Putting the Brakes on Sprawl:

Innovative Transportation Solutions From the U.S. and Europe

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November, 1999

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ACKNOWLEDGEMENTS

This report is a project of the Tellus Institute and was researched and authored by Steve Bernow, William Dougherty, Anne Reynolds and David Gurin. Copyediting was completed by Laura Williamson McCafferty and staff of Environmental Media Services. This project was made possible by a grant from the German Marshall Fund. For additional copies of this report, contact Environmental Media Services, 202/463-6670.

INTRODUCTION

The message -- *Sprawl is bad, and it's everywhere* -- is heard from politicians, newspapers, policy wonks and even some real estate developers. For those who accept this message, there arises a nagging question: How do we correct the impacts of sprawl – congestion, pollution, loss of open space – to make our urban and suburban communities better places to live?

There is no one formula for reversing the consequences of uncontrolled and unplanned growth. Yet, there are successful strategies that can help American towns and cities combat sprawl. This report examines some innovative transportation practices in six cities — practices that can lessen sprawl's impact on our neighborhoods and on our environment. The report groups the problems and solutions under three, interrelated themes: (1) relieving traffic congestion (2) overcoming inaccessibility, and (3) restoring neighborhood quality of life and downtown vitality. Each section examines selected practices in two cities, one American and one European. These models are intended to stimulate discussion of promising solutions that can guide growth and development policies well into the next century.

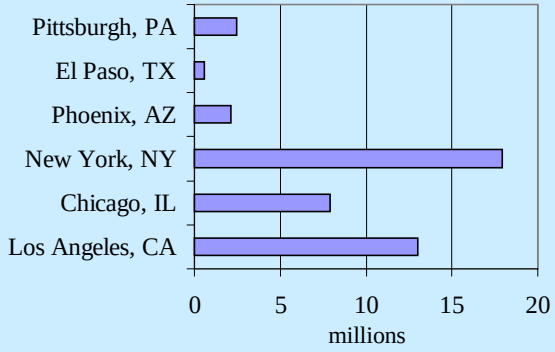
Sprawl and its Consequences

Sprawl has crept quietly outward -- mall by mall, office park by office park, cul-de-sac by cul-de-sac -- from America's large and small cities. We see each new housing development from our windshields. We venture farther from urban centers for our "country" drives, and sit in traffic at suburban intersections each afternoon, whether on the way to work or to the grocery store. In small cities, the downtown is not worth the trip, while strip malls mushroom in locations un-walkable from anywhere. In large cities, enjoying city nightlife often means a nightmare drive with nowhere to park.

While we see the aesthetic losses from sprawl, we live the transportation changes — more time in our cars, more miles traveled to work, more cars on the road. Sprawling development creates an increased demand for transportation services. Too often local and regional governments assume the answer lies with the automobile. Instead of making our homes and communities more accessible by foot, bicycle, bus or rail, they lay down more pavement for roads and parking spaces. Individually, cars are marvelous transportation machines. But collectively, cars create huge social costs — loss of public access and public space, diminished community and urban vitality, degraded visual aesthetics, threatened safety, and damage to our health and our environment.

Even as we strive to make our cars operate more cleanly, the more we drive and the longer we sit in traffic each day, the harder it is to reduce air pollution. While emissions from individual cars have been declining as new cars enter the fleet under EPA's tailpipe regulations, the rate of decrease has slowed in recent years. In the case of nitrogen oxides, emissions have gone up. More hours on the road means higher emissions, and more damage to our health and our environment. Automobile travel by the average American household has increased by almost 40% since 1970, from about 17 thousand to about 24 thousand miles per year. During the same time period, car ownership by the average American household has increased by almost 30 percent (from 1.5 cars to 1.9 cars). Millions of people in the U.S. live in cities where air pollution is seriously above federal air quality standards (see Figure 1).

Figure 1: People exposed in U.S. cities where carbon monoxide, ozone, and particulates all exceed national health standards (EPA, 1998)



Many U.S. cities register levels of nitrogen oxides—from cars, diesel trucks and buses—above safety guidelines set by the World Health Organization. In sunlight, the nitrogen oxides and reactive hydrocarbons from exhaust pipes produce ground-level ozone known as smog. At relatively low levels, smog can reduce lung function even in healthy people. At high levels, continued exposure can be lethal to vulnerable populations, such as the elderly and people with asthma.

Carbon monoxide is also emitted from cars. It can reduce the oxygen-carrying capacity of red blood cells, which raises rates of heart disease, lung disease, anemia and headaches in the urban population.

Breathable small particles emitted from cars also continue to be a problem. While early efforts to control air pollution focused on visible soot, scientists later learned that microscopic particles emitted by vehicles are a greater threat to health because they can be breathed more deeply into our lungs. More than 50,000 lives might be saved in the U.S. each year if regulations required further reduction in small particle emissions, a significant portion of which come from gasoline and diesel burning cars and trucks (see Table 1).

Over half of the pollution entering our lakes and rivers comes from the toxic runoff from roads, parking lots, and storm drains. A paved lot or highway just can't filter runoff like a field, wetland or forest. As we continue to pave our country, water quality will suffer, no matter how many enforcement actions EPA takes against factories and sewage treatment plants.

Sprawl is also a global environmental problem. Probably the most menacing environmental problem of transportation is it burns fossil fuels, which adds carbon dioxide (CO_2) to the atmosphere. CO_2 occurs naturally in the atmosphere in very small amounts. The climate of the Earth and its capacity to support life depend upon that small amount of CO_2. It acts as a "greenhouse gas" to trap a portion of the sun's heat that would otherwise radiate back into space, maintaining the range of temperatures the planet has experienced for millennia. But as more CO_2 accumulates in the atmosphere, dangerous global climate disruption could occur. The U.S. emits

Table 1: Worst 10 U.S. cities ranked by estimated premature deaths from particulate air pollution (NRDC, 1996)

Rank	Urban Area	Annual premature Deaths
1	Los Angeles	5,873
2	New York	4,024
3	Chicago	3,479
4	Philadelphia	2,599
5	Detroit	2,123
6	Riverside-San Bernadino	1,905
7	San Francisco-Oakland	1,270
8	Pittsburgh	1,216
9	St. Louis	1,195
10	Cleveland	1,161

more than one-fifth of the world's total CO_2 emissions, with one-third of that coming from transportation. If emissions are not reduced by at least half over the next several decades, the world can expect global temperatures to increase. Sea levels could rise by up to three feet, endangering island and coastal communities. Think of New York, Miami, San Francisco and dozens of other coastal cities and towns being halfway under water. More frequent, severe weather events would exacerbate these effects. While the detailed consequences of such climate disruption can not be precisely predicted, it is likely that cities, natural habitats, agricultural systems, economies, and human health would all be adversely affected. To prevent further global warming, drastic reductions are needed in emissions from transportation. Unfortunately, sprawling development increases the demand for transportation, and thus increases emissions that advance global climate change.

The environmental problems of sprawl are often difficult to see – gradual declines in air quality, the gradual disappearance of roadside meadows and forests, and global climate change. The quality of life losses are easier to perceive – Can your kids bicycle safely to soccer practice? Can you walk to buy a quart of milk, or does every errand become a journey in your car? Are traffic jams now an anticipated part of your daily commute? Is it pleasant to ride your bike to the city park, or are you taking your life in your hands? Has your downtown declined because most businesses are relocating to the suburbs?

What should growing towns and cities do to meet these challenges? Understanding the sprawl/transportation/environment connection isn't enough. These problems often breed a vague and persistent sense of helplessness. A growing population and increasing wealth need not inevitably lead to more parking lots, highways, traffic, and pollution. There are better ways to grow. We examine some of them here.

Three Problems in Search of Solutions

Relieving Traffic Congestion

In 1998, a New York Daily News headline proclaimed: "CAR SICK: NY. City Suffers $6.6 Bln Lost Revenues Because It's Jam City." The article lamented the amount of time, money and good spirits wasted in traffic. It pointed out that a walker could cross town faster than a driver. And New York's problems are hardly unique. For too long, Americans have "solved" the problem of congestion with more lanes, more highways, and more highway access ramps. This is a short-term solution that quickly loses its effectiveness as traffic grows to fill the new lanes, roads and highways. Congestion remains, pollution increases, more land is paved, and the cycle repeats. Statistics support our sense that there are more cars on the road, more miles being traveled by car, and more congestion (see Appendix)**.**

There are other ways to travel than by car — by bus, trolley, and subway or by walking or biking. We can gauge congestion by how much traveling is done using these alternatives. In dense cities such as New York, as much as 90 percent of journeys to work are by public transit during peak commuting hours. But even in New York, only 40 percent of trips during all hours are by public transit. And for American cities as a whole, public transit captures just over 3 percent of all trips, compared to 15 percent in Europe. In cities such as Phoenix, Houston and Detroit, public transit's share is a mere 1 percent. Clearly, to reduce road congestion, more trips must be completed using alternatives to the automobile.

Table 2: Most Congested Urban Areas in the USA ***(adapted from TTI, 1998)***

Rank	Urban Area	Roadway Congestion Index
1	Los Angeles	1.57
2	Washington, DC-MD-VA	1.43
3	Miami-Hialeah	1.34
4	Chicago, IL-Northwestern, IN	1.34
5	San Francisco-Oakland	1.33
6	Seattle	1.27
7	Detroit	1.24
8	Atlanta	1.24
9	San Diego	1.23
10	San Bernadino-Riverside	1.22

Note: the roadway congestion index is a measure of vehicle travel density on major urban roadways during peak periods. A value greater than 1.0 indicates undesirable congestion.

The decline in American public transportation has led to amnesia about the evolution of U.S. urban form and transit. Before World War II, most American cities were, as many European cities still are, places with dense centers, where people lived within walking distance of the grocer, and a trolley ride from industrial jobs or downtown shopping.

In the early 1900s, U.S. cities grew along streetcar lines. Subways and commuter railroads further extended the urban reach and made it possible for masses of people to move to and from city central business districts. These centers were brimming with workers, shoppers and other pedestrians. Suburban homes were within walking distance of railroad and streetcar stations. These streetcar suburbs were satellites of their cities. Inter-urban streetcars were capable of traveling 70 mph from city to far-flung suburbs and even to other cities. The country was knit together by a formidable grid of railroads. But much of the U.S. abandoned this tradition of urban and inter-urban transit, opting instead for auto-oriented development. In the 1920s, New York had a thousand miles of trolley lines and, in what might be a surprise to many, so did Los Angeles, where the Pacific Electric System spread 75 miles from Riverside to San Fernando to Long Beach. It is an almost forgotten fact of technological history that privately-owned American trolley car companies in the 1930s perfected superb trolleys. They had quicker acceleration, used fuel more efficiently than buses, and rode quietly and without fumes on smooth welded track. They were spacious and comfortable and their wide double doors, close to the ground, allowed quick embarking and disembarking. Bus technology, even today, cannot do better. And there were also interurban streetcars capable of 70mph from city to far-flung suburb and even to other cities. In those days, the country was knit together by a formidable grid of railroads.

