Chapter 3

How Does Our System Function Today?

This chapter describes the Nation's surface transportation system, one of the engineering marvels of the modern world. This network of highways, transit routes, railroads, and waterways moves massive numbers of people and goods, and was key to the Nation's economic superiority in the late Twentieth Century.

The concept of intermodalism refers to the relationship between different modes of transportation, particularly the use of multiple forms of transportation to reach one destination. The Intermodal Surface Transportation Efficiency Act of 1991 committed the Federal government to developing a more intermodal transportation network. By improving the links between modes, policymakers hoped to more efficiently move people and goods.

The United States has an extraordinarily interconnected transportation system. In fact, problems like congestion would be far greater without the multiple travel options offered by this system. Traffic on the Nation's highways—particularly in metropolitan areas—would have been substantially worse if transit had not experienced recent ridership growth. Between 1996 and 2006, the Passenger Miles Traveled on the Nation's transit networks increased by 2.4 percent annually, climbing from 39 billion to nearly 50 billion. In 2006, this equated to more than 10 billion trips taken by transit. In the Northeastern United States, one of the densest regions of the country, high-speed rail service has played an increasingly important role as an alternative to both air and auto travel.

Another example of the complementary nature of the country's transportation modes is the way freight is moved across the country. Containers from container ships are loaded onto railcars (or drayed by trucks to trains) and then moved by rail to inland distribution points, where they are transferred to trucks for transport to their final destinations. In 2004, private rail networks moved more than 1.7 trillion ton-miles of commodities. Trucks moved another 1.3 trillion ton-miles of freight, and the Nation's domestic waterways transported 684 billion ton-miles of goods. Highway congestion would be far worse without these alternative systems that move the Nation's goods.

Today's surface transportation network is diverse and decentralized, spread out over the vast geography of the United States. The system has proven resilient to growing demand over the past few decades, but the Commission is greatly concerned about its long-term strength and sustainability. The Commission is particularly concerned about five key challenges that threaten to overwhelm the Nation's transportation network:

- Many highways, transit lines, railroads, and waterways are old and deteriorating, buckling under levels of traffic that were unforeseen by the engineers who designed them.
- Congestion—once limited to just the big coastal cities—now affects communities in every region of the country.
- Despite four decades of efforts to improve public safety, the Nation's surface transportation system—particularly its highways—is far too dangerous.
- The Nation's transportation network is too dependent on petroleum, a finite resource largely imported from other parts of the world. The transportation sector's energy use has greatly harmed the world's environment.
- The Nation's population is expected to swell to 420 million residents by 2050. Without proper planning, this growth could overwhelm the Nation's infrastructure and damage its environment.

The Elements of the Nation's Surface Transportation System

The United States has one of the most extensive surface transportation networks in the world. Its highways, transit networks, railroads, ports, and waterways supplement and interact with one another. These different modes of transportation should not be thought of separately, but as parts of a system that can meet the Nation's needs.

Highways

Highways form the backbone of the Nation's transportation system, connecting every State and region of the country. The extensiveness and vitality of this highway network helped position the United States as one of the world's superpowers.

Traditionally, roads in the United States have been built, owned, and maintained by the public sector. The effectiveness of the country's highway system, however, depends greatly on interaction with the private sector. Most vehicles that use the Nation's highway network are owned by private individuals or companies. This interaction contrasts with the Nation's transit infrastructure, which is generally provided by public agencies, and with freight railroads, where infrastructure and vehicles are owned by private companies.

Highways provide Americans with a high degree of personal mobility, allowing people to travel where and with whom they want. Unlike most forms of public transit, there are no set schedules as to when highways may be used. Highways are popular with many Americans because they represent convenience and freedom, although congestion and other problems have increasingly limited the mobility of this part of the transportation system.

Highways have improved the quality of life and economic well-being of many rural communities. As noted in Chapter 1, the Interstate Highway System opened up new markets in the rural United States, and linked many rural communities to distant cities. More needs to be done, however, to develop rural areas and link these communities through various transportation modes to jobs and markets. Some of the poorest communities are in rural America. As an example, a 2004 report by the Population Reference Bureau showed that 48 of the 50 counties with the highest child poverty rates are rural (Reports on America, Population Reference Bureau, Volume 4, No.1, March 2004).

Surveys conducted by the U.S. Department of Transportation prove the popularity of the country's highway system. The National Household Travel Survey includes detailed information on daily and long-distance trips, the use of household vehicles, and public attitudes about transportation issues. Every survey completed between 1969 and 2001 showed that highways were the overwhelming mode of choice for most Americans. In 2001, the year of the last survey, about 87 percent of daily trips involved the use of personal vehicles on the Nation's highway system.[1]

Highways are also a key conduit for freight movement in the United States. Trucks carried 60 percent of the 19 billion tons of goods shipped in 2002, and they made up about 70 percent of the value of all freight shipments. As described previously in Chapter 1, the American highway system has helped make goods convenient to households and businesses in every corner of the Nation.

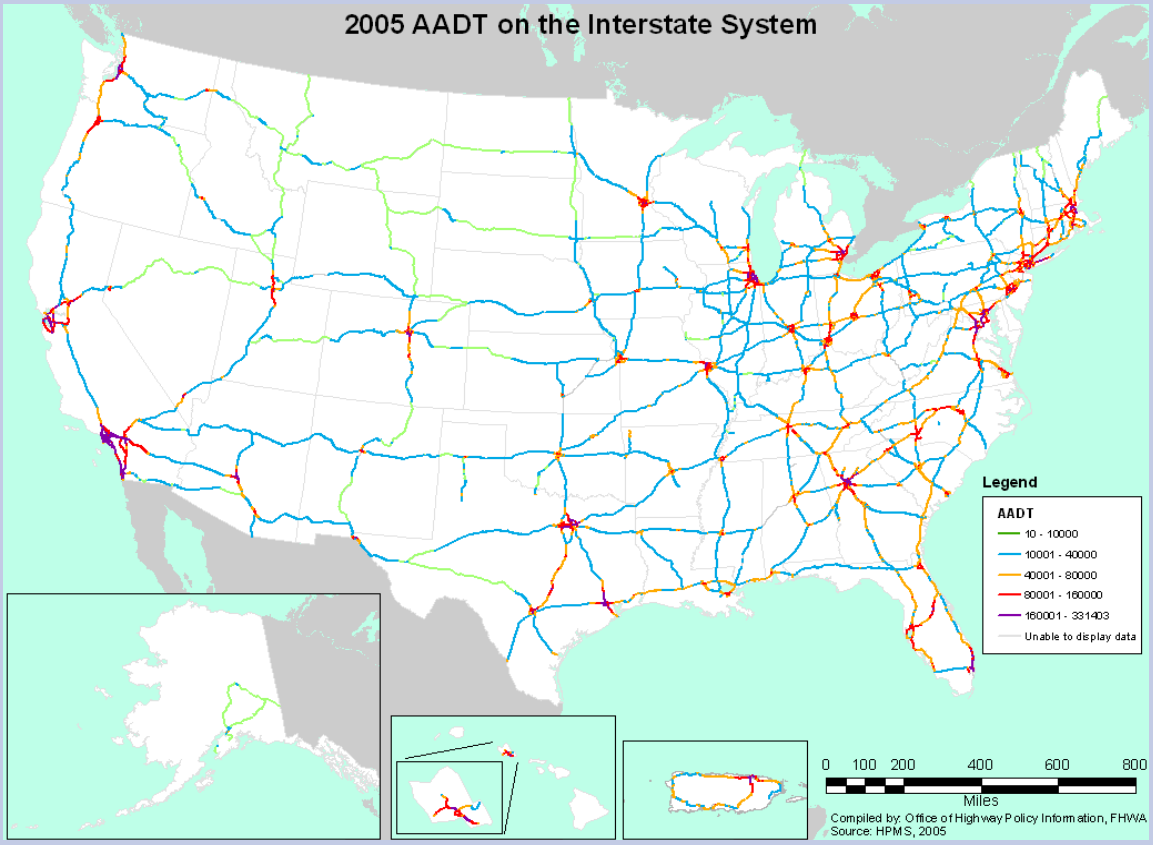
The Federal-Aid Highway Act of 1956 laid the foundation for the modern highway system. This legislation established a system in which the Federal government provides financing for Interstates, but the States construct and maintain these higher-order roads. The Nation's highway system reflects this tradition of decentralized ownership. While Interstates carry much of the Nation's traffic, they only made up slightly more than one percent of all road mileage in the United States in 2004 (see Exhibit 3-1). About 69 percent of road mileage consists of local routes, the lowest order of the Federal Highway Administration functional classifications.

The American highway system also reflects the country's vast geography and widespread population. A 1996 study for an American automobile magazine found that no point in the 48 contiguous States is more than 30 miles from a dwelling or paved highway. In 2004, about 75 percent of the 4 million miles of public roads in the United States were in rural areas (those with fewer than 5,000 residents). Another 20 percent of road miles were in urbanized areas with 50,000 or more people. The remaining miles lay within small urban areas with populations between 5,000 and 50,000 people.[2]

"We must integrate highway planning and funding into a broader focus for our entire transportation network…The integration of highway, transit rail, waterway, and aviation planning is essential if we're going to meet the demographic needs and development needs of the future."
– Gerald Nicely, Tennessee Commissioner of Transportation, at the Commission's Memphis field hearing.

There were 594,101 bridges in the United States in 2004. The "typical" bridge in the United States serves a local road in a rural community. About

Exhibit 3-1. Average daily traffic volumes on the Interstate Highway System



The map shows average daily traffic volumes on the Interstate Highway System. High traffic volume routes are concentrated in and around major cities, while traffic volumes in rural areas are much lower.

Source: Highway Performance Monitoring System

77 percent of the Nation's bridges in 2004 were in rural areas, while the remaining 23 percent were in urban communities.[3]

Public Transit

Public transit takes on many forms. Electrified urban railways are generally classified as either heavy rail (multiple car trains operating on exclusive, separated right of way) or light rail (smaller trains with operations at grade or in right of way shared with cars and pedestrians). Commuter rail lines operate with diesel or electric locomotives over tracks shared with freight rail or intercity passenger rail, connecting suburban residents with central city employment centers. Exhibit 3-2 shows the current extent of urban rail transit systems in the United States; systems in additional cities are also being developed. Other transit modes, including buses, demand response (also called paratransit), and vanpools, provide service across a broader area and operate over streets and highways shared with private vehicles (although exclusive busways are being developed in some cities).

