libraries by the lower classes was disappointingly sparse. Much to the chagrin of reformers, the lower classes chose more lively amusement parks and beer gardens over pastoral parks. Instead of using the library, they read newspapers, dime novels, and various publications of ethnic, labor, religious, and political groups.

A Failure of Expectations

As such, the public libraries and pastoral parks built in the late nineteenth century—no matter their grandiose and stately design—did not fulfill the expectations of their creators. It seems almost quaint now to think that the nineteenth-century elite believed in the power of these institutions to reduce class tensions and rechannel dissatisfaction into individual upward mobility. But they did believe it. At the dedication of the multiple-purpose institution comprised of a library, gymnasium, and music hall that Andrew Carnegie donated to Homestead, Pennsylvania, in 1898—six years after he broke a strike and destroyed the union there—he said, "How a man spends his hours of recreation is really the key of his progress in all the virtues." Similarly, Frederick Law Olmsted's expectations for Central Park in New York City are characterized by the historian Geoffrey Blodgett (1966), as follows: "the natural simplicity of pastoral landscape would, he hoped, inspire communal feelings among all urban classes, muting resentments over disparities of wealth and fashion. For an untrusting, watchful crown of urban strangers, the park would restore that 'communicativeness' which Olmsted prized as a central American need."

Failure to accomplish their original goals led to similar changes in both institutions: The emphasis shifted to a more active policy of outreach centered on smaller, neighborhood-based units that included branch libraries and neighborhood playgrounds. Similarly, with inspiration from the example of the settlement house workers, the focus shifted away from adult males to concentrate more on children, by providing organized activities run by trained personnel such as children's librarians and recreation workers. Now, in the twenty-first century, investment in large pastoral parks, as well as the refurbishing and expansion of museums, seems to be inspired as much by their potential contributions to an area's tourist economy as they are by a desire to improve the well-being of the resident population. They have become part of the economic development strategy of cities that are trying to retain and attract young workers to the central city.

Transportation: Roads and Rails in Metro Areas

Above the water mains and sewers, in front of the libraries, and beside the pastoral parks lies the urban transportation system. As we saw in Chapter 3, during the age of waterborne transportation, the first U.S. cities were located along rivers and harbors. It was the completion of the Erie Canal early in the nineteenth century that vaulted

New York City into its position of preeminence among U.S. cities—a position it has held unchallenged for nearly two centuries. Later, in the mid-nineteenth century, during the age of railroad construction, the location of the routes helped to determine the growth of places like Chicago. Rail transportation first connected one city with another; later, it became an important means of transportation within cities. In both instances, land values along the routes rose as those locations became more accessible and therefore more valuable for development. In the case of the intracity lines, the entrepreneurs prospered from the sale of land adjacent to the tracks more than from the transit lines themselves.

Transportation routes helped to channel the path of subsequent economic development. As cities grew, however, the need for improved transportation between established population centers also influenced subsequent patterns of investment in transportation. In New York State, for example, many of the largest cities, including Albany and Buffalo, originally grew because of their location along the Erie Canal. In later eras, railroad and highway routes connected these existing population centers, following the route of the canal. In this example, we can see both the interaction of public policy—the decision by New York State to build the canal—and market forces, in this case, the decisions of thousands of households and firms to locate in a place with good transportation, as well as the interaction between transportation decisions and land-use decisions. In an iterative process, decisions about transportation affect patterns of land use, but patterns of land use then affect subsequent transportation decisions.

A metropolitan area's transportation network is a crucial part of its physical infrastructure. If we were designing a city on a blank slate, our initial choices about where to place our investments in transportation infrastructure and how to balance rail networks with highways would have a profound impact on the shape of the resulting city. Once the city is built, however, our choices about subsequent transportation investment would be constrained by the existing patterns of land use. A transportation project such as a subway that would make sense in a highly centralized metropolitan area like New York is less likely to work in a more decentralized metropolitan area like Houston.

Unless we are building a fresh new city, we will need to take the "dead hand of history" into account. As the saying goes, "all roads lead to Rome." In the days of the Roman Empire, that is what the emperors wanted. More than 2,000 years later, many of the routes originally laid out by the Romans are still in use throughout Europe. That is a "dead hand" that extended its influence over two millennia.

In looking at the transportation problems that arise in metropolitan areas, we will need to concern ourselves with short-term issues (getting transportation prices right) versus long-term issues (guiding future transportation investment), externalities (pollution, congestion, and accidents), and conflicts between the criteria of efficiency and equity—for example, a new commuter rail link might reduce highway congestion in a metropolitan area, but would do nothing to solve the mobility problems of the area's poor.

What Consumers Want: The Demand Side of Metropolitan Transportation

Aspiring journalists are told that their news stories must include the *who*, *what*, *when*, *where*, *why*, and *how* of the situation. Similarly, with regard to the demand for transportation, we can ask: *who* is doing the traveling, *at what time* and *for what purpose*, *from what origin to what destination*, and *by what means?* How can a metropolitan area's transportation system—a network that might include airports, highways, heavy rail, light rail, ferries, buses, and streets that might or might not be attractive to pedestrians and bicyclists—serve the varied needs of the out-of-town business traveler or tourist, as well as the needs of residents who might be journeying to work or to a doctor's appointment, shopping for groceries, or going out for entertainment or for visits with friends and relatives? How does the demand for transportation differ between households who own cars and those who do not and between individuals who can drive cars and those who cannot?

Travel Trends

The U.S. Department of Transportation has been collecting data on personal travel through periodic surveys, starting with the 1969 *Nationwide Personal Transportation Survey* (*NPTS*). Most recently, the *National Household Travel Survey* (*NHTS*) was conducted in 2001 (Hu and Reuscher 2004). Because of changes in methodology, some data can be compared over the entire period from 1969 to 2001, while others can be compared only for the period 1990–2001. Overall, the data show a nation ever more reliant on the private automobile to serve a greater portion of its transportation needs. Chapter 13 discusses in greater detail how the interaction between land-use patterns and modes of transportation has contributed greatly to this increased reliance on private vehicles. Even as average household size in the United States has declined from 3.16 people in 1969 to 2.58 in 2001, the number of vehicles per household has increased, from 1.16 to 1.89, so that by 2001, there were 1.06 vehicles per licensed driver—slightly *more* than one vehicle for every licensed driver in the household (see **Table 10.2**).

