Socioeconomics of Urban Travel: Evidence from the 2001 NHTS

The 2001 National Household Travel Survey (NHTS) confirms most of the same travel trends and variations among socioeconomic groups documented by its predecessors, the Nationwide Personal Transportation Surveys (NPTS) of 1969, 1977, 1983, 1990, and 1995. The private car continues to dominate urban travel among every segment of the American population, including the poor, minorities, and the elderly. By comparison, public transport accounts for less than 2% of all urban travel. Even the lowest-income households make only 5% of their trips by transit. The most important difference in the 2001 NHTS is the doubling in modal share of walk trips in cities, due to a much improved survey technique that captured previously unreported walks.

While the private car dominates travel, there are important variations in auto ownership and travel behavior by income, race, ethnicity, sex, and age. Overall, the poor, racial and ethnic minorities, and the elderly have much lower mobility rates than the general population. Moreover, the poor, blacks, and Hispanics are far more likely to use transit than other groups. Indeed, minorities and low-income households account for 63% of the nation's transit riders. Different socioeconomic groups also have different rates of carpooling, taxi use, bicycling, and walking. In addition, they travel different distances and at different times of day. Many of these socioeconomic variations in travel behavior have important consequences for public policy.

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This is the fourth in a series of articles for *Transportation Quarterly* analyzing urban travel trends and differences in travel behavior among a range of socioeconomic groups.[1] We examine the 2001 National Household Travel Survey (NHTS), which was released in January 2003. Our focus is on interrelated variations in motor vehicle ownership, mobility levels, means of transportation (travel mode), trip distance, time of day of travel, and purpose of travel as these dimensions of travel behavior vary by income group, ethnic and racial group, sex, and age. We compare the results of the 2001 NHTS with those of its predecessor, the Nationwide Personal Transportation Survey (NPTS), in 1969, 1977, 1983, 1990, and 1995.

The most salient trend in American travel behavior over the past four decades has been increased reliance on the private car for urban travel, with corresponding declines in public transit and walking. The journey-to-work portion of the US Census, for example, reports that the percentage of work trips made by public transit fell from 12.6% in 1960 to only 4.7% in 2000 (see Table 1). The share of walk trips fell from 10.3% to only 2.9%. Conversely, the private car's share of work trips rose from 66.9% to 87.9%.[2] Similarly, the series of NPTS and NHTS surveys, which also include nonwork

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trips, show that Americans have been relying increasingly on the car for all their travel purposes, not just for the journey-to-work (see Table 2). Thus, the auto's share of daily, local travel rose from 81.8% of trips in 1969 to 86.4% in 2001, while public transit's share fell from 3.2% to 1.6% over the same period.[3]

Corresponding to that increased reliance on the automobile, motor vehicle ownership is now almost universal in the United States, with 91.7% of American households owning at least one motor vehicle in 2001, and 58.5% of households owning two or more vehicles.[4] Indeed, the total number of motor vehicles per household rose from 1.2 in 1969 to 1.9 in 2001, and the number of motor vehicles per licensed driver rose from 0.7 to 1.1.[5] Yet further confirming this growing auto availability, the total number of autos and light trucks per 1,000 persons rose from 340 in 1960 to 766 in 2001, giving the USA by far the highest rate of personal vehicle ownership in the world, about 50% higher than in most Western European countries.[6]

While these aggregate statistics confirm the extreme auto dependence of American cities, they mask important variations by region of the country, by city size, and among socioeconomic groups. There are important differences in travel behavior by income, age, sex, race, and ethnicity. Motor vehicle ownership, mobility rates, means of transport, trip distance, trip purpose, and time of day of travel vary from one group to another. Such differences can be crucial in designing equitable transport policies at all government levels.

For example, peak-hour congestion pricing on roadways and off-peak discounts for transit should take into account the income differences of travelers by time of day. Similarly, the regressivity of financing transportation through gasoline taxation, roadway tolls, transit fares, and user charges of any sort depends on the income distribution of

Table 1: Trends in Modal Split for the Journey-to-Work (1960 - 2000) (percentage of work trips by means of transportation)

Mode of Transportation	Census Year				
	1960	1970	1980	1990	2000
Total Auto	66.9	77.7	84.1	86.5	87.9
SOV	na	na	64.4	73.2	75.7
HOV	na	na	19.7	13.4	12.2
Public Transit	12.6	8.9	6.4	5.3	4.7
Walk	10.3	7.4	5.6	3.9	2.9
Bicycle	na	na	0.5	0.4	0.4
Work at Home	7.5	3.5	2.3	3.0	3.3
Other	2.6	2.5	1.1	0.9	0.8
All	100	100	100	100	100

Source: US Decennial Census, *Supplemental Survey: Journey-to-Work,* various census years, 1960 to 2000, as tabulated by Alan Pisarski and reported in A. Pisarski, *Commuting in America III.* Washington, DC: Eno Transportation Foundation, forthcoming in 2003.

Note: Only the 1960 Census work trip survey included a category called "not reported," which accounted for 4.3% of all 1960 responses. To make the 1960 distributions comparable with those of later years, which do not include an "unreported" category, the 1960 reported modal shares were scaled up by a factor of 1.045 so that their total would equal approximately 100%.

Table 2: Trends in Modal Split for Daily Travel in the United States (1969-2001) (percent of trips by transport mode, all trip purposes)

Mode of Transportation	1969 (1)	1977	1983	1990	1995	2001
Auto[2]	81.8	83.7	82.0	87.1	86.5	86.4
Transit	3.2	2.6	2.2	2.0	1.8	1.6
Walk[2]	na	9.3	8.5	7.2	5.4	8.6
Bicycle	na	0.7	0.8	0.7	0.9	0.9
Other[3]	5.0	3.7	6.5	3.0	5.4	2.5

Source: Federal Highway Administration, Nationwide Personal Transportation Surveys 1969, 1977, 1983, 1990, and 1995; and National Household Travel Survey, 2001.

Note: Unlike all subsequent tables, these NPTS and NHTS modal split percentages are for daily, local travel in aggregate for the entire USA, both urban and rural, as reported by the FHWA in its own NPTS and NHTS reports. Our own tabulations, from Table 3 onward, include only local trips in urban areas.

1. The 1969 NPTS did not sample walk and bike trips, thus artificially inflating the modal split shares of the motorized modes compared to the NPTS surveys in later years. To ensure some degree of comparability, we adjusted downward the reported motorized shares of trips in 1969 by 10%, using the percentage of walk and bike trips in 1977. That is why the column adds to 90% and not 100%. Our adjustment is rough, but otherwise, the 1969 and later NPTS modal split distributions would be completely incomparable.
2. The decrease in auto mode share from 1995 to 2001, and the corresponding increase in walk mode share during the same period, are due to a change in sampling methodology that captures previously unreported walk trips.
3. The "other" categories includes mainly school bus trips, which account for roughly 2 -3% of all trips in each of the survey years. It also includes taxicabs, ferries, airplanes, and helicopters.

travelers across different means of transport, trip distances, locations, and times of day of travel. On the benefit side, the equity impacts of subsidy expenditures depend on variations in socioeconomic characteristics of travelers along those same dimensions of travel behavior. The extent to which the poor benefit from transit subsidies depends on the degree to which they actually use the specific type of transit being subsidized. Disaggregation of travel statistics also helps identify groups suffering from low mobility and may suggest the most effective approaches to remedying their inadequate accessibility to transport services.

The 2001 NHTS

The National Household Travel Survey was conducted for the first time in 2001 and replaces the Nationwide Personal Transportation Survey for daily travel and the American Travel Survey (ATS) for long-distance travel. Since this article deals exclusively with urban travel, we focus on the daily trip portion of the NHTS and compare that part of the 2001 survey with the former NPTS surveys of 1969, 1977, 1983, 1990, and 1995. While the decennial Census provides information for the journey to work (less than a fifth of all trips), the NPTS and NHTS surveys are the only sources of comprehensive, nationwide data on trips for all purposes. Similar to the NPTS surveys, the NHTS reports a wide range of information about the socioeconomic characteristics of households, as well as their motor vehicle ownership and many aspects of their travel. For example, it reports the number of trips per day and, for each trip, the means of travel, day and time of travel, trip distance, and trip purpose.

The 2001 NHTS was funded and coordinated by the US Department of Transportation (Federal Highway Administration, Bureau of Transportation Statistics, and the National Highway Traffic Safety Administration). Two private firms, however, actual-

ly conducted the survey through telephone interviews: Westat (Rockville, MD) and Battelle/Morpace (Farmington Hills, MI).

The 2001 NHTS incorporates several important improvements in survey methodology, just as the 1995 NPTS had greatly improved over earlier NPTS surveys. For example, walk trips had been significantly underreported in all earlier surveys. Thus, the 2001 NHTS included several special prompts in the survey questionnaire to ensure that all walk trips were reported. Moreover, because earlier surveys had reported some questionable trip lengths, multiple data collection methods were used to achieve more accurate trip distances. The 2001 survey also collected more detailed information on trips made to access transit services.

Of course, the NHTS suffers from all the problems of telephone surveys. Most importantly, it undersamples low-income households without telephones. To correct that problem, survey responses were weighted to make the overall sample representative of the population as a whole. Indeed, the weighting of undersampled households in the 2001 NHTS was more extensive than in any previous survey. The NHTS does not, however, take into account the increasing number of households with only cellular phones that cannot be reached by standard telephone survey techniques.

The 2001 NHTS was conducted over the 14-month period from March 2001 to May 2002, thus ensuring coverage of every month of the year. Unfortunately, that timing turned out to be problematic due to the September 11, 2001 terrorist attacks on the World Trade Center in New York City and the Pentagon in Washington, DC. The attacks disrupted transport services for months, especially curtailing long-distance travel. It is not certain what impacts the attacks had on urban travel, but it seems likely that both the amount of travel and modal choice were affected. That may have distorted the survey results to some unknown extent.