Today's suburbs are no longer anchored to cities, as many once were. Residents drive to malls to shop and to office buildings or industrial parks to work. Once-clear metropolitan boundaries are now blurred. Atlanta, one of the fastest-growing metro areas in the country, is marching north while Chattanooga is creeping south. Though 115 miles apart, sprawl has shortened the distance between these two metropolitan areas to 16 miles and a single county. Both cities have public transportation systems, yet they serve only a small percentage of this immense developed area. The vast majority of the population depends on the automobile to meet its travel needs. The result? Atlanta is one of the most congested cities in the U.S., while Chattanooga, at one time one of the country's most polluted cities, is on the mend because of recent efforts to overcome the consequences of sprawl.

How do we now relieve road congestion and other consequences of uncontrolled growth? The simple solution — getting cars off the road — is not so simple to implement. Expanding and improving alternatives to the automobile requires vision, planning, public engagement, and public investment.

But there have been some notable efforts, both in the U.S. and abroad. Munich is often cited as a European success story for changing travel behavior. It is one of the very few places where the percentage of trips using alternatives to the automobile has *increased* — from an already high 58 percent in 1976 to 62 percent by 1996. Although this increase may not seem dramatic, consider that for the U.S. as a whole, from 1980 to 1990 the percentage of trips using alternatives to the automobile decreased from about 14% to about 11%. This report examines how Munich successfully encouraged the use of public transit, walking and cycling to relieve congestion.

Munich is one of the few places where the percentage of trips using non-auto travel has increased — growing from 58 percent in 1976 to 62 percent by 1996.

On the American side, San Francisco has achieved modest success reducing automobile traffic through a station car demonstration project, development planned around light rail stations, an innovative ride-sharing program, and the use of electric cars and alternative fuels.

Overcoming Inaccessibility

Even if people wanted to leave their cars at home, this isn't a viable option for many Americans. Only a small percentage of U.S. cities are served by subway systems. Most homes are located far from public transportation. City-dwellers who do have access to transit often can't use it to get to where they want to go — to jobs, leisure activities or shopping. In too many U.S. cities, transportation systems do not fulfill the promise of access for all. Indeed, they crowd out other means of access by ignoring or limiting alternatives to cars and roads.

Further hindering accessibility is the reluctance of local governments to make serious financial contributions to public transportation. Low public investment in urban transit means limited service, and limited service in turn breeds low demand. Public transit is used by car owners only in very crowded cities and, even then, only during peak hours. Public transit infrastructures that are used for short periods of the day make the system more expensive per rider.

Stockholm realized suburban growth, while inevitable, could be shaped with aggressive land-use policies mixed homes with jobs, recreation and shopping opportunities to create a polycentric metropolis with an accessible cultural and commercial center.

Inaccessibility cannot be solved without developing alternatives to the automobile as the primary method of transportation. While investment in public transportation is important, examples from Europe and the United States show this investment reaps its greatest rewards when paired with efforts to influence land development patterns. Stockholm's leaders realized that suburban growth was inevitable, but sought to shape it through aggressive land-use policies. New satellite communities were built along rail links. These communities mixed homes with jobs, recreation, and shopping opportunities, transforming Stockholm from a monocentric city into a polycentric metropolis with an accessible cultural and commercial center.

Portland, Oregon has partnered public transportation investment with clustering land use policies.

In the U.S., Portland, Oregon has partnered public transportation investment with clustering land use policies. Portland's light rail and urban growth boundaries make it unique among American cities and provide models for regions trying to curb the inaccessibility created by sprawl.

Restoring Downtown Vitality and Neighborhood Quality of Life

Downtown areas should be vibrant, offering restaurants, theater, music, and cafes. They should provide parks and public squares for rest, reverie and human interaction. A lunch break downtown should conveniently provide lunch, a trip to the bank and post office, and window-shopping. City-dwellers and suburbanites alike hope for the wide sidewalks and open spaces that make neighborhoods livable, as well as safe streets, clean air, views of sky, water and trees, and easy access to markets and work. Unfortunately, this is too often not the case.

The traffic cell system in Delft doesn't just restrict cars, but also facilitates non-car travel to make biking and walking viable options.

Yet there are innovations that could change the role of cars, revitalize downtown areas, and reclaim space for people. Traffic calming, started in Europe and adopted in some American cities, uses obstacles to slow traffic in residential neighborhoods and grafts some unconventional thinking onto the conventional urban grid. It doesn't fundamentally change the transportation system, but slowing cars can create a more civilized city and make walking and cycling more realistic options.

Delft, in the Netherlands, is a small city that offers an approach for bringing people downtown, taming the car, and creating more pleasant neighborhoods for biking, walking, and porch sitting. Through a *traffic cell* system and a design called *woonerf,* Delft demonstrates innovations to improve downtown vitality and neighborhood quality of life.

Innovative redevelopment planning and transit services are helping to leverage Chattanooga's downtown revitalization efforts.

In the U.S., Chattanooga has also explored new means for attracting downtown visitors and minimizing the environmental impacts of modern transportation. Although it is still feeling the impacts of sprawl, the city is enthusiastic about finding solutions for small U.S. cities with disappearing downtown areas, and has made substantial efforts to include the public in the planning process.

Outlook

All over the world, creative citizens, engineers and planners are thinking about solutions to the problems associated with uncontrolled growth: road congestion, inaccessibility, and community livability. In the sections that follow, we consider the approaches in three American and three European cities: Munich, Stockholm, and Delft in Europe, San Francisco, Portland, and Chattanooga in the U.S. These cities span a range of historical, demographic, municipal planning and geographic contexts, offering important lessons on how cities can move toward more sustainable transportation and land use patterns.

URBAN INNOVATIONS

This report examines some innovative transportation and planning practices in six exemplary cities, grouping both problems and solutions under three themes. The first, relieving traffic congestion, tells the stories of Munich and San Francisco. The second, overcoming inaccessibility, describes the efforts of Stockholm and Portland. The third, restoring neighborhood quality of life and downtown vitality, recounts the experiences of Delft and Chattanooga. These examples are intended to provide ideas for reversing the advance of urban sprawl and reshaping the ineffective transportation systems it has spawned. A look at how these six cities compare to other major U.S. metropolitan areas from a transportation standpoint is provided in the Appendix.

Battling Congestion

Munich and San Francisco are two large cities battling typical problems with congestion. Although certainly the battle has not been won in either place, both cities have made significant progress in developing successful alternative means of transportation, through a comprehensive long-term commitment to a suite of initiatives that both push people out of their cars and pull them onto public transit.

MUNICH:	❖ PUBLIC TRANSPORTATION INNOVATION
	❖ RESTRICTING CAR USE

Munich is often acclaimed as one of Europe's dramatic success stories in changing travel behavior through coordinated land-use and transportation policies. Germany's third-largest city and capital of Bavaria, metropolitan Munich is home to almost 2.5 million residents, about half of whom live outside the city core. In a country well known for its high-paced autobahns and high-performance BMWs, Munich is, in contrast, also identified with successful strategies for combating congestion and maintaining alternatives to driving.

Bucking Trends in Automobile Dependency

Despite strong trends toward increased car ownership and use throughout Germany, many cities are turning their attention to the use of alternative methods of transportation. Smaller cities such as Münster and Frieburg are often cited as good examples. But Munich has been the leader among large German cities in expanding public transit, bicycling and walking, while decreasing its dependence on cars.

To put Munich's advances in perspective, consider travel patterns in the Rhine-Ruhr metropolitan area, Germany's most populous region (eight million people concentrated in 24 separate cities). A distinctly polycentric region, the Rhine-Ruhr emphasized the car during post-war reconstruction, which led to a dense network of *autobahns* and national highways knitting together urban areas, including Düsseldorf, Wuppertal, Essen, Duisburg, and Dortmund.

Table 3: Modal split trends; estimated percentage of total trips by mode ***(adapted from Pucher, 1998)***

	Private Car		***Transit***		***Other***	
	Rhine-Ruhr	Munich	Rhine-Ruhr	Munich	Rhine-Ruhr	Munich
1976	40	42	15	19	45	39
1980	43	39	14	21	44	40
1984	44	39	13	23	43	39
1988	50	40	12	24	39	37
1992	52	36	13	25	35	39
1996	52	38	15	25	33	37

Notes: 1996 Munich values are for 1995; "other" modes consist of walking and cycling.

In 1976, Germans made 40 percent of all trips by car. But by 1996, 52 percent of all trips in the Rhine-Ruhr metropolitan region were by car. In contrast, the share of total trips by car in Munich *declined* from 42 percent to 38 percent over this same period. And while the share of total trips by transit has been relatively flat in the Rhine-Ruhr metropolitan region, it has *increased* from 19 percent to 25 percent in Munich. (These trends are summarized in Table 3.)

A look at Munich's commuting patterns is also telling. Of the nearly 900,000 daily, motorized commuting trips to and from the city, about 67 percent (50 percent into the city and 75 percent within the city) are by public transit, an *astoundingly* high share (Cervero, 1998). About 80 percent of daily commuters travel in one direction, confirming Munich's essentially monocentric character.

These trends are all the more remarkable because Germans have one of the highest rates of car use in the world, and display a certifiable love affair with their cars. In such an auto-oriented society, known for a highway system without speed limits, vehicle ownership and use has been typically identified with freedom, prosperity, and status. Yet, metropolitan Munich has found a way to temper the national passion for the car, luring residents out of cars and into sustainable alternatives at impressive levels. Three key policies stand out in explaining how this has been accomplished: transit-oriented land-use policies; steady expansion, improvement, and effective marketing of transit services; and restricting automobile use.

Transit-linked Urban Development

Like most German cities, Munich's development reflects many centuries as a densely settled, walled community. Even in the first half of this century, a time of growing population and the emergence of transportation innovations, Munich remained compact, owing in large part to a lack of available land for new development. In the aftermath of World War II, and the destruction of the city center, efforts to rebuild the city deliberately focused on retaining its old urban form, with narrow streets, expansive central squares, and pedestrian-friendly walkways.