U.S. motorists typically drove many more miles at the beginning of the twenty-first century than they did back at the end of the 1960s. Overall, average annual miles driven per licensed driver increased by nearly 60 percent, from 8,685 miles in 1969 to 13,785 miles in 2001. While men drove half again as many miles in 2001 as in 1969 (16,920 versus 11,352, respectively), women drove nearly 90 percent more (10,233 miles in 2001 versus 5,411 miles in 1969) (see **Table 10.3**). By 2001, the average amount of time spent in a vehicle (as a driver or as a passenger) exceeded an hour a day for people between the ages of 19 and 64. People aged 65 and older spent nearly an hour a day inside a vehicle and even children less than five years old spent about three-quarters of an hour each day inside a vehicle (see **Figure 10.2**).

Where were we all going? Among women, about 15 percent of trips were for commuting to or from work or traveling on work-related business. Nearly half the trips were for family and personal business. Men's trips were more likely to involve commuting to work or traveling on work-related business and less likely to

Table 10.2 Auto Vehicle Use in the United States: Summary of Demographic Trends, 1969, 1977, 1983, 1990, 1995 *NPTS*, and 2001 *NHTS*

	1969	1977	1983	1990	1995	2001
Persons per household	3.16	2.83	2.69	2.56	2.63	2.58
Vehicles per household	1.16	1.59	1.68	1.77	1.78	1.89
Licensed drivers per household	1.65	1.69	1.72	1.75	1.78	1.77
Vehicles per licensed driver	0.70	0.94	0.98	1.01	1.00	1.06
Workers per household	1.21	1.23	1.21	1.27	1.33	1.35
Vehicles per worker	0.96	1.29	1.39	1.40	1.34	1.39

Note: The 1969 survey does not include pickups and other light trucks as household vehicles.
Source: Hu and Reuscher 2004, table 2, p. 11.

involve family and personal business. Men and women had similar proportions of trips to school or church (about 10%) and for social or recreational purposes (about 26%).

The amount of time that drivers spend behind the wheel varies across metropolitan areas of different sizes. As **Table 10.4** demonstrates, among drivers who were traveling on the day for which the data were collected, the average time they spent behind the wheel was 81.35 minutes in 2001, nearly 10 minutes more than the comparable figure for 1990. Drivers spent about 76 minutes behind the wheel in smaller metropolitan areas and about 85 minutes in the largest cities. That difference

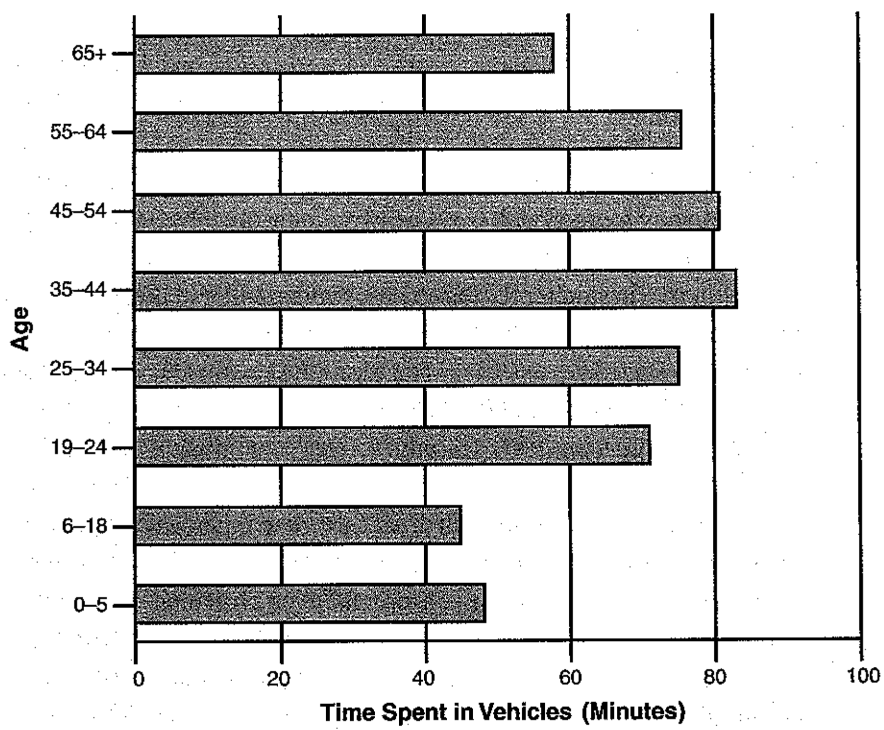

Figure 10.2 Time Spent in Auto Travel per Day by Age of Traveler. *Source:* Hu and Reuscher 2004, figure 5, p. 28.

Table 10.3 Average Annual Miles per Licensed Driver by Driver Age and Gender (Driver's Self-Estimate), 1969, 1977, 1983, 1990, 1995 *NPTS*, and 2001 *NHTS*

							Percent Change	
Driver Age	**1969**	**1977**	**1983**	**1990**	**1995**	**2001**	**Annual Rate, 1969–2001**	**Total Change, 1969–2001**
All								
16 to 19	4,633	5,662	4,986	8,485	7,624	7,331	1.44	58.23
20 to 34	9,348	11,063	11,531	14,776	15,098	15,650	1.62	67.42
35 to 54	9,771	11,539	12,627	14,836	15,291	15,627	1.48	59.93
55 to 64	8,611	9,196	9,611	11,436	11,972	13,177	1.34	53.03
65+	5,171	5,475	5,386	7,084	7,646	7,684	1.25	48.60
All	8,685	10,006	10,536	13,125	13,476	13,785	1.45	58.72
Men								
16 to 19	5,461	7,045	5,908	9,543	8,206	8,228	1.29	50.67
20 to 34	13,133	15,222	15,844	18,310	17,976	18,634	1.10	41.89
35 to 54	12,841	16,097	17,808	18,871	18,858	19,287	1.28	50.20
55 to 64	10,696	12,455	13,431	15,224	15,859	16,883	1.44	57.84
65+	5,919	6,795	7,198	9,162	10,304	10,163	1.70	71.70
All	11,352	13,397	13,962	16,536	16,550	16,920	1.26	49.05
Women								
16 to 19	3,586	4,036	3,874	7,387	6,873	6,106	1.68	70.27
20 to 34	5,512	6,571	7,121	11,174	12,004	12,266	2.53	122.53
35 to 54	6,003	6,534	7,347	10,539	11,464	11,590	2.08	93.07
55 to 64	5,375	5,097	5,432	7,211	7,780	8,795	1.55	63.63
65+	3,664	3,572	3,308	4,750	4,785	4,803	0.85	31.09
All	5,411	5,940	6,382	9,528	10,142	10,233	2.01	89.11

Notes: (1) All tables reporting totals could include some unreported characteristics. (2) In 1995, some drivers who indicated that they drove "no miles" for their average annual miles were changed to "miles not reported."
Source: Hu and Reuscher 2004, table 23, p. 41.

of 11 minutes a day may seem trivial, but when you multiply it by 365 days, it means that in the largest metro regions, drivers spent nearly 55 hours more per year in their cars than those who live in smaller regions. If we compare that to how much time the typical American spends on his or her job, it is equivalent to more than one and a half weeks.