As with the earlier NPTS surveys, the NHTS only includes the civilian, noninstitutionalized population of the United States. It explicitly excludes motels, hotels, prisons, military barracks, convents, monasteries, and any living quarters with 10 or more unrelated occupants. The NHTS included college students, however, provided that dormitory, fraternity or sorority rooms had telephones and fewer than 10 occupants. The 2001 survey interviewed 25,721 households nationwide, but we analyzed the responses of only the 19,768 households living in urban areas. We further restricted our analysis to urban travel by eliminating all trips over 75 miles. The resulting sample included 173,974 urban trips (out of 248,517 total trips for the entire NHTS sample). Our analysis of the NHTS, therefore, varies from other studies that examine the entire sample, including nonurban households and trips.

Impact of Trip Purpose on Modal Choice

As already noted in Tables 1 and 2, public transit has been serving a declining percentage of all trip purposes, but its share of work trips has been consistently higher than for nonwork trips. That is evident not only from comparing the journey-to-work data from the Census (Table 1) with the NPTS all-purpose data (Table 2), but also from disaggregating the NHTS data by trip purpose, as in Table 3. It shows that transit served 3.7% of all work trips in 2001, compared to 1.4% of shopping trips, 1.0% of social and recreational trips, and 2.2% of school and church trips. The rail transit modes are especially focused on the work trip.

Single occupant auto use (SOV) is the predominant choice for the work trip, accounting for 75.4% of all journeys to work. Carpooling—via high occupancy vehicle (HOV)—is much more prevalent, however, for all other trip purposes, accounting for over half of such trips. Family members are often passengers on car trips for shopping,

Table 3: Variation in Modal Choice by Trip Purpose (percentage of trips by means of transportation)

Mode of Transportation	Trip Purpose			
	Work and Work Related	Shopping and Services	Social and Recreation	School and Church
Total Auto	92.1	91.5	84.1	72.9
SOV[1]	75.4	38.4	27.6	17.1
HOV[2]	16.8	53.2	56.6	55.9
Total Transit	3.7	1.4	1.0	2.2
Bus and Light Rail[3]	2.1	1.2	0.7	1.8
Metro/Subway/Heavy Rail[4]	1.1	0.1	0.3	0.4
Commuter Rail[5]	0.5	0.0	0.0	0.0
Total Nonmotorized	3.9	6.8	14.0	11.2
Walk	3.4	6.5	12.7	10.5
Bicycle	0.5	0.3	1.3	0.7
School Bus	0.1	0.0	0.2	13.6
Taxicab	0.1	0.1	0.1	0.1
Other	0.1	0.2	0.5	0.1
All	100	100	100	100

Source: Calculated by the authors from the 2001 NHTS.

Notes: In order to isolate urban travel, the sample was limited to residents of urban areas and trips of 75 miles or less.

1. SOV (single occupancy vehicle) includes vehicles with driver and no passengers.
2. HOV (high occupancy vehicle) includes vehicles with two or more occupants.
3. Light rail also includes conventional streetcars.
4. Metro/subway/heavy rail includes elevated rail and rail rapid transit.
5. Commuter rail includes suburban/regional rail systems and short-distance service provided by Amtrak.

recreation, church, and school, while they seldom accompany each other to work.

Walking and bicycling are most used for social and recreational trips and for trips to school. Nonmotorized transportation is used much less for work trips, probably due to the longer length of work trips and the need to minimize travel time. Likewise, few travelers rely on walking or cycling for shopping, probably because those modes are not well suited to carrying packages. Moreover, most shopping facilities are now located far from residential neighborhoods, no longer within walking or cycling distance for most households.

Regional Variations in Transit Use, Walking, and Cycling

The nationwide aggregate statistics shown in most tables in this article hide the enormous variation in travel behavior from one region of the country to another. As shown in Table 4, the most transit-oriented region, the Mid-Atlantic, has a transit modal share that is 15 times higher than in the least transit-oriented region, the East South Central (5.8% vs. 0.4%). The Pacific and New England regions follow the Mid-Atlantic region in order of their transit shares (2.2% and 1.8%, respectively).

Regional variations in walking are also striking, and strongly correlated with transit modal share. Thus, the highest walk modal share is also in the Mid-Atlantic states (15.8%), followed by the Pacific region (10.6%), and New England (10.3%). Conversely, the lowest shares of walk trips are in the East South Central (6.0%) and the West South Central (6.3%). The correlation between transit use and walking is probably due to the more walkable, compact urban form in transit-oriented cities and the crucial role of walking to access transit stops.

Bicycling has a somewhat different regional pattern, with the highest level in the Pacific (1.1%), but roughly the same levels in the rest of the country (0.7% to 0.9%), except for the East South Central, which has a much lower level (0.4%). Thus, the East South Central has the lowest levels of transit use, walking, and cycling, and is the most dependent on the auto for all travel.

Impact of Income on Travel Behavior

Just as with the 1995 NPTS, the 2001 NHTS shows a striking increase in travel with increased income levels. We have altered the income categories in 2001 to account for inflation and the shifting distribution of households to higher income levels. Nevertheless, the impact of income on daily trip frequency and mileage covered is virtually the same for both surveys. Thus, households with incomes less than $20,000 a year made an average of 3.2 trips per person, per day in 2001 compared to 4.8 trips per day for households with incomes of $100,000 or more (see Table 5). Not only do higher-income households make more trips per day, but they also make longer trips, covering almost twice the total mileage per day of low-income households (31.8 miles vs. 17.9 miles per person, per day).

The much lower mobility rates of the low-income households might be interpreted as a basic inequity in our urban transportation system. Clearly, many low-income households are cut off from some destinations they need to reach because they cannot afford the automotive transportation needed to access most parts of metropolitan areas. That is especially serious in the case of inaccessible job sites, since poverty is thus directly perpetuated. Moreover, inability to reach medical, educational, training, shopping, and recreational facilities can also seriously impair the quality of life of poor households.

Table 4: Regional Variations in Modal Shares for Transit, Walking, and Bicycling (percentage of trips by transit)

Mode of Transportation	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific
Total Transit	1.8	5.8	1.3	0.6	1.6	0.4	0.7	0.8	2.2
Bus and Light Rail	0.7	3.0	0.9	0.5	1.2	0.4	0.7	0.8	2.0
Metro/Subway/ Heavy Rail	0.9	2.3	0.2	0.0	0.3	0.0	0.0	0.0	0.1
Commuter Rail	0.3	0.5	0.2	0.0	0.1	0.0	0.0	0.0	0.1
Total Nonmotorized	11.0	16.7	9.5	7.3	8.5	6.4	7.1	9.5	11.7
Walk	10.3	15.8	8.6	6.6	7.6	6.0	6.3	8.7	10.6
Bicycle	0.7	0.8	0.9	0.7	0.9	0.4	0.8	0.8	1.1

Source: Calculated by the authors from the 2001 NHTS.

Table 5: Daily Travel per Capita by Income Class

Household Income	Trips per Day, per Person	Miles Traveled per Day, per Person
Less than $20,000	3.2	17.9
$20,000 to $39,999	3.9	26.4
$40,000 to $74,999	4.2	30.2
$75,000 to $99,999	4.3	30.7
$100,000 and over	4.8	31.8
All	4.0	26.9

Source: Calculated from the 2001 NHTS by Mary Ann Keyes, Federal Highway Administration, US Department of Transportation.
Note: In order to isolate urban travel, the sample was limited to residents of urban areas and trips of 75 miles or less.

To some extent, however, the lower mobility of low-income households reflects their higher rates of unemployment and retirement, and thus fewer trips to work. Their shorter trip lengths might also result from the concentration of the poor in central cities, where things are closer together and do not require such long trips as in the suburbs.

As expected, the rate of auto ownership rises with increasing household income (see Table 6 and Figure 1). While 26.5% of households with incomes less than $20,000 have no motor vehicle at all, only 5.0% of households in the next highest income category ($20,000 to $39,999) have no motor vehicle. Only 1.2% of households with incomes over $75,000 have no motor vehicle. Thus, by far the largest jump in auto ownership comes at the low end of the income scale. A car is obviously one of the first purchases households make as soon as they can, even if it strains their already limited budgets. Indeed, it is probably unique to the United States that three-fourths of even its poorest households own a car. That reflects the extent to which the car has become a virtual necessity for even the most basic transportation needs in most American metropolitan areas.

Similarly, the rate of multiple car ownership increases with income. Thus, the percentage of households with two or more cars increases from 25.2% in the under $20,000 category to 50.9% in the $20,000 to $39,999 category and 87.8% in the $100,000 and over category. The percentage of households with three or more cars increases from 7.7% in the under $20,000 category to 15.3% in the $20,000 to $39,999 category and 38.5% in the $100,000 and over category. The sharp increase in multiple car ownership with increased income is fully expected, and is also consistent with all earlier NPTS surveys. Increased income obviously makes cars more affordable. Moreover, there is a positive correlation between income and household size in the NHTS sample, so higher-income households also have more cars because they are larger. Nevertheless, even 7.7% of low-income households reported owning three or more cars, which seems a bit surprising. That might reflect underreported incomes or substantial assets of retired households with low current incomes.

