

KEY ISSUE 4

Why Do Suburbs Face Distinctive Issues?

- Urban Expansion
- The Peripheral Model
- Suburban Segregation
- Transportation and Suburbanization

In 1950, only 20 percent of Americans lived in suburbs compared to 40 percent in cities and 40 percent in small towns and rural areas. In 2000, after a half-century of rapid suburban growth, 50 percent of Americans lived in suburbs compared to only 30 percent in cities and 20 percent in small towns and rural areas. ■

Urban Expansion

Until recently in the United States, as cities grew, they expanded by adding peripheral land. Now cities are surrounded by a collection of suburban jurisdictions whose residents prefer to remain legally independent of the large city.

Annexation

The process of legally adding land area to a city is **annexation**. Rules concerning annexation vary among states. Normally, land can be annexed to a city only if a majority of residents in the affected area vote in favor of doing so.

Peripheral residents generally desired annexation in the nineteenth century, because the city offered better services, such as water supply, sewage disposal, trash pickup, paved streets, public transportation, and police and fire protection. Thus, as U.S. cities grew rapidly in the nineteenth century, the legal boundaries frequently changed to accommodate newly developed areas. For example, the city of Chicago expanded from 26 square kilometers (10 square miles) in 1837 to 492 square kilometers (190 square miles) in 1900 (Figure 13-19).

Today, however, cities are less likely to annex peripheral land because the residents prefer to organize their own services rather than pay city taxes for them. Originally, some of these peripheral jurisdictions were small, isolated towns that had a tradition of independent local government before being swallowed up by urban growth. Others are newly created communities whose residents wish to live close to the large city but not be legally part of it.

Defining Urban Settlements

Instead of annexing peripheral areas, cities now are surrounded by suburbs. As a result, several definitions have been created to characterize cities and their suburbs:

- City: a legal entity
- Urbanized area: a continuously built-up area
- Metropolitan area: a functional area

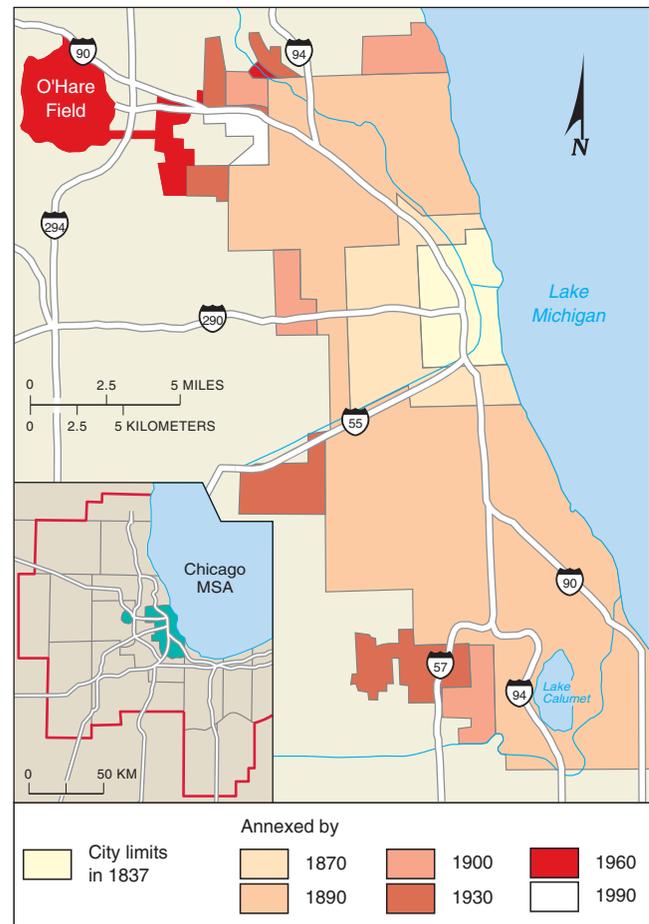


FIGURE 13-19 Annexation in Chicago. During the nineteenth century, the city of Chicago grew rapidly through annexation of peripheral land. Relatively little land was annexed during the twentieth century; the major annexation was on the northwest side for O'Hare Airport. The inset shows that the city of Chicago covers only a small portion of the Chicago metropolitan statistical area.

THE CITY. The term **city** defines an urban settlement that has been legally incorporated into an independent, self-governing unit (Figure 13-20). In the United States, a city surrounded by suburbs is sometimes called a **central city**.

Virtually all countries have a local government system that recognizes cities as legal entities with fixed boundaries. A city has locally elected officials, the ability to raise taxes, and responsibility for providing essential services. The boundaries of the city define the geographic area within which the local government has legal authority.

Population has declined since 1950 by about one-half in the central cities of Baltimore, Buffalo, Cleveland, Detroit, Pittsburgh, and St. Louis, and by about one-third in Birmingham, Boston, Cincinnati, Dayton, Newark, Rochester, and Syracuse. The number of tax-paying middle-class families and industries has invariably declined by much higher percentages in these cities.

URBANIZED AREA. In the United States, the central city and the surrounding built-up suburbs are called an **urbanized area**. More precisely, an urbanized area consists of a central city