According to the 2001 *NHTS*, the proportion of households without a vehicle has declined from 20.6 percent in 1969 to only 8.1 percent in 2001. As **Table 10.5** shows, the proportion of households without a vehicle has fallen over time, but increases with the size of the metropolitan area. Less than 6 percent of households in smaller metropolitan areas or outside of cities are without a vehicle. In the largest metropolitan areas, nearly 12 percent—more than one in nine households—do without.

In a nation so reliant on private vehicles, what does it mean to live in a household without one? A small number of these households might be "car-free" by choice—for example, relatively prosperous Manhattan residents who could afford to own a car but choose not to because of the hassles of traffic and parking in their dense

Table 10.4 Average Time Spent Driving a Private Vehicle in a Typical Day by MSA Size, Adjusted 1990 and 1995 *NPTS*, and 2001 *NHTS* (in Minutes)

	Only Persons Who Drove on Their Travel Day		
MSA Size	**1990 Adj**	**1995**	**2001**
All	71.88	73.24	81.35
Not in MSA	69.20	72.96	81.74
< 250,000	67.94	69.35	76.40
250,000 to 499,999	71.66	71.72	76.50
500,000 to 999,999	72.42	73.35	79.34
1 to 2.9 million	74.38	72.19	79.55
3+ million	71.08	75.02	85.12

Notes: (1) For 1990 and 1995, average time spent driving does not include any driving done in a segmented trip. Also excludes driving done as an "essential part of work." (2) Note that only the 1990 data have been adjusted to make them more comparable with the 1995 and 2001 data. Thus, there are limits on the conclusions that can be drawn in comparing travel with earlier survey years. The adjustments to 1990 data affect only person trips, vehicle trips, person miles of travel (PMT) and vehicle miles of travel (VMT).
Source: Hu and Reuscher 2004, table 15, p. 30.

neighborhoods. These households have many other travel modes easily available to them, including taxicabs. They also have the option of renting a car occasionally should the need arise.

For the vast majority of households without vehicles, though, it is not a matter of choice; these are households that are too poor to own a car. In an era in which the most robust job growth within metropolitan areas has occurred outside the central city in the suburbs, these households confront serious employment problems. They are also likely to find that their transportation needs are not addressed very well by existing public transit routes.

Table 10.5 Percent of Households without a Vehicle within MSA Size Group, 1977, 1983, 1990, 1995 *NPTS*, and 2001 *NHTS*

	Percent of Households within an Area without a Vehicle					
(S)MSA Size	**1977**	**1983**	**1990**	**1995**	**2001**	**Percent Change, 1977–2001**
Not in (S)MSA	12.2	10.5	7.7	5.3	5.8	−52
< 250,000	13.7	10.1	8.6	4.8	5.8	−58
250,000 to 499,999	12.2	8.1	5.7	7.3	5.2	−57
500,000 to 999,999	14.0	14.3	8.4	6.3	7.0	−50
1 to 2.9 million	14.2	12.1	8.2	6.9	6.4	−55
3+ million	26.1	25.4	12.4	11.2	11.9	−54
All	15.3	13.5	9.2	8.1	8.1	−47

Notes: (1) The population size groups for 1977–1983 NPTS are SMSA Size Groups and 1990–2001 are MSA Size Groups. (2) All tables reporting totals could include some unreported characteristics.
Source: Hu and Reuscher 2004, table 19, p. 36.

The Journey to Work

Although the demand for transportation—the need for mobility and access—encompasses far more than just the journey to work, it is there that some of the thorniest problems arise. Traveling from Point A to Point B involves costs—the expenses of owning and operating a car or paying a fare on public transportation, as well as the opportunity cost of one's time. If you are relocating from one metropolitan area to another because you have accepted a new job, you might look for housing that is conveniently located to your new workplace. Conversely, if you are committed to staying where you are, you might look for jobs in firms located within a reasonable commute from your home. However, there are likely to be trade-offs. You might have to accept a longer commute to be able to afford a larger house with more land in a metro area where housing is cheaper on the fringes of the region. In the case of the metropolitan areas with the hottest housing markets, you might need to move to a more distant suburb just to be able to afford anything at all. Alternatively, you might accept a long commute to take a job with better wages and working conditions or better chances for promotion. If there is more than one worker in the household, a delicate process of triangulation might ensue—a balancing act between home and two or more job destinations. With the typical family now having two working adults, this balancing job is more difficult than ever.

Once the questions of where to live and where to work have been resolved (at least for the time being), the next order of business for most commuters will be to figure out how to ease the pain of commuting. In getting from Point A to Point B, commuters face a complicated choice that is likely to involve speed, comfort, out-of-pocket cost, privacy, reliability, schedule flexibility, and protection from bad weather. On many of these criteria, traveling solo by private vehicle is a more attractive option than taking mass transit or carpooling. For many, a more comfortable door-to-door ride from home to work, or the need for trip-chaining—dropping kids off at school, picking them up at day care, stopping to get the groceries or the dry cleaning—will make commuters opt for the use of a private automobile rather than using a bus, subway, other mass transit, or a carpool.

In their pathbreaking book on urban transportation, Meyer, Kain, and Wohl (1965) point out that decentralization in mid-twentieth-century U.S. metropolitan areas was occurring as rapidly in places with well-developed public transportation systems as in places without them. Even in places where consumers had a choice between public transportation and the automobile, they overwhelmingly chose the automobile. Moreover, Meyer, Kain, and Wohl argue, as decentralization affected not only residential location but also the location of businesses, commuting patterns would continue to shift away from job destinations in the central city. Instead, a growing share of commuters would be cross-commuting (traveling from one suburb to another) or they would be reverse-commuting (traveling from homes in the central city to job destinations in the suburbs). Given the large economies of scale required to justify the creation of a fixed rail system, the authors argue that the shift

Table 10.6 Commuting to Work, 1960–2000: Percent Using Each Mode

	1960	**1970**	**1980**	**1990**	**2000**
Private Vehicle	69.5	80.6	85.9	88	87.9
Public Transit	12.6	8.5	6.2	5.1	4.7
Walked to Work	10.4	7.4	5.6	3.9	2.9
Other	6.8	2.5	1.6	1.3	1.2
Worked at Home	7.5	3.5	2.3	3	3.3
Total	100	100	100	100	100

Notes: Private Vehicle includes cars, trucks, and vans; includes solo drivers and carpools; Public Transit includes bus, streetcar, subway, railroad, ferryboat, and taxicab.
Source: McGuckin and Srinivasan 2003, exhibit 1.1.

in commuting patterns would make new investment in fixed rail systems undesirable and that it would be a poor use of resources.

