Chapter 2

Transit and the Changing World

The car culture has been blamed for a long list of local and global problems—faceless sprawl, premature deaths from accidents and air pollution, the uprooting of inner-city neighborhoods, social isolation and class segregation, depletion of fossil fuels, climate change, noise pollution, and exploitation of Third World economies (to satisfy First World consumption and energy demands). Critics charge that auto-dependent lifestyles are the main culprit behind worldwide environmental degradation and must be radically altered for the sake of sustainability. Promoting transit is just one of many options available for reversing course and deflating the automobile's expanding role in modern societies.

What's wrong with this picture? Has humankind been lulled, by some unexplained force, into a prodigious way of living and travel, seemingly oblivious to the long-term consequences? Unlikely. The spread of our cities and the growing reliance on car travel that has resulted is largely a product of rising prosperity and free choice, though, one might add, abetted considerably by government policies and inaction, such as subsidies for large-lot living and underpriced car travel, that have further promoted auto-dependent living. When people decide where to live or how to travel, they generally make rational personal choices, weighing the pros and cons of alternatives and doing what, on balance, is best for them. In America, social unrest, increased crime, and deteriorating school districts have had far more to do with the middle class leaving cities for suburbia than any innate love affair with the car. The automobile has been both figuratively and literally a vehicle—a means to an end, be it to escape central-city irritations, to cut business expenses by locating on cheaper land, or to take in bucolic scenery.

Free-market choices, however, do not alone explain transportation and land use outcomes of the past half-century. Also important have been powerful megatrends, such as telecommunication advances, economic restructuring, and the expanding roles of women in the workplace, that

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continue to alter and reshape how and where people live, work, shop, and travel. Together, these megatrends have worked in favor of increased automobility in nearly all corners of the globe. The long-term social and environmental consequences of rising worldwide motorization are indeed worrisome, lending credence and a certain amount of urgency to the transit metropolis as an alternative model of urbanization in the twenty-first century. Only by understanding and working with the many forces that are changing where and how people travel will it be possible to build and maintain successful and sustainable transit metropolises of the future.

This chapter examines the forces behind global motorization trends, as well as their broader social, environmental, and economic implications. It raises serious questions about the sustainability of past and present trends, providing background and hopefully some justification for why the transit metropolis, as a paradigm for regional policy making and planning, deserves serious consideration as we approach a new millennium.

Economic Restructuring: The Twin Forces of Concentration and Dispersal

The global economy is rapidly changing, and cities are feeling the shakeout. New modes of production and advancements in information technologies are fundamentally altering the landscapes of cities and regions throughout the world. Post-industrialization—the shift from goods producing and handling to information processing, as momentous as the transition from agrarian to manufacturing economies a century and a half ago—has brought about both concentration and decentralization. Some Information Age jobs are clustering in cities, some are ending up in subcenters, and many are settling in far-flung places.

Today's global economy requires central places—such as New York, London, Tokyo, and Zurich—to serve as command and control posts for multinational corporations.[1] Financial and business services that rely on face-to-face contact and easy access to specialized skills often congregate in large CBDs. Finance and business services in the New York metropolitan area are, for example, more concentrated in Manhattan today than they were in the 1950s.[2] Where high-end businesses go, five-star hotels, upscale retailers, and major cultural draws soon follow. Thus, major urban centers in different corners of the globe are prospering under this new world order. To continue to prosper, they will need continuing improvements in public infrastructure, including mass transit systems.

Another profound change has been the trend toward flexibly specialized modes of production, such as in the high-technology sector (where highly networked small and medium-size enterprises are mutually dependent on one another's presence and proximity for innovation). "Flex spec"

production favors spatial agglomeration, though not in central cities but rather in outlying clusters and corridors (e.g., California's Silicon Valley, Boston's Route 128, Stockholm's Arlanda E4 Corridor, and London's Heathrow M4 Corridor).[3] Factors such as proximity to major international airports and leading universities govern where many high-technology firms locate. Businesses that cater mostly to regional and subnational markets, such as engineering and consulting firms, often concentrate in suburban megacenters—for example, Ballston and Tysons Corner, west of Washington, D.C.; Croydon, outside London; Shinjuku, west of central Tokyo; and La Defense on Paris's west side. The clustering of restaurants, shops, and business services close to these firms has produced veritable mini-downtowns in the suburbs, what Joel Garreau has termed "edge cities."[4] Given their compactness and kaleidoscope of activities, edge cities and high-tech corridors are places where properly designed, high-quality transit services can succeed.

Of course, the countertrend to clustering and subcentering brought on by the Information Age has been dispersal. The information highway, cyberspace, and the emergence of "smart" office parks laced with fiber optic cables and satellite dishes have freed many companies to spin off their lower-tier, back-office functions to the outer suburbs and beyond. Today's workers can handle routine communications and obtain information electronically from remote, less costly locations. This is underscored by the location choices of many credit companies that have reassigned routine, low-skilled information-processing functions, such as billing and collection services, from major urban centers to such far-flung, low-cost locations as South Dakota, Jamaica, and Ireland. Similarly, most wholesaling, construction, and consumer services have located in the suburbs and exurbs to lower business expenses. During the 1980s, about three-quarters of employment growth in U.S. metropolitan areas occurred outside of central cities. Today, more than 60 percent of the nation's office stock is in the suburbs.[5]

The twin forces of concentration and dispersal brought on by economic restructuring and the Information Age have produced a variety of urban and suburban landscapes, posing significant challenges to transit as we know it. Most regions of the world today can most accurately be characterized as multicentered, or polycentric, in form, featuring a dominant central business district orbited by second, third, and even fourth tier subcenters (which in turn are flanked by loosely organized strips and sprawled development). Recent studies of growth trends in greater London, metropolitan Chicago, and the San Francisco Bay Area have documented this evolution.[6] Yet subcenters themselves vary significantly, from small to moderate-size low-intensity clusters aligned along freeway corridors to dense, nodal edge cities well suited to transit riding.[7] In some

areas, the distinction between subcenters and sprawl is beginning to blur. A recent study of Southern California's evolving settlement pattern characterized urban form as "beyond polycentricity," noting the region's employment density gradient has steadily flattened, with downtown Los Angeles's share of regional jobs now at only about 5 percent, one of the lowest anywhere.[8] Even more astonishing, the authors, Peter Gordon and Harry Richardson of the University of Southern California's planning program, go on to note that metropolitan Los Angeles nonetheless has the highest net population density of any American metropolitan area—with more than 15,000 persons per square kilometer in 1990, the region was 7 percent denser than metropolitan New York, even after netting out open space and undevelopable land.[9] How can it be? America's most spread-out metropolis is supposedly also its densest!

Of course, accompanying job dispersal has been the steady, ongoing exodus of households out of central cities, a trend that is centuries old but that has accelerated since the advent of freeways. More than three-quarters of residents from the twenty-five largest U.S. metropolitan areas today live in the suburbs. And where households go, shopping plazas, grocery stores, restaurants, and other consumer services follow. In Europe, North America, and other parts of the developed world, once-bedroom suburbs are being transformed into urban, mixed-use places, featuring a mosaic of activities not too different from those historically confined to central cities.

The scattering of activities to all corners of the modern metropolis poses unprecedented challenges to public transportation. Dispersal threatens to dilute transit's ridership base. Nevertheless, as reviewed in this book, some cities have launched transit services that effectively adapt to changing economic conditions and decentralization forces. Capitalizing on the trend toward front-office concentration, cities such as Stockholm, Zurich, Melbourne, and Munich have maintained radially focused rail services that efficiently feed into their central cities, complemented by surface trams that circulate within downtown. Recognizing the opportunities afforded by subcentering, other cities, including Ottawa and Curitiba, have designed interconnected networks of exclusive-lane bus services that link together outlying depots. In both places, the process of transferring is near effortless. Still other places, Singapore and Copenhagen among them, have created new towns that invite internal bike travel and external rail travel.

