantly during this period.

Figure 8 Household Transportation Expenditures (Johnson, Rogers and Tan 2001)

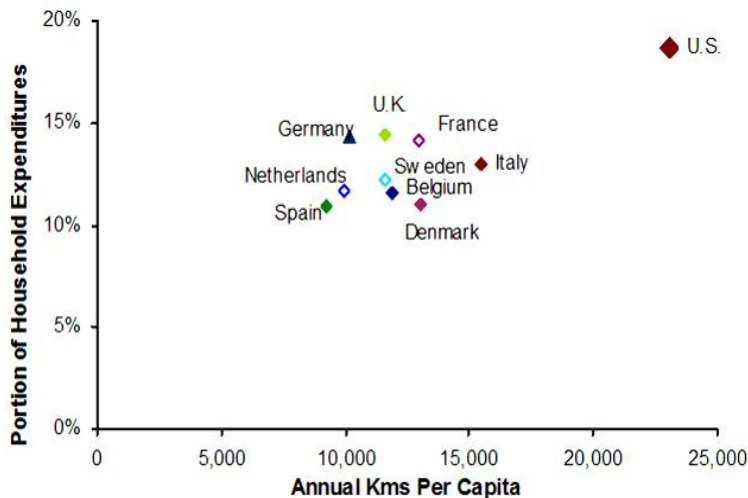


The portion of household budgets devoted to transport increased significantly during the Twentieth Century.

Several recent studies investigate how geographic factors affect transportation costs, and other costs such as housing affordability (CTOD and CNT 2006). This is an important because individuals and communities often make trade-offs between these costs, for example, between a more central location with higher housing and lower transportation costs, and a more isolated location where housing is cheaper but transportation costs will be higher. Comprehensive affordability analysis considers these trade-offs.

Figure 9 illustrates the relationship between household transportation expenditures and per capita vehicle travel for various higher income countries. Transportation costs range from about 10% up to nearly 20% of household expenditures, with the highest rates in the U.S., despite much lower vehicle and fuel taxes than in European countries.

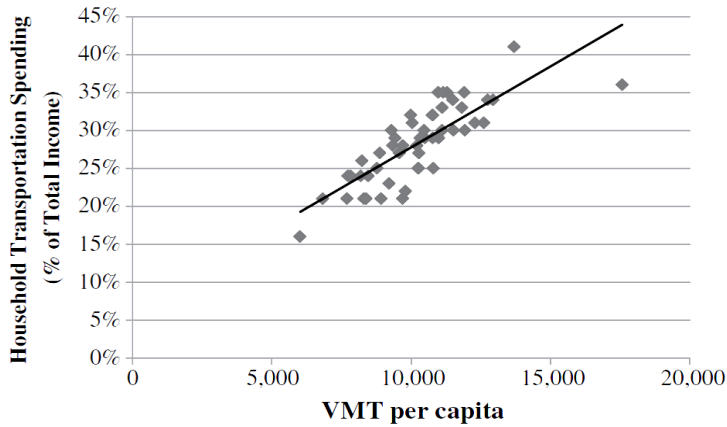
Figure 9 Per Capita Vehicle Travel Versus Transport Expenditures (EC 2011)



The portion of household budgets devoted to transport is much higher in the U.S. than in peer countries, apparently due to much higher rates of per capita vehicle travel.

Figure 10 indicates a strong positive relationship between vehicle travel and household transportation expenditures.

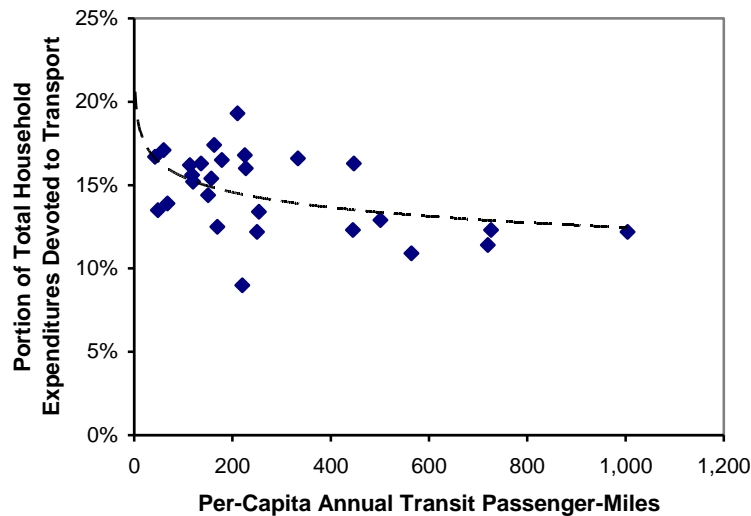
Figure 10 Household Transport Expenditures Versus VMT (Garceau, et al. 2013)



The portion of household income devoted to transportation increases with per capita vehicle miles traveled (VMT). Each dot represents a U.S. state.

Transportation affordability tends to increase with improved mobility options (better walking, cycling and transit) and more compact, accessible development.

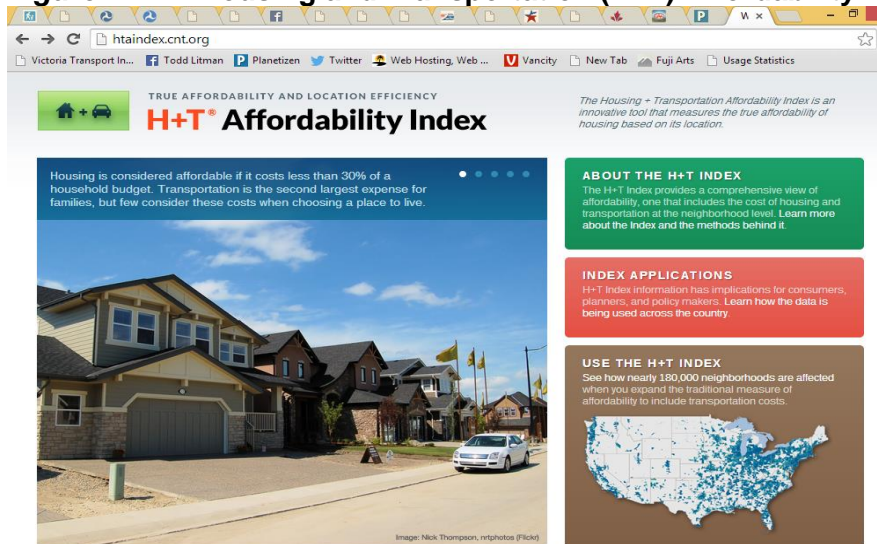
Figure 11 Transport Expenditures Versus Transit Travel (EC 2011)



The portion of total household expenditures devoted to transportation (automobiles and transit) tends to decline with increased transit ridership indicating the consumer savings provided by more multi-modal transport systems.

For example, the *Housing and Transportation (H+T) Affordability Index* illustrated below uses real estate market and census data to estimate housing and transportation costs in specific areas and compare them with household incomes. This information can be used by households, real estate agents, planners, developers and researchers to evaluate these costs and affordability when making housing and development decisions.

Figure 12 Housing and Transportation (H+T) Affordability Index



The Housing and Transportation Affordability Index calculates housing and transportation costs for specific locations, and compares these with households' incomes.

Housing Affordability Debates

There is considerable debate concerning how best to evaluate housing affordability and how development policies affect it. Studies such as the *International Housing Affordability Survey* (Cox and Pavletich 2015) argue that smart growth policies that encourage more compact development significantly reduce housing affordability, but critics argue that the Survey is biased to make sprawl seem more affordable than it actually is (Litman 2015):

- It appears overweighs single-family housing and underweights multi-family housing, and so overstates average housing prices in compact cities where a greater share of affordable housing is multi-family.
- It ignores the additional transportation and infrastructure costs of sprawled locations, which offset lower housing costs. A low-priced house is not truly affordable if its location has high transport costs. Experts recommend that affordability be evaluated based on combined housing and transport expenditures in recognition of the trade-offs that households often make between these costs (CNT 2008).
- It assumes that high housing costs in compact cities such as San Francisco and Washington DC result entirely from urban growth boundaries, ignoring other factors, such as regulations that limit urban infill, which many experts consider a larger cause of housing unaffordability (Cutler 2014; Lewyn and Jackson 2014).

A major study by the University of Utah's Metropolitan Research Center developed a sprawl index that incorporates indicators of *density* (people and jobs per square mile), *mix* (whether neighborhoods had a mix of homes, jobs and services), *centricity* (the strength of activity centers and downtowns) and *roadway connectivity* (the density of connections in the roadway network); a higher rating indicates more compact, *smart growth* development (Ewing and Hamidi 2014). This analysis found that the portion of household income spent on transportation is lower and the portion spent on housing is higher in smart growth communities. Each 10% increase in an index score was associated with a 3.5% decrease in transportation costs and a 1.1% increase in housing costs relative to income. Since transportation costs decline faster than housing costs rise, this results in a net decline in combined housing and transportation costs.

The trade-offs between housing and transportation costs can have long-term impacts on household wealth generation since housing expenditures tend to provide far more equity than transportation expenditures (Ferdous, et al. 2008; Litman 2010). For example, a household that spends \$15,000 annually on mortgage payments and \$5,000 on transport accrues about \$100,000 more equity over a decade than if it spends \$10,000 on mortgage payments and \$10,000 on transport. In addition, improving lower-income households' ability to live in accessible, multi-modal neighborhoods tends to increase economic mobility – the chance that a child born in a lower-income household will become more economically successful as an adult (Ewing, et al. 2016).

Various factors affect consumer transportation expenditures and affordability, described in the following section.

Factors Affecting Transportation Affordability

This section discusses various factors that can affect transportation affordability.

Travel Demands

Peoples' transportation needs and abilities vary. People who have more responsibilities, such as working or caregiving, tend to have more transportation needs. People with physical and mental disabilities may be unable to use some affordable travel options (such as walking and cycling, and conventional public transit). These factors should be taken into account in transport affordability evaluation. For example, transit agencies may offer family discounts or free fares for children traveling with parents, and people with disabilities may require taxi subsidies for the sake of affordability.