As **Table 10.6** indicates, the proportion of workers who commute by private vehicle rose dramatically between 1960 and 2000. Moreover, while carpooling accounted for about 20 percentage points of the 69.5 percent of those who commuted by private vehicle in 1960, it accounted for only 12.2 percentage points of the 87.9 percent of those who commuted by private automobile in 2000 (McGuckin and Srinivasan 2003). Data for 2003 (U.S. Department of Transportation 2005b) show that nearly nine out of ten commuters travel by private vehicle—79 percent of all commuters drive solo and an additional 9 percent carpool (see **Figure 10.3**). With so many people on the road, the 2005 *Urban Mobility Study* revealed that the number of hours a day in which commuters face congested roads increased from 4.5 hours in 1982 to 7.1 hours in 2003. This certainly gives new meaning to the term rush "hour." On the other hand, the increase in average commuting time has been far less dramatic: it rose from 21.7 minutes in 1980 to 25.5 minutes in 2000 (Pisarski 2006).

While these figures show the increasing role of solo driving among commuters, they should not be taken as a pure expression of consumer preferences. Changes in the location and types of workplaces, as well as the location and structure of households, have also played an important role in determining the transportation we select. The continued decentralization of residences and workplaces has made it likelier that workers will have fewer alternatives to commuting by private vehicle. The changing demographics of the workforce and the workplace—including the increase in the proportion of women workers since 1960 and the variability in work schedules—make carpooling less feasible for many. The more dispersed the location of firms and families, the less likely that mass transit will have the ridership to support regular bus service, let alone commuter rail or subway service.

Externalities and Mass-Transit Subsidies

If commuting motorists paid the full cost for opting to use their private autos for transit, we could leave the story here, noting simply that driving to work alone is an increasingly popular choice. But it is not as simple as that. Each individual who

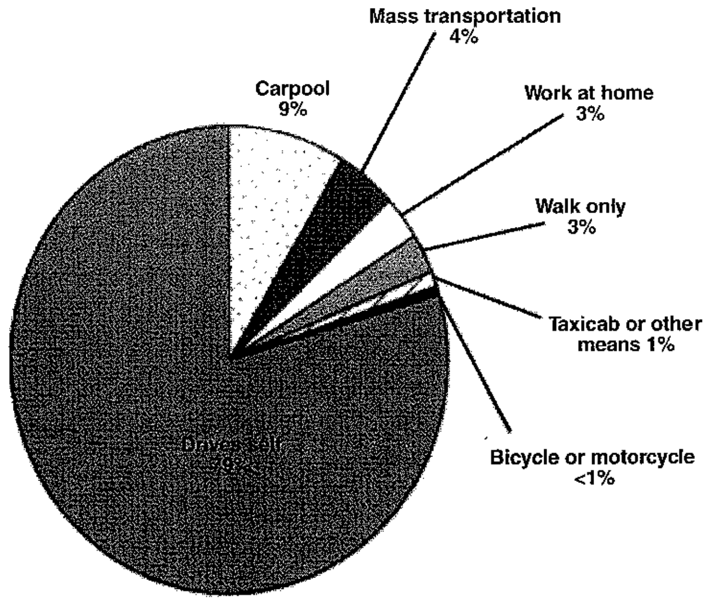

Figure 10.3 How People Get to Work, 2003. *Sources:* U.S. Department of Housing and Urban Development and U.S. Department of Commerce, U.S. Bureau of the Census, *American Housing Survey for the United States*, H150 (Washington, D.C., biennial issues), http://www.bts.gov/publications/transportation_statistics_annual_report/2005/html/chapter_02/figure_04_09.html.

drives to work alone imposes costs on other drivers and on the larger community. The more people who choose to use this transportation mode, the higher the external costs imposed on others. These externalities arise chiefly in the form of growing traffic congestion and, therefore, time-delayed trips; air and water pollution from the use of automobiles; and a growing incidence of accidents on the more congested highways. Like any negative externality, too many solo drivers will choose to drive during periods of congestion unless the cost of the externalities is somehow factored into the price of driving.

Essentially, the social cost of solo driving is higher—perhaps significantly higher—than the private cost. The private costs to the individual motorist—no matter how much it costs to own a car—do not include the spillover costs to other motorists or to the residents of the area. Generally speaking, the denser the region, the higher the social cost. Those who live in rural areas impose much lower social costs than those who drive their vehicles in downtown Manhattan or any large central city.

One interesting corollary of this phenomenon concerns the question of subsidies for mass transit. It is highly unlikely that a public transit authority would be able to charge a price that would cover the average cost of operating buses or subway systems. As the price of a bus or subway ride rises, the ridership normally declines, which would be the case for most goods or services. The higher the price, the lower the quantity of rides demanded. The new higher price multiplied by the new lower ridership yield a revenue that is below the full cost of providing the service. Yet, given the enormous fixed cost of operating a mass-transit system, charging a low