Telecommunications and Commuting

The conventional view of communications advances is that they reduce travel by liberating commuters from the daily strain of driving to and

from work. Others have suggested that home working and telecommuting will fail to bring about transportation and environmental benefits because people will adjust by making more and longer nonwork trips; borrowing from time-budget theory, the suggestion is that people have an innate, almost insatiable desire to travel, and they compensate for no longer having to commute by driving more often to shopping malls and taking longer weekend excursions. For the most part, research to date sides with the proposition that telecommunications substitutes for, rather than stimulates, trip making. A study of a pilot telecommuting program of 200 employees in Sacramento, California, found no increases in nonwork trips, and indeed out-of-home trips became more efficient.[10] Vehicle kilometers traveled (VKT) went down among telecommuters (to just 20 percent of the distance they normally traveled on commuting days), and on the one or two days a week they drove to their offices, they tended to make efficient chained trips (e.g., from work to a shopping center to a dry cleaners to a restaurant to home). Even greater reductions in travel were found several months into a telecommuting demonstration program in Rijswijk, the Netherlands.[11] A recent study of telework centers, which are neighborhood-based shared workplaces equipped with advanced communications facilities, in the greater Seattle-Tacoma area found VKT was cut by more than half.[12] Yet telecommunications has not proven to be the panacea that some had hoped for, in large part because most occupational roles are not suited for home working, at least not on a regular basis. Management fears of losing oversight controls over teleworkers have also thwarted past initiatives. Another concern is that home workers will feel cut off from office social life and promotion opportunities. It is for these reasons that part-time telecommuting—say, working at home one or two days a week and in the office the remaining workweek—has gained popularity.

Decentralization and Commuting

While telecommunications stands to substitute for automobile and transit trips alike, the impacts of decentralization have been one-sided—notably favoring automobile travel. The once-dominant radial commute, a legacy of the monocentric metropolis, has been replaced by a patchwork quilt of crosstown, crisscross travel. For the thirty-five largest U.S. metropolitan areas with more than a million residents, the share of workers commuting to jobs in the central city fell from 48.4 percent in 1970 to 38.3 percent in 1990.[13] Today, more than twice as many commutes occur within suburbs as between suburbs and central cities.[14] Of course, these trends do not square well with the physical configurations of most transportation networks, designed to serve radial trips. Thus, there is a mismatch between the geography of travel and the geometry of transportation facilities. Tight budgets, environmental concerns, and stiff neighborhood

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opposition to road building cast doubt on whether this situation will change in the foreseeable future.

Motorization

The megatrend that has the most serious global implications is the rapidly increasing rate of motorization, especially in developing countries. Of course, motorization is a sign of prosperity. A plot of cars per capita and wealth (gross national product per capita) for twenty-six world cities across five continents found a very strong positive correlation.[15] The ability of our planet to absorb astronomical increases in vehicle populations, however, both in terms of dwindling fossil fuel supplies and potential greenhouse gas emissions, is worrisome. A 1994 study by the Organization for Economic Cooperation and Development (OECD) estimated that urban travel alone will increase by 50 percent between 1990 and the year 2005.[16] Only 8 percent of the world's population owns a car. (In 1981, the fifty-nine poorest countries of the world, containing more than 60 percent of its population, together owned fewer cars than did residents of Los Angeles.[17]) If Third World countries begin to get anywhere close to the private automobile use found in the developed world, the strains placed on natural and social environments will be unprecedented. The report warned that the spread of German and U.S. auto ownership rates (520 and 750 vehicles per 1,000 inhabitants, respectively) to the citizens of Poland, Russia, India, Indonesia, and China would wreak havoc on the globe's finite resources.

All signs suggest that many countries are following a path toward America's level of vehicle ownership:

- From 1980 to 1994, per capita levels of automobile ownership rose by 1,300 percent in Korea, 225 percent in Turkey, and 175 percent in Portugal.[18]
- In the former East Germany, motor vehicle population jumped 75 percent in just three years (1989 to 1992).[19] Eastern European countries such as Poland that have been transitioning from socialist to market economies have seen vehicle ownership increase as high as 40 percent a year.
- Annual increases in vehicle registrations in China, Thailand, Hungary, and Pakistan today are four to fifteen times higher than in the United States (which itself transformed from a society of one car per household in 1969 to a society of close to two cars per household in 1995, during a time that average household size declined by 17 percent).[20] Motor vehicle fleets are growing far faster than the gross national products (GNP) of all rapidly industrializing nations.

- The fastest rates of motorization can be found in the megacities of Asia. One study reports that in Shanghai, China, motor vehicle population tripled from 94,400 in 1985 to 272,000 in 1994.[21] Another claims the vehicle fleet grew by 172 percent between 1990 and 1991 alone.[22] Jakarta, Manila, and Bangkok have been averaging annual vehicle growth rates of 10 to 15 percent over the past decade.[23]

One sign of motorization pressures in many newly industrializing economies is the fast growth in two-wheel motorcycles and motor scooters. Most Taiwanese, Malaysian, and Thai cities average more than 200 motorcycles per 1,000 inhabitants (and some have over 400), with cities in Indonesia, Vietnam, and India following suit. For many young wage earners, motorcycles and scooters are a steppingstone to eventual car ownership—in much of Asia, just as the middle class filters through housing stock (from rental units to eventual home ownership) as they transition through life, they also filter through motor vehicle stocks. Smaller vehicles do not always spare the environment. Many motorcycles in Asia are powered by two-stroke engines (largely phased out in other parts of the world), which emit as much as ten times more hydrocarbons and smoke per kilometer as four-stroke motorcycles and even cars.[24] According to one estimate, the South (i.e., the Southern Hemisphere, including the poor countries of Africa, Southeast Asia, and Latin America) is responsible for 45 percent of the annual increase in fuel emissions that are causing global warming, and much of this is attributed to rapid increases in motorization, including two-wheelers.[25]

The Changing Nature of Travel and Its Causes

Rising incomes and car ownership, coupled with the spread of our cities, has sharply increased motorized travel throughout much of the world. Besides being more frequent in number, motorized trips are also occurring increasingly over longer distances and in single-occupant cars. Despite the accelerated movement of jobs to suburbs over the past decade or two, which one might think would put many people closer to their jobs, average commute distances have risen in the United States—from 13.6 kilometers each way in 1983 to 18.6 kilometers in 1995, a 36.5 percent jump.[26] A recent study of eleven large European cities similarly found that average work trip lengths increased from 8.1 kilometers in 1980 to 9.6 kilometers in 1990, an 18.5 percent rise.[27] Longer journeys have contributed more to traffic growth in Europe than has the rising number of trips. Qing Shen reports a similar trend in Shanghai, China, where the average journey to work lengthened from 6.2 kilometers in 1981 to 8.1 kilometers ten years later.[28]

Clearly, decentralization has not brought people and jobs closer in many settings. Why? Research in the United States places part of the blame on exclusionary zoning that keeps apartments and affordable housing out of many areas experiencing rapid job growth since low-end housing often costs cities more in services than they produce in property tax income.[29] Others contend that the growing importance of other factors in influencing residential location, such as being in a good school district, and the trend toward two-earner households, account for rising commute distances.[30]

The decline in public transit's share of metropolitan travel has been a nearly universal trend; however, nowhere has it been more precipitous than in the United States. Despite the infusion of billions of subsidy dollars and the construction of several hundred kilometers of new rail links, annual boardings for the forty-four largest U.S. metropolitan areas fell by 534 million, or 12.2 percent, from 1990 to 1995.[31] More ridership was lost during the first half of the 1990s than during the entire decade of the 1980s. Of course, the same forces behind the automobile's growing dominance—rising incomes and decentralization—have had a hand in transit's shrinking mobility role. However, a number of additional factors—some due to deliberate public policy choices, others not—have also played a role. Among these have been changes in lifestyle and urban demography, pricing, transit service levels, and institutional arrangements.

Demographic and Lifestyle Shifts

Throughout the Western world, as baby boomers have entered their peak earning years, motor vehicle consumption has also peaked. This is reflected in the United States, where in 1990 the number of registered automobiles surpassed the number of licensed drivers. Baby boomers average more travel not only because of higher incomes and more cars, but also because they are more active—they go out more often, have more expansive social networks, and chauffeur kids. Some note that as baby boomers age and are replaced by the baby-bust generation, travel rates can be expected to dip, or at least reach their saturation levels, in coming years. This, however, will likely hold only in the developed world. In much of Africa, Asia, and Latin America, places with bottom-heavy population pyramids, each succeeding generation will continue to be much larger than the preceding one.

