Transportation Statistics Annual Report 2001

U.S. Department of Transportation
Bureau of Transportation Statistics

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Our mission: To lead in developing transportation data and information of high quality and to advance their effective use in both public and private transportation decisionmaking.

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Preface

Congress requires the Bureau of Transportation Statistics (BTS) to report on transportation statistics to the President and Congress. *Transportation Statistics Annual Report 2001 (TSAR)* is the eighth such report prepared in response to this congressional mandate, laid out in 49 U.S.C. 111 (j). The report discusses the extent and condition of the transportation system; its use, performance, security, and safety record; transportation's economic contributions and costs; and its energy and environmental impacts. All modes of transportation are covered in the report.

The BTS publication, *National Transportation Statistics (NTS),* a companion to this annual report, has more comprehensive and longer time series, tabulated data than could be accommodated here. *NTS* is available both in print and online at www.bts.gov.

Chapter 1

Summary

Summary

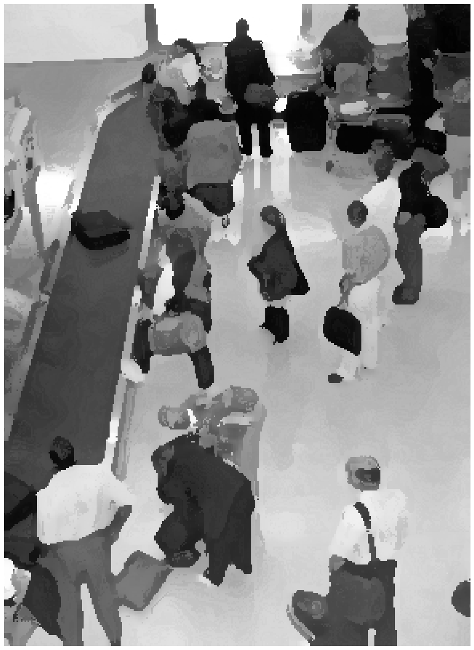
This eighth Transportation Statistics Annual Report (TSAR), like those before it, provides data and analysis on the U.S. transportation system: its extent and condition, relationship to the nation's security and economic growth, safety aspects, reliance on energy, environmental impacts, and contribution to mobility and accessibility. The report was prepared in 2001 and in early 2002. Because it relies on annual data, the most recent data available for the report covered 2000 and, in some cases, only 1999.

Two events significantly affected transportation in 2001 while this report was being prepared. First, in late 2000, a downturn in the U.S. economy became apparent. A mild recovery was underway in September 2001 when terrorists attacked New York and Washington, using four commercial airliners as missiles. The immediate, acute impacts of this shock to the transportation system are well known. When this report was being finalized, however, it was too early to accurately assess the long-term effects of the attacks, as a more secure transportation system was still evolving. Because of the importance of terrorism impacts on transportation, special attention has been given in the report to provide data covering 2001 where possible.

The State of Transportation Statistics

In its legislative mandate for the Bureau of Transportation Statistics (BTS), Congress called on BTS to provide it with recommendations for improving transportation statistical information in this annual report. Good information is central to effective transportation decision-making, whether by governments, businesses, or consumers. Having the right data and information available in the right form and at the right time is key.

While many of the pressing transportation data problems and gaps that



existed before BTS was created over a decade ago have been addressed, there is a continuing need for good, reliable data and information. Gaps in data may involve the absence of data, data that are poor in quality, or data that are collected but not provided in a timely manner or in a form that decisionmakers can use effectively. An assessment of such gaps, undertaken by BTS in consultation with major stakeholders, is pointing out many gaps pertinent to a broad range of passenger, freight, and other transportation decisionmaking. Some gaps could be filled through modifications in existing data instruments, while others might require new initiatives. The State of Transportation Statistics chapter provides many specific examples of remaining data problems and solutions. The following six chapters highlight transportation issues, presenting data in tabular and graphic forms along with capsule analyses. In doing so, these chapters also reveal differences in the availability, reliability, and quality of transportation data.

Transportation System Condition and Extent

As the fourth largest country in land area, the United States has over 4 million miles of highways, railroads, and waterways that connect all parts of the country. It also has 19,000 public and private airports and 440,000 miles of oil and gas transmission pipelines.

Over the last decade, the condition of the nation's airport runways, roads, and bridges has generally improved even while the number of vehicles in the nation's highway fleet, for instance, has grown (by 17 percent to total almost 226 million vehicles in 2000). Nearly 80 percent of the runways at commercial airports in the country remained in good condition in 2000; however, the number of those airports declined from 568 to 546 between 1990 and 2000. Over 41,000 U.S.-flag commercial vessels were operating in both foreign and domestic maritime trade in 2000.

Mobility and Access to Transportation

The transportation system enables people and businesses to overcome the distance between places. For travelers, this includes having easy access to modes of transportation that will get them between home and work, from store to store, and off on vacation. Almost 4.8 trillion passenger-miles of travel (covering all modes) occurred in 2000, an annual increase of 2.3 percent since 1990. Businesses need to efficiently move both people and goods, increasingly worldwide. There were over 3.8 trillion ton-miles of domestic freight shipments in 1999, representing an annual growth of 2 percent since 1990.

More specifically, highway vehicle-miles of travel (vmt) increased 2.5 percent annually between 1990 and 2000 with light-duty trucks (including sport utility vehicles, pickups, and minivans) rising to 34 percent of vmt. During the same period, automobile vmt declined from 66 percent to 58 percent. In 2000, more than 76 percent of commuters drove alone to work by car, van, or truck, up from 73 percent. However, transit ridership grew 7 percent, from 8.8 billion to 9.4 billion unlinked passenger trips between 1990 and 2000, reaching its highest level in more than 40 years.

Congestion increased on highways in major metropolitan areas, and 22 percent of air travelers' flights were delayed, canceled, or diverted in 2001, up from 19 percent in 1990. International overnight travel by various modes to the United States increased by 31 percent, while the number of U.S. residents traveling out of the country rose 36 percent between 1990 and 2000. Amtrak recorded 23 million passenger trips in fiscal year (FY) 2000, up 4.5 percent from 22 million in FY 1990.

Between 1991 and 2000, domestic air cargo tonnage grew from 5 million tons to 13 million tons, an annual growth rate of 11 percent. Suggesting possible impacts on ports and intermodal facilities, the U.S. waterborne container trade balance shifted more toward imports by a gap of over 4 million 20-foot equivalent container units (TEUs) in 2000, up from a gap of 609,000 TEUs in 1992.

Security

As the terrorist attacks of September 2001 made clear, the nation's economic well-being and security are dependent on a transportation system that can move people, goods, and military personnel and equipment without the fear of intentional disruption or damage by terrorists or other criminal elements.

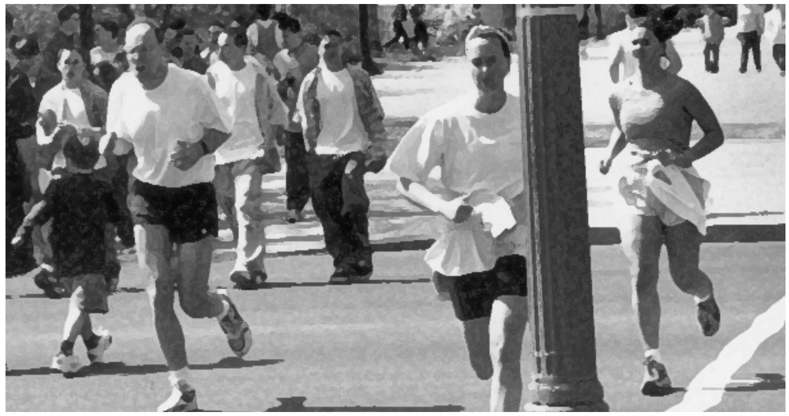
The hijacking and crashing of four civilian aircraft on September 11, 2001, ended a 10-year lull in hijackings of U.S. air carriers and resulted in the deaths of an estimated 3,035 people (see box on page 110). The terrorist attacks precipitated an unprecedented shutdown of the entire U.S. civil air system for several days, severely straining the balance of the transportation system and reducing mobility for many.

Other security concerns involve maintaining U.S. capability in airplane manufacturing and shipbuilding and interdicting people and drugs from illegally entering the country. The U.S. Coast Guard (USCG) stopped 4,136 people trying to enter the United States illegally during 2001, down 70 percent from 13,790 in 1991. USCG also interdicted 173,000 pounds of cocaine and marijuana during FY 2001, up nearly 30 percent from FY 1991. Whereas, cocaine represented, on average, 60 percent of USCG interdictions during the last 10 years, it made up 80 percent of the drugs interdicted during FY 2001.

Safety

Reducing transportation-related deaths, injuries, and property damage is a key goal of the transportation community. While much progress has been made in reducing the number of deaths, these numbers remain high. Crashes and incidents involving transportation vehicles, vessels, aircraft, and pipelines claimed 44,314 lives in 2000 and injured more than 3 million people.

Transportation incidents ranked as the eighth leading cause of death in the United States in 2000, down from the seventh leading cause of death in 1990. (Alzheimer's disease surpassed transportation incidents as a leading cause of death in 1999.) Among people



under 45, transportation incidents were one of the top causes of death throughout the decade.

Motor vehicle collisions accounted for about 95 percent of transportation-related deaths in 2000. While the use of safety belts saved almost 12,000 lives in 2000 (two and a half times as many lives as in 1990), motor vehicle collisions have consistently accounted for between 93 and 95 percent of transportation-related fatalities since 1990. Alcohol-related fatalities fell from 51 percent of motor vehicle-related fatalities in 1990 to 41 percent in 2000. Despite this decrease, alcohol-related traffic incidents still resulted in 17,380 deaths in 2000.

Commercial air fatalities totaled 531 in 2001 (including the 265 on board the aircraft hijacked on September 11), while 553 people were killed in general aviation accidents. Ten years earlier, 62 people died in commercial air incidents and 799 in general aviation incidents.

Economic Growth

Transportation is a vital component of the U.S. economy. As a sizable element of the country's Gross Domestic Product, transportation employs millions of people and consumes a large amount of the economy's goods and services. Demand for transportation-related goods and services represents about 11 percent of the U.S. economy and supports one in eight jobs.

Households spent an average of $7,400 on transportation in 2000. This represented 19.5 percent of their income in 2000, compared with 18 percent in 1990. Throughout the decade household spending on transportation was second only to the amount spent on housing. Average gasoline motor fuel prices peaked at $1.67 per gallon in June 2000 and $1.81 per gallon in May 2001, but these increases did not make a major impact on fuel consumption.

U.S. international merchandise trade via all modes rose 28 percent to $2 trillion between 1997 and 2000, with Canada retaining its status as our top trading partner. Mexico was our second largest partner in 2000.

In the public sector, inflation-adjusted transportation revenues of federal, state, and local governments totaled $118.9 billion in 1999, an increase of almost 45 percent since 1990. Expenditures rose 22 percent during the same period. The value of highway capital stock (including infrastructure and vehicles) increased by 25 percent between 1988 and 2000.

Energy and the Environment

The many benefits of transportation are tempered by its environmental effects. The sector's dependence on fossil fuels is at the root of many such problems. However, construction and maintenance of transportation infrastructure and facilities, refining of fuels, and vehicle and equipment manufacturing, maintenance, and disposal also affect the environment.

Transportation sector energy use grew at an annual rate of 1.9 percent between 1990 and 2000, to represent 26 percent of total U.S. energy consumption. However, transportation consumed 67 percent of the petroleum used in 2000. While alternative fuels usage has grown 5.9 percent annually since 1992, it only comprised 0.22 percent of total motor vehicle fuel use in 2000.

Most transportation air pollutant emissions have declined since 1970. Only nitrogen oxides and ammonia emissions remain above their 1990 levels. In addition, transportation sector greenhouse gas emissions of carbon dioxide have risen 19 percent since 1990. However, the greenhouse gas intensity of the U.S. economy declined 15 percent between 1990 and 2000.

Transportation affects the marine environment in a number of ways: oil spills, dredging of sediments to maintain and enlarge waterways and ports, and ship wastewater discharges are among them. The amount of oil spilled in U.S. waterways varies annually; in 2000, 1.4 million gallons were reported spilled, of which 73 percent were from marine vessels and pipelines. The U.S. Army Corps of Engineers dredges about 300 million cubic yards of sediments—some of it contaminated—from navigation channels each year.

Almost all (97 percent) of the lead content of disposed batteries was reused in 1999, but only 26 percent of the 4.7 million tons of scrapped tires were recycled. These data cover passenger cars, trucks, and motorcycles. Data on the waste products of other modes and components of transportation vehicles and equipment are not available on an annual basis.

Chapter 2

State of Transportation Statistics

State of Transportation Statistics

The U.S. transportation system, one of the world's largest, serves 284 million residents and 7 million business establishments dispersed over the fourth largest country (by land area). This complex system enables economic activity, making it possible for even small towns or businesses to physically link with the rest of the world, and offers citizenry a high degree of mobility, facilitating access to goods, services, work, recreation, and social activities. The system must continually adjust to changes in external conditions, such as shifting markets, global competition, changing demographics, safety concerns, weather conditions, energy and environmental constraints, and security needs.

Given the nature of the system, good information is key to effective transportation decisionmaking, whether by governments, businesses, or consumers. Having the right data and information available in the right form, at the right time can affect decisions as different in scale and importance as what route to pick on the morning commute, which modes to use to ship goods, where to locate transportation facilities, and how to allocate public or private investments for transportation.

With such vastly different uses for transportation data and information, the system for collection, analysis, and dissemination of this data and information is itself complex, involving multiple public and private entities. Some of the complexity arises from the uniqueness of key transportation data (box 1). Public access to some information—especially that collected by government agencies—is often not difficult, while information collected by or from private sources is frequently kept proprietary or confidential. States, planning organizations, localities, and transportation authorities collect much data, often for operational and planning purposes; however, its utility beyond the specific location may be limited, because it is not available in a form that enables others to easily use it, for example, a standard format. The federal government often obtains data from states or other public agencies and collects data through surveys and other means, for its own purposes.

With all of this data, several questions arise:

- Do the data cover the right subjects?
- Are the data relevant to decisionmaking needs?
- Are the data reliable and accurate?

Box 1
The Unique Characteristics of Transportation Data

Transportation is about movement. Each movement of people or goods has a starting and ending point and follows a route. The size of such movements, as well as the potential demands for future travel activity are usually represented as origin-to-destination (O–D) movements, or flows, between pairs of places, while the supply of transportation facilities and services is represented by nodes and links in a multimodal transportation network that reflects the physical connectivity between these places. Links in this representation may be sections of highway, rail lines, waterways, pipelines, or bicycle, pedestrian, or air routes, while nodes may be highway intersections, airports and railway stations, intermodal terminals, or other locations where links terminate or converge. Together, these links and nodes constitute a transportation network over which people and goods travel.

This necessarily spatial view of the transportation system can be viewed at a number of different levels of resolution: from intercity flows for which metropolitan areas are the nodes of interest and for which annual trade or personal travel volumes represent the O–D flows of interest; to vehicle, pedestrian, and cyclist movements in localized geographic areas in which local streets and bike paths are the links, and street intersections are the nodes. The spatial representation of transportation movements also presents some unique challenges for data collection and analysis. This is especially the case when trying to combine data collected at different regional scales as well as at different levels of spatial resolution.

Transportation data are collected for many purposes, including operational needs, project evaluation, local and regional planning, national planning and policy formulation, and performance measurement. Some of these data are within the purview of federal entities, but the separation between federal, state, and local roles is not always clear. Aggregating local data to get a complete national picture is impossible if data are not gathered in all relevant jurisdictions or if they are collected in different ways by different agencies. For example, while local truck movements are best collected at the local or metropolitan area level, data on interregional or "through" truck movements are more easily collected at the federal or statewide level. Individual metropolitan areas encounter problems in gathering such data, because all origins and destinations will not be within their jurisdiction.

Data gathered by the federal government, however, often require sampling to obtain cost-effective national or regional statistics. As a result, these data sometimes lack the detailed geographic specificity or complete within-region coverage needed by local planners and policymakers. This is particularly true for O–D-specific, long-distance highway traffic, including long-haul truck traffic. Sampling has an important role to play here in obtaining representative data at reasonable cost.

There is also a temporal dimension to be considered in this spatial data collection. Not only average freight and passenger flows but also the day-to-day and season-to-season variability in these volume measures need to be known if the level of service being provided by the transportation network is to be properly understood. The same is true for the travel costs associated with these movements, with day-to-day reliability in transit times on congested parts of today's transportation network playing an important role in both the selection of routes and the determination of O–D-specific travel costs.

- Are the data understandable, accessible, and timely for decisionmaking?

With an eye toward improving the transportation information system, Congress in 1991 authorized the establishment of the Bureau of Transportation Statistics (BTS). BTS's mandates were reaffirmed by reauthorization legislation in 1998. As part of this mandate, Congress called on BTS to assess both the state of the transportation system and the state of transportation statistics in a transportation statistics annual report. Specifically, the report is to include ". . . recommendations for improving transportation statistical information." This chapter, in response to BTS's congressional mandate, focuses on public dimensions of transportation statistics.

THE IMPORTANCE OF DATA

The need for data has been a continuing theme throughout the extensive history of transportation statistics (box 2). A long period of increasing interest in transportation statistics reached a zenith in 1977 with major data-collection activities in all modes of transportation, the publication of comprehensive analyses of national transportation needs and a national

Box 2
Historical Highlights: Transportation Statistics

1887	The Interstate Commerce Commission is established, initiating the collection of data from carriers to support regulation.
1920–1921	The U.S. Army Corps of Engineers begins publishing data on water transportation commerce and ports.
1934	The Federal-Aid Highway Act authorizes funds to be spent by state highway departments on surveys and economic analyses.
1944–1970	The largest metropolitan areas conduct large-scale studies of urban travel and transportation capacity.
1945	The Bureau of Public Roads (predecessor to the Federal Highway Administration—FHWA) publishes the first *Highway Statistics* report.
1957–1963	The U.S. Census Bureau initiates the Census of Transportation, including surveys of trucks, unregulated motor carriers, commodity movements, and long-distance passenger travel.
1958	The Federal Aviation Administration Act mandates collection of airline financial and operating statistics.
1960	The U.S. Census Bureau begins to collect journey-to-work data as part of the Decennial Census of Population and Housing.
1962	The Federal-Aid Highway Act establishes a data-rich comprehensive planning process for metropolitan areas.
1966	The Department of Transportation (DOT) Act creates DOT and requires the Secretary of Transportation to ". . . promote and undertake the development, collection, and dissemination of technological, statistical, economic, and other information relevant to domestic and international transportation."
1968	FHWA begins publishing a biennial highway needs report.
1969	FHWA initiates the first Nationwide Personal Transportation Survey. DOT summarizes the state of statistics in *Transportation Information: A Report to the Committee on Appropriations, U.S. House of Representatives, from the Secretary of Transportation* (the Red Book). The U.S. Coast Guard initiates the Boating Accident Report Database.
1970–1971	DOT publishes the first edition of *National Transportation Statistics*. Passage of the National Environmental Policy Act and Clean Air Act highlight the need for environmental data related to transportation. The U.S. Census Bureau significantly expands the content and geographic detail of journey-to-work data collected under the Decennial Census of Population and Housing.
1972–1974	DOT publishes two *National Transportation Reports* in which data are compiled on all modes.
1973	The U.S. Coast Guard establishes the basis for the Marine Safety Information Management System, which later becomes the Marine Information for Safety in Law Enforcement System, after the Federal Water Pollution Control Act mandates the reporting of any discharge of harmful quantities of oil or hazardous substances.
1974	The National Urban Mass Transportation Assistance Act mandates collection of data on the transit industry under Section 15. Energy data becomes a major concern with the first oil embargo.
1975	The Federal Railroad Administration establishes the Railroad Accident/Incident Reporting System database. The Fatal Accident Reporting System is initiated by the National Highway Traffic Safety Administration. The U.S. Census Bureau conducts a survey of domestic transportation of foreign trade.

(continues on next page)

Box 2 (continued)

1977	A national transportation atlas and DOT *National Transportation Report* is published under the title *Trends and Choices*. The U.S. Census Bureau conducts the quinquennial Commodity Transportation Survey and National Travel Survey. The Research and Special Programs Administration receives the Hazardous Materials Information System initiated by the DOT's Hazardous Materials Regulations Board in 1971. The Federal Transit Act amendments create the National Transit Database Reporting System on mass transportation financial and operating information.
1978–1980	Aviation, railroads, and motor carriers undergo significant economic deregulation, and many data-collection programs by regulatory agencies are subsequently reduced or terminated.
1979	The National Transportation Policy Study Commission calls for a continuing commitment to the development of transportation statistics.
1982	The U.S. Census Bureau terminates the quinquennial collection of data on commodity flows and passenger travel due to funding and methodological problems.
1990	DOT publishes *Moving America: New Directions, New Opportunities—A Statement of National Transportation Policy Strategies for Action*, which calls for a renewed commitment to transportation statistics.
1991	The Transportation Research Board completes its recommendations in its report, *Data for Decisions: Requirements for National Transportation Policy Making*. The Intermodal Surface Transportation Efficiency Act (ISTEA) is passed, mandating the establishment of the Bureau of Transportation Statistics (BTS).
1992	FHWA begins work with the U.S. Census Bureau on the Commodity Flow Survey. The DOT management order implementing the ISTEA mandate for BTS is signed in December, and management of the Commodity Flow Survey is transferred to BTS.
1993–1995	BTS and the U.S. Census Bureau conduct the Commodity Flow Survey, the American Travel Survey, and initiate the Transborder Surface Freight Transportation program. BTS publishes its first *Transportation Statistics Annual Report* and resumes publication of *National Transportation Statistics*. BTS receives the surviving data functions of the Civil Aeronautics Board.
1996	BTS receives the motor carrier financial and operating statistics program from the Interstate Commerce Commission.
1998	The Transportation Equity Act for the 21st Century (TEA-21) reaffirms BTS's data mandates and adds some new emphases including global competitiveness, bicycle and pedestrian travel, capital stocks accounting, the intermodal transportation database, and the National Transportation Library.
2000	BTS launches the monthly Omnibus Survey. *The Changing Face of Transportation*, successor to the 1977 *Trends and Choices* report, is published by DOT. The Federal Motor Carrier Safety Administration receives the Motor Carrier Management Information System from FHWA and con tinues the publication of motor carrier safety data.
2001–2002	BTS and FHWA jointly conduct the National Household Travel Survey, combining the American Travel and Nationwide Personal Transportation surveys. BTS and the U.S. Census Bureau begin data collection for the next Commodity Flow Survey.

transportation atlas, and a joint program of multimodal data collections by the Department of Transportation (DOT) and the Census Bureau of the Department of Commerce.

Transportation statistics entered a period of decline after 1977 as deregulation and shrinking budgets brought many federal programs to an end. Comprehensive national analyses of transportation were not conducted by the federal government between 1979 and 1989. Nor were national multimodal data on commodity flows collected between 1977 and 1993. However, the demand for this information remained strong, as was reflected in various mandates placed on BTS when it was established by the Intermodal

Surface Transportation Efficiency Act and then reauthorized by the Transportation Equity Act for the 21st Century.

Underlying the importance of transportation data is the knowledge that data are key tools for the work of the transportation community: for making informed policy decisions; supporting rules and standards; creating, evaluating, and changing programs; effective planning; and conducting research. Fundamentally, without good data, the transportation system cannot be properly assessed and appropriate strategic changes made to enhance its performance.

Because changes cannot always wait for good data and the appropriate analysis that flows from it, transportation decisions are sometimes made today using data that are inferior. Knowing this, BTS has striven throughout its 10 years to change this situation, to assure that transportation data are relevant, timely, comparable, complete, high quality, and useful. Bad data can mean faulty decisions. Conversely, when data are unimpeachable, they enhance objectivity and draw attention to matters that might otherwise be missed. Good data can focus contentious policy debates.

Still, good data are often unavailable because they are expensive to collect. The Commodity Flow Survey (CFS), the core federal program for collecting freight movement data, costs several million dollars to produce. Despite its relatively high cost and efforts to improve it, the CFS has serious limitations. It does not cover all freight movements, lacks important geographic detail, and is only available every five years. CFS brings to attention a problem facing other significant data-collection efforts in transportation: how to assess the benefits of more or new data-collection efforts against the costs of data collection itself. A strong argument can often be made that the cost of a mistake because of unavailable or bad data can be far larger than the cost to develop appropriate data systems. A single highway project, for instance, can cost millions of dollars more than the cost of gathering a full set of nationwide data on flows of cargo shipments. With apologies to Roger Bacon: He who has no data cannot learn the other sciences . . . and what is worse, they know not their own shortcomings nor their proper remedies.[1] Bacon was referring to mathematics, but, without data, decision-makers may not know the shortcomings of their policies or how to construct proper remedies.

Assessing the costs and benefits of data collection poses a challenge to statistical agencies that are the producers, custodians, and disseminators of data. A relatively new statistical agency like BTS, which has been charged by Congress to identify what a comprehensive system of transportation statistics might be, has to judge not only what data might be useful but also whether the benefits justify the costs. In transportation, benefits may often have to be assumed, especially in the absence of data that can reveal them.

To produce good data, the fragmentary nature of transportation institutions must be overcome. Many of the major transportation issues today cut across modes and political boundaries. Solving these problems may require multimodal solutions, including either intermodal transfers or a better allocation of origin-to-destination (O–D) flows across competing modes. For instance, increases in congestion currently impact the cost-effective movement of both people and freight, with

[1] This thought is reminiscent of Bacon's work, *On Experimental Science,* published in 1268.

subsequent negative effects on the economy, the environment, and energy consumption. Sustainable solutions to congestion mitigation will also involve multiple modes, and identifying the most promising solutions will mean finding improved ways of comingling data sources across the different modes.

Those who collect transportation data are often constrained by past history. Much local, state, and national data cannot be merged to produce larger pictures of transportation status and needs. There are highway, air, railroad, and maritime accident and fatality data, but comparisons are risky because data definitions and collection methodologies differ. Passenger and freight data exist but not for every mode in comparable fashion. Institutions can rise above this "stovepiping" of transportation data by, for instance, finding ways to genuinely cooperate with each other, but often there are disincentives to making the necessary changes. It will take time and resources to accomplish a more integrated transportation data system, but savings will accrue in the long term.

Finally, a good data system needs to be agile. It must produce timely data and be flexible enough to adjust its orientation as the needs of transportation shift. Much of transportation lies within the private sector where the pace of change can be rapid. In such a context, timely data focused on changes in the mix of modes, geography, and demand for transportation in relation to supply has never been more important.

TODAY'S TRANSPORTATION DATA SYSTEM

The present transportation statistics system consists of an array of data systems each constructed for specific, sometimes narrow purposes. These systems exist much like a collection of pieces from different jigsaw puzzles of the same picture. The pieces answer some questions well but leave many others unanswered or partly or poorly answered. The pieces do not constitute a whole because of a number of factors, including conflicting data users needs; incompatible definitions; diverse collection methods; and data overlaps, omissions, timeliness, coverage, and apparent inconsistencies. Many of the most pressing transportation data problems faced by decisionmakers when BTS was formed a decade ago have been addressed. The following discussion and its contrast with a visionary system suggest that important challenges remain.

Data Users

The transportation community has a highly diverse set of data users (box 3) whose needs do not always complement one another; in fact, they can be in conflict at times. No one can realistically provide all data in all the accessible forms to all users, nor can anyone easily select an optimal subset of users on which to focus data efforts. However, by concentrating on finding broad solutions to data needs, providers might be able to satisfy many users. For instance, an Intelligent Transportation System can capture information an operator can use to manage urban traffic flow. These data can also be used for measuring performance of the road system and for validating planning models. Then, if the data are archived, they would allow highway planners to identify areas of excessive congestion to determine project priorities or researchers to determine parameters for developing traffic flow models.

This approach suggests that the process of identifying data needs be a collaborative one

Box 3
Categories of Data Users and Their Needs

Policymakers in government or business make transportation decisions at the local, state, or federal level. Many groups—lobbyists, opinion makers, businesses, and nongovernmental organizations—closely monitor or seek to influence such decisions.

Planners—public and private, government and business—need data collected over time for longer term purposes such as carrying out cost-benefit analyses, allocating resources, promulgating regulations, or planning programs and projects.

Operators include government representatives (e.g., air traffic controllers or emergency responders) and industry personnel (e.g., freight dispatchers). They run day-to-day operations and often require real-time data about specific locations, vehicles, events, or conditions to make on-the-spot decisions to control operations and to provide information to transportation system users.

Enforcers are generally government officials, although there are private security organizations that have similar responsibilities. They need data to ensure the safety and integrity of the transportation system by monitoring and controlling the transportation system users. They can accomplish this with a mix of real-time and historical data about individuals, events, and locations.

Academics doing basic or applied research in support of one of the other four categories. They generally use very detailed data, often collected over time, that allow them to hone in on a specific issue.

involving all potential stakeholders. Further, it means moving away from the concept of data owners who create and maintain systems for their own purposes and only reluctantly consider the needs of others. Instead, data stewards could focus on designing systems with as wide an input as possible with the ultimate aim of sharing data to the maximum extent possible. Even then, some conflicts are inevitable. For instance, the public may be in favor of having highway monitoring systems that permit operators to reroute traffic in response to an incident. They may even agree to have that same data archived so that planners can identify trouble spots requiring infrastructure adjustments. But, the public is often reluctant to let enforcers have access to that same data if the intent is to use it to identify and track movements of specific individuals.

Standard Definitions

Issues of data comparability abound and can stem from differences in levels of detail and purpose among data collectors. The federal government may be primarily interested in national-level data, while state and local governments may want similar data but on a regional or local basis. Local and regional data may not allow aggregation for analysis of national characteristics and trends. These data are often developed in ways that lead to incompatibilities among localities or regions. Federal collections, which are also often developed without consulting a full range of users, tend to lack data specific enough, in content or quantity, to meet local needs. International data may not be comparable among countries, making comparisons misleading even though they are often made.

Both the public and private sectors need and collect data, often the same type of information, but not always for the same purposes. Each can be unwilling to share with the other. Industry may not want government, especially regulators, to know any more than what the law says government is entitled to know. They are also wary about competitors getting information that could shed light on their operations or plans. Regulators may not want the private sector to have access to operational data. Businesses and trade associations that collect, package, and sell data sometimes compete with governments that either charge less or tend to give data away.

Much of the conundrum over data comparability comes down to standards. A common misperception about standards is that everything has to be identical: hardware, software, and communications systems. In today's world of information technology, this is not true. The critical issue revolves around the lack of standard definitions for the data. Examples are numerous. There is no common definition of a transportation fatality across all transportation modes. Buses are defined differently by various DOT administrations. Different maritime organizations use a variety of vessel classification schemes. Without standard definitions, combining or comparing data elements is extremely difficult if not impossible. Software may be able to match up datasets that report data in different formats, but it is not so easy when the relationships are not straightforward. Coordination and cooperation are key. Agreement among data collectors, managers, and users on common definitions, data elements, and structure would resolve most incompatibility problems.

Suboptimal Data

There are a number of ways in which data collection results in suboptimal data. Two examples are federal government mandates that call for data submission without funds to cover the cost of reporting or that fail to provide something in return for the reporting effort. While DOT often provides transportation funding to states, these funds are seldom tied to data requirements. Thus, states develop data systems that fit their own needs and budgets, resulting in data that may only generally conform to the mandate.

Industries or others are required by regulation to submit certain data, some of which they may already collect individually for their own needs. However, if the government does not provide easy access to the industry-wide data that results from the mandate or is not timely in making the data available, then the private sector gets little in return, leaving it with minimal incentive to provide data other than to avoid punitive action. To improve data availability, BTS's new TranStats database is intended to provide "one-stop shopping" for transportation data. As such, it could provide industry a tangible return on the effort expended to comply with mandated data-reporting requirements.

Suboptimal data can also result when data collection is not the primary focus of those given collection responsibilities. For instance, the police officer at an automobile accident scene must ensure the safety of the victims and property, protection of potential evidence, and traffic management before gathering highway traffic safety data. This suggests that data-collection procedures should be designed, where possible, in ways that do not interfere with other, more important tasks. Even then, collection may result in data shortcomings or inaccuracies. In the safety arena, commonly known data gaps include lack of detail about motor vehicle crash scenes, the people involved, crash causes, and the severity of injuries. However, seeking alternative data-collection methods and sources may be more appropriate rather than adding burdens to crash site responders. Insurance companies and medical service providers, for instance, may be sources of more detailed damage and injury data, although confidentiality issues would likely have to be addressed before data could be shared.

Cost-Effectiveness

Data budgets have to compete with other priorities within government agencies, industry, or other organizations. Difficulties in assessing positive outcomes from data use can lead to minimal levels of funding. The entity that does pay will expect to have the final say on what, where, when, and how the data are collected and used. This can result in stovepiped data systems where the developer optimizes the design to meet its organizational needs and pays little heed to other possible uses of the data. Cooperative efforts can help avoid this, as exemplified by the National Household Travel Survey. This project, which surveys 25,000 households to develop a national picture of travel habits and patterns, is jointly funded and managed by the Federal Highway Administration and BTS. While the survey is not large enough to ensure adequate coverage for analysis much below the national level, the survey instrument is made available to states and metropolitan planning organizations (MPOs) to collect more regionalized data. The state or MPO provides the funding for an addition to the survey and gets the desired data at less cost than if it developed and administered its own comparable survey. This approach also allows for comparisons between MPO and national data.

When decisionmakers do not have good data, they manage without it. Projects still get approved and funded, and some level of improvement in transportation occurs. The expense of additional data collection and analysis may not, thus, appear necessary. However, poor data do not generally result in the most cost-effective solutions. A Catch-22 situation can result. Without proof that the data would be beneficial, better data collection may not be approved. Without the better data, proof of its usefulness may not exist.

Frequency

What is the right frequency for data collections? The easy answer is that it depends on the use of the data, but there are other factors. The CFS is a nationwide survey of shippers conducted by the Census Bureau in partnership with BTS. To date, the survey has generated freight transportation data for 1993 and 1997, and the next set of data (covering 2002) will be released in 2003. Some say this five-year cycle is sufficient since the federal government produces an economic census every five years, DOT's legislative reauthorization occurs about every five years, and the planning process runs over a five-year period. Having commodity flow information every five years to measure how the national transportation system is being used by all modes and to determine if performance is improving or declining is, in this view, adequate. However, those who need freight flow information for local infrastructure assessment or for building a business strategy do not agree, because five-year-old data are too stale for their decisionmaking processes.

One way to overcome this difference of opinion would be to conduct multiple surveys: a nationwide survey every five years for federal government purposes and others done more frequently by state or local governments and by industry. However, this proposition is costly and can result in data incompatibility problems, as discussed earlier. Once again, a coordinated approach involving data users in different levels of government and in industry could produce less costly but unified data that meet a variety of user needs. A modified CFS with a smaller sample size, collected more frequently, may meet the need for more timely data and be aggregated at five- or six-year intervals to provide a more comprehensive picture of freight flows. This approach requires breaking with tradition and adopting innovative solutions but has the potential to meet more needs at a reasonable cost.

Comparability

When data users get a different answer to the same question, they rightfully complain about a lack of comparability in data. The reason, however, often relates to differing sources and the status of data rather than fundamental problems with the data.

Multiple data sources that cover the same topic will not necessarily give the same answer. For instance, a user can get foreign waterborne commerce information from the Census Bureau's U.S. International Trade in Goods and Services report and the *Journal of Commerce's* Port Import/Export Reporting Service (PIERS) database. The Census data are generated from trade-based data, while the *Journal of Commerce* data are from vessel manifests. Data from different collection methods can be used to check the quality of each system, while centralized data distribution can reduce user confusion. The Office of Management and Budget designated the U.S. Army Corps of Engineers as the central collection agency for the U.S. Foreign Waterborne Transportation Statistics program. The Corps has access to both trade- and manifest-based data, knows the strengths and deficiencies of each, and can combine the information from both sources to give the most complete picture of import and export cargo movement.

A different type of inconsistency results from the use of preliminary versus final data. Preliminary data releases allow for timelier but lesser quality data. The National Highway Traffic Safety Administration (NHTSA) publishes an early assessment of traffic fatalities each spring covering the previous calendar year. These data are revised at a later date when all fatality information has been reported and the data have gone through NHTSA's data quality validation process. Preliminary data are extremely valuable to those who need information for performance monitoring or planning purposes. Timely indicators can identify problem areas and result in early interventions. Decisions can be made sooner with preliminary estimates, with the understanding that timeliness is being balanced against greater accuracy.

Omissions

Missing data occur for a number of reasons (boxes 4 and 5) and result in an incomplete picture of who and what is transported. Existing data collections are often either too general to break down to the level of specificity users desire, or they do not adequately cover subjects of interest. For instance, little is known about some aspects of the usage of public vehicles, such as ambulances, police vehicles or garbage trucks; retail vehicles, such as delivery trucks; or private cars used as delivery vehicles. Data on commuter air carriers and air cargo is not as extensive or consistent with that collected from the larger passenger air carriers, yet commuter jets and air cargo operations have become significant elements of the air transportation system. General aviation and recreational boating, after highway vehicles, account for the most transportation fatalities, yet exposure data are limited.

Missing elements generate questions that cannot be answered: What are the travel patterns of the elderly, the disabled, low-income households, pedestrians, bicyclists, recreational boaters, and so forth? How can exposure to risk be calculated if how often and how much they travel is not known? How many large truck, delivery, emergency, and service vehicle trips take place each day? When do they occur and what routes do they take? How can their impact on congestion be

Box 4
Telephone Surveys: Who Gets Left Out?

Some important transportation data are collected through telephone surveys. However, telephone surveys run the risk of not accurately accounting for the transportation patterns and needs of lower income, minority, non-English speaking, and other segments of the population. A review of the U.S. Census Bureau's *American Housing Survey for the United States: 1999* bears this out. While only 4.4 million (4.2 percent) of the 102.8 million U.S. households do not have telephones available, the distribution is not evenly spread across the population. Renters, for instance, make up only 33 percent of households but constitute 51 percent of households without telephones. Similar disparities exist for blacks and Hispanics who make up 13 percent and 9 percent, respectively, of the total households but 20 percent and 13 percent, respectively, of households without telephones. Additionally, while 14 percent of households have incomes below the poverty level, they comprise 25 percent of the homes without phones. The percentages are higher in central cities.

A slightly different issue exists for those who only have mobile phones. With the popularity of cellular telephones rising because of their convenience and declining cost, some households have opted to forgo having a regular (i.e., landline) telephone. Since mobile phone owners may incur charges for incoming calls, most telephone surveys exclude cellular numbers. This leaves another segment of the population unrepresented in surveys even though they have telephones.

Lastly, telephone surveys may require responses in English. The 1990 census data show that nearly 8 million, or a little more than 3 percent of the 230 million people in the United States over the age of 5, live in households where no person 14 or older speaks English well enough to respond to an English-only survey. Therefore, it is important that survey design take into consideration the impact of who might be missed and find ways to include these segments of the population either through alternative sampling or statistical methods.

Box 5
Data Confidentiality

Confidentiality concerns raise questions about what should be protected and ultimately determine the content and uses of data systems and limit access to data even when legitimate needs arise. The laws and regulations concerning data confidentiality are designed to limit the release of data. Legislation, such as the Freedom of Information Act (FOIA), is intended to guarantee access to information. Government and industry may be authorized to collect data with personal, proprietary, law enforcement or classified information, but they may also be permitted to withhold or prohibited from releasing that data to others if it would violate confidentiality rules.

Personal information. The Privacy Act guarantees citizens protection against unwarranted invasion of their privacy, including collection and dissemination of personal information.

Proprietary information. Commercial enterprises may limit the distribution of information that is business-sensitive.

Law enforcement information. Certain law enforcement information may be protected from disclosure to ensure the safety of law enforcement personnel and the integrity of operations.

Classified information. Information that is classified by the federal government for reasons of national security is prohibited from public disclosure.

The general solution is to aggregate the data to a level where confidentiality is moot. Statistical agencies such as BTS can play a pivotal role here. They usually have legislation that protects data from certain FOIA requests, making them logical collectors of confidential information. They then can aggregate that information to a level where confidentiality concerns are eliminated and provide that data to those who need it. If they cannot release the data, they may be able to conduct the desired analysis of the protected data and provide the results in a manner that protects confidentiality.

calculated if how often and how much they travel is unknown?

These questions reflect an interest among data users to target specific segments of the population and transportation users to ensure that their impact on the transportation system and the system's impact on them can be measured and appropriate action taken. Filling gaps in the behavioral data are important: to federal, state, and local governments to determine allocation of resources; to business and industry to determine market strategy and operating policy; and to the public to address issues of equity and safety of transportation services. New data collections or modification of existing methods will be necessary to provide a more complete picture of U.S. travel patterns.

Intermodalism

Effective movement of both people and freight can involve multiple modes of transportation. These types of trips are poorly represented in current transportation data. Sometimes, this can occur because of the way questions about travel are posed. Prior to September 2001, policymakers were very concerned about the apparent growing congestion in air travel resulting in air flight delays. BTS has focused on improving data collection and dissemination on this specific issue. However, part of air travel involves getting from city centers or other origins to airports by other modes of transportation; it is the combination of modes and how they are integrated that determine the true length of a trip for an individual. Similarly, multiple modes of transportation are commonly used to move freight shipments from their initial origin to final destination. However, these intermodal data are not readily available. Each modal portion is often captured but in data systems with different formats, definitions, and data elements, making it difficult to integrate the data into a single trip (box 6).

Box 6

One Intermodal Shipment

A shipment of electronic equipment moving from overseas to a U.S. retail outlet arrives in the Port of Long Beach, California, via containership. The container is transferred to a railcar and travels by train to Chicago, where the load is broken into separate shipments. The electronics equipment is placed on a large truck with other shipments and driven to a distribution center in Indianapolis, where the truck's cargo is unloaded and the electronic equipment shipment is separated out. The shipment is then placed in a delivery van and driven to its final destination in Fort Wayne, Indiana.

Some information about this shipment would be included in multiple data sources, such as the *Waterborne Commerce of the United States* database maintained by the U.S. Army Corps of Engineers for the maritime portion of the trip, in the *Rail Waybill Sample* conducted for the Surface Transportation Board for the train portion of the trip, by the Bureau of Transportation Statistics' Commodity Flow Survey (CFS) for the intercity truck portion of the trip, and by the company that provided delivery to the final destination for its segment of the total trip. The data collected are not consistent throughout, nor are all the data sources publicly available. The CFS would not capture information about the shipment if the shipper for the entire trip is foreign, since this survey does not cover imports. But the CFS would capture the data for the domestic segments of the trip handled by a domestic shipper. A similar scenario of differing modes of transportation and segmented data collection could be produced for passenger travel with the same result: data users would not have an integrated picture of the entire trip. This inaccurate picture of intermodal travel and freight movement occurs because of the many incompatible data sources and the gaps in coverage by national surveys.

Data Focus: Prevention v. Survival

Datasets are generally collected with a particular, and usually narrow, focus in mind. This narrow focus will supply answers to some questions but can ignore important related issues. The best examples of this situation are in the area of safety data. All modes of transportation capture extensive safety data, particularly on accidents, however, each mode may go about it in different ways for different purposes.

Aviation accidents are few in number but often result in loss of life. The National Transportation Safety Board (NTSB), accordingly, does an exhaustive job of investigating crashes to determine why they happened. On the other hand, there are so many highway traffic accidents each year (ranging from minor fender-benders to fatal crashes) that a great deal of attention has been paid to collecting survivability information. This disparate focus has left both modes with data gaps. Limited data are captured on aviation passenger survivability leaving NTSB analysts unable to conduct indepth research on how to make aircraft safer for passengers during crashes. Conversely, if limited data are collected about causes of highway accidents, traffic safety researchers could be left with a poor understanding of how to prevent highway accidents.

Security Data and Data Security

Overlaying all of these transportation data issues today is how to achieve a balance between the need for security data and data security. There is currently a paucity of transportation security data available, especially in a consolidated fashion, on costs, incidents, and critical infrastructure. Prior to September 2001, security concerns about transportation infrastructure focused on military deployments; that is, making sure the routes to get military personnel and supplies to destinations overseas were kept open. Now, security issues are centered on potential disruptions of infrastructure and impacts on the physical and economic well-being of the country. This new focus requires more extensive information on transportation routes, system capacity, and vulnerabilities.

Meanwhile, concern about potentially damaging uses of data has led to restrictions, for security purposes, on the release of data. Data about transportation infrastructure, particularly geographic information, are not as readily accessible as they once were. After September 2001, the White House issued a memo requesting that federal agencies review the information they make available on the Internet to safeguard potentially sensitive data. More broadly, agencies now follow Department of Justice guidelines when reviewing requests under the Freedom of Information Act.

BTS: A LEADER IN TRANSPORTATION STATISTICS

The primary role of BTS, as expressed in its mission statement, is ". . . to lead in the development of transportation data and information of high quality and to advance their effective use in both public and private decisionmaking."[2] Legislation granted BTS a leadership role in the domain of transportation statistics but not authority over the data programs of other transportation administrations. While BTS spends almost half its budget on data collection, the bulk of transportation data are collected by other DOT administrations, federal agencies, and nonfederal entities, both public and private. Thus, BTS plays a coordinating role, helping to overcome the complexities of integration among levels (e.g., local, national, and international) and types of data and data that cut across modes.

Data Systems Coordination

Given the decentralized nature inherent in the national transportation data system, greater coordination between data users and data collectors is needed. BTS and other federal agencies need to play a prominent role in ensuring that data gathered by state and local agencies use comparable national definitions.

In recent years, BTS has taken on a number of functions aimed at coordination, including: development of *TransStats, the Intermodal Transportation Database;* geographic information systems (GIS) for transportation; and the Safety Data Initiative. Also, to enhance coordination and the flow of data and information among data producers and users,

[2] U.S. Department of Transportation, Bureau of Transportation Statistics, "A Strategic Plan for Transportation Statistics (2000–2005)," March 2000, available at http://www.bts.gov, as of May 2002.

BTS maintains the National Transportation Library (NTL).

TranStats, the Intermodal Transportation Database. *TranStats* is a network-based portal to the wealth of transportation-related data collected by DOT as well as others outside DOT. The aim is one-stop shopping for transportation data, and ultimately—in conjunction with the NTL—one-stop shopping for all of the information needed to carry out transportation research. The premise is fairly simple. By reducing the overall amount of time needed for data gathering, more time is available for analysis, and by providing easy linkages across datasets, new insights are facilitated. Having all of the data in one place also provides side benefits (and challenges). It potentially exposes discrepancies in definitions, differences in schemes, and data gaps—offering new opportunities for improving data quality, comparability, and coverage. It also provides an opportunity to more easily develop standards for presentation and documentation, to make transportation data more usable.

The most prominent feature of *TranStats* is the scope of its data. BTS plans to eventually include all of the major datasets within DOT, as well as a variety of demographic, economic, and social data, to enable wide-ranging analyses. *TranStats* also will contain powerful web-based tools to look at the data, including the ability to construct tables, graphics, and maps and do selective downloads.

Geographic Information Systems. Because of the spatial nature of transportation, geographic displays are an ideal way to analyze travel data and can present compelling pictures for decisionmakers. BTS creates, maintains, and distributes geospatial data through the National Transportation Atlas Database program. These data are obtained from multiple sources and include the National Highway Planning network, a national rail network, public-use airports and runways, and Amtrak stations. In the near future, layers will be added for land use, waterways, and transit. Together, the data comprise the transportation layer of the National Spatial Data Infrastructure. BTS distributes transportation geodata and a number of geographic reference files including state, county, congressional district, and metropolitan statistical area boundaries.

To coordinate the development of GIS data, standards, and tools within DOT, BTS created a Geographic Information Working Group. BTS is also partnering with other federal agencies to share geospatial data over the Internet and is building geographic information systems into the design of *TranStats* to provide dynamic mapping of statistical information.

Safety Data Initiative. BTS was the lead agency in a DOT-wide effort to improve safety data. Four working groups were established with team members from all transportation modes (i.e., air, rail, highway, water, and pipelines) and other federal agencies, as well as from academia. The working groups developed plans for 10 research projects.

National Transportation Library. BTS maintains an electronic "virtual" library, the NTL, that is accessible through the Internet. The library provides broad access to the nation's transportation research and planning literature. Currently, NTL contains over 150,000 documents and abstracts for another half million. NTL also maintains the DOTBOT search engine, indexing documents from 170 DOT websites. Through its partnership with the Transportation Research Board, NTL provides access to over 420,000 bibliographic records in the Transportation Research Information Services (TRIS) Online database.

Data Collection

As has been mentioned, good data are needed for effective transportation decisionmaking at all levels of society. Data for freight and passenger movements by mode, for instance, enable policymakers to estimate investment needs, track economic trends, and assess the financial health and performance of the transportation system.

BTS is responsible for several national-level datasets. The National Household Travel Survey (NHTS) is being conducted for 2001/2002 in partnership with the Federal Highway Administration. The 2002 Commodity Flow Survey is being done in partnership with the Census Bureau, following CFS data produced for 1993 and 1997. To improve freight data, BTS has considered an annual freight survey, which would provide more timely, complete, and detailed O–D commodity flow data and other types of freight traffic volume and shipment cost data. This new survey would include sectors now excluded in the CFS and supply more detailed data at the metropolitan level than is currently available. As a first step, the agency has asked the Transportation Research Board to conduct a 12-month study, "Freight Transportation Data: A Framework for Development," to offer expert advice on the development of the new survey.

At the international level, BTS tabulates, analyzes, and disseminates monthly North American land trade flow data, which are collected by the U.S. Customs Service and processed by the Census Bureau. These data provide information on commodity type by surface mode of transportation (rail, truck, pipeline, mail, and other). In addition, they include geographic detail for U.S. exports to and imports from Canada and Mexico. The information is used to monitor freight flow changes under the North American Free Trade Agreement, as well as for trade corridor studies, transportation infrastructure planning, marketing and logistics analyses, and other purposes. Similarly, BTS also tabulates, analyzes, and disseminates monthly passenger border-crossing and entry data collected by the Customs Service. These data provide information on the number of passengers and vehicles entering the United States across the northern and southern borders.

For air passenger travel and freight movements, BTS (through its Office of Airline Information) collects and publishes monthly ontime airline data, as well as more extensive monthly operating data for both domestic and foreign airlines. BTS also collects detailed financial statistics for domestic airlines and various statistics on service quality. The data reporting is mandated by law, and several issues are now driving changes in the reporting regulations. Prior to September 2001, public concern about airline delays led to legislation requiring better data on the causes of delay, and in mid-2002 BTS was in the final stages of rulemaking on data collection that would cover causal information. BTS also has been working for some time to modernize the data-collection program, bringing it up-to-date with changes that have occurred in the airline industry and with advances in information technology.

Airline data collected and compiled by BTS include:

- U.S. air carrier financial statistics (quarterly and annually);
- U.S. air carrier traffic statistics (monthly, quarterly, and annually);
- U.S. air carrier passenger origin-destination, itinerary, and ticket pricing data (monthly, quarterly, and annually;
- foreign air carrier traffic statistics (monthly);

- U.S. airport activity statistics (quarterly and annually); and
- U.S. major air carrier ontime and flight delay data (monthly).

BTS supported DOT's Office of the Secretary in its review of claims for and decisions on payments to air carriers under the Air Transportation Safety and System Stabilization Act, enacted after the terrorist attacks on September 11, 2001, to aid the airline industry. BTS support included data processing, claims review, and data validation and analysis. By the middle of 2002, DOT had authorized the payment of almost $4.3 billion to air carriers.

BTS, through its Office of Motor Carrier Information, manages a mandatory data-collection program of financial and operating statistics.[3] All trucking companies with gross annual operating revenues of $3 million or more are required to file annual reports, and those with revenue of $10 million or more are also required to file quarterly reports. In addition, all bus companies with gross operating revenues of $5 million or more are required to file annual reports. Types of data collected from trucking companies include:

- company name and identifying motor carrier numbers;
- company's segment of the trucking industry ("revenue commodity group");
- annual revenue, expenses, and net income;
- annual driver and helper wages;
- annual miles traveled, total number of shipments, and ton-miles; and
- the number of drivers with and without commercial licenses employed and the number of trucks and truck-tractors the company operates (owned or leased), as of the end of the reporting year.

These data are widely used in the private and public sector by motor carriers for benchmarking and competitive analyses, academics for scholarly analyses and to train future trucking industry executives, law firms for expert testimony in court cases, federal and state government agencies for studies of the trucking industry, consulting firms, and trade journals and other publications to show rankings and business information for individual trucking companies. BTS plans to make annual report data (1999 and thereafter) available electronically via *TranStats*. Data users will then be able to extract data they need by individual company and industry segment or access the entire annual data series for analysis using statistical analytical software.

The monthly *Omnibus Survey* is coordinated by BTS for offices in DOT, enabling data collection on the transportation system, how it is used, and how users view it. The survey provides timely, high-quality data on issues related to safety, security, mobility and access, the human and natural environment, and economic growth to support informed planning and decisionmaking. In addition to monthly core questions covering DOT's strategic goals, administrations can add questions to the survey. These questions typically cover specific events or issues of interest to the various DOT administrations or measure public reaction to issues like fluctuating fuel prices, seat belt use, airline service, or boating safety. In addition to the *Omnibus Survey,* BTS conducts occasional special topic surveys. For instance, after the terrorist attacks of September 2001, BTS conducted a survey to assess the public's intentions for traveling over the holidays and their expected mode

[3] 49 CFR 1420. The Interstate Commerce Commission collected financial and operating statistics data from the time that the Motor Carrier Act of 1935 went into effect until 1994, at which time BTS took over the data collection.

choices and in early 2002 surveyed the public's perspectives on government efforts to improve transportation security.

Compilation, Analysis, and Dissemination

BTS compiles extensive data from diverse sources into collections relevant for policymakers and other transportation data users. These compilations range from sets of data tables to presentations of data with analyses, and include:

- *Transportation Statistics Annual Report,* prepared under BTS's le'gislative mandate, covers nearly 100 transportation topics, analyzing time series data and recent developments.
- *Transportation Indicators,* available monthly on the BTS website,[4] tracks over 130 indicators.
- *National Transportation Statistics,* an annual publication with over 250 data tables, is organized into four broad categories (i.e., system, safety, economy, and energy/environment) and is available in hard copy and on the BTS website.
- *Pocket Guide to Transportation,* an annual pocket-sized booklet of key transportation data presented in tables and figures.
- *North American Trade and Travel Trends (2001),* a data and analysis presentation of recent trends in U.S. trade and passenger travel with Canada and Mexico.
- *U.S. International Travel and Transportation Trends (2002),* an overview of U.S. international and regional travel trends between 1990 and 2000, plus significant changes in air travel since September 2001.
- *Maritime Trade and Transportation (2002),* an overview with data and analysis of maritime issues.
- *State Transportation Profiles,* presentations of individual state transportation data from federal and other national data sources. The first edition in this series, covering all 50 states and the District of Columbia, will be issued during 2002 and 2003.
- *Government Transportation Financial Statistics (2002),* a trend analysis of federal, state, and local transportation revenues and expenditures, is available on the BTS website.

In addition to the analysis conducted for these and other BTS publications, the agency is engaged in a number of focused transportation studies. These include studies of leading transportation indicators, productivity measures in various transportation sectors, and transit availability. BTS is also working to develop measures of sprawl, as well as measures for DOT Strategic Outcome goals. These latter measures cover, among others, transportation-related deaths and injuries, access to transportation systems for individual users, travel costs and times, the U.S. international competitive position in transportation goods and services, and transportation dependence on foreign fuel supplies.

BTS and the Bureau of Economic Analysis (BEA) in the U.S. Department of Commerce developed Transportation Satellite Accounts (TSA), which provide detailed information about transportation's contribution to the Gross Domestic Product (GDP). A key feature is estimation of the value added to the economy by the in-house transportation sector (transportation undertaken by firms in the nontransportation sector of the economy, such as trucks owned and operated by grocery chains). Before the TSAs were developed, reliable estimates of this value added were not available. BTS and BEA have also been developing a method

[4] Available at http://www.bts.gov.

for capital stock accounting to measure the value of the nation's transportation infrastructure, as directed by the Transportation Equity Act for the 21st Century (TEA-21.)

Filling Data Gaps

Gaps in data may involve the absence of data, data that are of poor quality, or data that are collected but not provided in a timely manner or in a form that a decisionmaker can use. For example, a known major data gap is the absence of good inland O–D data covering traffic moving in international commerce. In 2001 and 2002, BTS comprehensively assessed gaps in transportation data and the benefits and costs of possible solutions. This project was conducted in consultation with major stakeholders including those within DOT and among congressional staff, state DOTs, metropolitan planning organizations, the transportation industry, and research organizations.

Solutions to several critical data problems are being planned or are underway in BTS. Surveys of bicycle and pedestrian travel and of persons with disabilities will provide information on demographic groups for which little data has been collected in the past. The planned American Freight Survey will fill gaps in coverage to provide data on freight flows that were not captured in past surveys. It will collect information on travel costs and times to identify bottlenecks that are vital in the context of national competitiveness and on containerization useful for security purposes. The National Household Travel Survey will provide improved travel data on trips in the 50- to 100-mile range. Implementation of Safety Data Initiative recommendations will reengineer safety data systems to reduce redundancy and improve quality and timeliness. This will result in uniform reporting of fatality and accident data and allow comparability across modes of transportation.

However, other gaps exist and solutions have yet to be designed. There remains an incomplete picture of hazardous materials transportation due to the lack of data identifying shippers, carriers, and the transportation workforce involved in the industry. Also needed are better data on the rapid developments in the transportation requirements of service industries and effects of e-commerce on just-in-time delivery systems on these and other sections of the freight-generating economy. Little data exist on the travel characteristics of those involved in recreational boating. The number, characteristics, and their contribution to traffic flows are unknown for certain types of motor vehicles such as those providing municipal services, for example, ambulances, municipal trash haulers, and government motor pools. Transportation workforce labor hours are not captured for all segments of the transportation industry making it difficult to conduct analyses of economic issues or safety concerns, such as fatigue. These, and several other, gaps will be addressed in the *Data Gaps Final Report* due to be completed in 2003.

Assuring Data Quality, Good Statistical Practice, and Measuring Results

Legislation requires BTS to issue guidelines for DOT data collection to ensure that transportation data are accurate, reliable, relevant, and in a form that permits systematic analysis. In addition, the Office of Management and Budget issued a requirement in 2001 that agencies develop information quality guidelines. As an active participant in the Interagency Council for Statistical Policy working group, BTS has the lead role in developing these guidelines for all of DOT.

As part of these responsibilities, BTS developed the portion of the new DOT information guidelines that cover statistical information. These guidelines applied to all of DOT as of October 1, 2002. In addition, BTS will use the guidelines as a foundation for a more comprehensive *Guide to Good Statistical Practice*. This guide will be a handbook for transportation data program managers and analysts on all aspects of data quality, including data system planning, collection, processing, analysis, interpretation, dissemination, and evaluation.

BTS also has an ongoing data quality assessment project. In 2001, the agency assessed 5 DOT data systems (in conjunction with the Safety Data Action Plan) and plans to assess 10 more in 2002. The databases reviewed in 2001 included hazardous materials incidents and enforcement actions, airline passenger travel, transit safety and security, and airline safety. In addition, BTS assisted the Office of the Secretary of Transportation in a review of data submitted by air carriers to support claims for compensation after the September 11 shutdown of the air traffic system.

In accordance with the Government Performance and Results Act, DOT maintains a performance measurement system. BTS provides technical support for the development of performance measures, analysis of performance data, and reliability assessment. As part of this work, BTS develops verification and validation plans and coordinates with DOT agencies to develop "data details" that describe the scope and limitations of the data elements.

THE FUTURE

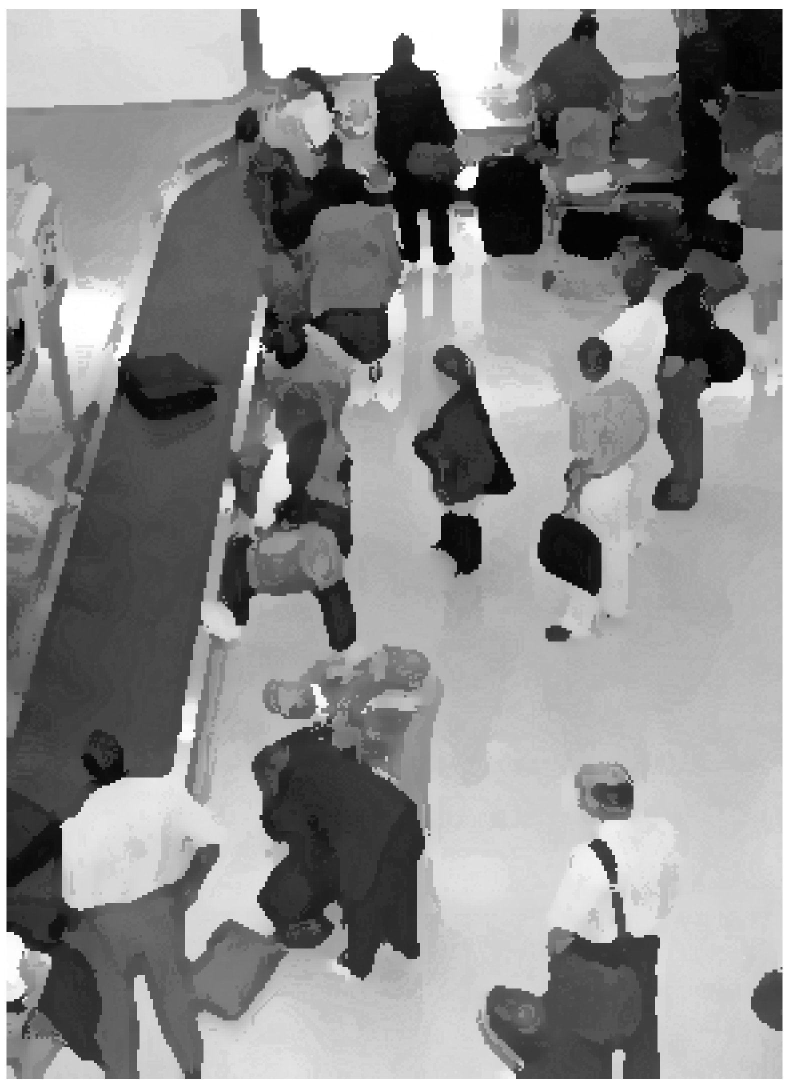
In BTS's vision of the future, data and information of high quality will support every significant transportation policy decision, thus advancing the quality of life and economic well-being of all Americans. BTS plans to be at the focal point of this vision, to develop its capabilities such that people will come to BTS before starting a planning effort or transportation policy study because the Bureau has good data and the information they need.

To be that focal point, BTS will have data ready for every significant policy analysis. BTS will be agile, assuring that data cover emerging trends in transportation. The data will be good, clean, and timely. The data will also be easy to get and use and be complemented by analysis. BTS will accomplish this, not alone, but as part of a team or network of data collectors and providers, both public and private.

In essence, the BTS goal is to make transportation better—to enhance DOT's strategic goals: security, safety, mobility, economic growth, and the human and natural environment.

Chapter 3

Transportation System Condition and Extent



Introduction

The U.S. transportation system makes possible a high level of personal mobility and freight activity for the nation's 284 million residents and nearly 7 million business establishments. In 2000, over 230 million motor vehicles, transit vehicles, railroad cars, and boats were available for use on the over 4 million miles of highways, railroads, and waterways that connect all parts of the United States, the fourth largest country in the world in land area. The transportation system also includes about 228,000 aircraft and over 19,000 public and private airports (an average of about 6 per county), and 440,000 miles of oil and gas transmission lines. This extensive transportation network supported an estimated 4.8 trillion passenger-miles of travel in 2000 and 3.8 trillion ton-miles of commercial freight shipments in 1999.

In general, the nation's transportation infrastructure has changed very little in recent years, while the number of vehicles has grown, in some cases dramatically. Road lane-miles, for instance, have grown by just 4 percent between 1980 and 2000, while cars and light trucks have increased by 40 percent. In air transportation, the number of aircraft operated by air carriers has increased by more than 35 percent since 1990, while the number of certificated airports (those serving scheduled air carrier operations with aircraft seating more than 30 passengers) has shrunk. The heavy use of the nation's infrastructure raises the specter of deterioration. Data show, however, the nation's roads, bridges, and airport runways, in general, improved in the 1990s.

As the level of traffic continues to climb and the amount of infrastructure remains the same, improved management of the system is one method being used to keep traffic flowing. The increasing use of information technology is important not only in commercial aviation, railroading, and waterborne commerce, but also in highway transportation, transit, general aviation, and boating. Information technology enhances the capability to monitor, analyze, and control infrastructure and vehicles and offers real-time information to system users. These technologies have a great deal of potential to help people and businesses use the transportation system more efficiently.

Transportation System Extent

The widespread availability of a large variety of transportation options brings a high level of mobility to most of the nation's residents and businesses. Tables 1 through 6 provide a snapshot of the key elements of the U.S. transportation system.

Table 1
Highways: 2000 Data (unless noted)

Public roads
- 46,677 miles of Interstate highways
- 114,511 miles of other National Highway System (NHS) roads
- 3,789,927 miles of non-NHS roads

Vehicles and use
- 134 million cars, driven 1.6 trillion miles
- 79 million light trucks, driven 0.9 trillion miles
- 8 million commercial trucks with 6 tires or more and combination trucks, driven 0.2 trillion miles
- 746,000 buses (all types), driven 7.6 billion miles
- 4.3 million motorcycles, driven 10.5 billion miles

Passenger and freight motor carriers
- 4,000 private motorcoach companies operating in the U.S. and Canada (1999), 860 million passengers[1] (1999)
- 511,000 interstate freight motor carriers,[2] 1.1 trillion ton-miles carried[3]

[1] American Bus Association, *Motorcoach Census 2000,* available at http://www.buses.org, as of Mar. 27, 2002.
[2] U.S. Department of Transportation, Federal Motor Carrier Safety Administration, analysis and information online, "SafeStat Online," available at http://ai.volpe.dot.gov/SafeStat/safestatmain.asp, as of September 2001.
[3] Eno Foundation, Inc., *Transportation in America, 2000* (Washington, DC: 2001).

SOURCE: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2000* (Washington, DC: 2001), tables HM-15 and VM-1, also available at http://www.fhwa.dot.gov/ohim/hs00/index.htm, as of Mar. 26, 2002.

Table 2
Air: 2000 Data (unless noted)

Airports
- 5,317 public-use airports
- 13,964 private-use airports

Airports serving large certificated carriers[1]
- 29 large hubs (72 airports), 479 million enplaned passengers
- 31 medium hubs (53 airports), 102 million enplaned passengers
- 54 small hubs (69 airports), 40 million enplaned passengers
- 585 nonhubs (610 airports), 18 million enplaned passengers

Aircraft
- 8,228 certificated air carrier aircraft,[2] 5.4 billion domestic miles flown[2]
- 219,464 active general aviation aircraft[3] (1999), 3.9 billion statute-miles flown[4] (1997)

Passenger and freight companies[5]
- 75 carriers
- 616 million domestic revenue passenger enplanements
- 14.8 billion domestic ton-miles of freight

Certificated air carriers (domestic and international)
- Majors: 14 carriers, 672,000 employees, 590 million revenue passenger enplanements
- Nationals: 32 carriers, 56,000 employees, 80 million revenue passenger enplanements
- Regionals: 29 carriers, 3,600 employees, 6 million revenue passenger enplanements

[1] U.S. Department of Transportation, Bureau of Transportation Statistics, Office of Airline Information, *Airport Activity Statistics of Certificated Air Carriers, 12 Months Ending December 31, 2000* (Washington, DC: 2001).
[2] Aerospace Industries Association, *Aerospace Facts and Figures* (Washington, DC: 2000/2001).
[3] U.S. Department of Transportation, Federal Aviation Administration, *General Aviation and Air Taxi Activity and Avionics Survey, Calendar Year 1999* (Washington, DC: 2001).
[4] U.S. Department of Transportation, Federal Aviation Administration, *General Aviation and Air Taxi Activity and Avionics Survey, Calendar Year 1997,* FAA-APO-99-4 (Washington, DC: 1999).
[5] U.S. Department of Transportation, Bureau of Transportation Statistics, Office of Airline Information, *Air Carrier Traffic Statistics* (Washington, DC: 2000).

SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, *National Transportation Statistics 2001,* available at http://www.bts.gov.

To put the system into perspective, the system's 4 million miles of roads would circle the globe more than 157 times, its rail lines 7 times, and its oil and gas pipelines 56 times. The average distance traveled by a car or light truck annually (about 12,000 miles) equals a journey nearly halfway around the world, or added together, about one-tenth the distance to the nearest star outside our solar system.

The capacity of the air and transit systems in the United States is also phenomenal. There are more than enough seats on airplanes operated by U.S. air carriers to seat the entire population of Delaware (784,000 people). And the number of cars in the New York City subway system alone is more than large enough for the entire population of Baton Rouge, Louisiana (228,000 people), to have a seat at the same time.

Table 3
Rail: 2000 Data

Miles of road operated
- 120,597 miles by major (Class I) railroads
- 20,978 miles by regional railroads
- 28,937 miles by local railroads
- 22,741 miles by Amtrak[1]

Equipment
- 1.4 million freight cars
- 20,028 freight locomotives in service

Freight railroad firms
- Class I: 8 systems, 168,360 employees, 1.4 trillion revenue ton-miles of freight carried
- Regional: 35 companies, 11,254 employees
- Local: 517 companies, 12,194 employees

Passenger (Amtrak)[1]
- 25,000 employees, 1,894 passenger/other cars
- 378 locomotives, 22.5 million passengers carried (FY 2000)

[1] National Railroad Passenger Corp., *Annual Report 2000* (Washington, DC: 2000), also available at http://www.amtrak.com/pdf/00annualrpt.pdf, as of September 2001.

SOURCE: Association of American Railroads, *Railroad Facts: 2001 Edition* (Washington, DC: 2001).

Table 4
Transit: 2000 Data (preliminary)

Vehicles
- 75,013 buses (also included in buses under highway), 21.2 billion passenger-miles
- 12,168 heavy and light rail, 15.2 billion passenger-miles
- 5,073 commuter rail, 9.4 billion passenger-miles
- 119 ferries, 330 million passenger-miles
- 33,080 demand responsive, 839 million passenger-miles
- 6,159 other vehicles, 984 million passenger-miles

Transit agencies
- 554 federally funded urbanized area agencies
- 1,074 federally funded rural agencies
- 3,594 federally funded specialized transportation agencies
- 753 other agencies
- 346,415 employees

NOTE: Data for fiscal year 2000 are preliminary.

SOURCE: American Public Transportation Association, *Transit Factbook 2001* (Washington, DC: 2001), tables 30, 46, 62, and 84.

(continues on next page)

Table 5
Water: 2000 Data

U.S.-flag fleet (active and inactive)
Great Lakes: 614 vessels, 58 billion ton-miles (domestic commerce)
Inland: 32,868 vessels, 303 billion ton-miles (domestic commerce)
Ocean: 7,872 vessels, 294 billion ton-miles (domestic commerce)
Recreational boats: 12.8 million numbered boats[1]

Commercial facilities[2]
Great Lakes: 611 deep-draft, 143 shallow-draft
Inland: 2,367 shallow-draft
Ocean: 4,079 deep-draft, 2,109 shallow-draft

[1] U.S. Department of Transportation, U.S. Coast Guard, *Boating Statistics–2000* (Washington, DC: 2001).
[2] U.S. Army Corps of Engineers, Navigation Data Center, *Geographic Distribution of U.S. Waterway Facilities,* available at http://www.wrsc.usace.army.mil/ndc/fcgeodis.htm, as of January 2001.

SOURCE: Except as noted, **number of vessels—**U.S. Army Corps of Engineers, Institute for Water Resources, *Waterborne Transportation Lines of the United States: Calendar Year 2000* (Fort Belvoir, VA: 2001), also available at http://www.iwr.usace.army.mil/ndc/veslchar.htm, vol. 1, table 1, as of April 2001; **ton-miles—**U.S. Army Corps of Engineers, Institute for Water Resources, *Waterborne Commerce of the United States* (Washington, DC: 2001), Part 5, table 1–4.

Table 6
Pipeline: 1999 Data

Oil[1]
Crude lines: 86,000 miles, 336 billion ton-miles
Product lines: 91,000 miles, 287 billion ton-miles

Natural gas (estimates)[2]
Transmission: 263,000 miles of pipe
Distribution: 1,046,000 miles of pipe, 184 companies, 138,000 employees

[1] Eno Foundation, Inc., *Transportation in America, 2000* (Washington, DC: 2001).
[2] American Gas Association, *Gas Facts* (Washington, DC: 1999).

Information Technology Use

From the telegraph used by railroads in the 19th century to radio and radar used in ships and planes at the beginning of the 20th century, information technology (IT) has enhanced the capabilities of our transportation systems. In recent years, these technologies have been integrated into all modes of transportation. Highway and transit applications of IT now are joining the other modes as new technology allows drivers to "navigate" roads.

Intelligent transportation systems (ITS) comprise a broad range of technologies, including those in the IT category, and help improve the efficiency, effectiveness, and safety of transportation. Travelers can obtain information and guidance from electronic surveillance, communications channels, and traffic analysis. ITS also boosts the capability to monitor, route, control, and manage information to facilitate travel.

The variety of technologies and approaches across the ITS spectrum, however, complicates assessments of the extent of their use. The U.S. Department of Transportation (DOT), Federal Highway Administration's ITS Joint Program Office conducts periodic surveys to gauge urban implementation in 75 metropolitan areas[1] in the United States [2]. The surveys collect data on deployment for nine ITS infrastructure components for highways, transit, and highway-rail grade crossings within the boundaries of metropolitan planning organizations (MPOs).

A single ITS component may use several technologies or approaches. For instance, electronic toll collection (ETC) technologies automatically collect payments through the application of in-vehicle, roadside, and communications technologies. About 73 percent of the metropolitan areas surveyed had toll collection lanes with ETC capacity in fiscal year (FY) 2000, up from 36 percent in FY 1997 [2].

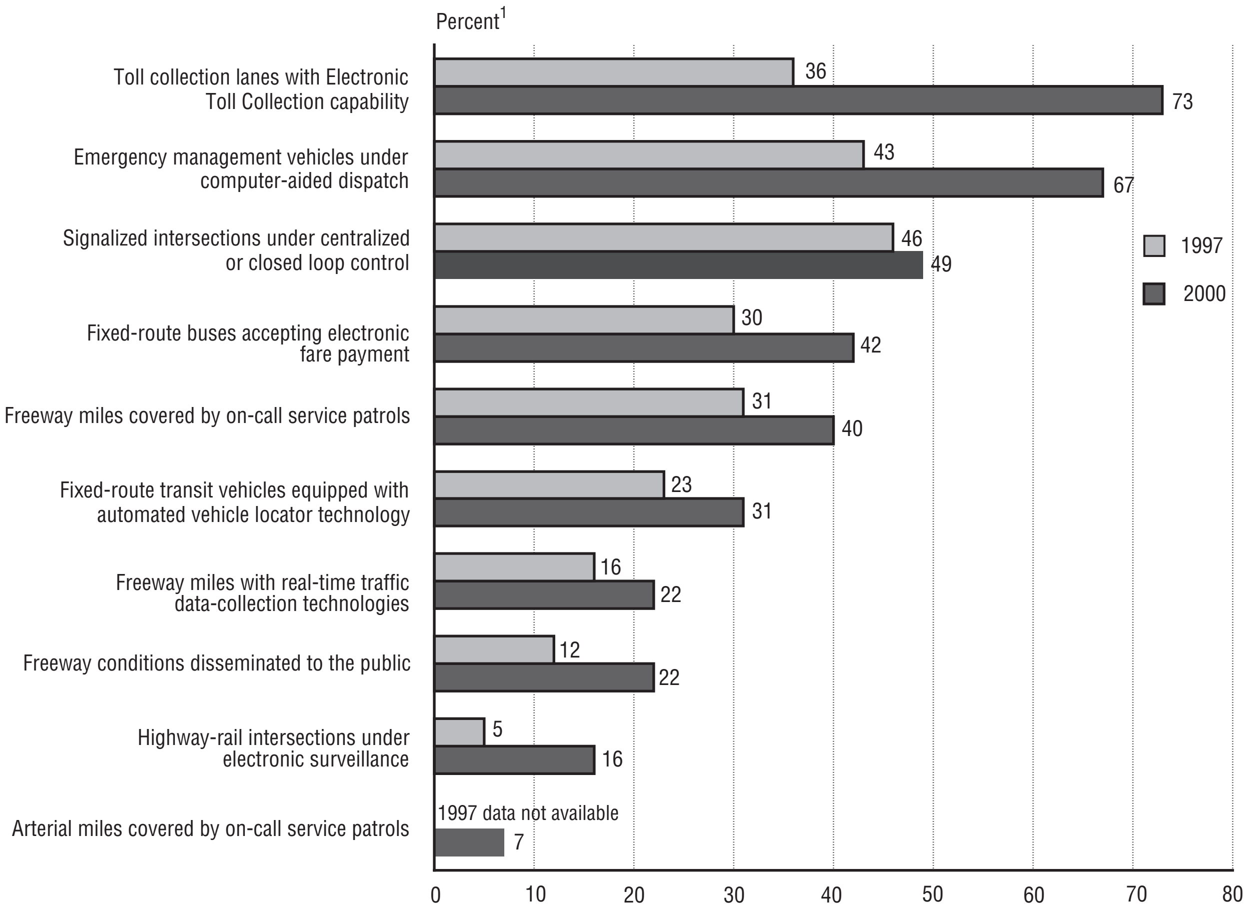
Multiple ETC technology deployment highlights the growing importance of integrating ITS. Beyond measuring fixed ITS assets like vehicles, the ITS Joint Program Office also studies the integration among agencies operating the infrastructure. Federal officials define ITS integration as the transfer of information between three types of organizations: state departments of transportation, local governments, and transit agencies.

Traffic signal control and electronic toll collection are two of the top three highway ITS technologies currently being deployed (figure 1). These technologies directly benefit travelers by smoothing out trips on toll roads and signaled arterial roads. Highway-rail grade crossings have one of the lowest rates of deployment, but a major federal initiative is providing funds to address this area.

The Global Positioning System (GPS) is being used in all transportation modes (even walking), although to what overall extent is uncertain. Thirty-one percent of the metropolitan areas surveyed in 2000 showed some

[1] The DOT IT Joint Program Office now measures 78 metropolitan areas. However, to maintain reporting consistency across a 10-year goal period, the office compares only data from the original 75 metropolitan areas.

Figure 1
ITS Infrastructure Deployment in 75 Metropolitan Areas: 1997 and 2000
Selected elements



[1] Percentage of the infrastructure components in all 75 areas that have the ITS technology deployed; e.g., 73 percent of the toll collection lanes in all 75 areas in 2000 had the capability to collect tolls electronically.

SOURCE: U.S. Department of Transportation, Federal Highway Administration, ITS Joint Program Office, ITS Deployment Tracking: 2000 Survey Results, available at http://www.itsdeployment2.ed.ornl/its2000, as of Oct. 31, 2002.

deployment of automatic vehicle location devices in fixed-route transit vehicles [2]. GPS is not only used for commercial aviation, but also for general aviation. About 70 percent of corporate and over half of business-use aircraft have GPS devices, compared with about 40 percent of personal-use aircraft [1].

In 1996, the U.S. Coast Guard brought its Maritime Differential GPS (DGPS) online. Reference stations located every 200 miles along the coast and major rivers allow ships with the proper GPS receiving equipment to identify their positions within 5 to 10 meters, compared with 100 meters for other positioning systems. This is an important navigational aid, as some channels are less than 100 meters wide. The DOT is now implementing Nationwide DGPS to bring the same positioning accuracy to all parts of the continental United States and Alaska.

Railroads are developing positive train control (PTC) systems that will use nationwide DGPS to provide precise positioning information. PTC can prevent overspeed accidents and collisions between trains and between trains and maintenance-of-way crews. PTC can also improve the efficiency of railroad operations by reducing train over-the-road delays and increasing running time reliability, track capacity, and asset utilization. [3].

Sources

1. U.S. Department of Transportation, Federal Aviation Administration, General Aviation and Air Taxi Survey, 1996, available at http://api.hq.faa.gov/ga96/gatoc.htm, as of Dec. 5, 2000, table 7.2.
2. U.S. Department of Transportation, Federal Highway Administration, ITS Joint Program Office, ITS Deployment Tracking: 2000 Survey Results, available at http://www.itsdeployment2.ed.ornl/its2000, as of Oct. 31, 2002.
3. U.S. Department of Transportation, Federal Railroad Administration, "What Is Positive Train Control?" available at http://frarnd.volpe.dot.gov, as of Dec. 4, 2000.

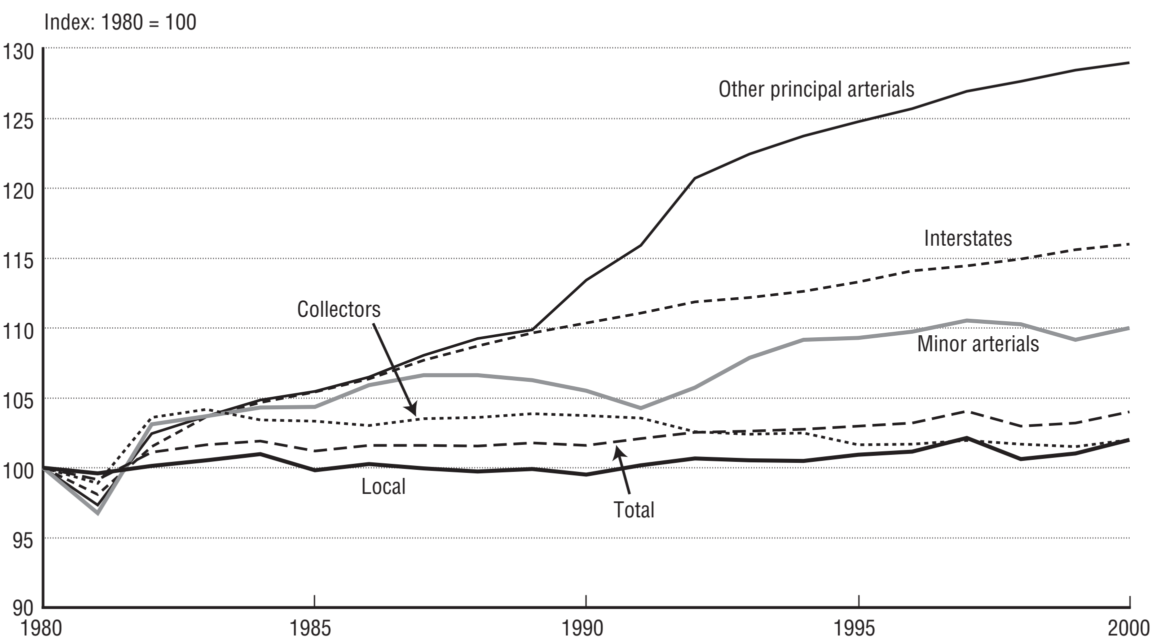
Roads

Road building and widening continue to slowly increase the extent of the public road system and the length of lane-miles open to the public. Since 1980, miles of public road increased only about 2 percent, although, as a result of road widening, lane-miles increased nearly twice as much (3.8 percent). This small change in overall lane-miles masks growth in the higher elements of the roadway system. Between 1980 and 2000, Interstate lane-miles increased by 16 percent and principal arterials increased by 29 percent (figure 1; also see box on p. 57 on the Highway Functional Classification System) [1].

Source

1. U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics* (Washington, DC: Annual editions).

Figure 1
Trends in Lane-Miles of Roadway by Functional Class: 1980–2000



SOURCES: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics* (Washington, DC: Annual editions), table HM-60.

U.S. Vehicle Fleet

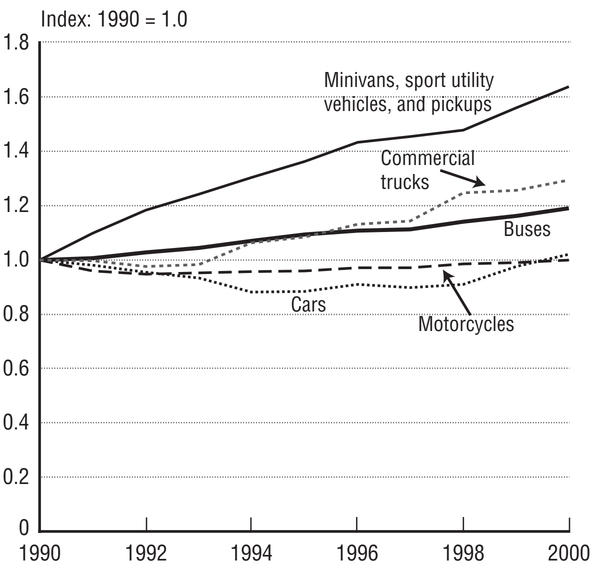
Between 1990 and 2000, the most noteworthy development in the U.S. highway vehicle fleet was the rapid growth in the number of registered light-duty trucks, including minivans, pickups, and sport utility vehicles (figure 1). During this period, the number of these vehicles grew from nearly 48 million to over 79 million, an increase of about 64 percent. This category now accounts for 35 percent of the total U.S. fleet, up from 25 percent in 1990. Fueled by the rapid increase in the number of light-duty trucks, the total U.S. fleet grew to nearly 226 million vehicles in 2000, a 17 percent increase over the 193 million vehicles registered in 1990 [1].

In contrast to the rapid and continual growth of light-duty trucks, the total number of cars and motorcycles in the fleet declined during the 1990s but by 2000 had regained their 1990 levels. Over the same period, the number of large trucks and buses increased at roughly the same rate as the total U.S. highway fleet, rising to just over 8 million large trucks and 746,000 buses by 2000. The 134 million cars in 2000 represent 59 percent of the total fleet, down from a 69 percent share in 1990 [1].

Source

1. U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2000* (Washington, DC: 2001).

Figure 1
Highway Vehicle[1] Trends: 1990–2000



[1] Registered vehicles.

SOURCES: 1991–1995—U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics Summary to 1995* (Washington, DC: 1997), tables MV-201 and VM201a.
1996–1997— ____. *Highway Statistics 1997* (Washington, DC: 1998), table VM-1.
1998–2000— ____. *Highway Statistics 2000* (Washington, DC: 2001), table VM-1.

Magnetic Levitation High-Speed Rail

As a result of work underway, the travel time of high-speed intercity rail service may be reduced in half in the future using magnetic levitation (maglev) technology. A maglev system employs magnetic forces to lift, propel, and guide a vehicle over a guideway using state-of-the-art electric power and control systems.

Under the Transportation Equity Act for the 21st Century, the U.S. Congress created a national Magnetic Levitation Transportation Technology Deployment Program in the U.S. Department of Transportation (DOT). In May 1999, DOT's Federal Railroad Administration (FRA) gave planning funds to seven state maglev projects. These funds enabled the seven projects to compete for the second phase of deployment [1].