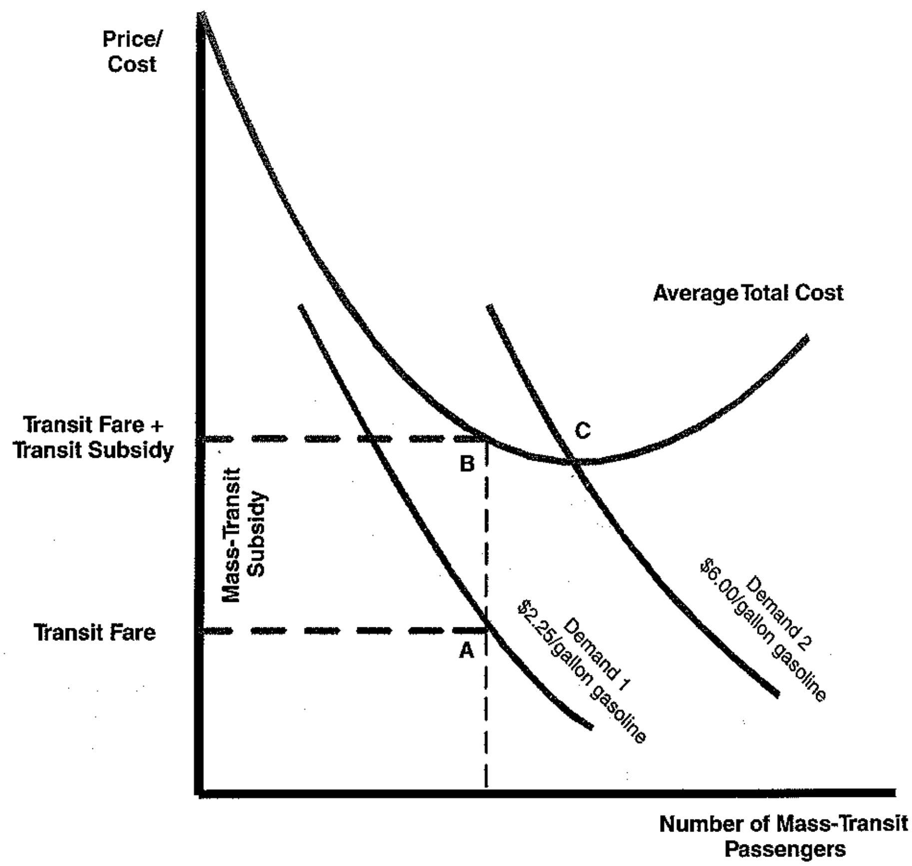

Figure 10.4 Mass-Transit Subsidy. At relatively low gasoline prices, the demand for public transportation is low and the system operates with excess capacity. Revenues do not cover costs. If the price of gasoline were to rise substantially, the demand for mass transit would rise, the system would operate at capacity, and revenues would cover costs.

price to attract more riders will not usually generate enough new ridership to cover total costs either.

This can be seen in **Figure 10.4**. With the price of gasoline at $2.25 per gallon, the demand curve for mass transit lies everywhere below the Average Total Cost curve for mass transit. If the transit authority sets the transit fare at A, a subsidy of AB is needed to cover the transit system's average total cost. If the authority were to raise the transit fare, the number of mass-transit passengers would decline, but at no price can the system survive without a subsidy. Essentially, the authority must consider how many mass-transit riders it would want to subsidize in order to encourage people to leave their cars at home and reduce auto congestion on the highways. Note that it is possible to operate the mass-transit system without a subsidy (at Point C on Demand Curve 2), but only if taxes on gasoline are raised so high as to discourage drivers from using their cars. In this case, presumably many more commuters would choose to use urban bus, trolley, and subway transport as the cheaper option, even at a transit fare that covered the entire average total cost of the public transit system.

Because gasoline prices (including federal and state taxes) are still at levels that do not force auto drivers to shift to mass transit, virtually all mass-transit systems in the United States require some form of subsidy from local, state, and federal government. These subsidies are quite large. According to data from the National Transit Database, revenue from fares covered only 33.5 percent of the operating expenses of transit systems in 2004 (Federal Transit Administration 2005).

Normally, this would suggest that automobile drivers are subsidizing mass-transit riders. But, given rising congestion costs on highways and roads and the added time and frustration needed to get from Point A to Point B by car, it can be argued that the real subsidy may go in the opposite direction. Those who use private cars to get to work or to do chores, especially during rush hour, are actually subsidized by mass-transit riders. The subsidy does not take the form of a cash allowance, but the form of less congestion and less time to get to work. In our busy lives, "time is money." The commuters who leave their cars behind and rely on mass transit reduce the amount of congestion and drive time for those who continue to use their cars. In this case, a "subsidy" goes from the mass-transit user to those who commute by auto.

Very few studies have actually attempted to measure these social benefits of mass transit. One, by Winston and Maheshri (2006), examines twenty-five urban rail systems and finds that social benefits, including reduced travel time for drivers, are greater than costs only for the San Francisco Bay Area system (Bay Area Rapid Transit, or BART). They argue that net benefits (benefits minus costs) are negative for all the other systems, including the two largest ones in New York City and in Washington, D.C. However, another study of the Washington, D.C. Metro system, using a different methodology, found the opposite: net social benefits were positive, with congestion-reduction benefits of the system far larger than the subsidies (Nelson et al. 2007). The controversy continues.

There are some interesting policy implications that we might consider based on this way of thinking about transit. But before we examine the various policy alternatives available for addressing the externalities caused by motorists, as well as the mobility needs of those without access to automobiles, we need to explore the supply side of urban transportation markets. How have past decisions affected the array of transportation options available to us today?

The Supply Side of Metropolitan Transportation

If transportation were like apples, we would have a highly competitive market in which there were many producers, each accounting for only a small amount of total output. It would be relatively easy for new producers to enter the market on a small scale if they were attracted by profitable opportunities. Economist Adam Smith's "invisible hand" (the assertion that a large number of independent producers interacting in a market with a large number of independent buyers results in a socially optimal outcome) would ensure that the result of each producer acting in his own self-interest would be low prices and a large array of choices for consumers.

But the transportation market is not at all like the apple market. Like other components of a metropolitan area's physical infrastructure, transportation networks are subject to huge economies of scale. Like the water and sewer systems we have already examined, transportation networks are yet another example of a natural monopoly in which it is more efficient for one large supplier to produce the entire output. In this case, we are not talking about the individual automobile or, for that matter, the individual bus, streetcar, or subway train. Rather, we refer to the highways, roads, and metro rail systems that have enormous economies of scale and therefore tend to be natural monopolies. Not surprisingly, in most cases—but not all—these are constructed, maintained, and run by the public sector. Therefore, in looking at the supply side of metropolitan area transportation, we are really examining the decisions about infrastructure investment made by past and present governments at the local, state, and federal levels.

Before the steam engine, the first large-scale public transportation systems took the form of canals, the most famous being the Erie Canal in New York State, first proposed in 1808 and completed in 1825. The canal systems of the early nineteenth century gave way to the railroads, whose construction began in the middle of that century. By the late nineteenth and early twentieth centuries, rail lines were built not only to facilitate transportation between cities but, most importantly, also within them. Before the advent of the automobile and truck and the construction of hardened road surfaces, rail was the fastest and most convenient form of transportation for passengers and freight within the city.

Because of the extraordinarily high fixed costs and large scale of these systems, state and local governments played a crucial role in their creation. In some instances, these were government projects; in others, private developers received franchise rights as well as some financial support from state and local governments. Eventually, most of these private systems were no longer profitable and were taken over by government agencies. Thus, the same transformation from private ownership to public we saw in the case of water and sewer systems also applied to transportation.

Although state and local governments were building roadways from the 1920s through the early part of the 1950s to accommodate the increasingly popular automobile, the passage of the federal government's 1956 National Interstate and Defense Highways Act profoundly changed the transportation and land-use patterns of U.S. metropolitan areas. This legislation created the Highway Trust Fund (HTF). All proceeds from the federal gasoline tax would go directly into this earmarked fund. Until the early 1970s, the fund could be used for one purpose only—to build interstate highways.