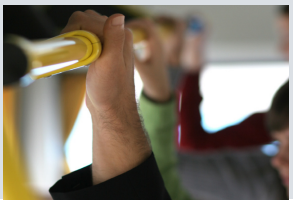
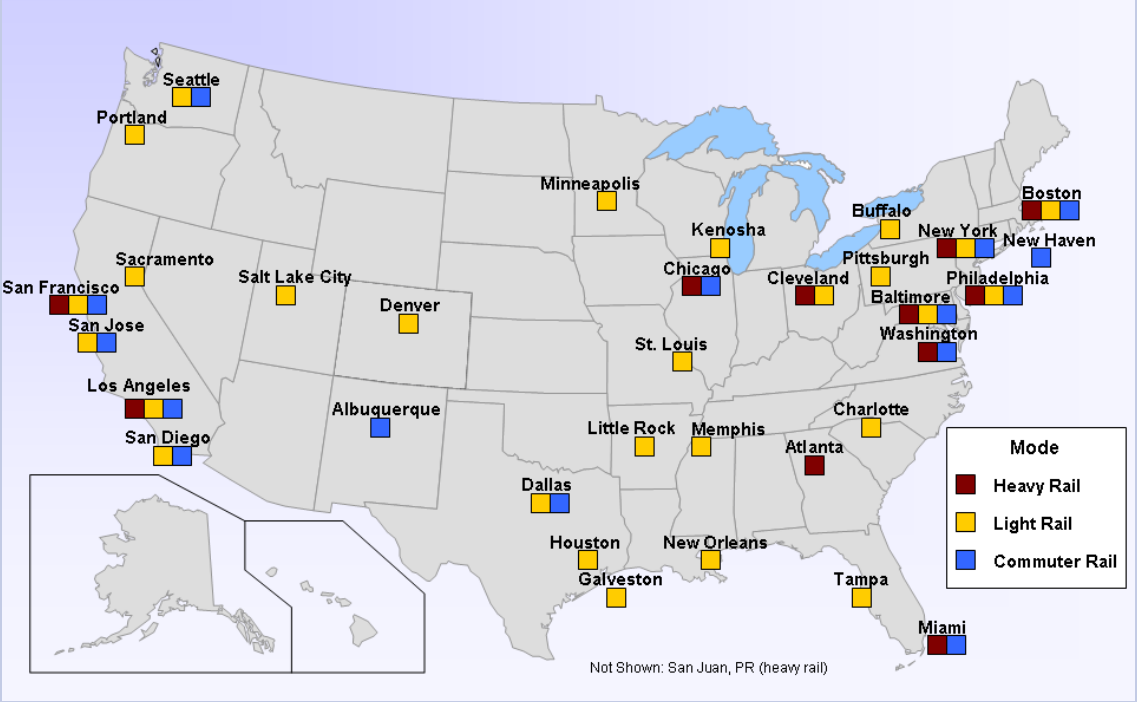


Exhibit 3-2. Cities with rail transit systems in 2007

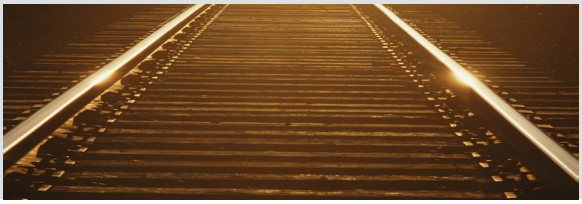


The map shows rail transit systems, including heavy rail, light rail, and commuter rail, in cities both large and small throughout the United States.

Source: National Transit Database

Transit is an essential element of the Nation's transportation network, providing basic mobility for people who do not own cars. The 2001 National Household Travel Survey found that 43 percent of the Nation's transit riders live in households with yearly incomes of less than $20,000, and that 44 percent come from households without cars. Transit use is not, however, limited to those who cannot afford private vehicles.[4] Many riders come from households that own cars, but these riders choose to use public transit because it is often more convenient and less expensive than highway transportation. Just as an adequate highway network provides mobility for people who prefer a suburban or rural lifestyle, a high-quality transit system does the same for people who opt to live in a dense, urban environment.

Transit is critical to the Nation's productivity and economic development. Businesses and governments depend on transit to move large numbers of people during peak periods. Transit greatly reduces the number of motorists on the Nation's highways, lessening the impact of congestion. Transit also plays an important role in the development of new communities. Corridors with well-functioning transit systems often attract restaurants, office buildings, and retail establishments.



Like highway infrastructure, the Nation's transit network is not a Federal asset, but is overwhelmingly owned and operated by local governments. Only five States directly own and operate transit systems. Each government has its own method for planning, building, maintaining, operating, and reporting on the components it owns. This gives governments great flexibility, but makes it difficult to coordinate action for objectives beyond individual State and local jurisdictions.

The Nation's transit infrastructure is extensive. Bus and demand response systems serve residents in 359 of the total 465 urbanized areas in the United States. Rail transit systems serve residents in 34 American cities. The Nation's transit infrastructure, however, is not limited to urban communities.[5] A mix of fixed route bus systems and demand response systems serve many rural communities, providing critical services to residents, especially persons with disabilities, senior citizens, and low income individuals. There are also 1,215 transit systems providing basic mobility services to residents in rural or small urban areas.

In 2004, transit agencies in urban areas operated more than 120,000 vehicles. Rail systems included nearly 11,000 miles of track and nearly 3,000 stations. There were close to 800 bus and rail maintenance facilities in urban areas. In rural communities, according to the most recent survey of operators in 2000, there were over 19,000 transit vehicles in service.[6]

Intercity Passenger Rail

Intercity passenger rail was a crucial factor in the settlement and economic development of the United States. It was the primary means of mid- and long-distance transportation from the mid-1800s until the early 1950s. It provided a vital connection between the East and West coasts, opened the Western and Central United States to settlement, and was important to the military in transporting troops and supplies.

Most trains during this early time period carried both passengers and freight. Trains provided faster, more reliable, and safer transportation than previous modes. They allowed heavier goods and more people to be transported over longer distances, and they contributed to the Nation's economic and military strength.

Many large and small cities were served at one time by more than one railroad, each with its own station. Some cities developed union stations, bringing two or more railroads under one roof and efficiently serving many passenger train routings. Since the middle of the Twentieth Century, the use of this infrastructure for passenger rail has slowly diminished. In the 1970s, all passenger service was consolidated under Amtrak. Passenger route-miles were rationalized and reduced due to significant unprofitability. Several factors have contributed to this trend, including the rapid expansion of low-cost air travel and the encroachment of urban development.

Today, the Alaska Railroad and Amtrak operate a national passenger rail network of long-distance and corridor trains, serving more than 500 stations in 47 states over 21,000 route-miles. Exhibit 3-3 provides a map of this system. All passenger lines in the United States are joint-use with freight operations. Most intercity passenger rail is operated over privately owned freight rail networks. Amtrak's Northeast Corridor and several State-owned intercity passenger rail corridors also have freight use.

Some intercity passenger trains can reach speeds of at least 110 miles per hour. For this reason, rail

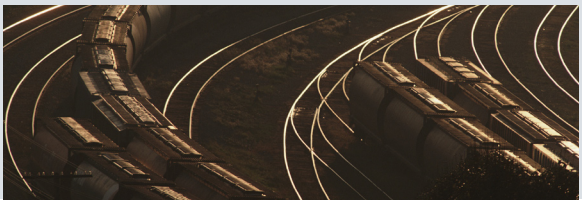


Exhibit 3-3. Existing intercity passenger rail network

Background map based on *America 2050: A Prospectus,* www.america2050.org, Regional Plan Association

The map shows the current intercity passenger rail network in the United States, which connects our major population centers.

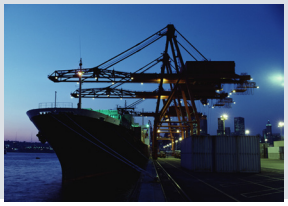
Source: Amtrak

has proven an increasingly popular alternative to highway and air travel, particularly in congested parts of the country. Intercity passenger rail also offers direct access to downtown stations and a degree of convenience and comfort not found in other transportation modes. The price of intercity passenger rail travel, however, limits who can access this form of transportation. Furthermore, the joint-use element of passenger rail on freight networks can make meeting on-time performance metrics a challenge, since passenger rail pays only the incremental costs of operating on freight networks, very few other capital costs, and none of the expansion costs for investments needed to handle passenger rail.

Freight Rail

The Nation's freight rail networks—with more than 140,810 miles of track—move more than 2.2 billion tons of commodities every year. The seven large Class I railroads—the backbone of the Nation's private rail system—accounted for 95,664 miles, about 68 percent of total mileage. About 52,340 miles are considered by the Class I railroads to be in primary corridors. Exhibit 3-4 illustrates the extent of the country's freight rail system.