This decision — to maintain the city's historic form — was crucial to Munich's ability to promote alternatives to the private car (Cervero, 1998). Munich's strategy of linking transportation planning and urban development was also key. In 1963 and 1965, against the backdrop of rapid urban sprawl and mounting traffic congestion in the central business district, the City Council also approved plans to develop a high-quality, regional transit system. The system was motivated by a vision of maintaining and reinforcing Munich's dominant role in the regional economy and focusing urban growth along suburban railway corridors extended radially from the city core.

Investments in the *S-Bahn* (suburban railway) and *U-Bahn* (subway) resulted from this vision of transit-linked development, and prompted the emergence of mixed-use, planned communities such as Arabella Park and Zamila Park, built in close proximity to rail stations. Munich's success results from strategic land-use planning, pro-active city government, and a strong regional transit authority with a particularly high level of cooperation among local institutions**.** Current development continues to be firmly cast within this commitment to transit, preserving the architectural and cultural character of urban areas and strong regional coordination.

❖ PUBLIC TRANSPORTATION INNOVATION

Today, Munich provides a full range of travel options: heavy rail, light rail, and buses (see Box 1). Expansion has been matched by service coordination in which routes, station stops, timetables, and ticketing areas have been fully integrated, leading to sharp drops in the average time needed for transferring. Improvements for streetcars have featured track modernization and new vehicles. Munich uses traffic rules that give priority to buses and streetcars, speeding up travel for public transit in mixed traffic. The rail system has been improved by new vehicles, more regularly scheduled services, and better service integration and ticketing. Complementing these upgrades has been a variety of effective marketing innovations that result in faster transfers, such as the single pass transfer, as well as synchronized timetables and greater route availability. System expansion and service improvements have paid off: since 1980, *total person kilometers of service,*[1] or the amount of public transit use per person per year, has increased from 16 billion to almost 24 billion kilometers per person per year.

Munich facilitates access to its rail system. Park-and-Ride services, viewed as vital for attracting suburban commuters, have been significantly expanded at outlying rail stations. Since 1972, the number of parking spaces at *S-Bahn* and *U-Bahn* stations has been increasing by roughly 10 percent per year -- from 3,000 in 1972 to nearly 27,000 in 1995. At the same time, Bike-and-Ride facilities are being upgraded to attract other segments of the suburban community. Today, there are more bike racks at rail stations than there are parking spaces.

Improvements to Munich's public transportation system did not come cheaply. Regional fares in Munich have increased more than elsewhere in Germany. Increasing fares enabled the city to hold its transit subsidy roughly constant over the years, at 50-55 percent per passenger trip. Notably, this level is still slightly lower than for Germany as a whole, where the public transit subsidy stands at about 60 percent per passenger trip. Riders have nevertheless responded positively, suggesting that substantial improvements in transit service options and quality can more than compensate for higher prices.

❖ RESTRICTING CAR USE

Reducing regional dependence on the automobile has also been accomplished by discouraging driving. As in other large cities in Germany, Munich has restricted automobile traffic by narrowing streets, increasing the number of curves, and installing speed bumps, concrete planters, wider sidewalks, and bicycle lanes. These traffic-calming measures tend to reduce

[1] "Total person kilometers of service" is a measure of transit service that captures the total distance traveled by users. It takes into account the larger capacity of rail vehicles and different sizes of buses, and reflects both seating and standing room.

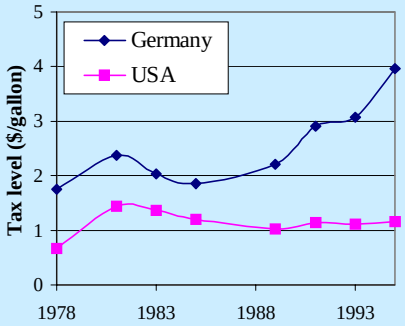
average speeds to below 20 mph, making it less dangerous and more attractive for pedestrians and cyclists. Though not as far along as a city such as Frieburg, where *all* residential neighborhoods use traffic-calming measures, Munich has significantly increased the number and extent of its traffic-calmed communities.

Munich has also established car-free pedestrian zones. This system of interlocking streets in the city center and main shopping districts that are off-limits to private automobiles. Many other shopping streets and plazas have sharp restrictions to private car access.

The city also actively promotes bicycle use. Since 1980, Munich has doubled the extent of its bikeway network. Currently, the city provides roughly 500 kilometers of bikeways on or along streets and nearly 140 kilometers of bikeways through parks, woods, and nature reserves (Pucher, 1998).

In addition to these measures, Munich has taken steps to make parking more difficult and expensive. Most free, non-metered parking has been eliminated. Munich charges about 40 DM (roughly $25) for a working day's curbside parking in the central business district, roughly *eight times* the price of a round trip by bus, streetcar, or metro.

Figure 2: Fuel Taxes in Germany and USA (from IEA, 1998)



National policies that make the cost of car use reflect a larger share of its social costs complement these local measures. The total tax on gasoline is about $3 per gallon, typical for Western European countries but nearly four times higher than in the United States (see Figure 2). In Germany, fuel taxes represented almost 80 percent of the price of petrol in 1994; in the USA, taxes accounted for 33 percent of the price of a gallon of gasoline in that year. High fuel taxes add incentives for Germans to switch from private cars to less costly forms of transportation, which in turn have lower social costs.

One further noteworthy development is the deliberate slowdown in urban road expansion throughout West Germany. From a growth rate of almost 2 percent per year in the 1960s, the supply of urban roads had declined to an annual increase of 0.5 percent per year by the 1980s.

Lessons from Munich

Munich teaches us that it is possible to shift commuters out of their cars and into alternative modes of transportation, if a long-term government commitment to policies that reinforce such alternatives exists. Munich retains its old urban form, provides attractive transit, bicycling and walking alternatives, and restricts private car use in the daily commute. In a culture enamored with the automobile, and at a time when the car's share of total trips has been increasing in most cities in Western Europe, Munich's accomplishments are impressive, offering hope that developing and sustaining alternatives to the automobile are both practical and achievable.

SAN FRANCISCO	❖ STATION CARS
	❖ ALTERNATIVE TRANSPORTATION MODES AND FUELS

San Francisco is ranked one of the top 10 most congested cities in the U.S. So why hold it up as a model for fighting congestion? Because San Franciscans have not sat idly by in the face of traffic – and their efforts offer some plausible solutions for large American cities as they move into the 21st century.

Box 1: San Francisco's Cable Cars

In San Francisco, the transit share of total trips is 19 percent, a greater share than for any other city in the 9-county Bay Area. The San Francisco Municipal Railway (MUNI) runs a growing system of cable cars, streetcars, and buses. In the late 1980's and early 1990s, occasional Trolley Festivals on Market Street were so successful that it was decided to restore full-time streetcar service using cars bought from Philadelphia. In January 1998, service began on another new line, the "E" line, with stops along Kin Street and the Embarcadero Metro Station under Market Street.

Home to nearly 800,000 people, San Francisco is the most prominent city in a nine-county Bay Area that includes more than 6.5 million people. In a city where cable cars and streetcars have been emblematic, San Francisco has taken measures that, if expanded and complemented, could help it to supercede its legacy of automobile dependency, while ushering in more sustainable transportation and land use.

Here's the Bad News

Until World War II, Bay Area residents lived in relatively compact communities in the inner bay, or in the far rural reaches of the region. For city dwellers, commuting and shopping trips took advantage of extensive streetcar networks in the central business district. While these trends are thriving in San Francisco itself (see Box 1), transportation and housing policies of the past four decades have strongly encouraged auto-dependency and scattered development in suburban areas. Throughout the Bay Area, an entire urban landscape has been changed to accommodate car travel.

Over the past 40 years, billions of dollars have been invested in Bay Area freeways and bridges. More than 4 million registered vehicles now travel over 93 million vehicle miles daily in the region. Well over 100,000 hours per year are wasted due to traffic congestion, on a personal and economic scale. Vast tracts of land have been consumed for car-induced suburban development, disappearing at about twice the rate of population growth. The challenge to the regional environment, as evidenced by noise, air pollution, and the engulfing, paving and fragmentation of large swaths of land, suggests that the cost to citizens of this region are even greater than the bill for the highways themselves.

How have San Franciscans tried to defy these trends? The 1956 Rapid Transit Plan called for the development of a transit system that would help channel growth along manageable radial corridors fanning out from the city center. This led to the establishment of the Bay Area Rapid Transit (BART) system which has thus far proven modestly successful. In 1989, business, civic, and political leaders in San Francisco formed the much-ballyhooed Bay Vision 2020 Commission to chart a new course for regional planning. But, after receiving little support from the governor and legislature, it vanished without a trace.

Not surprisingly, transportation problems are expected to worsen in the absence of major initiatives to change the situation. In its most recent regional transportation plan, the Metropolitan Planning Commission acknowledged that even with close to $90 billion of investment over the next 20 years, automobile transportation in the urban area will likely worsen considerably in the Bay Area (see Table 4), leading to even worse traffic congestion.

Table 4: **Regional Travel Activity Forecast** *(adapted from Metropolitan Transportation Commission, 1998)*

	1990	2020	Change
Average daily vehicle miles traveled (thousands)	93,643	136,590	+46%
Average daily vehicle hours of delay (thousands)	105	366	+249%
Average roadway speeds (mph during AM peak)	42.4	39.6	-7 %

Yet this future is not inevitable. The San Francisco Bay Area has become the site of some major transportation initiatives that have received national exposure for their effectiveness. The three that stand out include: suburban transit-oriented development; introduction of station cars; and programs to encourage alternative transportation modes and fuels. Ultimately, these will need to be expanded and complemented by other measures to affect a transition to a sustainable pattern of urban land-use, access and mobility.

Emerging Transit-Oriented Development in the Suburbs

BART, the Bay Area's 34-station, 75-mile rail system, has been largely shunned in favor of freeway-served corridors. Along the major commuting corridors, the transit share of total trips is quite low, between 2 percent and 4 percent. However, it is important to put these patterns in perspective. BART emerged from a far less sophisticated and comprehensive planning context than the city of Munich. In that city, the direction of urban sprawl was tempered by a clear vision about how the city could and should grow. There was significantly more coordination between transit and regional planning activities.

In contrast, the rapid transit system of the San Francisco Bay Area has been primarily shaped by market-driven urban growth. Noticeably lacking since BART's inception has been a systematic framework in which transit and regional development goals could be closely compared and coordinated. While the strategy in Munich was to build suburbs along existing rail lines, the pattern in San Francisco has been to build rail lines after the suburbs were established.

Nevertheless, there is evidence that certain suburban areas are taking effective steps to rectify this. Two communities, Walnut Creek and Pleasant Hill, have been widely acclaimed for successfully promoting transit-oriented development.