Below are various factors to consider when evaluating transportation affordability for specific people and groups:

- Income and wealth (or conversely, poverty).
- Daily and household responsibilities, such as commuting to school or a job, caregiving (such as being responsible for children or disabled adults), or special needs (such as requiring frequent medical treatments) tend to have more transportation needs.
- Physical and mental abilities, particularly ability to use affordable modes such as walk and bicycle (including their ability to carry loads), and public transit.
- Ability to understand and read the local language.
- Ability to drive, including access to a vehicle and legal certification to drive.

These factors have cumulative effects. A person who is unable to drive may have few transportation problems if they are unemployed, have no caregiving responsibilities, and are physically able, but the same person would face significant problems if they are looking for work, responsible for a child or disabled adult, or if they develop a physical disability. An index can be used to evaluate people's transportation needs and abilities, and therefore the degree of transportation deprivation and inaffordability they face, and the justification for providing targeted services and discounts to them.

Implications:

- Affordability analysis should consider people's specific needs and abilities
- Special services and targeted discounts may be justified for people with special needs.

Accessibility Versus Mobility

Conventional transportation planning is *mobility-based*, it evaluates transport system quality based only on the amount that people can travel within their time and money budgets. However, mobility is seldom an end in itself, The ultimate goal of most transport activity is *accessibility*, which refers to people's ability to reach desired goods, services and activities (Levinson and El-Geneidy 2006; Litman 2007).

Mobility-based planning assumes that faster, more costly modes, such as automobiles, are better than slower, more affordable modes, such as walking, cycling and public transit, and favors lower-density, urban fringe development over infill. Accessibility-based planning recognizes the important roles that alternative modes (walking, cycling, ridesharing and public transit) can play in an efficient transportation system, and acknowledges the increased accessibility that results from more connected road networks which allow more direct travel between destinations, and more compact land use development patterns, reducing the distances that people must travel to reach services and activities. Mobility-based planning tends to evaluate transportation affordability based on the affordability of driving. Accessibility-based planning considers additional impacts and options when evaluating affordability and so expands the scope of strategies that can be used to improve affordability.

This is important because transport planning often involves trade-offs between mutually-exclusive options. For example, money spent on roads cannot be used to improve walking and cycling facilities or public transit services., Roadspace devoted to vehicle parking cannot be used for sidewalks, bike-lanes or bus-lanes. As a result, mobility-oriented planning tends to create automobile-dependent transportation systems and sprawled development patterns which degrade affordable transportation options. Accessibility-based planning supports alternative modes and more accessible development patterns, creating communities where households can own fewer vehicles, drive less and rely more on affordable transport options.

Accessibility-based planning is particularly important for low-income non-drivers, including people with disabilities, and youths who lack driver's licenses. These groups can benefit significantly from improvements to affordable modes and more accessible community development patterns which maximize their ability to access services and activities without an automobile.

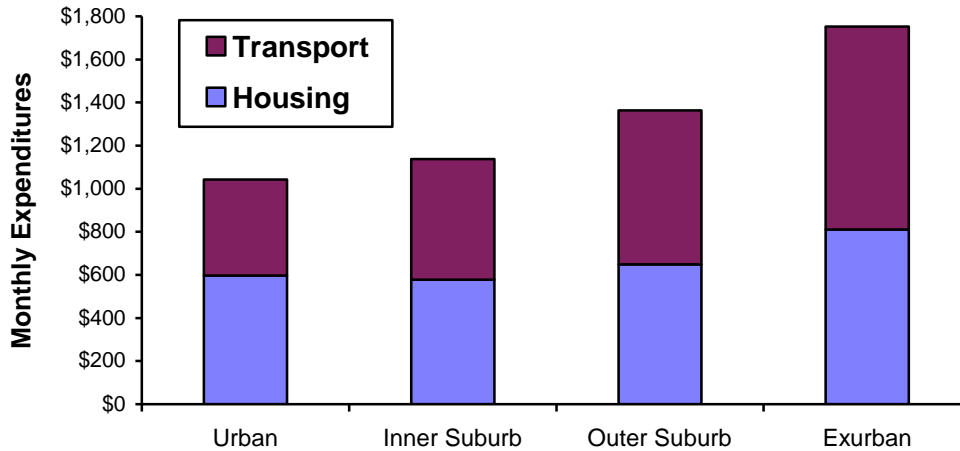
Implications:

- Transportation affordability should be evaluated based on accessibility rather than mobility, so that all accessibility impacts and options can be considered.
- Accessibility-oriented solutions are often more cost effective and beneficial overall than mobility-oriented solutions, particularly for disadvantaged populations.

Land Use Development Patterns

Land use development factors such as density, mix and roadway connectivity can affect the amount of travel needed to reach services and activities. Residents of more accessible communities tend to spend less on transportation (Figure 13), and non-drivers have better travel options than in more automobile dependent areas.

Figure 13 Housing and Transport Costs (CTOD 2006)



Although housing costs vary little, transportation costs increase significantly in less urban areas.

The degree to which affordable housing and lower-wage jobs have accessible locations affects transportation affordability. *Location efficient development* is a term for special efforts to insure that affordable housing options are located in accessible, multi-modal areas, where residents can achieve a high level of accessibility with reduced car ownership and use, and therefore improved transportation options (VTPI 2006).

Implications:

- Land use accessibility is an important factor in transportation affordability.
- Residents of more accessible and multi-modal communities tend to spend more on transportation than residents of more automobile-dependent communities, and non-drivers tend to have better accessibility options.
- Locating affordable housing and lower-wage jobs in more accessible locations is a practical way to increase transportation affordability.

Transportation Options

Transportation options (also called mobility options, transport diversity and transport choice) refer to the quantity and quality of transport modes and services available in a particular situation. In general, the greater the quantity and quality of affordable modes (walking, cycling and public transit), the more affordable the transport system. For example, Bailey (2007) found that, other factors held constant, households located within 0.75 miles of high quality public transit saved approximately \$1,400 in fuel costs and \$5,586 in total transport costs (vehicle ownership and operating savings minus additional transit fares).

Different modes play different roles in an efficient and affordable transport system. Walking and cycling are important modes on their own and provide access to public transit; sometimes the best way to improve public transit is to improve walking and cycling conditions. Public transit is important for regional trips, and high quality public transit can provide a catalyst for more accessible, multi-modal communities, call *transit-oriented development*. The quality of transport options can be evaluated using multi-modal level-of-service (LOS) ratings which grade service quality from A (best) to F (worst), as indicated in Table 2.

Table 2 Multi-Modal Level Of Service (“Transport Options,” VTPI 2006; FDOT 2002)

Mode	Level of Service Factors
Universal design (disability access)	Degree to which transport facilities and services accommodate people with disabilities and other special needs.
Walking	Sidewalk/path quality & connectivity, street crossing conditions, land use conditions, security, prestige.
Cycling	Path quality & connectivity, street riding conditions, parking conditions, security, safety education.
Ridesharing	Ridematching services, chances of finding rideshare matches, HOV priority.
Public transit	Service coverage, frequency, speed (particularly compared with driving), vehicle and waiting area comfort, user information, price, security, prestige.
Automobile	Speed, congestion delay, roadway conditions, parking convenience, safety.
Carsharing	Availability, convenience, price, variety of vehicles available, vehicle quality, prestige.
Telework	Employer acceptance/support of telecommuting, Internet access.
Delivery services	Coverage, speed, convenience, affordability.

This table indicates specific factors for evaluating the service quality of transport modes.

Implications:

- Improving lower-cost transport options and increasing the number of destinations served by such modes tends to improve transport affordability.
- Increased convenience, comfort, affordability, security, user information and prestige of affordable modes can increase affordability.

Transportation Costs

Various specific costs affect affordability, including:

- Vehicle purchase costs and fees.
- Vehicle insurance and registration fees.
- Fuel prices.
- Road tolls and parking fees.
- Transit and taxi fares.
- Telecommunications and delivery services.

For example, an increase in vehicle insurance and registration fees, parking and road tolls, fuel prices, or transit fares tends to reduce transportation affordability for the affected groups.

Affordability analysis should generally take into account all costs, including vehicle ownership costs and any incremental parking costs. Automobile travel also imposes significant external costs, including traffic and parking congestion, accident risk and pollution damages, and motor vehicles occasionally require costly repairs; efforts to make driving more affordable may increase these costs, and

Many travelers prefer most expensive modes, such as private automobiles, for status sake. To the degree that automobile travel is a *positional good* (people choose it for status sake), making driving more affordable provides smaller net benefit, because increased status to automobile users is offset by increased stigma to users of more affordable modes.

For many lower-income workers, walking, cycling and public transit have a higher *effective speed*, considering both the time spent travelling and time spent earning money to pay for travel. For example, a typical \$10 per hour worker who spends \$4,000 annually on vehicle expenses is devoting 400 annual hours or about 96 minutes per workday to automobile transportation. They may be better off overall choosing a slower but less costly mode, because the additional time spent travelling is more than offset by the reduced time spent working, or the ability to spend more money on other goods.

Implications:

- Affordability analysis should consider all transportation costs.
- Analysis should be based on total costs rather than individual cost components.
- Analysis should account for indirect costs, including congestion, accident and pollution costs, and impacts on the stigma associated with affordable modes.
- Some analysis should consider *generalized costs*, including financial expenses and the monetized value of travel time, and conversely, *effective speeds*, the time required to travel and to earn money to pay travel expenses.