Also powerfully influencing travel worldwide has been the changing role of women in the workplace. Today, some three-quarters of all women in the United States are in the private labor force. The feminization of America's work force is reflected by the fact that the number of workers grew almost 250 percent faster than population during the 1980s. Since many women must balance roles as wage earners and homemakers, their

travel patterns tend to be more complex than men's. The need to chain trips between work, child-care centers, the store to pick up groceries, and home forces many women to drive. Their greater automobile dependence is reflected in the fact that use of transit and carpooling has been declining faster for women than men in the United States.[32] A secondary factor contributing to increased trip chaining has been the growth in Americans working two jobs—estimated at 7 percent of the nation's work force in 1995 and likely growing.[33] Moonlighting increases auto dependence.

The demographic trend that might favor transit in the future is the maturing of populations, especially in the Western world. While the elderly are generally more transit-dependent than other age groups, in car-dominant societies such as the United States, seniors still make at least three of four trips in a private vehicle, either as the driver or as a passenger. Winning more seniors over to transit will hinge on elevating the quality and safety of services, in addition to more effectively integrating urban development and transit provisions.

Economic Factors

Pricing policies have also hurt transit around much of the world. In the United States, the retail price of regular-grade gasoline, including taxes, fell by 7 percent between 1980 and 1993 in real-dollar terms (from $1.141 to $1.113 in 1993 currency). Over the same period, fleet-averaged fuel efficiency increased by 40 percent (from 24.8 to 34.6 kilometers per gallon), a product of improved engine design, downsizing of vehicles, and better aerodynamics.[34] As a result of both factors—declining real prices and improved fuel economy—the real price of gasoline paid by America's motoring public for each kilometer traveled fell by almost 50 percent. Yet over the same period, inflation-adjusted transit fares rose by nearly the same magnitude, 47 percent. According to John Pucher and Ira Hirschman, whereas the cost of a transit trip averaged less than a liter of gasoline in 1980, by a decade later it cost over 130 percent more.[35]

Differences in price trends have similarly favored motoring in much of Europe. A study of more than 100 European cities from sixteen countries attributed transit's eroding market shares during the early 1980s partly to real-currency declines in automobile operating costs matched by rising transit fares.[36] In more recent times, nowhere have the disparities been more glaring than in the former East Germany. There, public transit fares increased tenfold between 1990 and 1992 in the wake of national reunification and the return to a market economy. In contrast, the price of a liter of gasoline actually fell by about 14 percent over the same two years. By 1994, the ratio of gasoline prices to transit fares was 0.7:1 in eastern Germany. According to John Pucher, these changing price differentials, along with the extremely important social status and symbol of freedom

attached to owning a car, have been behind transit's steadily declining share of urban travel in the former East Germany, from 60 percent in 1977 to 35 percent in 1991.[37]

In the United States, free parking—which motorists enjoy 99 percent of the time they make a trip—has long been a strong inducement to drive.[38] Donald Shoup has calculated that free parking is usually worth more than if motorists received free gasoline for their daily work trips. Zoning standards that inflate parking supplies, as a hedge against cars possibly spilling over into neighborhood streets, have only magnified the problem. A study of hundreds of parking facilities across ten U.S. cities found that peak parking demand absorbed, on average, only 56 percent of capacity.[39] Since parking lots are such big space consumers, their overdesign only adds insult to injury for transit riders and pedestrians, who end up having to trek longer distances, such as between a bus stop on the perimeter of a parking lot and a shopping mall entrance.

Comparatively cheap gasoline and free parking probably have a bigger impact on mode choice than we think. When people decide whether to drive or take a bus, they compare costs mainly in terms of conspicuous, out-of-the-pocket payments, such as bus fares, parking, and bridge tolls. Many overlook the sunk, fixed costs of owning a car and having to periodically pay for insurance and upkeep when making marginal choices on how to travel. It is when cash has to be regularly pulled out of the pocket, such as for transit fares, that travelers take strong notice of prices. Many Americans accept the $20,000 to $40,000 they pay for owning a car as a "subscription fee," a payment necessary to have full access to societal offerings.

The economic incentives to drive go well beyond cheap gasoline and free parking. Total subsidies to U.S. motorists have been placed at between $300 billion and more than $2,400 billion annually.[40] American motorists pay only 60 percent of the costs of road construction, maintenance, administration, and law enforcement through taxes and user charges—resulting in an annual subsidy to motorists of some $35 billion in 1993 currency.[41] America's direct motoring subsidies contrast sharply with European experiences, where the ratio of roadway taxes to expenditures range from 1.3 in Switzerland to 5.1 in the Netherlands.[42] Overall, fuel taxes per liter in Europe are five to ten times higher than in the United States, resulting in fuel prices that are two to four times heftier, mainly due to the tax differential. Differences in sales tax rates on new car purchases and gasoline are even greater in Europe—three to eighteen times higher than in the United States—with Denmark laying claim to the highest markup. It is no coincidence that both the Netherlands and Denmark, the two European countries that tax the car the heaviest, also channel the largest shares of their transportation budgets to mass transit services and bicycling.

Far larger and more worrisome are the indirect subsidies to motoring, such as the underpricing of scarce resources such as clean air, land (including space consumed by free parking), and fossil fuels. Studies show that indirect subsidies from free parking alone are at least twice as high as direct motoring subsidies (i.e., undertaxed fees for road construction, maintenance, and traffic law enforcement). Totaling the unpaid hidden costs of accidents, pollution, social disruption, global climate change, and other externalities puts subsidies for motoring in the United States in the neighborhood of $2,000 for every man, woman, and child, or about 5 percent of the gross domestic product (GDP).[43] Studies of hidden subsidies to motorists in Europe similarly place the monetary figure at about 5 percent of the continent's total GDP.[44] While (as discussed later in this chapter) subsidies for transit riding in the United States are probably comparable to those for motoring on a per passenger kilometer basis, motoring subsidies are so huge in the aggregate (again, as much as $2,400 billion annually) that they probably swamp the impacts of some $15 billion in annual subsidies to U.S. transit riders.

Cross-country comparisons illuminate some of the basic economic forces at play that affect travel demand. Figure 2.1 shows that among the most affluent countries of the world and on a per capita basis, fewer roads and cars, matched by higher gasoline prices, are associated with substantially less vehicle kilometers traveled—specifically in comparison to the United States, the world's most prodigious consumer of fossil fuels and

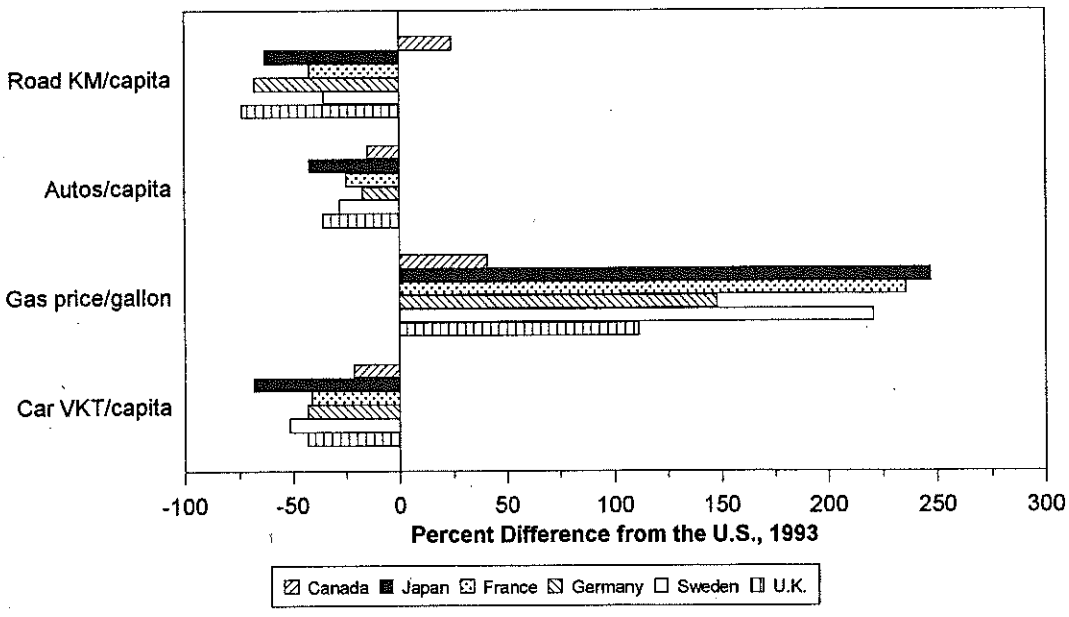

FIGURE 2.1. COMPARISON OF TRANSPORTATION SUPPLY, PRICE, AND TRAVEL DATA FOR SIX AFFLUENT COUNTRIES, RELATIVE TO THE UNITED STATES.