Walnut Creek is located about 35 kilometers east of downtown San Francisco. Since the opening of the BART station, new offices have sprung up around the station (about 1 million square meters of privately financed office space has been built within a 1-kilometer radius of the station). This far exceeds development at any other station located beyond the central business district. And it was not a coincidence. Aggressive municipal planning was a critical factor in this outcome, as the city undertook major infrastructure improvements, such as better road access to the area and sidewalks, as well as the underwriting of certain costs associated with land acquisition.

Pleasant Hill is located one station east from Walnut Creek. Between 1988 and 1995, more than 2,000 housing units and 200,000 square meters of office and commercial space were built within a one-half kilometer radius of the Pleasant Hill BART station. Pleasant Hill also benefited from an aggressive local redevelopment authority, which assembled irregular parcels into tracts better suited to development, sought out private investors, and made significant infrastructure improvements (e.g., underground utility lines). Surveys have indicated that between 40 percent and 50 percent of commuters to Pleasant Hill take BART to work.

In contrast to nearby communities, Walnut Creek and Pleasant Hill are models of how transit-oriented development can work. The success of these two communities in attracting housing and office development can be credited in large part to municipal planning which sought to leverage the benefits of the local transit station. Armed with a vision of attracting mixed-use growth around the station, local planning has supported policies that aim to recast the BART station as a focal point in development efforts. Residents have responded positively to this approach - in Pleasant Valley, 60 percent of those living in housing units near the station say that BART was a major factor in moving there.

❖ STATION CARS

The San Francisco Bay Area electric station-car demonstration project sought to overcome some of BART's weaknesses. Typically, suburban transit stations are surrounded by huge parking facilities that isolate the station from the surrounding community and sharply limit pedestrian access. This conventional arrangement limits opportunities for nearby development. The station car system provides a fleet of shared cars to a group of individuals for commuting to the station and then, throughout the day, makes the vehicles available for errands. For example, a commuter could drive a station car from home to a suburban train station, then ride the train to work. Another commuter could take the train to the same station, then use the car to get to work in the suburbs. In principle, the station car is a more efficient alternative, because it reduces the amount of prime land near the station dedicated to parking, while providing transit options to better serve the growing number of suburban work sites.

The San Francisco demonstration also aimed to determine the viability of electric vehicle (EV) station cars for making short, everyday trips in a variety of settings, such as between home and BART stations and between BART stations and work sites. Other short trips were encouraged during the workday or during evenings and weekends when the cars were at the homes of participants. The station cars were used by a variety of individuals recruited from BART, Pacific Gas & Electric Company (PG&E), local corporations, and the general public. A total of 40 cars were included in the program.

Between November 1995 and March 1998, 94 people (including 2-person carpools) participated in the demonstration. Some of the station cars were used as pool cars or, when vehicles were available, leased on a short-term basis to people not in the program. The station cars were driven almost 155,000 miles and produced almost 180,000 passenger miles traveled. The use of station cars replaced over 16,000 automobile trips that would have otherwise occurred mainly on freeways. The original program ended in March 1998.

BART has now taken the lead in implementing a second phase to this program. The purpose of the second phase is to expand the program to other regions and to show the viability of multiple-use station cars. In cooperation with the City of Berkeley and a corporation in Alameda, BART plans to test multiple uses of its current station cars and a set of 12 new compressed natural gas (CNG) vehicles from Honda. BART commuters will take the cars home overnight and on weekends. Lawrence Livermore National Laboratory employees will take the cars from the station to the lab (about 10 miles) each workday, and the cars will be used for "car-sharing" at the lab during the day.

The demonstration produced numerous positive benefits such as reductions in air pollution and gasoline consumption. It also showed that small EVs are currently a viable form of pollution-free transportation for short trips. Data such as car usage and occupancy levels from the demonstration indicates that, if expanded to other rail stations, ferries and express bus routes, the station car concept has the potential to alleviate the Bay Area's transit-related problems during the first decade of the next century.

❖ Alternative Transportation Modes and Fuels

The *RIDES* initiative, launched in the late seventies with funding from the Federal Highway Administration, the California Department of Transportation and the Metropolitan Transport Commission, is a regional ridesharing resource for both commuters and employers. In the past two decades, the program has helped more than 330,000 commuters join carpools and vanpools and provided commute-program information to more than 2,500 employers, developers and local governments.

San Francisco is also the site of an experimental alternative fuel vehicle (AFV) initiative. It is one of the nation's 60 or so "Clean Cities," a designation stemming from its participation in a program sponsored by the U.S. Department of Energy to encourage the use of AFVs and their supporting infrastructure. The Bay Area remains one of 100 metropolitan areas around the country that have not attained federal air quality standards. The San Francisco Clean Cities program promotes the use of lower polluting fuels such as compressed natural gas, ethanol, methanol, and electric vehicles. At present, a total of 642 alternative fueled vehicles are in use, with an additional 1,000 vehicles expected to come into operation over the next two years. A new CNG fueling facility is under construction, financed with grant funds, and expected to open June 1996. Also, the electrification of certain MUNI diesel bus lines continues.

Local community action has also helped to restore a more pedestrian-friendly character to downtown areas. Roberta Gratz and Norman Mintz (1998) note that neighborhood activism has played a big role in blocking the reconstruction of the 6-block freeway terminus, destroyed after the 1989 earthquake. Debates about where it should be relocated, the negative impacts of expressways on neighborhoods, and the benefits of traffic calming are characteristic of this community involvement. While the freeway was operational, local streets were used as major

roads, with no curbside parking, four-lane traffic, and a continual din of rushing cars. In its place, a waterfront revitalization plan is underway, which will eventually include a 25-foot-wide pedestrian promenade, a palm-lined boulevard, and a light rail transit connection.

Lessons from San Francisco

San Francisco has begun to free itself from California's dependence on multi-lane highways with policies that offer practical and more appealing alternatives, such as its station car and alternative fuel initiatives. However, the city's efforts must be augmented by other policies, such as: removing the subsidies given to city parking; providing incentives and land-use planning to encourage mixed-use development; tolls and other road pricing that discourage drivers from using roads during high traffic periods; and investing in attractive alternative modes of travel.

Overcoming Inaccessibility

Stockholm and Portland provide examples of how long-term policies linking transportation and land-use planning can make downtowns and suburbs more accessible. Satellite towns planned around rail stations near Stockholm provide easy access to the city and amenities within walking distance of home. Portland, meanwhile, curtails rampant growth through controversial, but effective, Urban Growth Boundaries and a commitment to public transportation with regional cooperation.

STOCKHOLM:	❖ **SATELLITE TOWNS**
	❖ **INVESTMENT IN PUBLIC TRANSPORTATION**

Stockholm is frequently cited as one of Europe's best examples of coordinated planning of rail transit and urban development. Situated where Lake Mälaren flows into the Baltic Sea, the city is sheltered by an archipelago that encompasses tens of thousands of islands. Today, greater Stockholm includes more than 1.5 million residents, most of who live in surrounding communities that are radially linked by a regional rail system to its central business district.

❖ SATELLITE TOWNS

Like other European municipalities, Stockholm went through a period of rapid expansion during the latter part of the 20th century. Unlike most other European cities, however, Stockholm successfully avoided the population dispersal and subsequent automobile dependency that characterized post-war urban growth. The city realized early on that suburban growth was inevitable, but sought to contain it by aggressive and targeted land-use policies in which rail links were the focal point of new satellite communities. The result has been a transformation from a pre-war monocentric city into a post-war polycentric metropolis in which both employment and population are better balanced than in most other cities in Europe.

This transformation was made possible because of an aggressive City Council, a strong tradition of regarding housing and transportation as social services, and public control of large blocs of land within and just beyond the city's borders. The goal of Stockholm's planning efforts was to maintain its place as the region's cultural and commercial center while sparing the central business area the impacts of overly dense industrialization.

In the 1940's, the City Council embarked on an ambitious program to build satellite towns, separated by greenbelts, and to link them to its central business area. Industrial facilities and businesses were given incentives to locate within satellite communities, with policies to guide their distribution in rough proportion to the distribution of population centers. Greenbelts such as Stockholm's 10-kilometer long Royal Ecopark provide significant natural space in close proximity to urban residents.

Box 2: The Stockholm Rail System: A Snapshot. Stockholm's City Council created its rail system, the Tunnelbana, in 1941, after just six hours of debate. Today, the system consists of 100 stations, nearly half of which are situated underground. At 110 kilometers, it is one of the world's longest subway systems, measured on a km-per-capita basis.

The city's rail system is complemented by a fully integrated regional bus and train service.

Over time, Stockholm developed its inter-municipal railway system, known as the Tunnelbana (see Box 2), in close coordination with urban growth plans. According to researcher Robert Cervero (1998), the resulting integrated public transit system is a "direct outcome of a comprehensive planning campaign that targeted overspill growth after World War II to master-planned, rail-served suburbs."

❖ Investment in Public Transportation

Stockholm's investments in coordinated land-use and rail systems grew out of the vision of dense satellite communities in which most residents would be within walking distance of a rail stop and would not need to commute downtown by automobile. Communities such as Kista, Skarpnack and Vällingby have been called "sustainable new towns," or walkable communities with high-density housing located close to the rail station. Transit investments have taken the following forms:

- Three complete subway lines were built and connected to each other by bus lines, and to the Swedish State Railways' regional train service at the Central Station/T-Centralen. This plan was presented in 1965, and met Stockholm's transportation needs through the 1980s.
- As the northern suburbs of Stockholm spread out, a third line, the Järva line, was built for 10-car trains. This line leaves greater distances between stations in order to allow cars to travel at a higher average speed.
- In the 1990's, City Council developed the so-called "Dennis package," with outer ring roads for car traffic and a light rail line connecting Stockholm's western and southern areas. During early planning, road pricing was to be implemented for the outer toll roads (see Box 3).