Of the seven projects, DOT selected two in January 2001 as the best positioned for early demonstration of the technology. One project would connect Baltimore, Maryland, and Washington, DC, along 40 miles of the Eastern Seaboard. The other project, the 54-mile Pennsylvania High-Speed Maglev Corridor, would link Pittsburgh International Airport to Pittsburgh and its eastern suburbs [2]. Once this feasibility phase is completed, one of the projects will be eligible for $950 million for construction if Congress appropriates the funds.

Overall, FRA has provided $50.8 million through fiscal year 2002 for preconstruction planning for all seven projects (table 1). Just over half of these funds are supporting the two selected projects.

Sources

1. U.S. Department of Transportation, Federal Railroad Administration, "The Maglev Deployment Program," available at http://www.fra.dot.gov/o/hsgt/maglev.htm, as of Sept. 10, 2001.
2. _____. "U.S. Secretary of Transportation Slater Selects Two High Speed Maglev Projects," press release, Jan. 18, 2001, available at http://www.fra.dot.gov/o/hsgt/hot.htm, as of Sept. 17, 2001.

Table 1
Maglev Corridors and Funding

State	Maglev project	Funds granted through FY 2002 (millions of dollars)
California	Los Angeles International Airport–West Los Angeles–Union Station[1]	5.3
California–Nevada	Anaheim–Las Vegas via Ontario, Barstow/Victorville, and Primm[2]	5.4
Florida	Port Canaveral–Space Center–Titusville	4.2
Georgia–Tennessee	Hartsfield–Atlanta International Airport–Chattanooga Municipal Airport[4]	4.2
Louisiana	New Orleans Airport–Union Passenger Terminal–Lake Ponchartrain–St.Tammany Parish[3]	4.2
Maryland–Washington, DC	Camden Yards, Baltimore–Baltimore-Washington International Airport–Union Station, Washington, DC[5]	11.6
Pennsylvania	Pittsburgh International Airport–Pittsburgh–Monroeville–Greensburg[6]	15.9

[1] California Maglev Project website, available at http://www.calmaglev.org, as of Sept. 17, 2001.
[2] California-Nevada Interstate Maglev Project, "Overview," available at http://www.ci.las-vegas.nv.us/maglevproject/overview4.htm, as of Sept. 18, 2001.
[3] U.S. Department of Transportation, Federal Railroad Administration, "Transportation Secretary Announces $1.96 Million in Funding for New Orleans Maglev," press release, Mar. 3, 2000, available at http://www.fra.dot.gov/o/hsgt/hotfiles/maglev.htm, as of Sept. 17, 2001.
[4] Atlanta to Chattanooga Maglev, "Overview," available at http://www.acmaglev.com/overview.htm, as of Sept. 17, 2001.
[5] Baltimore-Washington Maglev Project, "Maglev Route: Corridor Overview," available at http://www.bwmaglev.com/about/maglev_route.htm, as of Sept. 17, 2001.
[6] The Pennsylvania Project, High Speed MAGLEV, project description, available at http://www.maglevpa.com/project.html, Sept. 17, 2001.

SOURCES: *Routes:* U.S. Department of Transportation, Federal Railroad Administration, "Table of High-Speed Rail and Maglev States and Corridors," available at http://www.fra.dot.gov/o/hsgt/states/index.htm, as of Sept. 15, 2001.
Funding: U.S. Department of Transportation, Federal Railroad Administration, Railroad Development, personal communication, Oct. 3, 2002.

Urban Transit

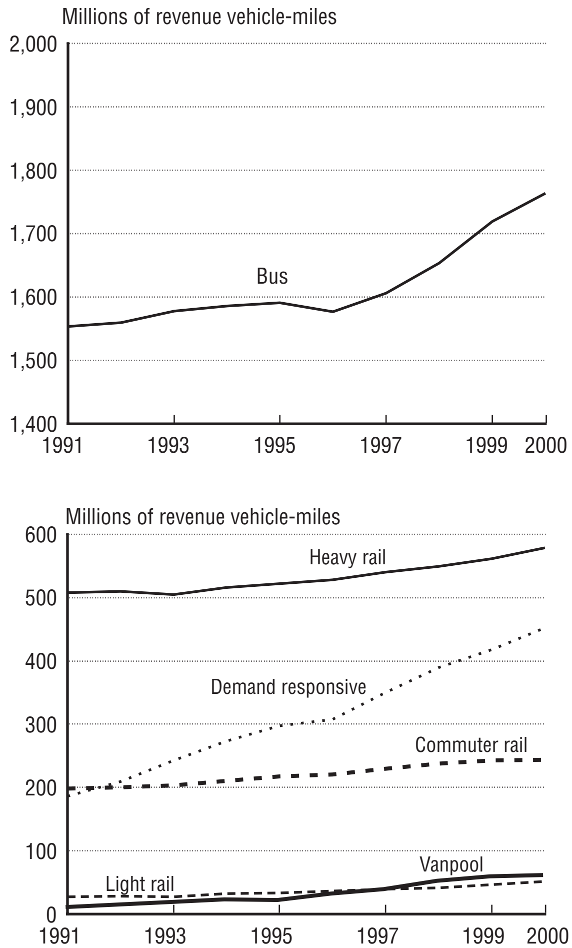
Urban transit is a complex mix of heavy, light, and commuter rail; buses and demand responsive vehicles; ferries; and other less prevalent types such as inclined planes, trolley buses, and automated guideways. This mode, measured by revenue vehicle-miles of service provided, grew by nearly 30 percent between 1991 and 2000 to over 3 billion miles. The U.S. population grew by 12 percent over this same period. The largest transit modes, bus and heavy rail, showed the slowest growth during this period (about 14 percent), while demand responsive transit grew the fastest (143 percent) (figure 1). Among rail modes, both light rail and commuter rail have seen substantial increases in service provided over this period, 90 percent and 25 percent, respectively [1].

Transit agencies in urbanized areas receive formula funding from the Federal Transit Administration for the purchase of vehicles. In fiscal year 2000, 152 agencies purchased 6,619 vehicles with formula funds. Most of the vehicles purchased (73 percent) were buses. Large urbanized area agencies purchased 69 percent of the buses (table 1) [2].

Sources

1. U.S. Department of Transportation, Federal Transit Administration, National Transit Database, Annual years.
2. U.S. Department of Transportation, Federal Transit Administration, 2000 Statistical Summaries: FTA Grant Assistance Programs, "Table 91: Obligation of Flex Funds/FHWA Transfers, by Area/State (Fiscal Years 1992-2000)," available at http://www.fta.dot.gov/library/reference/statsum01/table19.html, as of Oct. 5, 2001.

Figure 1
Revenue Vehicle-Miles by Urban Transit Mode: 1991–2000



NOTE: Other modes, including ferryboat, trolley bus, and automated guideway, are not shown.

SOURCE: U.S. Department of Transportation, Federal Transit Administration, National Transit Database, Annual years.

Table 1
Vehicles Purchased Under the Area Formula Funding Program: Fiscal Year 2000

Population category	Number of areas	Buses 35–40 ft	Buses 30 ft	Buses < 30 ft	Articulated buses	Vans and station wagons	Trolley buses	Other
Large	36	2,736	152	474	192	612	68	21
Medium	71	508	89	313	28	560	13	65
Small	45	223	69	283	2	166	33	12
Total	**152**	**3,467**	**310**	**1,070**	**222**	**1,338**	**114**	**98**

KEY TO POPULATION CATEGORIES: Large = over 1 million; medium = 200,000 to 1 million; small = less than 200,000.

NOTE: *Other* includes articulated trolleys, commuter buses, intercity buses, and used buses.

SOURCE: U.S. Department of Transportation, Federal Transit Administration, "Table 19: Obligation of Flex Funds/FHWA Transfers, by Area/State (Fiscal Years 1992–2000)," *2000 Statistical Summaries: FTA Grant Assistance Programs,* available at http://www.fta.dot.gov/library/reference/statsum01/table19.html,as of Sept. 26, 2001.

Rural Transit

Over one-third of the U.S. population lives outside urbanized areas. The Federal Transit Administration provides funding for rural transit through its Section 5311 program, part of the Transportation Equity Act for the 21st Century. Within this program, there are approximately 1,215 transit providers serving 91 million people in 773 cities with populations between 10,000 and 50,000 (15 percent of the rural population).

While the number of providers remained relatively constant between 1994 and 2000, the fleet sizes grew significantly. The average number of vehicles per provider was 17.5 in 2000, an increase of 60 percent from 1994. Annual trips per year increased 62 percent during this time, from 95 million in 1994 to 154 million in 2000.

SOURCE: Community Transit Association of America, Status of Rural Public Transportation-2000, available at http://www.ctaa. org/ntrc/rtap/pubs/status2000, as of Oct. 19, 2001.

U.S.-Flag Vessels

The U.S.-flag oceangoing merchant fleet consisted of 421 operating vessels in 2002 (table 1). The total U.S.-flag commercial fleet operating in both foreign and domestic trades, however, consisted of 29,263 vessels. This does not include more than 5,000 tugs/towboats 1,500, other types of workboats (e.g., crewboats, supply boats, and utility vessels), or over 1,200 passenger vessels (table 2).

Over 98 percent of the total U.S.-flag commercial fleet operated in U.S. domestic trade during 2000 (table 1). There are three major sectors of U.S. domestic trade: the inland waterways, Great Lakes, and domestic deep sea or coastwise trades. Barges operate primarily on the U.S. inland waterways and carry more than 90 percent of that tonnage [1]. The Great Lakes fleet consists of self-propelled vessels and integrated tug/barge units. Most of these "Lakers" only carry cargo between the Great Lakes ports. Containerships and tankers operate in the U.S. domestic deep sea trade.

The Jones Act (Section 27 of the Merchant Marine Act of 1920) requires that maritime cargoes and passengers moving between U.S. ports be transported in vessels built and maintained in the United States, owned by American citizens, and crewed by U.S. mariners [2]. As of April 2001, 157 privately owned, self-propelled vessels (of 1,000 gross tons and over) had unrestricted domestic trading privileges under the Jones Act (table 3).

Sources

1. U.S. Department of Transportation, Bureau of Transportation Statistics, Maritime Administration, and U.S. Coast Guard, *Maritime Trade and Transportation 99,* BTS99-02 (Washington, DC: 1999).
2. U.S. Department of Transportation, Maritime Administration, *MARAD '99* (Washington, DC: May 2000).

Table 1
Cargo-Carrying U.S.-Flag Fleet by Area of Operation: January 2000–June 2000
Thousands of metric tons

	Liquid carriers		Dry bulk carriers		Containerships		Other freighters[1]		Total fleet	
Area of operation	Number	Tons	Number	Tons	Number	Tons	Number	Tons	Number	Tons
Foreign trade	**79**	**2,457**	**235**	**2,124**	**61**	**2,368**	**46**	**1,072**	**421**	**8,021**
Self-propelled	**31**	**1,952**	**10**	**477**	**61**	**2,368**	**45**	**1,052**	**147**	**5,849**
≥ 1,000 gross tons	31	1,952	10	477	61	2,368	45	1,052	147	5,849
< 1,000 gross tons	0	0	0	0	0	0	0	0	0	0
Nonself-propelled[2]	**48**	**505**	**225**	**1,647**	**0**	**0**	**1**	**20**	**274**	**2,172**
≥ 1,000 gross tons	42	498	145	1,419	0	0	1	20	188	1,937
< 1,000 gross tons	6	7	80	228	0	0	0	0	86	235
Domestic trade	**3,437**	**16,393**	**21,435**	**37,186**	**50**	**757**	**3,920**	**4,621**	**28,842**	**58,957**
Coastal (including noncontiguous)	**599**	**9,779**	**448**	**1,596**	**50**	**757**	**1,435**	**1,658**	**2,532**	**13,790**
Self-propelled	**102**	**6,075**	**1**	**33**	**24**	**596**	**66**	**162**	**193**	**6,866**
≥ 1,000 gross tons	84	6,063	1	33	24	596	10	143	119	6,835
< 1,000 gross tons	18	12	0	0	0	0	56	19	74	31
Nonself-propelled[2]	**497**	**3,704**	**447**	**1,563**	**26**	**161**	**1,369**	**1,496**	**2,339**	**6,924**
≥ 1,000 gross tons	410	3,603	158	1,152	26	161	149	818	743	5,734
< 1,000 gross tons	87	101	289	411	0	0	1,220	678	1,596	1,190
Internal waterways	**2,819**	**6,522**	**20,912**	**33,511**	**0**	**0**	**2,397**	**2,800**	**26,128**	**42,833**
Self-propelled	**0**	**0**	**0**	**0**	**0**	**0**	**26**	**18**	**26**	**18**
≥ 1,000 gross tons	0	0	0	0	0	0	0	0	0	0
< 1,000 gross tons	0	0	0	0	0	0	26	18	26	18
Nonself-propelled	**2,819**	**6,522**	**20,912**	**33,511**	**0**	**0**	**2,371**	**2,782**	**26,102**	**42,815**
≥ 1,000 gross tons	1,263	4,129	215	599	0	0	72	254	1,550	4,982
< 1,000 gross tons	1,556	2,393	20,697	32,912	0	0	2,299	2,528	24,552	37,833
Great Lakes	**19**	**92**	**75**	**2,079**	**0**	**0**	**88**	**163**	**182**	**2,334**
Self-propelled	**4**	**20**	**53**	**1,873**	**0**	**0**	**4**	**21**	**61**	**1,914**
≥ 1,000 gross tons	2	19	50	1,871	0	0	1	21	53	1,911
< 1,000 gross tons	2	1	3	2	0	0	3	0	8	3
Nonself-propelled	**15**	**72**	**22**	**206**	**0**	**0**	**84**	**142**	**121**	**420**
≥ 1,000 gross tons	14	70	7	186	0	0	4	26	25	282
< 1,000 gross tons	1	2	15	20	0	0	80	116	96	138
Total, commercial fleet[3]	**3,516**	**18,850**	**21,670**	**39,310**	**111**	**3,125**	**3,966**	**5,693**	**29,263**	**66,978**
National Defense Reserve Fleet[4]	**28**	**884**	**0**	**0**	**5**	**86**	**143**	**2,423**	**176**	**3,393**
Ready Reserve Force	9	268	0	0	3	50	77	1,539	89	1,857
Other reserve	19	616	0	0	2	36	66	884	87	1,536
Other government	**0**	**0**	**0**	**0**	**0**	**0**	**7**	**237**	**7**	**237**
Sealift vessels	0	0	0	0	0	0	7	237	7	237
GRAND TOTAL	**3,544**	**19,734**	**21,670**	**39,310**	**116**	**3,211**	**4,116**	**8,353**	**29,446**	**70,608**

[1] Includes general cargo, roll on-roll off, multipurpose, lighter aboard ship (LASH) vessels, and deck barges. Excludes offshore supply vessels.
[2] Integrated tug barges of 1,000 gross registered tons (grt) and greater are contained in nonself-propelled categories as follows: foreign trade–2 liquid (78,300 tons), 2 dry bulk (48,100 tons), 1 other freighter (20,000); domestic coastal–9 liquid (371,155 tons), 1 dry bulk (21,500 tons); Great Lakes–2 liquid (18,955), 7 dry bulk (192,700); translakes–1 dry bulk (5,400).
[3] Excludes one passenger vessel of 7,250 deadweight tons (dwt) operated in noncontiguous domestic trade.
[4] Self-propelled vessels ≥ 1,000 grt; excludes 10 passenger vessels of 91,701 dwt.
SOURCE: U.S. Department of Transportation, Maritime Administration, Office of Statistical and Economic Analysis; adapted from U.S. Army Corps of Engineers, U.S. Coast Guard, and U.S. Customs Service data, available at http://www.marad.dot.gov/Marad_Statistics/PDF/Jan-Jun-00%20U.S.%20Cargo-Carrying%20Fleet.pdf, as of Oct. 25, 2001.

Table 2
U.S.-Flag Fleet of Passenger Vessels, Tugs/Towboats, and Other Work Boats
Inventory data as of July 1, 2001

Vessel type	Number	Capacity unit
Passenger vessels		**Passengers**
< 150 passenger capacity	753	51,774
≥ 150 passenger capacity	512	316,290
Total	**1,265**	**368,064**
Tugs/towboats		**Horsepower**
< 1,500 horsepower	3,340	2,464,621
≥ 1,500 horsepower	2,111	7,273,218
Total	**5,451**	**9,737,839**
Other work boats[1]		**Metric tons**
< 1,000 tons capacity	1,404	273,876
≥ 1,000 tons capacity	113	83,508
Total	**1,517**	**357,384**

[1] Includes crewboats and supply and utility vessels.

SOURCE: U.S. Department of Transportation, Maritime Administration, Office of Statistical and Economic Analysis, available at http://www.marad.dot.gov/Marad_Statistics/PDF/jan-jun-00 U.S. cargo-carrying fleet.pdf, as of Oct. 24, 2001.

Table 3
Privately Owned Self-Propelled Merchant Vessels with Unrestricted Domestic Trading Privileges (Jones Act): As of April 1, 2001
Thousands of tons,
vessels ≥ 1,000 gross registered tons

Vessel type	Number of ships	Gross registered tons	Deadweight
Tanker	103	3,410	6,695
Dry bulk carrier	7	103	184
Full container	30	690	761
Roll-on/roll-off	13	377	239
Cruise/passenger	1	20	7
Freighter	3	45	65
Total	**157**	**4,645**	**7,951**

SOURCE: U.S. Department of Transportation, Maritime Administration, Office of Statistical & Economic Analysis, available at http://www.marad.dot.gov/MARAD_statistics/Jact_Sum_0401.html, as of Oct. 23, 2001.

Ports and Cargo-Handling Services

U.S. ports that engage in foreign trade are facing key challenges such as waterfront congestion, port terminal productivity, and security needs. Nevertheless, U.S. foreign waterborne trade reached 1.2 billion metric tons in 2000, an increase of 2.4 percent over 1999 [4].

Landside access to water ports comprises a system of intermodal rail and truck services [5]. Landside congestion, caused by inadequate control of truck traffic into and out of port terminals combined with the lack of adequate on-dock or near-dock rail access, affects the productivity of U.S. ports and the flow of U.S. international trade. Generally, productivity is difficult to measure. Cargo throughput can be used as a measure; however, it does not take into account the more efficient use of resources gained from capital investment [2].

The U.S. port industry has invested approximately $22 billion since 1946 on improvements in its facilities and infrastructure—about one-third of that total (approximately $6.4 billion) was invested between 1996 and 2000 (table 1). Investments include new construction and modernization/rehabilitation. In 2000, new construction accounted for two-thirds of total expenditures. After trailing in investments in the previous years, Atlantic ports accounted for 22 percent of total expenditures in 2000 [5]. The Maritime Administration, U.S. Department of Transportation, expects that U.S. public ports will invest $9.4 billion between 2001 and 2005 [5].

Changes in vessel design impact access to both landside and waterside services. For example, container vessels have increased in size and capacity, which, in turn, drives a need for adequate transshipment hub and feeder ports.

The top ports in U.S. foreign trade are deep draft (with drafts of at least 40 feet) [3]. Twenty-five U.S. ports received 73 percent of total vessel calls (table 2). Of vessels over

Table 1
U.S. Public Port Capital Expenditures by Type of Facility: 1996–2000
Thousands of current dollars

	1996	1997	1998	1999	2000	Total
General cargo	191,898	227,543	154,133	127,864	241,424	942,862
Specialized general cargo	533,648	547,651	506,840	436,750	330,006	2,354,895
Dry bulk	76,513	127,536	90,338	57,701	37,058	389,146
Liquid bulk	5,977	966	2,143	16,074	8,168	33,328
Passenger	34,740	59,342	26,532	71,824	59,849	252,287
Other	61,805	131,534	222,602	100,829	86,188	602,958
Infrastructure	254,350	318,528	259,882	194,311	177,471	1,204,542
Dredging	142,221	129,354	151,927	110,327	117,489	651,318
Total	**1,301,152**	**1,542,454**	**1,414,397**	**1,115,680**	**1,057,653**	**6,431,336**

SOURCE: U.S. Department of Transportation, Maritime Administration, Office of Ports and Domestic Shipping, *U.S. Port Development Expenditure Report* (Washington, DC: 2001).

1,000 gross tons, tankers and containerships called at U.S. ports more often in 2000 than did other types of vessels.

The 2000/2001 U.S. economic slowdown detrimentally affected U.S. ports, particularly those on the West Coast. U.S imports declined from a 15 percent annual growth rate in early to mid-2000 to an estimated 6 percent drop during the first two quarters of 2001 [1].

Sources

1. DRI-WEFA, *The U.S. Forecast Summary* (Eddystone, PA: August 2001).
2. Robinson, Dolly, "Measures of Port Productivity and Container Terminal Design," *Cargo Systems*, April 1999.
3. U.S. Department of Transportation, *The Maritime Transportation System: A Report to Congress* (Washington, DC: 1999).
4. U.S. Department of Transportation, Maritime Administration, *U.S. Foreign Waterborne Transportation Statistics 1999 & 2000*, available at http://www.marad.dot.gov, as of Oct. 17, 2001.
5. _____. *U.S. Port Development Expenditure Report* (Washington, DC: December 2001).

Table 2
Top 25 U.S. Ports by Cargo Vessel Type and Calls: 2000
Vessels over 1,000 gross tons

	Total		Tanker		Dry bulk		Container		Other	
	Calls	000 dwt	Calls	000 dwt	Calls	000 dwt	Calls	000 dwt	Calls	000 dwt
Los Angeles/Long Beach	5,426	243,752	905	65,819	797	38,674	2,955	124,281	769	14,978
New Orleans, LA[1]	5,650	237,505	1,377	81,182	2,796	127,422	423	11,109	1,054	17,792
Houston, TX	6,327	215,467	3,111	133,432	885	39,160	651	19,999	1,680	22,875
New York, NY	4,817	188,006	1,287	66,018	399	17,485	2,199	87,675	932	16,827
San Francisco, CA[1]	3,676	165,601	819	52,233	637	23,346	1,936	82,958	284	7,064
Philadelphia, PA	3,240	132,469	967	82,233	533	22,372	497	11,478	1,243	16,385
Hampton Roads, VA[1]	2,660	111,365	158	7,498	507	32,991	1,592	62,169	403	8,706
Beaumont, TX	1,268	86,392	1,032	76,333	140	8,383	NA	NA	96	1,677
Corpus Christi, TX	1,455	84,893	964	64,312	350	19,040	2	83	139	1,458
Charleston, SC	2,234	82,167	148	5,988	144	5,003	1,552	62,499	390	8,676
LOOP Terminal, LA	307	79,650	291	77,023	16	2,627	NA	NA	NA	NA
Columbia River, WA[1]	2,219	77,896	279	13,907	1,279	46,457	263	10,027	398	7,505
Texas City, TX	1,281	70,954	1,152	64,610	89	5,763	3	72	37	510
Savannah, GA	1,966	63,775	238	7,733	340	10,833	740	31,516	648	13,693
Baltimore, MD	1,795	56,590	164	5,038	469	23,637	409	14,669	753	13,247
Valdez, AK	441	54,094	440	54,092	NA	NA	NA	NA	1	2
Tacoma, WA	1,232	47,486	70	3,207	219	10,211	568	27,950	375	6,119
Seattle, WA	1,170	45,715	50	2,795	230	10,301	794	31,182	96	1,438
Lake Charles, LA	794	45,341	474	34,339	125	5,894	6	86	189	5,022
Miami, FL	2,728	42,258	11	424	117	2,745	1,125	28,376	1,475	10,713
Mobile, AL	993	41,178	146	8,752	450	26,540	17	158	380	5,728
Jacksonville, FL	1,685	37,988	204	8,848	193	7,067	476	9,441	812	12,632
Port Everglades, FL	2,625	37,528	348	15,129	128	4,953	703	9,116	1,446	8,331
Freeport, TX	725	36,367	521	30,319	54	3,510	81	1,070	69	1,469
Portland, ME	509	31,125	350	26,672	60	3,750	1	3	98	702
Total, top 25 ports	**51,797**	**2,071,810**	**14,601**	**922,118**	**10,160**	**459,488**	**14,038**	**501,634**	**12,998**	**188,571**
Top 25 (percent)	**72.4%**	**74.0%**	**75.7%**	**73.3%**	**74.0%**	**76.8%**	**73.6%**	**74.9%**	**66.8%**	**69.1%**
Total, all ports	**71,548**	**2,798,448**	**19,299**	**1,257,664**	**13,729**	**598,325**	**19,067**	**669,623**	**19,453**	**272,835**

[1]Includes all area ports.

KEY: dwt = deadweight ton; NA = not applicable.

SOURCE: U.S. Department of Transportation, Maritime Administration, Office of Statistical and Economic Analysis; based on Lloyd's Maritime Information Services, *Vessel Movements* (London, England: 2001).

Airport Runways

In general, U.S. airport runway pavement is in good condition. When it is deteriorated, runway pavement can cause damage to aircraft turbines, propellers, and landing gear, and may result in runway closure. To prevent major problems, runway pavement requires regular maintenance to seal cracks and repair damage as well as a major overhaul every 15 to 20 years [1]. The U.S. Department of Transportation, Federal Aviation Administration (FAA), inspects runways at public-use airports and classifies runway condition as good, fair, or poor (see table for definitions).

Airport runway quality improved from 1986 to 2000 (table 1). At the over 3,000 airports listed in the FAA's National Plan of Integrated Airport Systems (NPIAS), runways in fair or poor condition dropped from 39 percent in 1986 to 27 percent in 2000. Those in good condition rose from 61 percent to 73 percent. At commercial service airports, a subset of the NPIAS, only 2 percent of runways were in poor condition in 2000. Overall, commercial airport runways remain in better condition than other NPIAS airports.

As with highway systems, increasing runway extent and capacity can take many years. In 2001, expansion projects were in various stages of completion at 13 commercial service airports (table 2).

Source

1. U.S. Department of Transportation, Federal Aviation Administration, *National Plan of Integrated Airport Systems (1998-2002)* (Washington, DC: 2000).

Table 1
U.S. Airport Runway Pavement Conditions: 1986 and 2000

	1986	2000
NPIAS[1] airports, total	**3,243**	**3,361**
Condition (%)		
Good	61	73
Fair	28	22
Poor	11	5
Commercial service airports,[2] total	**550**	**546**
Condition (%)		
Good	78	79
Fair	15	19
Poor	7	2

[1] The Federal Aviation Administration's (FAA) National Plan of Integrated Airport Systems (NPIAS) is composed of all commercial service airports, all reliever airports, and selected general aviation airports. It does not include over 1,000 publicly owned public-use landing areas, privately owned public-use airports, and other civil landing areas not open to the general public. NPIAS airports account for 100% of all enplanements and serve 91.5% of all aircraft (based on an estimated fleet of 200,000 aircraft). In 1997, there were 14,961 non-NPIAS airports.
[2] Commercial service airports are defined as public airports receiving scheduled passenger service and having at least 2,500 enplaned passengers per year.

NOTE: Data are as of January 1 of each year. Runway pavement condition is classified by FAA as follows:
Good: All cracks and joints are sealed.
Fair: Mild surface cracking, unsealed joints, and slab edge spalling.
Poor: Large open cracks, surface and edge spalling, vegetation growing through cracks and joints.

SOURCE: Various sources as cited in U.S. Department of Transportation, Bureau of Transportation Statistics, *National Transportation Statistics 2001* (Washington, DC: 2002).

Table 2
Runway Expansion Projects

Airport	Scheduled completion date (year)				
	2003	2004	2005	2006	2007
Atlanta			X		
Boston			X		
Charlotte		X			
Cincinnati			X		
Denver	X				
Houston	X				
Miami	X				
Minneapolis		X			
Orlando	X				
Seattle-Tacoma				X	
St.Louis-Lambert				X	
Washington-Dulles					X

SOURCE: U.S. Department of Transportation, Federal Aviation Administration, "Operational Evolution Plan: Timelines," December 2001, available at http://www.faa.gov/programs/oep/Timelines.htm, click on Airrival/Departure Rate, as of May 2002.

Highway Conditions

Overall, 40 percent of the nation's urban and rural roads were in good or very good condition in 2000, while 19 percent were mediocre or poor. The rest are in fair condition (table 1). The generally poorer condition of urban roads, as compared with rural roads, can be attributed to the higher levels of traffic they carry. Urban roads handled about 60 percent of all traffic in 2000 with far fewer miles of road. Indeed, on average in 2000, each lane-mile of urban road carried nearly 870,000 vehicles compared with about 170,000 vehicles by each lane-mile of rural road.

The condition of rural roads has generally improved since 1993, as have the higher level urban systems (figure 1). Miles of rural Interstates in poor or mediocre condition have declined from 35 percent to 14 percent, and miles of urban Interstates in poor or mediocre condition have declined from 42 percent to 30 percent. Rural and urban Interstates accounted for nearly one-quarter of all vehicle-miles traveled (vmt) in 2000. Miles of other freeways

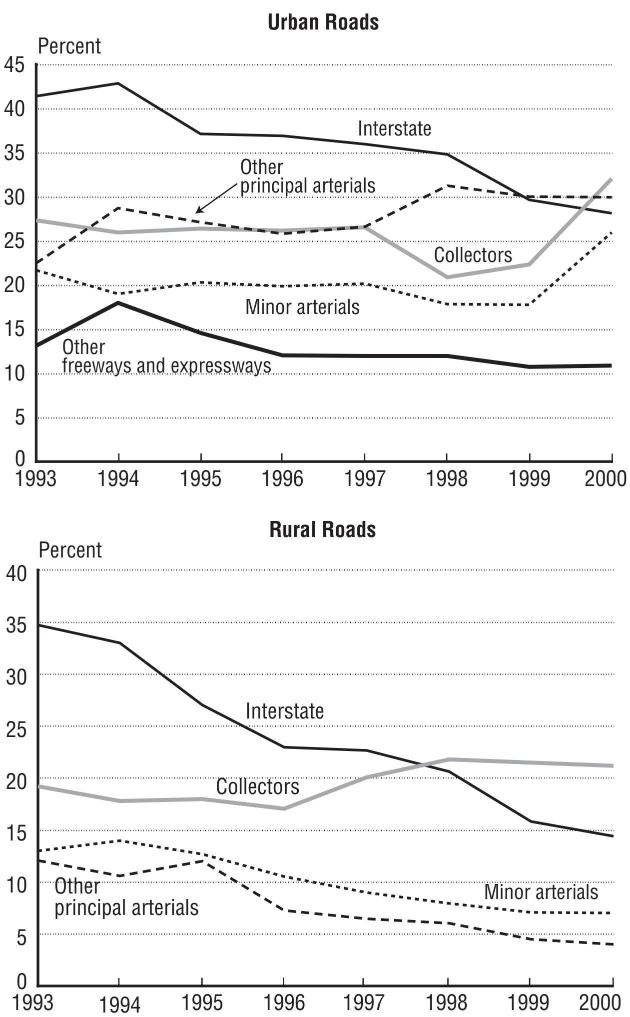
Table 1
Condition of Roads: 1993 and 2000
In percent

Type of road	Poor and mediocre	Fair	Good and very good
Urban			
1993	25	42	33
2000	29	39	33
Rural			
1993	19	45	36
2000	15	42	43
Total			
1993	21	44	35
2000	19	41	40

NOTE: Rural does not include minor collectors or local.

SOURCE: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics* (Washington, DC: Annual issues), table HM-63 for rural major collectors, urban minor arterials, and urban collectors; table HM-64 for all other categories.

Figure 1
Roads in Poor or Mediocre Condition by Functional Class: 1993–2000



SOURCE: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics* (Washington, DC: Annual issues).

Highway Classification

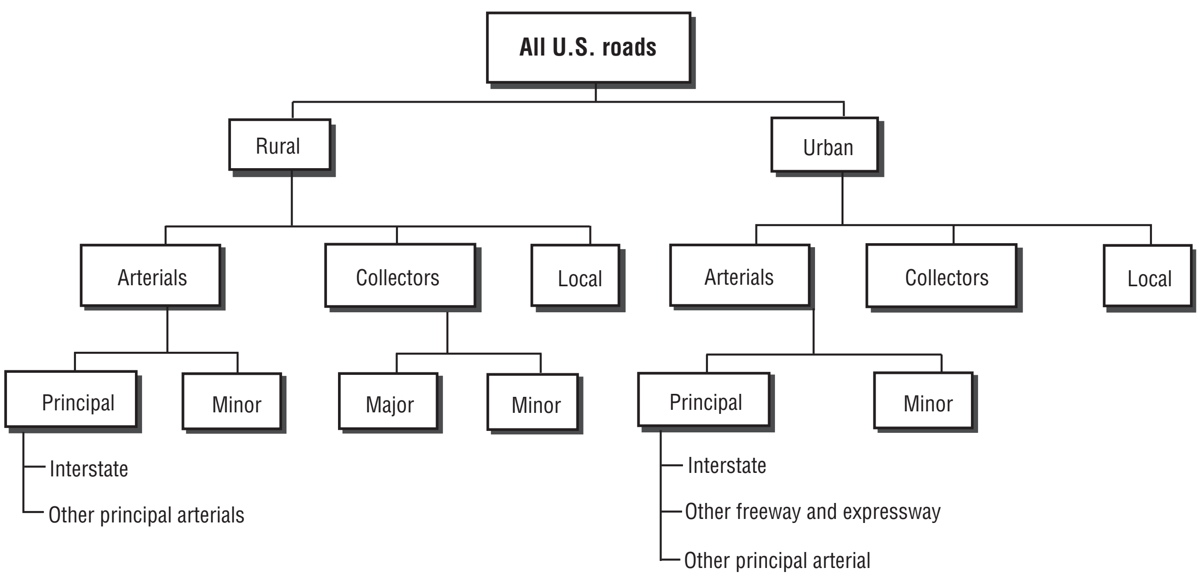
The Federal Highway Administration classifies roads according to the type of service provided and the type of area (rural or urban) using the Highway Functional Classification System (HFCS) (see figure below). There are three major types of roads: arterial, collector, and local.

Arterials provide the highest level of mobility for long, uninterrupted travel. Arterials are designed to a higher standard than other roads, have multiple lanes, and limited access. The Interstate Highway System is part of the arterial network. Rural arterials provide interstate and intercounty service. Rural principal arterials, in general, connect areas with populations of 25,000 or more. The urban principal arterial network serves large urban centers and high traffic corridors. Urban principal arterials also provide continuity with rural arterials and serve most trips entering and leaving urban areas. Urban minor arterials connect with urban principal arterials and rural connectors and are designed for medium length trips and moderate mobility.

Collectors provide shorter distance access between and within residential and business areas at lower speeds than arterials. These roads collect and distribute traffic from the arterial network and connect with local roads. Most collectors are two lanes.

Local roads pick up traffic from collectors and provide direct access to residences and businesses.

Highway Functional Classification System



SOURCES

U.S. Department of Transportation, Federal Highway Administration, Federal Transit Administration, *1999 Status of the Nation's Highways, Bridges, and Transit: Conditions and Performance* (Washington, DC: 2000).

U.S. Department of Transportation, Federal Highway Administration, *Our Nation's Highways: Selected Facts and Figures 1998* (Washington, DC: 1998).

and expressways in urban areas (accounting for another 6 percent of all vmt) in poor or mediocre condition declined from 13 percent in 1993 to 11 percent in 2000.

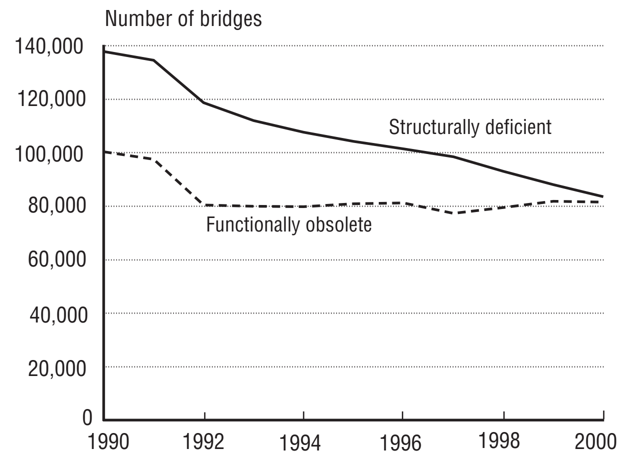
Of concern in rural areas is the condition of major collectors, roads carrying about 8 percent of all vmt in 2000. The proportion of miles of these types of facilities in poor or mediocre condition increased from 19 percent to 22 percent between 1993 and 2000. In urban areas, the major concerns are other principal arterials that carried about 15 percent of total vmt in 2000 and minor arterials that carried another 12 percent. Over the same period, the proportion of other principal arterials in poor or mediocre condition increased from 23 percent to 30 percent while the proportion of minor arterials in that condition increased from 22 to 26 percent. The condition of urban collectors[1] also deteriorated over this period, but these facilities carry much less traffic—about 5 percent of vmt in 2000.

[1] In both 1998 and 1999, the condition of about half the miles of urban *minor arterials* and about 40 percent of urban *collectors* were not reported.

Bridge Conditions

The condition of bridges nationwide has improved markedly since 1990. Of the nearly 600,000 roadway bridges in 2000, 28 percent were found to be structurally deficient or functionally obsolete, an improvement of 31 percent since 1990. About 14 percent of *all* bridges were either structurally deficient or functionally obsolete in 2000 [1]. Structurally deficient bridges are those that are restricted to light vehicles, require immediate rehabilitation to remain open, or are closed. Functionally obsolete bridges are those with deck geometry (e.g., lane width), load carrying capacity, clearance, or approach roadway alignment that no longer meet the criteria for the system of which the bridge is a part.[1] In the 1990s, while the number of structurally deficient bridges steadily declined, the number of functionally obsolete bridges remained fairly constant (figure 1).

Figure 1
Structurally Deficient and Functionally Obsolete Bridges: 1990–2000



SOURCE: U.S. Department of Transportation, Federal Highway Administration, Office of Engineering, Bridge Division, National Bridge Inventory database, available at http://www.fhwa.dot.gov/bridge/-britab.htm, as of Sept. 27, 2001.

Overall, bridges in rural areas suffer more from structural deficiencies than functional obsolescence, whereas the reverse is true in urban areas (table 1). Nearly 22 percent of the bridges in rural areas that support local roads were structurally deficient and one-fifth of urban Interstate bridges were functionally obsolete in 2000. Nevertheless, a large number of both structurally deficient and functionally obsolete bridges support local roads in rural areas [1]. Although the number of deficient bridges has declined nationwide, the experience of individual states varies widely. Between 1995 and 2000, the number of deficient and obsolete bridges increased in 13 states and the District of Columbia (see map).

Source

1. U.S. Department of Transportation, Federal Highway Administration, Office of Engineering, Bridge Division, National Bridge Inventory database, available at http://www.fhwa.dot.gov/bridge/britab.htm, as of Sept. 27, 2001.

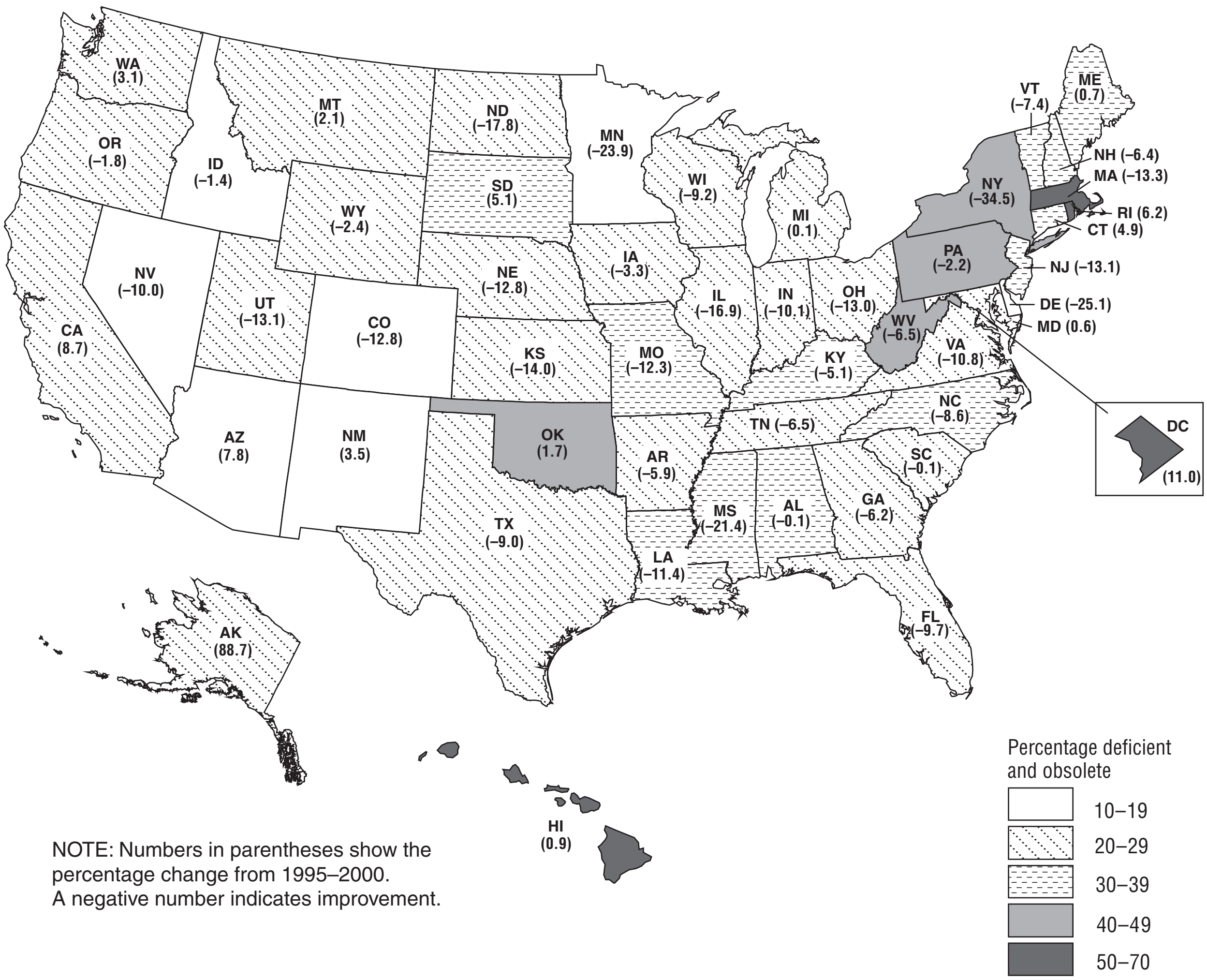
[1] Structurally deficient bridges are counted separately from functionally obsolete bridges even though most structurally deficient bridges are, in fact, functionally obsolete.

Table 1
Bridge Conditions by Functional Class: 2000

Type of roadway	Not deficient		Structurally deficient		Functionally obsolete	
	Number	Percent	Number	Percent	Number	Percent
Rural						
Interstates	23,277	84	1,108	4	3,195	12
Other principal arterials	30,113	84	1,963	6	3,564	10
Minor arterials	31,614	80	3,401	9	4,668	11
Major collectors	73,834	77	11,638	12	10,266	11
Minor collectors	35,499	74	6,830	14	5,454	12
Local roads	138,960	66	45,941	22	24,965	12
Rural total	**333,297**	**73**	**70,881**	**16**	**52,112**	**11**
Urban						
Interstates	20,438	73	1,757	6	5,679	21
Other freeways and espressways	11,759	73	985	6	3,368	21
Other principal arterials	16,876	68	2,413	10	5,513	22
Minor arterials	14,586	63	2,497	11	6,072	26
Collectors	9,735	63	1,828	12	3,839	25
Local roads	17,897	69	3,215	12	4,927	19
Urban total	**91,291**	**68**	**12,695**	**10**	**29,398**	**22**
Rural and urban total	**424,588**	**72**	**83,576**	**14**	**81,510**	**14**

SOURCE: U.S. Department of Transportation, Federal Highway Administration, Office of Bridge Technology, National Bridge Inventory database, available at http://www.fhwa.dot.gov/bridge/britab.htm, as of December 2000.

Bridge Conditions by State: 2000



SOURCE: U.S. Department of Transportation, Federal Highway Administration, Office of Bridge Technology, National Bridge Inventory database, available at http://www.fhwa.dot.gov/bridge/britab.htm, as of June 6, 2001.

Chapter 4

Mobility and Access to Transportation

Introduction

Transportation exists to help people and businesses overcome the distance between places (e.g., work and home, factory and store, store and home). Two concepts, mobility and accessibility, are most often used to measure the success of the transportation system. Mobility measurements focus on how often and far people and goods travel. Accessibility is a measure of the relative ease with which people and businesses can reach a variety of locations. Mobility and access are often positively related, but not always. For instance, less travel (lower mobility) might be the result of better access in cases where opportunities are located nearby. Many factors affect mobility and access, including the availability and cost of transportation and the infrastructure in place to facilitate it, population growth and economic fluctuations, and the knowledge of and ability to apply logistical options (particularly for businesses).

Both mobility and accessibility were affected by the terrorist attacks on the United States in September 2001. At the time this report was prepared, only the immediate and short-term impacts were known and, in many cases, only anecdotally. Air travel and some freight movements within and to and from the United States were halted entirely for several days after the attacks. By the end of the year, air travel had not returned to its previous activity level. General aviation was shut down for a longer period, and in early 2002 a few airfields in the vicinity of Washington, DC, were still closed. Maritime shipments were slowed because of a new Coast Guard policy of boarding all foreign ships to check manifests prior to their arrival in U.S. ports. Increased inspection at land crossing points has delayed shipments as well. Intercity train and bus travel rose in the immediate aftermath, but whether this will result in a fundamental shift in mode choices is unknown.

Even in the months before September 2001, transportation had been affected by slower economic growth. Prior to that downturn and during a prolonged period of expansion, however, both passenger travel and goods movement were increasing. About 4.8 trillion passenger-miles of travel were supported by the system in 2000, an annual increase of 2.3 percent since 1990. In addition, there were over 3.8 trillion ton-miles of domestic freight shipped in 1999, representing an annual growth rate of 2.0 percent since 1990.

Increases in population, numbers of workers, vehicle availability, and disposable personal income are among the factors that contribute to passenger travel growth. This growth can be seen, for instance, in international travel. Between 1990 and 2000, the number of U.S. residents traveling out of the country rose 36 percent. Growth is also evident when measured by mode.

Highway passenger travel continues to grow, with travel in light trucks (including minivans, pickups, and sport utility vehicles) posting the largest increases. The light truck share of passenger-miles of travel grew from 14 percent in 1975 to 32 percent in 2000. Despite some gains for the transit mode, the number of people driving to work alone continued its upward trend along with the distance traveled. Accessibility measures show growth, as well: the number of household vehicles, for instance, has risen to equal the number of licensed drivers. Nevertheless, there were 9.5 million households without a car in 1999. By 2000, just over 83 percent of the nationwide fleet of transit buses were equipped with ramps or lifts to provide access to the disabled. However, only about 34 percent of heavy-rail transit stations were accessible by 2000.

Congestion on the highways and in the skies slows traffic and creates a drag on the nation's economic productivity. On the highways, hours of delay per person more than tripled between 1982 and 1999, with people in the largest metropolitan areas suffering from the worst congestion. Each person in the largest metropolitan areas lost an average of 41 hours in 1999. Flight delays tend to vary from year to year making comparisons difficult. In 2001, 22 percent of flights by major U.S. air carriers were delayed, canceled, or diverted. Causes of congestion in the air and on the highways show some similarities: system capacity that is not keeping pace with increasing volumes and delays caused by inclement weather. Because data are not regularly collected for waterborne transportation, measures of the extent of congestion for this mode are not available.

Economic activity is a key factor affecting freight movement. So, too, are changes in business logistics, such as the location of distribution centers at greater distances from consumers and the wide use of just-in-time manufacturing. Air carrier and intercity trucking ton-miles are increasing at a faster rate than the other modes. Compared with other freight modes, air is used more often to move higher value commodities over longer distances. Despite the rapid growth of goods movement by air, however, most freight (measured in tons) is moved by trucks.

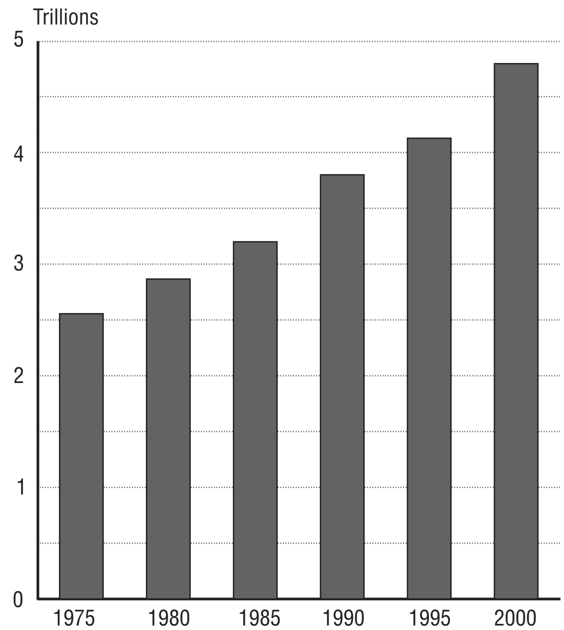
Passenger Travel

All modes of transportation continued to show growth in passenger-miles of travel (pmt) through 2000. Light trucks (pickups, minivans, and sport utility vehicles) posted the biggest gains, increasing its share of pmt from 14 percent to 32 percent over the 1975 to 2000 period. In absolute terms, passenger travel in light trucks grew from 363 million miles in 1975 to 1.5 trillion miles in 2000. The passenger car share of pmt declined from 76 percent in 1975 to 53 percent in 2000. Air travel also increased its share from 5 percent to 11 percent. Overall, pmt, excluding miles traveled in heavy trucks, grew from about 2.6 trillion in 1975 to almost 4.8 trillion in 2000 (figure 1). On a per capita basis, people traveled 17,000 miles in 2000 compared with 11,900 in 1975 [3].

Several factors contributed to the continued growth in pmt (figure 2). The resident population, for example, increased by nearly 66 million people, a rise of 31 percent between 1975 and 2000. Moreover, the number of people in the civilian labor force, most of whom commute to work, grew almost twice as fast as the population over the same period. People also have more money to spend on transportation, particularly for automobiles and air travel. Disposable personal income per capita rose from $14,393 in 1975 to $23,640 in 2000 (in chained 1996 dollars) [2].

An increasing number of people can now afford to buy vehicles and travel services, especially since the cost of the most widely used kinds of transportation—travel in cars and

Figure 1
Passenger-Miles of Travel

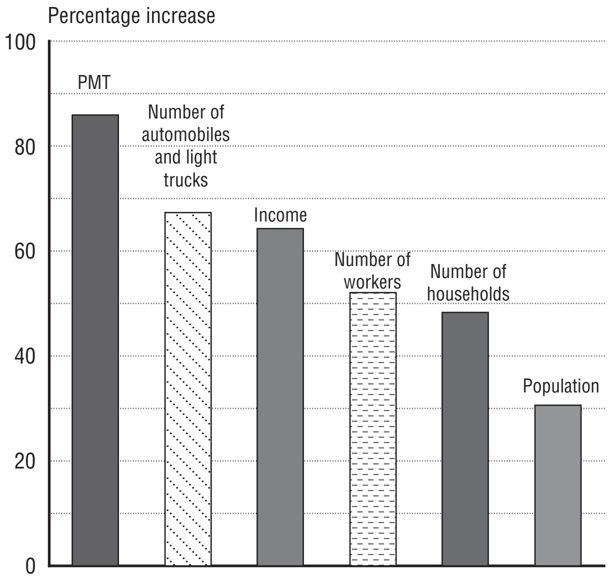


SOURCE: 1975–1995—various sources as cited in U.S. Department of Transportation, Bureau of Transportation Statistics, *National Transportation Statistics 2001* (Washington, DC: 2002); 2000 data—various sources as compiled by the Bureau of Transportation Statistics.

Estimating Passenger-Miles of Travel

Passenger-miles of travel are estimated on a yearly basis by adding together estimates for each mode, which are derived from separate sources. Passenger-miles of travel for large air carriers and intercity trains are estimated from tickets and are very accurate. A variety of methods are used to estimate travel in other modes, each with different strengths and weaknesses. For more information see the Accuracy Profiles in BTS's *National Transportation Statistics 2001* (www.bts.gov).

Figure 2
Increases in Passenger-Miles of Travel (PMT) and Factors Affecting Travel Demand: 1975–2000



SOURCES: U.S. Department of Commerce, U.S. Census Bureau, *Statistical Abstract of the United States: 2001* (Washington, DC: 2002); various sources as cited in U.S. Department of Transportation, Bureau of Transportation Statistics, *National Transportation Statistics 2001* (Washington, DC: 2002); and various sources as compiled by the Bureau of Transportation Statistics.

planes—fell in real terms. For example, the inflation-adjusted average airfare for domestic scheduled service declined from $174 in 1975 to $110 in 1995 and has stayed at that level through 1999 (measured in chained 1996 dollars) [3]. Despite recent fluctuations, gasoline prices, too, have been at historically low levels for much of the past 15 years [1]. Intercity rail fares also decreased between 1975 and 1999, but average intercity bus fares increased more than inflation during this period. Average bus fares went from $17 to $23 between 1975 and 1999 (in chained 1996 dollars) [3]. Rising bus fares tend to affect individuals with lower incomes more than people at higher income levels.

Sources

1. American Petroleum Institute. "How Much We Pay for Gasoline: 1999–April 2000 Review," May 2000, available at http://www.api.org/pasp/big-gas.pdf, as of Sept. 9, 2000.
2. U.S. Department of Commerce, U.S. Census Bureau, *Statistical Abstract of the United States, 2001* (Washington, DC: 2002).
3. U.S. Department of Transportation, Bureau of Transportation Statistics, *National Transportation Statistics 2001* (Washington, DC: 2002), table 3-15b.

Vehicle-Miles of Travel

With increases in both population and individual travel, highway usage has risen substantially. Annual vehicle-miles of travel (vmt) in the United States rose by nearly 30 percent to 2.8 trillion miles between 1990 and 2000, an annual increase of 2.5 percent. Vmt per capita rose by just over 13 percent during the same period, an annual increase of 1.3 percent.

The most heavily populated states, California, Texas, Florida, and New York, are the most heavily traveled. However, Wyoming, the least populated state, had the highest vmt per capita in 2000 at 16,400, followed by Georgia, Alabama, Oklahoma, and New Mexico at over 12,500. The District of Columbia and New York had the lowest vmt per capita at just under 7,000. The percentage change in vmt per capita between 1990 and 2000 ranged from a 32 percent increase in Mississippi to a 3 percent decline in Hawaii, with 12 states showing an increase of at least 20 percent over the 10-year period (see map on the next page).

In recent years, the makeup of the U.S. vehicle fleet changed as well, altering the share of vmt by vehicle type (figure 1). While the share of total vmt by buses and single-unit and combination trucks has remained relatively constant, the increasing popularity of sport utility vehicles and other light trucks in recent years has resulted in a shift in the percentage of total vmt from automobiles to light trucks. Although still the dominant vehicle type in terms of vmt, the share of automobile vmt declined from 66 percent of total vmt to 58 percent between 1990 and 2000. Over the

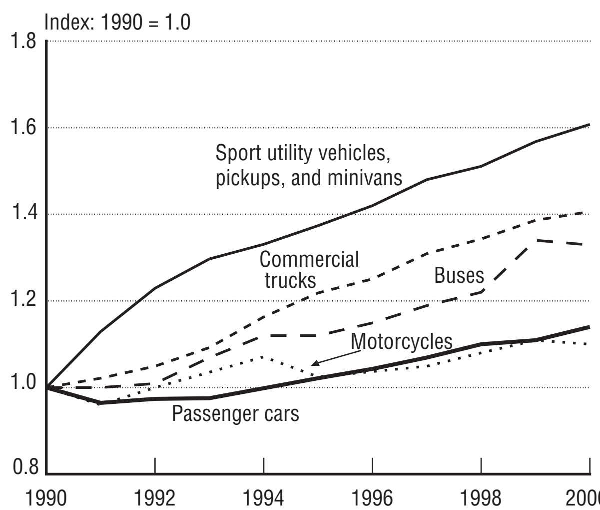
The Highway Performance Monitoring System

The Federal Highway Administration (FHWA) analyzes and presents vehicle-miles of travel data in its annual report, *Highway Statistics,* using the Highway Performance Monitoring System (HPMS). In HPMS, FHWA compiles state-provided data into a national-level database, combining "sample data on the condition, use, performance and physical characteristics of facilities functionally classified as arterials and collectors (except rural minor collectors) and system-type data for all public road facilities within each State." States report data annually. However, in some years, estimates may be made for states with incomplete data.

Source

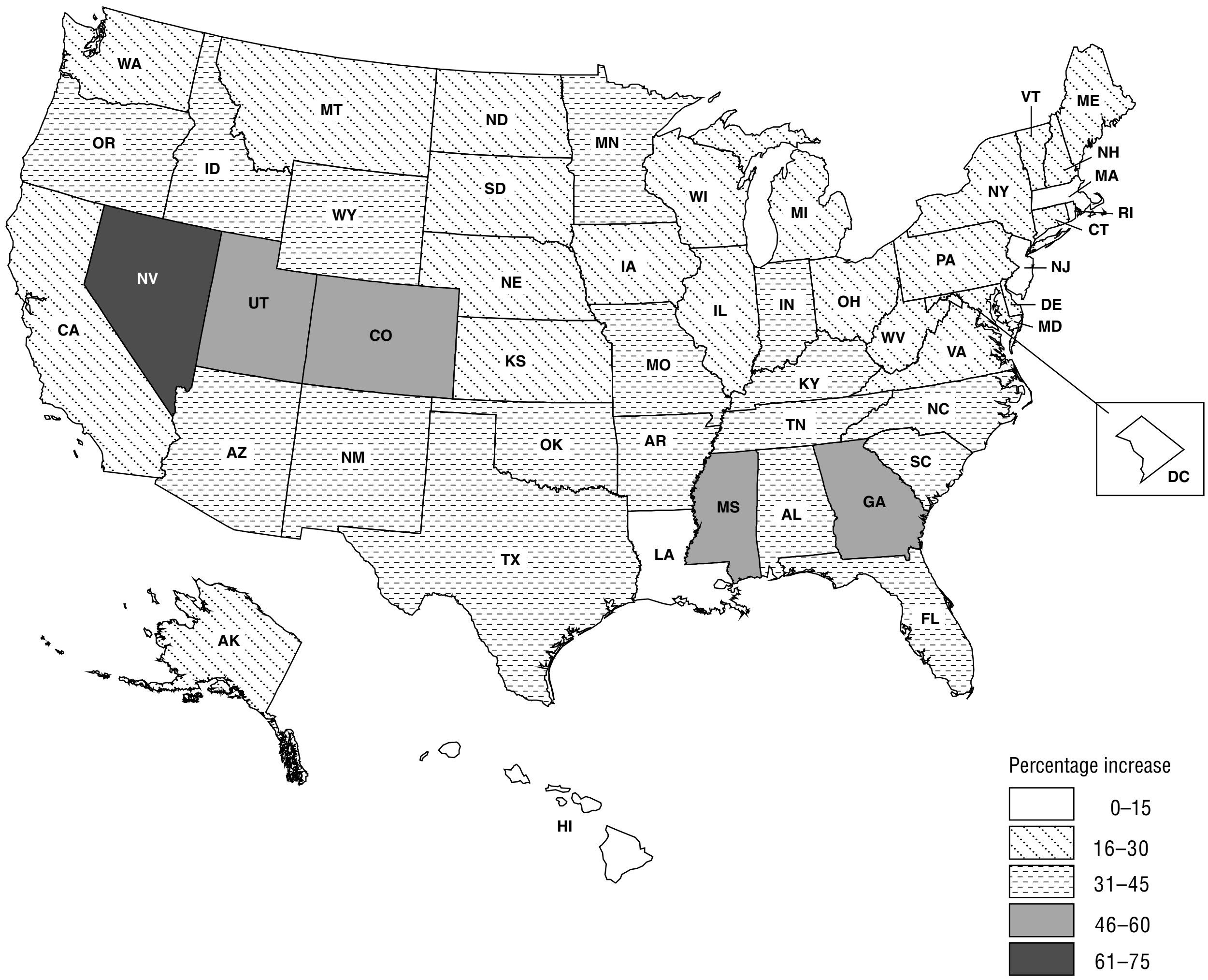
U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 1998* (Washington, DC: 1999), p. V-1.

Figure 1
Changes in Vehicle-Miles of Travel by Vehicle Type: 1990–2000



SOURCE: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics* (Washington, DC: Annual issues).

Percentage Change in Vehicle-Miles of Travel: 1990–2000



SOURCE: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics* (Washington, DC: Annual issues).

same period, the percentage of total vmt by light trucks (a classification including minivans, pickup trucks, and sport utility vehicles) rose to 34 percent of total vmt [1].

Source

1. U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics* (Washington, DC: Annual issues).

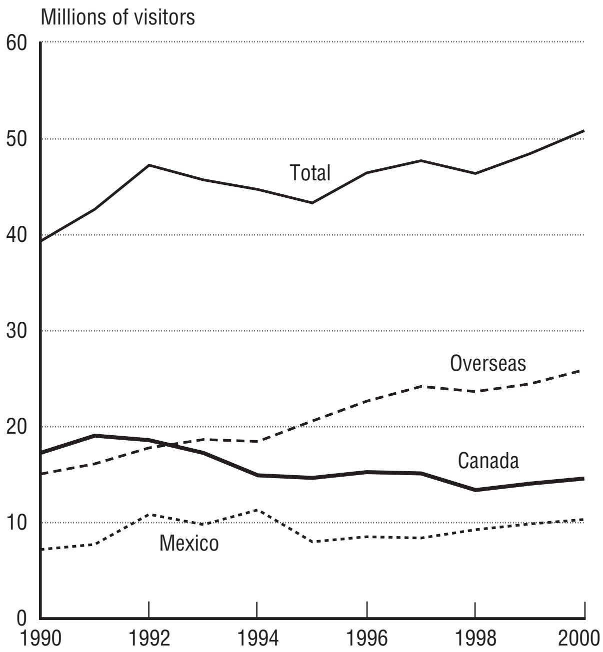
International Travel To and From the United States

Overnight travel between the United States and foreign countries for both business and pleasure grew during the 1990s (figures 1 and 2). However, the terrorist attacks of September 2001 and the preceding economic slowdown caused a decline in late 2001 and early 2002 in land border crossings and air travel (box 1).

International travel data does not take into account people staying for less than one night (box 2). Still, the decade-long growth in overnight travel has implications for the infrastructure at America's borders (including airports and land border crossings) and the demand on transportation infrastructure by foreign nationals while they are in the country. There are also economic implications related to travel spending.

Factors that have contributed to growth include the globalization of the production of goods and services, lower priced air transportation, economic growth, and rising incomes in

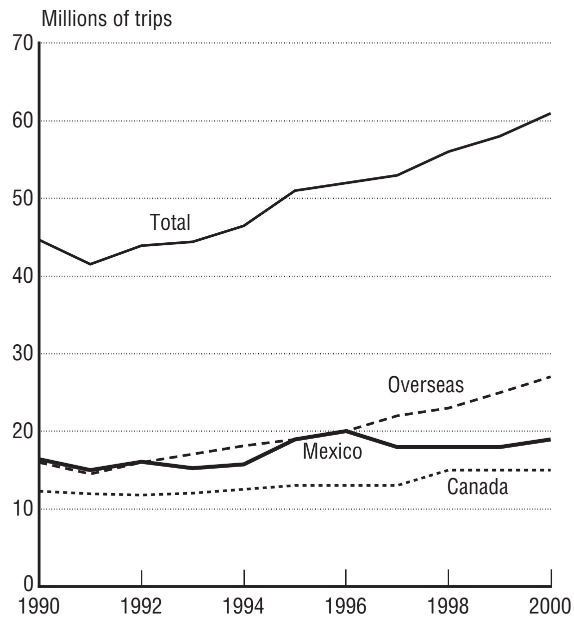
Figure 1
International Overnight Visitors to the United States: 1990–2000
Trips of one or more nights



NOTE: Data for Canada and Mexico do not include same-day travel.

SOURCES: U.S. Department of Commerce, International Trade Administration, Office of Tourism Industries, *International Visitors (Inbound) and U.S. Residents (Outbound): 1990–2000* (Washington, DC: 2001); _____. *Arrivals to the U.S. 1999–1998 (All Countries by Residency)* (Washington, DC: 2000).

Figure 2
International Overnight Trips by U.S. Residents: 1990–2000
Trips of one or more nights



NOTE: Data for Canada and Mexico do not include same-day travel.

SOURCES: U.S. Department of Commerce, International Trade Administration, Office of Tourism Industries, *International Visitors (Inbound) and U.S. Residents (Outbound) (1990–2000)* (Washington, DC: 2001); _____. *Select Destinations Visited by U.S. Resident Travelers 1999–1998* (Washington, DC: 2000).

Box 1

Security and Travel Time Post-September 11

Immediately following September 11, the key gateways of international travel—airports and land border crossings—were affected by a sharp decline in traffic and new security concerns and procedures. Entries into the United States from Canada and Mexico fell in the months immediately following September into early 2002. For instance, in September 2001 the number of personal vehicles entering the United States from Canada and Mexico was 20 percent less than in September 2000. The decline continued in October 2001 with a decrease of 24 percent over October 2000 levels [2].

Although international air travel grew during the 1990s, it was beginning to slow in early 2001 due to the economic downturn. The September 2001 terrorist attacks further depressed air travel. International revenue passenger-miles on U.S. carriers fell by 29 percent in September 2001 and 37 percent in October 2001 when compared with the same months in 2000. International enplanements also declined by similar amounts, 27 and 32 percent less than the September and October 2000 levels.

Government agencies charged with protecting U.S. borders have tightened inspections and security procedures for both people and freight.[1] The anti-terrorism law, the USA Patriot Act (Public Law 107-56), enacted on October 26, 2001, authorized a tripling of U.S. agents along the Canadian border. Border enforcement is expected to increase on the Mexican border, as well. The Immigration and Naturalization Service's (INS) fiscal year 2003 budget request proposed 570 new border patrol agent positions. Half would be deployed to the northern border and half along the southwest border. In addition, aviation issues closely related to large travel volumes, such as airport capacity shortfalls, congestion, and liberalization, have taken a back seat to security concerns.

Heightened security has essentially added a new element to travel time, forcing passengers to not only count the total duration of delays and cancellations among the possible inconveniences to their travel plans but to also reserve ample time to clear security before each flight. Advisories after September 2001 suggested passengers arrive at airports two hours before domestic flight departures, and three hours prior to international departures. Since Spring 2002 these recommendations have been relaxed as better knowledge is gained about airport security timing issues. Land border crossings have also been affected. In the Seattle INS district, while traffic decreased 55 percent, wait time at the border increased 443 percent from October through December 2001, compared with the same period in 2000 [1].

[1] The agencies primarily responsible for border control and immigration are: 1) the Immigration and Naturalization Service, responsible for checking travelers' documents at legal points of entry; 2) the Customs Service, which checks cargo, vehicles, and passenger baggage at all ports of entry; 3) the Coast Guard, which polices seaports, coastlines, and waterways; and 4) the Transportation Security Administration, part of the newly created Department of Homeland Security which monitors and is in charge of security for all modes of transportation.

Sources

1. Coleman, R.S., District Director, Immigration and Naturalization Service Seattle District, presentation at the Ship Operations Cooperative Program Annual Meeting, Feb. 12-13, 2002, Seattle, WA.
2. U.S. Department of Transportation, Bureau of Transportation Statistics, Border Crossing Data, available at http://www.bts.gov/itt/, as of June 2002.

many parts of the world. The United States received 7 percent of the nearly 699 million international overnight visitors in 2000. Expenditures by these visitors totaled $476 billion worldwide, with 17 percent spent in the United States [1, 2].

In 2000, a record 51 million overnight international visitors traveled to the United States. Nearly three-quarters of them were from five countries: Canada, Mexico, Japan, the United Kingdom, and Germany (table 1). The number of visitors from overseas (all countries except Canada and Mexico) has risen in the past few years (figure 1). Canadian travel to the United States has been increasing since 1998, after a gradual decline through most of the decade.

In 2000, U.S. residents made more than 60 million international trips. Major destinations were Mexico, Canada, and the United Kingdom (table 2). International travel by U.S. residents between 1990 and 2000 grew by more than 36 percent, with travel overseas growing the fastest (figure 2).

Sources

1. U.S. Department of Transportation, Bureau of Transportation Statistics, *U.S. International Travel and Transportation Trends* (Washington, DC: 2002).

Box 2
Data on International Travel To and From the United States

The data here are limited to people staying one or more nights at their international destination and, therefore, do not include all cross-border movements between the United States, Canada, and Mexico. The data for international arrivals reported in this section come mainly from the Visitors Arrivals Program (Form I-94) administered by the U.S. Department of Justice's Immigration and Naturalization Service (INS) in cooperation with the U.S. Department of Commerce's Office of Tourism Industries.

The Visitors Arrivals Program includes overseas visitors staying for one or more nights for a period of less than 12 months whether for business, pleasure, or study. It does not include people transiting the United States en route to another country. Mexican tourist arrival estimates derived from the I-94 program are limited to those visiting the U.S. interior, beyond the 40 kilometer (25 mile) U.S. border zone, and those traveling by air. These data are supplemented by data from Banco de México to report total Mexican arrivals on an annual basis for people staying one or more nights.

For Canadians, the Office of Tourism Industries relies on Statistics Canada's International Visitor Survey to provide monthly inbound visitors (again, for one or more nights) from Canada to the United States.

Data for U.S. residents traveling internationally are derived from the U.S. International Air Travel Statistics (Form I-92) program, also a joint effort between the INS and the Office of Tourism Industries. Data are collected from airlines for all international arriving and departing flights with the exception of those to and from Canada. U.S. resident travel data to Canada for one or more nights is provided by Statistics Canada's International Visitor Survey. Estimates of U.S. resident travel to Mexico by means of transportation other than air is provided by Banco de México.

2. World Tourism Organization, Organization Tourism Market Trends (Madrid, Spain: Sept. 25, 2001).

Table 1
Top 15 Countries of Origin of International Overnight Visitors to the United States: 2000

Rank	Country	Trips (thousands)	Percent
1	Canada	14,594	29
2	Mexico	10,322	20
3	Japan	5,061	10
4	United Kingdom	4,703	9
5	Germany	1,786	4
6	France	1,087	2
7	Brazil	737	1
8	South Korea	662	1
9	Italy	612	1
10	Venezuela	577	1
11	Netherlands	553	1
12	Australia	540	1
13	Argentina	534	1
14	Republic of China (Taiwan)	457	1
15	Colombia	417	1
	Total, top 15	**42,642**	**84**
	Total, all countries	50,891	100

NOTE: Percentages do not add to totals due to rounding.

SOURCE: U.S. Department of Commerce, International Trade Administration, Office of Tourism Industries, "Top 55 Overseas Markets for International Visitor Arrivals to the United States: 2000 and 1999," available at http://tinet.ita.doc.gov, as of Sept. 25, 2001.

Table 2
Top 15 Countries Visited Overnight by U.S. Residents: 2000

Rank	Country	Trips (thousands)	Percent
1	Mexico	18,849	31
2	Canada	15,114	25
3	United Kingdom	4,189	7
4	France	2,927	5
5	Germany	2,309	4
6	Italy	2,148	4
7	Japan	1,262	2
7	Spain	1,262	2
8	Netherlands	1,101	2
9	Switzerland	994	2
10	Bahamas	913	2
11	Jamaica	886	1
12	Hong Kong	832	1
13	Republic of Korea	779	1
14	Ireland	725	1
15	Australia	698	1
	Total, top 15	**54,988**	**90**
	Total, all countries	60,816	100

SOURCE: U.S. Department of Commerce, International Trade Administration, Office of Tourism Industries, "U.S. Resident Travel Abroad, Historical Visitation: Outbound, 1990–2000," available at http://tinet.ita.doc.gov, as of Sept. 25, 2001.

Top Passenger Border Crossings

Over 290 million people entered the United States at crossing points on the U.S.-Mexico border in 2000, more than triple the 95 million entering on the U.S.-Canada border (table 1). Most people traveled across the border in personal vehicles, although a large number of people entered the United States from Mexico on foot. El Paso, Texas, and San Ysidro, California (near San Diego), were the top vehicle crossing points. On the Canadian border, the top crossing points were Detroit, Michigan, and Buffalo-Niagara Falls, New York (table 2).

Table 1
Land Gateways on the Canadian and Mexican Borders: 2000

	Entering the U.S. from	
	Canada (thousands)	Mexico (thousands)
Personal vehicles	36,915	91,157
Buses	189	271
Personal vehicle passengers	90,047	239,795
Bus passengers	4,873	3,466
Train passengers	270	18
Pedestrians	585	47,090
Total passengers and pedestrians	**95,775**	**290,369**

SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, based on U.S. Department of Treasury, U.S. Customs Service, Office of Field Operations, Operations Management Database, 2001.

Table 2
Top 5 Gateways for Passengers in Personal Vehicles Entering the United States: 2000

Canada	Number (thousands)
Detroit, MI	21,724
Buffalo-Niagara Falls, NY	16,523
Blaine, WA	8,235
Sault Ste. Marie, MI	6,866
Port Huron, MI	3,881
Mexico	
El Paso, TX	48,420
San Ysidro, CA	31,025
Hidalgo, TX	21,948
Calexico, CA	20,094
Brownsville, TX	19,693

SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, based on U.S. Department of Treasury, U.S. Customs Service, Office of Field Operations, Operations Management Database, 2001.

Enplanements at Major U.S. Airports

Although more than 800 airports in the United States provided some form of air passenger service to the public in 2000, most enplanements (i.e., passenger boardings) occur at a relatively small number of airports. In 2000, for instance, 84 percent of all U.S. air passengers enplaned at 50 airports (table 1, pages 76–77). Ten airports alone accounted for about one-third of all 2000 enplanements.

Air travel became more affordable during the 1990s leading to a general increase in passenger traffic at U.S. airports. Between 1990 and 2000, enplanements at all airports grew by nearly 50 percent from 439 million to 639 million [1, 2]. Some airports grew much faster than the average and/or experienced very large growth in the number of passengers boarded. Enplanements doubled at six major airports (of the top 50 in 2000) between 1990 and 2000: Greater Cincinnati, Sacramento International, Portland International, McCarren International (Las Vegas), George Bush Intercontinental (Houston), and Baltimore-Washington International. Moreover, 5 major airports increased boardings by 7 million or more over this period: Hartsfield International (Atlanta), McCarren International, George Bush Intercontinental, Minneapolis-St. Paul International, and Detroit Metropolitan Wayne County.

Factors leading to a rapid rise in enplanements at specific airports include: location in or near a rapidly growing metropolitan area (e.g., Las Vegas, Phoenix, and Atlanta) or major tourist destination (e.g., Las Vegas and Orlando), serving as a hub for a major commercial airline (e.g., Cincinnati and Houston), and serving a fast growing low-fare airline such as Southwest Airlines (e.g., Baltimore-Washington International).

Sources

1. U.S. Department of Transportation, Bureau of Transportation Statistics, *Airport Activity Statistics of Certificated Air Carriers: Summary Tables, Twelve Months Ending December 31, 2000* (Washington, DC: 2001).
2. U.S. Department of Transportation, Federal Aviation Administration and Research and Special Programs Administration, *Airport Activity Statistics of Certificated Route Air Carriers, Twelve Months Ending December 31, 1990* (Washington, DC: 1991).

(continues on next page)

Table 1
Passengers Boarded at the Top 50 U.S. Airports[1]

Airport	Rank in 2000	Enplaned passengers in 2000	Rank in 1990	Enplaned passengers in 1990	Growth, 1990–2000 (percent)	Change, 1990–2000 (number)
Atlanta, GA (Hartsfield Intl.)	1	38,255,778	3	22,665,665	69	15,590,113
Chicago, IL (O'Hare)	2	30,888,464	1	25,636,383	20	5,252,081
Dallas/Ft. Worth, TX (Dallas/Ft. Worth Intl.)	3	27,841,040	2	22,899,267	22	4,941,773
Los Angeles, CA (Los Angeles Intl.)	4	25,109,993	4	18,434,056	36	6,675,937
Denver, CO (Denver Intl.)	5	17,643,261	6	11,961,839	47	5,681,422
Phoenix, AZ (Phoenix Sky Harbor Intl.)	6	17,239,215	7	10,727,494	61	6,511,721
Detroit, MI (Wayne County)	7	16,929,968	9	9,903,078	71	7,026,890
Las Vegas, NV (McCarran Intl.)	8	16,738,909	18	7,796,218	115	8,942,691
Minneapolis, MN (Minneapolis-St. Paul Intl.)	9	16,710,197	16	8,837,228	89	7,872,969
San Francisco, CA (San Francisco Intl.)	10	16,664,399	5	13,474,929	24	3,189,470
Houston, TX (George Bush Intercontinental)	11	15,814,709	20	7,543,899	110	8,270,810
Newark, NJ (Newark)	12	15,205,447	10	9,853,925	54	5,351,522
St. Louis, MO (Lambert-St.Louis Muni.)	13	15,101,246	13	9,332,091	62	5,769,155
Orlando, FL (Orlando Intl.)	14	13,465,706	19	7,677,769	75	5,787,937
Seattle, WA (Seattle-Tacoma Intl.)	15	13,308,253	21	7,385,594	80	5,922,659
Miami, FL (Miami Intl.)	16	12,654,506	14	9,226,103	37	3,428,403
Boston, MA (Logan Intl.)	17	11,505,983	12	9,549,585	20	1,956,398
New York, NY (La Guardia)	18	11,425,705	8	10,725,465	7	700,240
Philadelphia, PA (Philadelphia Intl.)	19	10,973,074	24	6,970,820	57	4,002,254
New York, NY (John F. Kennedy Intl.)	20	10,648,410	11	9,687,068	10	961,342
Charlotte, NC (Douglas Muni.)	21	10,377,837	22	7,076,954	47	3,300,883
Cincinnati, OH (Greater Cincinnati)	22	9,962,765	32	3,907,625	155	6,055,140
Baltimore, MD (Baltimore-Washington Intl.)	23	8,979,425	29	4,420,425	103	4,559,000
Salt Lake City, UT (Salt Lake City Intl.)	24	8,700,973	25	5,388,178	61	3,312,795
Honolulu, HI (Honolulu Intl.)	25	8,684,893	15	9,002,217	–4	–317,324
Pittsburgh, PA (Greater Pittsburgh)	26	8,650,976	17	7,912,394	9	738,582
San Diego, CA (Intl.-Lindbergh)	27	7,624,519	26	5,260,907	45	2,363,612
Tampa, FL (Tampa Intl.)	28	7,430,829	27	4,781,020	55	2,649,809
Ft. Lauderdale, FL (Ft. Lauderdale-Hollywood Intl.)	29	7,140,518	34	3,875,357	84	3,265,161
Washington, DC (Reagan Washington Natl.)	30	6,983,212	23	7,034,693	–1	–51,481
Chicago, IL (Midway)	31	6,972,213	37	3,547,040	97	3,425,173
Washington, DC (Dulles Intl.)	32	6,649,323	28	4,448,592	49	2,200,731
Portland, OR (Portland Intl.)	33	6,558,859	42	3,025,345	117	3,533,514
Cleveland, OH (Hopkins Intl.)	34	6,154,094	35	3,836,050	60	2,318,044
San Jose, CA (Norman Y. Mineta Intl.)	35	6,044,278	41	3,128,393	93	2,915,885

[1] Rank order by total enplaned passengers on large certificated U.S. air carriers, scheduled and nonscheduled operations, at all airports served within the 50 states, the District of Columbia, and other U.S. areas designated by the Federal Aviation Administration. Prior to 1993, all scheduled and some nonscheduled enplanements for certificated air carriers were included; no enplanements were included for air carriers offering charter service only. Large certificated air carriers operate aircraft with seating capacity of more than 60 seats or a maximum payload capacity of more than 18,000 pounds. Data for commuter, intrastate, and foreign-flag air carriers are not included.

Table 1 (continued)
Passengers Boarded at the Top 50 U.S. Airports

Airport	Rank in 2000	Enplaned passengers in 2000	Rank in 1990	Enplaned passengers in 1990	Growth, 1990–2000 (percent)	Change, 1990–2000 (number)
Kansas City, MO (Kansas City Intl.)	36	5,748,758	40	3,358,116	71	2,390,642
Oakland, CA (Oakland Metropolitan Intl.)	37	5,126,648	44	2,670,788	92	2,455,860
Memphis, TN (Memphis Intl.)	38	4,977,238	33	3,887,208	28	1,090,030
Raleigh-Durham, NC (Raleigh-Durham)	39	4,838,779	30	4,361,369	11	477,410
San Juan, PR (Luis Munoz Marin Intl.)	40	4,834,298	36	3,618,090	34	1,216,208
New Orleans, LA (New Orleans Intl.)	41	4,822,265	39	3,361,062	43	1,461,203
Nashville, TN (Metropolitan)	42	4,365,127	38	3,404,243	28	960,884
Houston, TX (William P. Hobby)	43	4,322,108	31	3,972,327	9	349,781
Sacramento, CA (Sacramento Intl.)	44	3,873,003	56	1,737,096	123	2,135,907
Los Angeles, CA (Orange County)	45	3,828,324	51	2,203,700	74	1,624,624
Austin, TX (Robert Muller Muni.)	46	3,635,209	53	2,054,955	77	1,580,254
Indianapolis, IN (Indianapolis Intl.)	47	3,629,716	47	2,601,839	40	1,027,877
Dallas, TX (Love Field)	48	3,594,539	43	2,882,836	25	711,703
Hartford/Springfield/Westfield, CT (Bradley Intl.)	49	3,508,023	50	2,312,455	52	1,195,568
San Antonio, TX (San Antonio Intl.)	50	3,466,266	48	2,593,896	34	872,370
Total, top 50 airport		**535,609,278**		**361,953,646**	**48**	**173,655,632**
Total, all airports		638,902,993		438,544,001	46	200,358,992

NOTES: In 1990, Ontario, CA, ranked 45th (2,640,734); West Palm Beach, FL, ranked 46th (2,609,138); and Albuquerque, NM, ranked 49th (2,384,647).

SOURCES: 1990—U.S. Department of Transportation, Federal Aviation Administration and Research and Special Programs Administration, *Airport Activity Statistics of Certificated Route Air Carriers, 12 Months Ending December 31, 1990* (Washington, DC: 1991), tables 3 and 4.
2000—U.S. Department of Transportation, Bureau of Transportation Statistics, *Airport Activity Statistics of Certificated Air Carriers: Summary Tables,Twelve Months Ending December 31, 2000* (Washington, DC: 2001), tables 3 and 4.

ADA Access to Public Transit Services

Accessibility for all Americans is a fundamental goal of public transit services. This includes access to bus and demand responsive transit, rail transit (heavy, commuter, and light), and other transit modes (trolley and ferry). The Americans with Disabilities Act (ADA), in fact, requires public transit services (fleets and facilities) to be accessible to persons with special needs.

The nationwide fleet of ADA lift- or ramp-equipped transit buses increased from 52.2 percent of the fleet in 1993 to 83.6 percent of the fleet in 2000 (table 1). While greater compliance with ADA requirements can be seen from 1993 to 2000, the rate of compliance has differed among types of buses (figure 1). The small bus fleet had the highest level of compliance in 1994 and articulated buses, the lowest compliance. In 2000, the small bus fleet continued to have the highest compliance, while large buses had the lowest compliance [1].

Rail transit infrastructure consists of track and stations. At a maximum service level, 14 heavy-rail transit agencies operate 8,245 vehicles over 2,163 miles of track. Among the 997 rail stations in 1997 serving heavy rail, 25.7 percent (256 stations) were ADA accessible. Between 1997 and 2000, the total number of heavy-rail stations increased by only 12 (to 1,009), while the number of ADA accessible stations increased 32.8 percent (to 340). Still, by 2000, ADA accessible stations equaled only 33.7 percent of the total number of stations, leaving a balance of 66.3 percent inaccessible. The level of compliance by heavy-rail transit agencies ranges from 0 percent to 100 percent (table 2). The New York City Transit Authority system, for instance, with 46 percent of the total number of stations, has an accessibility rate of just 8 percent. Excluding these stations from the total increases the overall accessibility rate for the rest of the heavy-rail system to 55.3 percent.

Table 1
ADA Lift- or Ramp-Equipped Transit Buses: 1993–2000

Year	Number of buses[1]	ADA lift- or ramp-equipped buses (number)	ADA lift- or ramp-equipped buses (percent)
1993	55,726	29,088	52.2
1994	57,023	31,065	54.5
1995	57,322	35,381	61.7
1996	57,369	38,316	66.8
1997	58,975	40,932	69.4
1998	60,830	46,278	76.1
1999	63,618	51,213	80.5
2000	65,324	54,585	83.6
% change, 1993–2000	17.2%	87.7%	

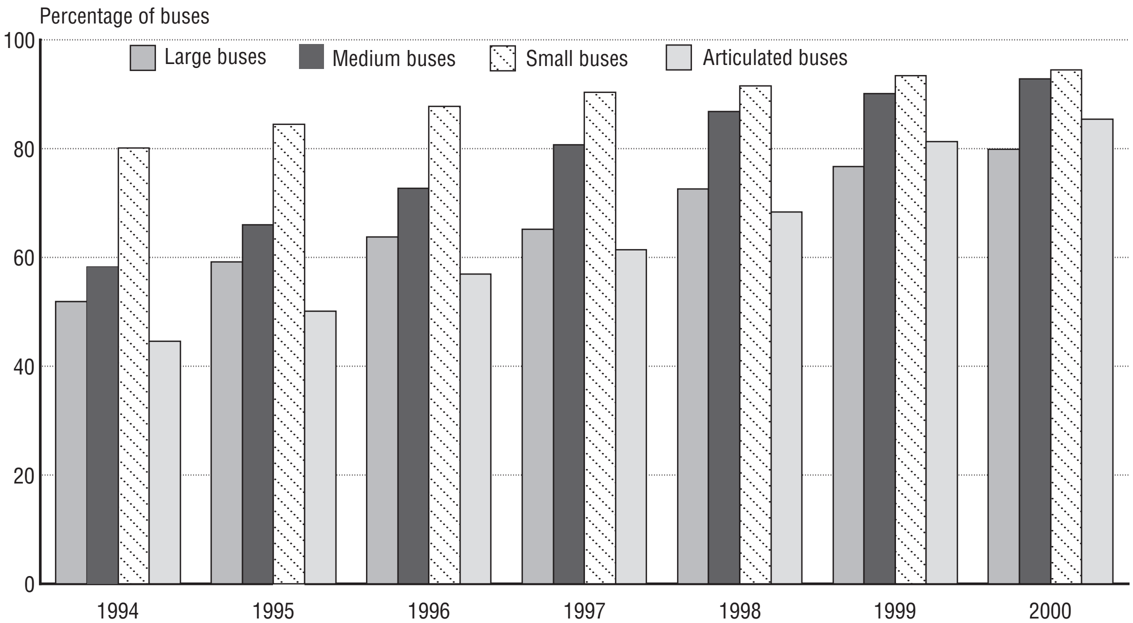
[1] Includes buses of transit agencies receiving federal funding for bus purchases, as well as buses of agencies not receiving federal funds that voluntarily report data to the Federal Transit Administration.