Transportation Affordability Indicators

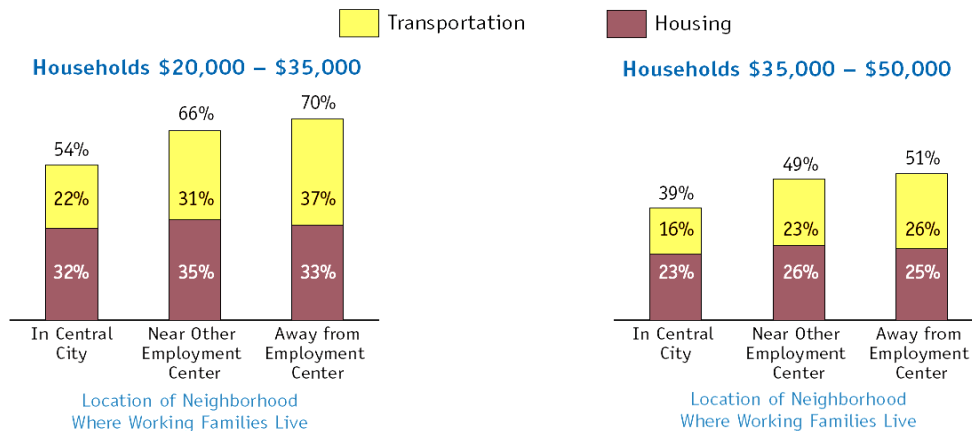
Various indicators that can be used to evaluate transportation affordability are described below.

Affordability Index – Combined Transportation and Housing Costs

Real estate experts often recommend that households spend no more than 32% of their budget on housing, including rent or mortgages, maintenance and utilities. Since households often face tradeoffs between housing and transport costs, one unintended consequence of focusing on housing costs alone is that many households are encouraged to choose cheaper but more isolated housing in which lower housing costs are more than offset by higher transportation costs. As a result, many experts recommend evaluating household affordability based on combined housing and transportation costs. The *Housing + Transportation Affordability Index* (<http://htaindex.cnt.org>) calculates these factors together in order to help planners, real estate professionals and consumers choose the truly optimal and most affordable housing option.

Some planning strategies, such as smart growth development policies, may increase land costs per acre, but by increasing density can reduce costs per housing unit, and by allowing more accessible, infill development, can provide significant transportation savings (Nelson, et al., 2002; Wassmer and Baass 2005; Quednau 2016; Tomalty and Haider 2008). For example, Lipman (2006) found that transport costs range from about 10% in multi-modal communities up to about 25% in automobile dependent communities, as illustrated in Figure 14. Makarewicz, et al. (2008) found similar patterns in the Minneapolis-St. Paul region. Isalou, Litman and Shahmoradi (2014), found similar patterns in Qom, Iran, indicating that the same patterns occur in developing countries. Location efficient development, which locates affordable housing in areas with good travel options and reduces residential parking costs, can therefore increase overall affordability (CTOD and CNT 2006; CNU 2008; ULI 2009; CHP 2009).

Figure 14 Share of Income Spent on Housing and Transport (Lipman 2006)



Source: Center for Neighborhood Technology calculations.

NOTE: Employment centers are job locations with a minimum of 5,000 employees.

The portion of income devoted to combined housing and transportation by lower and moderate income households increases with distance from major employment centers. Housing cost reductions are more than offset by increased transport costs, reducing overall affordability.

Miller, et al. (2004) used census consumer expenditure data and transportation survey information to compare housing and transportation costs for residents of various locations in the Toronto region. They found that suburban locations tends to cost more overall than city locations. In 1996, (the latest year for which complete comparable data is available) the study estimates that a family with one car living 50 kilometres outside downtown Toronto, spent \$1,600 more a year on travel. For households with two vehicles — the norm for most suburban families — the annual cost rises to about \$5,800 more. The same house in the suburbs would cost about \$1,100 a year more in mortgage, property taxes, utilities and maintenance to run than a similarly valued home downtown.

“It is generally believed that many households choose to live in suburban locations either because housing costs are lower there or because households can obtain ‘more house’ for a given expenditure,” said study author Eric Miller. “But housing costs and travel costs tend to increase as one moves away from the central areas of the region’s cities, particularly from (downtown) Toronto. The idea that city living is too expensive just does not seem to hold up,” the study concludes.

A number of specific Smart Growth and TDM strategies can help increase housing affordability (Arigoni 2001; CNU 2008; Tomalty and Haider 2008). These include:

- *Intensification*: increase housing supply in areas with reduced housing and transportation costs, such as transit-oriented development, brownfields, and commercial corridors.
- *Housing Form*: increase the supply of more affordable housing types, such as smaller lots and homes, rental accommodation, secondary suites, mobile homes and modular houses.
- *Development Process*: measures to reduce the cost of housing generally – e.g., transportation planning standards, alternative engineering standards, parking standards, improving the approvals process, and addressing NIMBY.
- *Parking Management*: implement strategies that reduce parking requirements.
- *Location Efficient Development*: allow reduced parking requirements and more attractive mortgages for housing in accessible, multi-modal communities.
- *Smart Growth Fiscal Reforms*: reduce development and utility costs for infill development.

Implications:

- Affordability analysis should consider housing and transportation costs together.
- Transportation costs should be considered by consumers when evaluating housing affordability and by lenders when evaluating a household’s borrowing capability.
- Location-efficient development can be considered a transportation affordability strategy.

Transportation Makes Atlanta Very Unaffordable

Metro Atlanta sells itself as an affordable city. Well, that's just not true — especially for working families.
Maria Saporta, *Atlanta Journal-Constitution*, 06/11/07

Metro Atlanta actually is the second-most expensive major city in the nation for families earning between \$20,000 and \$50,000 a year, according to recent analysis. Those families spend an average of 29% of their income on housing and 32% of their income on transportation for a total of 61%. The analysis was done by the Center for Housing Policy, which compared housing and transportation costs in 28 of the major cities in the United States. The only city more expensive than metro Atlanta is San Francisco, where 35% of a working family's income goes toward housing and 27% goes toward transport, 63% total.

"That startled me," said John O'Callaghan, president and CEO of the Atlanta Neighborhood Development Partnership, which helps finance affordable housing. "Atlanta has been built on the car. People drive until they can find a home they can afford. But they don't add up the car payments, car insurance and transportation costs. And it's getting worse as gas prices are going up."

As one of the least dense major cities in the country, long commutes are a way of life. Susan Adams, director of ANDP's Mixed-Income Communities Initiative, said Atlanta's average commute is 12 miles one-way compared to an average of nine miles among the 27 other cities. Once again, the inability for metro Atlanta to deal with its transportation is having a direct impact on the affordability of our region.

Up to now, affordability has focused on housing costs, which means that metro Atlanta has been able to hide its dirty secret of its increasing transportation costs. But no more. Nationally, housing experts now are measuring affordability by including a region's transportation costs in a new index. Eventually, urban leaders hope that Realtors, developers, homeowners and apartment dwellers will be just as sensitive to their transportation costs as their housing costs. "Transportation costs are very influential in the Atlanta region, and it has a big impact on our per-capita income," said Mike Alexander, chief of research for the Atlanta Regional Commission. "Generally, compared to other places, we are an affordable place to live, but you have to include transportation costs, or it's not a fair comparison."

The combination of rising transportation costs and the decline in per-capita income growth should sound the alarm to people in Georgia. If metro Atlanta loses its cachet of being one of the nation's more affordable cities, we will be less attractive to people and companies interesting in relocating here. But it doesn't have to be this way. At ARC's Atlanta Regional Housing Forum last week, several ideas were discussed on how to turn these trends around. "Density is the single best way of getting affordable housing," said Bruce Gunter, CEO of Progressive Redevelopment. "We are not dense at all. We are going to have to completely rethink about how we grow."

A key element of affordability is to have people live close to where they work. If people can walk to work or only drive a few miles, it will decrease their transportation costs. Jim Durrett, executive director of the Livable Communities Coalition, said that developing affordable housing around job centers is something that employers are beginning to understand. Cutting down on commuting will help improve the quality of life of employees.

There also is the transit piece. Town centers that include residences, offices, retail, restaurants and services also are better served by transit. And transit often is much less expensive than owning and operating a car. "You have to get the right transportation links to get people to their jobs," O'Callaghan said. "Transportation is a big piece of that. And there are other life costs to spending time in the car. It impacts our health. And it impacts the time we spend with our families."

Examples of Affordability Analysis

Various indicators can be used to evaluate transportation affordability, including the portion of household expenditures devoted to transportation, the quantity and quality of affordable transportation options available to a particular group or for a particular type of trip, and the quality of accessibility for non-drivers compared with drivers.

State-level Affordability Analysis

Garceau, et al. (2013) found that U.S. states with higher automobile commute mode shares also have higher rates of VMT per capita, a larger portion of household budgets devoted to transportation, and higher per capita carbon emissions. Higher VMT per capita also corresponds to higher government spending on transportation, which likely reflects the expense of maintaining, repairing and expanding road networks. States with higher automobile-dependency also incurred higher social costs as measured by automobile-related fatalities.

Transportation Affordability Evaluation Framework

Fan and Huang (2011) developed a contextualized transportation affordability analysis framework that accounts for the different demands and abilities of various demographic and geographic groups. They apply this framework in a case study of the Twin Cities metropolitan area, which evaluates the quality of access in different geographic areas and the transportation financial and time costs of various demographic groups. This analysis indicates that socio-economically disadvantaged groups, such as lower-income working parents, have relatively low auto ownership rates but have high mobility needs, particularly in auto-oriented locations that require more travel for access, leading to high transport costs. The researchers conclude that improving transportation affordability and social welfare requires a combination of reduced automobile dependence and financial subsidies for car access among disadvantaged populations.

Mobility Gap Analysis

Leigh, Scott & Cleary (1999) developed a method for quantifying a community's *mobility gap*, defined as the amount of additional transit service required for households without a motor vehicle to have a comparable level of mobility as vehicle owning households. This is a conservative estimate because it does not account for unmet mobility needs of non-drivers in vehicle-owning households. Only about a third of transit needs are currently being met in typical areas they evaluated, indicating a level of service (LOS) rating D, based on ratings shown in Table 3. This approach can be used to predict the LOS rating that will occur under various transit planning and investment scenarios.