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emitter of greenhouse gases.[45] Part of the explanation for these differences is America's generally lower population densities. Overall, however, Sweden is 25 percent less densely populated than the United States (although its cities tend to be much more densely populated); yet the typical Swede still logs only half as many VKT per capita as the average American. Clearly, America's comparatively high levels of automobility and cheap gasoline prices are matched by comparatively high levels of resource consumption.

Changing Transit Service Levels and Financial Support

Deteriorating service levels have undermined transit in many cities. Declining ridership often triggers service cuts, which in turn drive even more customers away, forcing even further service cuts—the all too familiar vicious cycle of decline that has crippled transit the world over. Only through an infusion of government subsidies has it been possible to sustain transit service levels in most wealthy countries. Nevertheless, shifting political priorities, tight budgets, and government's retrenchment from the public transit arena have in many cases cut into subsidy transfers. In the United States, federal operating assistance for transit fell by 50 percent in real-dollar terms from 1985 to 1995; the losses were partly made up by higher fares and increased local assistance, but also by reduced service levels.[46]

Critics point out, with some justification, that aid to transit in the United States has produced relatively little payoff—nationwide transit ridership has remained fairly stagnant over the past three decades, at about 7 to 8 billion passenger trips (ignoring transfers) annually, while its market share of motorized trips has fallen from about 5 percent to under 3 percent. By comparison, highway travel has more than quadrupled since 1970. Studies show that a large share of government subsidies to transit get consumed by higher labor costs and fewer kilometers of service per worker.[47] Where transit agencies enjoy a protected monopoly status and face little competition from other common-carrier services, operating subsidies have led more to lax management practices and overly generous worker compensation packages than they have to increased ridership. Competitive contracting of public transit services has been used in many countries to contain rising costs.

Capital support for transit has generally increased faster than operating assistance in North America and Europe over the past decade. Most money, however, has gone toward modernization of aging equipment as opposed to system expansion. America's older subway and commuter rail systems, such as those in New York, Philadelphia, and Boston, have been substantially upgraded through station modernization and the rehabilitation of tracks, tunnels, and signaling systems. The New York metropolitan

area alone, which accounts for about a third of all transit trips made in the United States, spent about $15 billion on rehabilitation during the 1980s. Still, capital support for transit continues to lag way behind the roadway sector (which itself is, in many instances, in need of significant rehabilitation). For the United States as a whole, for example, $74 billion went into highway programs in 1994, seven times as much money as went into transit (though highway backers are quick to note that transit got a lot more capital assistance on a per passenger kilometer basis than did highways). In Eastern and Central Europe, between 1989 and 1994 nearly 60 percent of all funds from three sources—the European Bank for Reconstruction and Development, the European Investment Bank, and the International Bank for Reconstruction and Development—went to the road sector, versus 5 percent for transit. Approximately 60 percent of the World Bank's urban transport lending goes to roads, compared to 17 percent for transit.[48] Even fiscal conservatives have chimed in about favoritism in government programs. Paul Weyrich and William Lind of the Free Congress Foundation in Washington, D.C., remark:

> The current division of market share between the automobile and mass transit is no way the product of a free market. On the contrary, it reflects massive and sustained government intervention on behalf of automobiles. . . . Massive government intervention has so skewed the market toward the automobile that many consumers do not have the option of a high-quality transit system.[49]

Government assistance to transit is often defended on the basis that countervailing subsidies are necessary to offset the historical underpricing of auto motoring and subsidized highway projects. Finding ways to channel more of the assistance into service enhancements as opposed to supporting higher wages and less work continues to be a challenge for many transit properties. Economists often call for directing subsidies at users, in the form of vouchers for the poor, instead of providers (i.e., transit agencies), while at the same time deregulating the market so that operators compete for voucher income, as ways to remove the perverse impacts of subsidies and inject greater competition into the urban transportation sector.

Institutional Factors

Some institutional factors have probably hurt transit services, and some have likely abetted them. In many areas with multiple transit providers and oversight authorities, services coordination is hampered by the balkanization of decision making. In Bangkok, Thailand, for instance, more than thirty government agencies are responsible for the city's transporta-

tion policy, management, and operations. Until the recession hit in early 1997, three different rail transit projects, each sponsored by a different federal ministry, were proceeding along toward implementation in hopes of relieving Bangkok of its worsening traffic nightmares. Where private operators dominate the local transit scene, coordination can be all the more difficult. In Rio de Janeiro, more than sixty private bus companies currently service the city. Fragmentation not only produces inefficiencies and duplication, but also leads to uncoordinated services and quite often fare structures that penalize those who must transfer across transit systems.

Efforts to expand the role of the private sector in delivering transit services has probably, on balance, been a positive institutional trend. With the onset of federal subsidy cuts under the Reagan administration, many U.S. transit properties began competitively contracting out services in the 1980s to the lowest bidder that could meet minimal service standards. Studies show private operators of fixed-route bus services brought cost savings of between 22 and 54 percent (mainly from hiring nonunionized, lower-waged employees), along with higher labor productivity (more vehicle kilometers per driver).[50] Great Britain's sweeping privatization program, introduced under the Thatcher administration in the mid-1980s, similarly cut transit operating costs. While fares have generally risen throughout Great Britain, so have service levels and patronage in most markets. Deregulation led to the introduction of private minibus services in many outlying areas.[51] Many rural and exurban residents, however, have seen services totally withdrawn. Privatization of urban and interurban bus services has also occurred in much of Norway, Sweden, and Denmark. In the Netherlands, Germany, and other parts of Europe, privatization has been fostered mainly by governments selling off railway assets, other than tracks, and competitively tendering with the private franchisers to operate on the tracks at agreed-upon minimum service levels.

Problems of an Automobile-Dependent World

Transit's eroding mobility role, matched by rising levels of automobile travel, have heightened concerns over whether these trends are sustainable over the long run. By "sustainable" is meant the stewardship of natural and humanmade resources so that the quality of living and the health of our cities, countrysides, and open spaces do not deteriorate from one generation to another. While the word *sustainability* is often associated with natural ecologies and habitats, increasingly the notion is being extended to other spheres as well—economic health and well-being, preservation of the historical significance of cities, and improvements in overall social conditions. Coming up with good criteria for monitoring

progress toward achieving sustainability in the transportation sector has proven elusive. Some analysts call for tracking per capita trends in vehicle hours and vehicle kilometers traveled, numbers of motorized trips, and single-occupant vehicular travel since increases in tailpipe emissions, energy usage, and land consumption are strongly correlated with these measures.[52] Of course, the impact of transportation on livability is also an important dimension of sustainability. There is a growing, unsettling feeling among many urbanites that quality of life is slipping, and indeed something has gone seriously awry in how we plan, design, and manage our cities and surrounding environs. John Whitelegg, who directs an environmental epidemiology research unit in the United Kingdom, believes that child health is the ultimate gauge of sustainability—only when we build cities and transportation systems that lower the risks of asthma and respiratory illnesses, that allow kids to play with little fear of passing cars, and that reduce the vast distances that impede social interactions, he argues, will humankind be on a sustainable course.[53]

This section reviews recent evidence on the consequences of changing mobility trends and their broader implications for sustainability, including worsening traffic congestion, deteriorating air quality, and costly sprawl. Of course, most of these impacts are interconnected, suggesting that a systems approach is needed if they are to be effectively dealt with. The section also reviews recent studies that have attempted to attach dollar figures to the net social costs of motorization and considers, finally, whether there are net benefits to the car culture.