Exhibit 3-5 shows the number of passenger and freight trains that operate over the national freight



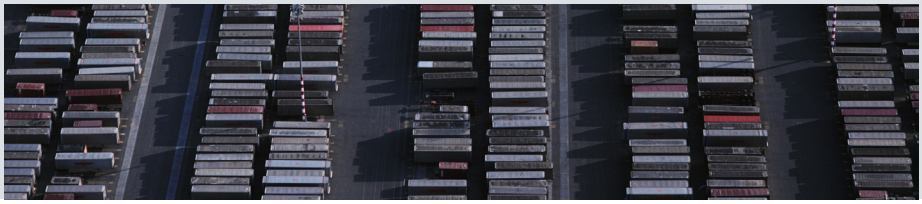
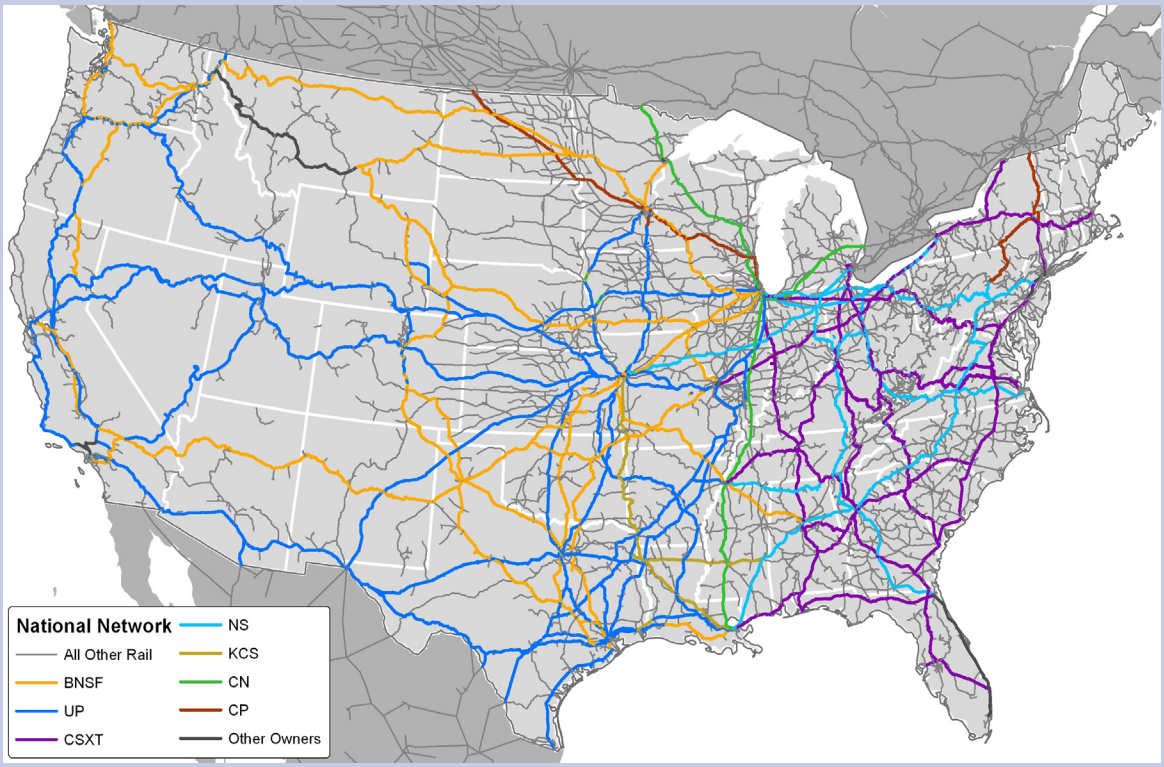


Exhibit 3-4. The U.S. freight rail network



The map shows the freight rail network in the United States, including routes operated by both the major carriers and smaller railroads.

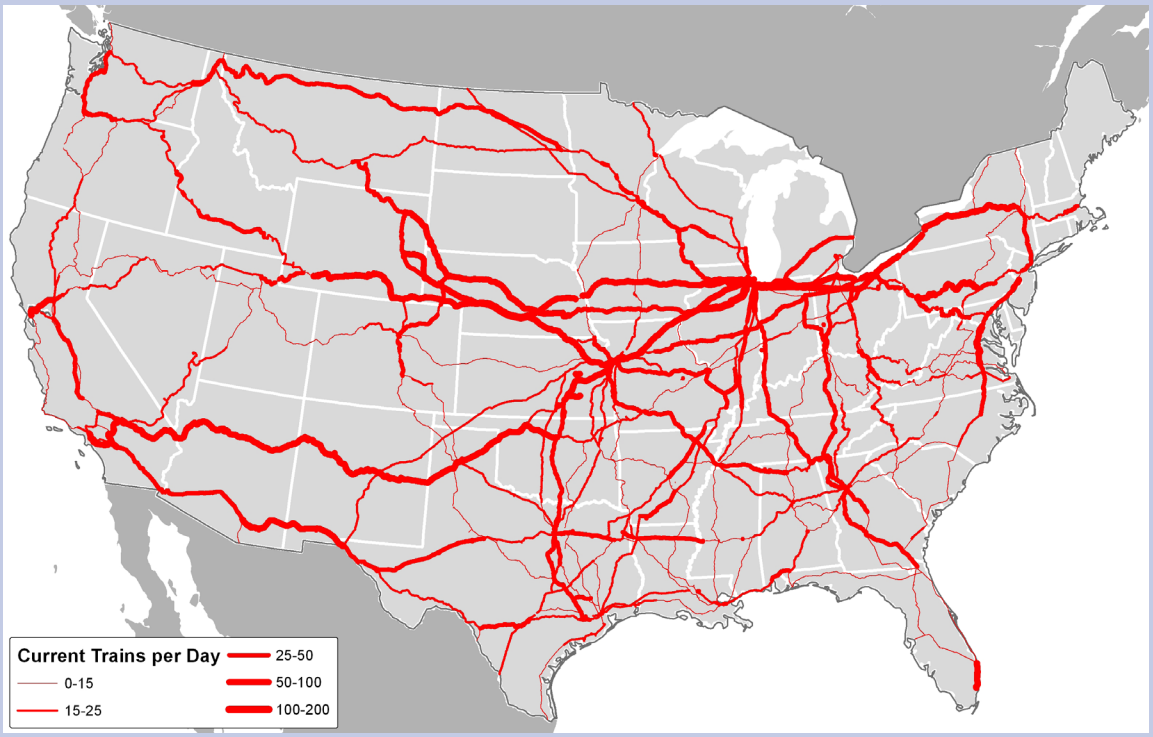
Source: Association of American Railroads

rail network. The total number of trains that operate on the national network ranges from 200 trains to none per day on each of the freight rail corridors.

Ports and Waterways

As described in Chapter 1, one of the most important functions of the surface transportation network is to strengthen the Nation's economic relationship with the rest of the world. The Nation's ports and waterways link the United States to the majority of its international commerce. About 95 percent of the country's overseas foreign trade is moved by ship. One way or another, this cargo moves on the Nation's

Exhibit 3-5. Train traffic on the U.S. freight rail network



The map shows average daily freight and passenger train traffic on routes operated by major freight railroads in the United States.

Source: Association of American Railroads

highways or railroads, either as goods to be exported or imports arriving for distribution in the United States.

According to the American Association of Port Authorities, there are 360 American sea and river ports. This number includes facilities along the Great Lakes and the Atlantic, Gulf, and Pacific Coasts of the continental United States, as well as Alaska, Hawaii, Puerto Rico, Guam, and the U.S. Virgin Islands. There are 150 public agencies that manage parts of these ports, some with broader powers than simply maritime transportation. Port authorities, for example, may have jurisdiction over airports, bridges, tunnels, transit networks, investment zones, and economic development districts. The Nation's publicly owned port facilities are complemented by thousands of private terminals that process and distribute goods.

In addition to the Nation's ports, there is an extensive system of inland and intracoastal waterways that transports materials throughout the United States. The dominant form of is the towboat, which pushes a series of barges. On smaller waterways, a tow may consist of 15 barges, while it is not uncommon for a tow on larger passages to include over 40 barges.

The Great Lakes St. Lawrence Seaway System, also known as "America's Fourth Seacoast," is a vital waterborne transportation link for moving goods between the heartland of North America and international markets. The Seaway System, a binational waterway operated jointly by the U.S. and Canada, encompasses the St. Lawrence River and the five Great Lakes, and extends 2,300 miles from the Gulf of the St. Lawrence at the Atlantic Ocean to the Western end of Lake Superior at the twin ports of Duluth, Minnesota, and Superior, Wisconsin.

For nearly 50 years, the binational St. Lawrence Seaway has served as a transportation corridor for the international movement of bulk and general cargoes such as steel, iron ore, grain, and coal, serving a North American region that makes up one quarter of the U.S. population and nearly half of the Canadian population. Maritime commerce on the Great Lakes Seaway System annually sustains more than 150,000 U.S. jobs, $4.3 billion in personal income, $3.4 billion in transportation-related business revenue, and $1.3 billion in federal, state, and local taxes.

The binational waterway is expected to become an even more important commercial transportation route over the next decade as the U.S. and Canadian governments seek ways to ease highway and rail congestion, especially along North America's East and West Coasts and Midwest region. In the past few years, the St. Lawrence Seaway has enjoyed significant growth in new business as the waterway has become a viable alternative for shippers looking to avoid port, highway, and rail congestion. Each Seaway maximum size vessel carries roughly 25,000 metric tons, the equivalent of 870 semi-trucks. As congestion-related initiatives such as Short Sea Shipping continue to develop, the St. Lawrence Seaway will further improve its position as a competitive alternative for shipments to and from the Midwest. Recent forecasts show a doubling of containerized traffic carried by all modes in the U.S./Canadian Great Lakes St. Lawrence Seaway region from 35 million forty-foot equivalent units (FEUs) to 70 million FEUs by 2050.

According to the U.S. Army Corps of Engineers, there are over 12,000 miles of inland and intracoastal waterways in the United States. Exhibit 3-6 describes this network. Most of these are located in the eastern United States, including the Gulf Coast, the Mississippi and Ohio River Valleys, and the American portion of the Saint Lawrence Seaway. This system includes 191 commercially active lock sites and 237 lock chambers. These locks allow tows to "stair-step" their way through the waterway network and reach distant inland ports. In addition to the locks, the inland and intracoastal waterway system also includes 1,000 harbor channels and 3,700 passenger and cargo terminals.

Challenges Facing the Nation's Infrastructure

The Nation faces serious challenges that threaten the quality and integrity of its surface transportation network. Harmful trends are

"Transportation in this country is breaking down. We talk about a crisis in the future. We're there now."

– Gerald Shaheen, Group President of Caterpillar, Inc., and Chairman of the Board for the U.S. Chamber of Commerce, at the Commission's New York field hearing.

Exhibit 3-6. The inland waterway system in the United States

The map shows that the inland waterway system of the United States primarily includes the Mississippi River and its tributaries, as well as intracoastal waterways along the Gulf and Atlantic seaboards.