As the highway network grew, automobile travel became ever more attractive and feasible. With more drivers on the road and more miles driven, gasoline tax revenues continued to grow, the highway trust fund coffers were filled, and so it became easy to finance round after round of highway construction. Subsidies increase the demand for whatever is subsidized. Highways are perhaps America's best example.

The flip side of this positive reinforcement loop for motorists was that as commuters abandoned public transit for private automobiles, revenues from fare collections fell, transit agencies faced budget problems that necessitated cuts in service, and poorer-quality service drove more commuters away from transit and toward automobiles. The United States became more reliant on highways and on the low-density suburban expansion they spawned.

Issues in Contemporary Metropolitan Transportation Policy

So here we are, early in the twenty-first century, living with the transportation infrastructure decisions that were made 50, 100, and even 150 years ago. How can we make the best use of what we currently have, and how can we make wise decisions about transportation infrastructure investment now so that future generations will have a more reliable, environmentally friendly system for their use?

These are not easy questions to answer, and even in instances where there is substantial agreement about the nature of the problem, there is no clear agreement among policy makers about the best solution.

Short-Run Issues: Getting Prices Right. Tomatoes are cheap and delicious in the summertime, when they are easy to grow in many parts of the country. They are more expensive and often not as tasty in the winter, when many are grown with greater effort and expense inside special hothouses. It is not surprising that consumers will buy more tomatoes when they are cheaper, fewer when they are more expensive. In the tomato market, the lower summer price and the higher winter price reflect the actual difference in production costs. The market works the way it is supposed to work. Prices, which reflect underlying production costs, send the right signals to consumers, who change their buying behavior accordingly and economize on their use of tomatoes in winter when the prices are higher.

In a market system, prices can play an extremely useful role in guiding consumer choice, but only if they reflect accurate cost information. If the price a consumer faces does not accurately reflect the cost of making that choice, decisions will be distorted. If a motorist's cost to drive his car does not reflect the full cost to society of his making that choice, he will make too many car trips, drive too many miles, and drive during the "wrong" time of day. One issue for getting prices right is that automobile transportation is generally priced too low, and the underpricing is even more extreme during the rush-hour commute. Another, as noted above, is that the actual—though often unacknowledged and implicit—subsidy to the rush-hour motorist is often greater than the explicit subsidy given to transit riders, thereby distorting the choice between automobile and transit. What would we need to do to get prices right?

Although the federal gasoline tax is often referred to as a "user tax" because motorists' payments are correlated with the amount of driving they do and the tax revenues are earmarked for transportation projects, it does not actually fit that description. A true **user tax** gets the consumer to confront the full cost of his activity.

In the case of the federal gasoline tax, there are many **cross-subsidies**. Drivers in some states receive far more from the HTF than they contribute. Over the period from 1956 to 2002, for example, Alaska received six and a half times as much funding from the HTF as its drivers contributed (Wachs 2005). Other cross-subsidies are said to favor drivers of heavy trucks over lighter vehicles and rush-hour motorists over drivers in off-peak times.

Similar cross-subsidies affect state gasoline tax receipts and expenditures as well. In Ohio, for example, some of the funds received from state fuel taxes are distributed equally across the state's eighty-eight counties, so that motorists in dense urban areas end up subsidizing the roadways of the state's rural areas. Funds generated in urban areas with greater road maintenance requirements are often siphoned off to rural areas with less pressing needs (Hill et al. 2005). Also, like the HTF before the 1970s, Ohio's receipts from fuel taxes may be used only for highways, not for public transit. These constraints occur in many other states as well, and are barriers to a more efficient use of transportation revenues and resources.

Economists are fond of reminding people that there is "no free lunch," meaning that everything has an opportunity cost, and that it is being paid by someone, somewhere, even if the good is provided free of charge to the consumer. Consider the case of free parking that is provided to employees who drive to work. There were costs involved in acquiring the land and building the parking structures or paving the parking lots. If business firms deduct these costs from their taxes as business expenses, it means that taxpayers in general are subsidizing those employees who drive to work. As Donald Shoup argues in *The High Cost of Free Parking* (2005, p. 2), "If drivers don't pay for parking, who does? Everyone does, even if they don't drive. Initially the developer pays for the required parking, but soon the tenants do, and then their customers, and so on, until the cost of parking has diffused everywhere in the economy."

Shoup argues that ubiquitous free parking distorts the consumers' choice of travel mode because of its implicit subsidy to motorists. In the case of employers' subsidizing parking for their workers, Shoup estimates that the total variable cost per day for a typical commuter—operating costs plus parking cost—would be $8.09, but with employer-provided free parking, it's only $2.32. Free parking subsidizes the commuting motorist for more than two-thirds of the variable costs of driving to work.

The externalities of congestion, pollution, and accidents are other ways that the motorist does not confront the actual cost of his behavior. As we demonstrated in Chapter 9, the question of what, if any, toll to charge for a car crossing a bridge depends in part on whether the bridge has reached its capacity. Once the bridge is congested, another driver trying to cross increases travel time not only for himself but also for other drivers.

There are many instances in which consumers will face higher prices for a given product, depending on the timing of their demand. In-season rates for airplane travel or resort hotels are higher than they would be for those who are willing to travel off-season. Movie theaters charge higher prices for their evening shows than for their matinees. Restaurants might offer "early bird specials" for diners who are willing to