Income is the primary determinant of auto ownership, which, in turn, is the main determinant of modal choice. As shown in Table 7, the ownership of even one car dramatically transforms travel behavior. Thus, transit use drops from 19.1% of trips by households with no car to only 2.7% of trips by households with one car. Equally striking, walk trips fall from 41.1% of trips by households with no car to only 12.5% of trips by households with one car. Bike trips fall from

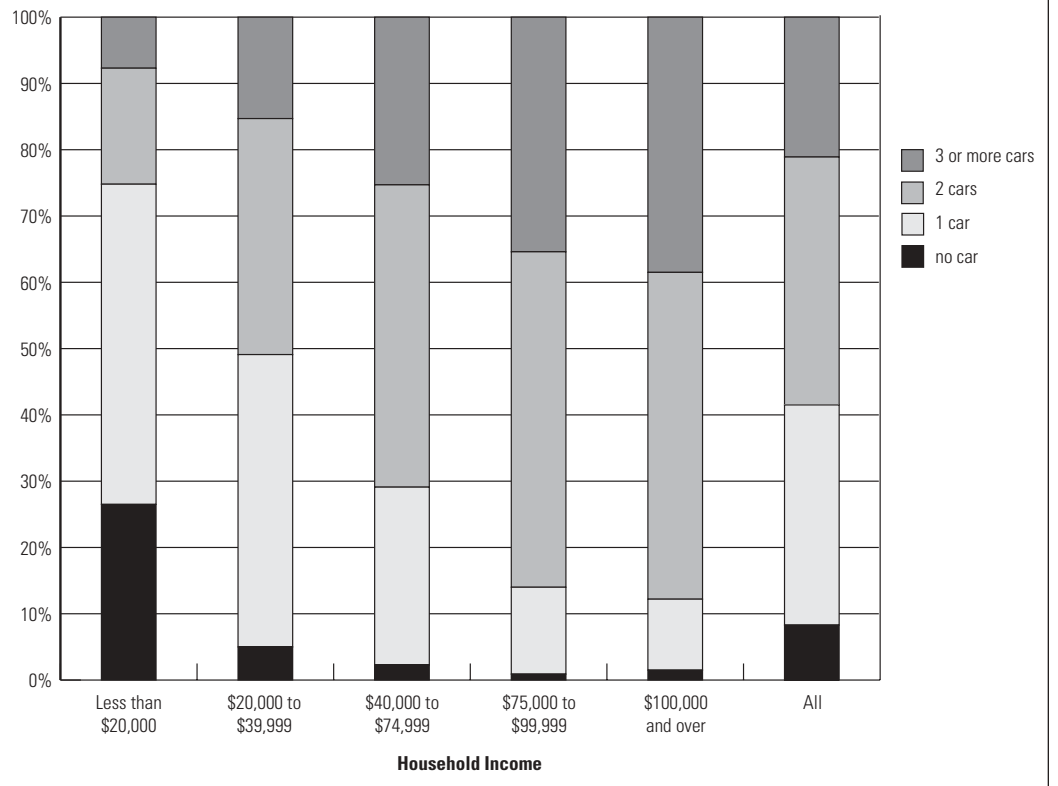
Table 6: Vehicle Ownership by Income Class (percentage distribution within each income class)

Vehicles Per Household	Household Income					
	Less than $20,000	$20,000 to $39,999	$40,000 to $74,999	$75,000 to $99,999	$100,000 and over	All
0	26.5	5.0	2.3	0.9	1.5	8.3
1	48.3	44.1	26.8	13.1	10.7	33.2
2	17.5	35.6	45.6	50.6	49.3	37.4
3 or more	7.7	15.3	25.3	35.4	38.5	21.1
Total	100	100	100	100	100	100

Source: Calculated by the authors from the 2001 NHTS.

Notes: The sample was limited to residents of urban areas. Vehicles include passenger cars, as well as station wagons, passenger vans, sport-utility vehicles, pickup trucks, light trucks, motorcycles, mopeds, and recreational vehicles. This data include only residents of urban areas and urban clusters.

Figure 1: Vehicle Ownership by Income Class (percentage of households in each income class)



Source: See Table 6.

2.4% to 0.7% of all trips. And taxi trips fall from 1.0% to 0.2% of all trips. Subsequent increases in auto ownership to two, three, or more cars per household have relatively minor additional impacts on travel behavior, although they further decrease transit use, walking, and cycling, as expected. Thus, households with three or more cars make only 0.5% of their trips by transit, 6.3% by walking, 0.8% by bicycle, and 0.1% by taxi.

These patterns mirror those in the 1995 NPTS and roughly conform to expectations. Both surveys find considerable auto use even among households with no cars: 34.1% of all trips in 2001 and 29.6% of all trips in 1995. Most of those auto trips are reported as passengers in someone else's car (for HOV), but 5.2% were made as drivers in 2001 (vs. 5.7% in 1995).[7] That can only be explained as the result of renting cars or borrowing them from neighbors, friends, or relatives who own cars.

The bad news for transit in Table 7 is that most households abandon public transportation as soon as they own their first car. The doubling of auto ownership per capita since 1960 is surely one of the most important reasons for the steady decline in transit's modal share, as shown in Tables 1 and 2. The already high and still rising level of auto

Table 7: Impact of Auto Ownership on Mode Choice (percentage of trips by means of transportation)

Mode of Transportation	Total Number of Vehicles in Household				
	0	1	2	3 or more	All
Total Auto	34.1	81.9	88.8	90.5	85.9
SOV[1]	5.2	36.8	36.6	42.5	37.3
HOV[2]	28.9	45.1	52.2	48.0	48.6
Total Transit	19.1	2.7	0.6	0.5	1.7
Bus and Light Rail[3]	14.1	1.9	0.4	0.3	1.2
Metro/Subway/Heavy Rail[4]	4.8	0.7	0.1	0.1	0.4
Commuter Rail[5]	0.2	0.2	0.1	0.1	0.1
Total Nonmotorized	43.5	13.2	8.8	7.1	10.4
Walk	41.1	12.5	7.8	6.3	9.5
Bicycle	2.4	0.7	0.9	0.8	0.9
School Bus	1.5	1.7	1.4	1.4	1.5
Taxicab	1.0	0.2	0.1	0.1	0.1
Other	0.9	0.3	0.4	0.3	0.4
All	100	100	100	100	100

Source: Calculated by the authors from the 2001 NHTS.

Notes: In order to isolate urban travel, the sample was limited to residents of urban areas and trips of 75 miles or less.

1. SOV (single occupancy vehicle) includes vehicles with driver and no passengers.
2. HOV (high occupancy vehicle) includes vehicles with two or more occupants.
3. Light rail also includes conventional streetcars.
4. Metro/subway/heavy rail includes elevated rail and rail rapid transit.
5. Commuter rail includes suburban/regional rail systems and short-distance service provided by Amtrak.

ownership in the United States will remain a strong deterrent to transit use in the coming years.

Walking and cycling plummet with increasing car ownership (from 43.5% to 7.1% of all trips), thus depriving people of much needed exercise. With 64% of Americans overweight in 2001, and 31% obese, leading medical and public health journals have explicitly advocated more walking and cycling for daily travel as the most affordable, feasible, and dependable way for Americans to get the additional exercise they need.[8] Similarly, the US Surgeon General specifically recommends more walking and cycling for practical, daily travel as an ideal approach to raising physical activity levels.[9] The availability of cars appears to present an almost irresistible temptation to drive instead of walking or cycling, even for short trips. Walking in European cities has also declined over the past few decades as auto ownership levels have risen, and obesity levels are now rising there as well, although they are only about a third of American obesity rates.[10]

Unfortunately, the large increase in walk trips registered by the 2001 NHTS is probably not due to actual increases in walking. As already noted, there was a significant improvement in the survey questionnaire to capture the many walk trips not reported by the earlier NPTS surveys. While the share of trips by walking in 2001 seems realistic, the jump from 5.5% in 1995 to 9.5% in 2001 (as seen in Table 2) is exaggerated, since previous surveys were so defective in their sampling of walk trips. The slight decline in auto modal share reported from 1995 to 2001 is also artificial, since the new sampling procedure for walk trips considerably raised the number of total nonauto trips.

Table 8 shows the total impact of income on choice of travel mode, thus reflecting both its indirect impact via auto ownership and its direct impact through the overall need to travel and its correlation with employment. It also reflects the tendency of higher-income households to live in auto-dependent suburbs, where cars are necessary to reach almost all destinations. As expected, auto use rises with income, but the only increase in the auto's share of travel is from the poorest to the next higher income class (from 75.9% to 87.3% of all trips). With subsequent increases in income, there is virtually no additional increase in auto modal split share. Moreover, even the poorest households are only slightly less likely than affluent households to make their trips as drivers instead of as passengers in cars.

Just as Table 6 indicates that roughly three-fourths of the poorest households own at least one car, Table 8 shows that roughly three-fourths of their trips are by car. Thus, the automobile is the primary mode of travel not only of the affluent but also of the poor. Perhaps most surprising is that only 4.6% of the trips made by the lowest-income households are by any form of public transit. Indeed, the poor use cars 17 times more than transit for their urban trips (75.9% vs. 4.6%). Although the expense of owning, insuring, and operating a car unquestionably strains the limited budgets of poor households, they are left with virtually no alternative to the automobile. America's polycentric, sprawling metropolitan areas force almost all households to own and use cars to reach most destinations. In addition, transit systems often neglect the special travel needs of low-income households. Indeed, several studies suggest that low-income neighborhoods suffer from inferior service, excessively high fares, overcrowding, and routes that do not match their desired trip patterns.[11]

While transit use generally declines with increased income, there are large and important variations by type of transit. Bus usage, in particular, plummets as incomes rise. Thus, the poor are eight times as likely as the affluent to take the bus (4.0% vs. 0.5% of trips). In sharp contrast, the affluent are three times more likely than the poor to take suburban rail (0.3% vs. 0.1% of trips).

Table 8: Modal Split by Income Class (percentage of trips by means of transportation)

Mode of Transportation	Household Income					
	Less than $20,000	$20,000 to $39,999	$40,000 to $74,999	$75,000 to $99,999	$100,000 and over	All
Total Auto	75.9	87.3	88.1	87.4	86.9	85.9
SOV[1]	30.0	37.9	39.2	38.6	37.9	37.3
HOV[2]	45.9	49.5	48.9	48.7	49.0	48.6
Total Transit	4.6	1.4	1.1	0.9	1.5	1.7
Bus and Light Rail[3]	4.0	1.0	0.7	0.5	0.5	1.2
Metro/Subway/ Heavy Rail[4]	0.6	0.3	0.3	0.3	0.7	0.4
Commuter Rail[5]	0.1	0.0	0.1	0.2	0.3	0.1
Total Nonmotorized	17.0	9.7	9.0	9.4	9.5	10.4
Walk	16.2	8.8	8.1	8.5	8.7	9.5
Bicycle	0.9	0.9	0.9	0.9	0.8	0.9
School Bus	1.9	1.3	1.4	1.5	1.4	1.5
Taxicab	0.2	0.1	0.1	0.2	0.3	0.1
Other	0.3	0.2	0.4	0.6	0.4	0.4
All	100	100	100	100	100	100

Source: Calculated by the authors from the 2001 NHTS.