Source: U.S. Army Corps of Engineers

already impacting families, businesses, and communities in countless ways. Left unchecked, they will continue to erode the transportation system and undermine the basic foundations of our economy.

Age and Deterioration

One of the greatest threats to the Nation's surface transportation network is the deterioration that comes naturally from age and use. Many highways, bridges, transit lines, and railroad lines are buckling under levels of traffic that were unforeseen by the engineers who designed them. Weather, air pollution, and the corrosive impact of road salt have caused decay throughout much of the transportation network.

Other problems are caused by what is below the surface transportation network, including water pipes and other utility conduits. Many of the Nation's water systems were built during periods when cities grew the fastest: at the end of the Nineteenth Century, in the 1920s,

and after the Second World War. The U.S. Environmental Protection Agency estimates that unless cities invest more in water and sewer system improvement, almost half of the Nation's underground pipes will be in poor, very poor, or "life elapsed" status by 2020. As these aging pipes burst, they create sinkholes in the roads above them that are sometimes so large they swallow whole cars.

Throughout the United States, agencies are working to repair and upgrade the Nation's aging transportation infrastructure. There are many success stories, such as advancements that have greatly improved pavement quality and extended the lives of the Nation's highways and bridges. The Commission concludes, however, that much more must be done to upgrade the Nation's entire transportation network to acceptable conditions. Despite some hopeful signs, the Commission is greatly concerned about the age and deterioration of the Nation's roads, bridges, railroads, transit systems, ports and waterways.

Much of the Nation's highway network was built before the Second World War and during the construction of the Interstate System. The most heavily used bridges in the U.S., those on the Interstate System, were built during the early years of the Federal-Aid Highway Program. According to the National Bridge Inventory, about 17 percent were built during the 1950s, 44 percent were constructed during the 1960s, and 20 percent were erected in the 1970s.

Today, 13 percent of all bridges in the U.S. are structurally deficient, which means they need significant maintenance, rehabilitation, or replacement. Another 14 percent are functionally obsolete, which means they do not have the lane widths, shoulder widths, or vertical clearances adequate to serve traffic demand. Meanwhile, about one of every seven miles traveled on the Nation's roads (or 15.1 percent) is on pavement ranked "not acceptable" by the Highway Performance Monitoring System.

Over the past decade, transportation officials have made a special effort to reverse some of the effects of age and deterioration on the Nation's bridges—with some hopeful results. The percentage of structurally deficient bridges fell from 13.7 percent in 2002 to 13.1 percent in 2004. The percentage of functionally obsolete bridges during this same period dropped very slightly, from 13.8 percent to 13.6 percent. Similarly, the condition of the Nation's highways—as measured by surface roughness—slightly improved between 1995 and 2004. In 2004, about 44.2 percent of travel on arterials and collectors for which data was available occurred on pavements with "good" or better ride quality. This was up from about 39.8 percent in 1995. Still, the overall quality of the Nation's highways and bridges concerns civil engineers and policymakers throughout the U.S. Without the strategies outlined in Volume I of this report, the Commission concludes that demographic and economic changes and inadequate investment are likely to reverse the improvements made to the Nation's surface transportation infrastructure in recent years.

The Nation's transit infrastructure is also impacted by age and deterioration. Almost one-third of urban bus maintenance facilities—31 percent—were in an unacceptable condition in 2004. The estimated average condition of the urban bus fleet that year was 3.08, which corresponds to a rating of "fair" on a scale of 1 to 5. In 2004, 51 percent of urban rail passenger stations were rated as substandard. The average condition of a rail vehicle condition was 3.50, or "fair," on a scale of 1 to 5. Eight percent of rail transit track was found to be in a substandard or poor condition. The average age of a rail transit vehicle was 20 years in 2004, according to the National Transit Database.

WHAT CAUSES CONGESTION?

"In a word, 'you.' Most of the Mojave Desert is not congested. But the rural portions also support very few jobs, have hardly any schools, and provide a very small contribution to the nation's economic production. The 100 largest metropolitan regions, on the other hand, contribute 70 percent of the Gross Domestic Product and have 69 percent of the jobs. It is not surprising that congestion exists in large areas given the number of people and the amount of freight moving in many directions over the course of two peak periods of two or three hours each...

The second cause is the slow growth in supply—both roads and public transportation over the last 20 years. Congestion has increased even though there are more roads and more transit service…

A third factor causes many trips to be delayed by events that are irregular, but frequent. Crashes, vehicle breakdowns, improperly timed traffic signals, events, and weather are factors that cause a variety of traffic congestion problems."

-From the Texas Transportation Institute's *2007 Urban Mobility Report*

There is no national database for freight rail infrastructure comparable to the Highway Performance Monitoring System or the National Transit Database. The general consensus of the industry is that the overall physical condition of the Class I rail system is good, although there is a need to upgrade critical points of Class I infrastructure such as tunnels, mountain passes, and unstable alignments. Analysts believe that the condition of Class II and Class III lines varies from good to poor.

On the Nation's inland and intracoastal waterway system, many locks are simply too old to accommodate modern barge traffic. Older locks were designed to process 600 foot tows, while many tows today are twice that length. As a result, longer tows must be broken down into two or more segments and reassembled after passing through a lock.

Overall, the American Society of Civil Engineers gave the Nation's infrastructure—including its surface transportation network, dams, wastewater treatment facilities, and energy facilities—a grade of "D" in 2005.[7]

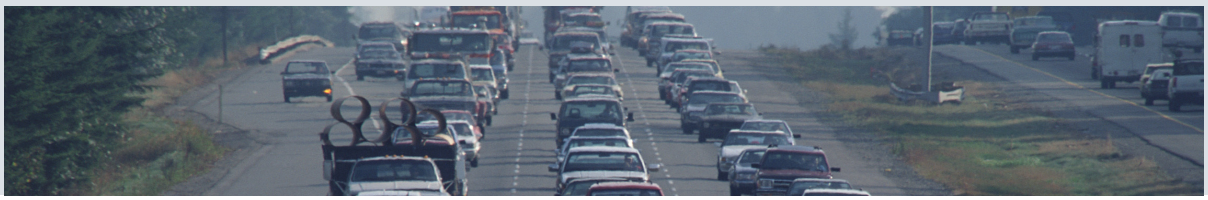
Crippling Levels of Congestion

Without a doubt, congestion is one of the greatest threats to the integrity of the Nation's transportation system and the country's overall vitality and quality of life. Over the past decade, congestion has reached alarming levels across the United States. Gridlock is becoming a shared experience for tens of millions of motorists every day, impacting communities across the country.

The planners who designed the country's modern transportation system likely never imagined the demands of the Twenty-First Century. All elements of the surface transportation network are overwhelmed by congestion in one form or another, although it is the Nation's highway system that is perhaps the most visible sign of this crisis.

In 2005, the Vehicle Miles Traveled (VMT) on the Nation's highways reached 3 trillion miles for the first time, five times the level experienced in 1955. Over the past decade alone, travel growth on the Nation's highways has averaged 2.2 percent annually. While most roads are in rural areas, most highway travel is in metropolitan communities. Nearly two-thirds of all travel is in large urban areas, while the remaining one-third is in rural areas.

Throughout the United States, our metropolitan areas have become traffic chokepoints, mired in gridlock that seems to worsen every year. The Texas Transportation Institute's 2007 Urban



Mobility Report lays out the problem in stark terms. In 1982, there was only one metropolitan region where the average traveler experienced 40 or more hours of delay per year—Los Angeles.[8] Today, that number has grown to 28 metropolitan areas in every corner of the Nation, as shown in Exhibit 3-7.

The effects of congestion are worst in the Nation's largest communities. In the 14 largest urban areas, annual delay rose from 21 hours per peak-period traveler in 1982 to 54 hours in 2005. Gridlock, however, is no longer just a "big city problem." The average traveler in an urban community, regardless of size, wasted 38 hours stuck in traffic in 2005, compared to 14 hours in 1982.[9] This means that motorists in metropolitan regions are wasting the equivalent of an entire workweek stuck in traffic. Americans in mid-sized communities are dealing with congestion that was once limited to the largest regions, and those in the largest communities are suffering through traffic jams that would have been unimaginable to many commuters a generation ago.

The effects of congestion are easy to understand on an individual scale—the loss of time a traveler might spend at work or at home, wasted gasoline, and added stress. On a National level, however, the impact is huge. According to the 2007 Urban Mobility Report, drivers in metropolitan areas in 2005 experienced 4.2 billion hours of delay, enough for 105 million weeks of vacation. Americans in these areas wasted 2.9 billion gallons of fuel, enough to fill 58 supertankers. The combined "congestion cost" was a staggering $78 billion.

Because of heavy congestion and rising fuel prices, the total logistics cost to American businesses—the expense of managing, moving, and storing goods—rose to 10 percent of Gross Domestic Product (GDP) in 2006. This followed a period in which the Nation's low cost of moving products help make the American economy one of the most productive in the world. The burden of congestion is particularly significant for the Nation's port operators and shippers, since most of the country's largest ports are located in already crowded urban areas.

Exhibit 3-7. Congested urban areas

In 1982, only Los Angeles experienced over 40 hours of delay per peak traveler. By 2005, 28 cities across the United States exceeded that threshold.