SOURCE: U.S. Department of Transportation, Federal Transit Administration, *2000 National Transit Summaries and Trends* (Washington,DC: 2001).

Source

1. U.S. Department of Transportation, Federal Transit Administration, *2000 National Transit Summaries and Trends*, available at http://www.ntdprogram.com, as of Feb. 15, 2002.

Figure 1
ADA Lift- or Ramp-Equipped Buses: 1994–2000



SOURCE: U.S. Department of Transportation, Federal Transit Administration, *2000 National Transit Summaries and Trends*, available at http://www.ntdprogram.com, as of Feb. 15, 2000.

Table 2
ADA Accessible Heavy-Rail Stations by Agency: 1997 and 2000

		Number of stations		Number of accessible stations	
State	**Agency**	**1997**	**2000**	**1997**	**2000**
California	San Francisco—Bay Area Rapid Transit	39	39	39	39
California	Los Angeles County Metro	8	16	8	16
Washington, DC	Washington Metropolitan Area Transit Authority	75	78	75	78
Florida	Miami-Dade Transit Agency	21	21	0	0
Georgia	Metro Atlanta Rapid Transit Authority	36	36	36	36
Illinois	Chicago Transit Authority	141	142	0	54
Massachusetts	Boston—Massachusetts Bay Transportation Authority	53	53	33	37
Maryland	Maryland Transportation Authority	14	14	14	14
New Jersey	Port Authority Transit	13	13	3	5
New York	New York City Transit	468	468	30	41
New York	Port Authority	13	13	6	6
New York	Staten Island	22	22	2	2
Ohio	Greater Cleveland RTA	18	18	6	8
Pennsylvania	Philadelphia—Southeast Pennsylvania Transit Authority	76	76	4	4
Total		**997**	**1,009**	**256**	**340**

SOURCES: U.S. Department of Transportation, Federal Transit Administration, *National Transit Database*, 1997 and 2000.

Commuting to Work

Nearly 9 out of 10 workers in 2000 traveled to work by car, truck, or van (table 1), and most of those driving to work drove alone [1]. These Census 2000 Supplementary Survey data are not directly comparable with 1990 decennial census data for several reasons, including the fact that the former does not cover the group quarters population,[1] perhaps understating some categories, such as walking. However, the national trends revealed by a comparison of the two data sets are consistent with other evidence of changes in how people get to work [2]. In particular, the census data show that the share of workers driving alone to work increased and carpooling decreased between 1990 and 2000, while the share of workers using public transportation remained about the same (figure 1).

[1] The group quarters population consists of people not living in households. It includes, for instance, those who are institutionalized and people who live in group housing, such as college dormitories, military quarters, and group homes.

Table 1
Mode of Travel to Work: 2000

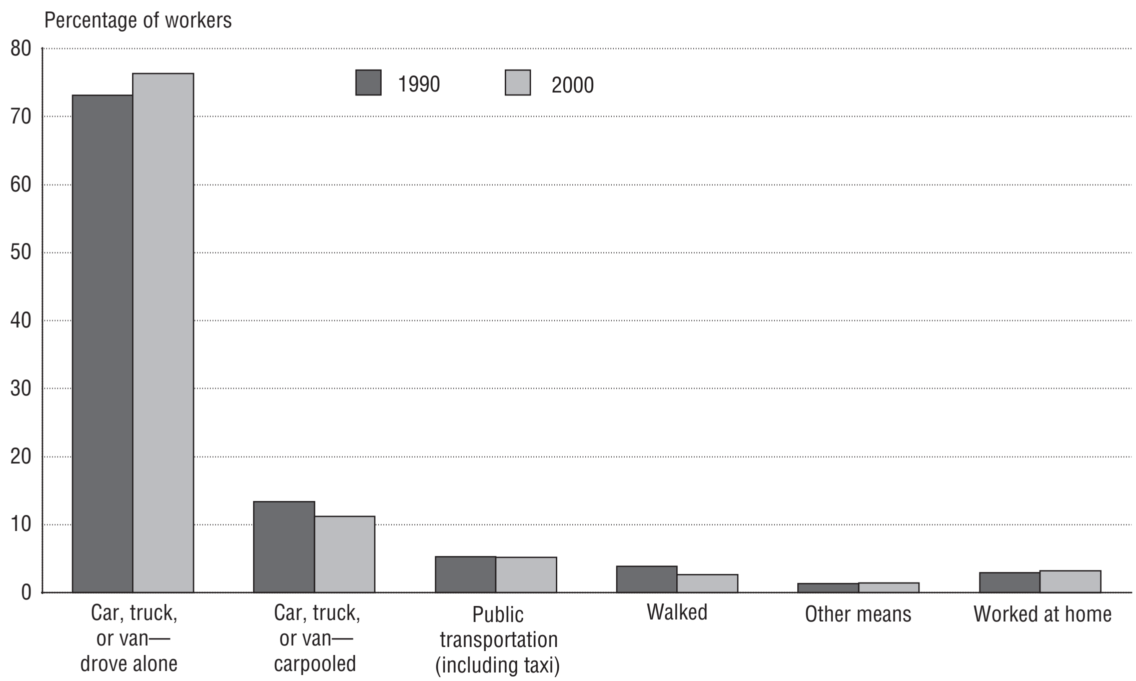
Mode	Percent
Car, truck, or van—drove alone	76.3
Car, truck, or van—carpooled	11.2
Public transportation (including taxi)	5.2
Walked	2.7
Other means	1.4
Worked at home	3.2

SOURCE: U.S. Department of Commerce, U.S. Census Bureau, *Census 2000 Supplementary Survey for the United States,* available at http://factfinder.census.gov/home/en/C2SS.html, as of Mar. 27, 2002.

Sources

1. U.S. Department of Commerce, U.S. Census Bureau, *Census 2000 Supplementary Survey for the United States*, available at http://factfinder.census.gov/home/en/C2SS.html, as of Mar. 27, 2002.
2. U.S. Department of Transportation, Bureau of Transportation Statistics, *Transportation Statistics Annual Report 2000* (Washington, DC: 2001).

Figure 1
Usual Means of Travel to Work: 1990 and 2000

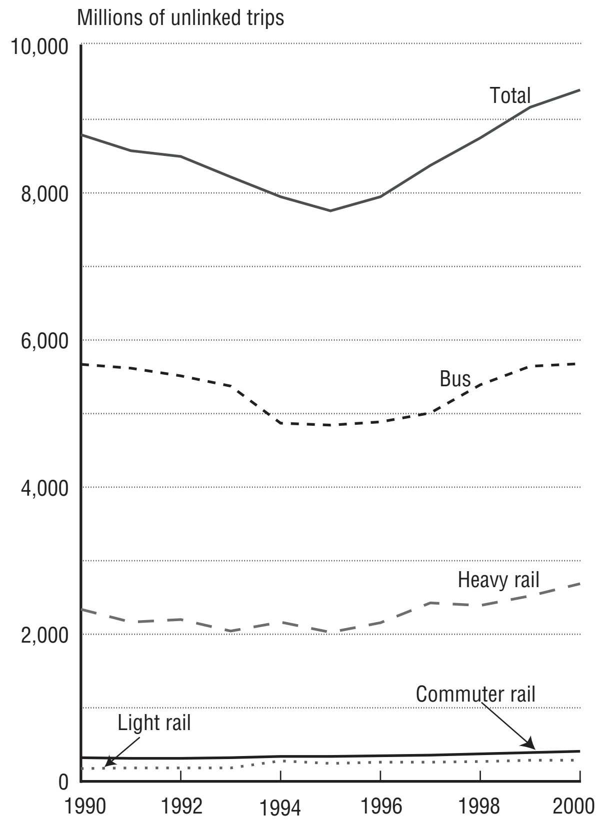


SOURCES: U.S. Department of Commerce, U.S. Census Bureau, *Census 2000 Supplementary Survey for the United States,* available at http://factfinder.census.gov/home/en/C2SS.html, as of Mar. 27, 2002.
_____. *Means of Transportation to Work for the U.S.: 1990 Census,* available at http://www.census.gov/population/socdemo/journey/usmode90.txt, as of Sept. 17, 2001.

Transit Ridership

Transit ridership grew steadily between 1995 and 2000 to reach 9.4 billion unlinked[1] trips in 2000 [1], an increase of 21 percent. The number of trips made in 2000 represents a 3.9 percent annual increase since 1995 and the highest ridership in more than 40 years [3]. Rail transit ridership posted particularly strong growth (figure 1). Between 1995 and 2000, heavy rail grew 32 percent, followed by commuter rail at 20 percent, and light rail at 17 percent. Bus ridership dipped in the mid-1990s but by 2000 had risen back to the level of ridership held in 1990. Most transit trips are still taken by bus [1, 2].

Figure 1
Transit Ridership by Mode: 1990–2000



NOTE: Total includes other modes not shown, such as ferry boats, inclined planes, and trolley buses.

SOURCE: American Public Transportation Association, *Public Transportation Fact Book 2001* (Washington, DC: 2001).

Sources

1. American Public Transit Association, "APTA Transit Ridership Report," available at http://www.apta.com/stats/ridershp/riderep/history.pdf, as of Sept. 7, 2001.
2. ____. *Public Transportation Fact Book 2001* (Washington, DC: 2001).
3. ____. "Public Transportation Ridership Tops 9.4 Billion in 2000," available at http://www.apta.com/news/releases/2000rides.htm, as of Sept. 7, 2001.

[1] Each time a passenger boards a vehicle it is counted as an unlinked trip, regardless of the number of vehicles the passenger must board to travel from origin to destination.

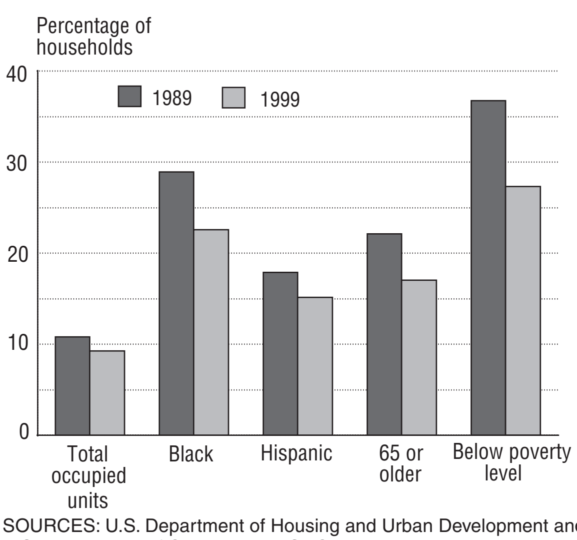
Households Without Vehicles

Because of improvements in vehicle reliability and longevity and rising incomes, more people now own a motor vehicle than 10 years ago. However, about 9.5 million households—representing 9 percent of all households—were without a car, van, or truck in 1999 [1]. This is down from 10.1 million households (11 percent of all households) in 1989 [2].

Black, Hispanic, poor, and elderly households are more likely to be without a car, van, or truck than the population as a whole, despite relatively large increases in vehicle ownership among these groups (figure 1). Not surprisingly, poor households are the least likely to have vehicles. The number of households below the poverty level without a vehicle dropped 10 percent, from 37 percent in 1989 to 27 percent in 1999.

The geographic location of a household also affects vehicle ownership. For instance, households in central city urban areas are less likely to own motor vehicles than households in the suburbs, urban areas outside a metropolitan statistical area, or rural areas (figure 2). Similarly, when data are aggregated on a regional basis, the heavily urban Northeast has the highest share of households without vehicles (figure 3).

Figure 1
Households Without Vehicles: 1989 and 1999



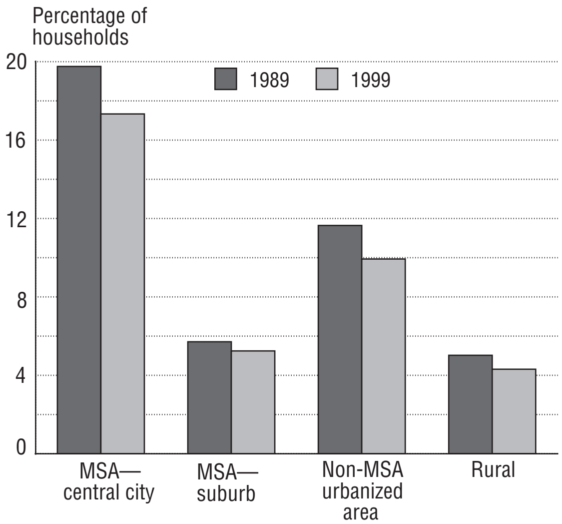
SOURCES: U.S. Department of Housing and Urban Development and U.S. Department of Commerce, U.S. Census Bureau, *American Housing Survey for the United States: 1999,* H150 (Washington, DC: 2000). _____. *American Housing Survey for the United States: 1989,* H150 (Washington, DC: 1990).

Sources

1. U.S. Department of Housing and Urban Development and U.S. Department of Commerce, U.S. Census Bureau, *American Housing Survey for the United States: 1999,* H150/99 (Washington, DC: 2000).
2. _____. *American Housing Survey for the United States: 1989,* H150/89 (Washington, DC: 1990).

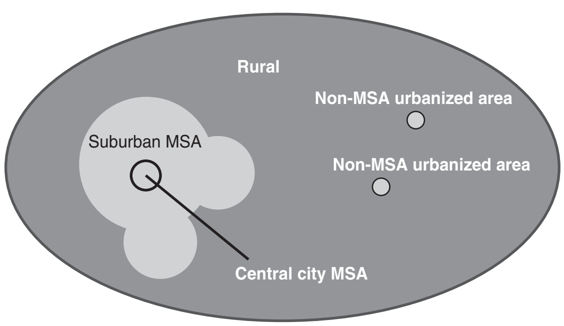
(continues on next page)

Figure 2
Households Without Vehicles in Urban, Suburban, and Rural Areas: 1989 and 1999



NOTE: MSAs = metropolitan statistical areas (see box below).
SOURCE: U.S. Department of Housing and Urban Development and U.S. Department of Commerce, U.S. Census Bureau, *American Housing Survey for the United States: 1999,* H150/99 (Washington, DC 2000).
_____. *American Housing Survey for the United States: 1989,* H150/89 (Washington, DC: 1990).

"Census Island," USA



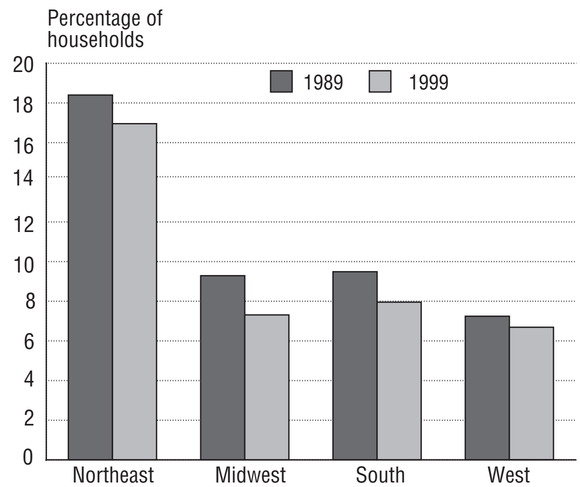
Central cities are urban counties with at least 50,000 inhabitants. A Metropolitan Statistical Area (MSA) contains a central city and the outlying suburban counties. An outlying county must have a high level of social and economic integration with the central city (or cities) to be considered part of the MSA. These outlying counties comprise the Suburban MSA.

Non-MSA urbanized areas are places outside the boundaries of MSAs with at least 2,500 inhabitants. A place can be an incorporated area, or a closely settled population center without corporate limits.

Areas not classified as urban are rural.

SOURCE: U.S. Department of Commerce, U.S. Census Bureau.

Figure 3
Households Without Vehicles by Region: 1989 and 1999



KEY:
Northeast—Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, Pennsylvania, and New Jersey.
Midwest—Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, Kansas, Nebraska, North Dakota, and South Dakota.
South—Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Tennessee, Kentucky, Arkansas, Louisiana, Oklahoma, and Texas.
West—Montana, Wyoming, Colorado, New Mexico, Arizona, Utah, Idaho, Alaska, Washington, Oregon, Nevada, California, and Hawaii.

SOURCES: U.S. Department of Housing and Urban Development and U.S. Department of Commerce, U.S. Census Bureau, *American Housing Survey for the United States: 1999,* H150 (Washington, DC: 2000).
_____. *American Housing Survey for the United States: 1989,* H150 (Washington, DC: 1990).

Highway Congestion in Metropolitan Areas

Being stuck in traffic is a source of frustration for many travelers, particularly commuters, but the impacts go far beyond those individuals immediately affected. By wasting people's time, increasing the time it takes to transport goods, and causing missed meetings and appointments, highway congestion is a drag on economic productivity. Congestion is also an environmental concern. Extra fuel is consumed by cars traveling under these conditions because of increased acceleration, deceleration, and idling. Greater fuel consumption leads to higher emissions of greenhouse gases and may raise the level of other air pollutants.

The Texas Transportation Institute (TTI) studies 68 metropolitan areas in order to estimate congestion and some of its impacts in the United States. TTI found that between 1982 and 1999 congestion measured by average annual delay per person increased in all areas (see the map on the next page). Overall in the study areas, average annual delay per person has more than tripled during the 17-year period, rising from 11 hours per person in 1982 to 36 hours in 1999 (table 1). Furthermore, drivers in the largest metropolitan areas (with a population of over 3 million) experienced the worst congestion (41 hours per person on average in 1999), and those in small metropolitan areas (population of 500,000 or less) the least (10 hours a year per person) (figure 1).

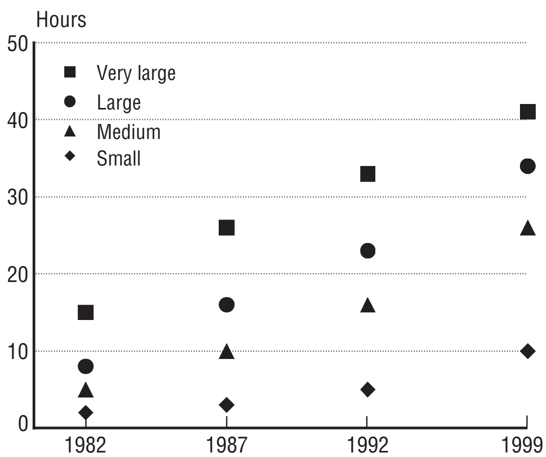
Table 1
Congestion Measures in 68 Metropolitan Areas

Year	Annual delay per person (hours)	Wasted fuel per person (gallons)	Annual fuel wasted per urban area (million gallons)
1982	11	17	26
1986	18	28	43
1990	26	39	65
1992	27	41	69
1995	30	46	81
1997	34	51	92
1999	36	55	100

NOTE: The "annual delay/eligible driver" and "wasted fuel/eligible driver" terminology used in previous reports has been discontinued and replaced with "per person" calculations in this report.

SOURCE: D. Shrank and T. Lomax, *The 2001 Urban Mobility Report* (College Station, TX: Texas Transportation Institute, 2001).

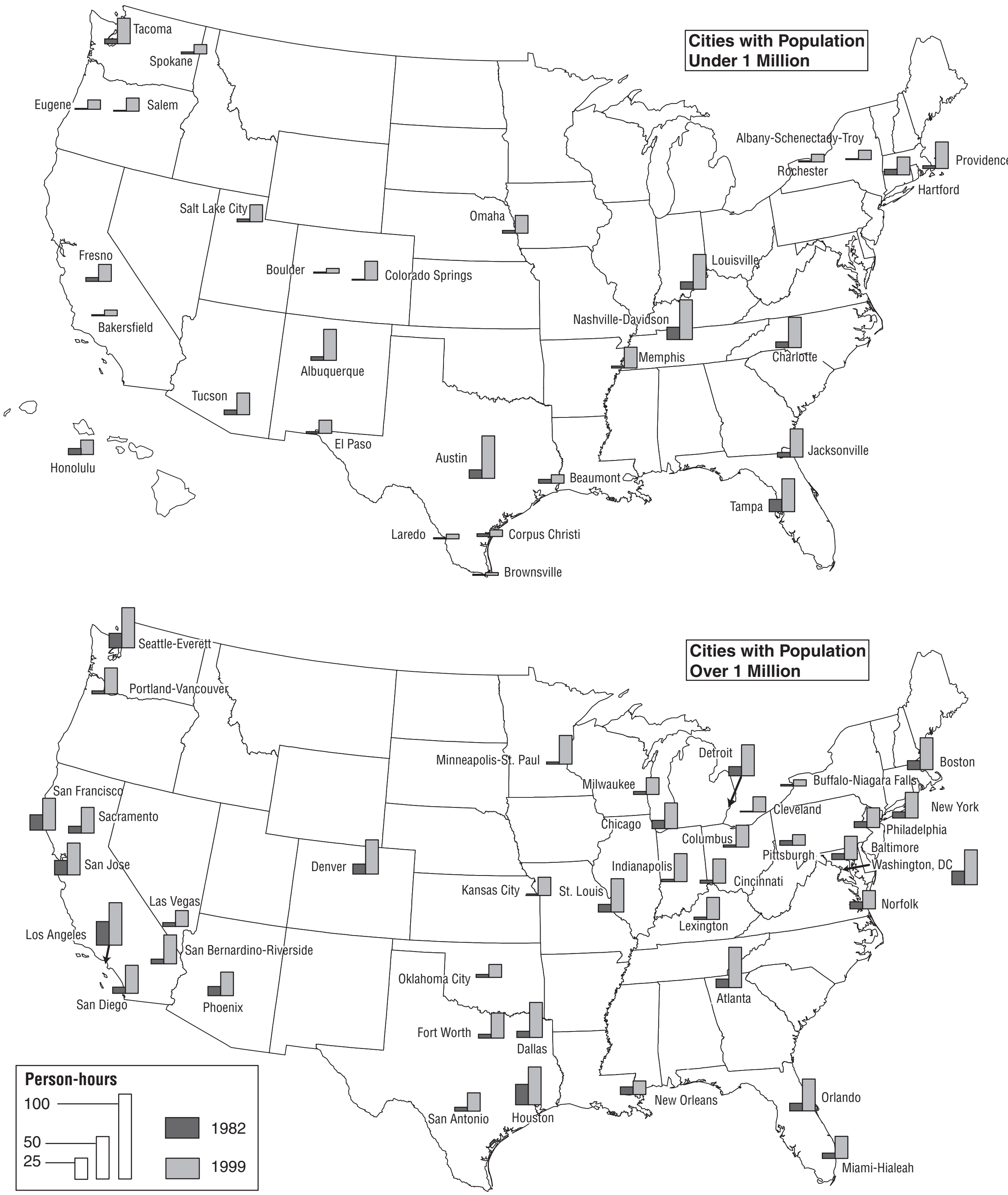
Figure 1
Annual Hours of Congestion Delay per Person by Metropolitan Area Size



KEY: Very large = over 3 million; Large = over 1 million–30 million; Medium = over 500,000–1 million; Small = 500,000 or less.

SOURCE: D. Shrank and T. Lomax, *The 2001 Urban Mobility Report* (College Station, TX: Texas Transportation Institute, 2001).

Annual Person-Hours of Delay per Person: 1982 and 1999



NOTES: The cities shown represent the 50 largest metropolitan areas, as well as others chosen by the states sponsoring the study. For a detailed explanation of the formulas used, see the source document.

SOURCE: Texas Transportation Institute, *2001 Annual Mobility Report* (College Station, TX: 2001).

U.S. Airline Delays

Delayed or canceled commercial airline flights cost consumers in many unmeasured ways, including lost personal time, missed meetings, and increased anxiety and stress. Delay also costs the airlines. The Federal Aviation Administration (FAA) estimates that commercial aviation delays cost airlines over $3 billion annually and projected in 2000 that delays throughout the system would continue to increase as the demand for air travel rose [1]. Both FAA and the airlines consider that improvements in air traffic control should mitigate some flight delay problems. In addition, FAA and the industry, under the FAA's National Airspace System (NAS) Operational Evolution Plan, have begun to implement ways to reduce delays in the national aviation system attributable to weather, increasing flight volume, and limited system capacity [3].

Both the Bureau of Transportation Statistics (BTS) and FAA track airline delays. According to BTS, a flight is counted as an "on-time departure" if the aircraft leaves the airport gate less than 15 minutes after its scheduled departure time, regardless of the time the aircraft actually lifts off from the runway. Also, BTS counts an arriving flight as "on time" if it arrives less than 15 minutes after its scheduled gate arrival time.

Unlike BTS, which tracks air carrier performance, FAA tracks delays in terms of how well the air traffic control system performs [2]. Tracking begins once a flight is under FAA air traffic control (i.e., after the pilot's request to taxi out to the runway). As such, an aircraft could wait an hour or more at the gate before requesting clearance to taxi. Once under air traffic control, as long as the aircraft took off within 15 minutes of the airport's standard taxi-out time, FAA considers the flight departed on time. [1].

About one-quarter of flights by major U.S. air carriers were delayed between 1996 and 2001, according to BTS data (figure 1). In 2001, 22 percent of flights were delayed, canceled, or diverted, down from a 10-year high of 27 percent in 2000 [2].

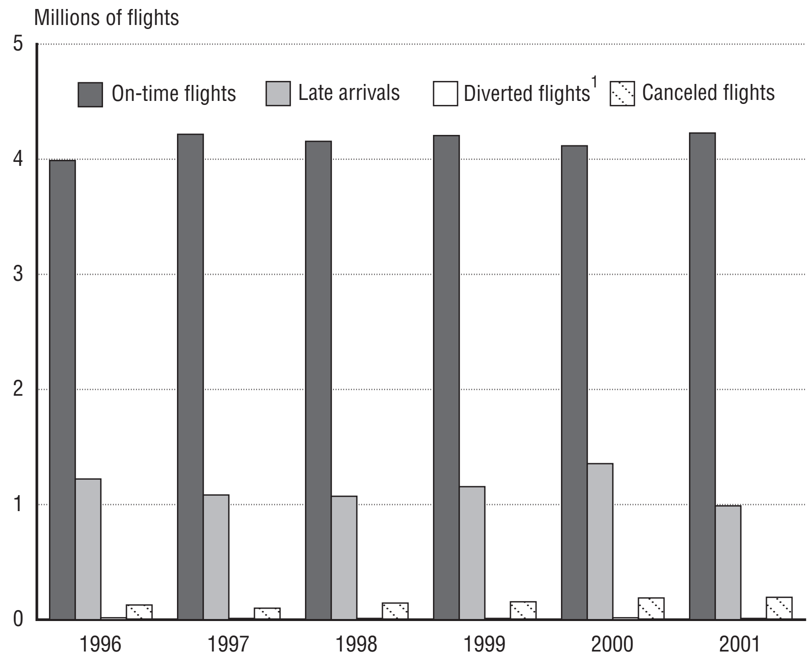
Most delays take place while a plane is on the ground, although the actual cause of a delay may occur elsewhere. Poor weather is the most common cause of delays (figure 2). The growth in flight volume was a major contributor to delays and cancellations during the 1990s. The total number of flight operations[1] at the nation's airports increased by 7 percent, from 63.0 million to 67.7 million flights, between 1992 and 2000[2] [4]. Delayed flights rose from less than one in five flights to more than one in four flights during the same period [2].

A slowing economy contributed to a 3 percent reduction in total flight operations between August 2000 and August 2001 [4].

[1] Flight operations, as reported by FAA, include takeoffs and landings by all types of aircraft (commercial and general aviation) at approximately 3,400 domestic airports.

[2] Comparable data are not available for 1990 and 1991.

Figure 1
U.S. Major Air Carriers On-Time Performance: 1996–2001



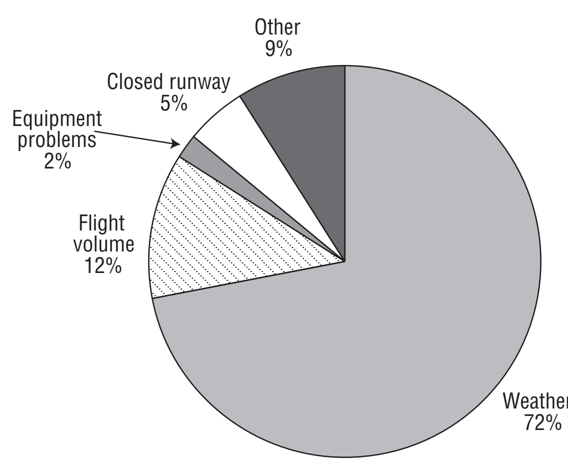
[1] Because relatively few flights were diverted from their original destinations, that category is not clearly visible on the graph. The following number of flights were diverted (by year): 14,121 (1996); 12,081 (1997); 13,161 (1998); 13,555 (1999); 14,254 (2000); and 12,144 (2001). Please note that the chart displays millions of flights.

SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, *Airline On-Time Performance Database,* available at http://www.bts.gov., as of May 2002.

The demand for flights also dropped considerably following the terrorist attacks in September 2001 (box 1). The reduction in flight volume during 2001 contributed to a 5 percent decrease in flight delays compared with 2000 [2].

There is much debate about the role of airline scheduling in causing delays. The hub and spoke systems used by the major airlines concentrate flights into the hub airports. The worst delays tend to be at peak travel times during the day and at certain times of the year (e.g., holidays and the summer months) when travel volume is heavier. When heavy volume is combined with bad weather between a hub airport and its spokes, the ripple effect can cause delays at dozens of other airports [1] (table 1).

Figure 2
FAA-Cited Causes of Delays: 2001
(After pushing back from the gate)



SOURCE: U.S. Department of Transportation, Federal Aviation Administration, *Operations Network (OPSNET) Database*, available at http://www.faa.gov/programs/oep/.

Box 1
Impacts of the September 11, 2001, Terrorist Attacks

The September 11, 2001, terrorist attacks forced the U.S. Department of Transportation (DOT) to take the unprecedented step of closing down the nation's aviation system and, further, to restrict operations in parts of the system. The attacks also affected the public's demand for air travel by increasing concerns for air safety and decreasing the likelihood of quick recovery for an economy that was already weak.

The result was an exceptional fall in all types of flight operations recorded by the Federal Aviation Administration: 2 million (35 percent) fewer operations in September 2001 than in September 2000. The 233,000 cancellations for the 12 months ending September 2001 were 42 percent higher than the previous high set in September 2000. The 86,000 cancellations recorded between September 11 and September 30 were higher than for any year (ending in September) since 1995. Even these numbers understate the impact of the attacks, because flights that are offered for sale, but canceled more than 7 days before scheduled departure, are not reported to the Bureau of Transportation Statistics. Airlines reported 151,000 flights for September 1 to 10 but only 139,000 flights for September 21 to 30, a decline of almost 9 percent.

SOURCES: U.S. Department of Transportation, Bureau of Transportation Statistics, analysis based on U.S. Department of Transportation, Federal Aviation Administration, Operations Network (OPSNET) Database, as of May 2002.

In August 2000, the U.S. Department of Transportation (DOT) created a task force comprising a cross-section of aviation stakeholders, including representatives from airlines, consumer groups, labor unions, and airport operators, to examine the reasons for flight delays and develop recommendations on how to modify airline on-time reporting. Currently, the on-time information that the 10 largest U.S. passenger carriers are required to submit to BTS[3] identifies only the frequency and duration of flight delays and cancellations, not the cause. As a preliminary step to expanding rules for air carrier on-time reporting, the task force implemented a pilot test program for reporting causes of flight delays [2]. DOT also

[3] American Eagle was added to the list of carriers that must report on-time data and began reporting in January 2001. This carrier is excluded from the data and figures in this report to retain comparability with previous years.

Table 1
Top 10 Large Airports for Percentage of Flights Delayed, Canceled, or Diverted: 2001

Rank	Airport	Number of scheduled departures	Flights not departing on time	Number of scheduled arrivals	Flights diverted away from airport	Canceled	% late arrivals	% of flights not arriving on time
1	Seattle-Tacoma	102,752	23,961	102,734	225	3,074	27.5	30.7
2	San Francisco	121,735	26,621	121,738	316	6,389	23.2	28.7
3	New York La Guardia	103,874	22,020	103,888	674	7,774	20.3	28.4
4	New York JFK	41,224	10,019	41,208	160	1,944	22.7	27.8
5	Philadelphia	116,815	27,556	116,832	398	5,533	22.3	27.4
6	Chicago O'Hare	282,049	69,497	282,046	788	15,479	21.3	27.1
7	Boston Logan	103,969	22,948	103,950	208	7,377	19.5	26.8
8	Los Angeles	195,376	42,195	195,386	253	7,704	21.7	25.8
9	Newark	117,822	23,014	117,798	342	6,075	19.5	25.0
10	Miami	62,319	13,139	62,334	101	1,715	21.5	24.4

NOTES: A *flight* is defined as late if the aircraft departs from or arrives at the gate more than 15 minutes after its scheduled departure or arrival time. A *large airport* is an airport with at least 1 percent of domestic passenger enplanements in 2000.

SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, *Airline On-Time Performance Database,* available at http://www.bts.gov., as of May 2002.

developed a notice of proposed rulemaking that would modify the current regulations governing the submission of on-time flight performance reports to require the reporting of causal information relative to flight delays and cancellations.

Sources

1. Mead, K.M., Inspector General, U.S. Department of Transportation, "Flight Delays and Cancellations," statement before the Committee on Commerce, Science, and Transportation, United States Senate, Sept. 14, 2000.
2. U.S. Department of Transportation, Bureau of Transportation Statistics, Office of Airline Information, personal communications, November 2000–November 2002.
3. U.S. Department of Transportation, Federal Aviation Administration, *NAS Operational Evolution Plan,* available at http://www.faa.gov/programs/oep/OMDEX.htm, as of April 2002.
4. _____. OPSNET database.

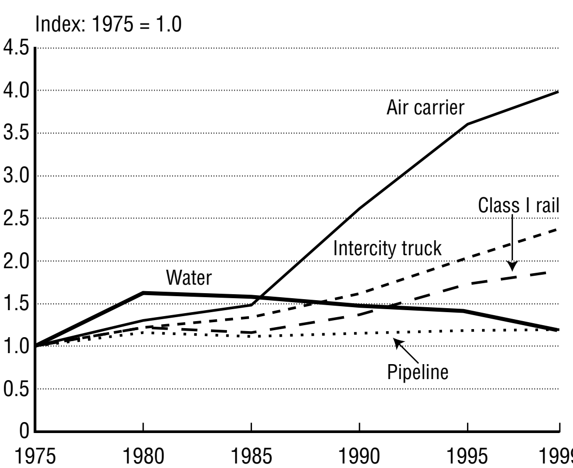
Domestic Freight Shipments

Freight movements grew significantly over the past quarter century despite a general trend in the economy toward services and high-value, low-weight products. Between 1975 and 1999, domestic freight ton-miles increased 67 percent, from 2.3 trillion to 3.8 trillion, with air carriers and intercity trucking growing faster than the other modes (figure 1). Despite the decline in the maritime mode since 1980, attributable to the decline in Alaskan crude oil shipments, water transportation still accounted for 656 billion ton-miles in 1999.

Population growth and economic activity are some of the factors that determine freight demand; increases in both mean a greater volume of goods produced and consumed and thus more freight moved (figure 2). Between 1975 and 1999, the resident population rose by 57 million, an increase of 26 percent, while the gross domestic product more than doubled from $4 trillion to $8.9 trillion (in inflation-adjusted chained 1996 dollars). The growth in freight ton-miles was slower than the growth in economic activity during this period but outpaced the increase in population.

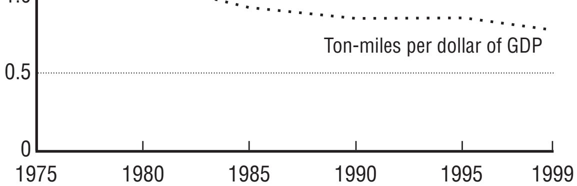
As economic activity expanded, particularly in the 1990s, changes in what, where, and how goods were produced affected freight demand and contributed to the increase in total ton-miles. The composition of goods produced also

Figure 1
Growth in Domestic Freight Ton-Miles: 1975–1999



SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, *National Transportation Statistics 2001* (Washington, DC: 2002).

Figure 2
Domestic Ton-Miles, Gross Domestic Product, and Resident Population: 1975–1999



KEY: GDP = Gross Domestic Product.

SOURCE: GDP data—U.S. Department of Commerce, Bureau of Economic Analysis, available at www.bea.doc.gov/bea/dn/gdplev.htm, as of Apr. 20, 2001. Ton-miles data—U.S. Department of Transportation, Bureau of Transportation Statistics, *National Transportation Statistics 2001* (Washington, DC: 2002). Population data—U.S. Department of Commerce, U.S. Census Bureau, available at www.census.gov/population/estimates/nation/popclockest.txt, as of Apr. 20, 2001.

changed as the economy shifted toward more services and high-value, low-weight products. This shift can be measured by the ratio of ton-miles per dollar of Gross Domestic Product (GDP), which has declined since 1975. This decline suggests that, as the economy becomes more service-based, it is also becoming less freight transportation intensive. For instance, it takes more freight ton-miles to produce $1,000 worth of steel than it does to produce $1,000 worth of cellular phones. Today, even traditional products, such as automobiles, are made from lighter, but often more expensive, materials such as engineered plastics.

However, freight ton-miles per capita rose more than 30 percent, from about 10,600 in 1975 to 14,000 in 1999. As economic growth has accelerated, disposable personal income per capita has increased and individual purchasing power risen. Businesses have responded by shipping more freight per resident population.

The manufacture, assembly, and distribution of goods continue to change as components of products are produced in facilities located thousands of miles apart, some halfway around the globe. Today, many businesses manage worldwide production and distribution systems, increasing global trade in goods and the demand for freight transportation. Changes in where goods are produced can directly increase total ton-miles and change the average length of haul of shipments. Such changes also affect freight mode choice, with more commodities being shipped by multiple modes as distances increase. This worldwide spatial distribution of production activities and trade impacts transportation requirements in the United States. For example, expanding trade with the Pacific Rim continues to make West Coast container ports more dominant than East Coast ports and poses challenging landside and intermodal access demands.

Freight Analysis Framework Tool

To help public and private entities better manage freight movement across the country, the U.S. Department of Transportation (DOT) has created an analytical tool called Freight Analysis Framework (FAF). Developed by the Federal Highway Administration, in collaboration with the Federal Railroad Administration, the Maritime Administration, the Bureau of Transportation Statistics, and DOT's Office of Intermodalism, the FAF provides a methodology for estimating freight flows. Focused on highway, railroad, water, and air modes of transportation, the FAF allows exploration of the geographic relationships between local flows and the overall national transportation system. The underlying comprehensive database for the FAF comprises various government and private sector databases.

Using the FAF, economic forecasts for 2010 and 2020 are translated into transportation demands that are assigned to a simulation of the transportation network. For instance, the FAF has predicted that between 1998 and 2020 domestic freight tonnage will grow at an annual rate of 2.4 percent (67 percent over the 22 years) and U.S. international tonnage will grow at 2.8 percent (85 percent overall). These flows can be projected on national, regional, state, or local maps to aid in analysis of the impacts. This enables, for instance, planners and decisionmakers at all levels of government and the private sector to evaluate the potential for transportation corridor congestion, helping to plan solutions.

SOURCE: U.S. Department of Transportation, Federal Highway Administration, Freight Analysis Framework, available at http://www.ops.fhwa.dot.gov/freight/, as of Nov. 5, 2002.

Air Cargo

During the past decade, the U.S. domestic air cargo industry moved increasing amounts of freight while providing speedy, reliable, and safe freight services to support business activity and household package delivery in the United States. Between 1991 and 2000, domestic air cargo tonnage more than doubled, from 5 million tons to 13 million tons, an annual growth rate of 11 percent (table 1). Measured in revenue ton-miles, air freight grew 6 percent annually between 1991 and 2000.

Air freight remains a vital link that enables quick access by firms and households to goods produced throughout the United States and the world. Since 1991, the air freight ton-miles per capita has increased over 50 percent, rising to almost 53 ton-miles per person per year by 2000. At the same time, miles per ton-mile declined by over 35 percent (table 1). This decline in average air cargo flight distance may be a result of changes in the marketplace, especially during the second half of the decade when enplaned revenue tons increased at a much greater rate than revenue ton-miles. Contributing factors include changes in the competitive relationship between air and surface modes, increasing the attractiveness of air for short-haul shipments; creation of new markets for short-haul air shipments because of fundamental changes in the U.S. economy, as discussed below; and a maturing of the air cargo system making it more competitive for short-haul shipments.

Table 1
Domestic Air Revenue Freight Tons and Ton-Miles: 1991–2000

Year	Enplaned revenue tons (millions)	Revenue ton-miles (billions)	Revenue ton-miles per capita	Miles per revenue ton
1991	4.9	8.7	34.6	1,799
1992	5.1	9.7	37.9	1,912
1993	6.4	10.5	40.9	1,650
1994	6.8	11.6	44.7	1,711
1995	7.2	12.3	47.0	1,713
1996	8.0	12.7	47.7	1,572
1997	11.1	13.4	50.2	1,213
1998	11.8	13.7	50.7	1,162
1999	12.1	14.0	51.3	1,160
2000	12.7	14.7	52.5	1,161

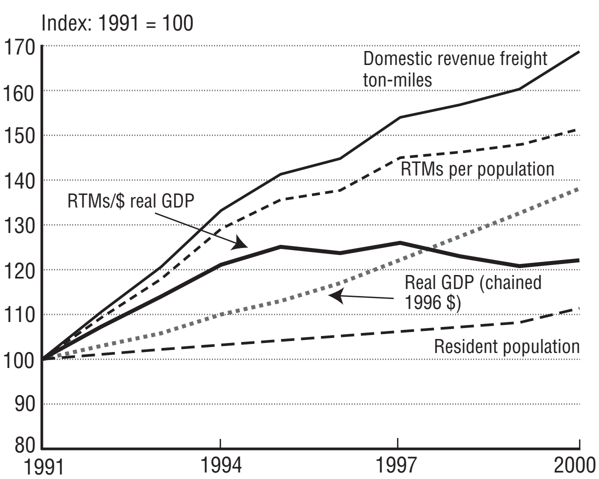
SOURCES: 1991–1995: U.S. Department of Transportation, Federal Aviation Administration, *Airport Activity Statistics of Certificated Route Air Carriers* (Washington, DC: Various years).
1996–2000: U.S. Department of Transportation, Bureau of Transportation Statistics, *Airport Activity Statistics of Certificated Air Carriers* (Washington, DC: Various years).

Strong growth in the U.S. economy during the 1990s, evolving production and distribution systems, and interest in electronic commerce have spurred growth in air cargo. Air freight has outpaced increases in real Gross Domestic Product (GDP) and U.S. resident population (figure 1). Furthermore, air freight grew significantly in line with a general trend in the economy toward services and high-value products. This is evidenced by the trends in revenue ton-miles per dollar of real GDP.

Air cargo continues to be impacted by a shift toward services and new methods of product manufacturing, production, and distribution. While scheduled air service rose in response to demands to move air cargo quickly during the past decade, nonscheduled service grew much faster, transporting only 3 percent of domestic enplaned revenue tonnage in 1991 but 40 percent in 2000 (figure 2). Nonscheduled service gives businesses greater flexibility to move cargo fast and efficiently on short notice and may provide a quicker response to just-in-time business demands.

Unused freight ton-miles, a measure of excess capacity in the air cargo industry, steadily grew between 1991 and 2000 (figure 3 on the next page). In 2000, 27 billion ton-miles of air cargo capacity were unused, accounting for nearly 65 percent of the available freight ton-miles. The relative proportion of excess capacity, however, remained stable during the decade. The average air cargo load factor also remained stable at around 35 percent despite an overall increase in available capacity to nearly 42 billion ton-miles in 2000.

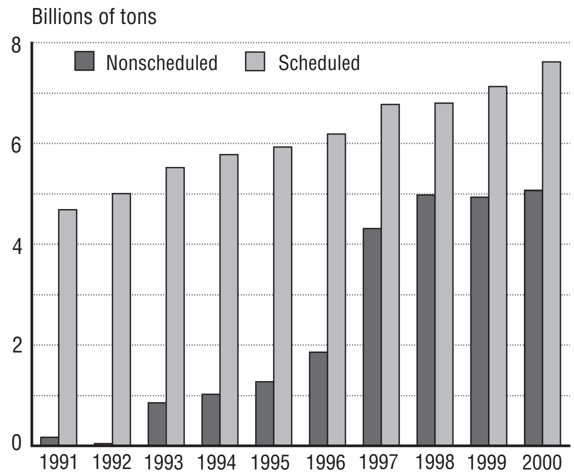
Figure 1
Domestic Air Revenue Freight Ton-Miles, Population, and Real Gross Domestic Product: 1991–2000



KEY: RTMs = revenue ton-miles; GDP = gross domestic product.

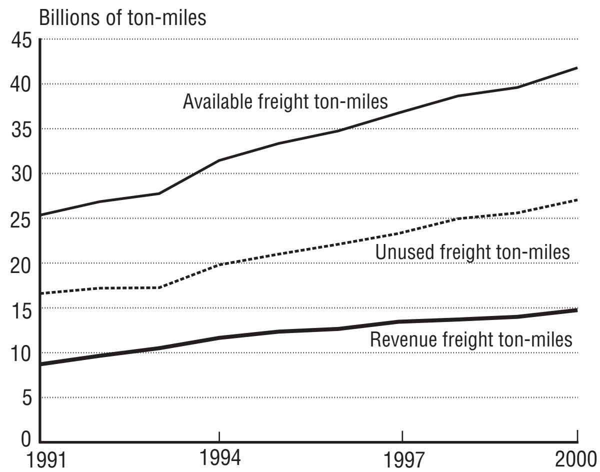
SOURCES: 1991–1995: U.S. Department of Transportation, Federal Aviation Administration, *Airport Activity Statistics of Certificated Route Air Carriers* (Washington, DC: Various years).
1996–2000: U.S. Department of Transportation, Bureau of Transportation Statistics, *Airport Activity Statistics of Certificated Air Carriers* (Washington, DC: Various years).

Figure 2
Enplaned Air Revenue Tonnage by Type of Service: 1991–2000



SOURCES: 1991–1995: U.S. Department of Transportation, Federal Aviation Administration, *Airport Activity Statistics of Certificated Route Air Carriers* (Washington, DC: Various years).
1996–2000: U.S. Department of Transportation, Bureau of Transportation Statistics, *Airport Activity Statistics of Certificated Air Carriers* (Washington, DC: Various years).

Figure 3
Domestic Air Revenue Freight Capacity: 1991–2000



SOURCES: 1991–1995: U.S. Department of Transportation, Federal Aviation Administration, *Airport Activity Statistics of Certificated Route Air Carriers* (Washington, DC: Annual issues).
1996–2000: U.S. Department of Transportation, Bureau of Transportation Statistics, *Airport Activity Statistics of Certificated Air Carriers* (Washington, DC: Annual issues).

U.S. Container Trade

U.S. container trade increased nearly 7 percent from 1999 to 2000. This trade is concentrated in 25 ports and has become more concentrated in the last 4 years in 10 U.S. container ports (table 1).

Prior to the economic slowdown that began in late 2000, demand for U.S. exports was not keeping pace with U.S. consumer demand for imports. Accordingly, the balance of international container trade (i.e., the volume of U.S. containerized exports compared with containerized imports) shifted in favor of U.S. imports, particularly in recent years. Between 1993 and 1997, the balance of U.S. international container trade was less than 1 million 20-foot equivalent units (TEUs) per year (figure 1). By 2000, this gap had widened to a difference of over 4 million TEUs.

Of the top 10 U.S. container ports, the Port of Los Angeles has the deepest maintained channel depth, followed by the Port of Long Beach. The largest container vessel serving U.S. ports has a draft of 45 feet [1]. Out of 441 containerships on order in world shipyards as of June 2001, 98 will have capacities greater than 5,000 TEUs [2]. Because there are few U.S. ports with channel

Table 1
Top 10 U.S. Container Ports: Traffic (thousands of TEUs) and Channel Depth (feet): 1992–2000

Port	1992	1993	1994	1995	1996	1997	1998	1999	2000	Authorized channel depth	Maintained channel depth
Los Angeles	1,639	1,627	1,786	1,849	1,873	2,085	2,293	2,552	3,228	70	60
Long Beach	1,356	1,543	1,939	2,137	2,357	2,673	2,852	3,048	3,204	76	63
New York	1,294	1,306	1,404	1,537	1,533	1,738	1,884	2,027	2,200	45	40
Charleston	564	579	655	758	801	955	1,035	1,170	1,246	45	40
Oakland	746	772	879	919	803	843	902	915	989	50	42
Seattle	743	781	967	993	939	953	976	962	960	34	52
Norfolk	519	519	570	647	681	770	793	829	850	55	50
Houston	368	392	419	489	538	609	657	714	733	45	40
Savannah	387	406	418	445	456	529	558	624	720	48	42
Miami	418	469	497	497	505	624	602	618	684	42	42
Total, top 10 ports	**8,035**	**8,394**	**9,534**	**10,271**	**10,486**	**11,779**	**12,552**	**13,458**	**14,814**		
Top 10, % of total	**76%**	**69%**	**72%**	**77%**	**71%**	**76%**	**81%**	**81%**	**83%**		
Total, all U.S. ports	**10,583**	**12,238**	**13,173**	**13,328**	**14,794**	**15,556**	**15,556**	**16,564**	**17,938**		

KEY: TEUs = 20-foot equivalent units.

SOURCE: *Journal of Commerce,* Port Import/Export Reporting Service (PIERS), various container data files; and U.S. Army Corps of Engineers, Navigation Data Center, channel depth data, personal commuication, June 2001.

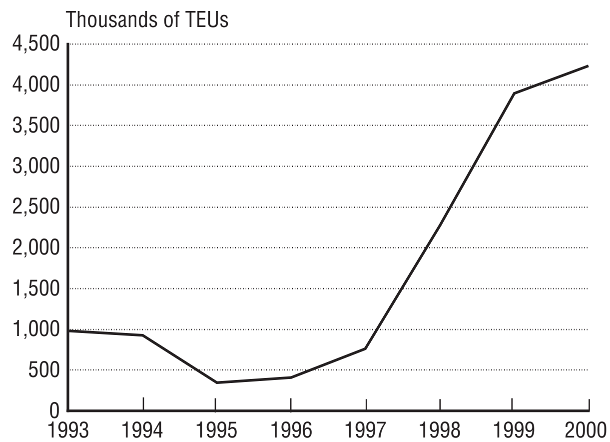
depths sufficient for such containerships, the ports may evolve into a system whereby a main port (i.e., hub) feeds cargoes to a network of ports using smaller draft ships.

Sources

1. Journal of Commerce, "Special Report: Top 50 Container Lines," *JOC Week*, vol. 2, no. 34, Aug. 27, 2001–Sept. 2, 2001.

2. Lloyd's Register of Shipping, *World Shipbuilding Statistics* (London, England: June 2001).

Figure 1
Balance of U.S. International Container Trade—Net Imports: 1993–2000



KEY: TEUs = 20-foot equivalent units.

SOURCE: *The Journal of Commerce,* Port Import/Export Reporting Service (PIERS) data, various years.

Intermodal Freight Capacity

Intermodal movement of freight-shipments transported by multiple modes-has grown sharply in recent decades. Rail shipments with an intermodal component have steadily increased, containers transported by ship that typically move intermodally have largely replaced break bulk shipments, and almost all air freight shipments travel via truck at some point between their origin and destination. As the movement of intermodal freight through airports and seaports continues to rise, the potential for bottlenecks exists. These bottlenecks are likely to occur where the volume of freight moving through a facility or area exceeds the capacity of the transportation system to operate without significant and costly delays.

Transportation planners can use analytical tools to help them identify potential bottlenecks and assess the status of current intermodal freight movements. Analysis using a tool developed by the U.S. Department of Transportation (see box) shows that in 1999, Memphis, Los Angles, and Newark International Airports moved the largest tonnage of freight in the country. Among the top 40 airports, George Bush Intercontinental Airport in Houston, Texas, was ranked first by the freight-to-capacity ratio[1] (table 1). This suggests that although Houston's airport ranks 21st in tonnage moved, its throughput is nearly three times the current infrastructure capacity. However, having a higher than average freight-to-capacity ratio on an annual basis does not necessarily result in bottlenecks since freight shipments may vary daily and move during off-peak hours.

Highway traffic volume and delay around intermodal facilities caused by both freight and passenger vehicles also directly impacts the effectiveness of transferring freight between modes. When freight airports are ranked by the average annual daily traffic (AADT) count within a five-mile radius, the most congested airports are San Francisco, Chicago O'Hare, and Oakland, California. These three airports are also at the top of the list when ranked by traffic delays per lane-mile within five miles of the airport facilities.

The intensity of use and the potential for intermodal bottlenecks for the top U.S. seaports based on the tons of throughput can also be displayed (table 2). The Port of Long Beach, California, ranks first in AADT per lane-mile and delay per lane-mile, followed by ports of Oakland and Richmond, California. On a freight-to-capacity ratio, however, Baton Rouge, Louisiana, and Port Arthur, Texas, are the highest rated ports.

[1] This ratio compares the volume of freight transported to the relative capacity of the transportation infrastructure in handling that level of freight. It divides freight traffic on the transportation network by a measure of *nominal flow* representing a reasonable annual traffic level for facilities of its kind. Assigned flows in excess of nominal flow do not automatically imply a capacity problem, merely that flows are above average for that type of facility.

The Intermodal Bottleneck Evaluation Tool

The Bureau of Transportation Statistics in partnership with the U.S. Department of Transportation's Office of Intermodalism and the Federal Highway Administration sponsored the development of an Intermodal Bottleneck Evaluation Tool (IBET) to provide information and assist transportation planners and policymakers in identifying potential freight bottlenecks in the U.S. transportation system. IBET analyzes freight moved through three types of intermodal facilities: airports (truck-air transfers); seaports (truck-water, rail-water, inland water-deep sea transfers); and truck-rail interchange terminals. It calculates and measures the intensity of infrastructure use for each intermodal facility; estimates the relative significance of these facilities to national, regional, and international freight movement; and ranks facilities on the intensity of use.

IBET uses data from a variety of sources and distributes the freight flows over national transportation network models maintained at the U.S. Department of Energy's Oak Ridge National Laboratory. The freight flows are then assigned over the nation's highway, rail, maritime, and aviation networks using a geographic information system. Modal and intermodal networks, and origin-destination use patterns are displayed by IBET as well as rankings of highway and aviation delays, average annual daily traffic volumes, national freight volumes, and highway freight generated by the major ports.

Five categories of bottlenecks are addressed by IBET: highway-seaport access, seaport congestion, highway-airport access, airport congestion, and highway-rail terminal access. For each bottleneck, IBET can show domestic import and export flows, as well as through traffic by state of origin and destination. IBET, however, does not evaluate the intermodal operations of specific facilities or terminals, measure the impact of operational change on congestion, or incorporate time-of-day fluctuation in analyzing congestion. The evaluation of infrastructure improvements or the calculation of the monetary impact of congestion or mitigation projects is also not measured by IBET. A variety of measures used by IBET to assess intermodal freight bottlenecks are listed below.

Intermodal Freight Bottleneck Measures

Intermodal facility	Bottleneck measure	Land-side access	Within terminal access	Port-side access
Airports	Intensity of use	AADT per lane-mile	Aircraft operations per runway	
		Annual tons per lane-mile	Tons of throughput	
	Observed delay		Delay per 1,000 operations	
	Estimated delay	Delay per highway lane-mile		
Seaports	Intensity of use	AADT per lane-mile	Throughput tons per terminal capacity	
		Annual tons per lane-mile		
	Observed delay			
	Estimated delay	Delay per highway lane-mile		
Truck-rail terminal access	Intensity of use	AADT per lane-mile	Throughput tons per terminal capacity	AADT per lane-mile
		Annual tons per lane-mile		Annual tons per lane-mile
	Observed delay			
	Estimated delay	Delay per highway lane-mile		

KEY: AADT = average annual daily traffic.

SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, “Intermodal Bottleneck Evaluation Tool,” prepared by Oak Ridge National Laboratory, September 2000.

(continues on next page)

Table 1
Airport Freight Capacity and Bottleneck Measures: 1999

Airport	AADT per lane-mile		Freight-to-capacity ratio[1]		Delay per lane-mile	
	Rank	Number	Rank	Ratio	Rank	Hours
San Francisco Internatl	1	21,140	30	0.7	1	289
Chicago O'Hare Internatl	2	19,792	9	1.6	2	275
Metropolitan Oakland Internatl	3	19,737	18	1.2	4	260
Los Angeles Internatl	4	18,919	39	0.2	3	269
Norman Y. Mineta San Jose Internatl	5	15,484	28	0.8	10	134
Lambert-St. Louis Internatl	6	15,378	17	1.2	12	114
Cleveland-Hopkins Internatl	7	14,527	3	2.1	15	98
Minneapolis-St. Paul Internatl	8	14,222	32	0.6	18	85
Miami Internatl	9	14,070	12	1.5	6	159
San Diego Internatl	10	13,453	37	0.3	13	104
Seattle-Tacoma Internatl	11	13,390	20	1.2	9	136
Boston Logan Internatl	12	13,365	38	0.3	8	141
Dallas/Fort Worth Internatl	13	13,121	29	0.7	23	72
Washington Dulles Internatl	14	12,992	15	1.4	7	157
Fort Lauderdale/Hollywood Internatl	15	12,703	8	1.8	11	126
John F. Kennedy Internatl	16	12,645	35	0.4	5	162
Newark Internatl	17	11,999	19	1.2	21	74
Hartsfield Atlanta Internatl	18	11,948	16	1.4	14	102
Salt Lake City Internatl	19	11,883	31	0.7	27	60
Charlotte/Douglas Internatl	20	11,825	4	2.1	30	56
Baltimore-Washington Internatl	21	11,759	26	0.8	26	61
Cincinnati/Northern Kentucky Internatl	22	11,669	6	1.8	31	56
Indianapolis Internatl	23	11,435	14	1.4	24	65
Detroit Metropolitan Wayne County	24	11,427	34	0.5	19	84
Philadelphia Internatl	25	11,041	25	0.8	16	87
James M. Cox Dayton Internatl	26	10,836	7	1.8	37	31
George Bush Intercontinental, Houston	27	10,770	1	3.0	17	86
Sacramento Internatl	28	10,756	13	1.4	33	44
Tampa Internatl	29	10,595	33	0.6	20	82
Portland Internatl	30	10,435	22	1.0	22	73
Denver Internatl	31	10,068	24	0.9	28	59
Raleigh-Durham Internatl	32	9,863	23	0.9	34	42
Phoenix Sky Harbor Internatl	33	9,602	10	1.5	29	56
Ontario Internatl	34	9,423	5	1.8	25	64
McCarran Internatl	35	9,008	21	1.1	35	40
Pittsburgh Internatl	36	8,831	36	0.4	38	27
Memphis Internatl	37	8,661	11	1.5	36	37
Orlando Internatl	38	8,393	2	2.3	32	52
Kansas City Internatl	39	7,177	27	0.8	39	1
Anchorage Internatl	40	U	40	0.0	40	–

[1] This ratio compares the volume of freight transported to the relative capacity of the transportation infrastructure in handling that level of freight. It divides freight traffic on the transportation network by a measure of *nominal flow* representing a reasonable annual traffic level for facilities of its kind. Assigned flows in excess of nominal flow do not automatically imply a capacity problem, merely that flows are above average for that type of facility.

KEY: – = value too small to report; AADT = average annual daily traffic; U = data are unavailable.

SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, Intermodal Bottleneck Analysis Tool data, October 2001.

Table 2
Seaport Freight Capacity and Bottleneck Measures: 1999

Seaport	AADT per lane-mile		Freight-to-capacity ratio[1]		Delay per lane-mile	
	Rank	Number	Rank	Ratio	Rank	Hours
Long Beach	1	18,687	20	1.12	1	265
Oakland	2	17,850	15	1.24	2	204
Richmond	3	15,465	18	1.15	3	155
Boston	4	13,138	37	0.48	6	116
Port Everglades	5	13,090	9	1.57	5	132
New York	6	12,573	26	0.98	7	110
Honolulu	7	12,239	40	0.00	17	71
Miami	8	12,232	17	1.18	4	133
Baltimore	9	11,815	22	1.08	16	72
Tacoma	10	11,731	10	1.56	8	102
New Haven	11	11,489	23	1.05	21	51
Seattle Elliott Bay	12	11,272	25	1.00	9	100
Houston	13	11,172	7	1.89	10	88
Philadelphia	14	10,381	27	0.94	15	73
Paulsboro	15	10,341	24	1.04	12	80
Marcus Hook	16	10,340	21	1.10	14	74
Portland	17	10,153	16	1.23	11	80
Tampa Bay	18	9,995	31	0.64	19	67
Vancouver	19	9,978	19	1.12	13	79
Newport News	20	9,876	32	0.58	18	69
Norfolk Harbor	21	9,571	34	0.51	20	64
Providence	22	9,206	38	0.21	24	36
Jacksonville	23	9,030	28	0.92	23	42
New Orleans	24	8,758	13	1.45	22	44
Anacortes	25	7,889	30	0.73	26	20
Port Arthur	26	7,408	2	2.97	31	5
Baton Rouge	27	7,123	1	3.21	28	15
Pascagoula	28	7,072	4	2.30	33	4
Port of South Louisiana	29	7,010	8	1.84	30	5
Savannah	30	6,626	12	1.51	29	10
Mobile Harbor	31	6,613	6	1.90	32	4
Charleston	32	6,552	29	0.75	27	17
Portland	33	5,814	36	0.48	35	3
Lake Charles	34	5,587	3	2.59	38	0.7
Wilmington	35	5,404	33	0.53	25	24
Galveston	36	5,000	39	0.14	36	1
Corpus Christi	37	4,658	11	1.53	34	3
Freeport	38	4,015	35	0.50	37	0.9
Matagorda Ship Channel	39	2,800	14	1.41	40	–
Port of Plaquemine	40	U	5	2.30	39	–

[1] This ratio compares the volume of freight transported to the relative capacity of the transportation infrastructure in handling that level of freight. It divides freight traffic on the transportation network by a measure of *nominal flow* representing a reasonable annual traffic level for facilities of its kind. Assigned flows in excess of nominal flow do not automatically imply a capacity problem, merely that flows are above average for that type of facility.

KEY: – = value too small to report; AADT = average annual daily traffic; U = data are unavailable.

SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, Intermodal Bottleneck Analysis Tool data, October 2001.

Intermodal Rail Traffic

Railroad intermodal traffic—moving a trailer or container on a rail flatcar—has grown faster than any other segment of the railroad industry, tripling since 1980. Containers-on-flatcars (COFC) have led this growth in recent years with the increase of doublestack container service fueled by higher levels of international trade from the Pacific Rim countries.

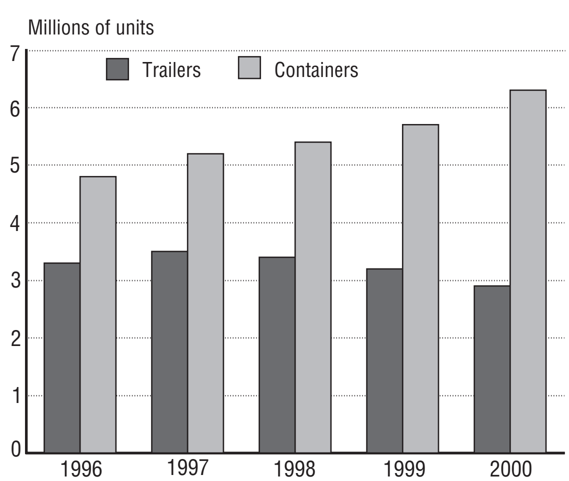
Intermodal traffic grew from 8.1 million COFCs and trailer-on-flatcars (TOFCs) in 1996 to 9.2 million in 2000, an increase of almost 14 percent (figure 1). During the same period, COFC shipments increased over 31 percent while TOFC shipments dipped about 12 percent. Furthermore, the number of railroad flatcars used for intermodal transportation declined overall, indicating an improvement in railroad equipment utilization and increased productivity (figure 2).

The largest flows of intermodal traffic are between California and Illinois and consist primarily of moving containers from ships to their final destinations. Overall, intermodal rail shipments move an average 1,400 miles, much longer than the average rail move of less than 900 miles [1]. Intermodal rail equipment is used in 16 percent of all ton-miles of rail traffic and is second only to coal in ton-miles carried. The great majority of intermodal rail traffic, 69 percent, is classified as Miscellaneous Mixed Freight and is thought to involve primarily the shipment of lightweight, high-value retail goods.

Source

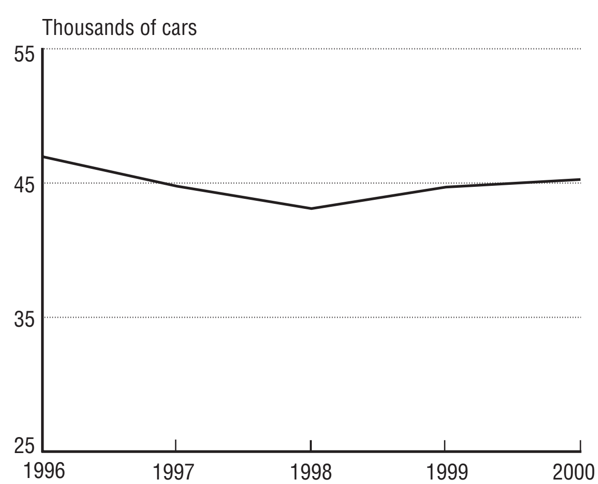
1. U.S. Department of Transportation, Surface Transportation Board, Carload Waybill Sample, 1999.

Figure 1
U.S. Intermodel Rail Traffic: 1996–2000



NOTE: Data for 2000 are preliminary.
SOURCES: Association of American Railroads, *Railroad Facts 2000 Edition* (Washington, DC: October 2000), Intermodal Traffic table, p. 26.
_____. "Weekly Railroad Traffic: 2000 Annual Summary," 2001.

Figure 2
Rail Trailer/Container Flatcars: 1996–2000



SOURCE: Association of American Railroads, "Freight Cars, 1991–2001 Summary," *Railroad Equipment Report: 2001* (Washington, DC: July 2001), p. 42.

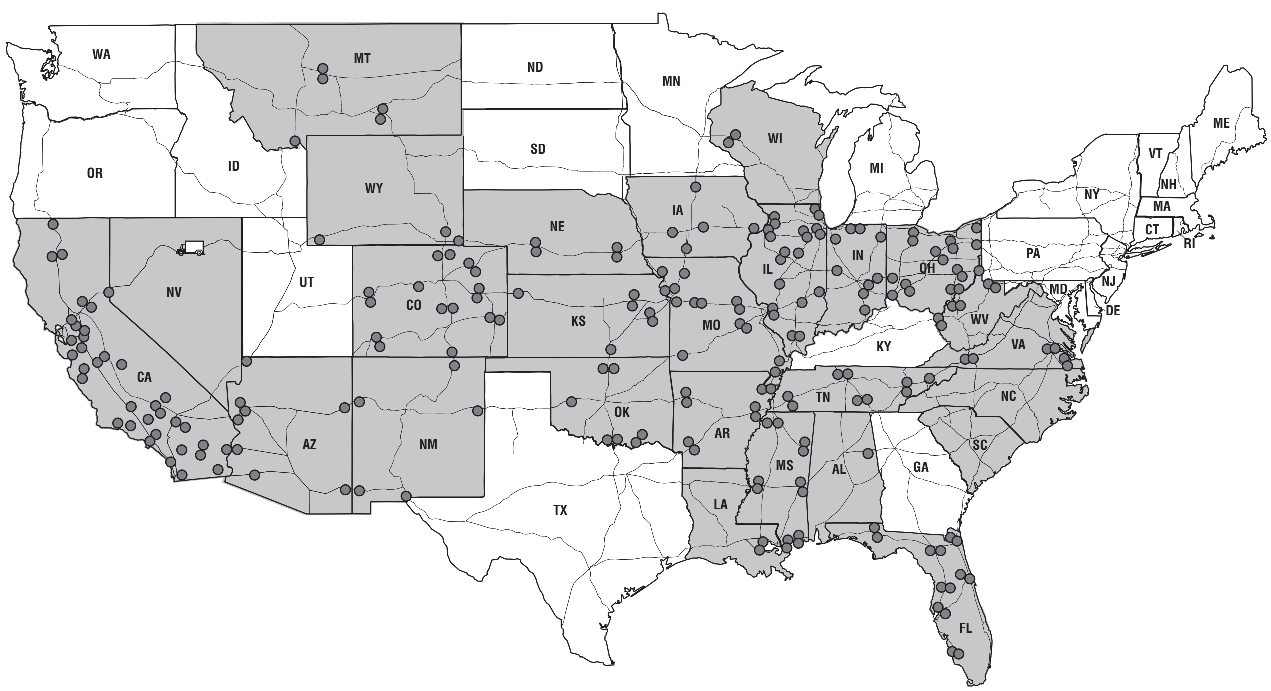
ITS and Commercial Vehicle Operations

For several decades, the motor carrier industry and government agencies have been investigating ways to improve commercial vehicle operations with the use of intelligent transportation systems (ITSs). Many of these systems are in use today, such as vehicle onboard safety monitoring and interstate exchange of driver credentials. Other highway ITSs, for example, real-time traffic monitoring, remotely controlled high-occupancy vehicle (HOV) access gates, and electronic toll collection, are not specific to commercial vehicle operations but can improve them.

PrePass is one ITS available for commercial vehicles in 25 states (see map). This automatic vehicle identification system uses transponders on truck windshields to enable participating commercial vehicles to bypass designated weigh stations and port-of-entry facilities. By eliminating the need to stop at highway weigh stations, PrePass improves shipping efficiency and safety for all highway users and reduces fuel consumption and vehicle maintenance by decreasing vehicle braking and acceleration.

PrePass evolved out of a project initiated by the Federal Highway Administration

PrePass System Sites



NOTE: Number below state abbreviation indicates total operational sites.

SOURCE: PrePass: A Nationwide Weigh Station Bypass System, PrePass System Map, available at http://www.prepass.com, as of July 2002.

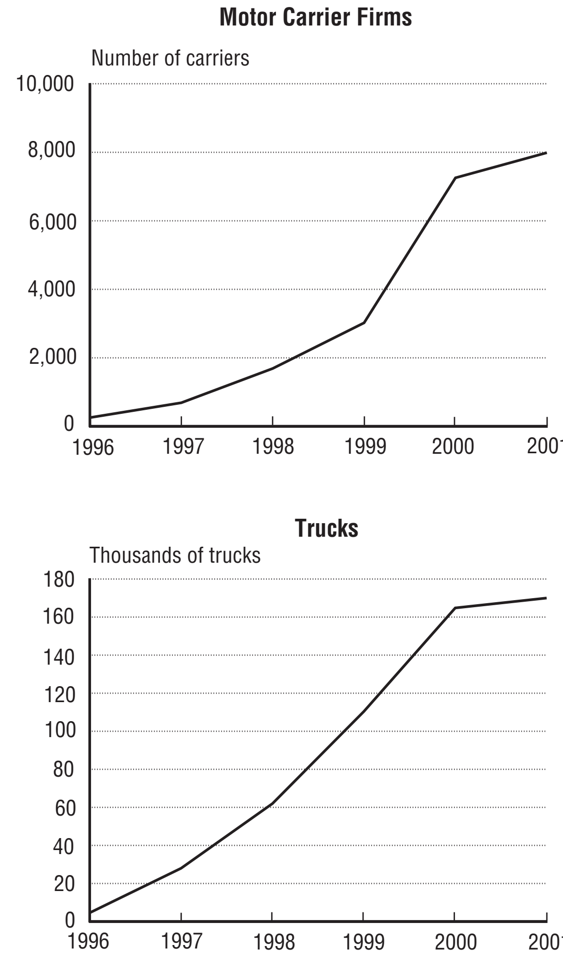
(FHWA) in the 1980s. A demonstration and evaluation program involving three states (Oregon, California, and Arizona); Alberta, Canada; and the trucking industry was completed in 1994. Subsequently, California and Arizona opted to continue the project and formed a nonprofit partnership (Heavy Vehicle Electronic License Plate (HELP), Inc.) with motor carriers to promote and operate PrePass. HELP, Inc. has set up over 220 operational sites in 25 states and registered over 7,900 carriers with more than 170,000 vehicles into [1] (figure 1).

There are other cooperative efforts between states to implement similar systems. For instance, the NORPASS system is in use in seven northwestern states. Oregon's Green Light program operates at 21 weigh stations, handling over 1,000 carriers with more than 14,000 trucks [2]. In 1999, FHWA initiated rulemaking to establish standards and specifications for the transponders used in various weigh station pre-clearance systems [3, 4]. FHWA expects to issue the rules after completing the testing of transponders.

Sources

1. Heavy Vehicle Electronic License Plate (HELP), Inc., available at http://www.prepass.com/, as of Nov. 1, 2001.
2. Oregon Department of Transportation, "Oregon Green Light," available at http://www.odot.state.or.us/trucking/its/green/light.htm/, as of Nov. 1, 2001.
3. _____. "U.S. DOT Seeks Transponder Standards to Ensure Interoperability," available at http://www.odot.state.or.us/trucking/its/transponders.htm/, as of Nov. 1, 2001.
4. U.S. Department of Transportation, Docket Summary Information, Docket No. FHWA-1999-5844, available at http://dms.dot.gov/, as of Nov. 1, 2001.

Figure 1
Growth in the Use of PrePass: 1996–2001



SOURCE: Heavy Vehicle Electronic License Plate (HELP), Inc., available at http://www.prepass.com/, charts c and d, as of Nov. 1, 2001.

Chapter 5
Security

Introduction

As the terrorist attacks of September 11, 2001, made clear, the nation's economic well-being and security are dependent on a transportation system that can move people, goods, and military personnel and equipment without fear of disruption or damage. The hijacking of four U.S. aircraft and their unprecedented use as weapons resulted in an extraordinary total shutdown of the nation's air transportation and put a severe strain on the balance of the system.

Transportation systems, both overseas and in the United States, have long attracted terrorists and criminals, particularly because these systems are accessible, attract broad media coverage when attacked, and disruptions may affect a large number of people. The September 2001 attacks however, came after a 10-year lull in U.S. hijackings, although terrorist and criminal attacks aimed at transportation worldwide have been increasing in the last five years.

Securing all transportation modes, facilities, and the people who use them is a vast undertaking. Most of the national focus since September 2001 has been on aircraft and airports. However, attention is also being directed at all other modes. The United States has 25 major seaports, receiving about 140 seagoing ships a day loaded with bulk or containerized cargo. Cruise ships call at dozens of U.S. ports. Rail freight carriers have over 150,000 miles of track and more than 20,000 locomotives, plus dispatching centers, yards, bridges, and tunnels to defend against terrorism. In addition, Amtrak serves about 61,000 passengers daily using 515 stations in 46 states. With about 90 percent of hazardous materials shipments taking place along the nation's highways, improving enroute security of this particular cargo is also now a priority.

Protecting the nation's borders from illegal drugs, contraband, and aliens is yet another example of how transportation and national security are inextricably linked. The increasing flow of international trade and passenger travel means that more cars, trucks, and railcars are crossing U.S. borders and more ships are arriving at U.S. ports, thus enhancing opportunities for illegal activities. The U.S. Coast Guard seized a record 132,480 pounds of cocaine with an estimated import value of $4.4 billion in fiscal year 2000, while also confiscating over

50,000 pounds of marijuana. Immediately after September 11, the Coast Guard repositioned many of its resources to protect U.S. ports and coasts.

Finally, our national security is dependent on key transportation-related industries: shipbuilding, aircraft manufacturing, and energy production. The armed forces' reliance on ships and aircraft makes the maintenance of a strong manufacturing base in these industries a vital concern. The U.S. shipbuilding industry has experienced a long-term decline, with just over 1 percent of total world gross tonnage of worldwide shipbuilding orders in mid-2001. In contrast, U.S. production of large transport aircraft has increased since the mid-1990s, albeit the industry experienced a sharp decline in orders after September 2001. Petroleum supplies 97 percent of the U.S. transportation system's energy needs. Since 1997, however, the United States has imported more than half the oil that it consumes, making transportation vulnerable to international disruptions in supply.

Terrorist Threats to Transportation

The terrorist attacks of September 2001 transformed the threat environment under which the United States operates. The security of the transportation system was particularly called into question when four U.S. airliners were hijacked during domestic flights and crashed—two into the World Trade Center, one into the Pentagon, and one in rural Pennsylvania. Although the exact number of casualties from the attack may never be known, all 265 people aboard the aircraft and 125 people on the ground at the Pentagon died, and an estimated 2,645 people in the World Trade Center were killed (see box on the next page). Since the attacks, the nation has worked to enhance the security of aviation and all other transportation modes, including maritime, transit, highway, and pipeline.

In an unprecedented event, the entire civilian air transportation system was shut down within hours of the September 11th attacks. The commercial aviation portion of the system resumed partial operation within two days, after the airlines instituted emergency security measures, as directed by the Federal Aviation Administration. The Administration and U.S. Congress moved within months to comprehensively shore up vulnerabilities throughout the transportation system by enacting the Aviation and Transportation Security Act of 2001.

The new law makes substantial changes to aviation security—intensifying the screening of passengers, baggage, and cargo—and places responsibility largely at the federal level. To oversee and improve the security of all transportation modes, the Act also established a new agency, the Transportation Security Administration within the U.S. Department of Transportation (DOT) [3]. The Administration subsequently proposed moving the agency, along with DOT's U.S. Coast Guard, to the new Department of Homeland Security, signed into law on November 25, 2002.

Terrorism has long been an international security concern. The number of terrorist attacks worldwide has fluctuated over the past decade (figure 1). The number of attacks in 2000 was 25 percent below the 10-year high of 565 attacks in 1991. The number of casualties resulting from these attacks has also fluctuated, from a low of 344 people in 1991 to a high of 6,693 people in 1998 (table 1). Terrorism-related casualties were also relatively low in 1999 and 2000 because of the absence of any attacks involving large numbers of people [8, 9].

Attacks on U.S. interests have been rising since 1994. Two hundred incidents occurred during 2000, up over 300 percent from 1994. Attacks targeting U.S. interests rose from 20 percent to 47 percent of the total number of terrorist attacks worldwide during that period. This change was due primarily to an increase in the number of attacks on U.S. interests in other countries. More than three-quarters of the anti-U.S. terrorist incidents in 2000 were directed at the Cano Limon crude oil pipeline in Colombia [8, 9].

Calculating Fatalities Resulting from the September 11, 2001, Terrorist Attacks

Fatalities resulting from the terrorist attacks on September 11, 2001, include those killed on the ground at the World Trade Center (WTC) in New York City and at the Pentagon in Washington, DC, as well as those on board the four aircraft. The number of aircraft fatalities (265) and fatalities at the Pentagon (125) is considered to be conclusive, while the number of people who perished at the WTC is estimated. Thus, the total number of fatalities (3,035) can only be reported as an estimate.

To calculate the estimated total number of fatalities on September 11, 2001, this report relied on two primary sources. The New York City Office of Emergency Management, Office of Public Affairs, periodically releases data on the total number of fatalities on the ground at the WTC. As of December 18, 2002, this office reported 2,792 fatalities. These include both people who were on the ground and in the buildings when the airplanes struck the towers, as well as the passengers and crew in the airplanes. The New York City data, however, do not include the 10 terrorists on board the 2 flights. Adjusting for these factors results in an estimated 2,645 fatalities on the ground at the WTC.

The Aviation Safety Network publishes detailed data by flight on all airplane crashes worldwide. This data source reported a total of 265 fatalities among the crew and passengers (including terrorists) on board the 4 aircraft (see table below). That total is consistent with the number published by the National Transportation Safety Board; and the number of fatalities per plane is consistent with the U.S. Department of State.

Flight	Site	Crew	Passengers	Total
American Airlines #11	World Trade Center	11	81	92
United Air Lines #175	World Trade Center	9	56	65
American Airlines #77	Pentagon	6	58	64
United Air Lines #93	Shanksville, PA	7	37	44
Total		**33**	**232**	**265**

SOURCES

Aviation Safety Network, available at http://aviation-safety.net/database/2001/2001.shtml, as of Dec. 20, 2002.

National Transportation Safety Board, available at http://www.ntsb.gov/aviation/Stats.htm, as of Dec. 20, 2002.

New York City Office of Emergency Management, Office of Public Affairs, personal communication, Dec. 18, 2002.

U.S. Department of State, *Basic Facts, September 11, 2001,* available at http://www.state.gov/coalition/cr/fs/12701.htm, as of Dec. 20, 2002.

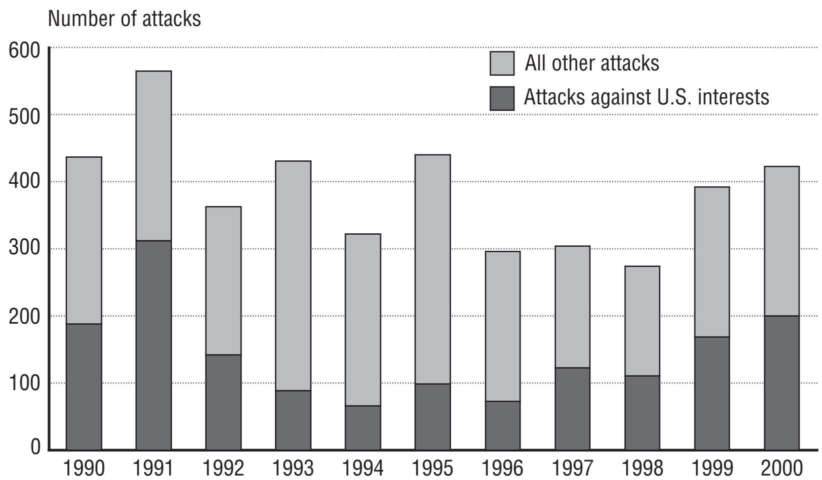
Worldwide, the number of domestic attacks[1] on transportation systems grew dramatically between 1995 and 1998, the last year for which published data were available when this report was prepared, driving total violent acts against transportation up 107 percent (figure 2). Transportation infrastructure draws terrorists because it is accessible; attracts broad media coverage when attacked; may be associated with a national symbol, such as a country's airlines; and large numbers of people can be affected by a single act.

Although aviation is an attractive target, other transportation modes have been hit more often in the past (table 2). In 1998, attacks against buses accounted for the greatest number of deaths and injuries for a single mode: 1,676. Around the world, the highest percentage of attacks occurred on highways and maritime vessels and at facilities such as ports (table 3).

Within the United States, violent attacks on transportation have also increased, doubling between 1997 and 1998. Since September 2001, the use of aircraft and other vehicles to

[1] Domestic or indigenous terrorism involves groups or individuals that target their own government or people without foreign involvement. International terrorism involves the citizens or territory of more than one country.

Figure 1
International Attacks Against U.S. Interests as a Proportion of Total Attacks: 1990–2000



NOTE: The relatively high number of incidents and anti-U.S. incidents in 1991 cannot be attributed to any one group or cause.

SOURCE: U.S. Department of State, *Patterns of Global Terrorism* (Washington, DC: Annual issues); and personal communication, Jan. 18, 2002.

cause destruction and mass casualties has emerged as a major domestic terrorist threat. However, as with international trends, the U.S. airline industry has not been targeted as frequently as other modes of transportation. In fact, prior to September 2001, there had been no such hijacking incidents in nearly 10 years [10, 11].

While most of the national focus since September 2001 has been on aircraft and airports, securing the other modes has become all important. The United States has 25 major ports, receiving about 140 seagoing ships a day loaded with bulk or containerized cargo. Cruise ships call at dozens of U.S. ports. In 2000, more than 10 million Americans took cruises to over 200 ports around the world [4]. Rail freight carriers own over 150,000 miles of track and more than 20,000 locomotives, plus dispatching centers, yards, bridges, and tunnels [2]. Amtrak serves 515 stations in 46 states and has 378 locomotives and about 61,000 passengers who use its service daily [7].

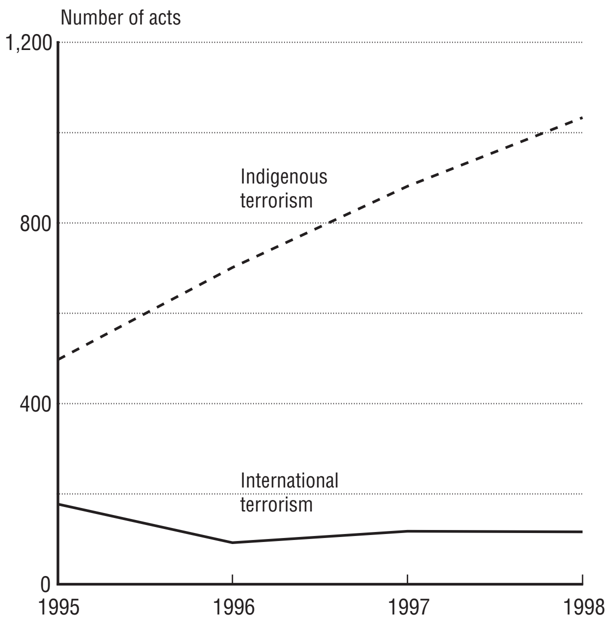
Table 1
International Terrorist Incidents and Casualties: 1990–2000

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Incidents	437	565	363	431	322	440	296	304	274	392	423
Casualties	900	344	727	1,502	977	6,454	3,226	914	6,693	939	1,196

NOTE: Incidents in 1995, 1996, and 1998 resulted in mass casualties—about 5,000 people were injured during a poisonous gas attack on a Tokyo subway in 1995; a bombing in Sri Lanka caused nearly 1,500 casualties in 1996; and 3 U.S. embassy bombings in Africa resulted in about 5,300 casualties in 1998.

SOURCES: U.S. Department of State, *Patterns of Global Terrorism: 2000* (Washington, DC: 2001); and personal communication, Jan. 18, 2002.

Figure 2
Worldwide Violent Acts Against Transportation: 1995–1998



SOURCE: U.S. Department of Transportation, Office of the Secretary of Transportation, Office of Intelligence and Security, *Worldwide Terrorist and Violent Criminal Attacks Against Transportation—1998* (Washington, DC: 1999).

Table 2
Worldwide Casualties by Transportation Mode: 1998

Mode	Deaths	Injuries
Bus	647	1,029
Highways	579	336
Rail	161	607
Maritime/piracy	105	37
Aviation	77	13
Pipelines	74	154
Bridges	10	14
Subways	3	4

SOURCE: U.S. Department of Transportation, Office of the Secretary of Transportation, Office of Intelligence and Security, *Worldwide Terrorist and Violent Criminal Attacks Against Transportation—1998* (Washington, DC: 1999).

Table 3
Percentage of Worldwide Violent Attacks on Transportation, by Mode: 1998

Mode	Percent
Highways	24
Maritime/piracy	21
Bus	18
Pipelines	12
Rail	10
Aviation	7
Bridges	2
Other	2
Subway	1

NOTE: Maritime/piracy includes both attacks on maritime facilities, including ports, and piracy of vessels.

SOURCE: U.S. Department of Transportation, Office of the Secretary of Transportation, Office of Intelligence and Security, *Worldwide Terrorist and Violent Criminal Attacks Against Transportation—1998* (Washington, DC: 1999).