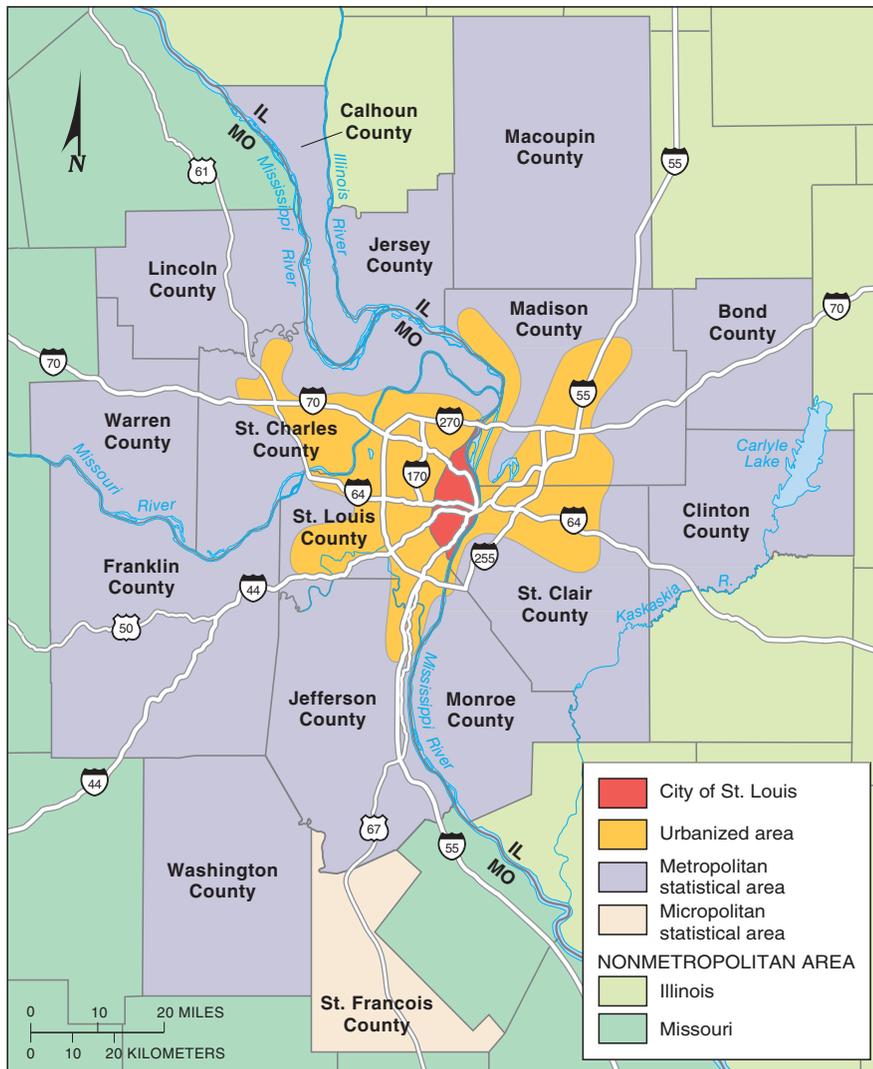


FIGURE 13-20 City, urbanized area, and metropolitan statistical area of St. Louis. Surrounding the city of St. Louis is an urbanized area that spreads westward into St. Louis County and eastward across the Mississippi River into Illinois. The St. Louis metropolitan statistical area includes seven Missouri counties and eight in Illinois, as well as the city of St. Louis. The St. Louis-St. Charles-Farmington combined statistical area includes the St. Louis MSA and the Farmington micropolitan statistical area (Farmington is the county seat and largest city in St. Francois County).

plus its contiguous built-up suburbs where population density exceeds 1,000 persons per square mile (400 persons per square kilometer). Approximately 70 percent of the U.S. population lives in urbanized areas, including about 30 percent in central cities and 40 percent in surrounding jurisdictions. Working with urbanized areas is difficult because few statistics are available about them. Most data in the United States and other countries are collected for cities, counties, and other local government units, but urbanized areas do not correspond to government boundaries.

METROPOLITAN STATISTICAL AREA. The concept of urbanized area also has limited applicability because it does not accurately reflect the full influence that an urban settlement has in contemporary society. The area of influence of a city extends beyond legal boundaries and adjacent built-up jurisdictions. For example, commuters may travel a long distance to work and shop in the city or built-up suburbs. People in a wide area

watch the city's television stations, read the city's newspapers, and support the city's sports teams. Therefore, we need another definition of urban settlement to account for its more extensive zone of influence.

The U.S. Bureau of the Census has created a method of measuring the functional area of a city, known as the **metropolitan statistical area (MSA)**. An MSA includes the following:

- An urbanized area with a population of at least 50,000
- The county within which the city is located
- Adjacent counties with a high population density and a large percentage of residents working in the central city's county (e.g., a county with a density of 25 persons per square mile and at least 50 percent working in the central city's county)

Studies of metropolitan areas in the United States are usually based on information about MSAs. The MSAs are widely used because many statistics are published for counties, the basic MSA building block.

The census designated 366 MSAs as of 2009, encompassing 84 percent of the U.S. population. Older studies may refer to SMSAs, or standard metropolitan statistical areas, which the census used before 1983 to designate metropolitan areas in a manner similar to MSAs. An MSA is not the perfect tool for measuring the functional area of a city. One problem is that some MSAs include extensive land area that is not urban. For example, Great Smoky Mountains National Park is partly in the Knoxville, Tennessee, MSA; Sequoia National Park is in the Visalia-Porterville, California, MSA. The MSAs comprise some 20 percent of total U.S. land area, compared to only 2 percent for urbanized areas. The urbanized area typically occupies only 10 percent of an MSA land area but contains nearly 90 percent of its population.

The census has also designated smaller urban areas as **micropolitan statistical areas (μ SAs)**. These include an urbanized area of between 10,000 and 50,000 inhabitants, the county in which it is found, and adjacent counties tied to the city. The United States had 574 micropolitan statistical areas as of 2008, for the most part found around southern and western communities previously considered rural in character. About 10 percent of Americans live in a micropolitan statistical area. The 366 MSAs and 574 μ SAs together are known as **core based statistical areas (CBSAs)**.

Recognizing that many MSAs and μ SAs have close ties, the census has combined some of them into 124 **combined statistical areas (CSAs)**. A CSA is defined as two or more contiguous CBSAs tied together by commuting patterns. The 124 CSAs plus the remaining 187 MSAs and 406 μ SAs not combined into CSAs together are known as **primary census statistical areas (PCSAs)**.

Local Government Fragmentation

The fragmentation of local government in the United States makes it difficult to solve regional problems of traffic, solid-waste disposal, and the building of affordable housing. The number of local governments exceeds 1,400 in the New York area, 1,100 in the Chicago area, and 20,000 throughout the United States. Approximately 40 percent of these 20,000 local governments are general units, such as cities and counties. The remainder serve special purposes, such as schools, sanitation, transportation, water, and fire districts.

Long Island, which extends for 150 kilometers (90 miles) east of New York City and is approximately 25 kilometers (15 miles) wide, contains nearly 800 local governments. The island includes 2 counties, 2 cities, 13 towns, 95 villages, 127 school districts, and more than 500 special districts (such as for garbage collection). The multiplicity of local governments on Long Island leads to problems. When police or firefighters are summoned to the State University of New York at Old Westbury, two or three departments sometimes respond because the campus is in five districts. The boundary between the communities of Mineola and Garden City runs down the center of Old Country Road, a busy four-lane route. Mineola set a 40-mile-per-hour speed limit for the eastbound lanes, whereas Garden City set a 30-mile-per-hour speed limit for the westbound lanes.

The large number of local government units has led to calls for a metropolitan government that could coordinate—if not replace—the numerous local governments in an urban area. Most U.S. metropolitan areas have a **council of government**, which is a cooperative agency consisting of representatives of the various local governments in the region. The council of government may be empowered to do some overall planning for the area that local governments cannot logically do. Strong metropolitan-wide governments have been established in a few places in North America. Two kinds exist:

- **Consolidations of City and County Governments.** Examples include Indianapolis and Miami. The boundaries of Indianapolis were changed to match those of Marion County, Indiana.

Government functions that were handled separately by city and county now are combined into a joint operation in the same office building. In Florida, the city of Miami and surrounding Dade County have combined some services, but the city boundaries have not been changed to match those of the county.

- **Federations.** Examples include Toronto and other large Canadian cities. Toronto's metropolitan government was created in 1953 through federation of 13 municipalities. A two-tier system of government existed until 1998, when the municipalities were amalgamated into a single government.

Overlapping Metropolitan Areas

Some adjacent MSAs overlap. A county between two central cities may send a large number of commuters to jobs in each. In the northeastern United States, large metropolitan areas are so close together that they now form one continuous urban



FIGURE 13-21 Megalopolis. Also known as the Boswash corridor, Megalopolis extends more than 700 kilometers (440 miles) from Boston on the northeast to Washington, D.C., on the southwest. Megalopolis contains one-fourth of the U.S. population on 2 percent of the country's total land area.