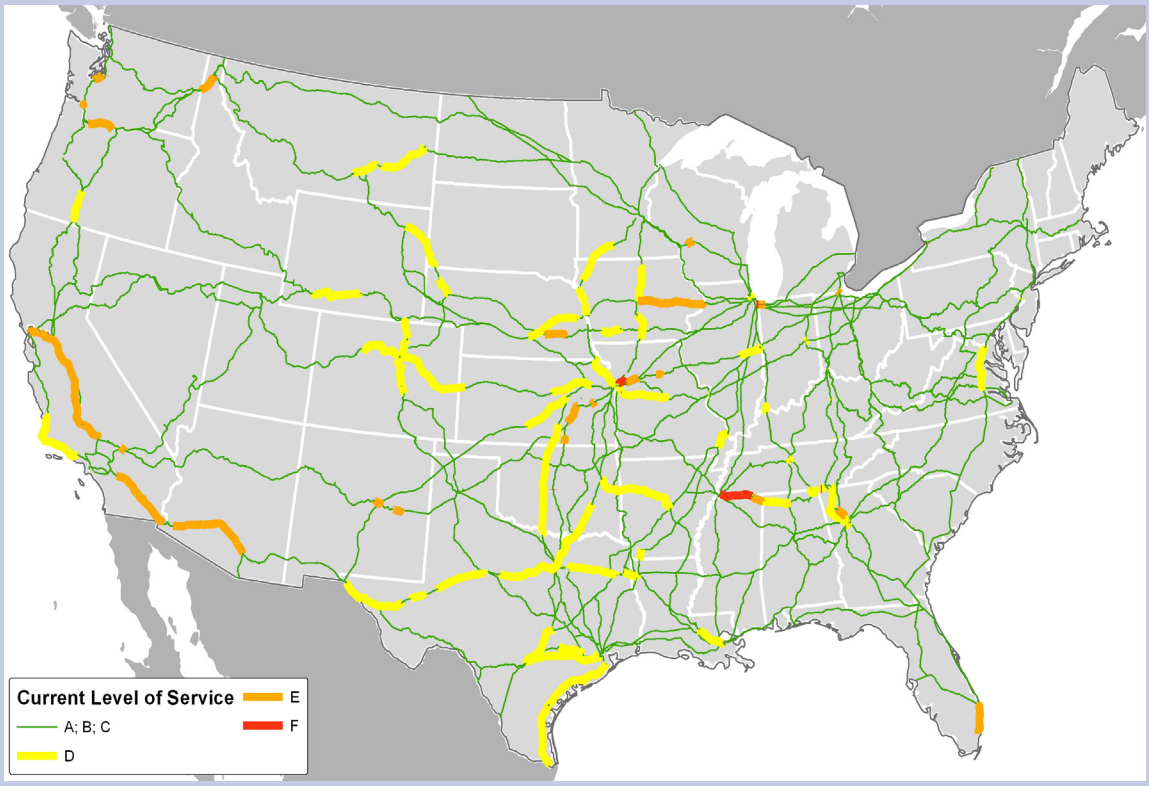
Source: Texas Transportation Institute

By contrast, the Nation's freight rail network is relatively uncongested at current volumes of cargo (see Exhibit 3-8). Eighty-eight percent of today's primary freight rail corridor mileage is operating below practical capacity (Levels of Service (LOS) A/B/C). About 12 percent is near or at practical capacity (LOS D/E), and less than 1 percent is operating above capacity (LOS F). Over the next three decades, however, growing volumes of cargo are expected to lead to a significant deterioration in LOS on the freight rail network.

Too Many Injuries and Deaths

When a train crashes or a bridge collapses, it gets national media attention. The day-to-day crashes that occur near our homes and work places are virtually invisible. The reason for this reduced focus may be understandable—the loss of a single life when a car leaves the roadway is less dramatic than the loss of 10 lives in a train accident. The cumulative toll caused by smaller incidents, however, is much more costly because of the larger number of car and truck crashes.

Exhibit 3-8. Levels of service on the U.S. freight rail network in 2006



The map shows levels of service (LOS) on major U.S. railroads. Rail corridors operating at LOS A, B, or C (shown in green) are below practical capacity. Corridors operating at LOS D (shown in yellow) are near practical capacity, and those operating at LOS E (shown in orange) are at practical capacity. The most severe congestion is on corridors at LOS F (shown in red), where traffic exceeds capacity.

Source: Association of American Railroads

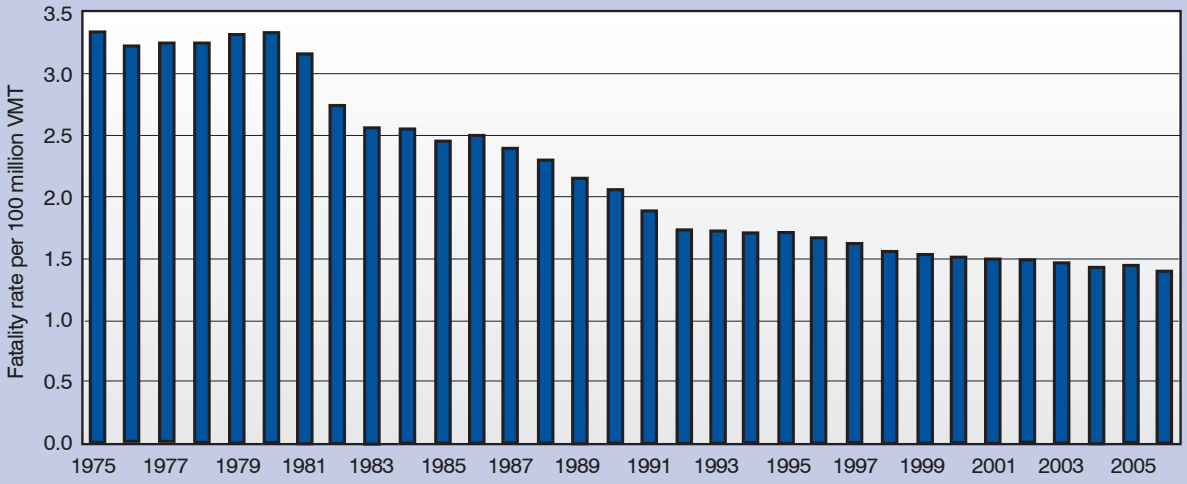
Because the Nation has devoted significant resources to making transportation systems safer, fatality and injury rates have greatly declined over the last several decades. While the Commission acknowledges this progress, it still views the carnage of over 40,000 annual deaths on our transportation networks as unacceptable. Transportation safety, particularly highway safety, must be raised to the highest level of national priorities.

Highways are the most dangerous way to travel, despite great progress in reducing crashes over the past half-century. The fatality rate dropped from 5.3 fatalities per 100 million VMT in 1965 to 1.7 fatalities per 100 million VMT in 1995. Since 1995, however, the rate of decrease has slowed, declining to 1.4 fatalities per 100 million VMT by 2006. Exhibit 3-9 describes this flattening trend.

In 2006, there were 42,642 fatalities and 2,575,000 injuries on the Nation's highways, many more than the number on all other modes of transportation combined (see Exhibit 3-10). The Nation's road system, in fact, accounts for 94 percent of the fatalities and 99 percent of the injuries that occur on the Nation's surface transportation network. The fact that highway travel accounts for such a high share of fatalities and injuries reflects many factors, not the least of which is that more than 99 percent of the miles traveled by vehicles carrying passengers takes place on the Nation's highway and road system (although transit and rail carry many more passengers than automobiles per vehicle-mile). In addition, commercial transportation services often operate in enclosed systems with professional operators.

The scope of this problem is enormous. The economic cost alone for motor vehicle crashes in 2000, both reported and unreported, was estimated to be $231 billion, equal to over two percent of the Nation's GDP. That includes lost

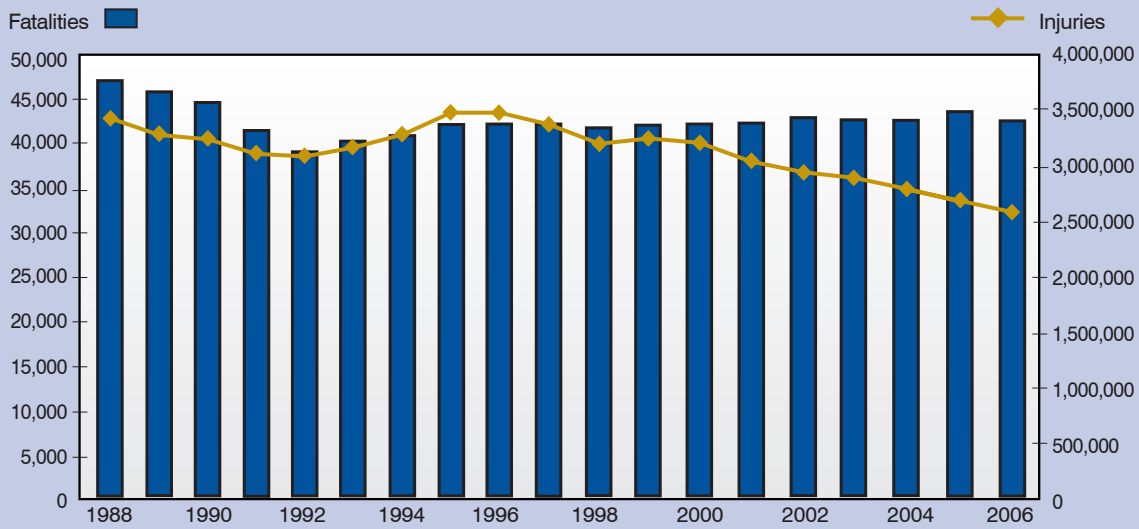
Exhibit 3-9. Highway fatality rates in the United States, 1975–2006



The chart shows that the highway fatality rate in the United States today is less than half what it was 30 years ago. Most of these gains, however, occurred in the 1980s; the rate has declined much more slowly since then.

Source: National Highway Traffic Safety Administration

Exhibit 3-10. Fatalities and injuries in motor vehicle crashes in the United States, 1988–2006



The chart indicates that total fatalities on highways in the United States have been relatively stable over the last two decades. The total number of injuries in motor vehicle crashes has steadily declined since peaking in the mid 1990s.

Source: National Highway Traffic Safety Administration

productivity, medical expenses, property damage, and crash-related highway delay. This value does not include the immense personal costs of loss of life and quality of life for crash victims and their families and friends.

The highest fatality rates in the United States are associated with roadway departure, rural roads, unbelted occupants, alcohol involvement, and speeding. An area of particular concern is motorcycle safety, where fatalities have risen sharply since the mid-1990s. By 2005, motorcycle fatalities more than doubled from their levels a decade before, while registrations rose roughly 50 percent and VMT remained virtually unchanged. This trend has been so pronounced that the increase in motorcycle fatalities has essentially offset the impact of higher belt use and improved vehicle safety.