Within the 29 communities in the country with rail transit systems, there are over 10,300 miles of track and 2,000 stations to protect [1]. These systems are not only vulnerable to attack but are also particularly useful in emergency situations. On September 11, emergency response crews and the public in New York City and Washington relied on subways, trains, buses, and ferries to evacuate the crash sites and assist victims. Subway train systems, however, with large numbers of passengers in enclosed spaces, may be especially prone to attacks by poisonous gas. The release of poisonous Sarin nerve gas in 1998 in a Tokyo subway killed 12 passengers [10]. Now, communities are seeking to integrate transit systems into emergency response plans and to shore up transit security. For instance, transit administrators in Washington, DC, expedited a pilot project placing airborne toxin sensors in underground subway stations following the September 2001 attacks. Late in 2001, Congress appropriated $45 million for the District of Columbia to expand the use of sensors and other safety equipment, develop a regionally integrated response plan to national security events, and cover security costs incurred during 2001 [5, 6].

Sources

1. American Public Transit Association, *Transit Statistics: Fiscal Year 1999,* available at http://www.apta.com/stats/, as of Jan. 18, 2002.
2. Association of American Railroads, *Railroad Facts: 2001 Edition* (Washington, DC: 2001).
3. Aviation and Transportation Security Act of 2001, Public Law 107-71, available at http://thomas.loc.gov/, as of Jan. 9, 2001.
4. Cross, L., "Seaport Security: Research, Equipment and Training Needs," paper presented to the Transportation Research Board, available at http://www.nas.edu/trb/publications/MarineBoard/2001SummerPorts/Session9Cross.pdf, as of Jan. 14, 2002.
5. Department of Defense Appropriations Act of 2002, Public Law 107-117, available at http://thomas.loc.gov/, as of Jan. 9, 2001.
6. District of Columbia Appropriations Act of 2002, Public Law 107-96, 107th Congress, available at http://thomas.loc.gov/, as of Jan. 9, 2001.
7. National Railroad Passenger Corp., *Annual Report 2000* (Washington, DC: 2000).
8. U.S. Department of State, *Patterns of Global Terrorism* (Washington, DC: Annual issues), also available at http://www.state.gov/, as of Jan. 8, 2002.

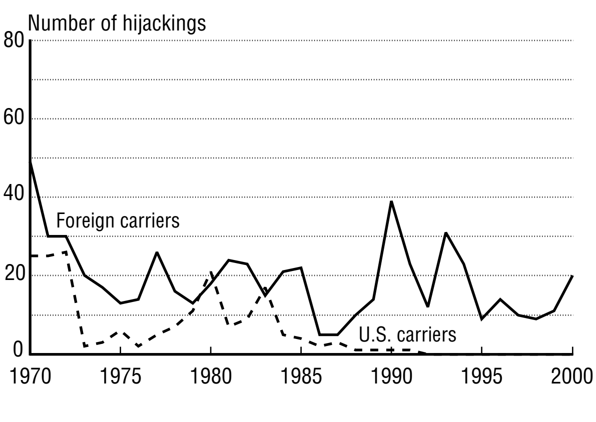
9 _____. Personal communication, Jan. 18, 2002.

10. U.S. Department of Transportation, *The Changing Face of Transportation* (Washington, DC: 2000).
11. ______. Office of the Secretary of Transportation, Office of Intelligence and Security. *Worldwide Terrorist and Violent Criminal Attacks Against Transportation—1998* (Washington, DC: 1999).

International Terrorism and Civil Aviation

The hijacking of four civilian aircraft on September 11, 2001, ended a 10-year lull in hijackings of U.S. carriers. They were also the first U.S. hijackings to result in massive fatalities (or loss of aircraft) and the first time civilian aircraft were successfully used as missiles. The terrorists hijacked two United Air Lines and two American Airlines planes, crashing two of them into the World Trade Center in New York City, one into the Pentagon in Washington, DC, and one in rural Pennsylvania. All 265 people on board died, 125 were killed on the ground at the Pentagon, and an estimated 2,645 people lost their lives in New York City (see box on page 110). Many others were seriously injured.

Figure 1
Worldwide Civil Aviation Hijackings: 1970–2000



NOTE: There were no hijackings of U.S.-registered carriers from 1991 through 2000. Data are through 2000 and do not include the hijacking of 4 airplanes by terrorists on Sept. 11, 2001.

SOURCE: U.S. Department of Transportation, Federal Aviation Administration, Office of Civil Aviation Security, *Criminal Acts Against Civil Aviation* (Washington, DC: 2001), also available at http://cas.faa.gov/crimacts/, as of June 2002.

Airplane Hijackings in 2001

Worldwide, there were 9 airliner hijackings resulting in 265 occupant fatalities in 2001. The vast majority—265 fatalities—resulted from the terrorist attacks of September 11, when 4 U.S. airliners were hijacked and crashed in the United States.

Two of the other hijackings took place in Africa, two in Asia, and one in Latin America. Crew and passengers overpowered the hijackers in three of these incidents resulting in no fatalities. However, three occupant fatalities occurred during the March 2001 hijacking of a Russian airliner en route from Istanbul, Turkey. The plane was diverted to Medina Airport, Saudi Arabia, where one hijacker, one flight attendant, and one passenger were killed before Saudi security ground forces regained control of the plane.

Hijacking and other terrorism-related fatalities are generally reported separately from aviation accident fatalities. In 2001, there were 36 civilian aviation accidents not involving terrorism, in which 870 occupants of the planes were killed.

[1] An *occupant* is a passenger, crew member, and/or hijacker onboard the aircraft.

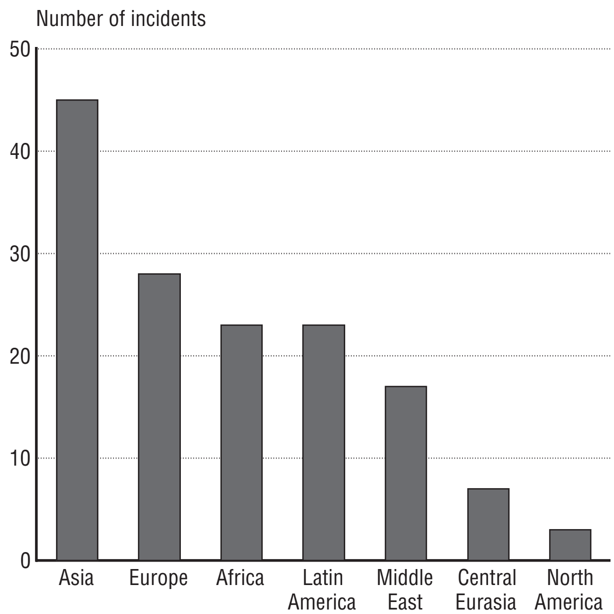
SOURCE: Aviation Safety Network, Accident Database, available at http://aviation-safety.net/, as of April 2002.

The number of air hijackings has varied each year since 1970 (figure 1). In 1970, there were 65 hijackings worldwide; in 1980 and 1990, there were 39 and 40, respectively. The number of hijackings fluctuated in the intervening years, generally staying below 30. Over the same 30-year period, the number of flights, enplanements, and passenger-miles flown by scheduled air carriers increased dramatically. While attacks against civil aviation worldwide claimed only 2 lives and wounded 27 other people in 2000, the toll was much higher in 2001 (see box above). Hijackings and airport attacks accounted for nearly three-quarters of the overall incidents against civil aviation during the past five years (table 1). Only 2 percent of these were bombings.

Asia experienced the highest number of attacks on aviation between 1996 and 2000 (figure 2) and accounted for 45 percent of all incidents in 2000. Of the six hijackings that occurred in Asia, a domestic Afghan flight was rerouted to London, England, where several of the passengers and hijackers requested asylum. There was just one incident in North America during 2000.

The hijackings of September 2001 are the latest in the ongoing evolution in terrorist threats to aviation. For example, after the Federal Aviation Administration (FAA) responded to a rash of hijackings in the 1970s by deploying metal detectors at domestic airports, terrorists began to board aircraft and leave explosive devices in the aircraft via carry-on baggage at various overseas locations. Similarly, after FAA began examining carry-on baggage, terrorists were successful in placing explosive devices on board aircraft via checked baggage without actually boarding the aircraft [1]. Now, terrorists have exploited a new area of vulnerability by adopting the tactic of suicide hijackings.

Figure 2
Incidents Against Aviation by Geographic Region: 1996–2000



SOURCE: U.S. Department of Transportation, Federal Aviation Administration, Office of Civil Aviation Security, *Criminal Acts Against Civil Aviation* (Washington, DC: 2001), also available at http://cas.faa.gov/crimacts/, as of June 2002.

The bombing of Pan Am flight 103 over Lockerbie, Scotland, in December 1988, stimulated some of the most significant changes in aviation security prior to September 2001. However, the most stringent security measures were on flights bound for or arriving from overseas destinations, because the vast majority of criminal and terrorist acts against civil aviation up until that time had taken place overseas.

Table 1
Incidents Against Aviation by Category: 1996–2000

Category	Number of incidents
Hijackings	64
Airport attacks	30
Off-airport facility attacks	13
Attacks on general aviation	13
Commandeerings[1]	13
Shootings at aircraft	10
Bombings	3

[1] Unlike a hijacking, which occurs in flight, a commandeering occurs when the aircraft is on the ground.

SOURCE: U.S. Department of Transportation, Federal Aviation Administration, Office of Civil Aviation Security, *Criminal Acts Against Civil Aviation* (Washington, DC: 2001), also available at http://cas.faa.gov/crimacts/, as of June 2002.

Sources

1. U.S. General Accounting Office, Resources, Community, and Economic Development Division, *Aviation Security: Additional Actions Needed To Meet Domestic and International Challenges* (Washington, DC: January 1994).

Maritime Security

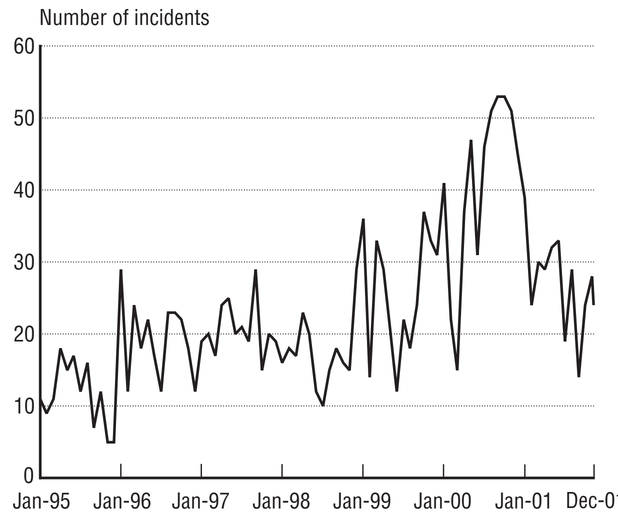
The Port of New York and New Jersey was shut down immediately after the events of September 11, 2001. But the maritime community (e.g., ferry operators) substituted for much of the normal land-based transportation that was unavailable that day and transported more than 1 million people from south Manhattan [3]. Throughout the country, vessels arriving at U.S. ports were subjected to a U.S. Customs "Level 1 Alert" resulting in substantially increased vigilance by Customs officers during the processing of cargo, crews, and passengers entering the country [9].

As with air transportation security, maritime security is an international and domestic issue. It involves both preventing illegal alien migrants and drugs from entering the country and securing ports, waterways, and vessels from terrorist threats. Of the 1,033 terrorist and criminal attacks aimed at transportation systems worldwide in 1998,[1] 21 percent were directed at maritime ports and vessels [8]. Acts of piracy and armed robbery against ships worldwide increased 135 percent between 1998 and 2000 and then declined 34 percent in 2001 (figure 1).

Domestically, among 27 transportation attacks in 1998, 5 were maritime incidents [8]. One incident—an act of piracy against a ship in the Miami River—resulted in the drowning of 2 of the 13 pirates. Historically, one of the more infamous attacks occurred in the Mediterranean Sea in October 1983 when terrorists boarded an Italian cruise ship, the *Achille Lauro*. They killed an American tourist on board when their demands were not met but then surrendered. In 2000, Americans made up more than 82 percent of the passengers on all cruises worldwide [2].

U.S. waterborne trade, transportation, and the U.S. economy in general is dependent on the efficient flow of goods and people through U.S. ports and inland waterways. As of December 2001, there were 9,309 U.S. commercial waterway facilities[2] (including more

Figure 1
International Piracy and Armed Robbery Against Ships: 1995–2001



SOURCE: International Maritime Organization, personal communication, Feb. 11, 2002.

[1] When this report was prepared, the most recent year for which comprehensive data on terrorism directed at transportation were publicly available was 1998.

[2] Waterway facilities as counted by the U.S. Army Corps of Engineers are piers, wharves, and docks. Not included are those facilities used exclusively for recreational or active military craft and generally those providing nonmaritime use.

than 300 ports) that engage in U.S. foreign and domestic trade. Along the inland waterways, the U.S. Army Corps of Engineers owns or operates 230 lock sites and 276 lock chambers [4]. U.S. ports received over 71,000 tanker, dry bulk, container, and other types of cargo vessels in 2000 (table 1). While most of the calls are concentrated in just 25 ports, all facilities have established some security measures.

Given the dispersed nature of the U.S. maritime transportation system, numerous federal, state, and local government entities and private industry share responsibilities for ensuring its security. At the federal level, the U.S. Coast Guard (USCG) has the primary operational responsibility. In the immediate response to September 2001, USCG repositioned much of its manpower and equipment away from U.S. coastal waters for interdiction purposes

Table 1
U.S. Port Cargo Vessel Calls: 2000
Vessels over 1,000 gross tons

Top 25 ports	Total vessel calls	Tanker	Dry bulk	Container	Other
Houston, TX	6,327	3,111	885	651	1,680
New Orleans, LA[1]	5,650	1,377	2,796	423	1,054
Los Angeles/Long Beach, CA	5,426	905	797	2,955	769
New York, NY	4,817	1,287	399	2,199	932
San Francisco, CA[1]	3,676	819	637	1,936	284
Philadelphia, PA	3,240	967	533	497	1,243
Miami, FL	2,728	11	117	1,125	1,475
Hampton Roads, VA[1]	2,660	158	507	1,592	403
Port Everglades, FL	2,625	348	128	703	1,446
Charleston, SC	2,234	148	144	1,552	390
Columbia River, WA[1]	2,219	279	1,279	263	398
Savannah, GA	1,966	238	340	740	648
Baltimore, MD	1,795	164	469	409	753
Jacksonville, FL	1,685	204	193	476	812
Corpus Christi, TX	1,455	964	350	2	139
Texas City, TX	1,281	1,152	89	3	37
Beaumont, TX	1,268	1,032	140	0	96
Tacoma, WA	1,232	70	219	568	375
Seattle, WA	1,170	50	230	794	96
Mobile, AL	993	146	450	17	380
Lake Charles, LA	794	474	125	6	189
Freeport, TX	725	521	54	81	69
Portland, ME	509	350	60	1	98
Valdez, AK	441	440	0	0	1
LOOP Terminal, LA	307	291	16	0	0
Total top 25 ports	**50,896**	**12,395**	**10,072**	**16,342**	**12,087**
Percentage of total ports	72.4	75.7	74	73.6	66.8
Total all ports	**71,548**	**19,299**	**13,729**	**19,067**	**19,453**

[1] Includes all area ports.

SOURCE: U.S. Department of Transportation, Maritime Administration, Office of Statistical and Economic Analysis, extracted from Lloyd's Maritime Information Services, *Vessel Movements* (London, England: 2001).

to locations near port facilities to ensure the security of ports and terminals. This shift in priorities was accomplished, in part, by a call up of nearly 2,000 USCG reservists by early 2002 [6]. Among the near-term consequences of this shift, however, were a 25 percent reduction in drug interdiction and an even greater reduction in fisheries law enforcement [3].

Working with local officials, Coast Guard Captains of the Ports have been given the authority to adopt security measures to ensure the safety and security of the port to which they are assigned. For instance, USCG has established security zones in all U.S. ports and a Sea Marshal program at select ports to position armed USCG personnel aboard commercial deep draft vessels. By late January 2002, marshals had escorted over 1,000 vessels. To further protect vessels while transiting through U.S. ports, coastal zones, and inland waterways, USCG has set up 100-yard security zones around all U.S. Navy, USCG, and cruise ships [7]. Furthermore, USCG has been working with U.S. port authorities to develop or improve existing individual port security plans [5].

A longstanding rule has required vessels over 300 gross tons and all foreign vessels regardless of tonnage bound for U.S. ports to notify USCG at least 24 hours prior to arrival. Since October 4, 2001, vessels planning to enter U.S. ports must notify USCG 96 hours before arrival and provide information about all crewmembers and passengers on board [1]. In addition, certain vessels that had been exempt from the previous reporting requirements are subject to the new rules.

Sources

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Hazardous Materials Transportation Security

Essential to industrial production and our economic well-being, the transportation of hazardous materials is a necessary component of everyday life. Recognizing the necessity but also the risks associated with hazardous materials, the federal government has long had a role in regulating its transportation. As a result of the events of September 2001, the federal government has increased its focus on security, as well as safety, in its regulation and oversight role.

There are approximately 800,000 domestic hazardous materials shipments each day using all modes of transportation. The great majority (about 90 percent) of hazardous materials are transported on highways. These shipments are mostly petroleum products and flammable gases but also include explosives, poisons, corrosives, flammable materials, infectious substances, and radioactive materials. They are transported widely throughout the country on short, medium, and long hauls. En route security has emerged as a major concern among security officials. To address this, they have recommended that motor carriers select their routes taking security into account, limit stops, place locks on tanks, and obtain escorts for selected materials. In addition, security officials are encouraging the reporting of suspicious activity, enhancement of security around facilities, and security training for employees.

Since September 2001, the U.S. Department of Transportation (DOT) and other federal agencies have taken numerous, multifaceted steps to prevent and prepare for possible terrorist actions involving the transportation of hazardous materials. The USA Patriot Act (Public Law 107-56) enacted in late September 2001 requires that the Federal Bureau of Investigation conduct background checks of carriers and drivers of hazardous materials (see box). DOT is encouraging better coordination among carriers, shippers, and consignees of hazardous materials to ensure tighter control of shipments. The department is also investigating technological options that could increase security by, for example, providing real-time tracking and improved intelligence gathering and sharing.

The DOT technology reviews are being done, in part, to better understand how to balance information needs of emergency responders with security concerns. DOT is also evaluating, from a security perspective, the prioritization and segmentation of the risks associated with hazardous materials transportation (by class, material, and quantity). DOT's Federal Motor Carrier Safety Administration has been making security sensitivity visits to motor carriers transporting hazardous materials to review their policies, procedures, and personnel. Over 24,000 visits have resulted in about 100 referrals to appropriate law enforcement agencies for further investigation.

(continues on next page)

People and Firms Licensed to Carry Hazardous Materials

Data gaps can suddenly appear when policy priorities shift. The events of September 2001 brought into focus a need to more precisely identify the carriers and drivers who transport hazardous materials. Current data systems, for example, raise questions about how many U.S. trucking firms are transporting hazardous materials and where the firms are located. In addition, while drivers of trucks carrying hazardous materials must have a hazardous materials endorsement on their commercial drivers license (CDL), it is not possible to know with certainty how many current CDL holders have the endorsement.

Motor carriers register with the U.S. Department of Transportation (DOT) Federal Motor Carrier Safety Administration (FMCSA) to obtain a DOT identification number. Since September 2001, FMCSA has undertaken a review of the 52,000 motor carriers registered to carry hazardous materials and, as of January 2002, made security visits to over 24,000 carriers. During this process, FMCSA has discovered that nearly 8,000 motor carriers are no longer in business or no longer carry hazardous materials.

The federal government in partnership with the states set up a Commercial Drivers Licensing System (CDLIS) in 1989 as a safety measure to prevent commercial drivers from obtaining licenses from more than one state. States query the CDLIS each time an application for a CDL is made, but records are not necessarily removed as turnover occurs among commercial drivers. In early 2002, out of over 10 million records in CDLIS, there were 2.5 million records of drivers with hazardous materials endorsements. However, there were, at most, 3.3 million employed truck drivers of all types in the United States in 2000.

The Bureau of Labor Statistics (BLS) reports two different estimates of truck drivers. The BLS annual Occupational Employment and Wage Estimates are establishment data (i.e., collected from employers) and include all drivers employed by firms, while its Employment Projections are generated from household surveys and, unlike the former, include self-employed drivers (see table below). In both cases, BLS separates truck drivers into three groups. Heavy and tractor-trailer truck drivers hold CDLs, and most drivers with hazardous materials endorsements are likely to be within this group. The other two groups of drivers do not necessarily hold CDLs, because the trucks or vans they drive are under 26,000 pounds gross vehicle weight. However, if they transport hazardous materials shipments, they are required to have a CDL with the endorsement. Based on the 1:4 ratio of endorsed CDLs to total CDL records in CDLIS, the Bureau of Transportation Statistics estimates that between 500,000 and 600,000 truck drivers could be transporting hazardous materials.

Employed Truck Drivers: 2000

	Data from	
	Occupational employment and wage estimates	Employment projections
Truck drivers, heavy and tractor-trailer (SOC 53-3032)	1,577,070	1,749,270
Truck drivers, light or delivery services (SOC 53-3033)	1,033,220	1,116,862
Driver/sales workers (SOC 53-3031)[1]	373,660	401,764
Total	**2,983,950**	**3,267,896**

[1] According to the U.S. Department of Labor's Standard Occupation Code, Driver/Sales Workers (SOC 53-3031) ". . . drive a truck or other vehicle over established routes or within an established territory and sell goods, such as food products, including restaurant takeout items, or pick up and deliver items, such as laundry." As such, they may transport hazardous materials.

KEY: SOC = standard occupation code.

Sources

U.S. Department of Labor, Bureau of Labor Statistics, "2000 National Occupational Employment and Wage Estimates, Transportation and Material Moving Occupations," Occupational Employment Statistics, available at http://www.bls.gov/oes/2000/oes_53Tr.htm, as of February 2002.

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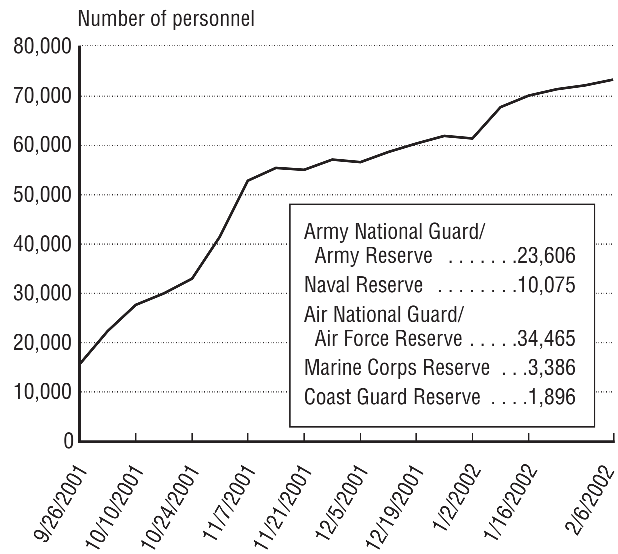
Movement of Military Forces and Equipment

Our nation's civilian transportation infrastructure provides vital strategic mobility for equipment and forces in times of national emergency. Since the end of the Cold War, U.S. armed forces have shifted from anticipating a possible global conflict with a dangerous and powerful adversary to being prepared for rapid deployment in localized incidents. At the same time, fewer U.S. troops are permanently stationed in foreign countries. This smaller, more mobile, U.S. military force structure places different demands on our transportation system [2].

Within several months of September 2001, over 70,000 National Guard and Reservists were mobilized to provide domestic support and to serve in Operation Enduring Freedom (figure 1). These troops are about 30 percent of the total number of National Guard and Reservists mobilized during the 1991 Gulf War. In contrast to the Gulf War, however, many more of the 2001/2002 activated National Guard and Reservists were deployed to locations in the United States to participate in Operation Noble Eagle.

The ability of the United States to respond to military emergencies requires adequate U.S.-controlled maritime shipping capacity to move equipment, fuel, supplies, and ammunition [4]. The U.S. Department of Defense (DOD) relies on commercial transportation providers for a large percentage of its peacetime freight and personnel movements, as well as wartime movements. A major portion of this commercial transportation capacity includes the use of U.S.-flagged vessels and

Figure 1
National Guard and Reserve Mobilized: Sept. 26, 2001–Feb. 6, 2002

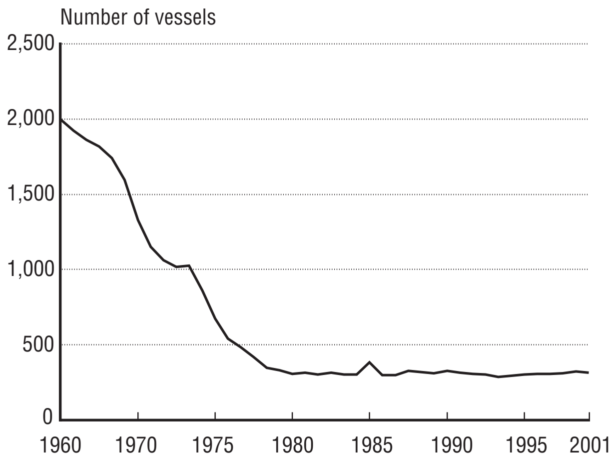


SOURCE: U.S. Department of Defense, "National Guard and Reserve Mobilized," weekly press releases, Sept. 26, 2001–Feb. 6, 2002, available at http://www.defenselink.mil/news/releases.html, as of Feb. 6, 2002.

the U.S. merchant marine under the Maritime Administration's Maritime Security Program (MSP). The MSP was established to help ensure the existence of and access to as many as 47 modern and militarily useful U.S.-flagged oceangoing commercial vessels with U.S. crews for DOD sealift requirements [4].

The National Defense Reserve Fleet (NDRF), owned by the government, supports DOD during national emergencies and consists of U.S. vessels strategically docked throughout the United States. The NDRF, which included 2,000 vessels in 1960, had 316 ships in fiscal year 2001 (figure 2). The total capacity of the NDRF has also declined. However, it has not

Figure 2
National Defense Reserve Fleet: 1960–2001



NOTE: The NDRF accepted over 80 ships from the Navy in 1984 that were subsequently sold for scrap.

SOURCE: U.S. Department of Transportation, Maritime Administration, personal communication, Jan. 18, 2002.

declined as quickly as the number of vessels. As older, smaller ships have been withdrawn from the NDRF, the individual ships that remain in service are larger on average. Furthermore, a greater emphasis has been placed on maintaining a fleet that can be deployed rapidly, rather than a large fleet. The NDRF was refocused due to various factors, including the end of the Cold War, budget priority shifts, greater reliance on commercial vessels, and increased airlift capabilities. The Ready Reserve Fleet (RRF), a subset of the NDRF, can be tendered to the Navy's Military Sea Command during armed conflicts and humanitarian emergencies in 4 to 30 days, depending on the location of vessels and their readiness [6]. The RRF had 76 ships in 2001, down from 90 the previous year due to the downgrade of 14 older, shallow-draft breakbulk[1] vessels. Other RRF vessels have undergone deck expansion to adjust for the loss of cargo capacity [5]. Over 100,000 U.S. merchant mariners are qualified to serve on large ocean-going vessels. Approximately two-thirds of qualified mariners would be available for service aboard a U.S.-flagged vessel in a national defense emergency and, of these available mariners, most could serve for 90 days or more [3].

The Civil Reserve Air Fleet (CRAF) is another key component of the nation's security resources. Selected aircraft from commercial U.S. airlines are contracted to CRAF to support DOD airlift requirements when military aircraft needs exceed capabilities. The CRAF program provides incentives for civil carriers to commit their aircraft. In 2000, 31 carriers and 702 aircraft were enrolled in CRAF [1] (table 1). As of January 2002, CRAF had not been called on to aid Operation Enduring Freedom or Operation Noble Eagle due to a high level of voluntary participation in these operations [1].

Finally, the nation's rail and highway systems play critical roles in the movement of military equipment and personnel. When the need arises, vast amounts of military equipment and personnel are moved from continental U.S.-based military installations to various seaports and airports. Most of this equipment travels over U.S. highways [2].

The Strategic Highway Network (STRAHNET) system of public highways provides access, continuity, and emergency transportation of personnel and equipment in times of peace and war. The 61,000-mile system, designated by the Federal Highway Administration in partnership with DOD, comprises about 45,400 miles of Interstate and defense

[1] A *breakbulk vessel* is a cargo vessel with the capacity to carry loose or noncontainerized goods.

Table 1
Members of the Civil Reserve Air Fleet

Long-range international	Short-range international	Aeromedical evacuation
Airborne Express	Alaska Airlines	Delta Airlines
Air Transport International	American Trans Air	US Airways
American Airlines	Champion Air	
American Trans Air	Continental Airlines	**Domestic**
Arrow Air	DHL Airways	America West Express
Atlas Air	Evergreen International	Frontier Airlines
Continental Airlines	Lynden Air Cargo	Midwest Express
Delta Airlines	Miami Air International	Southwest Airlines
DHL Airways	North American Airlines	
Emery Worldwide	Spirit Airlines	**Alaskan**
Evergreen International	Sunworld International	Northern Air Cargo
Federal Express Corp		Lynden Air Cargo
Gemini Air Cargo		
Hawaiian Airlines		
North American Airlines		
Northwest Airlines		
Omni Air Express		
Polar Air Cargo		
Southern Air		
United Air Lines		
United Parcel Service		
UPS Airlines		
US Airways		
World Airways		

SOURCE: U.S. Department of Transportation, Federal Aviation Administration, Office of Aviation Policy and Plans, personal communication, Oct. 16, 2002.

highways and 15,600 miles of other public highways. STRAHNET is complemented by about 1,700 miles of connectors—additional highway routes linking more than 200 military installations and ports to the network [2] (see map).

Sources

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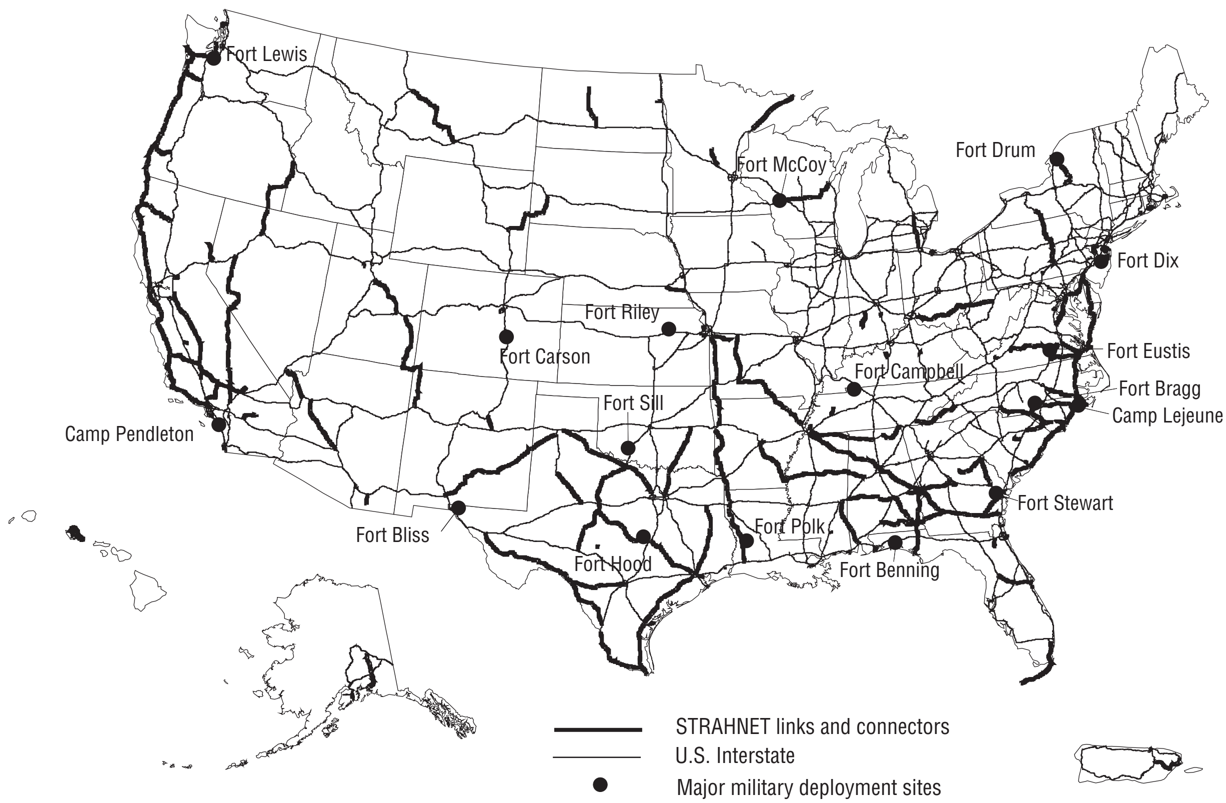
6. ____. Office of Ship Operations, *The National Defense Reserve Fleet,* available at http://www.marad.dot.gov/offices/press-gm.htm, as of June 28, 2000.

Strategic Highway Network (STRAHNET)



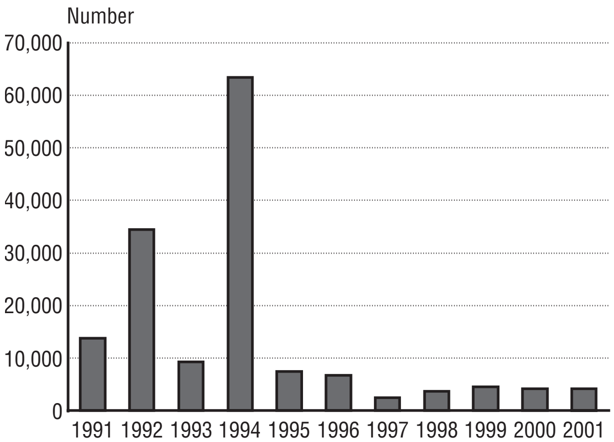
SOURCE: U.S. Deparment of Transportation, Federal Highway Administration, 1999.

Alien Smuggling and Interdiction

People seeking to enter the U.S. illegally cross (or attempt to cross) U.S. borders using all transportation modes and on foot. The U.S. Coast Guard (USCG) is responsible for interdictions at sea (figure 1). The number of migrants stopped by USCG is small (3,948 in fiscal year 2001) compared with total Immigration and Naturalization Service (INS) arrests (1.2 million people in fiscal year 2001).[1] However, many USCG interdiction cases begin as search and rescue operations, often because migrants travel in overcrowded and unseaworthy vessels.

The number of USCG interdictions can vary greatly from year to year. In the peak year of 1994, over 98 percent of the 63,426 interdicted migrants were Haitians and Cubans. Migrants from these two countries and from the Dominican Republic, Ecuador, and the People's Republic of China (PRC) constitute the bulk of USCG interdictions each year. However, the number from any one country can vary by year. For instance, the number of migrant interdictions from the PRC declined to 64 people in 2001 from a high of 1,351 in 1999. In past years, illegal PRC migrants have used Guam as a stopping point to gain entrance into the United States. Migrant flow has shifted away from Guam, largely in response to USCG interdiction efforts. Many Chinese migrants now seek to transit through Mexico and Central America for eventual passage across the United States land border [2].

Figure 1
U.S. Coast Guard Migrant Interdictions at Sea: 1991–2001



SOURCE: U.S. Department of Transportation, U.S. Coast Guard, *Coast Guard Interdictions by Sea: Calendar Year 1982–2002,* available at http://www.uscg.mil/, as of January 2002.

Cuban interdiction operations differ from those of other countries. Under the 1966 Cuban Adjustment Act (Public Law 89-732), Cuban migrants who reach U.S. shores can stay in the United States and obtain permanent residency status within one year. If captured at sea, they are returned to Cuba or taken to a safe haven [2]. Many Cubans are transported in regular high-speed boats that blend into normal boating traffic. Near the U.S. shore, migrants are transferred to small rafts that are difficult to interdict. USCG interdicted nearly 47 percent fewer illegal Cuban migrants in 2001 compared with 1999. There are several reasons, including

[1] Most migrants caught by USCG are returned to their country of origin and, thus, not turned over to INS. In fiscal year 2001, for instance, 74 percent of Dominican Republic, 97 percent of Cuban, and 99 percent of Haitian migrants were returned. Each year, however, all migrants from the People's Republic of China are turned over to INS.

improved efficiency in granting immigrant visas by the U.S. Interest Section in Havana, more Cubans taking illegal flights to the United States from third countries, and more Cubans traveling to Mexico by air and then crossing the land border illegally [2].

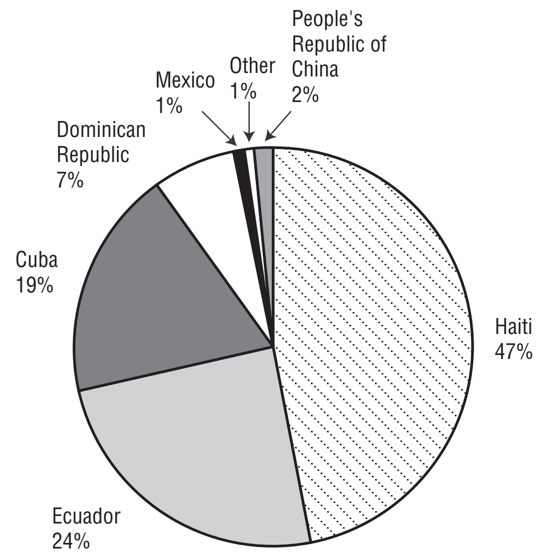
Although total interdictions have stayed between 4,000 and 4,500 the last four years, USCG expects illegal migrant activity by sea to rise. Of the 4,136 interdictions in 2001, 72 percent were Haitians and Ecuadorians (figure 2).

Professional criminals vie for a share of the $10 billion a year migrant smuggling activity [1]. For example, as much as $6 million may be paid by a large boatload of migrants from the PRC to be smuggled into the United States. PRC migrants pay smugglers up to $40,000 each, and Cuban migrants pay up to $8,000 each [2].

Sources

1. Office of Naval Intelligence and U.S. Department of Transportation, U.S. Coast Guard, *Threats and Challenges to Maritime Security* (Washington, DC: March 1999).
2. U.S. Department of Transportation, U.S. Coast Guard, *The 2000 Annual Report of the U.S. Coast Guard* (Washington, DC: 2001).

Figure 2
U.S. Coast Guard Interdictions at Sea by Nationality: 2001



NOTE: Percentages may not add to 100 due to rounding.

SOURCE: U.S. Department of Transportation, U.S. Coast Guard, *Coast Guard Interdictions by Sea: Calendar Year 2001,* available at http://www.uscg.mil/, as of January 2002.

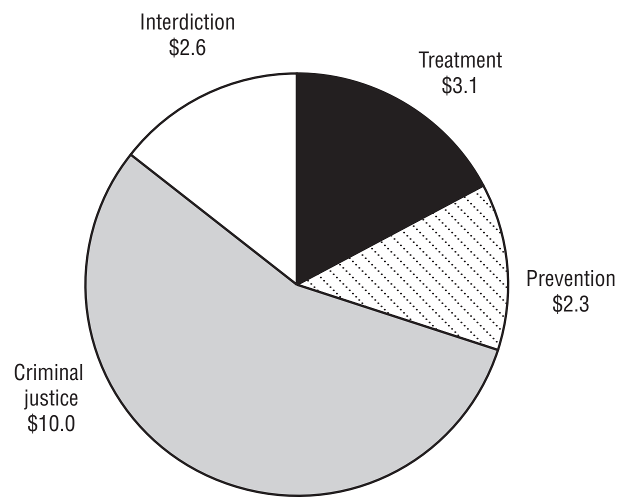
Drug Smuggling and Interdiction

An estimated 6.7 percent of Americans 12 years of age and older (14 million people) were illicit drug users in 1999. To address this problem, the United States spent $18 billion on drug control programs in fiscal year (FY) 2001. Of the total, the United States earmarked $2.6 billion for drug interdiction operations (figure 1) [1]. Since September 2001, the lead interdiction agencies—the U.S. Coast Guard (USCG) and the U.S. Customs Service (Customs)—have had to give greater attention to port and border security.

In the last decade, both agencies have been facing growing challenges in their efforts to interdict illegal drugs. The increasing flow of trade and passenger travel means that more cars, trucks, and railcars are crossing U.S. borders and more ships are arriving at U.S. ports from all over the world. Moreover, the growth in the use of containers to ship commodities has facilitated cargo transfers and increased intermodal transportation services, thus allowing an easier worldwide flow of goods from road to rail to sea. With increasing traffic and the flow of goods comes increasing opportunity to smuggle illegal drugs [2].

Competition among U.S. ports has encouraged efficiency over security in the past. Of the 17 million containers arriving at maritime ports annually, Customs has closely inspected only 2 percent. Customs has established a forum on commercial shipping security with foreign manufacturers, exporters, carriers, importers, and other industry sectors in the wake of the terrorist attacks. In order to avoid delays that may result from heightened security, Customs intends to expedite the inspection process for active and approved participants in the forum [7].

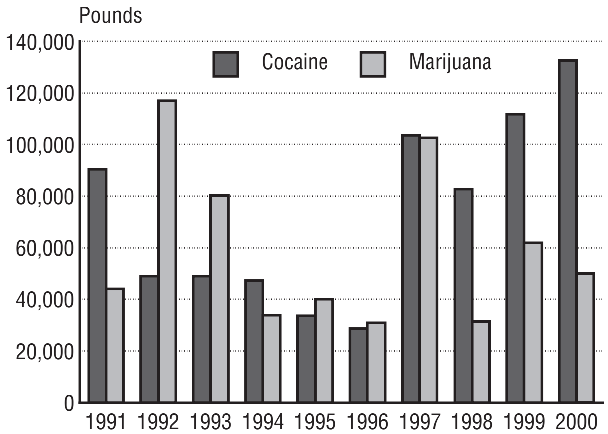
Figure 1
Federal Drug Control Spending by Function: Fiscal Year 2001
In billions



SOURCE: Executive Office of the President, Office of National Drug Control Policy, available at http://whitehousedrugpolicy.gov, as of Sept. 6, 2001.

Customs has intercepted a growing volume of illegal drugs along the nation's borders. In FY 2001, officials seized 308,635 pounds of heroin, cocaine, and marijuana, up 319 percent from FY 1995 [8]. Customs officials expect that increased inspection of all arriving cars, trucks, and individuals—due to the level one alert status maintained since September 2001—may result in a higher drug seizure rate during FY 2002, particularly in Texas and New Mexico [6]. From October through December 2001, Customs seized nearly 86,603 pounds of heroin, cocaine, and

Figure 2
U.S. Coast Guard Drug Seizures: Fiscal Years 1991–2000



SOURCE: U.S. Department of Transportation, U.S. Coast Guard, Office of Law Enforcement, "Drug Interdiction," available at http://www.uscg.mil/hq/g-o/g-opl/mle/drugs.htm, as of Jan. 9, 2002.

marijuana, up almost 81 percent from the same period in 2000 [8].

The Coast Guard has also conducted more intensive antiterrorism operations at the nation's ports since the terrorist attacks. Not only has USCG committed more personnel, ships, and resources to protecting the nation's ports and coastline, but it now scrutinizes ship passengers and crew more thoroughly. Whereas ships were required to provide the Coast Guard a 24-hour advance notice of arrival when traveling from a foreign port, now they must provide a 96-hour advance notice of arrival, along with a ship manifest and list of persons aboard [3].

Although the heightened state of security may divert resources away from traditional drug interdiction efforts, intensified scrutiny of maritime traffic may also aid interdiction. Data for 2001/2002 are not available to show this effect, but the Coast Guard has seized growing quantities of illegal drugs since 1998 (figure 2). Most recently, in FY 2000, USCG seized a record 132,480 pounds of cocaine with an estimated import value of $4.4 billion in FY 2000, while also confiscating over 50,000 pounds of marijuana [4, 5].

Sources

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U.S. Aircraft Manufacturing

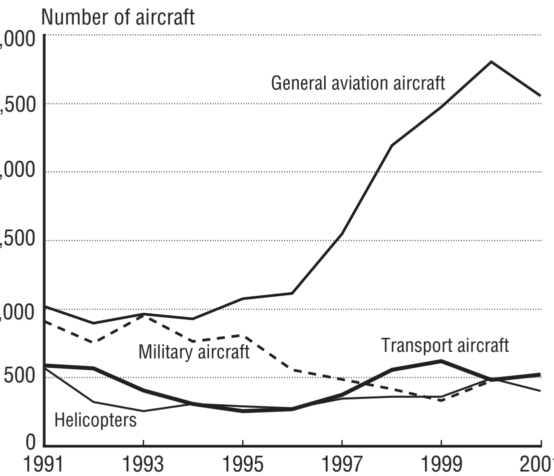
Both commercial and military aircraft play a key role in supporting the security of the United States. Thus, maintaining a strong manufacturing base with a trained and skilled workforce capable of designing and building aircraft and aircraft components is an issue of national security.

In 2000, the aerospace industry (which includes civil and military aircraft as well as space and missile systems producers) employed an estimated 793,000 workers, representing about 4 percent of all manufacturing jobs in the United States. The number of U.S. aircraft produced annually has declined sharply since a high of over 18,000 civil aircraft was produced in 1979 (figure 1). While the U.S. aerospace industry as a whole remains internationally competitive, economic conditions and the September 11 terrorist attacks have caused aircraft manufacturers to expect a sharp decline in demand for new civilian planes [2].

Since 1979, the numbers of large transport-category aircraft produced have varied each year but show an overall increase of 39 percent, with 522 of these aircraft produced in 2001. The Aerospace Industries Association forecasts that U.S. production will decline by 28 percent in 2002 compared with 2001 [3].

Sales of general aviation aircraft were depressed in 2001. Shipments dropped 10 percent to 2,556 from a decade-long high of 2,802 in 2000. However, the industry is still far from the 20-year low of 899 in 1992. During the late 1990s, the general aviation industry rebounded, but it has yet to reach the record high of 17,817 aircraft produced in 1978 [1, 2].

Figure 1
U.S. Civil and Military Aircraft Production: 1991–2001



NOTE: Data for 2001 are preliminary. Data for 2001 military aircraft production are not available.

SOURCES: 1969–1999: Aerospace Industries Association, *Aerospace Fact and Figures, 2000/2001* (Washington, DC: 2000). 2000–2001: _____. *Year-End Review and Forecast,* available at http://www.aia-aerospace.org/stats/yr_ender/tables/2001/table5.cfm, as of Jan. 7, 2002.

The U.S. aerospace industry is the single largest U.S. net exporter of manufactured goods, with a positive trade balance in 2001 of $30 billion (figure 2). The industry exports over 40 percent of its total output and over 70 percent of its commercial products. Aircraft manufacturing and sales make up the largest component of the U.S. aerospace industry. U.S. manufacturers shipped 3,483 civil aircraft in 2001 with a total value of $44 billion, an increase of nearly $5 billion over 2000 levels but a decline of 297 aircraft. The 522 civil transport aircraft produced in 2001 represent a value of $35 billion [3].

While U.S. production of civil aircraft had been increasing in recent years, production of military aircraft was declining. In 2000, the United States produced 477 military aircraft, down from 811 in 1995. Of that total, 244 were exported and 233 were delivered to U.S. military agencies. Much of the decline in U.S. military aircraft production can be attributed to the end of the Cold War [1].

Sources

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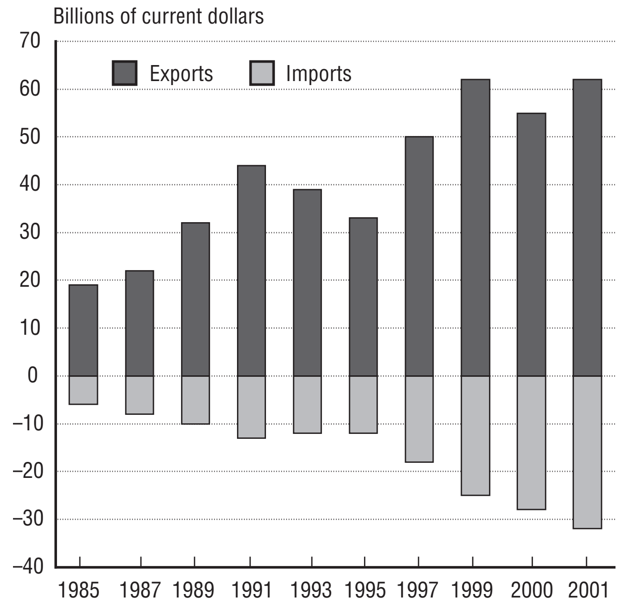
Figure 2
Aerospace Exports and Imports



SOURCE: Aerospace Industries Association, Aerospace Statistics, available at http://www.aia-aerospace.org/stats/aero_stats/aero_stats.cfm, as of Feb. 24, 2002.

U.S. Merchant Shipbuilding and Repair

Because of the need to ship military forces and materiel around the globe, maintaining a strong manufacturing base capable of designing and building ships is a national security concern. Ships provide much of the capacity needed to move international trade. Shipbuilding is, thus, a key industry in the United States and around the world.

South Korea overtook Japan in 1999 as the world leader in merchant shipbuilding in terms of gross tonnage. These two countries accounted for 69 percent of the gross tonnage of merchant ships on order as of September 2001. The United States ranked 8th, with almost 1.5 percent of the world's gross tonnage on order (table 1). Nevertheless, the U.S. shipbuilding industry has made some progress in its efforts to reemerge as an active participant in the commercial shipbuilding market (figure 1). The United States has 19 major private shipyards that can build vessels over 122 meters in length. More than 200 privately owned firms repair ships, but only 73 are classified as major repair yards with the capacity to handle vessels over 400 feet in length [3].

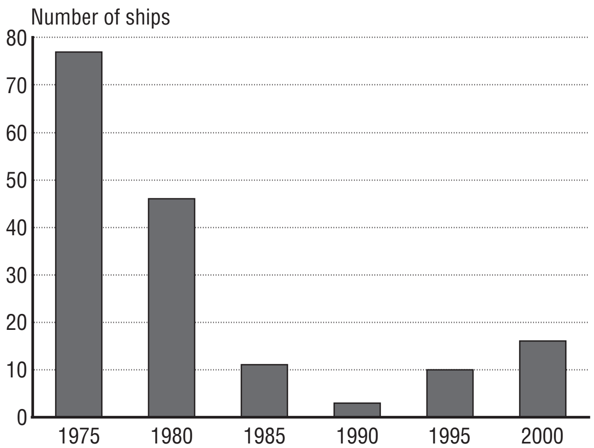
Between 1994 and 1999, the U.S. shipbuilding industry invested more than $5.6 billion in capital improvement projects, the majority of which were targeted at increasing efficiency and competitiveness. Investments were made in new shipyard layouts, and new cranes, transporters, automated equipment, and highly mechanized production systems were purchased [2]. Several government programs also have provided assistance in revitalization efforts. These include the National Shipbuilding and Conversion Act of 1993 and an expanded Federal Ship Financing Program (Title XI) of the Merchant Marine Act of 1936. Title XI provides credit guarantees

Table 1
World Orderbook as of September 2001
Self-propelled vessels of 100 gross tons and over

Rank	Country of build	Number of vessels	Total gross tons
1	South Korea	507	31,299,355
2	Japan	455	19,152,803
3	China (People's Republic)	307	5,443,164
4	Poland	132	2,805,792
5	Germany	100	2,252,726
6	Italy	65	2,220,642
7	Croatia	50	1,553,957
8	United States	46	1,038,059
9	China (Republic of Taiwan)	32	960,648
10	Finland	13	871,252
11	Romania	103	871,250
12	Spain	92	691,139
13	France	23	667,833
14	Netherlands	196	577,603
15	Denmark	13	528,820
16	Ukraine	30	435,832
17	Russia	79	356,287
18	Philippines	11	338,000
19	Singapore	54	328,475
20	Turkey	54	273,171
	Top 20 total	**2,362**	**72,666,808**
	Top 20, percentage of total	89%	99%
	World total	2,648	73,581,049

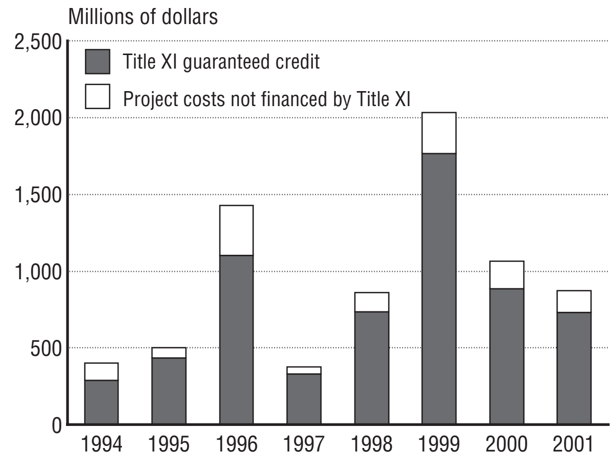
SOURCE: U.S. Department of Transportation, Maritime Administration, Office of Statistical and Economic Analysis, extracted from Lloyd's Maritime Information Service, World Orderbook data, as of January 2002.

Figure 1
U.S. Commercial Shipbuilding Orderbook History: As of January 2002
Ships of 1,000 gross tons and over



SOURCE: U.S. Department of Transportation, Maritime Administration, Office of Shipbuilding, available at http://www.marad.dot.gov/Marad-Statistics.html, as of Jan. 7, 2002.

Figure 2
Federal Ship Financing Program: Fiscal Years 1994–2001
Approved Title XI applications



SOURCE: U.S. Department of Transportation, Maritime Administration, Office of Ship Financing, "Title XI Financing," available at http://www.marad.dot.gov/TitleXI/index.html, as of Feb. 4, 2002.

for both shipbuilding and port improvement, up to a maximum of 87.5 percent of total project costs. The total value of approved Title XI projects varies from year to year, mainly because of market factors (figure 2). Several large projects approved during 1996 and 1999, for instance, account for the spikes in those years. In 2000, the value of all projects approved dropped about 48 percent to just over $1 billion and decreased again in 2001 by 18 percent [4].

Revitalization efforts, however, have been complicated by an overall decline in world shipbuilding price levels. In 1999, world newbuilding price levels were less than in 1998 [2]. Price levels for 30,000 and 70,000 deadweight ton (dwt) bulk carriers declined the most of all vessel types, by 21 and 17 percent, respectively. In contrast, the price levels of the largest category of bulk carriers, 120,000 dwt, decreased the least: 8 percent compared with 1998. The downward trend in vessel prices continued to be fueled by increasing competition among Asian shipyards during 1999. South Korea gained a greater share of the market during the late 1990s due to productivity and technology enhancements, as well as devaluation of its currency. During the first half of 2000, worldwide prices for the smaller categories of bulk carriers and tankers remained constant, while the largest categories of bulk carriers and tankers rebounded somewhat from recent declines [1].

Sources

1. United Nations Conference on Trade and Development, *Review of Maritime Transport 2000* (New York, NY: United Nations, 2000), p. 35.
2. U.S. Department of Transportation, Maritime Administration, *MARAD '99* (Washington, DC: May 2000), pp. 16–20.
3. ____. Office of Shipbuilding, available at http://www.marad.dot.gov/Marad-Statistics.html, as of Jan. 7, 2002.
4. ____. Office of Ship Financing, "Title XI Financing," available at http://www.marad.dot.gov/TitleXI/index.html, as of Feb. 4, 2002.

World Petroleum Reserves

Because transportation depends on petroleum for about 95 percent of its energy needs, the long-term availability of petroleum supplies is a key concern. The U.S. Geological Survey (USGS) estimates that the United States has 11 percent (83 billion barrels) of the worldwide total of still undiscovered conventional petroleum, 76 billion barrels of reserve growth, and 32 billion barrels of remaining reserves (table 1). Alaska, Texas, California, and offshore areas of the Gulf of Mexico accounted for 78 percent of U.S. proved oil reserves in 2000 [1].

Total world oil resources are about 2,311 billion barrels, including undiscovered oil, reserve growth, and remaining reserves. Undiscovered conventional oil reserves are estimated to be 732 billion barrels worldwide. This estimate is 20 percent higher than earlier USGS assessments, reflecting the expectation that greater reserves than were previously thought to exist will be discovered in the Middle East, the northeast Greenland Shelf, the West Siberia and Caspian Sea areas of the former Soviet Union, and the Niger and Congo delta areas of Africa. USGS also notes that for some areas, such as Canada, Mexico, and China, estimated undiscovered reserves are lower than previously reported [2].

In the last 100 years, an estimated 710 billion barrels of oil have been produced worldwide. The United States has produced about 171 billion barrels or nearly 50 percent of its total oil endowment [2]. After annual declines through most of the 1990s, proved reserves rose 1.3 percent in 2000 over 1999 [1]. Most of this increase is attributed to discoveries of new reserves in the offshore areas of the Gulf of Mexico. Although worldwide resources are plentiful, their availability is affected by production costs, technologies, markets, and national policies. The price of crude oil also affects reserve totals. The higher oil prices of December 2000, for instance, turned some uneconomic 1999 U.S. reserves into 2000 proven reserves.

Table 1
World Petroleum Endowment
Billion barrels

	World (excluding U.S.)	United States
Undiscovered conventional	649	83
Reserve growth (conventional)	612	76
Remaining reserves	859	32
Total	**2,120**	**191**
Cumulative production	**539**	**171**
Total oil endowment	**2,659**	**362**

SOURCE: U.S. Department of the Interior, U.S. Geological Survey, *World Petroleum Assessment 2000—Description and Results* (Washington, DC: June 2000), also available at http:/energy.cr.usgs.gov/, as of February 2002.

Sources

1. U.S. Department of Energy, Energy Information Administration, *U.S. Crude Oil, Natural Gas, and Natural Gas Plant Liquids Reserves 2000* (Washington, DC: 2001).
2. U.S. Department of the Interior, U.S. Geological Survey, *World Petroleum Assessment 2000—Description and Results* (Washington, DC: June 2000), also available at http://energy.cr.usgs.gov/, as of February 2002.

Transportation's Dependence on Imported Oil

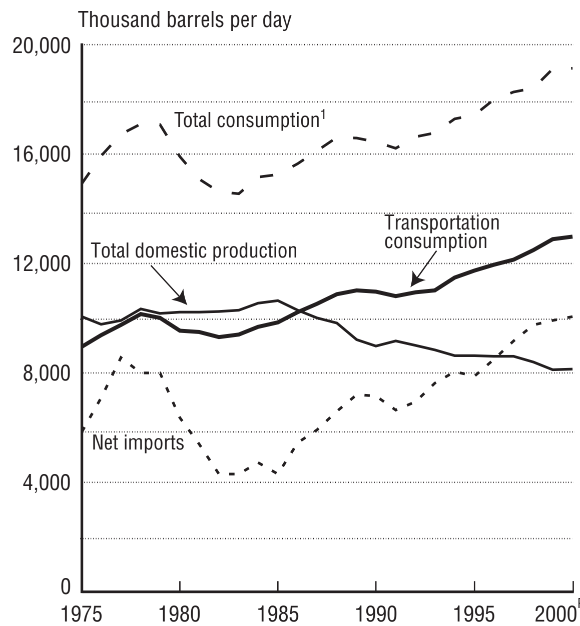
Transportation is the only sector of the economy that consumes much more oil today than it did 20 years ago, making it vulnerable to oil disruptions. Beginning in 1997, the United States imported more than half of the crude oil and petroleum products that it consumed (figure 1), with net imports reaching 10.1 million barrels a day (mmbd) in 2000. The transportation sector alone consumed nearly 13 mmbd, which is equivalent to all domestic production plus approximately 40 percent of imports [2].

Oil imports emerged as a national security issue in the early 1970s when they grew to a significant fraction of total oil consumption, and several supplier nations coordinated efforts to reduce supplies on the world market. Today, Canada, Saudi Arabia, Venezuela, Mexico, and Nigeria are the top five suppliers of U.S. crude oil and petroleum products [2] (table 1). Of these, Saudi Arabia, Nigeria, and Venezuela are members of the Organization of Petroleum Exporting Countries (OPEC).[1] In 2000, OPEC supplied about 50 percent (5.1 mmbd) of net imports, or 26 percent of total U.S. oil consumption (figure 2).

The U.S. Department of Energy, Energy Information Administration, expects non-OPEC oil production to increase in the future. Much of this increase will come from the former Soviet Union. Other areas expected to increase production levels include offshore regions of West Africa, the North Sea, Canada, Mexico, Colombia, and Brazil [1].

[1] OPEC includes Algeria, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, United Arab Emirates, and Venezuela.

Figure 1
U.S. Petroleum Production and Consumption: 1975–2000



[1] Total end use consumption by transportation, residential, commercial, and industrial sectors.

KEY: P = preliminary.

SOURCE: U.S. Department of Energy, Energy Information Administration, *Annual Energy Review 2000,* tables 5.1 and 5.12c, available at http://www.eia.doe.gov/emeu/aer/contents.html.

Nevertheless, as U.S. consumption increases and domestic production decreases, dependence on foreign oil supplies is rising. Whether a high level of oil imports poses serious strategic and economic problems for the United States depends on several factors, such as oil prices, ability of markets to respond to changes in supply and demand, OPEC's market share, and the importance of oil to the economy.

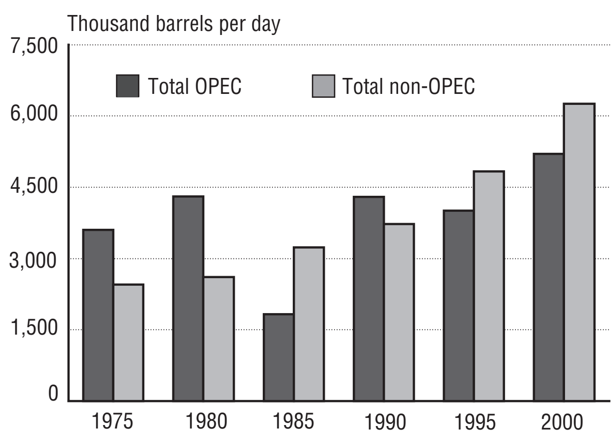
Table 1
Major Suppliers of U.S. Crude Oil and Petroleum Products
Thousand barrels per day, average

Year	Canada	Saudi Arabia	Venezuela	Mexico	Nigeria	Iraq	United Kingdom	Norway	Colombia	Angola	Virgin Islands	Kuwait	Algeria
1975	846	715	702	71	762	2	14	17	9	75	407	16	282
1980	455	1,261	481	533	857	28	176	144	4	42	388	27	488
1985	770	168	605	816	293	46	310	32	23	110	247	21	187
1990	934	1,339	1,025	755	800	518	189	102	182	237	282	86	280
1995	1,332	1,344	1,480	1,068	627	0	383	273	219	367	278	218	234
2000	1,807	1,572	1,546	1,373	896	620	366	343	342	301	291	272	225

NOTE: The country of origin for petroleum products may not be the country of origin for the crude oil used to produce the products. Refined products imported from western European refining areas may have been produced from Middle Eastern crude oil.

SOURCE: U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, January 2002, tables 3.3a–3.3h, available at http://www.eia.doe.gov/emeu/mer/, as of February 2002.

Figure 2
U.S. Oil Imports



SOURCE: U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review,* January 2000, tables 3.3d and 3.3h, available at http://www.eia.doe.gov/emeu/mer/, as of February 2002.

Sources

1. U.S. Department of Energy, Energy Information Administration, *Annual Energy Outlook 2001* (Washington, DC: December 2000).

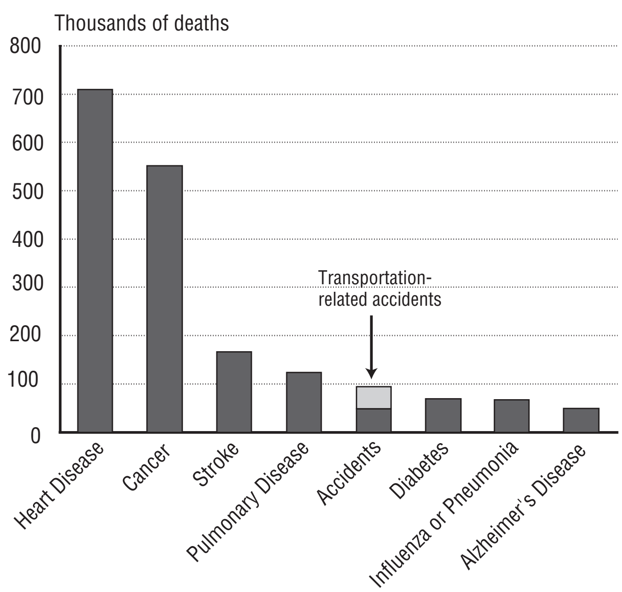
2. _____. *Annual Energy Review 2000*, tables 5.1 and 5.12c, available at http://www.eia.doe.gov/emeu/aer/contents.html.

Chapter 6
Safety

Introduction

Promoting "public health and safety by working toward the elimination of transportation-related deaths, injuries, and property damage" is a high priority of the U.S. Department of Transportation (DOT) [1]. The United States has made much progress in reducing the number of transportation-related deaths, but crashes and incidents involving transportation vehicles, vessels, aircraft, and pipelines still claimed over 44,000 lives and injured more than 3 million people in 2000. Transportation accidents are the ninth single leading cause of death in the United States (figure 1). However, motor vehicle crashes are the leading cause of death for people between 4 and 33 years of age [2].

Figure 1
Leading Causes of Death of People of All Ages in the United States: 2000



NOTE: Preliminary data.

SOURCE: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics, *National Vital Statistics* 49(12), Oct. 9, 2001, table B.

Motor vehicle collisions account for about 95 percent of transportation-related deaths and an even higher percentage of transportation injuries. Human behavior—such as alcohol and drug use, reckless operation of vehicles, failure to properly use occupant protection devices, and fatigue—is a major factor in a high proportion of crashes.

DOT has set specific targets for the next few years to improve transportation safety. These include goals to lower the U.S. commercial air carrier fatal crash rate by 80 percent by 2007, reduce the highway fatality rate to 1.0 per 1 million vehicle-miles traveled by 2008, and reduce commercial truck-related fatalities by 50 percent by 2010. Specific safety initiatives for rail, transit, maritime, and pipelines are also in place.

Source

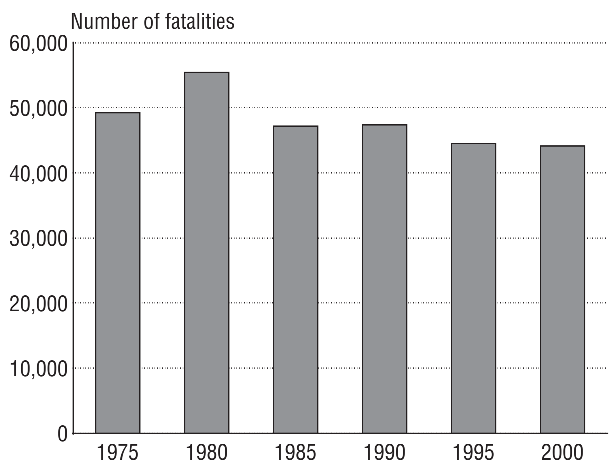
1. U.S. Department of Transportation, *Performance Plan, Fiscal Year 2003* (Washington, DC: March 2002).
2. U.S. Department of Transportation, National Highway Traffic Safety Administration, *Traffic Safety Facts 2000: Overview* (Washington, DC: October 2001).

Transportation Fatalities: A Modal Picture

Over the last 25 years, the total number of fatalities on the nation's roads, rails, and waterways and in the skies declined (figure 1). Despite progress, transportation crashes and incidents claimed 44,314 lives in 2000, of which 41,945 involved highway vehicles. Occupants of passenger cars and light trucks (i.e., sport utility vehicles, vans and minivans, and pickup trucks) accounted for over 70 percent of the transportation fatalities in 2000; pedestrians, motorcyclists, bicyclists, and others involved in motor vehicle collisions accounted for most of the remaining deaths (table 1).

Of the 2,369 transportation fatalities in 2000 that did not involve highway vehicles, recreational boating and general aviation (e.g., private planes for individual and business use) together claimed the lives of 1,293 people. Commercial carriers (airlines, trains, waterborne vessels, and buses) accounted for slightly under 1,000 fatalities. Many of these were bystanders and others outside of vehicles.

Figure 1
Total Fatalities by All Modes of Transportation



NOTE: For 1975, 1980, and 1985 some double counting may be included. The double counting affects about 1 percent of the data and should not impact the trend shown in the chart.

SOURCE: Various sources as cited in U.S. Department of Transportation, Bureau of Transportation Statistics, *National Transportation Statistics 2002* (Washington, DC: 2002).

Table 1
Transportation Fatalities: A Modal Picture—2000

Rank	Category	Fatalities	Percent
1	Passenger car occupants	22,699	51.2
2	Light-truck occupants	11,526	26.0
3	Pedestrians struck by motor vehicles	4,763	10.7
4	Motorcyclists	2,897	6.5
5	Large-truck occupants	754	1.7
6	Recreational boating	701	1.6
7	Pedalcyclists struck by motor vehicles	693	1.6
8	General aviation	594	1.3
9	Railroad trespassers (excluding grade crossings)	463	1.0
10	Motor vehicle occupants, not otherwise specified	450	1.0
11	Motor vehicle nonoccupants, not otherwise specified[1]	141	0.3
12	Air carriers	92	0.2
13	Waterborne transportation (not vessel-related)[2]	87	0.2
14	Heavy-rail transit (e.g., subway)	80	0.2
15	Air taxi	71	0.2
16	Rail grade crossings, not involving motor vehicles	64	0.1
17	Private road rail grade crossings, with motor vehicles	55	0.1
18	Waterborne transportation (vessel-related)	32	0.07
19	Light-rail transit	30	0.07
20	Railroad employees on duty and contractors	25	0.06
21	Bus occupants (school, intercity, and transit)	22	0.05
22	Gas distribution pipelines	22	0.05
23	Rail-related, not otherwise specified	20	0.05
24	Gas transmission pipelines	15	0.03
25	Transit bus (not accident-related)[3]	8	0.02
26	Commuter air	5	0.01
27	Passengers on railroad trains	4	0.01
28	Hazardous liquid pipelines	1	0.00
	Total	**44,314**	
Redundant with above			
	Large-truck occupants and nonoccupants	5,282	
	Public grade crossings, with motor vehicles	306	
	Commuter rail (included in railroad)	87	
	Transit buses (accident-related)	82	
	Air, ground fatalities (not on board)	13	
	Demand responsive transit (accident-related)	8	

[1] Includes all nonoccupant fatalities, except pedalcyclists and pedestrians.
[2] Statistics reflect deaths and injuries to vessel personnel that are not related to vessel incidents or accidents. Statistics include missing personnel, but do not include deaths and injuries due to altercations, diving accidents, homicides, suicides, attempted suicides, or natural causes.
[3] Includes homicides and suicides.

SOURCES:
Air—National Transportation Safety Board, available at http://www.ntsb.gov/aviation, as of Oct. 2, 2002.
Highway—U.S. Department of Transportation, National Highway Traffic Safety Administration, *Fatality Analysis Reporting System* (FARS) database, available at http://www-fars.nhtsa.dot.gov/, as of April 2002.
Railroad—U.S. Department of Transportation, Federal Railroad Administration, *Railroad Safety Statistics, Annual Report 2000* (Washington, DC: July 2001), tables 1-1, 1-2, and 1-4.
Transit—U.S. Department of Transportation, Federal Transit Administration, *Safety Management Information Statistics* (Washington, DC: Annual issues).
Waterborne transportation—U.S. Department of Transportation, U.S. Coast Guard, Office of Investigations and Analysis, Compliance Analysis Division (G-MOA-2), personal communication, Dec. 5, 2001.
Recreational boating—U.S. Department of Transportation, U.S. Coast Guard, Office of Boating Safety, *Boating Statistics* (Washington, DC: Annual issues).
Pipeline—U.S. Department of Transportation, Research and Special Programs Administration, Office of Pipeline Safety, available at http://ops.dot.gov, as of Nov. 14, 2001.

Transportation Fatality Rates

The more people travel, the greater the risk they incur. Thus, using the absolute numbers of fatalities to compare the safety of a given mode over time (table 1) can be misleading, since any change in the fatality numbers might be explained by a change in the amount of transportation activity. A clearer picture can be derived from exposure rates. Exposure rates are calculated by dividing the absolute numbers of fatalities (or other adverse outcome) by an activity measure, such as number of trips, number of miles traveled, or number of hours of vehicle operation.

Figure 1 shows fatality rates for selected modes for a time period of two decades or more. It is clear that safety in most modes has improved over the last 25 years. However, for several of the modes, the greatest improvement in fatality rates tended to occur in the earlier years of the period.

The activity measures used as denominators are not the same for all modes. For highway travel, exposure to risk is approximately proportional to distance traveled, hence the use of vehicle-miles as the denominator. For aviation, the greatest proportion of crashes occurs during takeoff and landing; hence risk is approximately proportional to the number of operations (measured as departures). Data on departures are not available for general aviation for recent years, so hours flown is used instead. For some means of travel, there are no good measures of the risks entailed. For example, while over 4,700 pedestrians were struck by motor vehicles and died in 2000, exposure measures are lacking because good data are not available for the amount of time, distances, or other circumstances of pedestrian travel.

Highway submodes show considerable improvement in fatality rates since 1975, when the federal government began to collect systematic national data from states. While all highway submodes show improved rates, there is much variation among them. Occupants of passenger cars and light trucks (including pickup trucks, vans, and sport utility vehicles) have much higher fatality rates than occupants of large trucks. Motorcycle riders have the highest fatality rate by far among the highway submodes (27.65 fatalities per 100 million vehicle-miles. The fatality rates per 100 million vehicle-miles are 1.31 and 1.22 for passenger car and light-truck occupants, respectively, versus 0.37 for large-truck occupants. A large number of factors influence the difference in fatality rates. For example, the greater size and mass of large trucks serves to protect the occupants of these vehicles in crashes with smaller vehicles or less massive objects.

Many factors may interact to explain the decreasing fatality rates. For highway modes, promotion of safety belt, child safety seat, and motorcycle helmet usage, and measures to discourage drunk driving have all had a beneficial effect. So, too, have improvements in vehicle and highway design and greater separation of traffic. Finally, some of the decrease in transportation fatalities may be a consequence of better and prompter medical attention for victims of transportation crashes and accidents.

Table 1
Fatalities by Transportation Mode

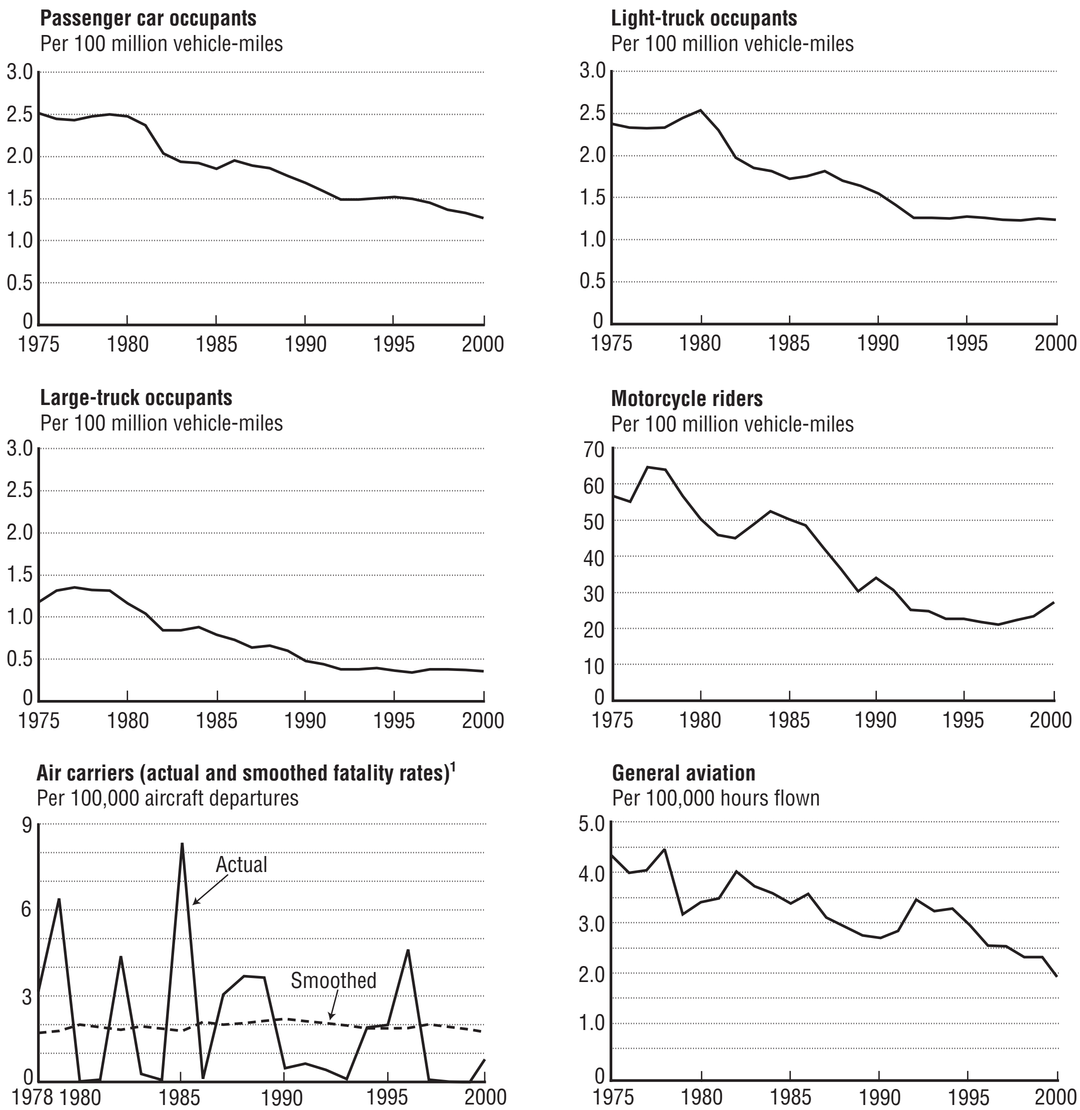
Year	Air carriers[1]	Commuter air[1]	On-demand air taxi[2]	General aviation[2]	Highway[3]	Rail[4]	Transit[5]	Waterborne[6]	Recreational boating	Gas and hazardous liquid pipeline
1975	124	28	69	1,252	44,525	575	N	573	1,466	15
1980	1	37	105	1,239	51,091	584	N	487	1,360	19
1985	526	37	76	956	43,825	454	N	261	1,116	33
1990	39	7	R51	R767	44,599	599	339	186	865	9
1995	168	9	52	734	41,817	567	274	183	829	21
2000[7]	92	5	71	594	41,945	544	292	119	701	38

[1] Large carriers operating under 14 CFR 121, all scheduled and nonscheduled service.
[2] All scheduled and nonscheduled service operating under 14 CFR 135 and all operations other than those operating under 14 CFR 121 and 14 CFR 135.
[3] Includes occupants of passenger cars, light trucks, large trucks, buses, motorcycles, other or unknown vehicles, nonmotorists, pedestrians, and pedalcyclists. Motor vehicle fatalities at grade crossings are counted here.
[4] Includes fatalities resulting from train accidents, train incidents, and nontrain incidents (e.g., fires in railroad repair sheds). Thus, the data cover many nonpassengers, making comparisons to other modes difficult. Motor vehicle fatalities at grade crossings are counted in the highway column. Figures include Amtrak.
[5] Includes motor bus, commuter rail, heavy rail, light rail, demand responsive, van pool, and automated guideway. Some transit fatalities are also counted in other modes. Reporting criteria and source of data changed between 1989 and 1990. Starting in 1990, fatality figures include those occurring throughout the transit station, including nonpatrons. Fatalities include those arising from incidents involving no moving vehicle (e.g., falls on transit property). Thus, the data cover many nonpassengers, making comparisons to other modes difficult. Prior to 1998, only data from directly operated transit services were reported. Beginning in 1998, fatality data for purchased transit service, such as paratransit services, were included.
[6] Includes fatalities related to vessel and nonvessel casualties (e.g., an individual who falls overboard and drowns).
[7] Rail, transit, and waterborne 2000 numbers are preliminary.

KEY: N = data are nonexistent; R = revised.

SOURCES: 1975–1999—U.S. Department of Transportation, Bureau of Transportation Statistics, *National Transportation Statistics 2000* (Washington, DC: 2001).
2000—**Aviation:** National Transportation Safety Board, *Aviation Accident Statistics,* available at http://www.ntsb.gov/aviation, as of Oct. 2, 2002.
Highway: U.S. Department of Transportation, National Highway Traffic Safety Administration, *Traffic Safety Fact Sheet 2000: Overview,* DOT HS 809 329, (Washington, DC: 2001), table 1; and personal communication, Nov. 1, 2002.
Rail: U.S. Department of Transportation, Federal Railroad Administration, Office of Safety and Analysis, *Railroad Safety Statistics Annual Report 2000,* available at http://safetydata.fra.dot.gov/officeofsafety/Forms/Default.asp, as of Dec. 7, 2001.
Transit: U.S. Department of Transportation, Federal Transit Administration, *Safety Management Information Statistics 1999,* available at http://transit-safety.volpe.dot.gov/Data/DamSam.asp, as of Dec. 7, 2001; and personal communication, Nov. 21, 2001.
Water: U.S. Department of Transportation, U.S. Coast Guard, Office of Boating Safety, *Boating Statistics* (Washington, DC: Annual issues); and personal communication, Dec. 7, 2001.
Pipeline: U.S. Department of Transportation, Research and Special Programs Administration, Office of Pipeline Safety, *Pipeline Statistics,* available at http://ops.dot.gov, as of Nov. 14, 2001.

Figure 1
Fatality Rates for Selected Modes



[1] For air carriers, the data were dampened, or smoothed, to reduce the month-to-month fluctuations. This dampening was performed using an exponential smoothing model, with a weight of 0.95. Departure data, and hence the denominator of the rates, are not strictly comparable between pre- and post-1977 eras.

SOURCES: **1975–2000**—Various sources, as cited in U.S. Department of Transportation, Bureau of Transportation Statistics, *National Transportation Statistics 2001,* available at http://www.bts.gov.
2000–Aviation: National Transportation Safety Board, *Aviation Accident Statistics,* available at http://www.ntsb.gov/aviation/stats.htm, as of Oct. 2, 2002.
Highway: U.S. Department of Transportation, National Highway Traffic Safety Administration, *Traffic Safety Fact Sheet 2000: Overview,* DOT HS 809 329, (Washington, DC: 2001), table 1; and personal communication, Nov. 1, 2002.

Highway Crash Characteristics

The overwhelming majority of highway fatalities occur as a result of single-vehicle crashes and crashes involving two vehicles. For example, in 2000, 42 percent of traffic crash fatalities were vehicle occupants (including drivers) killed in single-vehicle crashes and 38 percent of fatalities occurred as a result of two-vehicle crashes (table 1). Crashes in which three or more vehicles were involved caused only 7 percent of traffic fatalities in 2000.

An average of one-third of all motor vehicle crash fatalities nationwide result from single vehicle run-off-the-road (ROR) crashes, and two-thirds of these ROR fatalities occur in rural areas. It has been estimated that 40 to 60 percent of these crashes are due to driver fatigue, drowsiness, or inattention. The Federal Highway Administration recommends the use of rumble strips along the roadway shoulder as an effective way to reduce these incidents. The noise produced by vehicle tires on these rumble strips warns drivers that they are leaving the roadway. Studies of the effectiveness of shoulder rumble strips indicate that they can reduce the overall rate of ROR crashes between 15 and 70 percent [1]. In the future, the development of in-vehicle technologies that detect driver drowsiness and inattention and suitably warn the driver may further reduce the incidence of such crashes.

Table 1
Total Fatalities in Motor Vehicle Crashes by Type of Crash: 2000

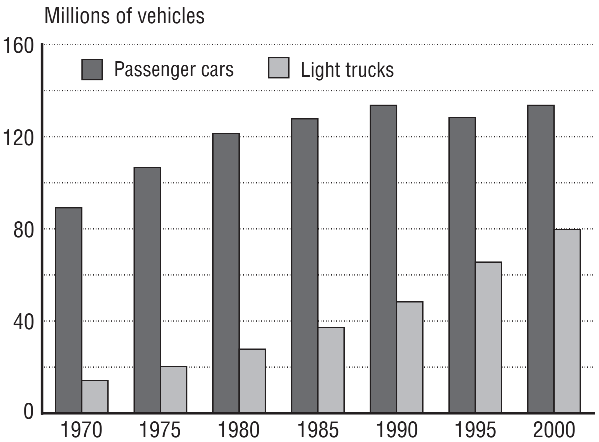
Type of crash	Number
Drivers/occupants killed in single-vehicle crashes	17,471
Drivers/occupants killed in two-vehicle crashes	15,758
Drivers/occupants killed in crashes of three-vehicles or more	3,119
Pedestrians killed in single-vehicle crashes	4,340
Bicyclists killed in single-vehicle crashes	668
Pedestrians/bicyclists killed in multiple-vehicle crashes	448
Others/unknown	141
Total	**41,945**

SOURCE: U.S. Department of Transportation, National Highway Traffic Safety Administration, *Fatality Analysis Reporting System* (FARS) database, available at http://www-fars.nhtsa.dot.gov/, as of April 2002.

Traffic crashes between light trucks or vans and passenger cars is of increasing concern. Since the early 1980s, the category of light trucks and vans (LTVs) has grown dramatically (figure 1). LTVs include pickup trucks, vans, minivans, truck-based wagons, and sport utility vehicles (SUVs).

Differences in vehicle size, weight, and geometry in multivehicle crashes can put occupants of passenger cars at greater risk in a crash with a light-duty truck than in a crash involving two or more passenger cars. For example, a study done for NHTSA by the University of Michigan Transportation Research Institute shows that when an SUV strikes a passenger car in a frontal crash, occupants of the car are almost twice as likely to have fatal injuries as the occupants of the SUV. In frontal collisions between two cars of similar weight, the ratio of deaths is 1:1. The same study found that, in side impact crashes, SUVs are more injurious as a striking vehicle than are passenger cars. For example, when SUVs strike passenger cars on the left side, the risk of death to the car driver can be 25 times greater than the risk to the SUV occupant. However, in the

Figure 1
Growth in the Number of Passenger Cars and Light Trucks



SOURCES: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics Summary to 1995,* FHWA-PL-97-009 (Washington, DC: July 1997), table MV-201.
_____. *Highway Statistics 2000* (Washington, DC: 2001).

same type of crash involving two cars, the risk of death to the driver of the car being struck is only 10 times greater than the occupant of the other car [3].

Another issue related to SUVs is their propensity to rollover during certain steering maneuvers. SUVs are constructed with higher ground clearance for occasional offroad use and, thus, have a higher center of gravity. SUV height, along with other factors, contributes to the average rate of 98 rollover fatalities per million registered vehicles compared with 44 such fatalities per million registered vehicles for all other light vehicle types [4]. Also, in fatal crashes in 2000 SUVs were twice as likely to rollover when compared to passenger cars, increasing the risk of occupant ejection, fatality, or injury [2].