Traffic Congestion

Traffic congestion is pandemic in many cities of the world. Sitting in traffic wastes time and energy, dumps extra pollutants into the air, causes stress, cuts into worker productivity, and prompts drivers to be more reckless than they otherwise would, increasing accidents. Of course, traffic congestion is not necessarily all bad—it is a sign that a community has a healthy, growing economy and has refrained from overinvesting in roads. In theory, the economically efficient level of congestion is where the costs of delays and accidents experienced by motorists are balanced by the costs of added capacity over the full service life of a project. The fact that prices (e.g., land costs, value of time among motorists, etc.) vary so much across corridors makes setting "optimal congestion" levels impractical. The net social costs of traffic congestion are high in most industrialized countries, estimated at between 2 and 3 percent of GDP.[54]

The traditional response to traffic congestion has been to widen existing roads and build new ones. This often provides only ephemeral relief since added capacity attracts new growth and lures motorists from other, more crowded corridors. A recent panel study of California metropolitan

areas found new road capacity induced travel: between 1973 and 1990, every 10 percent increase in highway lane-kilometers led to a 9 percent increase in vehicle kilometers traveled (VKT) within a four-year period, controlling for the influences of other factors.[55] Usually it is just a matter of time before newly improved roads fill up again. It is now widely accepted that "you can't pave your way out of traffic congestion." Nor does it seem many places would be able to even if they could. Community opposition, environmental regulations, and funding shortages have conspired to make new road construction virtually impossible in many urban corridors. Among the thirty-nine largest U.S. metropolitan areas, the number of lane-kilometers of expressways and major arterials increased just 13 percent during the 1980s compared to a 32 percent increase in VKT. This translated into an increase in average travel delay of 57 percent.[56]

Slowdowns in road building, combined with rapid motorization, have proven to be a recipe for traffic tie-ups the world over. In continental Europe, densities on the main highway network increased 45 percent from 1980 to 1995.[57] Conditions have deteriorated the most in Eastern Europe's capital cities. Warsaw's peak-period speeds fell from 30 kilometers per hour in 1988 to 14 to 20 kilometers per hour in 1994.[58]

Of course, the worst traffic snarls are found in the world's megacities. Decades of haphazard growth and little or no planning, combined with rapid motorization, have finally caught up with the developing world. Few Third World cities devote more than 10 percent of their land area to roads; in contrast, roads take up 20 to 25 percent of total area in most European cities and more than 35 percent of all space in U.S. cities. Not only are roads relatively few and narrow, their designs are rarely coordinated in any functional or hierarchical sense. Main arteries sometimes abruptly dead-end, and narrow neighborhood streets do double duty as major distributors. Also, many thoroughfares in Third World cities are poorly maintained and pocked with potholes. During bad weather, traffic can slow to a standstill. The spillover of food vendors and pedestrians onto streets, the siting of markets at critical intersections, and poor enforcement of traffic laws only make matters worse.

Congestion, be it on roads or on a golf course, is generally a sign that prices are too low. When traffic volumes approach about 95 percent of capacity, it takes only a few more cars entering the stream for the system to break down, forcing all traffic to a stop-and-go crawl. These few additional motorists absorb only the time delays they themselves incur, not the collective costs of additional time delays inflicted on others upstream. These are deadweight losses in the sense that some motorists would pay for less delay and others would forgo travel if they were charged for their contribution to congestion; however, there is no mechanism for these transactions to take place. Traffic congestion is a classic case of the "tragedy of the commons"—the shared, underpriced public resource, road

space, is overconsumed since no one pays marginal social costs, to the detriment of the community as a whole.[59] While traffic tie-ups affect all vehicles, buses are particularly susceptible since they are less nimble and slower to accelerate and decelerate. Thus bus riders usually end up absorbing a larger share of costs from congestion than the average motorist.

Government tax policies, it is worth noting, have had a direct hand in rising motorization and traffic congestion. In 1991, the Thai government reduced import duties on small cars from about 300 percent to 20 to 30 percent to spur competition between local and foreign automobile manufacturers. One year later, Bangkok's ownership rates ballooned to 200 cars per 1,000 residents, higher than in Singapore and Hong Kong and only slightly less than Tokyo's rate. Today, Bangkok is one of the highest car-owning, car-using, and energy-consuming cities in the developing world. It is also one of the most congested. Traffic currently crawls at below 8 kilometers per hour during much of the day, and along several major thoroughfares at just 3.7 kilometers per hour, slower than a brisk walk. One recent study put the average delay for motorized trips of more than 5 kilometers at two hours.[60] Because of traffic paralysis, Bangkok is losing its competitive edge in attracting investment, both domestically and from abroad. Shipment delays due to traffic jams have driven up the cost of local goods. One of Bangkok's fastest-growing housing rental markets today is said to be downtown apartments, leased by suburbanites seeking to avoid daily commutes.[61]

Similar stories can be told of South America. Lima's vehicle population soared when the Peruvian government relaxed import restrictions in the early 1990s. From 1992 to 1995, the number of commuter vans jumped from 6,000 to 47,000. In Bogotá, Colombia, the lowering of import tariffs contributed to a 12 percent annual increase in vehicle registration, yet the road system has remained virtually unchanged over the past two decades. A crosstown trip in Bogotá can today take up to three hours during rush hour.[62] Brazil's anti-inflation plan has allowed many lower-income households to buy a vehicle for the first time, triggering a meteoric rise in car ownership, on the order of 12 to 15 percent annually in São Paulo and Brasília. São Paulo's last comprehensive city plan was drawn up in 1968. It called for 100 kilometers of new metro lines and 135 kilometers of new freeways by the time the region's population surpassed 10 million. Since the plan, not a single freeway has been built and only 43 kilometers of rail lines have been added. São Paulo's traffic engineering department estimates that on a typical day, traffic jams extend 85 kilometers in length across the city, which over an entire year costs residents some US$10 billion in time delays.[63]

Transit advocates tout buses and trains as a solution to traffic woes. The American Public Transit Association (APTA) maintains that a fully

loaded 14-meter bus can replace a lane of cars moving at 40 kilometers per hour over six 100-meter city blocks.[64] By their calculations, a fully loaded, six-car heavy rail train can substitute for nearly 100 city blocks of moving cars. Of course, coaxing motorists over to transit is no small feat. One study of bus-only cities in the United States and Europe estimated that it is generally twice as fast to travel by car as by bus.[65] Even in larger rail-based cities in Japan and Europe, the study found point-to-point travel times by car to be 3 to 23 percent shorter than by transit. The central premise of this book is that transit will only become time-competitive with the car by improving the match between how services are configured and cities are designed. Reduced time delays, especially for transit users, would be an important benefit. Of course, the aim is not to eliminate congestion fully, for to do so would, over time, lull people back to their old motoring habits. Rather, the hope would be to reduce traffic congestion to more socially acceptable and manageable levels.

Air Pollution

In most developed countries, air pollution is largely a product of an auto-dependent society. Motor vehicles produce numerous air pollutants, including carbon monoxide, particulate matter, nitrogen oxides, hydrocarbons, sulfur oxides, carbon dioxide, and methane. In the United States, between 30 and 40 percent of humanmade hydrocarbon and nitrogen oxide emissions, two of the chief precursors to the formation of ground-level photochemical smog, and about two-thirds of carbon monoxide emissions come from the tailpipes of cars and trucks. In Europe, the shares attributable to motor vehicles are even higher.[66] Today, smog is a serious problem in more than 100 U.S. cities, with the worst conditions in California and the industrial areas of the Northeast.[67] At extreme levels, smog can impair visibility, damage crops, dirty buildings, and, most troubling, threaten human health. Smog has been linked to asthma attacks, eye irritations, and upper and lower respiratory problems.[68] There is growing concern that the most serious long-term health threat might come from very fine particulate matter (of ten or fewer microns). Tiny particulates can more easily bypass the body's natural filtration system, posing long-term risks to the respiratory system by lodging deeply in the lungs. Recent research suggests that non-tailpipe particulate pollution (e.g., attrition dust from brake pads and tires) may be a more serious health threat than previously thought.[69]

The damage attributable to auto-related air pollution in the United States has been placed at approximately $10 billion annually according to one estimate and just over two cents per vehicle mile traveled according to another (both in 1990 currency).[70] Despite much cleaner automobiles (1996 model cars emitted 90 percent less pollution than the typical 1970

model) and trip reduction mandates, air quality in many urban areas of the United States has improved little and in some places has worsened. This is partly because mitigation measures have been swamped by the growth in vehicle population, number of trips, and miles driven, especially in slow-moving traffic.