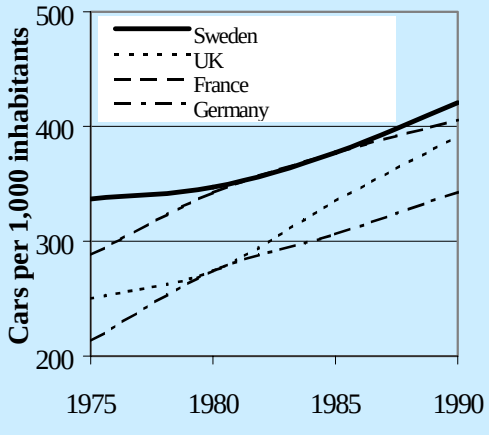
Box 3: Road Pricing Schemes in Stockholm *(adapted from Hicks, 1999).* Road-pricing systems apply fixed or variable charges to vehicles electronically, based on the time of day, the class of the vehicle, how congested conditions are, the level of vehicle occupancy ,and other factors. What exactly is "road-pricing? In Europe, the definition of road-pricing varies. In some countries it refers to highway tolls without factoring in the external economic, environmental and social costs. In other countries, these other costs are factored in to the tolls people pay when using the roads. The whole issue of road pricing can be very politically volatile. Sweden has had problems implementing its road-pricing strategy with its toll-ring project in Stockholm dying in political debate ("toll-rings" are similar to toll-road beltways in the U.S.) The projects and their financing sparked so much controversy with press and politicians that the government decided in the 11th hour that it couldn't raise the money for transportation infrastructure. In August 1997, the Swedish government asked the Swedish National Road Administration and the National Tax Board to evaluate an environmentally influenced fee-paying system for automobile traffic.

These investments were coupled with siting considerations that promoted the rail stop as an integral part of the community center: Exit a typical rail station to find the town center, with its large public square, nearby shops and offices, and public amenities. Such an atmosphere, Robert Cervero (1998) argues, “adds color and breathes life into the community.” Indeed, this combination of function and form renders the typical transit stop in greater Stockholm a focal point for business, recreation, and leisure.

The Road Not Taken…

Public ownership of land played a large role in making rail system investments possible, helping to transform Stockholm into a transit-oriented, rather than an automobile-dependent metropolis. What is particularly compelling about Stockholm’s rail development experience is that it occurred in a relatively affluent nation, with large low-density tracts of flat land, boasting one of Europe’s highest car ownership rates (as shown in Figure 2). In typical American cities, this same set of attributes produced entirely different results -- increased regional highway capacity to accommodate sprawling suburbs.

Figure 3: Car Ownership Patterns in Europe ***(Davis and McFarlin, 1996)***



Sweden was one of the last European countries to industrialize, growing at its most rapid pace from the late 1940s to the early 1960s. The strong public transit/land-use approach, which characterized that period, has continued to the present day. At the national level, Sweden demonstrated one of Europe's lowest levels of automobile dependency, with 36 percent of all urban trips being made with the car, compared to 48 percent in Germany, 45 percent in the UK, and 47 percent in France (Gordon, 1991).

Indeed, Stockholm's strategy of investing in coordinated land-use and rail systems has led to one of the highest uses of public transportation in Europe. Roughly half of all workers commute by bus or rail. (Pharoah and Apel, 1995) Moreover, in a recent review of transportation patterns in 37 urban centers, a research team led by Jeff Kenworthy (1997) found Stockholm to be the *only* city with a decline in per capita annual car use between 1980 and 1990 -- about 230 less kilometers traveled in 1990 compared to 1980. This trend stands in stark contrast to other European cities, which experienced a net increase of about 1,000 kilometers per year over the same period, and to US cities, which saw an increase of over 2,000 kilometers per year.

Stockholm's public transit ridership showed significant gains between 1980 and 1990, with a usage increase of 15 percent on a per capita basis. Today, on average, city residents in Stockholm get on board public transit 325 times a year. This increase in ridership occurred while populations increased in both the city center and outer suburbs. One of the truly remarkable characteristics of daily commuting patterns is the relative balance in transit traffic flows. Unlike many cities of the world, where trains are nearly full in one direction but half-empty in the other, directional splits are typically 45:55 on some rail lines in the greater Stockholm area.

Supporting Policies

In a city with a high degree of affluence and car ownership, commuting Stockholmers prefer to leave their cars at home, opting for the local train or bus instead. How did this come about, and how is it sustained? Stockholm's effective urban transportation patterns did not develop in isolation. City planners took deliberate steps toward a long-term goal of increased amenities, access and mobility. The blueprint for the integration of suburban development and rail transit relied on several policies that can help to explain Stockholm's success.

- **Low rail fares.** Public subsidies have varied over the years but typically account for about 67 percent of annual operating costs, roughly the same level as in many American cities. Clearly, other supporting policies are needed, as noted below.
- **Relatively high costs for owning and operating vehicles**. This includes high parking fees in the city center, whereas parking fees near Tunnelbana stations have been reduced. Also, Sweden imposes high motor fuel taxes: over 70 percent of the total price of a gallon of fuel.
- **High degree of public subsidy for housing near rail stops**. More than 90 percent of dwelling units built in planned satellite communities were built on city land and enjoyed some form of subsidy. Stockholm built large tracts of public housing in satellite communities in the vicinity of rail stops, thus greatly facilitating transit-served suburban mobility.

Lessons from Stockholm

Stockholm teaches the value of including public transportation in suburban development plans, rather than trying to find transportation solutions after congestion occurs. Stockholm's post-war suburbs do not depend on highways, and their transportation systems did not come as an afterthought. New communities and transit rail connections were an integrated part of a clear regional plan. In contrast to most other large urban centers in Europe and the U.S., Stockholm's transit system is the mode of choice for the daily commute, yielding ease of mobility and environmental benefits. This is all the more impressive given that it is a very prosperous region, in which most households own automobiles and could well drive to work if more attractive options were not available.

PORTLAND:	❖ URBAN GROWTH BOUNDARY
	❖ LIGHT RAIL AND FARE-LESS SQUARE

Portland is perhaps the most frequently cited example of an American metropolis working to reduce its dependence on the automobile. It is the center of a three-county metropolitan area with roughly 1.3 million inhabitants. Portland's commitment to planned growth and anti-sprawl sentiment pre-dates the public outcry now arising in many U.S. cities. It's approach – linking public transportation and land use – has helped it to achieve results.

Oregon's Planning Context

It is impossible to explore Portland's Urban Growth Boundary without discussing the planning context. Portland is unique in that its regional planning authority actually *has* authority.

More than 20 years ago, Oregonians predicted growth and hammered out a statewide system for land-use planning and growth management. At one point in the 1970s, ozone and carbon monoxide levels in downtown Portland violated federal standards one out of every three days of the year. A combination of factors—rapid suburban growth, increasing air pollution, a deteriorating downtown, threats to a significant natural resources sector in the state's economy and an environmental ethic—led Oregon to undertake aggressive and innovative urban transportation planning to prevent congestion, sprawl and large-scale environmental damage. Portland has developed this forward-thinking attitude with investments in public transit, a commitment to downtown vitality, and a continued emphasis on public visioning and planning.

In contrast to most American cities, Portland has a regional government to coordinate transportation planning. Formed in 1979, Portland Metro was given a home rule charter in 1990 that provided for a directly elected regional government. The Metro region encompasses 24 cities and parts of 3 counties, comprising 232,000 acres. Portland Metro's authority and mission make it unique in the United States: its primary responsibility is regional land-use planning. Rather than focus on typical day-to-day governmental operations, Metro is required to focus on the region's future. It can override municipal zoning decisions that are inconsistent with regional plans. It also manages some regional functions, including waste collection and disposal, transportation planning, and regional tourist facilities. Metro's goal is to ensure that residents have access to nature, clean air and water, balanced transportation choices, safe and stable neighborhoods, arts and culture, a strong regional economy, and resources for future generations.

❖ URBAN GROWTH BOUNDARY

Each Oregon city is required to maintain an urban growth boundary (UGB) beyond which development is discouraged, limited or prohibited. Critics argue that growth boundaries have inflated housing prices and limited affordable housing. But since more than 90 percent of the state's population growth during the 1980's took place inside of UGBs (Cervero, 1998), they are generally seen as having a positive impact. Under the UGB approach, Portland's regional government can steer commercial and residential development into areas accessible by transit, and protect large tracts of rural and natural lands.

In 1972, Portland put into place a Downtown Plan that, coupled with the constraints of UGBs, helped to channel investments to the city center. A centrally located bus transit center, landscaped public spaces, the Oregon Convention Center, the Trailblazer's Rose Garden Arena,

and a restored riverfront area all grew out of this plan. Notably, since 1972, downtown employment has risen from 50,000 to 105,000 people employed in 1998. Despite this growth, no new road capacity has been added downtown and additional parking has been severely limited.

Portland's growth boundary is not unchangeable. In December 1998, the Metro Council made final decisions about how the UGB will expand, adding about 5300 acres, and creating enough space for 23,000 housing units and 14,000 jobs, according to Metro estimates. The expansion will occur in "urban reserve areas" — land not set-aside for agriculture, forestry, or conservation.

❖ LIGHT RAIL AND FARE-LESS SQUARE

A Revived Commitment to Transit – Back to the Future?

Portland's transit history is like that of many mid-sized U.S. cities. By 1958 oil-fueled buses had replaced electric streetcars, cable cars and trolleys. While automobile use suffered slightly during the Depression and World War II, it eventually reigned supreme, and Portland's extensive urban rail system was completely retired. After many years of mergers and sales, the last of Portland's transit companies, Rose City Transit, was turned over to the newly formed Tri-County Metropolitan Transit District (Tri-Met) in 1969. What makes Portland unique is the renewed interest in rail that occurred after Tri-Met's formation. Portland's efforts to bring back urban rail began in the 1970s. Tri-Met's light-rail service, called MAX, began service in 1986.

The decision to invest in light rail has since influenced the progress of Portland's public transportation systems. Tri-Met operates MAX as well as all bus service. The first MAX line connected downtown Portland to the suburb of Gresham, 24 km to the east. The west-side line opened in 1998, serving the fast-growing community of Hillsboro, to the west. Advocates of light rail hope to have a 93-km network in place by 2010.

Yet this system is not without its critics — those who contend that high costs, low ridership, and low modal share do not warrant further public investment in rail. A funding proposal for a north-south line has been voted down twice in recent years, and a proposed MAX line to the airport has also been criticized but is still in discussion.

How have light rail and bus transit influenced commuting behavior in Portland? By 1990, 11 percent of Portland City residents commuted via public transportation, while 6 percent of commuters in the Metro Region used public transit (Cervero, 1998). About 13 percent of Tri-Met's rides are provided by MAX and the rest by bus. Still, the automobile claimed 73 percent of regional commuting trips, while public transit covered a mere 3 percent of total trips in 1990. Rail supporters maintain that once a more extensive network is in place, public transportation's share of total trips will increase. Tri-Met reports that during its 11 year history, MAX's annual ridership has increased 47 percent. Bus ridership is up 43 percent since MAX began, owing in part to a 22 percent increase in its service hours. Between 1990-95, public transit in the Portland region (measured in trips/person/year) increased 4.5 percent. During the same period, public transit usage declined in the 20 U.S. cities closest to Portland in size. (Geddes, 1997).