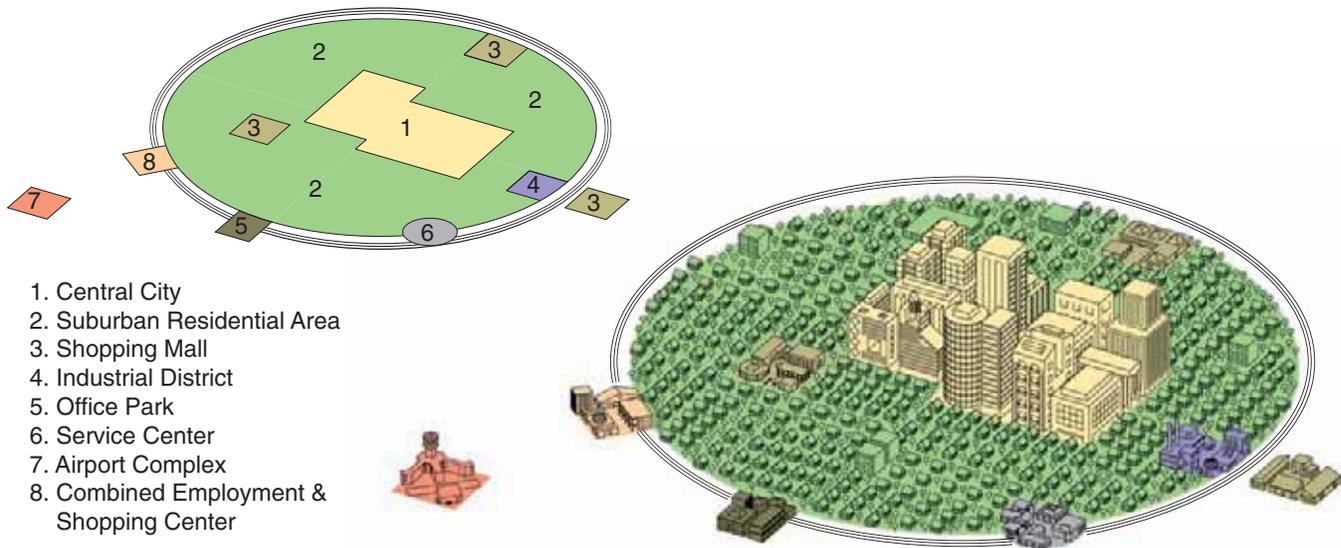


FIGURE 13-22 Peripheral model of urban areas. The central city is surrounded by a beltway or ring road. Around the beltway are suburban residential areas and nodes, or edge cities, where consumer and business services and manufacturing cluster. (Adapted from Chauncy D. Harris, “The Nature of Cities and Urban Geography in the Last Half Century.” Reprinted with permission from *Urban Geography*, vol. 18, no. 1 (1997), p. 17. © V. H. Winston & Son, Inc., 360 South Ocean Blvd., Palm Beach, FL 33480. All rights reserved.)

complex, extending from north of Boston to south of Washington, D.C. Geographer Jean Gottmann named this region Megalopolis, a Greek word meaning “great city”; others have called it the Boswash corridor (Figure 13-21).

Other continuous urban complexes exist in the United States—the southern Great Lakes between Chicago and Milwaukee on the west and Pittsburgh on the east, and southern California from Los Angeles to Tijuana. Among important examples in other MDCs are the German Ruhr (including the cities of Dortmund, Düsseldorf, and Essen), Randstad in the Netherlands (including the cities of Amsterdam, the Hague, and Rotterdam), and Japan’s Tokaido (including the cities of Tokyo and Yokohama).

Within Megalopolis, the downtown areas of individual cities such as Baltimore, New York, and Philadelphia retain distinctive identities, and the urban areas are visibly separated from each other by open space used as parks, military bases, and dairy or truck farms. But at the periphery of the urban areas, the boundaries overlap. Once considered two separate areas, Washington and Baltimore were combined into a single MSA after the 1990 census. Washingtonians visit the Inner Harbor in downtown Baltimore, and Baltimoreans attend major-league hockey and basketball games in downtown Washington. However, combining them into one MSA did not do justice to the distinctive character of the two cities, so the Census Bureau again divided them into two separate MSAs after the 2000 census but grouped them into one combined statistical area.

The Peripheral Model

North American urban areas follow what Chauncey Harris (creator of the multiple nuclei model) called the peripheral model. According to the **peripheral model**, an urban area

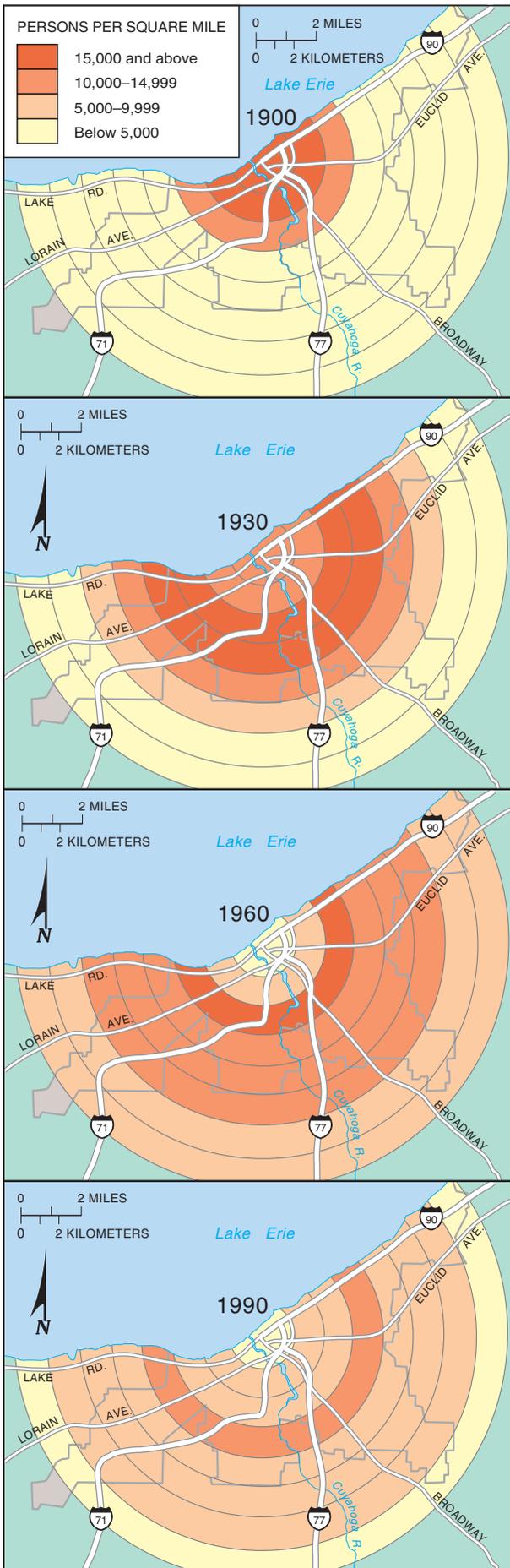
consists of an inner city surrounded by large suburban residential and business areas tied together by a beltway or ring road (Figure 13-22). Peripheral areas lack the severe physical, social, and economic problems of inner-city neighborhoods. But the peripheral model points to problems of sprawl and segregation that characterize many suburbs.