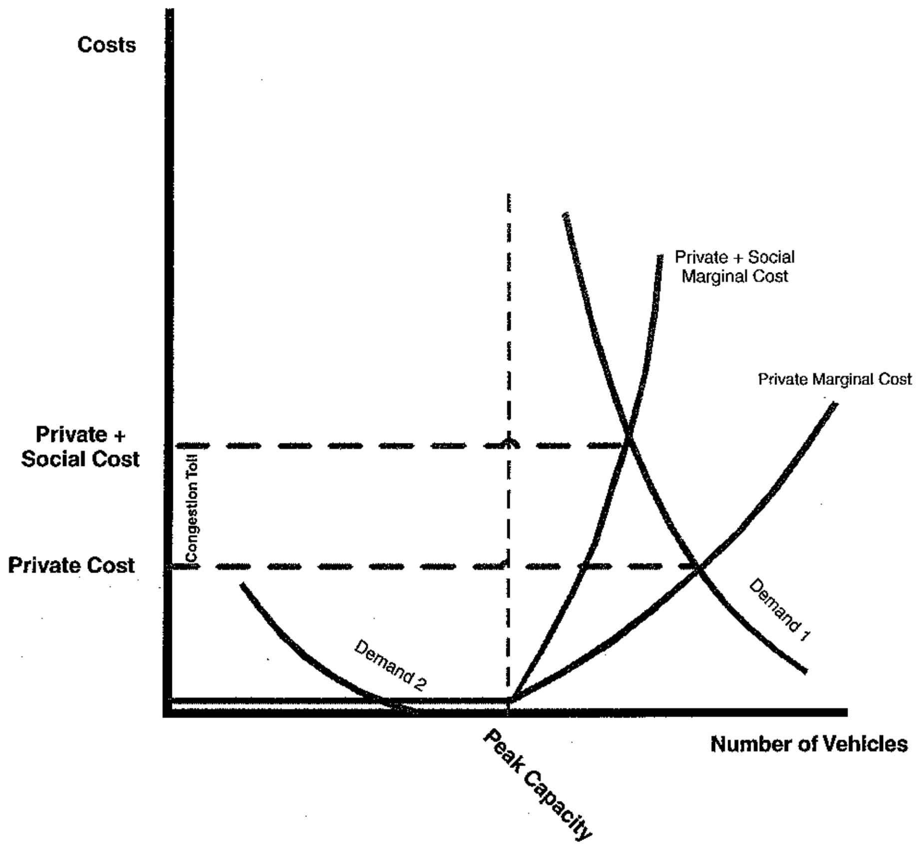

Figure 10.5 Peak Load Pricing. During times of low off-peak demand when there is excess capacity, the cost of allowing one additional driver on the road is minimal, and therefore there is no need to charge a congestion toll. However, once the road has reached its capacity, the cost of adding each additional driver rises. Some of these costs are borne by the driver, but others are spillover costs that the driver does not take into account. The purpose of the congestion toll is to have the driver take these spillover costs into account.

come in before the evening rush. In all of these instances, there is a fixed seating capacity, and building additional capacity would be difficult and expensive. There are times when the demand is higher than can be easily accommodated and other times when there is a good deal of excess capacity. Charging different prices for the peak load versus the off-peak demand helps to make better use of the existing capacity by shifting some of the demand to a time when it can more easily be handled.

Although peak-load pricing is common in the private sector, it has not been used as much in the public sector. Many economists argue that it should be, and that is their basis for endorsing **congestion pricing** for highways. As **Figure 10.5** shows, there is a greater and more inelastic demand (D_1) for highway travel during the morning rush hour, when many people need to arrive at work at the same time, and during the evening rush hours, when many people want to leave work at the same time. The demand is less elastic because unlike many other trips, going to work cannot be avoided or postponed. At other times of the day, the demand for highway use is much smaller and more elastic (D_2)—say, two to four o'clock in the morning, when most people are at home and asleep. On the cost side, the marginal cost of allowing one more car on the highway in the wee hours of the morning is trivial since the highway is not likely to be congested. Once congestion begins and cars slow down during rush hour, the marginal private cost (MPC) of having one extra car traveling on the highway begins to rise, and continues to climb as more cars try to travel at the same time. The individual driver experiences the increase in marginal private cost. It takes commuters more time to get to work, they use more gasoline, they bear the frustration of crawling along in traffic, and they are aware that this stop-and-go driving will mean extra maintenance expenses to keep their cars in good working order.

However, in addition to the increasing marginal private cost as congestion increases, there is also an even faster increasing marginal social cost (MSC): the sum of marginal private cost and the external cost imposed on others. For instance, the concentration of automobile exhaust fumes pollutes the neighborhoods in which the congestion is occurring, and their residents consequently will have higher levels of respiratory illnesses. In addition, employers will not operate as efficiently when workers are delayed by traffic, and emergency vehicles will not be able to make their way through traffic jams in a timely fashion.

The idea of congestion pricing is to charge a toll equivalent to these external costs. If solo motorists face a higher price for traveling during congested times, they might have the incentive to the change their behavior—to carpool or to select a different mode of transportation. Congestion pricing takes many specific forms. In Singapore and in London, cars are charged a price for entering downtown business districts during the day. In the United States, on some toll roads, higher tolls are charged during rush hours. Most recently, some areas have been expanding the use of special carpool lanes—High-Occupancy Vehicle (HOV) lanes, developed to encourage carpooling—to include single-occupancy vehicles willing to pay a toll. These lanes have been renamed HOT (High-Occupancy plus Toll) lanes. In the case of Interstate 15 in San Diego, for example, the price for single-occupancy vehicles to enter the HOT lane changes every few minutes with the level of congestion. Single-occupancy motorists then have a choice of whether to spend more time or more money to get to their destination. As the number of cars equipped with transponders continues to grow, it will be feasible to use congestion pricing in a wider variety of situations.

Even if automobile travel occurs under free-flow circumstances where there is no congestion, every additional driver adds to air pollution and the emission of greenhouse gases. These are externalities generated by motorists for which they are generally not forced to pay and, therefore, another way that automobile travel is underpriced. As we have seen during periods of gasoline price spikes, consumers will respond to higher prices with efforts to change their behavior. Sales of gas-guzzling vehicles fall off dramatically. Newspapers run feature articles about motorists switching to bicycles or public transit. There have even been reports of increased ridership on school buses as growing numbers of parents forgo the usual practice of driving their children to school. But unless gasoline prices are high, there is little incentive to switch to these modes of transit.

All of this implies that raising gasoline taxes would be an effective way to counteract the underpricing of automobile travel. Following good market principles, higher gasoline prices would do all of the following:

- More commuters would use mass transit, which produces fewer emissions per passenger.
- Motorists would purchase more fuel-efficient cars, reducing the amount of emissions and greenhouse gases per mile.
- Households would consider living closer to the central city or closer to their jobs in order to reduce the cost of commuting, thereby reducing emissions as well.

Getting prices right would encourage motorists to change their behavior and thereby lead to a more efficient use of existing resources. The problem is a political one—convincing voters, most of whom currently drive to work or use their cars most days of the year, to agree to a tax hike on gasoline. Most politicians are leery of going to their constituents with such a plan.

Long-Run Issues: Deciding on Future Transportation Infrastructure Investment. What about the future? What factors should policy makers consider in making decisions about new investment in transportation infrastructure?

The Interstate Highway System has been substantially complete since 1991, and a new agenda for transportation infrastructure investment is the subject of continuing debate. Should we continue to encourage dependence on private vehicles? How do we address the mobility and access needs of those who are unable to drive because of age, infirmity, or poverty? If we are to encourage other transportation modes including public transit, bicycles, and walking, what does that imply for changes in land-use policy? Although the interaction between land-use policy and transportation infrastructure investment will be explored more fully in Chapter 13, we will focus here on transportation policy initiatives and the controversies surrounding them.