Air pollution from cars, trucks, and scooters is especially troubling in large cities of the developing world, where emissions and leaded fuel are often not regulated and vehicle fleets tend to be fairly old. Bangkok reputedly has the highest concentrations of volatile hydrocarbons and particulates in the world, a result of too many inefficient, poorly maintained vehicles and two-stroke motorcycles idling in traffic jams for hours.[71] A study of Bangkok police officers regularly exposed to road traffic found they had blood lead levels significantly above World Health Organization (WHO) standards.[72] With so many cars and trucks belching smoke, gas masks have become standard uniform equipment among Bangkok's traffic patrol officers.

The potential value of transit in reducing air pollution has long been a source of contention. Obviously, fully loaded buses and trains emit less pollutants per passenger kilometer than do automobiles with one or two occupants. The American Public Transit Association (APTA) claims that, on a per-passenger-kilometer basis (using national averages for vehicle occupancy), riding transit in lieu of driving for a typical work trip will reduce emissions as follows: hydrocarbons and carbon monoxide by 99 percent, and nitrogen oxides by 60 percent if the trip is by electric rail transit; and hydrocarbons by 90 percent, carbon monoxide by 75 percent, and nitrogen oxides by 12 percent if travel is by diesel bus.[73] From 1965 to 1995, APTA contends that transit riding has kept some 1.6 million tons of hydrocarbons and 10 million tons of carbon monoxide from ever entering urban air basins. Others counter that these estimates are skewed by oversampling peak-period services, and that half-empty diesel buses running during slack hours and the construction emissions from building lightly used rail systems have hurt air quality in some cities.[74] There can be little disputing that significant air quality benefits will accrue only if transit wins over large numbers of former motorists. Significant shares of passengers on many new light rail systems in the United States have been drawn from buses and carpools, thus negating some of the hoped-for air quality benefits. Transit's best hope for materially improving air quality in the future, I believe, is to better align itself with urban settlement patterns. Only then can enough trips be diverted from cars and trucks to yield substantial air quality benefits.

Greenhouse Gases and Climate Change

If there is one truly global issue raised by rapid motorization, it is the risk of increased greenhouse gas emissions changing climates and meteoro-

logical conditions throughout the world. There is a growing scientific consensus that humanmade greenhouse gases—including carbon dioxide, chlorofluorocarbons, and methane—are building up in the Earth's atmosphere, and that global temperatures are rising as a result.[75] Climate changes can alter levels of precipitation, ocean currents, and seasonal weather patterns, leading to crop damage, rising sea levels, and possibly even the extinction of plant and animal species. In the United States, Western Europe, and the rest of the developed world, automobiles and trucks are the two largest sources of carbon dioxide emissions, responsible for 22 percent of the total.[76] The United States, with just 4.6 percent of the world's population, produces nearly one-quarter of all energy-related carbon dioxide emissions. However, it is the rapidly developing and motorizing countries of the Southern Hemisphere that pose the greatest threat to global climate change. Walter Hook and Michael Replogle estimate that the South is responsible for 45 percent of the annual increases in greenhouse gas emissions.[77]

Climate change took center stage among environmental concerns discussed by world leaders at the 1992 Earth Summit in Rio de Janeiro and the 1996 World Habitat Conference in Istanbul. More than 160 countries are now parties to the U.N. Framework Convention on Climate Change. A hefty carbon tax is viewed widely as an important first step toward significantly reducing greenhouse gas emissions. One recent study estimated that fuel prices would have to increase by 7 percent per year in real terms over a twenty-year period in order to cut worldwide greenhouse gas emissions in half.[78] Among the other called-for strategies is a reduction in the use of coal for electrical power generation, such as for urban rail services. Peter Newman warns that this is not unilaterally the best course of action for reducing carbon dioxide emissions. He argues that rail transit allows for compact, mixed-use development that substantially lowers travel—according to his calculations, by as much as 84 percent in Asia's wealthiest cities, Hong Kong, Tokyo, and Singapore, each of which is compact and well served by rail transit.[79] The workable nexus of transit and urban form, Newman contends, more than offsets the greenhouse gas impacts of coal-generated electricity used to propel metro trains. Conditions would be much worse if megacity travelers relied as much on gasoline-fueled transportation as Americans.

Energy Consumption

As countries modernize and industrialize, increased consumerism and motorization sharply increase the demand for energy. Finite supplies of fossil fuels, however, pose serious threats to sustained economic growth and even world peace. Because of the heavy reliance of major world powers on imported oil, especially from the Middle East, major interruptions in supplies can not only throw the global economy into a tailspin but, as

experiences have shown, can also spark political tensions and military confrontations.

From 1973 to 1990, global transportation energy use grew by an average of 2.4 percent per year; by 1990, the transportation sector accounted for at least one-quarter of primary energy use.[80] Transportation consumes considerably higher shares of energy supplies in rapidly developing countries. In the United States, the transportation sector accounts for about three-quarters of petroleum used, and about two-thirds of this amount is burned in motor vehicles. Though just 4.6 percent of the world's population, Americans consume more than 25 percent of all petroleum sold at the pump each year. The per capita rate of fuel consumption in the United States is 87 percent higher than in the United Kingdom, 155 percent higher than in Japan, 460 percent higher than in Mexico, 56 *times* that of Nigeria, and 280 *times* more than Nepal's (though 57 percent less than Qatar's).[81] One study estimated that each U.S. urbanite consumes, on average, ten times as much gasoline as his or her Japanese counterpart and more than twenty times as much as European city-dwellers.[82] Such differences drive up the costs of U.S. goods and products in international markets, undermining the country's international competitiveness.

Current trends suggest that transport energy use may well double over the next twenty to thirty years.[83] Although new automobiles are far more fuel-efficient than ever before, as in the case of air quality, these gains are being offset by ever-increasing traffic volumes and lengthening trips. In wealthy countries, gasoline consumption rates have risen in recent years as motor vehicles have increased in weight, a result of improvements in safety, comfort, and in-car amenities. Heavier vehicles also reflect changing taste preferences, such as for minivans and sports utility vehicles (despite the trend toward declining household sizes). In the United States, big-vehicle preferences have been buttressed by cheap fuel and motoring prices.

Transit metropolises can help conserve energy in several ways. Compact, transit-oriented development shortens trips, thus encouraging nonmotorized travel. And conversion of low-occupancy auto trips to mass transit cuts down on per capita fuel consumption.[84] In 1995, the average commute by private automobiles in the United States consumed 6,500 BTUs per passenger kilometer, compared to 5,940 BTUs per passenger kilometer if the trip was by bus transit and 5,440 if the trip was by rail transit.[85] Transit's energy advantages are even higher elsewhere. In German cities, bus transit is estimated to be four times more energy-efficient than the car, and tram and metro services 2.5 times more efficient.[86] In addition to moving more people with less energy, rail transit can be propelled by electricity generated from renewable, nonpetroleum sources, such as wind and hydro-power. Some critics charge, however, that when the energy expenditures for constructing rail systems are counted, rail investments can be net energy losers. One study estimated that, because

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of the high energy outlays in building the transbay tube, San Francisco's Bay Area Rapid Transit (BART) system uses 3.6 percent more energy annually than would an exclusive busway along the Bay Bridge.[87] Clearly, unless trains attract large numbers of former motorists, the energy conservation benefits of new metros will remain questionable. Targeting new growth around rail stations will be essential if new rail investments are to yield meaningful environmental benefits and energy savings.

Other Environmental Concerns

Other environmental concerns associated with automobile dependence include noise pollution, premature loss of farmland, wetlands, and open space (from auto-induced sprawl), soil pollution and contamination, water pollution from drilling and processing of petroleum as well as from drainage of automobile fluids and road salts, and the scarring of natural landscapes from scrapping vehicles and tires. To this list might be added visual intrusion and community severance. Of course, transit investments are guilty of many of the same sins, but environmental damage would be far less if busways and railways were favored over six-lane freeways.

Noise from roaring engines, screeching tires, and blaring horns is stressful. Using real estate sales data, one study put the noise damage from cars and trucks on residential properties for the United States as a whole at about $9 billion annually (in 1989 dollars).[88] Residents of the world's megacities experience the worst noise pollution. Roadside monitors in Bangkok regularly record daily ambient noise levels of 75 to 80 decibels, considerably above the 65-decibel maximum considered safe for humans.[89] While buses and trains are certainly noisier than the typical car or truck, the substitution of public transport trips for private motoring can substantially reduce ambient noise levels. On the other hand, compact development can expose many residents to high noise levels. Japanese cities tend to be noisier than their U.S. and European counterparts, with 30 percent of Japan's urban population regularly exposed to noise levels above 65 decibels.[90] However, many well-planned, rail-oriented communities in Japan are far less noisy than central Tokyo or Osaka. Experiences in the privately built, rail-served new towns of outer Tokyo suggest careful attention to design can mitigate noise impacts and other potential problems associated with urban agglomeration (see Chapter 7).