Notes: In order to isolate urban travel, the sample was limited to residents of urban areas and trips of 75 miles or less.

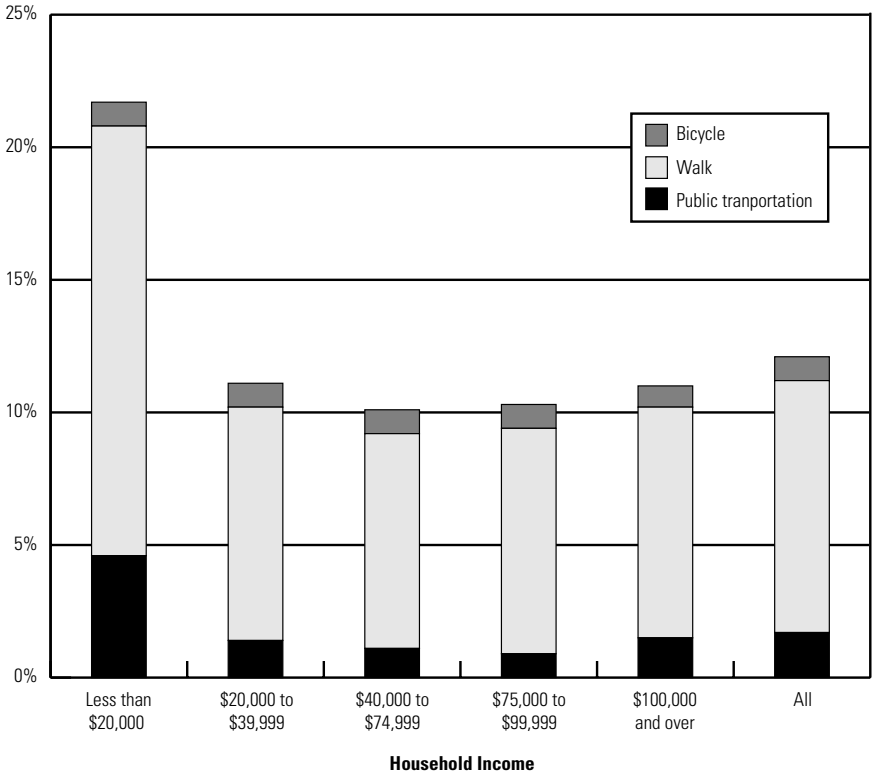
1. SOV (single occupancy vehicle) includes vehicles with driver and no passengers.
2. HOV (high occupancy vehicle) includes vehicles with two or more occupants.
3. Light rail also includes conventional streetcars.
4. Metro/subway/heavy rail includes elevated rail and rail rapid transit.
5. Commuter rail includes suburban/regional rail systems and short-distance service provided by Amtrak.

Bridging these two extremes, metro services have a rather bipolar distribution of riders, with usage concentrated most among the poor and the affluent, but including many riders in the middle-income classes as well. The metro's modal split share falls from 0.6% among the poor to 0.3% among the middle class and then rises to 0.7% among the most affluent.

These differences in rider incomes among transit modes are due to many factors. Most importantly, suburban rail tends to serve long trips from high-income suburbs to well paying jobs in the downtowns of major metropolitan areas. Suburban rail can sometimes outperform the automobile by offering faster, more comfortable, more dependable, and less stressful peak-hour travel, thus attracting even affluent passengers. Bus trips are generally shorter, slower, and less comfortable, and they focus more on local trips within central cities. Since they also suffer from an image of low-quality, lower-class service, buses rarely compete with the automobile among affluent travelers. The exceptions are a few specific markets such as express services to large downtowns.

Metro services appear to serve the broad-

Figure 2: Differences Among Income Classes in Modal Shares of Public Transport, Walking, and Cycling (percent of trips by type of transport, all trip purposes)



Source: See table 8.

est spectrum of the population, partly because they are an essential way to get around for almost everyone in New York City, which accounts for half of the nation's metro riders, and thus dominates all national statistics on metro usage.[12] High metro usage by affluent riders might be partially attributed to high-income households in exclusive or recently gentrified inner city neighborhoods. In addition, many new metro systems, such as those in Washington, DC and San Francisco, provide services comparable to suburban rail, extending far out to affluent suburban communities. Subsidized free or low-cost parking provided at outlying stations further encourages use by relatively affluent commuters. At the other end of the spectrum, metro use by the poor can be attributed to the many low-income households living in inner city neighborhoods within the service area of most metro systems. The income distribution of metro riders is bimodal not only in New York City but also in Boston, Washington, DC, Chicago, and virtually every other major city with a metro system.

Recent studies indicate that neighborhoods around some rail transit stations have been gentrifying, attracting increasing numbers of affluent households. As a result,

property values near such stations have risen significantly.[13] Indeed, low-income households can no longer afford the rising housing costs near some rail stations, forcing them to move to areas with less transit accessibility. The gentrification of working class neighborhoods has helped revitalize many inner cities and older suburbs, while increasing transit use among the affluent. Unfortunately, it has reduced the accessibility of low-income households to rail transit, and appears to have lessened their use of both metro and commuter rail.

For example, households in the highest income group in the 2001 NHTS ($100,000 and over) made 1.0% of their trips by metro and commuter rail, while the highest income group in the 1995 NPTS ($80,000 and over) made only 0.7% of their trips by rail transit. By comparison, the lowest income group in the 2001 NHTS (under $20,000) made only 0.7% of their trips by rail transit, considerably less than the 1.2% rail transit share of the lowest income group in the 1995 NPTS (under $15,000).[14] That suggests that metro and commuter rail use has been increasing among the affluent but declining among the poor.[15] Although the 1995 and 2001 income categories are not exactly comparable, the 31.5% increase in per capita income in the USA during those years make the income brackets roughly equivalent.[16]

Government intervention may be necessary to ensure the affordability of transit-accessible housing for poor and working class households. For example, Fannie Mae's location-efficient mortgage program, which focuses on neighborhoods near transit stops, might be further expanded and targeted more toward low-income households.[17]

Large differences in transit rider incomes are important for public policy purposes, since rail transit almost always requires much larger subsidies than bus transit. Thus, a refocusing of subsidies on improving bus services would probably benefit the poor more than spending most future subsidies on expensive new rail transit systems. Of course, there are many other reasons for subsidizing rail transit. For example, some studies suggest that rail systems are more effective than buses in achieving congestion and pollution relief, energy savings, economic development, and more compact land use.[18] Moreover, transit systems must be viewed as a synergistic whole, and even households that usually ride buses benefit from the greater connectivity, speed, and coverage permitted by truly multimodal transit services. Low-income households make a much higher percentage of their trips by transit in large cities with multimodal systems that include rail.

Table 9 shows variation in transit's modal share by income class and size of metropolitan area. Transit use increases sharply with population size. Thus, for all income groups in aggregate, transit modal share rises from 0.4% in areas with less than 250,000 population to 3.4% in areas with a population of 3 million or more.

Each of the income groups shown in Table 9 uses transit much more in large metropolitan areas than in small metropolitan areas. While only 0.1% of affluent households use transit in small metropolitan areas, that modal share rises to 2.2% in the largest metropolitan areas. The increase is due to the greater availability of rail transit in large cities, and the greater likelihood that affluent households will use rail transit compared to bus transit. The jump in transit use by the poor is even greater, from 1.1% to 10.6%. And the poor use transit more than the affluent in every population size category. Yet the ratio of transit mode shares between the poor and the affluent is highest in the smallest metropolitan areas (11:1) and lowest in the largest metropolitan areas (5:1), indicating that the poor account for a higher percentage of total transit riders in small cities than in large cities. In short, most transit riders in small cities are bus riders and most of them are poor. By comparison, transit riders

Table 9: Public Transit's Market Share by Population Size and Household Income (percentage of trips by transit)

Metropolitan Area Population	Household Income					
	Less than $20,000	$20,000 to $39,999	$40,000 to $74,999	$75,000 to $99,999	$100,000 and over	All
Less than 250,000	1.1	0.4	0.1	0.1	0.1	0.4
250,000 - 499,999	2.2	0.3	0.4	0.1	0.3	0.6
500,000 - 999,999	1.8	0.9	0.1	0.1	0.1	0.6
1,000,000 - 2,999,999	5.4	0.6	0.6	0.3	0.3	1.1
3 million or more	10.6	3.4	2.3	1.5	2.2	3.4
Nation	4.8	1.1	0.9	0.7	1.1	1.6

Source: Calculated by the authors from the 2001 NHTS.

Note: The metropolitan statistical area (MSA) totals in this table differ slightly from our other urban totals because MSAs by definition include entire counties, parts of which can be rural.

in the largest metropolitan areas use both bus and rail transit and include a much higher proportion of affluent users.

Table 8 reveals some interesting impacts of income on rates of walking, cycling, and taxi use. Walking declines sharply with increasing income, from 16.2% of all trips in the poorest income category to about 9% in all other income categories. The difference is all at the lower end of the income scale and is clearly due to lower auto ownership, as discussed earlier. Bicycling, by comparison, appears to be roughly the same at all incomes levels, accounting for about 0.9% of all trips across the income spectrum. Taxi use is bimodal, with the highest usage among the poor and the affluent. For the poor, taxis provide the closest substitute for the cars they are less likely to own. For the affluent, taxis provide convenient access to airports and train stations, and quick local trips within downtown areas.