On a per passenger-mile basis, transit is one of the safest forms of surface transportation. Transit safety has also improved in recent years, falling from a fatality rate of 13.6 per 100 million VMT in 1990 to 7.9 per 100 million VMT in 2004. Put another way, the absolute number of fatalities dropped from 339 lives in 1990 to 248 lives in 2004, and most of those in 2004 were not passengers. The National Safety Council estimates that riding a transit bus is 79 times safer per passenger mile than traveling by automobile. Transit rail passengers are 42 times safer than those traveling by car. Still, the 248 fatalities and 18,982 injuries that occurred on transit systems in 2004 remain a source of concern for Federal officials and transit operators. Security is also a critical concern, as recent acts of terrorism on European and Indian transit systems have demonstrated the vulnerability of these networks.

Safety has substantially improved on the Nation's freight rail network, although the number of deaths and injuries at rail crossings is still too

high. The railroad industry's overall safety record has significantly improved over the past several decades, and most safety trends are moving in the right direction. In 1975, rail-related fatalities totaled 1,492 nationally. That number had declined to 892 fatalities by 2005. About 97 percent of these deaths were at grade crossings or related to trespassing on railroad tracks. Trespassing is a major problem for the railroad industry and the Nation as a whole, accounting for two-thirds of all rail-related fatalities. Greater steps must be taken to limit access to railroad tracks and discourage trespassers from entering railroad facilities.

Transportation on the Nation's inland and coastal waterways has become increasingly safer. Excluding recreational boating, the safety of transportation on the Nation's inland and coastal waterways has improved significantly. Fatalities fell from 598 deaths in 1970 to 93 deaths in 2004. Recent accidents have involved tourist vessels rather than freight vessels, including the capsizing of the *Ethan Allen* on Lake George and a water taxi in Baltimore's Inner Harbor, both in 2004.

Moving Beyond Oil and Protecting the Environment

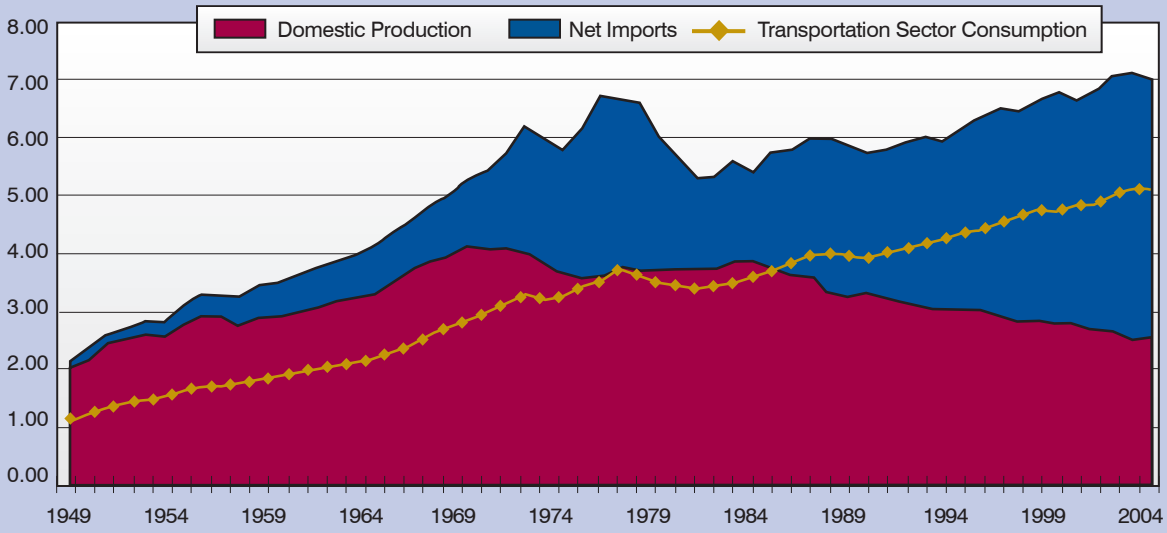
Transportation is inherently dependent on energy. For the first several millennia of civilization, that energy was supplied by people, draft animals, and wind power. The development of the steam engine paved the way for rapid advances in transportation technology, and culminated in the development of the internal combustion engine, which remains the dominant form of propulsion technology today. Although the modern transportation system has led to an unprecedented degree of prosperity and mobility, there have also been negative consequences. Combustion-based engine technologies are largely powered by non-renewable fossil fuels, and produce emissions that harm the environment.

Today, the transportation sector is almost entirely dependent on petroleum. In 2005, petroleum-based fuels represented 97 percent of the total energy consumed by the American transportation network. Sixty percent of all the oil consumed in the United States is imported. This leaves the transportation sector particularly vulnerable to supply interruptions and price volatility in world petroleum markets, potentially threatening national security. As shown in Exhibit 3-11, growing transportation sector energy consumption is largely responsible for the increasing level of imported oil entering the United States.

Conventional oil production outside the major oil-exporting countries is expected to peak within the next decade, which could mean even greater price volatility and supply uncertainties. Oil sands, extra heavy oil, coal, and oil shale can be converted into conventional fuels at costs comparable to current oil prices, but it will take many years to develop the capacity to produce large quantities of fuel from these "unconventional" sources. The transportation sector accounts for 68 percent of total petroleum consumption in the United States (and 16 percent of total world oil consumption), a share that has risen in recent decades as the use of petroleum-based fuels has declined in other sectors of the economy. Thus, any policies aimed at conserving limited oil supplies must be focused on transportation.

Energy supply constraints are not the only reason for concern about high transportation energy consumption. Evidence of global climate change is mounting. Emissions of greenhouse gases from the burning of fossil fuels by transportation and other sources will exacerbate global warming. Within the United States, one-third of greenhouse gas emissions come from transportation sources (see Exhibit 3-12). Even if supplies of liquid fuels from the unconventional sources noted above were adequate to support transportation needs, the use

Exhibit 3-11. Annual petroleum production, imports, and consumption in the United States, 1949–2006



The chart shows that U.S. petroleum imports have increased rapidly over the last 25 years, as domestic production has declined and consumption has increased, led by the transportation sector.

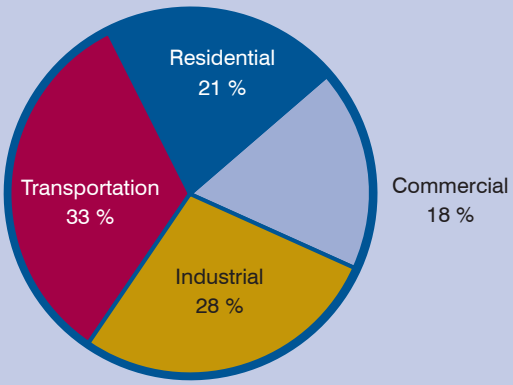
Source: Energy Information Administration

of those fuels would continue to produce large quantities of greenhouse gases.

There are essentially three strategies for reducing petroleum dependency and greenhouse gas emissions from surface transportation. In light of the severity of emission reductions necessary to stabilize global temperature rise, it is likely we will need to pursue a combination of all three strategies. The first approach would focus on improving the fuel economy of motorized vehicles, either through government-mandated targets (such as more stringent Corporate Average Fuel Economy standards) or by supporting research into more efficient engine technologies.

A second approach is to further the development of alternative fuel sources for surface transportation, such as biomass fuels, hydrogen, and electricity derived from renewable sources; nuclear energy; or fossil fuels (with carbon capture

Exhibit 3-12. U.S. carbon emissions from fossil energy consumption by end-use sector in 2005



The chart shows that the transportation sector is the largest contributor of greenhouse gas emissions in the United States.

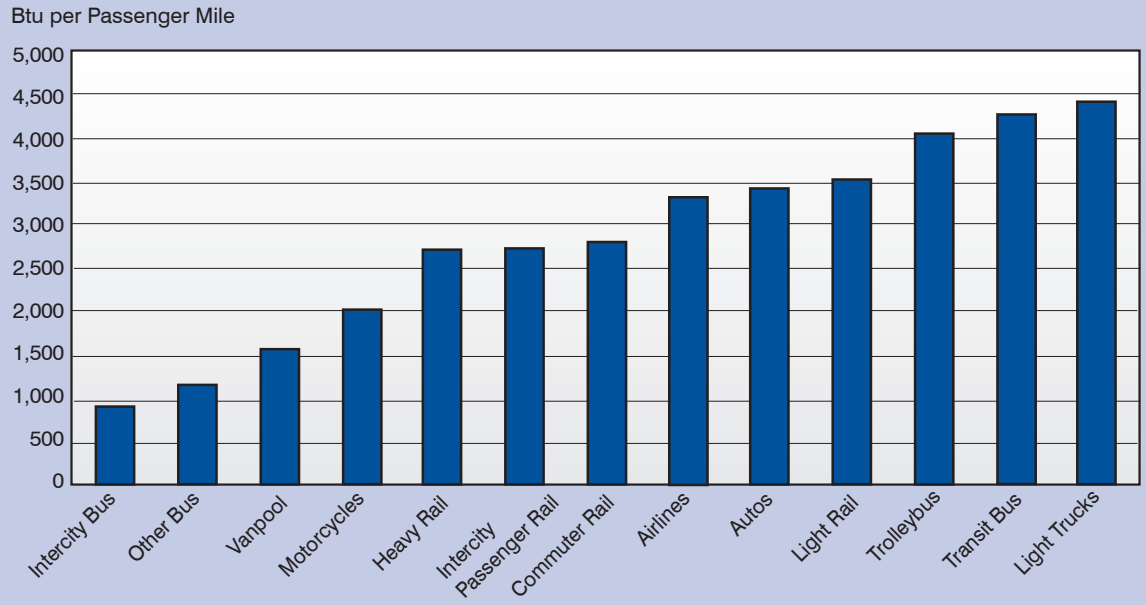
Source: Energy Information Administration

and sequestration). The technology to produce such fuels in quantity is still in its infancy, however, and significant challenges remain in developing both vehicle propulsion systems and the fuel delivery systems to support widespread adoption of alternative fuels and electrical propulsion.