Another serious threat posed by rapid motorization is the loss of arable land. Cars and freeways are notorious land consumers, pushing the envelope of urban development outward and in the process threatening productive farmland, natural habitats, wetlands, and open space. Not only does a typical fast-moving four-seat sedan take up the amount of road space occupied by forty bus passengers or twelve cyclists, but each car requires up to 25 square meters (including aisles and driveways) to park in an urban setting. A well-patronized light rail line can substitute for

highways and parking that require fifty times as much space.[91] Because of automobile dependence, U.S. cities average twice as much road space and parking per capita as their Western Europe counterparts. The impacts of space consumption go well beyond consuming pastureland and open expanses. The spreading out of urban activities lengthens journeys and deters walking and cycling, increasing tailpipe emissions and energy consumption in the process. In many U.S. cities, where up to 30 percent of the land is occupied by parking, the high proportion of bitumen surfaces to natural vegetation reduces oxygen production and increases stormwater pollution.

Traffic Accidents

Worldwide, there are more than 2,500 fatalities and 50,000 injuries each day from traffic accidents.[92] The economic losses amount to an estimated 2 to 4 percent of the GDPs of most wealthy countries.[93] Research suggests that traffic fatalities decline with lower motor vehicle use. In a recent international comparison, Jeff Kenworthy and his research associates found that, relative to the U.S. sample, fatality rates were 18 percent lower in Australian cities, 40 percent lower in European cities, and 55 percent lower in the three wealthy Asian cities (Hong Kong, Tokyo, and Singapore).[94]

In the developing world, traffic accidents are reaching epidemic proportions. According to the World Health Organization (WHO), three-quarters of all traffic accidents occur in the Southern Hemisphere, even though there are many more motorized vehicles north of the equator.[95] In 1990, traffic accidents ranked ninth among causes of death and disability worldwide. By 2020, WHO expects the road-traffic toll to jump to third place worldwide (second place in developing countries). Part of the problem is the poor enforcement of traffic laws in developing countries, but the more serious problem is pedestrians, cyclists, carts, and scooters competing against cars, trucks, and buses for limited road space. In New Delhi, three-quarters of people killed on the road are pedestrians, cyclists, and motorcyclists.[96] Shanghai averages ten times as many traffic fatalities per capita as Tokyo, partly because of the high exposure of pedestrians and cyclists to fast-moving traffic, but also because of delays, caused by traffic congestion, in providing first aid to accident victims.[97]

Unlike the other negative impacts of car dependence reviewed so far, most economists do not view traffic accidents as an externality—although fatalities and injuries certainly cost society, these costs are largely borne by those who willfully choose to travel. People weigh the risk of traffic accidents when they opt to drive or pedal a bike, and the very act of travel suggests that they generally consider net benefits to offset whatever risks. In wealthy countries, most citizens indemnify themselves against the risk of traffic accidents through insurance payments, thus absorbing

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costs and, should they require it, receiving compensation. Of course, in the developing world, where insurance is often a luxury, the losses, pain, and suffering experienced by victims and their families, who often are among society's poorest, can be catastrophic.

Social Inequities

Among the most troubling concerns about a car-dependent society are the social injustices that result from physically and socially isolating significant segments of society. Those who are too poor, disabled, young, or old to own or drive a car are effectively shut out of many of society's offerings. For the elderly and physically disabled, isolation can mean loneliness, depression, and inattention to health-care needs. For many working moms, isolation all too often means thousands of extra hours spent escorting kids and family members to and from out-of-the-way places. And for far too many of the inner-city poor, isolation means an inability to reach or even find out about job opportunities, what has been called the "spatial mismatch" problem. This view holds that, in America, inner-city joblessness and intergenerational poverty are rooted in the physical separation of the urban poor, and in particular young black males, from expanding job opportunities in the suburbs. A study of commuting in Philadelphia, Chicago, and Los Angeles found that unequal accessibility to jobs explained nearly half of the difference in employment rates between black and white teenagers.[98]

In her classic account of city life, *The Death and Life of Great American Cities,* Jane Jacobs underscores how essential diversity and day-to-day human contact are toward maintaining social cohesion, a sense of well-being, and attachment to a community.[99] The car culture, it seems, has brought with it an unraveling of long-held community bonds. The *Chicago Tribune* in the summer of 1996 ran a series called "Nation of Strangers," warning that the "hypermobility" of the suburban era—working, sleeping, playing, and schooling at locations reached only by long automobile rides—has broken down community identity, created sterile environments, and impoverished the nation's collective spirit.[100] Cloistered, class-segregated growth, made possible by the automobile, has been blamed for widening racial divisions in America. Anthony Downs warns that Americans will eventually suffer the social costs of continuing to isolate significant segments of society in impoverished inner-city areas, in the form of increasing crime, drug abuse, births out of wedlock, fatherless households, and gang warfare.[101] Douglas Massey and Nancy Denton equate the systematic segregation of African Americans that has resulted from white flight and urban sprawl to *American Apartheid,* the title of their 1993 book, concluding that isolated ghetto conditions stimulate the very kinds of antisocial behavior that middle-class America deplores.[102]

Concerns about automobile-led sprawl, and its role in creating a per-

manent underclass of city-dwellers, are voiced mainly in the United States. Concentrated inner-city poverty is less of a problem in Western Europe and virtually nonexistent in Japan. In contrast to the Western world, many poor households in developing countries have been displaced to the periphery of metropolitan areas. Living on the outskirts, away from central city jobs, often imposes significant financial hardships. In large cities with poor public transit connections, low-income households spend as much as a quarter of their earnings on transportation, and those living on the fringe can spend more than three to four hours a day getting to and from work.[103] Many pay multiple fares transferring from one private transit carrier to another.

Transit is often looked upon to help narrow the mobility gaps created by auto-dependent landscapes. In Philadelphia, Los Angeles, Milwaukee, and other U.S. cities, reverse-commute buses and vanpools connect inner-city residents to suburban job sites, usually at deeply discounted fares. There is some evidence that these services have made a difference. Milwaukee's Job-Ride reverse-commute van service, for instance, has been credited with placing more than 3,000 inner-city residents in permanent jobs and reducing welfare rolls.[104] In much of Latin America, jitneys provide vital mobility links between shanty-towns on the periphery and in-city job opportunities.

An equally important role for transit is to function as a catalyst to central-city redevelopment as well as culturally diverse suburban growth. As discussed later in this book, rail stations have become focal points for rebuilding what once were declining central districts in Singapore, Melbourne, Munich, and other cities. In Scandinavia, rail lines built in advance of demand have been used to guide spillover growth into planned communities that are richly diverse in terms of residents' ages, backgrounds, and incomes. In the United States, efforts are now under way to transform once-decaying inner-city neighborhoods in Oakland and San Diego, California, into socially diverse and economically viable "transit villages." The Federal Transit Administration has launched the Livable Communities Initiative to fund transit-supportive projects, such as adult-training centers sited near rail stops, as a means of leveraging central-city redevelopment. These movements share a "back to the future" sentiment—an underlying belief that communities of tomorrow should be built more like the streetcar suburbs of yesteryear. A century or so ago, many Americans lived in communities huddled around rail stops. The compactness and defined edges of these rail-served communities gave them distinct identities and instilled a strong sense of place among their inhabitants. When people took transit, they encountered others from all walks of life each and every day. Whether on the trolley or en route to or from the depot, they met, talked, and got to know each other. While the contemporary transit village movement remains modest in scope, a growing number of developers and architects are betting that more and more

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Americans would gladly trade in an auto-dependent suburban lifestyle for a chance to live in a safe, well-designed traditional community oriented to transit.