Although most of these income differences are consistent with those shown in the 1995 NPTS, there are some discrepancies. For example, the 1995 NPTS showed a marked decline in cycling with increased income, while the 2001 NHTS shows no drop at all. It is possible that bicycling among higher income classes has increased substantially since 1995, or it might simply be due to differences in survey methods. Likewise, the 1995 NPTS showed a much higher level of taxi use among the poor (0.5%) than found in the 2001 NHTS (0.2%). It is unclear why taxi use among the poor is less pronounced than in 1995.

Table 10 reflects basically the same sort of information as Table 8 but presents the distribution of each mode's users among the various income classes, and not the distribution of each income class's trips among the modes (modal split). This information is especially useful for calculating the equity impacts of transportation finance. It shows more clearly than Table 8, for example, that mainly the poor use buses. Households earning less than $20,000 account for 47.1% of bus riders but only 19.7% of metro riders and 6.3% of suburban rail riders. Conversely, households earning $100,000 or more account for 41.6% of suburban rail riders and 27.2% of metro riders, but only 6.8% of bus riders.[19]

Table 10 highlights the bimodal nature of taxi use, with 22.3% of taxi passengers from the lowest income class and 33.3% from the highest income class. Pedestrians are somewhat more concentrated in the lower income

Table 10: Income Distribution of Each Mode's Users (percentage composition by income class)

Mode of Transportation	Household Income					
	Less than $20,000	$20,000 to $39,999	$40,000 to $74,999	$75,000 to $99,999	$100,000 and over	All
Total Auto	12.3	25.0	32.5	14.4	15.8	100
SOV[1]	11.2	24.9	33.3	14.7	15.9	100
HOV[2]	13.2	25.0	31.8	14.2	15.8	100
Total Transit	37.8	19.8	21.0	7.4	14.1	100
Bus and Light Rail[3]	47.1	21.4	19.0	5.6	6.8	100
Metro/Subway/ Heavy Rail[4]	19.7	18.7	25.2	9.1	27.2	100
Commuter Rail[5]	6.3	7.0	26.1	19.1	41.6	100
Total Nonmotorized	22.7	22.8	27.4	12.8	14.3	100
Walk	23.6	22.6	26.9	12.6	14.2	100
Bicycle	13.5	24.1	32.8	15.0	14.6	100
School Bus	17.9	22.1	30.0	15.0	15.0	100
Taxicab	22.3	12.5	14.0	17.9	33.3	100
Other	12.3	16.5	30.5	23.2	17.4	100
All	13.9	24.6	31.7	14.2	15.7	100
Overall Sample Distribution						
Households	22.7	27.8	27.9	10.3	11.3	100
Persons	17.5	25.2	30.1	13.1	14.0	100
Trips	13.9	24.6	31.7	14.2	15.7	100

Source: Calculated by the authors from the 2001 NHTS.

Notes: In order to isolate urban travel, the sample was limited to residents of urban areas and trips of 75 miles or less.

1. SOV (single occupancy vehicle) includes vehicles with driver and no passengers.
2. HOV (high occupancy vehicle) includes vehicles with two or more occupants.
3. Light rail also includes conventional streetcars.
4. Metro/subway/heavy rail includes elevated rail and rail rapid transit.
5. Commuter rail includes suburban/regional rail systems and short-distance service provided by Amtrak.

classes, but bicyclists are distributed evenly across the entire income spectrum, roughly in proportion to their share of the population.

As expected, high-income households make longer trips than low-income households, as shown in Table 11. For all modes in aggregate, the average trip length for low-income households is 1.5 miles shorter than for the highest-income households (5.6 miles vs. 7.1 miles). Differences in car trip lengths are not very large, however—only a mile between the top and bottom income classes (6.7 miles vs. 7.7 miles). That suggests that any user charge or tax proportional to vehicle miles traveled (such as roadway tolls or the gasoline tax) would be regressive, since

the poor would pay only slightly less than the affluent, and the payments would be a much higher percentage of their incomes.[20] To offset such regressivity, the tax revenues would have to be distributed in a way that explicitly benefits low-income households.

While the lengths of auto trips vary only slightly by income, the differences are much larger for transit. Low-income households make transit trips that are only about half as long as those by the most affluent transit riders, but there is substantial variation by type of transit. Metro trip lengths are only slightly different among income classes, possibly due to the long subway trips made by low-income residents of The Bronx, Brooklyn, and Queens to other parts of New York City's vast subway network. Income-based differences in bus and commuter rail trip lengths are much larger. The affluent make bus trips that are almost twice as long as those made by poor households (10.3 miles vs. 5.9 miles), and they make commuter rail trips that are four times longer (27.8 miles

Table 11: Average Trip Length by Mode and Income Class (in miles)

Mode of Transportation	Household Income					
	Less than $20,000	$20,000 to $39,999	$40,000 to $74,999	$75,000 to $99,999	$100,000 and over	All
Total Auto	6.7	7.4	7.8	7.7	7.7	7.5
SOV[1]	6.4	7.0	7.9	8.4	7.9	7.6
HOV[2]	6.9	7.7	7.7	7.2	7.4	7.5
Total Transit	6.0	8.0	8.3	12.0	13.2	8.3
Bus and Light Rail[3]	5.9	7.7	7.0	6.7	10.3	6.8
Metro/Subway/ Heavy Rail[4]	7.2	8.3	8.0	14.7	8.7	8.7
Commuter Rail[5]	7.4	13.5	18.3	23.2	27.8	22.1
Total Nonmotorized	0.7	0.8	0.8	0.9	1.0	0.8
Walk	0.6	0.7	0.7	0.7	0.9	0.7
Bicycle	1.5	1.5	1.8	2.4	2.5	1.9
School Bus	5.0	5.2	5.6	5.2	5.2	5.3
Taxicab	4.1	5.2	7.5	6.2	5.6	5.6
Other	2.2	2.8	3.0	8.8	5.6	4.7
All	5.6	6.7	7.1	7.1	7.1	6.8

Source: Calculated by the authors from the 2001 NHTS.

Notes: In order to isolate urban travel, the sample was limited to residents of urban areas and trips of 75 miles or less.

1. SOV (single occupancy vehicle) includes vehicles with driver and no passengers.
2. HOV (high occupancy vehicle) includes vehicles with two or more occupants.
3. Light rail also includes conventional streetcars.
4. Metro/subway/heavy rail includes elevated rail and rail rapid transit.
5. Commuter rail includes suburban/regional rail systems and short-distance service provided by Amtrak.

vs. 7.4 miles). That suggests that distance-based fares would generally favor the poor, since they make shorter trips. The exception appears to be metro systems, but there are some metro systems where distance-based fares would also favor the poor. Indeed, the systems in Washington, DC and San Francisco already have distance-based fare systems. By comparison, the flat-fare structure in New York City not only encourages long trips but also discourages short trips, since riders pay the same whether they travel one mile or thirty miles, and can transfer for free between subway lines as well as between subway and bus lines.

Finally, low-income households make considerably shorter walk and bike trips than high-income households. Their walk trips are about two-thirds as long, and their bike trips are three-fifths as long. The longer trips of more affluent households might be due to higher incidence of recreational walking and cycling for exercise or relaxation. It might also be due to the more central locations of poor households, where more compact, mixed-use neighborhoods facilitate shorter trips.

The last of the income-based differences we examine here is the variation in time of day of travel. Somewhat similar to the trip distance patterns in the previous table, there are no major differences among income classes in their time of day of car travel. The lowest-income category accounts for 9.4% of peak-hour car trips vs. 11.0% of off-peak car trips (see Table 12). Thus, peak-hour pricing of roadways might be quite regressive indeed, either forcing the poor off the roads during peak hours or extracting burdensome fees from them out of their limited budgets. Of course, the proceeds of congestion pricing could be redistributed to offset its regressivity, but the initial pricing itself unquestionably would be regressive. In London, for example, revenues from the newly instituted congestion pricing in the city center are used for improvements to public transport. The revenues might also be used to finance discount transit passes for low-income riders or special services targeted to serving low-income neighborhoods.

Time-of-day differences in transit travel are much larger. For all transit modes in aggregate, the poor account for 24.9% of peak-hour transit trips but for 39.4% of off-peak trips. The differences are greatest for the rail transit modes. Poor households account for twice the percentage of off-peak metro riders as peak-hour riders (18.1% vs. 8.9%) and four times the percentage of off-peak commuter rail riders as peak-hour riders (11.7% vs. 3.1%). Thus, large off-peak discounts on transit fares would greatly benefit poor transit riders. Since rail transit enjoys substantial extra capacity during the off-peak hours, the marginal cost of any additional riders then would be virtually zero, justifying very low off-peak fares even on efficiency grounds.

From an equity perspective, the preceding variations in auto ownership, mobility, and travel behavior among different income groups are probably the most important. Nevertheless, there are significant variations by ethnic and racial group, by sex, and by age group that must also be considered in the development of transport policies.

Variation in Travel Behavior by Race and Ethnicity

Because blacks and Hispanics have considerably lower incomes than whites, the differences in travel behavior among these three groups also reflect differences among income classes. One thing they have in common is that they all rely overwhelmingly on the private car to get around. Although whites make the highest percentage of trips by car (87.6%), the other three groups are not far behind, with Asians and Hispanics at 83.1% and blacks at 78.9% (see Table 13).