Sources

1. U.S. Department of Transportation, Federal Highway Administration, *Effectiveness of Rumble Strips,* available at http://safety.fhwa.dot.gov, as of Dec. 20, 2001.
2. U.S. Department of Transportation, National Highway Traffic Safety Administration, *Fatality Analysis Reporting System*, available at http://www-fars.nhtsa.dot.gov/, as of April 2002.
3. U.S. Department of Transportation, National Highway Traffic Safety Administration/University of Michigan Transportation Research Institute, *Fatality Risks in Collisions Between Cars and Light Trucks* (Washington, DC: September 1998).
4. U.S. Department of Transportation, Office of the Assistant Secretary of Public Affairs, *News Release: DOT Requires Upgraded Rollover Warning Label for Sport Utility Vehicles,* Mar. 5, 1999, available at http://www.nhtsa.dot.gov/nhtsa/announce/press/1999/1999press.dbm, as of Dec. 20, 2001.

Highway Crashes on Rural and Urban Roads

Two- and three-lane rural roads make up the majority of the highway system in the United States. If Interstate highways are excluded, these rural roads represent four times the highway mileage of urban roads in the U.S. highway system [1].

Almost 60 percent of all fatal crashes in 2000 occurred on rural roads. Seventy-one percent of these crashes were on roads with speed limits of 55 mph or more (table 1). Conversely, almost 70 percent of urban highway crashes occur on roads with speed limits under 55 mph. Irrespective of speed limits, most rural and urban highway crashes occur on principal arterial and other roads rather than on Interstate highways; 88 percent of crashes in the case of rural roads and 86 percent, for urban roads [2].

Road conditions contribute to the greatest proportion of fatal crashes in rural areas. In particular, two-way traffic on roads posted for high speed limits is a concern. Rural drivers often must deal with challenging road geometry (e.g., width, alignment, and sight distances) and challenging geography (e.g., steep grades and mountain passes). Adverse weather can further affect rural road conditions and sparse and patchy telecommunications infrastructure can slow emergency response time when a crash occurs.

Sources

1. Transportation Research Board, National Cooperative Highway Research Program, *Accident Mitigation Guide for Congested Rural Two-Lane Highways,* Report 440 (Washington, DC: 2000).
2. U.S. Department of Transportation, National Highway Traffic Safety Administration, Fatality Analysis Reporting System (FARS) database, available at www-fars.nhtsa.dot.gov/, as of April 2002.

Table 1
Fatal Crashes by Speed Limits and Type of Road: 2000

	Rural			Urban				
Speed limit	Interstate	Principal arterial	Other	Interstate	Principal arterial	Other	Unknown[1]	Total
30 mph or less	1	35	926	3	540	2,249	110	3,864
35 or 40 mph	9	147	1,738	42	1,664	2,602	158	6,360
45 or 50 mph	33	526	2,831	105	1,700	1,325	153	6,673
55 mph	174	1,893	7,538	594	1,002	535	407	12,143
60 mph or higher	2,526	1,571	1,709	1,399	849	202	73	8,329
No posted limit	1	1	139	1	2	12	1	157
Total	**2,744**	**4,173**	**14,881**	**2,144**	**5,757**	**6,925**	**902**	**37,526**

[1] "Unknown" includes fatal accidents for which road type or speed limit was unknown or not recorded in the accident report. In FARS, those data are reported separately.

SOURCE: U.S. Department of Transportation, National Highway Traffic Safety Administration, *Fatality Analysis Reporting System* (FARS) database, available at http://www-fars.nhtsa.dot.gov/, as of April 2002.

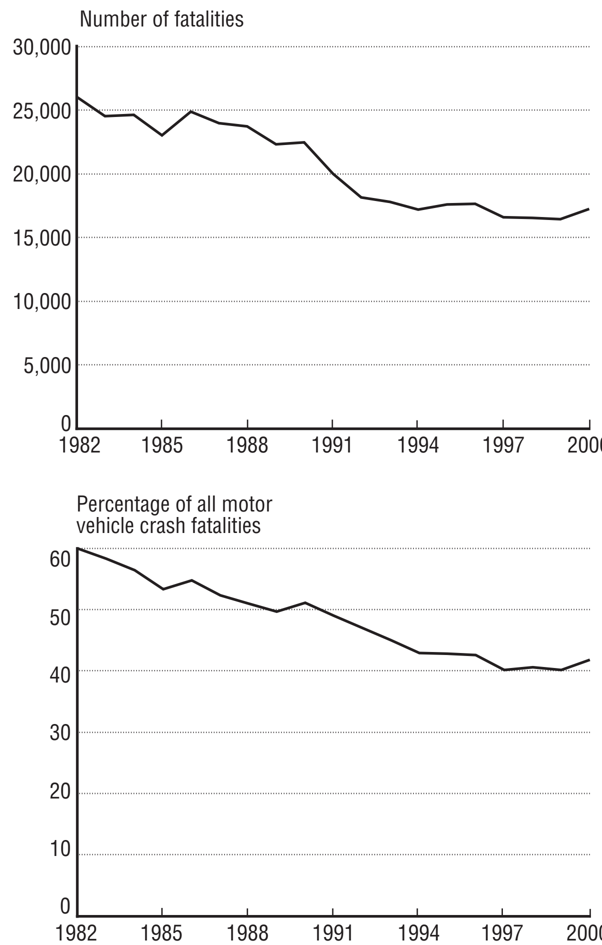
Alcohol-Related Highway Crashes

In 2000, 41 percent of the 41,945 highway fatalities were related to alcohol, a 2 percent increase over 1999. In 1982, the first year for which data are available, 25,165 people died in alcohol-related motor vehicle crashes—57 percent of all highway fatalities. By 2000, alcohol-related fatalities had dropped to 17,380 (figure 1). The U.S. Department of Transportation has a goal of reducing alcohol-related fatalities to no more than 11,000 by 2005 [2].

Improved state and local education programs, stricter law enforcement, adoption of a 0.08 blood alcohol concentration (BAC) by 33 states and the District of Columbia, higher minimum drinking ages, more stringent license revocation laws, and reduced tolerance for drinking and driving have all been cited as factors in reducing alcohol-related deaths [1]. Despite improvements, 22 percent of passenger car drivers, 20 percent of light truck drivers, 1 percent of large truck operators, and 29 percent of motorcycle operators involved in fatal crashes in 2000 were legally intoxicated with a BAC of 0.10 or greater [3].

Just over 38 percent of the drivers between the ages of 21 and 24 who were involved in a fatal motor vehicle highway crash in 2000 had a BAC of 0.01 or more; over 32 percent had a BAC of 0.08 or more (figure 2). While the highest of any age group, this does represent a decline from 46 percent and 39 percent, respectively, in 1990. Overall, the percentage of all drivers with any alcohol content (BAC of 0.01 or more) involved in a fatal highway

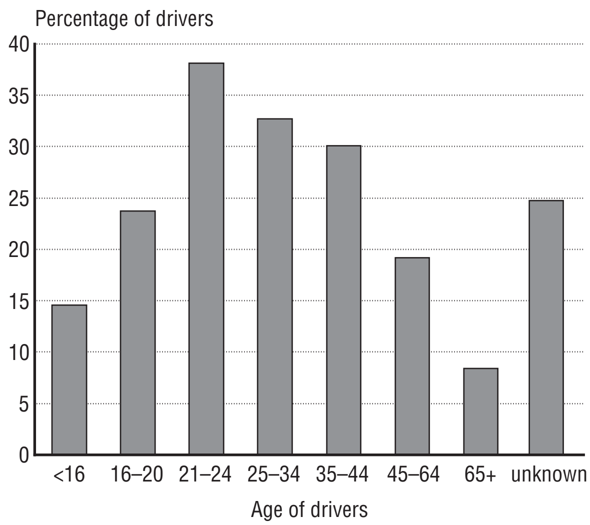
Figure 1
Alcohol-Related Fatalities in Motor Vehicle Crashes: 1982–2000



NOTE: These data reflect the methodological change in estimating missing blood alcohol concentration test results, adopted by the National Highway Traffic Safety Administration in 2002.

SOURCES: U.S. Department of Transportation, National Highway Traffic Safety Administration, personal communication, Nov. 1, 2002.

Figure 2
Alcohol Involvement of Drivers in Fatal Crashes by Age: 2000
0.08 BAC or greater



NOTE: These data reflect the methodological change in estimating missing blood alcohol concentration test results, adopted by the National Highway Traffic Safety Administration in 2002.

SOURCE: U.S. Department of Transportation, National Highway Traffic Safety Administration, personal communication, Nov. 1, 2002.

crash declined from 33 percent to 26 percent between 1990 and 2000 [3].

Alcohol-related fatalities declined more quickly in the 1980s than in the 1990s. Between 1994 and 2000, the percentage of highway fatalities attributed to alcohol declined by only 1 percent—from 42 percent to 41 percent. Moreover, while alcohol-related fatalities among drivers 16 to 20 years of age decreased, alcohol consumption in this age group increased every year from 1993 to 2000 [2].

In 2000, Congress enacted legislation that provides strong encouragement for states to adopt the 0.08 BAC [5]. States have until October 1, 2003, to pass the stricter limit or face the withholding of 2 percent of their federal highway construction funds. After 2003, states that fail to pass the 0.08 BAC will lose an additional 2 percent of their federal funding every year. By October 1, 2006, and each year thereafter, states that still have not adopted 0.08 BAC laws will lose 8 percent of their funding [4].

Fatality rates vary by state (see map on next page). It is illegal in every state and the District of Columbia to drive a motor vehicle while under the influence of alcohol. In addition, every state has laws that make it illegal for a person to drive a motor vehicle with a specific amount of alcohol in his or her blood. As of November 2002, 17 states defined intoxicated driving as 0.10 BAC—the level at which a person's blood contains 1/10th of 1 percent of alcohol. Thirty-three states and the District of Columbia have enacted 0.08 BAC laws[1] [1].

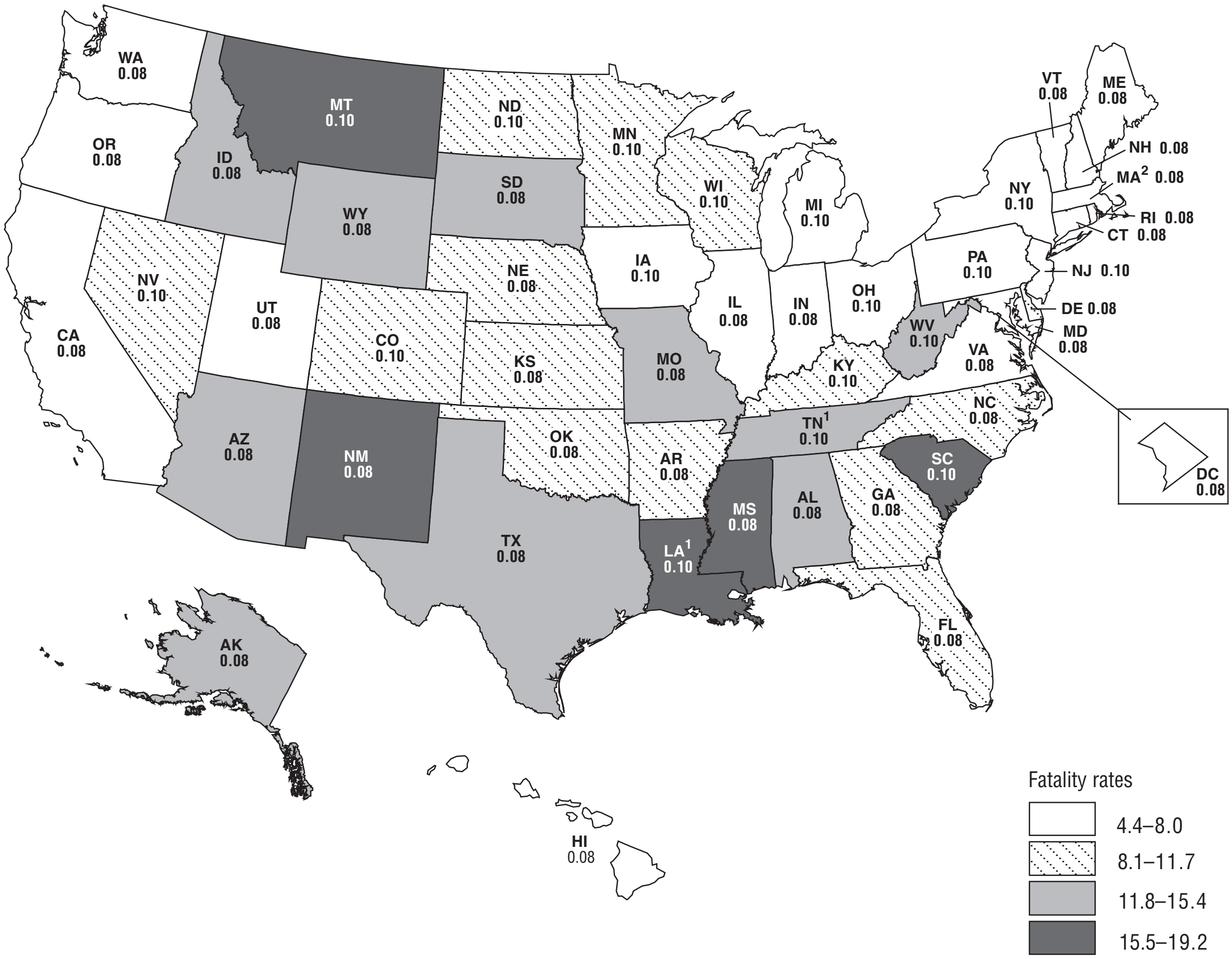
Highway safety advocates have encouraged states to take a systems approach to reducing drunk driving. Some states have enacted a combination of measures. In addition to 0.08 BAC limits, such measures include stringent license revocation laws (under which a person deemed to be driving under the influence has his or her driving privileges suspended or revoked), comprehensive screening and treatment programs for alcohol offenders, vehicle impoundment, and zero tolerance BAC and other laws for youths [6].

Sources

1. Insurance Institute for Highway Safety/Highway Loss Data Institute, *DUI/DWI Laws as of November 2002*, available at http://www.hwysafety.org, as of November 2002.
2. U.S. Department of Transportation, *FY 2000 Performance Report/FY 2002 Performance Plan* (Washington, DC: 2001), also available at http://www.dot.gov/ost, as of Dec. 3, 2001.
3. U.S. Department of Transportation, National Highway Traffic Safety Administration, personal communication, Nov. 1, 2002.
4. _____. "Congress Agrees to 0.08% Blood Alcohol as the Legal Level for Impaired Driving," *NHTSA Now Newsletter*, Oct. 16, 2000.

[1] Massachusetts has adopted a 0.08 BAC law but does not meet federal requirements to avoid sanctions in 2003 under the federal 0.08 law.

Alcohol-Related Motor Vehicle Fatality Rates per 100,000 Licensed Drivers and Illegal Blood Alcohol Content Levels: 2000



[1] Louisiana's 0.08 BAC law goes into effect on Sept. 30, 2003; Tennessee's on July 1, 2003.
[2] Massachusetts has not established a level at which a driver is legally considered intoxicated (0.08 is evidence of alcohol impairment).

NOTES: A blood alcohol concentration (BAC) level of 0.10 means that alcohol makes up one-tenth of 1 percent of a person's blood. These data reflect the methodological change in estimating missing blood alcohol concentration test results, adopted by the National Highway Traffic Safety Administration in 2002.

SOURCES:
Fatality rates—U.S. Department of Transportation, National Highway Traffic Safety Administration, *Traffic Safety Facts 2000* (Washington, DC: 2001); and personal communication, Nov. 1, 2002.
_____. *Highway Statistics 2000* (Washington, DC: 2001).
Illegal BACs—U.S. Department of Labor, Working Partners for an Alcohol- and Drug-Free Workplace, *Special Issue: Impaired Driving,* available at http://www.dol.gov/dol/workingpartners.htm, as of June 2002.
Insurance Institute for Highway Safety/Highway Loss Data Institute, *DUI/DWI Laws as of November 2002,* available at www.hwysafety.org, as of November 2002.

5. U.S. Department of Transportation, Office of Public Affairs, "Statement by U.S. Transportation Secretary Rodney Slater Upon Signing of Transportation Appropriations Act by President Clinton," Oct. 23, 2000.

6. U.S. General Accounting Office, Resources, Community, and Economic Development Division, *Highway Safety: Effectiveness of State 0.08 Blood Alcohol Laws* (Washington, DC: June 1999).

Occupant Protection: Safety Belts, Air Bags, and Child Restraints

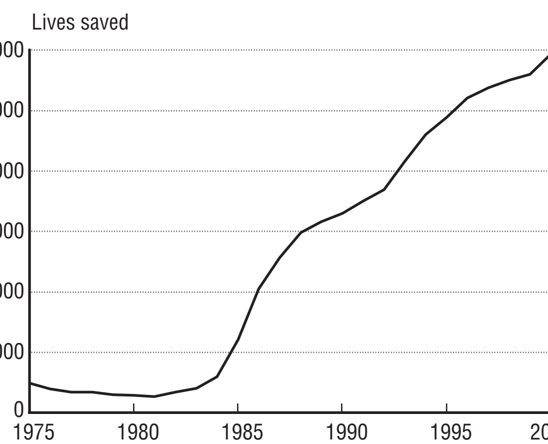
The National Highway Traffic Safety Administration (NHTSA) estimates that, in 2000, safety belts saved the lives of 11,889 passenger vehicle occupants over 4 years old (figure 1). NHTSA also estimates that 21,127 lives could have been saved that year if all passenger vehicle occupants aged 4 and older wore safety belts [1].

The number of lives saved has increased dramatically since 1984 when states began to enact safety belt laws. A June 2001 NHTSA survey showed that 73 percent of passenger vehicle occupants used safety belts [3]. Usage rates differ noticeably among the states based on how the safety belt laws are enforced (see map on next page). There are three levels of enforcement: primary enforcement allows a police officer to stop and cite someone for not wearing a safety belt; secondary enforcement allows a police officer to cite someone for not wearing a safety belt only if they have been stopped for some other infraction; and no enforcement [1]. Usage in the 17 states with primary enforcement was 78 percent as opposed to 67 percent in the 33 states with secondary enforcement laws (see map on page 154). Safety belt usage in New Hampshire, which does not require adults to wear safety belts, was 56 percent.

Beginning in September 1997 (model year 1998), all new passenger vehicles were required to have driver and passenger air bags. The following year, the same requirement was applied to light trucks. NHTSA estimates that, as of 2000, more than 106 million air-bag-equipped passenger vehicles were on the road, including 81 million with dual air bags. In 2000, an estimated 1,584 lives were saved by air bags. From 1987 through 2000, an estimated total of 6,553 lives were saved [1].

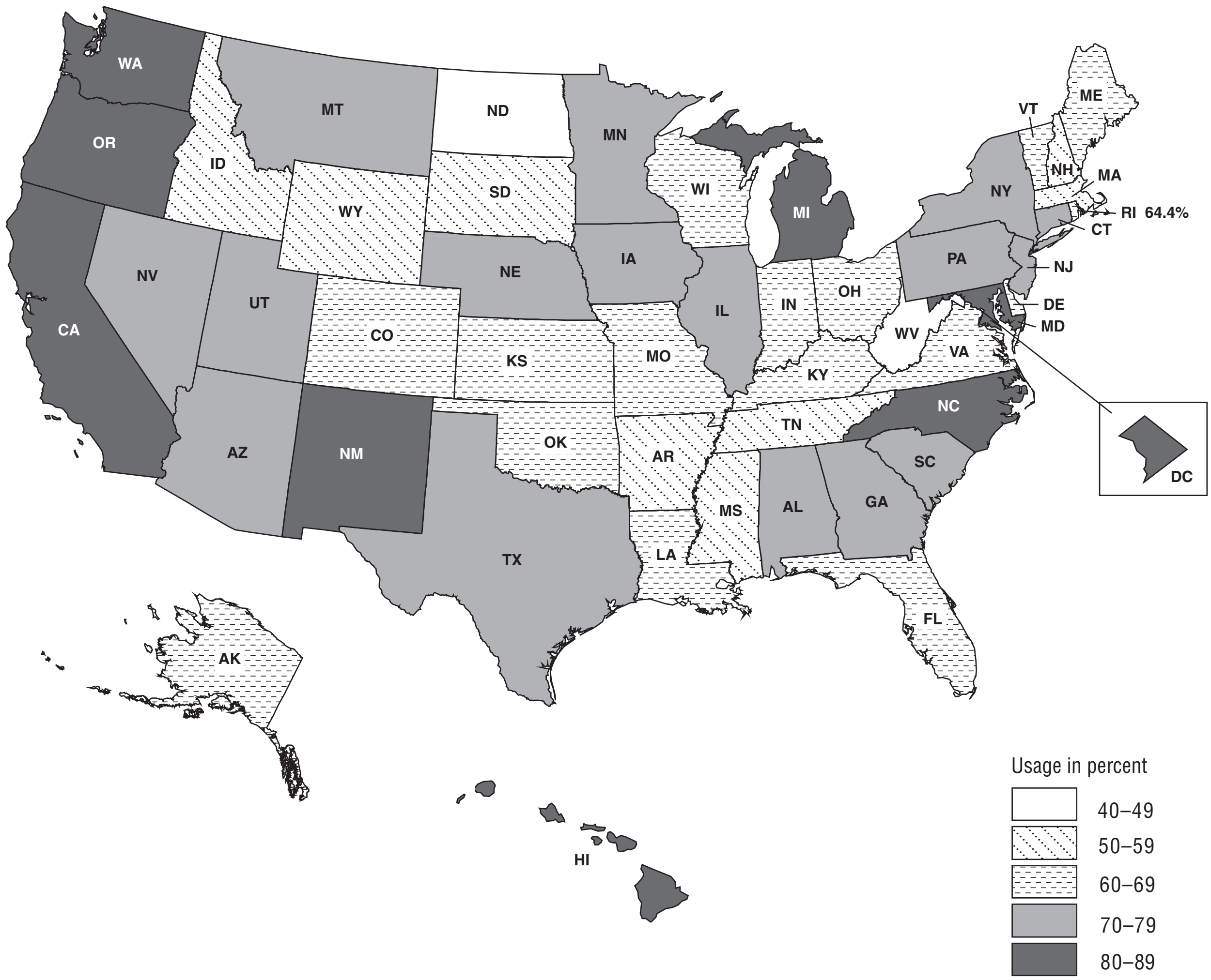
According to NHTSA, air bags, combined with safety belts, offer the most effective safety protection available today for passenger vehicle occupants. Air bags are supplemental protection and are designed to deploy in moderate-to-severe frontal crashes. Adults and some children riding in front seats have been injured or killed by air bags inflating in low severity crashes. While far more lives have been saved by air bags than have been lost, since 1990, 195 deaths from injuries caused by air bags have occurred. This includes 119 children riding in the front seat [2]. If children under the age of 13 ride in the back seat of

Figure 1
Estimated Number of Lives Saved Each Year by Use of Safety Belts: 1975–2000



SOURCE: U.S. Department of Transportation, National Highway Traffic Safety Administration *Traffic Safety Facts 2000: Occupant Protection* (Washington, DC: 2001).

Safety Belt Use Rates: 2000[1]



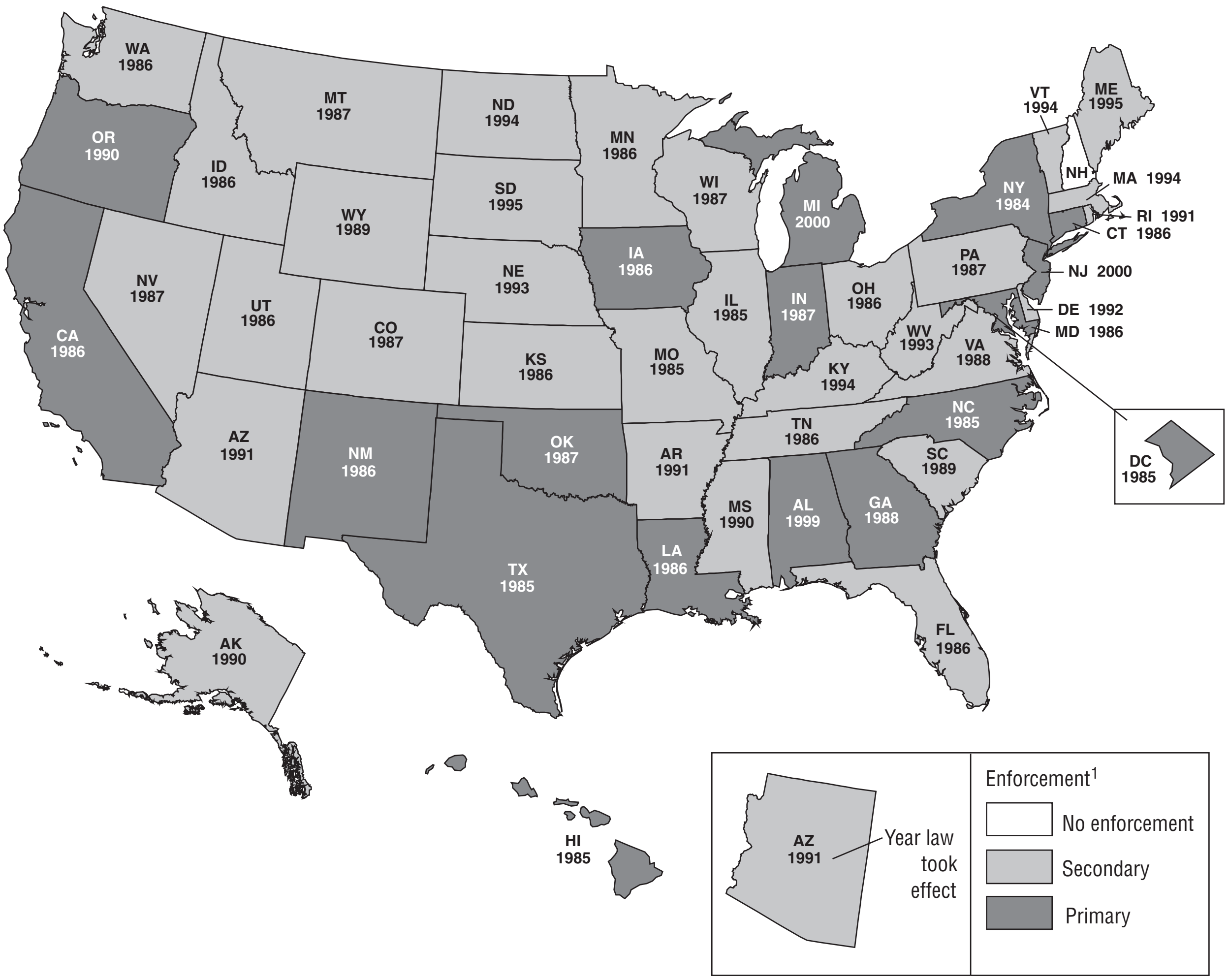
[1] Maine and New Hampshire data are for 1998 from U.S. Department of Transportation, National Highway Traffic Safety Administration, *Traffic Safety Facts 1998* (Washington, DC: 1999).

SOURCE: U.S. Department of Transportation, National Highway Traffic Safety Administration, "Research Note: 1998–2000 State Shoulder Belt Use Survey Results," May 2001.

passenger vehicles and are secured by appropriate restraint systems, risk of injuries or death from air bags can be avoided [1].

In 2000, 541 passenger vehicle occupant fatalities were reported among children less than 5 years of age [1]. NHTSA estimated that in 2000, use of child restraint systems saved the lives of 316 children under the age of 5. An additional 143 lives could have been saved—for a total of 458—if every child under age 5 had been properly restrained in a child safety seat. From 1975 through 2000, an estimated 4,816 lives were saved by child restraints [1].

Type of Safety Belt Use Laws, by State: As of 2001



[1] Primary enforcement allows police officers to stop vehicles and write citations whenever they observe violations of safety belt laws. Secondary enforcement permits police officers to write a citation only after a vehicle is stopped for some other traffic violation.

SOURCE: U.S. Department of Transportation, National Highway Traffic Safety Administration, "Summary of Vehicle Occupant Protection Laws, 4th Edition," January 2001.

Sources

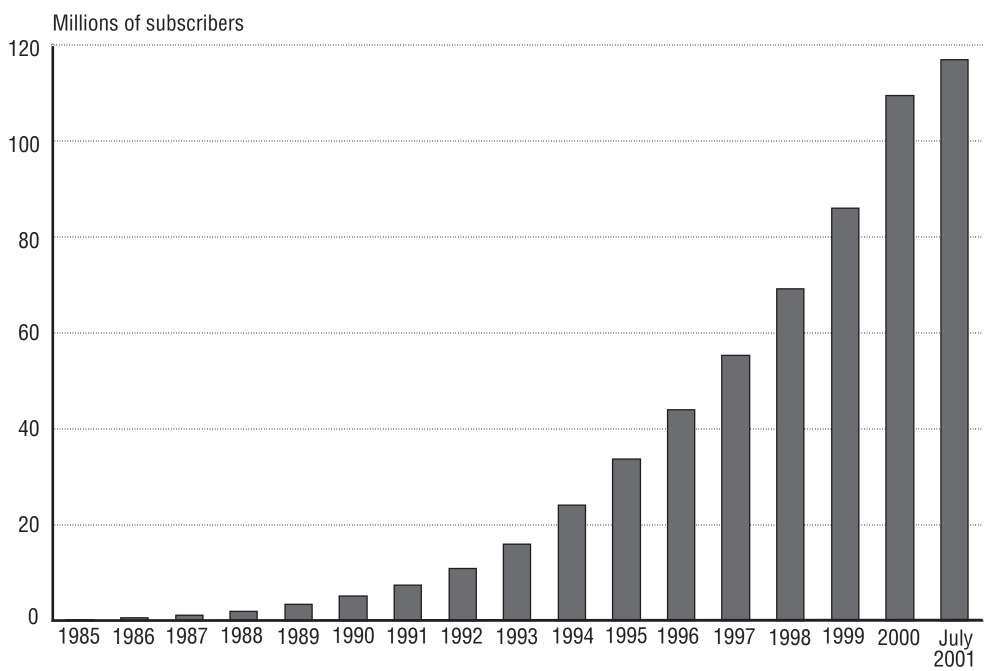
1. U.S. Department of Transportation, National Highway Traffic Safety Administration, *Traffic Safety Facts 2000: Occupant Protection* (Washington, DC: 2001); and personal communication, Nov. 1, 2002.
2. ____. *Air Bag Fatalities and Serious Injury Report* (Washington, DC: 2001), also available at http://www.nhtsa.dot.gov/people/ncsa, as of Dec. 10, 2001.
3. ____. "Research Note: Observed Shoulder Belt Use from the June Mini National Occupant Protection Use Survey (NOPUS), August 2001.

Cell Phones and Motor Vehicles

As cell phones have gained in popularity, they have become a growing concern with respect to highway safety. Nearly 120 million Americans now subscribe to a cell phone service, up from 7.6 million in 1991 (figure 1). Many Americans use their phones while driving. The National Highway Traffic Safety Administration (NHTSA) estimates 3 percent of passenger vehicle drivers are talking on hand-held cell phones at any given time. Of the 54 percent of drivers who usually have a wireless phone in their vehicle, 73 percent reported using their phone while driving. [5]

The precise effects of cell phone use on public safety have not been determined, but preliminary studies suggest that cell phones distract drivers. A forthcoming study by the National Safety Council found that drivers engaged in cell phone conversations missed twice as many simulated traffic signals and took longer to react to those signals they detected. The results were the same for hand-held and hands-free devices [2].

Figure 1
Cell Phone Service Subscriptions: 1985–July 2001



NOTE: Includes all active cellular, personal communications service (PCS), and Enhanced Specialized Mobile Radio (ESMR) telephone service subscriptions. The survey excludes satellite phone, paging, and messaging services, to the extent they are provided separately from cellular, PCS, and ESMR services.

SOURCE: Cellular Telecommunications & Internet Association, "Semi-Annual Wireless Industry Survey," available at http://www.wow-com.com/industry/stats/, as of Nov. 14, 2001.

State police forces have not been required to collect information on cell phones in vehicle accident reports until recently. Within the past two years 18 states have enacted laws requiring police to include information on cell phone usage in vehicle accident reports. Louisiana, New Jersey, New Mexico, Pennsylvania, and Virginia have approved cell phone and driving studies [1].

State legislators have also begun to regulate cell phone use in motor vehicles (table 1). New York became the first state to ban drivers from using hand-held devices. Massachusetts requires that drivers keep one hand on the steering wheel at all times, which may encourage increased use of hands-free devices. Due to a concern that hands-free devices might interfere with drivers' ability to hear noises from the surrounding environment, Illinois and Florida have prohibited the use of headsets except for single-sided headsets. Arizona and Massachusetts school bus drivers are prohibited from using cell phones while driving, and several other states have proposed similar legislation. As of late 2001, an additional 20 states were debating laws related to cell phones and motor vehicles.

Despite safety concerns due to driver distraction, wireless technologies provide some clear safety and traffic management benefits. The Cellular Telephone and Internet Association estimates that motorists on cell phones place 139,000 emergency calls every day. Most laws restricting cell phone use have recog-

Table 1
State Laws on the Use of Cellular Telephones: As of November 2001

State	Description	Penalties
Arizona	A school bus driver shall not wear an audio headset or earphones or use a cellular telephone whenever the school bus is in motion.	Administrative code provision; no penalty specified
California	Rental cars with cellular telephone equipment must include written operating instructions concerning its safe use.	$100 maximum for first violation; $200 maximum for second; $250 for third and subsequent violations committed within one year
Florida	Cellular phone use is permitted as long as it provides sound through one ear and allows surrounding sound to be heard with the other ear.	$30 for each violation; nonmoving violation
Illinois	A single-sided headset or earpiece is permitted with a mobile phone while driving.	No penalty
Massachusetts	Cellular phone use is permitted as long as it does not interfere with the operation of the vehicle and one hand remains on the steering wheel at all times.	$35 maximum for first violation; $35–$75 for second violation; $75–$150 for third and subsequent violations committed within 1 year
	No person shall operate a moving school bus while using a mobile telephone.	No penalty specified
New York	Drivers prohibited from talking on hand-held mobile phones while operating a motor vehicle.	Not more than $100

SOURCE: National Conference of State Legislators, *Cell Phones and Highway Safety: 2001 State Legislative Update,* available at http://www.ncsl.org/programs/esnr/2001cellph.htm, as of Nov. 19, 2001.

nized this benefit by allowing motorists to place calls in an emergency. In a 1997 study, NHTSA found that state police are generally appreciative of the quick notification capabilities afforded by cell phones [4]. Furthermore, that study and a 1997 study published in the New England Journal of Medicine found that cell phones can reduce emergency response times and save lives [3]. In addition to being helpful in emergency situations, the NHTSA study found that cell phones enable motorists to quickly notify authorities of road hazards, congestion, or problem drivers. And in the case of roadside mechanical problems, cell phones enhance drivers' personal security by allowing them to contact help immediately.

Sources

1. National Conference of State Legislators, *Cell Phones and Highway Safety: 2001 State Legislative Update,* available at http://www.ncsl.org/programs/esnr/2001cellph.htm, as of Nov. 19, 2001.
2. National Safety Council, "Does Cell Phone Conversation Impair Driving Performance?" preliminary report, available at http://www.nsc.org/library/shelf/inincell.htm, as of Nov. 14, 2001.
3. Cohen P.J., K.P. Quinlan, O. Paltiel, A. Ambrose, D.A. Redelmeier, R.J. Tibshirani, M. Maclure, and M.A. Mittleman. "Cellular Telephones and Traffic Accidents," *New England Journal of Medicine* vol. 336, No. 7, Feb. 13, 1997, pp. 453-458, abstract available at http://content.nejm.org/cgi/content/short/336/7/453, as of Nov. 19, 2001.
4. U.S. Department of Transportation, National Highway Traffic Safety Administration, *An Investigation of the Safety Implications of Wireless Communications in Vehicles,* available at http://www.nhtsa.dot.gov/people/injury/research/wireless/, as of Nov. 14, 2001.
5. U.S. Department of Transportation, National Highway Traffic Safety Administration, "National Occupant Protection Use Survey 2000," available at http://www.nhtsa.dot. gov/ncsa/, as of Nov. 14, 2001.

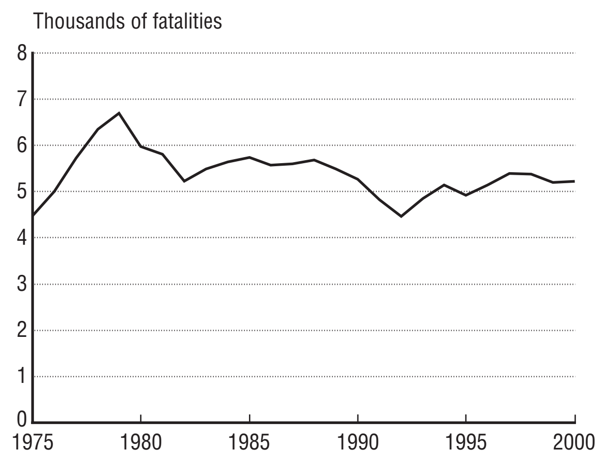
Large Trucks

Crashes involving large trucks[1] resulted in 5,282 fatalities in 2000. Annually, the number of such fatalities varies, from a low of 4,462 in 1992 to a high of 6,702 in 1979 (figure 1). The number of drivers and occupants of large trucks killed in crashes has declined since the late 1970s, when fatalities averaged about 1,200, compared with 672 in the 1990s. The overwhelming majority of people killed in large truck collisions—78 percent in 2000—were occupants of other vehicles or nonmotorists [1].

In two-vehicle crashes involving a large truck and a passenger vehicle, driver-related crash factors were cited by police officers at the scene for 25 percent of the truck drivers involved and for 82 percent of the passenger vehicle drivers. Table 1 shows the percent of crashes in which either the large-truck driver or the passenger-vehicle driver or both were cited for one or more of the top 12 factors identified.

Large truck safety issues have received increased attention in recent years. In 1999, Congress passed the Motor Carrier Safety Improvement Act, which created the Federal Motor Carrier Safety Administration[2] within the U.S. Department of Transportation. Among other provisions, the legislation calls for increased roadside inspections, compliance reviews and enforcement actions, improvements in safety data, and additional research into crash causes. About 24 percent of the over 2.4 million motor carrier vehicles inspected in 2000 were taken out of service (figures 2 and 3).

Figure 1
Fatalities in Large Truck Crashes: 1975–2000



SOURCES: U.S. Department of Transportation, National Highway Traffic Safety Administration, *Traffic Safety Facts 2000* (Washington, DC: 2001), table 11.
____. *Fatality Analysis Reporting System* (FARS) database, available at http://www-fars.nhtsa.dot.gov/, as of April 2002.

Source

1. U.S. Department of Transportation, National Highway Traffic Safety Administration, *Traffic Safety Facts 2000: Large Trucks* (Washington, DC: 2001).

[1] Trucks with a gross vehicle weight greater than 10,000 pounds.

[2] In addition to large trucks, the Federal Motor Carrier Safety Administration oversees passenger vehicles designed to transport eight or more persons and vehicles used to transport hazardous materials.

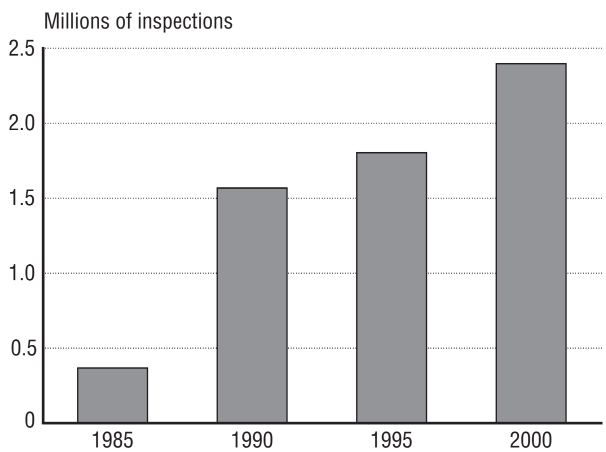
Table 1
Driver-Related Factors Cited in Two-Vehicle Fatal Crashes Between Large Trucks and Passenger Vehicles: 2000

	Large-truck driver		Passenger-vehicle driver	
Top factors cited	Number of factors	Percent	Number of factors	Percent
Failure to yield right-of-way	313	11.7	527	19.7
Driving too fast for conditions or speeding	109	4.1	438	16.4
Failure to keep in proper lane	101	3.8	698	26.1
Failure to obey traffic signs/devices	75	2.8	300	11.2
Inattentive (talking, eating, etc.)	75	2.8	288	10.8
Erratic/reckless driving	38	1.4	164	6.1
Running off road	32	1.2	135	5.1
Following improperly	31	1.2	64	2.4
Making other improper turn	25	0.9	68	2.5
Drowsy, sleepy, asleep, fatigued	17	0.6	58	2.2
Avoiding, swerving or sliding due to ice, snow, etc.	15	0.6	90	3.4
Driving on wrong side of road	13	0.5	130	4.9

NOTE: Total number of large-truck and passenger-car drivers involved in two-vehicle, large-truck/passenger-vehicle crashes in 2000 = 5,461.

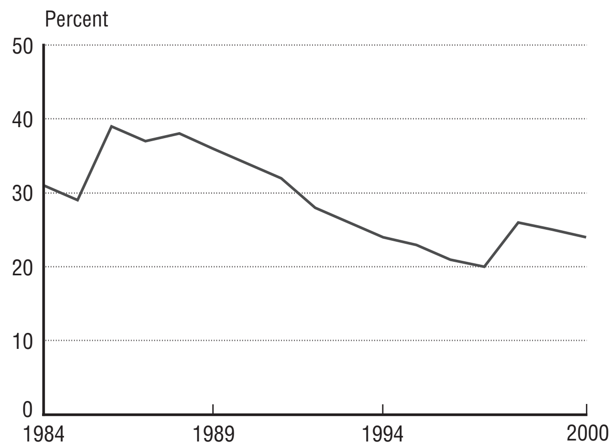
SOURCE: U.S. Department of Transportation, National Highway Traffic Saffety Administration, *Fatality Analysis Reporting System* (FARS) database, available at http://www-fars.nhtsa.dot.gov/, as of April 2002.

Figure 2
Motor Carrier Vehicle Inspections



SOURCE: U.S. Department of Transportation, Federal Motor Carrier Safety Administration, Motor Carrier Inspection database, available at http://ai.volpe.dot.gov/mcspa.asp, as of Dec. 7, 2001.

Figure 3
Percentage of Vehicle Inspections in Which the Vehicle is Taken Out of Service: 1984–2000



SOURCE: U.S. Department of Transportation, Federal Motor Carrier Safety Administration, Motor Carrier Inspection database, available at http://ai.volpe.dot.gov/mcspa.asp, as of Dec. 7, 2001.

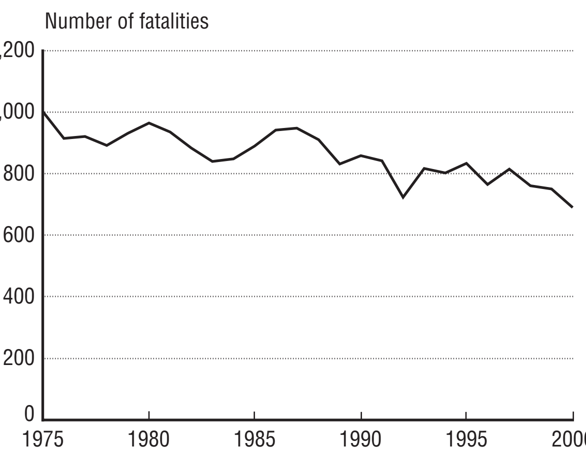
Bicyclists

Almost 700 bicyclists and other pedalcyclists[1] were killed in crashes with motor vehicles in 2000, a 31 percent reduction since 1975 (figure 1). This continues a 25-year trend of a steady decline in the number of pedalcycle deaths and, to a lesser extent, in the pedalcyclist portion of the overall motor vehicle fatalities. Pedalcyclist fatalities in 2000 amounted to only 1.6 percent of all 41,945 highway fatalities; whereas, in 1975, they were 2.2 percent. A similar trend exists for pedalcyclist injuries. An estimated 51,000 were injured in traffic crashes in 2000 compared with 67,000 in 1995 [5, 6, 7].

It is difficult to fully assess pedalcyclist fatality and injury trends, because exposure data for the mode—that is, the number of trips pedalcyclists make or the amount of time they spend cycling—are limited and vary by season. For instance, various Bureau of Transportation Statistics Omnibus surveys show that in the summer months about 20 percent of adults ride bicycles but in the winter months only about 10 percent do [4].

Along with the decreasing number of fatalities in the last 25 years, another trend is apparent. Most pedalcycle deaths (involving motor vehicles) now occur among riders 15 years of age and older, rather than among children and young teens (figure 2). The fatalities in 1975 attributed to child pedalcyclists (under 15 years old) represented 61 percent of the total that year. This age group's fatalities in 2000, however, comprised only 26 percent of the total while the 25 to 54 age group sustained the highest (43 percent). In 1975, the latter age group represented only 10 percent of the total fatalities. The same phenomenon has occurred in the 55 to 64 and over 65 age groups. When the pedalcycle fatalities are compared with the number of people by age group in 1975 and 2000, a different pattern emerges (table 1). While there were almost 5 pedalcycle fatalities per million people in 1975, by 2000 fatalities were down to less than 3. In 1975, these fatality rates were much higher for those under 15 years of age, while in 2000 the rate (or likelihood of being killed) was about the same for all age

Figure 1
Bicycle Fatalities in Motor Vehicle Crashes: 1975–2000



SOURCES: U.S. Department of Transportation, National Highway Traffic Safety Administration, *Fatality Analysis Reporting System* (FARS) database, available at http://www-fars.nhtsa.dot.gov/, as of April 2002.

[1] A pedalcyclist is a person on a vehicle powered solely by pedals. Pedalcycles may have one to four wheels. Bicycles (pedalcycles with two wheels) are the dominate type.

Table 1
Pedalcyclist Fatalities by Age Group: 1975 and 2000

Age group	Number of fatalities 1975	Number of fatalities 2000	Percent of fatalities 1975	Percent of fatalities 2000	Fatalities per million people (in age group) 1975	Fatalities per million people (in age group) 2000
Under 15 years	614	178	61.2	25.7	11.2	2.9
15–24	223	90	22.2	13.0	5.7	2.3
25–54	103	298	10.3	43.0	1.3	2.4
55–64	23	59	2.3	8.5	1.1	2.4
Over 65	40	68	4.0	9.8	1.8	2.1
Total	1,003	693	100.0	100.0	4.7	2.4

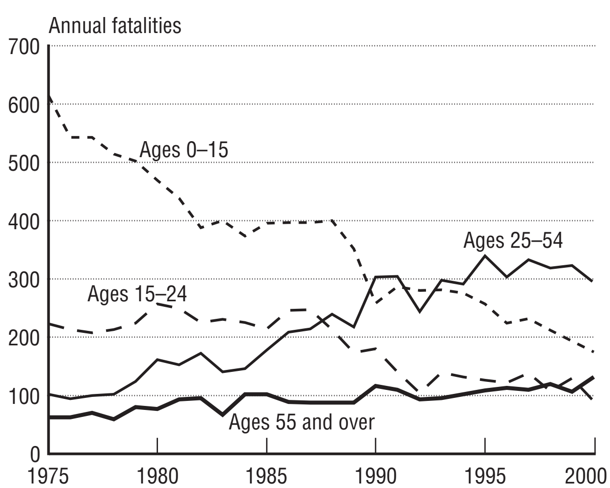
SOURCES: Fatalities—U.S. Dep[artment of Transportation, National Highway Traffic Safety Administration, *Fatality Analysis Reporting System* (FARS) database, available at http://www-fars.nhtsa.dot.gov/, as of April 2002.
Population data (2000)—U.S. Department of Commerce, U.S. Census Bureau, *Statistical Abstract of the United States: 2001,* available at http://www.census.gov.
Population data (1975)—U.S. Department of Transportation, Bureau of Transportation Statistics, calculated from data in U.S. Department of Commerce, U.S. Census Bureau, *Statistical Abstract of the United States: 1981* (Washington, DC: 1981).

groups. The median age of pedalcyclist fatalities shifted from 13 years old in 1975 to 36 years old in 2000.

Factors other than age appear to affect pedalcycling fatalities. In 2000, for instance, most pedalcycle fatalities (63 percent) occurred in urban areas, with two-thirds of these arising at nonintersection locations. In addition, most of the pedalcyclists injured or killed in 2000 were males: 78 percent and 88 percent, respectively [2]. In more than one-third of pedalcyclist fatalities, alcohol use was reported; one-fifth (21 percent) of pedalcyclists killed were intoxicated [8]. Nearly one-third of pedalcyclists involved in crashes were riding against traffic [1, table 37]. In fact, a study that calculated relative risk based on exposure rates found that pedalcycling against traffic increased the risk of a collision with a motor vehicle by a factor of 3.6 [9].

Although 90 percent of pedalcycle fatalities involve a collision with a motor vehicle, most pedalcycle injuries do not. There are about 500,000 pedalcycle-related emergency room visits annually [3]. Most of these pedalcycle mishaps involve falls and collisions with fixed objects; collisions with motor vehicles account for just 15 percent of the visits [2]. Collisions with pedestrians, other pedalcycles, and animals are apparently prevalent, but states do not generally record these data since they do not involve motor vehicles.

Figure 2
Bicycle Fatalities by Age of Bicyclist: 1975–2000



SOURCE: U.S. Department of Transportation, National Highway Traffic Safety Administration, *Fatality Analysis Reporting System* (FARS) database, available at http://www-fars.nhtsa.dot.gov/, as of April 2002.

Sources

1. Hunter, W.W., J.C. Stutts, and W.E. Pein, *Pedalcycle Crash Types: A 1990s Informational Guide,* FHWA-RD-96-104 (Washington, DC: U.S. Department of Transportation, Federal Highway Administration, 1997).
2. Rivara, F.P., D.C. Thompson, and R.S. Thompson, *Circumstance and Severity of Pedalcycle Injuries* (Seattle, WA: Snell Memorial Foundation, Harborview Injury Prevention and Research Center, 1996).
3. Tinsworth, D., C. Polen, and S. Cassidy, *Pedalcycle-Related Injuries: Injury, Hazard, and Risk Patterns, Technical Report* (Washington, DC: U.S. Consumer Product Safety Commission, 1993).
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6. ______. *Traffic Safety Facts 1996—Overview* (Washington, DC: 1996).
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8. ______. *Traffic Safety Facts 2000—Pedalcyclists* (Washington, DC: 2000).
9. Wachtel, A. and D. Lewiston, "Risk Factors for Pedalcycle-Motor Vehicle Collisions at Intersections," *ITE Journal,* September 1994, pp. 30–35.

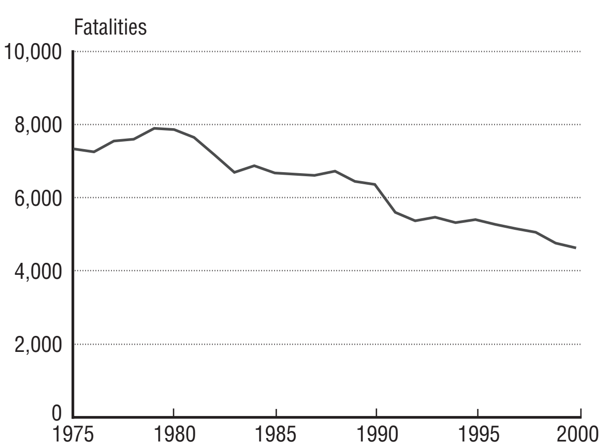
Pedestrians

In 2000, 4,763 pedestrians were killed in crashes involving motor vehicles, a 37 percent reduction since 1975 (figure 1). Many factors can contribute to motor vehicle-related pedestrian fatalities (table 1).

Data evaluating exposure risks faced by pedestrians are very limited. State data on pedestrian fatalities per 100,000 population show that the levels of fatalities vary across the country (figure 2).

Pedestrians comprised less than 3 percent of the 3,189,000 people injured in motor vehicle crashes in 2000, but just over 11 percent of the fatalities involving motor vehicles. The majority of pedestrian fatalities in 2000 occurred in urban areas (71 percent), at nonintersection locations (78 percent), in normal weather conditions (91 percent), and at night (64 percent). Additionally, males accounted for about 68 percent of the pedestrian fatalities in 2000. An estimated 31 percent of pedestrians killed in traffic crashes in 2000 were intoxicated (with a blood alcohol concentration of 0.10 or more), whereas only 13 percent of the drivers involved in fatal pedestrian crashes were [1].

Figure 1
Pedestrian Fatalities in Motor Vehicle Crashes: 1975–2000



SOURCE: U.S. Department of Transportation, National Highway Traffic Safety Administration, *Fatality Analysis Reporting System* (FARS) database, available at http://www-fars.nhtsa.dot.gov/, as of April 2002.

Source

1. U.S. Department of Transportation, National Highway Traffic Safety Administration, *Traffic Safety Facts 2000: Pedestrians* (Washington, DC: 2001).

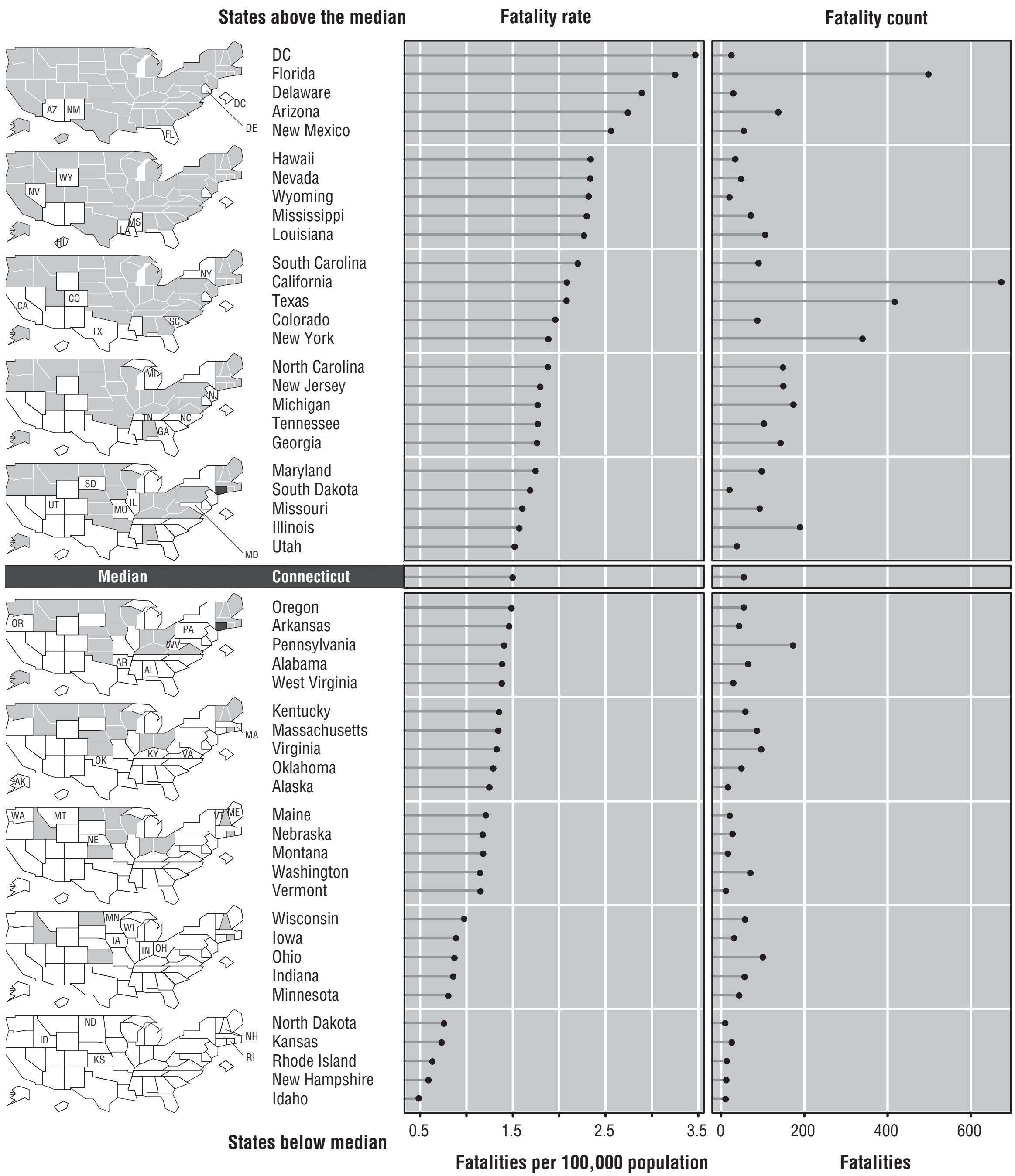
Table 1
Factors Relating to Pedestrian Fatalities: 2000

Factors	Number
Improper crossing of roadway or intersection	1,415
Walking, playing, working, etc., in roadway	1,214
Failure to yield right-of-way	680
Darting or running into road	612
Not visible	460
Inattentive (talking, eating, etc.)	124
Failure to obey traffic signs, signals, or officer	86
Physical impairment	84
Ill, blackout	22
Emotional (e.g., depressed, angry, disturbed)	21
Getting on/off/in/out of vehicle	21
Mentally challenged	17
Pedestrian pushing vehicle	11
Other factors	65
Unknown	81

NOTE: The sum of the numbers is greater than the total pedestrians killed as more than one factor may be present for the same pedestrian.

SOURCE: U.S. Department of Transportation, National Highway Traffic Safety Administration, *Fatality Analysis Reporting System* (FARS) database, available at http://www-fars.nhtsa.dot.gov/, as of April 2002.

Figure 2
Pedestrian Traffic Fatalities by State: 2000



NOTE: Washington, DC, a 68 square-mile territory, has approximately 523,000 residents and hosts a daily influx of 1 million commuters. The pedestrian fatality rate in DC may be high relative to the 50 states because the district is more densely populated and urban compared with states.

SOURCE: U.S. Department of Transportation, National Highway Traffic Safety Administration, *Fatality Analysis Reporting System* (FARS) database, November 2001.

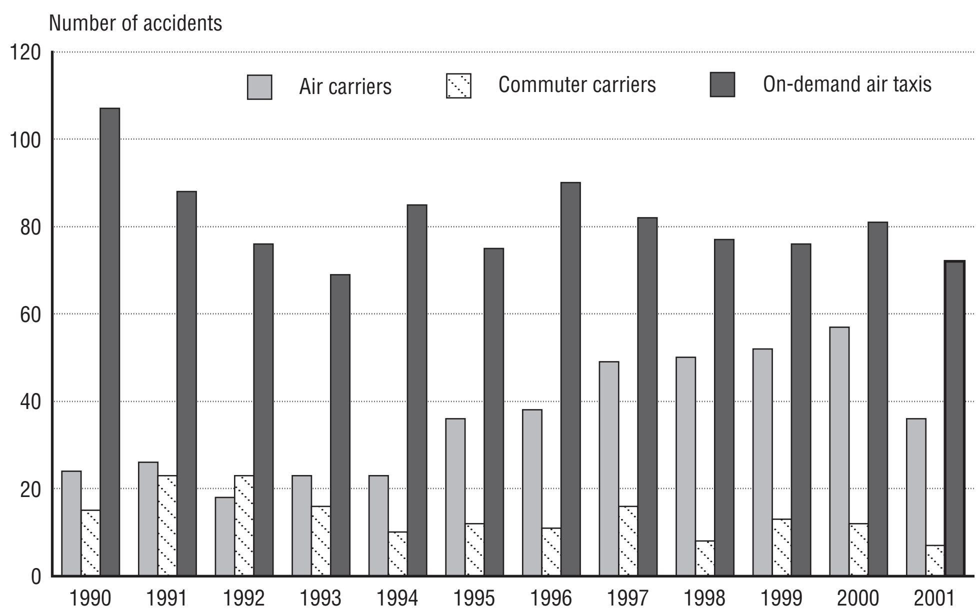
Commercial Aviation

Despite the tragic loss of four U.S. airliners to a terrorist attack in September 2001, aviation continues to be a remarkably safe mode of transportation. U.S. air carriers experience less than one fatal crash for every million flights [1]. Preliminary statistics show that trend unchanged in spite of September 11.

There were 36 air carrier accidents in 2001, including the 4 crashes on September 11 (figure 1). Despite the loss of four aircraft on September 11 and American Airlines Flight 587 on November 12, the air carrier fatality rate has remained stable. Fatalities resulting from criminal acts are not included in the calculation of accident fatality rates (see box on the next page). Air carriers experienced 0.22 deaths per 100,000 flight hours in 2001, the same fatality rate in 1991 and less than that in 2000 (0.32 deaths per 100,000 hours) (figure 2).

However, the six fatal air carrier accidents in 2001 resulted in 531 fatalities (table 1). That is the highest number of air carrier fatalities in over 40 years. On September 11,

Figure 1
Commercial Aviation Accidents by Type of Operation:1990–2001



NOTE: Data for 2001 are preliminary.

SOURCE: National Transportation Safety Board, *Accidents, Fatalities, and Rates: 1982–2001* (Washington, DC: 2002).

Aviation Fatalities Resulting from Sabotage, Suicide, or Terrorism

The National Transportation Safety Board (NTSB), an independent government agency, tracks the number of U.S. aviation accidents and fatalities. NTSB includes all aviation fatalities resulting from illegal acts—sabotage, suicide, or terrorism—in its data. However, because these fatalities result from intentional acts of violence, rather than accidents, NTSB excludes them from its calculations of fatality rates.

According to NTSB statistics, illegal acts have resulted in 583 aviation fatalities since 1982 (the earliest year for which data are available) (see table below). However, although NTSB normally includes ground fatalities in its accounting of fatalities, the Board did not include the people killed on the ground as a result of the September 11 crashes.

An estimated 2,645 people were killed when two planes hit the World Trade Center in New York City. A third plane hit the Pentagon, killing 125 people inside the building. A fourth plane crashed in a field in rural Pennsylvania and did not result in any ground fatalities.

U.S. Air Carrier Fatalities Involving Illegal Acts: 1982–2001

Year	Location	Operator	Aboard	Ground	Total
1982	Honolulu, HI	Pan American	1	0	1
1986	Near Athens, Greece	Trans World	4	0	4
1987	San Luis Obispo, CA	Pacific Southwest	43	0	43
1988	Lockerbie, Scotland	Pan American	259	11	270
1994	Memphis, TN	Federal Express	0	0	0
2001	New York, NY	American Airlines	92	–	92
2001	New York, NY	United Airlines	65	–	65
2001	Arlington, VA	American Airlines	64	–	64
2001	Shanksville, PA	United Airlines	44	–	44
Total			**572**	**11**	**583**

NOTE: Fatalities of approximately 3,000 people not on board have been excluded for the Sept. 11, 2001, crashes.

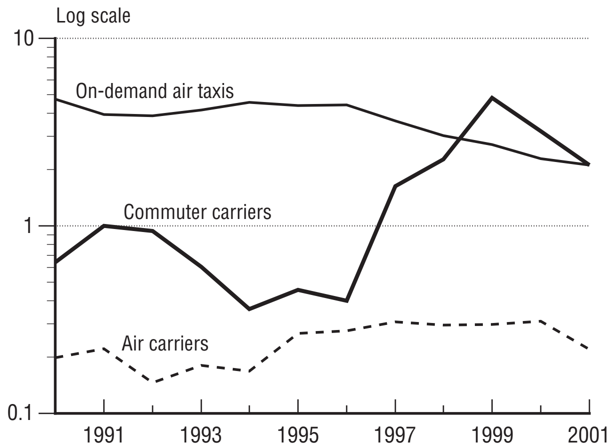
SOURCE: National Transportation Safety Board, *Aviation Accidents, Fatalities, and Rates: 1982–2001* (Washington, DC: 2002), table 12.

all 265 people on board 4 planes were killed when the planes were crashed by terrorists. American Airlines Flight 587 was en route from John F. Kennedy International Airport in New York City to Santo Domingo in the Dominican Republic when it crashed shortly after takeoff on November 12. All 260 people on board and 5 people on the ground were killed by the crash. One ground worker was struck and killed by an airplane propeller in August.

In addition to air carriers, there are two other categories of commercial aviation flights: scheduled commuter flights and on-demand air taxis.[1] There were 2 fatal U.S. commuter plane accidents and 18 fatal on-demand air taxi accidents during 2001, resulting in 73 deaths [1]. Overall, commercial aviation, including air carrier, commuter, and on-demand air taxi flights, accounted for 52 percent of all air-related fatalities in 2001.

[1] For safety reporting and analysis, commercial aviation consists of air carriers (those with aircraft having 10 or more seats), cargo haulers, commuter carriers (those with aircraft having 9 seats or fewer in scheduled service), air taxi service (those carriers with aircraft having 9 seats or fewer in unscheduled service), and helicopter service.

Figure 2
Commercial Carrier Accident Rates: 1990–2001
(Per 100,000 flight hours)



NOTE: Data for 2001 are preliminary.

SOURCE: National Transportation Safety Board, *Accidents, Fatalities, and Rates: 1982–2001* (Washington, DC: 2002).

The remaining fatalities resulted from general aviation accidents.

The overall accident rate for all three types of commercial aviation operations combined is 0.58 accidents per 100,000 flight hours. However, differences in the accident rates among the three types of operations do exist (figure 2). For example, the accident rate for air carriers has historically been well below that of commuter carriers and air taxis.

Finally, although the overall accident and fatality rates for commercial aviation remain low, the continued growth forecast for U.S. aviation in the coming decade raises concern. The Federal Aviation Administration (FAA) estimates that commercial aviation aircraft (excluding air taxis) will fly more than 24 million hours in 2007, a 37 percent increase over 1999. Commercial aviation (excluding air taxis) experienced an average of six fatal accidents each year in the United States between 1994 and 1996. If the projected growth in flight hours occurs and the fatal accident rate is not reduced, aviation experts estimate that the number of fatal commercial aviation accidents could rise to nine per year by 2007. To address this potential danger, FAA's "Safer Skies" program has a goal of reducing the number of fatal commercial accidents per million flight hours by 80 percent by 2007 [2].

Sources

1. National Transportation Safety Board, *Accidents, Fatalities, and Rates: 1982–2001* (Washington, DC: 2002), also available at http://www.ntsb.gov/aviation/htm, as of April 2002.
2. U.S. Department of Transportation, Federal Aviation Administration, *Safer Skies: A Focused Agenda,* 2000, available at http://www/faa.gov/apa/safer_skies/saftoc.htm, as of Sept. 20, 2000.

Table 1
Number of Commercial Aviation Fatalities by Type of Operation: 1990–2001

Category	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Air carriers	39	62	33	1	239	168	380	8	1	12	92	[1]531
Commuter carriers	6	99	21	24	25	9	14	46	0	12	5	13
On-demand air taxis	51	78	68	42	63	52	63	39	45	38	71	60

[1] Does not include ground fatalities, which are normally part of the total fatalities and are included in the other years shown in the table.

NOTE: Data for 2001 are preliminary.

SOURCE: National Transportation Safety Board, *Accidents, Fatalities, and Rates: 1982–2001* (Washington, DC: 2002).

General Aviation

Most aviation accidents involve general aviation (GA) aircraft[1] (table 1); however, GA fatalities and fatality rates have decreased over the last quarter century (figure 1). In 1975, general aviation experienced 1,252 fatalities—over twice as many as the 553 reported in 2002 (preliminary data). Moreover, the fatality rate (expressed as fatalities per 100,000 hours flown) declined from 4.35 to 1.22 over the same period [2].

The major causes of fatal general aviation accidents are weather, pilot loss of control or other maneuvering errors made during flight, and accidents on approach to the airport [5]. Nearly one-quarter of all general aviation accidents between 1989 and 1999 were related to weather [3]. Furthermore, the number of fatalities also varies a great deal by month, with fewer fatalities generally occurring in the winter months because of fewer flights (figure 2).

Another area of concern is the growing number of runway incursions[2] involving GA aircraft. In 1999, GA pilot error caused 139 (76 percent) of the 183 runway incursions [1].

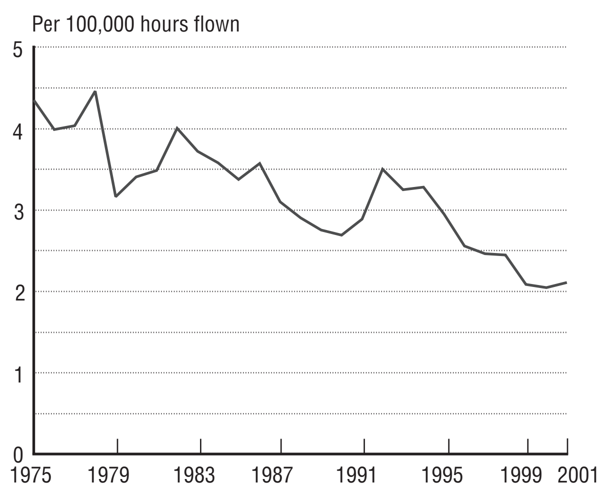
Table 1
Fatal Accidents and Deaths by Type of Aviation Operation: 1990–2001

Type of operation	Fatal accidents		Deaths	
	Number	Percent	Number	Percent
General aviation	4,628	93	8,295	77
Commercial aviation	347	7	2,510	23
Total	**4,975**	**100**	**10,805**	**100**

NOTES: The number of commercial aviation fatal accidents and deaths include those that occurred on Sept. 11, 2001.
2001 data are preliminary.

SOURCE: National Transportation Safety Board, *Aviation Accident Statistics,* available at http://www.ntsb.gov/aviation/Stats.htm, as of April 2002.

Figure 1
General Aviation Fatality Rates: 1975–2001



NOTE: 2001 data are preliminary.

SOURCES: National Transportation Safety Board, *Accidents, Fatalities, and Rates: 1982–2001* (Washington, DC: 2002), also available at http://www.ntsb.gov/aviation/Stats.htm, as of April 2002; and U.S. Department of Transportation, Bureau of Transportation Statistics, *National Transportation Statistics Historical Compendium: 1960–1992* (Washington, DC: 1993).

[1] General aviation includes a wide variety of aircraft, ranging from corporate jets to small piston-engine aircraft used for recreational purposes, as well as helicopters, gliders, and aircraft used in operations such as firefighting and agricultural spraying.

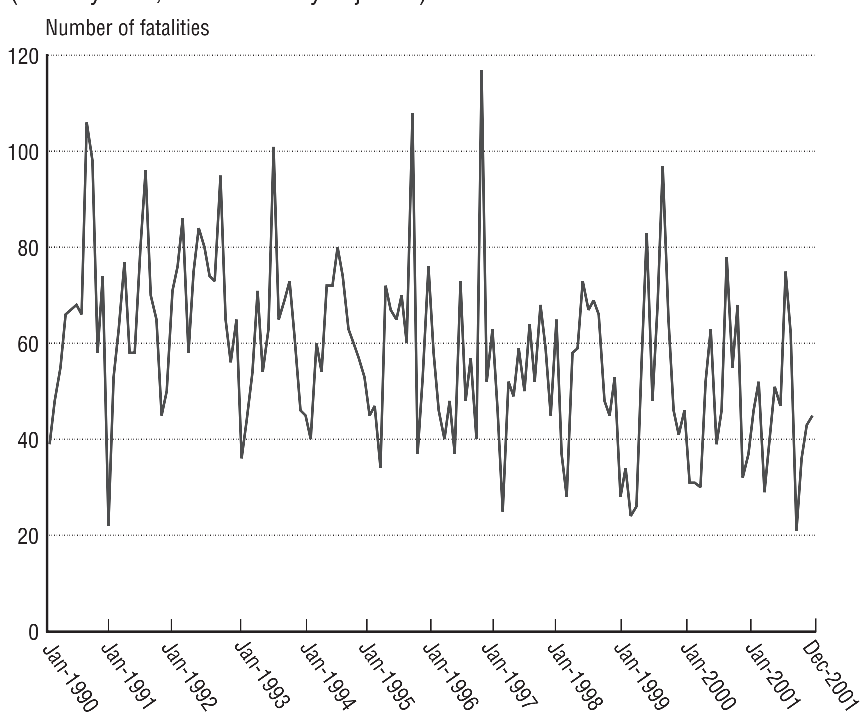
[2] A *runway incursion* is any occurrence on a runway involving an aircraft, vehicle, or pedestrian that creates a collision hazard for aircraft taking off, intending to take off, landing, or intending to land.

Changes in flight hours can also affect accident rates. The Federal Aviation Administration (FAA) estimates that GA flight hours will increase to about 36 million hours by 2007—nearly 19 percent higher than 1999. Although general aviation accidents and fatalities have been trending downward for 25 years, aviation experts believe these numbers will rise over the next decade with the projected increase in flight hours. Because of the potential safety implications associated with rapid growth in both commercial and GA flight hours, FAA initiated the "Safer Skies" program in 1998 with the goal of reducing aviation accident rates [4].

Sources

1. Deyoe, Robin, Runway Safety Program Office, Federal Aviation Administration, U.S. Department of Transportation, personal communication, Sept. 13, 2000.
2. National Transportation Safety Board, *Accidents, Fatalities, and Rates: 1982–2000* (Washington, DC: 2001), also available at http:// www.ntsb.gov/aviation/htm, as of Apr. 17, 2001.
3. U.S. Department of Transportation, Federal Aviation Administration, Weather Study Index, available at https://www.nasdac.faa.gov/aviation_studies/weather_study/studyindex.html, as of June 2002.
4. ____. *Safer Skies: A Focused Agenda,* 2000, available at http://www/faa.gov/apa/safer_skies/saftoc.htm, as of Sept. 20, 2000.
5. U.S. General Accounting Office, Resources, Community, and Economic Development Division, *Aviation Safety: Safer Skies Initiative Has Taken Initial Steps to Reduce Accident Rates by 2007* (Washington, DC: June 2000).

Figure 2
General Aviation Fatalities: 1990–2001
(Monthly data, not seasonally adjusted)



NOTE: 2001 data are preliminary.

SOURCE: National Transportation Safety Board, Office of Aviation Safety, available at http://www.ntsb.gov/aviation, as of April 2002.

Commercial Maritime Vessel Incidents

About 50,000 commercial vessels carrying freight and passengers call at U.S. ports every year. In 2000, there were almost 7,000 verified U.S. and foreign vessel incidents[1] in U.S. waters. Over the last six years, the number of commercial vessel incidents in U.S. waters has declined (table 1). Approximately 90 percent of these incidents occurred among 10 vessel types, and this concentration has been increasing since 1997.

Towboats and tugboats have ranked as the number one vessel type involved in incidents since 1994. Prior to 1994, fishing vessels ranked number one; they now rank second. However, the number of incidents involving both of these vessel types has been declining in recent years [5]. Towboats and tugboats primarily push and pull barges on U.S. inland waterways and provide tug assist services in ports and along coastal areas. Towboats and tugboats, which can handle as many as 35 barges at a time, have limited maneuverability, especially when the crew is involved in maneuvering barges [4]. People falling overboard account for the majority of the fatalities in the inland towing industry [2].

A study of U.S. maritime incident data revealed that in 2000 the highest proportion (42 percent) of all maritime fatalities occurred among commercial fishing vessels. The next highest proportion of fatalities were among towboats and barges (11 percent), freight ships (10 percent), and passenger vessels (10

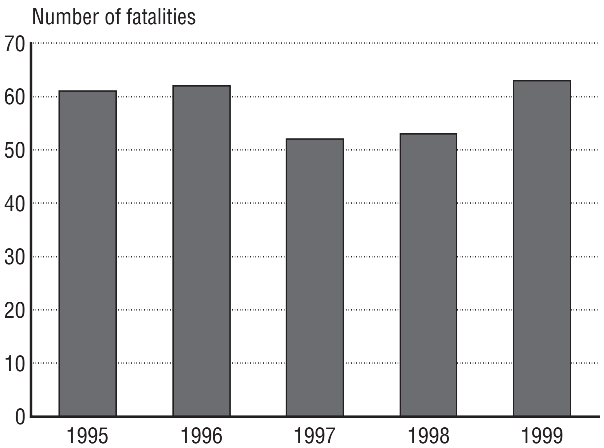
[1] Incidents are defined as collisions, groundings, and "allisions" (when two vessels sideswipe each other).

Table 1
Number of Commercial Vessel Incidents by Type of Vessel—Top 10 Vessel Types: 1992–2000

Vessel type	1992	1993	1994	1995	1996	1997	1998	1999	2000
Towboat/tugboat	1,508	1,690	2,355	2,633	2,429	2,211	2,180	2,049	1,802
Fishing boat	1,984	1,991	1,959	1,546	1,296	1,284	1,154	1,232	1,125
Passenger ship	684	789	932	982	977	903	944	936	908
Freight barge	723	795	909	983	964	792	747	771	640
Tank barge	818	861	1,066	949	799	778	729	647	619
Freight ship	915	955	1,037	937	746	701	689	668	510
Recreational boat	489	639	718	277	189	325	411	437	480
Tank ship	542	545	628	467	355	358	348	286	230
Oversized vessel	210	242	184	135	136	146	179	138	131
Unclassified vessel	146	132	175	153	397	393	223	166	115
Total, top 10	**8,019**	**8,639**	**9,963**	**9,062**	**8,288**	**7,891**	**7,604**	**7,330**	**6,560**
Total, all vessels	**8,734**	**9,457**	**10,852**	**9,806**	**9,191**	**8,915**	**8,479**	**7,862**	**6,903**
Percentage of total, top 10	91.8%	91.4%	91.8%	92.4%	90.2%	88.5%	89.7%	93.2%	95.0%

SOURCE: U.S. Department of Transportation, U.S. Coast Guard, Resources Management Directorate, Data Administration Division, personal communication, February 2001.

Figure 1
Worker Fatalities on Fishing Vessels: 1995–1999



SOURCE: U.S. Department of Transportation, U.S. Coast Guard, *U.S. Coast Guard Marine Safety and Environmental Protection Business Plan FY 2001–2005,* available at http://www.uscg.mil, as of February 2001.

Figure 2
Commercial Vessel Incidents Involving Recreational Boats: 1992–2000

SOURCE: U.S. Department of Transportation, U.S. Coast Guard, Resources Management Directorate, Data Administration Division, personal communication, February 2001.

percent) [1]. The U.S. Coast Guard, which estimates that there are between 100,000 to 120,000 vessels in the U.S. commercial fishing fleet, believes the industry to be one of the most hazardous in the nation [3]. The number of fishing vessel worker fatalities may be climbing after a drop in 1997 (see figure 1). This may be due to increased economic pressure and competition in the commercial fishing industry, which encourages risk taking [3].

The number of recreational boats involved in commercial vessel incidents has been climbing since 1996 (figure 2). The safety of these boaters can be dependent on their ability to identify commercial vessels, particularly tugboats and towboats, and accurately assess their movements [2].

Sources

1. Ungs, Timothy J. and Michael L. Adess, U.S. Department of Transportation, U.S. Coast Guard, *Water Transportation and the Maritime Industry,* available at http://www.uscg.mil, as of February 2001.
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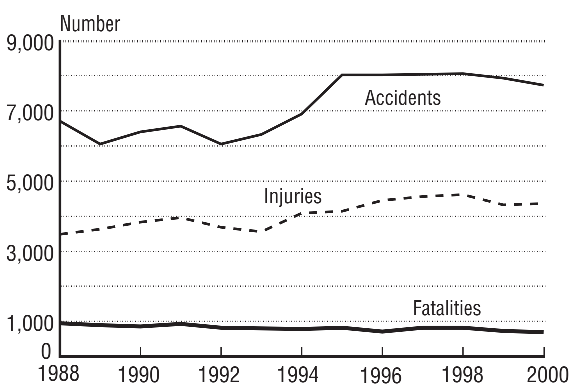
3. ____. *U.S. Coast Guard Marine Safety and Environmental Protection Business Plan FY 2001–2005,* available at http://www.uscg.mil, as of February 2001.
4. U.S. Department of Transportation, U.S. Coast Guard, Marine Safety Office, Providence, RI, available at http://www.uscg.mil, as of Feb. 24, 2001.
5. U.S. Department of Transportation, U.S. Coast Guard, Resources Management Directorate, Data Administration Division, personal communication, February 2001.

Recreational Boating

Most fatalities, injuries, and accidents on the water involve recreational boating. In 2000, the U.S. Coast Guard (USCG) reported a total of 7,740 recreational boating accidents and 4,355 injuries (figure 1). Personal watercraft and open motorboats account for the highest number of these accidents. Although fatalities remain high, the number has declined from 865 in 1990 to 701 in 2000. More than one-third of recreational boating accidents involved collisions with other vessels in 2000 (table 1). Substantially more drownings were related to the use of open motorboats than for any other type of recreational craft (table 2).

Figure 1
Recreational Boating Accidents, Injuries, and Fatalities: 1990–2000



SOURCE: U.S. Department of Transportation, U.S. Coast Guard, Office of Boating Safety, *Boating Statistics 2000* (Washington, DC: 2001).

Table 1
Types of Recreational Boating Accidents: 2000

Accident type	Accidents	Injuries	Fatalities
Collision with vessel	2,706	1,413	67
Collision with fixed object	851	484	42
Falls overboard	610	434	213
Capsizing	502	207	205
Grounding	494	257	8
Skier mishap	442	459	4
Flooding/swamping	419	61	47
Fall in boat	316	327	5
Struck submerged object	199	41	7
Sinking	187	40	22
Fire/explosion (fuel)	183	93	2
Struck by boat	157	131	5
Collision with floating object	151	73	9
Fire/explosion (other than fuel)	116	25	7
Struck by motor/propeller	88	86	3
Carbon monoxide	8	19	3
Other and unknown	311	205	52
Totals	**7,740**	**4,355**	**701**

SOURCES: U.S. Department of Transportation, U.S. Coast Guard, Office of Boating Safety, *Boating Statistics 2000* (Washington, DC: 2001); and personal communication, Apr. 29, 2002.

The majority of recreational boating accidents occurred during vessel operation and were caused by operator error, such as recklessness, inattention, and speed (table 3). Alcohol involvement accounted for 6.8 percent of accidents due to operator error in 2000. USCG found that 84 percent of all boating fatalities occurred on boats where the operator lacked safe boating education [1].

Regardless of the cause of the accident or the type of boat involved, boaters can improve their chances of survival by wearing life jackets or using other personal flotation devices (PFDs). Eight out of 10 fatal boating accident

Table 2
Number of Fatalities by Type of Vessel: 2000

Boat type	Total	Drownings	Other deaths
Open motorboat	**361**	280	81
Canoe/kayak	**104**	93	11
Personal watercraft	**68**	24	44
Cabin motorboat	**65**	32	33
Rowboat	**38**	35	3
Inflatable	**16**	15	1
Auxiliary sail	**12**	12	0
Houseboat	**9**	7	2
Sail (only)	**7**	4	3
Pontoon	**3**	3	0
Jet boat	**1**	0	1
Air boat	**1**	1	0
Other and unknown	**16**	13	3
Total	**701**	**519**	**182**

SOURCE: U.S. Department of Transportation, U.S. Coast Guard, Office of Boating Safety, *Boating Statistics 2000* (Washington, DC: 2001).

victims were not wearing a PFD. USCG estimates that the use of life jackets could have saved the lives of 445 drowning victims in 2000 [1].

Sources

1. U.S. Department of Transportation, U.S. Coast Guard, Office of Boating Safety, *Boating Statistics 2000* (Washington, DC: 2001).

Table 3
Recreational Boating Accidents Due to Operator Error: 2000

Cause	Accidents
Operator inattention	959
Careless/reckless operation	907
Operator inexperience	905
Excessive speed	630
No proper lookout	602
Alcohol use	346
Passenger/skier behavior	303
Restricted vision	116
Rules of the road infraction	107
Sharp turn	48
Overloading	47
Improper anchoring	42
Standing/sitting on gunwale, bow or transom	33
Failure to ventilate	19
Lack of or improper boat lights	14
Off throttle steering-jet	9
Starting in gear	4
Drug use	3
Number of accidents	**5,094**

SOURCE: U.S. Department of Transportation, U.S. Coast Guard, Office of Boating Safety, *Boating Statistics 2000* (Washington, DC: 2001).

Rail

Most railroad fatalities occur on railroad rights-of-way and at highway-rail grade crossings, not on trains. (Railroad casualties include people killed and injured in train and non-train incidents and accidents on railroad-operated property.) Of the 937 people killed in accidents and incidents involving railroads in 2000, only 4 were train passengers. As major train accidents are relatively infrequent, the number of fatalities fluctuates from year to year (table 1). The fatality rate per million train-miles changed little between 1978 and 1993, but since that time has dropped by about 40 percent (figure 1).

Although far fewer people die in highway-rail grade-crossing accidents than in the past, the toll is still large (figure 2). Of the 425 lives lost in 2000 in this type of accident, none were passengers on trains; all were in motor vehicles or on foot [1].

Trespassers not at grade crossings (people on railroad property without permission) accounted for 463 (49 percent) of the railroad deaths in 2000. Better understanding of trespassing and its motivations could be essential to addressing this high toll.

Source

1. U.S. Department of Transportation, Federal Railroad Administration, *Railroad Safety Statistics Annual Report 2000* (Washington, DC: July 2001).

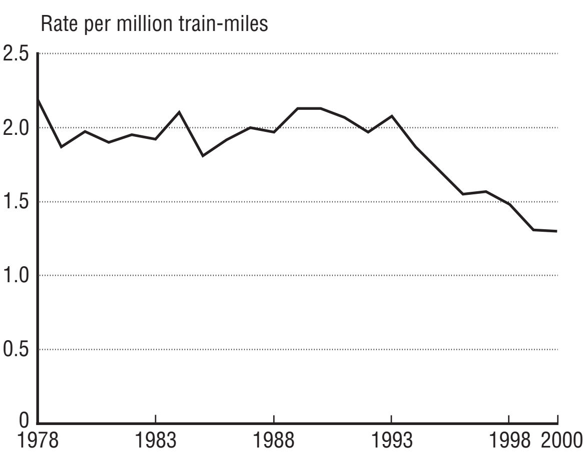
Table 1
Train Accidents and Fatalities
Excludes highway-rail crossings

Year	Accidents	Fatalities
1978	10,991	61
1980	8,205	29
1985	3,275	8
1990	2,879	10
1995	2,459	14
2000	2,983	10

NOTE: *Train accidents* are events involving on-track rail equipment that result in monetary damage to the equipment and track above a certain threshold. In 1998, that threshold was $6,600. Most trespasser, nontrespasser, and employee fatalities result from events that are categorized as incidents (rather than accidents).

SOURCE: U.S. Department of Transportation, Federal Railroad Administration, *Accident/Incident Overview* (Washington, DC: Annual issues).

Figure 1
Rail-Related Fatality Rate: 1978–2000



NOTE: Includes all rail-related fatalities (highway-rail grade crossing, trespasser, nontrespasser, employee, passenger, and other fatalities).

SOURCE: U.S. Department of Transportation, Federal Railroad Administration, *Accident/Incident Overview* (Washington, DC: Annual issues).