Table 3 Transit Level Of Service Ratings (Leigh, Scott & Cleary 1999, p. VIII-3)

Portion of Demand Met	Transit Level-Of-Service
90% or more	A
85-89%	B
50-74%	C
25-49%	D
10-24%	E
Less than 10%	F

A variety of factors can be considered when evaluating a community's transit needs and the mobility gap between residents who drive and those who do not. These include vehicle ownership (residents of households that do not own a motor vehicle tend to rely significantly on transit), age (residents in the 10-21 and 65+ year age ranges tend to rely on transit more than those 21-65), income (lower-income people tend to use transit more than higher-income people), race and residency status (non-white and immigrant residents tend to rely more on transit than white and U.S. born residents).

Transit-Oriented Development

Living in a transit-oriented community tends to reduce total household transportation costs, according to research comparing U.S. cities based on the quality of their transit system (Bailey 2007; FTA 2008; Litman 2004; Pollack, Bluestone and Billingham 2010; Polzin, Chu and Raman 2008).

Residents of cities with high quality transit systems devote just 12.0% of their income to transport, compared with approximately 15% in more automobile-dependent cities, as illustrated in Figure 11. This represents about \$500 in annual per capita transport cost savings in the transit-oriented cities. International comparisons show similar patterns (Kenworthy, et al. 1997).

Transportation Affordability Improvement Strategies

*These strategies increase transportation affordability by improving the quality of lower-cost modes. For more information see the **Online TDM Encyclopedia** (www.vtpi.org/tdm).*

Nonmotorized Transportation Improvements

Nonmotorized transportation (walking, cycling, handcars, etc.) are affordable forms of transportation by themselves, and as access modes to transit. There are many ways to improve pedestrian and cycling transportation.

Ridesharing

Informal ridesharing is a particularly important option for non-drivers and lower-income residents.

School Trip Management

Improving mobility options (walking routes, bicycle safety education, ridesharing, transit services) for students and parents can benefit lower-income households.

Telework

Telecommunications can often substitute for physical travel. Telework programs can help people obtain Internet connections and skills, particularly those who are lower-income.

Taxi Service Improvements

Taxi service is an important transportation option in many situations. Establishing formal taxi service can improve transportation options in many rural communities.

Transit Improvements

Transit services provide affordable mobility. Lower-income people tend to rely heavily on transit. Shifting travel from automobile to transit can provide vehicle operating cost savings, and may allow households to reduce vehicle ownership and associated costs.

Bike/Transit Integration

Bicycling integrates well with public transit (bus, train, ferry, and air transport). Transit is most effective for moderate- and long-distance trips on busy corridors, while cycling is effective for shorter-distance trips with multiple stops. Combining transit and cycling can provide a high level of affordable mobility.

Mobility Management Marketing

Many lower income people would like to use alternative transportation modes, but they feel stigmatized doing so. Mobility management marketing programs that raise the status of walking, cycling, public transit travel and car sharing can help increase transportation affordability.

Address Security Concerns

Many lower income people would like to use alternative transportation modes, but they feel unsafe doing so. Programs that address security concerns of walkers, cyclists and transit users, can help increase transportation affordability.

Increase the Affordability of Transport Services

These strategies reduce the financial costs of transport services.

Commuter Financial Incentives

Commuter Financial Incentives such as Parking Cash Out and Transit Benefits reward people who use alternative commute modes. This provides financial benefits to lower-income workers, who tend to use alternative modes more than average.

Commute Trip Reduction Programs

Commute Trip Reduction (CTR) (also called *Employee Trip Reduction* or *Vehicle Trip Reduction*) programs give commuters resources and incentives to reduce their automobile trips. Such programs can provide services that improve commuter affordability, including rideshare matching, guaranteed ride home, alternative scheduling, and walking and cycling improvements.

Transit Affordability

Increase the affordability of public transit travel through targeted discounts and subsidies that reduce transit fares relative to wages (Toronto Public Health 2013).

Location Efficient Development

Location Efficient Development consists of residential and commercial development located and designed to maximize accessibility. This improves affordable transportation options, such as walking, cycling and transit, and tends to significantly reduce household transportation costs. If implemented with parking management, it can increase housing affordability by reducing parking costs.

Improve Land Use Accessibility

These strategies improve transportation affordability by improving land use accessibility, which reduces the amount of physical travel needed to reach goods and activities.

Smart Growth

Smart Growth includes various land use management strategies that reduce automobile dependency by increasing transportation options and accessibility. It can increase overall household affordability by reducing transport costs and increasing housing options in more accessible neighborhoods. Specific Smart Growth strategies include:

- Access management
- Clustering
- Location efficient development
- New urbanism
- Transit oriented development

Address Security Concerns

Many lower income people would like to live in more accessible neighborhoods or use alternative transportation modes, but they feel unsafe doing so. Programs that address the security concerns of urban neighborhoods, can help increase transportation affordability.

Make Automobile Use More Affordable

These strategies improve transportation affordability by reducing the cost of using an automobile.

Carsharing

Carsharing refers to automobile rental services intended to substitute for private vehicle ownership. It makes occasional use of a vehicle affordable, even for low-income households.

Pay-As-You-Drive Pricing

Pay-As-You-Drive vehicle insurance and registration fees convert these into variable costs: the less you drive the less you pay. This makes vehicle ownership more affordable if motorists limit their driving.

Vehicle Fees

A common strategy proposed for increasing transportation affordability is to minimize motor vehicle user fees such as fuel taxes, road tolls and parking fees. However, these strategies can have undesirable overall economic and transportation impacts, and their ability to increase affordability is limited. Low vehicle user fees require increases in other fees and taxes, such as rents and property taxes. The affordability impacts depend on exactly how these costs are distributed.

Only about two-thirds of low-income households own a motor vehicle and lower-income households drive relatively few annual miles, particularly on congested urban highways (the roads that are most often tolled) so general fuel tax and toll reductions are an inefficient way to increase low income household affordability. Higher income consumers capture most of the benefits. Targeted discounts and exemptions are far more efficient.

Also, low vehicle fees tends to increase total vehicle travel, which increases traffic congestion, accident risk and pollution emissions. Economically and physically disadvantaged people often bear these costs, including increased congestion delays when they travel by automobile or bus; increased accident risk when they walk, bicycle or drive; and increased exposure to air and noise pollution.

Described differently, vehicle fees may increase without reducing overall affordability if implemented with strategies that increase housing affordability and transport options, and with targeted discounts and subsidies. Overall affordability impacts depend on several factors, including how groups are defined (for example, whether analysis evaluates impacts on low-income motorists or on all low-income people, including those who do not drive), the quality of transport options available, and how revenues are used. If revenues are used to reduce other taxes or improve affordable transportation options (such as improving walking and cycling conditions, and transit services), lower-income households may benefit overall.

Housing Affordability

Policies that stimulate more dispersed, automobile-dependent home location by lower-income households places them at financial risk (Dodson and Sipe 2006). To the degree that lower current fuel prices encourage sprawl development patterns and sprawled housing choices by lower-income households it reduces their future affordability.

More affordable transportation tends to improve households' economic resilience, that is, they are better able to respond to unexpected financial burdens such as fuel price increases, vehicle failures or income losses, and so it reduces housing foreclosures. According to the *Location Efficiency and Mortgage Default* study, the probability of mortgage foreclosure increases as neighborhood vehicle ownership levels rise, after controlling for income (NRDC 2010; Pivo 2013). These results suggest that public policies that support location efficiency can help to reduce mortgage foreclosures, and that loans are safer for housing in more multi-modal locations.

Several strategies can increase affordable-accessible housing (Tompkins County 2009; Obrinsky and Stein 2007; Pollack, Bluestone and Billingham 2010):

- Reduced parking requirements (Litman 2003; San Diego 2011).
- Unbundling parking (i.e., renting parking separately from housing).
- Reduced restrictions on density, land use mix and secondary suites.
- *Location Efficient Mortgages*, which means that lenders recognize the potential savings of a more accessible housing location when assessing a household's borrowing ability.
- Smart growth reforms that reduce development and utility costs for infill development.
- Urban service improvements (such as better local schools, traffic calming, and street maintenance) can make urban neighborhoods more attractive and suitable for lower-income residents.

True Housing Affordability – by Jim Lazar

An "affordable" home is one that:

- Is located close to transit, shopping, schools and employment, so households can reduce the number of vehicles they must own (for example, owning one rather than two cars), and the miles they must drive. This can save \$2,000 - \$5,000 per year in vehicle ownership and operating costs.
- Is energy efficient. This can save \$500 - \$1,000 per year.
- Is built with quality materials. This can reduce annual maintenance and replacement costs.
- Is built with non-toxic materials. This helps prevent respiratory illnesses, saving 2-10 sick days annually. The economic value of good health is extremely high, if difficult to measure.
- Supports community cohesion (more friendly neighborly interactions). This tends to increase security, reduce expenses such as childcare, and improve residents' quality of life.

It is the sum of the mortgage payments, the maintenance costs, the transportation costs, health care costs and child care costs that determines affordability, not just the seller's asking price for a home.

Examples and Case Studies

Examples of affordable transport policies and projects are described below.

Redeveloping Parking Lots (CNT 2006)

The study, *Paved Over: Surface Parking Lots or Opportunities for Tax-Generating, Sustainable Development?* (www.cnt.org/repository/PavedOver-Final.pdf) by the Center for Neighborhood Technology, evaluates the potential economic and social benefits if surface parking lots around rail transit stations were developed into mixed-use, pedestrian friendly, transit-oriented developments, with case studies of nine suburban communities with rail transit service in Cook County, Illinois. The analysis concludes that such development could help to meet the region's growing demand for affordable, workforce, senior, and market rate housing near transit, and provides various benefits including increased tax revenues and reduced per capita vehicle travel. It estimates that parking lots in these nine areas could generate 1,188 new residential units and at least 167,000 square feet of new commercial space, providing additional property tax revenues in the hundreds of thousands of dollars per year at each site, plus significant reductions in trip generation and transportation costs compared with more conventional development.

Oil Vulnerability Index

Fishman and Brennan (2009) developed an *Oil Vulnerability Index* which assesses the household financial risks of oil price increases in Victoria, Australia. The analysis indicates that fast-growing outer suburbs are particularly vulnerable to oil price rises due to their high levels of automobile travel and relatively low incomes. Future petrol price increases are likely to place significant financial stress on such households.