One could argue that Portland's transit system, for all its progress, has not prevented congestion or dependence on the automobile. But Portland has maintained more diversified travel options — and thus accessibility — than many U.S. cities of its size. Perhaps more importantly, Portland's commitment to public transit has provided the institutional setting and infrastructure required for further progress towards a sustainable urban transit system.

Fareless Square: A Commitment to Downtown Accessibility

In 1974, a Tri-Met staff report suggested making a free public-travel area in downtown Portland. Recognizing the connections between a free travel zone and the public goals of traffic control, air quality and accessibility, Tri-Met created "Fareless Square." In this area, both bus and light rail travel are free. Tri-Met hopes that this will attract those who have never used public transportation and increase use for those who have. Although distances traveled are short, these trips reduce car trips within the downtown area, and thereby reduce congestion and protect air quality. Travel between retail, financial, hotel and entertainment sites is free, an added attraction for tourists, downtown workers and businesses. According to a 1998 Tri-Met survey, about 50 percent of downtown's transit riders use the services in the fare-less area. Further, the free public-travel area may increase support for Tri-Met from the downtown business community and the suburban or day-tourist rider.

Public Vision, Public Debate

Urban transportation innovation in Portland is made possible through substantial public support. The people of Portland continue to demonstrate a commitment to ensuring that in meeting their needs for access and mobility, transportation problems do not degrade their quality of life.

Despite these efforts, Portland still faces many of the same problems as cities throughout the nation: more traffic congestion; sprawl, even within the growth boundary; and development that creates auto-dependency. But Portland keeps fighting these national trends with strong involvement by individuals, advocacy groups and the public sector. In early 1989, Metro went back to the planning table, creating the Regional Urban Growth Goals and Objectives, adopted in 1991. The development of a 50-year vision became the next step, the Regional 2040 Project, which described and assessed alternative pictures of Portland's future. This process pointed to many important steps that will be contentious, such as holding the line on the growth boundary and further investment in public transit.

It's A Question of Equity

"To achieve regional livability, we can't continue to serve only those areas that promise the highest ridership. Service evaluation must consider how well we are promoting local and regional livability; supporting build out of local development plans; minimizing existing congestion and new auto trips; and achieving a variety of other goals including a sustained economy. Ridership, alone, can no longer be the principal evaluation tool."

Tri-Met, 1998. Transit Choices for Livability

In another demonstration of its continuous planning, Metro's Transportation Planning Department recently coordinated an extensive series of public meetings to develop the 20 year Regional Transportation Plan, which covers all transportation modes: cars, public bus and rail, pedestrian, bike, and freight. A process to update the Plan, first adopted in 1983, was started in 1995. A Citizen Advisory Committee set policies for the process, placing a renewed emphasis on alternatives to the automobile for work, shopping, and recreation.

Transit Choices for Livability, a citizens committee convened by Tri-Met, studied the transit-related actions necessary to meet Metro's 2040 Plan. Using an extensive public outreach process, the committee developed several recommendations to Tri-Met, such as increasing

suburban services (currently only 30 percent of Tri-Met service) and developing "community transit." In defining "community transit," the committee emphasized that there is no single solution to providing high quality transit in all areas of the region. While light rail make sense in some places, other communities might require or desire other solutions, such as increased reliance on Tri-Met's "locals" -- brightly colored mini-buses circulating within communities and onto employment sites.

Local individuals and organizations have played a role equivalent to that of local or statewide planning agencies. One effective initiative began in 1988, when a proposed highway spawned the creation of the LUTRAC project (Making the Land Use, Transportation, and Air Quality Connection). Environmental organizations, agencies, and businesses joined together to develop and study transportation alternatives. LUTRAC has become a nationally acclaimed model for framing these issues, undertaking analyses, facilitating citizen input, and presenting workable transportation alternatives to highways. By 1997, LUTRAC succeeded in scrapping plans for the controversial Western Bypass.

Support by State Land-Use Planning

In 1973, Oregon embarked on an aggressive approach to land-use management, which has evolved into a regulatory-oriented framework for fighting sprawl. The Oregon legislature established statewide planning goals and created the Land Conservation and Development Commission. The goals acknowledge the need for compromise between development and conservation goals -- the underpinning of "Smart Growth." These goals are meant to encourage development and redevelopment in existing urban areas while protecting farm and forest lands and other natural resources. Although this growth management program has its critics, it has stood the test of time. Voters rejected initiatives to repeal the growth management laws in 1976, 1978, and 1982.

Oregon's approach relies largely on local governments to implement its planning goals. Each city and county must follow a comprehensive plan that satisfies statewide goals (see Box 4).

The program mandates several measures to protect and improve urban amenities, such as urban growth boundaries and re-zoning for affordable housing. State zoning was provided for about 25 million acres of farmland and private forest land, and for 1.6 million acres of commercial development and urban and rural residential development.

The existence of the land-use plans and the LUDC streamlined the decision-making and permitting processes, reducing appeals and litigation. The Land Use Board of Appeals (LUBA) was created in 1979 to hear all appeals

Box 4: Oregon's Planning Goals Address …

1. Citizen involvement
2. Land use planning
3. Agricultural lands
4. Forest lands
5. Open spaces, scenic and historic areas and natural resources
6. Air, water, and land resources quality
7. Areas prone to natural disasters/ hazards
8. Recreation needs
9. Economic development
10. Housing
11. Public facilitates and services
12. Transportation
13. Energy conservation
14. Urbanization
15. Willamette greenway
16. Estuarine resources
17. Coastal shorelands
18. Beaches and dunes
19. Ocean resources

from local land use decisions. The program also reduced local "anti-growth" or NIMBY measures, which are much less common in Oregon than in nearby (and more sprawl-prone) California.

Lessons from Portland

What factors have made Portland a leader in urban/regional transportation innovation among U.S. cities? The state's commitment to land-use planning, Portland's metropolitan government, its investment in light rail and downtown vitality, and its dedication to continuous improvement, planning, visioning and public involvement. The evolution of Portland's approach illustrates that institutional commitment and public advocacy are necessary to effectively link transit and land use under the U.S. system of government and interest group politics. Despite its difficulties, Portland achieved results in the form of a vibrant and accessible downtown.

Protecting Neighborhood Quality of Life

The irony of rampant suburban development is that it begins with convenience in mind, but too quickly the cul-de-sac developments, strip malls and miles of additional roadway spawn problems of their own: unsafe and highly trafficked streets, noisy and congested highways, and pollution caused by excessive use of automobiles. Sprawl draws people away from established downtowns, leaving many small U.S. urban centers deserted. In the small city category, we look to Delft, The Netherlands, and Chattanooga, Tennessee for models of good planning and innovative solutions to these problems. In Delft, we look at measures to draw visitors downtown while relieving city traffic problems, and we examine residential design techniques that tame the automobile and bring quieter streets to neighborhoods. In Chattanooga, we examine how a city once deemed America's most polluted rehabilitated itself through innovative public transportation and public planning.

DELFT:	❖ DOWNTOWN TRAFFIC CELLS
	❖ THE WOONERF MOVEMENT
	❖ TAKING BIKING SERIOUSLY

The city of Delft in the Netherlands is situated in the Randstad, a densely populated area that includes a ring of large cities: Rotterdam, The Hague, Leiden, Haarlem, Amsterdam, and Utrecht. By comparison, Delft is a small city, home to about 100,000 people. It is surrounded by the "Green Heart," an agricultural area protected from urban/suburban development. The city is noted for its improvements in safety, mobility, bike and pedestrian access, aesthetics, and the environment, and the speed and ease with which its residents are able to travel within its borders.

Controlling Cars in Delft

Since the 1970s, municipal authorities have been combining efforts to calm traffic, provide bicycle infrastructure, improve public transit, redesign residential areas, and coordinate planned development with transportation networks. Together, these initiatives have maintained the character of Delft's urban core, promoted cycling and walking, and protected safety and the environment from transportation impacts, despite a rise in car ownership and population.

Car ownership trends in the Netherlands reflect those seen throughout northern Europe: from 1950-70, the number of vehicles in the Netherlands jumped from 110,000 to 2.3 million (Moon and Patterson, 1995). While the number of commuters also rose during this period, the percentage using public transit declined. Dutch downtown areas were, of course, never designed to handle such an auto traffic burden. But the increasing pressure motivated the Delft government to provide alternatives to car use and to take action to head off a potential traffic nightmare.

In general, the Dutch have confronted the urban transportation dilemma by trying to calm traffic and control automobile usage. Calmer traffic can dramatically improve pedestrian safety and the overall atmosphere of the city, as any urban walker can attest.

Box 5: Driving Factors in the Netherlands

- **Dutch traffic** accounted for about 18 percent of the Netherlands total energy consumption in 1995, compared to 43 percent for industry and 19 percent for households. Ten percent of total energy consumption is from private cars, less than 1 percent from buses, and 5 percent from trucks. (NOVEM, 1998)
- **Mobile sources** of air pollution contributed 21 percent of Dutch CO_2 emissions, 26 percent of SO_2 emissions, and 67 percent of NOx emissions. (NOVEM, 1998)
- **Car use** is expected to increase 70 percent during the 1986-2010 period; the number of cars will jump to 6-7 million from the current 5 million, and freight traffic increase is estimated at 70-80 percent. (Haq, 1994)
- **Mobility** is on the increase in the Netherlands. But during 1986-1993, the greatest increase in passenger kilometers was by public transit, which increased 41.8 percent, followed by car drivers at 13.5 percent. (Haq, 1994)
- **Dense population** in the Netherlands adds to transportation demand, but also provides a market for public transit networks. The Netherlands has an average 442 people per square km. (Haq, 1994)

❖ Downtown Traffic Cells

In Delft, a key traffic calming mechanism has been the traffic cell system developed in 1974. The downtown area is divided into four zones or cells. Because each cell has only one entry point, autos and trucks traveling between cells of the downtown area must exit a cell, return to a road that circles the downtown area, and enter another cell through a specified entry point. Since personal vehicles cannot travel directly from cell to cell, downtown car use is discouraged, especially as drivers see bus and tram operators quickly moving from one cell to another. So, while it limits access to cars and trucks, the system clears the path for buses, trams, bicycles and pedestrians.

Several of Delft's canals provide boundaries between the cells, with bridges used exclusively for buses and walkers. Physical traffic barriers that can be temporarily removed provide other boundaries. The traffic cell system means less traffic in the designated downtown area, helping public transit remain on schedule. This convenience and dependability encourage further use, and travelers are thus pushed *and* pulled towards public transit. Pedestrian-only areas add to the charm and safety of downtown. Moon and Patterson report that while merchants were originally fearful the system would leave businesses inaccessible by car, increased accesses by public transit and heavy pedestrian flow have largely allayed these fears.