Figure 2
Highway-Rail Grade-Crossing Fatalities: 1993–2000

SOURCE: U.S. Department of Transportation, Federal Railroad Administration, *Railroad Safety Statistics Annual Report 2000* (Washington, DC: July 2001), also available at http://www.fra.dot.gov, as of Dec 18, 2001.

Pipelines

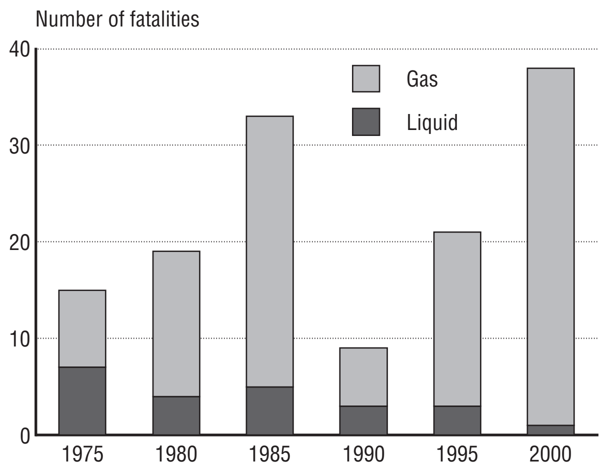
Pipelines carry vast quantities of liquids and gases to fuel the nation's commercial and consumer demands. Transmission pipelines, which total about 325,000 miles, transport natural gas over long distances from sources to communities. Distribution pipelines, which then move natural gas to residential, commercial, and industrial customers, consist of about 1.7 million miles and are primarily intrastate. Hazardous liquid pipelines total about 156,000 miles and transport mostly crude oil and refined petroleum products to terminals and facilities [2].

Pipelines are a relatively safe way to transport energy resources and other products, but they are subject to forces of nature, human actions, and material defects that can cause potentially catastrophic accidents [3]. The U.S. Department of Transportation issues regulations covering pipeline design, construction, operation, and maintenance for both natural gas and interstate hazardous liquid pipelines.

Pipeline Accident and Incident Data Reporting

There are approximately 900 operators of transmission pipelines, 2,500 operators of distribution pipelines, and 220 operators of hazardous liquid pipelines. Operators are required to report accidents and incidents (i.e., releases of pipeline content) to the Department of Transportation's Office of Pipeline Safety (OPS) within 30 days. The data are reported on individual forms, and OPS compiles the information in three distinct databases. Each of the pipeline databases have similar but varying cause codes to record failures of the three types of pipelines. About 25 percent of the forms filed in the databases show "other" as the reported cause. This code is often used on pipeline forms to report releases that have occurred as a result of natural disasters, such as a flood or landslide, or when the cause could not be determined within the required reporting period. OPS is revising the forms used to collect data for the three databases in an attempt to improve the accuracy and detail of the data collected.

Figure 1
Fatalities in Pipeline Incidents



SOURCE: U.S. Department of Transportation, Research and Special Programs Administration, Office of Pipeline Safety.

The number of fatalities related to pipeline incidents varies from year to year, reflecting the high consequences associated with a limited number of failures (figure 1). The 38 pipeline fatalities in 2000 were more than twice the number recorded in 1975 [1]. One natural gas pipeline rupture was responsible for killing 12 people near the Pecos River in Carlsbad, New Mexico, in August 2000. It was the deadliest pipeline incident in the continental United States in almost 25 years. Overall, there were 234 gas pipeline incidents and 146 liquid pipeline accidents in 2000.[1]

[1] The use of the terms "gas pipeline incident" and "liquid pipeline accident" does not imply different types of events but rather is a consequence of the official reporting forms.

Major causes of pipeline accidents include excavation and other outside force damage, material failure, and corrosion. However, the causes vary by year and by type of pipeline. Most gas pipeline incident reports consistently cite external damage (i.e., "damage by outside force") (tables 1 and 2). However, for liquid pipelines the "other" category most often designates the cause, depending on the year (table 3).

Major advances in the materials used for pipes and welding, inspections, and the installation process over the past 25 years have reduced the number of leaks and made those that take place less severe. New corrosion coatings and new application processes have produced dramatically longer lives for pipes.

Sources

1. National Transportation Safety Board, *We Are All Safer,* SR-98-01, 2nd ed. (Washington, DC: July 1998), also available at http://www.ntsb.gov/Publictn/1998/SR9801.pdf, as of Dec. 20, 2001.
2. U.S. General Accounting Office, *The Office of Pipeline Safety is Changing How it Oversees the Pipeline Industry*, GAO/RCED-00-128 (Washington, DC: May 2000).
3. U.S. Department of Transportation, Research and Special Programs Administration, Office of Pipeline Safety, *Pipeline Statistics* (Washington, DC: 2000), also available at http://ops.dot.gov/stats.htm, as of Dec. 20, 2001.

Table 1
U.S. Gas Transmission Pipeline Incidents: 1995–2000

							Average	
Cause	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**1995–2000**	**Percent**
Construction/material defect	13	8	12	19	8	7	11	15
Corrosion, external	4	8	5	8	3	14	7	9
Corrosion, internal	5	7	16	14	10	16	11	15
Corrosion, not specified	0	0	0	0	1	1	0.3	0.4
Damage by outside force	27	38	28	37	18	20	28	37
Other	15	16	12	21	14	22	17	22
Total	**64**	**77**	**73**	**99**	**54**	**80**	**75**	**99**

SOURCE: U.S. Department of Transportation, Research and Special Programs Administration, Office of Pipeline Safety, from Form RSPA F-7100.2, available at http://ops.dot.gov/stats.htm, as of Oct. 1, 2001.

Table 2
U.S. Gas Distribution Pipeline Incidents: 1995–2000

							Average	
Cause	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**1995–2000**	**Percent**
Accidentally caused by operator	6	6	4	7	6	7	6	5
Construction/operating error	5	6	4	5	8	9	6	5
Corrosion, external	3	1	3	6	4	4	4	3
Corrosion, internal	0	1	0	0	0	1	0.3	0.3
Corrosion, not specified	0	0	0	0	3	0	1	0.4
Damage by outside force	66	64	57	89	72	82	72	60
No data	0	1	0	0	0	6	1	1
Other	17	31	34	30	26	45	31	25
Total	**97**	**110**	**102**	**137**	**119**	**154**	**120**	**100**

SOURCE: U.S. Department of Transportation, Research and Special Programs Administration, Office of Pipeline Safety, from Form RSPA F-7100.1, available at http://ops.dot.gov/stats.htm, as of Oct. 1, 2001.

Table 3
U.S. Liquid Pipeline Accidents by Cause: 1995–2000

Cause	1995	1996	1997	1998	1999	2000	Average 1995–2000	Percent
Corrosion, external	23	39	33	19	24	21	27	16
Corrosion, internal	13	21	16	20	11	11	15	9
Corrosion, not specified	0	0	1	1	1	1	1	0.4
Failed pipe	14	10	11	7	3	7	9	5
Failed weld	9	9	3	6	14	10	9	5
Incorrect operation by operator personnel	26	11	11	7	16	9	13	8
Malfunction of control or relief equipment	5	6	7	9	7	5	7	4
Other	45	49	49	42	63	46	49	29
Damage by outside force	53	48	40	42	29	36	41	24
Total	**188**	**193**	**171**	**153**	**168**	**146**	**170**	**100**

SOURCE: U.S. Department of Transportation, Research and Special Programs Administration, Office of Pipeline Safety, from Form RSPA F-7100.1, available at http://ops.dot.gov/stats.htm, as of Oct. 1, 2001.

Hazardous Materials Transportation Accidents and Incidents

Like all modes of transportation, the movement of hazardous materials comes with the risk of accidents and incidents, including the threat of explosion, fire, or contamination of the environment. The safe transportation of hazardous materials has long been an area of governmental concern and oversight. The U.S. Department of Transportation (DOT), together with the Nuclear Regulatory Commission (for radioactive materials), are responsible for developing safety regulations for the transportation of hazardous materials, including training and packaging requirements, emergency response measures, enforcement, and data collection.

In 2000, over 17,000 incidents were reported to DOT's Hazardous Materials Information System (HMIS), the primary source of national data on hazardous materials transportation safety (table 1). These incidents resulted in 13 deaths and 244 injuries directly attributable to the materials being transported [1]. More than 85 percent of reported incidents occurred on the nation's highways.

Modal incident data reported to the HMIS database can be sorted into various hazard classes. There are nine broad hazard classes defined in the hazardous materials regulations. They include several categories of explosives; flammable, nonflammable, and poisonous gases; flammable and combustible liquid; flammable, spontaneously combustible, and dangerous when wet material; oxidizers and organic peroxide; poisonous materials and infectious substances (see box); radioactive material; corrosive material; and miscellaneous

Table 1
Hazardous Materials Transportation Fatalities, Injuries, and Incidents: 1991–2000

Fatalities

Year	Air	Highway	Rail	Water	Total
1991	0	10	0	0	**10**
1992	0	16	0	0	**16**
1993	0	15	0	0	**15**
1994	0	11	0	0	**11**
1995	0	7	0	0	**7**
1996	110	8	2	0	**120**
1997	0	12	0	0	**12**
1998	0	13	0	0	**13**
1999	0	7	0	0	**7**
2000	0	12	1	0	**13**
Total	**110**	**111**	**3**	**0**	**224**

Injured persons

Year	Air	Highway	Rail	Water	Total
1991	31	333	75	0	**439**
1992	23	465	116	0	**604**
1993	50	511	66	0	**627**
1994	57	425	95	0	**577**
1995	33	296	71	0	**400**
1996	33	216	926	0	**1,175**
1997	24	156	45	0	**225**
1998	20	153	22	2	**197**
1999	12	205	35	0	**252**
2000	5	157	82	0	**244**
Total	**288**	**2,926**	**1,533**	**2**	**4,749**

Incidents

Year	Air	Highway	Rail	Water	Total
1991	299	7,644	1,155	12	**9,110**
1992	413	7,760	1,130	8	**9,311**
1993	622	11,080	1,120	8	**12,830**
1994	929	13,995	1,157	6	**16,087**
1995	814	12,764	1,153	12	**14,743**
1996	916	11,917	1,112	6	**13,951**
1997	1,028	11,863	1,103	5	**13,999**
1998	1,380	12,971	990	11	**15,352**
1999	1,576	14,443	1,061	8	**17,088**
2000	1,419	14,861	1,052	15	**17,347**
Total	**9,402**	**119,771**	**11,040**	**91**	**140,304**

NOTE: Hazardous Materials Information System data, including historical data, are updated and corrected on a regular basis.
SOURCE: U.S. Department of Transportation, Hazardous Materials Information System database, available at http://www.hazmat.dot.gov, as of July 19, 2001.

hazardous materials. The 9 classes are further disaggregated into 22 divisions to enhance the usefulness of the data for analytical purposes. These data, along with flow/exposure data provided by the Commodity Flow Survey,[1] can assist in evaluating the risk of transporting hazardous materials.

For air, highway, and rail modes, two categories of materials constitute the great majority of incidents: flammable combustible liquids and corrosive materials (table 2). This is true for water shipments, as well, but HMIS data for this mode are sparse, because only those water incidents involving packaged hazardous materials, generally in non-bulk packages, are subject to the HMIS incident reporting. Most water spills are reported to the U.S. Coast Guard (see the Energy and the Environment chapter).

Source

1. U.S. Department of Transportation, Hazardous Materials Information System database, available at http://hazmat.dot.gov, as of July 19, 2001.

Infectious Substance: Anthrax

When shipped as a material between laboratories conducting experiments, anthrax is treated as a hazardous material and falls under the infectious substance division. Shipments, thus, have to conform to the U.S. Department of Transportation (DOT) regulations, which include how the material is packaged.

Anthrax contaminated wastes generated from cleaning up private and public office buildings and post offices following the Fall 2001 mailings of envelopes containing the substance are, however, treated as infectious wastes, a category of solid wastes regulated under the Resource Conservation and Recovery Act (RCRA). The U.S. Environmental Protection Agency, which is responsible for implementing RCRA in partnership with individual states, set up special guidelines on disposal practices for the anthrax-contaminated wastes. Shipments of the wastes to disposal areas, however, must conform to DOT hazardous materials rules.

[1] The Commodity Flow Survey (CFS) is conducted every five years by the Bureau of Transportation Statistics in partnership with the U.S. Census Bureau as part of the Economic Census. Data covering 1993 and 1997 are available at http://www.bts.gov. Data and information from the 2002 CFS will be available in late 2003.

Table 2
Hazardous Materials Incidents for the Highway, Air, and Rail Modes: 1995–2000

Highway

Hazard class	1995	1996	1997	1998	1999	2000	Total 1995–2000	Percentage of total
Other regulated material, Class D[1]	1	3	1	2	0	0	7	0.01
Explosive, mass explosion hazard	5	0	1	1	2	2	11	0.01
Explosive projection hazard	0	0	1	1	0	1	3	<0.01
Explosive, fire hazard	0	1	0	0	1	1	3	<0.01
Explosive, no blast hazard	3	1	1	3	2	0	10	0.01
Very insensitive explosive	6	4	4	9	8	3	34	0.04
Extremely insensitive detonating	0	0	0	0	0	0	0	0.00
Combustible liquid	386	310	279	352	280	263	1,870	2.30
Flammable gas	131	113	102	95	89	112	642	0.80
Nonflammable compressed gas	145	118	124	171	229	266	1,053	1.30
Poisonous gas	30	35	28	21	30	25	169	0.21
Flammable/combustible liquid	5,090	4,922	4,722	5,240	5,541	5,636	31,151	39.00
Flammable solid	82	77	87	95	116	106	563	0.70
Spontaneously combustible	22	19	15	27	20	16	119	0.15
Dangerous when wet material	32	22	15	11	14	16	110	0.14
Oxidizer	333	244	376	457	408	373	2,191	2.70
Organic peroxide	99	98	96	130	158	202	783	1.00
Poisonous materials	1,154	988	924	1,055	938	890	5,949	7.50
Infectious substance (etiologic)	0	1	4	3	168	136	312	0.39
Radioactive material	7	8	9	9	8	4	45	0.06
Corrosive material	4,717	4,629	4,762	4,968	6,604	6,486	32,166	40.00
Miscellaneous hazardous materials	594	396	372	399	388	415	2,564	3.20
Total	**12,837**	**11,989**	**11,923**	**13,049**	**15,004**	**14,953**	**79,755**	**100.00**

Air

Hazard class	1995	1996	1997	1998	1999	2000	Total 1995–2000	Percentage of total
Other regulated material, Class D[1]	52	54	44	120	73	61	404	5.60
Explosive, mass explosion hazard	0	1	1	1	0	0	3	0.04
Explosive projection hazard	1	0	0	0	0	0	1	0.01
Explosive, fire hazard	0	0	1	0	2	0	3	0.04
Explosive, no blast hazard	2	3	3	10	8	10	36	0.50
Very insensitive explosive	0	0	0	0	0	0	0	0.00
Extremely insensitive detonating	0	0	0	0	0	0	0	0.00
Combustible liquid	1	2	1	0	5	3	12	0.17
Flammable gas	22	27	31	27	46	48	201	2.80
Nonflammable compressed gas	33	26	39	59	42	62	261	3.60
Poisonous gas	0	0	0	2	0	1	3	0.04
Flammable/combustible liquid	515	553	616	788	944	832	4,248	59.20
Flammable solid	4	2	4	7	10	5	32	0.45
Spontaneously combustible	0	0	1	1	1	0	3	0.04
Dangerous when wet material	4	0	1	1	3	1	10	0.14
Oxidizer	3	6	11	13	14	13	60	0.80
Organic peroxide	1	4	5	2	5	1	18	0.25
Poisonous materials	25	49	47	62	75	76	334	4.70
Infectious substance (etiologic)	2	2	6	7	4	3	24	0.33
Radioactive material	3	8	3	3	5	7	29	0.40
Corrosive material	133	157	186	227	312	260	1,275	17.80
Miscellaneous hazardous materials	21	29	34	59	38	40	221	3.10
Total	**822**	**923**	**1,034**	**1,389**	**1,587**	**1,423**	**7,178**	**100.00**

(Table 2 continues on the next page)

Table 2 (continued)
Hazardous Materials Incidents for the Highway, Air, and Rail Modes: 1995–2000

Rail

Hazard class	1995	1996	1997	1998	1999	2000	Total 1995–2000	Percentage of total
Other regulated material, Class D[1]	0	0	0	0	0	0	0	0.00
Explosive, mass explosion hazard	0	1	1	0	1	0	3	0.05
Explosive projection hazard	0	0	1	0	1	0	2	0.03
Explosive, fire hazard	0	0	0	0	0	0	0	0.00
Explosive, no blast hazard	0	0	0	0	1	0	1	0.02
Very insensitive explosive	0	0	0	0	0	0	0	0.00
Extremely insensitive detonating	0	0	0	0	0	0	0	0.00
Combustible liquid	54	59	46	34	55	59	307	4.70
Flammable gas	87	62	64	61	80	86	440	6.70
Nonflammable compressed gas	96	89	113	93	111	87	589	9.00
Poisonous gas	21	19	10	16	21	17	104	1.60
Flammable/combustible liquid	334	358	346	339	412	371	2,160	33.00
Flammable solid	2	2	4	2	1	4	15	0.23
Spontaneously combustible	1	2	0	0	0	1	4	0.06
Dangerous when wet material	2	2	3	4	2	2	15	0.23
Oxidizer	24	20	23	32	23	30	152	2.30
Organic peroxide	2	1	0	0	0	0	3	0.05
Poisonous materials	37	23	27	21	24	38	170	2.60
Infectious substance (etiologic)	0	0	0	0	0	0	0	0.00
Radioactive material	0	1	6	18	2	2	29	0.44
Corrosive material	447	416	398	314	294	305	2,174	33.20
Miscellaneous hazardous materials	59	70	78	62	49	62	380	5.80
Total	**1,166**	**1,125**	**1,120**	**996**	**1,077**	**1,064**	**6,548**	**100.00**

[1] Material, such as a consumer commodity, which presents a limited hazard during transportation due to its form, quantity, and packaging (49 CRF, ch. 1, sec. 173.144).

NOTE: Due to multiple classes being involved in a single incident, the totals above may not correspond to the totals in other reports.

SOURCE: U.S. Department of Transportation, Hazardous Materials Information System (HMIS) database, available at http://www.hazmat.dot.gov, as of July 19, 2001.

Worker Fatalities

Occupational risk from transportation incidents is often overlooked in safety analyses. However, these incidents are the largest single cause of occupational fatalities. Of the 5,915 occupational fatalities for all workers in 2000, 43 percent of them occurred as a result of a transportation incident (table 1). Among transportation occupational fatalities, 74 percent resulted from transportation incidents (table 2).

While the number of occupation fatalities for all workers in the United States fell 5 percent between 1992 and 2000, transportation causes rose 4 percent. Much of this increase may be due to highway incidents, which increased 18 percent during the period, and accounted for over half of the transportation-related occupational deaths in 2000. Just over 14 percent of all occupational fatalities in 2000 were truck drivers and 706 (83 percent) of them died in transportation incidents. Since the number of airplane accidents can vary greatly from year to year, so too do occupational deaths attributed to air transportation. The 280 deaths in 2000 were 21 percent below those in 1992, but 26 percent higher than the 223 deaths in 1998 [1].

The risk of being killed while working in a transportation occupation is more than five times the average for all occupations. Among transportation occupations, airplane pilots and navigators and taxicab drivers were at highest risk. Bus drivers had the lowest risk of being killed on the job. The risk of work-related

Table 1
Transportation-Related Occupational Fatalities: 1992 and 2000

	1992	2000
Total occupational fatalities (all causes)	**6,217**	**5,915**
Total transportation-related fatalities	**2,484**	**2,571**
Highway	1,158	1,363
Off-highway road (farm, industrial, premises)	436	399
Air transportation	353	280
Worker struck by vehicle, mobile equipment	346	370
Water transportation	109	84
Railroad transportation	66	71
Other, not elsewhere classified	16	4

NOTE: Data for 2000 are preliminary. Because these data are generated by a different methodology, they may not be consistent with other transportation fatality-by-mode data presented in this document.

SOURCE: U.S. Department of Labor, Bureau of Labor Statistics, *Census of Fatal Occupational Injuries,* 1992 and 2000, available at http://www.bls.gov/iif/oshcfoi1.htm, as of Dec. 20, 2001.

Transportation Worker Fatalities and September 2001

Among those who died as a result of the terrorist attacks in September 2001 were 33 airline employees on 4 aircraft. Eight of the deaths were pilots; 25 were flight attendants. The Bureau of Labor Statistics (BLS) in its Census of Fatal Occupational Injuries accounts for air transportation workers in several categories. Only airplane pilot and navigator fatalities, captured within a broad category called "Technical, sales, and administrative support," are disaggregated in published BLS data. Flight attendant deaths are included, among others, under "public transportation attendants" within BLS's "Service occupations" category. Thus, the BLS data in tables 2 and 3 represent an undercount of actual transportation worker fatalities. BLS recorded five public transportation attendant fatalities in 2000. According to National Safety Board preliminary fatal accident data, there were 10 crew fatalities in 2000 of which 4 were flight attendants.

SOURCE: National Transportation Safety Board, "Fatal Accidents, 2000 Preliminary Data for All Operations Under 14 CFR 121 and for Scheduled Operations Under 14 CFR 135," available at http://www.ntsb.gov/aviation/Table11.htm/, as of Dec. 19, 2001.

Table 2
Occupational Fatalities in Transportation Occupations: 2000

	Total fatalities	Transportation incidents	Assaults and violent acts	Contact with objects and equipment	Falls	Exposure to harmful substance or environment	Fires and explosions
All occupations	**5,915**	**2,578**	**932**	**1,009**	**736**	**481**	**179**
Transportation occupations	**1,264**	**939**	**82**	**147**	**48**	**37**	**11**
Truck drivers	852	706	24	73	22	16	5
Drivers (sales workers)	45	33	9	–	–	–	–
Bus drivers	21	17	–	–	–	–	–
Taxicab drivers and chauffeurs	70	25	44	–	–	–	–
Airplane pilots and navigators	130	128	–	–	–	–	–
Rail transportation occupations	21	17	–	–	–	–	–
Water transportation occupations	26	13	–	–	–	5	–
Other transportation occupations[1]	99	0	–	–	–	–	–

[1] Includes other vehicle operators, couriers, and material moving labor, etc.

KEY: – = no data reported or data that do not meet publication criteria.

NOTE: Because these data are generated by a different methodology, they may not be consistent with other transportation fatality-by-mode data presented in this document.

SOURCE: U.S. Department of Labor, Bureau of Labor Statistics, *Census of Fatal Occupational Injuries,* available at http://www.bls.gov/iif/oshcfoi1.htm, as of Dec. 20, 2001.

fatalities for all occupations, on average, was 45 fatalities for every million employees in 2000 (table 3). In contrast, the risk for transportation occupations was 255 fatalities per million employees.

Between 1993 (the first year for which data are available) and 2000, the national average risk of work-related fatalities decreased 19 percent. For transportation occupations as a whole, however, it decreased only 4 percent, though the risk for taxicab drivers, rail transportation occupations, and water transportation occupations decreased appreciably. In 1993, the risk for taxicab drivers was 1,658 fatalities per million employees, the highest among all transportation occupations. By 2000, it fell to 538, much lower than that for airplane pilots and navigators.

Table 3
Occupational Fatality Rates of Transportation Occupations: 1993–2000
Per million employees

	1993	2000
All occupations	**56**	**45**
Transportation occupations	**267**	**255**
Truck drivers	328	326
Drivers (sales workers)	133	120
Bus drivers	28	33
Taxicab drivers and chauffeurs	1,658	538
Airplane pilots and navigators	1,188	1,152
Rail transportation occupations	464	221
Water transportation occupations	967	389

SOURCE: U.S. Department of Labor, Bureau of Labor Statistics, *Census of Fatal Occupational Injuries,* available at http://www.bls.gov/iif/oshcfoi1.htm, as of Dec. 20, 2001.

Source

1. U.S. Department of Labor, Bureau of Labor Statistics, *Census of Fatal Occupational Injuries,* 1992, 1993, 1998, and 2000.

Chapter 7

Economic Growth

Introduction

Transportation is a vital component of the U.S. economy. It not only enables most economic activity, but is a sizable portion of the country's Gross Domestic Product. As such, transportation employs millions of people and consumes a large amount of the economy's goods and services. About one-fifth of household spending is on transportation. Transportation is also an important element of federal, state, and local government revenues and expenditures. For instance, the federal government's motor fuel tax collected about $19 billion from households in 1999, an average of $185 per household. In addition to discussing the size of transportation in the economy, transportation employment, fuel taxes, and transportation spending by households, this chapter presents data on labor productivity, gasoline prices, highway capital stocks, and international trade.

Demand for transportation-related goods and services represents more than one-tenth of the U.S. economy and supports one in eight jobs. These goods and services encompass a whole range of activities from vehicle production and automobile insurance to road building and public transportation. The amount of goods and services produced by each worker, measured in dollars per hour of work (labor productivity), has increased markedly in most sectors of transportation over the past 45 years. In the rail industry, productivity gains have been particularly strong since deregulation in 1980. On average, a worker in the rail industry now produces more than three times as much as in 1980. This increased labor productivity has made transportation less expensive for consumers.

Households spent on average $7,400 on transportation in 2000, nearly 20 percent of that year's average household expenditures. This amount is second only to the amount they spent on housing. The vast majority of household spending on transportation goes for vehicle purchase, operation, and maintenance. Transportation expenditures have not increased as fast as vehicle-miles traveled per household. Household spending on transportation, of course, varies according to a number of factors, including age and location. For example, people in the western states spent more than those in any other region.

International trade is a growing part of the U.S. economy. The lowering of trade tariffs via the Free Trade Agreement of 1989 with

Canada and the North American Free Trade Agreement (NAFTA) of 1993 have contributed to the increasing importance of North American trade. Canada has been and remains the top trading partner of the United States. In 1999, Mexico surpassed Japan to become America's second largest trading partner. Still, trade with other countries remains very important. About 67 percent of foreign trade in 2000 was with countries other than Canada and Mexico. The vast majority of these goods are transported by ship. International waterborne trade has, therefore, grown along with international trade, while domestic waterborne transportation over the past 15 years has stayed relatively constant.

Transportation Demand in GDP Growth

Purchases of transportation-related goods and services accounted for 10.7 percent of the Gross Domestic Product (GDP) in 2000, or $1,054 billion (table 1) [1]. This broad measure, called transportation-related final demand, reflects all consumer and government purchases of goods and services and exports related to transportation. The list of purchases is diverse and extensive, including vehicles, parts, engines, fuel, maintenance, and auto insurance.

The share of transportation-related final demand in GDP has fluctuated slightly between 10.5 percent and 11.0 percent from 1975 through 2000. Only housing, health care, and food accounted for greater shares of GDP in 2000 (figure 1).

Source

1. U.S. Department of Transportation, Bureau of Transportation Statistics, 2001, based on data in U.S. Department of Commerce, Bureau of Economic Analysis, *Survey of Current Business* (Washington, DC: Various issues).

Table 1
Transportation-Related Components of U.S. Gross Domestic Product: 1975 and 2000
Billions of current dollars

	1975	2000
Personal consumption of transportation		
Motor vehicles and parts	54.8	346.8
Gasoline and oil	39.7	165.3
Transportation services	35.7	272.8
Total	***130.2***	***784.9***
Gross private domestic investment		
Transportation structures	1.4	5.2
Transportation equipment	1.9	195.9
Total	***3.3***	***201.1***
Exports (+)		
Civilian aircraft, engines, and parts	3.2	48.1
Automotive vehicles, engines, and parts	10.8	80.2
Passenger fares	1.0	20.7
Other transportation	5.8	30.2
Total	*20.8*	*179.2*
Imports (–)		
Civilian aircraft, engines, and parts	0.5	26.4
Automotive vehicles, engines, and parts	12.1	195.9
Passenger fares	2.3	24.2
Other transportation	5.7	41.1
Total	*20.6*	*287.6*
Net exports of transportation-related goods and services	***0.2***	***–108.4***
Government transportation-related purchases		
Federal	4.9	19.6
State and local	32.1	147.6
Defense-related	2.8	8.9
Total	***39.9***	***176.1***
Total transportation final demand[1]	173.6	1,053.7
Gross Domestic Product (GDP)	1,630.6	9,872.9
Total transportation in GDP (percent)	**10.6%**	**10.7%**

[1] Includes demand for transportation net exports, i.e., transportation imports subtracted from transportation exports.

SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, calculated from data in U.S. Department of Commerce, Bureau of Economic Analysis, *Survey of Current Business,* issues from 1975–October 2001.

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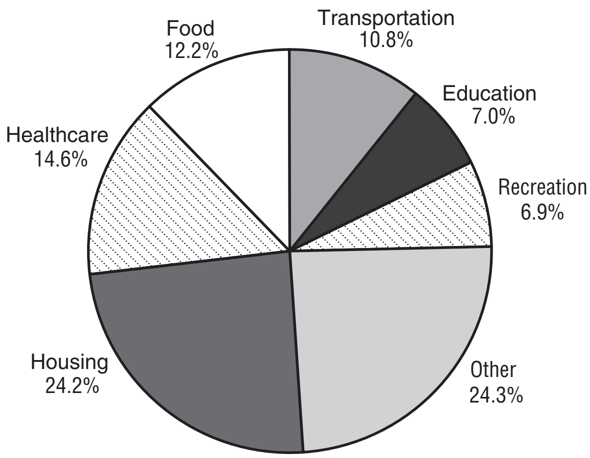
Figure 1
U.S. Gross Domestic Product by Major Societal Function: 2000



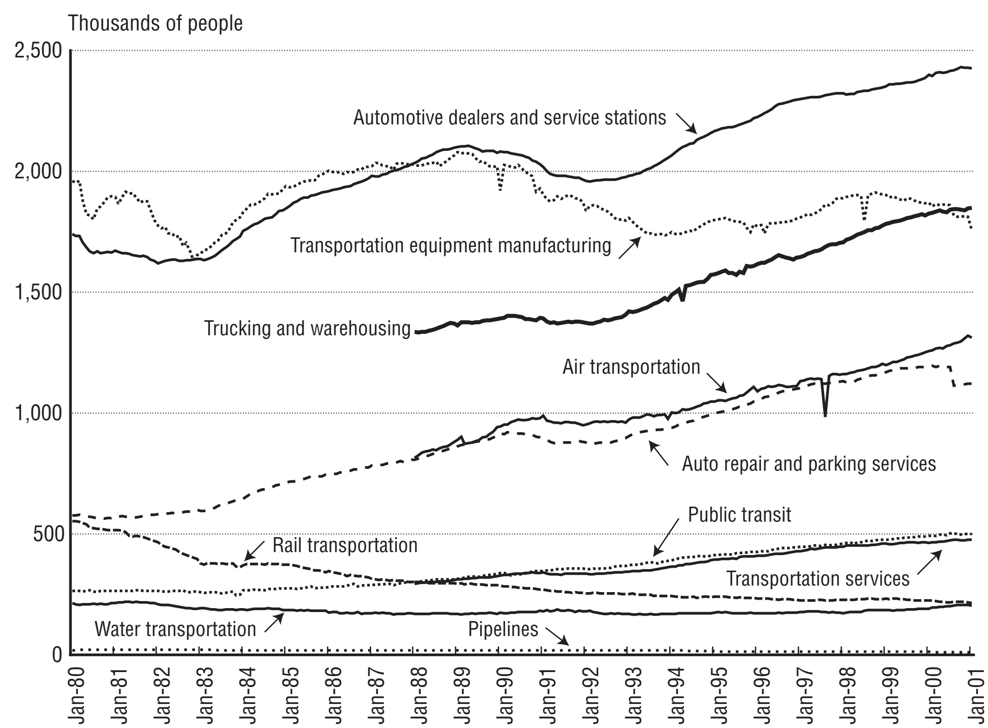
SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, calculated from data in U.S. Department of Commerce, Bureau of Economic Analysis, *Survey of Current Business,* October 2001.

Transportation-Related Employment by Industry

Employment is an important indicator of economic growth and social well-being. At the beginning of 2001, more than 10 million people were employed in for-hire transportation, vehicle manufacturing, and related industries, such as automobile sales and repair. These jobs accounted for about 7.4 percent of total civilian employment. By the end of 2001, however, these jobs accounted for 7.3 percent (see box on the next page). The automotive dealers and service station industry has been the largest employer among transportation-related industries since the late 1980s, followed by transportation equipment manufacturing, trucking and warehousing, air transportation, and auto repair and parking services (figure 1).

Transportation-related industry employment data, however, do not include transportation occupations in nontransportation industries, such as truck drivers working for wholesale and retail stores. Based on data

Figure 1
Employment in Transportation-Related Industries: January 1980–January 2001
Seasonally adjusted



SOURCE: U.S. Department of Labor, Bureau of Labor Statistics, "Employees on Nonfarm Payrolls by Industry, Seasonally Adjusted," available at http://stats.bls.gov/web/empsit/supp.toc.html#btables, as of September 2001.

Transportation Employment Affected in 2001

Transportation industry employment in 2001, especially commercial aviation, was affected by the September 2001 terrorist attacks as well as a weakening economy. Air transportation employment was already declining from a high point of 1.32 million people in February 2001 when the terrorist attacks occurred. By December 2001, air transportation employment had fallen almost 10 percent to 1.19 million people. Overall employment in transportation dropped from 10.08 million people in January 2001 to 9.92 million in October, a decline of 1.5 percent [1].

from the U.S. Department of Labor's Bureau of Labor Statistics, the Bureau of Transportation Statistics estimated that in 2000 non-transportation industries employed about 2.7 million people in transportation occupations, such as truck drivers, bus drivers, and driver/sales workers; about 2.2 million in transportation-supporting occupations, such as travel agents, cargo and freight agents, and transit and rail police; and about 3.8 million in material-moving occupations, such as freight movers, truck loaders, and longshoremen. When these components are included, total transportation and related employment in 2000 would have accounted for 14 percent of employment, or one out of every seven U.S. civilian jobs [1].

Source

1. U.S. Department of Transportation, Bureau of Transportation Statistics, *Transportation Indicators* (Washington, DC: April 2002).

For-Hire Transportation Industry

The for-hire transportation industry contributed $314 billion to the U.S. economy in 2000 (table 1). Its share in the Gross Domestic Product (GDP), however, has declined from 4.4 percent in 1960, to 3.6 percent in 1975, to 3.2 percent in 2000 (measured in current dollars) [1]. Many factors may explain this change, including the growth of in-house trucking services by companies that are not in the transportation business (e.g., grocery store chains) and a U.S. economy that is becoming increasingly service oriented.

Of all for-hire transportation industries, trucking and warehousing and air transportation contributed the largest share to U.S. GDP. In 2000, trucking and warehousing and air transportation contributed $126 billion and $93 billion, respectively. Together, they accounted for more than two-thirds of transportation GDP. Not surprisingly, air transportation had the highest growth rate followed by transportation services over the 1960 to 2000 period (figure 1). The trucking and warehousing industry experienced considerable growth from 1975 to 1985. While its growth rate declined from 1986 to 1995, it has picked up again since 1996 [1].

Source

1. U.S. Department of Commerce, Bureau of Economic Analysis, "Gross Domestic Product by Industry," available at http://www.bea.doc.gov/bea/dn2.htm, as of November 2001.

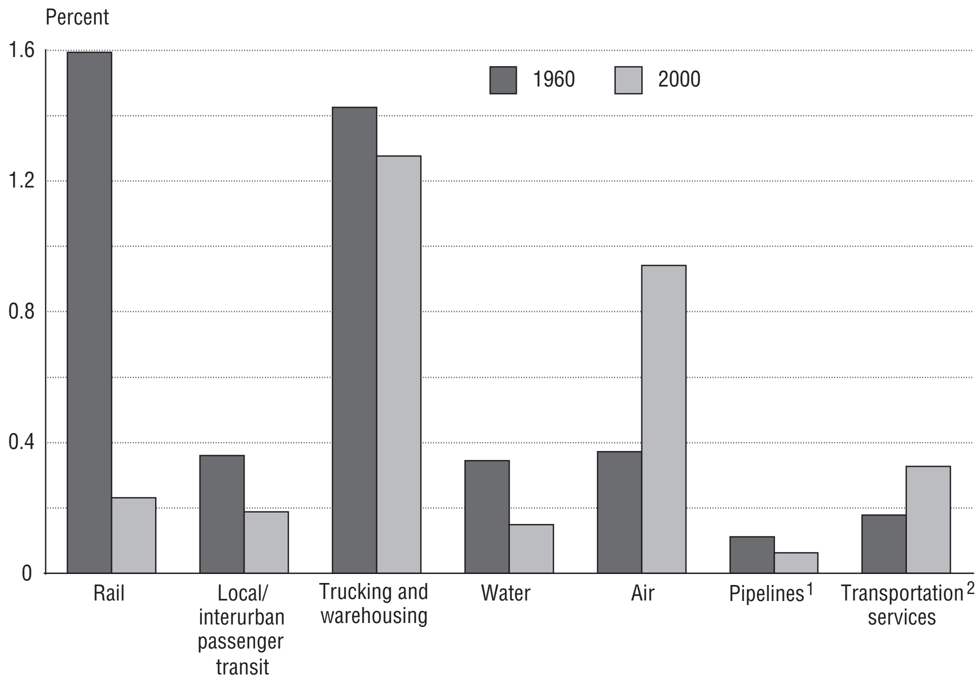
Table 1
U.S. Gross Domestic Product Attributed to For-Hire Transportation Industries
Billions of current dollars

Industry	1960	1965	1970	1975	1980	1985	1990	1995	2000
Gross domestic product	527.4	720.1	1,039.7	1,635.2	2,795.6	4,213.0	5,803.2	7,400.5	9,872.9
Transportation	**23.1**	**29.5**	**39.9**	**59.2**	**102.9**	**140.4**	**177.4**	**233.4**	**313.9**
Rail transportation	8.4	9.1	10.0	12.6	20.8	22.0	19.8	23.6	22.9
Local and interurban passenger transit	1.9	2.2	2.9	3.5	5.3	7.7	9.1	12.4	18.7
Trucking and warehousing	7.5	10.7	15.0	24.2	40.1	56.3	69.4	89.0	126.0
Water transportation	1.8	2.2	2.9	4.0	7.2	8.3	10.0	11.6	14.8
Air transportation	2.0	3.4	6.4	10.2	18.2	27.1	45.3	67.7	93.0
Pipelines, except natural gas	0.6	0.7	1.1	1.8	5.2	7.3	5.5	5.5	6.2
Transportation services[1]	0.9	1.3	1.6	3.1	6.2	11.7	18.2	23.5	32.3

[1] *Transportation services* include establishments furnishing services incidental to transportation (e.g., forwarding and packing services, and the arrangement of passenger and freight transportation) and is consistent with the U.S. Department of Labor's Standard Industrial Classification for transportation services (SIC-4700).

SOURCE: U.S. Department of Commerce, Bureau of Economic Analysis, "Gross Domestic Product by Industry," available at http://www.bea.doc.gov/bea/dn2.htm, as of November 2001.

Figure 1
For-Hire Transportation Shares in the Gross Domestic Product: 1960 and 2000



[1] Pipelines does not include natural gas.
[2] *Transportation services* include establishments furnishing services incidental to transportation (e.g., forwarding and packing services, and the arrangement of passenger and freight transportation) and is consistent with the U.S. Department of Labor's Standard Industrial Classification for transportation services (SIC-4700).

SOURCE: U.S. Department of Commerce, Bureau of Economic Analysis, "Gross Domestic Product by Industry," available at http://www.bea.doc.gov/bea/dn2/gpo.htm, as of November 2001.

Transportation Labor Productivity

For the last 25 years, transportation has been one of the leaders in U.S. productivity growth. As shown in figure 1, U.S. business sector productivity, measured in real output per employee, grew 46 percent between 1975 and 1999. In contrast, several transportation modes had much higher growth rates over this period. For example, between 1975 and 1999, railroad labor productivity grew 294 percent; for-hire trucking grew 105 percent; air transportation grew 95 percent; and pipeline grew 65 percent. In recent years, however, labor productivity growth in the trucking industry and air transportation flattened out. When compared with the economy as a whole, labor productivity in the railroad and pipeline industries continues to increase at a faster rate, while the bus mode fluctuates from year to year [1]. Data for water transportation are not available, because the Bureau of Labor Statistics (BLS) does not currently produce this series. The Bureau of Transportation Statistics is working with BLS to initiate data collection for this mode.

Deregulation, technological change, and labor force reductions have all contributed to higher labor productivity in transportation. Specifically, air transportation labor productivity increased because of the introduction of larger and faster aircraft, computerized passenger reservation systems, the hub-and-spoke flight network, and changes in requirements for flight personnel. In the railroad industry, consolidation of companies, more efficient use of equipment and lines, increased ton-miles, and labor force reductions have played a role.

Source

1. U.S. Department of Labor, Bureau of Labor Statistics, Office of Productivity and Technology, "Historical Indexes of Output per Employee, All Published Industries, Productivity Trends for Transportation Industries," available at ftp://ftp.bls.gov/pub/special.requests/opt/dipts/oaehaiin.txt, as of October 2001.

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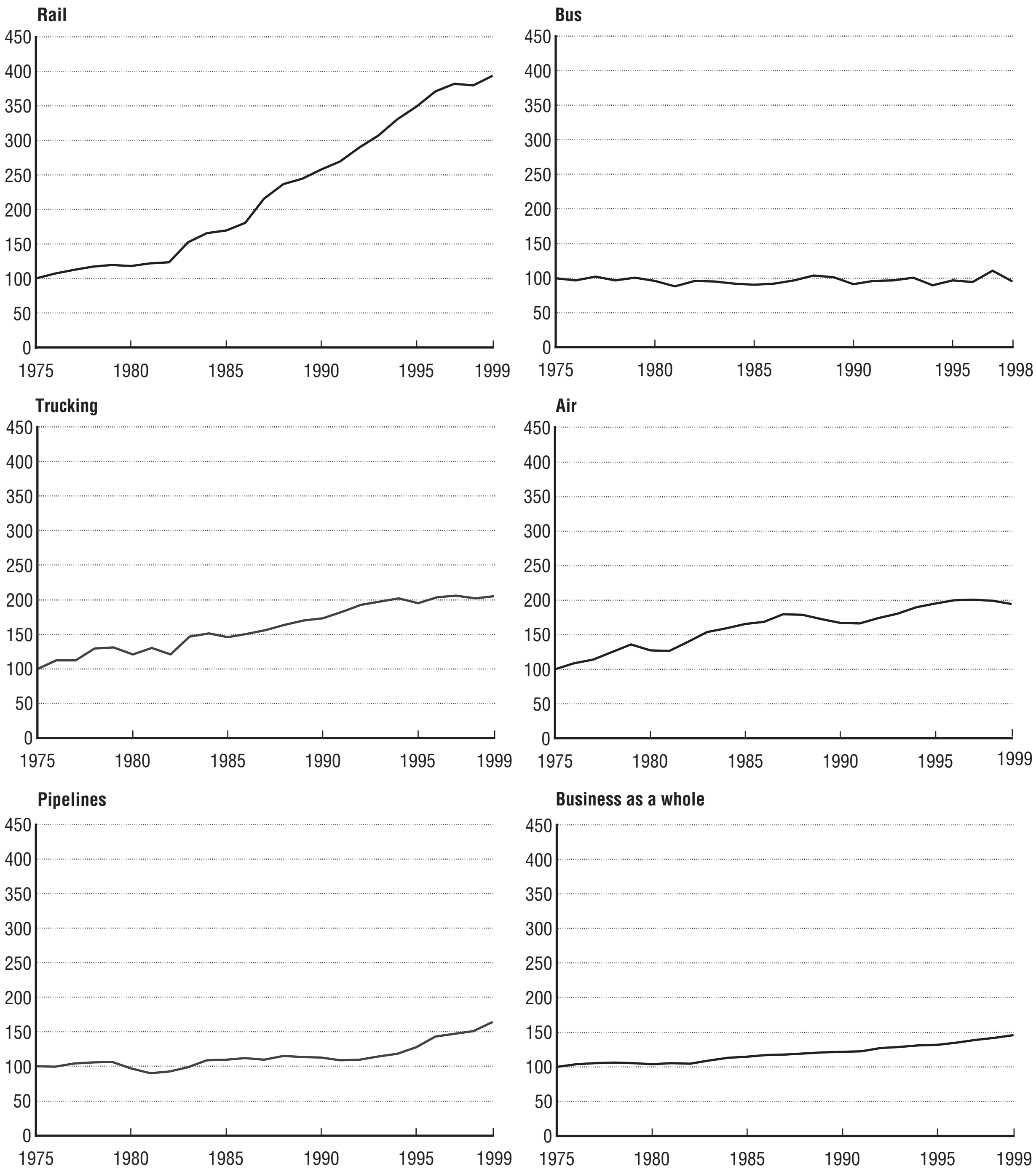
Figure 1
Labor Productivity Trends by Mode
Index: 1975 = 100



NOTES: Output is measured by quality-adjusted ton- and passenger-miles for railroad and air transportation, quality-adjusted ton-miles for trucking and pipelines, and passenger-miles for buses. Quality-adjusted refers to differences in services and handling, e.g., the difference between flying first class and coach or differences in the handling requirements and revenue generation of high- and low-value commodities. No data are available for water transportation. Most recent data available are provided.

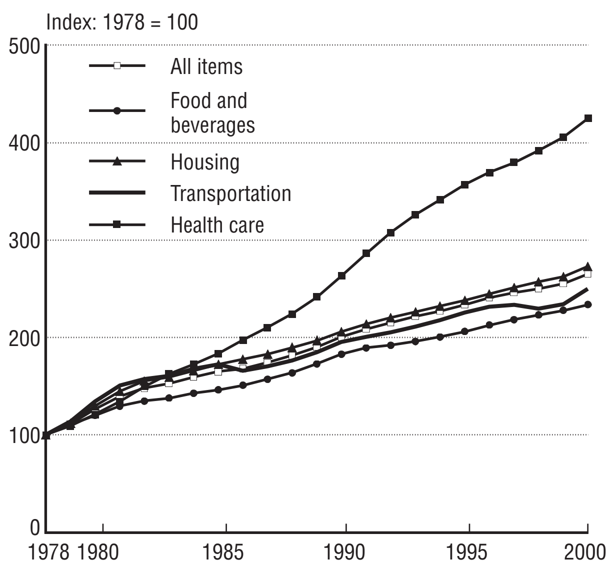
SOURCE: U.S. Department of Labor, Bureau of Labor Statistics, Office of Productivity and Technology, available at http://www.bls.gov/iprdata1.htm, as of May 2001.

Consumer Prices for Transportation

Improvements in transportation labor productivity have made transportation less expensive for consumers. Since 1978, transportation prices increased less than those for other major consumer expenditure categories. For example, the price for the same amount of goods or services increased 172 percent for housing and 322 percent for health care between 1978 and 2000 (figure 1). By comparison, the overall price of transportation increased 148 percent. In more recent years, from 1994 to 2000, price inflation for transportation was the lowest among the four major consumer expenditure categories.

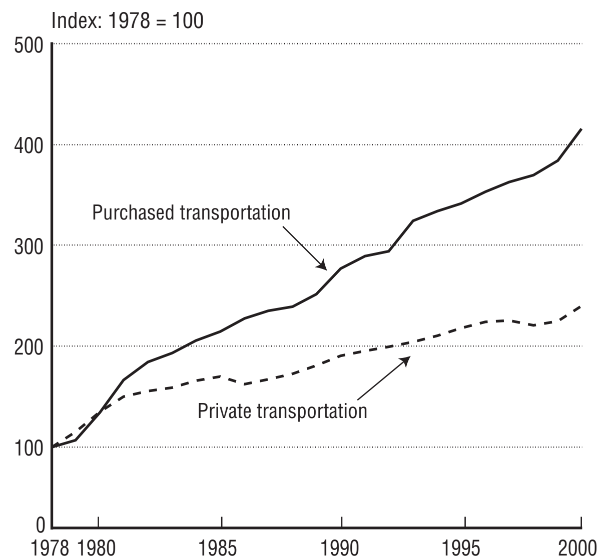
Within transportation, the price for consumer-operated transportation (e.g., private passenger car transportation) increased more slowly than for purchased transportation services. Between 1978 and 2000, the price of consumer-operated transportation increased 139 percent, while the price of purchased transportation services increased 307 percent (figure 2).

Figure 1
Consumer Price Indexes for Selected Items: 1978–2000



SOURCE: U.S. Department of Labor, Bureau of Labor Statistics, data available at http://www.bls.gov/cpihome.htm, as of May 2001.

Figure 2
Consumer Price Indexes for Purchased and Private Transportation Services: 1978–2000



SOURCE: U.S. Department of Labor, Bureau of Labor Statistics, data available at http://www.bls.gov/cpihome.htm, as of May 2001.

Gasoline Prices

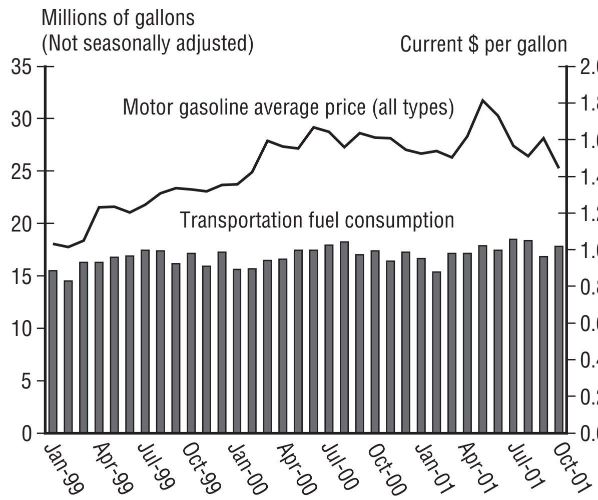
Fuel prices tend to fluctuate, affecting both individual consumers and industry. The average price of motor gasoline in the United States peaked in 2000 at $1.67 per gallon in June but hit a low of $1.56 in August. In 2001, the average price peaked at $1.81 in May. Although these fuel prices were far below record highs in real terms, the rapid rises attracted consumer attention and affected the profitability of transportation industries, whose profit margins, on average, have been less than 7 percent in the past few years [1].

One important factor underlying the volatility of motor gasoline price in the United States is the relative insensitivity of consumption to price changes (figure 1).[1] Thus, the price of motor gasoline is almost completely, at least in the short run, dependent on supply. A small shortage in supply would cause a large increase in price, while a small surplus in supply would cause a large decrease in price.

In the latter half of 2001, due to the already slowing U.S. economy and particularly the reduction in some travel after the September terrorist attacks, demand for gasoline fell short of its anticipated level. This, in turn, resulted in a short-run gasoline supply surplus. Gasoline prices reacted instantly, falling from $1.61 per gallon in September to $1.44 per gallon in October 2001.

The Bureau of Transportation Statistics has developed a method for measuring the impact of fuel price changes on the transportation industry. This analysis, based on fuel cost per dollar of net output, shows that higher fuel prices in 2000 impacted the railroad, transit, air, and trucking modes more than they did water transportation and pipelines. For instance, higher prices in 2000 cost railroads and transit an estimated additional 11 cents to produce $1 of net output, while the additional costs for water transportation and pipelines were 3 and 0.5 cents, respectively (figure 2) [2, 3, 4].

Figure 1
Price of Motor Gasoline[1] vs. Consumption: January 1999–October 2001



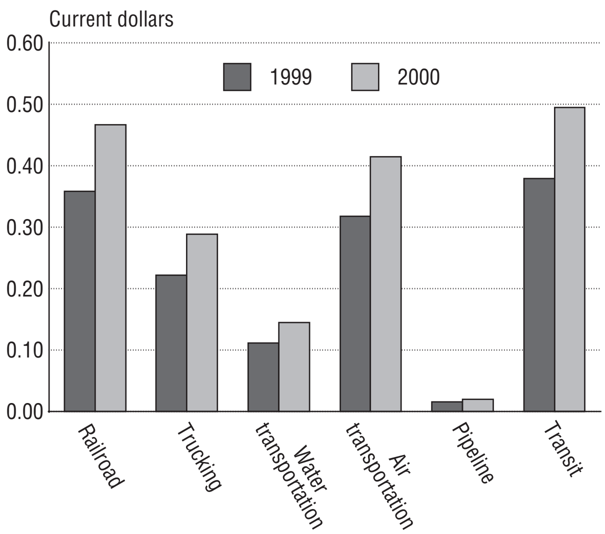
[1]Includes all types of gasoline and automotive diesel.

NOTE: Monthly motor fuel consumption data are estimated based on a total of finished motor gasoline produced and imported, subtracted from the change in stocks and exports.

SOURCES: Fuel price data—U.S. Department of Labor, Bureau of Labor Statistics, Average Price Data, U.S. City Average, Gasoline (all types), monthly, November 2001.
Fuel consumption data—U.S. Department of Transportation, Bureau of Transportation Statistics, based on U.S. Department of Energy, Energy Information Administration, "Energy Consumption by Transportation Sector," monthly, November 2001.

[1] A Bureau of Transportation Statistics analysis in 2000 concluded that the price of motor gasoline has to increase 14 percent for a 1 percent reduction in motor gasoline consumption to occur in the United States.

Figure 2
Fuel Cost per Dollar of Net Output of the For-Hire Transportation Industries: 1999 and 2000



SOURCE: U.S. Department of Transportation (USDOT), Bureau of Transportation Statistics (BTS), estimates based on U.S. Department of Energy, Energy Information Administration, "Energy Consumption by Transportation Sector," monthly, November 2001; U.S. Department of Commerce, Bureau of Economic Analysis, "Gross Product by Industry," November 2001; and USDOT, BTS, U.S. 1996 Transportation Satellite Accounts.

Sources

1. U.S. Department of Commerce, Bureau of Economic Analysis, *Survey of Current Business,* various issues.
2. ____. "Gross Domestic Product by Industry," October 2000.
3. U.S. Department of Transportation, Bureau of Transportation Statistics, estimates based on U.S. Department of Energy, Energy Information Administration, "Energy Consumption by Transportation Sector," monthly reports, 2001.
4. ____. *U.S. Transportation Satellite Accounts for 1996*, data, available at http://www.bea.doc.gov/bea/dn2. htm, as of May 2001.

Household Spending on Transportation

Households spend more money, on average, on transportation than any other expenditure category except housing. In 2000, households spent about $7,400 on transportation, or 19.5 percent of their total spending (table 1). This share was about the same as in 1984 (the first year for which data are available). Roughly 94 percent of household transportation expenditures in 2000 went to purchase, maintain, and operate cars and other private vehicles. Purchased transportation services, including airline, intercity train and bus, and mass transit, accounted for less than 6 percent of household transportation expenditures that year (table 2).

Measured in constant 1982 dollars, household transportation expenditures increased almost 17 percent between 1984 and 2000 (figure 1). During the same period, vehicle-miles traveled per household increased about 28 percent, indicating that transportation has become cheaper to consumers.

Household transportation expenditures vary by region (table 3). Households in the western part of the country spent more on transportation in 2000 than did households in the three other regions.[1] However, five years earlier, households in the Midwest were spending more. Transportation expenditures in the Northeast have always been the lowest both in terms of total amount and share of household spending. A reason for this phenomenon is that households in the Northeast are more reliant on public transportation. In 2000, for

Table 1
Consumer Expenditure Trends

	1984	1990	2000
Average annual household expenditures (current $)	$21,975	$28,381	$37,027
Category	**Percentage of total expenditures**		
Housing	30.4	30.7	32.4
Transportation	19.6	18.0	19.5
Food	15.0	15.1	13.6
Personal insurance and pensions	8.6	9.1	8.8
Apparel and services	6.0	5.7	4.9
Health care	4.8	5.2	5.4
Education	2.0	2.0	1.7
Other	13.7	14.7	13.8

SOURCE: U.S. Department of Labor, Bureau of Labor Statistics, "Consumer Expenditure Survey," 1984–2000, available at http://www.bls.gov, as of April 2002.

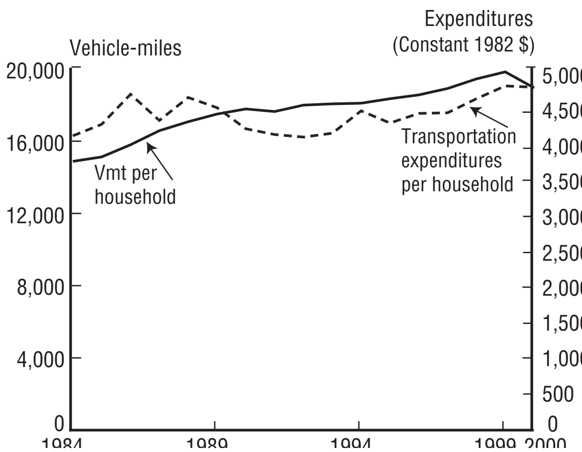
Table 2
Household Transportation Expenditures: 2000

Type of expenditure	
Average annual household transportation expenditures (current $)	$7,417
Components and their shares	**Percent**
Vehicle purchases	**46.1**
Cars and trucks, new	23.9
Cars and trucks, used	21.6
Other vehicles	0.6
Gasoline and motor oil	**17.4**
Other vehicle expenses	**30.8**
Vehicle insurance	10.5
Maintenance and repairs	8.4
Vehicle rental, lease, license, and other charges	7.4
Vehicle finance charges	4.4
Purchased transportation services	**5.8**

SOURCE: U.S. Department of Labor, Bureau of Labor Statistics, "Consumer Expenditure Survey," 2000, available at http://www.bls.gov, as of April 2002.

[1] The regional comparisons here and the following urban/rural and age group comparisons have not been tested for statistical significance.

Figure 1
Average Household Transportation Expenditures and Vehicle-Miles Traveled: 1984–2000



SOURCES: U.S. Department of Transportation, Bureau of Transportation Statistics:
Estimates of vehicle-miles traveled (vmt) calculated from data in U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics* (Washington, DC: 1984–2000).
Estimates of transportation expenditures calculated from data in U.S. Department of Labor, Bureau of Labor Statistics, "Consumer Expenditure Survey," 1984–2000, available at http://www.bls.gov.cex/home.htm, as of June 2002.

instance, households in the Northeast spent an average of $600 or 9 percent of their transportation expenditures on public transportation. This compares with $283 (4 percent) in the South, $403 (5 percent) in the Midwest, and $527 (7 percent) in the West [1].

Spending on transportation differs among rural and urban households as well. During much of the 1990s, rural households, on average, spent more on transportation than urban households. In 2000, for instance, average urban household transportation expenditures were $7,410, while those of rural households were $7,467 [1].

Not surprisingly, the age of the head of the household also has an impact on transportation spending (see figure 2 on the next page). Household transportation expenditures rise as the age of the head of the household increases, peaking between 45 and 54 years of age and

Table 3
Annual Household Transportation Expenditures by Region: 1995 and 2000

	Northeast	Midwest	South	West
	Transportation expenditures (in current dollars)			
1995	$5,471	$6,367	$6,046	$6,057
2000	$6,664	$7,841	$7,211	$7,943
	Share of household total expenditures			
1995	16.6%	20.0%	20.0%	17.2%
2000	17.1%	20.0%	20.8%	19.2%

SOURCE: U.S. Department of Labor, Bureau of Labor Statistics, "Consumer Expenditure Survey," 1995 and 2000, available at http://www.bls.gov, as of April 2002.

then decreasing. In 2000, for example, households in which the head of the household was between 45 and 54 years of age spent, on average, $8,827 on transportation, while households in the under 25 years of age bracket spent about 60 percent of that amount. Spending on transportation was lowest ($2,875) in households headed by people 75 years of age or older. However, transportation as a share of total household expenditures was highest in young households, averaging 23 percent. The percentage decreased gradually as age increased, reaching its lowest point at 13 percent for households in the 75 years and over age bracket.

Half of the transportation expenditures in young households were to purchase vehicles, compared with 39 percent for households in the oldest age group. Moreover, younger households spent a smaller share of transportation expenditures on purchased transportation services, such as air travel, mass transit, and taxi fares [1].

Source

1. U.S. Department of Labor, Bureau of Labor Statistics, "Consumer Expenditure Survey," 2000, available at http://www.bls.gov, as of April 2002.

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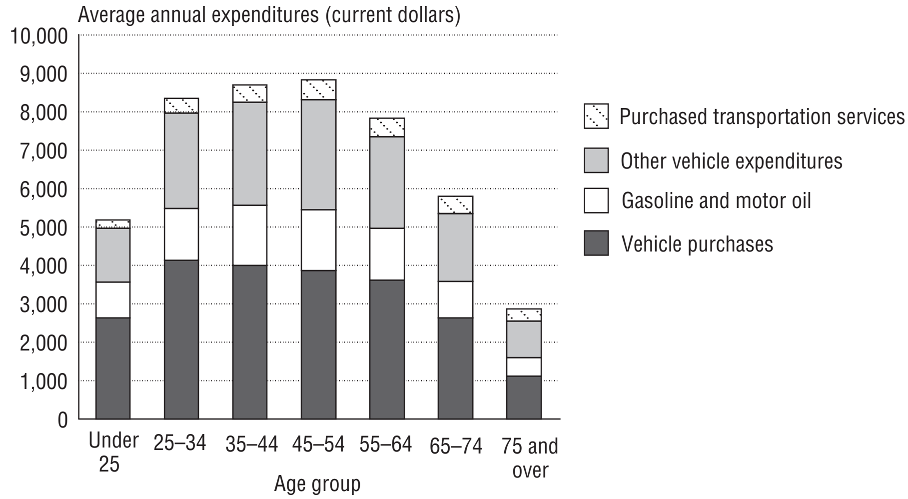
Figure 2
Household Transportation Expenditures by Age Group: 2000



SOURCE: U.S. Department of Labor, Bureau of Labor Statistics, "Consumer Expenditure Survey," 2000, available at http://www.bls.gov, as of April 2002.

Government Transportation Revenues and Expenditures

Each year in the United States, federal, state, and local governments collect various transportation revenues—usually in the form of taxes—and spend these revenues to improve their transportation systems.[1] In 2001, the Bureau of Transportation Statistics (BTS) concluded a study of government transportation financial statistics covering fiscal years 1985 to 1999[2] [1].

According to the BTS study, the inflation-adjusted transportation revenues of all governments totaled $118.9 billion in 1999[3] ($126.9 billion in current dollars), an increase of 64 percent since 1985 (table 1). Between 1985 and 1999, states collected most of the revenues (47 percent, on an annual average basis), followed by the federal government (34 percent) and local governments (19 percent). Revenues of the federal government, however, grew the fastest (90 percent). But much of this growth occurred from 1997 to 1999, partly a consequence of changes in federal management of transportation funds required by the Transportation Equity Act of the 21st Century. Between 1985 and 1999, local government revenues grew 69 percent and state revenues, 42 percent.

Table 1
Government Transportation Revenues
Chained 1996 $ in billions

Fiscal year	Federal	State	Local	Total
1985	25.8	33.9	12.9	72.6
1990	26.1	40.2	15.9	82.2
1995	30.8	45.9	19.1	95.8
1999	48.9	48.2	21.8	118.9

SOURCES: U.S. Department of Transportation (USDOT), Bureau of Transportation Statistics, compiled from:
Federal highways and transit: USDOT, Federal Highway Administration, *Highway Statistics* (Washington, DC: Annual issues), table FE-210, pp. IV–22 (Historical Data).
Federal air: USDOT, Federal Aviation Administration, *Budget in Brief* (Washington, DC: Annual issues), available at http://www.faa.gov/aba/html_budget/index.html, as of October 2001.
Federal water and pipeline: Executive Office of the President of the United States, Office of Management and Budget, *Budget of the United States Government: Appendix* (Washington, DC: Annual issues).
State and local: U.S. Department of Commerce (USDOC), U.S. Census Bureau, "State and Local Government Finance Estimates," available at ftp://ftp.census.gov/pub/outgoing/govs/, as of October 2001.
Chain-type price index: USDOC, Bureau of Economic Analysis, "National Income and Product Accounts Tables," 2001, table 7.1, Quantity and Price Indexes for Gross Domestic Product, available at http://www.bea.doc.gov/bea/dn/nipaweb/, as of October 2001.

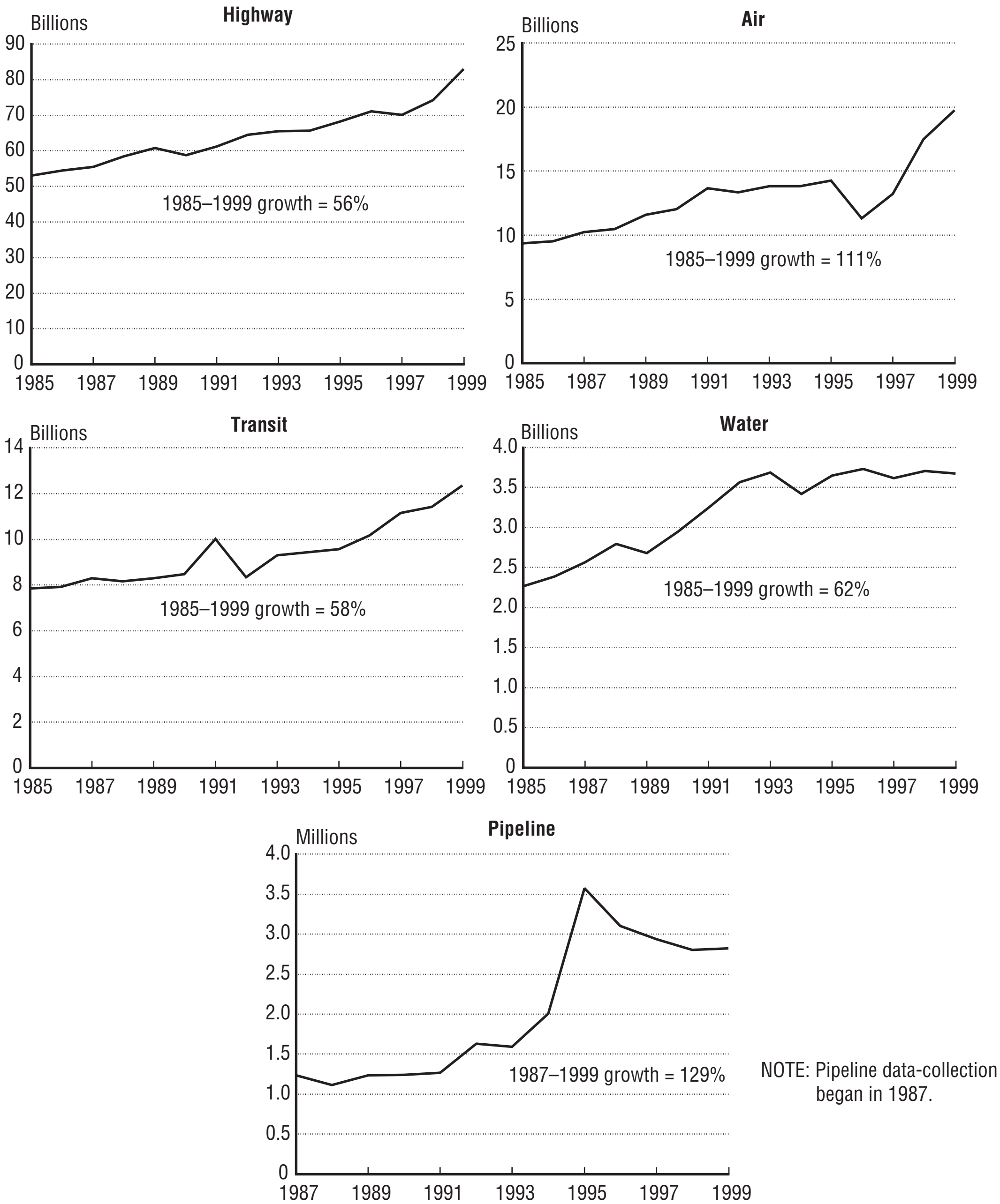
On a modal basis, revenues vary by mode and annually (figure 1). Highways, for instance, generated the most revenues between 1985 and 1999, while pipeline revenues made up less than 1 percent of the total. Federal and state motor fuel taxes and state motor vehicle taxes were the most important sources of revenues for the highway mode, averaging 80 percent of highway collections from 1985 through 1999. Federal passenger and local airport charges are the major sources of revenues for air, also aver-

[1] Transportation revenues include money received by the government from transportation-related taxes, user charges, or fees earmarked to fund transportation-related expenditures. The following types of receipts are not counted as transportation revenues: 1) taxes collected from users of the transportation system that go into a general fund; 2) nontransportation-related general fund revenues that are used to finance transportation activities; 3) proceeds from borrowing, whether short term or long term; and 4) proceeds from the sale of investments and the payment of loans.

[2] 1999 is the latest year for which the data from all three levels of government were available.

[3] The data presented here are in chained 1996 dollars, unless otherwise noted.

Figure 1
Government Transportation Revenues by Mode: FY 1985–1999
Chained 1996 dollars



SOURCES: U.S. Department of Transportation (USDOT), Bureau of Transportation Statistics, compiled from:
Federal highway, transit, rail, pipeline, and general support: USDOT, Federal Highway Administration, *Highway Statistics* (Washington, DC: Annual issues), table FE-210, pp. IV–22.
Federal air: USDOT, Federal Aviation Administration, *Budget in Brief* (Washington, DC: Annual issues), available at http://www.faa.gov/aba/html_budget/index.html, as of October 2001.
Federal water and pipeline: Executive Office of the President of the United States, Office of Management and Budget, *Budget of the United States Government: Appendix* (Washington, DC: Annual issues).
State and local: U.S. Department of Commerce (USDOC), U.S. Census Bureau, "State and Local Government Finance Estimates," available at ftp://ftp.census.gov/pub/outgoing/govs/, as of October 2001.
Chain-type price index: USDOC, Bureau of Economic Analysis, "National Income and Product Accounts Tables," 2001, table 7.1, Quantity and Price Indexes for Gross Domestic Product, available at http://www.bea.doc.gov/bea/dn/nipaweb/, as of October 2001.

aging 80 percent. The bulk of transit revenues (56 percent) were raised through local transit charges, with 30 percent coming from the transit account of the Highway Trust Fund and 14 percent from state transit charges. Local government water charges (44 percent),[4] federal water receipts (41 percent),[5] and state water charges (15 percent) were the main sources of water mode revenues.

Railroad activity also generates government revenues, but because the revenues are not specifically earmarked to fund transportation programs, they are not treated as transportation-related revenues [1]. For instance, federal taxes on rail fuel are put into the U.S. general fund and hence are not treated as transportation revenues. In addition, state and local taxes on rail property (and the property of other modes) are not treated as transportation-related revenues, because the amount of these revenues that may be used for transportation projects is not known. Amtrak, the national passenger railroad service, is not an entity of the federal government; as such, its revenues are not considered government transportation revenues.

In 1999, transportation-related spending by all levels of government reached $144.9 billion ($154.8 billion in current dollars), an increase of 35 percent over 1985 (table 2). These transportation expenditures represented about 5 percent of total government spending.

Table 2
Government Transportation Expenditures
Chained 1996 $ in billions

Fiscal year	Federal	State and local	Total
1985	39.6	67.9	107.5
1990	37.7	81.0	118.6
1995	41.6	91.8	133.5
1999	41.4	103.6	144.9

SOURCES: U.S. Department of Transportation (USDOT), Bureau of Transportation Statistics, compiled from:
Federal highway, transit, rail, pipeline, and general support: USDOT, Federal Highway Administration, *Highway Statistics* (Washington, DC: Annual issues), table FE-210, pp. IV–22. Executive Office of the President of the United States, Office of Management and Budget, *Budget of the United States Government: Appendix* (Washington, DC: Annual issues).
Federal air and water: Executive Office of the President of the United States, Office of Management and Budget, *Budget of the United States FY 2002—Public Budget Database,* "Outlays," available at http://w3.access.gpo.gov/usbudget/fy2002/db.html, as of October 2001. ____. *Budget of the United States Government: Appendix* (Washington, DC: Annual issues). National Aeronautics and Space Administration, *Aeronautics and Space Report of the President* (Washington, DC: Annual issues), appendix E-3, available http://www.hq.nasa.gov/office/hqlibrary/books/nasadoc.html, as of October 2001. U.S. Army Corps of Engineers, personal communication, October 2001.
State and local: U.S. Department of Commerce (USDOC), U.S. Census Bureau, "State and Local Government Finance Estimates," available at ftp://ftp.census.gov/pub/outgoing/govs/, as of October 2001.
Chain-type price index: USDOC, Bureau of Economic Analysis, "National Income and Product Accounts Tables," 2001, table 7.1, Quantity and Price Indexes for Gross Domestic Product, available at http://www.bea.doc.gov/bea/dn/nipaweb/, as of October 2001.

State and local spending (of their own funds) together amounted to $103.6 billion in 1999 and experienced higher growth (53 percent) than did federal spending from 1985 to 1999.

During the 1985 to 1999 period, almost two-thirds (61 percent, on average) of total government transportation spending was on highways (figure 2). Rail and pipeline, meanwhile, accounted for less than 1 percent each.

State and local governments' own transportation revenues are augmented annually by federal grants. Between 1985 and 1999, these grants remained almost constant, increasing only about 4 percent to $26.3 billion. A major share (76 percent, on average) of the federal grants went to highways, followed by transit (17 percent) and air (6 per-

[4] Local and state water charges include, for example, canal tolls and user fees for commercial or industrial water transport and port terminal facilities.

[5] Federal water receipts include, for example, amounts received from harbor maintenance user fees, St. Lawrence Seaway toll charges, inland waterway fuel taxes, excise taxes, the Oil Spill Liability Trust Fund, the Offshore Oil Pollution Fund, and the Deep Water Port Liability Fund.

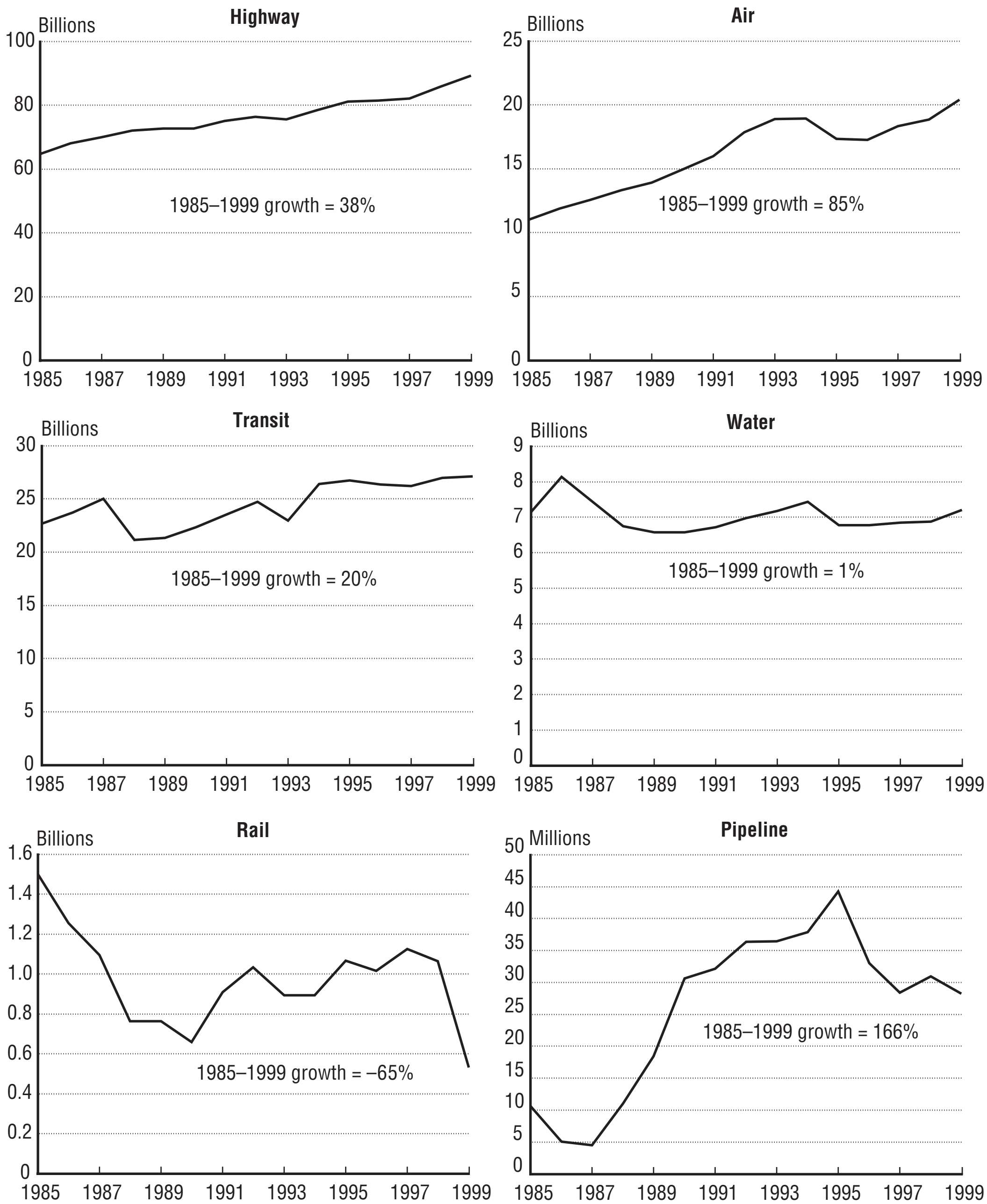
cent). Less than 1 percent of the federal grants were used for water, rail, and pipeline programs during the same period.

Per capita revenues and expenditures differ substantially at the state level. In 1999, for instance, per capita revenues fluctuated from $155 in South Carolina to $772 dollars in the District of Columbia, while per capita expenditures ranged from $288 in South Carolina to $2,054 in the District of Columbia (see maps, pages 208–209). Most states raised more and spent more per capita on transportation activities in 1999 compared with 1985.

Source

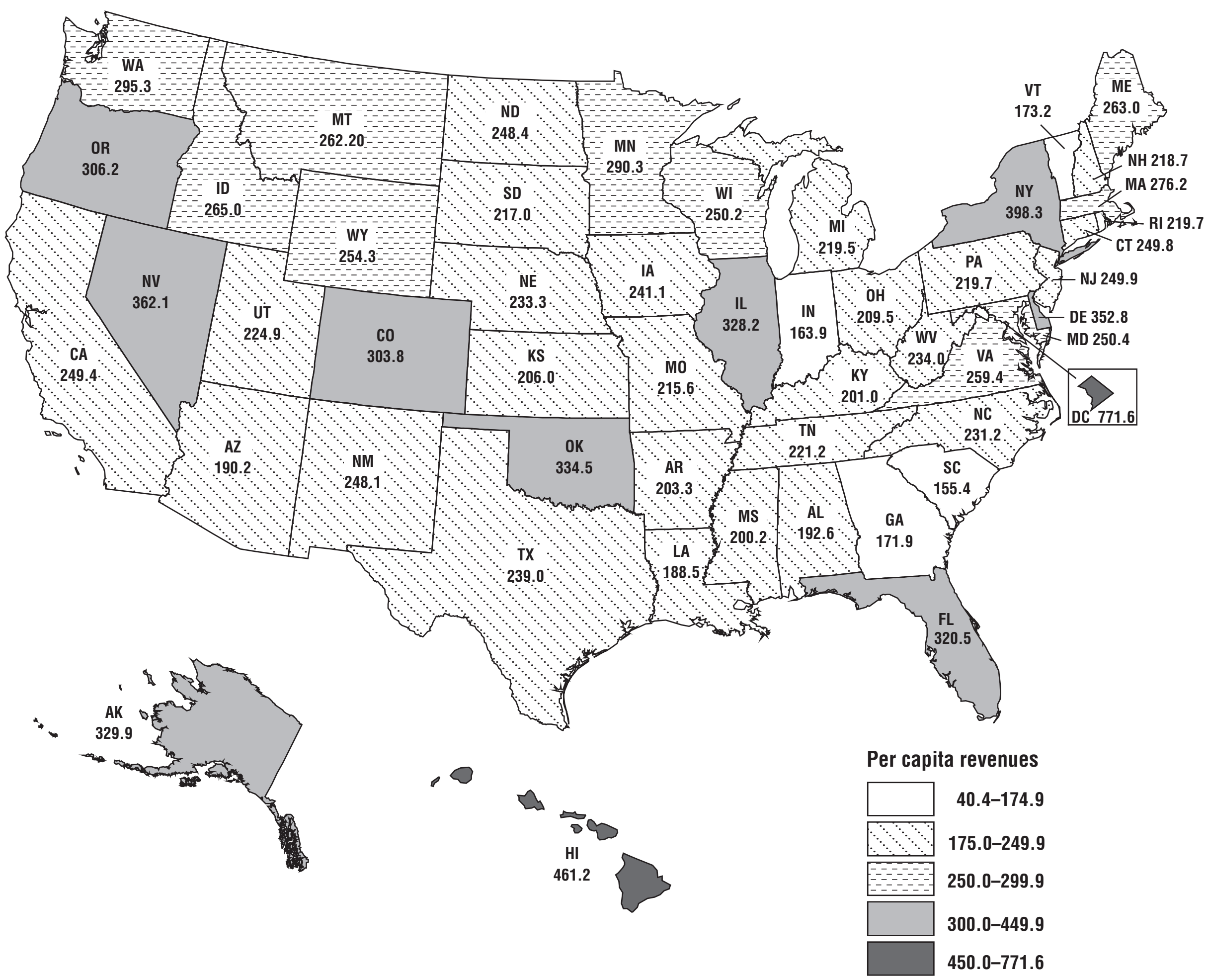
1. U.S. Department of Transportation, Bureau of Transportation Statistics, *Government Transportation Financial Statistics 2001,* available at http://www.bts.gov, as of July 2002.

Figure 2
Government Transportation Expenditures by Mode: FY 1985–1999
Chained 1996 dollars



SOURCES: U.S. Department of Transportation (USDOT), Bureau of Transportation Statistics, compiled from:
Federal highway, transit, rail, pipeline, and general support: USDOT, Federal Highway Administration, *Highway Statistics* (Washington, DC: Annual issues), table FE-210, pp. IV–22. Executive Office of the President of the United States, Office of Management and Budget, *Budget of the United States Government: Appendix* (Washington, DC: Annual issues).
Federal air and water: Executive Office of the President of the United States, Office of Management and Budget, *Budget of the United States FY 2002—Public Budget Database,* "Outlays," available at http://w3.access.gpo.gov/usbudget/fy2002/db.html, as of October 2001.
____. *Budget of the United States Government: Appendix* (Washington, DC: Annual issues). National Aeronautics and Space Administration, *Aeronautics and Space Report of the President* (Washington, DC: Annual issues), appendix E-3, available http://www.hq.nasa.gov/office/hqlibrary/books/nasadoc.html, as of October 2001. U.S. Army Corps of Engineers, personal communication, October 2001.
State and local: U.S. Department of Commerce (USDOC), U.S. Census Bureau, "State and Local Government Finance Estimates," available at ftp://ftp.census.gov/pub/outgoing/govs/, as of October 2001.
Chain-type price index: USDOC, Bureau of Economic Analysis, "National Income and Product Accounts Tables," 2001, table 7.1, Quantity and Price Indexes for Gross Domestic Product, available at http://www.bea.doc.gov/bea/dn/nipaweb/, as of October 2001.

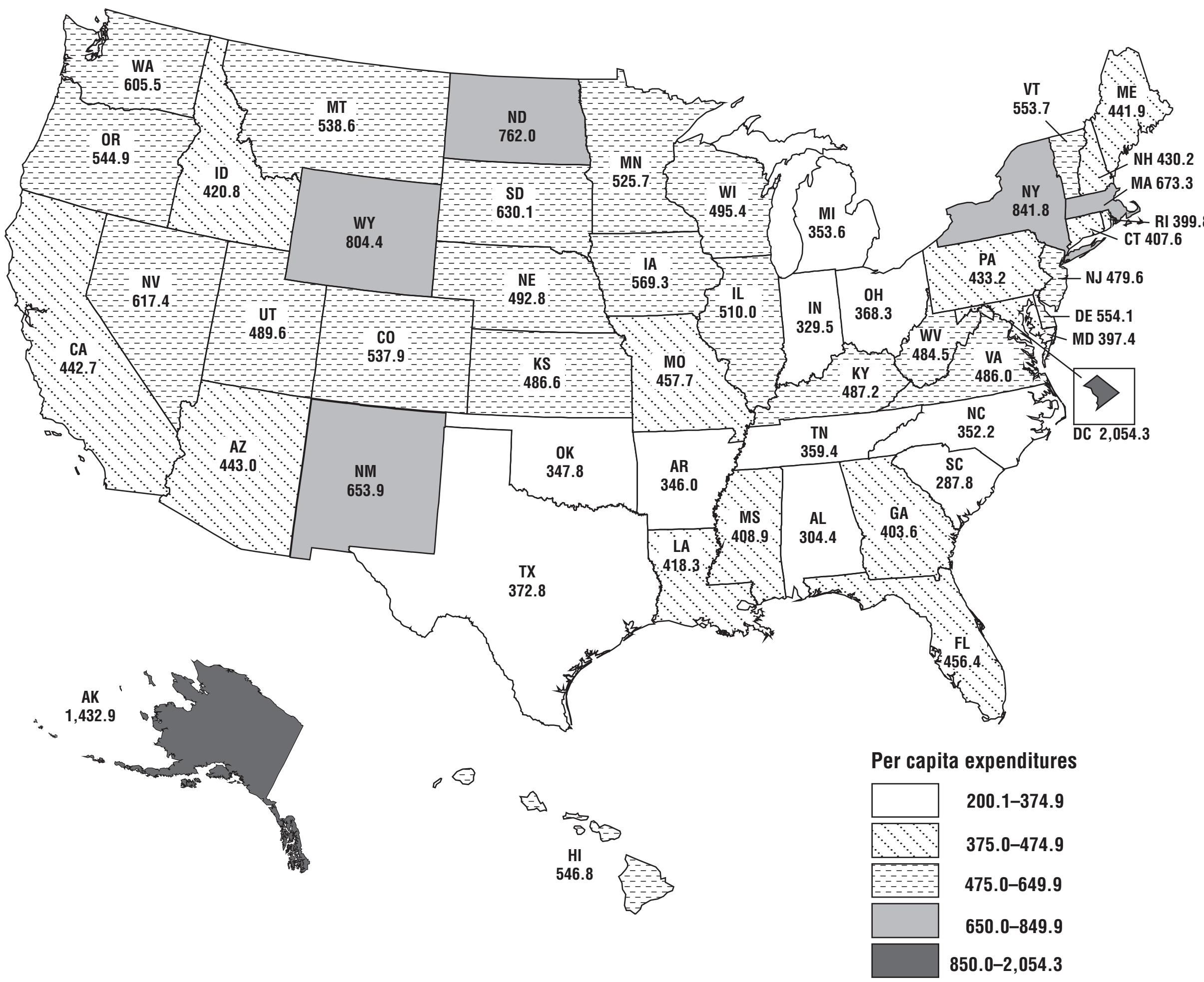
Per Capita State and Local Transportation Revenues: FY 1999
Chained 1996 dollars



NOTE: Includes highway, air, transit, and water transportation.