Third, transportation energy consumption may also be reduced by focusing on the demand for transportation. Trip generation and trip lengths can be addressed through land use and economic development policies (discussed more below) that encourage efficiency in the location of economic activities. In some cases, policies aimed at other goals (such as encouraging development in low-density rural areas or zoning policies encouraging the separation of residential and commercial uses) have unintended consequences that may increase travel. Ensuring that origins and destinations are more closely spaced could reduce travel demand while maintaining accessibility to economic and social opportunities. In freight, allowing longer combination vehicles could also reduce the amount of truck travel on the Nation's principal highways (though this would raise other issues regarding modal equity and highway cost allocation). The balance of transportation system use among different modes can also affect energy consumption (see Exhibits 3-13 and 3-14).

Burning fossil fuels for surface transportation causes pollutants as well as greenhouse gases to be emitted, affecting ambient air quality and directly impacting health and wildlife. The maps in

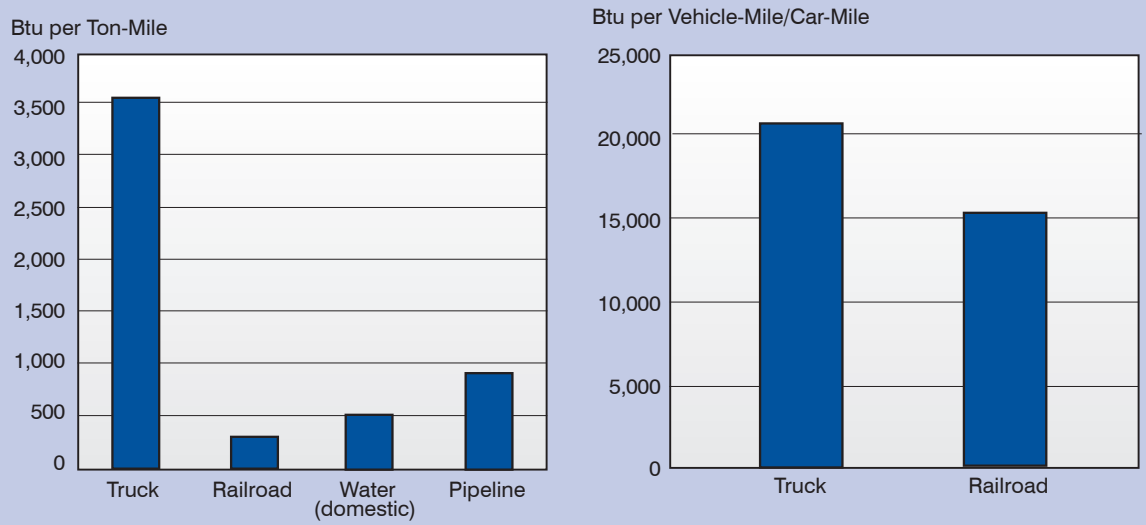
Exhibit 3-13. Energy intensity for different passenger transportation modes



Intercity buses and other buses (including charters, tour buses, and school buses) are the most energy-efficient form of passenger transportation on a per-passenger-mile basis due to their relatively high load factors (high percentage of seats filled on a given trip). On average, most forms of urban and intercity passenger rail service are less energy-intensive than airlines, cars, light trucks, or transit buses.

Sources: *Highway Statistics; National Transportation Database; Transportation Energy Databook; American Bus Association*

Exhibit 3-14. Energy intensity for freight transportation modes



On a per-ton basis, trucking uses more than 10 times as much energy on average to transport freight than rail transportation. However, the average truck carries just under 6 tons of freight, while the average railcar carries a load of 46 tons, reflecting the heavier, bulky commodities that railroads generally haul. Thus, when comparing energy intensity on a per-vehicle-mile or per-car-mile basis, the differences between the two modes are significantly reduced (though rail is still less energy intensive).

Sources: *Transportation Energy Databook, National Transportation Statistics*

Exhibit 3-15 depict the areas of the U.S. that fail to attain national health-based standards for two key pollutants: ground-level ozone (or smog) and fine particulate matter. The transportation sector is the largest source of emissions for both pollutants.

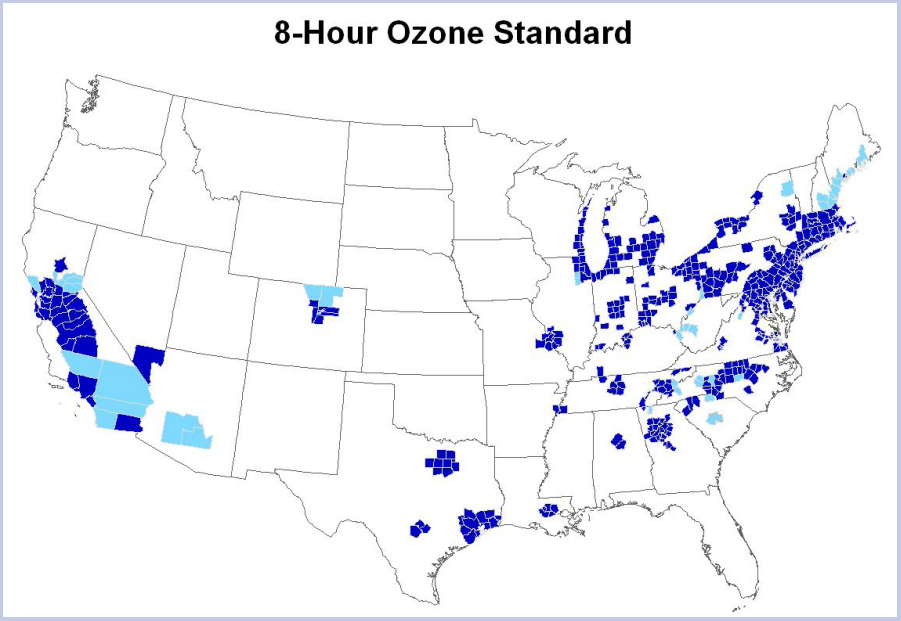
One of the key environmental successes in the U.S. over the last 40 years has been the dramatic reduction in emission rates for carbon monoxide, nitrogen oxides, hydrocarbons, and particulates through the adoption of advanced emissions control technologies. As a result, air quality has greatly improved in our cities. However, there are concerns about the extent to which further technological advances can continue to outpace growing levels of highway travel. As a result, continued travel growth threatens to limit or even reverse these gains in the future.

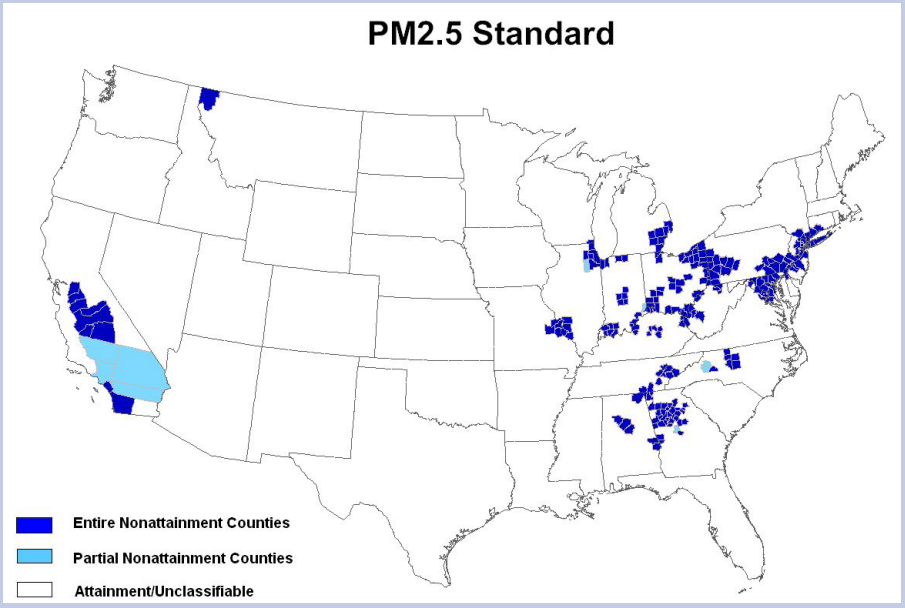
Planning for 120 Million More Americans

One of the greatest challenges facing the United States is its population growth over the next half-century. As noted in Chapter 1, the Nation's population is expected to swell to 420 million residents by 2050. A population of this size would strain any country's transportation network, but the magnitude of this increase has the potential to overwhelm an already saturated transportation network in the United States. The challenge for transportation agencies is not only to design and



Exhibit 3-15. Nonattainment areas for air quality in the United States: 8-hour ozone standard and PM2.5 standard





The maps indicate that many areas of the country still do not meet the minimum air quality standards set by EPA, especially for ground level ozone and fine particulate matter.

Source: Environmental Protection Agency

Transportation has been key to every wave of development in the Nation's history. With the advent of steam railroads in the 1830s and electric streetcars in the 1890s, cities expanded outward along rail lines. These rail lines enabled families to live away from the city core but still have access to downtown jobs, shopping, and cultural attractions. After World War II, the rapid rise in automobile ownership accelerated the growth of American suburbs. The Interstate Highway System and other public roads helped communities develop beyond rail lines or the city core. Metropolitan growth has since continued largely unabated and the metropolitan regions have experienced the most growth in traffic. Sparked by access to public roads, millions of acres of undeveloped land have been transformed into housing developments, shopping centers, and other developments.

implement tomorrow's transportation system, but to do so in a way that accommodates population growth and protects the environment.

Transportation is not merely impacted by new development; it influences the character of new growth by determining how land is accessed and developed. In recent years, development has consumed land at a rapid rate. In the 1990s, open space was converted to developed land at the rate of 2.2 million acres per year, or 252 acres per hour. This was 50 percent greater than the rate of conversion a decade before.

New development has numerous environmental effects, including the destruction of wildlife habitat and additional runoff from paved surfaces. In some of the Nation's fastest-growing communities, the property claimed by urbanization had once been the most productive. This land, ideal for farming, had originally contained hardwood forests and tall grass prairies with good soil.