Table 12: Peak vs. Off-peak Travel by Income Class
(percentage distribution of each mode's users by time of day and income)[1]

Mode of Transportation	Household Income					
	Less than $20,000	$20,000 to $39,999	$40,000 to $74,999	$75,000 to $99,999	$100,000 and over	All
Total Auto						
Peak	9.4	22.2	33.8	15.9	18.8	100
Off-peak	11.0	24.0	33.1	14.7	17.1	100
Total Transit						
Peak	24.9	20.1	22.2	12.8	20.0	100
Off-peak	39.4	21.0	18.9	5.4	15.2	100
Bus and Light Rail[2]						
Peak	36.8	24.6	20.5	10.3	7.9	100
Off-peak	47.3	21.8	18.2	4.7	8.1	100
Metro/Subway/Heavy Rail[3]						
Peak	8.9	15.3	28.1	11.3	36.5	100
Off-peak	18.1	22.2	21.8	6.0	31.9	100
Commuter Rail[4]						
Peak	3.1	9.9	19.8	25.2	42.0	100
Off-peak	11.7	5.0	18.3	13.3	51.7	100
Taxicab						
Peak	8.8	20.6	14.7	20.6	35.3	100
Off-peak	18.4	15.8	13.3	15.2	37.3	100
All Modes						
Peak	10.5	22.1	33.2	15.7	18.4	100
Off-peak	12.0	23.7	32.6	14.6	17.1	100

All Modes & All Incomes	
Peak	31.2
Off-peak	68.8

Source: Calculated by the authors from the 2001 NHTS.

Notes: In order to isolate urban travel, the sample was limited to residents of urban areas and trips of 75 miles or less.

1. Peak period was defined as 6 to 9 a.m. and 4 to 7 p.m. on weekdays; off-peak included all other times.
2. Light rail also includes conventional streetcars.
3. Metro/subway/heavy rail includes elevated rail and rail rapid transit.
4. Commuter rail includes suburban/regional rail systems and short-distance service provided by Amtrak.

The two nonmotorized modes show quite different usage patterns. Bicycling is the highest among whites and Hispanics (0.9% of all trips). For whites, cycling is mostly for recreation, while for Hispanics, it is to reach the workplace. Walking is lower for whites (8.6%) than for the other three groups, who make 12%-13% of their trips by walking.

The largest differences among racial and ethnic groups are in their use of transit. Blacks are almost six times as likely as whites to take their trips by transit in general (5.3% vs. 0.9%), and they are eight times as likely to take the bus (4.2% vs. 0.5%). They are also more likely to take the metro (0.9% vs. 0.3%) and even commuter rail (0.2% vs. 0.1%). Hispanics use transit less than blacks but still about three times more than whites (2.4% vs. 0.9%). Their use of rail transit is the same as blacks, but they rely on buses four times more (2.0% vs. 0.5%). By comparison, Asians show just the reverse tendency, with the highest rail transit modal split shares of any group but with bus usage less than among blacks or Hispanics. That might reflect the concentration of Asian immigrants in the very largest American cities with extensive rail transit systems.

It is clear from Table 13 that racial and ethnic minorities rely far more on transit than whites. Moreover, they account for a large percentage of all transit users (not shown in Table 13). Blacks and Hispanics together comprise 54% of the country's transit users: 62% of all bus riders, 35% of all metro riders, and 29% of all commuter rail riders.[21] If one includes low-income households as well, the combination of blacks, Hispanics, and low-income nonminority households comprises an even higher percentage of transit riders: 63% overall, and 73% of bus riders, 44% of metro riders, and 31% of commuter rail riders.

Thus, improving transit services and fare structures in American cities would generally benefit minorities, as well as low-income households. Nevertheless, blacks, Hispanics, and poor households all rely primarily on bus transit and far less on rail transit. Subsidies spent on improving bus systems would especially favor minorities, as well as low-income households in general.

As documented extensively in the literature, most transit systems have tended to take minority and low-income "captive riders" for granted and focused their fare and service policies on attracting middle-class and affluent riders out of their automobiles.[22] In many cases, the result has been lower-quality service for the poor and minorities and superior service, at high public subsidy cost, for the affluent. New and extended rail transit systems, in particular, have been aimed at luring affluent suburban motorists out of their cars to reduce congestion, air pollution, and energy use in American cities. Some have argued that it would be both more equitable and more efficient to target limited subsidy dollars to inner city bus services that are cheaper, more intensively used, and require far less subsidy per passenger served.[23]

The impacts of transit subsidies, service distribution, and fare structure on minority groups have had legal consequences, especially during the 1980s. Civil rights organizations filed numerous administrative complaints and law suits against transit systems whose fare and service policies were seen as discriminating against minority riders. They claimed that such discrimination violates Title VI of the Civil Rights Act, even if it is not intentionally aimed at harming minorities but has that effect. Recent court rulings requiring proof of intent have virtually ended legal challenges of this sort. Nevertheless, it remains an important issue, especially since minorities comprise such a high percentage of transit riders.[24]

Variation in Travel Behavior by Sex

At least in terms of their travel behavior, women and men are becoming more and

Table 13: Variation in Modal Choice by Race/Ethnicity (percentage of trips by means of transportation)

Mode of Transportation	Race/Ethnicity			
	Black	Asian	White	Hispanic[6]
Total Auto	78.9	82.7	87.6	83.1
SOV[1]	35.7	33.5	40.1	27.5
HOV[2]	43.2	49.3	47.6	55.5
Total Transit	5.3	3.2	0.9	2.4
Bus and Light Rail[3]	4.2	1.8	0.5	2.0
Metro/Subway/Heavy Rail[4]	0.9	1.1	0.3	0.3
Commuter Rail[5]	0.2	0.3	0.1	0.1
Total Nonmotorized	13.2	12.3	9.6	12.6
Walk	12.6	11.7	8.6	11.8
Bicycle	0.6	0.5	0.9	0.9
School Bus	2.1	1.4	1.3	1.5
Taxicab	0.2	0.2	0.1	0.1
Other	0.2	0.1	0.4	0.3
All	100	100	100	100
Overall Sample Distribution[7]				
Percent of Total Households	11.3	2.1	74.3	8.7
Percent of Total Trips	11.5	2.7	69.9	12.7

Source: Calculated by the authors from the 2001 NHTS.

Notes: In order to isolate urban travel, the sample was limited to residents of urban areas and trips of 75 miles or less.

1. SOV (single occupancy vehicle) includes vehicles with driver and no passengers.
2. HOV (high occupancy vehicle) includes vehicles with two or more occupants.
3. Light rail also includes conventional streetcars.
4. Metro/subway/heavy rail includes elevated rail and rail rapid transit.
5. Commuter rail includes suburban/regional rail systems and short-distance service provided by Amtrak.
6. The Hispanic category was defined to be mutually exclusive of blacks and whites.
7. Rows do not add to 100% because some racial and ethnic categories are not shown.

more alike. As shown in Table 14, there are only minor differences by sex in choice of travel mode. Men and women both rely on the private car for about 86% of their urban trips. The only difference here is that women are more likely than men to carpool (51.5% vs. 44.7%), perhaps because mothers often chauffeur their children to school, sports events, and friends' houses. Transit use, taxi use, and walking are only slightly different among men and women. The only major difference in travel behavior is that women are far less likely to cycle (0.5% vs. 1.2%). By comparison, women cycle almost as much as men in countries such as The Netherlands, Denmark, and Germany, where cities have invested heavily in cycling infrastructure and a range of policies to make cycling safe.[25]

Table 14: Variation in Modal Choice by Sex (percentage of trips by means of transportation)

Mode of Transportation	Sex		
	Male	Female	All
Total Auto	85.6	86.0	85.8
SOV[1]	40.8	34.5	37.6
HOV[2]	44.7	51.5	48.2
Total Transit	1.7	1.8	1.7
Bus and Light Rail[3]	1.1	1.3	1.2
Metro/Subway/Heavy Rail[4]	0.4	0.4	0.4
Commuter Rail[5]	0.2	0.1	0.1
Total Nonmotorized	10.6	10.5	10.5
Walk	9.3	9.9	9.6
Bicycle	1.2	0.5	0.9
School Bus	1.6	1.3	1.4
Taxicab	0.1	0.1	0.1
Other	0.5	0.3	0.4
All	100	100	100

Source: Calculated by the authors from the 2001 NHTS.

Notes: In order to isolate urban travel, the sample was limited to residents of urban areas and trips of 75 miles or less.

1. SOV (single occupancy vehicle) includes vehicles with driver and no passengers.
2. HOV (high occupancy vehicle) includes vehicles with two or more occupants.
3. Light rail also includes conventional streetcars.
4. Metro/subway/heavy rail includes elevated rail and rail rapid transit.
5. Commuter rail includes suburban/regional rail systems and short-distance service provided by Amtrak.

Variation in Travel Behavior by Age

Table 15 shows that mobility rates are lowest for children and the elderly, both in terms of trips per day and mileage covered. The age group 25-64 has the highest mobility at 4.4 trips per day and 32.7 miles per day. That is a third more trips per day than children and the elderly, and almost twice the mileage per day. Within the elderly grouping, however, there are enormous variations in mobility rates, much larger than the differences between the elderly and nonelderly. Thus, persons 85 years and older made only 1.9 trips per day, less than half the 3.9 trips per day made by those 65 to 69 years old. Similarly, persons 85 years and older covered only about a third as many miles per day as persons 65 to 69 years old.

While mobility rates clearly decline for the elderly, their choice of travel mode is quite similar to the rest of the adult population (see Table 16). Just as other Americans, they are overwhelmingly dependent on the car for getting around town. Indeed, they rely on the car for 89.1% of their trips, a higher percentage than for any other age group and three percentage points higher than the population as a whole. That is not surprising given the greater convenience, comfort, and privacy of the auto compared to other modes. What is perhaps surprising is that the

elderly make over half of their car trips as drivers, while most other age groups (except 40 to 64) make more trips as passengers than as drivers. Clearly, the elderly rely on the mobility and independence that the automobile enables them to preserve as they grow older. The main concern is that many elderly continue to drive in spite of serious deterioration of their eyesight, hearing, and reflexes, thus endangering themselves and others.

While elderly Germans and Dutch make over half their trips by walking or cycling, those nonmotorized modes account for only 9% of the trips of elderly Americans.[26] Even the Dutch elderly who are 75 or older make a fourth of all their trips by bike. Germans in this 75+ age group make 7% of their trips by bike. By comparison, Americans who are 65 or older make only 0.4% of their trips by bike.