The Bottom Line: Social Costs of an Auto-Dependent World

Putting a price tag on the cumulative social costs of automobility is fraught with methodological difficulties. Regardless, a plethora of recent studies have sought to tally up these costs. All of the studies net out the amount road users pay in the form of fuel taxes, tolls, and user fees to get at estimates of hidden subsidies to motoring. As discussed earlier, most investigations have focused on the world's most auto-dependent country, the United States. All take great pains to achieve a full accounting of costs, measuring everything from the external costs of air pollution and greenhouse gas emissions to the costs associated with maintaining a military presence in the Middle East to secure oil imports. Expressed in 1990 currency, research by the World Resources Institute, the Natural Resources Defense Council, the Transportation Policy Institute, and the U.S. Transportation Systems Center have independently put the unborne hidden subsidies for motoring at between $370 billion and $780 billion annually.[105] In what is perhaps the most complete and rigorous evaluation conducted to date, Mark DeLucchi of the University of California at Davis placed the hidden subsidies to U.S. motorists as high as slightly more than $1,000 billion each year.[106] DeLucchi's work incorporated the latest scientific evidence on the health and natural resource impacts of air pollution and greenhouse gas emissions and, unlike earlier studies, included the cost of bundled goods (e.g., free retail parking raises the price of goods since landowners pass their expenses for building and maintaining parking lots on to tenants, who in turn pass them on to customers).

Of course, cars and trucks alone are not solely responsible for these cumulative costs. Buses and trains also pollute, burn fuel, and disrupt communities. In fact, on a distance-unit basis, subsidies to U.S. motorists are probably somewhat comparable to, if not less than, what transit riders receive. Depending on which cost study one uses, hidden subsidies to U.S. motorists are between 11 and 23 cents per passenger kilometer, whereas the annual capital and operating subsidies to transit are about 23 cents per passenger kilometer (almost identical to the high-end subsidy estimate for motorists).[107] In the aggregate, however, the hidden costs of bus and train travel pale in comparison to those attributable to cars and trucks, and, of course, if bus and rail travel were replaced by private automobile trips, the net social bill would be considerably higher.

Outside the United States, studies on the full social costs of highway travel are few. Estimates have been derived, however, for individual cities. One study calculated the cost of automobile travel in West Berlin at about US$0.40 per passenger kilometer, expressed in 1988 currency. Public tran-

sit was estimated to cost the city about US$0.23 per passenger kilometer. The study concluded that West Berlin should refrain from improving roads in the future and instead expand and upgrade its transit services.

What about Benefits?

So far, this discussion has been silent about the benefits of the car culture. This is partly because very little is known, at least in a quantitative sense. There is simply no credible way to get at the full social benefits of automobility. Many analysts maintain that unborne costs are more than offset by the benefits conferred by private motor vehicles, including higher economic productivity and freedom to live and travel as one chooses. Even Mark DeLucchi, who has assigned higher social costs to automobile travel than anyone, writes: "motor-vehicle use provides enormous social benefits and, in our view, probably greatly exceeds the social cost."[108] While for some this is no doubt true, for many who are too poor to own a car, the social costs of an auto-oriented world could very well exceed purported benefits. This is an area where disparities likely abound.

Throughout much of the world, people aspire to the American way of living—owning single-family homes and cars and residing in places that are free from signs of poverty. In his book *New Visions for Metropolitan America,* Anthony Downs warns that "this vision is now so strongly entrenched that it has become almost political suicide for elected officials to challenge any of these elements."[109] The very fact that residents of pluralistic, free, democratic societies like the United States continue to elect politicians who perpetuate past practices of road building and auto-oriented development suggests that, on balance, most feel the benefits outweigh the costs.

Of course, it is the values and aspirations of Americans, Europeans, and others to live in low-density settings and to separate home from work that has given rise to sprawl, pollution, and traffic congestion, not the car per se. This does not mean, however, that people prefer to live far from their jobs and drive a lot. Many do because in auto-reliant, suburban environs they can find affordable housing, decent schools, and clean, safe neighborhoods. An important challenge in creating successful transit-oriented environments, then, is to plan, design, and build compact yet attractive communities that are well served by alternative modes such as transit and that are also affordable, have good schools, are safe to be in, and, in short, are like traditional suburbs in most other ways.

The apparent lifestyle preferences of many middle-income people to live in low-density settings and drive their cars at will have prompted some transportation analysts to argue in favor of "sustainable automobility" as a preferred policy direction for the future.[110] This view holds that most problems of the car culture can be fixed by developing more clean-fueled vehicles. After all, scientific advances and technological break-

throughs have solved many societal problems in the past, and there is no reason to believe, some argue, that the same will not hold in the future. In reality, however, the environmental benefits of innovations such as preheated catalytic converters and reformulated gasoline are being swamped by geometric growth in vehicle populations and motorized travel, especially in developing countries. And while we might be able to re-engineer the car to spew nontoxic emissions and run on renewable energy resources, and perhaps even bypass traffic snarls using on-board navigational aids, there is no technology that will redress the social injustices inherent in a sprawling, autocentric landscape—be it isolation of the poor from job opportunities or the immobility imposed on those too disabled to drive.

Even if we were to accept that the benefits of an auto-dependent world exceed costs, it is unclear whether this will hold over the long run. Many are skeptical, pointing out that known reserves of economically retrievable fossil fuels will support current levels of travel demand for only another thirty years or so. The reality is that we do not know the long-term consequences of extending current travel habits well into the future. By continuing along a path of increasing automobile dependence, we are taking risks whose outcomes will be borne by future generations. These are risks that growing numbers of people would prefer not to take.

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costs both borne and not borne by motorists. Three of DeLucchi's categories that can be assumed to represent unborne costs are: bundled private-sector goods (e.g., free parking at shopping malls); monetary externalities (e.g., travel time delay imposed on others); and nonmonetary externalities (e.g., air pollution). Two categories that can be assumed to represent costs borne directly by motorists are: personal nonmonetary costs of using motor vehicles (e.g., time spent traveling) and private-sector motor-vehicle goods and services (e.g., cost of purchasing a car). A sixth category—public infrastructure and services—can be assumed to include both borne and unborne costs, although DeLucchi does not break down cost estimates into these subgroups. Perhaps the most conservative estimate to date of the share of highway capital, maintenance, and administration costs not recovered from users is from Douglass Lee. He estimated the figure to be about $55 billion for the United States as a whole for 1991, expressed in 1990 currency. Applying Lee's figure to the other categories of unborne costs from DeLucchi's study produced the range of $452 billion to $1,018 billion. Sources: M. DeLucchi, Total Cost of Motor-Vehicle Use, *Access,* vol. 8, 1996, pp. 7–13; J. Murphy and M. DeLucchi, A Review of the Literature on the Social Cost of Motor Vehicle Use in the United States, *Journal of Transportation and Statistics,* vol. 1, no. 1, 1998, pp. 16–42; and Lee, *op. cit.*

107. Estimates were calculated for the 1992 calendar year as follows, with all monetary figures expressed in 1990 currency. In 1992, $4.3 billion in capital subsidy grants were funneled to U.S. public transit operators from state, federal, and local sources; this was slightly below grant totals for other years during the 1990s. Operating assistance from all sources was $10.1 billion. Thus, the direct financial subsidies to transit totaled $14.4 billion in 1992. Dividing this by the 64,616 million passenger kilometers traveled on transit that year yields a subsidy of $0.223 per passenger kilometer. Dividing DeLucchi's high-end estimate of total hidden subsidies to highway transportation of $1,018 billion by the 4,442 billion passenger kilometers traveled on America's roads during 1992 yields a per passenger kilometer subsidy of $0.229, virtually identical to the average for transit users. If lower estimates of the hidden subsidies to motorists are used, such as those derived by such environmental advocacy groups as the Natural Resources Defense Council, then the per passenger kilometer subsidies for auto motoring are actually less than those for transit riders. Setting the aggregate hidden subsidies to motorists at $500 billion annually, for instance, produces a per passenger kilometer subsidy of $0.113. Source of data on transit subsidies: American Public Transit Association, *op. cit.* Source of data on passenger kilometers traveled: Bureau of Transportation Statistics, *op. cit.*

108. DeLucchi, *op. cit.,* p. 8.

109. Downs, *op. cit.,* p. 7.

110. D. Hensher, Selective but Important Challenges Facing the Transport Sector, *Designing Transport & Urban Forms for the Australia of the 21st Century,* J. Richmond, ed. (Sydney: Institute of Transport Studies, University of New South Wales, 1996).

The Transit Metropolis

A GLOBAL INQUIRY

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