Transportation Cost Impacts on Household Affordability (Weinstein Agrawal, et al. 2011)

In-depth interviews examined how transportation financial stresses such as reduced income and higher fuel prices affect low-income families, including travel behavior and transport expenditures; the costs and benefits of various travel modes; cost management strategies; and opinions about the effects of changing transportation prices on travel behavior. Key findings include:

1. Most low-income households are concerned about their transportation costs.
2. Low-income individuals manage their household resources to survive on limited means and to respond to changes in income or transportation costs.
3. In making mode-choice decisions, low-income travelers carefully evaluate travel time and out-of-pocket expenses against the benefits of alternative modes.
4. Some low-income individuals willingly accept higher transport expenditures, such as automobile ownership or road tolls, if they believed that the benefits are worthwhile.
5. Although low-income households find ways to cover their transportation expenditures, many of these strategies have negative effects on their lifestyles.

The report concludes with recommendations for increasing transportation affordability, minimizing the impact of new transportation taxes or fees on low-income people, and developing new research and data collection strategies.

TOD Travel Impacts and Benefits (TransForm 2014)

The report, [Why Creating And Preserving Affordable Homes Near Transit Is A Highly Effective Climate Protection Strategy](#) used detailed data from the California Household Travel Survey to measure how demographic, geographic and economic factors affect household travel activity and fuel consumption. The results indicate that all types of households, and particularly lower-income households, tend to own fewer vehicles, drive less and consume less fuel if they live in transit-oriented neighborhoods. All else being equal, lower-income households drive 25-30% fewer miles when living within 1/2 mile of transit than those living in non-TOD, and 50% fewer miles when living within 1/4 mile of frequent transit service. The analysis also indicates that extremely low-income households living within 1/4 mile of frequent transit own half as many vehicles and drive half as many annual miles as higher income households located the same distance from frequent transit service. The researchers conclude that increasing the supply of affordable housing in transit-oriented development is a cost-effective way to reduce energy consumption and pollution emissions, and increase affordability.

Mixed-Income Housing TOD Action Guide (www.mitod.org/tools.php)

The *Mixed-Income Housing TOD Action Guide* describes many of the same strategies recommended in this report to help create more affordable-accessible housing:

- [Adjust Zoning to Promote Diversity](#)
- [Brownfield Remediation](#)
- [Community Land Trusts](#)
- [Condominium Conversion Controls](#)
- [Development Agreements](#)
- [Fast Track Permitting](#)
- [Fee Waivers, Reductions, Deferrals](#)
- [First-Right-of-Refusal Laws for Tenants and Nonprofits](#)
- [Implement physical transit-access improvements](#)
- [Improve transit knowledge](#)
- [Incentive-Based Zoning](#)
- [Inclusionary Zoning](#)
- [Joint Public/Private Development](#)
- [Land Banking](#)
- [Limited Equity Housing Co-ops](#)
- [Linkage fees](#)
- [Parking Maximums for Transit Areas](#)
- ["Project Based" Section 8 Preservation](#)
- [Provide greater access to transit discounts and resources](#)
- [Public Land Dedication or Write-Downs](#)
- [Public Land Disposition Plan](#)
- [Reduced Parking Requirements](#)
- [Regulatory Accommodation for Small Sites](#)
- [Rent Control](#)
- [Self-help programs](#)
- [Site parks & schools](#)
- [Site social service facilities](#)
- [Subsidized housing redevelopment/renovation](#)
- [Support start-up nonprofit developers](#)
- [Target-property Acquisition & Rehabilitation funds](#)
- [Tax Forgiveness for Back Taxes on Affordable Housing Opportunity Sites](#)
- [TOD-Targeted Homeownership Assistance](#)
- [TOD-Targeted Housing Financing](#)
- [Transfer taxes](#)

Transit Access To Low-Income Jobs (Hart and Lownes, 2013)

Many *low incomes and high rates of car ownership* (LIHCO) households own automobiles, despite significant financial burdens. This can partly be explained by these household's need to automobile commute to jobs that are either located in suburban areas poorly served by transit, or late at night. This analysis indicates that improving transit access to low-income jobs and increased late-night transit frequency might reduce auto ownership in LIHCO households, providing economic benefits.

Developing Country Transportation Affordability (Mahadevia, Joshi and Datey 2013)

The report, *Low-Carbon Mobility in India and the Challenges of Social Inclusion: Bus Rapid Transit (BRT) Case Studies in India* uses consumer expenditure survey data to evaluate transportation cost burdens and barriers to low-income households and disadvantaged groups in Indian cities, and the potential savings and benefits from transport improvements, such as Bus Rapid Transit (BRT).

GreenTRIP (www.transformca.org/GreenTRIP)

GreenTRIP is a Traffic Reduction + Innovative Parking certification program for new residential and mixed use developments. It rewards projects that reduce traffic and greenhouse gas emissions. *GreenTRIP* expands the definition of green building to include transport to and from the buildings. Each certified project receives a *Project Evaluation Report* which describes the project location, details and inventories how the project meets *GreenTRIP* standards. This typically includes features such as an accessible and multi-modal location (near shops and other services, good neighborhood walkability, near public transit), parking management, carshare services, discounted public transit passes, and affordable housing. The program provides the following support:

- *Tailored Traffic Reduction Strategies* – Experts work with developers, designers and operators to identify the most appropriate transport and parking management strategies.
- *Public Hearing Testimony* - *GreenTRIP* staff will explain the traffic and greenhouse gas reducing benefits achieved by *GreenTRIP* Certified projects to decision-makers and the public.
- *Market Differentiation* - Use of the *GreenTRIP* name and logo in promotional materials, and a plaque to mount on the project when built.

As of March 2010 the following projects were certified:

The Crossings (www.transformca.org/files/SLCrossingsProjEvalRpt.pdf)

Parker Place (www.transformca.org/files/ParkerPlace_ProjEvalRpt.pdf)

Station Park Green (www.transformca.org/files/StationParkGreenProjEvalRpt.pdf)

The Ohlone (www.transformca.org/files/OhloneProjEvalRpt.pdf)

Automobile Ownership and Economic Opportunity (Smart and Klein 2015)

Researchers Michael Smart and Nicholas Klein analyzed how automobile and transit access influences economically-disadvantaged people's ability to reach basic services and activities including health care, shops, school and jobs, and how these factors changed between 1999 and 2013.

They found that for most families, being "carless" is a temporary condition. While 13% of families in the US are carless in any given year, only 5% of families are carless for all seven waves of data examined in the analysis. The research also found that poor families, immigrants, and people of color (particularly blacks) are considerably more likely to transition into and out car ownership frequently and are less likely to have a car in any survey year than non-poor, US-born and white families. The research also found that improving automobile access is associated with a decreased probability of future unemployment and is associated with greater income gains, but the costs of owning and maintaining a car are often greater than the income gains associated with increased car ownership. The relationship between public transit and improved economic outcomes is less clear. The research found that transit serves an important purpose in providing mobility for people who do not to own a car, but living in areas with high-quality public transportation does not affect future earnings.

Accessible Suburban Multi-Family (Larco 2010)

Nearly a quarter of all suburban housing is multifamily, but such development tends to have poor accessibility due to inadequate connections (sidewalks, paths and roads) to nearby commercial areas. Such housing fails to reach its potential for reducing automobile travel and increasing active travel. The enclave nature of most suburban multifamily housing results, in part, from regulatory and planning practices that promote enclave design. This includes a general lack of specificity in multifamily codes; code-dictated buffers between dissimilar uses; a general lack of street network regulation for multifamily developments; a perception by planners that multifamily housing should primarily act as a buffer between commercial and single-family uses; a general un-welcoming attitude towards this development type; and a general lack of attention given to this housing typology. Various policy and planning reforms can improve suburban accessibility, including street connectivity standards; programs to create more sidewalks, crosswalks and pedestrian shortcuts; shifts to smaller parking lots, and walkability improvements within developments to facilitate pedestrian travel.

Conclusions

Affordability is often defined as households being able to spend less than 45% of total household budgets on housing and transportation combined. Many households, particularly lower-income households located in automobile-dependent areas spend far more than this threshold, leaving them with insufficient money to spend on other essential goods such as food and healthcare. Transportation inaffordability also constrains people's economic opportunities, such as their ability to access education and employment opportunities.

Since automobiles have high fixed costs and sometimes require costly repairs, transportation affordability requires that lower-income households can minimize vehicle ownership and use, for example, sharing a car among several drivers, or meeting their accessibility needs without a vehicle at all. This requires a multi-modal transport system with high quality walking, cycling, public transit, carsharing and taxi services, and affordable housing located in accessible, multi-modal locations.

Conventional planning considers a relatively limited range of transport affordability impacts and objectives. More comprehensive analysis can help decision makers better understand the affordability impacts of planning decisions, and to identify more effective strategies for improving transport affordability. The following factors should be considered when evaluating transport affordability:

- Impacts on accessibility rather than just mobility.
- Individual needs and abilities (such as physical ability).
- Household incomes and budgets.
- Land use patterns (the degree of accessibility).
- Transportation options (the quantity and quality of affordable transport modes).
- Transportation costs (including all costs, not just fuel or transit fares).
- Affordability index (combined transport and housing costs).
- Total economic impacts (including indirect, external and non-market costs and benefits).

There are many possible ways to improve transport affordability; it is important to be comprehensive when evaluating them. Strategies that reduce automobile costs and encourage automobile travel by low-income people expose them to sometimes large and unexpected repair costs, and increases external costs including traffic and parking congestion, accidents and pollution emissions. Those that improve affordable transport options, such as walking, cycling and public transit, help achieve other planning objectives and so can provide the greatest overall benefits. Locating affordable housing in multi-modal, accessible communities tends to significantly improve transportation affordability. Automobile transport affordability can be increased with distance-based vehicle insurance and registration pricing, parking cash out and unbundling, and carsharing, which makes occasional automobile use affordable.

Improving transport affordability can significantly increase disadvantaged people's opportunity and happiness, and so it helps support economic development and increase social equity. It is therefore an important transport planning objective.