SOURCES: U.S. Department of Transportation, Bureau of Transportation Statistics, based on U.S. Department of Commerce, U.S. Census Bureau, "State and Local Government Finance Estimates" and "State Population Estimates," 1985 and 1999.

Per Capita State and Local Transportation Expenditures After Federal Grants: FY 1999
Chained 1996 dollars



NOTE: Includes highway, air, transit, and water transportation.

SOURCES: U.S. Department of Transportation, Bureau of Transportation Statistics, based on U.S. Department of Commerce, U.S. Census Bureau, "State and Local Government Finance Estimates" and "State Population Estimates," 1985 and 1999.

Fuel Tax Revenue

Over half of the revenue for the Highway Trust Fund (HTF), which provides funding for surface transportation, comes from federal motor fuel taxes paid by households (figure 1 and box). In 1970, for example, households paid $8.5 billion (chained 1998 dollars) in federal motor fuel taxes, accounting for about 50 percent of HTF revenue. By 1999, the share of federal motor fuel taxes paid by households increased to 58 percent of the HTF, or $18.8 billion.

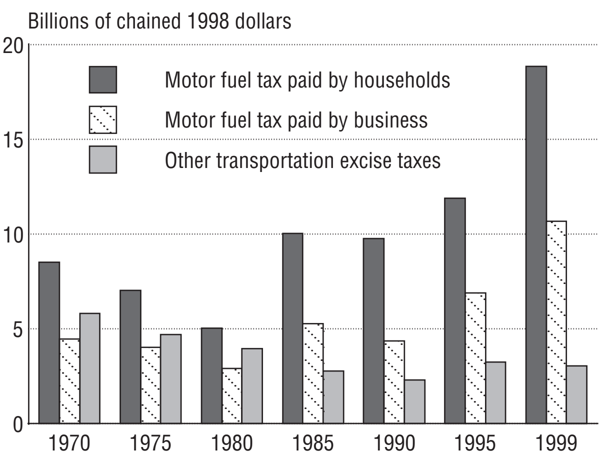
Households paid an average of $185 each in 1999 in federal fuel taxes, nearly six times the amount they did in 1966, when measured in current dollars (figure 2a). However, when the effect of inflation is removed, federal motor fuel taxes paid by the average American household increased by only 31 percent between 1966 and 1999 (figure 2b), while household real disposable income rose by 64 percent. Hence, the share of federal motor fuel tax in household disposable income decreased from 0.37 percent in 1966 to 0.29 percent in 1999 (figure 3).

Improvements in automobile fuel economy were largely responsible for the slower growth of household motor fuel consumption and hence household expenditures on the motor fuel tax relative to the growth of household income and travel demand. Between 1966 and 1999, vehicle-miles traveled per household increased 77 percent, while motor fuel consumption per household increased only 21 percent.

Where the Fuel Tax Revenues are Kept

States have collected taxes on gasoline since 1919, and in 1932 the U.S. Congress enacted the first federal tax on gasoline. These taxes were initially deposited in the General Fund. Beginning in 1956, federal motor fuel taxes were earmarked for the federal Highway Trust Fund. Since then, motor fuel taxes have increased several times (e.g., 9 cents per gallon in 1983, 14.1 cents per gallon in 1990, and 4.3 cents per gallon in 1993). Between December 1990 and October 1997, a percentage of the increase in federal motor fuel taxes was deposited in the General Fund for deficit reduction.

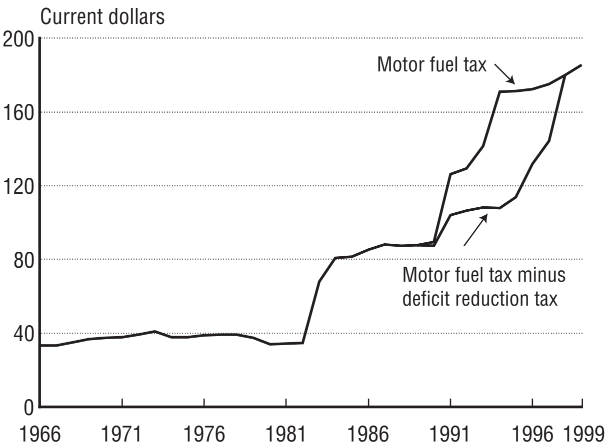
Figure 1
Highway Trust Fund Revenue Sources



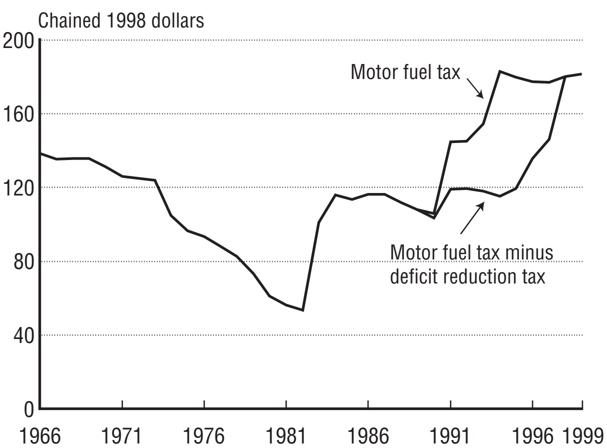
SOURCES:
U.S. Department of Transportation, Bureau of Transportation Statistics, "Federal Gas Tax: Household Expenditures from 1965 to 1995," *TranStat,* August 1997.
1999 data—U.S. Department of Transportation, Bureau of Transportation Statistics estimates based on U.S. Department of Commerce, Bureau of Economic Analysis, *Survey of Current Business,* various issues; U.S. Department of Labor, Bureau of Labor Statistics, "Consumer Expenditure Survey," 1999; and U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 1999* (Washington, DC: 2000).

Figure 2
Federal Motor Fuel Tax per Household: 1966–1999

(a) Current dollars

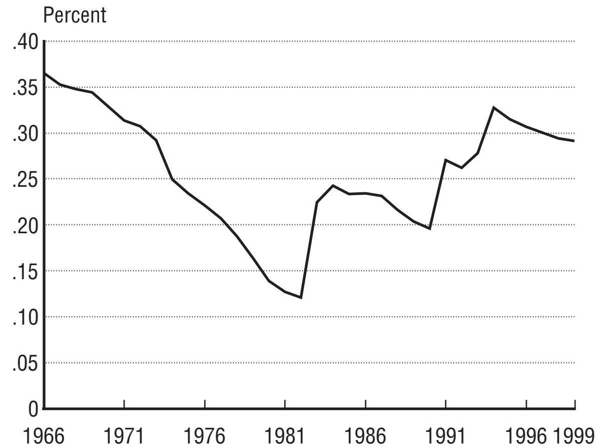


(b) Chained dollars



SOURCES:
U.S. Department of Transportation, Bureau of Transportation Statistics, "Federal Gas Tax: Household Expenditures from 1965 to 1995," *TranStat,* August 1997.
1998 and 1999 data—U.S. Department of Transportation, Bureau of Transportation Statistics estimates based on U.S. Department of Commerce, Bureau of Economic Analysis, *Survey of Current Business,* various issues; U.S. Department of Labor, Bureau of Labor Statistics, "Consumer Expenditure Survey," 1996, 1997, 1998, and 1999; and U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 1999* (Washington, DC: 2000).

Figure 3
Share of Federal Motor Fuel Tax in Household Disposable Income: 1966–1999



SOURCES:
U.S. Department of Transportation, Bureau of Transportation Statistics, "Federal Gas Tax: Household Expenditures from 1965 to 1995," *TranStat,* August 1997.
1998 and 1999 data—U.S. Department of Transportation, Bureau of Transportation Statistics estimates based on U.S. Department of Commerce, Bureau of Economic Analysis, *Survey of Current Business,* various issues; U.S. Department of Labor, Bureau of Labor Statistics, "Consumer Expenditure Survey," 1996, 1997, 1998, and 1999; and U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 1999* (Washington, DC: 2000).

Highway Capital Stocks

Through decades of public and private investment, the United States has developed a large and extensive transportation system that is an important component of our national wealth and a contributor to productive capacity. Currently, however, adequate economic data on transportation infrastructure and vehicle capital stocks are only available for highways, although an effort is underway to expand knowledge in this area (see box).

In 2000, the accumulated public capital stock in highways and streets was valued at $1.4 trillion (current dollars). From 1988 to 2000, the value (in chained 1996 dollars) of highway capital stock increased by 25 percent. More dramatic increases in the value of highway capital stock occurred between 1953 and 1971 when the Interstate system was under development. Figure 1 shows the growth pattern in public capital in highways and streets between 1925 and 2000. Since the early 1970s, the value of highway vehicle stocks has grown much faster than the value of highway capital stocks, indicating that highways support much more rolling stock today than they did 20 years ago.

Transportation Infrastructure Capital Stock Account

All levels of government, along with the private sector, invest in transportation infrastructure. The resulting infrastructure assets play a key role in U.S. productive capacity and also contribute to income and wealth generation. At the same time, infrastructure must be maintained to ensure adequate service. Despite its obvious importance, economic data on transportation infrastructure are inadequate.

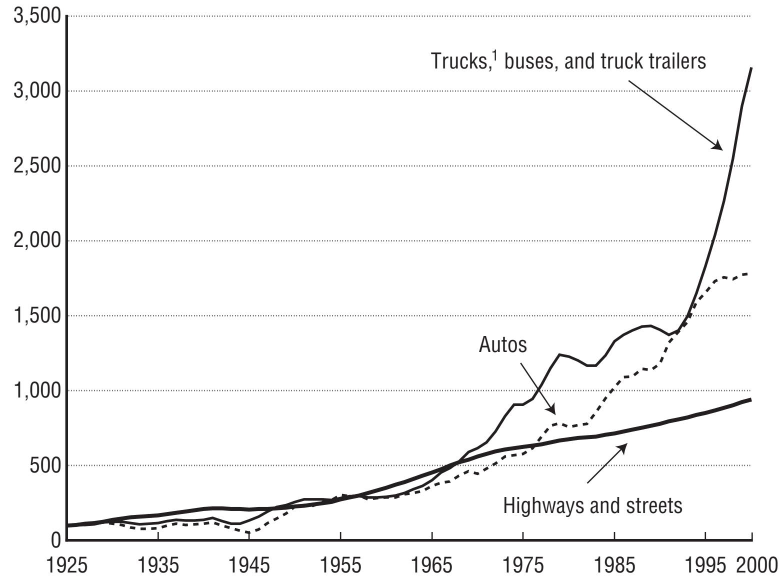
The Bureau of Transportation Statistics (BTS) of the U.S. Department of Transportation is developing a Transportation Infrastructure Capital Stock Account (TICSA) to overcome some of these data limitations. TICSA will provide comprehensive information on infrastructure investment, capital stock value, service value, asset retirement, and asset depreciation.

When completed, TICSA will include capital assets for highways and streets, airports and airways, ports and waterways, transit facilities, railroads, and pipelines. With such broad coverage, TICSA data will allow analysts to address such questions as:

1. What is the monetary value of transportation infrastructure used to support transportation operations in the U.S. economy?
2. What proportion of national income is invested in transportation infrastructure?
3. How much would need to be spent to maintain the current capacity of the transportation network or to increase its capacity to a certain level?
4. What is the rate of return of public investment in transportation infrastructure?
5. What is the relationship between transportation infrastructure investment and the growth in productivity in transportation industries?
6. How are transportation costs affected by the level of investment in transportation infrastructure, and how does this vary by mode?

BTS expects to have estimates of national highway capital stocks by late 2003.

Figure 1
Real Growth in Highway Capital Stocks Compared with Vehicle Stocks: 1925–2000
Chain-type index: 1925 = 100



[1] Includes light-duty and heavy-duty trucks.

NOTE: The highway capital stocks and vehicle stocks indices are quantity indices. They represent the relative quantity rather than the value of those goods.

SOURCE: U.S. Department of Commerce, Bureau of Economic Analysis, "Fixed Assets," available at http://www.bea.doc.gov/bea/dn/faweb, as of November 2001.

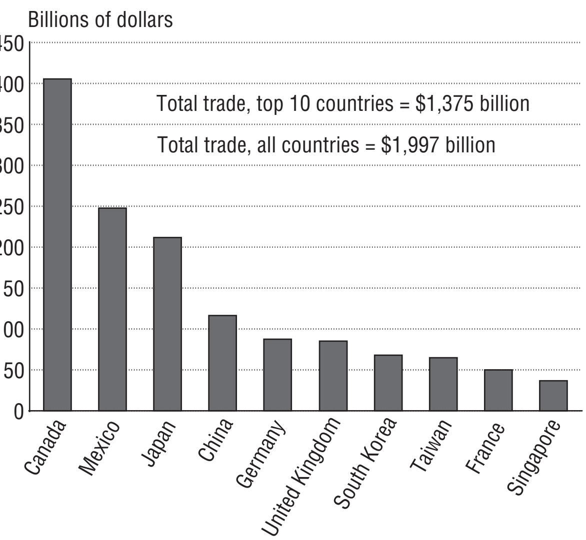
International Trade

Continuing growth of international trade is influencing the development of transportation systems and services within the United States. Increased international merchandise trade has spurred the development of marine and air cargo facilities, land border crossings, and domestic access infrastructure to connect international gateways with domestic U.S. origins and destinations. New technologies, including intelligent transportation systems, facilitate lower transportation costs and higher levels of service and speed.

Between 1997 and 2000, U.S. international merchandise trade rose 28.2 percent to $2 trillion (current dollars). Canada continued as the number one overall trade partner of the United States in 2000, a position that country has held for decades. Meanwhile, Mexico held steady in the number two position for the year, after surpassing Japan in 1999. In 2000, 10 nations accounted for almost 70 percent of all U.S. merchandise trade, and 5 of these were Asian Pacific countries (figure 1). Despite the recession in East and Southeast Asia in 1997, the overall U.S. trade relationship with many countries in the Pacific region expanded between 1998 and 2000.[1]

In 2000, higher value manufactured goods dominated U.S. trade, accounting for $1,704 billion (85 percent) of the value of all merchandise trade. Motor vehicles, electrical machinery and appliances, office machines (including computers and other automated data processing equipment) were among the top U.S. import and export commodities when measured by value. Transportation equipment was one of the leading U.S. manufactured exports, accounting for $43 billion in 2000. Agricultural goods accounted for approximately 5 percent of the value of U.S. international trade, and Japan was the top market for U.S. agricultural exports. Canada and Mexico were also leading purchasers and suppliers of

Figure 1
Top 10 U.S. Trade Partners, All Modes of Transportation: 2000



SOURCES: U.S. Department of Transporation, Bureau of Transportation Statistics, special tabulation, July 2001, based on U.S. Department of Commerce, U.S. Census Bureau, Foreign Trade Division, *U.S. Exports of Merchandise CD* and *U.S. Imports of Merchandise CD,* December 2000.

[1] U.S. overall merchandise trade with many Asian Pacific countries fell between 1997 and 1998 due to the region's recession. However, by 1999, trade with many of these same countries had risen to or exceeded the 1997 levels. Some of this trade growth was due to the expansion in imports from these countries, as these goods became relatively cheaper due to shifts in currency exchange rates.

U.S. agricultural commodities. Mineral fuels accounted for about 7 percent of the value of U.S. international trade in 2000; the majority of this trade was U.S. imports of crude petroleum and related products. Canada was the leading supplier of petroleum products to the United States in 2000, followed by Venezuela and Saudi Arabia.

Between 1997 and 2000, the relative roles of the transportation modes in carrying U.S. international trade were in flux due to the continuing growth in trade within North America and internationally. During this period, the value of U.S. international trade carried by truck increased 33 percent to $429 billion, air freight expanded 37 percent to $593 billion, while waterborne trade grew by approximately 18 percent. Despite the smaller relative increase in waterborne trade during this time, about $740 billion of U.S. exports and imports moved by this mode in 2000, accounting for about 37 percent of the value of all U.S. international trade (table 1).

By value, Japan was the leading U.S. maritime trade partner in 2000, representing over one-sixth of all U.S. waterborne trade. The ports of Los Angeles and Long Beach accounted for the majority of West Coast trade and also represented in 2000 over one-quarter of the value of overall waterborne trade for the United States (table 2).

Waterborne trade accounts for a higher percentage of U.S. international trade tonnage compared with other modes. The top four U.S. maritime trade partners by weight—Mexico, Venezuela, Canada, and Saudi Arabia (table 3)—are also the top four crude oil suppliers to the United States. Other major crude oil suppliers—Nigeria, Colombia, and the United Kingdom—are also among the top 10 maritime trade partners by weight. Houston and other Gulf Coast ports accounted for the majority of U.S. international waterborne tonnage, a large component of which is the trade of bulk commodities and crude petroleum.

Growth in air cargo, especially of high-value, time-sensitive commodities, continued into 2000. Lower shipping costs and more frequent service have made air cargo a major factor in the way global business is conducted. Air cargo is carried both by all-passenger carriers as well as air freight carriers, including integrated express carriers, such as Federal Express, United Parcel Service (UPS), DHL, Airborne Express, CF/Emery, Burlington and others. Air freight accounted for approximately 30 percent (by value) of U.S. interna-

International Trade Data

Overall and modal trade totals cited here are based on annual data reported by the Foreign Trade Division of the U.S. Census Bureau in *FT920 U.S. Merchandise Trade: Selected Highlights* (December 1999), *U.S. Exports of Merchandise CD* (December 1999), and *U.S. Imports of Merchandise CD* (December 1999). The U.S. Census Bureau also annually revises overall and country totals appearing in these products, which are then used by the U.S. Census Bureau and other federal agencies.

Accurately calculating the modal share of U.S. international trade for all transportation modes (including disaggregated land modes) was not possible until 1997 because of past collecting and processing methods. Modal data are not corrected in the revised figures provided by the U.S. Census Bureau. Therefore, this section relies on both the overall and mode of transportation data in the originally documented merchandise trade figures as cited in the report and CDs mentioned above.

Thus, this section on U.S. international trade analyzes changes between 1997 and 2000. At the same time, longer term trends are also noted and different reference years shown where necessary. Unless otherwise noted, the value of U.S. merchandise imports is based on U.S. general imports, customs value basis. Export value is f.a.s. (free alongside ship) and represents domestic and foreign exports valued at the port of exit (including the transaction price, inland freight, insurance, and other charges).

Table 1
Value of U.S. International Merchandise Trade by Mode of Transportation: 2000

Mode	Imports: Current U.S. $ (millions)	Imports: Percent	Exports: Current U.S. $ (millions)	Exports: Percent	Total trade: Current U.S. $ (millions)	Total trade: Percent
Total, all modes	**1,216,888**	**100.0**	**780,419**	**100.0**	**1,997,306**	**100.0**
Water	540,895	44.4	199,069	25.5	739,963	37.0
Air	308,642	25.4	284,356	36.4	592,999	29.7
Truck	216,485	17.8	212,215	27.2	428,700	21.5
Rail	70,755	5.8	23,442	3.0	94,198	4.7
Pipeline	23,129	1.9	463	0.1	23,592	1.2
Other and unknown	56,982	4.7	60,873	7.8	117,855	5.9

NOTES: Water: Excludes in-transit data (merchandise shipped from one foreign country to another via a U.S. water port).
Imports: Excludes imports valued at less than $1,250. Import value is based on U.S. general imports, customs value basis.
Exports: Excludes exports valued at less than $2,500. Export value is f.a.s. (free alongside ship) and represents the value of exports at the port of export, including the transaction price and inland freight, insurance, and other charges.

SOURCES: Compiled by U.S. Department of Transportation, Bureau of Transportation Statistics, July 2001.
Total, water, and air data: U.S. Department of Commerce, U.S. Census Bureau, Foreign Trade Division, *U.S. Exports of Merchandise CD* and *U.S. Imports of Merchandise CD,* December 2000.
Truck, rail, pipeline, and other and unknown data: U.S. Department of Transportation, Bureau of Transportation Statistics, *Transborder Surface Freight Data,* 2000, and special tabulations.

Table 2
Top 10 U.S. Maritime Ports for International Trade by Value and Weight: 2000
Preliminary data

Ranked by value	Port	Value ($ billions)	Percent	Ranked by weight	Port	Millions of metric tons	Percent
1	Los Angeles, CA	101.8	13.8	1	Houston, TX	109.2	9.4
2	Long Beach, CA	98.2	13.3	2	South Louisiana, LA	77.3	6.7
3	New York, NY	80.9	11.0	3	New Orleans, LA	67.2	5.8
4	Houston, TX	43.4	5.9	4	New York, NY	63.5	5.5
5	Seattle, WA	32.3	4.4	5	Corpus Christie, TX	54.8	4.7
6	Charleston, SC	31.5	4.3	6	Beaumont, TX	48.9	4.2
7	Norfolk, VA	25.2	3.4	7	Morgan City, LA	48.0	4.1
8	Oakland, CA	25.1	3.4	8	Long Beach, CA	40.5	3.5
9	Baltimore, MD	20.6	2.8	9	Los Angeles, CA	39.8	3.4
10	Tacoma, WA	19.8	2.7	10	Philadelphia, PA	33.2	2.9
	Total, top 10	**478.9**	**64.9**		**Total, top 10**	**582.4**	**50.3**

SOURCE: U.S. Department of Transportation, Maritime Administration, Office of Statistical and Economic Analysis, Annual Waterborne databanks, 2001.

tional trade in 2000. Japan was the leading trade partner for U.S. air freight, followed by the United Kingdom and Germany (figure 2). New York's John F. Kennedy (JFK) International Airport was the leading gateway for international air shipments, accounting for $132 billion in 2000. Following JFK were San Francisco, Los Angeles International Airport, and Chicago.[2]

[2] San Francisco includes the San Francisco International Airport and other smaller regional airports. Chicago includes O'Hare, Midway, and other smaller regional airports.

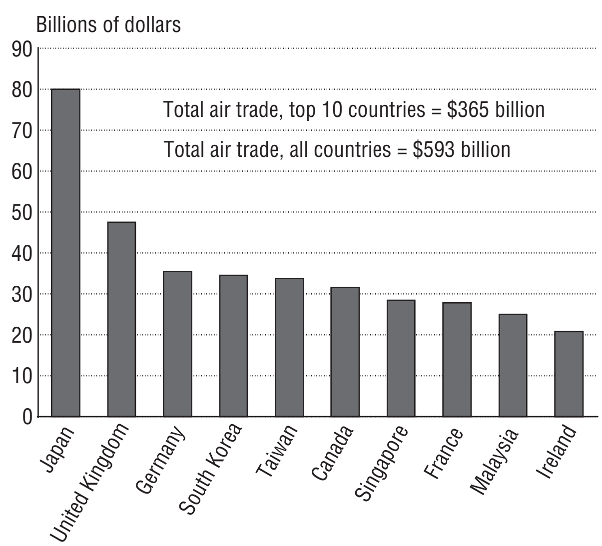
Table 3
Top 10 U.S. Maritime Trade Partners by Value and Weight: 2000

Ranked by value	Country	Value ($ billions)	Percent	Ranked by weight	Country	Millions of short tons	Percent
	All countries	**$740**	**100.0**		**All countries**	**1,273**	**100.0**
1	Japan	125	16.9	1	Mexico	119	9.4
2	China	93	12.6	2	Venezuela	116	9.1
3	Germany	41	5.5	3	Canada	95	7.4
4	South Korea	31	4.2	4	Saudi Arabia	84	6.6
5	Taiwan	28	3.8	5	Japan	79	6.2
6	United Kingdom	27	3.6	6	Nigeria	55	4.3
7	Mexico	24	3.2	7	China	50	3.9
8	Venezuela	23	3.1	8	Brazil	37	2.9
9	Saudi Arabia	17	2.4	9	Colombia	36	2.8
10	Brazil	14	2.2	10	United Kingdom	35	2.7
	Total, top 10	**426**	**57.5**		**Total, top 10**	**705**	**55.4**

NOTE: Excludes cargo in transit through the United States.

SOURCES: U.S. Department of Transportation, Bureau of Transportation Statistics, special tabulation, July 2001, based on U.S. Department of Commerce, U.S. Census Bureau, Foreign Trade Division, *U.S. Exports of Merchandise CD* and *U.S. Imports of Merchandise CD,* December 2000.

Figure 2
Top 10 U.S. Trade Partners by Air: 2000



SOURCES: U.S. Department of Transporation, Bureau of Transportation Statistics, special tabulation, July 2001, based on U.S. Department of Commerce, U.S. Census Bureau, Foreign Trade Division, *U.S. Exports of Merchandise CD* and *U.S. Imports of Merchandise CD,* December 2000.

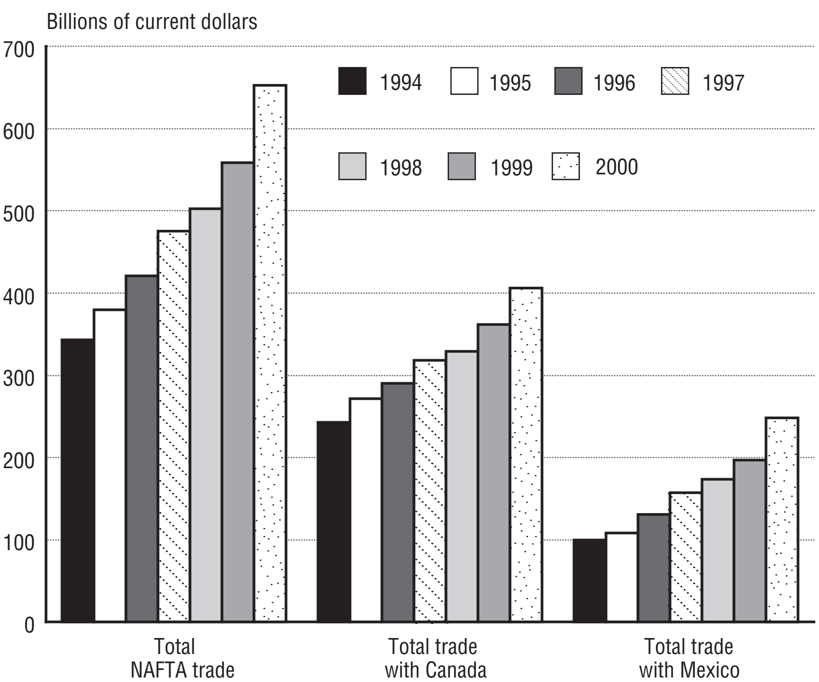
NAFTA Trade

The United States, Mexico, and Canada have signed two free trade agreements: the Free Trade Agreement in 1989 and the North American Free Trade Agreement (NAFTA) in 1993. Both agreements have led to the gradual reduction of tariffs on goods. These agreements have brought the share of U.S. merchandise trade with Canada and Mexico, now our two largest trading partners, to about 33 percent—Canada accounts for 20 percent and Mexico, 12 percent—in 2000.

Since NAFTA went into effect, the value of U.S. trade with Canada and Mexico has risen 91 percent in current dollars, from $343 billion to $653 billion (figure 1). In addition to the trade agreements, several other factors contributed to this increase, including the sustained economic expansion in the United States, U.S./Canada and U.S./Mexico exchange rates, and changes in industry manufacturing and distribution patterns.

Motor vehicles, parts, and accessories dominate NAFTA trade by value, as North

Figure 1
U.S. Merchandise Trade with NAFTA Partners: 1994–2000



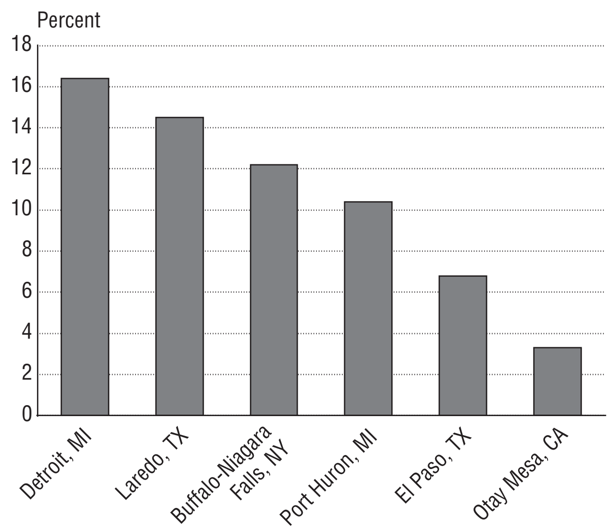
SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, special tabulation, August 2001, based on data from U.S.Department of Commerce, U.S. Census Bureau, Foreign Trade Division.

American automobile manufacturing is increasingly integrated across the three countries. Other leading commodities traded among NAFTA partners are consumer electronics, telecommunications equipment, petroleum and petroleum products, and aircraft equipment and parts [1, 2].

In 2000, trucks transported about 66 percent of the value of NAFTA merchandise trade, a share that has remained relatively constant since 1997. Rail accounted for about 14 percent of the share, and air and water modes accounted for approximately 7 and 5 percent, respectively. In recent years, trade by air has grown more rapidly than the other modes [3].

Six ports account for 64 percent of all North American trade by land, with Detroit, Michigan, and Laredo, Texas, handling the majority of trade on each U.S. border (figure 2). Trucks carry most of the trade at each of these ports, and the number of trucks entering at these border gateways has increased, in some cases, substantially (table 1). The origins

Figure 2
Top 6 Ports for U.S. Land Trade with NAFTA Partners, by Value: 2000



SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, Transborder Surface Freight Data, special tabulation, August 2001.

Table 1
Major NAFTA Border Crossings: 1996 and 2000
Trucks crossing into the United States

Rank in 2000	Port name	1996 (thousands)	2000 (thousands)	Percentage change (1996–2000)	Average number of trucks per day (1996)	Average number of trucks per day (2000)
1	Detroit, MI	1,332	1,769	32.8	3,649	4,848
2	Laredo, TX	1,016	1,493	47.0	2,784	4,091
3	Buffalo-Niagara Falls, NY	996	1,198	20.3	2,729	3,282
4	Port Huron, MI	636	839	31.9	1,742	2,299
5	El Paso, TX	556	720	29.6	1,523	1,974
6	Otay Mesa/San Ysidro, CA	531	688	29.6	1,455	1,886
7	Blaine, WA	402	517	28.6	1,101	1,416
8	Champlain-Rouses Pt., NY	279	391	40.1	764	1,071
9	Hidalgo, TX	205	374	82.5	562	1,025
10	Brownsville, TX	226	299	32.4	619	820
11	Calexico East/Calexico, CA	171	279	63.0	468	764
12	Alexandria Bay, NY	203	278	37.1	556	763
13	Nogales, AZ	229	255	11.2	627	698
14	Pembina, ND	141	214	52.0	386	587
15	Calais, ME	116	154	32.7	318	422

SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, special tabulation, August 2001, based on data from U.S. Department of the Treasury, U.S. Customs Service, Operations Management Warehouse database, May 2001.

and destinations of the trucks crossing at a particular port are often outside of the port state. For example, over 70 percent of the shipments that cross through the ports of Laredo and Buffalo have their respective origins or destinations outside of Texas or New York.

Ten U.S. states accounted for about two-thirds of the value of North American land trade in 2000 (table 2).[1]

Table 2
Top 10 U.S. Origins/Destinations for North American Merchandise Trade: 2000
All surface modes

State	Value (billions of current U.S. dollars)
Michigan	91.2
Texas	84.4
California	53.7
New York	35.9
Ohio	29.1
Illinois	29.1
Pennsylvania	17.5
Indiana	16.8
North Carolina	13.5
Arizona	12.6
Total top 10 states	**383.8**
Percentage of total NAFTA trade	**66.7**
All U.S. states	**575.7**

NOTES: Totals may not add due to rounding.
Total for all U.S. states includes data for shipments where the U.S. state of origin or destination was unknown.

SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, Transborder Surface Freight data, special tabulation, August 2001.

Sources

1. U.S. Department of Commerce, U.S. Census Bureau, Foreign Trade Division, *FT920 U.S. Merchandise Trade: Selected Highlights, December 1994* (Washington, DC: 1994).
2. ____. *FT920 U.S. Merchandise Trade: Selected Highlights, December 1999* (Washington, DC: 1999).
3. U.S. Department of Transportation (USDOT), Bureau of Transportation Statistics (BTS), special tabulation, August 2001, based on the following: USDOT, BTS, Transborder Surface Freight Data; and Source 2 above.

[1] State origins and destinations are based on official U.S. international trade statistics. Because of the way these data are collected, some border state activity may be overrepresented.

U.S. Waterborne Trade

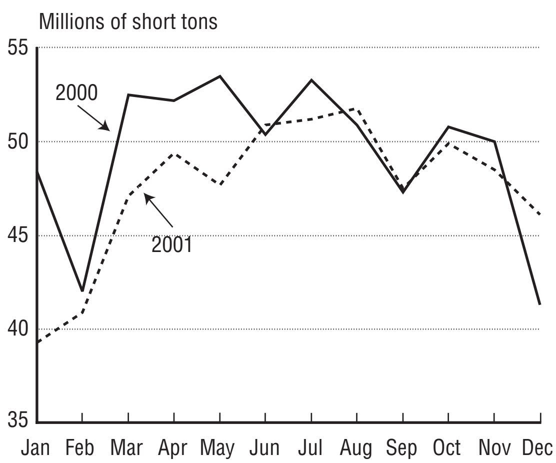
U.S. domestic waterborne trade was fairly stable from the mid-1980s until the 1990s, when U.S. coastal trade (i.e., domestic traffic over the ocean or the Gulf of Mexico) declined due to a decrease in Alaskan crude oil shipments. Internal U.S. trade, which occurs on U.S. rivers and waterways, varies monthly (figure 1). In 2000 when measured by tonnage, petroleum and petroleum product inland waterway shipments were down 5.3 percent and food and farm products were up 18.1 percent over 1999 levels. Coal shipments were down 1.7 percent over this period [1].

From 1999 to 2000, U.S. foreign waterborne trade increased 9.6 percent by value to total $737 billion and 2.4 percent by weight (to 1.2 billion metric tons) (figure 2). Liner service carried the largest share of this trade by value (65.7 percent) in 2000. However, by volume, tanker service had the largest share (51.9 percent) [2].

Sources

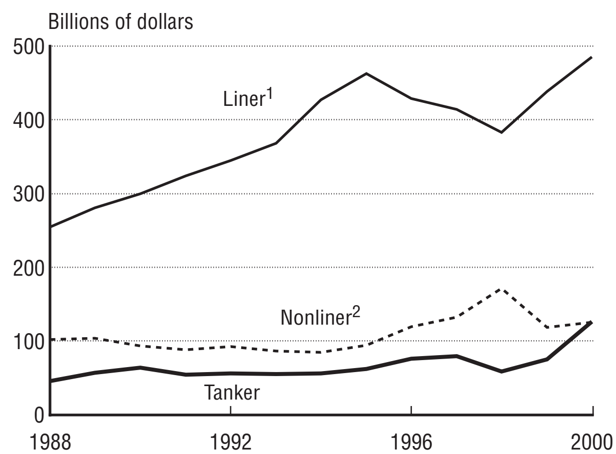
1. U.S. Army Corps of Engineers, Navigation Data Center, "Internal U.S. Waterway Monthly Tonnage Indicators," available at http://www.iwr.usace.army.mil/ndc/wcsc.htm, as of Oct. 30, 2002.
2. U.S. Department of Transportation, Maritime Administration, *U.S. Foreign Waterborne Transportation Statistics,* available at http://www.marad.dot.gov/statistics/usfwts/index.html, as of Sept. 7, 2001.

Figure 1
U.S. Domestic Waterborne Trade: 2000 and 2001



SOURCE: U.S. Army Corps of Engineers, Navigation Data Center, "Internal U.S. Waterway Monthly Tonnage Indicators," available at http://www.iwr.usace.army.mil/ndc/wcsc.htm, as of Oct. 30, 2002.

Figure 2
U.S. Foreign Waterborne Trade by Value: 1988–2000



[1] Primarily container vessels.
[2] "Tramp" or nonscheduled service.

SOURCES: U.S. Department of Transportation, Maritime Administration, Office of Statistical and Economic Analysis, "U.S. Imports and Exports by Customs District Ports," *U.S. Foreign Waterborne Transportation Statistics,* available at http://www.marad.dot.gov/statistics/usfwts/index.html, and "U.S. Foreign Waterborne Commerce," adapted from U.S. Department of Commerce, U.S. Census Bureau, U.S. foreign waterborne commerce data, various years.

Chapter 8

Energy and the Environment

Introduction

The U.S. Department of Transportation, under its human and natural environment strategic goal, is committed to protecting and enhancing communities and the natural environment affected by transportation. The economic and societal benefits provided by transportation also generate environmental impacts, and the sector's dependence on fossil fuels is at the root of many of these environmental problems. Construction of transportation infrastructure and facilities, and vehicle manufacturing, maintenance, use, and disposal affect the environment as well.

Transportation energy use has grown an average of 1.5 percent per year for the past two decades. Still, this growth rate is slower than that of the Gross Domestic Product and passenger-miles of travel, reflecting in part a general decline in the energy intensity of almost all modes. Today, however, the transportation sector consumes a greater share of petroleum (66 percent) than it did in 1973 (50 percent). The use of alternative and replacement fuels to reduce foreign oil dependence and environmental impacts has increased, but, despite incentives in place to promote these fuels, they still accounted for only a small faction of total motor vehicle fuel use in 2000.

Growth in energy consumption is causing a corresponding increase in greenhouse gas (GHG) emissions. The transportation sector emitted 1,819 million metric tons of carbon dioxide in 1999, an increase of 14.9 percent since 1990. Three-quarters of GHG emissions come from the use of highway vehicles. In addition to GHG emissions, transportation remains a primary source of emissions of three of the six air pollutants regulated under the Clean Air Act: carbon monoxide, nitrogen oxides, and volatile organic compounds. However, with the exception of nitrogen oxides, these emissions have been declining since 1990.

Transportation vehicle use can result in hazardous materials and oil spills. An average of 1.5 million gallons of oil is spilled into U.S. waters each year. In 1999, 24 percent of this oil was cargo carried by marine vessels, pipelines, railcars, and tank trucks.

Transportation infrastructure and its maintenance can also be sources of environmental damage. Each year the U.S. Army Corps of Engineers dredges an average of 271 million cubic yards of sediments from navigation channels. Contaminated sediments are confined in various ways, while the balance may be used beneficially to nourish beaches and wetlands. Sediments become contaminated from pollutants released into the nation's waters. Similarly, petroleum stored in underground tanks has a history of leaking into soils and ultimately into surface and underground waters. By 2001, after a decade of focused effort by the U.S. Environmental Protection Agency (EPA), there were almost 150,085 known petroleum tank releases around the country waiting to be cleaned up. The leaking of methyl-tertiary-butyl-ether (MTBE), largely from underground storage tanks, was recognized in 2000 as an issue serious enough for EPA to ask the U.S. Congress to ban or reduce its use as an additive in gasoline.

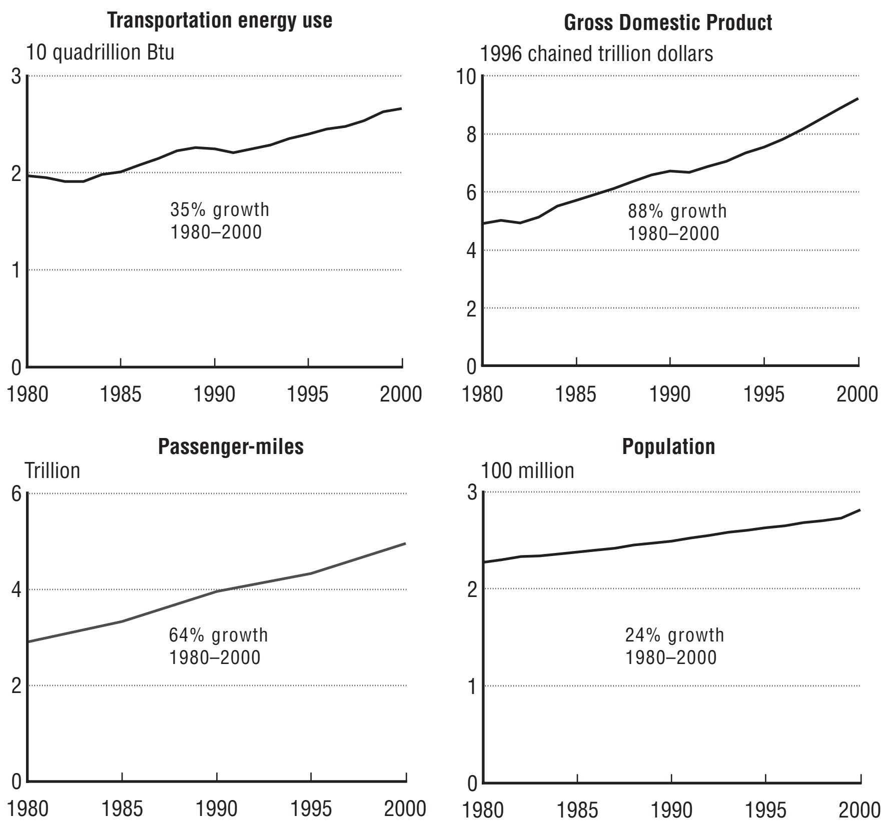
Rubber tires and lead-acid batteries are two of the few transportation wastes quantified on an annual basis. States and local governments often promote the establishment of systems to recycle these wastes at the end of their lifetime. However, while over 93 percent of the lead content of batteries was reused in 1999, only 24 percent of the 4.5 million tons of scrap tires generated were recycled. This left almost 3.5 million tons of car, truck, and motorcycle tires to be disposed of in landfills or incinerated.

Preservation of wetlands, urban sprawl, invasive species, and environmental justice are also areas of concern. The United States has an estimated 105 million acres of wetlands. An equal amount may have been lost since the 1600s, drained to develop rural and urban areas. Transportation affects wetlands when roads and railroads are built and people and cargo are moved through them and when airports and other facilities are placed in them.

Energy Use

As the economy has grown, so too has transportation energy use. From 1980 to 2000, transportation energy use grew from 19.7 quadrillion (quads) British thermal units (Btu) to 27.0 quads, an annual growth rate of 1.5 percent [1]. The overall growth rate is lower than that of the economy (as measured by Gross Domestic Product (GDP)) and the growth rate in passenger-miles, but not population (figure 1). It is influenced by a combination

Figure 1
Transportation Energy Use and Other Trends: 1980–2000



NOTE: 2000 data for passenger-miles do not include numbers for transit or general aviation.

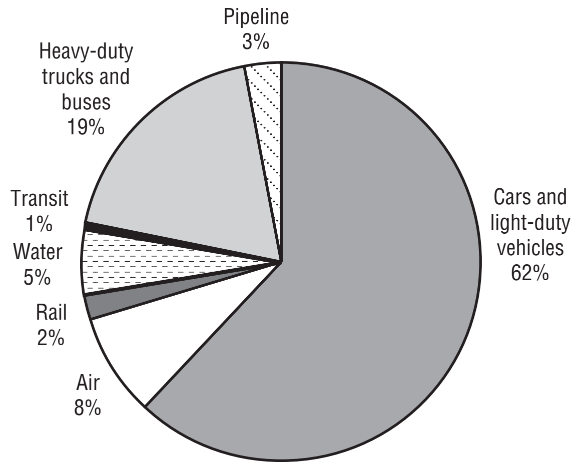
SOURCES:
Energy use: U.S. Department of Energy, Energy Information Administration, *Annual Energy Review,* DOE/EIA 0384(2000) (Washington DC: August 2001).
Gross Domestic Product: U.S. Department of Commerce (USDOC), Bureau of Economic Analysis, available at http://www.bea.doc.gov/, as of January 2001.
Passenger-miles: U.S. Department of Transportation, Bureau of Transportation Statistics, *National Transportation Statistics 2001,* available at http://www.bts.gov.
Population: USDOC, U.S. Census Bureau, available at http://www.census.gov/, as of January 2001.

Table 1
Total Energy Consumption by End-Use Sector
Quadrillion Btu

Year	Residential/ commercial	Industrial	Transportation
1980	26.551	32.192	19.695
1985	27.645	29.067	20.071
1990	30.052	31.743	22.541
1995	32.898	34.063	23.975
2000	36.141	35.844	27.101

SOURCE: U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review,* November 2001, table 2.1a, available at http://www.eia.doe.gov/emeu/mer/pdf/pages/sec2_3.pdf, as of Dec. 18, 2001.

Figure 2
Transportation Energy Use by Mode: 1999



NOTE: Data are preliminary.

SOURCE: U.S. Department of Transportation, *National Transportation Statistics 2001,* table 4-6, available at www.bts.gov.

of factors, including changes in transportation intensity of U.S. GDP, vehicle fuel efficiency, and personal travel propensity.

For decades, the transportation sector has accounted for between 25 percent and 27 percent of total U.S. energy consumption (table 1). In 1999, highway vehicles accounted for just over 80 percent of transportation energy use. Passenger cars used 36 percent of the sector's total, followed by light trucks (including minivans, pickups, and sport utility vehicles) with 26 percent, and heavier trucks with 19 percent. Among the nonhighway modes, air transportation is the biggest and fastest growing energy user. The pipeline mode, which accounted for about 3 percent of total transportation energy use, is the only mode that does not depend directly on petroleum. Typically, pipelines use natural gas and/or electric pumps to move products (figure 2).

Source

1. U.S. Department of Energy, Energy Information Administration, *Annual Energy Review 2000,* DOE/EIA-0384(2000) (Washington, DC: August 2001).

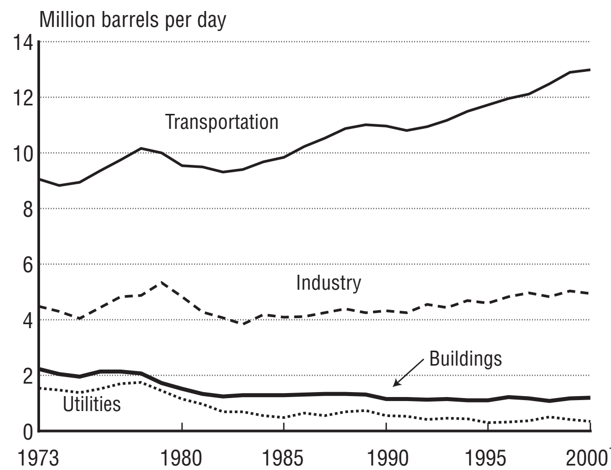
Petroleum Consumption

In the United States, petroleum consumption has risen faster in the transportation sector than in any other since 1973, before the first oil embargo. Continued growth in transportation activities has contributed, in large part, to the increase in oil consumption. While the oil price shocks of 1973–74 and 1979–80 depressed demand for a while, they did little to shake transportation's dependence on oil. Only a small fraction of transportation's energy needs are met by nonpetroleum sources, such as natural gas, methanol, and ethanol. Nonpetroleum sources are used primarily as gasoline blending agents to meet requirements of the Clean Air Act Amendments of 1990.

From 1973 to 2000, the residential and commercial buildings sector cut petroleum use in half, and the utilities sector reduced oil use by more than 60 percent. Over the same period, industrial sector oil use hovered between 4 million barrels per day (mmbd) and 5 mmbd, primarily because petroleum is an important feedstock for the petrochemicals industry. In contrast, oil use in the transportation sector rose from 9.05 mmbd in 1973 to 12.99 mmbd in 2000, an increase of about 41 percent. Due to these changes in consumption patterns among sectors, transportation today accounts for 67 percent of total U.S. petroleum demand compared with about 50 percent before 1973 [2] (figure 1).

The U.S. Department of Energy (DOE) expects the heavy concentration of oil demand in the transportation sector to continue. In fact,

Figure 1
U.S. Petroleum Use by Sector: 1973–2000



[1] 2000 data are estimates; utilities number is preliminary.

SOURCE: U.S. Department of Energy, Energy Information Administration, *Annual Energy Review 2000,* DOE/EIA-0384(00) (Washington, DC: August 2001), table 5.12a.

DOE projects overall petroleum demand to grow at an average annual rate of 1.5 percent through 2020, led by growth in the transportation sector. Given this, transportation's share of petroleum consumption would rise to 70 percent [1].

Sources

1. U.S. Department of Energy, Energy Information Administration, *Annual Energy Outlook 2002*, DOE/EIA-0383(2002) (Washington, DC: December 2001).
2. ____. *Annual Energy Review 2000,* DOE/EIA-0384(00) (Washington, DC: August 2001), table 5.12a.

Alternative and Replacement Fuels

Spurred by energy and environmental legislation, the use of alternative and replacement fuels in motor vehicles is growing, but not enough to indicate a trend away from the use of petroleum in the transportation sector. Between 1992 and 2000, estimated alternative fuel use grew by 5.9 percent annually (table 1). Nevertheless, alternative fuels comprise a tiny fraction of total motor vehicle fuel use—0.17 percent in 1992 and 0.22 percent in 2000. Alternate fuel growth is in proportion to the rise in the number of alternative fuel vehicles (table 2) [2].

Replacement fuels—alcohols and ethers (oxygenates)—are blended with gasoline to meet the requirements of the Clean Air Act Amendments of 1990. They comprise a larger proportion of the motor fuel market than alternative fuels, as shown in figure 1. Unlike petroleum, which is composed entirely of hydrogen and carbon atoms, alcohols and ethers contain oxygen and are derived from energy sources other than petroleum.

Table 1
Fuel Consumption in the United States: 1992 and 2000
Thousand gasoline-equivalent gallons

Type of fuel	1992	2000
Alternative fuels		
Liquefied petroleum gas	208,142	247,062
Compressed natural gas	16,823	98,351
Liquefied natural gas	585	7,121
Methanol (85%)[1]	1,069	585
Methanol, neat (100%)	2,547	437
Ethanol (85%)[1]	21	7,074
Ethanol (95%)[1]	85	13
Electricity	359	2,670
Subtotal	**229,631**	**363,313**
Replacement fuels/oxygenates		
MTBE[2]	1,175,000	3,087,900
Ethanol in gasohol	701,000	1,016,300
Biodiesel	U	6,816
Traditional fuels		
Gasoline[3]	110,135,000	125,720,000
Diesel	23,866,000	36,979,200
Total fuel consumption	**134,230,631**	**163,062,513**

[1] The remaining portion of 85% methanol and both ethanol fuels is a gasoline. Data include gasoline portion of the fuel.
[2] Methyl-tertiary-butyl-ether (MTBE) includes a small amount of other ethers, primarily tertiary-amyl-methyl-ether and ethyl-tertiary-butyl-ether.
[3] Includes ethanol in gasohol and MTBE.

KEY: U = unavailable.

SOURCE: U.S. Department of Energy, Energy Information Administration, *Alternatives to Traditional Transportation Fuels 1999 (revised),* table 10, available at http://www.eia.doe.gov/, as of Jan. 8, 2002 (1992 data) and Oct. 29, 2002 (2000 data).

Table 2
Estimated Number of Alternative Fueled Vehicles in the United States, by Fuel: 1992 and 2000

Type of fuel	1992	2000
Liquefied petroleum gas[1]	221,000	272,193
Compressed natural gas	23,191	100,738
Liquefied natural gas	90	2,090
Methanol, 85%[2]	4,850	10,426
Methanol, neat	404	0
Ethanol, 85%[2]	172	58,621
Ethanol, 95%[2]	38	4
Electricity	1,607	11,834
Total	**251,352**	**455,906**

[1] Numbers rounded to nearest thousand.
[2] The remaining portion of 85% methanol and both ethanol fuels is gasoline.

SOURCE: U.S. Department of Energy, Energy Information Administration, *Alternatives to Traditional Transportation Fuels 1999 (revised)*, table 1, available at http://www.eia.doe.gov/, as of Jan. 8, 2002 (1992 data) and Oct. 29, 2002 (2000 data).

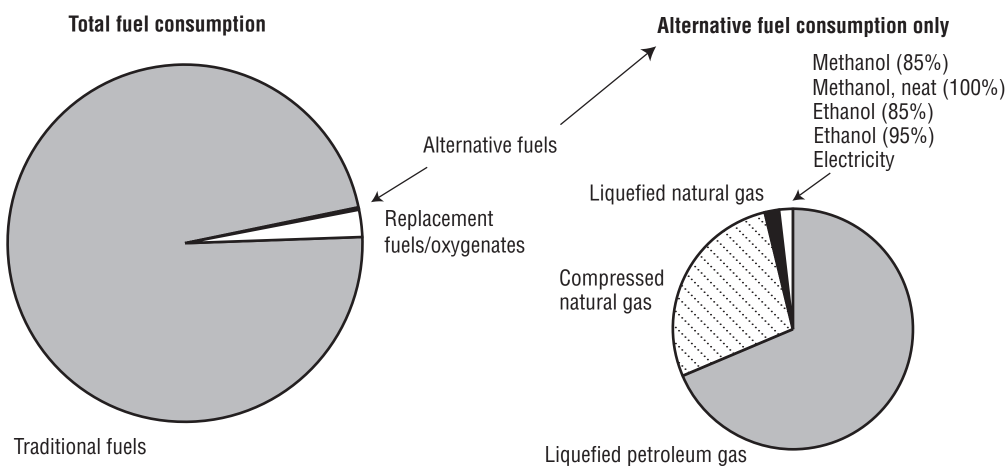
In areas where carbon monoxide emissions are a problem, fuel providers have been required since 1992 to add oxygenates to gasoline to promote more complete combustion. Gasoline that contains oxygenates is referred to as reformulated gasoline (RFG). Beginning in 1994, areas failing to attain air quality standards for ozone were required to use RFG, which must contain 2 percent oxygen by weight. In 2000, oxygenates made up 3.3 percent of the gasoline pool [2].

The most popular oxygenate is methyl-tertiary-butyl-ether (MTBE), a combination of methanol and isobutylene, made from natural gas. MTBE has several attributes that favor its use over ethanol as an oxygenate. However, the substance has been discovered—first in California in 1995—leaking from pipelines and storage tanks into drinking water. While MTBE is not classified as a carcinogen, studies have shown it can cause cancer in animals, and trace amounts of MTBE in water supplies produce an unpleasant order and taste. Various efforts are underway or being considered by 13 states, the U.S. Congress, and the U.S. Environmental Protection Agency to reduce or ban the use of MTBE as an oxygenate. As a result, the Energy Information Administration (EIA) projects that the amount of MTBE used by domestic refiners will be cut in half by 2004 to 123,000 barrels per day. Most of this decline in consumption results from a ban on MTBE in California due to begin at the end of 2002 [1]. However, subsequent to EIA's analysis, California decided to delay its ban until the end of 2003 because of a lack of infrastructure to assure adequate supplies of ethanol reformulated gasoline.

Sources

1. U.S. Department of Energy, Energy Information Administration, *Annual Energy Outlook 2002,* DOE/EIA-0383(2002) (Washington DC: December 2001).
2. ____. *Alternatives to Traditional Transportation Fuels 1999 (revised),* available at http://www.eia.doe.gov/fuelalternate.html, as of Jan. 8, 2002.

Figure 1
Estimated Vehicle Fuel Consumption in the United States: 2000



NOTES: The remaining portion of 85% methanol and ethanol fuels is gasoline. Figure is not proportional.

SOURCE: U.S. Department of Energy, Energy Information Administration, *Alternatives to Traditional Transportation Fuels 1999 (revised),* table 10, available at http://www.eia.doe.gov/fuelalternate.html, as of Jan. 8, 2002.

World Crude Oil Prices

The United States imports over 50 percent of its crude oil supplies, and changes in world prices of crude oil can have significant, direct impacts on the U.S. economy. Despite volatility in these prices, however, the transportation sector is not particularly responsive (i.e., has very low elasticity of demand). The disinclination of fuel users to replace petroleum with alternative fuels is a reason for this inelasticity.

World oil prices more than tripled between January 1999 and September 2000 as a result of oil production cutbacks by the Organization of Petroleum Exporting Countries (OPEC), with the cooperation of Mexico, Norway, and Russia (figure 1). This oil price hike prompted concern that oil dependence may once again have a serious effect on the transportation sector and the economy as a whole. However, in late 2000 world crude prices started to drop from their high of $32.86 per barrel, as a worldwide economic downturn began. By the end of 2001, prices had reached $18.69 per barrel, similar to the price in July 1999.

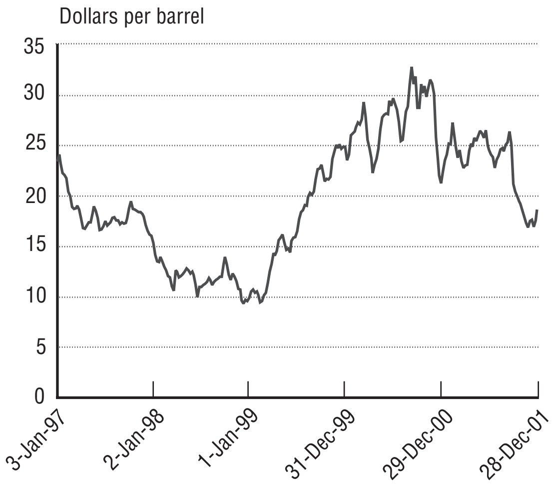
A Bureau of Transportation Statistics (BTS) analysis conducted in mid-2000 of the economic impact of the 1999/2000 increase in fuel prices estimated that, to drive the same distance and produce the same Gross Domestic Product as in 1999, U.S. households and businesses would have to spend an additional $67 billion (28 percent more) on transportation fuel in 2000 [1]. BTS concluded that households would absorb half of the additional cost and for-hire transportation firms about one-third, with the rest of the cost absorbed by nontransportation firms.

The average motor fuel cost to consumers on a per vehicle-miles traveled basis closely follows the trend in world crude oil prices (figure 2). At the beginning of 1997, on average, it cost Americans 7.5 cents to buy fuel to drive 1 mile. Then, as the world crude oil price fell below $10 per barrel (the lowest point in recent years), the fuel cost for driving 1 mile dropped to 5.5 cents, also the lowest point in recent years. Overall, the tripling of the price of crude oil in 1999 and 2000 caused the average fuel cost per mile to increase about 70 percent. Reflecting the low elasticity of demand, vehicle-miles traveled tends to fluctuate seasonally, rather than in response to world oil prices (figure 3).

Source

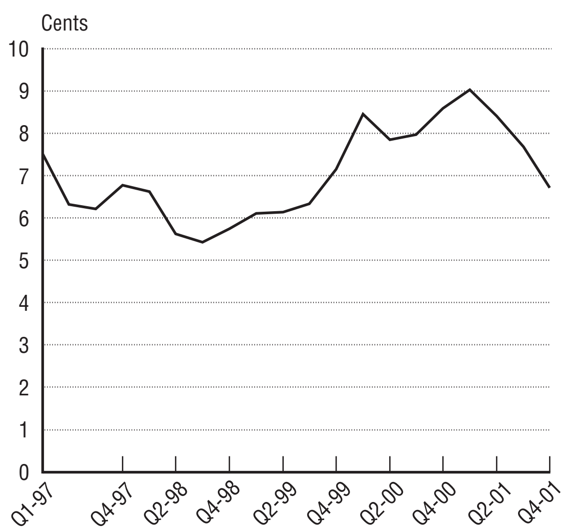
1. U.S. Department of Transportation, Bureau of Transportation Statistics, "The Economic Impact of the Recent Increase in Oil Prices," *Transportation Indicators: A Prototype,* May 2000.

Figure 1
World Crude Oil Prices
(Weekly)



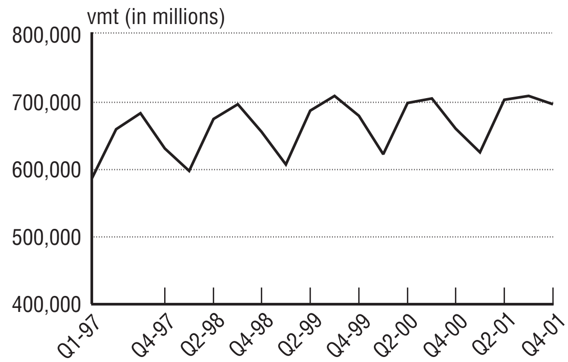
Source: U.S. Department of Energy, Energy Information Administration, available at http://www.eia.doe.gov/oil_gas/petroleum/pet_frame.html, as of March 2002.

Figure 2
Average Motor Fuel Cost per Vehicle-Mile Traveled by Consumers: 1997–2001



SOURCE: U.S. Department of Transportation, Federal Highway Administration, available at http://www.fhwa.dot.gov/ohim/tvtw/sept_tvt/tvtsept.pdf, as of June 2002.

Figure 3
Vehicle-Miles Traveled (vmt) in the United States: 1997–2001



SOURCE: U.S. Department of Transportation, Federal Highway Administration, *Traffic Volume Trends,* monthly issues, available at http://www.fhwa.dot.gov/ohim/, as of June 2002.

Energy Intensity of Passenger Travel and Freight Transportation

The amount of energy required to carry passengers and freight has declined on a per unit basis. Between 1980 and 1999, automobile energy use per passenger-mile of travel (pmt) by car fell by 13 percent (figure 1). This has occurred even though the average fuel economy of new car and light truck fleets leveled off in the 1990s [1].

Commercial air carriers reduced energy use per passenger-mile by more than 33 percent over the 1980 to 1999 period, due largely to higher occupancy [1]. Flying a full plane requires considerably less than twice the amount of fuel of a half-full one but yields twice the passenger-miles. Airlines have been increasingly successful in filling their planes; in some cases, reconfiguring seating to fit more passengers. Moreover, although newer airplanes are more efficient, this probably has less effect on energy intensity than the greater number of passengers.

The energy intensity of Amtrak intercity rail and intercity bus declined as well (–4 percent and –11 percent, respectively). At 964 British thermal units (Btu) per pmt in 1999, intercity buses are considered the most energy-efficient mode of transportation. Energy use per pmt on transit buses, however, increased 64 percent over this period to 4,610 Btu per pmt [1]. From a high of 3,828 Btu per pmt in 1994, by 1999 rail transit energy intensity had declined 17 percent to 3,168 Btu per pmt.

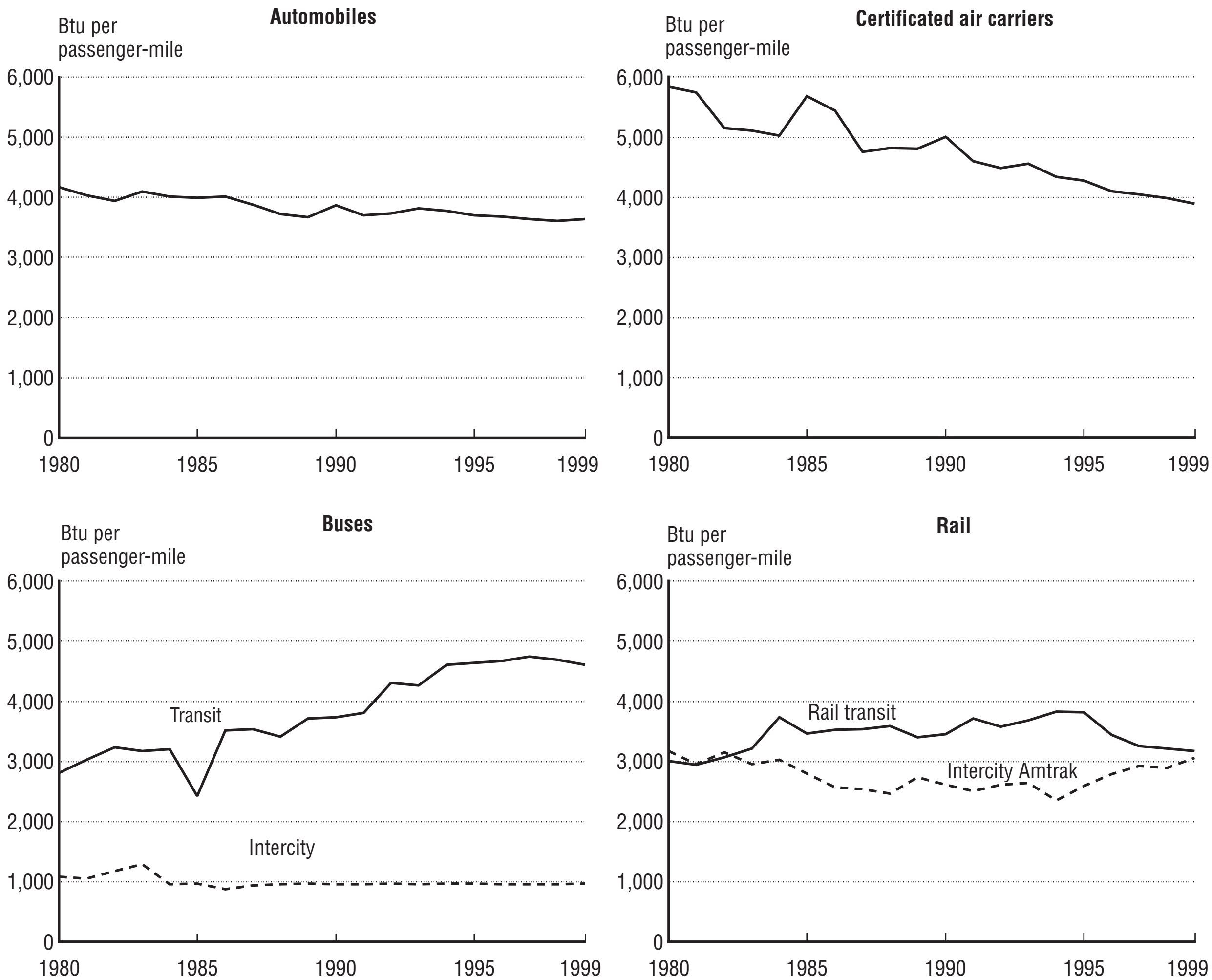
Because of data limitations and availability, less is known overall about the energy intensity of freight transportation, particularly the waterborne and heavy truck modes. Some data are available, however, and, in general, energy use per vehicle-mile has decreased, albeit slowly. The decrease in highway energy use per vehicle-mile combined with a general increase in truck size and weight limits suggest that truck energy use per ton-mile has also decreased. The energy intensity (in Btu per vehicle-mile) of heavy single-unit and combination trucks grew half a percent annually from 1989 to 1999. On a Btu per ton-miles basis, the energy intensity of Class I freight rail declined 1.9 percent while that of domestic waterborne commerce grew 1.3 percent annually between 1989 and 1999 [2].

It is important to note that intermodal comparisons should be considered approximations. Modal data are collected in different ways and based on different assumptions. Passenger-mile data are more relevant for passenger vehicles, while vehicle-mile or ton-mile data are more relevant for freight vehicles. Modes also perform different functions and serve different travel markets.

Sources

1. Davis, Stacy C., *Transportation Energy Data Book, Edition 21* (Oak Ridge TN: Oak Ridge National Laboratory, 2001), tables 2.11 and 2.12.
2. ____. Table 2.14.

Figure 1
Energy Intensities of Passenger Modes: 1980–1999



KEY: Btu = British thermal units.

SOURCE: Stacy C. Davis, *Transportation Energy Data Book, Edition 21* (Oak Ridge, TN: Oak Ridge National Laboratory, 2001), tables 2.11 and 2.12.

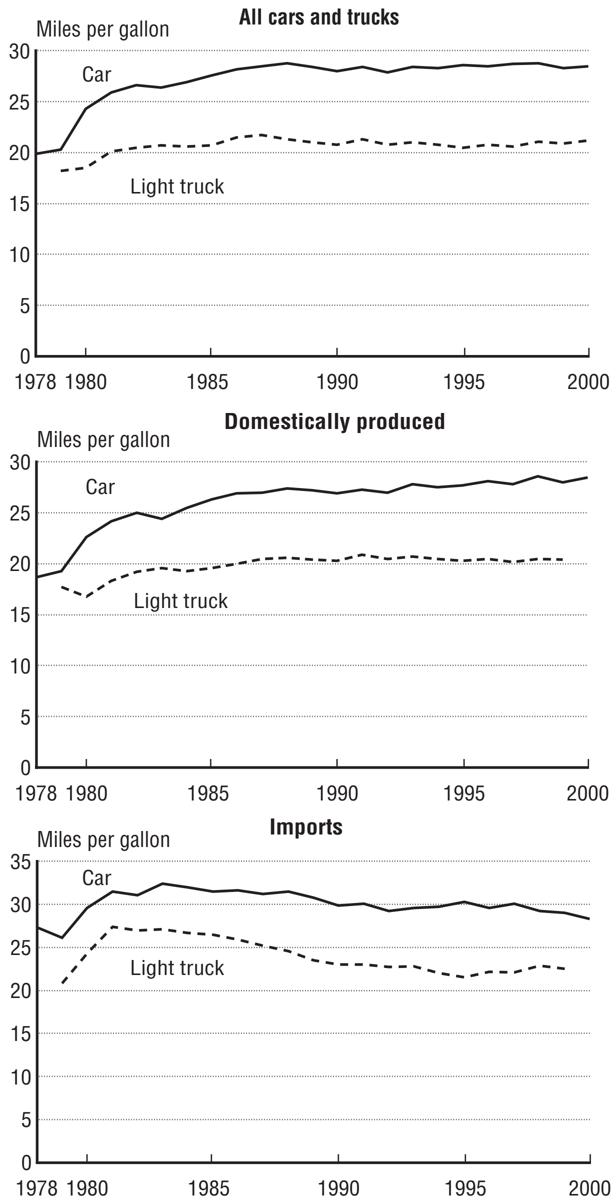
Car and Light Truck Fuel Efficiency

Passenger cars and light trucks are more fuel-efficient today than they were in 1978, when fuel economy standards were first implemented. Technologies like fuel injection engines, lockup torque in transmissions, and improved rolling resistance of tires have played a major role in this change. Between 1978 and 1988, new passenger car average fuel economy shot up from 19.9 miles per gallon (mpg) to 28.8 mpg, while light trucks improved somewhat from 18.2 mpg (1979) to 21.3 mpg. Since then, fuel economy has remained flat (figure 1).

Set by legislation, the Corporate Average Fuel Economy (CAFE) standard for new cars has been held constant at 27.5 mpg since 1990 (table 1). In 2000, the U.S. Congress asked the National Academy of Sciences to conduct a study, in consultation with the U.S. Department of Transportation, to evaluate the effectiveness and impacts of CAFE standards. A special National Research Council committee reported several findings and recommendations to Congress in 2001 but took no position on what the appropriate CAFE standards should be [1]. Subsequent to the release of the report, the National Highway Traffic Safety Administration (NHTSA) announced that it was proceeding with rulemaking for the light truck fleet for model year 2004 and is updating its mid-1990s study on the relationship between fuel economy standards and safety [4]. The passenger car standard remains at 27.5 mpg until Congress changes the current statute.

In recent years, efficiency gains have been offset by increases in vehicle weight and power and by consumer shifts to less efficient

Figure 1
New Passenger Car and Light Truck Fuel Economy Averages: Model Years 1978–2000



NOTE: As of 2000, NHTSA no longer separately reports domestically produced and imported light truck data.

SOURCE: U.S. Department of Transportation, National Highway Traffic Safety Administration, Automotive Fuel Economy Program, "Annual Update Calendar Year 2000," July 2001, table II-6, available at http://www.nhtsa.dot.gov/cars, as of August 2001.

vehicles, such as light trucks, especially sport utility vehicles, minivans, and pickup trucks. For example, the average weight of new cars (foreign and domestic) rose from a low of 2,805 pounds in 1987 to 3,126 pounds in 2000. The average weight of new cars today is still lower than the 3,349-pound weight of new cars in 1978. Furthermore, in response to consumer demand for new high performance cars, the ratio of horsepower to 100 pounds of weight increased from 3.98 in 1987 to 5.27 in 2000. For the domestic car fleet, the average is 5.26 horsepower per 100 pounds [5].

The popularity of light trucks continues to grow. Twice as many cars as light trucks were sold in the United States in 1990. However, in 2001, retail sales of light trucks (8.7 million) for the first time surpassed car sales (8.4 million) [3]. Clearly, many consumers are finding what they want in light trucks rather than cars: roominess, more carrying capacity, greater visibility, and a perception of safety (at least for themselves). However, this trend has implications for energy consumption and for emissions, because light trucks, on average, are less fuel-efficient than cars.

Using a different method of calculation, the U.S. Environmental Protection Agency (EPA) generates fuel economy data that are lower than the official CAFE averages (reported in figure 1). For 2001 model year light-duty vehicles, for instance, EPA estimated the average fuel economy to be 20.4 miles per gallon—the lowest in 21 years—and attributes the decline to the increasing market share of light trucks, plus overall increased vehicle weights and performance. If weight and performance attributes were similar to those in 1981, the 2001 fleet could have achieved more than 25 percent higher fuel economy [2].

Table 1
Changes in Fuel Economy Standards

New cars		New light trucks	
Model year	mpg	Model year	mpg
1978	18.0	1982	17.5
1979	19.0	1983	19.0
1980	20.0	1984	20.0
1981	22.0	1985	19.5
1982	24.0	1986	20.0
1983	26.0	1987–1989	20.5
1984	27.0	1990	20.0
1985	27.5	1991–1992	20.2
1986–1988	26.0	1993	20.4
1989	26.5	1994	20.5
1990–2002	27.5	1995	20.6
		1996–2002	20.7

SOURCE: U.S. Department of Transportation, National Highway Traffic Safety Administration, Automotive Fuel Economy Program, "Annual Update Calendar Year 2000," July 2001, table 11-1, available at http://www.nhtsa.dot.gov/cars, as of August 2000.

Sources

1. National Research Council, Transportation Research Board, *Effectiveness and Impact of Corporate Average Fuel Economy (CAFE) Standards* (Washington, DC: National Academy Press, 2001).
2. U.S. Environmental Protection Agency, *Light-Duty Automotive Technoloy and Fuel Economy Trends,* EPA420-R-01-008 (Washington DC: September 2001).
3. U.S. Department of Transportation, Bureau of Transportation Statistics, *Transportation Indicators,* May 2002.
4. U.S. Department of Transportation, National Highway Traffic Safety Administration, statement of Jeffrey W. Runge, Administrator, before the Committee on Commerce, Science, and Transportation, United States Senate, Dec. 6, 2001.
5. U.S. Department of Transportation, National Highway Traffic Safety Administration, Automotive Fuel Economy Program, "Annual Update Calendar Year 2000," July 2001, available at http://www.nhtsa.dot.gov/cars, as of August 2000.

Emissions of Greenhouse Gases

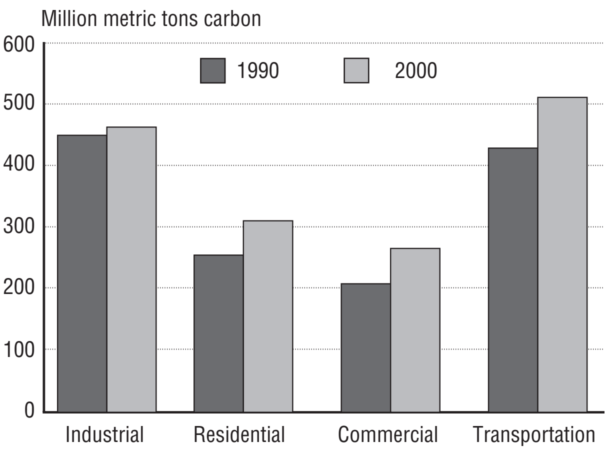
Most scientists believe that rising concentrations of greenhouse gases (GHGs) in the Earth's atmosphere could cause global climate change. GHGs, such as carbon dioxide, methane, and nitrous oxide, occur naturally and can be produced by human activities. Carbon dioxide is the predominant greenhouse gas produced by human activity, accounting for 83 percent of all U.S. GHG emissions in 2000. Nearly all carbon dioxide emissions are produced by the combustion of fossil fuels. Thus, there is a high correlation between energy use and carbon emissions [1].

Today, almost all of transportation's energy needs are supplied by oil. The combustion of petroleum in the transportation sector alone is responsible for about 27 percent of all GHGs emitted in the United States. From 1990 to 2000, emissions of carbon dioxide from transportation grew 19 percent (figure 1). This growth is less than that of the residential and commercial sectors (22 and 27 percent, respectively) but six times greater than in the industrial sector (3 percent). With emissions of 515 million metric tons of carbon in 2000, however, transportation leads all sectors.

On a modal basis, highway vehicles emit almost 80 percent of U.S. transportation's GHGs, and half of those come from passenger cars (table 1). Under the United Nations Framework Convention on Climate Change, to which the United States is a party, a nation's inventory of emissions does not include those stemming from international aircraft and ships. Thus, under the U.S. Environmental Protection Agency's method of estimating U.S. GHG emissions (see box), only domestic aircraft emissions are included in the breakdown by mode. With just 6 percent of emissions attributed to aviation, this mode ranks a distant second to highway vehicles.

The U.S. Department of Energy (DOE) has projected carbon dioxide emissions from energy use to grow 1.5 percent annually to 2,088 million metric tons of carbon equivalent (mmtce) by 2020. Transportation GHG emissions are expected to grow at a rate of

Figure 1
U.S. Carbon Dioxide Emissions from Energy Use by Sector: 1990 and 2000



NOTES: Electric utility emissions are distributed across end-use sectors. Numbers may not add to totals due to rounding. Tons of carbon can be converted to tons of carbon dioxide gas by multiplying by 3.667. One ton of carbon equals 3.667 tons of carbon dioxide gas.

2000 data are preliminary.

SOURCE: U.S. Department of Energy, Energy Information Administration, *Emissions of Greenhouse Gases in the United States 2000*, DOE/EIA-0573(00) (Washington, DC: November 2001), also available at http://www.eia.doe.gov/oiaf/1605/ggrpt/tbl5.html, as of April 2002.

Table 1
U.S. Transportation-Related Carbon Dioxide Emissions
(Teragrams of carbon dioxide equivalents)

Vehicle type	1990	1999	Growth rate 1990–1999
Passenger cars	620.0	688.9	11%
Light-duty trucks	283.1	364.8	29%
Other trucks	206.0	269.7	31%
Buses	10.7	12.9	21%
Aircraft[1]	176.7	184.6	4%
Boats and vessels	59.4	65.6	10%
Locomotives	28.4	35.1	24%
Other[2]	90.1	94.9	5%
Total	**1,474.4**	**1,716.5**	**16%**
International Bunker Fuels[3]	114.0	107.3	–6%

[1] Aircraft emissions are from all jet fuel (less bunker fuels) and aviation gas consumption.
[2] "Other" carbon dioxide emissions are from motorcycles, construction equipment, agricultural machinery, pipelines, and lubricants.
[3] U.S. emissions from International Bunker Fuels are from both civilian and military activities, but are not included in totals.

NOTE: The equation to convert teragrams of carbon dioxide equivalents ($TgCO_2Eq.$) to million metric tons of carbon equivalent (mmtce) is: $TgCO_2Eq.$ = mmtce x (44/12).

SOURCE: U.S. Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–1999,* EPA-236-R-01-001 (Washington, DC: April 2001), table ES-4.

1.9 percent, just above the 1990 to 2000 growth rate of 1.8 percent. DOE based the transportation rate of growth on expected increases in vehicle-miles traveled and in freight and air travel, accompanied by only small gains in vehicle efficiency [1].

The Bush Administration announced new climate change policies in February 2002 [2]. The administration plans to measure overall U.S. performance by tracking the greenhouse gas intensity of the U.S. economy (figure 2). The goal is to reduce the intensity by 18 percent by 2012. Between 1990 and 2000, the intensity declined by 17 percent, while emissions grew 14 percent and the economy grew 38 percent. To help meet its goal, the Administration has proposed two new research programs: The Climate Change Research Initiative and the National Climate Change Technology Initiative. The U.S. Department of Transportation's Center for Climate Change and Environmental Forecasting, established in 1999, identifies and evaluates options to reduce GHG emissions from and impacts on transportation.

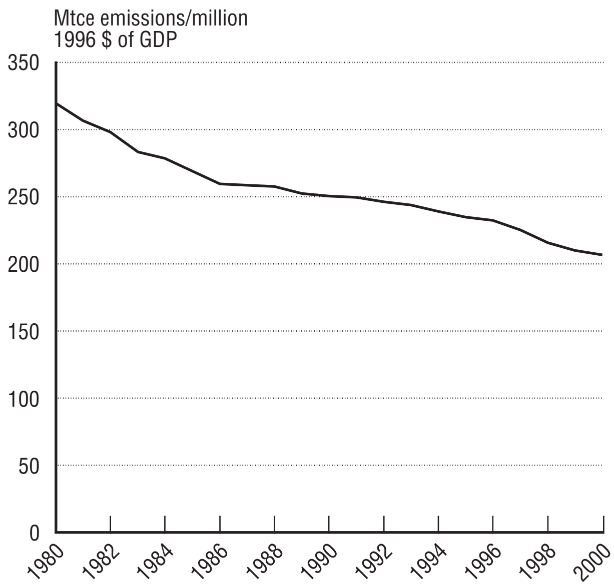
EPA and EIA Data Differ

Both the Energy Information Administration (EIA) and the U.S. Environmental Protection Agency (EPA) estimate annual U.S. greenhouse gas (GHG) emissions. EPA's data are the official inventory for the United States for reporting required under the United Nations Framework Convention on Climate Change (UNFCCC). Although EPA uses EIA fuel consumption data as a basis for some of its estimates, there are differences in the two agencies' methodologies that result in different datasets. Beginning with 1999 data, EPA reports GHG emissions data in teragrams (Tg), while EIA continues to use metric ton units. Total U.S. transportation carbon dioxide emissions in 1999 were 496 million metric tons of carbon equivalent (mmtce) according to EIA but 1,717 Tg of carbon dioxide equivalents (468 mmtce) according to EPA.

The Intergovernmental Panel on Climate Change (IPCC) was set up as the scientific body under UNFCCC, and EPA largely adheres to IPCC methodology guidelines designed to assure data harmonization among all reporting countries. EIA has more discretion in deciding which IPCC guidelines to follow. For instance, EIA's data cover 50 states and the District of Columbia, while EPA must include all U.S. territories as well. Some numbers EPA gets from EIA are revised. EIA fuel consumption data are gathered in physical units and EPA converts them to energy equivalents. In some cases, EPA emission estimates (e.g., for industrial coal) are lower than EIA's.

EIA releases its data five to six months before EPA does, and its data could be considered preliminary estimates. EPA data undergo external as well as internal review before they are released in time to meet a United Nations deadline of April each year. While EPA data are not as timely as are EIA data, EPA provides more detail of interest to transportation. For instance, EPA breaks down GHG data by modes and by various GHGs, such as carbon dioxide, nitrous oxide, and methane.

Figure 2
U.S. Greenhouse Gas Intensity of the U.S. Economy



KEY: GDP = gross domestic product; mtce = metric tons of carbon equivalent.

SOURCES: **GHG data**—U.S. Department of Energy, Energy Information Administration, *Emissions of Greenhouse Gases in the United States 2000,* table ES-2, available at http://www.eia.doe.gov/, as of May 2002. **GDP data**—U.S. Department of Commerce, Bureau of Economic Analysis, National Accounts Data, available at http://www.bea.gov/bea/dn1.htm, as of May 2002.

Sources

1. U.S. Department of Energy, Energy Information Administration, *Annual Energy Outlook 2002*, DOE/EIA-0383(2002) (Washington, DC: December 2001).
2. The White House, “President Announces Clear Skies & Global Climate Change Initiatives,” news release, Feb. 14, 2002, available at http://www.whitehouse.gov/news/releases/2002/, as of May 2002; and “Global Climate Change Policy Book,” available at http://www.whitehouse.gov/news/releases/2002/02/climatechange.html/, as of May 2002.

Air Pollutants

Overall, most transportation air emissions have declined since 1980 despite significant increases in U.S. population, gross domestic product, and vehicle-miles traveled. For instance, carbon monoxide (CO), volatile organic compounds (VOC), particulates, and lead have decreased. These reductions are due primarily to vehicle tailpipe and evaporative emissions standards established by the U.S. Environmental Protection Agency (EPA), improvements in vehicle fuel efficiency, and the ban on leaded fuel for motor vehicles.

Only nitrogen oxide (NO_x) emissions, which contribute to the formation of ground-level ozone, and ammonia remain above their 1990 level (figure 1). An increase in emissions from diesel vehicles is the leading factor in NO_x growth and has led to new standards that will go into effect in 2004 [2]. For instance, NO_x emissions standards for newly manufactured gasoline- and diesel-powered heavy-duty trucks will be reduced from 4.0 to 0.20 grams per brake horsepower-hour in 2007 (diesel) and 2008 (gasoline). In addition, the existing standards for diesel particulates are being reduced from 0.10 to 0.01 grams per brake horsepower-hour in 2007. Gasoline-powered heavy-duty trucks will be subject to the same standard starting in 2008 [1].

Although progress has been made in reducing pollutants, transportation still accounts for a sizable percentage of several key pollutants. In 1999, for example, transportation contributed about 57 percent of all CO emissions, 45 percent of NO_x, 37 percent of VOC, and 12 percent of lead [3] (see box 2). With the exception of lead, highway vehicles were the primary transportation source of these pollutants. The use of lead in aircraft fuel is responsible for nearly all transportation lead emissions. Figure 2 shows 1999 emissions by mode.

In 1997, EPA added ammonia to its National Emission Inventory. Gaseous ammonia reacts in the air with sulfur dioxide and NO_x to form ammonium sulfate and nitrate particles that are found in particulate matter of 2.5 microns in diameter or smaller. In 1999, transportation, primarily highway gasoline-powered vehicles, accounted for about 5 percent of total ammonia emissions.

Box 1

Data on Toxic Air Pollutants

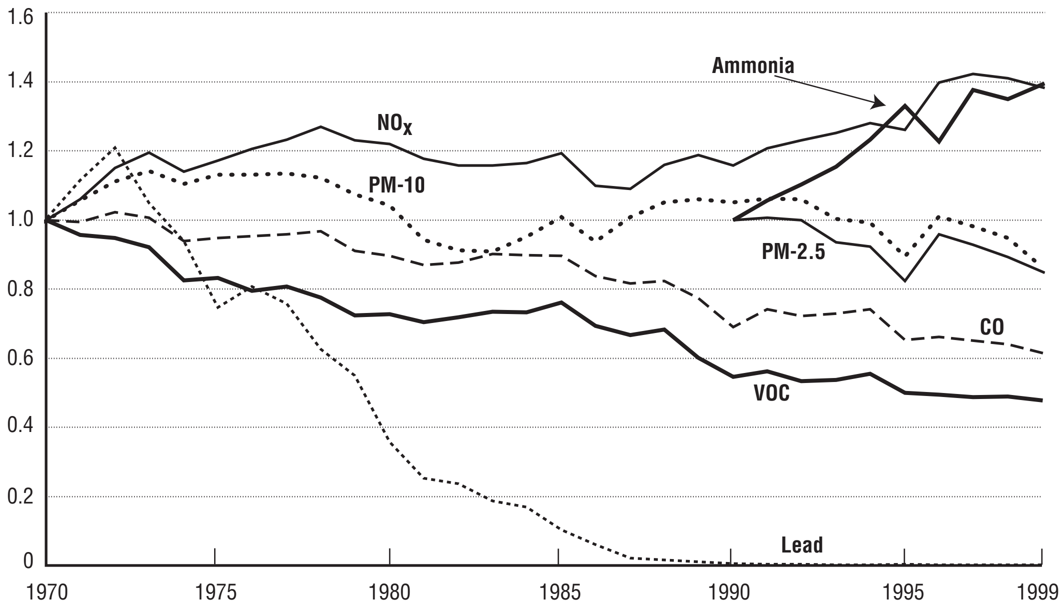
While the U.S. Environmental Protection Agency (EPA) has made annual estimates of emissions of six principal (so-called, criteria) air pollutants covering several decades, it has only recently concentrated on the larger set of hazardous (toxic) air pollutants. Two datasets on toxics are available: a 1990 to 1993 baseline and 1996. Data for 1999 may be available in 2002.