In the United States, there are no feasible alternatives to the private car for most trip purposes in most cities. That forces the elderly to drive, whether they want to or not. Not only does the forced reliance on the private car expose elderly Americans to considerable traffic dangers, it deprives them of valuable physical exercise they would get from walking and cycling.

There are few differences between the findings of the 1995 NPTS and the 2001 NHTS regarding the impact of age on travel behavior. The mobility rate differences among age groups are virtually identical. The modal split share of walking almost doubles for all age groups, but that is due to the change in survey methodology. The 1995 NPTS and 2001 NHTS both confirm the overwhelming reliance of the elderly on the private car, as well as their high proportion of car trips as drivers. The 2001 NHTS, however, reports a decline in transit use by the elderly (from 2.2% in 1995 to 1.3% of all trips in 2001).

It is notable that the elderly are less likely than the population as a whole to take transit (1.3% vs. 1.7% of trips). Most of the transit trips the elderly make are by bus, with the two rail transit modes together accounting for only 0.1% of all trips by elderly

Table 15: Impact of Age on Mobility Levels

Age	Trips per Day, per Person	Miles Traveled per Day, per Person
5 to 15	3.4	17.1
16 to 24	4.0	28.3
25 to 39	4.4	32.9
40 to 64	4.4	32.4
65+	3.4	18.7
65 to 69	3.9	24.4
70 to 74	3.8	20.8
75 to 79	3.1	16.2
80 to 84	2.8	13.6
85+	1.9	9.2
All	4.0	27.0

Source: Calculated from the 2001 NHTS by Mary Ann Keyes, Federal Highway Administration, US Department of Transportation.

Note: In order to isolate urban travel, the sample was limited to residents of urban areas and trips of 75 miles or less.

Americans. That might reflect the difficulty of reaching rail transit stations, which tend to be located farther away and require either a long walk or a bus trip and transfer to reach them. The elderly also have difficulty negotiating the stairs in some rail stations, many of which are still not accessible for persons with disabilities. That is especially true in old subway systems like New York City's, where less than 5% of stations are wheelchair accessible.[27] At most stations, the rider must negotiate two or three long flights of stairs and long, circuitous passageways. Older subway and commuter rail systems, with over 80% of the country's rail transit passengers, have found it too expensive to fully convert their stations.

In addition, most rail systems are radially designed, with a focus on serving peak-hour work trips between the suburbs and downtown. That obviously is not the sort of trip most elderly need to make. For shopping, medical, or social trips during the off-peak, bus services are usually a better option. That might also help explain the lesser use of rail transit by the elderly.

Table 16: Impact of Age on Modal Choice (percentage of trips by means of transportation)

Mode of Transportation	Age					
	5 to 15	16 to 24	25 to 39	40 to 64	65 & over	All
Total Auto	70.7	85.3	87.4	89.8	89.1	85.8
SOV[1]	0.5	39.2	43.6	51.9	45.7	37.6
HOV[2]	70.2	46.1	43.8	38.0	43.4	48.2
Total Transit	1.1	2.9	2.1	1.5	1.3	1.7
Bus and Light Rail[3]	0.9	2.1	1.2	1.0	1.2	1.2
Metro/Subway/Heavy Rail[4]	0.1	0.6	0.7	0.3	0.1	0.4
Commuter Rail[5]	0.0	0.2	0.2	0.2	0.0	0.1
Total Nonmotorized	18.4	10.0	9.8	8.2	9.3	10.5
Walk	15.2	9.3	9.2	7.8	8.9	9.6
Bicycle	3.2	0.6	0.6	0.4	0.4	0.9
School Bus	8.9	1.2	0.0	0.0	0.1	1.4
Taxicab	0.1	0.1	0.2	0.1	0.1	0.1
Other	0.8	0.4	0.3	0.3	0.2	0.4
All	100	100	100	100	100	100

Source: Calculated by the authors from the 2001 NHTS.

Notes: In order to isolate urban travel, the sample was limited to residents of urban areas and trips of 75 miles or less.

1. SOV (single occupancy vehicle) includes vehicles with driver and no passengers.
2. HOV (high occupancy vehicle) includes vehicles with two or more occupants.
3. Light rail also includes conventional streetcars.
4. Metro/subway/heavy rail includes elevated rail and rail rapid transit.
5. Commuter rail includes suburban/regional rail systems and short-distance service provided by Amtrak.

Conclusions and Policy Implications

The most obvious message from the 2001 NHTS is that the private car continues to dominate urban travel among every segment of the American population. Indeed, the car's percentage of total trips probably increased from 1995 to 2001, even though the 2001 NHTS shows a slight decline from 1995. As noted previously, the NHTS used a new survey methodology that almost doubled the number of reported walk trips, which in turn reduced the percentage of car trips. More surprising, perhaps, is the increased share of HOV trips compared to SOV (from 51.5% of car trips in 1995 to 56.6% in 2001). The increase might be due to the long-term decline in the percentage share of work trips, which have the lowest vehicle occupancy, and a corresponding rise in the percentage share of nonwork trips, which have the highest vehicle occupancies. Thus, the finding does not necessarily contradict US Census data that report a long-term decline in carpooling for the work trip. Rather, it may reflect the declining relative importance of the journey to work, which in 2001 accounted for less than a fifth of all trips.[28]

Public transit's share of urban trips continued to decline between 1995 and 2001, from 2.2% to 1.7%, but the reported decline is exaggerated due to the increased sampling of walk trips.[29] Since total unlinked transit trips—as reported by transit systems—actually rose by over a fifth between 1995 and 2001, such a sharp decline in transit's market share seems unlikely.[30] Some of the reported increase in unlinked transit trips, however, was artificial, resulting from additional transfers caused by the redesign of route networks with timed-transfer hubs. Moreover, the US Census shows a considerable decline in transit's market share of the work trip from 1990 to 2000 (from 5.3% to 4.7%). That also lends some credibility to the declining transit share of total trips (from 2.2% to 1.7%) reported by the 2001 NHTS.

Nonmotorized transportation's share of urban trips (not shown in Table 2, which includes both urban and rural trips) increased from 6.8% to 10.4% between 1995 and 2001. Bicycling's share remained stable at 0.9%, while the walking share rose from 5.9% to 9.5% due to the survey changes noted earlier. Taxi use declined from 0.18% to 0.13% of all urban trips.[31]

Clearly, the 1995 NPTS and 2001 NHTS are not directly comparable. As noted earlier in our description of the NHTS survey, several significant changes in methodology were made that affected the results. Thus, all the differences between 1995 and 2001 statistics must be viewed with caution. Nevertheless, the 1995 NPTS and 2001 NHTS show almost identical patterns of differences in travel behavior among different socioeconomic groupings. For example, both surveys confirm that only a small percentage of the urban poor use any form of transit (6.8% in 1995 vs. 4.6% in 2001) and instead rely on the auto for the vast majority of their trips (75.9% in both 1995 and 2001). Both surveys confirm the income disparities among transit riders, with bus riders the poorest and commuter rail riders the most affluent. Both show that poor transit riders are more likely to ride during the off-peak and to make shorter trips than affluent riders. Differences in travel behavior by ethnic and racial group, sex, and age are also virtually the same in 2001 as in 1995.

The overall policy implications of this socioeconomic analysis of the 2001 NHTS are roughly the same as those proposed by one of the authors in his analysis of the 1995 NPTS.[32] The disadvantaged in our society, especially the poor, minorities, and the elderly, depend crucially on the private car to get around the cities they live in. They use public transit for only a tiny percentage of their overall trips. Thus, public transit can-

not be the main strategy for improving the mobility of these groups. Automobiles are obviously a necessity for disadvantaged groups for reaching most employment, educational, medical, shopping, social, and recreational destinations. Even those who cannot really afford cars or who have physical or mental disabilities are forced to rely on the car.

Nevertheless, public transit plays a critical role in assuring the mobility of disadvantaged groups in the largest, densest cities. In metropolitan areas with populations of 3 million or more, public transit serves 9.7% of the trips of blacks, 10.6% of the trips of the poor, and 28.7% of the trips of households without cars.[33] It is essential that government housing policies be coordinated with transportation in order to ensure the continued accessibility of disadvantaged groups to transit. As noted earlier, low-income households are currently being displaced through the gentrification of neighborhoods around rail stations. Furthermore, government agencies have been decentralizing public housing for the poor and building it at lower densities, often located in neighborhoods with little if any transit service. Both housing and transportation policies should be coordinated to facilitate the accessibility of low-income households to transit.

Walking is probably the most ignored mode of transport, both in general as well as in reference to its importance among the disadvantaged. As shown in Tables 8 and 13, walking accounts for 16.2% of the trips by the poor, 12.6% of trips by blacks, and 11.8% of the trips of Hispanics. Yet in the United States, facilities for pedestrians are often inconvenient or nonexistent, leading to fatality rates per mile traveled 36 times higher than for occupants of cars and light trucks.[34] The lack of pedestrian safety especially affects minorities and the poor. For example, blacks account for 20% of all pedestrian deaths, almost twice their 12% share of the total population.[35]

In The Netherlands and Germany, pedestrian fatalities per mile walked are only a tenth as high as in the United States.[36] European countries have invested heavily in extensive auto-free pedestrian zones; pedestrian-activated crossing signals; pedestrian refuge islands for crossing wide streets; wide, well-lit sidewalks on both sides of all streets; and traffic calming of most residential neighborhoods. Moreover, German and Dutch pedestrians benefit from comprehensive restrictions on motor vehicle use, rigorous traffic education of motorists, and strict enforcement of traffic regulations protecting pedestrians. Such measures are essential for improving pedestrian safety in the USA as well.

While over $75 billion a year is spent on federally-assisted roadway projects, less than $1 billion a year is spent on pedestrian and bicycling projects.[37] Only 0.7% of federal transportation funds are spent on improving the pedestrian environment and making it safer to walk. Moreover, "no state spends more than 2.7% of their federal transportation funds on sidewalks, crosswalks, traffic calming, speed humps, multiuse paths, or safety programs for cyclists and pedestrians."[38] Given the importance of walking in our overall urban transportation system, it is regrettable that all levels of government in the United States have so woefully neglected the needs of pedestrians.