References And Resources For More Information

AAA (2013), *Your Driving Costs: How Much Are You Really Paying To Drive*, American Automobile Association (www.aaa.com).

AARP (2011), *Aging In Place: Stuck Without Options*, American Association for Retired Persons (www.aarp.org); at <http://t4america.org/docs/SeniorsMobilityCrisis.pdf>.

Abogo (<http://abogo.cnt.org>), named after a combination of “abode” and “go,” is a free Internet mapping tool that indicates the affordability and sustainability of specific neighborhoods.

Affordable Housing Design Advisor Website (www.designadvisor.org) provides information on affordable housing and communities development.

Affordable Housing Resource Center (www.novoco.com/resource.shtml).

Danielle Arigoni (2001), *Affordable Housing and Smart Growth: Making the Connections*, Smart Growth Network, Environmental Protection Agency (www.epa.gov); at www.epa.gov/dced/pdf/epa_ah_sg.pdf.

Linda Bailey (2007), “Public Transportation and Petroleum Savings in the U.S.: Reducing Dependence on Oil,” American Public Transportation Association (www.apta.com); at <http://tinyurl.com/23umk4x>.

Scott Bernstein, Carrie Makarewicz, Kara Heffernan, Albert Benedict and Ben Helphand (2004), *Increasing Affordability Through Reducing the Transportation and Infrastructure Cost Burdens of Housing*, Atlanta Neighborhood Development Partnerships (www.andpi.org).

Scott Bernstein (2014), *The Road to Prosperity: Real-Time Approaches to Economic Improvement*, Placemakers (www.placemakers.com); at <http://tinyurl.com/p5s2djw>.

Stephen Brobeck and J. Robert Hunter (2012), *Lower-income Households and the Auto Insurance Marketplace: Challenges and Opportunities*, Consumer Federation of America (www.consumerfed.org); at www.consumerfed.org/news/450.

Brookings Institute (2005), *The Price is Wrong: Getting the Market Right For Working Families in Philadelphia*, Metropolitan Policy Program, Brookings Institute (www.brookings.edu).

BLS (various years), *Consumer Expenditures*, Bureau of Labor Statistics (www.bls.gov); at www.bls.gov/cex/home.htm.

BTS (various years), *Transportation Statistics*, Bureau of Transportation Statistics (www.rita.dot.gov); at www.rita.dot.gov/bts/node/491081.

Cherise Burda and Geoffrey Singer (2015), *Location Matters: Factoring Location Costs into Home-buying Decisions*, Pembina Institute (www.pembina.org); at www.pembina.org/pub/location-matters).

CAA (2013), *Driving Costs; Beyond The Price Tag: Understanding Your Vehicle's Expenses*, Canadian Automobile Association (www.caa.ca); at <http://tinyurl.com/prjv2j7>.

CHP (2009), *Paycheck to Paycheck*, Center for Housing Policy; at www.nhc.org/chp/p2p.

CNT (2006), *Paved Over: Surface Parking Lots or Opportunities for Tax-Generating, Sustainable Development?*, Center for Neighborhood Technology (www.cnt.org); at www.cnt.org/repository/PavedOver-Final.pdf.

CNU (2008), *Parking Requirements and Affordable Housing*, Congress for the New Urbanism (www.cnu.org); at www.cnu.org/node/2241.

Coordination Council for Access and Mobility (www.ccamweb.org) is supported by the US Department of Transportation and the Department of Health and Human Services works to increase the cost-effectiveness of resources used for human service transportation.

Joe Cortright (2007), *Portland's Green Dividend*, CEOs for Cities (www.ceosforcities.org); at www.ceosforcities.org/city-dividends/green.

Wendell Cox and Hugh Pavletich (2015), *Demographia International Housing Affordability Survey*, Demographia (www.demographia.com); at www.demographia.com/dhi.pdf.

CTOD (2006), *Preserving and Promoting Diverse Transit-Oriented Neighborhoods*, Center for Transit-Oriented Development (www.reconnectingamerica.org); at www.cnt.org/repository/diverseTOD_FullReport.pdf.

CTOD (2008), *Realizing The Potential One Year Later: How Has The Market Downturn Played Out Along Five Transit Corridors In Five Very Different Markets?*, Center for Transit Oriented Development (www.reconnectingamerica.org) for the Federal Transit Administration (www.fta.dot.gov); at www.reconnectingamerica.org/public/stories/347.

CTOD (2009), *Mixed-Income Housing Near Transit: Increasing Affordability With Location Efficiency*, Center for Transit-Oriented Development and Reconnecting America (www.reconnectingamerica.org); at www.reconnectingamerica.org/public/display_asset/091030ra201mixedhousefinal.

CTOD (2009), *Mixed-Income Housing TOD Action Guide*, Center for Transit Oriented Development (CTOD) for Reconnecting America, the Center for Neighborhood Technology (www.reconnectingamerica.org); at http://reconnectingamerica.org/public/display_asset/090304mitodag0109.

CTOD and CNT (2006), *The Affordability Index: A New Tool for Measuring the True Affordability of a Housing Choice*, Center for Transit-Oriented Development and the Center for Neighborhood Technology, Brookings Institute (www.brookings.edu); at www.brookings.edu/metro/umi/20060127_affindex.pdf.

CTS (2010), *How Light-Rail Transit Improves Job Access for Low-Wage Workers*, Center for Transportation Studies (www.cts.umn.edu); at www.cts.umn.edu/Research/Featured/Transitways/documents/lowincome.pdf.

Kim-Mai Cutler (2014), *How Burrowing Owls Lead to Vomiting Anarchists (Or SF's Housing Crisis Explained)*, Techcrunch (www.techcrunch.com); at <http://techcrunch.com/2014/04/14/sf-housing>.

CWW (2009), *The Self-Sufficiency Standard*, Center for Women's Welfare (<http://selfsufficiencystandard.org/standard.html>). This defines the net income required to meet basic needs. It has been calculated for 37 states (<http://selfsufficiencystandard.org/pubs.html>).

DfT (2003), *Transport Analysis Guidance: 3.6.1: The Option Values Sub-Objective*, Department for Transport (www.dft.gov.uk); at www.dft.gov.uk/webtag/documents/expert/unit3.6.php#3.6.1.

Jago Dodson and Neil Sipe (2006), *Shocking the Suburbs: Urban Location, Housing Debt and Oil Vulnerability in the Australian City*, Research Paper 8, Griffith University (www98.griffith.edu.au); at www98.griffith.edu.au/dspace/bitstream/10072/12665/1/41353.pdf.

EC (annual reports), *Statistical Pocketbook: Mobility and Transport*, European Commission (www.ec.europa.eu); at http://ec.europa.eu/transport/facts-fundings/statistics/pocketbook-2014_en.htm, provides information on total household expenditures on transportation by country.

EuroStat (2008), *2005 Household Budget Survey*, EuroStat (<http://epp.eurostat.ec.europa.eu>); at http://epp.eurostat.ec.europa.eu/portal/page/portal/household_budget_surveys/introduction.

Reid Ewing and Shima Hamidi (2014), *Measuring Urban Sprawl and Validating Sprawl Measures*, Metropolitan Research Center at the University of Utah for the National Cancer Institute, the Brookings Institution and Smart Growth America (www.smartgrowthamerica.org); at www.arch.utah.edu/cgi-bin/wordpress-metroresearch.

Reid Ewing, et al. (2016), "Does Urban Sprawl Hold Down Upward Mobility?," *Landscape and Urban Planning*, Vol. 148, April, pp. 80-88; www.sciencedirect.com/science/article/pii/S016920461500242X.

Yingling Fan and Arthur Huang (2011), *How Affordable is Transportation? An Accessibility-Based Evaluation*, CTS Report 11-12, Transitway Impacts Research Program, Center for Transportation Studies (www.cts.umn.edu); at www.cts.umn.edu/Publications/ResearchReports/reportdetail.html?id=2024.

FDOT (2002), *Quality/Level of Service Handbook*, Florida Department of Transportation (www.dot.state.fl.us); at www.dot.state.fl.us/Planning/systems/sm/los/default.htm.

Nazneen Ferdous, Abdul Rawoof Pinjari, Chandra R. Bhat and Ram M. Pendyala (2008), *A Comprehensive Analysis of Household Transportation Expenditures Relative to Other Goods and Services: An Application to United States Consumer Expenditure Data*, University of Texas at

Austin (www.ce.utexas.edu); at www.ce.utexas.edu/prof/bhat/ABSTRACTS/ConsumerExpenditures_TRpartA_24Oct08.pdf.

Elliot Fishman and Tim Brennan (2009), *Oil Vulnerability in Melbourne*, Institute for Sensible Transport (www.sensibletransport.org.au); at <http://bit.ly/2pgpzCa>.

Howard Frumkin, Lawrence Frank and Richard Jackson (2004), *Urban Sprawl and Public Health: Designing, Planning, and Building For Healthier Communities*, Island Press (www.islandpress.org).

FTA (2008), *Better Coordination of Transportation and Housing Programs to Promote Affordable Housing Near Transit*, Federal Transit Administration, USDOT and Department of Housing and Urban Development; at www.huduser.org/Publications/pdf/better_coordination.pdf.

Timothy Garceau, et al. (2013), "Evaluating Selected Costs Of Automobile-Oriented Transportation Systems From A Sustainability Perspective," *Research in Transportation Business & Management*, Vol. 7, July 2013, pp. 43-53; www.sciencedirect.com/science/article/pii/S2210539513000059.

Peter M. Haas, Carrie Makarewicz, Albert Benedict, Thomas W. Sanchez and Casey J. Dawkins (2006), *Housing & Transportation Cost Trade-offs and Burdens of Working Households in 28 Metros*, Center for Neighborhood Technology (www.cnt.org); at www.cnt.org/repository/H-T-Tradeoffs-for-Working-Families-n-28-Metros-FULL.pdf.