Around the beltway are nodes of consumer and business services, called **edge cities**. Edge cities originated as suburban residences for people who worked in the central city, and then shopping malls were built to be near the residents. Now edge cities contain manufacturing centers spread out over a single story for more efficient operations and office parks where producer services cluster. Specialized nodes emerge in the edge cities—a collection of hotels and warehouses around an airport, a large theme park, a distribution center near the junction of the beltway, and a major long-distance interstate highway.

Density Gradient

As you travel outward from the center of a city, you can watch the decline in the density at which people live (Figure 13-23). Inner-city apartments or row houses may pack as many as 250 dwellings on a hectare of land (100 dwellings per acre). Older suburbs have larger row houses, semidetached houses, and individual houses on small lots, at a density of about 10 houses per hectare (4 houses per acre). A detached house typically sits on a lot of one-fourth to one-half hectare (0.6 to 1.2 acres) in new suburbs, and a lot of 1 hectare or greater (2.5 acres) on the fringe of the built-up area.

This density change in an urban area is called the **density gradient**. According to the density gradient, the number of houses per unit of land diminishes as distance from the center



city increases. Two changes have affected the density gradient in recent years:

- **Fewer People Living in the Center.** The density gradient thus has a gap in the center, where few live.
- **Fewer Differences in Density Within Urban Areas.** The number of people living on a hectare of land has decreased in the central residential areas through population decline and abandonment of old housing. At the same time, density has increased on the periphery through construction of apartment and town-house projects and diffusion of suburbs across a larger area.

The result of the two changes is to flatten the density gradient and reduce the extremes of density between inner and outer areas traditionally found within cities.

Cost of Suburban Sprawl

U.S. suburbs are characterized by **sprawl**, which is the progressive spread of development over the landscape. When private developers select new housing sites, they seek cheap land that can easily be prepared for construction—land often not contiguous to the existing built-up area (Figure 13-24). Sprawl is also fostered by the desire of many families to own large tracts of land.

As long as demand for single-family detached houses remains high, land on the fringe of urbanized areas will be converted from open space to residential land use. Land is not transformed immediately from farms to housing developments. Instead, developers buy farms for future construction of houses by individual builders. Developers frequently reject land adjacent to built-up areas in favor of detached isolated sites, depending on the price and physical attributes of the alternatives. The peripheries of U.S. cities therefore look like Swiss cheese, with pockets of development and gaps of open space.

Urban sprawl has some undesirable traits. Roads and utilities must be extended to connect isolated new developments to nearby built-up areas. The cost of these new roads and utilities is funded by taxes or the services are installed by the developer, who passes on the cost to new residents through higher home prices. Sprawl also wastes land. Some prime agricultural land may be lost through construction of isolated housing developments. In the interim, other sites lie fallow while speculators await the most profitable time to build homes on them. In reality, sprawl has little impact on the total farmland in the United States, but it does reduce the ability of city dwellers to get to the country for recreation, and it can affect the supply of local dairy products and vegetables. The low-density suburb also wastes more energy, especially because motor vehicles are required for most trips.

FIGURE 13-23 Density gradient in Cleveland. In 1900, the population was highly clustered in and near the central business district (CBD). By 1930 and 1960, the population was spreading, leaving the original core less dense. By 1990, population was distributed over a much larger area, the variation in the density among different rings was much less, and the area's lowest densities existed in the rings near the CBD. The current boundary of the city of Cleveland is shown. (First three maps adapted from Avery M. Guest, "Population Suburbanization in American Metropolitan Areas, 1940–1970." *Geographical Analysis* 7 (1975): 267–83, table 4. Used by permission of the publisher.)

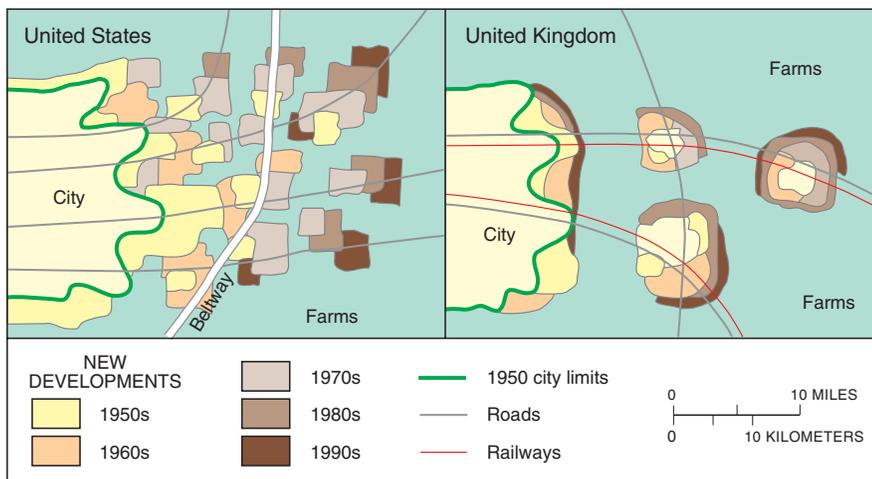


FIGURE 13-24 Suburban development patterns in the United Kingdom and the United States. The United States has much more sprawl than the United Kingdom. In the United Kingdom, new housing is more likely to be concentrated in new towns or planned extensions of existing small towns, whereas in the United States growth occurs in discontinuous developments.

The supply of land for the construction of new housing is more severely restricted in European urban areas. Officials attack sprawl by designating areas of mandatory open space. London, Birmingham, and several other British cities are surrounded by **greenbelts**, or rings of open space. New housing is built either in older suburbs inside the greenbelts or in planned extensions to small towns and new towns beyond the greenbelts. However, restriction of the supply of land on the urban periphery has driven up house prices in Europe.

Several U.S. states have taken strong steps in the past few years to curb sprawl, reduce traffic congestion, and reverse inner-city decline. The goal is to produce a pattern of compact and contiguous development, while protecting rural land for agriculture, recreation, and wildlife. Legislation and regulations to limit suburban sprawl and preserve farmland has been called **smart growth**. Oregon and Tennessee have defined growth boundaries within which new development must occur. Cities can annex only lands that have been included in the urban growth areas. New Jersey, Rhode Island, and Washington were also early leaders in enacting strong state-level smart-growth initiatives. Maryland enacted especially strong smart growth legislation in 1998. The Maryland smart-growth law prohibits the state from funding new highways and other projects that would extend suburban sprawl and destroy farmland. State money must be spent to “fill in” already urbanized areas.