One fundamental question is whether it is possible to solve traffic congestion problems by building more highway capacity. In his biography of Robert Moses, *The Power Broker: Robert Moses and the Fall of New York*, Robert Caro (1974) describes Moses's enthusiasm for highway construction spanning several decades in which he wielded extraordinary power in shaping the New York City metropolitan area's transportation network. Each time a new highway experienced congestion, Moses's solution was to build another. Decade after decade, new capacity was added, but congestion did not diminish. Caro reports that Moses also resisted the extension of public transit to the developing suburbs by rejecting proposals to build highway median strips that were capable of accommodating rail transit and by designing highway overpasses that were too low to allow clearance for buses.

Why does it seem so difficult to build our way out of congestion? The tendency of new road capacity to generate additional traffic is called "induced traffic," and according to Anthony Downs (2004) of the Brookings Institution, it is the result of a "triple convergence." First, when the new road initially opens, if it seems to offer a faster way to travel, commuters will be induced to shift the time they travel during the day. Off-peak travelers will return to traveling during peak hours. Second, commuters will switch their route from the road they are currently using to the new one. And, third, some mass-transit commuters will now shift their mode to highway use. In the end, congestion will occur soon after the additional highway is built. Supply creates its own demand.

In 1991, Congress made a dramatic change in federal transportation policy when it passed the Intermodal Surface Transportation Efficiency Act (ISTEA, pronounced "ice tea"). With the substantial completion of the Interstate Highway System, the new legislation focused on metropolitan transportation planning, development of alternatives to automobile transportation, linking transportation modes—such as bus–rail links—and making changes in transportation investment that would promote greater compliance with the Clean Air Act. It allowed greater flexibility in how metropolitan areas used their federal transportation dollars and shifted the focus of lessening traffic congestion by reducing the necessity of travel via private automobile rather than by vainly attempting to do so by increasing highway capacity (Vuchic 1999).

Although subsequent legislation—the 1998 Transportation Equity Act for the 21st Century (TEA-21) and the 2005 Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU)—has preserved these policy shifts, this is a contentious area. Proponents of automobile transportation and highway construction oppose this new approach. They argue that most public transit requires high-density development along transportation corridors and that such investment is not justified in a nation that has voted with its feet for low-density development.

Transportation Equity Issues. Aside from the longer term efficiency issues, there are also a number of equity issues. How do we provide mobility for those who are too young, too old, too infirm, or too poor to drive? If there is a spatial mismatch between the poor who are concentrated in the central cities and the availability of new jobs located on the periphery of the metropolitan area, there are three logical alternatives for reducing the severity of the problem: (1) move jobs closer to the areas where poor people are concentrated (this is the aim of the enterprise zone and empowerment zone programs that provide incentives for firms to locate in low-income areas); (2) move people closer to where the new jobs are located (this is one of the aims of the Moving to Opportunity program that helps low-income families move to affordable housing in the suburbs); or (3) improve the transportation options available to the poor so that they can more easily overcome the barrier of spatial separation between home and workplace.

Because commuter rail systems were designed to transport suburban residents to jobs in the central city, the stations are located in residential areas. Therefore, these systems do not work well to satisfy the needs of "reverse commuters"—those who commute from central city homes to widely dispersed suburban job locations.

Programs that subsidize car ownership for inner-city residents have been viewed with promise. Other alternatives to solving the mobility needs of those who cannot drive focus on "para-transit"—the use of small vans that are responsive to demand and whose dispatchers devise flexible routes that depend on the origins and destinations of those who wish to travel at any given time on any given day.

Moreover, as life expectancies increase and as baby-boom drivers age, we will need to pay more attention to the mobility needs of the elderly. As Rosenbloom (2005) notes, we do not yet understand these needs very well because paradoxically, as some elders might become too infirm to drive, many others with limited ability to walk or climb steps are still fully capable of driving. For this latter group, driving is what allows them to maintain their independence.

Ultimately, for all the reasons we have explored in this chapter, to meet the transportation needs of cities and towns in the future, we will need to have a better understanding of externalities, subsidies, commuting needs, and land-use patterns, and how each of these affects mobility and independence—not just for the poor, the elderly, and infirm, but for all of us. With changing demographics, growing environmental concerns, and changing life styles, what kind of urban transportation system will be best for individual households as well as the entire planet in the years to come?

References

Adler, Jonathan H. 2002. "Fables of the Cuyahoga: Reconstructing a History of Environmental Protection." *Fordham Environmental Law Journal* 14, no. 1: 89–146. New York: Fordham University School of Law.

Baer, William C., Seong-Youn Choi, and Dowell Myers. 1996. "The Changing Problem of Overcrowded Housing." *Journal of the American Planning Association* 62, no. 1: 66–84.

Blodgett, Geoffrey. 1966. *The Gentle Reformers: Massachusetts Democrats in the Cleveland Era.* Cambridge, Mass.: Harvard University Press.

Bloom, Khaled J. 1993. *The Mississippi Valley's Great Yellow Fever Epidemic of 1878.* Baton Rouge: Louisiana State University Press.

Bobinski, George. 1969. *Carnegie Libraries: Their History and Impact on American Public Library Development.* Chicago: American Library Association.

Bryce, James. 1888. *The American Commonwealth.* New York: Macmillan.

Burian, Steven J., Stephan J. Nix, Robert E. Pitt, and S. Rocky Durrans. 2000. "Urban Wastewater Management in the United States: Past, Present, and Future." *Journal of Urban Technology* 7, no. 3 (December): 33–62.

Caro, Robert. 1974. *The Power Broker: Robert Moses and the Fall of New York.* New York: Knopf.

Carson, Rachel. 1962. *Silent Spring.* Boston: Houghton Mifflin.

Crosby, Alfred W. 1989. *America's Forgotten Pandemic: The Influenza of 1918.* New York: Cambridge University Press.

Cutler, David, and Grant Miller. 2006. "Water, Water Everywhere: Municipal Finance and Water Supply in American Cities." In Edward Glaeser and Claudia Goldin, eds., *Corruption and Reform: Lessons from America's History.* National Bureau of Economic Research Conference Report Series. Chicago: University of Chicago Press, pp. 153–186.

Dolin, Eric. 2004. *Political Waters.* Amherst: University of Massachusetts Press.

Downs, Anthony. 2004. *Still Stuck in Traffic.* Washington, D.C.: Brookings Institution Press.

Duffy, John. 1990. *The Sanitarians: A History of American Public Health.* Urbana: University of Illinois Press.