Nicholas Hart and Nicholas E. Lownes (2013), "Urban Core Transit Access to Low-Income Jobs," *Transportation Research Record* 2357, Transportation Research Board (www.trb.org), pp. 58-65; at <http://trid.trb.org/view/1242944>.

HUD (2008), *Impact Fees & Housing Affordability: A Guide for Practitioners*, Office of Policy Development and Research, Department of Housing and Urban Development (www.huduser.org); at www.nmhc.org/Content/ServeFile.cfm?FileID=6877.

Ali A. Isalou, Todd Litman and Behzad Shahmoradi (2014), "Testing the Housing and Transportation Affordability Index in a Developing World Context: A Sustainability Comparison of Central and Suburban Districts in Qom, Iran," *Transport Policy*, Vol. 33, May pp. 33-39; www.sciencedirect.com/science/article/pii/S0967070X14000377.

Ali A. Isalou, Todd Litman, Kayoumars Irandoost and Behzad Shahmoradi (2014), "Evaluation of the Affordability Level of State-Sector Housing Built in Iran: Case Study of the Maskan-e-Mehr Project in Zanjan City," *Journal of Urban Planning and Development*, Vol. 140 ([http://dx.doi.org/10.1061/\(ASCE\)UP.1943-5444.0000235](http://dx.doi.org/10.1061/(ASCE)UP.1943-5444.0000235))

Wenya Jia and Martin Wachs (1998), *Parking Requirements and Housing Affordability; A Case Study of San Francisco*, University of California Transportation Center (www.uctc.net).

Jobs Access Project (<http://povertycenter.cwru.edu>) is a multi-faceted project by the Center on Urban Poverty and Social Change at Case Western Reserve University to investigate the relationship between job access and successful welfare-to-work transitions.

David S. Johnson, John M. Rogers and Lucilla Tan (2001), "A Century Of Family Budgets In The United States," *Monthly Labor Review* (www.bls.gov/opub/mlr/2001/05/art3full.pdf), May, pp. 28-46.

Jeff Kenworthy, Felix Laube, Peter Newman and Paul Barter (1997), *Indicators of Transport Efficiency in 37 Global Cities*, Sustainable Transport Research Group, Murdoch University (www.wistp.murdoch.edu.au), for the World Bank (www.worldbank.org).

Luke H. Klipp (2004), *The Real Costs of San Francisco's Off-Street Residential Parking Requirements: An Analysis of Parking's Impact on Housing Finance Ability And Affordability*, Transportation for a Livable City
www.livablecity.org/resources/Parking_Housing_Affordability_Final.pdf.

Jed Kolko (2014), *Where Is Homeownership Within Reach of the Middle Class and Millennials?*, (www.trulia.com); at www.trulia.com/trends/2014/11/middle-class-millennials-report.

Marc Lee, Erick Villagomez, Penny Gurstein, David Eby and Elvin Wyly (2008), *Affordable EcoDensity: Making Affordable Housing a Core Principle of Vancouver's EcoDensity Charter*, Canadian Center for Policy Alternatives (www.policyalternatives.ca); at www.policyalternatives.ca/documents/BC_Office_Pubs/bc_2008/affordable_ecodensity.pdf.

Leigh, Scott & Cleary (1999), *Transit Needs & Benefits Study*, Colorado Department of Transportation (www.dot.state.co.us).

David Levinson and Ahmed El-Geneidy (2006), *Development of Accessibility Measures*, Report No. 1 in the Series: Access to Destinations (Mn/DOT 2006-16), University of Minnesota's Center for Transportation Studies (www.cts.umn.edu/access-study/publications).

Michael Lewyn and Kristoffer Jackson (2014), *How Often Do Cities Mandate Smart Growth or Green Building?* Mercatus Center (www.mercatus.org), George Mason University; at <http://mercatus.org/publication/how-often-do-cities-mandate-smart-growth-or-green-building>.

Barbara Lipman (2005), "Something's Gotta Give: Working Families and the Cost of Housing," *New Century Housing*, Volume 5, Issue 2, Center for Housing Policy; at www.nhc.org/pdf/pub_nc_sgg_04_05.pdf.

Barbara Lipman (2006), *A Heavy Load: The Combined Housing and Transportation Burdens of Working Families*, Center for Housing Policy (www.nhc.org/pdf/pub_heavy_load_10_06.pdf).

Susan Liss, Nancy McGuckin and Nanda Srinivasan (2005), *Poverty and Mobility in America*, Federal Highway Administration; at <http://tinyurl.com/kw5jn4r>.

Todd Litman (2001), "You Can Get There From Here: Evaluating Transportation Choice," *Transportation Research Record 1756*, Transportation Research Board (www.trb.org), pp. 32-41; revised version at www.vtpi.org/choice.pdf.

Todd Litman (2003), *Parking Requirement Impacts on Housing Affordability*, VTPI (www.vtpi.org); at www.vtpi.org/park-hou.pdf.

Todd Litman (2004a), *Rail Transit In America: Comprehensive Evaluation of Benefits*, Victoria Transport Policy Institute (www.vtpi.org); at www.vtpi.org/railben.pdf; summarized in "Impacts of Rail Transit on the Performance of a Transportation System," *Transportation Research Record 1930*, Transportation Research Board (www.trb.org), 2005 pp. 23-29.

Todd Litman (2004b), *Evaluating Public Transit Benefits and Costs*, VTPI (www.vtpi.org); at www.vtpi.org/tranben.pdf.

Todd Litman (2005a), *Understanding Smart Growth Saving*, VTPI (www.vtpi.org); at www.vtpi.org/sg_save.pdf.

Todd Litman (2005b), *Transportation Cost and Benefit Analysis*, VTPI (www.vtpi.org); at www.vtpi.org/tca.

Todd Litman (2006), *Smart Growth Reforms*, VTPI (www.vtpi.org); at www.vtpi.org/smart_growth_reforms.pdf.

Todd Litman (2007), *Evaluating Accessibility for Transportation Planning*, Victoria Transport Policy Institute (www.vtpi.org); at www.vtpi.org/access.pdf.

Todd Litman (2008), *Evaluating Transportation Economic Development Impacts*, VTPI (www.vtpi.org); at www.vtpi.org/econ_dev.pdf.

Todd Litman (2009), *Where We Want To Be: Home Location Preferences And Their Implications For Smart Growth*, Victoria Transport Policy Institute (www.vtpi.org); at www.vtpi.org/sgcp.pdf.

Todd Litman (2009), "Mobility as a Positional Good: Implications for Transport Policy and Planning," *Car Troubles: Critical Studies of Automobility and Auto-Mobility*, Ashgate (www.ashgate.com); at www.vtpi.org/prestige.pdf.

Todd Litman (2010), *Affordable-Accessible Housing in a Dynamic City: Why and How to Support Development of More Affordable Housing in Accessible Locations*, Victoria Transport Policy Institute (www.vtpi.org); at www.vtpi.org/aff_acc_hou.pdf.

Todd Litman (2010a), *Raise My Taxes, Please! Evaluating Household Savings From High Quality Public Transit Service*, VTPI (www.vtpi.org); at www.vtpi.org/raisetaxes.pdf.

Todd Litman (2013), "The New Transportation Planning Paradigm," *ITE Journal*, Vol. 83, June, pp. 20-28; at www.vtpi.org/paradigm.pdf.

Todd Litman (2015), *More Critique of Demographia's International Housing Affordability Survey*, Planetizen (www.planetizen.com); at www.planetizen.com/node/73400.

William Lucy and David L. Phillips (2006), *Tomorrow's Cities, Tomorrow's Suburbs*, Planners Press (www.planning.org).

Carrie Makarewicz, Peter Haas, Albert Benedict and Scott Bernstein (2008), "Estimating Transportation Costs for Households by Characteristics of the Neighborhood and Household," *Transportation Research Record 2077*, TRB (www.trb.org), pp. 62-70; at <http://htaindex.cnt.org/downloads/Estimating-Transportation-Costs.pdf>.

Darshini Mahadevia, Rutul Joshi and Abhijit Datey (2013), *Low-Carbon Mobility in India and the Challenges of Social Inclusion: Bus Rapid Transit (BRT) Case Studies in India*, CEPT University Centre for Urban Equity (<http://cept.ac.in/178/center-for-urban-equity-cue->), UN Environmental Program; at www.unep.org/transport/lowcarbon/Pdf's/BRT_Casestudies_India_fullreport.pdf.

Jeremy Mattson (2012), *Travel Behavior and Mobility of Transportation-Disadvantaged Populations: Evidence from the National Household Travel Survey*, Upper Great Plains Transportation Institute (www.ugpti.org); at www.ugpti.org/pubs/pdf/DP258.pdf.

Barbara McCann (2000), *Driven to Spend; The Impact of Sprawl on Household Transportation Expenses*, STPP (www.transact.org).

Simon McDonnell, Josiah Madar and Vicki Been (2011), "Minimum Parking Requirements And Housing Affordability in New York City," *Housing Policy Debate*, Vol. 21, No. 1, January, pp. 45 – 68 (www.informaworld.com/smpp/content~content=a931285978~frm=abslink); based on *A Continuing Role for Minimum Parking Requirements in a Dense Growing City?*, Furman Center for Real Estate and Urban Policy; at http://lsr.nellco.org/cgi/viewcontent.cgi?article=1218&context=nyu_lewp.

Metro Vancouver (2012), *Metro Vancouver Apartment Parking Study; Revised Technical Report*, Metropolitan Planning, Environment, and Parks (www.metrovancouver.org); at www.metrovancouver.org/planning/development/strategy/Pages/Implementation.aspx. Also see, "Apartment parking spots lift development costs in Vancouver," *Georgia Strait*, www.straight.com/article-770756/vancouver/parking-spots-lift-prices.

Metro Vancouver (2012), *What Works: Affordable Housing Initiatives in Metro Vancouver Municipalities*, Metro Vancouver Regional Housing (www.metrovancouver.org); at www.metrovancouver.org/planning/development/housingdiversity/Pages/default.aspx.