Suburban Segregation

Public opinion polls in the United States show people’s strong desire for suburban living. In most polls, more than 90 percent of respondents prefer the suburbs to the inner city. It is no surprise then that the suburban population has grown much faster than the overall population in the United States.

Suburbs offer varied attractions—a detached single-family dwelling rather than a row house or apartment, private land

surrounding the house, space to park cars, and a greater opportunity for home ownership. The suburban house provides space and privacy, a daily retreat from the stress of urban living. Families with children are especially attracted to suburbs, which offer more space for play and protection from the high crime rates and heavy traffic that characterize inner-city life. As incomes rose in the twentieth century, first in the United States and more recently in other MDCs, more families were able to afford to buy suburban homes.

The modern residential suburb is segregated, and in two ways:

- **Segregated Social Classes.** Housing in a given suburban community is usually built for people of a single social class, with others excluded by virtue of the cost, size, or location of the housing.
- **Segregated Land Uses.** Residents are separated from commercial and manufacturing activities that are confined to compact, distinct areas.

Residential Segregation

The homogeneous suburb was a twentieth-century phenomenon. Before then, activities and classes in a city were more likely to be separated vertically rather than horizontally. In a typical urban building, shops were on the street level, with the shop owner or another well-to-do family living on one or two floors above the shop. Poorer people lived on the higher levels or in the basement, the least attractive parts of the building. The basement was dark and damp, and before the elevator was invented, the higher levels could be reached only by climbing many flights of stairs. Wealthy families lived in houses with space available in the basement or attic to accommodate servants. Once cities spread out over much larger areas, the old pattern of vertical separation was replaced by territorial segregation. Large sections of the city were developed with houses of similar interior dimension, lot size, and cost, appealing to people with similar incomes and lifestyles.

Zoning ordinances, developed in Europe and North America in the early decades of the twentieth century, encouraged spatial separation. They prevented the mixing of land uses within the same district. In particular, single-family houses, apartments, industry, and commerce were kept apart, because the location of one activity near another was considered unhealthy and inefficient. The strongest criticism of U.S. residential suburbs is that low-income people and minorities are unable to live in them because of the high cost of the housing and the unfriendliness of established residents. Suburban communities discourage the entry of those with lower incomes and minorities because of fear that property values will decline if the high-status composition of the neighborhood is altered. Legal devices, such as requiring each house to sit on a large lot and the prohibition of apartments, prevent low-income families from living in many suburbs.

In some metropolitan areas, the inner-city social and economic problems described earlier in this chapter are found in older suburbs immediately adjacent to the central city (Figure 13-25). As the central city is transformed into a vibrant community for higher-income people, inner suburbs become home to lower-income people displaced from gentrifying urban neighborhoods. Meanwhile, middle-class residents move from inner suburbs to newer homes on the periphery. Thus, the inner suburbs are unable to generate revenue to provide for the needs of a poorer population.

Suburbanization of Businesses

Businesses have moved to suburbs. Manufacturers have selected peripheral locations because land costs are lower. Service providers have moved to the suburbs because most of their customers are there.

SUBURBANIZATION OF RETAILING. Suburban residential growth has fostered change in traditional retailing patterns (Figure 13-26). Historically, urban residents bought food and

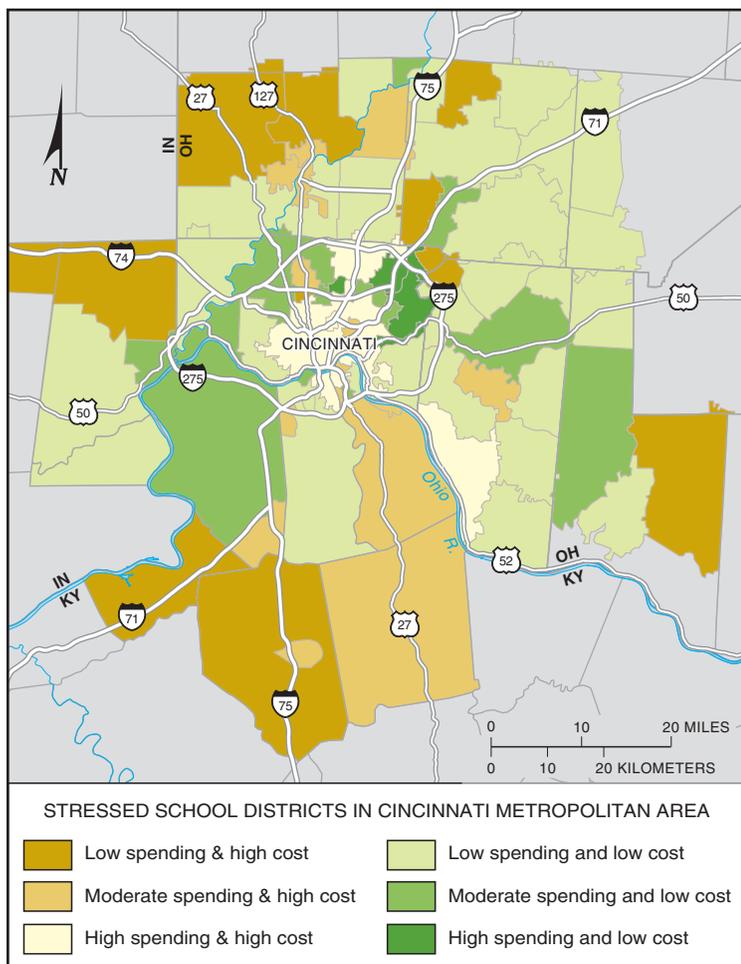


FIGURE 13-25 Suburban stress. In the Cincinnati MSA, the school districts considered high stress are mostly in the suburbs. A high-cost school district has either a rapidly growing or declining enrollment, or else a large percentage of students eligible for a free lunch program because of low income.

other daily necessities at small neighborhood shops in the midst of housing areas and shopped in the CBD for other products. But since the end of World War II, downtown sales have not increased, whereas suburban sales have risen at an annual rate of 5 percent. Downtown sales have stagnated because suburban residents who live far from the CBD won't make the long journey there. At the same time, small corner shops do not exist in the midst of newer residential suburbs. The low density of residential construction discourages people from walking to stores, and restrictive zoning practices often exclude shops from residential areas.

Instead, retailing has been increasingly concentrated in planned suburban shopping malls of varying sizes. Corner shops have been replaced by supermarkets in small shopping centers. Larger malls contain department stores and specialty shops traditionally reserved for the CBD. Generous parking lots surround the stores. A shopping mall is built by a developer, who buys the land, builds the structures, and leases space to individual merchants. Typically, a merchant's rent is a percentage of sales revenue.

Shopping malls require as many as 40 hectares (100 acres) of land and are frequently near key road junctions, such as the interchange of two interstate highways. Some shopping malls are elaborate multilevel structures exceeding 100,000 square meters (1 million square feet), with more than 100 stores arranged along covered walkways. The key to a successful large shopping mall is the inclusion of one or more anchors, usually large department stores. Most consumers go to a mall to shop at an anchor and, while there, patronize the smaller shops. In smaller shopping centers, the anchor is frequently a supermarket or discount store.