❖ The "Woonerf" Movement

Delft was also a site of experimentation for another city planning innovation, the *woonerf* movement. Since the 1970's, several city streets have been redesigned in an attempt to shift driving space back to living space, creating a "living yard" or *woonerf*. These reclaimed streets use street-scale traffic calming measures, such as roads narrowed to one lane, speed bumps, and trees lining the streets. Winding streets are also used to slow traffic. *Woonerf* streets are clearly

labeled, hoping to inspire a recognition and respect for the principles they represent. Plants and trees also provide aesthetic and environmental benefits.

A Matter of Local Renewal …

In the Netherlands, "…a turn-around in the attitudes of federal transportation officials and subsequent funding for bicycle improvements, coupled with local initiatives, account for a sort of renaissance of the bicycle."

Dunn and Patterson, 1995, p.5.

While only appropriate for streets without a large traffic burden, the typical *woonerf* design offers a suite of environmental, esthetic, and safety benefits: less traffic, more landscaping, safer streets, more pedestrian mobility, and increased property values. Many neighborhoods have requested these *woonerf* changes, and results show that homeowners on such streets are more likely to invest in improving their homes. Indeed, success with *woonerf* efforts in Delft led the Dutch government to adopt a dual traffic reduction and neighborhood improvement program as official national policy.

Although the *woonerf* is most often applied to individual residential streets, whole Delft neighborhoods have adopted its design concepts, including the Hof can Delft and Western Kwartier neighborhoods.

Serious About Biking

Biking is extremely popular in Delft: 43 percent of trips to work and 60 percent of trips to school are by bicycle. These high percentages surpass rates in other European countries, and certainly dwarf statistics for the United States, where the share of trips by bicycle in large metropolitan areas (i.e., greater than 1 million people) is less than 1%. In the Netherlands, bicycling is viewed as a serious means of transportation, rather than merely a means of recreation as it is in the U.S. As such, planners consider, and even depend upon, cycling commuters in their efforts to curb automobile dependency.

Approximately 9,500 of the 66,000 miles of paved roads (about 14 percent) in the Netherlands are dedicated exclusively to biking. Almost 30 percent of all Dutch trips are made by bicycle, a figure two to three times that of other Western European countries. About 35 percent of all train trips begin with cycling to the station. This cycling mentality grows in part from a public commitment to reducing the demand for car travel, reflected in national policies to promote biking, such as funding for cycling networks and provision of bike-only lanes.

In 1980, the Ministry of Transport subsidized creation of an urban bike network for the city of Delft. As part of this project, a "before-and-after" survey was designed to measure results. The evaluation looked at the improved area as well as a "control" neighborhood, and discovered that bicycle use increased by 6 percent in the project area, with riders shifting primarily from car use. The improvements aimed to provide a safe, comfortable, and continuous urban cycling network. City policies in Delft complement the network by favoring the bicycle: for example, bikes are allowed to line up ahead of autos for left turns.

… National Steps, and …

In the Netherlands, a liter of gasoline is almost three times the average price of a trip on public transportation. Whereas in the U.S., a liter of gasoline equals only about 40 percent of the average public transit fare.

Pucher, 1990

Supporting National Policies

Major policies include support for public transportation initiatives such as cycling networks and traffic cell design. But lesser known, incremental policies can also reap significant rewards. For example, in contrast to the American approach of requiring as much parking as possible at apartment complexes, the Dutch often allow only one parking space per unit.

In some areas of the city, limits have been placed on the number of parking spaces that an employer can provide, sometimes as low as one space for every five employees. Establishing limits on parking pushes commuters towards pubic transit. National pricing policies — such as establishing a road-use fee for vehicles during peak hours and reducing tax relief for use of company cars — also encourage use of public transportation.

A Commitment to Public Transit

Delft's innovations -- especially the traffic cell system – wouldn't work if they weren't accompanied by good public transportation options. Public transit ridership clearly depends on its convenience and speed. Dutch planners provide monthly and weekly bus passes and locate stops and routes so that no city home is more than 1,500 feet away from some form of public transportation. Bus-only lanes are used extensively. In Delft, a signal computer keeps buses running on schedule. Detectors at each intersection send signals to a data management system tracking every bus in the city. This system controls traffic signals (holding a green light, shortening a red) to allow buses to stay on schedule.

… Setting Future Goals

In the Netherlands, an estimated 40 percent of all car journeys are less than 5 km. Consequently, one national goal is to make bike travel faster than car travel for the typical 5-km journey.

Lessons from Delft

Delft offers some impressive figures on the use of alternatives to cars. Forty-three percent of trips to work are by bicycle. On the residential side, the *woonerf* streets and neighborhoods exhibit transportation benefits (safer walking and easier biking), as well as increased homeowner investment and higher property values. On the business/commercial side, the traffic cell design can usher those on foot, bike and bus into a downtown less clogged by traffic and with easy access to businesses, while restricting most auto travel to a beltway outside the city center.

Together, these complementary approaches — support for biking, *woonerfs*, traffic cells and transit — improve quality of life by addressing the nexus of urban transportation issues: safety, mobility, access, amenity, aesthetics, environmental burden, and speed and ease of travel. The traffic cell system doesn't just restrict cars, but also facilitates non-car travel. *Woonerfs* don't just restrict parking, but create a neighborhood in which walking and biking provide attractive alternatives to driving. These initiatives exist within the context of linked Dutch transportation and development policies, such as gasoline pricing, parking limits and the siting of new employers near transportation opportunities. They are local efforts firmly founded on a national commitment to solve urban transportation problems.

CHATTANOOGA:	❖ DOWNTOWN REVITALIZATION
	❖ ELECTRIC BUS INITIATIVE

Visioning in Chattanooga

Chattanooga is often heralded for its efforts at sustainability and community revitalization. It sits at the center of a three-state metropolitan area accommodating 439,000 people. The city straddles the Tennessee River at the junction of Tennessee, Alabama, and Georgia, in the heart of the Southeastern United States. Identified in 1969 as America's most polluted city, Chattanooga embarked on a forward-thinking project to clean the air and plan for a brighter, and greener, future. In many respects, initiatives to revitalize its downtown area, stimulate economic development and improve the environment set it apart from the typical U.S. city: Chattanooga was recognized as one of the most livable cities in North America by *Partners for Livable Places* in 1986 and 1994. Chattanooga's progress is largely the result of its public participation in creating a vision for its future. Its revitalization process has embodied transportation innovations, such as an electric bus initiative and mixed-use redevelopment that stems the growth of transportation demands and provides increased opportunities for pedestrians and bike riders.

In 1984, an extensive stakeholder process involving 1,700 residents resulted in the development of the *Vision 2000* plan and *Chattanooga Ventures*, a collaboration of government, foundations, businesses, and residents. Public input to planning continued, and the *ReVision 2000* process began in 1993, resulting in 27 specific social, environmental and economic goals. In both plans, transportation issues factored prominently through concerns about air quality and downtown vitality. Chattanooga's approach led to innovative solutions to some glaring problems of environmental quality and urban decay. It's vision for a more sustainable downtown business center has guided its recent turnaround.

❖ THE ELECTRIC BUS INITIATIVE

Since 1992, the Chattanooga Area Regional Transportation Authority (CARTA) has operated an electric shuttle that circulates the city's linear downtown, connecting key attractions, such as the Tennessee Aquarium and the Chattanooga Choo-Choo. Offered as a free service to citizens and visitors, a totally electric bus fleet runs every five minutes. To facilitate park-and-ride, CARTA's plans included three parking garages in the downtown area, each along the Shuttle route, which generate revenue to fund operation of the Shuttle and investment in buses.

The first parking facility, opened in 1995, is adjacent to the Chattanooga Choo-Choo at the south end of the Shuttle route, and includes 5,000 square feet of retail space and an Electric Vehicle Information Center sponsored by the Tennessee Valley Authority (TVA). The second parking garage, which opened in 1996, is adjacent to the Tennessee Aquarium and houses a seven-screen cinema. The Downtown Shuttle recorded nearly 1.5 million passenger trips in its first two years, and its success created opportunities for downtown businesses and a channel for shoppers and workers. Businesses located along the Shuttle route have shown significant increases in sales.

Another important aspect of the electric bus initiative is called the Living Laboratory, a collaborative effort of CARTA, TVA, the non-profit Electric Transit Vehicle Institute (ETVI) and Advanced Vehicle Systems, Inc. ETVI coordinates the Living Laboratory, which promotes the use of electric vehicles and shares knowledge about the project from Chattanooga's

experience. The Living Laboratory conducts 'real life' and controlled testing on various components, batteries, tires and the electric bus as a whole, and regularly conducts tours and presentations for visitors from other cities.

CARTA has conducted demonstrations of its buses for more than 35 cities and towns throughout the country. For fleet operators and city officials concerned with transit's environmental impact, the demonstrations provide a model of an effective electric transit operation.

❖ Downtown Revitalization

Urban transit and urban vitality are interrelated. Thus, the Downtown Shuttle and parking garages have been key to downtown revitalization, but they are not the only components. Chattanooga's Downtown Partnership promotes the city center through entertainment, beautification and sanitation, safety and economic development. The Partnership's focus on downtown is part of its implementation of Chattanooga's Economic Strategic Plan.

Box 6: Conventional Suburbs or *New Urbanism*?

Garages dominate the fronts of houses. Streets end in turn-around loops. A trip to the next *cul-de-sac* is circuitous. Shops are not in walking distance and work is further away. These are the conventional patterns of the late 20th century suburb. But some developers and architects have started to reject them and are instead designing developments that follow an older tradition: the grid pattern of parallel and perpendicular streets. They have put garages in alleys at the backs of houses; they have restored front porches and even built rows of attached houses. This is neo-traditional neighborhood planning or *New Urbanism*. It reflects the idea that people do not want to get in a car for every trip, and that the street they live on should be a social space not a service road.

When shown photos of traditional, old residential streets and contemporary suburban streets, and asked which they prefer, the majority of people choose the traditional streets**.** This preference is reflected in the brisk sales of houses in communities built in the new urbanist style, of which Seaside, Florida is the best known. But largely absent from these communities is the light rail or commuter train station that would link them to other communities and business centers. This is beyond the means of ordinary developers and awaits government policy that would encourage public and private investment in transit links. With such connections, balanced transportation could re-emerge in metropolitan regions and reduce problems associated with sprawl.