Jon Mielke, Jeremy Mattson and David Ripplinger (2008), *Assessing Impacts of Rising Fuel Prices on Rural Native Americans*, Upper Great Plains Transportation Institute, North Dakota State University (www.ugpti.org); at www.ugpti.org/pubs/pdf/DP208.pdf.

Eric Miller (2004), *Travel and Housing Costs in the Greater Toronto Area: 1986-1996*, Neptis Foundation (www.neptis.org).

Mixed-Income Transit-Oriented Development Action Guide (www.mitod.org), developed by the Center for Transit-Oriented Development, is a comprehensive website providing information on ways to create mixed-income housing in transit-oriented development.

Mr Money Mustache (2016), *Rent vs. Buy: If You Have to Ask, You Should Probably Rent*, Mr Money Mustache (www.mrmoneymustache.com); at www.mrmoneymustache.com/2015/07/27/rent-vs-buy.

MWCOG (2005), *Toolkit for Affordable Housing Development*, Metropolitan Washington Council of Governments (www.mwcog.org), Publication Number: 20058254; at www.mwcog.org/uploads/pub-documents/9VpbXg20060217144716.pdf.

Arthur C. Nelson, Rolf Pendall, Casy Dawkins and Gerrit Knaap (2002), *The Link Between Growth Management and Housing Affordability: The Academic Evidence*, Brookings Institution Center on Urban and Metropolitan Policy (www.brook.edu); at <http://bit.ly/21VvpUe>.

NPH (2003), *Community Acceptance Toolkit* (<http://nonprofithousing.org/resources/the-original-nph-toolkit>), by the Non-Profit Housing Association of Northern California provides information strategies to improve efficiency and increase housing affordability.

NAR (2013), *National Community Preference Survey*, National Association of Realtors (www.realtor.org); at www.realtor.org/sites/default/files/reports/2013/2013-community-preference-analysis-slides.pdf.

NRDC (2010), *Reducing Foreclosures and Environmental Impacts through Location-Efficient Neighborhood Design*, Natural Resources Defense Council (www.nrdc.org); at www.nrdc.org/energy/files/LocationEfficiency4pgr.pdf.

Mark Obrinsky and Debra Stein (2007), *Overcoming Opposition to Multifamily Rental Housing*, National Multi Housing Council (www.nmhc.org); at www.nmhc.org/Content/ServeFile.cfm?FileID=5717.

Konstantinos Panou and George Proios (2014), *Modeling Transportation Affordability with The Cumulative Density Function of the Mathematical Beta Distribution*, Transportation Research Board Annual Meeting (www.trb.org); at www.vtpi.org/TRB13-2708.pdf.

Gary Pivo (2013), *The Effect Of Transportation, Location, And Affordability Related Sustainability Features On Mortgage Default Prediction and Risk in Multifamily Rental Housing*, University of Arizona for Fannie Mae (www.fanniemae.com); at www.fanniemae.com/resources/file/aboutus/pdf/hoytpivo_mfhousing_sustainability.pdf. Also see, *Walk Score and Multifamily Default: The Significance of 8 and 80*, at www.fanniemae.com/resources/file/fundmarket/pdf/hoytpivo_mfhousing_walkscore_122013.pdf.

Rob Perks and Craig Raborn (2013), *Driving Commuter Choice in America: Expanding Transportation Choices Can Reduce Congestion, Save Money and Cut Pollution*, Natural Resources Defense Council (www.nrdc.org); at www.nrdc.org/transportation/files/driving-commuter-choice-IP.pdf.

Stephanie Pollack, Barry Bluestone and Chase Billingham (2010), *Maintaining Diversity in America's Transit-Rich Neighborhoods: Tools for Equitable Neighborhood Change*, Dukakis Center for Urban and Regional Policy (www.dukakiscenter.org); at www.dukakiscenter.org/storage/TRNEquityFull.pdf.

Steven E. Polzin, Xuehao Chu and Vishaka Shiva Raman (2008), *Exploration of a Shift in Household Transportation Spending from Vehicles to Public Transportation*, Center for Urban Transportation Research (www.nctr.usf.edu); at <http://www.nctr.usf.edu/pdf/77722.pdf>.

PSRC (2015), *Complete Housing Toolkit*, Puget Sound Regional Council (www.psrc.org); at www.psrc.org/growth/housing/hip/alltools. This website provides information on various affordable housing strategies.

Rachel Quednau (2016), *The Cost of Commuting vs. Living Close*, Strong Towns Journal (www.strongtowns.org); at www.strongtowns.org/journal/2016/3/29/the-cost-of-commuting-vs-living-close.

Stephanie Y. Rauterkus, Grant I. Thrall and Eric Hangen (2010), "Location Efficiency and Mortgage Default," *Journal of Sustainable Real Estate* (www.costar.com/josre/default.htm), Vol. 2, No. 1, pp. 117-141; at www.costar.com/uploadedFiles/JOSRE/JournalPdfs/06.117_142.pdf.

Reconnecting America and CTOD (2007), *Realizing the Potential: Expanding Housing Opportunities Near Transit*, Reconnecting America (www.reconnectingamerica.org) for the Federal Transit Administration and the U.S. Department of Housing and Urban Development.

Lorien Rice (2004), *Transportation Spending by Low-Income California Households: Lessons for the San Francisco Bay Area*, Public Policy Institute of California (www.ppic.org/content/pubs/R_704LRR.pdf).

Lisa Schweitzer (2009), "Empirical Research on the Social Equity of Gas Taxes, Emissions Fees, and Congestion Charges," *Special Report 303: Equity Of Evolving Transportation Finance Mechanisms*, Transportation Research Board (www.trb.org); at <http://onlinepubs.trb.org/onlinepubs/sr/sr303Schweitzer.pdf>.

Lisa Schweitzer and Brian Taylor (2008), "Just Pricing: The Distributional Effects Of Congestion Pricing And Sales Taxes," *Transportation*, Vol. 35, No. 6, pp. 797–812 (www.springerlink.com/content/1168327363227298); summarized in "Just Road Pricing," *Access* 36 (www.uctc.net/access); Spring, pp. 2-7; at www.uctc.net/access/36/access36.pdf.

Donald Shoup (2005), *The High Cost of Free Parking*, Planners Press (www.planning.org).

San Diego (2011), *Affordable Housing Parking Study*, City of San Diego (www.sandiego.gov); at www.sandiego.gov/planning/programs/transportation/pdf/ahpsfactsheet2.pdf.

SFU (2006), *Affordability by Design: Affordability for All*, City Program, Simon Fraser University (www.sfu.ca/city/city_pgm_pubs.htm).

Michael J. Smart and Nicholas J. Klein (2015), *A Longitudinal Analysis of Cars, Transit, and Employment Outcomes*, Mineta National Transit Research Consortium (<http://transweb.sjsu.edu>); at <http://transweb.sjsu.edu/PDFs/research/1244-cars-transit-employment-outcomes-longitudinal-analysis.pdf>.

Stats Canada (2014), *Survey of Household Spending*, Statistics Canada (www.statcan.gc.ca); at www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=3508.

Mac Taylor (2016), *Perspectives on Helping Low-Income Californians Afford Housing*, Legislative Analyst's Office (www.lao.ca.gov); at www.lao.ca.gov/Reports/2016/3345/Low-Income-Housing-020816.pdf.

Ray Tomalty and Murtaza Haider (2008), *Housing Affordability and Smart Growth in Calgary*, Plan-It Calgary, City of Calgary (www.calgary.ca); at <http://tinyurl.com/kfq4aha>.

Tompkins County (2009), *Promote Choice And Affordability In Housing Options; Vital Communities Toolbox*, Tompkins County (www.co.tompkins.ny.us); at www.co.tompkins.ny.us/planning/vct/3.html.

Toronto Public Health (2013), *Next Stop Health: Transit Access and Health Inequities in Toronto*, Toronto Public Health (www.toronto.ca/health); at www.toronto.ca/legdocs/mmis/2013/hl/bgrd/backgroundfile-56681.pdf.

TransForm (2009), *Windfall For All: How Connected, Convenient Neighborhoods Can Protect Our Climate and Safeguard California's Economy*, TransForm (www.TransformCA.org); summary at <http://transformca.org/files/reports/Transform-Windfall-Report-Summary.pdf>.

TransForm (2014), *Why Creating and Preserving Affordable Homes Near Transit is a Highly Effective Climate Protection Strategy*, TransForm (www.TransformCA.org) and the California Housing Partnership Corporation (www.chpc.net); at <http://tinyurl.com/pnf7u86>.

ULI (2009), *Beltway Burden: The Combined Cost of Housing and Transportation in the Greater Washington, DC Metropolitan Area*, ULI Terwilliger Center for Workforce Housing, Urban Land Institute (www.uli.org); at <http://commerce.uli.org/misc/BeltwayBurden.pdf>.

ULI (2009), *Bay Area Burden*, ULI Terwilliger Center for Workforce Housing (www.uli.org); at http://bayareaburden.org/wp-content/uploads/2009/11/Bay-Area-Burden_FINAL_lowres.pdf.

USGBC Affordable Housing Initiative (www.usgbc.org/DisplayPage.aspx?CMSPageID=2031), US Green Building Council. Provides guidelines for creating energy efficient affordable housing.

Vancouver EcoDensity (www.vancouver-ecodensity.ca) is a program to increase urban livability, affordability and environmental performance through more compact development.

VTPI (2006), *Online TDM Encyclopedia*, Victoria Transport Policy Institute (www.vtpi.org/tdm).

Robert W. Wassmer and Michelle C. Baass (2006), "Does a More Centralized Urban Form Raise Housing Prices," *Journal of Policy Analysis and Management*, Vol. 25, No. 2, pp. 439-462; at <http://hdl.handle.net/10.1002/pam.20180>.

Asha Weinstein Agrawal, et al. (2011), *Getting Around When You're Just Getting By: The Travel Behavior and Transportation Expenditures of Low-Income Adults*, Report 10-02, Mineta

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Transportation Institute (www.transweb.sjsu.edu); at
www.transweb.sjsu.edu/MTIportal/research/publications/documents/2806_10-02.pdf.

www.vtpi.org/affordability.pdf