The United States is in no danger of running out of land, although there are signs that future development cannot continue in the same manner as it has in the past half-century. In its report *Toward a New Metropolis*, The Brookings Institution notes that 427 billion square feet of new homes, shopping centers, and other buildings will be needed to accommodate the Nation's population in 2030. Half of that building space has not yet been constructed. Much of the country's remaining open space is located in deserts or mountains, suited only to low-density development.

As early as a century ago, cities such as New York were implementing their zoning and infrastructure models at the same time. Over the past two decades, planners have tried to mimic these policies, which worked well in the years before large-scale suburban growth. Many communities have clustered development around transit lines, reducing the need for automobile travel and related congestion and environmental impacts. Local officials have also recommended mixed-use development in which housing, employment centers, and institutions such as schools are blended into a new community rather than being zoned into separate areas. By doing so, these officials hope to shorten the distances people need to travel, increase pedestrian activity, and encourage the use of non-motorized forms of transportation, such as bicycles.

The surge in population anticipated between now and 2050, however, has led some to argue for bolder approaches toward accommodating development, and to criticize the fragmented planning and development process. Many have argued that State governments or metropolitan planning agencies must set boundaries beyond which growth is not allowed.

"The population of the United States is expected to increase by 50 percent by 2050, with much of the growth coming in heavily populated urban areas along the coasts, in the south, and in megaregions such as Chicago. So we must optimize our land-use patterns using sensible growth strategies that guide regions to make tough investment choices. Investments that support mixed-use, mixed-income developments near transit, retail, and jobs should move to the front of the line…The harsh truth is that continuation of past build-out policies will bankrupt our transportation system."

– John Gates, CEO and President of PortaeCo and Founder of Centerpoint Properties, on behalf of the Metropolitan Planning Council, at the Commission's Chicago field hearing.

Organizations such as the Regional Plan Association in New York have argued that planning decisions must be realigned along broader lines than existing political boundaries. The Regional Plan Association convened the National Committee for America 2050, which examined the growth of "megaregions" that will contain more than 70 percent of the Nation's growth by mid-century (see Exhibit 2-4 in Chapter 2). These megaregions span hundreds of miles, crossing State boundaries and linking cities that were previously isolated by farms and forests. The America 2050 report notes that "increasingly, investments and interventions must occur at the megaregional scale, which provides the necessary breadth of resources to grow and compete globally." The Commission agrees that transportation and planning agencies must have a broader perspective, which is why the Commission has endorsed new strategies that will improve mobility in larger urban communities.

In addition to considering the environmental impacts of new infrastructure, transportation agencies must determine how they will affect existing communities. There must be a clear break from the past, when some projects were hurried along with little input from local neighborhoods. This sometimes had terrible consequences.

During the early years of the Interstate Highway System, it was common practice to build expressways through low-income and minority communities that lacked the political, economic, and legal power to influence such projects. In many cases, these projects divided or destroyed thriving neighborhoods, and air pollution from automobiles and trucks increased medical problems such as asthma. Other surface transportation networks impacted communities in similar ways. Freight rail also moves through many low-income and minority communities. Maintenance facilities for all forms of transportation have sometimes been located in communities that can least resist these operations. At the same time, however, many of these facilities provide much-needed and well-paying jobs for these communities. Increasingly, any new such facility is built with extensive input from the community with regard to environmental impacts and mitigation.

In recent years, officials at all levels of government have tried to make environmental justice—which refers to the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income—a key part of the decision-making process. This is not a new concept. Under Title VI of the Civil Rights Act of 1964, the U.S. Department of Transportation is required to ensure that recipients of Federal aid do not discriminate. A 1994 Presidential Executive Order directed every Federal agency to make environmental justice part of its mission by addressing the effects of all programs, policies, and activities on "minority populations and low-income populations."

It is the Commission's conclusion that environmental justice should be considered in all surface transportation decisions. The concept does not just refer to minimizing the adverse impacts of highways and other transportation networks. It also means fitting transportation systems more harmoniously into communities. Our clear objective must be ensuring that mobility is enhanced for minority and lower-income communities, and the benefits of transportation policies are distributed equitably among all the Nation's citizens.

Discussion of Commission Transit Findings

The Commission recognizes that public transit, whose origins date back to the horse-drawn street cars that first allowed us to separate our homes from our places of work in the 1840s, is not a simple, one size-fits-all solution. Petroleum-fueled buses and electrified railways, whether heavy or light, serve different markets and purposes.

As buses displaced street railways in the 1920s for private operators who sought ways to lower their fixed operating costs in an era of price controls on their revenues and many ups and downs in ridership, now electrified street railways and light rail are seen as alternatives to buses to attract riders with choices, reduce noise and air pollution, and to better impact redevelopment and development in urban cores, the same mission that electrified street railways were seen to support in the early part of the 20th century when they helped to create the 'street car suburbs.'

The Commission has recommended that we shift our national focus to performance-based mobility decisions and bottom-up planning of what will best serve the major metropolitan regions and the megaregions over the next 50 years and beyond. This will, in our view, require states and localities to consider carefully the place that public transit, and particularly electrified transit, will have in the long term. The integration of transportation decisions into land use planning and future growth accommodation will be at the core of that exercise.

Transit should be a readily available answer to communities seeking to respond effectively to the mobility needs of a growing retiree population, provide economic opportunities to low income communities, respond to those communities' concerns about diesel air and noise pollution impacts, manage sprawl and reduce the amount of land and space committed to hard surface parking. In addition, transit options can free up urban highway capacity for commerce and to keep pace with projected growth, possibly postponing—or even obviating—the need to construct more. The Commission believes that the record shows that communities which provide existing car users with a comparable public transit experience succeed in reducing VMT—turning drivers into riders.

The increase in the price of oil is an obvious driver of increased transit ridership and transit development. People are responding to the run

up in oil prices by switching to public transit where they can. However, the environmental benefits of doing so should be recognized explicitly within this report. A shift of commuter travel from private automobiles to electrified vehicles and railways (which include some commuter rail, Heavy Rail (subways) Light Rail and streetcars) can play a significant role in reducing air pollution. *Public Transportation's Contribution to U.S. Greenhouse Gas Reduction,* published by SAIC in 2007, finds that a solo commuter switching his commute to existing public transportation can reduce his CO_2 emissions by 20 pounds in a single day or more than 4,800 pounds in a year. Greater savings would result from the expansion of electric rail service powered by non-fossil fuel generated electricity.

The Commission has carefully considered the relationship of transportation policies and energy security. We believe that our approach and programmatic recommendations, particularly for performance-based systems and bottom-up long term planning, will contribute to meeting national energy efficiency and independence objectives. We, furthermore, urge Congress to specifically integrate transportation policy into whatever policies it may enact—a national cap and trade system, a cap on petroleum use, or a national carbon tax, or whatever the national approach. The program choice can only be effective if comparable alternative transportation facilities are in place to provide mobility for America.

The Commission heard extensive testimony that public policy modal "silos" restrict or direct local transportation investment choices. In recommending that States, metropolitan regions satisfy national performance standards through the choices for transportation, metropolitan regions will be free to choose public transit options that best allow them to redirect their land use choices or to accommodate new growth in the most cost effective manner over the long term. Ideally, communities will have the ability to balance short term cost, funding availability, and planning horizons in their overall transportation plans in such a way that transit options will be advantaged.

The Commission was presented with a breadth of information relating to how transit, particularly electrified rail transit, has a demonstrated ability to spur development and, importantly, re-development in urban cores. Streetcar systems, which can be built inexpensively, have shown a particularly strong and positive impact on urban re-development. Some key examples include:

- *Portland Streetcar: Development Oriented Transit,* prepared by the Portland, Oregon, Office of Transportation and Portland Streetcar, Inc. in 2006, found that since 1997 $2.3 billion had been invested within two blocks of the streetcar right-of-way, including 7,248 new housing units and 4.6 million square feet of office, institutional, retail, and hotel construction.
- The Little Rock, Arkansas, Regional Chamber of Commerce, in "About Little Rock," calls the River Rail streetcar line, which opened in 2004, a "magnet for new businesses and development, another attraction for large conventions and one of several jewels in the restoration of two reviving downtown areas."
- The River line light rail development between Trenton New Jersey and Camden New Jersey has had a similar development impact, spurring well over $ 1 billion dollars in new development along the line and extending effectively the commuter belt for northern New Jersey and New York City, something that had not happened when the predecessor operation was a multi-stop low speed bus operation aimed at transit-dependent low income residents.

In addition, the Commission was presented with supportive information relating to electrification of transportation options, particularly new rail transit projects, but also bus transportation. These kinds of projects enjoy wide support across the communities where they exist and the Commission would encourage additional research into the cost, energy efficiency and overall emissions impact of electrification, as well as other non-petroleum fueled public transit. Federal policy in support of electrification and other non-petroleum fueled public transit, in light of environmental and energy security considerations, should be driven by the results of that more extensive research. (Note: In the future we may well rely on hybrid, hydrogen, or fuel cells which may be practical and available. Electric transit is available now which is why at present we recommend it.)

The Commission's report has detailed the extent of urban congestion. The Commission believes that public transportation, properly funded and supported, can help to provide the choice and alternatives for drivers that will get them out of their cars and out of congestion. Public transportation, especially in the form of electric railways, must and will play a significantly larger role in Americans' mobility over the next 50 years and beyond. Federal transportation policy should not only accommodate but encourage this development.

TRANSPORTATION FOR TOMORROW

National Surface Transportation Policy and Revenue Study Commission

Endnotes

1 U.S. Department of Transportation, Federal Highway Administration. *2006 Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance.* Washington, D.C.: 2007.

2 Ibid.

3 Ibid.

4 Ibid.

5 National Transit Database.

6 U.S. Department of Transportation, Federal Highway Administration. *2006 Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance*. Washington, D.C.: 2007.

7 Yardley, William. "Gaping Reminders of Aging and Crumbling Pipes." *The New York Times.* February 8, 2007.

8 Texas Transportation Institute. *2007 Annual Urban Mobility Report.* College Station, Texas: 2007.

9 Ibid.