Malls have become centers for activities in suburban areas that lack other types of community facilities. Retired people go to malls for safe, vigorous walking exercise, or they sit on a bench to watch the passing scene. Teenagers arrive after school to meet their friends. Concerts and exhibitions are frequently set up in malls.

SUBURBANIZATION OF FACTORIES AND OFFICES.

Factories and warehouses have migrated to suburbia for more space, cheaper land, and better truck access. Modern factories and warehouses demand more land because they spread their conveyor belts, forklift trucks, loading docks, and machinery over a single level for efficient operation. Suburban locations also facilitate truck shipments by providing good access to main highways and no central city traffic congestion, important because industries increasingly receive inputs and distribute products by truck.

Offices that do not require face-to-face contact are increasingly moving to suburbs where rents are lower than in the CBD. Executives can drive on uncongested roads to their offices from their homes in nearby suburbs and park their cars without charge. For other employees, though, suburban office locations can pose a hardship. Secretaries, custodians, and other lower-status office workers may not have cars, and public transportation may not serve the site. Other office workers might miss the stimulation and animation of a central location, particularly at lunchtime.

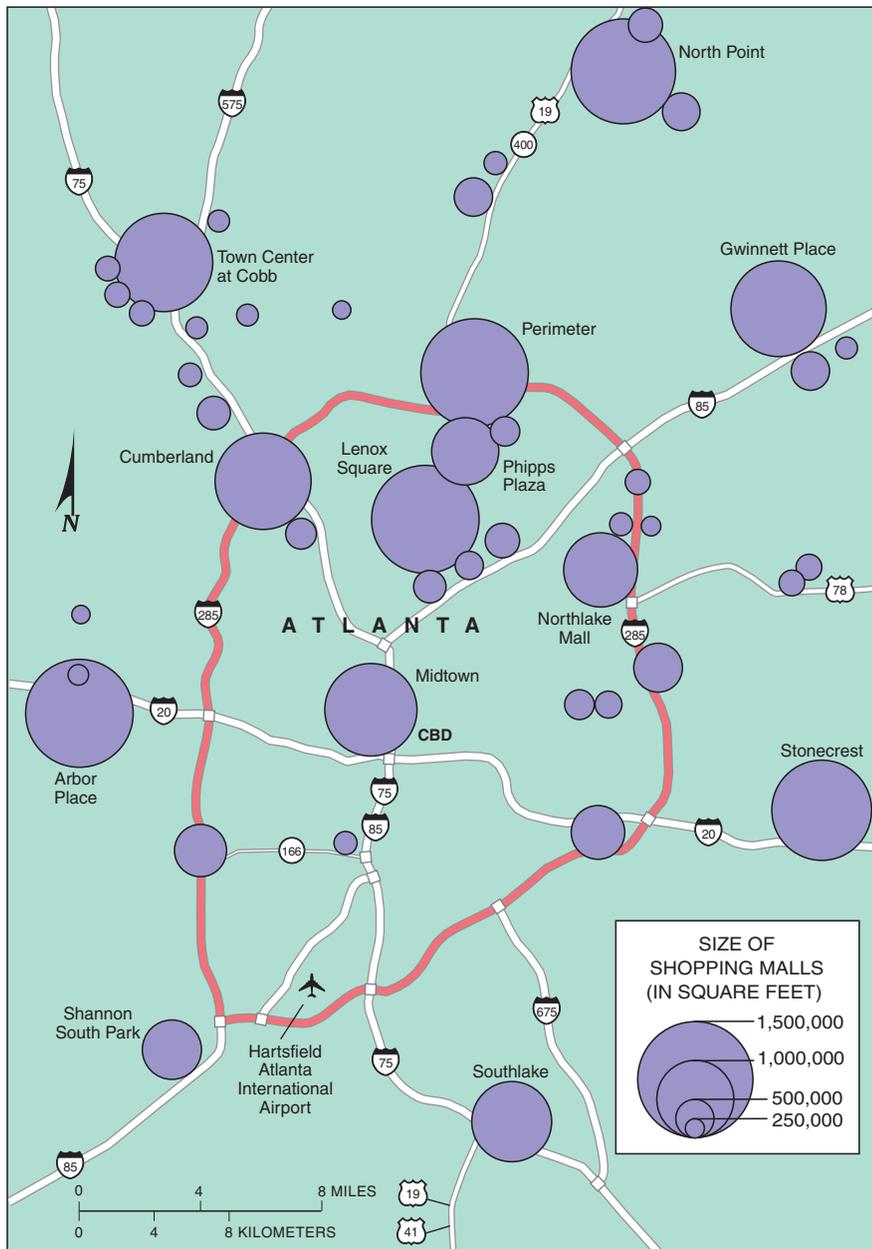


FIGURE 13-26 Major retail centers in Atlanta. Most shopping malls in the Atlanta metropolitan area, as elsewhere in North America, are in the suburbs, not the inner city. The optimal location for a large shopping mall is near an interchange on an interstate highway “beltway.” These encircle many American cities, such as I-285 around Atlanta.

Transportation and Suburbanization

People do not travel aimlessly; their trips have a precise point of origin, destination, and purpose. More than half of all trips are work-related—commuting between work and home, business travel, or deliveries. Shopping or other personal business and social journeys each account for approximately one-fourth of all trips. Together, all of these trips produce congestion in urban areas. Congestion imposes costs on individuals and

businesses by delaying arrival at destinations, and the high concentration of slowly moving vehicles produces increased air pollution (see Chapter 14).

Historically, the growth of suburbs was constrained by poor transportation. People lived in crowded cities because they had to be within walking distance of shops and places of employment. The invention of the railroad in the nineteenth century enabled people to live in suburbs and work in the central city. Cities then built railroads at street level (called trolleys, streetcars, or trams) and underground (subways) to accommodate commuters. Many so-called streetcar suburbs built in the nineteenth century still exist and retain unique visual identities. They consist of houses and shops clustered near a station or former streetcar stop at a much higher density than is found in newer suburbs.

Motor Vehicles

The suburban explosion in the twentieth century relied on motor vehicles rather than railroads, especially in the United States. Rail lines restricted nineteenth-century suburban development to narrow ribbons within walking distance of the stations. Cars and trucks permitted large-scale development of suburbs at greater distances from the center, in the gaps between the rail lines. Motor vehicle drivers have much greater flexibility in their choice of residence than was ever before possible.

Motor vehicle ownership is nearly universal among American households, with the exception of some poor families, older individuals, and people living in the centers of large cities such as New York. More than 95 percent of all trips within U.S. cities are made by car, compared to fewer than 5 percent by bus or rail. Outside the big cities, public transportation service is extremely rare or nonexistent. The U.S. government has encouraged the use of cars and trucks by paying

90 percent of the cost of limited-access, high-speed interstate highways, which stretch for 74,000 kilometers (46,000 miles) across the country. The use of motor vehicles is also supported by policies that keep the price of fuel below the level found in Europe.