The improved survey methodology in the 2001 NHTS reveals the crucial importance of walking for getting around cities, especially for the poor, minorities, and those without cars. Of course, there are many reasons to encourage more walking among all groups—to reduce roadway congestion, air pollution, noise, parking needs, energy use, and above all, to provide more daily physical exercise for everyone. Walking is especially important for the poor and minorities. Not only is it the most affordable of all transport modes, but it is also the most feasible in the inner city neighborhoods where many poor and minor-

ity households are concentrated and where so many things are within walking distance. Moreover, walking is the most important access mode for reaching transit stops. Since the poor and minorities depend on transit so much more than other socioeconomic groups, walking is crucial for that reason as well. For all these reasons, it is essential that federal, state, and local government agencies focus more on improving the safety, convenience, and feasibility of walking in our cities.

Endnotes

1. John Pucher, Chris Hendrickson, and Sue McNeil. "Socioeconomic Characteristics of Transit Riders: Some Recent Evidence." *Traffic Quarterly* 35(3) (1981): 461-483; John Pucher, and Fred Williams. "Socioeconomic Characteristics of Urban Travelers: Evidence from the 1990 NPTS." *Transportation Quarterly* 46(4) (1992): 561-582; John Pucher, Tim Evans, and Jeff Wenger. "Socioeconomics of Urban Travel: Evidence from the 1995 NPTS." *Transportation Quarterly* 52(3) (1998): 15-33.

2. The 1960 Census figures, unlike all later census years, included an "unreported" category that accounted for 4.3% of all survey responses. To make the 1960 modal split distributions comparable with later census years, the authors scaled up all reported modal shares by a factor of 1.045 so that the modal shares add up to approximately 100%.

3. It is important to note that these NPTS and NHTS modal split distributions in Table 2 differ from those in subsequent tables because they include all local, daily travel in the USA, including both rural and urban areas. These distributions were supplied directly by the Federal Highway Administration of USDOT. Long-term trend data were available only on this nationwide basis. Our own cross-tabulations of the 2001 NHTS, shown in subsequent tables, include only urban areas, except for Table 9, which includes some rural portions of counties in metropolitan statistical areas.

4. Calculated by the authors from the 2001 NHTS. For full details, see Table 6 of this article.

5. Federal Highway Administration and Bureau of Transportation Statistics. *Inklings: Preliminary Results from the 2001 NHTS*. Washington, DC: US Department of Transportation, 2003.

6. Federal Highway Administration. *Highway Statistics*. Washington, DC: US Department of Transportation, various years; and International Road Federation. *World Road Statistics 2002*. Washington, DC: International Road Federation, 2002.

7. John Pucher, Tim Evans, and Jeff Wenger. "Socioeconomics of Urban Travel: Evidence from the 1995 NPTS."

8. Katherine M. Flegal, Margaret D. Carroll, Cynthia L. Ogden, and Clifford L. Johnson. "Prevalence and Trends in Obesity Among Adults, 1999-2000." *Journal of the American Medical Association* 288(14) (2002): 1723-1727; Carlos Dora. "A Different Route to Health: Implications of Transport Policies." *British Medical Journal* 318 (1999): 1686-1689; Jeffrey P. Koplan, and William H. Dietz. "Caloric Imbalance and Public Health Policy." *Journal of the American Medical Association* 282 (1999): 1579-1581; Douglas Carnall. "Cycling and Health Promotion." *British Medical Journal* 320 (2000): 888; Simon P. Wolff, and C.J. Gilham. "Public Health Versus Public Policy? An Appraisal of British Urban Transport Policy." *Public Health* 105 (1991): 217-228; Mayer Hillman. "Health Promotion: The Potential of Non-motorized Transport," in Tony Fletcher, and Anthony J. McMichael (eds). *Health at the Crossroads: Transport Policy and Urban Health*. London: Wiley and Sons, 1997.

9. US Department of Health and Human Services. "Physical Activity and Health: A Report of the Surgeon General." Atlanta, GA: Centers for Disease Control and Prevention, 1996; and US Department of

Health and Human Services. *Healthy People 2010: Understanding and Improving Health*. 2nd ed. Washington, DC: US Government Printing Office, November 2000.

10. John Pucher, and Christian Lefevre. *The Urban Transport Crisis in Europe and North America*. London: Macmillan Press, 1996; World Health Organization. *Obesity in Europe: The Case for Action*. London: International Obesity Taskforce of the World Health Organization, September 2002. Accessible at: http://www.iotf.org/media/globalprev.htm.

11. John Pucher."Discrimination in Mass Transit." *Journal of the American Planning Association* 48(3) (1982): 315-326; Mark Garrett, and Brian Taylor. "Reconsidering Social Equity in Public Transit." *Berkeley Planning Journal* 13 (1999): 6-27; R. Bullard, and G. Johnson, eds. *Just Transportation*. Stony Creek, CT: New Society Publications, 1997.

12. John Pucher. "Renaissance of Public Transport in the USA?" *Transportation Quarterly* 56(1) (2002): 33-50.

13. R. Cervero, and M. Duncan. "Benefits of Proximity to Rail on Housing Markets: Experiences in Santa Clara County." *Journal of Public Transportation* 5(1) (2002): 1-18; R. Cervero, and M. Duncan. "Transit's Value-Added Effects: Light and Commuter Rail Services and Commercial Land Values." *Transportation Research Record* 1805 (2002): 8-15; J. Lin. "Gentrification and Transit in Northwest Chicago." *Journal of the Transportation Research Forum* 56(4) (2002): 175-191; G. Knaap, C. Ding, and L. Hopkins. "Do Plans Matter? The Effects of Light Rail Plans on Land Values in Station Areas." *Journal of Planning Education and Research* 21(1) (fall 2001): 32-39.

14. John Pucher, Tim Evans, and Jeff Wenger. "Socioeconomics of Urban Travel: Evidence from the 1995 NPTS."

15. This might also be true of light rail transit, but there were so few light rail observations in both the 1995 NPTS and the 2001 NHTS that it was impossible to separate out light rail for detailed socioeconomic analysis of its riders.

16. Thus, if the 31.1% growth rate is applied to the $15,000 income level in 1995, it would yield $19,700, quite close to the $20,000 cutoff we used for 2001. Applying 31.1% to the upper income category of $80,000 in 1995 yields $104,800, somewhat higher than the $100,000 category cutoff we used for 2001. The 31.1% growth in per capita income from 1995 to 2001 is derived from US Bureau of the Census, *2002 Statistical Abstract of the United States,* Table 2, on population trends and Table 640, on personal income trends.

17. For details on location efficient mortgages, see http://www.locationefficiency.com.

18. Vukan Vuchic. *Transportation for Livable Cities*. New Bruswick, NJ, CUPR Press, 1999; and Peter Newman, and Jeffrey Kenworthy. *Sustainability and Cities,* Washington, DC, Island Press, 1999.

19. We tried to disaggregate metros into old systems (such as in New York City, Boston, and Chicago) and new systems (such as in Washington, DC, San Francisco, and Atlanta), since the two types have quite different designs and rider characteristics. We also tried to disaggregate light rail systems into old streetcar systems (such as in Boston and San Francisco) and new LRT systems (such as in St. Louis, Sacramento, Portland, OR, and San Jose, CA). Unfortunately, there were not enough sample observations to permit such further disaggregation. Indeed, it was not even possible to produce a separate category for light rail and streetcar combined, since they only generated 38 total trip observations (0.02% of all trips). Thus, LRT/streetcar had to be lumped in with bus services, as in previous census and NPTS studies.

20. Taxes and user charges are regressive when payments as a percentage of income fall with increasing household income.

21. Calculated by the authors from the 2001 NHTS.

22. John Pucher. "Discrimination in Mass Transit;" Mark Garrett, and Brian Taylor. "Reconsidering Social Justice in Public Transit"; Robert D. Bullard, and Glenn S. Johnson. *Just Transportation.*

23. See note 22 above.

24. See note 22 above.

25. John Pucher, and Lewis Dijkstra. "Making Walking and Cycling Safer: Lessons from Europe." *Transportation Quarterly* 54(3) (2000): 25-50.

26. See note 25 above.

27. Information provided by the New York City Transit Authority.

28. Federal Highway Administration and Bureau of Transportation Statistics. *Inklings: Preliminary Results from the 2001 NHTS.* Washington, DC: US Department of Transportation, 2003.

29. The 1.7% transit modal share cited here for 2001 is for urban travel only, compared to a 1.6% transit modal share for both urban and rural travel combined, as shown in Table 2. Likewise, the 2.2% transit modal share cited here for 1995 is for urban travel only, as reported in John Pucher, Tim Evans, and Jeff Wenger. "Socioeconomics of Urban Travel: Evidence from the 1995 NPTS," Exhibit 3. By comparison, the 1.8% transit share shown in Table 2 includes both urban and rural travel.

30. John Pucher. "Renaissance of Public Transport in the USA?"

31. See Table 8 and John Pucher, Tim Evans, and Jeff Wenger. "Socioeconomics of Urban Travel: Evidence from the 1995 NPTS," Exhibit 3.

32. See note 31 above.

33. Calculated by the authors from the 2001 NHTS.

34. See note 25 above.

35. Surface Transportation Policy Project. *Mean Streets 2000.* Washington, DC: Surface Transportation Policy Project, 2001.

36. See note 25 above.

37. Federal Highway Administration. *Highway Statistics 2000.* Washington, DC: US Department of Transportation, 2002; US Rep. James Oberstar. Opening remarks at Railvolution Conference, Washington, DC, October 4, 2002; Surface Transportation Policy Project. *Mean Streets 2000.* Washington, DC: Surface Transportation Policy Project, 2001.

38. Surface Transportation Policy Project, 2001, p. 5.

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