In 2000, EPA designated 21 of the 188 hazardous air pollutants (HAPs) as mobile source air toxics (MSATs). Among these, mobile sources contribute 86 percent of the nation's air emissions of methyl-tertiary-butyl-ether (MTBE), 84 percent of ethylbenzene, 79 percent of xylene, 76 percent of acetaldehyde, and 60 percent of 1,3-butadiene.[1] EPA published a final rule on controlling MSAT emissions in March 2001.[2]

[1] The Bureau of Transportation Statistics published the 1996 data on 21 MSATs in its *Transportation Statistics Annual Report 2000* (Washington, DC: 2002), also available at http://www.bts.gov.

[2] 66 *Federal Register* 17229, Control of Emissions of Hazardous Air Pollutants from Mobile Sources, Mar. 29, 2001.

Figure 1
National Transportation Emissions Trends Index: 1970–1999
Index: 1970 = 1.0; 1990 = 1.0 for PM-2.5 and ammonia



KEY: CO = carbon monoxide; NOx = nitrogen oxides; VOC = volatile organic compounds; PM-10 = particulate matter 10 microns in diameter or smaller; PM-2.5 = particulate matter 2.5 microns in diameter or smaller.

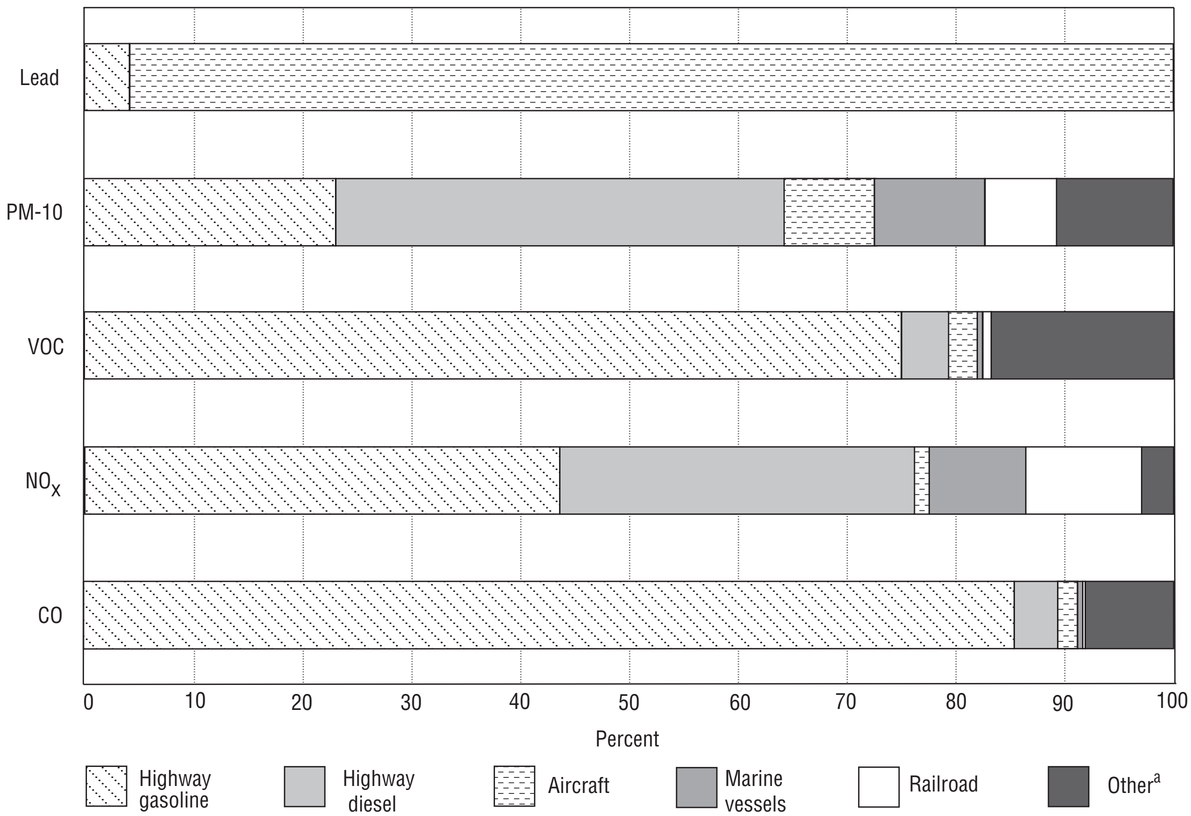
SOURCE: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, "National Emission Inventory (NEI), Air Pollutant Emission Trends," available at http://www.epa.gov/ttn/chief/trends/, as of January 2001.

The decline in emissions from transportation vehicles directly affects the nation's air quality, which is a measure of the concentration of pollutants in the atmosphere. Between 1981 and 2000, air quality based on six principal pollutants improved. The change in air quality ranges from a 14 percent decline in NO_x to a 93 percent decline in lead [2]. These data are calculated from averages of direct measurements in ambient air from monitoring sites across the country, most of which are located in urban areas.

Box 2
Mobile Source vs. Transportation Emissions

The U.S. Environmental Protection Agency's (EPA) National Emission Inventory (NEI) is updated annually and covers both mobile and stationary sources of pollution. The mobile portion contains "onroad" (highway) and "nonroad" (all other modes) emissions. However, the nonroad category also contains nontransportation sources such as farming and construction equipment, lawn and garden equipment, and logging, industrial, and light commercial equipment. While the Bureau of Transportation Statistics uses the mobile portion of the NEI to characterize transportation air emissions, it does so by first removing the nontransportation components of the data. Thus, data presented here cannot be directly compared with the EPA NEI data. For instance, the *mobile source* component of all carbon monoxide emissions in 1999 was 77 percent, nitrogen oxides were 56 percent, and volatile organic compounds were 47 percent.

Figure 2
Modal Share of Key Transportation Air Pollutants: 1999



[a] Other includes gasoline and diesel recreational vehicles, recreational marine vessels, airport service vehicles, and railroad maintenance equipment. Does not include farm, construction, industrial, logging, light commercial, and lawn and garden equipment.

KEY: CO = carbon monoxide; NO_x = nitrogen oxides; VOC = volatile organic compounds; PM-10 = particulate matter 10 microns in diameter or smaller.

SOURCE: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, “National Emission Inventory (NEI), Air Pollutant Emission Trends,” available at http://www.epa.gov/ttn/chief/trends/, as of January 2001.

Sources

1. U.S. Department of Transportation, Bureau of Transportation Statistics, *National Transportation Statistics 2001,* available at http://www.bts.gov.
2. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, *Latest Findings on National Air Quality: 2000 Status and Trends*, EPA 454/K-01-002, (Washington DC: September 2001).
3. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, “National Emission Inventory (NEI), Air Pollutant Emission Trends,” available at http://www.epa.gov/ttn/chief/trends/, as of January 2001.

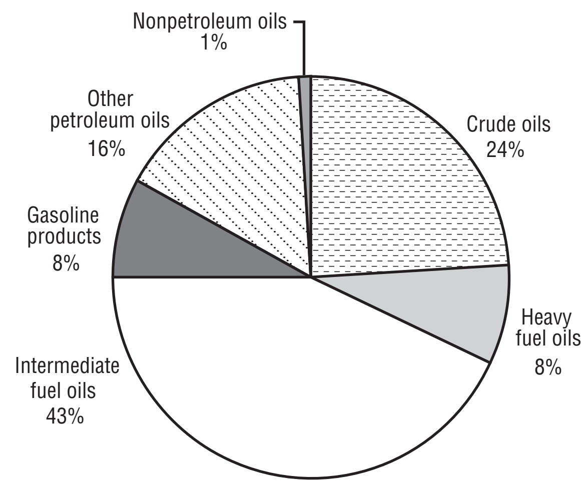
Oil Spills

Failures in transportation systems (vessels, pipelines, highway vehicles, and railroad equipment) or errors made by operators can result in spills of oil and hazardous materials. Better information is available about the extent of spill incidents than about the overall consequences of these spills on the environment and human health. The impact of each spill, for instance, will depend on the concentration and nature of the pollution, the location and volume of the spill, weather conditions, and the environmental resources affected.

When an oil spill occurs in U.S. waters, the responsible party is required to report the spill to the U.S. Coast Guard. The Coast Guard collects data on the number, location, and source of spills, volume and type of oil spilled, and the type of operation that caused spills. Between 1996 and 2000, an annual average of 1.5 million gallons of various types of oil were spilled by all sources (figure 1).

The total amount, source, and type of oil spilled varies each year (table 1). For instance, marine vessels and pipelines were responsible for 73 percent of the spills (by volume) reported in 2000, but just 40 percent in 1991 [3]. Much of the oil spilled tends to be cargo, but that too varies by year. It amounted to 51 percent of the volume of oil spilled in 1998 but just 24 percent in 1999 [1, 2]. New research suggests that, on an annual average basis, transportation of petroleum results in only a small portion of the petroleum that enters North American ocean waters each year (see box).

Figure 1
Reported Oil Spills by Type: 1996–2000
Annual average



SOURCE: U.S. Department of Transportation, U.S. Coast Guard, *Pollution Incidents In and Around U.S. Waters, A Spill Release Compendium: 1969–2000,* available at http://www.uscg.mil/, as of March 2002.

The largest oil spill in 2000 (and the largest since 1996) occurred when a tanker grounded in the Mississippi River, resulting in the loss of 538,000 gallons of crude oil from one of its cargo tanks. The largest pipeline incident in 2000 was a leak of about 175,000 gallons of oil into a tributary of the Delaware River [3].

Sources

1. American Petroleum Institute, *Oil Spills in U.S. Navigable Waters: 1989–1998* (Washington, DC: Feb. 22, 2000).
2. _____. *Oil Spills in U.S. Navigable Waters: 1990–1999* (Washington, DC: Jan. 18, 2001).
3. U.S. Department of Transportation, U.S. Coast Guard, *Pollution Incidents In and Around U.S. Waters, A Spill Release Compendium: 1969–2000,* available at http://www.uscg. mil/hq/, as of March 2002.

Table 1
Reported Oil Spills in U.S. Waterways: 1991–2000
Thousands of gallons

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Marine vessels	696	665	1,177	1,334	1,624	1,681	381	621	576	1,034
Pipelines	49	200	362	62	12	978	224	48	36	17
Facilities	446	505	350	677	869	406	205	16	368	311
Other[1]	10	236	146	349	77	24	72	33	148	45
Unknown	674	269	32	78	56	29	60	17	45	24
Total	**1,876**	**1,876**	**2,067**	**2,499**	**2,638**	**3,118**	**943**	**885**	**1,173**	**1,431**

[1] Depending on the year, this category may include other transportation sources such as aircraft and railroad equipment.

NOTE: Numbers may not add to totals due to rounding.

SOURCE: U.S. Department of Transportation, U.S. Coast Guard, *Pollution Incidents In and Around U.S. Waters, A Spill Release Compendium: 1969–2000,* available at http://www.uscg.mil/, as of March 2002.

Sources of Petroleum Entering North American Waters

Most of the estimated 29 million gallons of petroleum that enters North American waters[1] on average each year from anthropogenic sources is not the result of tanker and pipeline spills, according to a National Research Council (NRC) study. The study defined four categories of sources: natural seeps, petroleum extraction, transportation, and consumption. Among these latter three anthropogenic sources, releases that occur during consumption contribute nearly 86 percent of the petroleum that enters North American waters, while transportation contributes 9 percent (see table below).

NRC determined total consumption data by estimating releases from land-based runoff (including rivers), recreational marine vessels, spills from nontank vessels, operational discharges from vessels of 100 gross tons and less than 100 gross tons, and atmospheric deposition (including aircraft dumping). The study said that ". . . estimates for land-based sources of petroleum are the most poorly documented [of consumption data] and the uncertainty associated with the estimates range over several orders of magnitude."

Overall, however, the study concluded that accuracy of data on petroleum releases had improved since NRC had previously reported on this issue in 1985. The study also found that the environmental effects of a major oil spill are longer lasting than once thought and even small amounts of petroleum can seriously damage marine life and ecosystems.

Sources and Estimated Annual Average Amounts of Oil Entering North American Waters

	North American		Worldwide	
Source	Million gallons	Percent	Million gallons	Percent
Natural seeps	> 47.0		>180	
Petroleum extraction	0.9	3	11	5
Petroleum transportation	2.7	9	44	22
Petroleum consumption	25.0	86	140	72
Total (anthropogenic)	**29.0**		**195**	

NOTE: Percentages do not add to 100% due to rounding.

[1] North American waters include those of Canada, the United States, and Mexico.

SOURCE: National Research Council, *Oil in the Sea III: Inputs, Fates, and Effects* (Washington DC: National Academy Press, 2002).

Dredging Waterways

The nation's ports and navigation channels must be regularly dredged to maintain proper depths to accommodate shipping. The environment is affected in two ways by dredging. First, the dredging activity can, for instance, cause entrainment of fish eggs and larvae, resuspension of buried contaminated sediments, habitat loss, and collisions with marine mammals. To reduce the risks to biological resources, the U.S. Army Corps of Engineers imposes "environmental windows" on 80 percent of all federal dredging projects. Dredging is allowed to proceed during these windows, periods when adverse impacts are reduced below critical thresholds [1].

The other environmental impact of dredging is disposal of dredged sediments, especially when they are contaminated. The U.S. Environmental Protection Agency estimated that 3 million to 12 million cubic yards of material dredged each year are sufficiently contaminated to require special handling and disposal [5]. A more recent report on U.S. coastal waters concluded that, while it varies by region, 35 percent of the nation's total estuarine surface area contains contaminated sediments [4]. Contaminants include hydrocarbons, polychlorinated biphenyls (PCBs), pesticides, and metals.

National data, which the Corps aggregates on an annual basis from individual dredging contracts, do not identify how much material is contaminated, although the data show how dredged material is managed (figure 1). Several of the reporting categories (especially confined, open water/upland, and mixed) may include contaminated sediments.

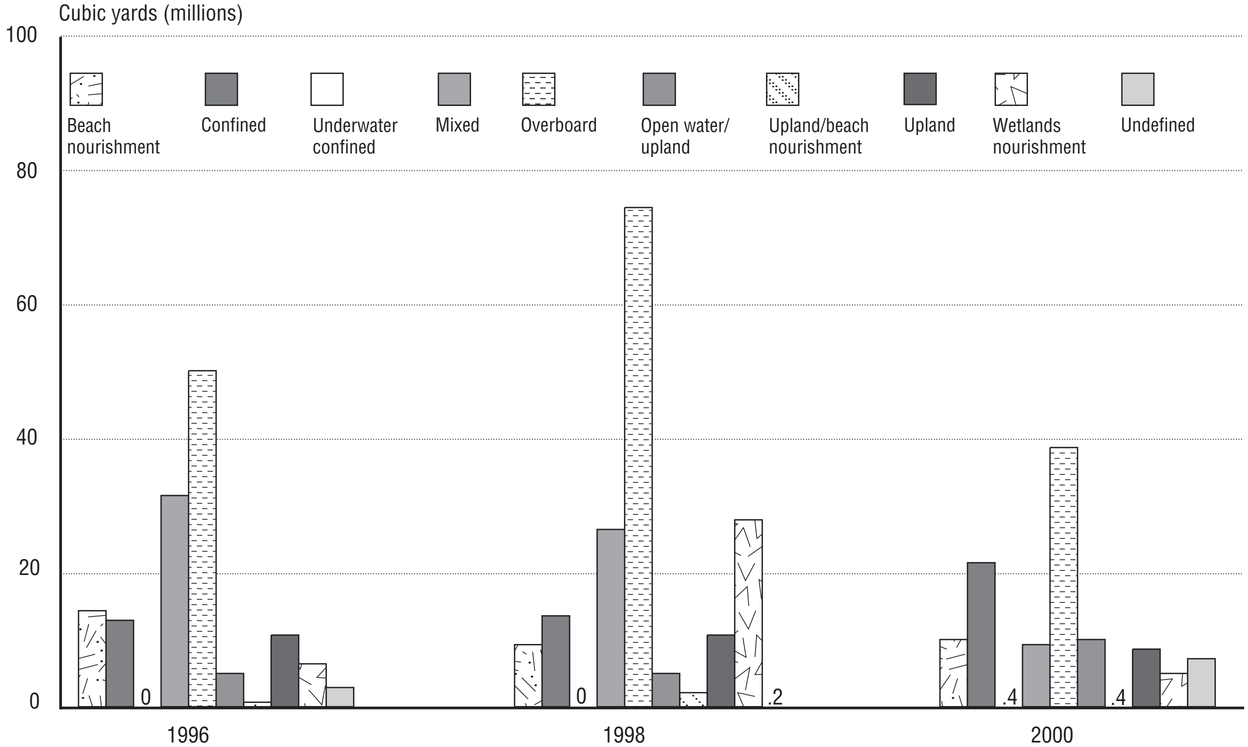
Dredging U.S. navigable waterways, the Corps produced 285 million cubic yards of materials at a total cost of $822 million in fiscal year 2000 [2]. Dredging costs per cubic yard remained fairly stable from 1990 to 1997 (figure 2). They rose 38 percent in 1998 but by 2000 had fallen back to about 23 percent above 1997. Environmental considerations can affect dredging costs. Environmental windows have cost implications as do disposal requirements. For instance, a rise in the proportion of contaminated materials in any one year can affect that year's total costs.

U.S. port authorities are responsible for dredging their berths and channels. They spent $117 million, 11 percent of their capital expenditures, on dredging in 2000 [3]. Data on disposal methods and the total amount of material dredged by ports are only occasionally available.

Sources

1. Transportation Research Board, Marine Board, *A Process for Setting, Managing, and Monitoring Environmental Windows for Dredging Projects,* Special Report 262 (Washington, DC: National Academy of Sciences, 2001).

Figure 1
Disposal/Use of Material Dredged by the U.S. Army Corps of Engineers



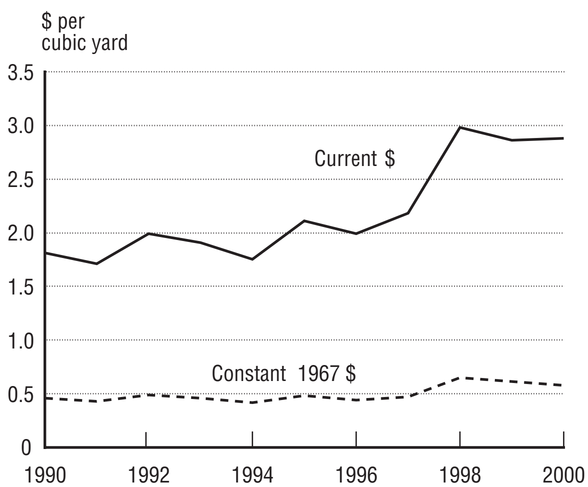
KEY:
Beach nourishment—beach restoration in which hydraulically pumped dredge material is directly placed onto an eroded beach.
Confined—placement of dredged material within diked nearshore or upland confined placement facilities that enclose and isolate the dredged material from adjacent waters.
Underwater confined—placement of dredged materials in an underwater area that is capped or otherwise isolated from the surrouding area.
Mixed—dredging operation that uses more than one dredged material placement alternative.
Overboard—placement of dredged material in rivers, lakes, estuaries, or oceans via pipeline or surface release from hopper dredges.
Open water/upland—combination of open water and upland placement of dredged material.
Upland/beach nourishment—combination of upland placement and beach nourishment using dredged material.
Upland—placement of dredge material on land above adjacent water surface elevation.
Wetlands nourishment—wetland restoration in which hydraulically pumped dredge material is directly placed in a wetland area.
Undefined—undefined or unknown at the time of data entry.

SOURCE: U.S. Army Corps of Engineers, Navigation Data Center, Dredging Information System, available at http://www.wrsc.usace.army.mil/ndc/drgmatdisp.htm, as of April 2002.

2. U.S. Army Corps of Engineers, Water Resources Support Center, Navigation Data Center, Dredging Information System, available at http://www.wrsc.usace.army.mil/ndc/drgmatdisp.htm, as of April 2002.
3. U.S. Department of Transportation, Maritime Administration, Office of Ports and Domestic Shipping, *United States Port Development Expenditure Report* (Washington, DC: December 2001).
4. U.S. Environmental Protection Agency, National Coastal Condition Report, EPA-620/R-01/005 (Washington, DC: September 2001).
5. U.S. Environmental Protection Agency, Office of Water, *EPA's Contaminated Sediment Management Strategy,* EPA-823-R-98-001 (Washington, DC: April 1998).

(continues on next page)

Figure 2
Cost of Dredging Navigable Waterways: 1990–2000



SOURCE: U.S. Army Corps of Engineers, Water Resources Support Center, Navigation Data Center, Dredging Information System, available at http://www.wrsc.usace.army.mil/ndc.drgmatdisp.htm, as of April 2002.

Leaking Underground Storage Tanks

Underground tanks for storing petroleum products, such as fuels for transportation, have a history of leaking petroleum into the nation's underground water. The U.S. Environmental Protection Agency (EPA) started collecting annual data on the problem and its resolution in fiscal year (FY) 1990 under the Underground Storage Tank Program.

By the end of FY 2001, EPA regions reported that there were 704,717 active underground tanks in the nation and that 1.5 million tanks had been closed [2]. Between 1990 and 2001, the number of confirmed releases[1] of petroleum from underground storage tanks (USTs) climbed at an average annual rate of 21 percent, while cleanups were completed at a rate of 29 percent per year (table 1). However, cleanups had not been initiated for nearly 39,700 releases. In addition, the U.S. General Accounting Office estimated that 29 percent of the new tanks were not being maintained and operated properly to prevent them from leaking [3].

As with oil spills in U.S. waters, these data do not reveal the overall environmental impact of releasing petroleum products into underground and surface waters. Furthermore, the data gathered show the number of incidents rather than volume; thus, even the full extent of the problem is not clear. For example, the amount of water contaminated by releases from underground tanks is not known. Petroleum products are also stored in aboveground tanks. However, no national data exist on numbers of incidents or volumes released from these tanks.

[1] A confirmed release is an identified incident and is not necessarily equivalent to the number of leaking underground storage tanks at any one site (e.g., a gasoline station).

Table 1
Leaking Underground Storage Tank Releases and Cleanups

	FY 1990	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001
Total confirmed releases	87,528	341,773	371,387	397,821	412,392	418,918
Cleanups initiated	51,770	292,446	314,965	346,300	367,603	379,243
Percentage of total	59%	86%	85%	87%	89%	91%
Cleanups completed	16,905	178,297	203,247	228,925	249,759	268,833
Percentage of total	19%	52%	55%	58%	61%	64%

NOTE: Data are cumulative and are as of the end of the fiscal year.

SOURCE: U.S. Environmental Protection Agency, Office of Underground Storage Tanks, *Corrective Action Measures Archive*, available at http://www.epa.gov/swerust1/cat/camarchv.htm, as of April 2002.

In 2000, concern arose about the leaking of methyl-tertiary-butyl-ether (MTBE) from storage tanks and other sources. MTBE is a constituent of reformulated gasoline, which is used in nonattainment areas of the country to improve air quality. Once released, MTBE moves rapidly through underground water. This substance has been detected in drinking water, with the highest levels in areas of the country using reformulated gasoline. Leaking USTs appear to be a major source of groundwater contamination from MTBE, but other sources include aboveground tanks, pipelines, and recreational boats [1]. Various efforts are underway or proposed in 13 states, the U.S. Congress, and EPA to reduce or ban the use of MTBE as an oxygenate in reformulated gasoline. California has, however, delayed its ban on MTBE for one year to the end of 2003. Ethanol, the alternate oxygenate, holds a much smaller share of the current national market (see the section on Alternative and Replacement Fuels in this chapter), and the state will have to create a new infrastructure to assure a sufficient supply of this type of reformulated gasoline.

Sources

1. U.S. Environmental Protection Agency, A*chieving Clean Air and Clean Water: The Report of the Blue Ribbon Panel on Oxygenates in Gasoline,* Executive Summary and Recommendations (Washington, DC: July 27, 1999).
2. U.S. Environmental Protection Agency, Office of Underground Storage Tanks, *Corrective Action Measures Archive,* available at http://www.epa.gov/swerust1/cat/camarchv.htm, as of April 2002.
3. U.S. General Accounting Office, *Environmental Protection: Improved Inspections and Enforcement Would Better Ensure the Safety of Underground Storage Tanks,* GAO-01-464 (Washington DC: May 4, 2001).

Transportation Wastes

Transportation equipment and infrastructure eventually become wastes. For instance, over 11.6 million passenger cars and trucks were scrapped in 1999 [3]. Additional wastes are generated as equipment (e.g., vehicles, aircraft, vessels, and locomotives) and parts are repaired during their lifetime. Scrapped equipment is generally dismantled, with some parts or materials recycled and the rest disposed. Fluids, such as used motor oils and refrigerants, may be regenerated or disposed. Improper disposal of any of these materials or fluids can pose environmental problems. Used tire piles can ignite, releasing toxic chemicals into the air. Oil can contaminate water bodies.

There are few data on the extent of transportation wastes created annually. Overall, people in the United States generated an estimated 230 million tons of municipal solid waste in 1999 [4]. Tires and batteries from passenger cars, trucks, and motorcycles contributed 6.6 million tons to this total (figures 1 and 2). The balance of transportation wastes, such as equipment, other batteries and tires, discards from dismantling operations, and motor oils, are not included, nor are infrastructure construction debris.[1]

The recovered portion of lead-acid batteries and tires is reused in some form and therefore does not end up in waste landfills or incinerators. Batteries are dismantled and 97 percent of the lead content and a significant portion of the polypropylene casing were recycled in 1999. Only 26 percent (by weight) of tires were recycled, however.

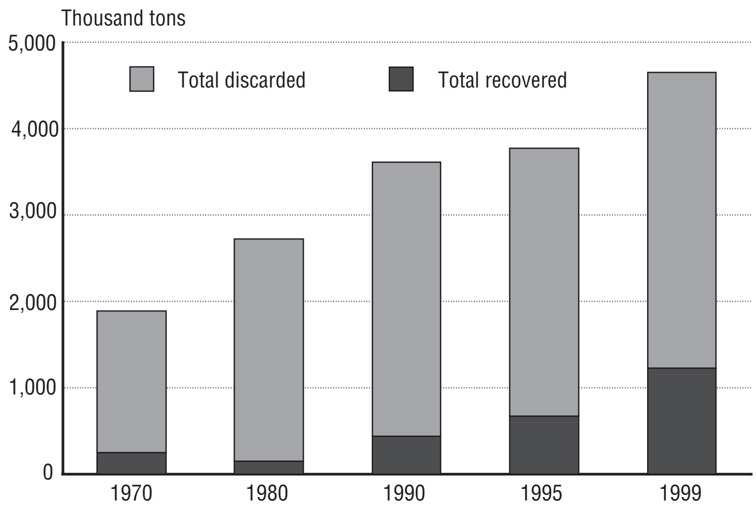
The transportation sector used an estimated 1,260 million gallons of lubricants in 1999, 50 percent of the lubricants consumed by all sectors that year [2]. Motor oils become wastes throughout a vehicle's lifecycle and may be burned as fuel, placed in landfills, rerefined, or incinerated. In addition, some are illegally dumped. The amount of waste motor oils generated each year and how it is disposed are estimated only periodically. About 250 million gallons of motor oil were recycled in 1997 [1].

[1] The Federal Highway Administration issued a Formal Policy on the Use of Recycled Materials in highway applications in February 2002.

Sources

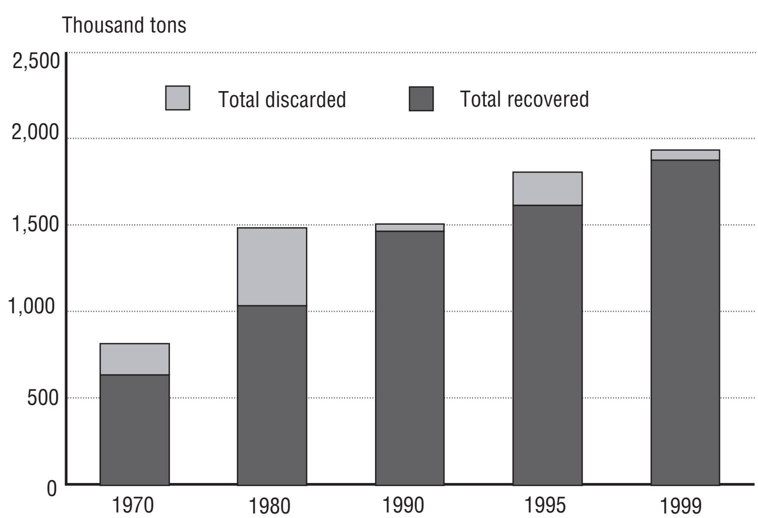
1. American Petroleum Institute, "Used Motor Oil: Collection and Recycling," available at http://www.recycleoil.org/Usedoilflow.htm, as of March 2002.
2. U.S. Department of Energy, Energy Information Administration, *State Energy Data Report 1999,* tables 11 and 15, available at http://www.eia.doe.gov/emeu/sedr/contents.html#PDF Files/, as of March 2002.
3. U.S. Department of Transportation, Bureau of Transportation Statistics, *National Transportation Statistics 2000* (Washington DC: 2001), table 4-54.
4. U.S. Environmental Protection Agency, *Municipal Solid Waste in the United States: 1999 Facts and Figures,* EPA530-R-01-014 (Washington, DC: July 2001).

Figure 1
Disposition of All Used Rubber Tires
Passenger cars, trucks, and motorcycles



SOURCES:
U.S. Environmental Protection Agency, *Municipal Solid Waste in the United States: 1999 Facts and Figures,* EPA530-R-01-014 (Washington DC: July 2001).
_____. *Characterization of Municipal Solid Waste in the U.S.* (Washington, DC: Various years).

Figure 2
Disposition of All Used Lead-Acid Batteries
Passenger cars, trucks, and motorcycles



SOURCES:
U.S. Environmental Protection Agency, *Municipal Solid Waste in the United States: 1999 Facts and Figures,* EPA530-R-01-014 (Washington DC: July 2001).
_____. *Characterization of Municipal Solid Waste in the U.S.* (Washington, DC: Various years).

Wetlands

Wetlands provide many environmental benefits. They serve as wildlife habitats and spawning grounds for fish, provide vast amounts of food for aquatic species, and help remove organic pollutants from bodies of water. Yet, it is only during the last few decades that the United States has considered wetlands a natural resource worth enhancing and preserving. This change in thinking occurred after an estimated half of the wetlands acreage believed to exist in the 1600s had been drained [5]. By 1997, the nation had an estimated 105.5 million acres of wetlands, having suffered a net loss of almost 650,000 acres of wetlands between 1986 and 1997[1] [3].

Transportation infrastructure and its use has contributed to the loss of wetlands, but it is unclear to what extent. For instance, when the Fish and Wildlife Service made their 1997 estimates, transportation activities were not reported separately but considered part of urban development, a category accounting for an estimated 30 percent of all wetland losses. Because federal policy requires compensatory mitigation to restore, create, or enhance impacted wetlands, developers of roads, airports, rail systems, and marine facilities must determine whether their projects will affect wetlands. If so, they may need to obtain a Clean Water Act Section 404 permit from the U.S. Army Corps of Engineers.

The only national trend data on transportation wetlands impacts have been collected, since 1996, by the Federal Highway Administration (table 1). These data cover wetlands acreage affected by federal-aid highways, which constitute 24 percent of the total miles of public roads in this country [4]. Although the Federal Aviation Administration (FAA) does not collect data on wetlands impacted by airports, airport runway expansion often involves an evaluation of those effects. FAA is particularly concerned that mitigation projects do not create habitats that would attract wildlife known to affect aircraft operations.

Table 1
Wetlands Lost and Created Under the Federal-Aid Highway Program: 1996–2000

Fiscal year	Acres impacted	Acres mitigated	Ratio of wetlands created to wetlands lost
1996	1,568	3,554	2.3:1
1997	1,699	4,484	2.6:1
1998	1,167	2,557	2.2:1
1999	2,354	5,409	2.3:1
2000	2,041	7,671	3.8:1
2001	1,905	4,017	2.11:1
Total	**10,734**	**27,692**	**2.6:1**

SOURCES: 1996–2000—U.S. Department of Transportation, Federal Highway Administration, *Wetlands Mitigation Data Report for the Federal-Aid Highway Program, Fiscal Year 2000* (Washington DC: 2001).

2001 data—_____. *Wetlands Mitigation Data Report for Federal-Aid Highway Projects, Fiscal Year 2001* available at http://www.fhwa.dot.gov/environment/wetland/mitrpt01.htm, as of March 2002.

[1] This amounts to an average annual rate of loss of 58,500 acres, according to the Fish and Wildlife Service. An alternate source of wetlands data—the U.S. Department of Agriculture, Natural Resources Conservation Service—has estimated an average annual loss of 32,600 acres between 1992 and 1997.

Some of the sediments the U.S. Army Corps of Engineers dredges from navigation channels are used to nourish wetlands. The amount varies each year; in fiscal year 2000, the Corps applied 96 million cubic yards of sediment to wetlands [1]. This was just over 4 percent of all Corps-dredged material that year compared with 16 percent (39 million cubic yards) in 1998.

While the available data provide some insight into transportation infrastructure's relative effect on wetlands, there are no data on impacts from runoff of salt, oils, and rubber from highways and other facilities, and air pollutants emitted by vehicles, locomotives, airplanes, and vessels as they move along or through wetland areas. Furthermore, acreage data provide no information on the quality of wetlands as measured by their value to society [2].

Sources

1. U.S. Army Corps of Engineers, Dredging Information System, available at http://www.wrsc.usace.army.mil/ndc/dcgmatdisp.htm, as of March 2002.
2. U.S. Congress, Congressional Research Service, "Wetlands Issues," Aug. 7, 2001.
3. U.S. Department of the Interior, Fish and Wildlife Service, *Status and Trends of Wetlands in the Conterminous United States: 1986 to 1997* (Washington, DC: December 2000).
4. U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2000* (Washington, DC: 2001), table HM-14.
5. U.S. Environmental Protection Agency, Office of Water, "What are Wetlands? Status and Trends," available at http:// www.epa.gov/owow/wetlands/vital/status.html, as of March 2002.

Transportation Environmental Indicators

Indicators are quantitative data that can be used to assess the magnitude of problems, help set priorities, develop performance measures and track progress toward goals, or educate stakeholders. To assess problems and measure progress, trend data are needed. The full range of environmental effects of the transportation system is extensive but few good indicators are available.

Figure 1 is a conceptual diagram of the environmental effects of transportation from a lifecycle perspective. Phases (or stages) of transportation include fuel production, vehicle manufacturing, fixed infrastructure development, travel (or vehicle use), maintenance, and disposal. Activities occurring during the phases result in environmental outcomes (e.g., pollution releases and changes in wetlands acreage). Outcomes can, in turn, affect the environment and human health, creating impacts that are usually negative (e.g., cancers, birth defects, asthma, stunted tree growth, and fish kills). Impacts, which can be chronic or acute, are highly dependent on two variables: concentration and exposure.

Activity, outcome, or impact data can be the source for indicators. However, outcome indicators are most commonly used for transportation. Activities are only indirectly related to environmental consequences. Increases in passenger car vehicle-miles traveled may or may not result in increased pollutant releases. Similarly, the volume of oil transported by marine vessels is not indicative of harm caused by oil spills at sea. Most available impact data do not directly identify sources, such as transportation. For instance, the U.S. Environmental Protection Agency (EPA) reports annually on changes in the nation's air quality. These data come from monitoring stations that measure concentrations of pollutants in the atmosphere. The sources of the pollutants may be factories, powerplants, dry cleaning facilities, printing shops, storage tanks, and so on, as well as vehicles.

Readily available data for outcome indicators are not comprehensive, especially for all modes and lifecycle phases. National trend data for outcomes are estimated, modeled, or collected only for some pollutants.

The most often used transportation environmental indicator comprises six criteria air pollutants regulated under the Clean Air Act (see page 225). The data are estimated annually by EPA and show the relative outcome contribution of these pollutants by mode (except pipelines) during the travel phase. With the emergence of the global climate change issue, an additional indicator is available. EPA and the Energy Information Administration, U.S. Department of Energy, now annually estimate the amount of six greenhouse gases emitted by the transportation sector.

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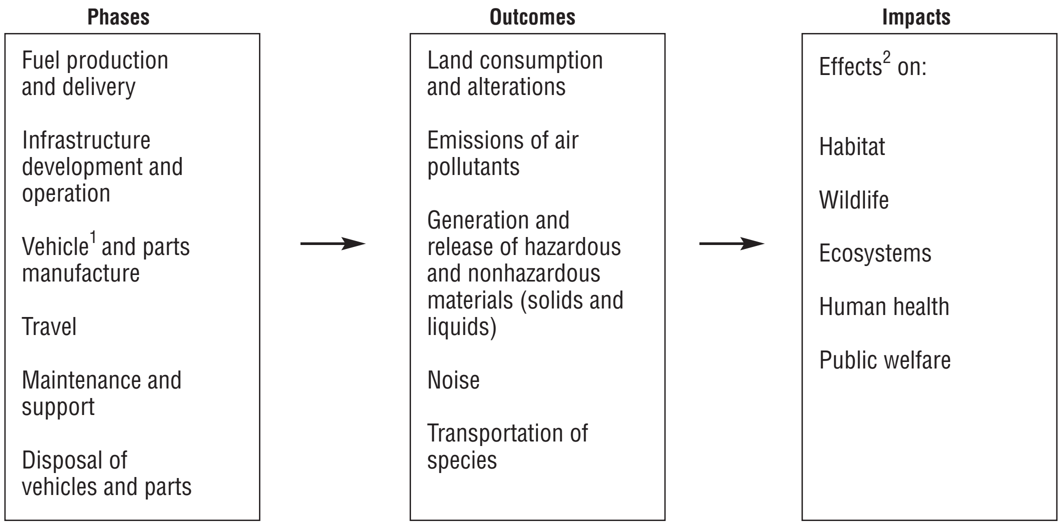
Figure 1
Effects of Transportation on the Environment



[1] Vehicle here includes highway vehicles, airplanes, marine vessels, railroad cars and locomotives, and transit equipment.
[2] Dependent on ambient levels or concentrations of pollutants and exposure to those outputs.

SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, based on U.S. Environmental Protection Agency, *Indicators of the Environmental Impacts of Transportation* (Washington, DC: October 1999), figure 1-1.

Appendices

Appendix A: List of Acronyms and Initialisms

AADT	average annual daily traffic
ADA	Americans with Disabilities Act
AFV	alternative fuel vehicle
BAC	blood alcohol concentration
BEA	Bureau of Economic Analysis
BLS	Bureau of Labor Statistics
BTS	Bureau of Transportation Statistics
Btu	British thermal unit
CAA	Clean Air Act
CAFE	Corporate Average Fuel Economy
CFR	Code of Federal Regulations
CFS	Commodity Flow Survey
CO	carbon monoxide
CO_2	carbon dioxide
CRAF	Civil Reserve Air Fleet
DGPS	Differential Global Positioning System
DOC	U.S. Department of Commerce
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOI	U.S. Department of the Interior
DOL	U.S. Department of Labor
DOT	U.S. Department of Transportation
dwt	deadweight tons
EDS	Explosive Detection Systems
EIA	Energy Information Administration
EJ	environmental justice
EPA	U.S. Environmental Protection Agency
ETC	electronic toll collection
ETMS	Enhanced Traffic Management System
FAA	Federal Aviation Administration
FAF	Freight Analysis Framework
FARs	Federal Aviation Regulations
FARS	Fatality Analysis Reporting System
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
FY	fiscal year

GA	general aviation
GAO	General Accounting Office
GDD	Gross Domestic Demand
GDP	Gross Domestic Product
GHG	greenhouse gas
GIS	geographic information systems
GPRA	Government Performance and Results Act
GPS	Global Positioning System
HAPs	hazardous air pollutants
HELP	Heavy Vehicle Electronic License Plate
HMIS	Hazardous Materials Information System
HPMS	Highway Performance Monitoring System
HSR	high-speed rail
HTF	Highway Trust Fund
IBET	Intermodal Bottleneck Evaluation Tool
INS	Immigration and Naturalization Service
IPCC	Intergovernmental Panel on Climate Change
ISTEA	Intermodal Surface Transportation Efficiency Act
IT	information technology
ITS	intelligent transportation system
LNG	liquefied natural gas
LPG	liquefied petroleum gas
LTV	light trucks and vans
MARAD	Maritime Administration
MMLD	Merchant Mariner Licensing Documentation
mmtc	million metric tons of carbon
mpg	miles per gallon
mph	miles per hour
MPO	metropolitan planning organization
MSATs	mobile source air toxics
MSP	Maritime Security Programs
MSW	municipal solid waste
MTBE	methyl-tertiary-butyl-ether
NAFTA	North American Free Trade Agreement
NAS	National Airspace System plan
NASS GES	National Automotive Sampling System General Estimates System
NDRF	National Defense Reserve Fleet
NHTS	National Household Travel Survey
NHTSA	National Highway Traffic Safety Administration
NO_2	nitrogen dioxide
NO_X	nitrogen oxides
NPIAS	National Plan of Integrated Airport Systems
NPL	National Priorities List
NPTS	Nationwide Personal Transportation Survey
NTL	National Transportation Library
NTSB	National Transportation Safety Board

OMB	Office of Management and Budget
OPEC	Organization of Petroleum Exporting Countries
OPS	Office of Pipeline Safety
OSRA	Ocean Shipping Reform Act
PFD	personal flotation device
PM-2.5	particulate matter of 2.5 microns in diameter or smaller
PM-10	particulate matter of 10 microns in diameter or smaller
pmt	passenger-miles of travel
PSC	Port State Control
PSR	Present Serviceability Rating
PTC	positive train control
PUV	personal-use vehicle
quads	quadrillion
RFG	reformulated gasoline
ROR	run-off-the-road
RRF	Ready Reserve Fleet
RSPA	Research and Special Programs Administration
SCTG	Standard Classification of Transported Goods
SO_2	sulfur dioxide
STRAHNET	Strategic Highway Network
SUV	sport utility vehicle
TEA-21	Transportation Equity Act for the 21st Century
TEU	20-foot equivalent container unit
TICSA	Transportation Infrastructure Capital Stock Account
TTI	Texas Transportation Institute
UNFCC	United Nations Framework Convention on Climate Change
USCG	U.S. Coast Guard
USGS	U.S. Geological Survey
UST	underground storage tank
vmt	vehicle-miles of travel
VOC	volatile organic compounds

Appendix B: Glossary

14 CFR 121 (air): *Code of Federal Regulations,* Title 14, part 121. Prescribes rules governing the operation of domestic, flag, and supplemental air carriers and commercial operators of large aircraft.

14 CFR 135 (air): *Code of Federal Regulations,* Title 14, part 135. Prescribes rules governing the operations of commuter air carriers (scheduled) and on-demand air taxi (unscheduled).

ACCIDENT (aircraft): As defined by the National Transportation Safety Board, an occurrence incidental to flight in which, as a result of the operation of an aircraft, any person (occupant or nonoccupant) receives fatal or serious injury or any aircraft receives substantial damage.

ACCIDENT (automobile): See Crash (highway).

ACCIDENT (gas): 1) An event that involves the release of gas from a pipeline or of liquefied natural gas (LNG) or other gas from an LNG facility resulting in personal injury necessitating in-patient hospitalization or a death; or estimated property damage of $50,000 or more to the operator or others, or both, including the value of the gas that escaped during the accident; 2) an event that results in an emergency shutdown of an LNG facility; or 3) an event that is significant in the judgment of the operator even though it did not meet the criteria of (1) or (2).

ACCIDENT (hazardous liquid or gas): Release of hazardous liquid or carbon dioxide while being transported, resulting in any of the following: 1) an explosion or fire not intentionally set by the operator; 2) loss of 50 or more barrels of hazardous liquid or carbon dioxide; 3) release to the atmosphere of more than 5 barrels a day of highly volatile liquids; 4) death of any person; 5) bodily harm resulting in one or more of the following—a) the loss of consciousness, b) the necessity of carrying a person from the scene, c) the necessity for medical treatment, d) disability that prevents the discharge of normal duties, and 6) estimated damage to the property of the operators and/or others exceeding $50,000.

ACCIDENT (highway-rail grade-crossing): An impact between on-track railroad equipment and an automobile, bus, truck, motorcycle, bicycle, farm vehicle, or pedestrian or other highway user at a designated crossing site. Sidewalks, pathways, shoulders, and ditches associated with the crossing are considered to be part of the crossing site.

ACCIDENT (rail): A collision, derailment, fire, explosion, act of God, or other event involving operation of railroad on-track equipment (standing or moving) that results in railroad damage exceeding an established dollar threshold.

ACCIDENT (recreational boating): An occurrence involving a vessel or its equipment that results in 1) a death; 2) an injury that requires medical treatment beyond first aid; 3) damage to a vessel and other property, totaling more than $500 or resulting in the complete loss of a vessel; or 4) the disappearance of the vessel under circumstances that indicate death or injury. Federal regulations (33 CFR 173–4) require the operator of any vessel that is numbered or used for recreational purposes to submit an accident report.

ACCIDENT (transit): An incident involving a moving vehicle, including another vehicle, an object, or person (except suicides), or a derailment/left roadway.

AIR CARRIER: The commercial system of air transportation comprising large certificated air carriers, small certificated air carriers, commuter air carriers, on-demand air taxis, supplemental air carriers, and air travel clubs.

AIR TAXI: An aircraft operator who conducts operations for hire or compensation in accordance with 14 CFR 135 (for safety purposes) or FAR Part 135 (for economic regulations or reporting purposes) in an aircraft with 30 or fewer passenger seats and a payload capacity of 7,500 pounds or less. An air taxi operates on an on-demand basis and does not meet the flight schedule qualifications of a commuter air carrier (see below).

AIRPORT: A landing area regularly used by aircraft for receiving or discharging passengers or cargo.

ALTERNATIVE FUELS: The Energy Policy Act of 1992 defines alternative fuels as methanol, denatured ethanol, and other alcohol; mixtures containing 85 percent or more (but not less than 70 percent as determined by the Secretary of Energy by rule to provide for requirements relating to cold start, safety, or vehicle functions) by volume of methanol, denatured ethanol, and other alcohols with gasoline or other fuels. Includes compressed natural gas, liquid petroleum gas, hydrogen, coal-derived liquid fuels, fuels other than alcohols derived from biological materials, electricity, or any other fuel the Secretary of Energy determines by rule is substantially not petroleum and would yield substantial energy security and environmental benefits.

AMTRAK: Operated by the National Railroad Passenger Corporation, this rail system was created by the Rail Passenger Service Act of 1970 (Public Law 91-518, 84 Stat. 1327) and given the responsibility for the operation of intercity, as distinct from suburban, passenger trains between points designated by the Secretary of Transportation.

ARTERIAL HIGHWAY: A major highway used primarily for through traffic.

ASPHALT: A dark brown to black cement-like material containing bitumen as the predominant constituent. The definition includes crude asphalt and finished products such as cements, fluxes, the asphalt content of emulsions, and petroleum distillates blended with asphalt to make cutback asphalt. Asphalt is obtained by petroleum processing.

AVAILABLE SEAT-MILES (air carrier): The aircraft-miles flown in each interairport hop multiplied by the number of seats available on that hop for revenue passenger service.

AVERAGE HAUL: The average distance, in miles, one ton is carried. It is computed by dividing ton-miles by tons of freight originated.

AVERAGE PASSENGER TRIP LENGTH (bus/rail): Calculated by dividing revenue passenger-miles by the number of revenue passengers.

AVIATION GASOLINE (general aviation): All special grades of gasoline used in aviation reciprocating engines, as specified by American Society of Testing Materials Specification D910 and Military Specification MIL-G5572. Includes refinery products within the gasoline range marketed as or blended to constitute aviation gasoline.

BARREL (oil): A unit of volume equal to 42 U.S. gallons.

BLOOD ALCOHOL CONCENTRATION (highway): A measurement of the percentage of alcohol in the blood by grams per deciliter.

BRITISH THERMAL UNIT (Btu): The quantity of heat needed to raise the temperature of 1 pound (approximately 1 pint) of water by 1 °F at or near 39.2 °F.

BULK CARRIER (water): A ship with specialized holds for carrying dry or liquid commodities, such as oil, grain, ore, and coal, in unpackaged bulk form. Bulk carriers may be designed to carry a single bulk product (crude oil tanker) or accommodate several bulk product types (ore/bulk/oil carrier) on the same voyage or on a subsequent voyage after holds are cleaned.

BUS: Large motor vehicle used to carry more than 10 passengers, including school buses, intercity buses, and transit buses.

CAFE STANDARDS: See Corporate Average Fuel Economy Standards.

CAR-MILE (rail): The movement of a railroad car a distance of one mile. An empty or loaded car-mile refers to a mile run by a freight car with or without a load. In the case of intermodal movements, the designation of empty or loaded refers to whether the trailers or containers are moved with or without a waybill.

CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY (air carrier): A certificate issued by the U.S. Department of Transportation to an air carrier under Section 401 of the Federal Aviation Act authorizing the carrier to engage in air transportation.

CERTIFICATED AIR CARRIER: An air carrier holding a Certificate of Public Convenience and Necessity issued by the U.S. Department of Transportation to conduct scheduled services interstate. These carriers may also conduct nonscheduled or charter operations. Certificated air carriers operate large aircraft (30 seats or more or a maximum load of 7,500 pounds or more) in accordance with FAR Part 121. See also Large Certificated Air Carrier.

CERTIFICATED AIRPORTS: Airports that service air carrier operations with aircraft seating more than 30 passengers.

CHAINED DOLLARS: A measure used to express real prices, defined as prices that are adjusted to remove the effect of changes in the purchasing power of the dollar. Real prices usually reflect buying power relative to a reference year. The “chained-dollar” measure is based on the average weights of goods and services in successive pairs of years. It is “chained” because the second year in each pair, with its weights, becomes the first year of the next pair. Prior to 1996, real prices were expressed in constant dollars, a weighted measure of goods and services in a single year. See also Constant Dollars and Current Dollars.

CLASS I RAILROAD: A carrier that has an annual operating revenue of $250 million or more after applying the railroad revenue deflator formula, which is based on the Railroad Freight Price Index developed by the U.S. Department of Labor, Bureau of Labor Statistics. The formula is the current year’s revenues multiplied by the 1991 average index or current year’s average index.

COASTWISE TRAFFIC (water): Domestic traffic receiving a carriage over the ocean or the Gulf of Mexico (e.g., between New Orleans and Baltimore, New York and Puerto Rico, San Francisco and Hawaii, Alaska and Hawaii). Traffic between Great Lakes ports and seacoast ports, when having a carriage over the ocean, is also considered coastwise.

COLLECTOR (highway): In rural areas, routes that serve intracounty rather than statewide travel. In urban areas, streets that provide direct access to neighborhoods and arterials.

COMBINATION TRUCK: A power unit (truck tractor) and one or more trailing units (a semitrailer or trailer).

COMMERCIAL BUS: Any bus used to carry passengers at rates specified in tariffs; charges may be computed per passenger (as in regular route service) or per vehicle (as in charter service).

COMMERCIAL SERVICE AIRPORT: Airport receiving scheduled passenger service and having 2,500 or more enplaned passengers per year.

COMMUTER AIR CARRIER: Different definitions are used for safety purposes and for economic regulations and reporting. For safety analysis, commuter carriers are defined as air carriers operating under 14 CFR 135 that carry passengers for hire or compensation on at least five round trips per week on at least one route between two or more points according to published flight schedules, which specify the times, days of the week, and points of service. On March 20, 1997, the size of the aircraft subject to 14 CFR 135 was reduced from 30 to fewer than 10 passenger seats. (Larger aircraft are subject to the more stringent regulations of 14 CFR 121.) Helicopters carrying passengers or cargo for hire, however, are regulated under CFR 135 whatever their size. Although, in practice, most commuter air carriers operate aircraft that are regulated for safety purposes under 14 CFR 135 and most aircraft that are regulated under 14 CFR 135 are operated by commuter air carriers, this is not necessarily the case.

For economic regulations and reporting requirements, commuter air carriers are those carriers that operate aircraft of 60 or fewer seats or a maximum payload capacity of 18,000 pounds or less. These carriers hold a certificate issued under section 298C of the Federal Aviation Act of 1958, as amended.

COMMUTER RAIL (transit): Urban passenger train service for short-distance travel between a central city and adjacent suburb. Does not include rapid rail transit or light rail service.

COMPRESSED NATURAL GAS: Natural gas compressed to a volume and density that is practical as a portable fuel supply. It is used as a fuel for natural gas-powered vehicles.

CONSTANT DOLLARS: Dollar value adjusted for changes in the average price level by dividing a current dollar amount by a price index. See also Chained Dollars and Current Dollars.

CORPORATE AVERAGE FUEL ECONOMY STANDARDS (CAFE): Originally established by Congress for new automobiles and later for light trucks. This law requires automobile manufacturers to produce vehicle fleets with a composite sales-weighted fuel economy not lower than the CAFE standards in a given year. For every vehicle that does not meet the standard, a fine is paid for every one-tenth of a mile per gallon that vehicle falls below the standard.

CRASH (highway): An event that produces injury and/or property damage, involves a motor vehicle in transport, and occurs on a trafficway or while the vehicle is still in motion after running off the trafficway.

CRUDE OIL: A mixture of hydrocarbons that exists in the liquid phase in natural underground reservoirs and remains liquid at atmospheric pressure after passing through surface-separating facilities.

CURRENT DOLLARS: Dollar value of a good or service in terms of prices current at the time the good or service is sold. See also Chained Dollars and Current Dollars.

DEADWEIGHT TONNAGE (water): The carrying capacity of a vessel in long tons (2,240 pounds). It is the difference between the number of tons of water a vessel displaces "light" and the number of tons it displaces when submerged to the "load line."

DEMAND RESPONSIVE VEHICLE (transit): A nonfixed-route, nonfixed-schedule vehicle that operates in response to calls from passengers or their agents to the transit operator or dispatcher.

DIESEL FUEL: A complex mixture of hydrocarbons with a boiling range between approximately 350 and 650 °F. Diesel fuel is composed primarily of paraffins and naphthenic compounds that auto-ignite from the heat of compression in a diesel engine. Diesel is used primarily by heavy-duty road vehicles, construction equipment, locomotives, and by marine and stationary engines.

DISTILLATE FUEL OIL: A general classification for one of the petroleum fractions produced in conventional distillation operations. Included are No. 1, No. 2, and No. 4 fuel oils and No. 1, No. 2, and No. 4 diesel fuels. Distillate fuel oil is used primarily for space heating, on- and off-highway diesel engine fuel (including railroad engine fuel and fuel for agricultural machinery), and electric power generation.

DOMESTIC FREIGHT (water): All waterborne commercial movement between points in the United States, Puerto Rico, and the Virgin Islands, excluding traffic with the Panama Canal Zone. Cargo moved for the military in commercial vessels is reported as ordinary commercial cargo; military cargo moved in military vessels is omitted.

DOMESTIC OPERATIONS (air carrier): All air carrier operations having destinations within the 50 United States, the District of Columbia, the Commonwealth of Puerto Rico, and the U.S. Virgin Islands.

DOMESTIC PASSENGER (water): Any person traveling on a public conveyance by water between points in the United States, Puerto Rico, and the Virgin Islands.

DRY CARGO BARGES (water): Large flat-bottomed, nonself-propelled vessels used to transport dry-bulk materials such as coal and ore.

ENERGY EFFICIENCY: The ratio of energy inputs to outputs from a process, for example, miles traveled per gallon of fuel (mpg).

ENPLANED PASSENGERS (air carrier): See Revenue Passenger Enplanements.

ETHANOL: A clear, colorless, flammable oxygenated hydrocarbon with a boiling point of 78.5 °C in the anhydrous state. It is used in the United States as a gasoline octane enhancer and oxygenate (10 percent concentration). Ethanol can be used in high concentrations in vehicles optimized for its use. Otherwise known as ethyl alcohol, alcohol, or grain-spirit.

FATAL CRASH (highway): A police-reported crash involving a motor vehicle in transport on a trafficway in which at least 1 person dies within 30 days of the crash as a result of that crash.

FATAL INJURY (air): Any injury that results in death within 30 days of the accident.

FATALITY: For purposes of statistical reporting on transportation safety, a fatality is considered a death due to injuries in a transportation crash, accident, or incident that occurs within 30 days of that occurrence.

FATALITY (rail): 1) Death of any person from an injury within 30 days of the accident or incident (may include nontrain accidents or incidents); or 2) death of a railroad employee from an occupational illness within 365 days after the occupational illness was diagnosed by a physician.

FATALITY (recreational boating): All deaths (other than deaths by natural causes) and missing persons resulting from an occurrence that involves a vessel or its equipment.

FATALITY (transit): A transit-caused death confirmed within 30 days of a transit incident. Incidents include collisions, derailments, personal casualties, and fires associated with transit agency revenue vehicles, transit facilities on transit property, service vehicles, maintenance areas, and rights-of-way.

FATALITY (water): All deaths and missing persons resulting from a vessel casualty.

FEDERAL ENERGY REGULATORY COMMISSION (FERC): The federal agency with jurisdiction over, among other things, gas pricing, oil pipeline rates, and gas pipeline certification.

FERRYBOAT (transit): Vessels that carry passengers and/or vehicles over a body of water. Generally steam or diesel-powered, ferryboats may also be hovercraft, hydrofoil, and other high-speed vessels. The vessel is limited in its use to the carriage of deck passengers or vehicles or both, operates on a short run on a frequent schedule between two points over the most direct water routes other than in ocean or coastwise service, and is offered as a public service of a type normally attributed to a bridge or tunnel.

FOSSIL FUELS: Any naturally occurring organic fuel formed in the Earth's crust, such as petroleum, coal, and natural gas.

FREIGHT REVENUE (rail): Revenue from the transportation of freight and from the exercise of transit, stopoff, diversion, and reconsignment privileges as provided for in tariffs.

FREIGHTERS (water): General cargo carriers, full containerships, partial containerships, roll-on/rolloff ships, and barge carriers.

GAS TRANSMISSION PIPELINES: Pipelines installed for the purpose of transmitting gas from a source or sources of supply to one or more distribution centers, or to one or more large volume customers; or a pipeline installed to interconnect sources of supply. Typically, transmission lines differ from gas mains in that they operate at higher pressures and the distance between connections is greater.

GASOHOL: A blend of finished motor gasoline (leaded or unleaded) and alcohol (generally ethanol but sometimes methanol) limited to 10 percent by volume of alcohol.

GASOLINE: A complex mixture of relatively volatile hydrocarbons, with or without small quantities of additives that have been blended to produce a fuel suitable for use in spark ignition engines. Motor gasoline includes both leaded or unleaded grades of finished motor gasoline, blending components, and gasohol. Leaded gasoline is no longer used in highway motor vehicles in the United States.

GENERAL AVIATION: 1) All civil aviation operations other than scheduled air services and nonscheduled air transport operations for taxis, commuter air carriers, and air travel clubs that do not hold Certificates of Public Convenience and Necessity. 2) All civil aviation activity except that of air carriers certificated in accordance with Federal Aviation Regulations, Parts 121, 123, 127, and 135. The types of aircraft used in general aviation range from corporate multiengine jet aircraft piloted by professional crews to amateur-built single-engine piston-driven acrobatic planes to balloons and dirigibles.

GENERAL ESTIMATES SYSTEM (highway): A data-collection system that uses a nationally representative probability sample selected from all police-reported highway crashes. It began operation in 1988.

GROSS DOMESTIC PRODUCT (U.S.): The total output of goods and services produced by labor and property located in the United States, valued at market prices. As long as the labor and property are located in the United States, the suppliers (workers and owners) may be either U.S. residents or residents of foreign countries.

GROSS VEHICLE WEIGHT RATING (truck): The maximum rated capacity of a vehicle, including the weight of the base vehicle, all added equipment, driver and passengers, and all cargo.

HAZARDOUS MATERIAL: Any toxic substance or explosive, corrosive, combustible, poisonous, or radioactive material that poses a risk to the public's health, safety, or property, particularly when transported in commerce.

HEAVY RAIL (transit): An electric railway with the capacity to transport a heavy volume of passenger traffic and characterized by exclusive rights-of-way, multicar trains, high speed, rapid acceleration, sophisticated signaling, and high-platform loading. Also known as "subway," "elevated (railway)," or "metropolitan railway (metro)."

HIGHWAY-RAIL GRADE CROSSING (rail): A location where one or more railroad tracks are crossed by a public highway, road, street, or a private roadway at grade, including sidewalks and pathways at or associated with the crossing.

HIGHWAY TRUST FUND: A grant-in-aid type fund administered by the U.S. Department of Transportation, Federal Highway Administration. Most funds for highway improvements are apportioned to states according to formulas that give weight to population, area, and mileage.

HIGHWAY-USER TAX: A charge levied on persons or organizations based on their use of public roads. Funds collected are usually applied toward highway construction, reconstruction, and maintenance.

INCIDENT (hazardous materials): Any unintentional release of hazardous material while in transit or storage.

INCIDENT (train): Any event involving the movement of a train or railcars on track equipment that results in a death, a reportable injury, or illness, but in which railroad property damage does not exceed the reporting threshold.

INCIDENT (transit): Collisions, derailments, personal casualties, fires, and property damage in excess of $1,000 associated with transit agency revenue vehicles; all other facilities on the transit property; and service vehicles, maintenance areas, and rights-of-way.

INJURY (air): See Serious Injury (air carrier/general aviation).

INJURY (gas): Described in U.S. Department of Transportation Forms 7100.1 or 7100.2 as an injury requiring "in-patient hospitalization" (admission and confinement in a hospital beyond treatment administered in an emergency room or out-patient clinic in which confinement does not occur).

INJURY (hazardous liquid pipeline): An injury resulting from a hazardous liquid pipeline accident that results in one or more of the following: 1) loss of consciousness, 2) a need to be carried from the scene, 3) a need for medical treatment, and/or 4) a disability that prevents the discharge of normal duties or the pursuit of normal duties beyond the day of the accident.

INJURY (highway): Police-reported highway injuries are classified as follows:

Incapacitating Injury: Any injury, other than a fatal injury, that prevents the injured person from walking, driving, or normally continuing the activities the person was capable of performing before the injury occurred. Includes severe lacerations, broken or distorted limbs, skull or chest injuries, abdominal injuries, unconsciousness at or when taken from the accident scene, and inability to leave the accident scene without assistance. Exclusions include momentary unconsciousness.

Nonincapacitating Evident Injury: Any injury, other than a fatal injury or an incapacitating injury, evident to observers at the scene of the accident. Includes lumps on head, abrasions, bruises, minor lacerations, and others. Excludes limping.

Possible Injury: Any injury reported or claimed that is not evident. Includes, among others, momentary unconsciousness, claim of injuries not obvious, limping, complaint of pain, nausea, and hysteria.

INJURY (highway-rail grade crossing): 1) An injury to one or more persons other than railroad employees that requires medical treatment; 2) an injury to one or more employees that requires medical treatment or that results in restriction of work or motion for one or more days, or one or more lost work days, transfer to another job, termination of employment, or loss of consciousness; 3) any occupational illness affecting one or more railroad employees that is diagnosed by a physician.

INJURY (rail): 1) Injury to any person other than a railroad employee that requires medical treatment, or 2) injury to a railroad employee that requires medical treatment or results in restriction of work or motion for one or more workdays, one or more lost workdays, termination of employment, transfer to another job, loss of consciousness, or any occupational illness of a railroad employee diagnosed by a physician.

INJURY (recreational boating): Injury requiring medical treatment beyond first aid as a result of an occurrence that involves a vessel or its equipment.

INJURY (transit): Any physical damage or harm to a person requiring medical treatment or any physical damage or harm to a person reported at the time and place of occurrence. For employees, an injury includes incidents resulting in time lost from duty or any definition consistent with a transit agency's current employee injury reporting practice.

INJURY (water): All personal injuries resulting from a vessel casualty that require medical treatment beyond first aid.

INLAND AND COASTAL CHANNELS: Includes the Atlantic Coast Waterways, the Atlantic Intracoastal Waterway, the New York State Barge Canal System, the Gulf Coast Waterways, the Gulf Intracoastal Waterway, the Mississippi River System (including the Illinois Waterway), the Pacific Coast Waterways, the Great Lakes, and all other channels (waterways) of the United States, exclusive of Alaska, that are usable for commercial navigation.

INTERCITY CLASS I BUS: As defined by the Bureau of Transportation Statistics, an interstate motor carrier of passengers with an average annual gross revenue of at least $1 million.

INTERCITY TRUCK: A truck that carries freight beyond local areas and commercial zones.

INTERNAL TRAFFIC (water): Vessel movements (origin and destination) that take place solely on inland waterways located within the boundaries of the contiguous 48 states or within the state of Alaska. Internal traffic also applies to carriage on both inland waterways and the water on the Great Lakes; carriage between offshore areas and inland waterways; and carriage occurring within the Delaware Bay, Chesapeake Bay, Puget Sound, and the San Francisco Bay, which are considered internal bodies of water rather than arms of the ocean.

INTERSTATE HIGHWAY: Limited access, divided highway of at least four lanes designated by the Federal Highway Administration as part of the Interstate System.

JET FUEL: Includes kerosene-type jet fuel (used primarily for commercial turbojet and turboprop aircraft engines) and naphtha-type jet fuel (used primarily for military turbojet and turboprop aircraft engines).

LAKEWISE OR GREAT LAKES TRAFFIC: Waterborne traffic between U.S. ports on the Great Lakes system. The Great Lakes system is treated as a separate waterways system rather than as a part of the inland system.

LARGE CERTIFICATED AIR CARRIERS: An air carrier holding a certificate issued under section 401 of the Federal Aviation Act of 1958, as amended, that: 1) operates aircraft designed to have a maximum passenger capacity of more than 60 seats or a maximum payload capacity of more than 18,000 pounds, or 2) conducts operations where one or both terminals of a flight stage are outside the 50 states of the United States, the District of Columbia, the Commonwealth of Puerto Rico, and the U.S. Virgin Islands. Large certificated air carriers are grouped by annual operating revenues: 1) majors (more than $1 billion in annual operating revenues), 2) nationals (between $100 million and $1 billion in annual operating revenues), 3) large regionals (between $20 million and $99,999,999 in annual operating revenues), and 4) medium regionals (less than $20 million in annual operating revenues).

LARGE REGIONALS (air): Air carrier groups with annual operating revenues between $20 million and $99,999,999.

LARGE TRUCK: Trucks over 10,000 pounds gross vehicle weight rating, including single-unit trucks and truck tractors.

LEASE CONDENSATE: A mixture consisting primarily of pentanes and heavier hydrocarbons, which are recovered as a liquid from natural gas in lease or field separation facilities. This category excludes natural gas liquids, such as butane and propane, which are recovered at natural gas processing plants or facilities.

LIGHT-DUTY VEHICLE: A vehicle category that combines light automobiles and trucks.

LIGHT RAIL: A streetcar-type vehicle operated on city streets, semi-exclusive rights-of-way, or exclusive rights-of-way. Service may be provided by step-entry vehicles or by level boarding.

LIGHT TRUCK: Trucks of 10,000 pounds gross vehicle weight rating or less, including pickups, vans, truck-based station wagons, and sport utility vehicles.

LIQUEFIED NATURAL GAS (LNG): Natural gas, primarily methane, that has been liquefied by reducing its temperature to –260 °F at atmospheric pressure.

LIQUEFIED PETROLEUM GAS (LPG): Propane, propylene, normal butane, butylene, isobutane, and isobutylene produced at refineries or natural gas processing plants, including plants that fractionate new natural gas plant liquids.

LOCOMOTIVE: Railroad vehicle equipped with flanged wheels for use on railroad tracks, powered directly by electricity, steam, or fossil fuel, and used to move other railroad rolling equipment.

LOCOMOTIVE-MILE: The movement of a locomotive unit, under its own power, the distance of 1 mile.

MAINS (gas): A network of pipelines that serves as a common source of supply for more than one gas service line.

MAJORS (air): Air carrier groups with annual operating revenues exceeding $1 billion.

MEDIUM REGIONALS (air): Air carrier groups with annual operating revenues less than $20 million.

MERCHANDISE TRADE EXPORTS: Merchandise transported out of the United States to foreign countries whether such merchandise is exported from within the U.S. Customs Service territory, from a U.S. Customs bonded warehouse, or from a U.S. Foreign Trade Zone. (Foreign Trade Zones are areas, operated as public utilities, under the control of U.S. Customs with facilities for handling, storing, manipulating, manufacturing, and exhibiting goods.)

MERCHANDISE TRADE IMPORTS: Commodities of foreign origin entering the United States, as well as goods of domestic origin returned to the United States with no change in condition or after having been processed and/or assembled in other countries. Puerto Rico is a Customs district within the U.S. Customs territory, and its trade with foreign countries is included in U.S. import statistics. U.S. import statistics also include merchandise trade between the U. S. Virgin Islands and foreign countries even though the Islands are not officially a part of the U.S. Customs territory.

METHANOL: A light, volatile alcohol produced commercially by the catalyzed reaction of hydrogen and carbon monoxide. Methanol is blended with gasoline to improve its operational efficiency.

METHYL-TERTIARY-BUTYL-ETHER (MTBE): A colorless, flammable, liquid oxygenated hydrocarbon that contains 18.15 percent oxygen. It is a fuel oxygenate produced by reacting methanol with isobutylene.

MINOR ARTERIALS (highway): Roads linking cities and larger towns in rural areas. In urban areas, roads that link but do not penetrate neighborhoods within a community.

MOTORBUS (transit): A rubber-tired, self-propelled, manually steered bus with a fuel supply onboard the vehicle. Motorbus types include intercity, school, and transit.

MOTORCYCLE: A two- or three-wheeled motor vehicle designed to transport one or two people, including motor scooters, minibikes, and mopeds.

NATIONALS (air): Air carrier groups with annual operating revenues between $100 million and $1 billion.

NATURAL GAS: A naturally occurring mixture of hydrocarbon and nonhydrocarbon gases found in porous geologic formations beneath the Earth's surface, often in association with petroleum. The principal constituent is methane.

NATURAL GAS PLANT LIQUIDS: Liquids recovered from natural gas in processing plants or field facilities, or extracted by fractionators. They include ethane, propane, normal butane, isobutane, pentanes plus, and other products, such as finished motor gasoline, finished aviation gasoline, special naphthas, kerosene, and distillate fuel oil produced at natural gas processing plants.

NEAR MIDAIR COLLISION (air): An incident in which the possibility of a collision occurred as a result of aircraft flying with less than 500 feet of separation, or a report received from a pilot or flight crew member stating that a collision hazard existed between two or more aircraft.

NONOCCUPANT (Automobile): Any person who is not an occupant of a motor vehicle in transport (e.g., bystanders, pedestrians, pedalcyclists, or an occupant of a parked motor vehicle).

NONSCHEDULED SERVICE (air): Revenue flights not operated as regular scheduled service, such as charter flights, and all nonrevenue flights incident to such flights.

NONSELF-PROPELLED VESSEL (water): A vessel without the means for self-propulsion. Includes dry cargo barges and tanker barges.

NONTRAIN INCIDENT: An event that results in a reportable casualty, but does not involve the movement of ontrack equipment and does not cause reportable damage above the threshold established for train accidents.

NONTRESPASSERS (rail): A person lawfully on any part of railroad property used in railroad operations or a person adjacent to railroad premises when injured as the result of railroad operations.

NONVESSEL-CASUALTY-RELATED DEATH (water): A death that occurs onboard a commercial vessel but not as a result of a vessel casualty, such as a collision, fire, or explosion.

OCCUPANT (highway): Any person in or on a motor vehicle in transport. Includes the driver, passengers, and persons riding on the exterior of a motor vehicle (e.g., a skateboard rider holding onto a moving vehicle). Excludes occupants of parked cars unless they are double parked or motionless on the roadway.

OCCUPATIONAL FATALITY: Death resulting from a job-related injury.

OPERATING EXPENSES (air): Expenses incurred in the performance of air transportation, based on overall operating revenues and expenses. Does not include nonoperating income and expenses, nonrecurring items, or income taxes.

OPERATING EXPENSES (rail): Expenses of furnishing transportation services, including maintenance and depreciation of the plant used in the service.

OPERATING EXPENSES (transit): The total of all expenses associated with operation of an individual mode by a given operator. Includes distributions of "joint expenses" to individual modes and excludes "reconciling items," such as interest expenses and depreciation. Should not be confused with "vehicle operating expenses."

OPERATING EXPENSES (truck): Includes expenditures for equipment maintenance, supervision, wages, fuel, equipment rental, terminal operations, insurance, safety, and administrative and general functions.

OPERATING REVENUES (air): Revenues from the performance of air transportation and related incidental services. Includes l) transportation revenues from the carriage of all classes of traffic in scheduled and nonscheduled services, and 2) nontransportation revenues consisting of federal subsidies (where applicable) and services related to air transportation.

OTHER FREEWAYS AND EXPRESSWAYS (highway): All urban principal arterials with limited access but not part of the Interstate system.

OTHER PRINCIPAL ARTERIALS (highway): Major streets or highways, many of multi-lane or freeway design, serving high-volume traffic corridor movements that connect major generators of travel.

OTHER RAIL REVENUE: Includes revenues from miscellaneous operations (i.e., dining- and bar-car services), income from the lease of road and equipment, miscellaneous rental income, income from nonoperating property, profit from separately operated properties, dividend income, interest income, income from sinking and other reserve funds, release or premium on funded debt, contributions from other companies, and other miscellaneous income.

OTHER REVENUE VEHICLES (transit): Other revenue-generating modes of transit service, such as cable cars, personal rapid transit systems, monorail vehicles, inclined and railway cars, not covered otherwise.

OTHER 2-AXLE 4-TIRE VEHICLES (truck): Includes vans, pickup trucks, and sport utility vehicles.

OXYGENATES: Any substance that when added to motor gasoline increases the amount of oxygen in that gasoline blend. Includes oxygen-bearing compounds such as ethanol, methanol, and methyl-tertiary-butyl-ether. Oxygenated fuel tends to give a more complete combustion of carbon into carbon dioxide (rather than monoxide), thereby reducing air pollution from exhaust emissions.

PASSENGER CAR: A motor vehicle designed primarily for carrying passengers on ordinary roads, includes convertibles, sedans, and stations wagons.

PASSENGER-MILE: 1) Air: One passenger transported 1 mile; passenger-miles for 1 interairport flight are calculated by multiplying aircraft-miles flown by the number of passengers carried on the flight. The total passenger-miles for all flights is the sum of passenger-miles for all interairport flights. 2) Auto: One passenger traveling 1 mile; e.g., 1 car transporting 2 passengers 4 miles results in 8 passenger-miles. 3) Transit: The total number of miles traveled by transit passengers; e.g., 1 bus transporting 5 passengers 3 miles results in 15 passenger-miles.

PASSENGER REVENUE: 1) Rail: Revenue from the sale of tickets. 2) Air: Revenues from the transport of passengers by air. 3) Transit: Fares, transfer, zone, and park-and-ride parking charges paid by transit passengers. Prior to 1984, fare revenues collected by contractors operating transit services were not included.

PASSENGER VESSELS (water): A vessel designed for the commercial transport of passengers.

PEDALCYCLIST: A person on a vehicle that is powered solely by pedals.

PEDESTRIAN: Any person not in or on a motor vehicle or other vehicle. Excludes people in buildings or sitting at a sidewalk cafe. The National Highway Traffic Safety Administration also uses an "other pedestrian" category to refer to pedestrians using conveyances and people in buildings. Examples of pedestrian conveyances include skateboards, nonmotorized wheelchairs, rollerskates, sleds, and transport devices used as equipment.

PERSON-MILES: An estimate of the aggregate distances traveled by all persons on a given trip based on the estimated transportation-network-miles traveled on that trip.

PERSON TRIP: A trip taken by an individual. For example, if three persons from the same household travel together, the trip is counted as one household trip and three person trips.

PERSONAL CASUALTY (transit): 1) An incident in which a person is hurt while getting on or off a transit vehicle (e.g., falls or door incidents), but not as a result of a collision, derailment/left roadway, or fire. 2) An incident in which a person is hurt while using a lift to get on or off a transit vehicle, but not as a result of a collision, derailment/left roadway, or fire. 3) An incident in which a person is injured on a transit vehicle, but not as a result of a collision, derailment/left roadway, or fire. 4) An incident in which a person is hurt while using a transit facility. This includes anyone on transit property (e.g., patrons, transit employees, trespassers), but does not include incidents resulting from illness or criminal activity.

PETROLEUM (oil): A generic term applied to oil and oil products in all forms, such as crude oil, lease condensate, unfinished oils, petroleum products, natural gas plant liquids, and nonhydrocarbon compounds blended into finished petroleum products.

PROPERTY DAMAGE (transit): The dollar amount required to repair or replace transit property (including stations, right-of-way, bus stops, and maintenance facilities) damaged during an incident.

PUBLIC ROAD: Any road under the jurisdiction of and maintained by a public authority (federal, state, county, town or township, local government, or instrumentality thereof) and open to public travel.

RAPID RAIL TRANSIT: Transit service using railcars driven by electricity usually drawn from a third rail, configured for passenger traffic, and usually operated on exclusive rights-of-way. It generally uses longer trains and has longer station spacing than light rail.

REFORMULATED GASOLINE: Gasoline whose composition has been changed to meet performance specifications regarding ozone-forming tendencies and release of toxic substances into the air from both evaporation and tailpipe emissions. Reformulated gasoline includes oxygenates and, compared with gasoline sold in 1990, has a lower content of olefins, aromatics, volatile components, and heavy hydrocarbons.

RESIDUAL FUEL OIL: The heavier oils that remain after the distillate fuel oils and lighter hydrocarbons are distilled away in refinery operations and that conform to American Society for Testing and Materials Specifications D396 and 976. Includes, among others, Navy Special oil used in steam-powered vessels in government service and No. 6 oil used to power ships. Imports of residual fuel oil include imported crude oil burned as fuel.

REVENUE: Remuneration received by carriers for transportation activities.

REVENUE PASSENGER: 1) Air: Person receiving air transportation from an air carrier for which remuneration is received by the carrier. Air carrier employees or others, except ministers of religion, elderly individuals, and handicapped individuals, receiving reduced rate charges (less than the applicable tariff) are considered nonrevenue passengers. Infants, for whom a token fare is charged, are not counted as passengers. 2) Transit: Single-vehicle transit rides by initial-board (first-ride) transit passengers only. Excludes all transfer rides and all nonrevenue rides. 3) Rail: Number of one-way trips made by persons holding tickets.

REVENUE PASSENGER ENPLANEMENTS (air): The total number of passengers boarding aircraft. Includes both originating and connecting passengers.

REVENUE PASSENGER LOAD FACTOR (air): Revenue passenger-miles as a percentage of available seat-miles in revenue passenger services. The term is used to represent the proportion of aircraft seating capacity that is actually sold and utilized.

REVENUE PASSENGER-MILE: One revenue passenger transported one mile.

REVENUE PASSENGER TON-MILE (air): One ton of revenue passenger weight (including all baggage) transported one mile. The passenger weight standard for both domestic and international operations is 200 pounds.

REVENUE TON-MILE: One short ton of freight transported one mile.

REVENUE VEHICLE-MILES (transit): One vehicle (bus, trolley bus, or streetcar) traveling one mile, while revenue passengers are on board, generates one revenue vehicle-mile. Revenue vehicle-miles reported represent the total mileage traveled by vehicles in scheduled or unscheduled revenue-producing services.

ROAD OIL: Any heavy petroleum oil, including residual asphaltic oil, that is used as a dust palliative and surface treatment on roads and highways. It is generally produced in six grades from zero, the most liquid, to five, the most viscous.

ROLL ON/ROLL OFF VESSEL (water): Ships that are designed to carry wheeled containers or other wheeled cargo and use the roll on/roll off method for loading and unloading.

RURAL HIGHWAY: Any highway, road, or street that is not an urban highway.

RURAL MILEAGE (highway): Roads outside city, municipal district, or urban boundaries.

SCHEDULED SERVICE (air): Transport service operated on published flight schedules.

SCHOOL BUS: A passenger motor vehicle that is designed or used to carry more than 10 passengers, in addition to the driver, and, as determined by the Secretary of Transportation, is likely to be significantly used for the purpose of transporting pre-primary, primary, or secondary school students between home and school.

SCHOOL BUS-RELATED CRASH: Any crash in which a vehicle, regardless of body design and used as a school bus, is directly or indirectly involved, such as a crash involving school children alighting from a vehicle.

SCOW (water): Any flat-bottomed, nonself-propelled, rectangular vessel with sloping ends. Large scows are used to transport sand, gravel, or refuse.

SELF-PROPELLED VESSEL: A vessel that has its own means of propulsion. Includes tankers, containerships, dry bulk cargo ships, and general cargo vessels.

SERIOUS INJURY (air carrier/general aviation): An injury that requires hospitalization for more than 48 hours, commencing within 7 days from the date when the injury was received; results in a bone fracture (except simple fractures of fingers, toes, or nose); involves lacerations that cause severe hemorrhages, or nerve, muscle, or tendon damage; involves injury to any internal organ; or involves second- or third-degree burns or any burns affecting more than 5 percent of the body surface.

SMALL CERTIFICATED AIR CARRIER: An air carrier holding a certificate issued under section 401 of the Federal Aviation Act of 1958, as amended, that operates aircraft designed to have a maximum seating capacity of 60 seats or fewer or a maximum payload of 18,000 pounds or less.

STATE AND LOCAL HIGHWAY EXPENDITURES: Disbursements for capital outlays, maintenance and traffic surfaces, administration and research, highway law enforcement and safety, and interest on debt.

STREETCARS: Relatively lightweight passenger railcars operating singly or in short trains, or on fixed rails in rights-of-way that are not always separated from other traffic. Streetcars do not necessarily have the right-of-way at grade crossings with other traffic.

SUPPLEMENTAL AIR CARRIER: An air carrier authorized to perform passenger and cargo charter services.

TANKER: An oceangoing ship designed to haul liquid bulk cargo in world trade.

TON-MILE (truck): The movement of one ton of cargo the distance of one mile. Ton-miles are calculated by multiplying the weight in tons of each shipment transported by the miles hauled.

TON-MILE (water): The movement of one ton of cargo the distance of one statute mile. Domestic ton-miles are calculated by multiplying tons moved by the number of statute miles moved on the water (e.g., 50 short tons moving 200 miles on a waterway would yield 10,000 ton-miles for that waterway). Ton-miles are not computed for ports. For coastwise traffic, the shortest route that safe navigation permits between the port of origin and destination is used to calculate ton-miles.

TRAFFICWAY (highway): Any right-of-way open to the public as a matter of right or custom for moving persons or property from one place to another, including the entire width between property lines or other boundaries.

TRAIN LINE MILEAGE: The aggregate length of all line-haul railroads. It does not include the mileage of yard tracks or sidings, nor does it reflect the fact that a mile of railroad may include two or more parallel tracks. Jointly-used track is counted only once.

TRAIN-MILE: The movement of a train, which can consist of many cars, the distance of one mile. A train-mile differs from a vehicle-mile, which is the movement of one car (vehicle) the distance of one mile. A 10-car (vehicle) train traveling 1 mile is measured as 1 train-mile and 10 vehicle-miles. Caution should be used when comparing train-miles to vehicle-miles.

TRANSIT VEHICLE: Includes light, heavy, and commuter rail; motorbus; trolley bus; van pools; automated guideway; and demand responsive vehicles.

TRANSSHIPMENTS: Shipments that enter or exit the United States by way of a U.S. Customs port on the northern or southern border, but whose origin or destination is a country other than Canada or Mexico.

TRESPASSER (rail): Any person whose presence on railroad property used in railroad operations is prohibited, forbidden, or unlawful.

TROLLEY BUS: Rubber-tired electric transit vehicle, manually steered and propelled by a motor drawing current, normally through overhead wires, from a central power source.

TRUST FUNDS: Accounts that are designated by law to carry out specific purposes and programs. Trust Funds are usually financed with earmarked tax collections.

TUG BOAT: A powered vessel designed for towing or pushing ships, dumb barges, pushed-towed barges, and rafts, but not for the carriage of goods.

U.S.-FLAG CARRIER OR AMERICAN FLAG CARRIER (air): One of a class of air carriers holding a Certificate of Public Convenience and Necessity, issued by the U.S. Department of Transportation and approved by the President, authorizing scheduled operations over specified routes between the United States (and/or its territories) and one or more foreign countries.

UNLEADED GASOLINE: See Gasoline.

UNLINKED PASSENGER TRIPS (transit): The number of passengers boarding public transportation vehicles. A passenger is counted each time he/she boards a vehicle even if the boarding is part of the same journey from origin to destination.

URBAN HIGHWAY: Any road or street within the boundaries of an urban area. An urban area is an area including and adjacent to a municipality or urban place with a population of 5,000 or more. The boundaries of urban areas are fixed by state highway departments, subject to the approval of the Federal Highway Administration, for purposes of the Federal-Aid Highway Program.

VANPOOL (transit): Public-sponsored commuter service operating under prearranged schedules for previously formed groups of riders in 8- to 18-seat vehicles. Drivers are also commuters who receive little or no compensation besides the free ride.

VEHICLE MAINTENANCE (transit): All activities associated with revenue and nonrevenue (service) vehicle maintenance, including administration, inspection and maintenance, and servicing (e.g., cleaning and fueling) vehicles. In addition, it includes repairs due to vandalism or to revenue vehicle accidents.

VEHICLE-MILES (highway): Miles of travel by all types of motor vehicles as determined by the states on the basis of actual traffic counts and established estimating procedures.

VEHICLE-MILES (transit): The total number of miles traveled by transit vehicles. Commuter rail, heavy rail, and light rail report individual car-miles, rather than train-miles for vehicle-miles.

VEHICLE OPERATIONS (transit): All activities associated with transportation administration, including the control of revenue vehicle movements, scheduling, ticketing and fare collection, system security, and revenue vehicle operation.

VESSEL CASUALTY (water): An occurrence involving commercial vessels that results in 1) actual physical damage to property in excess of $25,000; 2) material damage affecting the seaworthiness or efficiency of a vessel; 3) stranding or grounding; 4) loss of life; or 5) injury causing any person to remain incapacitated for a period in excess of 72 hours, except injury to harbor workers not resulting in death and not resulting from vessel casualty or vessel equipment casualty.

VESSEL-CASUALTY-RELATED DEATH (water): Fatality that occurs as a result of an incident that involves a vessel or its equipment, such as a collision, fire, or explosion. Includes drowning deaths.

WATERBORNE TRANSPORTATION: Transport of freight and/or people by commercial vessels under U.S. Coast Guard jurisdiction.

WAYBILL: A document that lists goods and shipping instructions relative to a shipment.

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