The motor vehicle is an important user of land in the city. An average city allocates about one-fourth of its land to roads and parking lots. Multilane freeways cut a 23-meter (75-foot) path through the heart of cities, and elaborate interchanges consume even more space. Valuable land in the central city is devoted to parking cars and trucks, although expensive underground and



GLOBAL FORCES, LOCAL IMPACTS

Intelligent Transportation Systems

The future health of urban areas depends on relieving traffic congestion. Geographic tools, including global positioning systems (GPS) and electronic mapping, are playing central roles in the design of intelligent transportation systems, either through increasing road capacity or through reducing demand.

The current generation of innovative techniques to increase road capacity is aimed at providing drivers with information so that they can make intelligent decisions about avoiding congestion. Radio stations in urban areas have long broadcast reports to advise motorists of accidents or especially congested highways. Information about traffic congestion is now being transmitted through computers, handheld devices, and vehicle monitors. Traffic hot spots are displayed on electronic maps and images, using information collected through sensors in the roadbeds and cameras placed at strategic locations. An individual wishing to know about a particular route can program an electronic device to receive a congestion alert and to suggest alternatives.

The other current application of geographic tools is to reduce demand through “smart” highways. Toronto and several California cities charge motorists higher tolls to drive on freeways during congested times. A transponder attached to a vehicle records the time of day it is on the highway. A monthly bill sent to the vehicle’s owner reflects the differential tolls. Singapore makes the most elaborate use of “smart” highway technology to minimize congestion. Every vehicle has a transponder that records tolls. To drive downtown during rush hour, a motorist must buy a license and demonstrate ownership of a parking

space. The government limits the number of licenses and charges high tolls to drive downtown. Motorists must pay an £8 (\$12) Congestion Charge to drive into Central London between 7 A.M. and 6.30 P.M. Monday through Friday (Figure 13-27). A similar system exists in Stockholm, where the charge varies depending on the time of day.

Future intelligent transportation systems are likely to increase capacity through hands-free driving. A motorist will drive to a freeway entrance, where the vehicle will be subjected to a thorough diagnostic (taking a half-second) to ensure that it has enough fuel and is in good operating condition. A menu offers a choice of predetermined destinations, such as “home” or “office,” or a destination can be programmed by hand.

A release will send the vehicle accelerating automatically on the entrance ramp onto the freeway. Sensors in the bumpers and fenders, attached to radar or GPS, alert vehicle systems to accelerate, brake, or steer as needed. Spacing between vehicles can be as little as 2 meters.

While the vehicle is automatically controlled, the “driver” swivels the seat to a workstation to make phone calls, check e-mail, surf the Internet, or write letters. Or the driver can read, watch television, or nap.

When the vehicle nears the programmed freeway exit, a tone warns that the driver will have to take back control. The vehicle is halted on the exit ramp until the driver firmly presses the brake to release the “autodrive” system, much as cruise control is currently disengaged. ■



FIGURE 13-27 London Congestion Charge. The sign warns motorists that they are approaching the Congestion Zone. A charge of £8 is levied for driving a private vehicle into central London.

multistory parking structures can reduce the amount of ground-level space needed. European and Japanese cities have been especially disrupted by attempts to insert new roads and parking areas in or near the medieval central areas.

Technological improvements may help congestion (see Global Forces, Local Impacts box). In general, traffic flow can be improved by increasing the capacity of the roads or reducing demand to drive on them.

Public Transit

Because few people live within walking distance of their place of employment, urban areas are characterized by extensive commuting. The heaviest flow of commuters is into the CBD in the morning and out of it in the evening.

The intense concentration of people in the CBD during working hours strains transportation systems because a large number of people must reach a small area of land at the same time in the morning and disperse at the same time in the afternoon. As much as 40 percent of all trips made into or out of a CBD occur during four hours of the day—two in the morning and two in the afternoon. **Rush hour**, or peak hour, is the four consecutive 15-minute periods that have the heaviest traffic.

ADVANTAGES OF PUBLIC TRANSIT. In larger cities, public transit is better suited than motor vehicles to moving large numbers of people, because each transit traveler takes up far less space. Public transportation is cheaper, less polluting, and more energy efficient than the automobile. It also is particularly suited to rapidly bringing a large number of people into a small area. A bus can accommodate 30 people in the amount of space occupied by one automobile, whereas a double-track rapid transit line can transport the same number of people as 16 lanes of urban freeway.

Motor vehicles have costs beyond their purchase and operation: delays imposed on others, increased need for highway maintenance, construction of new highways, and pollution. One-third of the high-priced central land is devoted to streets and parking lots, although multistory and underground garages also are constructed.

In most cities around the world, extensive networks of bus, tram, and subway lines have been maintained, and funds for new construction have been provided in recent years (Figure 13-28). Since the late 1960s, London has opened 50 kilometers (35 miles) of subways, including two new lines, plus 25 kilometers (15 miles) in light-rail transit lines to serve the docklands area, which has been transformed from industrial to residential and office use. During the same period, Paris has added 400 kilometers (250 miles) of new subway lines, primarily in a new system known as the Réseau Express Régional (R.E.R.) to serve outer suburbs.

Smaller cities have shared the construction boom. In France alone, new subway lines have been built since the 1970s in Lille, Lyon, and Marseille, and hundreds of kilometers of entirely new tracks have been laid between the country's major cities to operate a high-speed train known as the TGV (Train à Grande Vitesse). Growth in the suburbs has stimulated nonresidential construction, including suburban shops, industry, and offices.

PUBLIC TRANSIT IN THE UNITED STATES. In the United States, public transit is used primarily for rush-hour commuting by workers into and out of the CBD. One-half of trips to work are by public transit in New York, one-third in Boston, San Francisco, and Washington, and one-fourth in Chicago and Philadelphia.

But in other cities, public transit service is minimal or nonexistent. Despite the obvious advantages of public transportation

for commuting, only 5 percent of work trips are by public transit in the United States. Overall, public transit ridership in the United States declined from 23 billion per year in the 1940s to 10 billion in 2006. The average American loses 36 hours per year sitting in traffic jams and wastes 55 gallons of gasoline. In the United States, the total cost of congestion is valued at more than \$87 billion per year. But most Americans still prefer to commute by vehicle. Most people overlook these costs because they place higher value on the car's privacy and flexibility of schedule.

Early in the twentieth century, U.S. cities had 50,000 kilometers (30,000 miles) of street railways and trolleys that carried 14 billion passengers a year, but only a few hundred kilometers of track remain. The number of U.S. and Canadian cities with trolley service declined from approximately fifty in 1950 to eight in the 1960s. General Motors acquired many of the privately owned streetcar companies and replaced the trolleys with buses that the company made. Buses offer a more flexible service than do trolleys because they are not restricted to fixed tracks. However, bus ridership in the United States declined from a peak of 11 billion riders annually in the late 1940s to 6 billion in 2006. Commuter railroad service, like trolleys and buses, has also been drastically reduced in most U.S. cities.