Walnut Street Bridge is another example of Chattanooga's integrated approach to urban revitalization. The renovated Walnut Street Bridge, which dates from 1891, is now accessible to bicycles, joggers, horse drawn carriages and electric buses (but not cars). As the world's largest pedestrian walkway, it serves as a link between north and south shore development and provides walking access to the Tennessee Aquarium and Chattanooga's arts district.

Current development trends are so intertwined with auto-dependence that it is now difficult to remember which came first. One important reaction to auto-dominated development has been the *New Urbanism*, or neo-traditional neighborhood planning, a development style that does not cater exclusively to the automobile (see Box 6). *New Urbanism* promotes small urban centers that mix land-uses, combining stores, workplaces, civic buildings, parks, and a variety of housing options within walking distance of each other. With less need to drive, pollution and traffic congestion are reduced.

With concentrated development, more land can be reserved for open space. Perhaps most importantly, this planning paradigm promotes the notion, and increases the recognition that a compact, walkable neighborhood is a nice place to live, work, and play. *New Urbanism* is thus a sprawl-defying design and a transportation innovation, predicated on people walking to shops and having access to public transportation.

While New Urbanism typically applies to new development, Chattanooga's plan for the South Central Business District (SCBD) demonstrates many of New Urbanism's intentions in an urban redevelopment context. The SCBC encompasses 350 acres in the heart of Chattanooga. Once a busy industrial, commercial and residential area, the site now hosts both abandoned and operating foundries, dilapidated and active commercial buildings, and vacant lots. Through a unique planning process, including property owners, residents and experts, a plan was developed for the District in 1995. It will include an eco-industrial zone and environmental business incubator alongside a full market range of housing, a community stadium, an expanded trade center, and greenway. By co-locating employers, housing, retail, and recreation facilities, the plan combines the benefits of reduced transportation demand and urban land redevelopment.

Chattanooga's efforts achieved results: increased tourism, successful downtown businesses), and awards for quality of life. In one downtown area, polluted and in deep decline in the 1960's, the Riverset Apartments were completed in 1993 as the first new downtown housing development in 20 years. They were 100 percent leased in eight months.

Yet Still Typical . . .

Despite consensus-based visions and plans, an innovative electric bus initiative, and trend-reversing revitalization of Chattanooga's downtown, Chattanooga's transportation system remains plagued by the problems that frustrate other U.S. cities**.** While CARTA's annual mileage traveled has increased over the last five years, the average ridership has decreased. The number of personal vehicles in the county has increased 14 times as fast as population growth, and there are approximately 1.5 personal vehicles per person of driving age in Hamilton County. Unfortunately, these vehicles figure prominently in the daily commute: 94 percent of residents use a car, truck or van to get to work, and only 16 percent of those travel in carpools. For residents living and working in the MSA, only 1.4 percent use public transportation, while only 2.6 percent walk, bike, or use another means of transportation to get to work.

It is especially discouraging that the average weekday ridership on CARTA has decreased by roughly 23 percent from 1990 to 1996, as reported in *Life in Hamilton County: Indicators of Community Well-Being.* This document, compiled by the Metropolitan Council for Community Services, Inc as a report on the Chattanooga Indicators Project, gives two important reasons for the drop in CARTA's readership: cheap gasoline and reduced CARTA funding. Reduced funding for CARTA reduces services (which are already concentrated in Chattanooga proper) and thus demand, while less demand leads to further funding cuts. As long as its service area is limited, gasoline prices remain low, and the average commute is 20 minutes, CARTA will find it difficult to compete with the use of personal vehicles.

A notable exception to the decreasing use of CARTA buses is the 53 percent increase in use of the CARTA Care-A-Van, which provides transportation for people with disabilities. Meanwhile, total motor vehicle traffic accidents per 100,000 people are increasing. The metropolitan areas

of the state tend to have higher accident rates than other areas, probably owing to their higher traffic density and total miles driven, and their inferior road conditions.

Lessons from Chattanooga

Chattanooga teaches us that innovative redevelopment planning and transit services can effectively leverage downtown revitalization. But the city — and the region — is at a crossroads. Chattanooga could continue its aggressive efforts at sustainability and community revitalization, or allow funding of its budding and innovative transit services to further erode and complementary policies to go unexplored. For Chattanooga to retain its hard-earned distinction as the “most improved” city in the nation, it must continue transportation innovation on a wider scale, by providing and stimulating attractive transportation alternatives on the well-traveled commuting, shopping and recreational routes. While downtown vitality has increased, low transit ridership and increasing car commutes show that even in a progressive U.S. city, efforts to "tame" the auto have a long way to go.

SOLUTIONS FOR SPRAWLING CITIES

Planners and politicians alike are searching for solutions in response to growing public concern over the consequences of uncontrolled overdevelopment. As places spread further and further apart, Americans are driving more and more, causing a wide range of environmental and health concerns. More carbon dioxide can lead to climate disruption; damage to water quality from highway and parking lot runoff tainted with oil and leaking auto fluids; fragmentation and loss of natural lands. Americans' quality-of-life is also in jeopardy: traffic congestion and long commutes; deteriorating downtown areas and diminished neighborhood amenities; noisy and unsafe streets and roads; lost public and open spaces; and unattractive, big-box retail development are all consequences of sprawl.

The exemplary cities in this report illustrate that there is no one formula for reversing sprawl. Initiatives to discourage auto dependency will not work without the provision of good public transportation alternatives. Many of the models highlighted in this report can be used in combination to provide even bigger improvements to the public health, environment and overall quality of life in urban and suburban communities.

Some Lessons from Europe

While this report focused on both American and European solutions, European cities appear to be achieving greater success. Munich has been able to increase the percentage of trips traveled using alternatives to the automobile, while San Francisco has only managed to stem the decrease. Portland is a U.S. leader in land use control and is striving to invest in rail-link developments, whereas Stockholm already has fully developed satellite towns separated by greenbelts and clustered around stations on its extensive rail system. Chattanooga is a U.S. leader in downtown revitalization and considering environmental issues in its planning and development. Still, sprawl development around Chattanooga continues, and use of non-car alternatives is as low as any typical U.S. city. By comparison, Delft's commitment to traffic calming and provision of alternatives has paid off; a full 43 percent of trips to work are by bicycle. The central business district is designed to favor and facilitate public transit, while entire residential neighborhoods have been redesigned to slow traffic and encourage biking and walking.

Europe's relative success is not surprising. Although many pre-war U.S. cities had substantial density, diverse downtown districts and transit, European cities are much older and far denser, with historic centers less vulnerable to destruction in favor of parking lots or central city highways. In contrast, many of America's older cities have been re-shaped by the automobile, while newer and fast-growing cities, such as Tucson, have clearly been designed for the automobile from the outset.

In Europe, it is politically acceptable to tax and use the national treasury for the subsidy of public transportation. In the major cities of Italy, France, Germany, Sweden, Netherlands and Belgium, subsidies for public transportation are high by U.S. standards, and fares range between 15 to 40 percent of operating costs. In the U.S., fares range between 30 and 70 percent of operating costs. This means that European cities support transit at about double the level in the U.S. Moreover, while even a transit-centered city such as New York has not added a subway line of significance since prior to World War II, many European cities – such as Paris, London, Munich and Stockholm -- have continually expanded their subway systems. In Europe, the integration of local transit with national railway systems has also allowed national authorities to use their

resources for commuter services in metropolitan areas, knitting together the growing urban-suburban regions such as the Ranstaad area in Holland or the greater metropolitan Paris. French national railway and the Paris Metro combined to form a regional commuter system with the speed and size of the national railway and ease of ticketing of Metro. We have yet to realize such synergies in the U.S.

European governments likewise have greater authority to impose gasoline taxes, and, increasingly, to apply road tolls to motorists. This has two complementary and reinforcing effects. First, taxation allows governments to raise revenues for building, expanding, improving, better integrating, and operating public transit and rail systems. A well-developed and maintained system can wean some portion of travellers from private automobile use, while providing better access for those without cars. Second, taxing fuel motivates commuters to use alternative methods of transportation, especially if attractive alternatives are available. The cost of gasoline in Europe is about four times what it is in the U.S. The higher the price of driving, the more likely people will use alternatives to the automobile.

Getting Out of Our Cars

Yet for most of this century, innovation in urban transportation has focused on the private automobile. And as automobiles have grown faster and highways bigger and more abundant, public transit systems have often been neglected, as in the case of street cars, sometimes completely abandoned. And, but for modest federal fuel-efficiency and emissions standards, most automotive engineering ingenuity has gone into improved performance, not environmental improvements.

The approaches taken by the six cities noted in this report have one thing in common – they don't cater to cars. Rather than developing cities, pursuing development and designing transportation systems around the automobile, they attempt to reshape cities to better meet the important human and environmental ends of urban life, and to harmonize the automobile and its use with those means and ends. One of the biggest problems underlying current development policy in the U.S. is the assumption that automobile-dependent communities and the systems that support them are inevitable. When planners and policy-makers abandon this assumption, they can start to think creatively about making transportation more harmonious with environmental protection and neighborhood character.

Changes in transportation systems could limit where cars may go or charge drivers for the privilege of using congested roads during peak traffic periods. Investment that once went exclusively for building highways could be used for providing public transit, bicycle paths and rail links. Regional planning, incentives and public spending could influence settlement choices, and help create the land-use patterns and inter-modal linkages that offer a balanced and equitable set of options for mobility and access. City planners now recognize that they can't allow the car to shape the city; they have to shape the city and its transportation options for improved access, mobility, amenity, equity, and environmental quality.

APPENDIX

Key statistical information for each city discussed in report plus additional US cities having congestion problems

#	Name	1990 metropolitan Population density (people/km^2)	1990 Vehicle miles traveled per capita per day	1990 public transit share of total commuting trips (%)	1990 public transit subsidy levels (%)	1990 Transport-related fatalities (deaths per 1000)
1	Stockholm	5,310	7.8	55%	65%	0.09
2	Munich	5,360	7.0	46%	46%	0.25
3	Delft	3,368	NA	NA	NA	NA
4	San Francisco	1,431	20.9	10%	56%	0.14
5	Portland	1,048	20.6	6%	75%	0.20
6	Chattanooga	497	NA	3%	53%	NA
7	Atlanta	498	29.1	5%	57%	0.53
8	Los Angeles	2,017	22.0	7%	64%	1.11
9	Washington D.C	1,425	20.8	14%	50%	0.52
10	Miami	1,488	18.1	6%		0.33
11	Chicago	1,458	16.4	17%	53%	0.78
12	Seattle	921	23.6	7%	82%	0.10
13	Detroit	1,230	20.1	2%		0.51
14	San Bernardino-Riverside	923	21.4	1%	71%	0.71
15	San Diego	1,247	22.5	3%		0.36

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