The one exception to the downward trend in public transit in the United States is rapid transit. It is known to transportation planners as either fixed heavy rail (such as subways) or fixed light rail (such as streetcars). Cities such as Boston and Chicago have attracted new passengers through construction of new subway lines and modernization of existing service. Chicago has been a pioneer in the construction of heavy-rail rapid transit lines in the median strips of expressways. Entirely new subway systems have been built in recent years in U.S. cities, including Atlanta, Baltimore, Miami, San Francisco, and Washington.

The federal government has permitted Boston, New York, and other cities to use funds originally allocated for interstate highways to modernize rapid transit service instead. New York's subway cars, once covered with graffiti spray-painted by gang members, have been cleaned so that passengers can ride in a more hospitable environment. As a result of these improvements, subway ridership in the United States increased from 2 billion in 1995 to 3 billion in 2006.

The trolley—now known by the more elegant term of fixed light-rail transit—is making a modest comeback in North America. Once relegated almost exclusively to a tourist attraction in New Orleans and San Francisco, new trolley lines have been built or are under construction in Baltimore, Buffalo, Calgary, Edmonton, Los Angeles, Portland (Oregon), Sacramento, St. Louis, San Diego, and San Jose. Ridership in all cities combined was 400 million in 2006.

California, the state that most symbolizes the automobile-oriented American culture, is the leader in construction of new fixed light-rail transit lines. San Diego has added more kilometers than any other city. One line that runs from the center south to the Mexican border has been irreverently dubbed the "Tijuana trolley" because it is heavily used by residents of nearby Tijuana, Mexico. Los Angeles—the city perhaps most associated with the motor vehicle—has planned the most

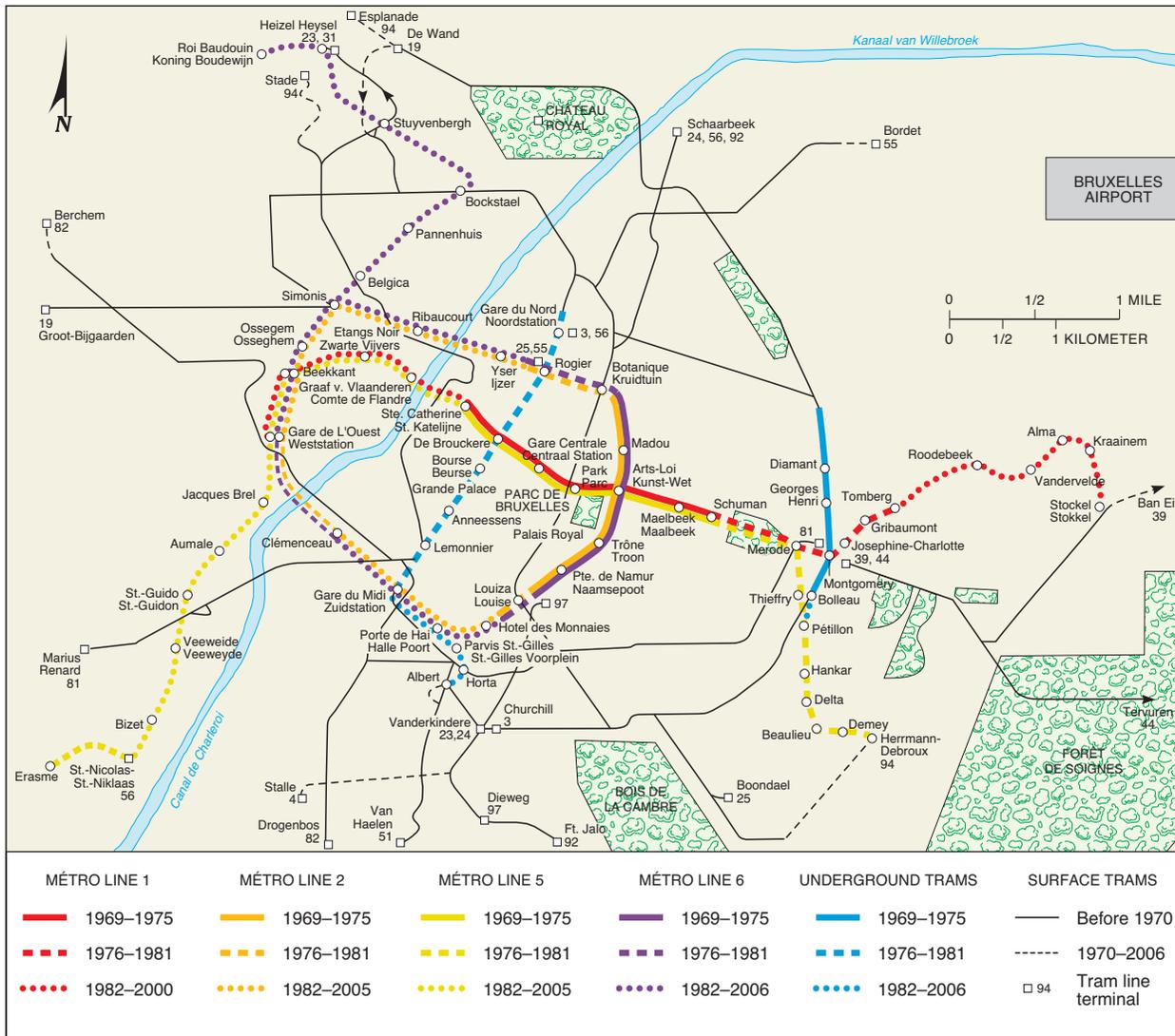


FIGURE 13-28 Brussels, Belgium, subway and tram lines. European cities such as Brussels have invested substantially to improve public transportation in recent years. Brussels provides a good example of a public transport system that integrates heavy rail (Métro) with light rail (trams). Trams initially used Métro tunnels, but the tunnels were large enough to convert to heavy-rail lines as funds became available.

extensive new light-rail system. The city had a rail network exceeding 1,600 kilometers (1,000 miles) as recently as the late 1940s, but the lines were abandoned when freeways were built to accommodate increasing automobile usage. Now Los Angeles wants to entice motorists out of their cars and trucks with new light-rail lines, but construction is very expensive and the lines serve only a tiny percentage of the region.

The minimal level of public transit service in most U.S. cities means that low-income people may not be able to reach places of employment. Low-income people tend to live in inner-city neighborhoods, but the job opportunities, especially those requiring minimal training and skill in personal services, are in suburban areas not well served by public transportation. Inner-city

neighborhoods have high unemployment rates at the same time that suburban firms have difficulty attracting workers. In some cities, governments and employers subsidize vans to carry low-income inner-city residents to suburban jobs.

Despite modest recent successes, public transit in the United States is caught in a vicious circle, because fares do not cover operating costs. As patronage declines and expenses rise, the fares are increased, which drives away passengers and leads to service reduction and still higher fares. Public expenditures to subsidize construction and operating costs have increased, but the United States does not fully recognize that public transportation is a vital utility deserving of subsidy to the degree long assumed by European governments.